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# Steel Building Design: Design Data

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**Publication P363  
(Reprinted March 2015)**

# **Steel Building Design: Design Data**

**In accordance with Eurocodes and the UK National Annexes**

Jointly published by:

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Publication Number: SCI P363                      ISBN 978-1-85942-186-4

British Library Cataloguing-in-Publication Data.

A catalogue record for this book is available from the British Library.

# FOREWORD

This publication presents design data derived in accordance with the following Parts of Eurocode 3 and their National Annexes:

- BS EN 1993-1-1:2005: Design of steel structures. Part 1-1: General rules and rules for buildings.
- BS EN 1993-1-5:2006: Design of steel structures. Part 1-5: Plated structural elements.
- BS EN 1993-1-8:2005: Design of steel structures. Part 1-8: Design of joints.

Where these Parts do not give all the necessary expressions for the evaluation of data, reference is made to other published sources.

The resistances in this publication have been calculated using the partial factors for resistance given in the UK National Annexes for the Eurocodes (NA to BS EN 1993-1-1:2005 as published in December 2008, NA to BS EN 1993-1-5:2006 as published in May 2008 and NA to BS EN 1993-1-8:2005 as published in November 2008). The partial factors are listed in Section 5.1. The other parameters given in the National Annex that have been used when calculating member resistances are given in the relevant section of this publication.

The following structural sections are covered in this publication:

- Universal beams, universal columns, joists, bearing piles, parallel flange channels and structural tees cut from universal beams and universal columns to BS 4-1.
- Universal beams and universal columns produced by Tata Steel but not included in BS 4-1.
- Asymmetric Slimflor® beams (ASB) produced by Tata Steel.
- Equal and unequal angles to BS EN 10056-1.
- Hot-finished structural hollow sections to BS EN 10210-2.
- Cold-formed structural hollow sections to BS EN 10219-2.

Section ranges listed cover sections that are readily available at the time of printing.

The preparation and editorial work for this Edition was carried out by Miss E Nunez Moreno and Mr E Yandzio, both of the SCI, with technical assistance from Mr A S Malik of the SCI and Mr C M King, formerly of the SCI. The project was coordinated by Mr D G Brown, also of the SCI.

The work leading to this publication has been jointly funded by Tata Steel, SCI and BCSA and their support is gratefully acknowledged.

## Reprint – 2015

Effective properties have been given for RHS subject to minor axis bending. For RHS subject to bending, the second moment of area presented is always the gross property. For RHS subject to axial load and bending, the choice of curve for lateral torsional buckling (for lengths greater than the limiting length) reflects the provisions of the UK National Annex. For circular hollow sections subject to axial load and bending, the reduced moment resistance reflects the provisions of the corrigenda to BS EN 1993-1-1.

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*\* Tables for these structural sections in S275 have not been prepared.  
See notes on pages C-14 and C-103.*

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*\* Tables for these structural sections in S275 have not been prepared.  
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# A EXPLANATORY NOTES

## 1 GENERAL

This publication presents design data in tabular formats as assistance to engineers who are designing buildings in accordance with BS EN 1993-1-1:2005<sup>[1]</sup>, BS EN 1993-1-5:2006<sup>[1]</sup> and BS EN 1993-1-8:2005<sup>[1]</sup>, and their respective National Annexes. Where these Parts do not give all the necessary expressions for the evaluation of data, reference is made to other published sources.

The symbols used are generally the same as those in these standards or the referred product standards. Where a symbol does not appear in the standards, a symbol has been chosen following the designation convention as closely as possible.

### 1.1 Material, section dimensions and tolerances

The structural sections referred to in this design guide are of weldable structural steels conforming to the relevant British Standards given in the table below:

**Table – Structural steel products**

Product	Technical delivery requirements		Dimensions	Tolerances
	Non alloy steels	Fine grain steels		
Universal beams, Universal columns, and universal bearing piles	BS EN 10025-2 <sup>[2]</sup>	BS EN 10025-3 <sup>[2]</sup> BS EN 10025-4 <sup>[2]</sup>	BS 4-1 <sup>[3]</sup>	BS EN 10034 <sup>[4]</sup>
Joists			BS 4-1	BS 4-1 BS EN 10024 <sup>[5]</sup>
Parallel flange channels			BS 4-1	BS EN 10279 <sup>[6]</sup>
Angles			BS EN 10056-1 <sup>[7]</sup>	BS EN 10056-2 <sup>[7]</sup>
Structural tees cut from universal beams and universal columns			BS 4-1	—
ASB (asymmetric beams) <i>Slimflor</i> <sup>®</sup> beam	Generally but see note b)	BS EN 10025,	See note a)	Generally BS EN 10034 <sup>[4]</sup> , but also see note b)
Hot finished structural hollow sections	BS EN 10210-1 <sup>[8]</sup>		BS EN 10210-2 <sup>[8]</sup>	BS EN 10210-2 <sup>[8]</sup>
Cold formed hollow sections	BS EN 10219-1 <sup>[9]</sup>		BS EN 10219-2 <sup>[9]</sup>	BS EN 10219-2 <sup>[9]</sup>
Notes: For full details of the British Standards, see the reference list at the end of the Explanatory Notes. a) See Tata Steel publication, <i>Advance</i> <sup>®</sup> <i>Sections: CE marked structural sections</i> <sup>[11]</sup> . b) For further details, consult Tata Steel. Note that EN 1993 refers to the product standards by their CEN designation, e.g. EN 10025-2. The CEN standards are published in the UK by BSI with their prefix to the designation, e.g. BS EN 10025-2.				

## 1.2 Dimensional units

The dimensions of sections are given in millimetres (mm).

## 1.3 Property units

Generally, the centimetre (cm) is used for the calculated properties but for surface areas and for the warping constant ( $I_w$ ), the metre (m) and the decimetre (dm) respectively are used.

$$\begin{aligned}\text{Note: } 1 \text{ dm} &= 0.1 \text{ m} &= 100 \text{ mm} \\ 1 \text{ dm}^6 &= 1 \times 10^{-6} \text{ m}^6 &= 1 \times 10^{12} \text{ mm}^6\end{aligned}$$

## 1.4 Mass and force units

The units used are the kilogram (kg), the Newton (N) and the metre per second squared ( $\text{m/s}^2$ ), so that  $1 \text{ N} = 1 \text{ kg} \times 1 \text{ m/s}^2$ . For convenience, a standard value of the acceleration due to gravity has been accepted as  $9.80665 \text{ m/s}^2$ . Thus, the force exerted by 1 kg under the action of gravity is 9.80665 N and the force exerted by 1 tonne (1000 kg) is 9.80665 kiloNewtons (kN).

## 1.5 Axis convention

The axis system used in BS EN 1993 is:

- $x$  along the member
- $y$  major axis, or axis perpendicular to web
- $z$  minor axis, or axis parallel to web

This system is convenient for structural analysis using computer programs. However, it is different from the axis system previously used in UK standards such as BS 5950.

# 2 DIMENSIONS OF SECTIONS

## 2.1 Masses

The masses per metre have been calculated assuming that the density of steel is  $7850 \text{ kg/m}^3$ .

In all cases, including compound sections, the tabulated masses are for the steel section alone and no allowance has been made for connecting material or fittings.

## 2.2 Ratios for local buckling

The ratios of the flange outstand to thickness ( $c_f / t_f$ ) and the web depth to thickness ( $c_w / t_w$ ) are given for I, H and channel sections.

$$c_f = \frac{1}{2}[b - (t_w + 2r)] \quad \text{for I and H sections}$$

$$c_f = [b - (t_w + r)] \quad \text{for channels}$$

$$c_w = d = [h - 2(t_f + r)] \quad \text{for I, H and channel sections}$$

For circular hollow sections the ratios of the outside diameter to thickness ( $d / t$ ) are given.

For square and rectangular hollow sections the ratios ( $c_f/t$ ) and ( $c_w/t$ ) are given where:

$$c_f = b - 3t \quad \text{and} \quad c_w = h - 3t$$

For square hollow sections  $c_f$  and  $c_w$  are equal. Note that these relationships for  $c_f$  and  $c_w$  are applicable to both hot-finished and cold-formed sections.

The dimensions  $c_f$  and  $c_w$  are not precisely defined in EN 1993-1-1 and the internal profile of the corners is not specified in either EN 10210-2 or EN 10219-2. The above expressions give conservative values of the ratio for both hot-finished and cold-formed sections.

## 2.3 Dimensions for detailing

The dimensions  $C$ ,  $N$  and  $n$  have the meanings given in the figures at the heads of the tables and have been calculated according to the formulae below. The formulae for  $N$  and  $C$  make allowance for rolling tolerances, whereas the formulae for  $n$  make no such allowance.

### 2.3.1 UB sections, UC sections and bearing piles

$$N = (b - t_w) / 2 + 10 \text{ mm} \quad (\text{rounded to the nearest 2 mm above})$$

$$n = (h - d) / 2 \quad (\text{rounded to the nearest 2 mm above})$$

$$C = t_w / 2 + 2 \text{ mm} \quad (\text{rounded to the nearest mm})$$

### 2.3.2 Joists

$$N = (b - t_w) / 2 + 6 \text{ mm} \quad (\text{rounded to the nearest 2 mm above})$$

$$n = (h - d) / 2 \quad (\text{rounded to the nearest 2 mm above})$$

$$C = t_w / 2 + 2 \text{ mm} \quad (\text{rounded to the nearest mm})$$

Note: Flanges of BS 4-1 joists have an 8° taper.

### 2.3.3 Parallel flange channels

$$N = (b - t_w) + 6 \text{ mm} \quad (\text{rounded up to the nearest 2 mm above})$$

$$n = (h - d) / 2 \quad (\text{taken to the next higher multiple of 2 mm})$$

$$C = t_w + 2 \text{ mm} \quad (\text{rounded up to the nearest mm})$$

## 3 SECTION PROPERTIES

### 3.1 General

All section properties have been accurately calculated and rounded to three significant figures. They have been calculated from the metric dimensions given in the appropriate standards (see Section 1.1). For angles, BS EN 10056-1 assumes that the toe radius equals half the root radius.

### 3.2 Sections other than hollow sections

#### 3.2.1 Second moment of area ( $I$ )

The second moment of area has been calculated taking into account all tapers, radii and fillets of the sections. Values are given about both the  $y$ - $y$  and  $z$ - $z$  axes.

### 3.2.2 Radius of gyration ( $i$ )

The radius of gyration is a parameter used in the calculation of buckling resistance and is derived as follows:

$$i = [I/A]^{1/2}$$

where:

$I$  is the second moment of area about the relevant axis

$A$  is the area of the cross-section.

### 3.2.3 Elastic section modulus ( $W_{el}$ )

The elastic section modulus is used to calculate the elastic design resistance for bending or to calculate the stress at the extreme fibre of the section due to a moment. It is derived as follows:

$$W_{el,y} = I_y / z$$

$$W_{el,z} = I_z / y$$

where:

$z, y$  are the distances to the extreme fibres of the section from the elastic  $y$ - $y$  and  $z$ - $z$  axes, respectively.

For parallel flange channels, the elastic section modulus about the minor ( $z$ - $z$ ) axis is given for the extreme fibre at the toe of the section only.

For angles, the elastic section moduli about both axes are given for the extreme fibres at the toes of the section only. For elastic section moduli about the principal axes  $u$ - $u$  and  $v$ - $v$ , see AD340<sup>[16]</sup>.

For asymmetric beams, the elastic section moduli about the  $y$ - $y$  axis are given for both top and bottom extreme fibres, and about the  $z$ - $z$  axis for the extreme fibre.

### 3.2.4 Plastic section modulus ( $W_{pl}$ )

The plastic section moduli about both  $y$ - $y$  and  $z$ - $z$  axes are tabulated for all sections except angle sections.

### 3.2.5 Buckling parameter ( $U$ ) and torsional index ( $X$ )

#### ***UB sections, UC sections, joists and parallel flange channels***

The buckling parameter ( $U$ ) and torsional index ( $X$ ) have been calculated using expressions in Steelbiz document SN002 *Determination of non-dimensional slenderness of I and H sections*<sup>[22]</sup>.

$$U = \left( \frac{W_{pl,y} g}{A} \right)^{0.5} \times \left( \frac{I_z}{I_w} \right)^{0.25}$$

$$X = \sqrt{\frac{\pi^2 E A I_w}{20 G I_T I_z}}$$

where:

$W_{pl,y}$  is the plastic modulus about the major axis

$$g = \sqrt{1 - \frac{I_z}{I_y}}$$

$I_y$  is the second moment of area about the major axis



$I_z$  is the second moment of area about the minor axis

$E = 210\,000\text{ N/mm}^2$  is the modulus of elasticity

$G$  is the shear modulus where  $G = \frac{E}{2(1+\nu)}$

$\nu$  is Poisson's ratio (= 0.3)

$A$  is the cross-sectional area

$I_w$  is the warping constant

$I_T$  is the torsional constant

### ***Tee sections and ASB sections***

The buckling parameter ( $U$ ) and the torsional index ( $X$ ) have been calculated using the following expressions:

$$U = [(4 W_{pl,y}^2 g^2 / (A^2 h^2))]^{1/4}$$

$$X = 0.566 h [A / I_T]^{1/2}$$

where:

$W_{pl,y}$  is the plastic modulus about the major axis

$$g = \sqrt{1 - \frac{I_z}{I_y}}$$

$I_y$  is the second moment of area about the major axis

$I_z$  is the second moment of area about the minor axis

$A$  is the cross-sectional area

$h$  is the distance between shear centres of flanges (for T sections,  $h$  is the distance between the shear centre of the flange and the toe of the web)

$I_T$  is the torsional constant.

### **3.2.6 Warping constant ( $I_w$ ) and torsional constant ( $I_T$ )**

#### ***Rolled I sections***

The warping constant and St Venant torsional constant for rolled I sections have been calculated using the formulae given in the SCI publication P057 *Design of members subject to combined bending and torsion*<sup>[12]</sup>.

In Eurocode 3 terminology, these formulae are as follows:

$$I_w = \frac{I_z h_s^2}{4}$$

where:

$I_z$  is the second moment of area about the minor axis

$h_s$  is the distance between shear centres of flanges (i.e.  $h_s = h - t_f$ )

$$I_T = \frac{2}{3} b t_f^3 + \frac{1}{3} (h - 2t_f) t_w^3 + 2\alpha_1 D_1^4 - 0.420 t_f^4$$

where:

$$\alpha_1 = -0.042 + 0.2204 \frac{t_w}{t_f} + 0.1355 \frac{r}{t_f} - 0.0865 \frac{r t_w}{t_f^2} - 0.0725 \frac{t_w^2}{t_f^2}$$

$$D_1 = \frac{(t_f + r)^2 + (r + 0.25 t_w) t_w}{2r + t_f}$$

$b$  is the width of the section

$h$  is the depth of the section

$t_f$  is the flange thickness

$t_w$  is the web thickness

$r$  is the root radius.

### **Tee sections**

For Tee sections cut from UB and UC sections, the warping constant ( $I_w$ ) and torsional constant ( $I_T$ ) have been derived as given below.

$$I_w = \frac{1}{144} t_f^3 b^3 + \frac{1}{36} \left( h - \frac{t_f}{2} \right)^3 t_w^3$$

$$I_T = \frac{1}{3} b t_f^3 + \frac{1}{3} (h - t_f) t_w^3 + \alpha_1 D_1^4 - 0.21 t_f^4 - 0.105 t_w^4$$

where:

$$\alpha_1 = -0.042 + 0.2204 \frac{t_w}{t_f} + 0.1355 \frac{r}{t_f} - 0.0865 \frac{t_w r}{t_f^2} - 0.0725 \frac{t_w^2}{t_f^2}$$

$D_1$  is as defined above

*Note:* These formulae do not apply to tee sections cut from joists, which have tapered flanges. For such sections, expressions are given in SCI Publication 057<sup>[12]</sup>.

### **Parallel flange channels**

For parallel flange channels, the warping constant ( $I_w$ ) and torsional constant ( $I_T$ ) have been calculated as follows:

$$I_w = \frac{(h - t_f)^2}{4} \left[ I_z - A \left( c_z - \frac{t_w}{2} \right)^2 \left( \frac{(h - t_f)^2 A}{4I_y} - 1 \right) \right]$$

$$I_T = \frac{2}{3} b t_f^3 + \frac{1}{3} (h - 2t_f) t_w^3 + 2\alpha_3 D_3^4 - 0.42 t_f^4$$

where:

$c_z$  is the distance from the back of the web to the centroidal axis

$$\alpha_3 = -0.0908 + 0.2621 \frac{t_w}{t_f} + 0.1231 \frac{r}{t_f} - 0.0752 \frac{t_w r}{t_f^2} - 0.0945 \left( \frac{t_w}{t_f} \right)^2$$

$$D_3 = 2 \left[ (3r + t_w + t_f) - \sqrt{2(2r + t_w)(2r + t_f)} \right]$$

*Note:* The formula for the torsional constant ( $I_T$ ) is applicable to parallel flange channels only and does not apply to tapered flange channels.

## Angles

For angles, the torsional constant ( $I_T$ ) is calculated as follows:

$$I_T = \frac{1}{3}bt^3 + \frac{1}{3}(h-t)t^3 + \alpha_3 D_3^4 - 0.21t^4$$

where:

$$\alpha_3 = 0.0768 + 0.0479 \frac{r}{t}$$

$$D_3 = 2 \left[ (3r + 2t) - \sqrt{2(2r + t)^2} \right]$$

## ASB sections

For ASB sections the warping constant ( $I_w$ ) and torsional constant ( $I_T$ ) are as given in Tata brochure, *Advance® sections* [11].

### 3.2.7 Equivalent slenderness coefficient ( $\phi$ ) and monosymmetry index ( $\psi$ )

#### Angles

The buckling resistance moments for angles have not been included in the bending resistance tables of this publication as angles are predominantly used in compression and tension only. Where the designer wishes to use an angle section in bending, BS EN 1993-1-1, 6.3.2 enables the buckling resistance moment for angles to be determined. The procedure is quite involved.

As an alternative to the procedure in BS EN 1993-1-1, supplementary section properties have been included for angle sections in this publication which enable the designer to adopt a much simplified method for determining the buckling resistance moment. The method is based on that given in BS 5950-1:2000 Annex B.2.9 and makes use of the equivalent slenderness coefficient and the monosymmetry index.

The equivalent slenderness coefficient ( $\phi_a$ ) is tabulated for both equal and unequal angles. Two values of the equivalent slenderness coefficient are given for each unequal angle. The larger value is based on the major axis elastic section modulus ( $W_{el,u}$ ) to the toe of the short leg and the lower value is based on the major axis elastic section modulus to the toe of the long leg.

The equivalent slenderness coefficient ( $\phi_a$ ) is calculated as follows:

$$\phi_a = \frac{W_{el,u} g}{\sqrt{AI_T}}$$

where:

$W_{el,u}$  is the elastic section modulus about the major axis u-u

$$g = \sqrt{1 - \frac{I_v}{I_u}}$$

$I_v$  is the second moment of area about the minor axis

$I_u$  is the second moment of area about the major axis

$A$  is the area of the cross-section

$I_T$  is the torsional constant.

The monosymmetry index ( $\psi_a$ ) is calculated as follows:

$$\psi_a = \left[ 2v_0 - \frac{\int v_i (u_i^2 + v_i^2) dA}{I_u} \right] \frac{1}{t}$$

where:

- $u_i$  and  $v_i$  are the coordinates of an element of the cross-section
- $v_0$  is the coordinate of the shear centre along the  $v$ - $v$  axis, relative to the centroid
- $t$  is the thickness of the angle.

### **Tee sections**

The monosymmetry index is tabulated for Tee sections cut from UBs and UCs. It has been calculated as:

$$\psi = \left( 2z_0 - \frac{z_0 b^3 t_f / 12 + b t_f z_0^3 + \frac{t_w}{4} [(c - t_f)^4 - (h - c)^4]}{I_y} \right) \frac{1}{(h - t_f / 2)}$$

where:

- $z_0 = c - t_f / 2$
- $c$  is the width of the flange outstand ( $= (b - t_w - 2r) / 2$ )
- $b$  is the flange width
- $t_f$  is the flange thickness
- $t_w$  is the web thickness
- $h$  is the depth of the section.

The above expression is based on BS 5950-1, Annex B.2.8.2.

### **ASB sections**

The monosymmetry index is tabulated for ASB sections. It has been calculated using the equation in BS 5950-1, Annex B.2.4.1, re-expressed in BS EN 1993-1-1 nomenclature:

$$\psi = \frac{1}{h_s} \left( \frac{2(I_{zc} h_c - I_{zt} h_t)}{(I_{zc} + I_{zt})} - \frac{(I_{zc} h_c - I_{zt} h_t) + (b_c t_c h_c^3 - b_t t_t h_t^3) + \frac{t}{4} (d_c^4 - d_t^4)}{I_y} \right)$$

where:

- $h_s = \left( h - \frac{t_c + t_t}{2} \right)$
- $d_c = h_c - t_c / 2$
- $d_t = h_t - t_t / 2$
- $I_{zc} = b_c^3 t_c / 12$
- $I_{zt} = b_t^3 t_t / 12$
- $h_c$  is the distance from the centre of the compression flange to the centroid of the section

- $h_t$  is the distance from the centre of the tension flange to the centroid of the section
- $b_c$  is the width of the compression flange
- $b_t$  is the width of the tension flange
- $t_c$  is the thickness of the compression flange
- $t_t$  is the thickness of the tension flange.

For ASB sections  $t_c = t_t$  and this is shown as  $t_f$  in the tables.

### 3.3 Hollow sections

Section properties are given for both hot-finished and cold-formed hollow sections (but not for cold-formed elliptical hollow sections). For the same overall dimensions and wall thickness, the section properties for square and rectangular hot-finished and cold-formed sections are different because the corner radii are different.

#### 3.3.1 Common properties

For general comment on second moment of area, radius of gyration, elastic and plastic modulus, see Sections 3.2.1, 3.2.2, 3.2.3 and 3.2.4.

For hot-finished square and rectangular hollow sections, the section properties have been calculated using corner radii of  $1.5t$  externally and  $1.0t$  internally, as specified by BS EN 10210-2<sup>[8]</sup>.

For cold-formed square and rectangular hollow sections, the section properties have been calculated using the external corner radii of  $2t$  if  $t \leq 6$  mm,  $2.5t$  if  $6 \text{ mm} < t \leq 10$  mm and  $3t$  if  $t > 10$  mm, as specified by BS EN 10219-2<sup>[9]</sup>. The internal corner radii used are  $1.0t$  if  $t \leq 6$  mm,  $1.5t$  if  $6 \text{ mm} < t \leq 10$  mm and  $2t$  if  $t > 10$  mm, as specified by BS EN 10219-2<sup>[9]</sup>.

#### 3.3.2 Plastic section modulus of hollow sections ( $W_{pl}$ )

The plastic section moduli ( $W_{pl}$ ) about both principal axes are given in the tables.

#### 3.3.3 Torsional constant ( $I_T$ )

For circular hollow sections:

$$I_T = 2I$$

For square, rectangular and elliptical hollow sections:

$$I_T = \frac{4A_p^2 t}{p} + \frac{t^3 p}{3}$$

where:

- $I$  is the second moment of area of a CHS
- $t$  is the thickness of the section
- $p$  is the mean perimeter length

For square and rectangular hollow sections:  $p = 2 [(b - t) + (h - t)] - 2 R_c (4 - \pi)$

For elliptical hollow sections:  $p = \frac{\pi}{2} (h + b - 2t) \left( 1 + 0.25 \left( \frac{h - b}{h + b - 2t} \right)^2 \right)$

$A_p$  is the area enclosed by the mean perimeter

For square and rectangular hollow sections:  $A_p = (b - t)(h - t) - R_c^2(4 - \pi)$

For elliptical hollow sections:  $A_p = \frac{\pi(h - t)(b - t)}{4}$

$R_c$  is the average of the internal and external corner radii

### 3.3.4 Torsional section modulus ( $W_t$ )

$W_t = 2W_{el}$  for circular hollow sections

$W_t = \frac{I_T}{\left(t + \frac{2A_p}{p}\right)}$  for square, rectangular and elliptical hollow sections

where:

$W_{el}$  is the elastic modulus and  $I_T$ ,  $t$ ,  $A_p$  and  $p$  are as defined in Section 3.3.3.

## 4 EFFECTIVE SECTION PROPERTIES

### 4.1 General

In BS EN 1993-1-1:2005, effective section properties are required for the design of members with Class 4 cross-sections. In this publication, effective section properties are given for sections subject to compression only and bending only. Effective section properties depend on the grade of steel used and are given for rolled I sections and angles in S275 and S355. Channels are not Class 4 and therefore no effective section properties are provided. For hot-finished and cold-formed hollow sections, effective section properties are only given for S355.

### 4.2 Effective section properties of members subject to compression

The effective cross section properties of Class 4 cross-sections are based on the effective widths of the compression parts.

The effective cross-sectional area,  $A_{eff}$ , of Class 4 sections in compression is calculated in accordance with BS EN 1993-1-1, 6.2.2.5 and BS EN 1993-1-5:2006, 4.3 and 4.4.

The effective section properties tables list the sections that can be Class 4 and the identifier 'W', 'F' or 'W, F' indicates whether the section is Class 4 due to the web, the flange or both. In rectangular hollow sections subject to bending about the major axis, the flanges are the short sides and the webs are the long sides.

The effective area of the section is calculated from:

For UB, UC and joists:  $A_{eff} = A - 4 t_f (1 - \rho_f) c_f - t_w (1 - \rho_w) c_w$

For rectangular hollow sections and square hollow sections:

$$A_{eff} = A - 2 t_f (1 - \rho_f) c_f - 2 t_w (1 - \rho_w) c_w$$

For parallel flange channels:  $A_{eff} = A - 2 t_f (1 - \rho_f) c_f - t_w (1 - \rho_w) c_w$

For equal angles:  $A_{eff} = A - 2 t (1 - \rho) h$

For unequal angles:  $A_{\text{eff}} = A - t(1 - \rho)(h + b)$

For circular hollow sections: Effective areas are not tabulated for circular hollow sections in this publication. BS EN 1993-1-1 6.2.2.5(5) refers the reader to BS EN 1993-1-6.

For elliptical hollow sections: Effective areas are not tabulated in this publication, but may be calculated from:<sup>[14]</sup>

$$A_{\text{eff}} = A \left( \frac{90t}{D_e} \frac{235}{f_y} \right)^{0.5}$$

where:

$$D_e \text{ is the equivalent diameter} = \frac{h^2}{b}$$

Expressions for the reduction factors  $\rho_t$ ,  $\rho_w$  and  $\rho$  are given in BS EN 1993-1-5, 4.4.

The ratio of effective area to gross area ( $A_{\text{eff}}/A$ ) is also given in the tables to provide a guide as to how much of the section is effective. Note that although BS EN 1993-1-1 classifies some sections as Class 4, their effective area according to BS EN 1993-1-5 is equal to the gross area.

### 4.3 Effective section properties of members subject to pure bending

The effective cross section properties of Class 4 cross-sections are based on the effective widths of the compression parts. The effective cross-sectional properties for Class 4 sections in bending have been calculated in accordance with BS EN 1993-1-1, 6.2.2.5 and BS EN 1993-1-5:2006, 4.3 and 4.4.

Cross-section properties are given for the effective second moment of area,  $I_{\text{eff}}$ , and the effective elastic section modulus,  $W_{\text{el,eff}}$ . The identifier 'W' or 'F' indicates whether the web or the flange controls the section Class 4 classification.

Equations for the effective section properties are not shown here because the process for determining these properties requires iteration. Also the equations are dependent on the classification status of each component part.

For the range of sections covered by this publication, only a selection of the hollow sections become Class 4 when subject to bending alone, in the major axis. Many rectangular hollow sections become Class 4 when subject to bending about the minor axis.

For cross-sections with a Class 3 web and Class 1 or 2 flanges, an effective plastic modulus,  $W_{\text{pl,eff}}$ , can be calculated following the recommendations given in BS EN 1993-1-1, 6.2.2.4 (1). This clause is applicable to open sections (UB, UC, joists and channels) and hollow sections.

For the range of sections covered by this publication, only a limited number of the hollow sections can be used with an effective plastic modulus,  $W_{\text{pl,eff}}$ , when subject to bending alone.

## 5 INTRODUCTION TO RESISTANCE TABLES

Reference

### 5.1 General

EN 1993-1-1  
unless  
otherwise  
noted

The design resistances given in the tables have been calculated using exact values of the section properties calculated from the specified dimensions. The values obtained have then been rounded to 3 significant figures.

Design resistance tables are given for steel grades S275 and S355, except for hollow sections where tables are given for grade S355 only (both hot finished and cold formed).

The following partial factors for resistance have been used throughout the publication for the calculation of the design resistances. The values are those given in the relevant UK National Annexes to Eurocode 3:

$\gamma_{M0}$  = 1.0 for the resistance of cross-sections

$\gamma_{M1}$  = 1.0 for the resistance of members

$\gamma_{M2}$  = 1.25 for bolts

$\gamma_{M2}$  = 1.25 for welds

$\gamma_{M3}$  = 1.25 for slip resistance at ULS

$\gamma_{M3,ser}$  = 1.1 for slip resistance at SLS

### 5.2 Yield strength

The member resistance tables are based on the following values of yield strength  $f_y$ .

3.2.1

Steel Grade	Maximum Thickness less than or equal to (mm)	Yield strength $f_y$ (N/mm <sup>2</sup> )
S275	16	275
	40	265
	63	255
	80	245
S355	16	355
	40	345
	63	335
	80	325

EN 10025-2

EN 10210-1

EN 10219-1

The above values are those given in the product standards BS 10025-2:2004 for open sections, BS EN 10210-1:2006 for hot-finished hollow sections and BS EN 10219-1:2006 for cold-formed hollow sections. The use of the values in the product standards is specified in the National Annex to BS EN 1993-1-1.



## 6 COMPRESSION TABLES

### 6.1 Compression members: UB and UC sections

6.2.4

#### (a) Design resistance of the cross-section, $N_{c,Rd}$

6.2.4 (2)

The design resistance is given by:

(i) For Class 1, 2 or 3 cross-sections:

$$N_{c,Rd} = \frac{A f_y}{\gamma_{M0}}$$

(ii) For Class 4 cross-sections:

$$N_{c,Rd} = \frac{A_{\text{eff}} f_y}{\gamma_{M0}}$$

where:

$A$  is the gross area of the cross-section

$f_y$  is the yield strength

$A_{\text{eff}}$  is the effective area of the cross-section in compression

$\gamma_{M0}$  is the partial factor for resistance of cross-sections ( $\gamma_{M0} = 1.0$  as given in the National Annex)

For Class 1, 2 and 3 cross sections the value of  $N_{c,Rd}$  is the same as the plastic resistance,  $N_{pl,Rd}$  given in the tables for axial force and bending, and is therefore not given in the compression tables.

For Class 4 sections, the value of  $N_{c,Rd}$  can be calculated using the effective areas tabulated in Section B of this publication. The values are not shown in the tables.

None of the universal columns are Class 4 under axial compression alone according to BS EN 1993-1-1, but some universal beams are Class 4 and these sections are marked thus\*.

The sections concerned are UB where the width to thickness ratio for the web in compression is:

Table 5.2

$$c/t = d/t_w > 42\varepsilon$$

where:

$d$  is the depth of straight portion of the web (i.e. the depth between fillets)

$t_w$  is the thickness of the web

$$\varepsilon = (235/f_y)^{0.5}$$

$f_y$  is the yield strength.

**(b) Design buckling resistance**

Design buckling resistances for two modes of buckling are given in the tables:

- Flexural buckling resistance, about each of the two principal axes:  $N_{b,y,Rd}$  and  $N_{b,z,Rd}$
- Torsional buckling resistance,  $N_{b,T,Rd}$

No resistances are given for torsional-flexural buckling because this mode of buckling does not occur in doubly symmetrical cross sections.

**(i) Design flexural buckling resistance,  $N_{b,y,Rd}$  and  $N_{b,z,Rd}$** 

The design flexural buckling resistances  $N_{b,y,Rd}$  and  $N_{b,z,Rd}$  depend on the non-dimensional slenderness ( $\bar{\lambda}$ ), which in turn depends on:

- The buckling lengths ( $L_{cr}$ ) given at the head of the table.
- The properties of the cross-section.

The non-dimensional slenderness has been calculated as follows:

6.3.1.3

For Class 1, 2 or 3 cross-sections:

$$\bar{\lambda}_y = \frac{L_{cr,y}}{93.9 \varepsilon i_y} \quad \text{for } y\text{-}y \text{ axis buckling}$$

$$\bar{\lambda}_z = \frac{L_{cr,z}}{93.9 \varepsilon i_z} \quad \text{for } z\text{-}z \text{ axis buckling}$$

For Class 4 cross-sections:

$$\bar{\lambda}_y = \frac{L_{cr,y}}{93.9 \varepsilon i_y} \sqrt{\frac{A_{eff}}{A}} \quad \text{for } y\text{-}y \text{ axis buckling}$$

$$\bar{\lambda}_z = \frac{L_{cr,z}}{93.9 \varepsilon i_z} \sqrt{\frac{A_{eff}}{A}} \quad \text{for } z\text{-}z \text{ axis buckling}$$

where:

$L_{cr,y}$ ,  $L_{cr,z}$  are the buckling lengths for the  $y$ - $y$  and  $z$ - $z$  axes respectively

$i_y$ ,  $i_z$  are the radii of gyration about  $y$ - $y$  and  $z$ - $z$  axes respectively.

The tabulated buckling resistance is only based on Class 4 cross-section properties if this value of force is sufficient to make the cross-section Class 4 under combined axial force and bending. The value of  $n$  ( $= N_{Ed}/N_{pl,Rd}$ ) at which the cross-section becomes Class 4 is shown in the tables for axial force and bending. Otherwise, the buckling resistance is based on Class 3 cross section properties. Tabulated values based on the Class 4 cross-section properties are printed in italic type.

An example is given below:

533 × 210 × 101 UB S275

For this section,  $c/t = d/t_w = 44.1 > 42\varepsilon = 39.6$

Hence, the cross section is Class 4 under compression alone.

The value of axial force at which the section becomes Class 4 is  $N_{Ed} = 2890$  kN (see axial force and bending table, where  $n = 0.845$  and  $N_{pl,Rd} = 3420$  kN).

For  $L_{cr,y} = 4$  m,  $N_{b,y,Rd} = 3270$  kN

The table shows 3270 kN in italic type because the value is greater than the value at which the cross-section becomes Class 4

For  $L_{cr,y} = 14$  m,  $N_{b,y,Rd} = 2860$  kN

The table shows 2860 kN in normal type because the value is less than the value at which cross-section becomes Class 4 (2890 kN).

(ii) Design torsional buckling resistance,  $N_{b,T,Rd}$

The design torsional buckling resistance  $N_{b,T,Rd}$  depends on the non-dimensional slenderness ( $\bar{\lambda}_T$ ), which in turn depends on:

6.3.1.4

- The buckling lengths ( $L_{cr}$ ) given at the head of the table
- The properties of the cross-section.

The non-dimensional slenderness has been calculated as follows:

$$\bar{\lambda}_T = \sqrt{\frac{A f_y}{N_{cr,T}}} \quad \text{for Class 1, 2 or 3 cross-sections}$$

$$\bar{\lambda}_T = \sqrt{\frac{A_{eff} f_y}{N_{cr,T}}} \quad \text{for Class 4 cross-sections}$$

where:

$$N_{cr,T} \text{ is the elastic torsional buckling force, given by } \frac{1}{i_0^2} \left( GI_T + \frac{\pi^2 EI_w}{L_{cr}^2} \right)$$

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SN001<sup>[23]</sup>

where:

$$i_0 = \sqrt{i_y^2 + i_z^2 + y_0^2}$$

$y_0$  is the distance from the shear centre to the centroid of the gross cross-section along the y-y axis (zero for doubly symmetric sections).

## 6.2 Compression members: hollow sections

6.2.4

### (a) Design resistance of the cross-section, $N_{c,Rd}$

6.2.4 (2)

The design resistance is given by:

(i) For Class 1, 2 or 3 cross-sections:

$$N_{c,Rd} = \frac{A f_y}{\gamma_{M0}}$$

(ii) For Class 4 cross-sections:

$$N_{c,Rd} = \frac{A_{eff} f_y}{\gamma_{M0}}$$

where:

- $A$  is the gross area of the cross-section
- $f_y$  is the yield strength
- $A_{\text{eff}}$  is the effective area of the cross-section in compression
- $\gamma_{M0}$  is the partial factor for resistance of cross-sections ( $\gamma_{M0} = 1.0$  as given in the National Annex).

For Class 1, 2 and 3 cross-sections, the value of  $N_{c,Rd}$  is the same as the plastic resistance,  $N_{pl,Rd}$  given in the tables for axial force and bending, and is therefore not given in the compression tables.

For Class 4 sections, the value of  $N_{c,Rd}$  can be calculated using the effective areas tabulated in Section B of this publication. The values are not shown in the tables.

Sections that are Class 4 under axial compression are marked thus \*. The sections concerned are:

- Square hollow sections, where  $c/t > 42\varepsilon$  and  $c = h - 3t$  Table 5.2
- Rectangular hollow sections, where  $c_w/t > 42\varepsilon$  and  $c_w = h - 3t$
- Circular hollow sections, where  $d/t > 90\varepsilon^2$

where:

- $h$  is the overall depth of the cross-section
- $t$  is the thickness of the wall
- $\varepsilon = (235/f_y)^{0.5}$
- $f_y$  is the yield strength.

- Elliptical hollow sections, where  $\frac{D_e}{t} > 90\varepsilon^2$  (See Reference 15)

Where:

$D_e$  is defined in Section 4.2.

### (b) Design buckling resistance 6.3.1.1

Design buckling resistances for flexural buckling are given in the tables.

The design flexural buckling resistances  $N_{b,y,Rd}$  and  $N_{b,z,Rd}$  depend on the non-dimensional slenderness ( $\bar{\lambda}$ ), which in turn depends on:

- The buckling lengths ( $L_{cr}$ ) given at the head of the table.
- The properties of the cross-section.

The non-dimensional slenderness has been calculated as follows: 6.3.1.3

For Class 1, 2 or 3 cross-sections:

$$\bar{\lambda}_y = \frac{L_{cr,y}}{93.9\varepsilon i_y} \quad \text{for } y\text{-}y \text{ axis buckling}$$

$$\bar{\lambda}_z = \frac{L_{cr,z}}{93.9 \varepsilon i_z} \quad \text{for } z\text{-}z \text{ axis buckling}$$

For Class 4 cross-sections:

$$\bar{\lambda}_y = \frac{L_{cr,y}}{93.9 \varepsilon i_y} \sqrt{\frac{A_{\text{eff}}}{A}} \quad \text{for } y\text{-}y \text{ axis buckling}$$

$$\bar{\lambda}_z = \frac{L_{cr,z}}{93.9 \varepsilon i_z} \sqrt{\frac{A_{\text{eff}}}{A}} \quad \text{for } z\text{-}z \text{ axis buckling}$$

where:

$L_{cr,y}, L_{cr,z}$  are the buckling lengths for the  $y$ - $y$  and  $z$ - $z$  axes respectively.

$i_y, i_z$  are the radii of gyration about the  $y$ - $y$  and  $z$ - $z$  axes respectively.

The tabulated buckling resistance is only based on Class 4 cross-section properties when the value of the force is sufficient to make the cross-section Class 4 under combined axial force and bending. The value of  $n$  ( $= N_{Ed} / N_{pl,Rd}$ ) at which the cross section becomes Class 4 is shown in the tables for axial force and bending. Otherwise, the buckling resistance is based on Class 3 cross-section properties. Tabulated values based on the Class 4 cross-section properties are printed in italic type.

For Class 4 circular hollow sections, BS EN 1993-1-1 refers the user to BS EN 1993-1-6. Resistance values for these sections have not been calculated and the symbol, \$, is shown instead.

For Class 4 elliptical hollow sections, the design buckling resistance has been taken as the greater of:

1. The design buckling resistance based on an effective area (see Section 4.2) and
2. The design buckling resistance based on the gross area, but reducing the design strength such that the section remains Class 3. The reduced design strength,  $f_{y,\text{reduced}}$ , is given by

$$f_{y,\text{reduced}} = \frac{235 \times 90 \times t}{D_e}$$

$D_e$  is defined in Section 4.2.

### 6.3 Compression members: parallel flange channels 6.2.4

#### (a) Design resistance of the cross-section, $N_{c,Rd}$ 6.2.4(2)

The design resistance is given by:

$$N_{c,Rd} = \frac{A f_y}{\gamma_{M0}}$$

where:

$A$  is the gross area of the cross-section

$f_y$  is the yield strength

$\gamma_{M0}$  is the partial factor for resistance of cross-sections ( $\gamma_{M0} = 1.0$  as given in the National Annex).

The value of  $N_{c,Rd}$  is the same as the plastic resistance,  $N_{pl,Rd}$ , given in the tables for axial force and bending and is, therefore, not given in the compression tables.

## (b) Design buckling resistance

Design buckling resistance values are given for the following cases:

- Single channel subject to concentric axial force.
- Single channel connected only through its web, by two or more bolts arranged symmetrically in a single row across the web.

### 1. Single channel subject to concentric axial force

Design buckling resistances for two modes of buckling are given in the tables:

- Flexural buckling resistance about the two principal axes:  $N_{b,y,Rd}$  and  $N_{b,z,Rd}$ .
- Torsional or torsional-flexural buckling resistance, whichever is less,  $N_{b,T,Rd}$ .

#### (i) Design flexural buckling resistance, $N_{b,y,Rd}$ and $N_{b,z,Rd}$

The design flexural buckling resistances  $N_{b,y,Rd}$  and  $N_{b,z,Rd}$  depend on the non-dimensional slenderness ( $\bar{\lambda}$ ) which, in turn, depends on:

- The buckling lengths ( $L_{cr}$ ) given at the head of the table.
- The properties of the cross-section.
- The non-dimensional slenderness, which has been calculated as follows:

$$\bar{\lambda}_y = \frac{L_{cr,y}}{93.9 \varepsilon i_y} \quad \text{for } y\text{-}y \text{ axis buckling}$$

$$\bar{\lambda}_z = \frac{L_{cr,z}}{93.9 \varepsilon i_z} \quad \text{for } z\text{-}z \text{ axis buckling}$$

where:

$L_{cr,y}, L_{cr,z}$  are the buckling lengths for the  $y\text{-}y$  and  $z\text{-}z$  axes respectively.

#### (ii) Design torsional and torsional-flexural buckling resistance, $N_{b,T,Rd}$

The resistance tables give the lesser of the torsional and the torsional-flexural buckling resistances. These resistances depend on the non-dimensional slenderness ( $\bar{\lambda}_T$ ), which in turn depends on:

- The buckling lengths ( $L_{cr}$ ) given at the head of the table.
- The properties of the cross-section.
- The non-dimensional slenderness, which has been calculated as follows:

$$\bar{\lambda}_T = \max \left( \sqrt{\frac{A f_y}{N_{cr,T}}}; \sqrt{\frac{A f_y}{N_{cr,TF}}} \right)$$

6.3.1.3

where:

$$N_{cr,T} \text{ is the elastic torsional buckling force, } = \frac{1}{i_0^2} \left( GI_T + \frac{\pi^2 EI_w}{L_{cr}^2} \right)$$

$$i_0 = \sqrt{i_y^2 + i_z^2 + y_0^2}$$

$y_0$  is the distance along the  $y$ - axis from the shear centre to the centroid of the gross cross-section.

$N_{cr,TF}$  is the elastic torsional-flexural buckling force,  $= A\sigma_{TF}$

$$\sigma_{TF} = \frac{1}{2\beta} \left( (\sigma_{Ey} + \sigma_T) - \sqrt{(\sigma_{Ey} + \sigma_T)^2 - 4\beta\sigma_{Ey}\sigma_T} \right)$$

$$\sigma_{Ey} = \frac{\pi^2 E}{(L_{ey} / i_y)^2}$$

$$\sigma_T = N_{cr,T} / A$$

$$\beta = 1 - (y_0/i_0)^2$$

$L_{ey}$  is the unrestrained length considering buckling about the  $y$ - $y$  axis.

## 2. Single channel connected only through its web, by two or more bolts arranged symmetrically in a single row across the web

Design buckling resistances for two modes of buckling are given in the tables:

- Flexural buckling resistance about each of the two principal axes:  $N_{b,y,Rd}$  and  $N_{b,z,Rd}$ . 6.3.1
- Torsional or torsional-flexural buckling resistance, whichever is less,  $N_{b,T,Rd}$ .

(i) Design flexural buckling resistance,  $N_{b,y,Rd}$  and  $N_{b,z,Rd}$

The design flexural buckling resistances,  $N_{b,y,Rd}$  and  $N_{b,z,Rd}$ , depend on the non-dimensional slenderness ( $\bar{\lambda}$ ), which in turn depends on:

- The system length ( $L$ ) given at the head of the tables.  $L$  is the distance between intersections of the centroidal axes of the channel and the members to which it is connected.
- The properties of the cross-section.
- The non-dimensional slenderness, which has been calculated as follows:

$$\bar{\lambda}_y = \frac{L_y}{93.9 \varepsilon i_y} \quad \text{for } y\text{-}y \text{ axis buckling} \quad \text{Annex BB.1.2}$$

$$\bar{\lambda}_{\text{eff},z} \geq 0.5 + 0.7 \bar{\lambda}_z \quad \text{where } \bar{\lambda}_z = \frac{L_z}{93.9 \varepsilon i_z} \quad \text{for } z\text{-}z \text{ axis buckling}$$

(Based on a similar rationale given in Annex BB.1.2 for angles)

where:

$L_{cr,y}, L_{cr,z}$  are the lengths between intersections

$i_y, i_z$  are the radii of gyration about the  $y$ - $y$  and  $z$ - $z$  axes.

$$\varepsilon = (235/f_y)^{0.5}$$

(ii) Design torsional and torsional-flexural buckling resistance,  $N_{b,T,Rd}$  6.3.1.4

The torsional and torsional-flexural buckling resistance has been calculated as given above for single channels subject to concentric force.

## 6.4 Compression members: single angles

### (a) Design buckling resistance

6.3.1.1

Design buckling resistances for 2 modes of buckling, noted as F and T, are given in the tables:

- F: Flexural buckling resistance (taking torsional-flexural buckling effects into account),  $N_{b,y,Rd}$  and  $N_{b,z,Rd}$ .
- T: Torsional buckling resistance,  $N_{b,T,Rd}$ .

(i) Design flexural buckling resistance,  $N_{b,y,Rd}$ ,  $N_{b,z,Rd}$

The tables give the lesser of the design flexural buckling resistance and the torsional flexural buckling resistance.

The design flexural buckling resistances,  $N_{b,y,Rd}$  and  $N_{b,z,Rd}$ , depend on the non-dimensional slenderness ( $\bar{\lambda}_{eff}$ ) which, in turn, depends on:

- The system length ( $L$ ) given at the head of the tables.  $L$  is the distance between intersections of the centroidal axes (or setting out line of the bolts) of the angle and the members to which it is connected.
- The properties of the cross-section.
- The non-dimensional slenderness, which has been calculated as follows:

For two or more bolts in standard clearance holes in line along the angle at each end or an equivalent welded connection, the slenderness has been taken as:

For Class 3 cross-sections:

$$\bar{\lambda}_{eff,y} = 0.5 + 0.7 \bar{\lambda}_y \quad \text{where} \quad \bar{\lambda}_y = \frac{L_y}{93.9 \varepsilon i_y}$$

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BB.1.2

$$\bar{\lambda}_{eff,z} = 0.5 + 0.7 \bar{\lambda}_z \quad \text{where} \quad \bar{\lambda}_z = \frac{L_z}{93.9 \varepsilon i_z}$$

$$\bar{\lambda}_{eff,v} = 0.35 + 0.7 \bar{\lambda}_v \quad \text{where} \quad \bar{\lambda}_v = \frac{L_v}{93.9 \varepsilon i_v}$$

For Class 4 cross-sections:

$$\bar{\lambda}_{eff,y} = 0.5 + 0.7 \bar{\lambda}_y \quad \text{where} \quad \bar{\lambda}_y = \frac{L_y}{93.9 \varepsilon i_y} \sqrt{\frac{A_{eff}}{A}}$$

$$\bar{\lambda}_{eff,z} = 0.5 + 0.7 \bar{\lambda}_z \quad \text{where} \quad \bar{\lambda}_z = \frac{L_z}{93.9 \varepsilon i_z} \sqrt{\frac{A_{eff}}{A}}$$

$$\bar{\lambda}_{eff,v} = 0.35 + 0.7 \bar{\lambda}_v \quad \text{where} \quad \bar{\lambda}_v = \frac{L_v}{93.9 \varepsilon i_v} \sqrt{\frac{A_{eff}}{A}}$$



where:

$L_y$ ,  $L_z$  and  $L_v$  are the system lengths between intersections.

These expressions take account of the torsional flexural buckling effects as well as the flexural buckling effects.

For the case of a single bolt at each end, BS EN 1993-1-1 refers the user to 6.2.9 to take account of the eccentricity. (Note: no values are given for this case).

(ii) Design torsional buckling resistance,  $N_{b,T,Rd}$

The design torsional buckling resistance  $N_{b,T,Rd}$  depends on the non-dimensional slenderness ( $\bar{\lambda}_T$ ) which, in turn, depends on: 6.3.1.3

- The system length ( $L$ ) given at the head of the table.
- The properties of the cross-section.
- The non-dimensional slenderness, which has been calculated as follows:

$$\bar{\lambda}_T = \sqrt{\frac{Af_y}{N_{cr,T}}} \quad \text{for Class 1, 2 or 3 cross-sections} \quad 6.3.1.4(2)$$

$$\bar{\lambda}_T = \sqrt{\frac{A_{eff}f_y}{N_{cr,T}}} \quad \text{for Class 4 cross-sections}$$

where:

$N_{cr,T}$  is the elastic torsional buckling force =  $\frac{AGI_T}{I_0}$

$G = \frac{E}{2(1+\nu)}$  is the shear modulus

$E$  is the modulus of elasticity

$\nu$  is Poisson's ratio (= 0.3)

$I_T$  is the torsional constant

$$I_0 = I_u + I_v + A(u_0^2 + v_0^2)$$

$I_u$  is the second moment of area about the  $u$ - $u$  axis

$I_v$  is the second moment of area about the  $v$ - $v$  axis

$u_0$  is the distance from shear centre to the  $v$ - $v$  axis

$v_0$  is the distance from shear centre to the  $u$ - $u$  axis.

## 7 TENSION TABLES

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### 7.1 Tension members: Single angles

6.2.3

For angles in tension connected through one leg, BS EN 1993-1-1, 6.2.3(5) refers to BS EN 1993-1-8, 3.10.3. However, the Eurocode does not cover the case of more than one bolt in the direction perpendicular to the applied load. Therefore, the resistance has been calculated using expressions from BS 5950-1 for angles bolted and welded through one leg. The resistance is independent of the number of bolts along the angle and their spacing. Tables only give values for the cross-sectional check; see AD351<sup>[17]</sup> for more information.

The value of the design resistance to tension,  $N_{t,Rd}$ , has been calculated as follows:

6.2.3(2)

$$N_{t,Rd} = \frac{A_{eq} f_y}{\gamma_{M0}}$$

where:

$A_{eq}$  is the equivalent tension area of the angle

$f_y$  is the yield strength

$\gamma_{M0}$  is the partial factor for resistance of cross sections ( $\gamma_{M0} = 1.0$ , as given in the National Annex).

The equivalent tension area of the section  $A_{eq}$  is given by:

For bolted sections:  $A_{eq} = A_e - 0.5a_2$

For welded sections:  $A_{eq} = A_e - 0.3a_2$

where:

$A_e = a_{e1} + a_{e2}$  but  $A_e \leq 1.2 (a_{n1} + a_{n2})$

$a_{e1} = K_e a_{n1}$  but  $a_{e1} \leq a_1$

$a_{e2} = K_e a_{n2}$  but  $a_{e2} \leq a_2$

$K_e = 1.2$  for grade S275

$= 1.1$  for grade S355

$a_{n1} = a_1 - n_{bolts} d_0$

$a_1 = h \times t$  if the long leg is connected

$= b \times t$  if the short leg is connected

$n_{bolts}$  is the number of bolts across the angle

$d_0$  is the diameter of the hole

$a_{n2} = a_2$

$a_2 = A - a_1$

$A$  is the gross area of a single angle.

Note: A block tearing check (BS EN 1993-1-8, 3.10.2) is also required for tension members. However, block tearing resistances have not been tabulated, as there are too many variables in the possible bolt arrangements

## 8 BENDING TABLES

### 8.1 Bending: UB sections, UC sections, joists and parallel flange channels 6.2.5 (2)

#### (a) Design resistance of cross-section

The design resistances for bending about the principal axes of the cross-section are given by: 6.2.8 (2)

(i) For Class 1, 2 cross-sections:

$$M_{c,y,Rd} = \frac{W_{pl,y} f_y}{\gamma_{M0}} \quad M_{c,z,Rd} = \frac{W_{pl,z} f_y}{\gamma_{M0}}$$

(ii) For Class 3 cross-sections with a Class 1 or 2 flange:

$$M_{c,y,Rd} = \frac{W_{pl,eff,y} f_y}{\gamma_{M0}}$$

where  $W_{pl,eff,y}$  is calculated according to BS EN 1993-1-5, 4.4.

(iii) For other Class 3 cross-sections:

$$M_{c,y,Rd} = \frac{W_{el,y} f_y}{\gamma_{M0}} \quad M_{c,z,Rd} = \frac{W_{el,z} f_y}{\gamma_{M0}}$$

(iv) For Class 4 cross-sections:

$$M_{c,y,Rd} = \frac{W_{eff,y} f_y}{\gamma_{M0}} \quad M_{c,z,Rd} = \frac{W_{eff,z} f_y}{\gamma_{M0}}$$

Notes:

- None of the universal beams, universal columns, joists or parallel flange channels in grade S275 or S355 are Class 4 under bending alone.
- Where the design shear force is high ( $> 50\%$  of the shear resistance), a reduced value of resistance for bending,  $M_{v,y,Rd}$  and  $M_{v,z,Rd}$ , should be calculated. No values are tabulated in this publication. Values of the design shear resistance,  $V_{c,Rd}$ , are given in the tables of web bearing and buckling resistance (see Section 9.1). 6.2.8 (3)

#### (b) Design lateral torsional buckling resistance moment 6.3.2

The lateral torsional buckling resistance moment,  $M_{b,Rd}$ , is given in the tables for a range of values of the following parameters:

- The length between lateral restraints,  $L$ , given at the head of the tables
- The value of factor  $C_1$

The lateral torsional buckling resistance moment,  $M_{b,Rd}$ , is given by: 6.3.2.1 (3)

$$M_{b,Rd} = \chi_{LT} W_y \frac{f_y}{\gamma_{M1}}$$

where:

$$W_y = W_{pl,y} \quad \text{for Class 1, 2 cross-sections}$$

$W_y = W_{pl,eff,y}$  for Class 3 cross-sections with Class 1 or 2 flanges

$W_y = W_{el,y}$  for other Class 3 cross-sections

$W_y = W_{eff,y}$  for Class 4 cross-sections

$\chi_{LT}$  is the reduction factor for lateral–torsional buckling. It depends on the

non-dimensional slenderness  $\bar{\lambda}_{LT} = \sqrt{\frac{W_y f_y}{M_{cr}}}$  and the imperfection factor corresponding to the appropriate buckling curve.

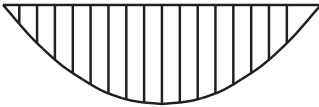
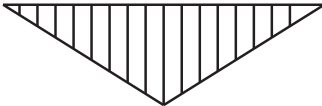

$M_{cr}$  is the elastic critical moment for lateral–torsional buckling based on gross section properties and takes into account the following:

- The moment distribution.
- The length between lateral restraints.

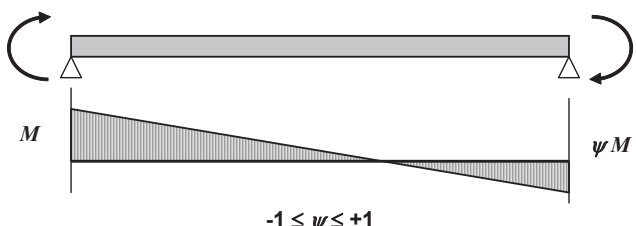
$$M_{cr} = C_1 \frac{\pi^2 EI_z}{L^2} \sqrt{\frac{I_w}{I_z} + \frac{L^2 GI_t}{\pi^2 EI_z}}$$

$C_1$  is a factor that takes into account the shape of the bending moment diagram. Values of  $C_1$  given in the tables include 1.0; 1.13; 1.35; 1.5; 1.77; 2.0 and 2.5. Steelbiz document SN003 *Elastic critical moment for lateral torsional buckling*<sup>[24]</sup> gives background information related to this factor. To take  $C_1 = 1,0$  is conservative.

The  $C_1$  values of 1.13, 1.35 and 1.77 correspond to common design situations, as shown below.

Loading	Bending moment diagram	$C_1$ factor
UDL, pin-ended beam		1.13
Central point load, pin-ended beam		1.35
Triangular bending moment diagram, pin at one end		1.77

For linear bending moment diagrams,  $C_1$  may be determined from the following table, based on  $\psi$ , the ratio of the end moments.

End moment loading	$\psi$	$C_1$
 <p style="text-align: center;"><math>-1 \leq \psi \leq +1</math></p>	+1.00	1.00
	+0.75	1.17
	+0.50	1.36
	+0.25	1.56
	0.00	1.77
	-0.25	2.00
	-0.50	2.24
	-0.75	2.49
	-1.00	2.76

For other shapes of bending moment diagram, the factor  $C_1$  may be determined from the ratio:

$$C_1 = \frac{M_{cr} \text{ for the actual bending moment diagram}}{M_{cr} \text{ for a uniform bending moment diagram}}$$

$M_{cr}$  may be determined by using the software *LTBeam*, freely available from [www.cticm.com](http://www.cticm.com)

The reduction factor  $\chi_{LT}$  is calculated for the ‘rolled sections’ case, using buckling curves ‘b’ or ‘c’ as appropriate and the values of  $\bar{\lambda}_{LT,0}$  and  $\beta$  given by the National Annex. The UK National Annex gives the following values: 6.3.2.3 (1)

$$\bar{\lambda}_{LT,0} = 0.4$$

$$\beta = 0.75$$

The reduction factor is modified to take account of the moment distribution between the lateral restraints of members using the modification factor  $f$ : 6.3.2.3(2) and the UK NA

$$\chi_{LT,mod} = \frac{\chi_{LT}}{f} \quad \text{but} \quad \chi_{LT,mod} \leq 1 \quad \text{and} \quad \chi_{LT,mod} \leq \frac{1}{\bar{\lambda}_{LT}^2}$$

$$f = 1 - 0.5(1 - k_c)[1 - 2.0(\bar{\lambda}_{LT} - 0.8)^2] \quad \text{but} \quad f \leq 1.0$$

$$k_c = \frac{1}{\sqrt{C_1}}$$

## 8.2 Bending: Hollow sections

### 8.2.1 Circular and square hollow sections

The design resistances for bending,  $M_{c,Rd}$ , and the design shear resistance,  $V_{c,Rd}$ , are tabulated for circular and square hollow sections in S355 steel. No values have been calculated for S275 circular and square hollow sections.  $M_{c,Rd}$  has been calculated as detailed in Section 8.1(a) above.

$V_{c,Rd}$  is given by: 6.2.6 (2)

$$V_{c,Rd} = \frac{A_v \left( \frac{f_y}{\sqrt{3}} \right)}{\gamma_{M0}}$$

where:

$A_v$  is the shear area

For circular hollow sections  $A_v = 2A/\pi$

For square hollow sections  $A_v = A/2$

$f_y$  is the yield strength

$\gamma_{M0}$  is the partial factor for resistance of cross-sections ( $\gamma_{M0} = 1.0$  as given in the National Annex).

The second moment of area ( $I$ ) is included in the tables because it is required for deflection checks.

For Class 4 CHS, BS EN 1993-1-4 refers the user to BS EN 1993-1-6. Moment resistance values for these sections have not been calculated and the symbol, \$, is shown instead.

### 8.2.2 Rectangular hollow sections

The following information is presented in the tables for rectangular hollow sections in S355 steel. No values have been calculated for S275 rectangular hollow sections.

(i) Design resistance for bending about the  $y$ - $y$  and  $z$ - $z$  axes and design shear resistance:

The values of  $M_{c,y,Rd}$ ,  $M_{c,z,Rd}$  and  $V_{c,Rd}$  have been calculated as detailed in Section 8.1(a) and Section 8.2.1 respectively, with the shear area for bending about the major axis taken as  $A_v = A h / (b + h)$ .

(ii) The section classification given in the tables applies to members subject to bending only about the appropriate axes. Sections may be Class 4 for pure bending about the  $y$ - $y$  or  $z$ - $z$  axis. It should be noted that a section may be Class 4 when bending about the  $z$ - $z$  axis and not Class 4 when bending about the  $y$ - $y$  axis.

(iii) The limiting length,  $L_c$ , is the length above which the design buckling resistance moment is reduced below the cross-sectional resistance due to lateral torsional buckling. The value of the limiting length is that at which the slenderness  $\bar{\lambda}_{LT} = 0.4$  which is the value of  $\bar{\lambda}_{LT,0}$  according to the UK National Annex.

The slenderness for lateral torsional buckling has been calculated as follows:

$$\bar{\lambda}_{LT} = \sqrt{\frac{W_y f_y}{M_{cr}}}$$

And for RHS the elastic critical buckling moment is:

$$M_{cr} = C_1 \frac{\pi^2 EI_z}{L^2} \sqrt{\frac{L^2 GI_T}{\pi^2 EI_z}}$$

From these expressions, conservatively assuming  $C_1 = 1.0$ , the limiting length above which LTB needs to be checked can be derived as follows:

$$L_c = \frac{\bar{\lambda}_{LT,0}^2 \pi \sqrt{E G I_z I_T}}{W_y f_y}$$

For lengths up to the limiting length,  $M_{b,Rd}$  is equal to  $M_{c,y,Rd}$ .

In the resistance tables for bending alone, no values of  $M_{b,Rd}$  are tabulated for lengths in excess of the limiting length. Values for lengths in excess of the limiting length are provided in the tables of combined bending and compression.

- (iv) The second moment of area ( $I$ ) is repeated in the tables as it is required for deflection checks.

### 8.2.3 Elliptical hollow sections

The following information is presented in the tables for hot rolled elliptical hollow sections in S355 steel. No values have been calculated for S275 elliptical hollow sections:

- (i) Design resistance for bending about the  $y$ - $y$  axis

For Class 1, 2 and 3 sections, the design resistances are calculated in accordance with Section 8.1.

- (ii) Design resistance for bending about the  $z$ - $z$  axis

For Class 1, 2 and 3 sections, the design resistances are calculated in accordance with Section 8.1.

For Class 4 sections, the design resistances are calculated as if the section were Class 3, using a reduced design strength such that the section remains Class 3.

The reduced design strength is taken as  $\frac{235 \times 90 \times t}{D_{e, \text{minor}}}$

where  $D_{e, \text{minor}}$  is the equivalent diameter for buckling about the minor axis and is given by:

$$D_{e, \text{minor}} = \frac{h^2}{b}$$

- (iii) Design resistance for shear

The design resistance for shear in the major axis of the elliptical section is calculated in accordance with Section 8.2.1. For an elliptical section, the shear area,  $A_v$ , is taken as:

$$A_v = (2h - 2t)t \quad [27]$$

- (iv) Limiting length,  $L_c$

The limiting length,  $L_c$ , above which the design buckling resistance moment is reduced below the cross-sectional resistance due to lateral torsional buckling has been calculated in accordance with Section 8.2.2.

## 9 RESISTANCE TO TRANSVERSE FORCES TABLES (WEB BEARING AND BUCKLING)

### 9.1 UB sections, UC sections, joists and parallel flange channels

#### (a) The design shear resistance

6.2.6 (1), (2)

The design shear resistance,  $V_{c,Rd}$ , is given by:

$$V_{c,Rd} = V_{pl,Rd} = \frac{A_v \left( \frac{f_y}{\sqrt{3}} \right)}{\gamma_{M0}}$$

where:

$A_v$  is the shear area

for rolled I sections  $A_v = A - 2bt_f + (t_w + 2r) t_f$  but not less than  $\eta h_w t_w$ ,

for parallel flange channels  $A_v = A - 2bt_f + (t_w + r) t_f$

$f_y$  is the yield strength

$\gamma_{M0}$  is the partial factor for resistance of cross sections ( $\gamma_{M0} = 1.0$  as given in the National Annex).

#### (b) Design resistance to local buckling

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The design resistance of an unstiffened web,  $F_{Rd}$ , to local buckling under transverse forces is given by:

6.2 (1)

$$F_{Rd} = \frac{f_y L_{eff} t_w}{\gamma_{M1}}$$

where:

$f_y$  is the yield strength

$t_w$  is the thickness of the web

$L_{eff}$  is the effective length for resistance to transverse force ( $= \chi_F \ell_y$ )

$$\chi_F = \frac{0.5}{\bar{\lambda}_F} \leq 1.0$$

$\ell_y$  is the effective loaded length

$\gamma_{M1}$  is the partial factor for resistance of members ( $\gamma_{M1} = 1.0$  as given in the National Annex)

$$\bar{\lambda}_F = \sqrt{\frac{\ell_y t_w f_y}{F_{cr}}}$$

$$F_{cr} = 0.9 k_F E \frac{t_w^3}{h_w}$$

$$k_F = 2 + 6 \left( \frac{s_s + c}{h_w} \right) \text{ but } k_F \leq 6$$

$h_w$  is the depth between flanges  $= h - 2t_f$

Figure 6.1



$s_s$  is the length of stiff bearing (see Figure 6.2 of BS EN 1993-1-5)

$c$  is the distance from the end of the stiff bearing to the end of the section.

The effective loaded length,  $\ell_y$ , has been calculated as the least value given by the following three expressions:

$$\ell_{y1} = s_s + 2t_f \left(1 + \sqrt{m_1 + m_2}\right) \quad \text{Eq (6.10)}$$

$$\ell_{y2} = \ell_e + t_f \sqrt{\frac{m_1}{2} + \left(\frac{\ell_e}{t_f}\right)^2 + m_2} \quad \text{Eq (6.11)}$$

$$\ell_{y3} = \ell_e + t_f \sqrt{m_1 + m_2} \quad \text{Eq (6.12)}$$

where:

$$\ell_e = \frac{k_F E t_w^2}{2f_y h_w} \leq s_s + c \quad \text{Eq (6.13)}$$

$$m_1 = \frac{b_f}{t_w}$$

$$m_2 = 0.02 \left(\frac{h_w}{t_f}\right)^2 \quad \text{if } \bar{\lambda}_F > 0.5$$

$$m_2 = 0 \quad \text{if } \bar{\lambda}_F \leq 0.5$$

(Note that, at present, BS EN 1993-1-5, 6.5(3) erroneously refers to Equations 6.11, 6.12 and 6.13. This error is due to be corrected by CEN.)

Values of  $F_{Rd}$  have been calculated for two values of  $c$ , where  $c$  is the distance from the end of the member to the adjacent edge of the stiff bearing length, as shown in Figure 6.1 of EN 1993-1-5. The values are: 6.1 (4)

$c = 0$  for a stiff bearing positioned at the end of the section

$c = c_{lim}$  for a stiff bearing positioned at a distance  $c_{lim}$  from the end of the section. This position represents the minimum value of  $c$  at which the maximum resistance of the web for a given stiff bearing length,  $s_s$  is attained.

where:

$$c_{lim} = \max(c_{buckling}; c_{bearing})$$

$$c_{buckling} = \frac{2h_w}{3} - s_s$$

$$c_{bearing} = 2t_f + t_f \sqrt{m_1 + m_2}$$

For the case where the stiff bearing is positioned at an intermediate distance (i.e.  $c < c_{lim}$ ) the resistance given for  $c = 0$  is conservative.

## 9.2 Square and rectangular hollow sections

BS EN 1993-1-5 does not cover the resistance to transverse forces for hollow sections. Therefore in this publication the approach previously presented in P202 *Volume 1 Section properties member capacities*<sup>[25]</sup> has been adopted and is presented below in terminology consistent with BS EN 1993-1-1.

### (a) Bearing

The bearing resistance,  $F_{Rd,bearing}$ , of the unstiffened web may be calculated using the factors  $C_1$  and  $C_2$  in the tables, using:

$$\begin{aligned} F_{Rd,bearing} &= (b_1 + nk)2t f_y / \gamma_{M0} \\ &= b_1 C_2 + C_1 \quad (\text{Resistance table notation}) \end{aligned}$$

where:

$b_1$  is the effective bearing length (see figures below)

$n = 5$ , for continuous web over bearing

$= 2$ , for end bearing

$k = t$  for hollow sections

$t$  is the wall thickness

$f_y$  is the yield strength.

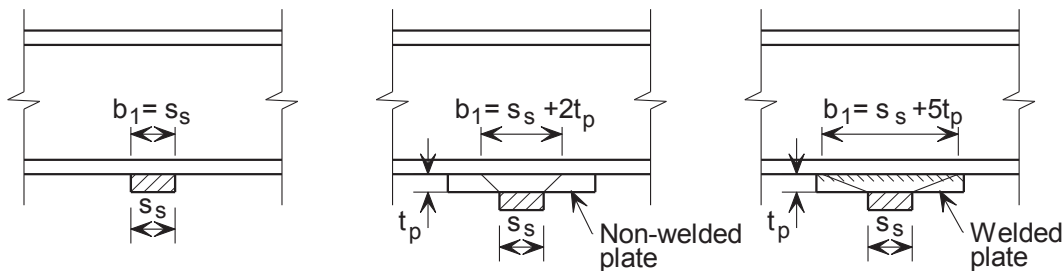


Figure illustrating examples of stiff bearing length,  $b_1$

The bearing factor,  $C_1$ , represents the contribution from the flanges adjacent to both webs and is given by:

$$C_1 = 2 n k t f_y / \gamma_{M0} \quad \text{Generally}$$

$$C_1 = 2 \times 5 t^2 f_y / \gamma_{M0} \quad \text{For a section continuous over the bearing}$$

$$C_1 = 2 \times 2 t^2 f_y / \gamma_{M0} \quad \text{For end bearing}$$

The bearing factor,  $C_2$ , is equal to  $2t f_y / \gamma_{M0}$  representing the stiff bearing contribution for both webs.

### (b) Buckling resistance

The buckling resistance,  $F_{Rd,buckling}$ , of the two unstiffened webs is given by:

$$\begin{aligned} F_{Rd,buckling} &= (b_1 + n_1) 2 t \chi f_y / \gamma_{M1} \\ &= b_1 C_2 + C_1 \quad (\text{Resistance table notation}) \end{aligned}$$

where:

$b_1$  is the stiff bearing length

$n_1$  is the length obtained by dispersion at  $45^\circ$  through half the depth of the section

$t$  is the wall thickness

$\chi$  is the reduction factor for buckling resistance, based on the slenderness  $\bar{\lambda}$  as given in Section 6.1

$f_y$  is the yield strength of the hollow section.

Unless loads or reactions are applied through welded flange plates, the additional effects of moments in the web due to eccentric loading must be taken into account, which will result in lower buckling values.

The buckling factor,  $C_2$ , is the stiff bearing component factor and is equal to  $C_1/h$

The buckling factor,  $C_1$ , is the portion of  $(n_1 t \chi f_y / \gamma_{M1})$  due to the beam alone.

$$C_1 = 4D t \chi f_y / 2\gamma_{M1} \quad \text{for welded flange plates}$$

$$C_1 = 4F \quad \text{for non-welded flange plates}$$

where:

$F$  is the limiting force in each web (derived below).

The factor of 4 allows for two webs and dispersion of load in two directions and applies to a member that is continuous over a bearing or an end bearing member with a continuously welded sealing plate.

For non-welded flange plates, the limiting force  $F$  depends on the equivalent eccentricity of loading from the centreline of the web given by:

$$e = 0.026b + 0.978t + 0.002h$$

This expression has been derived from research<sup>[13]</sup> and is also applicable to cold-formed hollow sections<sup>[18]</sup>.

If the flange is considered as a fixed-ended beam of length  $b - t$ , the two forces  $F$  create a fixed end moment  $M$ ;

$$M = Fe \left[ \frac{b - t - e}{b - t} \right]$$

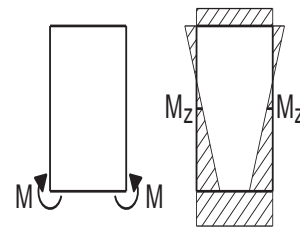
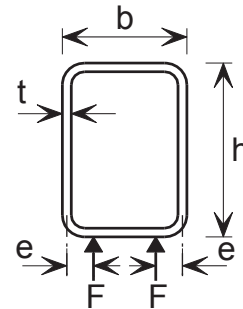
and thus, the moment at mid-height of the web,  $M_z$ , can be found as follows<sup>[26]</sup>:

$$M_z = \frac{0.5M(3+a)}{a^2 + 4a + 3} = \frac{0.5 \left[ Fe \left( \frac{b - t - e}{b - t} \right) \right] (3+a)}{a^2 + 4a + 3}$$

$$\frac{M_z}{F} = \frac{0.5 \left[ e \left( \frac{b - t - e}{b - t} \right) \right] (3+a)}{a^2 + 4a + 3}$$

where:

$$a = h/b$$



Using the interaction criterion 
$$\frac{F_{Ed}}{A\chi f_y/\gamma_{M1}} + \frac{M_{z,Ed}}{f_y W_{el,z}/\gamma_{M1}} \leq 1$$

The limiting value of  $F$  is given when the left hand side of this criterion =1.

If the length of the wall resisting  $F$  and  $M$  is  $h/2$ , given by a 45° dispersal in one direction,  $A = ht/2$  and  $W_{el,z} = ht^2/12$ . Substituting these values, introducing  $k = M_z/F$ , and rearranging, the limiting value becomes:

$$F = \frac{ht^2 n_b}{2t + 12 k\chi}$$

where:

$$n_b = \frac{\chi f_y}{\gamma_{M1}}$$

and  $k$  is given by the expression for  $M_z/F$  above.

### (c) Shear resistance

The shear resistance is given by:

6.2.6(2)

$$V_{c,Rd} = \frac{A_v f_y / \sqrt{3}}{\gamma_{M0}}$$

where:

$A_v$  is the shear area ( $= Ah / (b + h)$ )

$A$  is the area of the cross-section

$h$  is the overall depth

$b$  is the overall width

## 10 AXIAL FORCE & BENDING TABLES

EN 1993-1-1

Generally, members subject to axial compression forces and bending should be verified for cross section resistance (BS EN 1993-1-1, 6.2.9) and for member buckling resistance (BS EN 1993-1-1, 6.3.3.(4)).

The relevant parameters required to evaluate the interaction equations given in the above clauses are presented in tabular form.

The tables are applicable to members subject to combined tension and bending and to members subject to combined compression and bending. However, the values in the tables are conservative for tension, as the more onerous compression section classification limits have been used for calculating resistances to axial force.

Tables are given for cross-section resistances and for member buckling resistances, as explained below.

## 10.1 Axial force and bending: UB sections, UC sections, joists and parallel flange channels

6.2.9

### 10.1.1 Cross-section resistance check

For Class 1, 2 and 3 cross-sections the following conservative approximation may be used:

6.2.1(7)

$$\frac{N_{Ed}}{N_{pl,Rd}} + \frac{M_{y,Ed}}{M_{c,y,Rd}} + \frac{M_{z,Ed}}{M_{c,z,Rd}} \leq 1.0 \quad \text{Eq (6.2)}$$

Values of  $N_{pl,Rd}$ ,  $M_{c,y,Rd}$  and  $M_{c,z,Rd}$  are given in the tables. The section classification depends on the axial force applied and therefore  $M_{c,Rd}$  values are given for different values of  $N_{Ed}/N_{pl,Rd}$ . The values of these resistances have been calculated as given in the following sections.

No values are given for combined axial force and bending on Class 4 sections. Refer to BS EN 1993-1-1, 6.2.9.3(2).

#### (a) Design resistance for axial force

$$N_{pl,Rd} = \frac{Af_y}{\gamma_{M0}} \quad \text{Eq (6.6)}$$

where:

$A$  is the gross area of the cross-section

$f_y$  is the yield strength

$\gamma_{M0}$  is the partial factor for cross-sections ( $\gamma_{M0} = 1.0$  as given in the National Annex).

#### (b) Design resistances for bending about the principal axes of the cross-section

The design resistances for bending about the major and minor axes,  $M_{c,y,Rd}$  and  $M_{c,z,Rd}$ , have been calculated as in Section 8.1 using  $W_{pl,y}$ ,  $W_{el,y}$ ,  $W_{pl,z}$  and  $W_{el,z}$ , as appropriate. No values are given for the reduced resistances in the presence of high shear.

6.2.5 (2)

$M_{c,Rd}$  values for Class 4 cross-sections are not given in the tables. For checks of Class 4 cross-sections, see BS EN 1993-1-1, 6.2.9.3(2).

The symbol **✖** indicates that the section is Class 4 for a given value of  $N_{Ed}/N_{pl,Rd}$ .

The symbol **\$** indicates that the section is Class 4 and that it would be overloaded due to compressive axial force alone, i.e. the section is Class 4 and  $N_{Ed} > A_{eff} f_y$  for the given value of  $N_{Ed}/N_{pl,Rd}$ .

The Class 2 and Class 3 limits for the section subject to bending and compression are the maximum values of  $N_{Ed}/N_{pl,Rd}$ , up to which the section is either Class 2 or Class 3 respectively. The Class 2 limit is given in bold type.

5.5.2 (8)

As an alternative to Equation (6.2) for Class 1 and 2 sections, a less conservative criterion may be used as follows:

6.2.9.1(2)

$$M_{Ed} \leq M_{N,Rd} \quad \text{Eq (6.31)}$$

Values of  $M_{N,Rd}$  are given in the tables.

**(c) Design moment resistance about the y-y axis reduced due to axial force**

6.2.9

The reduced moment resistance,  $M_{N,y,Rd}$ , has been calculated as follows:

(i) Where both the following criteria are satisfied:

$$N_{Ed} \leq 0.25 N_{pl,Rd} \text{ and } N_{Ed} \leq \frac{0.5 h_w t_w f_y}{\gamma_{M0}} \quad \text{Eq (6.33 \& 6.34)}$$

where:

$$h_w \text{ is the clear web depth between flanges} = h - 2t_f \quad 6.2.9.1(4)$$

$$\gamma_{M0} \text{ is a partial factor } (\gamma_{M0} = 1.0 \text{ as given in the National Annex}).$$

The reduced design moment resistance is equal to the plastic resistance moment

$$M_{N,y,Rd} = M_{pl,y,Rd}$$

(ii) Where the above criteria are not satisfied the reduced design moment resistance is given by:

$$M_{N,y,Rd} = M_{pl,y,Rd} \left( \frac{1-n}{1-0.5a} \right) \quad \text{but } \leq M_{pl,y,Rd} \quad \text{Eq (6.36)} \quad 6.2.9.1(5)$$

where:

$$M_{pl,y,Rd} \text{ is the plastic resistance moment about the y-y axis}$$

$$n \text{ is the ratio } N_{Ed} / N_{pl,Rd}$$

$$a = (A - 2bt_f) / A \text{ but } \leq 0.5.$$

**(d) Design moment resistance about the z-z axis reduced due to axial force**

The reduced moment resistance,  $M_{N,z,Rd}$ , has been calculated as follows:

(i) Where the following criteria is satisfied:

$$N_{Ed} \leq \frac{h_w t_w f_y}{\gamma_{M0}} \quad \text{Eq (6.35)} \quad 6.2.9.1(4)$$

where:

$$h_w \text{ is the clear web depth between flanges} = h - 2t_f$$

$$\gamma_{M0} \text{ is the partial factor for cross sections } (\gamma_{M0} = 1.0 \text{ as given in the National Annex})$$

In this case, no allowance has been made for the effect of the axial force on the plastic resistance moment about the z-z axis and the reduced design moment resistance in this case is equal to the plastic resistance moment:

$$M_{N,z,Rd} = M_{pl,z,Rd}$$

(ii) Where the above criterion is not satisfied the reduced design moment resistance is given by: 6.2.9.1(5)

$$\text{For } n \leq a \quad M_{N,z,Rd} = M_{pl,z,Rd} \quad \text{Eq (6.37)}$$

$$\text{For } n > a \quad M_{N,z,Rd} = M_{pl,z,Rd} \left[ 1 - \left( \frac{n-a}{1-a} \right)^2 \right] \quad \text{but } \leq M_{pl,z,Rd} \quad \text{Eq (6.38)}$$

where:

$M_{pl,z,Rd}$  is the plastic resistance moment about the  $z$ - $z$  axis

$n$  is the ratio  $N_{Ed} / N_{pl,Rd}$

$a$  is as given in (c)

Because the values of  $M_{N,y,Rd}$  and  $M_{N,z,Rd}$  are only valid for Class 1 and Class 2 sections, no values are shown when  $N_{Ed} / N_{pl,Rd}$  exceeds the limit for a Class 2 section (shown as the symbol ' - ' in the tables).

Reduced design moment resistances for parallel flange channels are not presented in the tables. This is because BS EN 1993-1-1, 6.2.9 does not specifically cover the requirements for parallel flange channels.

### 10.1.2 Member buckling check

Interaction equations (6.61) and (6.62) from BS EN 1993-1-1, 6.3.3(4) must be satisfied for members subject to combined axial compression and bending. To check these interaction equations the following parameters given in (a), (b) and (c) are needed:

$$(a) \quad \chi_y \frac{N_{Rk}}{\gamma_{M1}} \quad \text{and} \quad \chi_z \frac{N_{Rk}}{\gamma_{M1}}$$

These are given in the tables as  $N_{b,y,Rd}$  and  $N_{b,z,Rd}$ . They are the compression resistances for buckling about the  $y$ - $y$  and the  $z$ - $z$  axis respectively. The adjacent  $N_{Ed} / N_{pl,Rd}$  limit ensures that the section is not Class 4 and has been calculated as in Section 6.1.

$$(b) \quad \chi_{LT} \frac{M_{y,Rk}}{\gamma_{M1}}$$

This term is given in the tables as  $M_{b,Rd}$ . Values are given for two  $N_{Ed} / N_{pl,Rd}$  limits. The higher limit indicates when the section is Class 3 and the lower limit (in bold) indicates when the section is Class 2.  $M_{b,Rd}$  is calculated accordingly, as described in Section 8.1. In both cases, it is conservatively assumed that  $C_1 = 1.0$ .

$$(c) \quad \frac{M_{z,Rk}}{\gamma_{M1}}$$

$M_{z,Rk}$  may be based on the elastic or plastic modulus, depending on the section classification, as shown in Table 6.7 of BS EN 1993-1-1. Values of  $f_y W_{el,z}$  are given. Values of  $f_y W_{pl,z}$  are given as  $M_{c,z,Rd}$  in the tables for cross-section resistance check. Values are quoted with  $\gamma_{M1} = 1.0$ , as given in the National Annex.

In addition, values of  $f_y W_{el,y}$  and  $N_{pl,Rd}$  are given in the tables for completeness.

According to the National Annex, either Annex A or Annex B of BS EN 1993-1-1 should be used to calculate the interaction factors  $k$  for UB, UC and joists. Annex B of BS EN 1993-1-1 should be used to calculate the interaction factors,  $k$ , for parallel flange channels

The symbol \* denotes that the cross-section is Class 4 under axial compression only (due to the web becoming Class 4). None of the sections listed are Class 4 due to the flanges being Class 4. Under combined axial compression and bending, the class of the cross-section depends on the axial force, expressed in terms of  $n$  ( $= N_{Ed}/N_{pl,Rd}$ ). Values of  $n$  are given, up to which the cross-section would be Class 2 or Class 3.

The limits in normal and bold type are the maximum values up to which the section is either Class 3 or Class 2, respectively. The tabulated resistances are only valid up to the given  $N_{Ed}/N_{pl,Rd}$  limit.

## 10.2 Axial force and bending: hollow sections

### 10.2.1 Cross-section resistance check

For Class 1, 2 and 3 cross-sections the following conservative approximation may be used: 6.2.1(7)

$$\frac{N_{Ed}}{N_{pl,Rd}} + \frac{M_{y,Ed}}{M_{c,y,Rd}} + \frac{M_{z,Ed}}{M_{c,z,Rd}} \leq 1.0 \quad \text{Eq (6.2)}$$

For CHS, SHS and RHS, values of  $N_{pl,Rd}$ ,  $M_{c,y,Rd}$  and  $M_{c,z,Rd}$  are given in the tables. The section classification depends on the axial force applied and therefore  $M_{c,Rd}$  values are given for different values of  $N_{Ed}/N_{pl,Rd}$ . The values of these resistances have been calculated as described in the following sections.

No  $M_{c,y,Rd}$  and  $M_{c,z,Rd}$  values are given for combined axial force and bending on Class 4 sections. Refer to BS EN 1993-1-1, 6.2.9.3(2).

The symbol \* denotes that the section is Class 4 when fully stressed under axial compression only.

For elliptical hollow sections, values of  $N_{pl,Rd}$ ,  $M_{c,y,Rd}$  and  $M_{c,z,Rd}$  are given in the tables.

If an elliptical hollow section is Class 4, the design compression and bending resistances are calculated based on the area and section modulus appropriate for a Class 3 section, using a reduced design strength such that the section is Class 3. The reduced design strength is calculated using the expression given in Section 6.2(b).

#### (a) Design resistance for axial force

$$N_{pl,Rd} = \frac{Af_y}{\gamma_{M0}}$$

where:

$A$  is the gross area of the cross-section

$f_y$  is the yield strength

$\gamma_{M0}$  is the partial factor for cross-sections ( $\gamma_{M0} = 1.0$  as given in the National Annex).

It should be noted that  $N_{pl,Rd}$  for a Class 4 elliptical hollow section, is based on the gross area and a reduced design strength, as described above.



**(b) Design resistances for bending about the principal axes of the cross section**

The design resistances for bending about the major and minor axes,  $M_{c,Rd}$ , (for CHS and SHS),  $M_{c,y,Rd}$  and  $M_{c,z,Rd}$  (for RHS and elliptical hollow sections), have been calculated as in Section 8.1 using  $W_{pl,y}$ ,  $W_{el,y}$  and  $W_{pl,z}$  and  $W_{el,z}$ , as appropriate. No values are given for the reduced resistance in the presence of high shear. 6.2.5 (2)

$M_{c,Rd}$  values for Class 4 cross-sections are not given in the tables. For checks of Class 4 cross-sections, see BS EN 1993-1-1, 6.2.9.3(2).

If an elliptical hollow section is Class 4, the design resistances are calculated based on the section modulus appropriate for a Class 3 section and a reduced design strength such that the section is Class 3. When subject to combined axial compression and bending, elliptical hollow sections are classified for axial compression, which may be more onerous than major axis bending.

The symbol **✕** indicates that the section is Class 4 for a given value of  $N_{Ed}/N_{pl,Rd}$ .

The symbol **\$** indicates that the section is Class 4 and that it would be overloaded due to compressive axial force alone i.e. the section is Class 4 and  $N_{Ed} > A_{eff} f_y$  for the given value of  $N_{Ed} / N_{pl,Rd}$ .

The Class 2 and Class 3 limits for the section subject to bending and compression are the maximum values of  $N_{Ed} / N_{pl,Rd}$  up to which the section is either Class 2 or Class 3, respectively. The Class 2 limit is given in bold type. 5.5.2 (8)

Limits are not given for elliptical hollow sections; the classification depends purely on the geometry of the section.

As an alternative to Equation (6.2) for Class 1 and 2 CHS, SHS and RHS sections a less conservative criterion may be used as follows: 6.2.9.1(2)

$$M_{Ed} \leq M_{N,Rd} \tag{Eq (6.31)}$$

Values of  $M_{N,Rd}$  are given in the tables.

**(c) Design moment resistance reduced due to axial force**

The reduced design resistances for bending have been calculated as follows:

(i) Circular hollow sections 6.2.9.1(6)

For bending about the y-y axis

$$M_{N,Rd} = W_{pl,y} f_y (1 - n^{1.7})$$

where:

$$n = N_{Ed} / N_{pl,Rd}$$

(ii) Rectangular and square hollow sections 6.2.9.1(5)

For bending about the y-y axis

$$M_{N,y,Rd} = M_{pl,y,Rd} \left( \frac{1 - n}{1 - 0.5 a_w} \right) \quad \text{but} \quad \leq M_{pl,y,Rd} \tag{Eq (6.39)}$$

where:

$$a_w = \frac{(A - 2bt)}{A} \text{ but } \leq 0.5$$

$M_{pl,y,Rd}$  is the plastic resistance moment about the  $y$ - $y$  axis

$n$  is the ratio  $N_{Ed} / N_{pl,Rd}$ .

Because the values of  $M_{N,y,Rd}$  are only valid for Class 1 and Class 2 sections, no values are shown when  $N_{Ed} / N_{pl,Rd}$  exceeds the limit for a Class 2 section (shown as the symbol ‘ – ’ in the tables).

For square hollow sections, the reduced moment resistance is the same for both axes, and is displayed as  $M_{N,Rd}$ .

For bending about the  $z$ - $z$  axis

6.2.9.1(5)

$$M_{N,z,Rd} = M_{pl,z,Rd} \left( \frac{1-n}{1-0.5a_f} \right) \text{ but } \leq M_{pl,z,Rd} \quad \text{Eq (6.40)}$$

where:

$$a_f = \frac{(A - 2ht)}{A} \text{ but } \leq 0.5$$

$M_{pl,z,Rd}$  is the plastic resistance moment about the  $z$ - $z$  axis

$n$  is the ratio  $N_{Ed} / N_{pl,Rd}$

Because the values of  $M_{N,z,Rd}$  are only valid for Class 1 and Class 2 sections, no values are shown when  $N_{Ed} / N_{pl,Rd}$  exceeds the limit for a Class 2 section (shown as the symbol ‘ – ’ in tables).

### 10.2.2 Member buckling check

Interaction equations (6.61) and (6.62) from BS EN 1993-1-1, 6.3.3(4) must be satisfied for members subject to combined axial compression and bending. To check these interaction equations the following parameters given in (a), (b) and (c) are needed:

$$(a) \quad \chi_y \frac{N_{Rk}}{\gamma_{M1}} \text{ and } \chi_z \frac{N_{Rk}}{\gamma_{M1}}$$

These are given in the tables as  $N_{b,y,Rd}$  and  $N_{b,z,Rd}$  for rectangular hollow sections and elliptical hollow sections, and as  $N_{b,Rd}$  for circular and square hollow sections. They are the compression resistances for buckling about the  $y$ - $y$  and the  $z$ - $z$  axis respectively. For CHS, SHS and RHS, the adjacent  $n$  limit, i.e.  $N_{Ed} / N_{pl,Rd}$ , ensures that the section is not Class 4 and has been calculated as in Section 6.1. For Class 4 elliptical hollow sections, the design compression is calculated based on the gross area, using a reduced design strength such that the section is Class 3.

When subject to combined axial compression and bending, elliptical hollow sections are classified for axial compression, which may be more onerous than major axis bending.

$$(b) \chi_{LT} \frac{M_{y,Rk}}{\gamma_{M1}}$$

This term is given in the table as  $M_{b,Rd}$  for rectangular and elliptical hollow sections. For rectangular hollow sections, values are given for two  $N_{Ed}/N_{pl,Rd}$  limits. The higher limit ensures the section is Class 3 and the lower limit (in bold) ensures the section is Class 2,  $M_{b,Rd}$  is calculated accordingly. See Section 8.1. For circular and square hollow sections, this term is not applicable and is therefore not given in the tables.

$$(c) \frac{M_{z,Rk}}{\gamma_{M1}}$$

$M_{z,Rk}$  may be based on the elastic or plastic modulus, depending on the section classification, as shown in Table 6.7 of BS EN 1993-1-1. Values of  $f_y W_{el,z}$  are given (for Class 4 elliptical hollow sections, a reduced value of  $f_y$  is used with the elastic modulus). Values of  $f_y W_{pl,z}$  are given as  $M_{c,z,Rd}$  ( $M_{c,Rd}$  for CHS) in the tables for cross-section resistance check. Values are quoted with  $\gamma_{M1} = 1.0$ , as given in the National Annex.

In addition, values of  $f_y W_{el,y}$  and  $N_{pl,Rd}$  are given in the tables for completeness.

For CHS, SHS and RHS, the symbol \* denotes that the cross-section is Class 4 under axial compression only (due to the web becoming Class 4). Under combined axial compression and bending, the class of the cross section depends on the axial force, expressed in terms of  $n$  ( $=N_{Ed}/N_{pl,Rd}$ ). Values of  $n$  are given, up to which the cross-sections would be Class 2 or Class 3.

The limits in normal and bold type are the maximum values up to which the section is either Class 3 or Class 2, respectively. The tabulated resistances are only valid up to the given  $N_{Ed}/N_{pl,Rd}$  limit.

For certain rectangular hollow sections, webs and flanges are Class 4. In these cases, section resistances provided are based on effective section properties. These sections are indicated by the ♦ symbol.

## 11 BOLTS AND WELDS

BS EN 1993-1-8

### 11.1 Bolt resistances

The types of bolts covered are:

- Classes 4.6, 8.8 and 10.9, as specified in BS EN ISO 4014<sup>[29]</sup>, BS EN ISO 4016<sup>[31]</sup>, BS EN ISO 4017<sup>[30]</sup> and BS EN ISO 4018<sup>[32]</sup>, assembled with a nut conforming to BS EN ISO 4032<sup>[33]</sup> or BS EN ISO 4034<sup>[34]</sup>. Such bolts should be specified as also complying with BS EN 15048<sup>[21]</sup>.
- Countersunk non-preloaded bolts as specified in BS 4933<sup>[28]</sup>, assembled with a nut conforming to BS EN ISO 4032<sup>[33]</sup> or BS EN ISO 4034<sup>[34]</sup>. Such bolts should be specified as also complying with BS EN 15048<sup>[21]</sup> and, for grade 8.8 and grade 10.9, with the mechanical property requirements of BS EN ISO 898-1<sup>[35]</sup>.

- Preloaded bolts as specified in BS EN 14399<sup>[20]</sup>. In the UK, either system HR bolts to BS EN 14399-3 or HRC bolts to EN 14399-10 should be used, with appropriate nuts and washers (including direct tension indicators to BS EN 14399-9, where required). Countersunk bolts to BS EN 14399-7 may alternatively be used. Bolts should be tightened in accordance with BS EN 1090-2<sup>[19]</sup>.

### (a) Non Preloaded Hexagon Head bolts and Countersunk bolts

For each grade:

- The first table gives the tensile stress area, the design tension resistance, the design shear resistance and the minimum thickness of ply passed through in order to avoid failure due to punching shear.
- The second table (and where applicable the third table) gives the design bearing resistance for the given bolt configurations.

(i) The values of the tensile stress area,  $A_s$ , are those given in the relevant product standard.

(ii) The design tension resistance of a bolt is given by:

Table 3.4

$$F_{t,Rd} = \frac{k_2 f_{ub} A_s}{\gamma_{M2}}$$

where:

$$k_2 = 0.63 \text{ for countersunk bolts}$$

$$= 0.9 \text{ for other bolts}$$

$f_{ub}$  is the ultimate tensile strength of the bolt from the relevant product standard

$A_s$  is the tensile stress area of the bolt

$\gamma_{M2}$  is the partial factor for bolts ( $\gamma_{M2} = 1.25$ , as given in the National Annex).

(iii) The shear resistance of the bolt is given by:

$$F_{v,Rd} = \frac{\alpha_v f_{ub} A_s}{\gamma_{M2}}$$

Table 3.4

where:

$$\alpha_v = 0.6 \text{ for Classes 4.6 and 8.8}$$

$$= 0.5 \text{ for Class 10.9}$$

$f_{ub}$  is the ultimate tensile strength of the bolt

$A_s$  is the tensile stress area of the bolt.

(iv) The punching shear resistance is expressed in terms of the minimum thickness of the ply for which the design punching shear resistance would be equal to the design tension resistance. The value has been derived from the expression for the punching shear resistance given in BS EN 1993-1-8, Table 3.4. The minimum thickness is given by:

Table 3.4

$$t_{\min} = \frac{B_{p,Rd} \gamma_{M2}}{0.6 \pi d_m f_u}$$

where:

$$B_{p,Rd} = F_{t,Rd}$$

$F_{t,Rd}$  is the design tension resistance per bolt

$d_m$  has been taken as:

Bolt	$d_m$ (mm)
M 12	18.5
M 16	23.2
M 20	29.2
M 24	35.0
M 30	45.0

$f_u$  is the ultimate tensile strength of the ply under the bolt head or nut

$A_s$  is the tensile stress area of the bolt.

(v) The bearing resistance of a bolt is given by:

$$F_{b,Rd} = \frac{k_1 \alpha_b f_u d t}{\gamma_{M2}}$$

Table 3.4

where:

$$k_1 = \min\left(2.8 \frac{e_2}{d_0} - 1.7; \quad 1.4 \frac{p_2}{d_0} - 1.7; \quad 2.5\right)$$

$e_2$  is the edge distance measured perpendicular to the direction of load transfer

$p_2$  is the gauge measured perpendicular to the direction of load transfer

$d_0$  is the hole diameter

$$\alpha_b = \min\left(\frac{e_1}{3d_0}; \quad \frac{p_1}{3d_0} - \frac{1}{4}; \quad \frac{f_{ub}}{f_u}; \quad 1.0\right)$$

$f_{ub}$  is the ultimate tensile strength of the bolt

$f_u$  is the ultimate tensile strength of the ply passed through

$e_1$  is the end distance measured in the direction of load transfer

$p_1$  is the pitch measured in the direction of load transfer

For countersunk bolts, the bearing resistance has been based on the thickness of the plate, minus half the depth of the countersinking. The depth of countersinking has been taken as half the bolt diameter, meaning the reduction in plate thickness is one quarter of the bolt diameter.

Bearing resistances have been calculated for the end distances, edge distances, pitch and gauge quoted in the tables.

The values of  $e_2$  in the second table are based on typical connections used in the UK and values of  $e_2$  in the third for Class 8.8 and 10.9 bolts table have been chosen to give increased resistances.

Clause 3.6.1(3) of BS EN 1993-1-8 states that where the threads do not comply with EN 1090 the relevant bolt resistances should be multiplied by a factor of 0.85.

Note 1 in Table 3.4 of BS EN 1993-1-8 gives the reduction factors that should to be applied to the bearing resistance for oversize holes and slotted holes.

**(b) Preloaded hexagon head bolts and countersunk bolts at serviceability and ultimate limit states**

- (i) The tensile stress area,  $A_s$ , tension resistance, shear resistance, punching shear resistance and bearing resistance are calculated as given above.

When calculating the punching shear resistance for preloaded bolts, the following values of  $d_m$  have been taken:

Bolt	$d_m$ (mm)
M 12	21.2
M 16	27.0
M 20	32.0
M 24	41.0
M 30	50.0

- (ii) The tension resistance has been calculated as for non-preloaded bolts.
- (iii) The bearing resistance has been calculated as for non-preloaded bolts.

- (iv) The slip resistance of the bolt is given by:

BS EN 1993-1-8, 3.9.1(1)

$$F_{s,Rd} = \frac{k_s n \mu}{\gamma_{M3,ser}} F_{p,C} \quad \text{at SLS}$$

$$F_{s,Rd} = \frac{k_s n \mu}{\gamma_{M3}} F_{p,C} \quad \text{at ULS}$$

where:

- $k_s$  is taken as 1.0
- $n$  is the number of friction surfaces
- $\mu$  is the slip factor

Slip resistances for a range of slip factors,  $\mu$  are provided. Designers should ensure the value selected is appropriate for the surfaces to be fastened, or should calculate revised resistances.

Table 3.6  
Table 3.7

$$F_{p,C} = 0.7 f_{ub} A_s \text{ is the preloading force}$$

$\gamma_{M3}$  is the partial factor for slip resistance (According to the National Annex,  $\gamma_{M3} = 1.25$  at ultimate limit state, and  $\gamma_{M3,ser} = 1.1$  at serviceability limit state).

Tables are provided for connections which are non-slip at the serviceability state and those that are non-slip at the ultimate limit state. In both cases, according to BS EN 1993-1-8, 3.4.1, bearing resistance must be checked, and resistance values are provided for this purpose.

Note that for connections which are non-slip at the serviceability limit state, the slip resistance must be equal to or greater than the design force due to the SLS values of actions (i.e. not the design force due to ULS actions).

## 11.2 Welds

BS EN 1993-1-8

Design resistances of fillet welds per unit length are tabulated. The design resistance of fillet welds will be sufficient if the following criteria are both satisfied:

4.5.3.3

$$\sqrt{\sigma_{\perp}^2 + 3(\tau_{\perp}^2 + \tau_{\parallel}^2)} \leq \frac{f_u}{\beta_w \gamma_{M2}} \quad \text{and} \quad \sigma_{\perp} \leq 0.9 f_u / \gamma_{M2} \quad \text{Eq (4.1)}$$

Each of these components of the stress in the weld can be expressed in terms of the longitudinal and transverse resistance of the weld per unit length as follows:

$$\sigma_{\perp} = \frac{F_{w,T,Ed} \sin \theta}{a}$$

$$\tau_{\perp} = \frac{F_{w,T,Ed} \cos \theta}{a}$$

$$\tau_{\parallel} = \frac{F_{w,L,Ed}}{a}$$

Therefore:

$$\sqrt{\left(\frac{F_{w,T,Ed} \sin \theta}{a}\right)^2 + 3\left[\left(\frac{F_{w,T,Ed} \cos \theta}{a}\right)^2 + \left(\frac{F_{w,L,Ed}}{a}\right)^2\right]} \leq \frac{f_u}{\beta_w \gamma_{M2}}$$

$$\frac{1}{a} \sqrt{F_{w,T,Ed}^2 (\sin^2 \theta + 3 \cos^2 \theta) + 3 F_{w,L,Ed}^2} \leq \frac{f_u}{\beta_w \gamma_{M2}}$$

$$\frac{1}{a} \sqrt{F_{w,T,Ed}^2 (1 + 2 \cos^2 \theta) + 3 F_{w,L,Ed}^2} \leq \frac{f_u}{\beta_w \gamma_{M2}}$$

$$\frac{1}{a} \sqrt{\frac{F_{w,T,Ed}^2}{K^2} + F_{w,L,Ed}^2} \leq \frac{f_u}{\sqrt{3} \beta_w \gamma_{M2}} \quad \text{with} \quad K = \sqrt{\frac{3}{(1 + 2 \cos^2 \theta)}}$$

From this equation, taking each of the components in turn as zero, the following expressions can be derived for the longitudinal and the transverse resistances of welds:

BS EN 1993-1-8

4.5.3.3(2)

Design weld resistance, longitudinal:  $F_{w,L,Rd} = f_{vw,d} a$

Design weld resistance, transverse:  $F_{w,T,Rd} = K F_{w,L,Rd}$

where:

$$f_{vw,d} \text{ is the design shear strength of the weld} = \frac{f_u}{\sqrt{3} \beta_w \gamma_{M2}} \quad \text{BS EN 1993-1-8} \\ \text{4.5.3.3(3)}$$

$$f_u = 410 \text{ N/mm}^2 \text{ for S275}$$

$$= 470 \text{ N/mm}^2 \text{ for S355}$$

These values are valid for thicknesses up to 100 mm

$$\beta_w = 0.85 \text{ for S275}$$

$$= 0.9 \text{ for S355}$$

BS EN 1993-1-8  
Table 4.1

$\gamma_{M2}$  is the partial factor for the resistance of welds ( $\gamma_{M2} = 1.25$  according to the National Annex)

$a$  is the throat thickness of the fillet weld

$$K = \sqrt{\frac{3}{(1 + 2 \cos^2 \theta)}}$$

The above expression for transverse weld resistance is valid where the plates are at  $90^\circ$  and therefore  $\theta = 45^\circ$  and  $K = 1.225$ .

## 12 SECOND DESIGNATIONS AND STEEL GRADES

### 12.1 Open Sections

The dimension and member resistance tables given in this publication are dual titled. The tables give the name of the section type, as given in the relevant British Standard (e.g. universal beams and universal columns, for I sections to BS 4-1 and equal leg angles and unequal leg angles to BS EN 10056-1), followed by the Tata Steel designation in their Advance® range of sections. An example of this dual titling is given below:

#### UNIVERSAL BEAMS

#### Advance® UKB

The Advance® range of sections encompasses all the UB, UC, Tee and PFC sections in BS 4-1 and most of the angle sections in BS EN 10056-1. The dimensions and properties of the Advance® sections are the same as those of the corresponding British Standard sections and the same standards for dimensional tolerance apply. The Advance® range also includes additional beam and column sections that are not in BS 4-1 and angle sections not in BS EN 10056-1; these are designated by '+' in the tables. These sections are manufactured to the same tolerances as those in the British Standards and the nominal dimensions may be taken as characteristic values and used in design.

The difference between Advance® sections and BS sections is that the Advance® sections are always CE Marked.

The table below shows the relationship between the BS 4-1 section designation and the section designation for the Advance® sections.



## Comparison of section designation systems

BS designation		Tata Steel Advance® designation	
Universal beam	UB*	UK Beam	UKB
Universal column	UC*	UK Column	UKC
Parallel flange channel	PFC*	UK Parallel flange channel	UKPFC
Tee		UK Tee	UKT
Equal leg angle Unequal leg angle	L	UK Angle	UKA
* These abbreviations are commonly used but are not a BS designation			

Tables are also included for Asymmetric *Slimflor* Beams. These sections are manufactured by Tata Steel; they are part of the Advance® range and they are CE Marked. These beams are manufactured to the same tolerances as those in the British Standards and the nominal dimensions may be used for design.

Tables are included for joist sections to BS 4-1. These are not part of the Advance® range.

Where resistance tables cover Advance® sections, the steel grade is also dual titled. The strength grade designation in BS EN 10025-2: 2004 is given first, followed by the grade designation for the Advance® sections. An example of this dual titling of the steel grade is given overleaf:

### S 275 / Advance® 275

The Advance® designation is a simplified designation that encompasses the specification to BS EN 10025 and the additional quality control procedures to ensure CE Marking. It also enables a shorter form of designating the grade when ordering. The table below shows the corresponding designations in the two systems.

#### Steel grade designations

BS Designation	Advance® Sections designation
BS EN 10025-2:2004 S275JR	Advance® 275JR
BS EN 10025-2:2004 S275J0	Advance® 275J0
BS EN 10025-2:2004 S275J2	Advance® 275J2
BS EN 10025-2:2004 S355JR	Advance® 355JR
BS EN 10025-2:2004 S355J0	Advance® 355J0
BS EN 10025-2:2004 S355J2	Advance® 355J2
BS EN 10025-2:2004 S355K2	Advance® 355K2

## Hollow Sections

The dimension and member resistance tables given in this publication are dual titled. The tables give the name of the section type, as given in the relevant British Standard (e.g. Hot finished circular hollow section, for a circular section to BS EN 10210-2, and Cold formed square hollow section, for a square section to BS EN 10219-2), followed by the Tata Steel designation from the Celsius® range of hot finished sections or from the Hybox® range of high strength cold formed sections. An example of this dual titling, for hot finished circular hollow sections, is as follows:

### HOT FINISHED CIRCULAR HOLLOW SECTIONS Celsius® CHS

The tables include circular, square, rectangular and elliptical hollow sections available in the Celsius® and Hybox® ranges and the dimensional and sectional properties are either as tabulated in the Standards or are calculated in accordance with the Standards. The only difference between a section to BS EN 10210-2 or to BS EN 10219-2 and its equivalent Celsius® or Hybox® sections is that the Tata Steel section will always be CE Marked.

The table below shows the relationship between section designations in BS EN 10210:2006 and BS EN 10219: 2006, and those for Celsius® and Hybox® sections produced by Tata Steel.

#### Comparison of designation systems for hollow sections

BS EN 10210: 2006	Tata Steel designation
Hot finished circular hollow section	Celsius® CHS
Hot finished square hollow section	Celsius® SHS
Hot finished rectangular hollow section	Celsius® RHS
Hot finished elliptical hollow section	Celsius® OHS
BS EN 10219: 2006	
Cold formed circular hollow section	Hybox® CHS
Cold formed square hollow section	Hybox® SHS
Cold formed rectangular hollow section	Hybox® RHS

In the resistance tables the steel grade is also dual titled. The strength grade designation given in BS EN 10210-1 or BS EN 10219-1 is given first, followed by the grade designation for the Celsius® or Hybox® sections. An example of this dual titling of the steel grade is given below:

### S 355 / Celsius® 355

In all cases, the mechanical properties of Celsius® or Hybox® hollow sections meet all the requirements given in BS EN 10210-1:2006 or BS EN 10219-1:2006, as appropriate. The table below shows the relationship between the steel grades given in the standards and those for Celsius® and Hybox® sections from Tata Steel.

#### Comparison of designations for hollow sections

BS Designation	Tata Steel designation
BS EN 10210-1:2006 S355J2H	Celsius® 355
BS EN 10219-1:2006 S355J2H	Hybox® 355

Note that a limited range of sections is also available in grade S355K2H – consult Tata Steel for availability.

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  - BS EN 1993-1-9:2005: Part 1-9: Fatigue strength of steel structures
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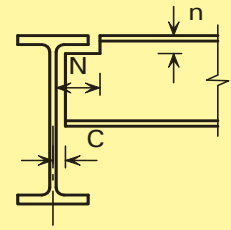
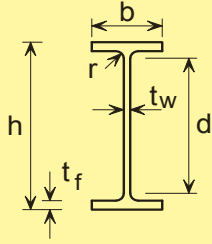
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**B.1. TABLES OF DIMENSIONS AND  
GROSS SECTION PROPERTIES**

# UNIVERSAL BEAMS

Advance® UKB



Dimensions

Section Designation	Mass per Metre kg/m	Depth of Section h mm	Width of Section b mm	Thickness		Root Radius r mm	Depth between Fillets d mm	Ratios for Local Buckling		Dimensions for Detailing			Surface Area	
				Web	Flange			Flange	Web	End Clearance C mm	Notch		Per Metre m <sup>2</sup>	Per Tonne m <sup>2</sup>
				t <sub>w</sub> mm	t <sub>f</sub> mm						c <sub>f</sub> / t <sub>f</sub>	c <sub>w</sub> / t <sub>w</sub>		
1016x305x487 +	486.7	1036.3	308.5	30.0	54.1	30.0	868.1	2.02	28.9	17	150	86	3.20	6.58
1016x305x437 +	437.0	1026.1	305.4	26.9	49.0	30.0	868.1	2.23	32.3	15	150	80	3.17	7.25
1016x305x393 +	392.7	1015.9	303.0	24.4	43.9	30.0	868.1	2.49	35.6	14	150	74	3.14	8.00
1016x305x349 +	349.4	1008.1	302.0	21.1	40.0	30.0	868.1	2.76	41.1	13	152	70	3.13	8.96
1016x305x314 +	314.3	999.9	300.0	19.1	35.9	30.0	868.1	3.08	45.5	12	152	66	3.11	9.89
1016x305x272 +	272.3	990.1	300.0	16.5	31.0	30.0	868.1	3.60	52.6	10	152	62	3.10	11.4
1016x305x249 +	248.7	980.1	300.0	16.5	26.0	30.0	868.1	4.30	52.6	10	152	56	3.08	12.4
1016x305x222 +	222.0	970.3	300.0	16.0	21.1	30.0	868.1	5.31	54.3	10	152	52	3.06	13.8
914x419x388	388.0	921.0	420.5	21.4	36.6	24.1	799.6	4.79	37.4	13	210	62	3.44	8.87
914x419x343	343.3	911.8	418.5	19.4	32.0	24.1	799.6	5.48	41.2	12	210	58	3.42	9.96
914x305x289	289.1	926.6	307.7	19.5	32.0	19.1	824.4	3.91	42.3	12	156	52	3.01	10.4
914x305x253	253.4	918.4	305.5	17.3	27.9	19.1	824.4	4.48	47.7	11	156	48	2.99	11.8
914x305x224	224.2	910.4	304.1	15.9	23.9	19.1	824.4	5.23	51.8	10	156	44	2.97	13.2
914x305x201	200.9	903.0	303.3	15.1	20.2	19.1	824.4	6.19	54.6	10	156	40	2.96	14.7
838x292x226	226.5	850.9	293.8	16.1	26.8	17.8	761.7	4.52	47.3	10	150	46	2.81	12.4
838x292x194	193.8	840.7	292.4	14.7	21.7	17.8	761.7	5.58	51.8	9	150	40	2.79	14.4
838x292x176	175.9	834.9	291.7	14.0	18.8	17.8	761.7	6.44	54.4	9	150	38	2.78	15.8
762x267x197	196.8	769.8	268.0	15.6	25.4	16.5	686.0	4.32	44.0	10	138	42	2.55	13.0
762x267x173	173.0	762.2	266.7	14.3	21.6	16.5	686.0	5.08	48.0	9	138	40	2.53	14.6
762x267x147	146.9	754.0	265.2	12.8	17.5	16.5	686.0	6.27	53.6	8	138	34	2.51	17.1
762x267x134	133.9	750.0	264.4	12.0	15.5	16.5	686.0	7.08	57.2	8	138	32	2.51	18.7
686x254x170	170.2	692.9	255.8	14.5	23.7	15.2	615.1	4.45	42.4	9	132	40	2.35	13.8
686x254x152	152.4	687.5	254.5	13.2	21.0	15.2	615.1	5.02	46.6	9	132	38	2.34	15.4
686x254x140	140.1	683.5	253.7	12.4	19.0	15.2	615.1	5.55	49.6	8	132	36	2.33	16.6
686x254x125	125.2	677.9	253.0	11.7	16.2	15.2	615.1	6.51	52.6	8	132	32	2.32	18.5
610x305x238	238.1	635.8	311.4	18.4	31.4	16.5	540.0	4.14	29.3	11	158	48	2.45	10.3
610x305x179	179.0	620.2	307.1	14.1	23.6	16.5	540.0	5.51	38.3	9	158	42	2.41	13.5
610x305x149	149.2	612.4	304.8	11.8	19.7	16.5	540.0	6.60	45.8	8	158	38	2.39	16.0
610x229x140	139.9	617.2	230.2	13.1	22.1	12.7	547.6	4.34	41.8	9	120	36	2.11	15.1
610x229x125	125.1	612.2	229.0	11.9	19.6	12.7	547.6	4.89	46.0	8	120	34	2.09	16.7
610x229x113	113.0	607.6	228.2	11.1	17.3	12.7	547.6	5.54	49.3	8	120	30	2.08	18.4
610x229x101	101.2	602.6	227.6	10.5	14.8	12.7	547.6	6.48	52.2	7	120	28	2.07	20.5
610x178x100 +	100.3	607.4	179.2	11.3	17.2	12.7	547.6	4.14	48.5	8	94	30	1.89	18.8
610x178x92 +	92.2	603.0	178.8	10.9	15.0	12.7	547.6	4.75	50.2	7	94	28	1.88	20.4
610x178x82 +	81.8	598.6	177.9	10.0	12.8	12.7	547.6	5.57	54.8	7	94	26	1.87	22.9
533x312x273 +	273.3	577.1	320.2	21.1	37.6	12.7	476.5	3.64	22.6	13	160	52	2.37	8.67
533x312x219 +	218.8	560.3	317.4	18.3	29.2	12.7	476.5	4.69	26.0	11	160	42	2.33	10.7
533x312x182 +	181.5	550.7	314.5	15.2	24.4	12.7	476.5	5.61	31.3	10	160	38	2.31	12.7
533x312x151 +	150.6	542.5	312.0	12.7	20.3	12.7	476.5	6.75	37.5	8	160	34	2.29	15.2

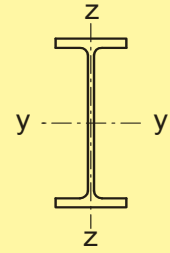
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+ These sections are in addition to the range of BS 4 sections.

FOR EXPLANATION OF TABLES SEE NOTE 2

# UNIVERSAL BEAMS

## Advance® UKB



### Properties

Section Designation	Second Moment of Area		Radius of Gyration		Elastic Modulus		Plastic Modulus		Buckling Parameter U	Torsional Index X	Warping Constant $I_w$ dm <sup>6</sup>	Torsional Constant $I_T$ cm <sup>4</sup>	Area of Section A cm <sup>2</sup>
	Axis y-y cm <sup>4</sup>	Axis z-z cm <sup>4</sup>	Axis y-y cm	Axis z-z cm	Axis y-y cm <sup>3</sup>	Axis z-z cm <sup>3</sup>	Axis y-y cm <sup>3</sup>	Axis z-z cm <sup>3</sup>					
1016x305x487 +	1022000	26700	40.6	6.57	19700	1730	23200	2800	0.867	21.1	64.4	4300	620
1016x305x437 +	910000	23400	40.4	6.49	17700	1540	20800	2470	0.868	23.1	56.0	3190	557
1016x305x393 +	808000	20500	40.2	6.40	15900	1350	18500	2170	0.868	25.5	48.4	2330	500
1016x305x349 +	723000	18500	40.3	6.44	14300	1220	16600	1940	0.872	27.9	43.3	1720	445
1016x305x314 +	644000	16200	40.1	6.37	12900	1080	14800	1710	0.872	30.7	37.7	1260	400
1016x305x272 +	554000	14000	40.0	6.35	11200	934	12800	1470	0.872	35.0	32.2	835	347
1016x305x249 +	481000	11800	39.0	6.09	9820	784	11300	1240	0.861	39.9	26.8	582	317
1016x305x222 +	408000	9550	38.0	5.81	8410	636	9810	1020	0.850	45.7	21.5	390	283
914x419x388	720000	45400	38.2	9.59	15600	2160	17700	3340	0.885	26.7	88.9	1730	494
914x419x343	626000	39200	37.8	9.46	13700	1870	15500	2890	0.883	30.1	75.8	1190	437
914x305x289	504000	15600	37.0	6.51	10900	1010	12600	1600	0.867	31.9	31.2	926	368
914x305x253	436000	13300	36.8	6.42	9500	871	10900	1370	0.865	36.2	26.4	626	323
914x305x224	376000	11200	36.3	6.27	8270	739	9530	1160	0.860	41.3	22.1	422	286
914x305x201	325000	9420	35.7	6.07	7200	621	8350	982	0.853	46.9	18.4	291	256
838x292x226	340000	11400	34.3	6.27	7980	773	9160	1210	0.869	35.0	19.3	514	289
838x292x194	279000	9070	33.6	6.06	6640	620	7640	974	0.862	41.6	15.2	306	247
838x292x176	246000	7800	33.1	5.90	5890	535	6810	842	0.856	46.5	13.0	221	224
762x267x197	240000	8170	30.9	5.71	6230	610	7170	958	0.869	33.1	11.3	404	251
762x267x173	205000	6850	30.5	5.58	5390	514	6200	807	0.865	38.0	9.39	267	220
762x267x147	169000	5460	30.0	5.40	4470	411	5160	647	0.858	45.2	7.40	159	187
762x267x134	151000	4790	29.7	5.30	4020	362	4640	570	0.853	49.8	6.46	119	171
686x254x170	170000	6630	28.0	5.53	4920	518	5630	811	0.872	31.8	7.42	308	217
686x254x152	150000	5780	27.8	5.46	4370	455	5000	710	0.871	35.4	6.42	220	194
686x254x140	136000	5180	27.6	5.39	3990	409	4560	638	0.870	38.6	5.72	169	178
686x254x125	118000	4380	27.2	5.24	3480	346	3990	542	0.863	43.8	4.80	116	159
610x305x238	209000	15800	26.3	7.23	6590	1020	7490	1570	0.886	21.3	14.5	785	303
610x305x179	153000	11400	25.9	7.07	4930	743	5550	1140	0.885	27.7	10.2	340	228
610x305x149	126000	9310	25.7	7.00	4110	611	4590	937	0.886	32.7	8.17	200	190
610x229x140	112000	4510	25.0	5.03	3620	391	4140	611	0.875	30.6	3.99	216	178
610x229x125	98600	3930	24.9	4.97	3220	343	3680	535	0.875	34.0	3.45	154	159
610x229x113	87300	3430	24.6	4.88	2870	301	3280	469	0.870	38.0	2.99	111	144
610x229x101	75800	2910	24.2	4.75	2520	256	2880	400	0.863	43.0	2.52	77.0	129
610x178x100 +	72500	1660	23.8	3.60	2390	185	2790	296	0.854	38.7	1.44	95.0	128
610x178x92 +	64600	1440	23.4	3.50	2140	161	2510	258	0.850	42.7	1.24	71.0	117
610x178x82 +	55900	1210	23.2	3.40	1870	136	2190	218	0.843	48.5	1.04	48.8	104
533x312x273 +	199000	20600	23.9	7.69	6890	1290	7870	1990	0.891	15.9	15.0	1290	348
533x312x219 +	151000	15600	23.3	7.48	5400	982	6120	1510	0.884	19.8	11.0	642	279
533x312x182 +	123000	12700	23.1	7.40	4480	806	5040	1240	0.886	23.4	8.77	373	231
533x312x151 +	101000	10300	22.9	7.32	3710	659	4150	1010	0.885	27.8	7.01	216	192

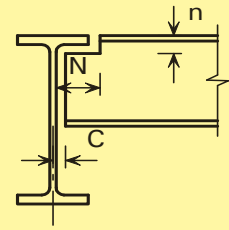
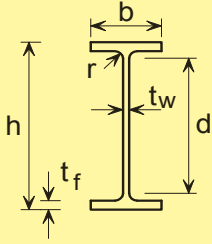
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+ These sections are in addition to the range of BS 4 sections.

FOR EXPLANATION OF TABLES SEE NOTE 3

# UNIVERSAL BEAMS

Advance® UKB



Dimensions

Section Designation	Mass per Metre kg/m	Depth of Section h mm	Width of Section b mm	Thickness		Root Radius r mm	Depth between Fillets d mm	Ratios for Local Buckling		Dimensions for Detailing			Surface Area	
				Web tw mm	Flange tf mm			Flange cf / tf	Web cw / tw	End Clearance C mm	Notch		Per Metre m <sup>2</sup>	Per Tonne m <sup>2</sup>
											N mm	n mm		
533x210x138 +	138.3	549.1	213.9	14.7	23.6	12.7	476.5	3.68	32.4	9	110	38	1.90	13.7
533x210x122	122.0	544.5	211.9	12.7	21.3	12.7	476.5	4.08	37.5	8	110	34	1.89	15.5
533x210x109	109.0	539.5	210.8	11.6	18.8	12.7	476.5	4.62	41.1	8	110	32	1.88	17.2
533x210x101	101.0	536.7	210.0	10.8	17.4	12.7	476.5	4.99	44.1	7	110	32	1.87	18.5
533x210x92	92.1	533.1	209.3	10.1	15.6	12.7	476.5	5.57	47.2	7	110	30	1.86	20.2
533x210x82	82.2	528.3	208.8	9.6	13.2	12.7	476.5	6.58	49.6	7	110	26	1.85	22.5
533x165x85 +	84.8	534.9	166.5	10.3	16.5	12.7	476.5	3.96	46.3	7	90	30	1.69	19.9
533x165x75 +	74.7	529.1	165.9	9.7	13.6	12.7	476.5	4.81	49.1	7	90	28	1.68	22.5
533x165x66 +	65.7	524.7	165.1	8.9	11.4	12.7	476.5	5.74	53.5	6	90	26	1.67	25.4
457x191x161 +	161.4	492.0	199.4	18.0	32.0	10.2	407.6	2.52	22.6	11	102	44	1.73	10.7
457x191x133 +	133.3	480.6	196.7	15.3	26.3	10.2	407.6	3.06	26.6	10	102	38	1.70	12.8
457x191x106 +	105.8	469.2	194.0	12.6	20.6	10.2	407.6	3.91	32.3	8	102	32	1.67	15.8
457x191x98	98.3	467.2	192.8	11.4	19.6	10.2	407.6	4.11	35.8	8	102	30	1.67	17.0
457x191x89	89.3	463.4	191.9	10.5	17.7	10.2	407.6	4.55	38.8	7	102	28	1.66	18.6
457x191x82	82.0	460.0	191.3	9.9	16.0	10.2	407.6	5.03	41.2	7	102	28	1.65	20.1
457x191x74	74.3	457.0	190.4	9.0	14.5	10.2	407.6	5.55	45.3	7	102	26	1.64	22.1
457x191x67	67.1	453.4	189.9	8.5	12.7	10.2	407.6	6.34	48.0	6	102	24	1.63	24.3
457x152x82	82.1	465.8	155.3	10.5	18.9	10.2	407.6	3.29	38.8	7	84	30	1.51	18.4
457x152x74	74.2	462.0	154.4	9.6	17.0	10.2	407.6	3.66	42.5	7	84	28	1.50	20.2
457x152x67	67.2	458.0	153.8	9.0	15.0	10.2	407.6	4.15	45.3	7	84	26	1.50	22.3
457x152x60	59.8	454.6	152.9	8.1	13.3	10.2	407.6	4.68	50.3	6	84	24	1.49	24.9
457x152x52	52.3	449.8	152.4	7.6	10.9	10.2	407.6	5.71	53.6	6	84	22	1.48	28.3
406x178x85 +	85.3	417.2	181.9	10.9	18.2	10.2	360.4	4.14	33.1	7	96	30	1.52	17.8
406x178x74	74.2	412.8	179.5	9.5	16.0	10.2	360.4	4.68	37.9	7	96	28	1.51	20.4
406x178x67	67.1	409.4	178.8	8.8	14.3	10.2	360.4	5.23	41.0	6	96	26	1.50	22.3
406x178x60	60.1	406.4	177.9	7.9	12.8	10.2	360.4	5.84	45.6	6	96	24	1.49	24.8
406x178x54	54.1	402.6	177.7	7.7	10.9	10.2	360.4	6.86	46.8	6	96	22	1.48	27.3
406x140x53 +	53.3	406.6	143.3	7.9	12.9	10.2	360.4	4.46	45.6	6	78	24	1.35	25.3
406x140x46	46.0	403.2	142.2	6.8	11.2	10.2	360.4	5.13	53.0	5	78	22	1.34	29.1
406x140x39	39.0	398.0	141.8	6.4	8.6	10.2	360.4	6.69	56.3	5	78	20	1.33	34.1
356x171x67	67.1	363.4	173.2	9.1	15.7	10.2	311.6	4.58	34.2	7	94	26	1.38	20.6
356x171x57	57.0	358.0	172.2	8.1	13.0	10.2	311.6	5.53	38.5	6	94	24	1.37	24.1
356x171x51	51.0	355.0	171.5	7.4	11.5	10.2	311.6	6.25	42.1	6	94	22	1.36	26.7
356x171x45	45.0	351.4	171.1	7.0	9.7	10.2	311.6	7.41	44.5	6	94	20	1.36	30.2
356x127x39	39.1	353.4	126.0	6.6	10.7	10.2	311.6	4.63	47.2	5	70	22	1.18	30.2
356x127x33	33.1	349.0	125.4	6.0	8.5	10.2	311.6	5.82	51.9	5	70	20	1.17	35.4
305x165x54	54.0	310.4	166.9	7.9	13.7	8.9	265.2	5.15	33.6	6	90	24	1.26	23.3
305x165x46	46.1	306.6	165.7	6.7	11.8	8.9	265.2	5.98	39.6	5	90	22	1.25	27.1
305x165x40	40.3	303.4	165.0	6.0	10.2	8.9	265.2	6.92	44.2	5	90	20	1.24	30.8

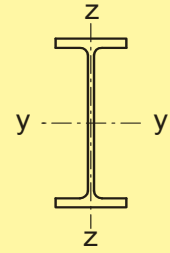
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FOR EXPLANATION OF TABLES SEE NOTE 2

# UNIVERSAL BEAMS

Advance® UKB



## Properties

Section Designation	Second Moment of Area		Radius of Gyration		Elastic Modulus		Plastic Modulus		Buckling Parameter U	Torsional Index X	Warping Constant $I_w$ dm <sup>6</sup>	Torsional Constant $I_T$ cm <sup>4</sup>	Area of Section A cm <sup>2</sup>
	Axis y-y cm <sup>4</sup>	Axis z-z cm <sup>4</sup>	Axis y-y cm	Axis z-z cm	Axis y-y cm <sup>3</sup>	Axis z-z cm <sup>3</sup>	Axis y-y cm <sup>3</sup>	Axis z-z cm <sup>3</sup>					
533x210x138 +	86100	3860	22.1	4.68	3140	361	3610	568	0.874	24.9	2.67	250	176
533x210x122	76000	3390	22.1	4.67	2790	320	3200	500	0.878	27.6	2.32	178	155
533x210x109	66800	2940	21.9	4.60	2480	279	2830	436	0.875	30.9	1.99	126	139
533x210x101	61500	2690	21.9	4.57	2290	256	2610	399	0.874	33.1	1.81	101	129
533x210x92	55200	2390	21.7	4.51	2070	228	2360	355	0.873	36.4	1.60	75.7	117
533x210x82	47500	2010	21.3	4.38	1800	192	2060	300	0.863	41.6	1.33	51.5	105
533x165x85 +	48500	1270	21.2	3.44	1820	153	2100	243	0.861	35.5	0.857	73.8	108
533x165x75 +	41100	1040	20.8	3.30	1550	125	1810	200	0.853	41.1	0.691	47.9	95.2
533x165x66 +	35000	859	20.5	3.20	1340	104	1560	166	0.847	47.0	0.566	32.0	83.7
457x191x161 +	79800	4250	19.7	4.55	3240	426	3780	672	0.881	16.5	2.25	515	206
457x191x133 +	63800	3350	19.4	4.44	2660	341	3070	535	0.879	19.6	1.73	292	170
457x191x106 +	48900	2510	19.0	4.32	2080	259	2390	405	0.876	24.4	1.27	146	135
457x191x98	45700	2350	19.1	4.33	1960	243	2230	379	0.881	25.8	1.18	121	125
457x191x89	41000	2090	19.0	4.29	1770	218	2010	338	0.878	28.3	1.04	90.7	114
457x191x82	37100	1870	18.8	4.23	1610	196	1830	304	0.879	30.8	0.922	69.2	104
457x191x74	33300	1670	18.8	4.20	1460	176	1650	272	0.877	33.8	0.818	51.8	94.6
457x191x67	29400	1450	18.5	4.12	1300	153	1470	237	0.873	37.8	0.705	37.1	85.5
457x152x82	36600	1180	18.7	3.37	1570	153	1810	240	0.872	27.4	0.591	89.2	105
457x152x74	32700	1050	18.6	3.33	1410	136	1630	213	0.872	30.1	0.518	65.9	94.5
457x152x67	28900	913	18.4	3.27	1260	119	1450	187	0.868	33.6	0.448	47.7	85.6
457x152x60	25500	795	18.3	3.23	1120	104	1290	163	0.868	37.5	0.387	33.8	76.2
457x152x52	21400	645	17.9	3.11	950	84.6	1100	133	0.859	43.8	0.311	21.4	66.6
406x178x85 +	31700	1830	17.1	4.11	1520	201	1730	313	0.880	24.4	0.728	93.0	109
406x178x74	27300	1550	17.0	4.04	1320	172	1500	267	0.882	27.5	0.608	62.8	94.5
406x178x67	24300	1360	16.9	3.99	1190	153	1350	237	0.880	30.4	0.533	46.1	85.5
406x178x60	21600	1200	16.8	3.97	1060	135	1200	209	0.880	33.7	0.466	33.3	76.5
406x178x54	18700	1020	16.5	3.85	930	115	1050	178	0.871	38.3	0.392	23.1	69.0
406x140x53 +	18300	635	16.4	3.06	899	88.6	1030	139	0.870	34.1	0.246	29.0	67.9
406x140x46	15700	538	16.4	3.03	778	75.7	888	118	0.871	39.0	0.207	19.0	58.6
406x140x39	12500	410	15.9	2.87	629	57.8	724	90.8	0.858	47.4	0.155	10.7	49.7
356x171x67	19500	1360	15.1	3.99	1070	157	1210	243	0.886	24.4	0.412	55.7	85.5
356x171x57	16000	1110	14.9	3.91	896	129	1010	199	0.882	28.8	0.330	33.4	72.6
356x171x51	14100	968	14.8	3.86	796	113	896	174	0.881	32.1	0.286	23.8	64.9
356x171x45	12100	811	14.5	3.76	687	94.8	775	147	0.874	36.8	0.237	15.8	57.3
356x127x39	10200	358	14.3	2.68	576	56.8	659	89.0	0.871	35.2	0.105	15.1	49.8
356x127x33	8250	280	14.0	2.58	473	44.7	543	70.2	0.863	42.1	0.081	8.79	42.1
305x165x54	11700	1060	13.0	3.93	754	127	846	196	0.889	23.6	0.234	34.8	68.8
305x165x46	9900	896	13.0	3.90	646	108	720	166	0.890	27.1	0.195	22.2	58.7
305x165x40	8500	764	12.9	3.86	560	92.6	623	142	0.889	31.0	0.164	14.7	51.3

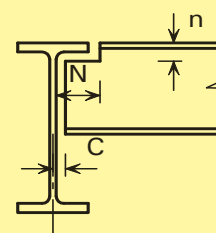
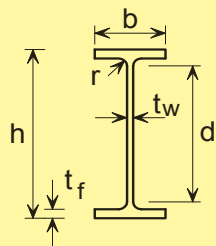
Advance® and UKB are trademarks of Tata Steel. A fuller description of the relationship between Universal Beams (UB) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

+ These sections are in addition to the range of BS 4 sections.

FOR EXPLANATION OF TABLES SEE NOTE 3

## UNIVERSAL BEAMS

### Advance® UKB



Dimensions

Section Designation	Mass per Metre kg/m	Depth of Section h mm	Width of Section b mm	Thickness		Root Radius r mm	Depth between Fillets d mm	Ratios for Local Buckling		Dimensions for Detailing			Surface Area	
				Web tw mm	Flange tf mm			Flange cf / tf	Web cw / tw	End Clearance C mm	Notch		Per Metre m <sup>2</sup>	Per Tonne m <sup>2</sup>
											N mm	n mm		
305x127x48	48.1	311.0	125.3	9.0	14.0	8.9	265.2	3.52	29.5	7	70	24	1.09	22.7
305x127x42	41.9	307.2	124.3	8.0	12.1	8.9	265.2	4.07	33.2	6	70	22	1.08	25.8
305x127x37	37.0	304.4	123.4	7.1	10.7	8.9	265.2	4.60	37.4	6	70	20	1.07	28.9
305x102x33	32.8	312.7	102.4	6.6	10.8	7.6	275.9	3.73	41.8	5	58	20	1.01	30.8
305x102x28	28.2	308.7	101.8	6.0	8.8	7.6	275.9	4.58	46.0	5	58	18	1.00	35.5
305x102x25	24.8	305.1	101.6	5.8	7.0	7.6	275.9	5.76	47.6	5	58	16	0.992	40.0
254x146x43	43.0	259.6	147.3	7.2	12.7	7.6	219.0	4.92	30.4	6	82	22	1.08	25.1
254x146x37	37.0	256.0	146.4	6.3	10.9	7.6	219.0	5.73	34.8	5	82	20	1.07	28.9
254x146x31	31.1	251.4	146.1	6.0	8.6	7.6	219.0	7.26	36.5	5	82	18	1.06	34.0
254x102x28	28.3	260.4	102.2	6.3	10.0	7.6	225.2	4.04	35.7	5	58	18	0.904	31.9
254x102x25	25.2	257.2	101.9	6.0	8.4	7.6	225.2	4.80	37.5	5	58	16	0.897	35.7
254x102x22	22.0	254.0	101.6	5.7	6.8	7.6	225.2	5.93	39.5	5	58	16	0.890	40.5
203x133x30	30.0	206.8	133.9	6.4	9.6	7.6	172.4	5.85	26.9	5	74	18	0.923	30.8
203x133x25	25.1	203.2	133.2	5.7	7.8	7.6	172.4	7.20	30.2	5	74	16	0.915	36.5
203x102x23	23.1	203.2	101.8	5.4	9.3	7.6	169.4	4.37	31.4	5	60	18	0.790	34.2
178x102x19	19.0	177.8	101.2	4.8	7.9	7.6	146.8	5.14	30.6	4	60	16	0.738	38.7
152x89x16	16.0	152.4	88.7	4.5	7.7	7.6	121.8	4.48	27.1	4	54	16	0.638	40.0
127x76x13	13.0	127.0	76.0	4.0	7.6	7.6	96.6	3.74	24.2	4	46	16	0.537	41.4

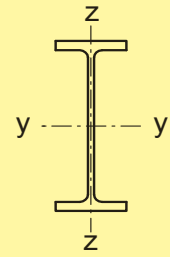
Advance® and UKB are trademarks of Tata Steel. A fuller description of the relationship between Universal Beams (UB) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

FOR EXPLANATION OF TABLES SEE NOTE 2



# UNIVERSAL BEAMS

## Advance® UKB



### Properties

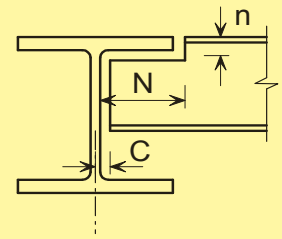
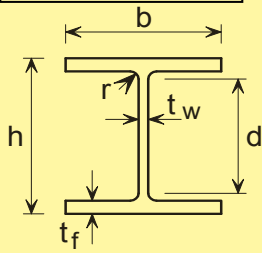
Section Designation	Second Moment of Area		Radius of Gyration		Elastic Modulus		Plastic Modulus		Buckling Parameter U	Torsional Index X	Warping Constant $I_w$ dm <sup>6</sup>	Torsional Constant $I_T$ cm <sup>4</sup>	Area of Section A cm <sup>2</sup>
	Axis y-y	Axis z-z	Axis y-y	Axis z-z	Axis y-y	Axis z-z	Axis y-y	Axis z-z					
	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>					
305x127x48	9570	461	12.5	2.74	616	73.6	711	116	0.873	23.3	0.102	31.8	61.2
305x127x42	8200	389	12.4	2.70	534	62.6	614	98.4	0.872	26.5	0.0846	21.1	53.4
305x127x37	7170	336	12.3	2.67	471	54.5	539	85.4	0.872	29.7	0.0725	14.8	47.2
305x102x33	6500	194	12.5	2.15	416	37.9	481	60.0	0.867	31.6	0.0442	12.2	41.8
305x102x28	5370	155	12.2	2.08	348	30.5	403	48.4	0.859	37.3	0.0349	7.40	35.9
305x102x25	4460	123	11.9	1.97	292	24.2	342	38.8	0.846	43.4	0.027	4.77	31.6
254x146x43	6540	677	10.9	3.52	504	92.0	566	141	0.891	21.1	0.103	23.9	54.8
254x146x37	5540	571	10.8	3.48	433	78.0	483	119	0.890	24.3	0.0857	15.3	47.2
254x146x31	4410	448	10.5	3.36	351	61.3	393	94.1	0.879	29.6	0.0660	8.55	39.7
254x102x28	4000	179	10.5	2.22	308	34.9	353	54.8	0.873	27.5	0.0280	9.57	36.1
254x102x25	3410	149	10.3	2.15	266	29.2	306	46.0	0.866	31.4	0.0230	6.42	32.0
254x102x22	2840	119	10.1	2.06	224	23.5	259	37.3	0.856	36.3	0.0182	4.15	28.0
203x133x30	2900	385	8.71	3.17	280	57.5	314	88.2	0.882	21.5	0.0374	10.3	38.2
203x133x25	2340	308	8.56	3.10	230	46.2	258	70.9	0.876	25.6	0.0294	5.96	32.0
203x102x23	2100	164	8.46	2.36	207	32.2	234	49.7	0.888	22.4	0.0154	7.02	29.4
178x102x19	1360	137	7.48	2.37	153	27.0	171	41.6	0.886	22.6	0.0099	4.41	24.3
152x89x16	834	89.8	6.41	2.10	109	20.2	123	31.2	0.890	19.5	0.00470	3.56	20.3
127x76x13	473	55.7	5.35	1.84	74.6	14.7	84.2	22.6	0.894	16.3	0.00200	2.85	16.5

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FOR EXPLANATION OF TABLES SEE NOTE 3

# UNIVERSAL COLUMNS

Advance® UKC



## Dimensions

Section Designation	Mass per Metre kg/m	Depth of Section h mm	Width of Section b mm	Thickness		Root Radius r mm	Depth between Fillets d mm	Ratios for Local Buckling		Dimensions for Detailing			Surface Area	
				Web t <sub>w</sub> mm	Flange t <sub>f</sub> mm			Flange c <sub>f</sub> / t <sub>f</sub>	Web c <sub>w</sub> / t <sub>w</sub>	End Clearance C mm	Notch		Per Metre m <sup>2</sup>	Per Tonne m <sup>2</sup>
											N mm	n mm		
356x406x634	633.9	474.6	424.0	47.6	77.0	15.2	290.2	2.25	6.10	26	200	94	2.52	3.98
356x406x551	551.0	455.6	418.5	42.1	67.5	15.2	290.2	2.56	6.89	23	200	84	2.47	4.48
356x406x467	467.0	436.6	412.2	35.8	58.0	15.2	290.2	2.98	8.11	20	200	74	2.42	5.18
356x406x393	393.0	419.0	407.0	30.6	49.2	15.2	290.2	3.52	9.48	17	200	66	2.38	6.06
356x406x340	339.9	406.4	403.0	26.6	42.9	15.2	290.2	4.03	10.9	15	200	60	2.35	6.91
356x406x287	287.1	393.6	399.0	22.6	36.5	15.2	290.2	4.74	12.8	13	200	52	2.31	8.05
356x406x235	235.1	381.0	394.8	18.4	30.2	15.2	290.2	5.73	15.8	11	200	46	2.28	9.70
356x368x202	201.9	374.6	374.7	16.5	27.0	15.2	290.2	6.07	17.6	10	190	44	2.19	10.8
356x368x177	177.0	368.2	372.6	14.4	23.8	15.2	290.2	6.89	20.2	9	190	40	2.17	12.3
356x368x153	152.9	362.0	370.5	12.3	20.7	15.2	290.2	7.92	23.6	8	190	36	2.16	14.1
356x368x129	129.0	355.6	368.6	10.4	17.5	15.2	290.2	9.4	27.9	7	190	34	2.14	16.6
305x305x283	282.9	365.3	322.2	26.8	44.1	15.2	246.7	3.00	9.21	15	158	60	1.94	6.86
305x305x240	240.0	352.5	318.4	23.0	37.7	15.2	246.7	3.51	10.7	14	158	54	1.91	7.96
305x305x198	198.1	339.9	314.5	19.1	31.4	15.2	246.7	4.22	12.9	12	158	48	1.87	9.44
305x305x158	158.1	327.1	311.2	15.8	25.0	15.2	246.7	5.30	15.6	10	158	42	1.84	11.6
305x305x137	136.9	320.5	309.2	13.8	21.7	15.2	246.7	6.11	17.90	9	158	38	1.82	13.3
305x305x118	117.9	314.5	307.4	12.0	18.7	15.2	246.7	7.09	20.6	8	158	34	1.81	15.4
305x305x97	96.9	307.9	305.3	9.9	15.4	15.2	246.7	8.60	24.9	7	158	32	1.79	18.5
254x254x167	167.1	289.1	265.2	19.2	31.7	12.7	200.3	3.48	10.4	12	134	46	1.58	9.46
254x254x132	132.0	276.3	261.3	15.3	25.3	12.7	200.3	4.36	13.1	10	134	38	1.55	11.7
254x254x107	107.1	266.7	258.8	12.8	20.5	12.7	200.3	5.38	15.6	8	134	34	1.52	14.2
254x254x89	88.9	260.3	256.3	10.3	17.3	12.7	200.3	6.38	19.4	7	134	30	1.50	16.9
254x254x73	73.1	254.1	254.6	8.6	14.2	12.7	200.3	7.77	23.3	6	134	28	1.49	20.4
203x203x127 +	127.5	241.4	213.9	18.1	30.1	10.2	160.8	2.91	8.88	11	108	42	1.28	10.0
203x203x113 +	113.5	235.0	212.1	16.3	26.9	10.2	160.8	3.26	9.87	10	108	38	1.27	11.2
203x203x100 +	99.6	228.6	210.3	14.5	23.7	10.2	160.8	3.70	11.1	9	108	34	1.25	12.6
203x203x86	86.1	222.2	209.1	12.7	20.5	10.2	160.8	4.29	12.7	8	110	32	1.24	14.4
203x203x71	71.0	215.8	206.4	10.0	17.3	10.2	160.8	5.09	16.1	7	110	28	1.22	17.2
203x203x60	60.0	209.6	205.8	9.4	14.2	10.2	160.8	6.20	17.1	7	110	26	1.21	20.2
203x203x52	52.0	206.2	204.3	7.9	12.5	10.2	160.8	7.04	20.4	6	110	24	1.20	23.1
203x203x46	46.1	203.2	203.6	7.2	11.0	10.2	160.8	8.00	22.3	6	110	22	1.19	25.8
152x152x51 +	51.2	170.2	157.4	11.0	15.7	7.6	123.6	4.18	11.2	8	84	24	0.935	18.3
152x152x44 +	44.0	166.0	155.9	9.5	13.6	7.6	123.6	4.82	13.0	7	84	22	0.924	21.0
152x152x37	37.0	161.8	154.4	8.0	11.5	7.6	123.6	5.70	15.5	6	84	20	0.912	24.7
152x152x30	30.0	157.6	152.9	6.5	9.4	7.6	123.6	6.98	19.0	5	84	18	0.901	30.0
152x152x23	23.0	152.4	152.2	5.8	6.8	7.6	123.6	9.65	21.3	5	84	16	0.889	38.7

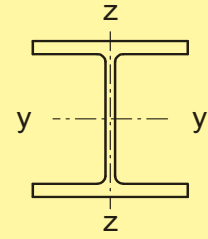
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+ These sections are in addition to the range of BS 4 sections.

FOR EXPLANATION OF TABLES SEE NOTE 2

# UNIVERSAL COLUMNS

Advance® UKC



## Properties

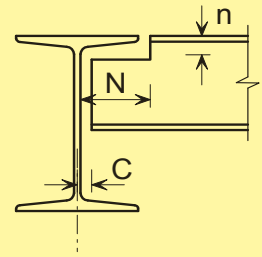
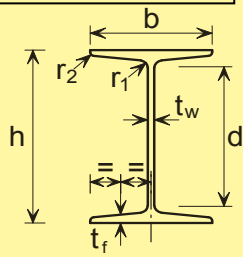
Section Designation	Second Moment of Area		Radius of Gyration		Elastic Modulus		Plastic Modulus		Buckling Parameter U	Torsional Index X	Warping Constant $I_w$ dm <sup>6</sup>	Torsional Constant $I_T$ cm <sup>4</sup>	Area of Section A cm <sup>2</sup>
	Axis y-y	Axis z-z	Axis y-y	Axis z-z	Axis y-y	Axis z-z	Axis y-y	Axis z-z					
	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>					
356x406x634	275000	98100	18.4	11.0	11600	4630	14200	7110	0.843	5.46	38.8	13700	808
356x406x551	227000	82700	18.0	10.9	9960	3950	12100	6060	0.841	6.05	31.1	9240	702
356x406x467	183000	67800	17.5	10.7	8380	3290	10000	5030	0.839	6.85	24.3	5810	595
356x406x393	147000	55400	17.1	10.5	7000	2720	8220	4150	0.837	7.86	18.9	3550	501
356x406x340	123000	46900	16.8	10.4	6030	2330	7000	3540	0.836	8.84	15.5	2340	433
356x406x287	99900	38700	16.5	10.3	5070	1940	5810	2950	0.835	10.17	12.3	1440	366
356x406x235	79100	31000	16.3	10.2	4150	1570	4690	2380	0.834	12.04	9.54	812	299
356x368x202	66300	23700	16.1	9.60	3540	1260	3970	1920	0.844	13.35	7.16	558	257
356x368x177	57100	20500	15.9	9.54	3100	1100	3460	1670	0.844	15.00	6.09	381	226
356x368x153	48600	17600	15.8	9.49	2680	948	2960	1430	0.844	17.01	5.11	251	195
356x368x129	40200	14600	15.6	9.43	2260	793	2480	1200	0.844	19.81	4.18	153	164
305x305x283	78900	24600	14.8	8.27	4320	1530	5110	2340	0.855	7.64	6.35	2030	360
305x305x240	64200	20300	14.5	8.15	3640	1280	4250	1950	0.854	8.73	5.03	1270	306
305x305x198	50900	16300	14.2	8.04	3000	1040	3440	1580	0.854	10.23	3.88	734	252
305x305x158	38700	12600	13.9	7.90	2370	808	2680	1230	0.851	12.46	2.87	378	201
305x305x137	32800	10700	13.7	7.83	2050	692	2300	1050	0.851	14.13	2.39	249	174
305x305x118	27700	9060	13.6	7.77	1760	589	1960	895	0.850	16.14	1.98	161	150
305x305x97	22200	7310	13.4	7.69	1450	479	1590	726	0.850	19.19	1.56	91.2	123
254x254x167	30000	9870	11.9	6.81	2080	744	2420	1140	0.851	8.48	1.63	626	213
254x254x132	22500	7530	11.6	6.69	1630	576	1870	878	0.850	10.32	1.19	319	168
254x254x107	17500	5930	11.3	6.59	1310	458	1480	697	0.848	12.38	0.898	172	136
254x254x89	14300	4860	11.2	6.55	1100	379	1220	575	0.850	14.46	0.717	102	113
254x254x73	11400	3910	11.1	6.48	898	307	992	465	0.849	17.24	0.562	57.6	93.1
203x203x127 +	15400	4920	9.75	5.50	1280	460	1520	704	0.854	7.38	0.549	427	162
203x203x113 +	13300	4290	9.59	5.45	1130	404	1330	618	0.853	8.11	0.464	305	145
203x203x100 +	11300	3680	9.44	5.39	988	350	1150	534	0.852	9.02	0.386	210	127
203x203x86	9450	3130	9.28	5.34	850	299	977	456	0.850	10.20	0.318	137	110
203x203x71	7620	2540	9.18	5.30	706	246	799	374	0.853	11.90	0.250	80.2	90.4
203x203x60	6120	2060	8.96	5.20	584	201	656	305	0.846	14.10	0.197	47.2	76.4
203x203x52	5260	1780	8.91	5.18	510	174	567	264	0.848	15.80	0.167	31.8	66.3
203x203x46	4570	1550	8.82	5.13	450	152	497	231	0.847	17.70	0.143	22.2	58.7
152x152x51 +	3230	1020	7.04	3.96	379	130	438	199	0.848	10.10	0.061	48.8	65.2
152x152x44 +	2700	860	6.94	3.92	326	110	372	169	0.848	11.50	0.050	31.7	56.1
152x152x37	2210	706	6.85	3.87	273	91.5	309	140	0.848	13.30	0.040	19.2	47.1
152x152x30	1750	560	6.76	3.83	222	73.3	248	112	0.849	16.00	0.031	10.5	38.3
152x152x23	1250	400	6.54	3.70	164	52.6	182	80.1	0.840	20.70	0.021	4.63	29.2

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+ These sections are in addition to the range of BS 4 sections.

FOR EXPLANATION OF TABLES SEE NOTE 3

## JOISTS

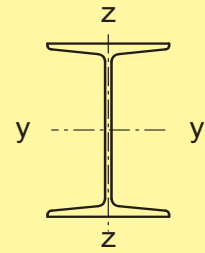


Dimensions

Section Designation	Mass per Metre kg/m	Depth of Section h mm	Width of Section b mm	Thickness		Radii		Depth between Fillets d mm	Ratios for Local Buckling		Dimensions for Detailing			Surface Area	
				Web tw mm	Flange tf mm	Root r1 mm	Toe r2 mm		Flange cf / tf	Web cw / tw	End Clearance C mm	Notch		Per Metre m <sup>2</sup>	Per Tonne m <sup>2</sup>
												N mm	n mm		
254x203x82	82.0	254.0	203.2	10.2	19.9	19.6	9.7	166.6	3.86	16.3	7	104	44	1.21	14.8
254x114x37	37.2	254.0	114.3	7.6	12.8	12.4	6.1	199.3	3.20	26.2	6	60	28	0.899	24.2
203x152x52	52.3	203.2	152.4	8.9	16.5	15.5	7.6	133.2	3.41	15.0	6	78	36	0.932	17.8
152x127x37	37.3	152.4	127.0	10.4	13.2	13.5	6.6	94.3	3.39	9.07	7	66	30	0.737	19.8
127x114x29	29.3	127.0	114.3	10.2	11.5	9.9	4.8	79.5	3.67	7.79	7	60	24	0.646	22.0
127x114x27	26.9	127.0	114.3	7.4	11.4	9.9	5.0	79.5	3.82	10.7	6	60	24	0.650	24.2
127x76x16	16.5	127.0	76.2	5.6	9.6	9.4	4.6	86.5	2.70	15.4	5	42	22	0.512	31.0
114x114x27	27.1	114.3	114.3	9.5	10.7	14.2	3.2	60.8	3.57	6.40	7	60	28	0.618	22.8
102x102x23	23.0	101.6	101.6	9.5	10.3	11.1	3.2	55.2	3.39	5.81	7	54	24	0.549	23.9
102x44x7	7.5	101.6	44.5	4.3	6.1	6.9	3.3	74.6	2.16	17.3	4	28	14	0.350	46.6
89x89x19	19.5	88.9	88.9	9.5	9.9	11.1	3.2	44.2	2.89	4.65	7	46	24	0.476	24.4
76x76x15	15.0	76.2	80.0	8.9	8.4	9.4	4.6	38.1	3.11	4.28	6	42	20	0.419	27.9
76x76x13	12.8	76.2	76.2	5.1	8.4	9.4	4.6	38.1	3.11	7.47	5	42	20	0.411	32.1

FOR EXPLANATION OF TABLES SEE NOTE 2

## JOISTS



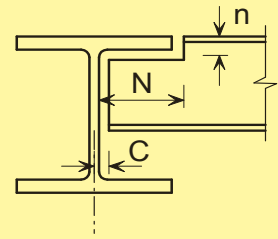
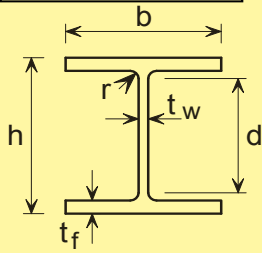
### Properties

Section Designation	Second Moment of Area		Radius of Gyration		Elastic Modulus		Plastic Modulus		Buckling Parameter U	Torsional Index X	Warping Constant $I_w$ dm <sup>6</sup>	Torsional Constant $I_T$ cm <sup>4</sup>	Area of Section A cm <sup>2</sup>
	Axis y-y	Axis z-z	Axis y-y	Axis z-z	Axis y-y	Axis z-z	Axis y-y	Axis z-z					
	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>					
254x203x82	12000	2280	10.7	4.67	947	224	1080	371	0.888	11.0	0.312	152	105
254x114x37	5080	269	10.4	2.39	400	47.1	459	79.1	0.884	18.7	0.0392	25.2	47.3
203x152x52	4800	816	8.49	3.50	472	107	541	176	0.890	10.7	0.0711	64.8	66.6
152x127x37	1820	378	6.19	2.82	239	59.6	279	99.8	0.867	9.3	0.0183	33.9	47.5
127x114x29	979	242	5.12	2.54	154	42.3	181	70.8	0.853	8.8	0.00807	20.8	37.4
127x114x27	946	236	5.26	2.63	149	41.3	172	68.2	0.868	9.3	0.00788	16.9	34.2
127x76x16	571	60.8	5.21	1.70	90.0	16.0	104	26.4	0.890	11.8	0.00210	6.72	21.1
114x114x27	736	224	4.62	2.55	129	39.2	151	65.8	0.839	7.9	0.00601	18.9	34.5
102x102x23	486	154	4.07	2.29	95.6	30.3	113	50.6	0.836	7.4	0.00321	14.2	29.3
102x44x7	153	7.82	4.01	0.907	30.1	3.51	35.4	6.03	0.872	14.9	0.000178	1.25	9.50
89x89x19	307	101	3.51	2.02	69.0	22.8	82.7	38.0	0.829	6.6	0.00158	11.5	24.9
76x76x15	172	60.9	3.00	1.78	45.2	15.2	54.2	25.8	0.820	6.4	0.000700	6.83	19.1
76x76x13	158	51.8	3.12	1.79	41.5	13.6	48.7	22.4	0.853	7.2	0.000595	4.59	16.2

FOR EXPLANATION OF TABLES SEE NOTE 3

## UNIVERSAL BEARING PILES

Advance® UKBP



Dimensions

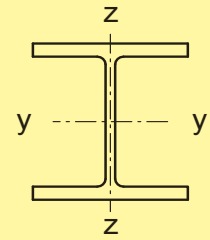
Section Designation	Mass per Metre kg/m	Depth of Section H mm	Width of Section b mm	Thickness		Root Radius r mm	Depth between Fillets d mm	Ratios for Local Buckling		Dimensions for Detailing			Surface Area	
				Web t <sub>w</sub> mm	Flange t <sub>f</sub> mm			Flange c <sub>f</sub> /t <sub>f</sub>	Web c <sub>w</sub> /t <sub>w</sub>	End Clearance C mm	Notch		Per Metre m <sup>2</sup>	Per Tonne m <sup>2</sup>
											N mm	n mm		
356x368x174	173.9	361.4	378.5	20.3	20.4	15.2	290.2	8.03	14.3	12	190	36	2.17	12.5
356x368x152	152.0	356.4	376.0	17.8	17.9	15.2	290.2	9.16	16.3	11	190	34	2.16	14.2
356x368x133	133.0	352.0	373.8	15.6	15.7	15.2	290.2	10.44	18.6	10	190	32	2.14	16.1
356x368x109	108.9	346.4	371.0	12.8	12.9	15.2	290.2	12.71	22.7	8	190	30	2.13	19.5
305x305x223	222.9	337.9	325.7	30.3	30.4	15.2	246.7	4.36	8.14	17	158	46	1.89	8.49
305x305x186	186.0	328.3	320.9	25.5	25.6	15.2	246.7	5.18	9.67	15	158	42	1.86	10.0
305x305x149	149.1	318.5	316.0	20.6	20.7	15.2	246.7	6.40	12.0	12	158	36	1.83	12.3
305x305x126	126.1	312.3	312.9	17.5	17.6	15.2	246.7	7.53	14.1	11	158	34	1.82	14.4
305x305x110	110.0	307.9	310.7	15.3	15.4	15.2	246.7	8.60	16.1	10	158	32	1.80	16.4
305x305x95	94.9	303.7	308.7	13.3	13.3	15.2	246.7	9.96	18.5	9	158	30	1.79	18.9
305x305x88	88.0	301.7	307.8	12.4	12.3	15.2	246.7	10.77	19.9	8	158	28	1.78	20.3
305x305x79	78.9	299.3	306.4	11.0	11.1	15.2	246.7	11.94	22.4	8	158	28	1.78	22.5
254x254x85	85.1	254.3	260.4	14.4	14.3	12.7	200.3	7.71	13.9	9	134	28	1.50	17.6
254x254x71	71.0	249.7	258.0	12.0	12.0	12.7	200.3	9.19	16.7	8	134	26	1.49	20.9
254x254x63	63.0	247.1	256.6	10.6	10.7	12.7	200.3	10.31	18.9	7	134	24	1.48	23.5
203x203x54	53.9	204.0	207.7	11.3	11.4	10.2	160.8	7.72	14.2	8	110	22	1.20	22.2
203x203x45	44.9	200.2	205.9	9.5	9.5	10.2	160.8	9.26	16.9	7	110	20	1.19	26.4

Advance® and UKBP are trademarks of Tata Steel. A fuller description of the relationship between Universal Bearing Piles (UBP) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

FOR EXPLANATION OF TABLES SEE NOTE 2

UNIVERSAL BEARING PILES

Advance® UKBP



Properties

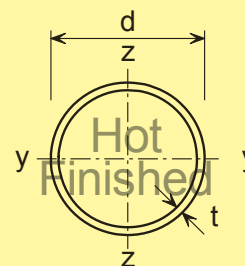
Section Designation	Second Moment of Area		Radius of Gyration		Elastic Modulus		Plastic Modulus		Buckling Parameter U	Torsional Index X	Warping Constant $I_w$ dm <sup>6</sup>	Torsional Constant $I_T$ cm <sup>4</sup>	Area of Section A cm <sup>2</sup>
	Axis y-y	Axis z-z	Axis y-y	Axis z-z	Axis y-y	Axis z-z	Axis y-y	Axis z-z					
	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>					
356x368x174	51000	18500	15.2	9.13	2820	976	3190	1500	0.822	15.8	5.37	330	221
356x368x152	44000	15900	15.1	9.05	2470	845	2770	1290	0.821	17.9	4.55	223	194
356x368x133	38000	13700	15.0	8.99	2160	732	2410	1120	0.823	20.1	3.87	151	169
356x368x109	30600	11000	14.9	8.90	1770	592	1960	903	0.822	24.2	3.05	84.6	139
305x305x223	52700	17600	13.6	7.87	3120	1080	3650	1680	0.827	9.5	4.15	943	284
305x305x186	42600	14100	13.4	7.73	2600	881	3000	1370	0.827	11.1	3.24	560	237
305x305x149	33100	10900	13.2	7.58	2080	691	2370	1070	0.828	13.5	2.42	295	190
305x305x126	27400	9000	13.1	7.49	1760	575	1990	885	0.829	15.7	1.95	182	161
305x305x110	23600	7710	13.0	7.42	1530	496	1720	762	0.830	17.7	1.65	122	140
305x305x95	20000	6530	12.9	7.35	1320	423	1470	648	0.829	20.2	1.38	80.0	121
305x305x88	18400	5980	12.8	7.31	1220	389	1360	595	0.831	21.6	1.25	64.2	112
305x305x79	16400	5330	12.8	7.28	1100	348	1220	531	0.833	23.8	1.11	46.9	100
254x254x85	12300	4220	10.6	6.24	966	324	1090	498	0.826	15.6	0.607	81.8	108
254x254x71	10100	3440	10.6	6.17	807	267	904	409	0.826	18.4	0.486	48.4	90.4
254x254x63	8860	3020	10.5	6.13	717	235	799	360	0.828	20.4	0.421	34.3	80.2
203x203x54	5030	1710	8.55	4.98	493	164	557	252	0.827	15.8	0.158	32.7	68.7
203x203x45	4100	1380	8.46	4.92	410	134	459	206	0.827	18.6	0.126	19.2	57.2

Advance® and UKBP are trademarks of Tata Steel. A fuller description of the relationship between Universal Bearing Piles (UBP) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

FOR EXPLANATION OF TABLES SEE NOTE 3

## HOT-FINISHED CIRCULAR HOLLOW SECTIONS

Celsius® CHS



Dimensions and properties

Section Designation		Mass per Metre kg/m	Area of Section A cm <sup>2</sup>	Ratio for Local Buckling d/t	Second Moment of Area I cm <sup>4</sup>	Radius of Gyration i cm	Elastic Modulus W <sub>el</sub> cm <sup>3</sup>	Plastic Modulus W <sub>pl</sub> cm <sup>3</sup>	Torsional Constants		Surface Area	
Outside Diameter d mm	Thickness t mm								I <sub>T</sub> cm <sup>4</sup>	W <sub>t</sub> cm <sup>3</sup>	Per Metre m <sup>2</sup>	Per Tonne m <sup>2</sup>
21.3	2.6 #	1.20	1.53	8.19	0.681	0.668	0.639	0.915	1.36	1.28	0.067	55.9
	2.9 #	1.32	1.68	7.34	0.727	0.659	0.683	0.990	1.45	1.37	0.067	50.9
	3.2	1.43	1.82	6.66	0.768	0.650	0.722	1.06	1.54	1.44	0.067	46.9
26.9	2.6 #	1.56	1.98	10.3	1.48	0.864	1.10	1.54	2.96	2.20	0.085	54.6
	2.9 #	1.72	2.19	9.28	1.60	0.855	1.19	1.68	3.19	2.38	0.085	49.6
	3.2	1.87	2.38	8.41	1.70	0.846	1.27	1.81	3.41	2.53	0.085	45.5
	3.6 #	2.07	2.64	7.47	1.83	0.834	1.36	1.97	3.66	2.72	0.085	41.1
33.7	2.6 #	1.99	2.54	13.0	3.09	1.10	1.84	2.52	6.19	3.67	0.106	53.1
	2.9 #	2.20	2.81	11.6	3.36	1.09	1.99	2.76	6.71	3.98	0.106	48.1
	3.2	2.41	3.07	10.5	3.60	1.08	2.14	2.99	7.21	4.28	0.106	44.0
	3.6 #	2.67	3.40	9.36	3.91	1.07	2.32	3.28	7.82	4.64	0.106	39.6
	4.0	2.93	3.73	8.43	4.19	1.06	2.49	3.55	8.38	4.97	0.106	36.1
	4.5 #	3.24	4.13	7.49	4.50	1.04	2.67	3.87	9.01	5.35	0.106	32.8
	5.0 #	3.54	4.51	6.74	4.78	1.03	2.84	4.16	9.57	5.68	0.106	30.0
42.4	2.6 #	2.55	3.25	16.3	6.46	1.41	3.05	4.12	12.9	6.10	0.133	52.1
	2.9 #	2.82	3.60	14.6	7.06	1.40	3.33	4.53	14.1	6.66	0.133	47.1
	3.2	3.09	3.94	13.3	7.62	1.39	3.59	4.93	15.2	7.19	0.133	43.0
	3.6 #	3.44	4.39	11.8	8.33	1.38	3.93	5.44	16.7	7.86	0.133	38.6
	4.0	3.79	4.83	10.6	8.99	1.36	4.24	5.92	18.0	8.48	0.133	35.1
	4.5 #	4.21	5.36	9.42	9.76	1.35	4.60	6.49	19.5	9.20	0.133	31.7
	5.0 #	4.61	5.87	8.48	10.5	1.33	4.93	7.04	20.9	9.86	0.133	28.9
48.3	2.6 #	2.93	3.73	18.6	9.78	1.62	4.05	5.44	19.6	8.10	0.152	51.8
	2.9 #	3.25	4.14	16.7	10.7	1.61	4.43	5.99	21.4	8.86	0.152	46.8
	3.2	3.56	4.53	15.1	11.6	1.60	4.80	6.52	23.2	9.59	0.152	42.7
	3.6 #	3.97	5.06	13.4	12.7	1.59	5.26	7.21	25.4	10.5	0.152	38.3
	4.0	4.37	5.57	12.1	13.8	1.57	5.70	7.87	27.5	11.4	0.152	34.8
	4.5 #	4.86	6.19	10.7	15.0	1.56	6.21	8.66	30.0	12.4	0.152	31.3
	5.0	5.34	6.80	9.66	16.2	1.54	6.69	9.42	32.3	13.4	0.152	28.4
	5.6 #	5.90	7.51	8.63	17.4	1.52	7.21	10.3	34.8	14.4	0.152	25.8
6.3	6.53	8.31	7.67	18.7	1.50	7.76	11.2	37.5	15.5	0.152	23.3	
60.3	2.6 #	3.70	4.71	23.2	19.7	2.04	6.52	8.66	39.3	13.0	0.189	51.0
	2.9 #	4.11	5.23	20.8	21.6	2.03	7.16	9.56	43.2	14.3	0.189	46.1
	3.2	4.51	5.74	18.8	23.5	2.02	7.78	10.4	46.9	15.6	0.189	42.0
	3.6 #	5.03	6.41	16.8	25.9	2.01	8.58	11.6	51.7	17.2	0.189	37.6
	4.0	5.55	7.07	15.1	28.2	2.00	9.34	12.7	56.3	18.7	0.189	34.0
	4.5 #	6.19	7.89	13.4	30.9	1.98	10.2	14.0	61.8	20.5	0.189	30.4
	5.0	6.82	8.69	12.1	33.5	1.96	11.1	15.3	67.0	22.2	0.189	27.8
	5.6 #	7.55	9.62	10.8	36.4	1.94	12.1	16.8	72.7	24.1	0.189	24.9
	6.3	8.39	10.7	9.57	39.5	1.92	13.1	18.5	79.0	26.2	0.189	22.5
8.0 #	10.3	13.1	7.54	46.0	1.87	15.3	22.1	92.0	30.5	0.189	18.3	

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Circular Hollow Sections (HFCHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

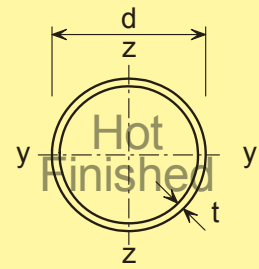
# Check availability

FOR EXPLANATION OF TABLES SEE NOTES 2 AND 3



## HOT-FINISHED CIRCULAR HOLLOW SECTIONS

Celsius® CHS



Dimensions and properties

Section Designation		Mass per Metre	Area of Section	Ratio for Local Buckling	Second Moment of Area	Radius of Gyration	Elastic Modulus	Plastic Modulus	Torsional Constants		Surface Area	
Outside Diameter	Thickness								$I_T$	$W_t$	Per Metre	Per Tonne
d	t	kg/m	A	d/t	I	i	$W_{el}$	$W_{pl}$	$I_T$	$W_t$	$m^2$	$m^2$
mm	mm		cm <sup>2</sup>		cm <sup>4</sup>	cm	cm <sup>3</sup>	cm <sup>3</sup>	cm <sup>4</sup>	cm <sup>3</sup>		
76.1	2.9	5.24	6.67	26.2	44.7	2.59	11.8	15.5	89.5	23.5	0.239	45.6
	3.2	5.75	7.33	23.8	48.8	2.58	12.8	17.0	97.6	25.6	0.239	41.6
	3.6 #	6.44	8.20	21.1	54.0	2.57	14.2	18.9	108	28.4	0.239	37.0
	4.0	7.11	9.06	19.0	59.1	2.55	15.5	20.8	118	31.0	0.239	33.7
	4.5 #	7.95	10.1	16.9	65.1	2.54	17.1	23.1	130	34.2	0.239	30.1
	5.0	8.77	11.2	15.2	70.9	2.52	18.6	25.3	142	37.3	0.239	27.2
	5.6 #	9.74	12.4	13.6	77.5	2.50	20.4	27.9	155	40.8	0.239	24.6
	6.3	10.8	13.8	12.1	84.8	2.48	22.3	30.8	170	44.6	0.239	22.0
8.0	13.4	17.1	9.51	101	2.42	26.4	37.3	201	52.9	0.239	17.8	
88.9	2.9 #	6.15	7.84	30.7	72.5	3.04	16.3	21.5	145	32.6	0.279	45.5
	3.2 #	6.76	8.62	27.8	79.2	3.03	17.8	23.5	158	35.6	0.279	41.3
	3.6 #	7.57	9.65	24.7	87.9	3.02	19.8	26.2	176	39.5	0.279	36.8
	4.0	8.38	10.7	22.2	96.3	3.00	21.7	28.9	193	43.3	0.279	33.2
	4.5 #	9.37	11.9	19.8	107	2.99	24.0	32.1	213	47.9	0.279	29.9
	5.0	10.3	13.2	17.8	116	2.97	26.2	35.2	233	52.4	0.279	27.0
	5.6 #	11.5	14.7	15.9	128	2.95	28.7	38.9	255	57.5	0.279	24.2
	6.3	12.8	16.3	14.1	140	2.93	31.5	43.1	280	63.1	0.279	21.7
	8.0	16.0	20.3	11.1	168	2.87	37.8	52.5	336	75.6	0.279	17.5
	10.0 #	19.5	24.8	8.89	196	2.81	44.1	62.6	392	88.2	0.279	14.3
101.6	3.2 #	7.77	9.89	31.8	120	3.48	23.6	31.0	240	47.2	0.319	41.2
	3.6 #	8.70	11.1	28.2	133	3.47	26.2	34.6	266	52.5	0.319	36.7
	4.0 #	9.63	12.3	25.4	146	3.45	28.8	38.1	293	57.6	0.319	33.2
	4.5 #	10.8	13.7	22.6	162	3.44	31.9	42.5	324	63.8	0.319	29.6
	5.0 #	11.9	15.2	20.3	177	3.42	34.9	46.7	355	69.9	0.319	26.8
	5.6 #	13.3	16.9	18.1	195	3.40	38.4	51.7	390	76.9	0.319	24.1
	6.3 #	14.8	18.9	16.1	215	3.38	42.3	57.3	430	84.7	0.319	21.5
	8.0 #	18.5	23.5	12.7	260	3.32	51.1	70.3	519	102	0.319	17.3
10.0 #	22.6	28.8	10.2	305	3.26	60.1	84.2	611	120	0.319	14.1	
114.3	3.2 #	8.77	11.2	35.7	172	3.93	30.2	39.5	345	60.4	0.359	40.9
	3.6	9.83	12.5	31.8	192	3.92	33.6	44.1	384	67.2	0.359	36.6
	4.0	10.9	13.9	28.6	211	3.90	36.9	48.7	422	73.9	0.359	33.0
	4.5 #	12.2	15.5	25.4	234	3.89	41.0	54.3	469	82.0	0.359	29.5
	5.0	13.5	17.2	22.9	257	3.87	45.0	59.8	514	89.9	0.359	26.6
	5.6 #	15.0	19.1	20.4	283	3.85	49.6	66.2	566	99.1	0.359	23.9
	6.3	16.8	21.4	18.1	313	3.82	54.7	73.6	625	109	0.359	21.4
	8.0	21.0	26.7	14.3	379	3.77	66.4	90.6	759	133	0.359	17.1
10.0 #	25.7	32.8	11.4	450	3.70	78.7	109	899	157	0.359	14.0	

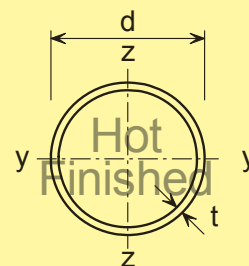
Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Circular Hollow Sections (HFCHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTES 2 AND 3

## HOT-FINISHED CIRCULAR HOLLOW SECTIONS

Celsius® CHS



Dimensions and properties

Section Designation		Mass per Metre	Area of Section	Ratio for Local Buckling	Second Moment of Area	Radius of Gyration	Elastic Modulus	Plastic Modulus	Torsional Constants		Surface Area	
Outside Diameter	Thickness								$I_T$	$W_t$	Per Metre	Per Tonne
d	t	kg/m	A	d/t	I	i	$W_{el}$	$W_{pl}$	$I_T$	$W_t$	m <sup>2</sup>	m <sup>2</sup>
mm	mm		cm <sup>2</sup>		cm <sup>4</sup>	cm	cm <sup>3</sup>	cm <sup>3</sup>	cm <sup>4</sup>	cm <sup>3</sup>		
139.7	3.2 #	10.8	13.7	43.7	320	4.83	45.8	59.6	640	91.6	0.439	40.7
	3.6 #	12.1	15.4	38.8	357	4.81	51.1	66.7	713	102	0.439	36.3
	4.0 #	13.4	17.1	34.9	393	4.80	56.2	73.7	786	112	0.439	32.8
	4.5 #	15.0	19.1	31.0	437	4.78	62.6	82.3	874	125	0.439	29.2
	5.0	16.6	21.2	27.9	481	4.77	68.8	90.8	961	138	0.439	26.4
	5.6 #	18.5	23.6	24.9	531	4.75	76.1	101	1060	152	0.439	23.7
	6.3	20.7	26.4	22.2	589	4.72	84.3	112	1180	169	0.439	21.2
	8.0	26.0	33.1	17.5	720	4.66	103	139	1440	206	0.439	16.9
	10.0	32.0	40.7	14.0	862	4.60	123	169	1720	247	0.439	13.7
	12.5 #	39.2	50.0	11.2	1020	4.52	146	203	2040	292	0.439	11.2
168.3	5.0	20.1	25.7	33.7	856	5.78	102	133	1710	203	0.529	26.3
	5.6 #	22.5	28.6	30.1	948	5.76	113	148	1900	225	0.529	23.5
	6.3	25.2	32.1	26.7	1050	5.73	125	165	2110	250	0.529	21.0
	8.0	31.6	40.3	21.0	1300	5.67	154	206	2600	308	0.529	16.7
	10.0	39.0	49.7	16.8	1560	5.61	186	251	3130	372	0.529	13.5
	12.5	48.0	61.2	13.5	1870	5.53	222	304	3740	444	0.529	11.0
193.7	5.0	23.3	29.6	38.7	1320	6.67	136	178	2640	273	0.609	26.2
	5.6 #	26.0	33.1	34.6	1470	6.65	151	198	2930	303	0.609	23.4
	6.3	29.1	37.1	30.7	1630	6.63	168	221	3260	337	0.609	20.9
	8.0	36.6	46.7	24.2	2020	6.57	208	276	4030	416	0.609	16.6
	10.0	45.3	57.7	19.4	2440	6.50	252	338	4880	504	0.609	13.5
	12.5	55.9	71.2	15.5	2930	6.42	303	411	5870	606	0.609	10.9
	16.0 #	70.1	89.3	12.1	3550	6.31	367	507	7110	734	0.609	8.71
	219.1	4.5 #	23.8	30.3	48.7	1750	7.59	159	207	3490	319	0.688
5.0 #		26.4	33.6	43.8	1930	7.57	176	229	3860	352	0.688	26.1
5.6 #		29.5	37.6	39.1	2140	7.55	195	255	4280	391	0.688	23.3
6.3		33.1	42.1	34.8	2390	7.53	218	285	4770	436	0.688	20.8
8.0		41.6	53.1	27.4	2960	7.47	270	357	5920	540	0.688	16.5
10.0		51.6	65.7	21.9	3600	7.40	328	438	7200	657	0.688	13.3
12.5		63.7	81.1	17.5	4350	7.32	397	534	8690	793	0.688	10.8
14.2 #		71.8	91.4	15.4	4820	7.26	440	597	9640	880	0.688	9.56
16.0		80.1	102	13.7	5300	7.20	483	661	10600	967	0.688	8.60
244.5	5.0 #	29.5	37.6	48.9	2700	8.47	221	287	5400	441	0.768	26.0
	5.6 #	33.0	42.0	43.7	3000	8.45	245	320	6000	491	0.768	23.3
	6.3 #	37.0	47.1	38.8	3350	8.42	274	358	6690	547	0.768	20.7
	8.0 #	46.7	59.4	30.6	4160	8.37	340	448	8320	681	0.768	16.4
	10.0 #	57.8	73.7	24.5	5070	8.30	415	550	10100	830	0.768	13.3
	12.5	71.5	91.1	19.6	6150	8.21	503	673	12300	1010	0.768	10.8
	14.2 #	80.6	103	17.2	6840	8.16	559	754	13700	1120	0.768	9.52
	16.0	90.2	115	15.3	7530	8.10	616	837	15100	1230	0.768	8.52

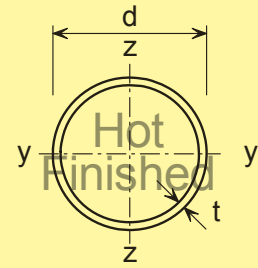
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# Check availability

FOR EXPLANATION OF TABLES SEE NOTES 2 AND 3

## HOT-FINISHED CIRCULAR HOLLOW SECTIONS

Celsius® CHS



Dimensions and properties

Section Designation		Mass per Metre kg/m	Area of Section A cm <sup>2</sup>	Ratio for Local Buckling d/t	Second Moment of Area I cm <sup>4</sup>	Radius of Gyration i cm	Elastic Modulus W <sub>el</sub> cm <sup>3</sup>	Plastic Modulus W <sub>pl</sub> cm <sup>3</sup>	Torsional Constants		Surface Area	
Outside Diameter d mm	Thickness t mm								I <sub>T</sub> cm <sup>4</sup>	W <sub>t</sub> cm <sup>3</sup>	Per Metre m <sup>2</sup>	Per Tonne m <sup>2</sup>
273.0	5.0 #	33.0	42.1	54.6	3780	9.48	277	359	7560	554	0.858	26.0
	5.6 #	36.9	47.0	48.8	4210	9.46	308	400	8410	616	0.858	23.3
	6.3 #	41.4	52.8	43.3	4700	9.43	344	448	9390	688	0.858	20.7
	8.0 #	52.3	66.6	34.1	5850	9.37	429	562	11700	857	0.858	16.4
	10.0	64.9	82.6	27.3	7150	9.31	524	692	14300	1050	0.858	13.2
	12.5	80.3	102	21.8	8700	9.22	637	849	17400	1270	0.858	10.7
	14.2 #	90.6	115	19.2	9700	9.16	710	952	19400	1420	0.858	9.44
323.9	5.0 #	39.3	50.1	64.8	6370	11.3	393	509	12700	787	1.02	25.9
	5.6 #	44.0	56.0	57.8	7090	11.3	438	567	14200	876	1.02	23.2
	6.3 #	49.3	62.9	51.4	7930	11.2	490	636	15900	979	1.02	20.7
	8.0 #	62.3	79.4	40.5	9910	11.2	612	799	19800	1220	1.02	16.3
	10.0	77.4	98.6	32.4	12200	11.1	751	986	24300	1500	1.02	13.2
	12.5	96.0	122	25.9	14800	11.0	917	1210	29700	1830	1.02	10.6
	14.2 #	108	138	22.8	16600	11.0	1030	1360	33200	2050	1.02	9.40
355.6	6.3 #	54.3	69.1	56.4	10500	12.4	593	769	21100	1190	1.12	20.6
	8.0 #	68.6	87.4	44.5	13200	12.3	742	967	26400	1490	1.12	16.4
	10.0 #	85.2	109	35.6	16200	12.2	912	1200	32400	1830	1.12	13.1
	12.5 #	106	135	28.4	19900	12.1	1120	1470	39700	2230	1.12	10.6
	14.2 #	120	152	25.0	22200	12.1	1250	1660	44500	2500	1.12	9.36
	16.0	134	171	22.2	24700	12.0	1390	1850	49300	2770	1.12	8.36
		171	171	22.2	24700	12.0	1390	1850	49300	2770	1.12	8.36
406.4	6.3 #	62.2	79.2	64.5	15800	14.1	780	1010	31700	1560	1.28	20.6
	8.0 #	78.6	100	50.8	19900	14.1	978	1270	39700	1960	1.28	16.3
	10.0	97.8	125	40.6	24500	14.0	1210	1570	49000	2410	1.28	13.1
	12.5 #	121	155	32.5	30000	13.9	1480	1940	60100	2960	1.28	10.5
	14.2 #	137	175	28.6	33700	13.9	1660	2190	67400	3320	1.28	9.32
457.0	6.3 #	70.0	89.2	72.5	22700	15.9	991	1280	45300	1980	1.44	20.6
	8.0 #	88.6	113	57.1	28400	15.9	1250	1610	56900	2490	1.44	16.3
	10.0	110	140	45.7	35100	15.8	1540	2000	70200	3070	1.44	13.1
	12.5 #	137	175	36.6	43100	15.7	1890	2470	86300	3780	1.44	10.5
	14.2 #	155	198	32.2	48500	15.7	2120	2790	96900	4240	1.44	9.29
	16.0	174	222	28.6	54000	15.6	2360	3110	108000	4720	1.44	8.28
508.0	6.3 #	77.9	99.3	80.6	31200	17.7	1230	1590	62500	2460	1.60	20.5
	8.0 #	98.6	126	63.5	39300	17.7	1550	2000	78600	3090	1.60	16.2
	10.0 #	123	156	50.8	48500	17.6	1910	2480	97000	3820	1.60	13.0
	12.5	153	195	40.6	59800	17.5	2350	3070	120000	4710	1.60	10.5
	14.2 #	173	220	35.8	67200	17.5	2650	3460	134000	5290	1.60	9.25
	16.0	194	247	31.8	74900	17.4	2950	3870	150000	5900	1.60	8.24

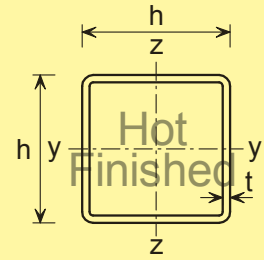
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# Check availability

FOR EXPLANATION OF TABLES SEE NOTES 2 AND 3

## HOT-FINISHED SQUARE HOLLOW SECTIONS

**Celsius® SHS**



Dimensions and properties

Section Designation		Mass per Metre	Area of Section	Ratio for Local Buckling $c/t^{(1)}$	Second Moment of Area	Radius of Gyration	Elastic Modulus	Plastic Modulus	Torsional Constants		Surface Area	
Size	Thickness								$I_T$	$W_t$	Per Metre	Per Tonne
$h \times h$ mm	t mm	kg/m	$A$ $cm^2$		$I$ $cm^4$	i cm	$W_{el}$ $cm^3$	$W_{pl}$ $cm^3$	$I_T$ $cm^4$	$W_t$ $cm^3$	$m^2$	$m^2$
40 x 40	3.0 #	3.41	4.34	10.3	9.78	1.50	4.89	5.97	15.7	7.10	0.152	44.5
	3.2	3.61	4.60	9.50	10.2	1.49	5.11	6.28	16.5	7.42	0.152	42.1
	3.6 #	4.01	5.10	8.11	11.1	1.47	5.54	6.88	18.1	8.01	0.151	37.8
	4.0	4.39	5.59	7.00	11.8	1.45	5.91	7.44	19.5	8.54	0.150	34.2
	5.0	5.28	6.73	5.00	13.4	1.41	6.68	8.66	22.5	9.60	0.147	27.8
50 x 50	3.0 #	4.35	5.54	13.7	20.2	1.91	8.08	9.70	32.1	11.8	0.192	44.2
	3.2	4.62	5.88	12.6	21.2	1.90	8.49	10.2	33.8	12.4	0.192	41.7
	3.6 #	5.14	6.54	10.9	23.2	1.88	9.27	11.3	37.2	13.5	0.191	37.2
	4.0	5.64	7.19	9.50	25.0	1.86	9.99	12.3	40.4	14.5	0.190	33.6
	5.0	6.85	8.73	7.00	28.9	1.82	11.6	14.5	47.6	16.7	0.187	27.3
	6.3	8.31	10.6	4.94	32.8	1.76	13.1	17.0	55.2	18.8	0.184	22.1
	7.1 #	9.14	11.6	4.04	34.5	1.72	13.8	18.3	58.9	19.8	0.182	19.8
8.0 #	10.0	12.8	3.25	36.0	1.68	14.4	19.5	62.3	20.6	0.179	17.9	
60 x 60	3.0 #	5.29	6.74	17.0	36.2	2.32	12.1	14.3	56.9	17.7	0.232	43.8
	3.2	5.62	7.16	15.8	38.2	2.31	12.7	15.2	60.2	18.6	0.232	41.3
	3.6 #	6.27	7.98	13.7	41.9	2.29	14.0	16.8	66.5	20.4	0.231	37.0
	4.0	6.90	8.79	12.0	45.4	2.27	15.1	18.3	72.5	22.0	0.230	33.4
	5.0	8.42	10.7	9.00	53.3	2.23	17.8	21.9	86.4	25.7	0.227	27.0
	6.3	10.3	13.1	6.52	61.6	2.17	20.5	26.0	102	29.6	0.224	21.8
	7.1 #	11.4	14.5	5.45	65.8	2.13	21.9	28.2	110	31.6	0.222	19.5
	8.0	12.5	16.0	4.50	69.7	2.09	23.2	30.4	118	33.4	0.219	17.5
70 x 70	3.0 #	6.24	7.94	20.3	59.0	2.73	16.9	19.9	92.2	24.8	0.272	43.5
	3.2	6.63	8.44	18.9	62.3	2.72	17.8	21.0	97.6	26.1	0.272	41.1
	3.6 #	7.40	9.42	16.4	68.6	2.70	19.6	23.3	108	28.7	0.271	36.6
	4.0	8.15	10.4	14.5	74.7	2.68	21.3	25.5	118	31.2	0.270	33.2
	5.0	9.99	12.7	11.0	88.5	2.64	25.3	30.8	142	36.8	0.267	26.7
	6.3	12.3	15.6	8.11	104	2.58	29.7	36.9	169	42.9	0.264	21.5
	7.1 #	13.6	17.3	6.86	112	2.54	32.0	40.3	185	46.1	0.262	19.3
	8.0	15.0	19.2	5.75	120	2.50	34.2	43.8	200	49.2	0.259	17.2
8.8 #	16.3	20.7	4.95	126	2.46	35.9	46.6	212	51.6	0.257	15.8	
80 x 80	3.0 #	7.18	9.14	23.7	89.8	3.13	22.5	26.3	140	33.0	0.312	43.4
	3.2	7.63	9.72	22.0	95.0	3.13	23.7	27.9	148	34.9	0.312	40.9
	3.6 #	8.53	10.9	19.2	105	3.11	26.2	31.0	164	38.5	0.311	36.4
	4.0	9.41	12.0	17.0	114	3.09	28.6	34.0	180	41.9	0.310	32.9
	5.0	11.6	14.7	13.0	137	3.05	34.2	41.1	217	49.8	0.307	26.6
	6.3	14.2	18.1	9.70	162	2.99	40.5	49.7	262	58.7	0.304	21.3
	7.1 #	15.8	20.2	8.27	176	2.95	43.9	54.5	286	63.5	0.302	19.1
	8.0	17.5	22.4	7.00	189	2.91	47.3	59.5	312	68.3	0.299	17.0
	8.8 #	19.0	24.2	6.09	200	2.87	50.0	63.7	332	72.0	0.297	15.6
	10.0 #	21.1	26.9	5.00	214	2.82	53.5	69.3	360	76.8	0.294	13.9
	12.5 #	25.2	32.1	3.40	234	2.70	58.6	78.9	404	83.8	0.288	11.4

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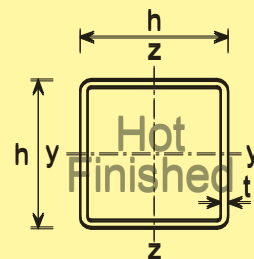
(1) For local buckling calculation  $c = h - 3t$ .

# Check availability

FOR EXPLANATION OF TABLES SEE NOTES 2 AND 3

## HOT-FINISHED SQUARE HOLLOW SECTIONS

Celsius® SHS



Dimensions and properties

Section Designation		Mass per Metre	Area of Section	Ratio for Local Buckling $c/t^{(1)}$	Second Moment of Area	Radius of Gyration	Elastic Modulus	Plastic Modulus	Torsional Constants		Surface Area	
Size	Thickness								$I_T$	$W_t$	Per Metre	Per Tonne
$h \times h$ mm	t mm	kg/m	$A$ $cm^2$		$I$ $cm^4$	i cm	$W_{el}$ $cm^3$	$W_{pl}$ $cm^3$	$I_T$ $cm^4$	$W_t$ $cm^3$	$m^2$	$m^2$
90 x 90	3.6 #	9.66	12.3	22.0	152	3.52	33.8	39.7	237	49.7	0.351	36.5
	4.0	10.7	13.6	19.5	166	3.50	37.0	43.6	260	54.2	0.350	32.8
	5.0	13.1	16.7	15.0	200	3.45	44.4	53.0	316	64.8	0.347	26.4
	6.3	16.2	20.7	11.3	238	3.40	53.0	64.3	382	77.0	0.344	21.2
	7.1 #	18.1	23.0	9.68	260	3.36	57.7	70.8	419	83.7	0.342	18.9
	8.0	20.1	25.6	8.25	281	3.32	62.6	77.6	459	90.5	0.339	16.9
	8.8 #	21.8	27.8	7.23	299	3.28	66.5	83.4	492	96.0	0.337	15.5
	10.0 #	24.3	30.9	6.00	322	3.23	71.6	91.3	536	103	0.334	13.8
12.5 #	29.1	37.1	4.20	359	3.11	79.8	105	612	114	0.328	11.3	
100 x 100	3.6	10.8	13.7	24.8	212	3.92	42.3	49.5	328	62.3	0.391	36.2
	4.0	11.9	15.2	22.0	232	3.91	46.4	54.4	361	68.2	0.390	32.7
	5.0	14.7	18.7	17.0	279	3.86	55.9	66.4	439	81.8	0.387	26.3
	6.3	18.2	23.2	12.9	336	3.80	67.1	80.9	534	97.8	0.384	21.1
	7.1 #	20.3	25.8	11.1	367	3.77	73.4	89.2	589	107	0.382	18.8
	8.0	22.6	28.8	9.50	400	3.73	79.9	98.2	646	116	0.379	16.8
	8.8 #	24.5	31.3	8.36	426	3.69	85.2	106	694	123	0.377	15.3
	10.0	27.4	34.9	7.00	462	3.64	92.4	116	761	133	0.374	13.7
12.5 #	33.0	42.1	5.00	522	3.52	104	135	879	150	0.368	11.2	
120 x 120	4.0 #	14.4	18.4	27.0	410	4.72	68.4	79.7	635	101	0.470	32.6
	5.0	17.8	22.7	21.0	498	4.68	83.0	97.6	777	122	0.467	26.2
	6.3	22.2	28.2	16.0	603	4.62	100	120	950	147	0.464	20.9
	7.1 #	24.7	31.5	13.9	663	4.59	110	133	1050	161	0.462	18.7
	8.0	27.6	35.2	12.0	726	4.55	121	146	1160	176	0.459	16.6
	8.8 #	30.1	38.3	10.6	779	4.51	130	158	1250	189	0.457	15.2
	10.0	33.7	42.9	9.00	852	4.46	142	175	1380	206	0.454	13.5
12.5	40.9	52.1	6.60	982	4.34	164	207	1620	236	0.448	11.0	
140 x 140	5.0	21.0	26.7	25.0	807	5.50	115	135	1250	170	0.547	26.1
	6.3	26.1	33.3	19.2	984	5.44	141	166	1540	206	0.544	20.8
	7.1 #	29.2	37.2	16.7	1090	5.40	155	184	1710	227	0.542	18.5
	8.0	32.6	41.6	14.5	1200	5.36	171	204	1890	249	0.539	16.5
	8.8 #	35.6	45.4	12.9	1290	5.33	184	221	2050	268	0.537	15.1
	10.0	40.0	50.9	11.0	1420	5.27	202	246	2270	294	0.534	13.4
12.5	48.7	62.1	8.20	1650	5.16	236	293	2700	342	0.528	10.8	

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Square Hollow Sections (HFSHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

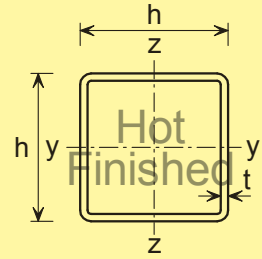
(1) For local buckling calculation  $c = h - 3t$ .

# Check availability

FOR EXPLANATION OF TABLES SEE NOTES 2 AND 3

## HOT-FINISHED SQUARE HOLLOW SECTIONS

Celsius® SHS



Dimensions and properties

Section Designation		Mass per Metre	Area of Section	Ratio for Local Buckling $c/t^{(1)}$	Second Moment of Area	Radius of Gyration	Elastic Modulus	Plastic Modulus	Torsional Constants		Surface Area	
Size	Thickness								$I_T$	$W_t$	Per Metre	Per Tonne
$h \times h$ mm	t mm	kg/m	$A$ $cm^2$		$I$ $cm^4$	i cm	$W_{el}$ $cm^3$	$W_{pl}$ $cm^3$	$I_T$ $cm^4$	$W_t$ $cm^3$	$m^2$	$m^2$
150 x 150	5.0	22.6	28.7	27.0	1000	5.90	134	156	1550	197	0.587	26.0
	6.3	28.1	35.8	20.8	1220	5.85	163	192	1910	240	0.584	20.8
	7.1 #	31.4	40.0	18.1	1350	5.81	180	213	2120	264	0.582	18.5
	8.0	35.1	44.8	15.8	1490	5.77	199	237	2350	291	0.579	16.5
	8.8 #	38.4	48.9	14.0	1610	5.74	214	257	2550	313	0.577	15.1
	10.0	43.1	54.9	12.0	1770	5.68	236	286	2830	344	0.574	13.3
	12.5	52.7	67.1	9.00	2080	5.57	277	342	3380	402	0.568	10.8
	14.2 #	58.9	75.0	7.56	2260	5.49	302	377	3710	436	0.563	9.57
	16.0 # r	65.2	83.0	6.38	2430	5.41	324	411	4030	467	0.559	8.55
160 x 160	5.0 #	24.1	30.7	29.0	1230	6.31	153	178	1890	226	0.627	26.0
	6.3	30.1	38.3	22.4	1500	6.26	187	220	2330	275	0.624	20.8
	7.1 #	33.7	42.9	19.5	1660	6.22	207	245	2600	304	0.622	18.5
	8.0	37.6	48.0	17.0	1830	6.18	229	272	2880	335	0.619	16.5
	8.8 #	41.1	52.4	15.2	1980	6.14	247	295	3130	361	0.617	15.0
	10.0	46.3	58.9	13.0	2190	6.09	273	329	3480	398	0.614	13.3
	12.5	56.6	72.1	9.80	2580	5.98	322	395	4160	467	0.608	10.8
	14.2 #	63.3	80.7	8.27	2810	5.90	351	436	4580	508	0.603	9.53
180 x 180	5.0 #	27.3	34.7	33.0	1770	7.13	196	227	2720	290	0.707	25.9
	6.3	34.0	43.3	25.6	2170	7.07	241	281	3360	355	0.704	20.7
	7.1 #	38.1	48.6	22.4	2400	7.04	267	314	3740	393	0.702	18.4
	8.0	42.7	54.4	19.5	2660	7.00	296	349	4160	434	0.699	16.4
	8.8 #	46.7	59.4	17.5	2880	6.96	320	379	4520	469	0.697	14.9
	10.0	52.5	66.9	15.0	3190	6.91	355	424	5050	518	0.694	13.2
	12.5	64.4	82.1	11.4	3790	6.80	421	511	6070	613	0.688	10.7
	14.2 #	72.2	92.0	9.68	4150	6.72	462	566	6710	670	0.683	9.43
200 x 200	5.0	30.4	38.7	37.0	2450	7.95	245	283	3760	362	0.787	25.9
	6.3	38.0	48.4	28.7	3010	7.89	301	350	4650	444	0.784	20.6
	7.1 #	42.6	54.2	25.2	3350	7.85	335	391	5190	493	0.782	18.4
	8.0	47.7	60.8	22.0	3710	7.81	371	436	5780	545	0.779	16.4
	8.8 #	52.2	66.5	19.7	4020	7.78	402	474	6290	590	0.777	14.9
	10.0	58.8	74.9	17.0	4470	7.72	447	531	7030	655	0.774	13.2
	12.5	72.3	92.1	13.0	5340	7.61	534	643	8490	778	0.768	10.6
	14.2 #	81.1	103	11.1	5870	7.54	587	714	9420	854	0.763	9.38
16.0	90.3	115	9.50	6390	7.46	639	785	10300	927	0.759	8.42	

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(1) For local buckling calculation  $c = h - 3t$ .

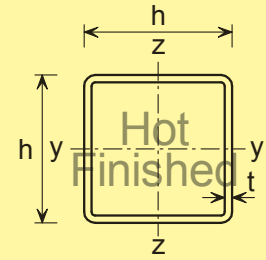
r External corner radius  $>2T$  but  $\leq 3T$

# Check availability

FOR EXPLANATION OF TABLES SEE NOTES 2 AND 3

## HOT-FINISHED SQUARE HOLLOW SECTIONS

Celsius® SHS



Dimensions and properties

Section Designation		Mass per Metre	Area of Section	Ratio for Local Buckling $c/t^{(1)}$	Second Moment of Area	Radius of Gyration	Elastic Modulus	Plastic Modulus	Torsional Constants		Surface Area	
Size	Thickness								$I_T$	$W_t$	Per Metre	Per Tonne
$h \times h$ mm	t mm	kg/m	$A$ $cm^2$		$I$ $cm^4$	i cm	$W_{el}$ $cm^3$	$W_{pl}$ $cm^3$	$I_T$ $cm^4$	$W_t$ $cm^3$	$m^2$	$m^2$
250 x 250	5.0 #	38.3	48.7	47.0	4860	9.99	389	447	7430	577	0.987	25.8
	6.3	47.9	61.0	36.7	6010	9.93	481	556	9240	712	0.984	20.6
	7.1 #	53.7	68.4	32.2	6700	9.90	536	622	10300	792	0.982	18.3
	8.0	60.3	76.8	28.3	7460	9.86	596	694	11500	880	0.979	16.3
	8.8 #	66.0	84.1	25.4	8110	9.82	649	758	12600	955	0.977	14.9
	10.0	74.5	94.9	22.0	9060	9.77	724	851	14100	1070	0.974	13.1
	12.5	91.9	117	17.0	10900	9.66	873	1040	17200	1280	0.968	10.6
	14.2 #	103	132	14.6	12100	9.58	967	1160	19100	1410	0.963	9.31
	16.0	115	147	12.6	13300	9.50	1060	1280	21100	1550	0.959	8.31
260 x 260	6.3 #	49.9	63.5	38.3	6790	10.3	522	603	10400	773	1.02	20.5
	7.1 #	56.0	71.3	33.6	7570	10.3	582	674	11600	861	1.02	18.3
	8.0 #	62.8	80.0	29.5	8420	10.3	648	753	13000	956	1.02	16.2
	8.8 #	68.8	87.6	26.5	9160	10.2	705	822	14200	1040	1.02	14.8
	10.0 #	77.7	98.9	23.0	10200	10.2	788	924	15900	1160	1.01	13.0
	12.5 #	95.8	122	17.8	12400	10.1	951	1130	19400	1390	1.01	10.5
	14.2 #	108	137	15.3	13700	9.99	1060	1260	21700	1540	1.00	9.27
	16.0 #	120	153	13.3	15100	9.91	1160	1390	23900	1690	0.999	8.29
300 x 300	6.3 #	57.8	73.6	44.6	10500	12.0	703	809	16100	1040	1.18	20.4
	7.1 #	64.9	82.6	39.3	11800	11.9	785	906	18100	1160	1.18	18.2
	8.0	72.8	92.8	34.5	13100	11.9	875	1010	20200	1290	1.18	16.2
	8.8 #	79.8	102	31.1	14300	11.9	954	1110	22100	1410	1.18	14.8
	10.0	90.2	115	27.0	16000	11.8	1070	1250	24800	1580	1.17	13.0
	12.5	112	142	21.0	19400	11.7	1300	1530	30300	1900	1.17	10.5
	14.2 #	126	160	18.1	21600	11.6	1440	1710	33900	2110	1.16	9.22
	16.0	141	179	15.8	23900	11.5	1590	1900	37600	2330	1.16	8.26
350 x 350	8.0	85.4	109	40.8	21100	13.9	1210	1390	32400	1790	1.38	16.1
	8.8 #	93.6	119	36.8	23100	13.9	1320	1520	35400	1950	1.38	14.8
	10.0	106	135	32.0	25900	13.9	1480	1720	39900	2190	1.37	12.9
	12.5	131	167	25.0	31500	13.7	1800	2110	48900	2650	1.37	10.4
	14.2 #	148	189	21.6	35200	13.7	2010	2360	54900	2960	1.36	9.19
	16.0	166	211	18.9	38900	13.6	2230	2630	61000	3260	1.36	8.21
400 x 400	8.0 #	97.9	125	47.0	31900	16.0	1590	1830	48700	2360	1.58	16.1
	8.8 #	107	137	42.5	34800	15.9	1740	2000	53300	2580	1.58	14.7
	10.0	122	155	37.0	39100	15.9	1960	2260	60100	2900	1.57	12.9
	12.5	151	192	29.0	47800	15.8	2390	2780	73900	3530	1.57	10.4
	14.2 #	170	217	25.2	53500	15.7	2680	3130	83000	3940	1.56	9.16
	16.0	191	243	22.0	59300	15.6	2970	3480	92400	4360	1.56	8.17
	20.0 ^	235	300	17.0	71500	15.4	3580	4250	112000	5240	1.55	6.59

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(1) For local buckling calculation  $c = h - 3t$ .

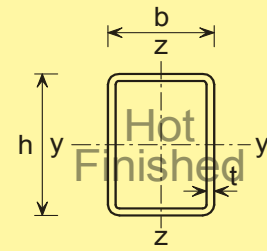
^ SAW process (single longitudinal seam weld, slightly proud)

# Check availability

FOR EXPLANATION OF TABLES SEE NOTES 2 AND 3

## HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Dimensions and properties

Section Designation		Mass per Metre	Area of Section	Ratios for Local Buckling		Second Moment of Area		Radius of Gyration		Elastic Modulus		Plastic Modulus		Torsional Constants		Surface Area		
Size	Thickness			$c_w/t^{(1)}$	$c_f/t^{(1)}$	Axis y-y	Axis z-z	Axis y-y	Axis z-z	Axis y-y	Axis z-z	Axis y-y	Axis z-z	$I_T$	$W_t$	Per Metre	Per Tonne	
h x b mm	t mm	kg/m	A 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 <sup>2</sup>	
50x30	3.0 #	3.41	4.34	13.7	7.00	13.6	5.94	1.77	1.17	5.43	3.96	6.88	4.76	13.5	6.51	0.152	44.5	
	3.2	3.61	4.60	12.6	6.38	14.2	6.20	1.76	1.16	5.68	4.13	7.25	5.00	14.2	6.80	0.152	42.1	
	3.6 #	4.01	5.10	10.9	5.33	15.4	6.67	1.74	1.14	6.16	4.45	7.94	5.46	15.4	7.31	0.151	37.8	
	4.0	4.39	5.59	9.50	4.50	16.5	7.08	1.72	1.13	6.60	4.72	8.59	5.88	16.6	7.77	0.150	34.2	
	5.0	5.28	6.73	7.00	3.00	18.7	7.89	1.67	1.08	7.49	5.26	10.0	6.80	19.0	8.67	0.147	27.8	
60x40	3.0 #	4.35	5.54	17.0	10.3	26.5	13.9	2.18	1.58	8.82	6.95	10.9	8.19	29.2	11.2	0.192	44.2	
	3.2	4.62	5.88	15.8	9.50	27.8	14.6	2.18	1.57	9.27	7.29	11.5	8.64	30.8	11.7	0.192	41.7	
	3.6 #	5.14	6.54	13.7	8.11	30.4	15.9	2.16	1.56	10.1	7.93	12.7	9.50	33.8	12.8	0.191	37.2	
	4.0	5.64	7.19	12.0	7.00	32.8	17.0	2.14	1.54	10.9	8.52	13.8	10.3	36.7	13.7	0.190	33.6	
	5.0	6.85	8.73	9.00	5.00	38.1	19.5	2.09	1.50	12.7	9.77	16.4	12.2	43.0	15.7	0.187	27.3	
60x40	6.3	8.31	10.6	6.52	3.35	43.4	21.9	2.02	1.44	14.5	11.0	19.2	14.2	49.5	17.6	0.184	22.1	
	80x40	3.0 #	5.29	6.74	23.7	10.3	54.2	18.0	2.84	1.63	13.6	9.00	17.1	10.4	43.8	15.3	0.232	43.8
		3.2	5.62	7.16	22.0	9.50	57.2	18.9	2.83	1.63	14.3	9.46	18.0	11.0	46.2	16.1	0.232	41.3
		3.6 #	6.27	7.98	19.2	8.11	62.8	20.6	2.81	1.61	15.7	10.3	20.0	12.1	50.8	17.5	0.231	37.0
		4.0	6.90	8.79	17.0	7.00	68.2	22.2	2.79	1.59	17.1	11.1	21.8	13.2	55.2	18.9	0.230	33.4
5.0		8.42	10.7	13.0	5.00	80.3	25.7	2.74	1.55	20.1	12.9	26.1	15.7	65.1	21.9	0.227	27.0	
80x40	6.3	10.3	13.1	9.70	3.35	93.3	29.2	2.67	1.49	23.3	14.6	31.1	18.4	75.6	24.8	0.224	21.8	
	7.1 #	11.4	14.5	8.27	2.63	99.8	30.7	2.63	1.46	25.0	15.4	33.8	19.8	80.9	26.2	0.222	19.5	
	8.0	12.5	16.0	7.00	2.00	106	32.1	2.58	1.42	26.5	16.1	36.5	21.2	85.8	27.4	0.219	17.5	
	90x50	3.0 #	6.24	7.94	27.0	13.7	84.4	33.5	3.26	2.05	18.8	13.4	23.2	15.3	76.5	22.4	0.272	43.5
		3.2	6.63	8.44	25.1	12.6	89.1	35.3	3.25	2.04	19.8	14.1	24.6	16.2	80.9	23.6	0.272	41.1
3.6 #		7.40	9.42	22.0	10.9	98.3	38.7	3.23	2.03	21.8	15.5	27.2	18.0	89.4	25.9	0.271	36.6	
4.0		8.15	10.4	19.5	9.50	107	41.9	3.21	2.01	23.8	16.8	29.8	19.6	97.5	28.0	0.270	33.2	
5.0		9.99	12.7	15.0	7.00	127	49.2	3.16	1.97	28.3	19.7	36.0	23.5	116	32.9	0.267	26.7	
90x50	6.3	12.3	15.6	11.3	4.94	150	57.0	3.10	1.91	33.3	22.8	43.2	28.0	138	38.1	0.264	21.5	
	7.1 #	13.6	17.3	9.68	4.04	162	60.9	3.06	1.88	36.0	24.4	47.2	30.5	149	40.7	0.262	19.3	
	8.0	15.0	19.2	8.25	3.25	174	64.6	3.01	1.84	38.6	25.8	51.4	32.9	160	43.2	0.259	17.2	
	100x50	3.0 #	6.71	8.54	30.3	13.7	110	36.8	3.58	2.08	21.9	14.7	27.3	16.8	88.4	25.0	0.292	43.5
		3.2	7.13	9.08	28.3	12.6	116	38.8	3.57	2.07	23.2	15.5	28.9	17.7	93.4	26.4	0.292	40.9
3.6 #		7.96	10.1	24.8	10.9	128	42.6	3.55	2.05	25.6	17.0	32.1	19.6	103	29.0	0.291	36.7	
4.0		8.78	11.2	22.0	9.50	140	46.2	3.53	2.03	27.9	18.5	35.2	21.5	113	31.4	0.290	33.1	
5.0		10.8	13.7	17.0	7.00	167	54.3	3.48	1.99	33.3	21.7	42.6	25.8	135	36.9	0.287	26.6	
100x50	6.3	13.3	16.9	12.9	4.94	197	63.0	3.42	1.93	39.4	25.2	51.3	30.8	160	42.9	0.284	21.4	
	7.1 #	14.7	18.7	11.1	4.04	214	67.5	3.38	1.90	42.7	27.0	56.3	33.5	173	46.0	0.282	19.2	
	8.0	16.3	20.8	9.50	3.25	230	71.7	3.33	1.86	46.0	28.7	61.4	36.3	186	48.9	0.279	17.1	
	8.8 #	17.6	22.5	8.36	2.68	243	74.8	3.29	1.82	48.5	29.9	65.6	38.5	197	51.1	0.277	15.7	
	10.0 #	19.6	24.9	7.00	2.00	259	78.4	3.22	1.77	51.8	31.4	71.2	41.4	209	53.6	0.274	14.0	

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(1) For local buckling calculation  $c_w = h - 3t$  and  $c_f = b - 3t$ .

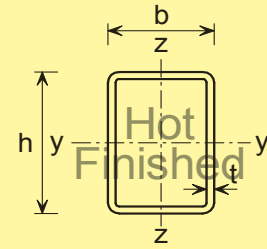
# Check availability

FOR EXPLANATION OF TABLES SEE NOTES 2 AND 3



## HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Dimensions and properties

Section Designation		Mass per Metre	Area of Section	Ratios for Local Buckling		Second Moment of Area		Radius of Gyration		Elastic Modulus		Plastic Modulus		Torsional Constants		Surface Area	
Size	Thickness			$c_w/t^{(1)}$	$c_f/t^{(1)}$	Axis y-y	Axis z-z	Axis y-y	Axis z-z	Axis y-y	Axis z-z	Axis y-y	Axis z-z	$I_T$	$W_t$	Per Metre	Per Tonne
h x b mm	t mm	kg/m	A 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 <sup>2</sup>
100x60	3.0 #	7.18	9.14	30.3	17.0	124	55.7	3.68	2.47	24.7	18.6	30.2	21.2	121	30.7	0.312	43.4
	3.2	7.63	9.72	28.3	15.8	131	58.8	3.67	2.46	26.2	19.6	32.0	22.4	129	32.4	0.312	40.9
	3.6 #	8.53	10.9	24.8	13.7	145	64.8	3.65	2.44	28.9	21.6	35.6	24.9	142	35.6	0.311	36.4
	4.0	9.41	12.0	22.0	12.0	158	70.5	3.63	2.43	31.6	23.5	39.1	27.3	156	38.7	0.310	32.9
	5.0	11.6	14.7	17.0	9.00	189	83.6	3.58	2.38	37.8	27.9	47.4	32.9	188	45.9	0.307	26.6
	6.3	14.2	18.1	12.9	6.52	225	98.1	3.52	2.33	45.0	32.7	57.3	39.5	224	53.8	0.304	21.3
	7.1 #	15.8	20.2	11.1	5.45	244	106	3.48	2.29	48.8	35.3	62.9	43.2	245	58.0	0.302	19.1
	8.0	17.5	22.4	9.50	4.50	264	113	3.44	2.25	52.8	37.8	68.7	47.1	265	62.2	0.299	17.0
	8.8 #	19.0	24.2	8.36	3.82	279	119	3.40	2.22	55.9	39.7	73.6	50.2	282	65.4	0.297	15.6
	10.0 #	21.1	26.9	7.00	3.00	299	126	3.33	2.16	59.9	42.1	80.2	54.4	304	69.3	0.294	13.9
120x60	3.0 #	8.12	10.3	37.0	17.0	194	65.5	4.33	2.52	32.3	21.8	40.0	24.6	156	37.2	0.352	43.3
	3.2 #	8.64	11.0	34.5	15.8	205	69.2	4.32	2.51	34.2	23.1	42.4	26.1	165	39.2	0.352	40.8
	3.6 #	9.66	12.3	30.3	13.7	227	76.3	4.30	2.49	37.9	25.4	47.2	28.9	183	43.3	0.351	36.5
	4.0	10.7	13.6	27.0	12.0	249	83.1	4.28	2.47	41.5	27.7	51.9	31.7	201	47.1	0.350	32.8
	5.0	13.1	16.7	21.0	9.00	299	98.8	4.23	2.43	49.9	32.9	63.1	38.4	242	56.0	0.347	26.4
	6.3	16.2	20.7	16.0	6.52	358	116	4.16	2.37	59.7	38.8	76.7	46.3	290	65.9	0.344	21.2
	7.1 #	18.1	23.0	13.9	5.45	391	126	4.12	2.34	65.2	41.9	84.4	50.8	317	71.3	0.342	18.9
	8.0	20.1	25.6	12.0	4.50	425	135	4.08	2.30	70.8	45.0	92.7	55.4	344	76.6	0.339	16.9
	8.8 #	21.8	27.8	10.6	3.82	452	142	4.04	2.27	75.3	47.5	99.6	59.2	366	80.8	0.337	15.5
	10.0 #	24.3	30.9	9.00	3.00	488	152	3.97	2.21	81.4	50.5	109	64.4	396	86.1	0.334	13.8
12.5 #	29.1	37.1	6.60	1.80	546	165	3.84	2.11	91.1	54.9	126	73.1	442	93.8	0.328	11.3	
120x80	3.6 #	10.8	13.7	30.3	19.2	276	147	4.48	3.27	46.0	36.7	55.6	42.0	301	59.5	0.391	36.2
	4.0	11.9	15.2	27.0	17.0	303	161	4.46	3.25	50.4	40.2	61.2	46.1	330	65.0	0.390	32.7
	5.0	14.7	18.7	21.0	13.0	365	193	4.42	3.21	60.9	48.2	74.6	56.1	401	77.9	0.387	26.3
	6.3	18.2	23.2	16.0	9.70	440	230	4.36	3.15	73.3	57.6	91.0	68.2	487	92.9	0.384	21.1
	7.1 #	20.3	25.8	13.9	8.27	482	251	4.32	3.12	80.3	62.8	100	75.2	535	101	0.382	18.8
	8.0	22.6	28.8	12.0	7.00	525	273	4.27	3.08	87.5	68.1	111	82.6	587	110	0.379	16.8
	8.8 #	24.5	31.3	10.6	6.09	561	290	4.24	3.04	93.5	72.4	119	88.7	629	117	0.377	15.3
	10.0	27.4	34.9	9.00	5.00	609	313	4.18	2.99	102	78.1	131	97.3	688	126	0.374	13.7
	12.5 #	33.0	42.1	6.60	3.40	692	349	4.05	2.88	115	87.4	153	113	789	141	0.368	11.2
150x100	4.0 #	15.1	19.2	34.5	22.0	607	324	5.63	4.11	81.0	64.8	97.4	73.6	660	105	0.490	32.5
	5.0	18.6	23.7	27.0	17.0	739	392	5.58	4.07	98.5	78.5	119	90.1	807	127	0.487	26.2
	6.3	23.1	29.5	20.8	12.9	898	474	5.52	4.01	120	94.8	147	110	986	153	0.484	20.9
	7.1 #	25.9	32.9	18.1	11.1	990	520	5.48	3.97	132	104	163	122	1090	168	0.482	18.7
	8.0	28.9	36.8	15.8	9.50	1090	569	5.44	3.94	145	114	180	135	1200	183	0.479	16.6
	8.8 #	31.5	40.1	14.0	8.36	1170	610	5.40	3.90	156	122	195	146	1300	196	0.477	15.2
	10.0	35.3	44.9	12.0	7.00	1280	665	5.34	3.85	171	133	216	161	1430	214	0.474	13.5
	12.5	42.8	54.6	9.00	5.00	1490	763	5.22	3.74	198	153	256	190	1680	246	0.468	10.9

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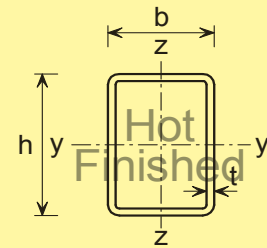
(1) For local buckling calculation  $c_w = h - 3t$  and  $c_f = b - 3t$ .

# Check availability

FOR EXPLANATION OF TABLES SEE NOTES 2 AND 3

## HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Dimensions and properties

Section Designation		Mass per Metre	Area of Section	Ratios for Local Buckling		Second Moment of Area		Radius of Gyration		Elastic Modulus		Plastic Modulus		Torsional Constants		Surface Area	
Size	Thickness			$c_w/t^{(1)}$	$c_f/t^{(1)}$	Axis y-y	Axis z-z	Axis y-y	Axis z-z	Axis y-y	Axis z-z	Axis y-y	Axis z-z	$I_T$	$W_t$	Per Metre	Per Tonne
h x b mm	t mm	kg/m	A 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 <sup>2</sup>
160x80	4.0 #	14.4	18.4	37.0	17.0	612	207	5.77	3.35	76.5	51.7	94.7	58.3	493	88.1	0.470	32.6
	5.0	17.8	22.7	29.0	13.0	744	249	5.72	3.31	93.0	62.3	116	71.1	600	106	0.467	26.2
	6.3	22.2	28.2	22.4	9.70	903	299	5.66	3.26	113	74.8	142	86.8	730	127	0.464	20.9
	7.1 #	24.7	31.5	19.5	8.27	994	327	5.62	3.22	124	81.7	158	95.9	804	139	0.462	18.7
	8.0	27.6	35.2	17.0	7.00	1090	356	5.57	3.18	136	89.0	175	106	883	151	0.459	16.6
	8.8 #	30.1	38.3	15.2	6.09	1170	379	5.53	3.15	147	94.9	189	114	949	161	0.457	15.2
	10.0	33.7	42.9	13.0	5.00	1280	411	5.47	3.10	161	103	209	125	1040	175	0.454	13.5
	12.5	40.9	52.1	9.80	3.40	1490	465	5.34	2.99	186	116	247	146	1200	198	0.448	11.0
180x60	4.0 #	14.4	18.4	42.0	12.0	697	121	6.16	2.56	77.4	40.3	99.8	45.2	341	72.2	0.470	32.6
	5.0 #	17.8	22.7	33.0	9.00	846	144	6.10	2.52	94.0	48.1	122	54.9	411	86.3	0.467	26.2
	6.3 #	22.2	28.2	25.6	6.52	1030	171	6.03	2.46	114	57.0	150	66.6	495	102	0.464	20.9
	7.1 #	24.7	31.5	22.4	5.45	1130	186	5.99	2.43	126	61.9	166	73.3	542	111	0.462	18.7
	8.0 #	27.6	35.2	19.5	4.50	1240	201	5.94	2.39	138	66.9	184	80.4	590	120	0.459	16.6
	8.8 #	30.1	38.3	17.5	3.82	1330	212	5.89	2.35	148	70.8	199	86.2	630	127	0.457	15.2
	10.0 #	33.7	42.9	15.0	3.00	1460	228	5.83	2.30	162	75.8	220	94.4	683	137	0.454	13.5
	12.5 #	40.9	52.1	11.4	1.80	1680	251	5.68	2.20	187	83.7	260	109	770	151	0.448	11.0
180x100	4.0 #	16.9	21.6	42.0	22.0	945	379	6.61	4.19	105	75.9	128	85.2	852	127	0.550	32.5
	5.0 #	21.0	26.7	33.0	17.0	1150	460	6.57	4.15	128	92.0	157	104	1040	154	0.547	26.1
	6.3 #	26.1	33.3	25.6	12.9	1410	557	6.50	4.09	156	111	194	128	1280	186	0.544	20.8
	7.1 #	29.2	37.2	22.4	11.1	1560	613	6.47	4.06	173	123	215	142	1410	205	0.542	18.5
	8.0 #	32.6	41.6	19.5	9.50	1710	671	6.42	4.02	190	134	239	157	1560	224	0.539	16.5
	8.8 #	35.6	45.4	17.5	8.36	1850	720	6.38	3.98	205	144	259	170	1690	240	0.537	15.1
	10.0 #	40.0	50.9	15.0	7.00	2040	787	6.32	3.93	226	157	288	188	1860	263	0.534	13.4
	12.5 #	48.7	62.1	11.4	5.00	2390	908	6.20	3.82	265	182	344	223	2190	303	0.528	10.8
200x100	4.0 #	18.2	23.2	47.0	22.0	1220	416	7.26	4.24	122	83.2	150	92.8	983	142	0.590	32.4
	5.0	22.6	28.7	37.0	17.0	1500	505	7.21	4.19	149	101	185	114	1200	172	0.587	26.0
	6.3	28.1	35.8	28.7	12.9	1830	613	7.15	4.14	183	123	228	140	1480	208	0.584	20.8
	7.1 #	31.4	40.0	25.2	11.1	2020	674	7.11	4.10	202	135	254	155	1630	229	0.582	18.5
	8.0	35.1	44.8	22.0	9.50	2230	739	7.06	4.06	223	148	282	172	1800	251	0.579	16.5
	8.8 #	38.4	48.9	19.7	8.36	2410	793	7.02	4.03	241	159	306	186	1950	270	0.577	15.1
	10.0	43.1	54.9	17.0	7.00	2660	869	6.96	3.98	266	174	341	206	2160	295	0.574	13.3
	12.5	52.7	67.1	13.0	5.00	3140	1000	6.84	3.87	314	201	408	245	2540	341	0.568	10.8
	14.2 #	58.9	75.0	11.1	4.04	3420	1080	6.75	3.80	342	216	450	268	2770	368	0.563	9.57
	16.0 # r	65.2	83.0	9.50	3.25	3680	1150	6.66	3.72	368	229	491	290	2980	391	0.559	8.55

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(1) For local buckling calculation  $c_w = h - 3t$  and  $c_f = b - 3t$ .

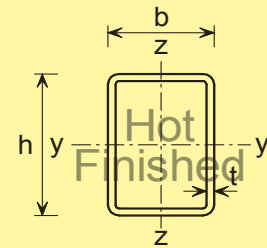
r External corner radius  $>2T$  but  $\leq 3T$

# Check availability

FOR EXPLANATION OF TABLES SEE NOTES 2 AND 3

## HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Dimensions and properties

Section Designation		Mass per Metre	Area of Section	Ratios for Local Buckling		Second Moment of Area		Radius of Gyration		Elastic Modulus		Plastic Modulus		Torsional Constants		Surface Area	
Size	Thickness			$c_w/t^{(1)}$	$c_f/t^{(1)}$	Axis y-y	Axis z-z	Axis y-y	Axis z-z	Axis y-y	Axis z-z	Axis y-y	Axis z-z	$I_T$	$W_t$	Per Metre	Per Tonne
h x b mm	t mm	kg/m	A 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 <sup>2</sup>
200x120	5.0 #	24.1	30.7	37.0	21.0	1690	762	7.40	4.98	168	127	205	144	1650	210	0.627	26.0
	6.3	30.1	38.3	28.7	16.0	2070	929	7.34	4.92	207	155	253	177	2030	255	0.624	20.8
	7.1 #	33.7	42.9	25.2	13.9	2290	1030	7.30	4.89	229	171	281	197	2250	282	0.622	18.5
	8.0	37.6	48.0	22.0	12.0	2530	1130	7.26	4.85	253	188	313	218	2500	310	0.619	16.5
	8.8 #	41.1	52.4	19.7	10.6	2730	1220	7.22	4.82	273	203	340	237	2700	334	0.617	15.0
	10.0	46.3	58.9	17.0	9.00	3030	1340	7.17	4.76	303	223	379	263	3000	367	0.614	13.3
	12.5 #	56.6	72.1	13.0	6.60	3580	1560	7.04	4.66	358	260	455	314	3570	428	0.608	10.8
	14.2 #	63.3	80.7	11.1	5.45	3910	1690	6.96	4.58	391	282	503	346	3920	464	0.603	9.53
16.0 #	70.2	89.4	9.50	4.50	4220	1810	6.87	4.50	422	302	550	377	4250	497	0.599	8.51	
200x150	5.0 #	26.5	33.7	37.0	27.0	1970	1270	7.64	6.12	197	169	234	192	2390	267	0.687	26.0
	6.3 #	33.0	42.1	28.7	20.8	2420	1550	7.58	6.07	242	207	289	237	2950	326	0.684	20.7
	7.1 #	37.0	47.1	25.2	18.1	2690	1720	7.55	6.03	268	229	322	264	3280	361	0.682	18.4
	8.0	41.4	52.8	22.0	15.8	2970	1890	7.50	5.99	297	253	359	294	3640	398	0.679	16.4
	8.8 #	45.3	57.7	19.7	14.0	3220	2050	7.47	5.96	322	273	390	319	3960	430	0.677	15.0
	10.0	51.0	64.9	17.0	12.0	3570	2260	7.41	5.91	357	302	436	356	4410	475	0.674	13.2
	12.5 #	62.5	79.6	13.0	9.00	4240	2670	7.30	5.80	424	356	525	428	5290	559	0.668	10.7
	14.2 #	70.0	89.2	11.1	7.56	4640	2920	7.22	5.72	464	389	582	473	5830	610	0.663	9.48
16.0 #	77.7	99.0	9.50	6.38	5040	3150	7.13	5.64	504	420	638	518	6370	658	0.659	8.50	
220x120	5.0 #	25.7	32.7	41.0	21.0	2130	829	8.06	5.03	193	138	236	155	1880	232	0.667	25.9
	6.3 #	32.0	40.8	31.9	16.0	2610	1010	8.00	4.98	237	168	292	191	2320	283	0.664	20.7
	7.1 #	35.9	45.7	28.0	13.9	2900	1120	7.96	4.94	263	186	326	213	2570	312	0.662	18.5
	8.0 #	40.2	51.2	24.5	12.0	3200	1230	7.91	4.90	291	205	362	236	2850	343	0.659	16.4
	8.8 #	43.9	55.9	22.0	10.6	3470	1320	7.87	4.87	315	221	394	256	3090	370	0.657	15.0
	10.0 #	49.4	62.9	19.0	9.00	3840	1460	7.82	4.81	349	243	440	285	3430	407	0.654	13.2
	12.5 #	60.5	77.1	14.6	6.60	4560	1710	7.69	4.71	415	285	530	341	4090	476	0.648	10.7
	14.2 #	67.8	86.3	12.5	5.45	5000	1850	7.61	4.63	454	309	586	376	4490	517	0.643	9.52
16.0 #	75.2	95.8	10.8	4.50	5410	1990	7.52	4.55	492	331	643	410	4870	555	0.639	8.50	
250x100	5.0 #	26.5	33.7	47.0	17.0	2610	618	8.80	4.28	209	124	263	138	1620	217	0.687	26.0
	6.3 #	33.0	42.1	36.7	12.9	3210	751	8.73	4.22	257	150	326	169	1980	264	0.684	20.7
	7.1 #	37.0	47.1	32.2	11.1	3560	827	8.69	4.19	285	165	363	188	2200	291	0.682	18.4
	8.0 #	41.4	52.8	28.3	9.50	3940	909	8.64	4.15	315	182	404	209	2430	319	0.679	16.4
	8.8 #	45.3	57.7	25.4	8.36	4270	977	8.60	4.12	341	195	439	226	2630	343	0.677	15.0
	10.0 #	51.0	64.9	22.0	7.00	4730	1070	8.54	4.06	379	214	491	251	2910	376	0.674	13.2
	12.5 #	62.5	79.6	17.0	5.00	5620	1250	8.41	3.96	450	249	592	299	3440	438	0.668	10.7
	14.2 #	70.0	89.2	14.6	4.04	6170	1340	8.31	3.88	493	269	655	329	3750	473	0.663	9.48
16.0 #	77.7	99.0	12.6	3.25	6690	1430	8.22	3.80	535	287	719	358	4050	505	0.659	8.50	

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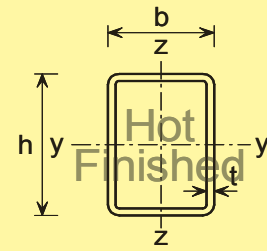
(1) For local buckling calculation  $c_w = h - 3t$  and  $c_f = b - 3t$ .

# Check availability

FOR EXPLANATION OF TABLES SEE NOTES 2 AND 3

## HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Dimensions and properties

Section Designation		Mass per Metre	Area of Section	Ratios for Local Buckling		Second Moment of Area		Radius of Gyration		Elastic Modulus		Plastic Modulus		Torsional Constants		Surface Area	
Size	Thickness			$c_w/t^{(1)}$	$c_f/t^{(1)}$	Axis y-y	Axis z-z	Axis y-y	Axis z-z	Axis y-y	Axis z-z	Axis y-y	Axis z-z	$I_T$	$W_t$	Per Metre	Per Tonne
h x b mm	t mm	kg/m	A 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 <sup>2</sup>
250x150	5.0 #	30.4	38.7	47.0	27.0	3360	1530	9.31	6.28	269	204	324	228	3280	337	0.787	25.9
	6.3	38.0	48.4	36.7	20.8	4140	1870	9.25	6.22	331	250	402	283	4050	413	0.784	20.6
	7.1 #	42.6	54.2	32.2	18.1	4610	2080	9.22	6.19	368	277	449	315	4520	457	0.782	18.4
	8.0	47.7	60.8	28.3	15.8	5110	2300	9.17	6.15	409	306	501	350	5020	506	0.779	16.4
	8.8 #	52.2	66.5	25.4	14.0	5550	2490	9.13	6.12	444	331	545	381	5460	547	0.777	14.9
	10.0	58.8	74.9	22.0	12.0	6170	2760	9.08	6.06	494	367	611	426	6090	605	0.774	13.2
	12.5	72.3	92.1	17.0	9.00	7390	3270	8.96	5.96	591	435	740	514	7330	717	0.768	10.6
	14.2 #	81.1	103	14.6	7.56	8140	3580	8.87	5.88	651	477	823	570	8100	784	0.763	9.38
	16.0	90.3	115	12.6	6.38	8880	3870	8.79	5.80	710	516	906	625	8870	849	0.759	8.42
260x140	5.0 #	30.4	38.7	49.0	25.0	3530	1350	9.55	5.91	272	193	331	216	3080	326	0.787	25.9
	6.3 #	38.0	48.4	38.3	19.2	4360	1660	9.49	5.86	335	237	411	267	3800	399	0.784	20.6
	7.1 #	42.6	54.2	33.6	16.7	4840	1840	9.45	5.82	372	263	459	298	4230	442	0.782	18.4
	8.0 #	47.7	60.8	29.5	14.5	5370	2030	9.40	5.78	413	290	511	331	4700	488	0.779	16.4
	8.8 #	52.2	66.5	26.5	12.9	5830	2200	9.37	5.75	449	314	557	360	5110	527	0.777	14.9
	10.0 #	58.8	74.9	23.0	11.0	6490	2430	9.31	5.70	499	347	624	402	5700	584	0.774	13.2
	12.5 #	72.3	92.1	17.8	8.20	7770	2880	9.18	5.59	597	411	756	485	6840	690	0.768	10.6
	14.2 #	81.1	103	15.3	6.86	8560	3140	9.10	5.52	658	449	840	537	7560	754	0.763	9.38
	16.0 #	90.3	115	13.3	5.75	9340	3400	9.01	5.44	718	486	925	588	8260	815	0.759	8.42
300x100	5.0 #	30.4	38.7	57.0	17.0	4150	731	10.3	4.34	276	146	354	161	2040	262	0.787	25.9
	6.3 #	38.0	48.4	44.6	12.9	5110	890	10.3	4.29	341	178	439	199	2500	319	0.784	20.6
	7.1 #	42.6	54.2	39.3	11.1	5680	981	10.2	4.25	379	196	490	221	2780	352	0.782	18.4
	8.0	47.7	60.8	34.5	9.50	6310	1080	10.2	4.21	420	216	546	245	3070	387	0.779	16.4
	8.8 #	52.2	66.5	31.1	8.36	6840	1160	10.1	4.18	456	232	594	266	3320	416	0.777	14.9
	10.0	58.8	74.9	27.0	7.00	7610	1280	10.1	4.13	508	255	666	296	3680	458	0.774	13.2
	12.5 #	72.3	92.1	21.0	5.00	9100	1490	9.94	4.02	607	297	806	354	4350	534	0.768	10.6
	14.2 #	81.1	103	18.1	4.04	10000	1610	9.85	3.94	669	321	896	390	4760	578	0.763	9.38
	16.0 #	90.3	115	15.8	3.25	10900	1720	9.75	3.87	729	344	986	425	5140	619	0.759	8.42
300x150	8.0 # rr	54.0	68.8	34.5	15.8	8010	2700	10.8	6.27	534	360	663	407	6450	613	0.879	16.3
	8.8 # rr	59.1	75.3	31.1	14.0	8710	2930	10.8	6.23	580	390	723	443	7020	664	0.877	14.8
	10.0 # rr	66.7	84.9	27.0	12.0	9720	3250	10.7	6.18	648	433	811	496	7840	736	0.874	13.1
	12.5 # rr	82.1	105	21.0	9.00	11700	3860	10.6	6.07	779	514	986	600	9450	874	0.868	10.6
	14.2 # rr	92.3	118	18.1	7.56	12900	4230	10.5	6.00	862	564	1100	666	10500	959	0.863	9.32
	16.0 # rr	103	131	15.8	6.38	14200	4600	10.4	5.92	944	613	1210	732	11500	1040	0.859	8.35

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(1) For local buckling calculation  $c_w = h - 3t$  and  $c_f = b - 3t$ .

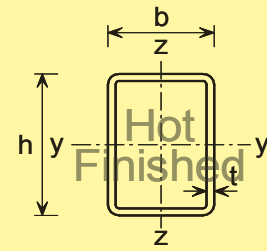
rr External corner radius > 3t (not compliant with BS EN 10210-2)

# Check availability

FOR EXPLANATION OF TABLES SEE NOTES 2 AND 3

## HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Dimensions and properties

Section Designation		Mass per Metre	Area of Section	Ratios for Local Buckling		Second Moment of Area		Radius of Gyration		Elastic Modulus		Plastic Modulus		Torsional Constants		Surface Area	
Size	Thickness			$c_w/t^{(1)}$	$c_f/t^{(1)}$	Axis y-y	Axis z-z	Axis y-y	Axis z-z	Axis y-y	Axis z-z	Axis y-y	Axis z-z	$I_T$	$W_t$	Per Metre	Per Tonne
h x b mm	t mm	kg/m	A 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 <sup>2</sup>
300x200	5.0 #	38.3	48.7	57.0	37.0	6320	3400	11.4	8.35	421	340	501	380	6820	552	0.987	25.8
	6.3	47.9	61.0	44.6	28.7	7830	4190	11.3	8.29	522	419	624	472	8480	681	0.984	20.6
	7.1 #	53.7	68.4	39.3	25.2	8730	4670	11.3	8.26	582	467	698	528	9470	757	0.982	18.3
	8.0	60.3	76.8	34.5	22.0	9720	5180	11.3	8.22	648	518	779	589	10600	840	0.979	16.3
	8.8 #	66.0	84.1	31.1	19.7	10600	5630	11.2	8.18	705	563	851	643	11500	912	0.977	14.9
	10.0	74.5	94.9	27.0	17.0	11800	6280	11.2	8.13	788	628	956	721	12900	1020	0.974	13.1
	12.5	91.9	117	21.0	13.0	14300	7540	11.0	8.02	952	754	1170	877	15700	1220	0.968	10.6
	14.2 #	103	132	18.1	11.1	15800	8330	11.0	7.95	1060	833	1300	978	17500	1340	0.963	9.31
	16.0	115	147	15.8	9.50	17400	9110	10.9	7.87	1160	911	1440	1080	19300	1470	0.959	8.31
300x250	5.0 #	42.2	53.7	57.0	47.0	7410	5610	11.7	10.2	494	449	575	508	9770	697	1.09	25.8
	6.3 #	52.8	67.3	44.6	36.7	9190	6950	11.7	10.2	613	556	716	633	12200	862	1.08	20.4
	7.1 #	59.3	75.5	39.3	32.2	10300	7750	11.6	10.1	683	620	802	708	13600	960	1.08	18.3
	8.0	66.5	84.8	34.5	28.3	11400	8630	11.6	10.1	761	690	896	791	15200	1070	1.08	16.2
	8.8 #	72.9	92.9	31.1	25.4	12400	9390	11.6	10.1	829	751	979	864	16600	1160	1.08	14.8
	10.0 #	82.4	105	27.0	22.0	13900	10500	11.5	10.0	928	840	1100	971	18600	1300	1.07	12.9
	12.5 #	102	130	21.0	17.0	16900	12700	11.4	9.89	1120	1010	1350	1190	22700	1560	1.07	10.5
	14.2 #	115	146	18.1	14.6	18700	14100	11.3	9.82	1250	1130	1510	1330	25400	1730	1.06	9.25
	16.0 #	128	163	15.8	12.6	20600	15500	11.2	9.74	1380	1240	1670	1470	28100	1900	1.06	8.28
340x100	10.0	65.1	82.9	31.0	7.00	10600	1440	11.3	4.16	623	288	823	332	4300	523	0.854	13.2
350x150	5.0 #	38.3	48.7	67.0	27.0	7660	2050	12.5	6.49	437	274	543	301	5160	477	0.987	25.8
	6.3 #	47.9	61.0	52.6	20.8	9480	2530	12.5	6.43	542	337	676	373	6390	586	0.984	20.6
	7.1 #	53.7	68.4	46.3	18.1	10600	2800	12.4	6.40	604	374	756	416	7120	651	0.982	18.3
	8.0 #	60.3	76.8	40.8	15.8	11800	3110	12.4	6.36	673	414	844	464	7930	721	0.979	16.3
	8.8 #	66.0	84.1	36.8	14.0	12800	3360	12.3	6.33	732	449	922	506	8620	781	0.977	14.9
	10.0 #	74.5	94.9	32.0	12.0	14300	3740	12.3	6.27	818	498	1040	566	9630	867	0.974	13.1
	12.5 #	91.9	117	25.0	9.00	17300	4450	12.2	6.17	988	593	1260	686	11600	1030	0.968	10.6
	14.2 #	103	132	21.6	7.56	19200	4890	12.1	6.09	1100	652	1410	763	12900	1130	0.963	9.31
	16.0 #	115	147	18.9	6.38	21100	5320	12.0	6.01	1210	709	1560	840	14100	1230	0.959	8.31
350x250	6.3 #	57.8	73.6	52.6	36.7	13200	7890	13.4	10.4	754	631	892	709	15200	1010	1.18	20.4
	7.1 #	64.9	82.6	46.3	32.2	14700	8800	13.4	10.3	843	704	999	794	17000	1130	1.18	18.2
	8.0 #	72.8	92.8	40.8	28.3	16400	9800	13.3	10.3	940	784	1120	888	19000	1250	1.18	16.2
	8.8 #	79.8	102	36.8	25.4	17900	10700	13.3	10.2	1030	853	1220	970	20800	1370	1.18	14.8
	10.0 #	90.2	115	32.0	22.0	20100	11900	13.2	10.2	1150	955	1380	1090	23400	1530	1.17	13.0
	12.5 #	112	142	25.0	17.0	24400	14400	13.1	10.1	1400	1160	1690	1330	28500	1840	1.17	10.5
	14.2 #	126	160	21.6	14.6	27200	16000	13.0	10.0	1550	1280	1890	1490	31900	2040	1.16	9.22
16.0 #	141	179	18.9	12.6	30000	17700	12.9	9.93	1720	1410	2100	1660	35300	2250	1.16	8.26	

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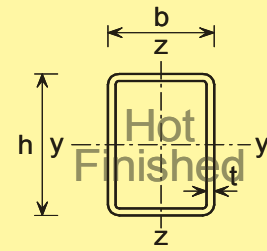
(1) For local buckling calculation  $c_w = h - 3t$  and  $c_f = b - 3t$ .

# Check availability

FOR EXPLANATION OF TABLES SEE NOTES 2 AND 3

## HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Dimensions and properties

Section Designation		Mass per Metre	Area of Section	Ratios for Local Buckling		Second Moment of Area		Radius of Gyration		Elastic Modulus		Plastic Modulus		Torsional Constants		Surface Area	
Size	Thickness			$c_w/t^{(1)}$	$c_f/t^{(1)}$	Axis y-y	Axis z-z	Axis y-y	Axis z-z	Axis y-y	Axis z-z	Axis y-y	Axis z-z	$I_T$	$W_t$	Per Metre	Per Tonne
h x b mm	t mm	kg/m	A 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 <sup>2</sup>
400x150	6.3 #	52.8	67.3	60.5	20.8	13300	2850	14.0	6.51	663	380	836	418	7600	673	1.08	20.4
	7.1 #	59.3	75.5	53.3	18.1	14800	3170	14.0	6.47	740	422	936	467	8470	748	1.08	18.3
	8.0 #	66.5	84.8	47.0	15.8	16500	3510	13.9	6.43	824	468	1050	521	9420	828	1.08	16.2
	8.8 #	72.9	92.9	42.5	14.0	18000	3800	13.9	6.40	898	507	1140	568	10300	898	1.08	14.8
	10.0 #	82.4	105	37.0	12.0	20100	4230	13.8	6.35	1010	564	1290	636	11500	998	1.07	12.9
	12.5 #	102	130	29.0	9.00	24400	5040	13.7	6.24	1220	672	1570	772	13800	1190	1.07	10.5
	14.2 #	115	146	25.2	7.56	27100	5550	13.6	6.16	1360	740	1760	859	15300	1310	1.06	9.25
16.0	128	163	22.0	6.38	29800	6040	13.5	6.09	1490	805	1950	947	16800	1430	1.06	8.28	
400x200	6.3 #	57.8	73.6	60.5	28.7	15700	5380	14.6	8.55	785	538	960	594	12600	917	1.18	20.4
	7.1 #	64.9	82.6	53.3	25.2	17500	5990	14.6	8.51	877	599	1080	665	14100	1020	1.18	18.2
	8.0	72.8	92.8	47.0	22.0	19600	6660	14.5	8.47	978	666	1200	743	15700	1140	1.18	16.2
	8.8 #	79.8	102	42.5	19.7	21300	7240	14.5	8.44	1070	724	1320	811	17200	1230	1.18	14.8
	10.0	90.2	115	37.0	17.0	23900	8080	14.4	8.39	1200	808	1480	911	19300	1380	1.17	13.0
	12.5	112	142	29.0	13.0	29100	9740	14.3	8.28	1450	974	1810	1110	23400	1660	1.17	10.5
	14.2 #	126	160	25.2	11.1	32400	10800	14.2	8.21	1620	1080	2030	1240	26100	1830	1.16	9.22
16.0	141	179	22.0	9.50	35700	11800	14.1	8.13	1790	1180	2260	1370	28900	2010	1.16	8.26	
400x300	8.0 #	85.4	109	47.0	34.5	25700	16500	15.4	12.3	1290	1100	1520	1250	31000	1750	1.38	16.1
	8.8 #	93.6	119	42.5	31.1	28100	18000	15.3	12.3	1400	1200	1660	1360	33900	1910	1.38	14.8
	10.0 #	106	135	37.0	27.0	31500	20200	15.3	12.2	1580	1350	1870	1540	38200	2140	1.37	12.9
	12.5 #	131	167	29.0	21.0	38500	24600	15.2	12.1	1920	1640	2300	1880	46800	2590	1.37	10.4
	14.2 #	148	189	25.2	18.1	43000	27400	15.1	12.1	2150	1830	2580	2110	52500	2890	1.36	9.19
	16.0 #	166	211	22.0	15.8	47500	30300	15.0	12.0	2380	2020	2870	2350	58300	3180	1.36	8.21
450x250	8.0	85.4	109	53.3	28.3	30100	12100	16.6	10.6	1340	971	1620	1080	27100	1630	1.38	16.1
	8.8 #	93.6	119	48.1	25.4	32800	13200	16.6	10.5	1460	1060	1770	1180	29600	1770	1.38	14.8
	10.0	106	135	42.0	22.0	36900	14800	16.5	10.5	1640	1190	2000	1330	33300	1990	1.37	12.9
	12.5	131	167	33.0	17.0	45000	18000	16.4	10.4	2000	1440	2460	1630	40700	2410	1.37	10.4
	14.2 #	148	189	28.7	14.6	50300	20000	16.3	10.3	2240	1600	2760	1830	45600	2680	1.36	9.19
	16.0	166	211	25.1	12.6	55700	22000	16.2	10.2	2480	1760	3070	2030	50500	2950	1.36	8.21
500x200	8.0 #	85.4	109	59.5	22.0	34000	8140	17.7	8.65	1360	814	1710	896	21100	1430	1.38	16.1
	8.8 #	93.6	119	53.8	19.7	37200	8850	17.7	8.61	1490	885	1870	979	23000	1560	1.38	14.8
	10.0 #	106	135	47.0	17.0	41800	9890	17.6	8.56	1670	989	2110	1100	25900	1740	1.37	12.9
	12.5 #	131	167	37.0	13.0	51000	11900	17.5	8.45	2040	1190	2590	1350	31500	2100	1.37	10.4
	14.2 #	148	189	32.2	11.1	56900	13200	17.4	8.38	2280	1320	2900	1510	35200	2320	1.36	9.19
	16.0 #	166	211	28.3	9.50	63000	14500	17.3	8.30	2520	1450	3230	1670	38900	2550	1.36	8.21
500x300	8.0 #	97.9	125	59.5	34.5	43700	20000	18.7	12.6	1750	1330	2100	1480	42600	2200	1.58	16.1
	8.8 #	107	137	53.8	31.1	47800	21800	18.7	12.6	1910	1450	2300	1620	46600	2400	1.58	14.7
	10.0	122	155	47.0	27.0	53800	24400	18.6	12.6	2150	1630	2600	1830	52500	2700	1.57	12.9
	12.5 #	151	192	37.0	21.0	65800	29800	18.5	12.5	2630	1990	3200	2240	64400	3280	1.57	10.4
	14.2 #	170	217	32.2	18.1	73700	33200	18.4	12.4	2950	2220	3590	2520	72200	3660	1.56	9.16
	16.0	191	243	28.3	15.8	81800	36800	18.3	12.3	3270	2450	4010	2800	80300	4040	1.56	8.17
	20.0 ^	235	300	22.0	12.0	98800	44100	18.2	12.1	3950	2940	4890	3410	97400	4840	1.55	6.59

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

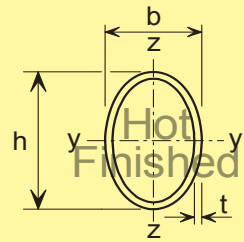
(1) For local buckling calculation  $c_w = h - 3t$  and  $c_f = b - 3t$ .

^ SAW process (single longitudinal seam weld, slightly proud)

# Check availability

FOR EXPLANATION OF TABLES SEE NOTES 2 AND 3

## HOT-FINISHED ELLIPTICAL HOLLOW SECTIONS



Dimensions and properties

Section Designation		Mass per Metre kg/m	Area of Section A cm <sup>2</sup>	Second Moment of Area		Radius of Gyration		Elastic Modulus		Plastic Modulus		Torsional Constants		Surface Area	
Size h x b mm	Thickness t mm			Axis y-y cm <sup>4</sup>	Axis z-z cm <sup>4</sup>	Axis y-y cm	Axis z-z cm	Axis y-y cm <sup>3</sup>	Axis z-z cm <sup>3</sup>	Axis y-y cm <sup>3</sup>	Axis z-z cm <sup>3</sup>	I <sub>T</sub> cm <sup>4</sup>	W <sub>t</sub> cm <sup>3</sup>	Per Metre m <sup>2</sup>	Per Tonne m <sup>2</sup>
150 x 75	4.0 #	10.7	13.6	301	101	4.70	2.72	40.1	26.9	56.1	34.4	303	60.1	0.363	33.9
	5.0 #	13.3	16.9	367	122	4.66	2.69	48.9	32.5	68.9	42.0	367	72.2	0.363	27.4
	6.3 #	16.5	21.0	448	147	4.62	2.64	59.7	39.1	84.9	51.5	443	86.3	0.363	22.0
200 x 100	5.0 #	17.9	22.8	897	302	6.27	3.64	89.7	60.4	125	76.8	905	135	0.484	27.1
	6.3 #	22.3	28.4	1100	368	6.23	3.60	110	73.5	155	94.7	1110	163	0.484	21.7
	8.0 #	28.0	35.7	1360	446	6.17	3.54	136	89.3	193	117	1350	197	0.484	17.3
	10.0 #	34.5	44.0	1640	529	6.10	3.47	164	106	235	141	1610	232	0.484	14.0
	12.5 #	42.4	54.0	1950	619	6.02	3.39	195	124	284	169	1890	269	0.484	11.4
250 x 125	6.3 #	28.2	35.9	2210	742	7.84	4.55	176	119	246	151	2220	265	0.605	21.5
	8.0 #	35.4	45.1	2730	909	7.78	4.49	219	145	307	188	2730	323	0.605	17.1
	10.0 #	43.8	55.8	3320	1090	7.71	4.42	265	174	376	228	3290	385	0.605	13.8
	12.5 #	53.9	68.7	4000	1290	7.63	4.34	320	207	458	276	3920	453	0.605	11.2
300 x 150	8.0 #	42.8	54.5	4810	1620	9.39	5.44	321	215	449	275	4850	481	0.726	17.0
	10.0 #	53.0	67.5	5870	1950	9.32	5.37	391	260	551	336	5870	577	0.726	13.7
	12.5	65.5	83.4	7120	2330	9.24	5.29	475	311	674	409	7050	686	0.726	11.1
	16.0 #	82.5	105	8730	2810	9.12	5.17	582	374	837	503	8530	818	0.726	8.78
400 x 200	8.0 #	57.6	73.4	11700	3970	12.6	7.35	584	397	811	500	11900	890	0.969	16.9
	10.0 #	71.5	91.1	14300	4830	12.5	7.28	717	483	1000	615	14500	1080	0.969	13.6
	12.5	88.6	113	17500	5840	12.5	7.19	877	584	1230	753	17600	1300	0.969	10.9
	16.0	112	143	21700	7140	12.3	7.07	1090	714	1540	936	21600	1580	0.969	8.64
500 x 250	10.0 #	90.0	115	28500	9680	15.8	9.19	1140	775	1590	976	29000	1740	1.21	13.4
	12.5 #	112	142	35000	11800	15.7	9.10	1400	943	1960	1200	35300	2110	1.21	10.8
	16.0 #	142	180	43700	14500	15.6	8.98	1750	1160	2460	1500	43700	2590	1.21	8.54

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Elliptical Hollow Sections (HFEHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

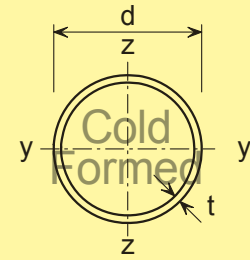
# Check availability

FOR EXPLANATION OF TABLES SEE NOTES 2 AND 3



## COLD-FORMED CIRCULAR HOLLOW SECTIONS

Hybox® CHS



Dimensions and properties

Section Designation		Mass per Metre kg/m	Area of Section A cm <sup>2</sup>	Ratio for Local Buckling d/t	Second Moment of Area I cm <sup>4</sup>	Radius of Gyration i cm	Elastic Modulus W <sub>el</sub> cm <sup>3</sup>	Plastic Modulus W <sub>pl</sub> cm <sup>3</sup>	Torsional Constants		Surface Area	
Outside Diameter d mm	Thickness t mm								I <sub>T</sub> cm <sup>4</sup>	W <sub>t</sub> cm <sup>3</sup>	Per Metre m <sup>2</sup>	Per Tonne m <sup>2</sup>
33.7	3.0	2.27	2.89	11.2	3.44	1.09	2.04	2.84	6.88	4.08	0.106	46.6
42.4	3.0	2.91	3.71	14.1	7.25	1.40	3.42	4.67	14.5	6.84	0.133	45.6
48.3	3.0	3.35	4.27	16.1	11.0	1.61	4.55	6.17	22.0	9.11	0.152	45.3
	4.0 #	4.37	5.57	12.1	13.8	1.57	5.70	7.87	27.5	11.4	0.152	34.8
60.3	3.0 #	4.24	5.40	20.1	22.2	2.03	7.37	9.86	44.4	14.7	0.189	44.6
	4.0	5.55	7.07	15.1	28.2	2.00	9.34	12.7	56.3	18.7	0.189	34.0
76.1	3.0	5.41	6.89	25.4	46.1	2.59	12.1	16.0	92.2	24.2	0.239	44.2
	4.0	7.11	9.06	19.0	59.1	2.55	15.5	20.8	118	31.0	0.239	33.7
88.9	3.0	6.36	8.10	29.6	74.8	3.04	16.8	22.1	150	33.6	0.279	43.8
	3.5 #	7.37	9.39	25.4	85.7	3.02	19.3	25.5	171	38.6	0.279	37.9
	4.0	8.38	10.7	22.2	96.3	3.00	21.7	28.9	193	43.3	0.279	33.2
	5.0	10.3	13.2	17.8	116	2.97	26.2	35.2	233	52.4	0.279	27.0
	6.3	12.8	16.3	14.1	140	2.93	31.5	43.1	280	63.1	0.279	21.7
114.3	3.0 #	8.23	10.5	38.1	163	3.94	28.4	37.2	325	56.9	0.359	43.4
	3.5	9.56	12.2	32.7	187	3.92	32.7	43.0	374	65.5	0.359	37.7
	4.0 #	10.9	13.9	28.6	211	3.90	36.9	48.7	422	73.9	0.359	33.0
	5.0	13.5	17.2	22.9	257	3.87	45.0	59.8	514	89.9	0.359	26.6
	6.0	16.0	20.4	19.1	300	3.83	52.5	70.4	600	105	0.359	22.4
	6.3	16.8	21.4	18.1	313	3.82	54.7	73.6	625	109	0.359	21.4
139.7	3.0 #	10.1	12.9	46.6	301	4.83	43.1	56.1	602	86.2	0.439	43.4
	4.0 #	13.4	17.1	34.9	393	4.80	56.2	73.7	786	112	0.439	32.8
	5.0	16.6	21.2	27.9	481	4.77	68.8	90.8	961	138	0.439	26.4
	6.0	19.8	25.2	23.3	564	4.73	80.8	107	1130	162	0.439	22.2
	6.3	20.7	26.4	22.2	589	4.72	84.3	112	1180	169	0.439	21.2
	8.0	26.0	33.1	17.5	720	4.66	103	139	1440	206	0.439	16.9
	10.0	32.0	40.7	14.0	862	4.60	123	169	1720	247	0.439	13.7
168.3	4.0	16.2	20.6	42.1	697	5.81	82.8	108	1390	166	0.529	32.6
	4.5 #	18.2	23.2	37.4	777	5.79	92.4	121	1550	185	0.529	29.1
	5.0	20.1	25.7	33.7	856	5.78	102	133	1710	203	0.529	26.3
	6.0	24.0	30.6	28.1	1010	5.74	120	158	2020	240	0.529	22.0
	6.3	25.2	32.1	26.7	1050	5.73	125	165	2110	250	0.529	21.0
	8.0	31.6	40.3	21.0	1300	5.67	154	206	2600	308	0.529	16.7
	10.0	39.0	49.7	16.8	1560	5.61	186	251	3130	372	0.529	13.5
12.5	48.0	61.2	13.5	1870	5.53	222	304	3740	444	0.529	11.0	
193.7	4.0 #	18.7	23.8	48.4	1070	6.71	111	144	2150	222	0.609	32.5
	4.5 #	21.0	26.7	43.0	1200	6.69	124	161	2400	247	0.609	29.0
	5.0	23.3	29.6	38.7	1320	6.67	136	178	2640	273	0.609	26.2
	6.0	27.8	35.4	32.3	1560	6.64	161	211	3120	322	0.609	21.9
	6.3	29.1	37.1	30.7	1630	6.63	168	221	3260	337	0.609	20.9
	8.0	36.6	46.7	24.2	2020	6.57	208	276	4030	416	0.609	16.6
	10.0	45.3	57.7	19.4	2440	6.50	252	338	4880	504	0.609	13.5
	12.5	55.9	71.2	15.5	2930	6.42	303	411	5870	606	0.609	10.9

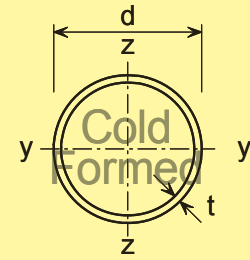
Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Circular Hollow Sections (CFCHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

FOR EXPLANATION OF TABLES SEE NOTES 2 AND 3



## COLD-FORMED CIRCULAR HOLLOW SECTIONS

Hybox® CHS



Dimensions and properties

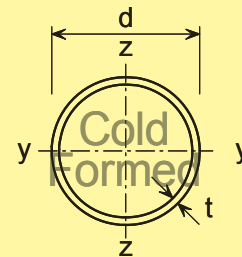
Section Designation		Mass per Metre	Area of Section	Ratio for Local Buckling	Second Moment of Area	Radius of Gyration	Elastic Modulus	Plastic Modulus	Torsional Constants		Surface Area	
Outside Diameter	Thickness								$I_T$	$W_t$	Per Metre	Per Tonne
d	t	kg/m	A	d/t	I	i	$W_{el}$	$W_{pl}$	$I_T$	$W_t$	m <sup>2</sup>	m <sup>2</sup>
mm	mm		cm <sup>2</sup>		cm <sup>4</sup>	cm	cm <sup>3</sup>	cm <sup>3</sup>	cm <sup>4</sup>	cm <sup>3</sup>		
219.1	4.5 #	23.8	30.3	48.7	1750	7.59	159	207	3490	319	0.688	28.9
	5.0	26.4	33.6	43.8	1930	7.57	176	229	3860	352	0.688	26.1
	6.0	31.5	40.2	36.5	2280	7.54	208	273	4560	417	0.688	21.8
	6.3	33.1	42.1	34.8	2390	7.53	218	285	4770	436	0.688	20.8
	8.0	41.6	53.1	27.4	2960	7.47	270	357	5920	540	0.688	16.5
	10.0	51.6	65.7	21.9	3600	7.40	328	438	7200	657	0.688	13.3
	12.0 #	61.3	78.1	18.3	4200	7.33	383	515	8400	767	0.688	11.2
	12.5	63.7	81.1	17.5	4350	7.32	397	534	8690	793	0.688	10.8
16.0	80.1	102	13.7	5300	7.20	483	661	10600	967	0.688	8.60	
244.5	5.0 #	29.5	37.6	48.9	2700	8.47	221	287	5400	441	0.768	26.0
	6.0	35.3	45.0	40.8	3200	8.43	262	341	6400	523	0.768	21.7
	6.3	37.0	47.1	38.8	3350	8.42	274	358	6690	547	0.768	20.7
	8.0	46.7	59.4	30.6	4160	8.37	340	448	8320	681	0.768	16.4
	10.0	57.8	73.7	24.5	5070	8.30	415	550	10100	830	0.768	13.3
	12.0 #	68.8	87.7	20.4	5940	8.23	486	649	11900	972	0.768	11.1
	12.5	71.5	91.1	19.6	6150	8.21	503	673	12300	1010	0.768	10.8
	16.0	90.2	115	15.3	7530	8.10	616	837	15100	1230	0.768	8.52
273	4.0 #	26.5	33.8	68.3	3060	9.51	224	289	6120	448	0.858	32.3
	4.5 #	29.8	38.0	60.7	3420	9.49	251	324	6840	501	0.858	28.8
	5.0 #	33.0	42.1	54.6	3780	9.48	277	359	7560	554	0.858	26.0
	6.0	39.5	50.3	45.5	4490	9.44	329	428	8970	657	0.858	21.7
	6.3	41.4	52.8	43.3	4700	9.43	344	448	9390	688	0.858	20.7
	8.0	52.3	66.6	34.1	5850	9.37	429	562	11700	857	0.858	16.4
	10.0	64.9	82.6	27.3	7150	9.31	524	692	14300	1050	0.858	13.2
	12.0 #	77.2	98.4	22.8	8400	9.24	615	818	16800	1230	0.858	11.1
	12.5	80.3	102	21.8	8700	9.22	637	849	17400	1270	0.858	10.7
16.0	101	129	17.1	10700	9.10	784	1060	21400	1570	0.858	8.46	
323.9	5.0 #	39.3	50.1	64.8	6370	11.3	393	509	12700	787	1.02	25.9
	6.0	47.0	59.9	54.0	7570	11.2	468	606	15100	935	1.02	21.7
	6.3 #	49.3	62.9	51.4	7930	11.2	490	636	15900	979	1.02	20.7
	8.0	62.3	79.4	40.5	9910	11.2	612	799	19800	1220	1.02	16.3
	10.0	77.4	98.6	32.4	12200	11.1	751	986	24300	1500	1.02	13.2
	12.0 #	92.3	118	27.0	14300	11.0	884	1170	28600	1770	1.02	11.0
	12.5	96.0	122	25.9	14800	11.0	917	1210	29700	1830	1.02	10.6
	16.0	121	155	20.2	18400	10.9	1140	1520	36800	2270	1.02	8.39
355.6	5.0 #	43.2	55.1	71.1	8460	12.4	476	615	16900	952	1.12	25.9
	6.0	51.7	65.9	59.3	10100	12.4	566	733	20100	1130	1.12	21.6
	6.3 #	54.3	69.1	56.4	10500	12.4	593	769	21100	1190	1.12	20.6
	8.0	68.6	87.4	44.5	13200	12.3	742	967	26400	1490	1.12	16.4
	10.0	85.2	109	35.6	16200	12.2	912	1200	32400	1830	1.12	13.1
	12.0 #	102	130	29.6	19100	12.2	1080	1420	38300	2150	1.12	11.0
	12.5	106	135	28.4	19900	12.1	1120	1470	39700	2230	1.12	10.6
	16.0	134	171	22.2	24700	12.0	1390	1850	49300	2770	1.12	8.36

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Circular Hollow Sections (CFCHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

FOR EXPLANATION OF TABLES SEE NOTES 2 AND 3

## COLD-FORMED CIRCULAR HOLLOW SECTIONS

Hybox® CHS



Dimensions and properties

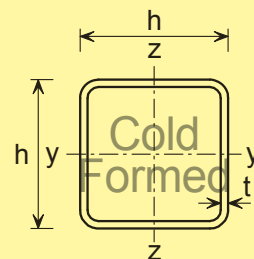
Section Designation		Mass per Metre	Area of Section	Ratio for Local Buckling	Second Moment of Area	Radius of Gyration	Elastic Modulus	Plastic Modulus	Torsional Constants		Surface Area	
Outside Diameter	Thickness								$I_T$	$W_t$	Per Metre	Per Tonne
d	t	kg/m	A	d/t	I	i	$W_{el}$	$W_{pl}$	$cm^4$	$cm^3$	$m^2$	$m^2$
mm	mm		$cm^2$		$cm^4$	cm	$cm^3$	$cm^3$				
406.4	6.0 #	59.2	75.5	67.7	15100	14.2	745	962	30300	1490	1.28	21.6
	6.3 #	62.2	79.2	64.5	15800	14.1	780	1010	31700	1560	1.28	20.6
	8.0	78.6	100	50.8	19900	14.1	978	1270	39700	1960	1.28	16.3
	10.0	97.8	125	40.6	24500	14.0	1210	1570	49000	2410	1.28	13.1
	12.0 #	117	149	33.9	28900	14.0	1420	1870	57900	2850	1.28	11.0
	12.5	121	155	32.5	30000	13.9	1480	1940	60100	2960	1.28	10.5
	16.0	154	196	25.4	37400	13.8	1840	2440	74900	3690	1.28	8.31
457	6.0 #	66.7	85.0	76.2	21600	15.9	946	1220	43200	1890	1.44	21.6
	6.3 #	70.0	89.2	72.5	22700	15.9	991	1280	45300	1980	1.44	20.6
	8.0	88.6	113	57.1	28400	15.9	1250	1610	56900	2490	1.44	16.3
	10.0	110	140	45.7	35100	15.8	1540	2000	70200	3070	1.44	13.1
	12.0 #	132	168	38.1	41600	15.7	1820	2380	83100	3640	1.44	10.9
	12.5	137	175	36.6	43100	15.7	1890	2470	86300	3780	1.44	10.5
	16.0	174	222	28.6	54000	15.6	2360	3110	108000	4720	1.44	8.28
508	6.0 #	74.3	94.6	84.7	29800	17.7	1170	1510	59600	2350	1.60	21.6
	6.3 #	77.9	99.3	80.6	31200	17.7	1230	1590	62500	2460	1.60	20.5
	8.0 #	98.6	126	63.5	39300	17.7	1550	2000	78600	3090	1.60	16.2
	10.0	123	156	50.8	48500	17.6	1910	2480	97000	3820	1.60	13.0
	12.0 #	147	187	42.3	57500	17.5	2270	2950	115000	4530	1.60	10.9
	12.5	153	195	40.6	59800	17.5	2350	3070	120000	4710	1.60	10.5
	16.0 #	194	247	31.8	74900	17.4	2950	3870	150000	5900	1.60	8.24

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Circular Hollow Sections (CFCHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

FOR EXPLANATION OF TABLES SEE NOTES 2 AND 3

## COLD-FORMED SQUARE HOLLOW SECTIONS

Hybox® SHS



Dimensions and properties

Section Designation		Mass per Metre	Area of Section	Ratio for Local Buckling $c/t^{(1)}$	Second Moment of Area	Radius of Gyration	Elastic Modulus	Plastic Modulus	Torsional Constants		Surface Area	
Size	Thickness								$I_T$	$W_t$	Per Metre	Per Tonne
$h \times h$ mm	t mm	kg/m	$A$ $cm^2$		$I$ $cm^4$	i cm	$W_{el}$ $cm^3$	$W_{pl}$ $cm^3$	$I_T$ $cm^4$	$W_t$ $cm^3$	$m^2$	$m^2$
25x25	2.0 #	1.36	1.74	9.50	1.48	0.924	1.19	1.47	2.53	1.80	0.093	68.2
	2.5	1.64	2.09	7.00	1.69	0.899	1.35	1.71	2.97	2.07	0.091	55.5
30x30	2.0 #	1.68	2.14	12.0	2.72	1.13	1.81	2.21	4.54	2.75	0.113	67.3
	2.5 #	2.03	2.59	9.00	3.16	1.10	2.10	2.61	5.40	3.20	0.111	54.6
	3.0	2.36	3.01	7.00	3.50	1.08	2.34	2.96	6.15	3.58	0.110	46.5
40x40	2.0 #	2.31	2.94	17.0	6.94	1.54	3.47	4.13	11.3	5.23	0.153	66.4
	2.5	2.82	3.59	13.0	8.22	1.51	4.11	4.97	13.6	6.21	0.151	53.6
	3.0	3.30	4.21	10.3	9.32	1.49	4.66	5.72	15.8	7.07	0.150	45.5
	4.0	4.20	5.35	7.00	11.1	1.44	5.54	7.01	19.4	8.48	0.146	34.7
50x50	2.5	3.60	4.59	17.0	16.9	1.92	6.78	8.07	27.5	10.2	0.191	53.1
	3.0	4.25	5.41	13.7	19.5	1.90	7.79	9.39	32.1	11.8	0.190	44.8
	4.0	5.45	6.95	9.50	23.7	1.85	9.49	11.7	40.4	14.4	0.186	34.0
	5.0	6.56	8.36	7.00	27.0	1.80	10.8	13.7	47.5	16.6	0.183	27.8
60x60	3.0	5.19	6.61	17.0	35.1	2.31	11.7	14.0	57.1	17.7	0.230	44.4
	4.0	6.71	8.55	12.0	43.6	2.26	14.5	17.6	72.6	22.0	0.226	33.7
	5.0	8.13	10.4	9.00	50.5	2.21	16.8	20.9	86.4	25.6	0.223	27.4
	6.0 #	9.45	12.0	7.00	56.1	2.16	18.7	23.7	98.4	28.6	0.219	23.2
70x70	3.0	6.13	7.81	20.3	57.5	2.71	16.4	19.4	92.4	24.7	0.270	44.0
	3.5	7.06	8.99	17.0	65.1	2.69	18.6	22.2	106	28.0	0.268	38.1
	4.0	7.97	10.1	14.5	72.1	2.67	20.6	24.8	119	31.1	0.266	33.5
	5.0	9.70	12.4	11.0	84.6	2.62	24.2	29.6	142	36.7	0.263	27.1
	6.0 #	11.3	14.4	8.67	95.2	2.57	27.2	33.8	163	41.4	0.259	22.9
80x80	3.0	7.07	9.01	23.7	87.8	3.12	22.0	25.8	140	33.0	0.310	43.7
	3.5	8.16	10.4	19.9	99.8	3.10	25.0	29.5	161	37.6	0.308	37.9
	4.0	9.22	11.7	17.0	111	3.07	27.8	33.1	180	41.8	0.306	33.0
	5.0	11.3	14.4	13.0	131	3.03	32.9	39.7	218	49.7	0.303	26.9
	6.0	13.2	16.8	10.3	149	2.98	37.3	45.8	252	56.6	0.299	22.6
90x90	3.0	8.01	10.2	27.0	127	3.53	28.3	33.0	201	42.5	0.350	43.8
	3.5	9.26	11.8	22.7	145	3.51	32.2	37.9	232	48.5	0.348	37.6
	4.0	10.5	13.3	19.5	162	3.48	36.0	42.6	261	54.2	0.346	33.0
	5.0	12.8	16.4	15.0	193	3.43	42.9	51.4	316	64.7	0.343	26.7
	6.0 #	15.1	19.2	12.0	220	3.39	49.0	59.5	368	74.2	0.339	22.4
100x100	3.0	8.96	11.4	30.3	177	3.94	35.4	41.2	279	53.2	0.390	43.7
	4.0	11.7	14.9	22.0	226	3.89	45.3	53.3	362	68.1	0.386	32.9
	5.0	14.4	18.4	17.0	271	3.84	54.2	64.6	441	81.7	0.383	26.6
	6.0	17.0	21.6	13.7	311	3.79	62.3	75.1	514	94.1	0.379	22.3
	8.0	21.4	27.2	9.50	366	3.67	73.2	91.1	645	114	0.366	17.1
120x120	3.0 #	10.8	13.8	37.0	312	4.76	52.1	60.2	488	78.2	0.470	43.4
	4.0	14.2	18.1	27.0	402	4.71	67.0	78.3	637	101	0.466	32.7
	5.0	17.5	22.4	21.0	485	4.66	80.9	95.4	778	122	0.463	26.4
	6.0	20.7	26.4	17.0	562	4.61	93.7	112	913	141	0.459	22.1
	8.0	26.4	33.6	12.0	677	4.49	113	138	1160	175	0.446	16.9
	10.0	31.8	40.6	9.00	777	4.38	129	162	1380	203	0.437	13.7

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Square Hollow Sections (CFSHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

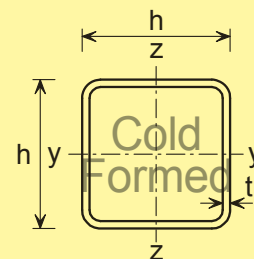
(1) For local buckling calculation  $c = h - 3t$ .

# Check availability

FOR EXPLANATION OF TABLES SEE NOTES 2 AND 3

## COLD-FORMED SQUARE HOLLOW SECTIONS

### Hybox® SHS



Dimensions and properties

Section Designation		Mass per Metre	Area of Section	Ratio for Local Buckling $c/t^{(1)}$	Second Moment of Area	Radius of Gyration	Elastic Modulus	Plastic Modulus	Torsional Constants		Surface Area	
Size	Thickness								$I_T$	$W_t$	Per Metre	Per Tonne
$h \times h$ mm	t mm	kg/m	$A$ $cm^2$		$I$ $cm^4$	i cm	$W_{el}$ $cm^3$	$W_{pl}$ $cm^3$	$I_T$ $cm^4$	$W_t$ $cm^3$	$m^2$	$m^2$
140x140	4.0	16.8	21.3	32.0	652	5.52	93.1	108	1020	140	0.546	32.6
	5.0	20.7	26.4	25.0	791	5.48	113	132	1260	170	0.543	26.2
	6.0	24.5	31.2	20.3	920	5.43	131	155	1480	198	0.539	22.0
	8.0	31.4	40.0	14.5	1130	5.30	161	194	1900	248	0.526	16.7
	10.0	38.1	48.6	11.0	1310	5.20	187	230	2270	291	0.517	13.5
150x150	4.0 #	18.0	22.9	34.5	808	5.93	108	125	1270	162	0.586	32.5
	5.0	22.3	28.4	27.0	982	5.89	131	153	1550	197	0.583	26.2
	6.0	26.4	33.6	22.0	1150	5.84	153	180	1830	230	0.579	21.9
	8.0	33.9	43.2	15.8	1410	5.71	188	226	2360	289	0.566	16.7
	10.0	41.3	52.6	12.0	1650	5.61	220	269	2840	341	0.557	13.5
160x160	4.0 #	19.3	24.5	37.0	987	6.34	123	143	1540	185	0.626	32.5
	5.0	23.8	30.4	29.0	1200	6.29	150	175	1900	226	0.623	26.2
	6.0	28.3	36.0	23.7	1410	6.25	176	206	2240	264	0.619	21.9
	8.0	36.5	46.4	17.0	1740	6.12	218	260	2900	334	0.606	16.6
	10.0	44.4	56.6	13.0	2050	6.02	256	311	3490	395	0.597	13.4
180x180	5.0	27.0	34.4	33.0	1740	7.11	193	224	2720	290	0.703	26.1
	6.0	32.1	40.8	27.0	2040	7.06	226	264	3220	340	0.699	21.8
	6.3 #	33.3	42.4	25.6	2100	7.03	233	273	3380	354	0.693	20.8
	8.0	41.5	52.8	19.5	2550	6.94	283	336	4190	432	0.686	16.5
	10.0	50.7	64.6	15.0	3020	6.84	335	404	5070	515	0.677	13.3
	12.0 #	58.5	74.5	12.0	3320	6.68	369	454	5870	584	0.658	11.3
	12.5	60.5	77.0	11.4	3410	6.65	378	467	6050	600	0.656	10.8
200x200	5.0	30.1	38.4	37.0	2410	7.93	241	279	3760	362	0.783	26.0
	6.0	35.8	45.6	30.3	2830	7.88	283	330	4460	426	0.779	21.7
	6.3 #	37.2	47.4	28.7	2920	7.85	292	341	4680	444	0.773	20.7
	8.0	46.5	59.2	22.0	3570	7.76	357	421	5820	544	0.766	16.5
	10.0	57.0	72.6	17.0	4250	7.65	425	508	7070	651	0.757	13.3
	12.0 #	66.0	84.1	13.7	4730	7.50	473	576	8230	743	0.738	11.2
	12.5	68.3	87.0	13.0	4860	7.47	486	594	8500	765	0.736	10.7
250x250	6.0	45.2	57.6	38.7	5670	9.92	454	524	8840	681	0.979	21.6
	6.3 #	47.1	60.0	36.7	5870	9.89	470	544	9290	711	0.973	20.6
	8.0	59.1	75.2	28.3	7230	9.80	578	676	11600	878	0.966	16.3
	10.0	72.7	92.6	22.0	8710	9.70	697	822	14200	1060	0.957	13.2
	12.0 #	84.8	108	17.8	9860	9.55	789	944	16700	1230	0.938	11.1
12.5	88.0	112	17.0	10200	9.52	813	975	17300	1270	0.936	10.7	
300x300	6.0	54.7	69.6	47.0	9960	12.0	664	764	15400	997	1.18	21.6
	6.3 #	57.0	72.6	44.6	10300	11.9	689	795	16200	1040	1.17	20.5
	8.0	71.6	91.2	34.5	12800	11.8	853	991	20300	1290	1.17	16.4
	10.0	88.4	113	27.0	15500	11.7	1040	1210	25000	1570	1.16	13.1
	12.0 #	104	132	22.0	17800	11.6	1180	1400	29500	1830	1.14	11.0
	12.5	108	137	21.0	18300	11.6	1220	1450	30600	1890	1.14	10.6

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Square Hollow Sections (CFSHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

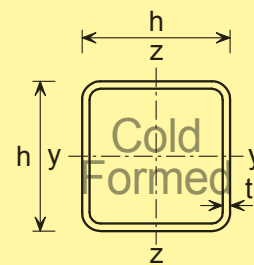
(1) For local buckling calculation  $c = h - 3t$ .

# Check availability

FOR EXPLANATION OF TABLES SEE NOTES 2 AND 3

## COLD-FORMED SQUARE HOLLOW SECTIONS

Hybox® SHS



Dimensions and properties

Section Designation		Mass per Metre	Area of Section	Ratio for Local Buckling $c/t^{(1)}$	Second Moment of Area	Radius of Gyration	Elastic Modulus	Plastic Modulus	Torsional Constants		Surface Area	
Size	Thickness								$I_T$	$W_t$	Per Metre	Per Tonne
$h \times h$ mm	t mm	kg/m	A cm <sup>2</sup>		I cm <sup>4</sup>	i cm	$W_{el}$ cm <sup>3</sup>	$W_{pl}$ cm <sup>3</sup>	cm <sup>4</sup>	cm <sup>3</sup>	m <sup>2</sup>	m <sup>2</sup>
350x350	6.0 #	64.1	81.6	55.3	16000	14.0	915	1050	24700	1370	1.38	21.5
	6.3 #	66.9	85.2	52.6	16600	14.0	951	1090	25900	1440	1.37	20.4
	8.0	84.2	107	40.8	20700	13.9	1180	1370	32600	1790	1.37	16.3
	10.0	104	133	32.0	25200	13.8	1440	1680	40100	2180	1.36	13.1
	12.0 #	123	156	26.2	29100	13.6	1660	1950	47600	2550	1.34	10.9
	12.5	127	162	25.0	30000	13.6	1720	2020	49400	2640	1.34	10.5
400x400	6.0 #	73.5	93.6	63.7	24100	16.0	1210	1380	37000	1810	1.58	21.5
	6.3 #	76.8	97.8	60.5	25100	16.0	1260	1440	38900	1890	1.57	20.4
	8.0	96.7	123	47.0	31300	15.9	1560	1800	48900	2360	1.57	16.2
	10.0	120	153	37.0	38200	15.8	1910	2210	60400	2890	1.56	13.0
	12.0 #	141	180	30.3	44300	15.7	2220	2590	71800	3400	1.54	10.9
	12.5	147	187	29.0	45900	15.7	2290	2680	74600	3520	1.54	10.5

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Square Hollow Sections (CFSHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

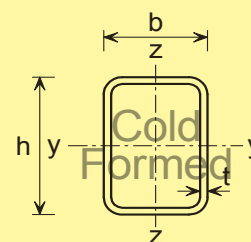
(1) For local buckling calculation  $c = h - 3t$ .

# Check availability

FOR EXPLANATION OF TABLES SEE NOTES 2 AND 3

## COLD-FORMED RECTANGULAR HOLLOW SECTIONS

### Hybox® RHS



Dimensions and properties

Section Designation		Mass per Metre	Area of Section	Ratios for Local Buckling		Second Moment of Area		Radius of Gyration		Elastic Modulus		Plastic Modulus		Torsional Constants		Surface Area	
Size	Thickness			$c_w/t^{(1)}$	$c_f/t^{(1)}$	Axis y-y	Axis z-z	Axis y-y	Axis z-z	Axis y-y	Axis z-z	Axis y-y	Axis z-z	$I_T$	$W_t$	Per Metre	Per Tonne
h x b mm	t mm	kg/m	A 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 <sup>2</sup>
50 x 25	2.0 #	2.15	2.74	22.0	9.50	8.38	2.81	1.75	1.01	3.35	2.25	4.26	2.62	7.06	3.92	0.143	66.5
	2.5	2.62	3.34	17.0	7.00	9.89	3.28	1.72	0.991	3.95	2.62	5.11	3.12	8.43	4.60	0.141	53.9
	3.0	3.07	3.91	13.7	5.33	11.2	3.67	1.69	0.969	4.47	2.93	5.86	3.56	9.64	5.18	0.140	45.6
50 x 30	2.0 #	2.31	2.94	22.0	12.0	9.54	4.29	1.80	1.21	3.81	2.86	4.74	3.33	9.77	4.84	0.153	66.4
	2.5	2.82	3.59	17.0	9.00	11.3	5.05	1.77	1.19	4.52	3.37	5.70	3.98	11.7	5.72	0.151	53.6
	3.0	3.30	4.21	13.7	7.00	12.8	5.70	1.75	1.16	5.13	3.80	6.57	4.58	13.5	6.49	0.150	45.5
	4.0	4.20	5.35	9.50	4.50	15.3	6.69	1.69	1.12	6.10	4.46	8.05	5.58	16.5	7.71	0.146	34.7
60 x 40	2.5 #	3.60	4.59	21.0	13.0	22.1	11.7	2.19	1.60	7.36	5.87	9.06	6.84	25.1	9.72	0.191	53.1
	3.0	4.25	5.41	17.0	10.3	25.4	13.4	2.17	1.58	8.46	6.72	10.5	7.94	29.3	11.2	0.190	44.8
	4.0	5.45	6.95	12.0	7.00	31.0	16.3	2.11	1.53	10.3	8.14	13.2	9.89	36.7	13.7	0.186	34.0
	5.0	6.56	8.36	9.00	5.00	35.3	18.4	2.06	1.48	11.8	9.21	15.4	11.5	42.8	15.6	0.183	27.8
70 x 40	3.0	4.72	6.01	20.3	10.3	37.3	15.5	2.49	1.61	10.7	7.75	13.4	9.05	36.5	13.2	0.210	44.5
	4.0	6.08	7.75	14.5	7.00	46.0	18.9	2.44	1.56	13.1	9.44	16.8	11.3	45.8	16.2	0.206	33.8
	5.0	7.34	9.36	11.0	5.00	52.9	21.5	2.38	1.52	15.1	10.8	19.8	13.3	53.8	18.7	0.203	27.6
70 x 50	3.0 #	5.19	6.61	20.3	13.7	44.1	26.1	2.58	1.99	12.6	10.4	15.4	12.2	53.6	17.1	0.230	44.4
	4.0	6.71	8.55	14.5	9.50	54.7	32.2	2.53	1.94	15.6	12.9	19.5	15.4	68.1	21.2	0.226	33.7
	5.0	8.13	10.4	11.0	7.00	63.5	37.2	2.48	1.90	18.1	14.9	23.1	18.2	80.8	24.6	0.223	27.4
80 x 40	3.0	5.19	6.61	23.7	10.3	52.3	17.6	2.81	1.63	13.1	8.78	16.5	10.2	43.9	15.3	0.230	44.4
	4.0	6.71	8.55	17.0	7.00	64.8	21.5	2.75	1.59	16.2	10.7	20.9	12.8	55.2	18.8	0.226	33.7
	5.0	8.13	10.4	13.0	5.00	75.1	24.6	2.69	1.54	18.8	12.3	24.7	15.0	65.0	21.7	0.223	27.4
80 x 50	3.0	5.66	7.21	23.7	13.7	61.1	29.4	2.91	2.02	15.3	11.8	18.8	13.6	65.0	19.7	0.250	44.3
	4.0	7.34	9.35	17.0	9.50	76.4	36.5	2.86	1.98	19.1	14.6	24.0	17.2	82.7	24.6	0.246	33.5
	5.0	8.91	11.4	13.0	7.00	89.2	42.3	2.80	1.93	22.3	16.9	28.5	20.5	98.4	28.7	0.243	27.2
80 x 60	3.0	6.13	7.81	23.7	17.0	70.0	44.9	3.00	2.40	17.5	15.0	21.2	17.4	88.3	24.1	0.270	44.0
	3.5	7.06	8.99	19.9	14.1	79.3	50.7	2.97	2.37	19.8	16.9	24.1	19.8	101	27.3	0.268	38.1
	4.0	7.97	10.1	17.0	12.0	87.9	56.1	2.94	2.35	22.0	18.7	27.0	22.1	113	30.3	0.266	33.5
	5.0	9.70	12.4	13.0	9.00	103	65.7	2.89	2.31	25.8	21.9	32.2	26.4	136	35.7	0.263	27.1
90 x 50	3.0 #	6.13	7.81	27.0	13.7	81.9	32.7	3.24	2.05	18.2	13.1	22.6	15.0	76.7	22.4	0.270	44.0
	4.0 #	7.97	10.1	19.5	9.50	103	40.7	3.18	2.00	22.8	16.3	28.8	19.1	97.7	28.0	0.266	33.5
	5.0	9.70	12.4	15.0	7.00	121	47.4	3.12	1.96	26.8	18.9	34.4	22.7	116	32.7	0.263	27.1

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Rectangular Hollow Sections (CFRHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

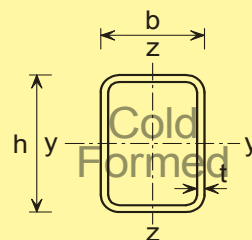
(1) For local buckling calculation  $c_w = d - 3t$  and  $c_f = h - 3t$ .

# Check availability

FOR EXPLANATION OF TABLES SEE NOTES 2 AND 3

## COLD-FORMED RECTANGULAR HOLLOW SECTIONS

Hybox® RHS



Dimensions and properties

Section Designation		Mass per Metre	Area of Section	Ratios for Local Buckling		Second Moment of Area		Radius of Gyration		Elastic Modulus		Plastic Modulus		Torsional Constants		Surface Area	
Size	Thickness			$c_w/t^{(1)}$	$c_f/t^{(1)}$	Axis y-y	Axis z-z	Axis y-y	Axis z-z	Axis y-y	Axis z-z	Axis y-y	Axis z-z	$I_T$	$W_t$	Per Metre	Per Tonne
h x b mm	t mm	kg/m	A 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 <sup>2</sup>
100 x 40	3.0	6.13	7.81	30.3	10.3	92.3	21.7	3.44	1.67	18.5	10.8	23.7	12.4	59.0	19.4	0.270	44.0
	4.0	7.97	10.1	22.0	7.00	116	26.7	3.38	1.62	23.1	13.3	30.3	15.7	74.5	24.0	0.266	33.5
	5.0 #	9.70	12.4	17.0	5.00	136	30.8	3.31	1.58	27.1	15.4	36.1	18.5	87.9	27.9	0.263	27.1
100 x 50	3.0	6.60	8.41	30.3	13.7	106	36.1	3.56	2.07	21.3	14.4	26.7	16.4	88.6	25.0	0.290	44.1
	4.0	8.59	10.9	22.0	9.50	134	44.9	3.50	2.03	26.8	18.0	34.1	20.9	113	31.3	0.286	33.2
	5.0	10.5	13.4	17.0	7.00	158	52.5	3.44	1.98	31.6	21.0	40.8	25.0	135	36.8	0.283	27.0
	6.0	12.3	15.6	13.7	5.33	179	58.7	3.38	1.94	35.8	23.5	46.9	28.5	154	41.4	0.279	22.7
100 x 60	3.0	7.07	9.01	30.3	17.0	121	54.6	3.66	2.46	24.1	18.2	29.6	20.8	122	30.6	0.310	43.7
	3.5	8.16	10.4	25.6	14.1	137	61.9	3.63	2.44	27.4	20.6	33.8	23.8	139	34.8	0.308	37.9
	4.0	9.22	11.7	22.0	12.0	153	68.7	3.60	2.42	30.5	22.9	37.9	26.6	156	38.7	0.306	33.0
	5.0	11.3	14.4	17.0	9.00	181	80.8	3.55	2.37	36.2	26.9	45.6	31.9	188	45.8	0.303	26.9
	6.0	13.2	16.8	13.7	7.00	205	91.2	3.49	2.33	41.1	30.4	52.5	36.6	216	51.9	0.299	22.6
100 x 80	3.0 #	8.01	10.2	30.3	23.7	149	106	3.82	3.22	29.8	26.4	35.4	30.4	196	41.9	0.350	43.8
	4.0	10.5	13.3	22.0	17.0	189	134	3.77	3.17	37.9	33.5	45.6	39.2	254	53.4	0.346	33.0
	5.0	12.8	16.4	17.0	13.0	226	160	3.72	3.12	45.2	39.9	55.1	47.2	308	63.7	0.343	26.7
	6.0	15.1	19.2	13.7	10.3	258	182	3.67	3.08	51.7	45.5	63.8	54.7	357	73.0	0.339	22.4
120 x 40	3.0 #	7.07	9.01	37.0	10.3	148	25.8	4.05	1.69	24.7	12.9	32.2	14.6	74.6	23.5	0.310	43.7
	4.0 #	9.22	11.7	27.0	7.00	187	31.9	3.99	1.65	31.1	15.9	41.2	18.5	94.2	29.2	0.306	33.0
	5.0 #	11.3	14.4	21.0	5.00	221	36.9	3.92	1.60	36.8	18.5	49.4	22.0	111	34.1	0.303	26.9
120 x 60	3.0	8.01	10.2	37.0	17.0	189	64.4	4.30	2.51	31.5	21.5	39.2	24.2	156	37.1	0.350	43.8
	3.5	9.26	11.8	31.3	14.1	216	73.1	4.28	2.49	35.9	24.4	44.9	27.7	179	42.2	0.348	37.6
	4.0	10.5	13.3	27.0	12.0	241	81.2	4.25	2.47	40.1	27.1	50.5	31.1	201	47.0	0.346	33.0
	5.0	12.8	16.4	21.0	9.00	287	96.0	4.19	2.42	47.8	32.0	60.9	37.4	242	55.8	0.343	26.7
	6.0	15.1	19.2	17.0	7.00	328	109	4.13	2.38	54.7	36.3	70.6	43.1	280	63.6	0.339	22.4
120 x 80	3.0	8.96	11.4	37.0	23.7	230	123	4.49	3.29	38.4	30.9	46.2	35.0	255	50.8	0.390	43.7
	4.0	11.7	14.9	27.0	17.0	295	157	4.44	3.24	49.1	39.3	59.8	45.2	331	64.9	0.386	32.9
	5.0	14.4	18.4	21.0	13.0	353	188	4.39	3.20	58.9	46.9	72.4	54.7	402	77.8	0.383	26.6
	6.0	17.0	21.6	17.0	10.3	406	215	4.33	3.15	67.7	53.8	84.3	63.5	469	89.4	0.379	22.3
	8.0	21.4	27.2	12.0	7.00	476	252	4.18	3.04	79.3	62.9	102	76.9	584	108	0.366	17.1
140 x 80	3.0 #	9.90	12.6	43.7	23.7	334	141	5.15	3.35	47.8	35.3	58.2	39.6	317	59.7	0.430	43.4
	4.0	13.0	16.5	32.0	17.0	430	180	5.10	3.30	61.4	45.1	75.5	51.3	412	76.5	0.426	32.8
	5.0 #	16.0	20.4	25.0	13.0	517	216	5.04	3.26	73.9	54.0	91.8	62.2	501	91.8	0.423	26.5
	6.0	18.9	24.0	20.3	10.3	597	248	4.98	3.21	85.3	62.0	107	72.4	584	106	0.419	22.2
	8.0	23.9	30.4	14.5	7.00	708	293	4.82	3.10	101	73.3	131	88.4	731	129	0.406	17.0
	10.0	28.7	36.6	11.0	5.00	804	330	4.69	3.01	115	82.6	152	103	851	147	0.397	13.8

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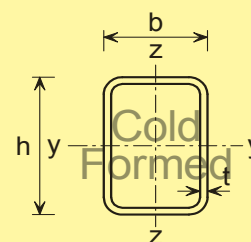
(1) For local buckling calculation  $c_w = d - 3t$  and  $c_f = h - 3t$ .

# Check availability

FOR EXPLANATION OF TABLES SEE NOTES 2 AND 3

## COLD-FORMED RECTANGULAR HOLLOW SECTIONS

### Hybox® RHS



Dimensions and properties

Section Designation		Mass per Metre	Area of Section	Ratios for Local Buckling		Second Moment of Area		Radius of Gyration		Elastic Modulus		Plastic Modulus		Torsional Constants		Surface Area	
Size	Thickness			$c_w/t^{(1)}$	$c_f/t^{(1)}$	Axis y-y	Axis z-z	Axis y-y	Axis z-z	Axis y-y	Axis z-z	Axis y-y	Axis z-z	$I_T$	$W_t$	Per Metre	Per Tonne
h x b mm	t mm	kg/m	A 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 <sup>2</sup>
150 x 100	3.0 #	11.3	14.4	47.0	30.3	461	248	5.65	4.15	61.4	49.5	73.5	55.8	507	81.4	0.490	43.3
	4.0	14.9	18.9	34.5	22.0	595	319	5.60	4.10	79.3	63.7	95.7	72.5	662	105	0.486	32.7
	5.0	18.3	23.4	27.0	17.0	719	384	5.55	4.05	95.9	76.8	117	88.3	809	127	0.483	26.3
	6.0	21.7	27.6	22.0	13.7	835	444	5.50	4.01	111	88.8	137	103	948	147	0.479	22.1
	8.0	27.7	35.2	15.8	9.50	1010	536	5.35	3.90	134	107	169	128	1210	182	0.466	16.8
	10.0	33.4	42.6	12.0	7.00	1160	614	5.22	3.80	155	123	199	150	1430	211	0.457	13.7
160 x 80	3.0 #	10.8	13.8	50.3	23.7	464	159	5.80	3.39	58.0	39.8	71.4	44.3	380	68.6	0.470	43.4
	4.0	14.2	18.1	37.0	17.0	598	204	5.74	3.35	74.7	50.9	92.9	57.4	494	88.0	0.466	32.7
	5.0	17.5	22.4	29.0	13.0	722	244	5.68	3.30	90.2	61.0	113	69.7	601	106	0.463	26.4
	6.0	20.7	26.4	23.7	10.3	836	281	5.62	3.26	105	70.2	132	81.3	702	122	0.459	22.1
	8.0	26.4	33.6	17.0	7.00	1000	335	5.46	3.16	125	83.7	163	100	882	150	0.446	16.9
	10.0 #	31.8	40.6	13.0	5.00	1150	380	5.32	3.06	143	95.0	191	117	1030	172	0.437	13.7
180 x 80	3.0	11.8	15.0	57.0	23.7	621	177	6.43	3.43	69.0	44.2	85.8	48.9	445	77.5	0.510	43.3
	4.0	15.5	19.7	42.0	17.0	802	227	6.37	3.39	89.1	56.7	112	63.5	578	99.6	0.506	32.6
	5.0	19.1	24.4	33.0	13.0	971	272	6.31	3.34	108	68.1	137	77.2	704	120	0.503	26.3
	6.0 #	22.6	28.8	27.0	10.3	1130	314	6.25	3.30	125	78.5	160	90.2	823	139	0.499	22.1
	8.0	28.9	36.8	19.5	7.00	1360	377	6.08	3.20	151	94.1	198	111	1040	170	0.486	16.8
	10.0 #	35.0	44.6	15.0	5.00	1570	429	5.94	3.10	174	107	234	131	1210	196	0.477	13.6
180 x 100	4.0 #	16.8	21.3	42.0	22.0	926	374	6.59	4.18	103	74.8	126	84.0	854	127	0.546	32.6
	5.0	20.7	26.4	33.0	17.0	1120	452	6.53	4.14	125	90.4	154	103	1050	154	0.543	26.2
	6.0	24.5	31.2	27.0	13.7	1310	524	6.48	4.10	146	105	181	120	1230	179	0.539	22.0
	8.0	31.4	40.0	19.5	9.50	1600	637	6.32	3.99	178	127	226	150	1570	222	0.526	16.7
	10.0	38.1	48.6	15.0	7.00	1860	736	6.19	3.89	207	147	268	177	1860	260	0.517	13.5
200 x 100	4.0	18.0	22.9	47.0	22.0	1200	411	7.23	4.23	120	82.2	148	91.7	985	142	0.586	32.5
	5.0	22.3	28.4	37.0	17.0	1460	497	7.17	4.19	146	99.4	181	112	1210	172	0.583	26.2
	6.0	26.4	33.6	30.3	13.7	1700	577	7.12	4.14	170	115	213	132	1420	200	0.579	21.9
	8.0	33.9	43.2	22.0	9.50	2090	705	6.95	4.04	209	141	267	165	1810	250	0.566	16.7
	10.0	41.3	52.6	17.0	7.00	2440	818	6.82	3.94	244	164	318	195	2150	292	0.557	13.5
200 x 120	4.0	19.3	24.5	47.0	27.0	1350	618	7.43	5.02	135	103	164	115	1350	172	0.626	32.5
	5.0	23.8	30.4	37.0	21.0	1650	750	7.37	4.97	165	125	201	141	1650	210	0.623	26.2
	6.0	28.3	36.0	30.3	17.0	1930	874	7.32	4.93	193	146	237	166	1950	245	0.619	21.9
	8.0	36.5	46.4	22.0	12.0	2390	1080	7.17	4.82	239	180	298	209	2510	308	0.606	16.6
	10.0	44.4	56.6	17.0	9.00	2810	1260	7.04	4.72	281	210	356	250	3010	364	0.597	13.4
200 x 150	4.0 #	21.2	26.9	47.0	34.5	1580	1020	7.67	6.16	158	136	187	154	1940	219	0.686	32.4
	5.0 #	26.2	33.4	37.0	27.0	1940	1250	7.62	6.11	193	166	230	189	2390	267	0.683	26.1
	6.0	31.1	39.6	30.3	22.0	2270	1460	7.56	6.06	227	194	271	223	2830	313	0.679	21.8
	8.0	40.2	51.2	22.0	15.8	2830	1820	7.43	5.95	283	242	344	283	3670	396	0.666	16.6
	10.0	49.1	62.6	17.0	12.0	3350	2140	7.31	5.85	335	286	413	339	4430	471	0.657	13.4

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(1) For local buckling calculation  $c_w = d - 3t$  and  $c_f = h - 3t$ .

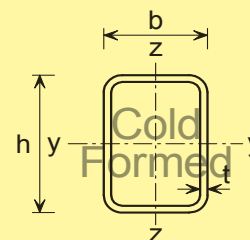
# Check availability

FOR EXPLANATION OF TABLES SEE NOTES 2 AND 3



## COLD-FORMED RECTANGULAR HOLLOW SECTIONS

### Hybox® RHS



Dimensions and properties

Section Designation		Mass per Metre	Area of Section	Ratios for Local Buckling		Second Moment of Area		Radius of Gyration		Elastic Modulus		Plastic Modulus		Torsional Constants		Surface Area	
Size	Thickness			$c_w/t^{(1)}$	$c_f/t^{(1)}$	Axis y-y	Axis z-z	Axis y-y	Axis z-z	Axis y-y	Axis z-z	Axis y-y	Axis z-z	$I_T$	$W_t$	Per Metre	Per Tonne
h x b mm	t mm	kg/m	A 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 <sup>2</sup>
250 x 150	5.0	30.1	38.4	47.0	27.0	3300	1510	9.28	6.27	264	201	320	225	3290	337	0.783	26.0
	6.0	35.8	45.6	38.7	22.0	3890	1770	9.23	6.23	311	236	378	266	3890	396	0.779	21.7
	6.3 #	37.2	47.4	36.7	20.8	4000	1830	9.18	6.20	320	243	391	276	4080	412	0.773	20.7
	8.0	46.5	59.2	28.3	15.8	4890	2220	9.08	6.12	391	296	482	340	5050	504	0.766	16.5
	10.0	57.0	72.6	22.0	12.0	5830	2630	8.96	6.02	466	351	582	409	6120	602	0.757	13.3
	12.0	66.0	84.1	17.8	9.50	6460	2930	8.77	5.90	517	390	658	463	7090	684	0.738	11.2
	12.5	68.3	87.0	17.0	9.00	6630	3000	8.73	5.87	531	400	678	477	7320	704	0.736	10.7
300 x 100	8.0	46.5	59.2	34.5	9.50	5980	1050	10.0	4.20	399	209	523	238	3080	385	0.766	16.5
	10.0	57.0	72.6	27.0	7.00	7110	1220	9.90	4.11	474	245	631	285	3680	455	0.757	13.3
300 x 200	6.0	45.2	57.6	47.0	30.3	7370	3960	11.3	8.29	491	396	588	446	8120	651	0.979	21.6
	6.3 #	47.1	60.0	44.6	28.7	7620	4100	11.3	8.27	508	410	610	463	8520	680	0.973	20.6
	8.0	59.1	75.2	34.5	22.0	9390	5040	11.2	8.19	626	504	757	574	10600	838	0.966	16.3
	10.0	72.7	92.6	27.0	17.0	11300	6060	11.1	8.09	754	606	921	698	13000	1010	0.957	13.2
	12.0 #	84.8	108	22.0	13.7	12800	6850	10.9	7.96	853	685	1060	801	15200	1170	0.938	11.1
12.5	88.0	112	21.0	13.0	13200	7060	10.8	7.94	879	706	1090	828	15800	1200	0.936	10.7	
400 x 200	6.0 #	54.7	69.6	63.7	30.3	14800	5090	14.6	8.55	739	509	906	562	12100	877	1.18	21.6
	6.3 #	57.0	72.6	60.5	28.7	15300	5290	14.5	8.53	766	529	942	585	12700	916	1.17	20.5
	8.0	71.6	91.2	47.0	22.0	19000	6520	14.4	8.45	949	652	1170	728	15800	1130	1.17	16.4
	10.0	88.4	113	37.0	17.0	23000	7860	14.3	8.36	1150	786	1430	888	19400	1370	1.16	13.1
	12.0 #	104	132	30.3	13.7	26200	8980	14.1	8.24	1310	898	1660	1030	22800	1590	1.14	11.0
12.5	108	137	29.0	13.0	27100	9260	14.1	8.22	1360	926	1710	1060	23600	1640	1.14	10.6	
450 x 250	6.0 #	64.1	81.6	72.0	38.7	22700	9250	16.7	10.6	1010	740	1220	817	20700	1250	1.38	21.5
	6.3 #	66.9	85.2	68.4	36.7	23600	9620	16.6	10.6	1050	769	1270	851	21700	1310	1.37	20.4
	8.0 #	84.2	107	53.3	28.3	29300	11900	16.5	10.5	1300	953	1590	1060	27200	1630	1.37	16.3
	10.0 #	104	133	42.0	22.0	35700	14500	16.4	10.4	1590	1160	1950	1300	33500	1980	1.36	13.1
	12.0 #	123	156	34.5	17.8	41100	16700	16.2	10.3	1830	1330	2260	1520	39600	2310	1.34	10.9
12.5 #	127	162	33.0	17.0	42500	17200	16.2	10.3	1890	1380	2350	1570	41100	2390	1.34	10.5	
500 x 300	6.0 #	73.5	93.6	80.3	47.0	33000	15200	18.8	12.7	1320	1010	1580	1120	32400	1690	1.58	21.5
	6.3 #	76.8	97.8	76.4	44.6	34300	15800	18.7	12.7	1370	1050	1650	1170	34100	1770	1.57	20.4
	8.0 #	96.7	123	59.5	34.5	42800	19600	18.6	12.6	1710	1310	2060	1460	42800	2200	1.57	16.2
	10.0 #	120	153	47.0	27.0	52300	23900	18.5	12.5	2090	1600	2540	1790	52700	2690	1.56	13.0
	12.0 #	141	180	38.7	22.0	60600	27700	18.3	12.4	2420	1850	2960	2090	62600	3160	1.54	10.9
12.5 #	147	187	37.0	21.0	62700	28700	18.3	12.4	2510	1910	3070	2170	65000	3270	1.54	10.5	

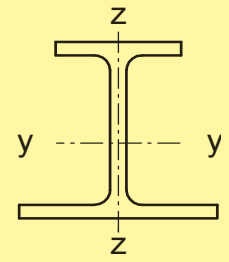
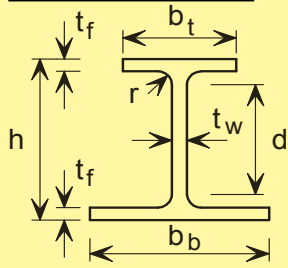
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(1) For local buckling calculation  $c_w = d - 3t$  and  $c_f = h - 3t$ .

# Check availability

FOR EXPLANATION OF TABLES SEE NOTES 2 AND 3

## ASB (ASYMMETRIC BEAMS)



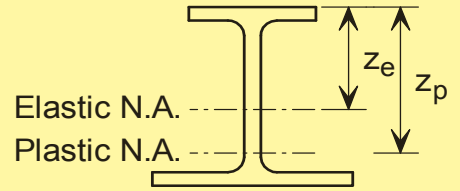
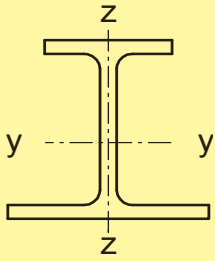
Dimensions and properties

Section Designation	Mass per Metre kg/m	Depth of Section h mm	Width of Flange		Thickness		Root Radius r mm	Depth between Fillets d mm	Ratios for Local Buckling			Second Moment of Area		Surface Area	
			Top	Bottom	Web	Flange			Flanges		Web	Axis y-y cm <sup>4</sup>	Axis z-z cm <sup>4</sup>	Per Metre m <sup>2</sup>	Per Tonne m <sup>2</sup>
			b <sub>t</sub> mm	b <sub>b</sub> mm	t <sub>w</sub> mm	t <sub>f</sub> mm			c <sub>ft</sub> /t <sub>f</sub>	c <sub>fb</sub> /t <sub>f</sub>	c <sub>w</sub> /t <sub>w</sub>				
300 ASB 249 ^	249	342	203	313	40.0	40.0	27.0	208	1.36	2.74	5.20	52900	13200	1.59	6.38
300 ASB 196	196	342	183	293	20.0	40.0	27.0	208	1.36	2.74	10.4	45900	10500	1.55	7.93
300 ASB 185 ^	185	320	195	305	32.0	29.0	27.0	208	1.88	3.78	6.50	35700	8750	1.53	8.29
300 ASB 155	155	326	179	289	16.0	32.0	27.0	208	1.70	3.42	13.0	34500	7990	1.51	9.71
300 ASB 153 ^	153	310	190	300	27.0	24.0	27.0	208	2.27	4.56	7.70	28400	6840	1.50	9.81
280 ASB 136 ^	136	288	190	300	25.0	22.0	24.0	196	2.66	5.16	7.84	22200	6260	1.46	10.7
280 ASB 124	124	296	178	288	13.0	26.0	24.0	196	2.25	4.37	15.1	23500	6410	1.46	11.8
280 ASB 105	105	288	176	286	11.0	22.0	24.0	196	2.66	5.16	17.8	19200	5300	1.44	13.7
280 ASB 100 ^	100	276	184	294	19.0	16.0	24.0	196	3.66	7.09	10.3	15500	4250	1.43	14.2
280 ASB 74	73.6	272	175	285	10.0	14.0	24.0	196	4.18	8.11	19.6	12200	3330	1.40	19.1

^ Sections are fire engineered with thick webs.

FOR EXPLANATION OF TABLES SEE NOTES 2 AND 3

## ASB (ASYMMETRIC BEAMS)



Properties (Continued)

Section Designation	Radius of Gyration		Elastic Modulus			Neutral Axis Position		Plastic Modulus		Buckling Parameter U	Torsional Index X	Mono-symmetry index* $\psi$	Warping Constant $I_w$ dm <sup>6</sup>	Torsional Constant $I_T$ cm <sup>4</sup>	Area of Section A cm <sup>2</sup>
	Axis y-y cm	Axis z-z cm	Axis y-y Top cm <sup>3</sup>	Axis y-y Bottom cm <sup>3</sup>	Axis z-z cm <sup>3</sup>	Elastic $z_e$ cm	Plastic $z_p$ cm	Axis y-y cm <sup>3</sup>	Axis z-z cm <sup>3</sup>						
300 ASB 249 ^	12.9	6.40	2760	3530	843	19.2	22.6	3760	1510	0.820	6.80	0.663	2.00	2000	318
300 ASB 196	13.6	6.48	2320	3180	714	19.8	28.1	3060	1230	0.840	7.86	0.895	1.50	1180	249
300 ASB 185 ^	12.3	6.10	1980	2540	574	18.0	21.0	2660	1030	0.820	8.56	0.662	1.20	871	235
300 ASB 155	13.2	6.35	1830	2520	553	18.9	27.3	2360	950	0.840	9.40	0.868	1.07	620	198
300 ASB 153 ^	12.1	5.93	1630	2090	456	17.4	20.4	2160	817	0.820	9.97	0.643	0.895	513	195
280 ASB 136 ^	11.3	6.00	1370	1770	417	16.3	19.2	1810	741	0.810	10.2	0.628	0.710	379	174
280 ASB 124	12.2	6.37	1360	1900	445	17.3	25.7	1730	761	0.830	10.5	0.807	0.721	332	158
280 ASB 105	12.0	6.30	1150	1610	370	16.8	25.3	1440	633	0.830	12.1	0.777	0.574	207	133
280 ASB 100 ^	11.0	5.76	995	1290	289	15.6	18.4	1290	511	0.810	13.2	0.616	0.451	160	128
280 ASB 74	11.4	5.96	776	1060	234	15.7	21.3	978	403	0.830	16.7	0.699	0.338	72.0	93.7

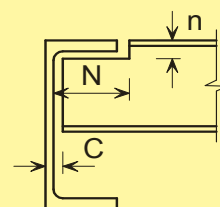
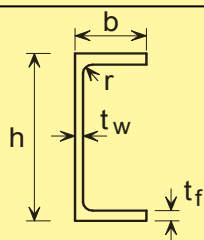
^ Sections are fire engineered with thick webs.

\* Monosymmetry index is positive when the wide flange is in compression and negative when the narrow flange is in compression

FOR EXPLANATION OF TABLES SEE NOTES 2 AND 3

## PARALLEL FLANGE CHANNELS

Advance® UKPFC



Dimensions

Section Designation	Mass per Metre kg/m	Depth of Section h mm	Width of Section b mm	Thickness		Root Radius r mm	Depth between Fillets d mm	Ratios for Local Buckling		Distance $e_0$ cm	Dimensions for Detailing			Surface Area	
				Web $t_w$ mm	Flange $t_f$ mm			Flange $c_f / t_f$	Web $c_w / t_w$		End Clearance C mm	Notch		Per Metre m <sup>2</sup>	Per Tonne m <sup>2</sup>
												N mm	n mm		
430x100x64	64.4	430	100	11.0	19.0	15	362	3.89	32.9	3.27	13	96	36	1.23	19.0
380x100x54	54.0	380	100	9.5	17.5	15	315	4.31	33.2	3.48	12	98	34	1.13	20.9
300x100x46	45.5	300	100	9.0	16.5	15	237	4.61	26.3	3.68	11	98	32	0.969	21.3
300x90x41	41.4	300	90	9.0	15.5	12	245	4.45	27.2	3.18	11	88	28	0.932	22.5
260x90x35	34.8	260	90	8.0	14.0	12	208	5.00	26.0	3.32	10	88	28	0.854	24.5
260x75x28	27.6	260	75	7.0	12.0	12	212	4.67	30.3	2.62	9	74	26	0.796	28.8
230x90x32	32.2	230	90	7.5	14.0	12	178	5.04	23.7	3.46	10	90	28	0.795	24.7
230x75x26	25.7	230	75	6.5	12.5	12	181	4.52	27.8	2.78	9	76	26	0.737	28.7
200x90x30	29.7	200	90	7.0	14.0	12	148	5.07	21.1	3.60	9	90	28	0.736	24.8
200x75x23	23.4	200	75	6.0	12.5	12	151	4.56	25.2	2.91	8	76	26	0.678	28.9
180x90x26	26.1	180	90	6.5	12.5	12	131	5.72	20.2	3.64	9	90	26	0.697	26.7
180x75x20	20.3	180	75	6.0	10.5	12	135	5.43	22.5	2.87	8	76	24	0.638	31.4
150x90x24	23.9	150	90	6.5	12.0	12	102	5.96	15.7	3.71	9	90	26	0.637	26.7
150x75x18	17.9	150	75	5.5	10.0	12	106	5.75	19.3	2.99	8	76	24	0.579	32.4
125x65x15	14.8	125	65	5.5	9.5	12	82.0	5.00	14.9	2.56	8	66	22	0.489	33.1
100x50x10	10.2	100	50	5.0	8.5	9	65.0	4.24	13.0	1.94	7	52	18	0.382	37.5

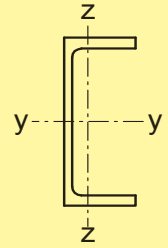
Advance® and UKPFC are trademarks of Tata Steel. A fuller description of the relationship between Parallel Flange Channels (PFC) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

$e_0$  is the distance from the centre of the web to the shear centre

FOR EXPLANATION OF TABLES SEE NOTE 2

## PARALLEL FLANGE CHANNELS

Advance® UKPFC



### Properties

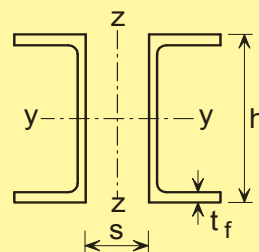
Section Designation	Second Moment of Area		Radius of Gyration		Elastic Modulus		Plastic Modulus		Buckling Parameter U	Torsional Index X	Warping Constant $I_w$ dm <sup>6</sup>	Torsional Constant $I_T$ cm <sup>4</sup>	Area of Section A cm <sup>2</sup>
	Axis y-y	Axis z-z	Axis y-y	Axis z-z	Axis y-y	Axis z-z	Axis y-y	Axis z-z					
	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>					
430x100x64	21900	722	16.3	2.97	1020	97.9	1220	176	0.917	22.5	0.219	63.0	82.1
380x100x54	15000	643	14.8	3.06	791	89.2	933	161	0.933	21.2	0.150	45.7	68.7
300x100x46	8230	568	11.9	3.13	549	81.7	641	148	0.944	17.0	0.0813	36.8	58.0
300x90x41	7220	404	11.7	2.77	481	63.1	568	114	0.934	18.3	0.0581	28.8	52.7
260x90x35	4730	353	10.3	2.82	364	56.3	425	102	0.943	17.2	0.0379	20.6	44.4
260x75x28	3620	185	10.1	2.30	278	34.4	328	62.0	0.932	20.5	0.0203	11.7	35.1
230x90x32	3520	334	9.27	2.86	306	55.0	355	98.9	0.949	15.1	0.0279	19.3	41.0
230x75x26	2750	181	9.17	2.35	239	34.8	278	63.2	0.945	17.3	0.0153	11.8	32.7
200x90x30	2520	314	8.16	2.88	252	53.4	291	94.5	0.952	12.9	0.0197	18.3	37.9
200x75x23	1960	170	8.11	2.39	196	33.8	227	60.6	0.956	14.7	0.0107	11.1	29.9
180x90x26	1820	277	7.40	2.89	202	47.4	232	83.5	0.950	12.8	0.0141	13.3	33.2
180x75x20	1370	146	7.27	2.38	152	28.8	176	51.8	0.945	15.3	0.00754	7.34	25.9
150x90x24	1160	253	6.18	2.89	155	44.4	179	76.9	0.937	10.8	0.00890	11.8	30.4
150x75x18	861	131	6.15	2.40	115	26.6	132	47.2	0.945	13.1	0.00467	6.10	22.8
125x65x15	483	80.0	5.07	2.06	77.3	18.8	89.9	33.2	0.942	11.1	0.00194	4.72	18.8
100x50x10	208	32.3	4.00	1.58	41.5	9.89	48.9	17.5	0.942	10.0	0.000491	2.53	13.0

Advance® and UKPFC are trademarks of Tata Steel. A fuller description of the relationship between Parallel Flange Channels (PFC) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

FOR EXPLANATION OF TABLES SEE NOTE 3

## TWO PARALLEL FLANGE CHANNELS LACED

### TWO Advance® UKPFC LACED



Dimensions and properties

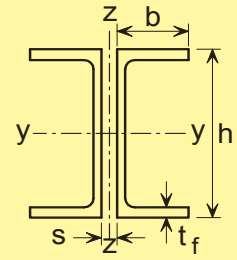
Composed of Two Channels	Total Mass per Metre kg/m	Total Area cm <sup>2</sup>	Space between Webs s mm	Second Moment of Area		Radius of Gyration		Elastic Modulus		Plastic Modulus	
				Axis y-y cm <sup>4</sup>	Axis z-z cm <sup>4</sup>	Axis y-y cm	Axis z-z cm	Axis y-y cm <sup>3</sup>	Axis z-z cm <sup>3</sup>	Axis y-y cm <sup>3</sup>	Axis z-z cm <sup>3</sup>
430x100x64	129	164	270	43900	44100	16.3	16.4	2040	1880	2440	2650
380x100x54	108	137	235	30100	30400	14.8	14.9	1580	1400	1870	2000
300x100x46	91.1	116	170	16500	16600	11.9	12.0	1100	898	1280	1340
300x90x41	82.8	105	175	14400	14400	11.7	11.7	962	811	1140	1200
260x90x35	69.7	88.8	145	9460	9560	10.3	10.4	727	588	849	886
260x75x28	55.2	70.3	155	7240	7190	10.1	10.1	557	472	656	692
230x90x32	64.3	81.9	120	7040	7190	9.27	9.37	612	479	709	731
230x75x26	51.3	65.4	135	5500	5720	9.17	9.35	478	401	557	592
200x90x30	59.4	75.7	90.0	5050	5030	8.16	8.15	505	372	583	577
200x75x23	46.9	59.7	105	3930	3910	8.11	8.09	393	306	454	462
180x90x26	52.1	66.4	75.0	3640	3730	7.40	7.49	404	292	464	459
180x75x20	40.7	51.8	90.0	2740	2770	7.27	7.31	304	231	352	358
150x90x24	47.7	60.8	45.0	2320	2380	6.18	6.26	310	212	357	338
150x75x18	35.7	45.5	65.0	1720	1810	6.15	6.30	230	168	264	265
125x65x15	29.5	37.6	50.0	966	1010	5.07	5.18	155	112	180	178
100x50x10	20.4	26.0	40.0	415	427	4.00	4.05	83.1	61.0	97.7	97.1

Advance® and UKPFC are trademarks of Tata Steel. A fuller description of the relationship between Parallel Flange Channels (PFC) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

FOR EXPLANATION OF TABLES SEE NOTES 2 AND 3

**TWO PARALLEL FLANGE CHANNELS BACK TO BACK**

**TWO Advance® UKPFC BACK TO BACK**



Dimensions and properties

Composed of Two Channels	Total Mass per Metre kg/m	Total Area cm <sup>2</sup>	Properties about Axis y-y				Radius of Gyration $i_z$ about Axis z-z (cm)				
			$I_y$ cm <sup>4</sup>	$i_y$ cm	$W_{el,y}$ cm <sup>3</sup>	$W_{pl,y}$ cm <sup>3</sup>	Space between webs, s (mm)				
							0	8	10	12	15
430x100x64	129	164	43900	16.3	2040	2440	3.96	4.23	4.31	4.38	4.49
380x100x54	108	137	30100	14.8	1580	1870	4.14	4.42	4.49	4.57	4.68
300x100x46	91.1	116	16500	11.9	1100	1280	4.37	4.66	4.73	4.81	4.92
300x90x41	82.8	105	14400	11.7	962	1140	3.80	4.08	4.16	4.23	4.35
260x90x35	69.7	88.8	9460	10.3	727	849	3.93	4.22	4.29	4.37	4.48
260x75x28	55.2	70.3	7240	10.1	557	656	3.11	3.40	3.47	3.55	3.66
230x90x32	64.3	81.9	7040	9.27	612	709	4.09	4.38	4.46	4.53	4.65
230x75x26	51.3	65.4	5500	9.17	478	557	3.29	3.58	3.66	3.73	3.85
200x90x30	59.4	75.7	5050	8.16	505	583	4.25	4.55	4.63	4.71	4.83
200x75x23	46.9	59.7	3930	8.11	393	454	3.44	3.74	3.82	3.89	4.01
180x90x26	52.1	66.4	3640	7.40	404	464	4.29	4.59	4.67	4.75	4.87
180x75x20	40.7	51.8	2740	7.27	304	352	3.39	3.68	3.76	3.84	3.95
150x90x24	47.7	60.8	2320	6.18	310	357	4.39	4.69	4.77	4.85	4.98
150x75x18	35.7	45.5	1720	6.15	230	264	3.52	3.82	3.90	3.98	4.10
125x65x15	29.5	37.6	966	5.07	155	180	3.05	3.36	3.44	3.52	3.64
100x50x10	20.4	26.0	415	4.00	83.1	97.7	2.34	2.65	2.73	2.82	2.94

Advance® and UKPFC are trademarks of Tata Steel. A fuller description of the relationship between Parallel Flange Channels (PFC) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

Properties about z axis:

$$I_z = (\text{Total Area}) \cdot (i_z)^2$$

$$W_{el,z} = I_z / (b + 0.5s)$$

where s is the space between webs.

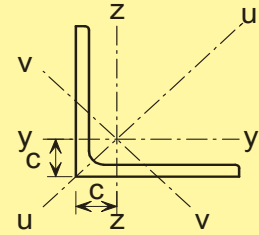
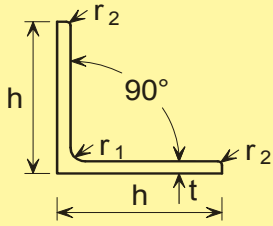
FOR EXPLANATION OF TABLES SEE NOTES 2 AND 3

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## EQUAL ANGLES

### Advance® UKA - Equal Angles



Dimensions and properties

Section Designation		Mass per Metre	Radius		Area of Section	Distance to centroid	Second Moment of Area			Radius of Gyration			Elastic Modulus	Torsional Constant	Equivalent Slenderness Coefficient
Size	Thickness		Root	Toe			Axis y-y, z-z	Axis u-u	Axis v-v	Axis y-y, z-z	Axis u-u	Axis v-v			
h x h mm	t mm	kg/m	r <sub>1</sub> mm	r <sub>2</sub> mm	cm <sup>2</sup>	c cm	cm <sup>4</sup>	cm <sup>4</sup>	cm <sup>4</sup>	cm	cm	cm	cm <sup>3</sup>	I <sub>T</sub> cm <sup>4</sup>	φ <sub>a</sub>
200x200	24	71.1	18.0	9.00	90.6	5.84	3330	5280	1380	6.06	7.64	3.90	235	182	2.50
	20	59.9	18.0	9.00	76.3	5.68	2850	4530	1170	6.11	7.70	3.92	199	107	3.05
	18	54.3	18.0	9.00	69.1	5.60	2600	4150	1050	6.13	7.75	3.90	181	78.9	3.43
	16	48.5	18.0	9.00	61.8	5.52	2340	3720	960	6.16	7.76	3.94	162	56.1	3.85
150x150	18 +	40.1	16.0	8.00	51.2	4.38	1060	1680	440	4.55	5.73	2.93	99.8	58.6	2.48
	15	33.8	16.0	8.00	43.0	4.25	898	1430	370	4.57	5.76	2.93	83.5	34.6	3.01
	12	27.3	16.0	8.00	34.8	4.12	737	1170	303	4.60	5.80	2.95	67.7	18.2	3.77
	10	23.0	16.0	8.00	29.3	4.03	624	990	258	4.62	5.82	2.97	56.9	10.8	4.51
120x120	15 +	26.6	13.0	6.50	34.0	3.52	448	710	186	3.63	4.57	2.34	52.8	27.0	2.37
	12	21.6	13.0	6.50	27.5	3.40	368	584	152	3.65	4.60	2.35	42.7	14.2	2.99
	10	18.2	13.0	6.50	23.2	3.31	313	497	129	3.67	4.63	2.36	36.0	8.41	3.61
	8 +	14.7	13.0	6.50	18.8	3.24	259	411	107	3.71	4.67	2.38	29.5	4.44	4.56
100x100	15 +	21.9	12.0	6.00	28.0	3.02	250	395	105	2.99	3.76	1.94	35.8	22.3	1.92
	12	17.8	12.0	6.00	22.7	2.90	207	328	85.7	3.02	3.80	1.94	29.1	11.8	2.44
	10	15.0	12.0	6.00	19.2	2.82	177	280	73.0	3.04	3.83	1.95	24.6	6.97	2.94
	8	12.2	12.0	6.00	15.5	2.74	145	230	59.9	3.06	3.85	1.96	19.9	3.68	3.70
90x90	12 +	15.9	11.0	5.50	20.3	2.66	149	235	62.0	2.71	3.40	1.75	23.5	10.5	2.17
	10	13.4	11.0	5.50	17.1	2.58	127	201	52.6	2.72	3.42	1.75	19.8	6.20	2.64
	8	10.9	11.0	5.50	13.9	2.50	104	166	43.1	2.74	3.45	1.76	16.1	3.28	3.33
	7	9.61	11.0	5.50	12.2	2.45	92.6	147	38.3	2.75	3.46	1.77	14.1	2.24	3.80
80x80	10	11.9	10.0	5.00	15.1	2.34	87.5	139	36.4	2.41	3.03	1.55	15.4	5.45	2.33
	8	9.63	10.0	5.00	12.3	2.26	72.2	115	29.9	2.43	3.06	1.56	12.6	2.88	2.94
75x75	8	8.99	9.00	4.50	11.4	2.14	59.1	93.8	24.5	2.27	2.86	1.46	11.0	2.65	2.76
	6	6.85	9.00	4.50	8.73	2.05	45.8	72.7	18.9	2.29	2.89	1.47	8.41	1.17	3.70
70x70	7	7.38	9.00	4.50	9.40	1.97	42.3	67.1	17.5	2.12	2.67	1.36	8.41	1.69	2.92
	6	6.38	9.00	4.50	8.13	1.93	36.9	58.5	15.3	2.13	2.68	1.37	7.27	1.09	3.41
65x65	7	6.83	9.00	4.50	8.73	2.05	33.4	53.0	13.8	1.96	2.47	1.26	7.18	1.58	2.67
60x60	8	7.09	8.00	4.00	9.03	1.77	29.2	46.1	12.2	1.80	2.26	1.16	6.89	2.09	2.14
	6	5.42	8.00	4.00	6.91	1.69	22.8	36.1	9.44	1.82	2.29	1.17	5.29	0.922	2.90
	5	4.57	8.00	4.00	5.82	1.64	19.4	30.7	8.03	1.82	2.30	1.17	4.45	0.550	3.48
50x50	6	4.47	7.00	3.50	5.69	1.45	12.8	20.3	5.34	1.50	1.89	0.968	3.61	0.755	2.38
	5	3.77	7.00	3.50	4.80	1.40	11.0	17.4	4.55	1.51	1.90	0.973	3.05	0.450	2.88
	4	3.06	7.00	3.50	3.89	1.36	8.97	14.2	3.73	1.52	1.91	0.979	2.46	0.240	3.57
45x45	5	3.06	7.00	3.50	3.90	1.25	7.14	11.4	2.94	1.35	1.71	0.870	2.20	0.304	2.84
40x40	5	2.97	6.00	3.00	3.79	1.16	5.43	8.60	2.26	1.20	1.51	0.773	1.91	0.352	2.26
	4	2.42	6.00	3.00	3.08	1.12	4.47	7.09	1.86	1.21	1.52	0.777	1.55	0.188	2.83
35x35	4	2.09	5.00	2.50	2.67	1.00	2.95	4.68	1.23	1.05	1.32	0.678	1.18	0.158	2.50
30x30	4	1.78	5.00	2.50	2.27	0.878	1.80	2.85	0.754	0.892	1.12	0.577	0.850	0.137	2.07
	3	1.36	5.00	2.50	1.74	0.835	1.40	2.22	0.585	0.899	1.13	0.581	0.649	0.0613	2.75
25x25	4	1.45	3.50	1.75	1.85	0.762	1.02	1.61	0.430	0.741	0.931	0.482	0.586	0.1070	1.75
	3	1.12	3.50	1.75	1.42	0.723	0.803	1.27	0.334	0.751	0.945	0.484	0.452	0.0472	2.38
20x20	3	0.882	3.50	1.75	1.12	0.598	0.392	0.618	0.165	0.590	0.742	0.383	0.279	0.0382	1.81

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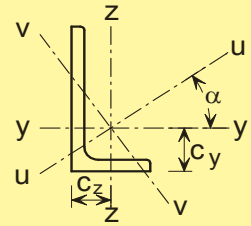
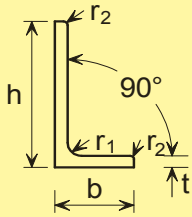
+ These sections are in addition to the range of BS EN 10056-1 sections.

c is the distance from the back of the leg to the centre of gravity.

FOR EXPLANATION OF TABLES SEE NOTES 2 AND 3

## UNEQUAL ANGLES

### Advance® UKA - Unequal Angles



Dimensions and properties

Section Designation		Mass per Metre	Radius		Dimension		Second Moment of Area				Radius of Gyration			
Size	Thickness		Root	Toe			Axis y-y	Axis z-z	Axis u-u	Axis v-v	Axis y-y	Axis z-z	Axis u-u	Axis v-v
h x b mm	t mm	kg/m	r <sub>1</sub> mm	r <sub>2</sub> mm	c <sub>y</sub> cm	c <sub>z</sub> cm	cm <sup>4</sup>	cm <sup>4</sup>	cm <sup>4</sup>	cm <sup>4</sup>	cm	cm	cm	cm
200x150	18 +	47.1	15.0	7.50	6.33	3.85	2380	1150	2920	623	6.29	4.37	6.97	3.22
	15	39.6	15.0	7.50	6.21	3.73	2020	979	2480	526	6.33	4.40	7.00	3.23
	12	32.0	15.0	7.50	6.08	3.61	1650	803	2030	430	6.36	4.44	7.04	3.25
200x100	15	33.8	15.0	7.50	7.16	2.22	1760	299	1860	193	6.40	2.64	6.59	2.12
	12	27.3	15.0	7.50	7.03	2.10	1440	247	1530	159	6.43	2.67	6.63	2.14
	10	23.0	15.0	7.50	6.93	2.01	1220	210	1290	135	6.46	2.68	6.65	2.15
150x90	15	26.6	12.0	6.00	5.21	2.23	761	205	841	126	4.74	2.46	4.98	1.93
	12	21.6	12.0	6.00	5.08	2.12	627	171	694	104	4.77	2.49	5.02	1.94
	10	18.2	12.0	6.00	5.00	2.04	533	146	591	88.3	4.80	2.51	5.05	1.95
150x75	15	24.8	12.0	6.00	5.52	1.81	713	119	753	78.6	4.75	1.94	4.88	1.58
	12	20.2	12.0	6.00	5.40	1.69	588	99.6	623	64.7	4.78	1.97	4.92	1.59
	10	17.0	12.0	6.00	5.31	1.61	501	85.6	531	55.1	4.81	1.99	4.95	1.60
125x75	12	17.8	11.0	5.50	4.31	1.84	354	95.5	391	58.5	3.95	2.05	4.15	1.61
	10	15.0	11.0	5.50	4.23	1.76	302	82.1	334	49.9	3.97	2.07	4.18	1.61
	8	12.2	11.0	5.50	4.14	1.68	247	67.6	274	40.9	4.00	2.09	4.21	1.63
100x75	12	15.4	10.0	5.00	3.27	2.03	189	90.2	230	49.5	3.10	2.14	3.42	1.59
	10	13.0	10.0	5.00	3.19	1.95	162	77.6	197	42.2	3.12	2.16	3.45	1.59
	8	10.6	10.0	5.00	3.10	1.87	133	64.1	162	34.6	3.14	2.18	3.47	1.60
100x65	10 +	12.3	10.0	5.00	3.36	1.63	154	51.0	175	30.1	3.14	1.81	3.35	1.39
	8 +	9.94	10.0	5.00	3.27	1.55	127	42.2	144	24.8	3.16	1.83	3.37	1.40
	7 +	8.77	10.0	5.00	3.23	1.51	113	37.6	128	22.0	3.17	1.83	3.39	1.40
100x50	8	8.97	8.00	4.00	3.60	1.13	116	19.7	123	12.8	3.19	1.31	3.28	1.06
	6	6.84	8.00	4.00	3.51	1.05	89.9	15.4	95.4	9.92	3.21	1.33	3.31	1.07
80x60	7	7.36	8.00	4.00	2.51	1.52	59.0	28.4	72.0	15.4	2.51	1.74	2.77	1.28
80x40	8	7.07	7.00	3.50	2.94	0.963	57.6	9.61	60.9	6.34	2.53	1.03	2.60	0.838
	6	5.41	7.00	3.50	2.85	0.884	44.9	7.59	47.6	4.93	2.55	1.05	2.63	0.845
75x50	8	7.39	7.00	3.50	2.52	1.29	52.0	18.4	59.6	10.8	2.35	1.40	2.52	1.07
	6	5.65	7.00	3.50	2.44	1.21	40.5	14.4	46.6	8.36	2.37	1.42	2.55	1.08
70x50	6	5.41	7.00	3.50	2.23	1.25	33.4	14.2	39.7	7.92	2.20	1.43	2.40	1.07
65x50	5	4.35	6.00	3.00	1.99	1.25	23.2	11.9	28.8	6.32	2.05	1.47	2.28	1.07
60x40	6	4.46	6.00	3.00	2.00	1.01	20.1	7.12	23.1	4.16	1.88	1.12	2.02	0.855
	5	3.76	6.00	3.00	1.96	0.972	17.2	6.11	19.7	3.54	1.89	1.13	2.03	0.860
60x30	5	3.36	5.00	2.50	2.17	0.684	15.6	2.63	16.5	1.71	1.91	0.784	1.97	0.633
50x30	5	2.96	5.00	2.50	1.73	0.741	9.36	2.51	10.3	1.54	1.57	0.816	1.65	0.639
45x30	4	2.25	4.50	2.25	1.48	0.740	5.78	2.05	6.65	1.18	1.42	0.850	1.52	0.640
40x25	4	1.93	4.00	2.00	1.36	0.623	3.89	1.16	4.35	0.700	1.26	0.687	1.33	0.534
40x20	4	1.77	4.00	2.00	1.47	0.480	3.59	0.600	3.80	0.393	1.26	0.514	1.30	0.417
30x20	4	1.46	4.00	2.00	1.03	0.541	1.59	0.553	1.81	0.330	0.925	0.546	0.988	0.421
	3	1.12	4.00	2.00	0.990	0.502	1.25	0.437	1.43	0.256	0.935	0.553	1.00	0.424

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+ These sections are in addition to the range of BS EN 10056-1 sections.

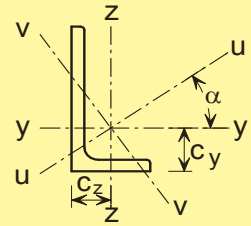
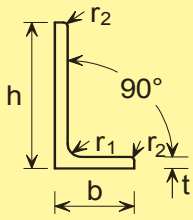
c<sub>y</sub> is the distance from the back of the short leg to the centre of gravity.

c<sub>z</sub> is the distance from the back of the long leg to the centre of gravity.

FOR EXPLANATION OF TABLES SEE NOTES 2 AND 3

## UNEQUAL ANGLES

### Advance® UKA - Unequal Angles



Dimensions and properties (continued)

Section Designation		Elastic Modulus		Angle Axis y-y to Axis u-u Tan $\alpha$	Torsional Constant $I_T$ cm <sup>4</sup>	Equivalent Slenderness Coefficient		Mono-symmetry Index $\psi_a$	Area of Section cm <sup>2</sup>
Size h x b mm	Thickness t mm	Axis y-y cm <sup>3</sup>	Axis z-z cm <sup>3</sup>			Min $\phi_a$	Max $\phi_a$		
200x150	18 +	174	103	0.549	67.9	2.93	3.72	4.60	60.0
	15	147	86.9	0.551	39.9	3.53	4.50	5.55	50.5
	12	119	70.5	0.552	20.9	4.43	5.70	6.97	40.8
200x100	15	137	38.5	0.260	34.3	3.54	5.17	9.19	43.0
	12	111	31.3	0.262	18.0	4.42	6.57	11.5	34.8
	10	93.2	26.3	0.263	10.66	5.26	7.92	13.9	29.2
150x90	15	77.7	30.4	0.354	26.8	2.58	3.59	5.96	33.9
	12	63.3	24.8	0.358	14.1	3.24	4.58	7.50	27.5
	10	53.3	21.0	0.360	8.30	3.89	5.56	9.03	23.2
150x75	15	75.2	21.0	0.253	25.1	2.62	3.74	6.84	31.7
	12	61.3	17.1	0.258	13.2	3.30	4.79	8.60	25.7
	10	51.6	14.5	0.261	7.80	3.95	5.83	10.4	21.7
125x75	12	43.2	16.9	0.354	11.6	2.66	3.73	6.23	22.7
	10	36.5	14.3	0.357	6.87	3.21	4.55	7.50	19.1
	8	29.6	11.6	0.360	3.62	4.00	5.75	9.43	15.5
100x75	12	28.0	16.5	0.540	10.05	2.10	2.64	3.46	19.7
	10	23.8	14.0	0.544	5.95	2.54	3.22	4.17	16.6
	8	19.3	11.4	0.547	3.13	3.18	4.08	5.24	13.5
100x65	10 +	23.2	10.5	0.410	5.61	2.52	3.43	5.45	15.6
	8 +	18.9	8.54	0.413	2.96	3.14	4.35	6.86	12.7
	7 +	16.6	7.53	0.415	2.02	3.58	5.00	7.85	11.2
100x50	8	18.2	5.08	0.258	2.61	3.30	4.80	8.61	11.4
	6	13.8	3.89	0.262	1.14	4.38	6.52	11.6	8.71
80x60	7	10.7	6.34	0.546	1.66	2.92	3.72	4.78	9.38
80x40	8	11.4	3.16	0.253	2.05	2.61	3.73	6.85	9.01
	6	8.73	2.44	0.258	0.899	3.48	5.12	9.22	6.89
75x50	8	10.4	4.95	0.430	2.14	2.36	3.18	4.92	9.41
	6	8.01	3.81	0.435	0.935	3.18	4.34	6.60	7.19
70x50	6	7.01	3.78	0.500	0.899	2.96	3.89	5.44	6.89
65x50	5	5.14	3.19	0.577	0.498	3.38	4.26	5.08	5.54
60x40	6	5.03	2.38	0.431	0.735	2.51	3.39	5.26	5.68
	5	4.25	2.02	0.434	0.435	3.02	4.11	6.34	4.79
60x30	5	4.07	1.14	0.257	0.382	3.15	4.56	8.26	4.28
50x30	5	2.86	1.11	0.352	0.340	2.51	3.52	5.99	3.78
45x30	4	1.91	0.910	0.436	0.166	2.85	3.87	5.92	2.87
40x25	4	1.47	0.619	0.380	0.142	2.51	3.48	5.75	2.46
40x20	4	1.42	0.393	0.252	0.131	2.57	3.68	6.86	2.26
30x20	4	0.807	0.379	0.421	0.1096	1.79	2.39	3.95	1.86
	3	0.621	0.292	0.427	0.0486	2.40	3.28	5.31	1.43

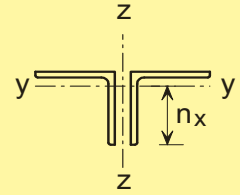
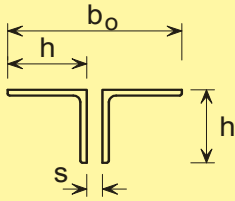
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+ These sections are in addition to the range of BS EN 10056-1 sections.

FOR EXPLANATION OF TABLES SEE NOTES 2 AND 3

## EQUAL ANGLES BACK TO BACK

### Advance® UKA - Equal Angles BACK TO BACK



#### Dimensions and properties

Composed of Two Angles		Total Mass per Metre kg/m	Distance n <sub>y</sub> cm	Total Area cm <sup>2</sup>	Properties about Axis y-y			Radius of Gyration i <sub>z</sub> about Axis z-z (cm)				
h x h mm	t mm				I <sub>y</sub> cm <sup>4</sup>	i <sub>y</sub> cm	W <sub>el,y</sub> cm <sup>3</sup>	Space between angles, s, (mm)				
								0	8	10	12	15
200x200	24	142	14.2	181	6660	6.06	470	8.42	8.70	8.77	8.84	8.95
	20	120	14.3	153	5700	6.11	398	8.34	8.62	8.69	8.76	8.87
	18	109	14.4	138	5200	6.13	362	8.31	8.58	8.65	8.72	8.83
	16	97.0	14.5	124	4680	6.16	324	8.27	8.54	8.61	8.68	8.79
150x150	18 +	80.2	10.6	102	2120	4.55	200	6.32	6.60	6.67	6.75	6.86
	15	67.6	10.8	86.0	1800	4.57	167	6.24	6.52	6.59	6.66	6.77
	12	54.6	10.9	69.6	1470	4.60	135	6.18	6.45	6.52	6.59	6.70
	10	46.0	11.0	58.6	1250	4.62	114	6.13	6.40	6.47	6.54	6.64
120x120	15 +	53.2	8.48	68.0	896	3.63	106	5.06	5.34	5.42	5.49	5.60
	12	43.2	8.60	55.0	736	3.65	85.4	4.99	5.27	5.35	5.42	5.53
	10	36.4	8.69	46.4	626	3.67	72.0	4.94	5.22	5.29	5.36	5.47
	8 +	29.4	8.76	37.6	518	3.71	59.0	4.93	5.20	5.27	5.34	5.45
100x100	15 +	43.8	6.98	56.0	500	2.99	71.6	4.25	4.54	4.62	4.69	4.81
	12	35.6	7.10	45.4	414	3.02	58.2	4.19	4.47	4.55	4.62	4.74
	10	30.0	7.18	38.4	354	3.04	49.2	4.14	4.43	4.50	4.57	4.69
	8	24.4	7.26	31.0	290	3.06	39.8	4.11	4.38	4.46	4.53	4.64
90x90	12 +	31.8	6.34	40.6	298	2.71	47.0	3.80	4.09	4.16	4.24	4.36
	10	26.8	6.42	34.2	254	2.72	39.6	3.75	4.04	4.11	4.19	4.30
	8	21.8	6.50	27.8	208	2.74	32.2	3.71	3.99	4.06	4.13	4.25
	7	19.2	6.55	24.4	185	2.75	28.2	3.69	3.96	4.04	4.11	4.22
80x80	10	23.8	5.66	30.2	175	2.41	30.8	3.36	3.65	3.72	3.80	3.92
	8	19.3	5.74	24.6	144	2.43	25.2	3.31	3.60	3.67	3.75	3.86
75x75	8	18.0	5.36	22.8	118	2.27	22.0	3.12	3.41	3.49	3.56	3.68
	6	13.7	5.45	17.5	91.6	2.29	16.8	3.07	3.35	3.43	3.50	3.62
70x70	7	14.8	5.03	18.8	84.6	2.12	16.8	2.89	3.18	3.26	3.33	3.45
	6	12.8	5.07	16.3	73.8	2.13	14.5	2.87	3.16	3.23	3.31	3.42
65x65	7	13.7	4.45	17.5	66.8	1.96	14.4	2.83	3.14	3.21	3.29	3.42
60x60	8	14.2	4.23	18.1	58.4	1.80	13.8	2.52	2.82	2.90	2.97	3.10
	6	10.8	4.31	13.8	45.6	1.82	10.6	2.48	2.77	2.85	2.92	3.04
	5	9.14	4.36	11.6	38.8	1.82	8.90	2.45	2.74	2.81	2.89	3.01
50x50	6	8.94	3.55	11.4	25.6	1.50	7.22	2.09	2.38	2.46	2.54	2.66
	5	7.54	3.60	9.60	22.0	1.51	6.10	2.06	2.35	2.43	2.51	2.63
	4	6.12	3.64	7.78	17.9	1.52	4.92	2.04	2.32	2.40	2.48	2.60

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+ These sections are in addition to the range of BS EN 10056-1 sections.

Properties about z-z axis:

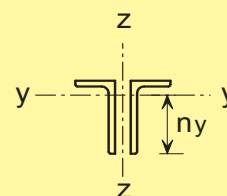
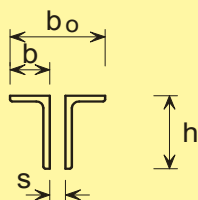
$$I_z = (\text{Total Area}) \cdot (i_z)^2$$

$$W_{el,z} = I_z / (0.5b_o)$$

FOR EXPLANATION OF TABLES SEE NOTES 2 AND 3

## UNEQUAL ANGLES BACK TO BACK

### Advance® UKA - Unequal Angles BACK TO BACK



Dimensions and properties

Composed of Two Angles		Total Mass per Metre kg/m	Distance ny cm	Total Area cm <sup>2</sup>	Properties about Axis y-y			Radius of Gyration iz about Axis z-z (cm)				
h x b mm	t mm				Iy cm <sup>4</sup>	iy cm	Wel,y cm <sup>3</sup>	Space between angles, s, (mm)				
								0	8	10	12	15
200x150	18 +	94.2	13.7	120	4750	6.29	348	5.84	6.11	6.18	6.25	6.36
	15	79.2	13.8	101	4040	6.33	294	5.77	6.04	6.11	6.18	6.28
	12	64.0	13.9	81.6	3300	6.36	238	5.72	5.98	6.05	6.12	6.22
200x100	15	67.5	12.8	86.0	3520	6.40	274	3.45	3.72	3.79	3.86	3.97
	12	54.6	13.0	69.6	2880	6.43	222	3.39	3.65	3.72	3.79	3.90
	10	46.0	13.1	58.4	2440	6.46	186	3.35	3.61	3.67	3.74	3.85
150x90	15	53.2	9.79	67.8	1522	4.74	155	3.32	3.60	3.67	3.75	3.86
	12	43.2	9.92	55.0	1250	4.77	127	3.27	3.55	3.62	3.69	3.80
	10	36.4	10.0	46.4	1070	4.80	107	3.23	3.50	3.57	3.64	3.75
150x75	15	49.6	9.48	63.4	1430	4.75	150	2.65	2.94	3.01	3.09	3.21
	12	40.4	9.60	51.4	1180	4.78	123	2.59	2.87	2.94	3.02	3.14
	10	34.0	9.69	43.4	1000	4.81	103	2.56	2.83	2.90	2.97	3.08
125x75	12	35.6	8.19	45.4	708	3.95	86.4	2.76	3.04	3.11	3.19	3.30
	10	30.0	8.27	38.2	604	3.97	73.0	2.72	2.99	3.07	3.14	3.26
	8	24.4	8.36	31.0	494	4.00	59.2	2.68	2.95	3.02	3.09	3.20
100x75	12	30.8	6.73	39.4	378	3.10	56.0	2.95	3.24	3.31	3.39	3.51
	10	26.0	6.81	33.2	324	3.12	47.6	2.91	3.19	3.27	3.34	3.46
	8	21.2	6.90	27.0	266	3.14	38.6	2.87	3.15	3.22	3.29	3.41
100x65	10 +	24.6	6.64	31.2	308	3.14	46.4	2.43	2.72	2.79	2.87	2.99
	8 +	19.9	6.73	25.4	254	3.16	37.8	2.39	2.67	2.74	2.82	2.93
	7 +	17.5	6.77	22.4	226	3.17	33.2	2.37	2.65	2.72	2.79	2.91
100x50	8	17.9	6.40	22.8	232	3.19	36.4	1.73	2.02	2.09	2.17	2.29
	6	13.7	6.49	17.4	180	3.21	27.6	1.69	1.97	2.04	2.12	2.24
80x60	7	14.7	5.49	18.8	118	2.51	21.4	2.31	2.59	2.67	2.74	2.86
80x40	8	14.1	5.06	18.0	115	2.53	22.8	1.41	1.71	1.79	1.87	2.00
	6	10.8	5.15	13.8	89.8	2.55	17.5	1.37	1.66	1.74	1.82	1.94
75x50	8	14.8	4.98	18.8	104	2.35	20.8	1.90	2.19	2.27	2.35	2.47
	6	11.3	5.06	14.4	81.0	2.37	16.0	1.86	2.14	2.22	2.30	2.42
70x50	6	10.8	4.77	13.8	66.8	2.20	14.0	1.90	2.19	2.26	2.34	2.46
65x50	5	8.70	4.51	11.1	46.4	2.05	10.3	1.93	2.21	2.28	2.36	2.48
60x40	6	8.92	4.00	11.4	40.2	1.88	10.1	1.51	1.80	1.88	1.96	2.09
	5	7.52	4.04	9.58	34.4	1.89	8.50	1.49	1.78	1.86	1.94	2.06

Advance® and UKA are trademarks of Tata Steel. A fuller description of the relationship between Angles and the Advance® range of sections manufactured by Tata Steel is given in note 12.

+ These sections are in addition to the range of BS EN 10056-1 sections.

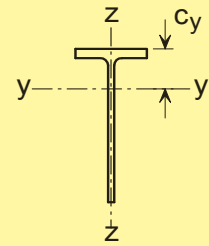
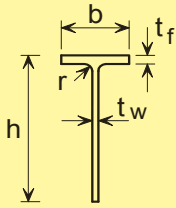
Properties about z-z axis:

$$I_z = (\text{Total Area}) \cdot (i_z)^2$$

$$W_{el,z} = I_z / (0.5b_0)$$

FOR EXPLANATION OF TABLES SEE NOTES 2 AND 3

Advance® UKT split from Advance® UKB



Dimensions and properties

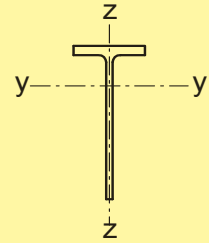
Section Designation	Cut from Universal Beam Section Designation	Mass per Metre kg/m	Width of Section b mm	Depth of Section h mm	Thickness		Root Radius r mm	Ratios for Local Buckling		Dimension c <sub>y</sub> cm	Second Moment of Area	
					Web t <sub>w</sub> mm	Flange t <sub>f</sub> mm		Flange c <sub>f</sub> /t <sub>f</sub>	Web c <sub>w</sub> /t <sub>w</sub>		Axis y-y cm <sup>4</sup>	Axis z-z cm <sup>4</sup>
254x343x63	686x254x125	62.6	253.0	338.9	11.7	16.2	15.2	6.51	29.0	8.85	8980	2190
305x305x119	610x305x238	119.0	311.4	317.9	18.4	31.4	16.5	4.14	17.3	7.11	12400	7920
305x305x90	610x305x179	89.5	307.1	310.0	14.1	23.6	16.5	5.51	22.0	6.69	9040	5700
305x305x75	610x305x149	74.6	304.8	306.1	11.8	19.7	16.5	6.60	25.9	6.45	7410	4650
229x305x70	610x229x140	69.9	230.2	308.5	13.1	22.1	12.7	4.34	23.5	7.61	7740	2250
229x305x63	610x229x125	62.5	229.0	306.0	11.9	19.6	12.7	4.89	25.7	7.54	6900	1970
229x305x57	610x229x113	56.5	228.2	303.7	11.1	17.3	12.7	5.54	27.4	7.58	6270	1720
229x305x51	610x229x101	50.6	227.6	301.2	10.5	14.8	12.7	6.48	28.7	7.78	5690	1460
178x305x50 +	610x178x100	50.1	179.2	303.7	11.3	17.2	12.7	4.14	26.9	8.57	5890	829
178x305x46 +	610x178x92	46.1	178.8	301.5	10.9	15.0	12.7	4.75	27.7	8.78	5450	718
178x305x41 +	610x178x82	40.9	177.9	299.3	10.0	12.8	12.7	5.57	29.9	8.88	4840	603
312x267x136 +	533x312x272	136.6	320.2	288.8	21.1	37.6	12.7	3.64	13.7	6.28	10600	10300
312x267x110 +	533x312x219	109.4	317.4	280.4	18.3	29.2	12.7	4.69	15.3	6.09	8530	7790
312x267x91 +	533x312x182	90.7	314.5	275.6	15.2	24.4	12.7	5.61	18.1	5.78	6890	6330
312x267x75 +	533x312x151	75.3	312.0	271.5	12.7	20.3	12.7	6.75	21.4	5.54	5620	5140
210x267x69 +	533x210x138	69.1	213.9	274.5	14.7	23.6	12.7	3.68	18.7	6.94	5990	1930
210x267x61	533x210x122	61.0	211.9	272.2	12.7	21.3	12.7	4.08	21.4	6.66	5160	1690
210x267x55	533x210x109	54.5	210.8	269.7	11.6	18.8	12.7	4.62	23.3	6.61	4600	1470
210x267x51	533x210x101	50.5	210.0	268.3	10.8	17.4	12.7	4.99	24.8	6.53	4250	1350
210x267x46	533x210x92	46.0	209.3	266.5	10.1	15.6	12.7	5.57	26.4	6.55	3880	1190
210x267x41	533x210x82	41.1	208.8	264.1	9.6	13.2	12.7	6.58	27.5	6.75	3530	1000
165x267x43 +	533x165x85	42.3	166.5	267.1	10.3	16.5	12.7	3.96	25.9	7.23	3750	637
165x267x37 +	533x165x75	37.3	165.9	264.5	9.7	13.6	12.7	4.81	27.3	7.46	3350	520
165x267x33 +	533x165x66	32.8	165.1	262.4	8.9	11.4	12.7	5.74	29.5	7.59	2960	429
191x229x81 +	457x191x161	80.7	199.4	246.0	18.0	32.0	10.2	2.52	13.7	6.22	5160	2130
191x229x67 +	457x191x133	66.6	196.7	240.3	15.3	26.3	10.2	3.06	15.7	5.96	4180	1670
191x229x53 +	457x191x106	52.9	194.0	234.6	12.6	20.6	10.2	3.91	18.6	5.73	3260	1260
191x229x49	457x191x98	49.1	192.8	233.5	11.4	19.6	10.2	4.11	20.5	5.53	2970	1170
191x229x45	457x191x89	44.6	191.9	231.6	10.5	17.7	10.2	4.55	22.1	5.47	2680	1040
191x229x41	457x191x82	41.0	191.3	229.9	9.9	16.0	10.2	5.03	23.2	5.47	2470	935
191x229x37	457x191x74	37.1	190.4	228.4	9.0	14.5	10.2	5.55	25.4	5.38	2220	836
191x229x34	457x191x67	33.5	189.9	226.6	8.5	12.7	10.2	6.34	26.7	5.46	2030	726
152x229x41	457x152x82	41.0	155.3	232.8	10.5	18.9	10.2	3.29	22.2	5.96	2600	592
152x229x37	457x152x74	37.1	154.4	230.9	9.6	17.0	10.2	3.66	24.1	5.88	2330	523
152x229x34	457x152x67	33.6	153.8	228.9	9.0	15.0	10.2	4.15	25.4	5.91	2120	456
152x229x30	457x152x60	29.9	152.9	227.2	8.1	13.3	10.2	4.68	28.0	5.84	1880	397
152x229x26	457x152x52	26.1	152.4	224.8	7.6	10.9	10.2	5.71	29.6	6.04	1670	322

Advance®, UKT and UKB are trademarks of Tata Steel. A fuller description of the relationship between Structural Tees and the Advance® range of sections manufactured by Tata Steel is given in note 12.

+ These sections are in addition to the range of BS 4 sections

FOR EXPLANATION OF TABLES SEE NOTES 2 AND 3

Advance® UKT split from Advance® UKB



Properties (continued)

Section Designation	Radius of Gyration		Elastic Modulus			Plastic Modulus		Buckling Parameter U	Torsional Index X	Mono-symmetry Index $\psi$	Warping Constant (*) $I_w$ cm <sup>6</sup>	Torsional Constant $I_t$ cm <sup>4</sup>	Area of Section A cm <sup>2</sup>
	Axis y-y	Axis z-z	Axis		Axis z-z	Axis y-y	Axis z-z						
	cm	cm	y-y Flange cm <sup>3</sup>	y-y Toe cm <sup>3</sup>	cm <sup>3</sup>	cm <sup>3</sup>	cm <sup>3</sup>						
254x343x63	10.6	5.24	1010	358	173	643	271	0.651	21.9	0.740	2090	57.9	79.7
305x305x119	9.03	7.23	1740	501	509	894	787	0.483	10.6	0.662	11300	391	152
305x305x90	8.91	7.07	1350	372	371	656	572	0.484	13.8	0.664	4710	170	114
305x305x75	8.83	7.00	1150	307	305	538	469	0.483	16.4	0.666	2690	99.8	95.0
229x305x70	9.32	5.03	1020	333	196	592	306	0.613	15.3	0.727	2560	108	89.1
229x305x63	9.31	4.97	915	299	172	531	268	0.617	17.1	0.728	1840	76.9	79.7
229x305x57	9.33	4.88	826	275	150	489	235	0.626	19.0	0.731	1400	55.5	72.0
229x305x51	9.40	4.76	732	255	128	456	200	0.644	21.6	0.736	1080	38.3	64.4
178x305x50 +	9.60	3.60	688	270	92.5	490	148	0.694	19.4	0.768	1230	47.3	63.9
178x305x46 +	9.64	3.50	621	255	80.3	468	129	0.710	21.5	0.774	1050	35.3	58.7
178x305x41 +	9.64	3.40	545	230	67.8	425	109	0.722	24.3	0.778	780	24.3	52.1
312x267x136 +	7.81	7.69	1690	469	644	857	993	0.247	7.96	0.613	17300	642	174
312x267x110 +	7.82	7.48	1400	389	491	696	757	0.332	9.93	0.617	8730	320	139
312x267x91 +	7.72	7.40	1190	317	403	562	619	0.324	11.7	0.618	4920	186	116
312x267x75 +	7.65	7.32	1010	260	330	458	505	0.326	14.0	0.619	2780	108	95.9
210x267x69 +	8.24	4.68	862	292	181	520	284	0.609	12.5	0.719	2490	125	88.1
210x267x61	8.15	4.67	775	251	160	446	250	0.600	13.8	0.719	1660	88.9	77.7
210x267x55	8.14	4.60	697	226	140	401	218	0.605	15.5	0.721	1200	63.0	69.4
210x267x51	8.12	4.57	650	209	128	371	200	0.606	16.6	0.722	951	50.3	64.3
210x267x46	8.14	4.51	593	193	114	343	178	0.613	18.3	0.724	737	37.7	58.7
210x267x41	8.21	4.38	523	179	96.1	320	150	0.634	20.8	0.730	565	25.7	52.3
165x267x43 +	8.34	3.44	519	192	76.6	346	122	0.672	17.7	0.758	670	36.8	54.0
165x267x37 +	8.39	3.30	449	176	62.7	321	100	0.693	20.6	0.765	514	23.9	47.6
165x267x33 +	8.41	3.20	390	159	52.0	291	83.1	0.708	23.6	0.771	378	15.9	41.9
191x229x81 +	7.09	4.55	830	281	213	507	336	0.573	8.24	0.699	3780	256	103
191x229x67 +	7.01	4.44	702	231	170	414	267	0.576	9.82	0.702	2130	146	84.9
191x229x53 +	6.96	4.32	569	184	130	328	203	0.583	12.2	0.706	1070	72.6	67.4
191x229x49	6.88	4.33	536	167	122	296	189	0.573	12.9	0.705	835	60.5	62.6
191x229x45	6.87	4.29	491	152	109	269	169	0.576	14.1	0.706	628	45.2	56.9
191x229x41	6.88	4.23	452	141	97.8	250	152	0.583	15.5	0.709	494	34.5	52.2
191x229x37	6.86	4.20	413	127	87.8	225	136	0.583	16.9	0.709	365	25.8	47.3
191x229x34	6.90	4.12	372	118	76.5	209	119	0.597	18.9	0.713	280	18.5	42.7
152x229x41	7.05	3.37	436	150	76.3	267	120	0.634	13.7	0.740	534	44.5	52.3
152x229x37	7.03	3.33	397	135	67.8	242	107	0.636	15.1	0.742	396	32.9	47.2
152x229x34	7.04	3.27	359	125	59.3	223	93.3	0.646	16.8	0.745	305	23.8	42.8
152x229x30	7.02	3.23	322	111	52.0	199	81.5	0.648	18.8	0.746	217	16.9	38.1
152x229x26	7.08	3.11	276	102	42.3	183	66.6	0.671	22.0	0.753	161	10.7	33.3

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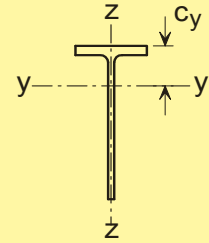
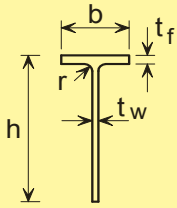
+ These sections are in addition to the range of BS 4 sections

(\*) Note units are cm<sup>6</sup> and not dm<sup>6</sup>.

FOR EXPLANATION OF TABLES SEE NOTES 2 AND 3



Advance® UKT split from Advance® UKB



Dimensions and properties

Section Designation	Cut from Universal Beam Section Designation	Mass per Metre kg/m	Width of Section b mm	Depth of Section h mm	Thickness		Root Radius r mm	Ratios for Local Buckling		Dimension c <sub>y</sub> cm	Second Moment of Area	
					Web t <sub>w</sub> mm	Flange t <sub>f</sub> mm		Flange c <sub>f</sub> /t <sub>f</sub>	Web c <sub>w</sub> /t <sub>w</sub>		Axis y-y cm <sup>4</sup>	Axis z-z cm <sup>4</sup>
178x203x43 +	406x178x85	42.6	181.9	208.6	10.9	18.2	10.2	4.14	19.1	4.91	2030	915
178x203x37	406x178x74	37.1	179.5	206.3	9.5	16.0	10.2	4.68	21.7	4.76	1740	773
178x203x34	406x178x67	33.5	178.8	204.6	8.8	14.3	10.2	5.23	23.3	4.73	1570	682
178x203x30	406x178x60	30.0	177.9	203.1	7.9	12.8	10.2	5.84	25.7	4.64	1400	602
178x203x27	406x178x54	27.0	177.7	201.2	7.7	10.9	10.2	6.86	26.1	4.83	1290	511
140x203x27 +	406x140x53	26.6	143.3	203.3	7.9	12.9	10.2	4.46	25.7	5.16	1320	317
140x203x23	406x140x46	23.0	142.2	201.5	6.8	11.2	10.2	5.13	29.6	5.02	1120	269
140x203x20	406x140x39	19.5	141.8	198.9	6.4	8.6	10.2	6.69	31.1	5.32	979	205
171x178x34	356x171x67	33.5	173.2	181.6	9.1	15.7	10.2	4.58	20.0	4.00	1150	681
171x178x29	356x171x57	28.5	172.2	178.9	8.1	13.0	10.2	5.53	22.1	3.97	986	554
171x178x26	356x171x51	25.5	171.5	177.4	7.4	11.5	10.2	6.25	24.0	3.94	882	484
171x178x23	356x171x45	22.5	171.1	175.6	7.0	9.7	10.2	7.41	25.1	4.05	798	406
127x178x20	356x127x39	19.5	126.0	176.6	6.6	10.7	10.2	4.63	26.8	4.43	728	179
127x178x17	356x127x33	16.5	125.4	174.4	6.0	8.5	10.2	5.82	29.1	4.56	626	140
165x152x27	305x165x54	27.0	166.9	155.1	7.9	13.7	8.9	5.15	19.6	3.21	642	531
165x152x23	305x165x46	23.0	165.7	153.2	6.7	11.8	8.9	5.98	22.9	3.07	536	448
165x152x20	305x165x40	20.1	165.0	151.6	6.0	10.2	8.9	6.92	25.3	3.03	468	382
127x152x24	305x127x48	24.0	125.3	155.4	9.0	14.0	8.9	3.52	17.3	3.94	662	231
127x152x21	305x127x42	20.9	124.3	153.5	8.0	12.1	8.9	4.07	19.2	3.87	573	194
127x152x19	305x127x37	18.5	123.4	152.1	7.1	10.7	8.9	4.60	21.4	3.78	501	168
102x152x17	305x102x33	16.4	102.4	156.3	6.6	10.8	7.6	3.73	23.7	4.14	487	97.1
102x152x14	305x102x28	14.1	101.8	154.3	6.0	8.8	7.6	4.58	25.7	4.20	420	77.7
102x152x13	305x102x25	12.4	101.6	152.5	5.8	7.0	7.6	5.76	26.3	4.43	377	61.5
146x127x22	254x146x43	21.5	147.3	129.7	7.2	12.7	7.6	4.92	18.0	2.64	343	339
146x127x19	254x146x37	18.5	146.4	127.9	6.3	10.9	7.6	5.73	20.3	2.55	292	285
146x127x16	254x146x31	15.5	146.1	125.6	6.0	8.6	7.6	7.26	20.9	2.66	259	224
102x127x14	254x102x28	14.1	102.2	130.1	6.3	10.0	7.6	4.04	20.7	3.24	277	89.3
102x127x13	254x102x25	12.6	101.9	128.5	6.0	8.4	7.6	4.80	21.4	3.32	250	74.3
102x127x11	254x102x22	11.0	101.6	126.9	5.7	6.8	7.6	5.93	22.3	3.45	223	59.7
133x102x15	203x133x30	15.0	133.9	103.3	6.4	9.6	7.6	5.85	16.1	2.11	154	192
133x102x13	203x133x25	12.5	133.2	101.5	5.7	7.8	7.6	7.20	17.8	2.10	131	154

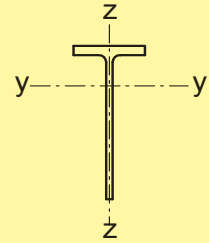
Advance®, UKT and UKB are trademarks of Tata Steel. A fuller description of the relationship between Structural Tees and the Advance® range of sections manufactured by Tata Steel is given in note 12.

+ These sections are in addition to the range of BS 4 sections

FOR EXPLANATION OF TABLES SEE NOTES 2 AND 3



Advance® UKT split from Advance® UKB



Properties (continued)

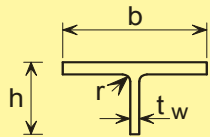
Section Designation	Radius of Gyration		Elastic Modulus			Plastic Modulus		Buckling Parameter U	Torsional Index X	Mono-symmetry Index $\psi$	Warping Constant (*) $I_w$ cm <sup>6</sup>	Torsional Constant $I_t$ cm <sup>4</sup>	Area of Section A cm <sup>2</sup>
	Axis y-y	Axis z-z	Axis		Axis z-z	Axis y-y	Axis z-z						
	cm	cm	y-y Flange cm <sup>3</sup>	y-y Toe cm <sup>3</sup>	cm <sup>3</sup>	cm <sup>3</sup>	cm <sup>3</sup>						
178x203x43 +	6.11	4.11	413	127	101	226	157	0.556	12.2	0.694	538	46.3	54.3
178x203x37	6.06	4.04	365	109	86.1	194	133	0.555	13.8	0.696	350	31.3	47.2
178x203x34	6.07	3.99	332	100	76.3	177	118	0.561	15.2	0.698	262	23.0	42.8
178x203x30	6.04	3.97	301	89.0	67.6	157	104	0.561	16.9	0.699	186	16.6	38.3
178x203x27	6.13	3.85	268	84.6	57.5	150	89.1	0.588	19.2	0.705	146	11.5	34.5
140x203x27 +	6.23	3.06	256	87.0	44.3	155	69.5	0.636	17.1	0.739	148	14.4	34.0
140x203x23	6.19	3.03	224	74.2	37.8	132	59.0	0.633	19.5	0.740	93.7	9.49	29.3
140x203x20	6.28	2.87	184	67.2	28.9	121	45.4	0.668	23.8	0.750	66.3	5.33	24.8
171x178x34	5.20	3.99	288	81.5	78.6	145	121	0.500	12.2	0.672	249	27.8	42.7
171x178x29	5.21	3.91	248	70.9	64.4	125	99.4	0.514	14.4	0.676	154	16.6	36.3
171x178x26	5.21	3.86	224	63.9	56.5	113	87.1	0.521	16.1	0.677	110	11.9	32.4
171x178x23	5.28	3.76	197	59.1	47.4	104	73.3	0.546	18.4	0.683	79.2	7.90	28.7
127x178x20	5.41	2.68	164	55.0	28.4	98.0	44.5	0.632	17.6	0.739	57.1	7.53	24.9
127x178x17	5.45	2.58	137	48.6	22.3	87.2	35.1	0.655	21.1	0.746	38.0	4.38	21.1
165x152x27	4.32	3.93	200	52.2	63.7	92.8	97.8	0.389	11.8	0.636	128	17.3	34.4
165x152x23	4.27	3.91	174	43.7	54.1	77.1	82.8	0.380	13.6	0.636	78.6	11.1	29.4
165x152x20	4.27	3.86	155	38.6	46.3	67.6	70.9	0.393	15.5	0.638	52.0	7.35	25.7
127x152x24	4.65	2.74	168	57.1	36.8	102	58.0	0.602	11.7	0.714	104	15.8	30.6
127x152x21	4.63	2.70	148	49.9	31.3	88.9	49.2	0.606	13.3	0.716	69.2	10.5	26.7
127x152x19	4.61	2.67	132	43.8	27.2	77.9	42.7	0.606	14.9	0.718	47.4	7.36	23.6
102x152x17	4.82	2.15	118	42.3	19.0	75.8	30.0	0.656	15.8	0.749	36.8	6.08	20.9
102x152x14	4.84	2.08	100.0	37.4	15.3	67.5	24.2	0.673	18.7	0.756	25.2	3.69	17.9
102x152x13	4.88	1.97	85.0	34.8	12.1	63.9	19.4	0.705	21.8	0.766	20.4	2.37	15.8
146x127x22	3.54	3.52	130	33.2	46.0	59.5	70.5	0.202	10.6	0.613	64.9	11.9	27.4
146x127x19	3.52	3.48	115	28.5	39.0	50.7	59.7	0.233	12.2	0.616	41.0	7.65	23.6
146x127x16	3.61	3.36	97.4	26.2	30.6	46.0	47.1	0.376	14.8	0.623	24.5	4.26	19.8
102x127x14	3.92	2.22	85.5	28.3	17.5	50.4	27.4	0.607	13.8	0.720	21.0	4.77	18.0
102x127x13	3.95	2.15	75.3	26.2	14.6	46.9	23.0	0.628	15.8	0.727	15.9	3.20	16.0
102x127x11	3.99	2.06	64.5	24.1	11.7	43.5	18.6	0.656	18.2	0.736	12.0	2.06	14.0
133x102x15	2.84	3.17	73.1	18.8	28.7	33.5	44.1	-	-	0.569	21.7	5.13	19.1
133x102x13	2.86	3.10	62.4	16.2	23.1	28.7	35.5	-	-	0.572	12.6	2.97	16.0

Advance®, UKT and UKB are trademarks of Tata Steel. A fuller description of the relationship between Structural Tees and the Advance® range of sections manufactured by Tata Steel is given in note 12.

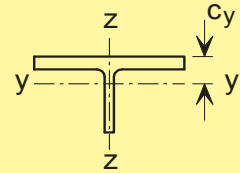
+ These sections are in addition to the range of BS 4 sections

(\*) Note units are cm<sup>6</sup> and not dm<sup>6</sup>.

FOR EXPLANATION OF TABLES SEE NOTES 2 AND 3



Advance® UKT split from Advance® UKC



Dimensions

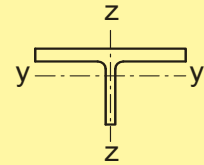
Section Designation	Cut from Universal Beam Section Designation	Mass per Metre kg/m	Width of Section b mm	Depth of Section h mm	Thickness		Root Radius r mm	Ratios for Local Buckling		Dimension C <sub>y</sub> cm
					Web t <sub>w</sub> mm	Flange t <sub>f</sub> mm		Flange C <sub>f</sub> /t <sub>f</sub>	Web C <sub>w</sub> /t <sub>w</sub>	
305x152x79	305x305x158	79.0	311.2	163.5	15.8	25.0	15.2	5.30	10.3	3.04
305x152x69	305x305x137	68.4	309.2	160.2	13.8	21.7	15.2	6.11	11.6	2.86
305x152x59	305x305x118	58.9	307.4	157.2	12.0	18.7	15.2	7.09	13.1	2.69
305x152x49	305x305x97	48.4	305.3	153.9	9.9	15.4	15.2	8.60	15.5	2.50
254x127x84	254x254x167	83.5	265.2	144.5	19.2	31.7	12.7	3.48	7.53	3.07
254x127x66	254x254x132	66.0	261.3	138.1	15.3	25.3	12.7	4.36	9.03	2.70
254x127x54	254x254x107	53.5	258.8	133.3	12.8	20.5	12.7	5.38	10.4	2.45
254x127x45	254x254x89	44.4	256.3	130.1	10.3	17.3	12.7	6.38	12.6	2.21
254x127x37	254x254x73	36.5	254.6	127.0	8.6	14.2	12.7	7.77	14.8	2.05
203x102x64 +	203x203x127	63.7	213.9	120.7	18.1	30.1	10.2	2.91	6.67	2.73
203x102x57 +	203x203x113	56.7	212.1	117.5	16.3	26.9	10.2	3.26	7.21	2.56
203x102x50 +	203x203x100	49.8	210.3	114.3	14.5	23.7	10.2	3.70	7.88	2.38
203x102x43	203x203x86	43.0	209.1	111.0	12.7	20.5	10.2	4.29	8.74	2.20
203x102x36	203x203x71	35.5	206.4	107.8	10.0	17.3	10.2	5.09	10.8	1.95
203x102x30	203x203x60	30.0	205.8	104.7	9.4	14.2	10.2	6.20	11.1	1.89
203x102x26	203x203x52	26.0	204.3	103.0	7.9	12.5	10.2	7.04	13.0	1.75
203x102x23	203x203x46	23.0	203.6	101.5	7.2	11.0	10.2	8.00	14.1	1.69
152x76x26 +	152x152x51	25.6	157.4	85.1	11.0	15.7	7.6	4.18	7.74	1.79
152x76x22 +	152x152x44	22.0	155.9	83.0	9.5	13.6	7.6	4.82	8.74	1.66
152x76x19	152x152x37	18.5	154.4	80.8	8.0	11.5	7.6	5.70	10.1	1.53
152x76x15	152x152x30	15.0	152.9	78.7	6.5	9.4	7.6	6.98	12.1	1.41
152x76x12	152x152x23	11.5	152.2	76.1	5.8	6.8	7.6	9.65	13.1	1.39

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+ These sections are in addition to the range of BS 4 sections

FOR EXPLANATION OF TABLES SEE NOTES 2 AND 3

Advance® UKT split from Advance® UKC



Properties

Section Designation	Second Moment of Area		Radius of Gyration		Elastic Modulus			Plastic Modulus		Mono-symmetry Index $\psi$	Warping Constant (*) $I_w$ cm <sup>6</sup>	Torsional Constant $I_t$ cm <sup>4</sup>	Area of Section A cm <sup>2</sup>
	Axis y-y	Axis z-z	Axis y-y	Axis z-z	Axis		Axis z-z	Axis y-y	Axis z-z				
	cm <sup>4</sup>	cm <sup>4</sup>	cm	cm	Flange y-y cm <sup>3</sup>	Toe y-y cm <sup>3</sup>	cm <sup>3</sup>	cm <sup>3</sup>	cm <sup>3</sup>				
305x152x79	1530	6280	3.90	7.90	503	115	404	225	615	0.268	3650	188	101
305x152x69	1290	5350	3.84	7.83	450	97.7	346	188	526	0.263	2340	124	87.2
305x152x59	1080	4530	3.79	7.77	401	82.8	295	156	448	0.262	1470	80.3	75.1
305x152x49	858	3650	3.73	7.69	343	66.5	239	123	363	0.258	806	45.5	61.7
254x127x84	1200	4930	3.36	6.81	391	105	372	220	569	0.261	4540	312	106
254x127x66	871	3770	3.22	6.69	323	78.3	288	159	439	0.250	2200	159	84.1
254x127x54	676	2960	3.15	6.59	276	62.1	229	122	348	0.245	1150	85.9	68.2
254x127x45	524	2430	3.04	6.55	237	48.5	190	94.0	288	0.242	660	51.1	56.7
254x127x37	417	1950	2.99	6.48	204	39.2	153	74.0	233	0.236	359	28.8	46.5
203x102x64 +	637	2460	2.80	5.50	233	68.2	230	145	352	0.279	2050	212	81.2
203x102x57 +	540	2140	2.73	5.45	211	58.8	202	123	309	0.270	1430	152	72.3
203x102x50 +	453	1840	2.67	5.39	190	50.0	175	103	267	0.266	951	104	63.4
203x102x43	373	1560	2.61	5.34	169	41.9	150	84.6	228	0.257	605	68.1	54.8
203x102x36	280	1270	2.49	5.30	143	31.8	123	63.6	187	0.254	343	40.0	45.2
203x102x30	244	1030	2.53	5.20	129	28.4	100	54.3	153	0.245	195	23.5	38.2
203x102x26	200	889	2.46	5.18	115	23.4	87.0	44.5	132	0.243	128	15.8	33.1
203x102x23	177	774	2.45	5.13	105	20.9	76.0	39.0	115	0.242	87.2	11.0	29.4
152x76x26 +	141	511	2.08	3.96	79.0	21.0	64.9	41.4	99.5	0.281	122	24.3	32.6
152x76x22 +	116	430	2.04	3.92	70.0	17.5	55.2	34.0	84.4	0.281	76.7	15.8	28.0
152x76x19	93.1	353	1.99	3.87	60.7	14.2	45.7	27.1	69.8	0.277	44.9	9.54	23.5
152x76x15	72.2	280	1.94	3.83	51.4	11.2	36.7	20.9	55.8	0.269	23.7	5.24	19.1
152x76x12	58.5	200	2.00	3.70	41.9	9.41	26.3	16.9	40.1	0.278	9.78	2.30	14.6

Advance®, UKT and UKC are trademarks of Tata Steel. A fuller description of the relationship between Structural Tees and the Advance® range of sections manufactured by Tata Steel is given in note 12.

+ These sections are in addition to the range of BS 4 sections

(\*) Note units are cm<sup>6</sup> and not dm<sup>6</sup>.

Values of U and X are not given, as lateral torsional buckling due to bending about the y-y axis is not possible, because the second moment of area about the z-z axis exceeds the second moment of area about the y-y axis.

FOR EXPLANATION OF TABLES SEE NOTES 2 AND 3

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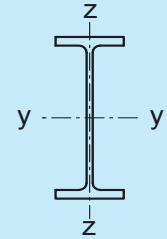
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**B.2. TABLES OF  
EFFECTIVE SECTION PROPERTIES**

# EFFECTIVE SECTION PROPERTIES

## UNIVERSAL BEAMS

Advance® UKB



Classification and effective area for sections subject to axial compression

Section Designation	S275 / Advance® 275					S355 / Advance® 355				
	Classification		Gross Area A cm <sup>2</sup>	Effective Area A <sub>eff</sub> cm <sup>2</sup>	A <sub>eff</sub> /A	Classification		Gross Area A cm <sup>2</sup>	Effective Area A <sub>eff</sub> cm <sup>2</sup>	A <sub>eff</sub> /A
1016x305x393 +	Not class 4		500	500	1.00	Class 4	W	500	<b>488</b>	0.976
1016x305x349 +	Class 4	W	445	<b>432</b>	0.970	Class 4	W	445	<b>418</b>	0.940
1016x305x314 +	Class 4	W	400	<b>379</b>	0.947	Class 4	W	400	<b>366</b>	0.916
1016x305x272 +	Class 4	W	347	<b>317</b>	0.913	Class 4	W	347	<b>306</b>	0.883
1016x305x249 +	Class 4	W	317	<b>287</b>	0.905	Class 4	W	317	<b>276</b>	0.872
1016x305x222 +	Class 4	W	283	<b>251</b>	0.888	Class 4	W	283	<b>241</b>	0.853
914x419x388	Not class 4		494	494	1.00	Class 4	W	494	<b>478</b>	0.968
914x419x343	Class 4	W	437	<b>426</b>	0.974	Class 4	W	437	<b>414</b>	0.948
914x305x289	Class 4	W	368	<b>354</b>	0.962	Class 4	W	368	<b>342</b>	0.929
914x305x253	Class 4	W	323	<b>301</b>	0.932	Class 4	W	323	<b>290</b>	0.899
914x305x224	Class 4	W	286	<b>259</b>	0.907	Class 4	W	286	<b>250</b>	0.874
914x305x201	Class 4	W	256	<b>227</b>	0.887	Class 4	W	256	<b>218</b>	0.852
838x292x226	Class 4	W	289	<b>271</b>	0.936	Class 4	W	289	<b>261</b>	0.904
838x292x194	Class 4	W	247	<b>224</b>	0.908	Class 4	W	247	<b>216</b>	0.875
838x292x176	Class 4	W	224	<b>200</b>	0.891	Class 4	W	224	<b>192</b>	0.856
762x267x197	Class 4	W	251	<b>239</b>	0.953	Class 4	W	251	<b>231</b>	0.922
762x267x173	Class 4	W	220	<b>204</b>	0.929	Class 4	W	220	<b>197</b>	0.896
762x267x147	Class 4	W	187	<b>168</b>	0.896	Class 4	W	187	<b>161</b>	0.862
762x267x134	Class 4	W	171	<b>149</b>	0.871	Class 4	W	171	<b>143</b>	0.839
686x254x170	Class 4	W	217	<b>209</b>	0.963	Class 4	W	217	<b>202</b>	0.933
686x254x152	Class 4	W	194	<b>182</b>	0.941	Class 4	W	194	<b>176</b>	0.909
686x254x140	Class 4	W	178	<b>164</b>	0.924	Class 4	W	178	<b>159</b>	0.892
686x254x125	Class 4	W	159	<b>144</b>	0.905	Class 4	W	159	<b>139</b>	0.872
610x305x179	Not class 4		228	228	1.00	Class 4	W	228	<b>220</b>	0.965
610x305x149	Class 4	W	190	<b>182</b>	0.956	Class 4	W	190	<b>177</b>	0.931
610x229x140	Class 4	W	178	<b>172</b>	0.968	Class 4	W	178	<b>167</b>	0.937
610x229x125	Class 4	W	159	<b>150</b>	0.945	Class 4	W	159	<b>145</b>	0.914
610x229x113	Class 4	W	144	<b>133</b>	0.926	Class 4	W	144	<b>129</b>	0.895
610x229x101	Class 4	W	129	<b>117</b>	0.904	Class 4	W	129	<b>113</b>	0.872
610x178x100 +	Class 4	W	128	<b>118</b>	0.921	Class 4	W	128	<b>113</b>	0.885
610x178x92 +	Class 4	W	117	<b>105</b>	0.900	Class 4	W	117	<b>101</b>	0.864
610x178x82 +	Class 4	W	104	<b>90.7</b>	0.872	Class 4	W	104	<b>86.9</b>	0.835
533x312x150 +	Not class 4		192	192	1.00	Class 4	W	192	<b>186</b>	0.970
533x210x122	Not class 4		155	155	1.00	Class 4	W	155	<b>149</b>	0.963
533x210x109	Class 4	W	139	<b>135</b>	0.972	Class 4	W	139	<b>131</b>	0.942
533x210x101	Class 4	W	129	<b>123</b>	0.956	Class 4	W	129	<b>119</b>	0.926
533x210x92	Class 4	W	117	<b>109</b>	0.934	Class 4	W	117	<b>106</b>	0.905
533x210x82	Class 4	W	105	<b>96.4</b>	0.918	Class 4	W	105	<b>93.1</b>	0.887

Advance® and UKB are trademarks of Tata Steel. A fuller description of the relationship between Universal Beams (UB) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

+ These sections are in addition to the range of BS 4-1 sections

W indicates that the section classification is controlled by the web.

Values of A<sub>eff</sub> not in **bold type** are the same as the gross area.

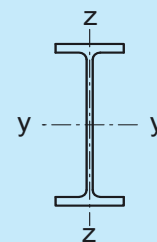
Only the sections which can be Class 4 under axial compression are given in the table.

FOR EXPLANATION OF TABLES SEE NOTE 4.

# EFFECTIVE SECTION PROPERTIES

## UNIVERSAL BEAMS

Advance® UKB



Classification and effective area for sections subject to axial compression

Section Designation	S275 / Advance® 275					S355 / Advance® 355				
	Classification		Gross Area A cm <sup>2</sup>	Effective Area A <sub>eff</sub> cm <sup>2</sup>	A <sub>eff</sub> /A	Classification		Gross Area A cm <sup>2</sup>	Effective Area A <sub>eff</sub> cm <sup>2</sup>	A <sub>eff</sub> /A
533x165x85 +	Class 4	W	108	<b>101</b>	0.937	Class 4	W	108	<b>97.6</b>	0.903
533x165x74 +	Class 4	W	95.2	<b>86.8</b>	0.911	Class 4	W	95.2	<b>83.5</b>	0.877
533x165x66 +	Class 4	W	83.7	<b>73.9</b>	0.883	Class 4	W	83.7	<b>70.9</b>	0.848
457x191x98	Not class 4		125	125	1.00	Class 4	W	125	<b>122</b>	0.975
457x191x89	Not class 4		114	114	1.00	Class 4	W	114	<b>109</b>	0.957
457x191x82	Class 4	W	104	<b>101</b>	0.968	Class 4	W	104	<b>97.8</b>	0.940
457x191x74	Class 4	W	94.6	<b>89.6</b>	0.947	Class 4	W	94.6	<b>86.9</b>	0.919
457x191x67	Class 4	W	85.5	<b>79.7</b>	0.932	Class 4	W	85.5	<b>77.2</b>	0.903
457x152x82	Not class 4		105	105	1.00	Class 4	W	105	<b>100</b>	0.954
457x152x74	Class 4	W	94.5	<b>91.0</b>	0.963	Class 4	W	94.5	<b>88.1</b>	0.932
457x152x67	Class 4	W	85.6	<b>80.6</b>	0.942	Class 4	W	85.6	<b>77.9</b>	0.911
457x152x60	Class 4	W	76.2	<b>69.7</b>	0.915	Class 4	W	76.2	<b>67.4</b>	0.884
457x152x52	Class 4	W	66.6	<b>59.4</b>	0.892	Class 4	W	66.6	<b>57.3</b>	0.860
406x178x74	Not class 4		94.5	94.5	1.00	Class 4	W	94.5	<b>90.8</b>	0.961
406x178x67	Class 4	W	85.5	<b>83.0</b>	0.970	Class 4	W	85.5	<b>80.7</b>	0.944
406x178x60	Class 4	W	76.5	<b>72.5</b>	0.948	Class 4	W	76.5	<b>70.4</b>	0.921
406x178x54	Class 4	W	69.0	<b>64.7</b>	0.938	Class 4	W	69.0	<b>62.7</b>	0.909
406x140x53 +	Class 4	W	67.9	<b>63.9</b>	0.941	Class 4	W	67.9	<b>61.8</b>	0.911
406x140x46	Class 4	W	58.6	<b>53.1</b>	0.906	Class 4	W	58.6	<b>51.4</b>	0.876
406x140x39	Class 4	W	49.7	<b>43.7</b>	0.880	Class 4	W	49.7	<b>42.1</b>	0.848
356x171x67	Not class 4		85.5	85.5	1.00	Class 4	W	85.5	<b>84.1</b>	0.983
356x171x57	Not class 4		72.6	72.6	1.00	Class 4	W	72.6	<b>69.7</b>	0.960
356x171x51	Class 4	W	64.9	<b>62.7</b>	0.966	Class 4	W	64.9	<b>61.0</b>	0.940
356x171x45	Class 4	W	57.3	<b>54.5</b>	0.952	Class 4	W	57.3	<b>53.0</b>	0.924
356x127x39	Class 4	W	49.8	<b>46.5</b>	0.934	Class 4	W	49.8	<b>45.0</b>	0.904
356x127x33	Class 4	W	42.1	<b>38.1</b>	0.905	Class 4	W	42.1	<b>36.8</b>	0.874
305x165x46	Class 4	W	58.7	<b>57.6</b>	0.982	Class 4	W	58.7	<b>56.3</b>	0.960
305x165x40	Class 4	W	51.3	<b>49.4</b>	0.962	Class 4	W	51.3	<b>48.2</b>	0.940
305x127x37	Not class 4		47.2	47.2	1.00	Class 4	W	47.2	<b>45.3</b>	0.960
305x102x33	Class 4	W	41.8	<b>40.1</b>	0.960	Class 4	W	41.8	<b>38.8</b>	0.929
305x102x28	Class 4	W	35.9	<b>33.5</b>	0.933	Class 4	W	35.9	<b>32.3</b>	0.900
305x102x25	Class 4	W	31.6	<b>29.0</b>	0.917	Class 4	W	31.6	<b>27.8</b>	0.880
254x146x37	Not class 4		47.2	47.2	1.00	Class 4	W	47.2	<b>46.4</b>	0.983
254x146x31	Not class 4		39.7	39.7	1.00	Class 4	W	39.7	<b>38.6</b>	0.971
254x102x28	Not class 4		36.1	36.1	1.00	Class 4	W	36.1	<b>35.0</b>	0.971
254x102x25	Not class 4		32.0	32.0	1.00	Class 4	W	32.0	<b>30.6</b>	0.957
254x102x22	Class 4	W	28.0	<b>27.2</b>	0.973	Class 4	W	28.0	<b>26.3</b>	0.940

Advance® and UKB are trademarks of Tata Steel. A fuller description of the relationship between Universal Beams (UB) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

+ These sections are in addition to the range of BS 4-1 sections

W indicates that the section classification is controlled by the web.

Values of A<sub>eff</sub> not in **bold type** are the same as the gross area.

Only the sections which can be Class 4 under axial compression are given in the table.

FOR EXPLANATION OF TABLES SEE NOTE 4.

## **EFFECTIVE SECTION PROPERTIES**

Classification and effective area for sections subject to axial compression

### **HOLLOW SECTIONS - S275**

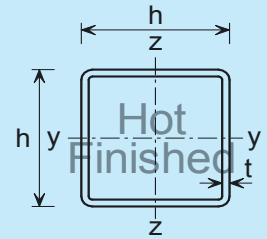
There are no effective property tables given for hot finished hollow sections in S275, because hot finished hollow sections are normally available in S355 only.

There are no effective property tables given for cold-formed hollow sections in S275, because cold-formed hollow sections are normally available in S235 and S355 only. No effective property tables are given for S235 either, because sections available may not be manufactured to BS EN 10219-2: 2006.

## EFFECTIVE SECTION PROPERTIES

### HOT-FINISHED SQUARE HOLLOW SECTIONS

Celsius® SHS



Classification and effective area for sections subject to axial compression

Designation		S355 / Celsius®355			
Size h x h mm	Wall Thickness t mm	Classification	Gross Area A cm <sup>2</sup>	Effective Area A <sub>eff</sub> cm <sup>2</sup>	A <sub>eff</sub> /A
200x200	5.0	Class 4	38.7	<b>35.2</b>	0.910
250x250	5.0 #	Class 4	48.7	<b>37.9</b>	0.779
	6.3	Class 4	61.0	<b>55.8</b>	0.915
260x260	6.3 #	Class 4	63.5	<b>56.6</b>	0.892
300x300	6.3 #	Class 4	73.6	<b>59.4</b>	0.807
	7.1 #	Class 4	82.6	<b>72.5</b>	0.878
	8.0	Class 4	92.8	<b>87.9</b>	0.947
350x350	8.0	Class 4	109	<b>93.5</b>	0.858
	8.8 #	Class 4	119	<b>109</b>	0.913
400x400	8.0 #	Class 4	125	<b>97.4</b>	0.779
	8.8 #	Class 4	137	<b>114</b>	0.835
	10.0	Class 4	155	<b>141</b>	0.910

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Square Hollow Sections (HFSHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

Values of A<sub>eff</sub> not in **bold type** are the same as the gross area.

# Check availability

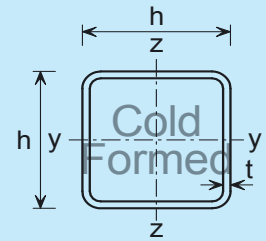
Only the sections which can be Class 4 under axial compression are given in the table.

FOR EXPLANATION OF TABLES SEE NOTE 4.

## EFFECTIVE SECTION PROPERTIES

### COLD-FORMED SQUARE HOLLOW SECTIONS

Hybox® SHS



Classification and effective area for sections subject to axial compression

Designation		S355 / Hybox®355			
Size h x h mm	Wall Thickness t mm	Classification	Gross Area A cm <sup>2</sup>	Effective Area A <sub>eff</sub> cm <sup>2</sup>	A <sub>eff</sub> /A
120x120	3.0 #	Class 4	13.8	<b>12.5</b>	0.909
150x150	4.0 #	Class 4	22.9	<b>21.7</b>	0.947
160x160	4.0 #	Class 4	24.5	<b>22.3</b>	0.909
200x200	5.0	Class 4	38.4	<b>34.9</b>	0.909
250x250	6.0	Class 4	57.6	<b>51.0</b>	0.885
	6.3 #	Class 4	60.0	<b>54.8</b>	0.913
300x300	6.0	Class 4	69.6	<b>54.1</b>	0.777
	6.3 #	Class 4	72.6	<b>58.4</b>	0.805
	8.0	Class 4	91.2	<b>86.3</b>	0.947
350x350	6.0 #	Class 4	81.6	<b>56.2</b>	0.689
	6.3 #	Class 4	85.2	<b>60.9</b>	0.715
	8.0	Class 4	107	<b>91.5</b>	0.855
400x400	6.0 #	Class 4	93.6	<b>57.8</b>	0.618
	6.3 #	Class 4	97.8	<b>62.8</b>	0.642
	8.0	Class 4	123	<b>95.4</b>	0.776
	10.0	Class 4	153	<b>139</b>	0.909

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Square Hollow Sections (CFSHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

Values of A<sub>eff</sub> not in **bold type** are the same as the gross area.

# Check availability

Only the sections which can be Class 4 under axial compression are given in the table.

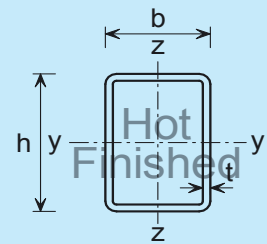
FOR EXPLANATION OF TABLES SEE NOTE 4.



## EFFECTIVE SECTION PROPERTIES

### HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Classification and effective area for sections subject to axial compression

Designation		S355 / Celsius®355					
Size h x b mm	Wall Thickness t mm	Classification		Gross Area A cm <sup>2</sup>	Effective Area A <sub>eff</sub> cm <sup>2</sup>	A <sub>eff</sub> /A	
120x60	3.0 #	Class 4	W	10.3	<b>9.67</b>	0.939	
	3.2 #	Class 4	W	11.0	<b>10.6</b>	0.965	
150x100	4.0 #	Class 4	W	19.2	<b>18.6</b>	0.968	
160x80	4.0 #	Class 4	W	18.4	<b>17.3</b>	0.939	
180x60	4.0 #	Class 4	W	18.4	<b>16.2</b>	0.879	
180x100	4.0 #	Class 4	W	21.6	<b>19.4</b>	0.897	
200x100	4.0 #	Class 4	W	23.2	<b>19.7</b>	0.851	
	5.0	Class 4	W	28.7	<b>27.0</b>	0.939	
200x120	5.0 #	Class 4	W	30.7	<b>29.0</b>	0.943	
200x150	5.0 #	Class 4	W	33.7	<b>32.0</b>	0.948	
220x120	5.0 #	Class 4	W	32.7	<b>29.6</b>	0.904	
250x100	5.0 #	Class 4	W	33.7	<b>28.3</b>	0.840	
	6.3 #	Class 4	W	42.1	<b>39.5</b>	0.938	
250x150	5.0 #	Class 4	W	38.7	<b>33.3</b>	0.861	
	6.3	Class 4	W	48.4	<b>45.8</b>	0.946	
260x140	5.0 #	Class 4	W	38.7	<b>32.5</b>	0.840	
	6.3 #	Class 4	W	48.4	<b>45.0</b>	0.929	
300x100	5.0 #	Class 4	W	38.7	<b>29.2</b>	0.754	
	6.3 #	Class 4	W	48.4	<b>41.3</b>	0.853	
	7.1 #	Class 4	W	54.2	<b>49.1</b>	0.907	
	8.0	Class 4	W	60.8	<b>58.4</b>	0.960	
300x150	8.0 # rr	Class 4	W	68.8	<b>66.4</b>	0.965	
300x200	5.0 #	Class 4	F, W	48.7	<b>37.4</b>	0.769	
	6.3	Class 4	W	61.0	<b>53.9</b>	0.884	
	7.1 #	Class 4	W	68.4	<b>63.3</b>	0.926	
	8.0	Class 4	W	76.8	<b>74.4</b>	0.968	
300x250	5.0 #	Class 4	F, W	53.7	<b>38.8</b>	0.722	
	6.3 #	Class 4	F, W	67.3	<b>57.6</b>	0.856	
	7.1 #	Class 4	W	75.5	<b>70.4</b>	0.933	
	8.0	Class 4	W	84.8	<b>82.4</b>	0.971	

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

W indicates that the section classification is controlled by the web.

F, W indicates that the section classification is controlled by both flange and web.

Values of A<sub>eff</sub> not in **bold type** are the same as the gross area.

# Check availability

rr means something different

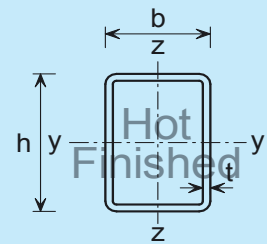
Only the sections which can be Class 4 under axial compression are given in the table.

FOR EXPLANATION OF TABLES SEE NOTE 4.

## EFFECTIVE SECTION PROPERTIES

### HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Classification and effective area for sections subject to axial compression

Designation		S355 / Celsius®355					
Size h x b mm	Wall Thickness t mm	Classification		Gross Area A cm <sup>2</sup>	Effective Area A <sub>eff</sub> cm <sup>2</sup>	A <sub>eff</sub> /A	
350x150	5.0 #	Class 4	W	48.7	<b>34.8</b>	0.715	
	6.3 #	Class 4	W	61.0	<b>48.9</b>	0.801	
	7.1 #	Class 4	W	68.4	<b>58.1</b>	0.849	
	8.0 #	Class 4	W	76.8	<b>69.0</b>	0.899	
	8.8 #	Class 4	W	84.1	<b>78.9</b>	0.939	
350x250	6.3 #	Class 4	F, W	73.6	<b>58.9</b>	0.800	
	7.1 #	Class 4	W	82.6	<b>72.3</b>	0.875	
	8.0 #	Class 4	W	92.8	<b>85.0</b>	0.916	
	8.8 #	Class 4	W	102	<b>96.8</b>	0.949	
400x150	6.3 #	Class 4	W	67.3	<b>49.8</b>	0.740	
	7.1 #	Class 4	W	75.5	<b>59.4</b>	0.787	
	8.0 #	Class 4	W	84.8	<b>71.0</b>	0.837	
	8.8 #	Class 4	W	92.9	<b>81.6</b>	0.878	
	10.0 #	Class 4	W	105	<b>98.0</b>	0.934	
400x200	6.3 #	Class 4	W	73.6	<b>56.1</b>	0.762	
	7.1 #	Class 4	W	82.6	<b>66.5</b>	0.806	
	8.0	Class 4	W	92.8	<b>79.0</b>	0.851	
	8.8 #	Class 4	W	102	<b>90.7</b>	0.889	
	10.0	Class 4	W	115	<b>108</b>	0.939	
400x300	8.0 #	Class 4	F, W	109	<b>92.8</b>	0.851	
	8.8 #	Class 4	W	119	<b>108</b>	0.905	
	10.0 #	Class 4	W	135	<b>128</b>	0.948	
450x250	8.0	Class 4	W	109	<b>88.7</b>	0.814	
	8.8 #	Class 4	W	119	<b>101</b>	0.848	
	10.0	Class 4	W	135	<b>121</b>	0.897	
500x200	8.0 #	Class 4	W	109	<b>81.9</b>	0.751	
	8.8 #	Class 4	W	119	<b>93.7</b>	0.787	
	10.0 #	Class 4	W	135	<b>113</b>	0.840	
	12.5 #	Class 4	W	167	<b>156</b>	0.935	
500x300	8.0 #	Class 4	F, W	125	<b>95.4</b>	0.764	
	8.8 #	Class 4	W	137	<b>112</b>	0.815	
	10.0	Class 4	W	155	<b>133</b>	0.861	
	12.5 #	Class 4	W	192	<b>181</b>	0.943	

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

W indicates that the section classification is controlled by the web.

F, W indicates that the section classification is controlled by both flange and web.

Values of A<sub>eff</sub> not in **bold type** are the same as the gross area.

# Check availability

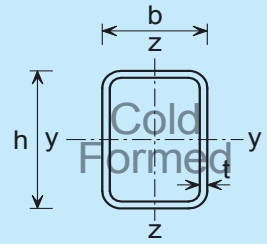
Only the sections which can be Class 4 under axial compression are given in the table.

FOR EXPLANATION OF TABLES SEE NOTE 4.

## EFFECTIVE SECTION PROPERTIES

### COLD-FORMED RECTANGULAR HOLLOW SECTIONS

Hybox® RHS



Classification and effective area for sections subject to axial compression

Designation		S355 / Hybox®355				
Size h x b mm	Wall Thickness t mm	Classification		Gross Area A cm <sup>2</sup>	Effective Area A <sub>eff</sub> cm <sup>2</sup>	A <sub>eff</sub> /A
120x40	3.0 #	Class 4	W	9.01	<b>8.38</b>	0.930
120x60	3.0	Class 4	W	10.2	<b>9.57</b>	0.938
120x80	3.0	Class 4	W	11.4	<b>10.8</b>	0.945
140x80	3.0 #	Class 4	W	12.6	<b>11.1</b>	0.883
150x100	3.0 #	Class 4	W	14.4	<b>12.5</b>	0.865
	4.0	Class 4	W	18.9	<b>18.3</b>	0.968
160x80	3.0 #	Class 4	W	13.8	<b>11.4</b>	0.825
	4.0	Class 4	W	18.1	<b>17.0</b>	0.938
180x80	3.0	Class 4	W	15.0	<b>11.6</b>	0.772
	4.0	Class 4	W	19.7	<b>17.5</b>	0.887
180x100	4.0 #	Class 4	W	21.3	<b>19.1</b>	0.895
200x100	4.0	Class 4	W	22.9	<b>19.4</b>	0.849
	5.0	Class 4	W	28.4	<b>26.7</b>	0.939
200x120	4.0	Class 4	W	24.5	<b>21.0</b>	0.859
	5.0	Class 4	W	30.4	<b>28.7</b>	0.943
200x150	4.0 #	Class 4	F, W	26.9	<b>22.8</b>	0.849
	5.0 #	Class 4	W	33.4	<b>31.7</b>	0.948
250x150	5.0	Class 4	W	38.4	<b>33.0</b>	0.860
	6.0	Class 4	W	45.6	<b>42.3</b>	0.927
	6.3 #	Class 4	W	47.4	<b>44.8</b>	0.945
300x100	8.0	Class 4	W	59.2	<b>56.8</b>	0.959
300x200	6.0	Class 4	W	57.6	<b>49.8</b>	0.865
	6.3 #	Class 4	W	60.0	<b>52.9</b>	0.882
	8.0	Class 4	W	75.2	<b>72.8</b>	0.968
400x200	6.0 #	Class 4	W	69.6	<b>51.7</b>	0.743
	6.3 #	Class 4	W	72.6	<b>55.1</b>	0.759
	8.0	Class 4	W	91.2	<b>77.4</b>	0.849
	10.0	Class 4	W	113	<b>106</b>	0.938
450x250	6.0 #	Class 4	F, W	81.6	<b>55.0</b>	0.674
	6.3 #	Class 4	F, W	85.2	<b>59.5</b>	0.699
	8.0 #	Class 4	W	107	<b>86.7</b>	0.810
	10.0 #	Class 4	W	133	<b>119</b>	0.895
	12.0 #	Class 4	W	156	<b>151</b>	0.965
500x300	6.0 #	Class 4	F, W	93.6	<b>57.1</b>	0.610
	6.3 #	Class 4	F, W	97.8	<b>61.9</b>	0.633
	8.0 #	Class 4	F, W	123	<b>93.4</b>	0.760
	10.0 #	Class 4	W	153	<b>131</b>	0.859
	12.0 #	Class 4	W	180	<b>167</b>	0.926
	12.5 #	Class 4	W	187	<b>176</b>	0.942

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Rectangular Hollow Sections (CFRHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

W indicates that the section classification is controlled by the web.

F, W indicates that the section classification is controlled by both flange and web.

Values of A<sub>eff</sub> not in **bold type** are the same as the gross area.

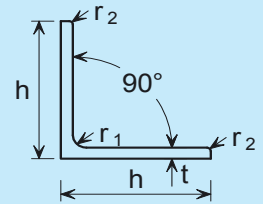
Only the sections which can be Class 4 under axial compression are given in the table.

FOR EXPLANATION OF TABLES SEE NOTE 4.

## EFFECTIVE SECTION PROPERTIES

### EQUAL ANGLES

#### Advance® UKA - Equal Angles



Classification and effective area for sections subject to axial compression

Designation		S275 / Advance® 275				S355 / Advance® 355			
Size	Thickness	Classification	Gross Area	Effective Area		Classification	Gross Area	Effective Area	
h x h mm	t mm		A cm <sup>2</sup>	A <sub>eff</sub> cm <sup>2</sup>	A <sub>eff</sub> /A		A cm <sup>2</sup>	A <sub>eff</sub> cm <sup>2</sup>	A <sub>eff</sub> /A
200x200	20.0	Not class 4	76.3	76.3	1.00	Class 4	76.3	76.3	1.00
	18.0	Class 4	69.1	69.1	1.00	Class 4	69.1	69.1	1.00
	16.0	Class 4	61.8	61.8	1.00	Class 4	61.8	<b>57.7</b>	0.934
150x150	15.0	Not class 4	43.0	43.0	1.00	Class 4	43.0	43.0	1.00
	12.0	Class 4	34.8	34.8	1.00	Class 4	34.8	<b>32.5</b>	0.934
	10.0	Class 4	29.3	<b>26.3</b>	0.898	Class 4	29.3	<b>23.8</b>	0.814
120x120	12.0	Not class 4	27.5	27.5	1.00	Class 4	27.5	27.5	1.00
	10.0	Class 4	23.2	23.2	1.00	Class 4	23.2	<b>22.3</b>	0.962
	8.0 +	Class 4	18.8	<b>16.9</b>	0.898	Class 4	18.8	<b>15.3</b>	0.814
100x100	10.0	Not class 4	19.2	19.2	1.00	Class 4	19.2	19.2	1.00
	8.0	Class 4	15.5	15.5	1.00	Class 4	15.5	<b>14.5</b>	0.934
90x90	8.0	Class 4	13.9	13.9	1.00	Class 4	13.9	13.9	1.00
	7.0	Class 4	12.2	12.2	1.00	Class 4	12.2	<b>11.2</b>	0.915
80x80	8.0	Not class 4	12.3	12.3	1.00	Class 4	12.3	12.3	1.00
75x75	8.0	Not class 4	11.4	11.4	1.00	Class 4	11.4	11.4	1.00
	6.0	Class 4	8.73	8.73	1.00	Class 4	8.73	<b>8.15</b>	0.934
70x70	7.0	Not class 4	9.40	9.40	1.00	Class 4	9.40	9.40	1.00
	6.0	Class 4	8.13	8.13	1.00	Class 4	8.13	<b>7.98</b>	0.981
60x60	6.0	Not class 4	6.91	6.91	1.00	Class 4	6.91	6.91	1.00
	5.0	Class 4	5.82	5.82	1.00	Class 4	5.82	<b>5.60</b>	0.962
50x50	5.0	Not class 4	4.80	4.80	1.00	Class 4	4.80	4.80	1.00
	4.0	Class 4	3.89	3.89	1.00	Class 4	3.89	<b>3.63</b>	0.934
45x45	4.5	Not class 4	3.90	3.90	1.00	Class 4	3.90	3.90	1.00
40x40	4.0	Not class 4	3.08	3.08	1.00	Class 4	3.08	3.08	1.00
30x30	3.0	Not class 4	1.74	1.74	1.00	Class 4	1.74	1.74	1.00

Advance® and UKA are trademarks of Tata Steel. A fuller description of the relationship between Equal Angles and the Advance® range of sections manufactured by Tata Steel is given in note 12.

Values of A<sub>eff</sub> not in **bold type** are the same as the gross area.

+ These sections are additional to the range in BS EN 10056-1

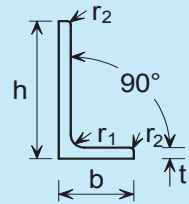
Only the sections which can be Class 4 under axial compression are given in the table.

FOR EXPLANATION OF TABLES SEE NOTE 4.

## EFFECTIVE SECTION PROPERTIES

### UNEQUAL ANGLES

#### Advance® UKA - Unequal Angles



Classification and effective area for sections subject to axial compression

Designation		S275 / Advance® 275				S355 / Advance® 355			
Size	Thickness	Classification	Gross Area	Effective Area		Classification	Gross Area	Effective Area	
h x b mm	t mm		A <sub>g</sub> cm <sup>2</sup>	A <sub>eff</sub> cm <sup>2</sup>	A <sub>eff</sub> /A <sub>g</sub>		A <sub>g</sub> cm <sup>2</sup>	A <sub>eff</sub> cm <sup>2</sup>	A <sub>eff</sub> /A <sub>g</sub>
200x150	18.0 +	Not class 4	60.1	60.1	1.00	Class 4	60.1	60.1	1.00
	15.0	Class 4	50.5	<b>49.3</b>	0.977	Class 4	50.5	<b>44.9</b>	0.889
	12.0	Class 4	40.8	<b>33.8</b>	0.827	Class 4	40.8	<b>30.5</b>	0.746
200x100	15.0	Not class 4	43.0	43.0	1.00	Class 4	43.0	<b>38.2</b>	0.889
	12.0	Class 4	34.8	<b>28.8</b>	0.827	Class 4	34.8	<b>25.9</b>	0.745
	10.0	Class 4	29.2	<b>20.8</b>	0.714	Class 4	29.2	<b>18.7</b>	0.640
150x90	12.0	Not class 4	27.5	27.5	1.00	Class 4	27.5	<b>25.7</b>	0.933
	10.0	Class 4	23.2	<b>20.8</b>	0.897	Class 4	23.2	<b>18.8</b>	0.812
150x75	12.0	Not class 4	25.7	25.7	1.00	Class 4	25.7	<b>24.0</b>	0.933
	10.0	Class 4	21.7	<b>19.5</b>	0.896	Class 4	21.7	<b>17.6</b>	0.812
125x75	10.0	Not class 4	19.1	19.1	1.00	Class 4	19.1	<b>17.8</b>	0.933
	8.0	Class 4	15.5	<b>13.5</b>	0.869	Class 4	15.5	<b>12.2</b>	0.786
100x75	8.0	Class 4	13.5	13.5	1.00	Class 4	13.5	<b>12.6</b>	0.934
100x65	8.0 +	Not class 4	12.7	12.7	1.00	Class 4	12.7	<b>11.9</b>	0.933
	7.0 +	Class 4	11.2	<b>10.4</b>	0.930	Class 4	11.2	<b>9.46</b>	0.844
100x50	8.0	Not class 4	11.4	11.4	1.00	Class 4	11.4	<b>10.6</b>	0.933
	6.0	Class 4	8.71	<b>7.20</b>	0.827	Class 4	8.71	<b>6.49</b>	0.746
80x60	7.0	Not class 4	9.38	9.38	1.00	Class 4	9.38	<b>9.33</b>	0.995
80x40	6.0	Not class 4	6.89	6.89	1.00	Class 4	6.89	<b>6.12</b>	0.889
75x50	6.0	Not class 4	7.19	7.19	1.00	Class 4	7.19	<b>6.71</b>	0.933
70x50	6.0	Not class 4	6.89	6.89	1.00	Class 4	6.89	<b>6.76</b>	0.981
65x50	5.0	Class 4	5.54	<b>5.51</b>	0.994	Class 4	5.54	<b>5.02</b>	0.907
60x40	5.0	Not class 4	4.79	4.79	1.00	Class 4	4.79	<b>4.60</b>	0.961
45x30	4.0	Not class 4	2.87	2.87	1.00	Class 4	2.87	2.87	1.00

Advance® and UKA are trademarks of Tata Steel. A fuller description of the relationship between Unequal Angles and the Advance® range of sections manufactured by Tata Steel is given in note 12.

Classification is determined when the section is loaded to capacity.

Values of A<sub>eff</sub> not in **bold type** are the same as the gross area.

+ These sections are additional to the range in BS EN 10056-1

Only the sections which can be Class 4 under axial compression are given in the table.

FOR EXPLANATION OF TABLES SEE NOTE 4

## **EFFECTIVE SECTION PROPERTIES**

Classification and effective area for sections subject to axial compression

### **HOLLOW SECTIONS - S275**

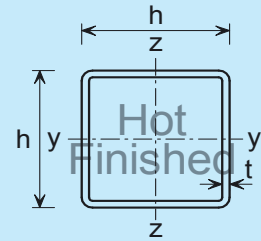
There are no effective property tables given for hot finished hollow sections in S275, because hot finished hollow sections are normally available in S355 only.

There are no effective property tables given for cold-formed hollow sections in S275, because cold-formed hollow sections are normally available in S235 and S355 only. No effective property tables are given for S235 either, because sections available may

## EFFECTIVE SECTION PROPERTIES

### HOT-FINISHED SQUARE HOLLOW SECTIONS

Celsius® SHS



Classification and effective section properties for sections subject to bending about y-y axis

Designation		S355 / Celsius®355				
Size h x h mm	Wall Thickness t mm	Classification		Properties		
				$I_{\text{eff},y}$ cm <sup>4</sup>	$W_{\text{el,eff},y}$ cm <sup>3</sup>	$W_{\text{pl,eff},y}$ cm <sup>3</sup>
200 x 200	5.0	Class 4	F	2360	231	*
250 x 250	5.0 #	Class 4	F	4433	335	*
250 x 250	6.3	Class 4	F	5817	456	*
260 x 260	6.3 #	Class 4	F	6503	487	*
300 x 300	6.3 #	Class 4	F	9743	619	*
300 x 300	7.1 #	Class 4	F	11216	725	*
300 x 300	8.0	Class 4	F	12865	847	*
350 x 350	8.0	Class 4	F	19952	1100	*
350 x 350	8.8 #	Class 4	F	22286	1247	*
400 x 400	8.0 #	Class 4	F	29050	1374	*
400 x 400	8.8 #	Class 4	F	32539	1561	*
400 x 400	10.0	Class 4	F	37772	1847	*

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Square Hollow Sections (HFSHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

\* Indicates that this parameter is not applicable to the section

F indicates that the section classification is controlled by the flange.

# Check availability

$W_{\text{el,eff},y}$  is the minimum value of the effective elastic modulus about the y-y axis for a Class 4 section.

$W_{\text{pl,eff},y}$  is the effective plastic modulus about the y-y axis for a Class 3 section.

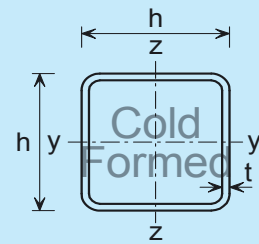
Only the sections which can be Class 3 or Class 4 when subject to pure bending are given in the table.

FOR EXPLANATION OF TABLES SEE NOTE 4.

## EFFECTIVE SECTION PROPERTIES

### COLD-FORMED SQUARE HOLLOW SECTIONS

Hybox® SHS



Classification and effective section properties for sections subject to bending about y-y axis

Designation		S355 / Hybox®355				
Size h x h mm	Wall Thickness t mm	Classification		Properties		
				$I_{eff,y}$ cm <sup>4</sup>	$W_{el,eff,y}$ cm <sup>3</sup>	$W_{pl,eff,y}$ cm <sup>3</sup>
120 x 120	3.0 #	Class 4	F	301	49.1	*
150 x 150	4.0 #	Class 4	F	792	104	*
160 x 160	4.0 #	Class 4	F	952	116	*
200 x 200	5.0	Class 4	F	2325	227	*
250 x 250	6.0	Class 4	F	5418	421	*
250 x 250	6.3 #	Class 4	F	5676	444	*
300 x 300	6.0	Class 4	F	9075	572	*
300 x 300	6.3 #	Class 4	F	9538	605	*
300 x 300	8.0	Class 4	F	12537	825	*
350 x 350	6.0 #	Class 4	F	13974	737	*
350 x 350	6.3 #	Class 4	F	14716	782	*
350 x 350	8.0	Class 4	F	19503	1075	*
400 x 400	6.0 #	Class 4	F	20268	918	*
400 x 400	6.3 #	Class 4	F	21372	974	*
400 x 400	8.0	Class 4	F	28460	1345	*
400 x 400	10.0	Class 4	F	36860	1802	*

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Square Hollow Sections (CFSHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

\* Indicates that this parameter is not applicable to the section

F indicates that the section classification is controlled by the flange.

# Check availability

$W_{el,eff,y}$  is the minimum value of the effective elastic modulus about the y-y axis for a Class 4 section.

$W_{pl,eff,y}$  is the effective plastic modulus about the y-y axis for a Class 3 section.

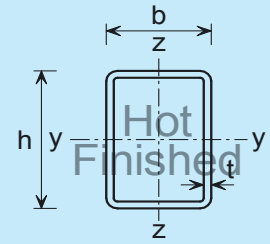
FOR EXPLANATION OF TABLES SEE NOTE 4.



# EFFECTIVE SECTION PROPERTIES

## HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Classification and effective section properties for sections subject to bending about y-y axis

Designation		S355 / Celsius®355				
Size h x b mm	Wall Thickness t mm	Classification		Properties		
				$I_{eff,y}$ cm <sup>4</sup>	$W_{el,eff,y}$ cm <sup>3</sup>	$W_{pl,eff,y}$ cm <sup>3</sup>
300 x 200	5.0 #	Class 4	F	6129	401	*
300 x 250	5.0 #	Class 4	F	6792	430	*
300 x 250	6.3 #	Class 4	F	8902	582	*
350 x 250	6.3 #	Class 4	F	12812	719	*
400 x 300	8.0 #	Class 4	F	25235	1248	*
500 x 300	8.0 #	Class 4	F	42983	1703	*

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in section 12.

\* Indicates that this parameter is not applicable to the section

F indicates that the section classification is controlled by the flange.

# Check availability

$W_{el,eff,y}$  is the minimum value of the effective elastic modulus about the y-y axis for a Class 4 section.

$W_{pl,eff,y}$  is the effective plastic modulus about the y-y axis for a Class 3 section.

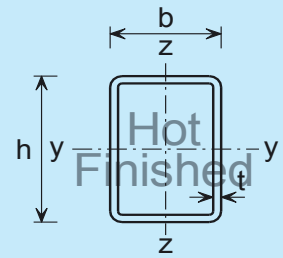
Only the sections which can be Class 3 or Class 4 when subject to pure bending are given in the table.

FOR EXPLANATION OF TABLES SEE NOTE 4.

## EFFECTIVE SECTION PROPERTIES

### HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Classification and effective section properties for sections subject to bending about z-z axis

Designation		S355 / Celsius®355				
Size h x b mm	Wall Thickness t mm	Classification		Properties		
				$I_{eff,z}$ cm <sup>4</sup>	$W_{el,eff,z}$ cm <sup>3</sup>	$W_{pl,eff,z}$ cm <sup>3</sup>
120 x 60	3.0 #	Class 4	F	62.9	20.3	-
120 x 60	3.2 #	Class 4	F	67.6	22.2	-
150 x 100	4.0 #	Class 4	F	317	62.4	-
160 x 80	4.0 #	Class 4	F	199	48.2	-
180 x 60	4.0 #	Class 4	F	112	35.1	-
180 x 100	4.0 #	Class 4	F	352	66.9	-
200 x 100	4.0 #	Class 4	F	373	69.3	-
200 x 100	5.0	Class 4	F	485	94.1	-
200 x 120	5.0 #	Class 4	F	732	119	-
200 x 150	5.0 #	Class 4	F	1220	158	-
220 x 120	5.0 #	Class 4	F	775	123	-
250 x 100	5.0 #	Class 4	F	552	102	-
250 x 100	6.3 #	Class 4	F	721	140	-
250 x 150	5.0 #	Class 4	F	1380	171	-
250 x 150	6.3	Class 4	F	1810	234	-
260 x 140	5.0 #	Class 4	F	1200	158	-
260 x 140	6.3 #	Class 4	F	1580	218	-
300 x 100	5.0 #	Class 4	F	609	107	-
300 x 100	6.3 #	Class 4	F	806	150	-
300 x 100	7.1 #	Class 4	F	924	177	-
300 x 100	8.0	Class 4	F	1050	206	-
300 x 150	8.0 #	Class 4	F	2640	346	-
300 x 200	5.0 #	Class 4	F	2900	262	*
300 x 200	6.3	Class 4	F	3840	362	-
300 x 200	7.1 #	Class 4	F	4420	427	-
300 x 200	8.0	Class 4	F	5070	499	-
300 x 250	5.0 #	Class 4	F	4830	353	*
300 x 250	6.3 #	Class 4	F	6390	485	*
300 x 250	7.1 #	Class 4	F	7360	570	-
300 x 250	8.0	Class 4	F	8450	666	-

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in section 12.

- Indicates that the effective section property is not applicable due to the section classification and the gross property should be used.

\* Indicates that this parameter is not applicable to the section

F indicates that the section classification is controlled by the flange.

# Check availability

$W_{el,eff,z}$  is the minimum value of the effective elastic modulus about the z-z axis for a Class 4 section.

$W_{pl,eff,z}$  is not applicable for RHS.

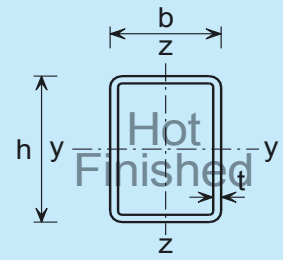
Only the sections which can be Class 3 or Class 4 when subject to pure bending are given in the table.

FOR EXPLANATION OF TABLES SEE NOTE 4.

# EFFECTIVE SECTION PROPERTIES

## HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Classification and effective section properties for sections subject to bending about z-z axis

Designation		S355 / Celsius®355				
Size h x b mm	Wall Thickness t mm	Classification		Properties		
				$I_{eff,z}$ cm <sup>4</sup>	$W_{el,eff,z}$ cm <sup>3</sup>	$W_{pl,eff,z}$ cm <sup>3</sup>
350 x 150	5.0 #	Class 4	F	1630	187	-
350 x 150	6.3 #	Class 4	F	2180	263	-
350 x 150	7.1 #	Class 4	F	2520	312	-
350 x 150	8.0 #	Class 4	F	2900	368	-
350 x 150	8.8 #	Class 4	F	3230	418	-
350 x 250	6.3 #	Class 4	F	6900	508	*
350 x 250	7.1 #	Class 4	F	7980	600	-
350 x 250	8.0 #	Class 4	F	9210	706	-
350 x 250	8.8 #	Class 4	F	10300	802	-
400 x 150	6.3 #	Class 4	F	2330	272	-
400 x 150	7.1 #	Class 4	F	2710	324	-
400 x 150	8.0 #	Class 4	F	3130	385	-
400 x 150	8.8 #	Class 4	F	3500	440	-
400 x 150	10.0 #	Class 4	F	4050	523	-
400 x 200	6.3 #	Class 4	F	4440	393	-
400 x 200	7.1 #	Class 4	F	5160	468	-
400 x 200	8.0	Class 4	F	5970	554	-
400 x 200	8.8 #	Class 4	F	6690	634	-
400 x 200	10.0	Class 4	F	7760	754	-
400 x 300	8.0 #	Class 4	F	15000	936	*
400 x 300	8.8 #	Class 4	F	16800	1070	-
400 x 300	10.0 #	Class 4	F	19500	1270	-
450 x 250	8.0	Class 4	F	10500	764	-
450 x 250	8.8 #	Class 4	F	11800	875	-
450 x 250	10.0	Class 4	F	13800	1050	-
500 x 200	8.0 #	Class 4	F	6710	590	-
500 x 200	8.8 #	Class 4	F	7560	678	-
500 x 200	10.0 #	Class 4	F	8830	816	-
500 x 200	12.5 #	Class 4	F	11400	1110	-
500 x 300	8.0 #	Class 4	F	16700	996	*
500 x 300	8.8 #	Class 4	F	18800	1140	-
500 x 300	10.0	Class 4	F	22000	1370	-
500 x 300	12.5 #	Class 4	F	28600	1860	-

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in section 12.

- Indicates that the effective section property is not applicable due to the section classification and the gross property should be used.

\* Indicates that this parameter is not applicable to the section

F indicates that the section classification is controlled by the flange.

# Check availability

$W_{el,eff,z}$  is the minimum value of the effective elastic modulus about the z-z axis for a Class 4 section.

$W_{pl,eff,z}$  is not applicable for RHS.

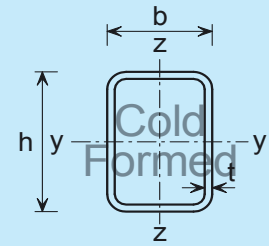
Only the sections which can be Class 3 or Class 4 when subject to pure bending are given in the table.

FOR EXPLANATION OF TABLES SEE NOTE 4.

# EFFECTIVE SECTION PROPERTIES

## COLD-FORMED RECTANGULAR HOLLOW SECTIONS

Hybox® RHS



Classification and effective section properties for sections subject to bending about y-y axis

Designation		S355 / Hybox®355				
Size h x b mm	Wall Thickness t mm	Classification		Properties		
				$I_{eff,y}$ cm <sup>4</sup>	$W_{el,eff,y}$ cm <sup>3</sup>	$W_{pl,eff,y}$ cm <sup>3</sup>
200 x 150	4.0 #	Class 4	F	1554	154	*
450 x 250	6.0 #	Class 4	F	21890	953	*
450 x 250	6.3 #	Class 4	F	22956	1005	*
500 x 300	6.0 #	Class 4	F	30541	1172	*
500 x 300	6.3 #	Class 4	F	32103	1238	*
500 x 300	8.0 #	Class 4	F	42060	1666	*

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Rectangular Hollow Sections (CFRHS) and the Hybox® range of sections manufactured by Tata Steel is given in section 12.

\* Indicates that this parameter is not applicable to the section

F indicates that the section classification is controlled by the flange.

# Check availability

$W_{el,eff,y}$  is the minimum value of the effective elastic modulus about the y-y axis for a Class 4 section.

$W_{pl,eff,y}$  is the effective plastic modulus about the y-y axis for a Class 3 section.

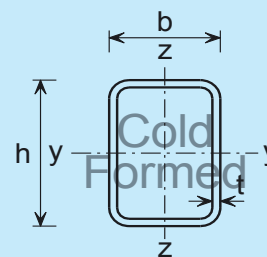
Only the sections which can be Class 3 or Class 4 when subject to pure bending are given in the table.

FOR EXPLANATION OF TABLES SEE NOTE 4.

# EFFECTIVE SECTION PROPERTIES

## COLD-FORMED RECTANGULAR HOLLOW SECTIONS

Hybox® RHS



Classification and effective section properties for sections subject to bending about z-z axis

Designation		S355 / Hybox®355				
Size h x b mm	Wall Thickness t mm	Classification		Properties		
				$I_{\text{eff},z}$ cm <sup>4</sup>	$W_{\text{el,eff},z}$ cm <sup>3</sup>	$W_{\text{pl,eff},z}$ cm <sup>3</sup>
120 x 40	3.0 #	Class 4	F	24.7	11.9	-
120 x 60	3.0	Class 4	F	61.8	20.0	-
120 x 80	3.0	Class 4	F	118	28.8	-
140 x 80	3.0 #	Class 4	F	129	30.5	-
150 x 100	3.0 #	Class 4	F	224	41.8	-
150 x 100	4.0	Class 4	F	312	61.4	-
160 x 80	3.0 #	Class 4	F	139	31.9	-
160 x 80	4.0	Class 4	F	196	47.5	-
180 x 80	3.0	Class 4	F	148	33.0	-
180 x 80	4.0	Class 4	F	210	49.6	-
180 x 100	4.0 #	Class 4	F	347	65.9	-
200 x 100	4.0	Class 4	F	368	68.3	-
200 x 100	5.0	Class 4	F	477	92.6	-
200 x 120	4.0	Class 4	F	556	86.3	-
200 x 120	5.0	Class 4	F	720	117	-
200 x 150	4.0 #	Class 4	F	923	115	*
200 x 150	5.0 #	Class 4	F	1200	156	-
250 x 150	5.0	Class 4	F	1360	168	-
250 x 150	6.0	Class 4	F	1680	216	-
250 x 150	6.3 #	Class 4	F	1760	228	-
300 x 100	8.0	Class 4	F	1020	200	-
300 x 200	6.0	Class 4	F	3570	334	-
300 x 200	6.3 #	Class 4	F	3750	354	-
300 x 200	8.0	Class 4	F	4930	485	-

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Rectangular Hollow Sections (CFRHS) and the Hybox® range of sections manufactured by Tata Steel is given in section 12.

- Indicates that the effective section property is not applicable due to the section classification and the gross property should be used.

\* Indicates that this parameter is not applicable to the section

F indicates that the section classification is controlled by the flange.

# Check availability

$W_{\text{el,eff},z}$  is the minimum value of the effective elastic modulus about the z-z axis for a Class 4 section.

$W_{\text{pl,eff},z}$  is not applicable for RHS.

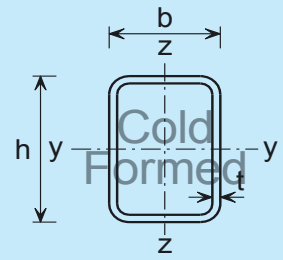
Only the sections which can be Class 3 or Class 4 when subject to pure bending are given in the table.

FOR EXPLANATION OF TABLES SEE NOTE 4.

# EFFECTIVE SECTION PROPERTIES

## COLD-FORMED RECTANGULAR HOLLOW SECTIONS

Hybox® RHS



Classification and effective section properties for sections subject to bending about z-z axis

Designation		S355 / Hybox®355				
Size h x b mm	Wall Thickness t mm	Classification		Properties		
				$I_{eff,z}$ cm <sup>4</sup>	$W_{el,eff,z}$ cm <sup>3</sup>	$W_{pl,eff,z}$ cm <sup>3</sup>
400 x 200	6.0 #	Class 4	F	4130	361	-
400 x 200	6.3 #	Class 4	F	4350	384	-
400 x 200	8.0	Class 4	F	5830	540	-
400 x 200	10.0	Class 4	F	7540	732	-
450 x 250	6.0 #	Class 4	F	7230	497	*
450 x 250	6.3 #	Class 4	F	7630	530	*
450 x 250	8.0 #	Class 4	F	10300	746	-
450 x 250	10.0 #	Class 4	F	13400	1020	-
450 x 250	12.0 #	Class 4	F	16300	1280	-
500 x 300	6.0 #	Class 4	F	11500	649	*
500 x 300	6.3 #	Class 4	F	12100	692	*
500 x 300	8.0 #	Class 4	F	16400	974	*
500 x 300	10.0 #	Class 4	F	21500	1340	-
500 x 300	12.0 #	Class 4	F	26300	1690	-
500 x 300	12.5 #	Class 4	F	27500	1780	-

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Rectangular Hollow Sections (CFRHS) and the Hybox® range of sections manufactured by Tata Steel is given in section 12.

- Indicates that the effective section property is not applicable due to the section classification and the gross property should be used.

\* Indicates that this parameter is not applicable to the section

F indicates that the section classification is controlled by the flange.

# Check availability

$W_{el,eff,z}$  is the minimum value of the effective elastic modulus about the z-z axis for a Class 4 section.

$W_{pl,eff,z}$  is not applicable for RHS.

Only the sections which can be Class 3 or Class 4 when subject to pure bending are given in the table.

FOR EXPLANATION OF TABLES SEE NOTE 4.

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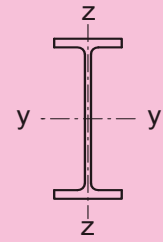
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**C. MEMBER RESISTANCES**

**S275**

UNIVERSAL BEAMS  
Advance® UKB



Section Designation	Axis	Compression resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ , $N_{b,T,Rd}$ (kN)												
		for												
		Buckling lengths (m)												
		2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
1016x305x487 +	$N_{b,y,Rd}$	15800	15800	15800	15800	15800	15800	15700	15600	15400	15200	15100	14900	14700
	$N_{b,z,Rd}$	14700	13300	11700	10000	8420	7000	5820	4870	4120	3520	3030	2640	2310
	$N_{b,T,Rd}$	15300	14300	13500	12900	12300	11900	11500	11200	11000	10800	10700	10500	10400
1016x305x437 +	$N_{b,y,Rd}$	14200	14200	14200	14200	14200	14200	14100	14000	13800	13700	13500	13400	13200
	$N_{b,z,Rd}$	13200	11900	10400	8920	7460	6180	5140	4300	3630	3100	2670	2320	2030
	$N_{b,T,Rd}$	13700	12800	12000	11400	10800	10300	9970	9670	9420	9220	9060	8920	8810
1016x305x393 +	$N_{b,y,Rd}$	12800	12800	12800	12800	12800	12800	12700	12500	12400	12300	12100	12000	11900
	$N_{b,z,Rd}$	11800	10600	9290	7910	6590	5450	4520	3770	3180	2710	2340	2030	1780
	$N_{b,T,Rd}$	12200	11400	10700	10000	9450	8980	8580	8260	8000	7780	7610	7460	7340
* 1016x305x349 +	$N_{b,y,Rd}$	<i>11400</i>	<i>11400</i>	<i>11400</i>	<i>11400</i>	<i>11400</i>	<i>11400</i>	<i>11400</i>	<i>11300</i>	<i>11200</i>	<i>11200</i>	11100	11100	11100
	$N_{b,z,Rd}$	11100	10300	9230	7960	6640	5450	4480	3710	3100	2630	2250	1950	1700
	$N_{b,T,Rd}$	11100	10600	10000	9470	8960	8500	8100	7760	7470	7230	7020	6860	6710
* 1016x305x314 +	$N_{b,y,Rd}$	<i>10000</i>	<i>10000</i>	<i>10000</i>	<i>10000</i>	<i>10000</i>	<i>10000</i>	<i>10000</i>	<i>9930</i>	<i>9870</i>	<i>9810</i>	<i>9740</i>	<i>9680</i>	<i>9610</i>
	$N_{b,z,Rd}$	<i>9510</i>	<i>8790</i>	<i>8250</i>	<i>7090</i>	<i>5900</i>	<i>4830</i>	<i>3960</i>	<i>3270</i>	<i>2740</i>	<i>2320</i>	<i>1980</i>	<i>1710</i>	<i>1500</i>
	$N_{b,T,Rd}$	<i>9740</i>	<i>9240</i>	<i>8740</i>	<i>8240</i>	<i>7750</i>	<i>7300</i>	<i>6900</i>	<i>6550</i>	<i>6260</i>	<i>6020</i>	<i>5810</i>	<i>5640</i>	<i>5500</i>
* 1016x305x272 +	$N_{b,y,Rd}$	<i>8400</i>	<i>8400</i>	<i>8400</i>	<i>8400</i>	<i>8400</i>	<i>8400</i>	<i>8370</i>	<i>8320</i>	<i>8260</i>	<i>8210</i>	<i>8160</i>	<i>8100</i>	<i>8050</i>
	$N_{b,z,Rd}$	<i>7970</i>	<i>7380</i>	<i>6670</i>	<i>5810</i>	<i>5100</i>	<i>4170</i>	<i>3420</i>	<i>2820</i>	<i>2360</i>	<i>2000</i>	<i>1710</i>	<i>1480</i>	<i>1290</i>
	$N_{b,T,Rd}$	<i>8150</i>	<i>7730</i>	<i>7300</i>	<i>6850</i>	<i>6400</i>	<i>5970</i>	<i>5580</i>	<i>5230</i>	<i>4940</i>	<i>4700</i>	<i>4490</i>	<i>4320</i>	<i>4180</i>
* 1016x305x249 +	$N_{b,y,Rd}$	<i>7600</i>	<i>7600</i>	<i>7600</i>	<i>7600</i>	<i>7600</i>	<i>7600</i>	<i>7570</i>	<i>7520</i>	<i>7470</i>	<i>7420</i>	<i>7370</i>	<i>7320</i>	<i>7270</i>
	$N_{b,z,Rd}$	<i>7180</i>	<i>6620</i>	<i>5930</i>	<i>5270</i>	<i>4430</i>	<i>3590</i>	<i>2920</i>	<i>2400</i>	<i>2010</i>	<i>1690</i>	<i>1450</i>	<i>1250</i>	<i>1090</i>
	$N_{b,T,Rd}$	<i>7360</i>	<i>6970</i>	<i>6550</i>	<i>6110</i>	<i>5660</i>	<i>5220</i>	<i>4830</i>	<i>4480</i>	<i>4180</i>	<i>3940</i>	<i>3730</i>	<i>3560</i>	<i>3420</i>
* 1016x305x222 +	$N_{b,y,Rd}$	<i>6660</i>	<i>6660</i>	<i>6660</i>	<i>6660</i>	<i>6660</i>	<i>6660</i>	<i>6620</i>	<i>6580</i>	<i>6540</i>	<i>6500</i>	<i>6450</i>	<i>6410</i>	<i>6360</i>
	$N_{b,z,Rd}$	<i>6250</i>	<i>5740</i>	<i>5090</i>	<i>4450</i>	<i>3720</i>	<i>2980</i>	<i>2410</i>	<i>1980</i>	<i>1650</i>	<i>1390</i>	<i>1190</i>	<i>1020</i>	<i>893</i>
	$N_{b,T,Rd}$	<i>6440</i>	<i>6080</i>	<i>5690</i>	<i>5280</i>	<i>4840</i>	<i>4420</i>	<i>4030</i>	<i>3700</i>	<i>3420</i>	<i>3180</i>	<i>2990</i>	<i>2830</i>	<i>2700</i>
914x419x388	$N_{b,y,Rd}$	13100	13100	13100	13100	13100	13100	13000	12900	12800	12700	12600	12500	12400
	$N_{b,z,Rd}$	12900	12400	11700	11000	10200	9280	8290	7310	6410	5610	4910	4320	3820
	$N_{b,T,Rd}$	13100	12600	12100	11700	11200	10800	10300	9930	9550	9210	8900	8630	8390
* 914x419x343	$N_{b,y,Rd}$	<i>11300</i>	<i>11300</i>	<i>11300</i>	<i>11300</i>	<i>11300</i>	<i>11300</i>	<i>11200</i>	<i>11100</i>	<i>11000</i>	<i>11000</i>	<i>10900</i>	10900	10900
	$N_{b,z,Rd}$	<i>11100</i>	<i>10900</i>	<i>10400</i>	<i>9710</i>	<i>8960</i>	<i>8120</i>	<i>7240</i>	<i>6370</i>	<i>5570</i>	<i>4860</i>	<i>4260</i>	<i>3740</i>	<i>3310</i>
	$N_{b,T,Rd}$	<i>11300</i>	<i>10900</i>	<i>10500</i>	<i>10000</i>	<i>9630</i>	<i>9210</i>	<i>8790</i>	<i>8390</i>	<i>8020</i>	<i>7670</i>	<i>7360</i>	<i>7090</i>	<i>6840</i>

Advance® and UKB are trademarks of Tata Steel. A fuller description of the relationship between Universal Beams (UB) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

+ These sections are in addition to the range of BS 4 sections.

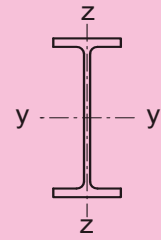
\* Section may be Class 4 under axial compression.

Values in italic type indicate that the section is a Class 4 section in pure compression and allowance has been made in calculating the resistance.

For values of the compression cross-sectional resistance  $N_{c,Rd}$ , see the values of  $N_{pl,Rd}$  in the tables for axial force and bending.

FOR EXPLANATION OF TABLES SEE NOTE 6.

UNIVERSAL BEAMS  
Advance® UKB



Section Designation	Axis	Compression resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ , $N_{b,T,Rd}$ (kN) for Buckling lengths (m)												
		2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
* 914x305x289	$N_{b,y,Rd}$	9380	9380	9380	9380	9380	9360	9300	9240	9170	9100	9040	8960	8890
	$N_{b,z,Rd}$	8900	8530	7670	6640	5560	4580	3760	3120	2610	2210	1900	1640	1430
	$N_{b,T,Rd}$	9110	8660	8190	7710	7240	6800	6400	6050	5750	5510	5300	5120	4970
* 914x305x253	$N_{b,y,Rd}$	7970	7970	7970	7970	7970	7960	7910	7860	7800	7750	7690	7630	7570
	$N_{b,z,Rd}$	7570	7020	6380	5770	4810	3940	3230	2680	2240	1900	1620	1400	1230
	$N_{b,T,Rd}$	7750	7350	6930	6500	6060	5640	5250	4910	4620	4370	4170	4000	3850
* 914x305x224	$N_{b,y,Rd}$	6880	6880	6880	6880	6880	6860	6820	6770	6730	6680	6630	6580	6520
	$N_{b,z,Rd}$	6520	6030	5440	4880	4140	3380	2760	2280	1900	1610	1380	1190	1040
	$N_{b,T,Rd}$	6680	6330	5960	5560	5150	4740	4370	4040	3760	3520	3330	3160	3020
* 914x305x201	$N_{b,y,Rd}$	6020	6020	6020	6020	6020	6010	5970	5930	5890	5840	5800	5760	5710
	$N_{b,z,Rd}$	5690	5250	4710	4070	3560	2880	2350	1930	1610	1360	1160	1000	876
	$N_{b,T,Rd}$	5840	5530	5190	4820	4430	4050	3690	3380	3110	2890	2700	2540	2410
* 838x292x226	$N_{b,y,Rd}$	7170	7170	7170	7170	7170	7130	7080	7030	6980	6920	6860	6800	6740
	$N_{b,z,Rd}$	6780	6260	5770	5050	4180	3410	2790	2300	1920	1630	1390	1200	1050
	$N_{b,T,Rd}$	6940	6570	6190	5790	5390	5010	4670	4370	4130	3920	3750	3600	3480
* 838x292x194	$N_{b,y,Rd}$	5950	5950	5950	5950	5950	5910	5870	5830	5780	5740	5690	5640	5590
	$N_{b,z,Rd}$	5610	5170	4620	4190	3430	2770	2260	1860	1550	1310	1120	966	843
	$N_{b,T,Rd}$	5750	5430	5100	4730	4360	4000	3670	3390	3150	2950	2780	2640	2530
* 838x292x176	$N_{b,y,Rd}$	5290	5290	5290	5290	5290	5260	5220	5180	5140	5100	5060	5010	4960
	$N_{b,z,Rd}$	4980	4570	4070	3500	3000	2420	1960	1610	1340	1130	966	834	727
	$N_{b,T,Rd}$	5110	4820	4510	4170	3820	3480	3160	2890	2660	2470	2310	2180	2070
* 762x267x197	$N_{b,y,Rd}$	6340	6340	6340	6340	6320	6270	6220	6170	6110	6050	5990	5930	5860
	$N_{b,z,Rd}$	5910	5590	4850	4010	3220	2580	2080	1710	1420	1190	1020	880	767
	$N_{b,T,Rd}$	6070	5710	5340	4960	4590	4260	3980	3750	3560	3400	3280	3170	3080
* 762x267x173	$N_{b,y,Rd}$	5420	5420	5420	5420	5400	5360	5310	5270	5220	5170	5120	5070	5010
	$N_{b,z,Rd}$	5040	4570	4190	3430	2740	2180	1760	1440	1190	1000	857	739	644
	$N_{b,T,Rd}$	5180	4870	4530	4170	3820	3510	3230	3000	2810	2660	2540	2430	2350
* 762x267x147	$N_{b,y,Rd}$	4440	4440	4440	4440	4430	4390	4360	4320	4280	4240	4200	4150	4110
	$N_{b,z,Rd}$	4120	3730	3240	2810	2220	1760	1410	1150	956	804	686	591	514
	$N_{b,T,Rd}$	4240	3980	3680	3360	3040	2750	2490	2270	2100	1960	1840	1750	1670
* 762x267x134	$N_{b,y,Rd}$	4100	4100	4100	4100	4080	4050	4020	3980	3940	3910	3870	3820	3780
	$N_{b,z,Rd}$	3790	3410	2940	2440	2000	1570	1260	1020	848	713	607	523	455
	$N_{b,T,Rd}$	3910	3650	3360	3050	2730	2430	2180	1970	1800	1670	1560	1470	1390

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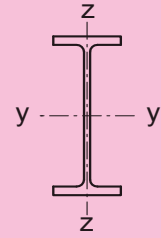
\* Section may be Class 4 under axial compression.

Values in italic type indicate that the section is a Class 4 section in pure compression and allowance has been made in calculating the resistance.

For values of the compression cross-sectional resistance  $N_{c,Rd}$ , see the values of  $N_{pl,Rd}$  in the tables for axial force and bending.

FOR EXPLANATION OF TABLES SEE NOTE 6.

UNIVERSAL BEAMS  
Advance® UKB



Section Designation	Axis	Compression resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ , $N_{b,T,Rd}$ (kN)												
		for												
		Buckling lengths (m)												
		2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
* 686x254x170	$N_{b,y,Rd}$	5540	5540	5540	5540	5490	5440	5390	5340	5280	5220	5170	5170	5170
	$N_{b,z,Rd}$	5170	4770	4100	3350	2670	2120	1710	1390	1160	975	831	717	624
	$N_{b,T,Rd}$	5280	4950	4610	4270	3950	3680	3450	3260	3100	2980	2880	2800	2730
* 686x254x152	$N_{b,y,Rd}$	4840	4840	4840	4840	4800	4750	4710	4660	4610	4560	4510	4450	4390
	$N_{b,z,Rd}$	4470	4040	3630	2950	2340	1860	1490	1220	1010	851	726	626	545
	$N_{b,T,Rd}$	4600	4310	4000	3680	3380	3110	2880	2690	2540	2410	2320	2230	2170
* 686x254x140	$N_{b,y,Rd}$	4360	4360	4360	4360	4320	4280	4240	4200	4160	4110	4060	4010	3960
	$N_{b,z,Rd}$	4030	3640	3280	2670	2110	1670	1340	1090	907	763	650	561	488
	$N_{b,T,Rd}$	4150	3880	3590	3290	2990	2730	2510	2320	2170	2050	1960	1880	1810
* 686x254x125	$N_{b,y,Rd}$	3810	3810	3810	3810	3780	3750	3710	3680	3640	3600	3550	3510	3460
	$N_{b,z,Rd}$	3510	3160	2710	2310	1810	1430	1140	930	770	647	551	475	413
	$N_{b,T,Rd}$	3620	3380	3110	2830	2550	2290	2080	1900	1760	1650	1550	1480	1420
610x305x238	$N_{b,y,Rd}$	8030	8030	8030	8000	7930	7850	7760	7680	7590	7490	7380	7270	7140
	$N_{b,z,Rd}$	7700	7210	6620	5910	5110	4320	3620	3040	2570	2190	1880	1630	1430
	$N_{b,T,Rd}$	7830	7470	7140	6840	6570	6330	6130	5960	5820	5700	5610	5530	5460
610x305x179	$N_{b,y,Rd}$	6040	6040	6040	6020	5960	5900	5830	5770	5700	5620	5540	5450	5350
	$N_{b,z,Rd}$	5780	5400	4930	4380	3760	3160	2640	2210	1860	1580	1360	1180	1030
	$N_{b,T,Rd}$	5870	5580	5280	4990	4700	4430	4190	3990	3810	3670	3540	3440	3350
* 610x305x149	$N_{b,y,Rd}$	4810	4810	4810	4800	4750	4700	4650	4600	4550	4490	4420	4350	4280
	$N_{b,z,Rd}$	4610	4310	4010	3620	3100	2600	2170	1810	1530	1300	1110	966	845
	$N_{b,T,Rd}$	4680	4440	4190	3930	3670	3430	3200	3000	2820	2680	2560	2460	2370
* 610x229x140	$N_{b,y,Rd}$	4560	4560	4560	4540	4500	4450	4400	4350	4340	4340	4290	4220	4140
	$N_{b,z,Rd}$	4270	3760	3120	2460	1910	1490	1190	968	800	672	572	493	428
	$N_{b,T,Rd}$	4290	3990	3690	3400	3140	2930	2760	2620	2510	2430	2360	2300	2260
* 610x229x125	$N_{b,y,Rd}$	3980	3980	3980	3960	3920	3880	3840	3800	3750	3700	3640	3580	3510
	$N_{b,z,Rd}$	3620	3330	2760	2160	1670	1310	1040	846	699	587	500	430	374
	$N_{b,T,Rd}$	3740	3470	3190	2910	2650	2440	2270	2130	2030	1940	1870	1820	1770
* 610x229x113	$N_{b,y,Rd}$	3540	3540	3540	3520	3480	3450	3410	3370	3330	3280	3230	3180	3120
	$N_{b,z,Rd}$	3210	2830	2460	1910	1470	1150	914	742	613	514	437	376	327
	$N_{b,T,Rd}$	3320	3070	2800	2540	2290	2080	1910	1780	1670	1590	1520	1460	1420
* 610x229x101	$N_{b,y,Rd}$	3210	3210	3210	3190	3150	3120	3090	3050	3010	2970	2920	2870	2810
	$N_{b,z,Rd}$	2890	2530	2190	1670	1270	989	784	635	524	439	373	321	279
	$N_{b,T,Rd}$	3000	2760	2500	2230	1980	1760	1600	1460	1360	1280	1210	1160	1120

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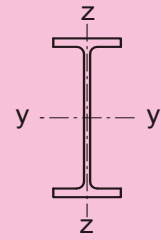
\* Section may be Class 4 under axial compression.

Values in italic type indicate that the section is a Class 4 section in pure compression and allowance has been made in calculating the resistance.

For values of the compression cross-sectional resistance  $N_{c,Rd}$ , see the values of  $N_{pl,Rd}$  in the tables for axial force and bending.

FOR EXPLANATION OF TABLES SEE NOTE 6.

UNIVERSAL BEAMS  
Advance® UKB



Section Designation	Axis	Compression resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ , $N_{b,T,Rd}$ (kN)												
		for												
		Buckling lengths (m)												
		2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
* 610x178x100 +	$N_{b,y,Rd}$	3120	3120	3120	3100	3070	3040	3000	2970	2930	2880	2840	2790	2730
	$N_{b,z,Rd}$	2610	2150	1520	1080	789	599	469	377	309	258	219	188	163
	$N_{b,T,Rd}$	2800	2510	2210	1940	1740	1590	1470	1390	1330	1280	1240	1210	1190
* 610x178x92 +	$N_{b,y,Rd}$	2900	2900	2900	2880	2850	2810	2780	2740	2710	2670	2620	2570	2520
	$N_{b,z,Rd}$	2390	1950	1350	945	689	522	408	328	269	224	190	163	141
	$N_{b,T,Rd}$	2590	2290	1980	1720	1510	1360	1250	1170	1110	1060	1030	997	973
* 610x178x82 +	$N_{b,y,Rd}$	2490	2490	2490	2480	2450	2420	2390	2360	2330	2300	2260	2220	2170
	$N_{b,z,Rd}$	2050	1610	1150	800	582	440	344	276	226	188	160	137	119
	$N_{b,T,Rd}$	2220	1950	1670	1420	1230	1090	985	910	854	811	778	751	730
533x312x272 +	$N_{b,y,Rd}$	9220	9220	9220	9150	9050	8950	8840	8720	8600	8460	8320	8150	7970
	$N_{b,z,Rd}$	8910	8390	7770	7040	6200	5330	4530	3830	3260	2790	2410	2090	1830
	$N_{b,T,Rd}$	9040	8690	8390	8140	7930	7770	7640	7530	7450	7380	7330	7280	7250
533x312x219 +	$N_{b,y,Rd}$	7390	7390	7390	7320	7240	7160	7070	6970	6870	6750	6630	6490	6340
	$N_{b,z,Rd}$	7120	6690	6170	5550	4850	4140	3500	2950	2500	2130	1840	1600	1400
	$N_{b,T,Rd}$	7220	6900	6610	6350	6110	5910	5750	5610	5490	5400	5320	5250	5190
533x312x182 +	$N_{b,y,Rd}$	6120	6120	6120	6060	5990	5920	5850	5770	5680	5580	5480	5360	5230
	$N_{b,z,Rd}$	5890	5520	5090	4570	3980	3390	2850	2400	2030	1730	1490	1300	1140
	$N_{b,T,Rd}$	5960	5680	5410	5150	4910	4690	4490	4330	4190	4080	3980	3900	3830
533x312x150 +	$N_{b,y,Rd}$	5090	5090	5090	5040	4980	4920	4850	4790	4710	4630	4540	4440	4330
	$N_{b,z,Rd}$	4890	4580	4210	3770	3280	2780	2340	1960	1660	1420	1220	1060	926
	$N_{b,T,Rd}$	4950	4700	4450	4200	3950	3720	3510	3330	3170	3040	2930	2840	2760
533x210x138 +	$N_{b,y,Rd}$	4660	4660	4660	4610	4550	4490	4430	4370	4290	4210	4130	4030	3920
	$N_{b,z,Rd}$	4160	3590	2880	2210	1690	1310	1040	841	694	582	494	425	370
	$N_{b,T,Rd}$	4340	4040	3760	3520	3330	3180	3060	2970	2900	2840	2800	2760	2730
533x210x122	$N_{b,y,Rd}$	4110	4110	4100	4060	4010	3960	3900	3850	3780	3710	3630	3550	3450
	$N_{b,z,Rd}$	3660	3160	2530	1940	1480	1150	910	737	608	510	434	373	324
	$N_{b,T,Rd}$	3810	3530	3250	3000	2800	2630	2510	2410	2340	2280	2230	2190	2160
* 533x210x109	$N_{b,y,Rd}$	3580	3580	3580	3540	3490	3480	3480	3440	3390	3320	3250	3170	3080
	$N_{b,z,Rd}$	3270	2810	2240	1700	1290	1000	795	643	531	445	378	325	282
	$N_{b,T,Rd}$	3320	3060	2790	2550	2340	2180	2050	1950	1870	1810	1770	1730	1700
* 533x210x101	$N_{b,y,Rd}$	3270	3270	3270	3230	3190	3150	3110	3060	3010	2960	2900	2890	2860
	$N_{b,z,Rd}$	2910	2600	2060	1570	1190	921	729	590	487	408	346	298	259
	$N_{b,T,Rd}$	3020	2780	2520	2280	2080	1920	1790	1690	1610	1550	1510	1470	1440
* 533x210x92	$N_{b,y,Rd}$	3010	3010	3000	2970	2930	2900	2860	2810	2770	2710	2660	2590	2520
	$N_{b,z,Rd}$	2670	2360	1880	1410	1060	820	649	524	432	362	307	264	229
	$N_{b,T,Rd}$	2780	2540	2280	2040	1830	1660	1530	1430	1360	1300	1250	1210	1180
* 533x210x82	$N_{b,y,Rd}$	2650	2650	2650	2620	2580	2550	2520	2480	2430	2390	2340	2280	2210
	$N_{b,z,Rd}$	2340	1990	1630	1210	910	700	552	446	367	307	261	224	195
	$N_{b,T,Rd}$	2440	2220	1980	1740	1530	1370	1240	1150	1070	1020	972	936	907

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+ These sections are in addition to the range of BS 4 sections.

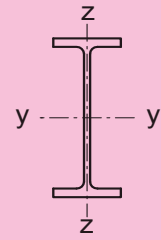
\* Section may be Class 4 under axial compression.

Values in italic type indicate that the section is a Class 4 section in pure compression and allowance has been made in calculating the resistance.

For values of the compression cross-sectional resistance  $N_{c,Rd}$ , see the values of  $N_{pl,Rd}$  in the tables for axial force and bending.

FOR EXPLANATION OF TABLES SEE NOTE 6.

UNIVERSAL BEAMS  
Advance® UKB



Section Designation	Axis	Compression resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ , $N_{b,T,Rd}$ (kN)												
		for												
		Buckling lengths (m)												
		2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
* 533x165x85 +	$N_{b,y,Rd}$	2680	2680	2680	2650	2620	2580	2550	2510	2470	2420	2370	2310	2240
	$N_{b,z,Rd}$	2240	1730	1200	842	614	465	364	292	239	200	169	145	126
	$N_{b,T,Rd}$	2380	2110	1860	1650	1490	1380	1300	1240	1190	1160	1130	1110	1090
* 533x165x74 +	$N_{b,y,Rd}$	2390	2390	2380	2350	2320	2290	2260	2220	2180	2140	2090	2040	1980
	$N_{b,z,Rd}$	1910	1490	1000	696	505	381	298	239	195	163	138	118	102
	$N_{b,T,Rd}$	2090	1830	1560	1350	1190	1080	1000	941	898	865	839	818	802
* 533x165x66 +	$N_{b,y,Rd}$	2030	2030	2030	2000	1980	1950	1920	1890	1860	1820	1780	1740	1680
	$N_{b,z,Rd}$	1620	1260	841	580	420	317	247	198	162	135	114	98.0	84.9
	$N_{b,T,Rd}$	1780	1540	1290	1090	946	843	770	716	677	646	623	604	590
457x191x161 +	$N_{b,y,Rd}$	5460	5460	5420	5350	5280	5200	5110	5020	4910	4790	4660	4500	4330
	$N_{b,z,Rd}$	4830	4130	3280	2490	1890	1460	1160	935	771	646	549	472	410
	$N_{b,T,Rd}$	5110	4850	4670	4550	4460	4400	4350	4320	4300	4280	4260	4250	4240
457x191x133 +	$N_{b,y,Rd}$	4510	4510	4470	4410	4350	4280	4210	4130	4040	3940	3820	3690	3540
	$N_{b,z,Rd}$	3960	3360	2640	1980	1500	1150	913	738	608	509	432	372	323
	$N_{b,T,Rd}$	4180	3920	3720	3570	3450	3370	3310	3270	3230	3210	3190	3170	3160
457x191x106 +	$N_{b,y,Rd}$	3580	3580	3550	3500	3450	3390	3330	3270	3190	3110	3010	2900	2780
	$N_{b,z,Rd}$	3130	2620	2030	1510	1140	874	690	557	459	384	326	280	243
	$N_{b,T,Rd}$	3290	3040	2820	2640	2500	2390	2310	2250	2200	2170	2140	2120	2100
457x191x98	$N_{b,y,Rd}$	3310	3310	3290	3240	3190	3140	3090	3030	2960	2880	2790	2690	2580
	$N_{b,z,Rd}$	2900	2430	1880	1400	1060	813	642	518	427	357	303	261	226
	$N_{b,T,Rd}$	3040	2800	2570	2390	2240	2130	2050	1980	1940	1900	1870	1840	1830
457x191x89	$N_{b,y,Rd}$	3020	3020	3000	2950	2910	2860	2810	2760	2690	2620	2540	2450	2340
	$N_{b,z,Rd}$	2630	2210	1700	1260	948	729	576	465	383	320	272	234	203
	$N_{b,T,Rd}$	2760	2520	2290	2100	1940	1830	1740	1670	1620	1580	1550	1520	1500
* 457x191x82	$N_{b,y,Rd}$	2770	2770	2740	2710	2660	2620	2620	2600	2530	2460	2380	2280	2180
	$N_{b,z,Rd}$	2470	2040	1550	1140	850	652	514	414	341	285	242	208	180
	$N_{b,T,Rd}$	2520	2290	2060	1860	1700	1580	1490	1420	1370	1330	1300	1270	1250
* 457x191x74	$N_{b,y,Rd}$	2460	2460	2440	2410	2370	2340	2290	2250	2200	2140	2070	2040	1980
	$N_{b,z,Rd}$	2140	1850	1400	1020	764	586	461	372	306	256	217	187	162
	$N_{b,T,Rd}$	2240	2020	1810	1610	1450	1330	1240	1170	1120	1080	1040	1020	999
* 457x191x67	$N_{b,y,Rd}$	2190	2190	2170	2140	2110	2070	2040	2000	1950	1900	1830	1770	1690
	$N_{b,z,Rd}$	1900	1650	1230	899	669	512	403	324	267	223	189	163	141
	$N_{b,T,Rd}$	1990	1790	1580	1390	1230	1110	1020	956	905	866	836	811	791

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+ These sections are in addition to the range of BS 4 sections.

\* Section may be Class 4 under axial compression.

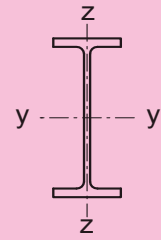
Values in italic type indicate that the section is a Class 4 section in pure compression and allowance has been made in calculating the resistance.

For values of the compression cross-sectional resistance  $N_{c,Rd}$ , see the values of  $N_{pl,Rd}$  in the tables for axial force and bending.

FOR EXPLANATION OF TABLES SEE NOTE 6.



UNIVERSAL BEAMS  
Advance® UKB



Section Designation	Axis	Compression resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ , $N_{b,T,Rd}$ (kN)												
		for												
		Buckling lengths (m)												
		1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
457x152x82	$N_{b,y,Rd}$	2780	2780	2780	2780	2780	2780	2760	2720	2680	2630	2590	2530	2470
	$N_{b,z,Rd}$	2650	2460	2230	1950	1650	1370	1130	791	576	436	341	273	224
	$N_{b,T,Rd}$	2700	2570	2440	2310	2190	2080	1980	1820	1710	1630	1570	1530	1500
* 457x152x74	$N_{b,y,Rd}$	2410	2410	2410	2410	2410	2410	2390	2360	2320	2290	2250	2250	2220
	$N_{b,z,Rd}$	2300	2200	1990	1740	1470	1210	1000	698	507	384	300	240	197
	$N_{b,T,Rd}$	2350	2230	2110	2000	1880	1770	1680	1520	1410	1330	1280	1240	1210
* 457x152x67	$N_{b,y,Rd}$	2220	2220	2220	2220	2220	2210	2200	2160	2130	2100	2060	2010	1970
	$N_{b,z,Rd}$	2100	1950	1840	1590	1320	1080	889	616	447	337	263	211	173
	$N_{b,T,Rd}$	2150	2040	1920	1810	1690	1570	1470	1310	1190	1110	1050	1010	976
* 457x152x60	$N_{b,y,Rd}$	1920	1920	1920	1920	1920	1910	1900	1870	1850	1820	1780	1750	1700
	$N_{b,z,Rd}$	1820	1690	1520	1380	1160	948	777	537	389	293	229	183	150
	$N_{b,T,Rd}$	1860	1760	1660	1550	1440	1340	1240	1080	964	885	828	788	757
* 457x152x52	$N_{b,y,Rd}$	1630	1630	1630	1630	1630	1630	1620	1600	1570	1550	1520	1490	1450
	$N_{b,z,Rd}$	1540	1430	1280	1110	968	785	639	439	317	239	186	149	122
	$N_{b,T,Rd}$	1580	1500	1410	1310	1200	1100	1010	856	748	673	621	583	555
406x178x85 +	$N_{b,y,Rd}$	2890	2890	2890	2890	2890	2870	2850	2800	2750	2700	2640	2580	2500
	$N_{b,z,Rd}$	2810	2660	2490	2280	2050	1790	1540	1130	844	647	509	411	338
	$N_{b,T,Rd}$	2850	2740	2620	2510	2410	2310	2220	2070	1960	1880	1810	1770	1730
406x178x74	$N_{b,y,Rd}$	2600	2600	2600	2600	2600	2580	2560	2520	2470	2420	2370	2300	2230
	$N_{b,z,Rd}$	2520	2380	2210	2020	1790	1550	1330	964	715	546	429	346	284
	$N_{b,T,Rd}$	2560	2450	2340	2230	2110	2010	1910	1740	1610	1520	1450	1400	1360
* 406x178x67	$N_{b,y,Rd}$	2280	2280	2280	2280	2280	2260	2250	2210	2170	2170	2140	2080	2010
	$N_{b,z,Rd}$	2210	2150	1990	1810	1610	1390	1180	855	633	483	380	306	251
	$N_{b,T,Rd}$	2240	2150	2050	1950	1840	1740	1650	1480	1350	1260	1190	1140	1100
* 406x178x60	$N_{b,y,Rd}$	1990	1990	1990	1990	1990	1980	1960	1930	1900	1860	1820	1770	1720
	$N_{b,z,Rd}$	1930	1830	1700	1620	1430	1240	1050	759	562	429	337	271	223
	$N_{b,T,Rd}$	1960	1880	1790	1700	1600	1510	1410	1250	1130	1030	965	914	876
* 406x178x54	$N_{b,y,Rd}$	1780	1780	1780	1780	1780	1760	1750	1720	1690	1660	1620	1580	1530
	$N_{b,z,Rd}$	1720	1620	1510	1410	1260	1080	910	652	480	366	287	231	190
	$N_{b,T,Rd}$	1750	1670	1590	1500	1410	1320	1220	1060	938	847	780	731	694

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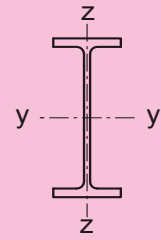
\* Section may be Class 4 under axial compression.

Values in italic type indicate that the section is a Class 4 section in pure compression and allowance has been made in calculating the resistance.

For values of the compression cross-sectional resistance  $N_{c,Rd}$ , see the values of  $N_{pl,Rd}$  in the tables for axial force and bending.

FOR EXPLANATION OF TABLES SEE NOTE 6.

UNIVERSAL BEAMS  
Advance® UKB



Section Designation	Axis	Compression resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ , $N_{b,T,Rd}$ (kN)												
		for												
		Buckling lengths (m)												
		1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
* 406x140x53 +	$N_{b,y,Rd}$	1760	1760	1760	1760	1760	1740	1730	1700	1670	1640	1600	1550	1500
	$N_{b,z,Rd}$	1650	1520	1410	1190	967	781	635	435	314	237	184	148	121
	$N_{b,T,Rd}$	1690	1600	1500	1390	1290	1200	1120	987	899	838	795	765	742
* 406x140x46	$N_{b,y,Rd}$	1460	1460	1460	1460	1460	1450	1440	1410	1390	1360	1330	1300	1260
	$N_{b,z,Rd}$	1370	1260	1120	965	824	665	539	369	266	200	156	125	102
	$N_{b,T,Rd}$	1410	1330	1240	1150	1060	967	889	766	682	625	584	556	534
* 406x140x39	$N_{b,y,Rd}$	1200	1200	1200	1200	1200	1190	1180	1160	1140	1120	1090	1060	1030
	$N_{b,z,Rd}$	1120	1030	905	763	650	519	418	284	204	154	120	95.6	78.2
	$N_{b,T,Rd}$	1160	1090	1010	927	840	757	684	569	493	441	405	379	360
356x171x67	$N_{b,y,Rd}$	2350	2350	2350	2350	2340	2320	2300	2250	2200	2150	2080	2010	1920
	$N_{b,z,Rd}$	2280	2150	1990	1810	1610	1390	1180	855	633	483	380	306	251
	$N_{b,T,Rd}$	2310	2210	2110	2010	1920	1830	1760	1630	1530	1470	1420	1380	1350
356x171x57	$N_{b,y,Rd}$	2000	2000	2000	2000	1980	1970	1950	1910	1870	1820	1760	1700	1620
	$N_{b,z,Rd}$	1930	1810	1680	1520	1340	1150	978	703	519	396	311	250	205
	$N_{b,T,Rd}$	1960	1870	1770	1680	1590	1500	1420	1280	1170	1100	1040	1000	972
* 356x171x51	$N_{b,y,Rd}$	1720	1720	1720	1720	1710	1700	1680	1650	1610	1580	1570	1510	1440
	$N_{b,z,Rd}$	1670	1580	1500	1350	1190	1020	859	616	454	346	271	218	179
	$N_{b,T,Rd}$	1690	1610	1530	1450	1360	1280	1200	1060	961	888	834	794	765
* 356x171x45	$N_{b,y,Rd}$	1500	1500	1500	1500	1490	1480	1460	1430	1400	1370	1320	1270	1260
	$N_{b,z,Rd}$	1450	1360	1270	1170	1020	870	732	521	383	291	228	183	151
	$N_{b,T,Rd}$	1470	1400	1330	1250	1170	1090	1010	877	777	705	652	614	585
* 356x127x39	$N_{b,y,Rd}$	1280	1280	1280	1280	1270	1260	1250	1220	1190	1160	1130	1080	1030
	$N_{b,z,Rd}$	1180	1060	941	754	592	466	373	252	181	135	105	84.0	68.7
	$N_{b,T,Rd}$	1210	1130	1050	959	876	804	744	656	599	561	535	517	503
* 356x127x33	$N_{b,y,Rd}$	1050	1050	1050	1050	1040	1030	1020	1000	978	952	922	886	844
	$N_{b,z,Rd}$	960	857	727	608	473	371	296	199	142	107	82.7	66.1	54.0
	$N_{b,T,Rd}$	991	922	846	765	687	619	562	479	426	391	367	350	338

Advance® and UKB are trademarks of Tata Steel. A fuller description of the relationship between Universal Beams (UB) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

+ These sections are in addition to the range of BS 4 sections.

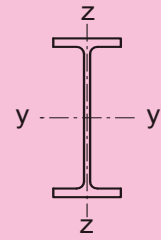
\* Section may be Class 4 under axial compression.

Values in italic type indicate that the section is a Class 4 section in pure compression and allowance has been made in calculating the resistance.

For values of the compression cross-sectional resistance  $N_{c,Rd}$ , see the values of  $N_{pl,Rd}$  in the tables for axial force and bending.

FOR EXPLANATION OF TABLES SEE NOTE 6.

UNIVERSAL BEAMS  
Advance® UKB



Section Designation	Axis	Compression resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ , $N_{b,T,Rd}$ (kN)												
		for												
		Buckling lengths (m)												
		1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
305x165x54	$N_{b,y,Rd}$	1890	1890	1890	1880	1860	1840	1820	1780	1730	1670	1600	1510	1410
	$N_{b,z,Rd}$	1830	1720	1600	1450	1280	1100	933	672	496	379	297	239	196
* 305x165x46	$N_{b,T,Rd}$	1850	1770	1690	1610	1530	1460	1400	1300	1230	1180	1140	1120	1090
	$N_{b,y,Rd}$	<i>1580</i>	<i>1580</i>	<i>1580</i>	<i>1580</i>	1570	1570	1560	1520	1480	1420	1360	1290	1200
* 305x165x40	$N_{b,z,Rd}$	<i>1560</i>	<i>1470</i>	<i>1360</i>	<i>1230</i>	1080	929	788	566	418	319	250	201	165
	$N_{b,T,Rd}$	1550	1480	1400	1330	1260	1190	1130	1020	945	891	851	821	799
	$N_{b,y,Rd}$	<i>1360</i>	<i>1360</i>	<i>1360</i>	<i>1350</i>	<i>1340</i>	<i>1320</i>	<i>1310</i>	<i>1280</i>	<i>1240</i>	<i>1200</i>	1150	1120	1040
	$N_{b,z,Rd}$	<i>1310</i>	<i>1240</i>	1150	1070	937	803	679	487	359	273	214	173	142
	$N_{b,T,Rd}$	<i>1330</i>	<i>1260</i>	<i>1200</i>	1130	1060	993	930	825	747	692	651	622	600
	305x127x48	$N_{b,y,Rd}$	1680	1680	1680	1670	1650	1640	1620	1580	1530	1470	1400	1310
$N_{b,z,Rd}$		1540	1380	1180	951	751	594	477	322	231	173	135	108	88.0
305x127x42	$N_{b,T,Rd}$	1600	1500	1420	1340	1270	1220	1180	1110	1080	1050	1030	1020	1010
	$N_{b,y,Rd}$	1470	1470	1470	1460	1440	1430	1410	1370	1330	1280	1210	1140	1050
305x127x37	$N_{b,z,Rd}$	1340	1200	1010	816	641	506	406	274	196	147	114	91.4	74.7
	$N_{b,T,Rd}$	1390	1300	1210	1130	1060	1000	953	885	841	812	792	778	767
	$N_{b,y,Rd}$	1300	1300	1300	1290	1270	1260	1250	1210	1170	1130	1070	1000	921
	$N_{b,z,Rd}$	1190	1050	889	711	558	439	352	237	170	127	99.0	79.1	64.6
	$N_{b,T,Rd}$	1220	1140	1060	975	902	840	790	718	672	642	621	606	596
	* 305x102x33	$N_{b,y,Rd}$	<i>1100</i>	<i>1100</i>	<i>1100</i>	<i>1100</i>	<i>1090</i>	<i>1070</i>	<i>1060</i>	<i>1040</i>	1030	1000	954	895
$N_{b,z,Rd}$		998	830	635	469	351	270	213	141	100	74.8	57.9	46.2	37.7
* 305x102x28	$N_{b,T,Rd}$	1010	928	842	764	700	651	612	561	530	510	496	487	480
	$N_{b,y,Rd}$	<i>921</i>	<i>921</i>	<i>921</i>	<i>916</i>	<i>906</i>	<i>896</i>	<i>886</i>	<i>864</i>	<i>837</i>	<i>806</i>	<i>768</i>	<i>756</i>	<i>695</i>
* 305x102x25	$N_{b,z,Rd}$	<i>800</i>	696	524	383	285	219	172	114	80.9	60.3	46.7	37.2	30.3
	$N_{b,T,Rd}$	844	767	687	611	548	499	461	411	381	361	348	339	332
	$N_{b,y,Rd}$	<i>797</i>	<i>797</i>	<i>797</i>	<i>791</i>	<i>783</i>	<i>774</i>	<i>765</i>	<i>745</i>	<i>722</i>	<i>694</i>	<i>659</i>	<i>629</i>	<i>598</i>
	$N_{b,z,Rd}$	<i>683</i>	<i>587</i>	430	310	229	175	137	90.7	64.2	47.9	37.0	29.5	24.0
	$N_{b,T,Rd}$	<i>726</i>	<i>654</i>	576	502	441	394	359	312	284	266	255	246	240

Advance® and UKB are trademarks of Tata Steel. A fuller description of the relationship between Universal Beams (UB) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

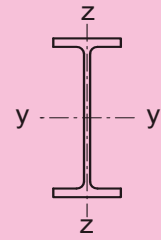
\* Section may be Class 4 under axial compression.

Values in italic type indicate that the section is a Class 4 section in pure compression and allowance has been made in calculating the resistance.

For values of the compression cross-sectional resistance  $N_{c,Rd}$ , see the values of  $N_{pl,Rd}$  in the tables for axial force and bending.

FOR EXPLANATION OF TABLES SEE NOTE 6.

UNIVERSAL BEAMS  
Advance® UKB



Section Designation	Axis	Compression resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ , $N_{b,T,Rd}$ (kN)												
		for												
		Buckling lengths (m)												
		1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
254x146x43	$N_{b,y,Rd}$	1510	1510	1500	1490	1470	1450	1430	1380	1320	1250	1160	1050	943
	$N_{b,z,Rd}$	1440	1340	1220	1070	917	766	637	447	326	247	193	155	127
254x146x37	$N_{b,T,Rd}$	1460	1390	1320	1260	1200	1150	1110	1050	1010	983	963	949	938
	$N_{b,y,Rd}$	1300	1300	1290	1280	1260	1250	1230	1190	1130	1070	991	900	803
254x146x31	$N_{b,z,Rd}$	1240	1150	1040	918	781	650	539	378	275	208	163	131	107
	$N_{b,T,Rd}$	1250	1190	1120	1060	1000	949	905	836	789	756	734	717	705
254x146x31	$N_{b,y,Rd}$	1090	1090	1090	1070	1060	1040	1030	992	946	888	817	736	653
	$N_{b,z,Rd}$	1040	958	864	752	632	522	430	299	217	164	128	103	84.3
254x102x28	$N_{b,T,Rd}$	1050	992	931	869	808	752	703	627	576	540	515	497	484
	$N_{b,y,Rd}$	993	993	989	976	964	950	935	902	860	808	743	669	594
254x102x25	$N_{b,z,Rd}$	869	732	569	425	320	246	195	129	92.0	68.7	53.2	42.4	34.6
	$N_{b,T,Rd}$	913	839	768	707	658	620	591	551	528	512	502	495	489
* 254x102x22	$N_{b,y,Rd}$	880	880	875	864	853	840	827	796	758	709	649	582	513
	$N_{b,z,Rd}$	764	635	486	359	269	207	163	108	76.8	57.3	44.4	35.4	28.8
* 254x102x22	$N_{b,T,Rd}$	805	733	662	598	546	505	475	434	410	394	383	376	371
	$N_{b,y,Rd}$	750	750	750	750	745	734	722	694	658	613	559	498	438
* 254x102x22	$N_{b,z,Rd}$	660	539	404	295	219	168	132	87.4	62.0	46.2	35.7	28.5	23.2
	$N_{b,T,Rd}$	681	616	548	485	434	395	366	327	304	289	279	272	267
203x133x30	$N_{b,y,Rd}$	1050	1050	1040	1020	1000	983	961	909	840	753	657	563	481
	$N_{b,z,Rd}$	988	907	807	689	568	463	378	260	188	142	111	88.7	72.6
203x133x25	$N_{b,T,Rd}$	1000	947	894	847	805	771	743	702	675	658	645	636	630
	$N_{b,y,Rd}$	880	880	866	853	838	821	803	757	696	621	539	460	392
203x133x25	$N_{b,z,Rd}$	825	755	668	565	463	375	306	210	152	114	89.0	71.3	58.3
	$N_{b,T,Rd}$	838	786	735	686	641	603	571	524	493	472	458	448	440
203x102x23	$N_{b,y,Rd}$	809	808	795	783	769	753	736	693	635	564	488	416	353
	$N_{b,z,Rd}$	719	619	495	378	288	223	177	118	84.1	62.9	48.7	38.9	31.7
203x102x23	$N_{b,T,Rd}$	746	692	644	605	574	551	534	510	495	486	480	475	472
	$N_{b,y,Rd}$	668	664	652	639	625	609	591	543	480	408	341	284	238
178x102x19	$N_{b,z,Rd}$	595	513	411	314	239	186	147	98.3	70.1	52.4	40.6	32.4	26.4
	$N_{b,T,Rd}$	615	569	528	494	468	448	433	412	400	392	387	383	380
152x89x16	$N_{b,y,Rd}$	558	550	538	524	509	491	468	410	341	276	223	183	151
	$N_{b,z,Rd}$	481	396	300	220	164	126	99.0	65.6	46.6	34.7	26.9	21.4	17.5
152x89x16	$N_{b,T,Rd}$	506	469	440	419	404	393	386	376	370	366	363	362	360
	$N_{b,y,Rd}$	452	441	429	414	396	373	344	278	215	168	133	107	88.2
127x76x13	$N_{b,z,Rd}$	374	289	204	145	106	80.7	63.2	41.6	29.5	21.9	16.9	13.5	11.0
	$N_{b,T,Rd}$	406	382	366	356	349	345	342	338	336	334	333	333	332

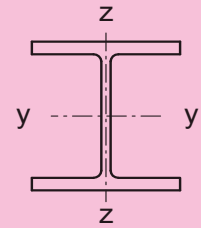
Advance® and UKB are trademarks of Tata Steel. A fuller description of the relationship between Universal Beams (UB) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

\* Section may be Class 4 under axial compression.

For values of the compression cross-sectional resistance  $N_{c,Rd}$ , see the values of  $N_{pl,Rd}$  in the tables for axial force and bending.

FOR EXPLANATION OF TABLES SEE NOTE 6.

UNIVERSAL COLUMNS  
Advance® UKC



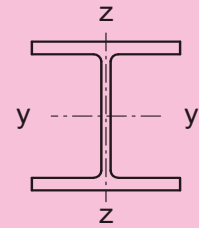
Section Designation	Axis	Compression resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ , $N_{b,T,Rd}$ (kN)												
		for												
		Buckling lengths (m)												
		2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
356x406x634	$N_{b,y,Rd}$	19800	19800	19500	19100	18700	18200	17700	17200	16700	16100	15400	14700	14000
	$N_{b,z,Rd}$	19800	18800	17800	16800	15600	14400	13200	12000	10800	9720	8720	7820	7030
	$N_{b,T,Rd}$	19800	19700	19400	19300	19200	19100	19100	19000	19000	19000	19000	19000	19000
356x406x551	$N_{b,y,Rd}$	17200	17200	16900	16600	16200	15800	15300	14900	14400	13800	13200	12600	12000
	$N_{b,z,Rd}$	17200	16300	15400	14500	13500	12500	11400	10300	9310	8350	7480	6710	6030
	$N_{b,T,Rd}$	17200	17000	16700	16500	16400	16400	16300	16300	16300	16200	16200	16200	16200
356x406x467	$N_{b,y,Rd}$	15200	15200	14900	14500	14200	13800	13400	12900	12400	11900	11400	10800	10200
	$N_{b,z,Rd}$	15100	14300	13500	12600	11700	10800	9770	8790	7870	7030	6270	5600	5020
	$N_{b,T,Rd}$	15200	14800	14500	14300	14200	14100	14100	14000	14000	14000	14000	14000	13900
356x406x393	$N_{b,y,Rd}$	12800	12800	12500	12200	11900	11500	11200	10800	10400	9910	9420	8910	8380
	$N_{b,z,Rd}$	12700	12000	11300	10600	9770	8940	8100	7270	6490	5780	5140	4590	4110
	$N_{b,T,Rd}$	12800	12300	12100	11900	11700	11600	11600	11500	11500	11500	11400	11400	11400
356x406x340	$N_{b,y,Rd}$	11000	11000	10800	10500	10200	9940	9620	9270	8900	8490	8050	7590	7130
	$N_{b,z,Rd}$	11000	10400	9750	9100	8410	7680	6940	6220	5550	4930	4390	3910	3500
	$N_{b,T,Rd}$	11000	10600	10300	10100	9950	9840	9770	9710	9660	9630	9600	9580	9560
356x406x287	$N_{b,y,Rd}$	9700	9680	9440	9200	8940	8660	8360	8040	7680	7300	6890	6470	6040
	$N_{b,z,Rd}$	9600	9060	8500	7910	7270	6610	5950	5300	4710	4170	3700	3290	2940
	$N_{b,T,Rd}$	9600	9190	8880	8650	8480	8350	8260	8190	8130	8090	8050	8020	8000
356x406x235	$N_{b,y,Rd}$	7920	7900	7700	7500	7290	7060	6810	6530	6240	5920	5580	5230	4880
	$N_{b,z,Rd}$	7840	7390	6930	6430	5910	5370	4820	4290	3800	3360	2980	2650	2360
	$N_{b,T,Rd}$	7810	7440	7140	6900	6710	6560	6450	6360	6290	6230	6190	6150	6120
356x368x202	$N_{b,y,Rd}$	6810	6780	6610	6440	6250	6050	5830	5590	5330	5050	4750	4450	4140
	$N_{b,z,Rd}$	6690	6280	5850	5390	4910	4400	3910	3440	3030	2660	2340	2070	1840
	$N_{b,T,Rd}$	6670	6330	6050	5820	5640	5490	5380	5290	5220	5160	5110	5080	5040
356x368x177	$N_{b,y,Rd}$	5990	5960	5810	5650	5480	5300	5100	4890	4660	4400	4140	3860	3590
	$N_{b,z,Rd}$	5880	5510	5130	4730	4300	3850	3420	3010	2640	2320	2040	1810	1610
	$N_{b,T,Rd}$	5860	5540	5270	5040	4850	4690	4570	4460	4380	4310	4260	4210	4180
356x368x153	$N_{b,y,Rd}$	5170	5140	5010	4870	4720	4570	4400	4210	4000	3780	3550	3320	3080
	$N_{b,z,Rd}$	5070	4750	4420	4070	3700	3310	2930	2580	2260	1990	1750	1550	1370
	$N_{b,T,Rd}$	5040	4750	4500	4270	4080	3910	3780	3660	3570	3490	3430	3380	3330
356x368x129	$N_{b,y,Rd}$	4350	4320	4210	4090	3960	3830	3680	3520	3340	3160	2960	2750	2550
	$N_{b,z,Rd}$	4260	3990	3710	3410	3100	2770	2450	2150	1890	1660	1460	1290	1140
	$N_{b,T,Rd}$	4230	3980	3750	3530	3340	3170	3020	2900	2800	2710	2640	2580	2530

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For values of the compression cross-sectional resistance  $N_{c,Rd}$ , see the values of  $N_{pl,Rd}$  in the tables for axial force and bending.

FOR EXPLANATION OF TABLES SEE NOTE 6.

UNIVERSAL COLUMNS  
Advance® UKC



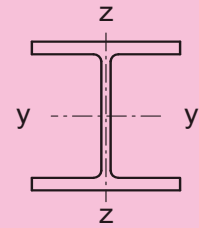
Section Designation	Axis	Compression resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ , $N_{b,T,Rd}$ (kN)													
		for													
		Buckling lengths (m)													
		2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	
305x305x283	$N_{b,y,Rd}$	9180	9100	8850	8590	8320	8020	7690	7320	6930	6510	6070	5630	5200	
	$N_{b,z,Rd}$	8860	8230	7550	6820	6050	5290	4580	3950	3410	2960	2580	2270	2000	
	$N_{b,T,Rd}$	9030	8750	8590	8480	8420	8370	8340	8320	8310	8290	8290	8280	8270	
305x305x240	$N_{b,y,Rd}$	8110	8010	7780	7540	7280	7000	6690	6350	5970	5580	5170	4770	4380	
	$N_{b,z,Rd}$	7790	7210	6580	5910	5200	4510	3880	3330	2870	2480	2160	1890	1670	
	$N_{b,T,Rd}$	7910	7610	7420	7300	7220	7170	7130	7100	7080	7060	7050	7040	7030	
305x305x198	$N_{b,y,Rd}$	6680	6590	6390	6190	5970	5730	5460	5170	4850	4520	4180	3840	3510	
	$N_{b,z,Rd}$	6400	5910	5390	4830	4240	3670	3150	2690	2320	2000	1740	1530	1350	
	$N_{b,T,Rd}$	6470	6180	5980	5850	5750	5690	5640	5600	5580	5560	5540	5530	5520	
305x305x158	$N_{b,y,Rd}$	5330	5240	5090	4920	4740	4540	4320	4080	3810	3540	3260	2990	2730	
	$N_{b,z,Rd}$	5090	4700	4270	3810	3330	2870	2450	2100	1800	1550	1350	1180	1040	
	$N_{b,T,Rd}$	5120	4850	4640	4490	4380	4290	4230	4180	4150	4120	4100	4080	4070	
305x305x137	$N_{b,y,Rd}$	4610	4530	4390	4250	4090	3910	3710	3500	3270	3020	2780	2540	2320	
	$N_{b,z,Rd}$	4400	4060	3680	3280	2860	2460	2100	1790	1540	1330	1150	1010	888	
	$N_{b,T,Rd}$	4420	4160	3950	3790	3670	3580	3510	3450	3410	3370	3350	3320	3310	
305x305x118	$N_{b,y,Rd}$	3980	3910	3780	3660	3520	3360	3190	3000	2800	2590	2380	2170	1980	
	$N_{b,z,Rd}$	3790	3490	3160	2810	2450	2100	1790	1530	1310	1130	980	857	755	
	$N_{b,T,Rd}$	3790	3550	3350	3180	3050	2940	2860	2800	2740	2700	2670	2640	2620	
305x305x97	$N_{b,y,Rd}$	3380	3310	3210	3090	2970	2830	2670	2500	2320	2140	1950	1770	1610	
	$N_{b,z,Rd}$	3210	2950	2660	2350	2030	1730	1470	1250	1070	917	795	695	611	
	$N_{b,T,Rd}$	3210	2980	2770	2590	2450	2320	2230	2150	2090	2040	1990	1960	1930	
254x254x167	$N_{b,y,Rd}$	5640	5470	5270	5050	4810	4530	4230	3890	3550	3210	2890	2590	2330	
	$N_{b,z,Rd}$	5260	4760	4210	3630	3060	2550	2130	1790	1510	1290	1110	970	851	
	$N_{b,T,Rd}$	5410	5220	5110	5040	5000	4980	4960	4940	4930	4930	4920	4920	4910	
254x254x132	$N_{b,y,Rd}$	4450	4300	4140	3960	3760	3530	3280	3010	2730	2460	2200	1970	1770	
	$N_{b,z,Rd}$	4140	3740	3290	2820	2370	1970	1640	1370	1160	989	852	742	650	
	$N_{b,T,Rd}$	4220	4020	3900	3820	3770	3730	3710	3690	3670	3660	3650	3650	3640	
254x254x107	$N_{b,y,Rd}$	3600	3470	3340	3190	3020	2820	2610	2380	2150	1930	1720	1540	1370	
	$N_{b,z,Rd}$	3340	3010	2640	2260	1880	1560	1300	1080	915	780	672	585	513	
	$N_{b,T,Rd}$	3380	3190	3060	2960	2900	2850	2820	2790	2780	2760	2750	2740	2730	
254x254x89	$N_{b,y,Rd}$	2990	2880	2770	2640	2500	2340	2150	1960	1770	1580	1410	1260	1130	
	$N_{b,z,Rd}$	2770	2490	2190	1860	1560	1290	1070	891	752	642	553	481	421	
	$N_{b,T,Rd}$	2790	2600	2460	2360	2280	2230	2190	2160	2130	2110	2100	2090	2080	
254x254x73	$N_{b,y,Rd}$	2550	2460	2360	2240	2110	1970	1810	1640	1470	1310	1160	1030	922	
	$N_{b,z,Rd}$	2360	2110	1840	1550	1290	1060	873	728	613	522	449	390	342	
	$N_{b,T,Rd}$	2360	2170	2020	1900	1800	1730	1680	1640	1610	1590	1570	1550	1540	

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For values of the compression cross-sectional resistance  $N_{c,Rd}$ , see the values of  $N_{pl,Rd}$  in the tables for axial force and bending.

FOR EXPLANATION OF TABLES SEE NOTE 6.

UNIVERSAL COLUMNS  
Advance® UKC



Section Designation	Axis	Compression resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ , $N_{b,T,Rd}$ (kN)												
		for												
		Buckling lengths (m)												
		1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
203x203x127 +	$N_{b,y,Rd}$	4290	4290	4240	4150	4060	3970	3860	3640	3370	3080	2760	2440	2150
	$N_{b,z,Rd}$	4280	4060	3830	3590	3330	3060	2780	2250	1790	1440	1170	961	803
	$N_{b,T,Rd}$	4290	4180	4090	4030	3990	3960	3940	3920	3900	3890	3890	3880	3880
203x203x113 +	$N_{b,y,Rd}$	3840	3840	3790	3710	3630	3540	3440	3240	2990	2720	2430	2150	1880
	$N_{b,z,Rd}$	3830	3630	3420	3200	2970	2720	2470	1990	1590	1270	1030	847	707
	$N_{b,T,Rd}$	3840	3720	3630	3560	3520	3490	3470	3440	3420	3410	3400	3400	3390
203x203x100 +	$N_{b,y,Rd}$	3370	3370	3320	3250	3170	3090	3010	2820	2600	2360	2100	1850	1610
	$N_{b,z,Rd}$	3350	3170	2980	2790	2580	2370	2150	1720	1370	1090	886	728	608
	$N_{b,T,Rd}$	3360	3240	3150	3080	3030	3000	2970	2940	2920	2910	2900	2890	2890
203x203x86	$N_{b,y,Rd}$	2920	2920	2870	2810	2740	2670	2590	2430	2230	2010	1790	1570	1360
	$N_{b,z,Rd}$	2900	2740	2580	2410	2230	2040	1840	1480	1170	934	755	621	518
	$N_{b,T,Rd}$	2900	2780	2690	2630	2570	2540	2510	2470	2440	2430	2420	2410	2400
203x203x71	$N_{b,y,Rd}$	2400	2400	2360	2300	2250	2190	2130	1990	1820	1640	1450	1270	1100
	$N_{b,z,Rd}$	2380	2250	2120	1970	1820	1670	1510	1200	952	758	613	504	420
	$N_{b,T,Rd}$	2380	2270	2180	2120	2060	2020	1980	1940	1910	1880	1870	1860	1850
203x203x60	$N_{b,y,Rd}$	2100	2100	2060	2010	1960	1900	1840	1710	1560	1390	1220	1050	911
	$N_{b,z,Rd}$	2080	1960	1840	1710	1570	1420	1280	1010	791	627	506	414	345
	$N_{b,T,Rd}$	2070	1970	1880	1810	1750	1700	1660	1600	1550	1530	1510	1490	1480
203x203x52	$N_{b,y,Rd}$	1820	1820	1790	1740	1700	1650	1600	1480	1350	1200	1050	908	785
	$N_{b,z,Rd}$	1800	1700	1590	1480	1360	1230	1110	871	683	541	436	357	297
	$N_{b,T,Rd}$	1800	1700	1620	1550	1490	1430	1390	1320	1280	1240	1220	1200	1190
203x203x46	$N_{b,y,Rd}$	1610	1610	1580	1540	1500	1460	1410	1310	1190	1050	918	794	684
	$N_{b,z,Rd}$	1590	1500	1410	1300	1200	1080	970	762	596	472	380	311	259
	$N_{b,T,Rd}$	1590	1500	1430	1350	1290	1240	1190	1120	1070	1030	1010	986	971
152x152x51 +	$N_{b,y,Rd}$	1790	1760	1710	1650	1590	1520	1450	1280	1090	912	758	632	532
	$N_{b,z,Rd}$	1710	1570	1430	1270	1110	949	809	591	442	341	270	219	180
	$N_{b,T,Rd}$	1730	1660	1600	1570	1540	1530	1510	1500	1490	1480	1480	1480	1470
152x152x44 +	$N_{b,y,Rd}$	1540	1520	1470	1420	1370	1310	1240	1090	925	770	638	531	447
	$N_{b,z,Rd}$	1470	1350	1220	1080	943	808	687	501	374	288	228	185	152
	$N_{b,T,Rd}$	1480	1410	1350	1320	1290	1270	1250	1240	1220	1220	1210	1210	1210
152x152x37	$N_{b,y,Rd}$	1300	1270	1230	1190	1140	1090	1030	905	766	635	525	437	367
	$N_{b,z,Rd}$	1230	1130	1020	903	782	668	568	412	308	237	187	151	125
	$N_{b,T,Rd}$	1240	1170	1110	1070	1040	1020	1000	976	962	952	946	941	938
152x152x30	$N_{b,y,Rd}$	1050	1030	999	964	926	883	836	729	614	508	419	348	292
	$N_{b,z,Rd}$	999	916	826	729	630	537	455	330	246	189	149	121	99.7
	$N_{b,T,Rd}$	1000	937	882	838	803	775	754	724	706	693	685	679	674
152x152x23	$N_{b,y,Rd}$	803	785	759	731	700	665	627	541	451	370	303	251	210
	$N_{b,z,Rd}$	758	692	620	543	465	393	331	238	177	136	107	86.5	71.3
	$N_{b,T,Rd}$	759	703	652	607	569	538	514	478	454	439	428	420	415

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+ These sections are in addition to the range of BS 4 sections.

For values of the compression cross-sectional resistance  $N_{c,Rd}$ , see the values of  $N_{pl,Rd}$  in the tables for axial force and bending.

FOR EXPLANATION OF TABLES SEE NOTE 6.

# COMPRESSION

## **HOT-FINISHED HOLLOW SECTIONS - S275**

There are no resistance tables given for hot-finished hollow sections in S275, because hot finished hollow sections are normally available in S355 only.

S355 resistance tables are given for hot-finished hollow sections in part D (pages D - 14 to D - 38). However, to maintain consistent page numbering between S275 resistance tables and S355 resistance tables, pages C - 14 to C - 38 are omitted here.

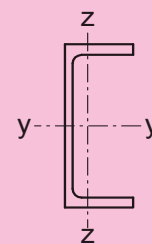
## **COLD-FORMED HOLLOW SECTIONS - S275**

There are no resistance tables given for cold-formed hollow sections in S275, because normally cold-formed hollow sections are normally available in S235 and S355 only. No resistance tables are given for S235 either, because sections available may not be manufactured to BS EN 10219-2: 2006.

S355 resistance tables are given for cold-formed hollow sections in part D (pages D - 39 to D - 52). However, to maintain consistent page numbering between S275 resistance tables and S355 resistance tables, pages C - 39 to C - 52 are omitted here.



PARALLEL FLANGE CHANNELS  
Advance® UKPFC



Subject to concentric axial compression

Section Designation	Axis	Compression resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ , $N_{b,T,Rd}$ (kN)												
		for												
		Buckling lengths (m)												
		1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
430x100x64	$N_{b,y,Rd}$	2180	2180	2180	2180	2170	2130	2090	2010	1930	1850	1770	1680	1590
	$N_{b,z,Rd}$	1970	1750	1490	1240	1010	817	668	464	338	257	201	162	133
	$N_{b,T,Rd}$	2000	1820	1660	1530	1430	1350	1280	1200	1140	1100	1070	1050	1030
380x100x54	$N_{b,y,Rd}$	1820	1820	1820	1820	1790	1760	1720	1650	1580	1500	1420	1330	1250
	$N_{b,z,Rd}$	1660	1480	1270	1070	873	713	586	409	298	227	178	143	118
	$N_{b,T,Rd}$	1660	1510	1380	1270	1180	1110	1060	989	942	909	883	860	838
300x100x46	$N_{b,y,Rd}$	1540	1540	1540	1510	1470	1430	1400	1320	1230	1150	1060	964	875
	$N_{b,z,Rd}$	1410	1260	1090	919	758	621	512	358	262	199	156	126	104
	$N_{b,T,Rd}$	1390	1270	1170	1090	1030	982	946	894	855	819	783	743	700
300x90x41	$N_{b,y,Rd}$	1450	1450	1450	1420	1380	1340	1310	1230	1150	1060	971	882	795
	$N_{b,z,Rd}$	1290	1120	931	750	597	477	387	266	193	146	114	91.4	74.9
	$N_{b,T,Rd}$	1290	1160	1060	983	926	884	853	807	773	743	713	679	640
260x90x35	$N_{b,y,Rd}$	1220	1220	1210	1170	1140	1100	1060	988	907	822	736	655	579
	$N_{b,z,Rd}$	1090	950	795	644	515	413	336	231	168	127	99.1	79.6	65.3
	$N_{b,T,Rd}$	1070	963	878	813	766	731	704	662	628	594	558	518	477
260x75x28	$N_{b,y,Rd}$	965	965	951	923	895	867	837	775	709	640	572	506	447
	$N_{b,z,Rd}$	813	669	520	395	303	237	189	127	91.5	68.8	53.5	42.8	35.1
	$N_{b,T,Rd}$	820	722	647	593	555	528	508	479	458	438	416	392	364
230x90x32	$N_{b,y,Rd}$	1130	1130	1100	1060	1030	991	952	871	785	697	613	535	467
	$N_{b,z,Rd}$	1010	883	743	604	485	390	317	219	159	120	94.0	75.5	61.9
	$N_{b,T,Rd}$	980	882	808	755	716	685	661	619	578	536	490	444	399
230x75x26	$N_{b,y,Rd}$	899	899	876	847	818	788	757	691	622	551	483	421	367
	$N_{b,z,Rd}$	763	632	496	379	292	228	182	123	88.7	66.7	51.9	41.6	34.0
	$N_{b,T,Rd}$	759	674	613	570	541	519	501	473	447	419	387	352	317

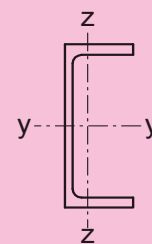
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$N_{b,T,Rd}$  is the lower of the torsional and the torsional-flexural buckling resistance.

For values of the compression cross-sectional resistance,  $N_{c,Rd}$ , see values of  $N_{pl,Rd}$  in the tables for axial force and bending.

FOR EXPLANATION OF TABLES SEE NOTE 6.

PARALLEL FLANGE CHANNELS  
Advance® UKPFC



Subject to concentric axial compression

Section Designation	Axis	Compression resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ , $N_{b,T,Rd}$ (kN)												
		for												
		Buckling lengths (m)												
		1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
200x90x30	$N_{b,y,Rd}$	1040	1040	999	961	922	882	840	751	659	570	489	418	359
	$N_{b,z,Rd}$	935	819	690	563	452	364	296	204	149	112	88.0	70.7	58.0
	$N_{b,T,Rd}$	894	807	745	700	667	639	614	565	514	461	409	360	317
200x75x23	$N_{b,y,Rd}$	822	817	787	757	726	694	661	591	518	447	383	327	281
	$N_{b,z,Rd}$	701	584	461	355	274	215	172	116	83.6	62.9	49.0	39.2	32.1
	$N_{b,T,Rd}$	687	615	566	532	508	488	471	439	403	364	324	286	251
180x90x26	$N_{b,y,Rd}$	913	897	861	824	786	746	705	617	529	447	377	318	271
	$N_{b,z,Rd}$	820	718	606	495	398	320	261	180	131	99.1	77.6	62.3	51.1
	$N_{b,T,Rd}$	769	687	629	586	554	527	502	454	405	358	313	273	238
180x75x20	$N_{b,y,Rd}$	712	699	670	641	610	578	545	475	405	341	287	242	206
	$N_{b,z,Rd}$	607	505	398	306	235	185	148	100.0	71.9	54.1	42.1	33.7	27.6
	$N_{b,T,Rd}$	587	520	472	440	416	397	380	347	312	276	242	211	184
150x90x24	$N_{b,y,Rd}$	836	802	762	720	677	630	582	485	397	323	265	220	185
	$N_{b,z,Rd}$	751	658	555	453	364	293	239	165	120	90.8	71.0	57.1	46.8
	$N_{b,T,Rd}$	686	612	561	523	491	461	432	374	320	271	230	195	167
150x75x18	$N_{b,y,Rd}$	627	601	571	540	506	471	435	362	296	241	198	164	138
	$N_{b,z,Rd}$	536	447	353	272	210	165	132	89.3	64.3	48.3	37.7	30.2	24.7
	$N_{b,T,Rd}$	504	446	407	379	357	336	317	277	238	203	172	146	125
125x65x15	$N_{b,y,Rd}$	510	480	449	416	381	344	307	241	188	148	119	97.6	81.2
	$N_{b,z,Rd}$	418	330	245	181	136	105	83.5	55.9	40.0	30.0	23.3	18.6	15.2
	$N_{b,T,Rd}$	407	368	341	319	297	274	251	205	166	135	111	91.9	77.3
100x50x10	$N_{b,y,Rd}$	342	315	286	255	222	191	163	120	89.7	69.2	54.8	44.4	36.6
	$N_{b,z,Rd}$	253	174	117	82.1	60.0	45.6	35.8	23.7	16.8	12.5	9.70	7.73	6.30
	$N_{b,T,Rd}$	275	253	234	213	190	167	146	110	84.5	66.1	52.9	43.1	35.8

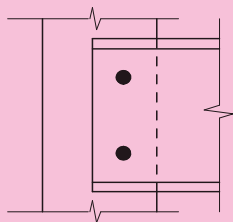
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$N_{b,T,Rd}$  is the lower of the torsional and the torsional-flexural buckling resistance.

For values of the compression cross-sectional resistance,  $N_{c,Rd}$ , see values of  $N_{pl,Rd}$  in the tables for axial force and bending.

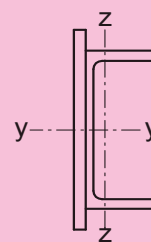
FOR EXPLANATION OF TABLES SEE NOTE 6.

PARALLEL FLANGE CHANNELS  
Advance UKPFC



Connected through web

One row of fasteners with  
two or more fasteners across the web



Section Designation	Axis	Compression resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ , $N_{b,T,Rd}$ (kN) for Length between intersections, L (m)												
		1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
		$N_{b,y,Rd}$	$N_{b,z,Rd}$	$N_{b,T,Rd}$	$N_{b,y,Rd}$	$N_{b,z,Rd}$	$N_{b,T,Rd}$	$N_{b,y,Rd}$	$N_{b,z,Rd}$	$N_{b,T,Rd}$	$N_{b,y,Rd}$	$N_{b,z,Rd}$	$N_{b,T,Rd}$	$N_{b,y,Rd}$
430x100x64	$N_{b,y,Rd}$	2180	2180	2180	2180	2170	2130	2090	2010	1930	1850	1770	1680	1590
	$N_{b,z,Rd}$	1490	1310	1130	979	846	734	640	464	338	257	201	162	133
	$N_{b,T,Rd}$	2000	1820	1660	1530	1430	1350	1280	1200	1140	1100	1070	1050	1030
380x100x54	$N_{b,y,Rd}$	1820	1820	1820	1820	1790	1760	1720	1650	1580	1500	1420	1330	1250
	$N_{b,z,Rd}$	1250	1110	965	837	727	632	553	409	298	227	178	143	118
	$N_{b,T,Rd}$	1660	1510	1380	1270	1180	1110	1060	989	942	909	883	860	838
300x100x46	$N_{b,y,Rd}$	1540	1540	1540	1510	1470	1430	1400	1320	1230	1150	1060	964	875
	$N_{b,z,Rd}$	1060	941	825	718	625	545	478	358	262	199	156	126	104
	$N_{b,T,Rd}$	1390	1270	1170	1090	1030	982	946	894	855	819	783	743	700
300x90x41	$N_{b,y,Rd}$	1450	1450	1450	1420	1380	1340	1310	1230	1150	1060	971	882	795
	$N_{b,z,Rd}$	968	837	716	610	521	447	387	266	193	146	114	91.4	74.9
	$N_{b,T,Rd}$	1290	1160	1060	983	926	884	853	807	773	743	713	679	640
260x90x35	$N_{b,y,Rd}$	1220	1220	1210	1170	1140	1100	1060	988	907	822	736	655	579
	$N_{b,z,Rd}$	819	711	610	521	446	384	332	231	168	127	99.1	79.6	65.3
	$N_{b,T,Rd}$	1070	963	878	813	766	731	704	662	628	594	558	518	477
260x75x28	$N_{b,y,Rd}$	965	965	951	923	895	867	837	775	709	640	572	506	447
	$N_{b,z,Rd}$	609	507	418	346	288	237	189	127	91.5	68.8	53.5	42.8	35.1
	$N_{b,T,Rd}$	820	722	647	593	555	528	508	479	458	438	416	392	364
230x90x32	$N_{b,y,Rd}$	1130	1130	1100	1060	1030	991	952	871	785	697	613	535	467
	$N_{b,z,Rd}$	759	660	568	486	417	359	312	219	159	120	94.0	75.5	61.9
	$N_{b,T,Rd}$	980	882	808	755	716	685	661	619	578	536	490	444	399
230x75x26	$N_{b,y,Rd}$	899	899	876	847	818	788	757	691	622	551	483	421	367
	$N_{b,z,Rd}$	571	478	396	328	274	228	182	123	88.7	66.7	51.9	41.6	34.0
	$N_{b,T,Rd}$	759	674	613	570	541	519	501	473	447	419	387	352	317

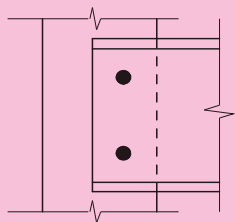
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$N_{b,T,Rd}$  is the lower of the torsional and the torsional-flexural buckling resistance.

For values of the compression cross-sectional resistance,  $N_{c,Rd}$ , see values of  $N_{pl,Rd}$  in the tables for axial force and bending.

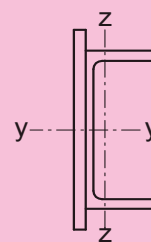
FOR EXPLANATION OF TABLES SEE NOTE 6.

PARALLEL FLANGE CHANNELS  
Advance UKPFC



Connected through web

One row of fasteners with  
two or more fasteners across the web



Section Designation	Axis	Compression resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ , $N_{b,T,Rd}$ (kN) for Length between intersections, L (m)												
		1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
		$N_{b,y,Rd}$	$N_{b,z,Rd}$	$N_{b,T,Rd}$										
200x90x30	$N_{b,y,Rd}$	1040	1040	999	961	922	882	840	751	659	570	489	418	359
	$N_{b,z,Rd}$	703	612	527	452	388	335	290	204	149	112	88.0	70.7	58.0
	$N_{b,T,Rd}$	894	807	745	700	667	639	614	565	514	461	409	360	317
200x75x23	$N_{b,y,Rd}$	822	817	787	757	726	694	661	591	518	447	383	327	281
	$N_{b,z,Rd}$	525	441	367	305	255	215	172	116	83.6	62.9	49.0	39.2	32.1
	$N_{b,T,Rd}$	687	615	566	532	508	488	471	439	403	364	324	286	251
180x90x26	$N_{b,y,Rd}$	913	897	861	824	786	746	705	617	529	447	377	318	271
	$N_{b,z,Rd}$	617	537	463	397	341	294	255	180	131	99.1	77.6	62.3	51.1
	$N_{b,T,Rd}$	769	687	629	586	554	527	502	454	405	358	313	273	238
180x75x20	$N_{b,y,Rd}$	712	699	670	641	610	578	545	475	405	341	287	242	206
	$N_{b,z,Rd}$	454	381	317	263	220	185	148	100.0	71.9	54.1	42.1	33.7	27.6
	$N_{b,T,Rd}$	587	520	472	440	416	397	380	347	312	276	242	211	184
150x90x24	$N_{b,y,Rd}$	836	802	762	720	677	630	582	485	397	323	265	220	185
	$N_{b,z,Rd}$	565	492	424	364	312	269	234	165	120	90.8	71.0	57.1	46.8
	$N_{b,T,Rd}$	686	612	561	523	491	461	432	374	320	271	230	195	167
150x75x18	$N_{b,y,Rd}$	627	601	571	540	506	471	435	362	296	241	198	164	138
	$N_{b,z,Rd}$	401	337	280	233	196	165	132	89.3	64.3	48.3	37.7	30.2	24.7
	$N_{b,T,Rd}$	504	446	407	379	357	336	317	277	238	203	172	146	125
125x65x15	$N_{b,y,Rd}$	510	480	449	416	381	344	307	241	188	148	119	97.6	81.2
	$N_{b,z,Rd}$	313	254	205	166	136	105	83.5	55.9	40.0	30.0	23.3	18.6	15.2
	$N_{b,T,Rd}$	407	368	341	319	297	274	251	205	166	135	111	91.9	77.3
100x50x10	$N_{b,y,Rd}$	342	315	286	255	222	191	163	120	89.7	69.2	54.8	44.4	36.6
	$N_{b,z,Rd}$	191	144	110	82.1	60.0	45.6	35.8	23.7	16.8	12.5	9.70	7.73	6.30
	$N_{b,T,Rd}$	275	253	234	213	190	167	146	110	84.5	66.1	52.9	43.1	35.8

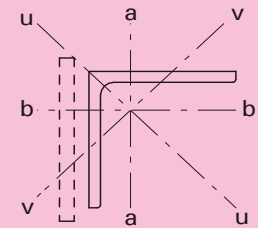
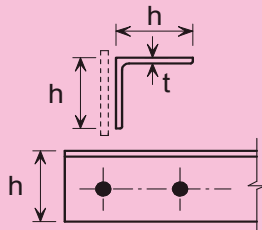
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$N_{b,T,Rd}$  is the lower of the torsional and the torsional-flexural buckling resistance.

For values of the compression cross-sectional resistance,  $N_{c,Rd}$ , see values of  $N_{pl,Rd}$  in the tables for axial force and bending.

FOR EXPLANATION OF TABLES SEE NOTE 6.

EQUAL ANGLES  
Advance® UKA - Equal Angles



Two or more bolts in line  
or equivalent welded at each end

Section Designation		Area cm <sup>2</sup>	Radius of Gyration			Buckling mode	Flexural buckling resistance (F) and torsional buckling resistance (T) (kN) for System length L (m)												
h x h mm	t mm		Axis a-a cm	Axis b-b cm	Axis v-v cm		1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
200x200	24	90.6	6.06	6.06	3.90		F	1970	1890	1800	1650	1500	1340	1200	953	764	622	515	432
						T	2190	2190	2190	2190	2190	2190	2190	2190	2190	2190	2190	2190	2190
	20	76.3	6.11	6.11	3.92	F	1660	1590	1520	1400	1260	1140	1010	807	648	528	437	367	312
						T	1760	1760	1760	1760	1760	1760	1760	1760	1760	1760	1760	1760	1760
	* 18	69.1	6.13	6.13	3.90	F	1510	1440	1370	1260	1140	1020	914	727	583	475	393	329	280
						T	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550	1550
	* 16	61.8	6.16	6.16	3.94	F	1400	1340	1270	1170	1050	944	842	668	535	436	360	302	257
						T	1360	1360	1360	1360	1360	1360	1360	1360	1360	1360	1360	1360	1360
150x150	18 +	51.2	4.55	4.55	2.93	F	1080	1020	905	788	678	582	501	377	292	232	188	155	131
						T	1240	1240	1240	1240	1240	1240	1240	1240	1240	1240	1240	1240	1240
	15	43.0	4.57	4.57	2.93	F	942	882	781	678	581	497	427	320	247	196	159	131	110
						T	1030	1030	1030	1030	1030	1030	1030	1030	1030	1030	1030	1030	1030
	* 12	34.8	4.60	4.60	2.95	F	763	715	635	551	473	405	348	262	202	160	130	108	90.4
						T	771	771	771	771	771	771	771	771	771	771	771	771	771
	* 10	29.3	4.62	4.62	2.97	F	581	547	495	435	378	327	283	215	167	133	108	89.7	75.5
						T	547	547	547	547	547	547	547	547	547	547	547	547	547
120x120	15 +	34.0	3.63	3.63	2.34	F	721	638	535	441	363	301	253	184	139	109	87.0	71.3	59.5
						T	857	857	857	857	857	857	857	857	857	857	857	857	857
	12	27.5	3.65	3.65	2.35	F	584	517	434	358	295	245	206	150	113	88.4	70.9	58.1	48.5
						T	659	659	659	659	659	659	659	659	659	659	659	659	659
	* 10	23.2	3.67	3.67	2.36	F	493	437	367	304	250	208	174	127	96.1	75.1	60.2	49.4	41.2
						T	523	523	523	523	523	523	523	523	523	523	523	523	523
	* 8 +	18.8	3.71	3.71	2.38	F	362	327	279	234	195	163	138	101	77.0	60.4	48.6	39.9	33.4
						T	350	350	350	350	350	350	350	350	350	350	350	350	350
100x100	15 +	28.0	2.99	2.99	1.94	F	572	473	376	297	238	193	159	113	84.6	65.5	52.1	42.5	35.2
						T	729	729	729	729	729	729	729	729	729	729	729	729	729
	12	22.7	3.02	3.02	1.94	F	465	383	305	241	193	157	129	92.0	68.6	53.1	42.2	34.4	28.6
						T	569	569	569	569	569	569	569	569	569	569	569	569	569
	10	19.2	3.04	3.04	1.95	F	394	325	259	205	164	133	110	78.4	58.5	45.3	36.1	29.4	24.4
						T	461	461	461	461	461	461	461	461	461	461	461	461	461
	* 8	15.5	3.06	3.06	1.96	F	318	263	210	167	133	108	89.6	63.8	47.6	36.9	29.4	23.9	19.9
						T	345	345	345	345	345	345	345	345	345	345	345	345	345

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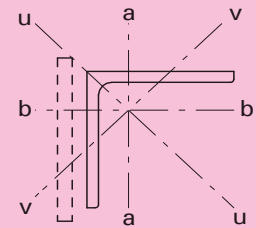
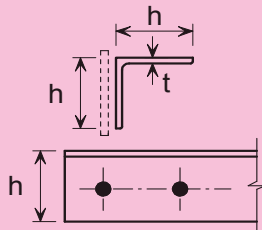
+ These sections are in addition to the range of BS EN 10056-1 sections.

\* Section is Class 4 under axial compression.

Values in italic type indicate that the section is Class 4 in pure compression and allowance has been made in calculating the resistance

FOR EXPLANATION OF TABLES SEE NOTE 6.

EQUAL ANGLES  
Advance® UKA - Equal Angles



Two or more bolts in line  
or equivalent welded at each end

Section Designation		Area cm <sup>2</sup>	Radius of Gyration			Buckling mode	Flexural buckling resistance (F) and torsional buckling resistance (T) (kN) for System length L (m)												
h x h mm	t mm		Axis a-a cm	Axis b-b cm	Axis v-v cm		1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
90x90	12 +	20.3	2.71	2.71	1.75	F	401	319	246	191	150	121	99.1	69.8	51.7	39.8	31.6	25.7	21.3
						T	519	519	519	519	519	519	519	519	519	519	519	519	519
	10	17.1	2.72	2.72	1.75	F	338	269	207	161	127	102	83.5	58.8	43.6	33.5	26.6	21.6	17.9
						T	422	422	422	422	422	422	422	422	422	422	422	422	422
	* 8	13.9	2.74	2.74	1.76	F	275	219	169	131	104	83.5	68.4	48.2	35.7	27.5	21.8	17.7	14.7
						T	322	322	322	322	322	322	322	322	322	322	322	322	322
* 7	12.2	2.75	2.75	1.77	F	242	193	150	116	91.7	73.9	60.6	42.7	31.7	24.4	19.4	15.7	13.0	
					T	269	269	269	269	269	269	269	269	269	269	269	269	269	269
80x80	10	15.1	2.41	2.41	1.55	F	282	215	160	121	94.3	75.1	61.1	42.6	31.3	24.0	19.0	15.4	12.7
						T	382	382	382	382	382	382	382	382	382	382	382	382	382
	8	12.3	2.43	2.43	1.56	F	231	176	131	99.7	77.5	61.8	50.3	35.1	25.8	19.8	15.6	12.7	10.5
						T	296	296	296	296	296	296	296	296	296	296	296	296	296
75x75	8	11.4	2.27	2.27	1.46	F	207	154	113	84.5	65.3	51.7	41.9	29.1	21.3	16.3	12.9	10.4	8.59
						T	279	279	279	279	279	279	279	279	279	279	279	279	279
	* 6	8.73	2.29	2.29	1.47	F	159	118	87.0	65.3	50.5	40.0	32.5	22.5	16.5	12.6	9.98	8.07	6.66
						T	195	195	195	195	195	195	195	195	195	195	195	195	195
70x70	7	9.40	2.12	2.12	1.36	F	164	118	85.1	63.2	48.4	38.2	30.8	21.3	15.6	11.9	9.34	7.55	6.22
						T	226	226	226	226	226	226	226	226	226	226	226	226	226
	* 6	8.13	2.13	2.13	1.37	F	142	103	74.3	55.2	42.3	33.4	27.0	18.6	13.6	10.4	8.19	6.61	5.45
						T	187	187	187	187	187	187	187	187	187	187	187	187	187
65x65	7	8.73	1.96	1.96	1.26	F	145	101	71.7	52.6	40.0	31.4	25.3	17.4	12.6	9.61	7.56	6.09	5.02
						T	212	212	212	212	212	212	212	212	212	212	212	212	212
60x60	8	9.03	1.80	1.80	1.16	F	141	95.5	66.3	48.2	36.4	28.4	22.8	15.6	11.3	8.57	6.72	5.41	4.45
						T	231	231	231	231	231	231	231	231	231	231	231	231	231
	6	6.91	1.82	1.82	1.17	F	109	73.8	51.4	37.3	28.2	22.1	17.7	12.1	8.78	6.66	5.23	4.21	3.46
						T	167	167	167	167	167	167	167	167	167	167	167	167	167
	* 5	5.82	1.82	1.82	1.17	F	91.6	62.2	43.3	31.4	23.8	18.6	14.9	10.2	7.39	5.61	4.40	3.54	2.92
						T	133	133	133	133	133	133	133	133	133	133	133	133	133
50x50	6	5.69	1.50	1.50	0.968	F	76.3	48.2	32.3	23.0	17.1	13.3	10.6	7.14	5.14	3.88	3.03	2.44	2.00
						T	143	143	143	143	143	143	143	143	143	143	143	143	143
	5	4.80	1.51	1.51	0.973	F	64.6	40.9	27.5	19.5	14.6	11.3	8.98	6.08	4.38	3.31	2.58	2.08	1.70
						T	116	116	116	116	116	116	116	116	116	116	116	116	116
	* 4	3.89	1.52	1.52	0.979	F	52.7	33.4	22.5	16.0	11.9	9.24	7.36	4.98	3.59	2.71	2.12	1.70	1.40
						T	87.6	87.6	87.6	87.6	87.6	87.6	87.6	87.6	87.6	87.6	87.6	87.6	87.6

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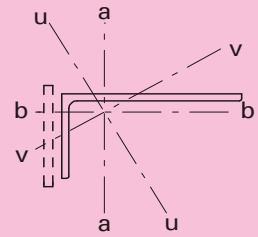
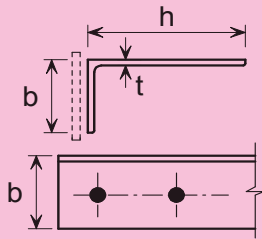
+ These sections are in addition to the range of BS EN 10056-1 sections.

\* Section is Class 4 under axial compression.

Values in italic type indicate that the section is Class 4 in pure compression and allowance has been made in calculating the resistance

FOR EXPLANATION OF TABLES SEE NOTE 6.

UNEQUAL ANGLES  
Advance® UKA - Unequal Angles



Short leg attached

Two or more bolts in line  
or equivalent welded at each end

Section Designation		Area cm <sup>2</sup>	Radius of Gyration			Buckling mode	Flexural buckling resistance (F) and torsional buckling resistance (T) (kN) for System length L (m)												
h x b mm	t mm		Axis a-a cm	Axis b-b cm	Axis v-v cm		1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
200x150	18 +	60.1	6.30	4.38	3.22	F	1270	1180	1090	987	864	752	655	501	392	313	256	213	179
						T	1380	1380	1380	1380	1380	1380	1380	1380	1380	1380	1380	1380	1380
	* 15	50.5	6.33	4.40	3.23	F	<i>1080</i>	<i>1010</i>	<i>930</i>	<i>839</i>	<i>734</i>	<i>639</i>	<i>555</i>	<i>425</i>	<i>332</i>	<i>266</i>	<i>217</i>	<i>180</i>	<i>152</i>
						T	<i>1090</i>	<i>1090</i>	<i>1090</i>	<i>1090</i>	<i>1090</i>	<i>1090</i>	<i>1090</i>	<i>1090</i>	<i>1090</i>	<i>1090</i>	<i>1090</i>	<i>1090</i>	<i>1090</i>
	* 12	40.8	6.36	4.44	3.25	F	<i>745</i>	<i>702</i>	<i>655</i>	<i>605</i>	<i>538</i>	<i>475</i>	<i>418</i>	<i>325</i>	<i>257</i>	<i>207</i>	<i>170</i>	<i>142</i>	<i>120</i>
						T	<i>693</i>	<i>693</i>	<i>693</i>	<i>693</i>	<i>693</i>	<i>693</i>	<i>693</i>	<i>693</i>	<i>693</i>	<i>693</i>	<i>693</i>	<i>693</i>	<i>693</i>
200x100	15	43.0	6.40	2.64	2.12	F	853	738	625	504	409	335	278	200	150	117	93.2	76.1	63.3
						T	964	964	964	964	964	964	964	964	964	964	964	964	964
	* 12	34.8	6.43	2.67	2.14	F	<i>585</i>	<i>517</i>	<i>448</i>	<i>375</i>	<i>309</i>	<i>257</i>	<i>216</i>	<i>157</i>	<i>119</i>	<i>92.7</i>	<i>74.4</i>	<i>60.9</i>	<i>50.8</i>
						T	<i>604</i>	<i>604</i>	<i>604</i>	<i>604</i>	<i>604</i>	<i>604</i>	<i>604</i>	<i>604</i>	<i>604</i>	<i>604</i>	<i>604</i>	<i>604</i>	<i>604</i>
	* 10	29.2	6.46	2.68	2.15	F	<i>431</i>	<i>386</i>	<i>339</i>	<i>293</i>	<i>244</i>	<i>205</i>	<i>173</i>	<i>127</i>	<i>97.0</i>	<i>76.2</i>	<i>61.3</i>	<i>50.4</i>	<i>42.1</i>
						T	<i>408</i>	<i>408</i>	<i>408</i>	<i>408</i>	<i>408</i>	<i>408</i>	<i>408</i>	<i>408</i>	<i>408</i>	<i>408</i>	<i>408</i>	<i>408</i>	<i>408</i>
150x90	15	33.9	4.74	2.46	1.93	F	659	561	453	358	286	232	192	136	102	78.6	62.5	50.9	42.3
						T	833	833	833	833	833	833	833	833	833	833	833	833	833
	12	27.5	4.77	2.49	1.94	F	<i>537</i>	<i>458</i>	<i>369</i>	<i>292</i>	<i>234</i>	<i>190</i>	<i>157</i>	<i>111</i>	<i>83.1</i>	<i>64.3</i>	<i>51.2</i>	<i>41.7</i>	<i>34.6</i>
						T	<i>632</i>	<i>632</i>	<i>632</i>	<i>632</i>	<i>632</i>	<i>632</i>	<i>632</i>	<i>632</i>	<i>632</i>	<i>632</i>	<i>632</i>	<i>632</i>	<i>632</i>
	* 10	23.2	4.80	2.51	1.95	F	<i>413</i>	<i>357</i>	<i>295</i>	<i>236</i>	<i>191</i>	<i>156</i>	<i>129</i>	<i>92.5</i>	<i>69.3</i>	<i>53.8</i>	<i>42.9</i>	<i>35.0</i>	<i>29.1</i>
						T	<i>452</i>	<i>452</i>	<i>452</i>	<i>452</i>	<i>452</i>	<i>452</i>	<i>452</i>	<i>452</i>	<i>452</i>	<i>452</i>	<i>452</i>	<i>452</i>	<i>452</i>
150x75	15	31.7	4.75	1.94	1.58	F	568	454	344	261	203	162	132	92.3	68.0	52.1	41.2	33.4	27.6
						T	780	780	780	780	780	780	780	780	780	780	780	780	780
	12	25.7	4.78	1.97	1.59	F	<i>463</i>	<i>372</i>	<i>281</i>	<i>214</i>	<i>166</i>	<i>133</i>	<i>108</i>	<i>75.6</i>	<i>55.7</i>	<i>42.7</i>	<i>33.8</i>	<i>27.4</i>	<i>22.6</i>
						T	<i>591</i>	<i>591</i>	<i>591</i>	<i>591</i>	<i>591</i>	<i>591</i>	<i>591</i>	<i>591</i>	<i>591</i>	<i>591</i>	<i>591</i>	<i>591</i>	<i>591</i>
	* 10	21.7	4.81	1.99	1.60	F	<i>359</i>	<i>294</i>	<i>227</i>	<i>175</i>	<i>137</i>	<i>110</i>	<i>90.0</i>	<i>63.2</i>	<i>46.7</i>	<i>35.9</i>	<i>28.5</i>	<i>23.1</i>	<i>19.1</i>
						T	<i>423</i>	<i>423</i>	<i>423</i>	<i>423</i>	<i>423</i>	<i>423</i>	<i>423</i>	<i>423</i>	<i>423</i>	<i>423</i>	<i>423</i>	<i>423</i>	<i>423</i>
125x75	12	22.7	3.95	2.05	1.61	F	415	334	251	192	150	120	97.4	68.1	50.2	38.5	30.5	24.7	20.4
						T	552	552	552	552	552	552	552	552	552	552	552	552	552
	10	19.1	3.97	2.07	1.61	F	<i>351</i>	<i>281</i>	<i>212</i>	<i>161</i>	<i>126</i>	<i>101</i>	<i>82.0</i>	<i>57.3</i>	<i>42.3</i>	<i>32.4</i>	<i>25.7</i>	<i>20.8</i>	<i>17.2</i>
						T	<i>439</i>	<i>439</i>	<i>439</i>	<i>439</i>	<i>439</i>	<i>439</i>	<i>439</i>	<i>439</i>	<i>439</i>	<i>439</i>	<i>439</i>	<i>439</i>	<i>439</i>
	* 8	15.5	4.00	2.09	1.63	F	<i>255</i>	<i>211</i>	<i>163</i>	<i>126</i>	<i>99.6</i>	<i>80.1</i>	<i>65.7</i>	<i>46.3</i>	<i>34.3</i>	<i>26.4</i>	<i>20.9</i>	<i>17.0</i>	<i>14.1</i>
						T	<i>289</i>	<i>289</i>	<i>289</i>	<i>289</i>	<i>289</i>	<i>289</i>	<i>289</i>	<i>289</i>	<i>289</i>	<i>289</i>	<i>289</i>	<i>289</i>	<i>289</i>

Advance® and UKA are trademarks of Tata Steel. A fuller description of the relationship between Angles and the Advance® range of sections manufactured by Tata Steel is given in section 12

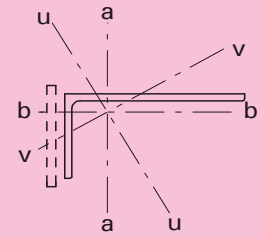
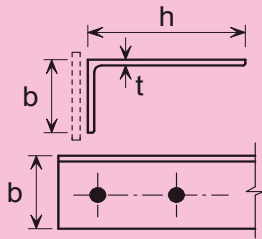
+ These sections are in addition to the range of BS EN 10056-1 sections.

\* Section is Class 4 under axial compression.

Values in italic type indicate that the section is Class 4 in pure compression and allowance has been made in calculating the resistance

FOR EXPLANATION OF TABLES SEE NOTE 6.

UNEQUAL ANGLES  
Advance® UKA - Unequal Angles



Short leg attached

Two or more bolts in line  
or equivalent welded at each end

Section Designation		Area cm <sup>2</sup>	Radius of Gyration			Buckling mode	Flexural buckling resistance (F) and torsional buckling resistance (T) (kN) for System length L (m)												
h x b mm	t mm		Axis a-a cm	Axis b-b cm	Axis v-v cm		1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
100x75	12	19.7	3.10	2.14	1.59	F	366	286	215	164	128	102	82.9	57.9	42.7	32.7	25.9	21.0	17.3
						T	500	500	500	500	500	500	500	500	500	500	500	500	500
	10	16.6	3.12	2.16	1.59	F	310	241	181	138	108	85.8	69.9	48.8	36.0	27.6	21.8	17.7	14.6
						T	405	405	405	405	405	405	405	405	405	405	405	405	405
	* 8	13.5	3.14	2.18	1.60	F	253	197	148	113	88.2	70.4	57.4	40.1	29.6	22.7	17.9	14.5	12.0
						T	307	307	307	307	307	307	307	307	307	307	307	307	307
100x65	10 +	15.6	3.14	1.81	1.39	F	271	200	145	108	83.0	65.6	53.0	36.7	26.8	20.5	16.1	13.0	10.7
						T	383	383	383	383	383	383	383	383	383	383	383	383	383
	8 +	12.7	3.16	1.83	1.40	F	222	164	119	88.9	68.3	54.0	43.7	30.2	22.1	16.9	13.3	10.7	8.87
						T	292	292	292	292	292	292	292	292	292	292	292	292	292
	* 7 +	11.2	3.17	1.83	1.40	F	185	140	102	76.6	59.1	46.8	38.0	26.3	19.3	14.8	11.6	9.41	7.77
						T	230	230	230	230	230	230	230	230	230	230	230	230	230
100x50	8	11.4	3.19	1.31	1.06	F	165	108	73.8	53.0	39.8	30.9	24.7	16.8	12.1	9.19	7.19	5.78	4.75
						T	262	262	262	262	262	262	262	262	262	262	262	262	262
	* 6	8.71	3.21	1.33	1.07	F	112	77.5	53.9	39.2	29.7	23.2	18.6	12.7	9.24	7.01	5.50	4.43	3.65
						T	151	151	151	151	151	151	151	151	151	151	151	151	151
80x60	7	9.38	2.51	1.74	1.28	F	157	111	78.6	57.8	44.1	34.6	27.9	19.2	14.0	10.6	8.35	6.74	5.55
						T	220	220	220	220	220	220	220	220	220	220	220	220	220
80x40	8	9.01	2.53	1.03	0.838	F	104	62.8	41.2	28.9	21.3	16.4	13.0	8.73	6.26	4.71	3.67	2.94	2.41
						T	222	222	222	222	222	222	222	222	222	222	222	222	222
	6	6.89	2.55	1.05	0.845	F	80.5	48.6	31.9	22.4	16.6	12.7	10.1	6.77	4.86	3.66	2.85	2.29	1.87
						T	155	155	155	155	155	155	155	155	155	155	155	155	155
75x50	8	9.41	2.35	1.40	1.07	F	138	90.4	61.8	44.4	33.4	25.9	20.7	14.1	10.2	7.71	6.04	4.86	3.99
						T	234	234	234	234	234	234	234	234	234	234	234	234	234
	6	7.19	2.37	1.42	1.08	F	106	69.9	47.8	34.4	25.9	20.1	16.1	10.9	7.92	5.99	4.69	3.78	3.10
						T	165	165	165	165	165	165	165	165	165	165	165	165	165
70x50	6	6.89	2.20	1.43	1.07	F	101	66.2	45.2	32.5	24.4	19.0	15.2	10.3	7.46	5.65	4.42	3.56	2.92
						T	161	161	161	161	161	161	161	161	161	161	161	161	161
65x50	* 5	5.54	2.05	1.47	1.07	F	80.9	53.1	36.3	26.1	19.6	15.2	12.2	8.29	6.00	4.54	3.55	2.86	2.35
						T	123	123	123	123	123	123	123	123	123	123	123	123	123
60x40	6	5.68	1.88	1.12	0.855	F	67.2	40.7	26.8	18.8	13.9	10.7	8.49	5.70	4.10	3.08	2.40	1.93	1.58
						T	139	139	139	139	139	139	139	139	139	139	139	139	139
	5	4.79	1.89	1.13	0.860	F	57.0	34.6	22.8	16.0	11.9	9.12	7.23	4.86	3.49	2.63	2.05	1.64	1.35
						T	111	111	111	111	111	111	111	111	111	111	111	111	111

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+ These sections are in addition to the range of BS EN 10056-1 sections.

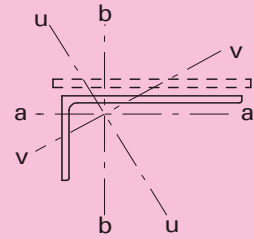
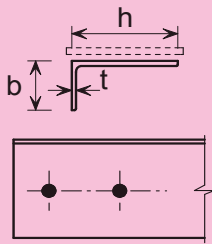
\* Section is Class 4 under axial compression.

Values in italic type indicate that the section is Class 4 in pure compression and allowance has been made in calculating the resistance

FOR EXPLANATION OF TABLES SEE NOTE 6.



UNEQUAL ANGLES  
Advance® UKA - Unequal Angles



Long leg attached

Two or more bolts in line  
or equivalent welded at each end

Section Designation		Area cm <sup>2</sup>	Radius of Gyration			Buckling mode	Flexural buckling resistance (F) and torsional buckling resistance (T) (kN) for System length L (m)													
			Axis a-a cm	Axis b-b cm	Axis v-v cm		1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0	
200x150	18 +	60.1	4.38	6.30	3.22	F	1270	1180	1090	987	864	752	655	501	392	313	256	213	179	
						T	1380	1380	1380	1380	1380	1380	1380	1380	1380	1380	1380	1380	1380	
	* 15	50.5	4.40	6.33	3.23	F	<i>1080</i>	<i>1010</i>	<i>930</i>	<i>839</i>	<i>734</i>	<i>639</i>	<i>555</i>	<i>425</i>	<i>332</i>	<i>266</i>	<i>217</i>	<i>180</i>	<i>152</i>	
						T	<i>1090</i>	<i>1090</i>	<i>1090</i>	<i>1090</i>	<i>1090</i>	<i>1090</i>	<i>1090</i>	<i>1090</i>	<i>1090</i>	<i>1090</i>	<i>1090</i>	<i>1090</i>	<i>1090</i>	<i>1090</i>
	* 12	40.8	4.44	6.36	3.25	F	<i>745</i>	<i>702</i>	<i>655</i>	<i>605</i>	<i>538</i>	<i>475</i>	<i>418</i>	<i>325</i>	<i>257</i>	<i>207</i>	<i>170</i>	<i>142</i>	<i>120</i>	
						T	<i>693</i>	<i>693</i>	<i>693</i>	<i>693</i>	<i>693</i>	<i>693</i>	<i>693</i>	<i>693</i>	<i>693</i>	<i>693</i>	<i>693</i>	<i>693</i>	<i>693</i>	<i>693</i>
200x100	15	43.0	2.64	6.40	2.12	F	853	738	625	504	409	335	278	200	150	117	93.2	76.1	63.3	
						T	964	964	964	964	964	964	964	964	964	964	964	964	964	
	* 12	34.8	2.67	6.43	2.14	F	<i>585</i>	<i>517</i>	<i>448</i>	<i>375</i>	<i>309</i>	<i>257</i>	<i>216</i>	<i>157</i>	<i>119</i>	<i>92.7</i>	<i>74.4</i>	<i>60.9</i>	<i>50.8</i>	
						T	<i>604</i>	<i>604</i>	<i>604</i>	<i>604</i>	<i>604</i>	<i>604</i>	<i>604</i>	<i>604</i>	<i>604</i>	<i>604</i>	<i>604</i>	<i>604</i>	<i>604</i>	<i>604</i>
	* 10	29.2	2.68	6.46	2.15	F	<i>431</i>	<i>386</i>	<i>339</i>	<i>293</i>	<i>244</i>	<i>205</i>	<i>173</i>	<i>127</i>	<i>97.0</i>	<i>76.2</i>	<i>61.3</i>	<i>50.4</i>	<i>42.1</i>	
						T	<i>408</i>	<i>408</i>	<i>408</i>	<i>408</i>	<i>408</i>	<i>408</i>	<i>408</i>	<i>408</i>	<i>408</i>	<i>408</i>	<i>408</i>	<i>408</i>	<i>408</i>	<i>408</i>
150x90	15	33.9	2.46	4.74	1.93	F	659	561	453	358	286	232	192	136	102	78.6	62.5	50.9	42.3	
						T	833	833	833	833	833	833	833	833	833	833	833	833	833	
	12	27.5	2.49	4.77	1.94	F	<i>537</i>	<i>458</i>	<i>369</i>	<i>292</i>	<i>234</i>	<i>190</i>	<i>157</i>	<i>111</i>	<i>83.1</i>	<i>64.3</i>	<i>51.2</i>	<i>41.7</i>	<i>34.6</i>	
						T	<i>632</i>	<i>632</i>	<i>632</i>	<i>632</i>	<i>632</i>	<i>632</i>	<i>632</i>	<i>632</i>	<i>632</i>	<i>632</i>	<i>632</i>	<i>632</i>	<i>632</i>	<i>632</i>
	* 10	23.2	2.51	4.80	1.95	F	<i>413</i>	<i>357</i>	<i>295</i>	<i>236</i>	<i>191</i>	<i>156</i>	<i>129</i>	<i>92.5</i>	<i>69.3</i>	<i>53.8</i>	<i>42.9</i>	<i>35.0</i>	<i>29.1</i>	
						T	<i>452</i>	<i>452</i>	<i>452</i>	<i>452</i>	<i>452</i>	<i>452</i>	<i>452</i>	<i>452</i>	<i>452</i>	<i>452</i>	<i>452</i>	<i>452</i>	<i>452</i>	<i>452</i>
150x75	15	31.7	1.94	4.75	1.58	F	568	454	344	261	203	162	132	92.3	68.0	52.1	41.2	33.4	27.6	
						T	780	780	780	780	780	780	780	780	780	780	780	780	780	
	12	25.7	1.97	4.78	1.59	F	<i>463</i>	<i>372</i>	<i>281</i>	<i>214</i>	<i>166</i>	<i>133</i>	<i>108</i>	<i>75.6</i>	<i>55.7</i>	<i>42.7</i>	<i>33.8</i>	<i>27.4</i>	<i>22.6</i>	
						T	<i>591</i>	<i>591</i>	<i>591</i>	<i>591</i>	<i>591</i>	<i>591</i>	<i>591</i>	<i>591</i>	<i>591</i>	<i>591</i>	<i>591</i>	<i>591</i>	<i>591</i>	<i>591</i>
	* 10	21.7	1.99	4.81	1.60	F	<i>359</i>	<i>294</i>	<i>227</i>	<i>175</i>	<i>137</i>	<i>110</i>	<i>90.0</i>	<i>63.2</i>	<i>46.7</i>	<i>35.9</i>	<i>28.5</i>	<i>23.1</i>	<i>19.1</i>	
						T	<i>423</i>	<i>423</i>	<i>423</i>	<i>423</i>	<i>423</i>	<i>423</i>	<i>423</i>	<i>423</i>	<i>423</i>	<i>423</i>	<i>423</i>	<i>423</i>	<i>423</i>	<i>423</i>
125x75	12	22.7	2.05	3.95	1.61	F	415	334	251	192	150	120	97.4	68.1	50.2	38.5	30.5	24.7	20.4	
						T	552	552	552	552	552	552	552	552	552	552	552	552	552	
	10	19.1	2.07	3.97	1.61	F	<i>351</i>	<i>281</i>	<i>212</i>	<i>161</i>	<i>126</i>	<i>101</i>	<i>82.0</i>	<i>57.3</i>	<i>42.3</i>	<i>32.4</i>	<i>25.7</i>	<i>20.8</i>	<i>17.2</i>	
						T	<i>439</i>	<i>439</i>	<i>439</i>	<i>439</i>	<i>439</i>	<i>439</i>	<i>439</i>	<i>439</i>	<i>439</i>	<i>439</i>	<i>439</i>	<i>439</i>	<i>439</i>	<i>439</i>
	* 8	15.5	2.09	4.00	1.63	F	<i>255</i>	<i>211</i>	<i>163</i>	<i>126</i>	<i>99.6</i>	<i>80.1</i>	<i>65.7</i>	<i>46.3</i>	<i>34.3</i>	<i>26.4</i>	<i>20.9</i>	<i>17.0</i>	<i>14.1</i>	
						T	<i>289</i>	<i>289</i>	<i>289</i>	<i>289</i>	<i>289</i>	<i>289</i>	<i>289</i>	<i>289</i>	<i>289</i>	<i>289</i>	<i>289</i>	<i>289</i>	<i>289</i>	<i>289</i>

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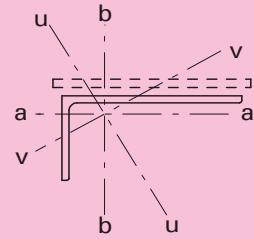
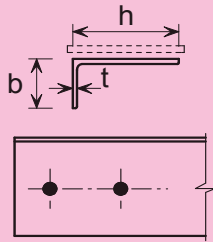
+ These sections are in addition to the range of BS EN 10056-1 sections.

\* Section is Class 4 under axial compression.

Values in italic type indicate that the section is Class 4 in pure compression and allowance has been made in calculating the resistance

FOR EXPLANATION OF TABLES SEE NOTE 6.

UNEQUAL ANGLES  
Advance® UKA - Unequal Angles



Long leg attached

Two or more bolts in line  
or equivalent welded at each end

Section Designation		Area cm <sup>2</sup>	Radius of Gyration			Buckling mode	Flexural buckling resistance (F) and torsional buckling resistance (T) (kN) for System length L (m)													
h x b mm	t mm		Axis a-a cm	Axis b-b cm	Axis v-v cm		1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0	
100x75	12	19.7	2.14	3.10	1.59	F	366	286	215	164	128	102	82.9	57.9	42.7	32.7	25.9	21.0	17.3	
						T	500	500	500	500	500	500	500	500	500	500	500	500	500	500
	10	16.6	2.16	3.12	1.59	F	310	241	181	138	108	85.8	69.9	48.8	36.0	27.6	21.8	17.7	14.6	
						T	405	405	405	405	405	405	405	405	405	405	405	405	405	405
	* 8	13.5	2.18	3.14	1.60	F	253	197	148	113	88.2	70.4	57.4	40.1	29.6	22.7	17.9	14.5	12.0	
						T	307	307	307	307	307	307	307	307	307	307	307	307	307	307
100x65	10 +	15.6	1.81	3.14	1.39	F	271	200	145	108	83.0	65.6	53.0	36.7	26.8	20.5	16.1	13.0	10.7	
						T	383	383	383	383	383	383	383	383	383	383	383	383	383	383
	8 +	12.7	1.83	3.16	1.40	F	222	164	119	88.9	68.3	54.0	43.7	30.2	22.1	16.9	13.3	10.7	8.87	
						T	292	292	292	292	292	292	292	292	292	292	292	292	292	292
	* 7 +	11.2	1.83	3.17	1.40	F	185	140	102	76.6	59.1	46.8	38.0	26.3	19.3	14.8	11.6	9.41	7.77	
						T	230	230	230	230	230	230	230	230	230	230	230	230	230	230
100x50	8	11.4	1.31	3.19	1.06	F	165	108	73.8	53.0	39.8	30.9	24.7	16.8	12.1	9.19	7.19	5.78	4.75	
						T	262	262	262	262	262	262	262	262	262	262	262	262	262	262
	* 6	8.71	1.33	3.21	1.07	F	112	77.5	53.9	39.2	29.7	23.2	18.6	12.7	9.24	7.01	5.50	4.43	3.65	
						T	151	151	151	151	151	151	151	151	151	151	151	151	151	151
80x60	7	9.38	1.74	2.51	1.28	F	157	111	78.6	57.8	44.1	34.6	27.9	19.2	14.0	10.6	8.35	6.74	5.55	
						T	220	220	220	220	220	220	220	220	220	220	220	220	220	220
80x40	8	9.01	1.03	2.53	0.838	F	104	62.8	41.2	28.9	21.3	16.4	13.0	8.73	6.26	4.71	3.67	2.94	2.41	
						T	222	222	222	222	222	222	222	222	222	222	222	222	222	222
	6	6.89	1.05	2.55	0.845	F	80.5	48.6	31.9	22.4	16.6	12.7	10.1	6.77	4.86	3.66	2.85	2.29	1.87	
						T	155	155	155	155	155	155	155	155	155	155	155	155	155	155
75x50	8	9.41	1.40	2.35	1.07	F	138	90.4	61.8	44.4	33.4	25.9	20.7	14.1	10.2	7.71	6.04	4.86	3.99	
						T	234	234	234	234	234	234	234	234	234	234	234	234	234	234
	6	7.19	1.42	2.37	1.08	F	106	69.9	47.8	34.4	25.9	20.1	16.1	10.9	7.92	5.99	4.69	3.78	3.10	
						T	165	165	165	165	165	165	165	165	165	165	165	165	165	165
70x50	6	6.89	1.43	2.20	1.07	F	101	66.2	45.2	32.5	24.4	19.0	15.2	10.3	7.46	5.65	4.42	3.56	2.92	
						T	161	161	161	161	161	161	161	161	161	161	161	161	161	161
65x50	* 5	5.54	1.47	2.05	1.07	F	80.9	53.1	36.3	26.1	19.6	15.2	12.2	8.29	6.00	4.54	3.55	2.86	2.35	
						T	123	123	123	123	123	123	123	123	123	123	123	123	123	123
60x40	6	5.68	1.12	1.88	0.855	F	67.2	40.7	26.8	18.8	13.9	10.7	8.49	5.70	4.10	3.08	2.40	1.93	1.58	
						T	139	139	139	139	139	139	139	139	139	139	139	139	139	139
	5	4.79	1.13	1.89	0.860	F	57.0	34.6	22.8	16.0	11.9	9.12	7.23	4.86	3.49	2.63	2.05	1.64	1.35	
						T	111	111	111	111	111	111	111	111	111	111	111	111	111	111

Advance® and UKA are trademarks of Tata Steel. A fuller description of the relationship between Angles and the Advance® range of sections manufactured by Tata Steel is given in section 12

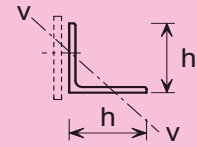
+ These sections are in addition to the range of BS EN 10056-1 sections.

\* Section is Class 4 under axial compression.

Values in italic type indicate that the section is Class 4 in pure compression and allowance has been made in calculating the resistance

FOR EXPLANATION OF TABLES SEE NOTE 6.

EQUAL ANGLES  
Advance® UKA - Equal Angles



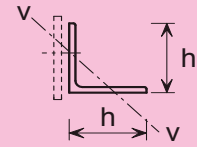
Section Designation		Mass per Metre kg/m	Radius of Gyration Axis v-v cm	Gross Area cm <sup>2</sup>	Bolt Size	Holes Deducted From Angle		Tension Resistance N <sub>u,Rd</sub> kN
h x h mm	t mm					No.	Diameter mm	
200x200	24	71.1	3.90	90.6	Weld	0	-	2060
					M24	1	26	1840
					M24	2	26	1690
					M20	3	22	1590
	20	59.9	3.92	76.3	Weld	0	-	1730
					M24	1	26	1540
					M24	2	26	1420
					M20	3	22	1330
	18	54.3	3.90	69.1	Weld	0	-	1570
					M24	1	26	1390
					M24	2	26	1290
					M20	3	22	1210
	16	48.5	3.94	61.8	Weld	0	-	1450
					M24	1	26	1290
					M24	2	26	1190
					M20	3	22	1120
150x150	18 +	40.1	2.93	51.2	Weld	0	-	1160
					M24	1	26	1030
					M20	2	22	927
	15	33.8	2.93	43.0	Weld	0	-	1010
					M24	1	26	896
					M20	2	22	807
	12	27.3	2.95	34.8	Weld	0	-	818
					M24	1	26	722
					M20	2	22	651
	10	23.0	2.97	29.3	Weld	0	-	688
					M24	1	26	606
					M20	2	22	546
120x120	15 +	26.6	2.34	34.0	Weld	0	-	803
					M24	1	26	685
					M20	1	22	705
	12	21.6	2.35	27.5	Weld	0	-	648
					M24	1	26	552
					M20	1	22	568
	10	18.2	2.36	23.2	Weld	0	-	546
					M24	1	26	464
					M20	1	22	477
	8 +	14.7	2.38	18.8	Weld	0	-	441
					M24	1	26	375
					M20	1	22	385

Advance® and UKA are trademarks of Tata Steel. A fuller description of the relationship between Angles and the Advance® range of sections manufactured by Tata Steel is given in note 12.

+ These sections are in addition to the range in BS EN 10056-1.

FOR EXPLANATION OF TABLES SEE NOTE 7.

EQUAL ANGLES  
Advance® UKA - Equal Angles



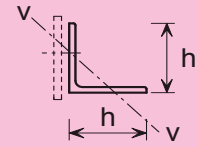
Section Designation		Mass per Metre kg/m	Radius of Gyration Axis v-v cm	Gross Area cm <sup>2</sup>	Bolt Size	Holes Deducted From Angle		Tension Resistance N <sub>u,Rd</sub> kN
h x h mm	t mm					No.	Diameter mm	
100x100	15 +	21.9	1.94	28.0	Weld	0	-	663
					M24	1	26	545
					M20	1	22	565
	12	17.8	1.94	22.7	Weld	0	-	536
					M24	1	26	440
					M20	1	22	456
	10	15.0	1.95	19.2	Weld	0	-	452
					M24	1	26	371
					M20	1	22	384
	8	12.2	1.96	15.5	Weld	0	-	364
					M24	1	26	298
					M20	1	22	309
90x90	12 +	15.9	1.75	20.3	Weld	0	-	480
					M20	1	22	400
					M16	1	18	416
	10	13.4	1.75	17.1	Weld	0	-	403
					M20	1	22	336
					M16	1	18	349
	8	10.9	1.76	13.9	Weld	0	-	327
					M20	1	22	272
					M16	1	18	282
	7	9.61	1.77	12.2	Weld	0	-	287
					M20	1	22	238
					M16	1	18	247
80x80	10	11.9	1.55	15.1	Weld	0	-	357
					M20	1	22	289
					M16	1	18	302
	8	9.63	1.56	12.3	Weld	0	-	290
					M20	1	22	234
					M16	1	18	245
75x75	8	8.99	1.46	11.4	Weld	0	-	269
					M20	1	22	214
					M16	1	18	225
	6	6.85	1.47	8.73	Weld	0	-	205
					M20	1	22	163
					M16	1	18	171

Advance® and UKA are trademarks of Tata Steel. A fuller description of the relationship between Angles and the Advance® range of sections manufactured by Tata Steel is given in note 12.

+ These sections are in addition to the range in BS EN 10056-1.

FOR EXPLANATION OF TABLES SEE NOTE 7.

EQUAL ANGLES  
Advance® UKA - Equal Angles

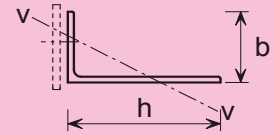


Section Designation		Mass per Metre kg/m	Radius of Gyration Axis v-v cm	Gross Area cm <sup>2</sup>	Bolt Size	Holes Deducted From Angle		Tension Resistance N <sub>u,Rd</sub> kN
h x h mm	t mm					No.	Diameter mm	
70x70	7	7.38	1.36	9.40	Weld	0	-	221
					M20	1	22	173
					M16	1	18	182
	6	6.38	1.37	8.13	Weld	0	-	191
					M20	1	22	149
					M16	1	18	157
65x65	7	6.83	1.26	8.73	Weld	0	-	206
					M20	1	22	157
					M16	1	18	166
60x60	8	7.09	1.16	9.03	Weld	0	-	213
					M16	1	18	169
	6	5.42	1.17	6.91	Weld	0	-	163
					M16	1	18	129
	5	4.57	1.17	5.82	Weld	0	-	137
					M16	1	18	108
50x50	6	4.47	0.968	5.69	Weld	0	-	134
					M12	1	14	108
	5	3.77	0.973	4.80	Weld	0	-	113
					M12	1	14	91.0
	4	3.06	0.979	3.89	Weld	0	-	91.4
					M12	1	14	73.5
45x45	4.5	3.06	0.870	3.90	Weld	0	-	91.8
					M12	1	14	71.8
40x40	5	2.97	0.773	3.79	Weld	0	-	89.5
					M12	1	14	67.5
	4	2.42	0.777	3.08	Weld	0	-	72.5
					M12	1	14	54.7
35x35	4	2.09	0.678	2.67	Weld	0	-	62.9
					M12	1	14	45.2
30x30	4	1.78	0.577	2.27	Weld	0	-	53.6
					M12	1	14	35.8
	3	1.36	0.581	1.74	Weld	0	-	40.9
					M12	1	14	27.4
25x25	4	1.45	0.482	1.85	Weld	0	-	43.9
					M12	1	14	26.2
	3	1.12	0.484	1.42	Weld	0	-	33.5
					M12	1	14	20.1
20x20	3	0.882	0.383	1.12	Weld	0	-	26.5
					M12	1	14	13.1

Advance® and UKA are trademarks of Tata Steel. A fuller description of the relationship between Angles and the Advance® range of sections manufactured by Tata Steel is given in note 12.

FOR EXPLANATION OF TABLES SEE NOTE 7.

UNEQUAL ANGLES  
Advance® UKA - Unequal Angles



Short leg attached

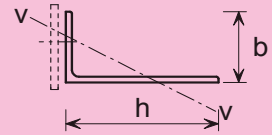
Section Designation		Mass per Metre kg/m	Radius of Gyration Axis v-v cm	Gross Area cm <sup>2</sup>	Bolt Size	Holes Deducted From Angle		Tension Resistance N <sub>u,Rd</sub> kN
h x b mm	t mm					No.	Diameter mm	
200x150	18 +	47.1	3.22	60.1	Weld	0	-	1330
					M24	1	26	1150
					M20	2	22	1050
	15	39.6	3.23	50.5	Weld	0	-	1160
					M24	1	26	999
					M20	2	22	910
	12	32.0	3.25	40.8	Weld	0	-	934
					M24	1	26	805
					M20	2	22	733
200x100	15	33.8	2.12	43.0	Weld	0	-	952
					M24	1	26	751
					M20	1	22	771
	12	27.3	2.14	34.8	Weld	0	-	769
					M24	1	26	607
					M20	1	22	622
	10	23.0	2.15	29.2	Weld	0	-	645
					M24	1	26	508
					M20	1	22	521
150x90	15	26.6	1.93	33.9	Weld	0	-	764
					M20	1	22	617
					M16	1	18	637
	12	21.6	1.94	27.5	Weld	0	-	618
					M20	1	22	499
					M16	1	18	515
	10	18.2	1.95	23.2	Weld	0	-	521
					M20	1	22	420
					M16	1	18	433
150x75	15	24.8	1.58	31.7	Weld	0	-	703
					M20	1	22	544
					M16	1	18	563
	12	20.2	1.59	25.7	Weld	0	-	569
					M20	1	22	440
					M16	1	18	455
	10	17.0	1.60	21.7	Weld	0	-	480
					M20	1	22	370
					M16	1	18	383

Advance® and UKA are trademarks of Tata Steel. A fuller description of the relationship between Angles and the Advance® range of sections manufactured by Tata Steel is given in note 12.

+ These sections are in addition to the range in BS EN 10056-1.

FOR EXPLANATION OF TABLES SEE NOTE 7.

UNEQUAL ANGLES  
Advance® UKA - Unequal Angles



Short leg attached

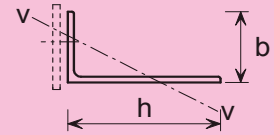
Section Designation		Mass per Metre kg/m	Radius of Gyration Axis v-v cm	Gross Area cm <sup>2</sup>	Bolt Size	Holes Deducted From Angle		Tension Resistance N <sub>u,Rd</sub> kN
h x b mm	t mm					No.	Diameter mm	
125x75	12	17.8	1.61	22.7	Weld	0	-	511
					M20	1	22	398
					M16	1	18	414
	10	15.0	1.61	19.1	Weld	0	-	430
					M20	1	22	334
					M16	1	18	348
	8	12.2	1.63	15.5	Weld	0	-	348
					M20	1	22	271
					M16	1	18	281
100x75	12	15.4	1.59	19.7	Weld	0	-	453
					M20	1	22	357
					M16	1	18	373
	10	13.0	1.59	16.6	Weld	0	-	381
					M20	1	22	300
					M16	1	18	313
	8	10.6	1.60	13.5	Weld	0	-	309
					M20	1	22	243
					M16	1	18	254
100x65	10 +	12.3	1.39	15.6	Weld	0	-	354
					M20	1	22	267
					M16	1	18	280
	8 +	9.94	1.40	12.7	Weld	0	-	287
					M20	1	22	217
					M16	1	18	227
	7 +	8.77	1.40	11.2	Weld	0	-	253
					M20	1	22	191
					M16	1	18	200
100x50	8	8.97	1.06	11.4	Weld	0	-	252
					M12	1	14	197
	6	6.84	1.07	8.71	Weld	0	-	192
					M12	1	14	150
80x60	7	7.36	1.28	9.38	Weld	0	-	215
					M16	1	18	168

Advance® and UKA are trademarks of Tata Steel. A fuller description of the relationship between Angles and the Advance® range of sections manufactured by Tata Steel is given in note 12.

+ These sections are in addition to the range in BS EN 10056-1.

FOR EXPLANATION OF TABLES SEE NOTE 7.

UNEQUAL ANGLES  
Advance® UKA - Unequal Angles



Short leg attached

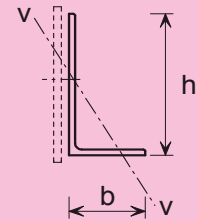
Section Designation		Mass per Metre kg/m	Radius of Gyration Axis v-v cm	Gross Area cm <sup>2</sup>	Bolt Size	Holes Deducted From Angle		Tension Resistance N <sub>u,Rd</sub> kN
h x b mm	t mm					No.	Diameter mm	
80x40	8	7.07	0.838	9.01	Weld	0	-	200
					M12	1	14	149
80x40	6	5.41	0.845	6.89	Weld	0	-	152
					M12	1	14	113
75x50	8	7.39	1.07	9.41	Weld	0	-	214
					M12	1	14	169
75x50	6	5.65	1.08	7.19	Weld	0	-	163
					M12	1	14	129
70x50	6	5.41	1.07	6.89	Weld	0	-	157
					M12	1	14	125
65x50	5	4.35	1.07	5.54	Weld	0	-	127
					M12	1	14	101
60x40	6	4.46	0.855	5.68	Weld	0	-	129
					M12	1	14	96.6
60x40	5	3.76	0.860	4.79	Weld	0	-	109
					M12	1	14	81.3
60x30	5	3.36	0.633	4.28	Weld	0	-	94.8
					M12	1	14	64.6
50x30	5	2.96	0.639	3.78	Weld	0	-	85.1
					M12	1	14	57.8
45x30	4	2.25	0.640	2.87	Weld	0	-	65.1
					M12	1	14	44.1
40x25	4	1.93	0.534	2.46	Weld	0	-	55.6
					M12	1	14	34.6
40x20	4	1.77	0.417	2.26	Weld	0	-	50.1
					M12	1	14	28.0
30x20	4	1.46	0.421	1.86	Weld	0	-	42.4
					M12	1	14	22.5
30x20	3	1.12	0.424	1.43	Weld	0	-	32.5
					M12	1	14	17.4

Advance® and UKA are trademarks of Tata Steel. A fuller description of the relationship between Angles and the Advance® range of sections manufactured by Tata Steel is given in note 12.

FOR EXPLANATION OF TABLES SEE NOTE 7.



UNEQUAL ANGLES  
Advance® UKA - Unequal Angles



Long leg attached

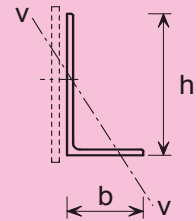
Section Designation		Mass per Metre kg/m	Radius of Gyration Axis v-v cm	Gross Area cm <sup>2</sup>	Bolt Size	Holes Deducted From Angle		Tension Resistance N <sub>u,Rd</sub> kN
h x b mm	t mm					No.	Diameter mm	
200x150	18 +	47.1	3.22	60.1	Weld	0	-	1400
					M24	1	26	1270
					M24	2	26	1170
					M20	3	22	1090
	15	39.6	3.23	50.5	Weld	0	-	1220
					M24	1	26	1110
					M24	2	26	1010
					M20	3	22	945
	12	32.0	3.25	40.8	Weld	0	-	983
					M24	1	26	891
					M24	2	26	817
					M20	3	22	762
200x100	15	33.8	2.12	43.0	Weld	0	-	1080
					M24	1	26	1000
					M24	2	26	911
					M20	3	22	842
	12	27.3	2.14	34.8	Weld	0	-	868
					M24	1	26	809
					M24	2	26	735
					M20	3	22	679
	10	23.0	2.15	29.2	Weld	0	-	727
					M24	1	26	677
					M24	2	26	615
					M20	3	22	569
150x90	15	26.6	1.93	33.9	Weld	0	-	838
					M24	1	26	771
					M20	2	22	681
	12	21.6	1.94	27.5	Weld	0	-	678
					M24	1	26	622
					M20	2	22	550
	10	18.2	1.95	23.2	Weld	0	-	570
					M24	1	26	522
					M20	2	22	463
150x75	15	24.8	1.58	31.7	Weld	0	-	796
					M24	1	26	740
					M20	2	22	651
	12	20.2	1.59	25.7	Weld	0	-	643
					M24	1	26	597
					M20	2	22	526
	10	17.0	1.60	21.7	Weld	0	-	541
					M24	1	26	501
					M20	2	22	442

Advance® and UKA are trademarks of Tata Steel. A fuller description of the relationship between Angles and the Advance® range of sections manufactured by Tata Steel is given in note 12.

+ These sections are in addition to the range in BS EN 10056-1.

FOR EXPLANATION OF TABLES SEE NOTE 7.

UNEQUAL ANGLES  
Advance® UKA - Unequal Angles



Long leg attached

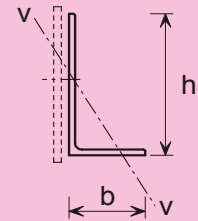
Section Designation		Mass per Metre kg/m	Radius of Gyration Axis v-v cm	Gross Area cm <sup>2</sup>	Bolt Size	Holes Deducted From Angle		Tension Resistance N <sub>u,Rd</sub> kN
h x b mm	t mm					No.	Diameter mm	
125x75	12	17.8	1.61	22.7	Weld	0	-	561
					M24	1	26	498
					M20	2	22	427
	10	15.0	1.61	19.1	Weld	0	-	471
					M24	1	26	417
					M20	2	22	358
	8	12.2	1.63	15.5	Weld	0	-	381
					M24	1	26	337
					M20	2	22	289
100x75	12	15.4	1.59	19.7	Weld	0	-	478
					M24	1	26	399
					M20	1	22	415
	10	13.0	1.59	16.6	Weld	0	-	402
					M24	1	26	335
					M20	1	22	348
	8	10.6	1.60	13.5	Weld	0	-	326
					M24	1	26	271
					M20	1	22	282
100x65	10 +	12.3	1.39	15.6	Weld	0	-	383
					M24	1	26	321
					M20	1	22	334
	8 +	9.94	1.40	12.7	Weld	0	-	310
					M24	1	26	260
					M20	1	22	271
	7 +	8.77	1.40	11.2	Weld	0	-	273
					M24	1	26	229
					M20	1	22	238
100x50	8	8.97	1.06	11.4	Weld	0	-	285
					M24	1	26	242
					M20	1	22	253
	6	6.84	1.07	8.71	Weld	0	-	217
					M24	1	26	184
					M20	1	22	192
80x60	7	7.36	1.28	9.38	Weld	0	-	227
					M20	1	22	186
					M16	1	18	195

Advance® and UKA are trademarks of Tata Steel. A fuller description of the relationship between Angles and the Advance® range of sections manufactured by Tata Steel is given in note 12.

+ These sections are in addition to the range in BS EN 10056-1.

FOR EXPLANATION OF TABLES SEE NOTE 7.

UNEQUAL ANGLES  
Advance® UKA - Unequal Angles



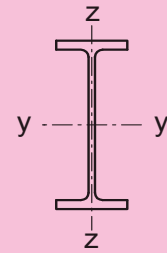
Long leg attached

Section Designation		Mass per Metre kg/m	Radius of Gyration Axis v-v cm	Gross Area cm <sup>2</sup>	Bolt Size	Holes Deducted From Angle		Tension Resistance N <sub>u,Rd</sub> kN
h x b mm	t mm					No.	Diameter mm	
80x40	8	7.07	0.838	9.01	Weld	0	-	226
					M20	1	22	189
					M16	1	18	200
	6	5.41	0.845	6.89	Weld	0	-	172
					M20	1	22	144
					M16	1	18	151
75x50	8	7.39	1.07	9.41	Weld	0	-	231
					M20	1	22	187
					M16	1	18	197
	6	5.65	1.08	7.19	Weld	0	-	176
					M20	1	22	142
					M16	1	18	150
70x50	6	5.41	1.07	6.89	Weld	0	-	167
					M20	1	22	132
					M16	1	18	140
65x50	5	4.35	1.07	5.54	Weld	0	-	133
					M20	1	22	102
					M16	1	18	109
60x40	6	4.46	0.855	5.68	Weld	0	-	139
					M16	1	18	112
	5	3.76	0.860	4.79	Weld	0	-	117
					M16	1	18	93.9
60x30	5	3.36	0.633	4.28	Weld	0	-	107
					M16	1	18	86.9
50x30	5	2.96	0.639	3.78	Weld	0	-	93.4
					M12	1	14	77.0
45x30	4	2.25	0.640	2.87	Weld	0	-	70.1
					M12	1	14	55.6
40x25	4	1.93	0.534	2.46	Weld	0	-	60.6
					M12	1	14	46.1
40x20	4	1.77	0.417	2.26	Weld	0	-	56.7
					M12	1	14	43.4
30x20	4	1.46	0.421	1.86	Weld	0	-	45.7
					M12	1	14	30.2
	3	1.12	0.424	1.43	Weld	0	-	35.0
					M12	1	14	23.1

Advance® and UKA are trademarks of Tata Steel. A fuller description of the relationship between Angles and the Advance® range of sections manufactured by Tata Steel is given in note 12.

FOR EXPLANATION OF TABLES SEE NOTE 7.

UNIVERSAL BEAMS  
Advance® UKB



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)												Second Moment of Area y-y axis $I_y$ $cm^4$
				2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	
1016x305x487 +  $M_{c,y,Rd} = 5920$ $M_{c,z,Rd} = 714$  Class = 1	1.00	5920	5820	5220	4710	4280	3900	3590	3310	3080	2870	2700	2540	2400	1020000	
	1.13	5920	5920	5510	5030	4600	4230	3910	3630	3380	3160	2970	2800	2650		
	1.35	5920	5920	5910	5470	5070	4720	4400	4110	3850	3620	3420	3230	3060		
	1.50	5920	5920	5920	5720	5340	5000	4690	4410	4150	3920	3700	3510	3330		
	1.77	5920	5920	5920	5920	5750	5440	5150	4870	4620	4390	4180	3980	3790		
	2.00	5920	5920	5920	5920	5920	5740	5470	5220	4970	4750	4540	4340	4150		
	2.50	5920	5920	5920	5920	5920	5920	5920	5920	5800	5590	5390	5190	5010		4830
1016x305x437 +  $M_{c,y,Rd} = 5300$ $M_{c,z,Rd} = 629$  Class = 1	1.00	5300	5170	4620	4150	3740	3390	3100	2850	2630	2450	2290	2150	2020	910000	
	1.13	5300	5300	4880	4430	4030	3690	3380	3120	2890	2690	2520	2360	2230		
	1.35	5300	5300	5240	4830	4460	4120	3820	3550	3310	3100	2910	2730	2580		
	1.50	5300	5300	5300	5060	4700	4380	4080	3820	3570	3360	3160	2980	2820		
	1.77	5300	5300	5300	5300	5070	4770	4500	4240	4000	3780	3580	3390	3220		
	2.00	5300	5300	5300	5300	5300	5050	4790	4550	4320	4100	3900	3710	3540		
	2.50	5300	5300	5300	5300	5300	5300	5300	5300	5090	4880	4690	4500	4320		4150
1016x305x393 +  $M_{c,y,Rd} = 4730$ $M_{c,z,Rd} = 553$  Class = 1	1.00	4730	4580	4070	3640	3260	2940	2660	2430	2240	2070	1930	1800	1690	808000	
	1.13	4730	4730	4310	3890	3520	3200	2910	2670	2460	2280	2120	1990	1860		
	1.35	4730	4730	4640	4250	3900	3590	3300	3050	2830	2630	2460	2300	2160		
	1.50	4730	4730	4730	4460	4120	3820	3540	3290	3060	2860	2670	2510	2360		
	1.77	4730	4730	4730	4730	4460	4180	3910	3670	3440	3230	3040	2870	2710		
	2.00	4730	4730	4730	4730	4700	4430	4180	3950	3730	3520	3330	3160	2990		
	2.50	4730	4730	4730	4730	4730	4730	4730	4650	4440	4240	4050	3870	3700		3540
1016x305x349 +  $M_{c,y,Rd} = 4400$ $M_{c,z,Rd} = 514$  Class = 1	1.00	4400	4220	3730	3310	2940	2630	2370	2150	1960	1810	1670	1560	1460	723000	
	1.13	4400	4400	3960	3550	3190	2870	2600	2360	2160	1990	1840	1710	1600		
	1.35	4400	4400	4270	3890	3540	3230	2950	2710	2490	2300	2130	1980	1850		
	1.50	4400	4400	4400	4080	3750	3450	3170	2920	2700	2500	2330	2170	2030		
	1.77	4400	4400	4400	4370	4070	3790	3520	3280	3050	2850	2660	2500	2340		
	2.00	4400	4400	4400	4400	4300	4030	3780	3540	3320	3120	2930	2760	2600		
	2.50	4400	4400	4400	4400	4400	4400	4400	4230	4020	3810	3620	3430	3260		3100
1016x305x314 +  $M_{c,y,Rd} = 3940$ $M_{c,z,Rd} = 454$  Class = 1	1.00	3940	3750	3310	2910	2580	2290	2050	1850	1680	1540	1420	1320	1230	644000	
	1.13	3940	3930	3510	3130	2790	2500	2250	2030	1850	1690	1560	1440	1340		
	1.35	3940	3940	3790	3440	3120	2820	2560	2330	2130	1960	1810	1670	1550		
	1.50	3940	3940	3940	3620	3310	3020	2760	2530	2320	2140	1980	1830	1700		
	1.77	3940	3940	3940	3880	3600	3330	3080	2840	2630	2440	2270	2110	1970		
	2.00	3940	3940	3940	3940	3800	3550	3310	3080	2870	2680	2500	2340	2190		
	2.50	3940	3940	3940	3940	3940	3930	3720	3510	3320	3130	2960	2790	2640		

Advance® and UKB are trademarks of Tata Steel. A fuller description of the relationship between Universal Beams (UB) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

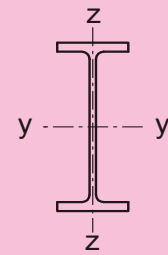
+ These sections are in addition to the range of BS 4 sections.

<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8.

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

**UNIVERSAL BEAMS**  
**Advance® UKB**



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)												Second Moment of Area y-y axis $I_y$ $cm^4$
				2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	
1016x305x272 +  $M_{c,y,Rd} = 3400$ $M_{c,z,Rd} = 389$  Class = 1	1.00	3400	3230	2840	2490	2180	1920	1710	1530	1380	1260	1150	1070	989	554000	
	1.13	3400	3380	3010	2670	2370	2110	1880	1690	1520	1380	1270	1160	1080		
	1.35	3400	3400	3250	2940	2650	2380	2150	1940	1760	1600	1470	1350	1240		
	1.50	3400	3400	3390	3100	2820	2550	2320	2100	1920	1750	1610	1480	1370		
	1.77	3400	3400	3400	3330	3070	2820	2590	2380	2180	2010	1850	1710	1590		
	2.00	3400	3400	3400	3400	3250	3020	2790	2580	2390	2210	2050	1900	1770		
	2.50	3400	3400	3400	3400	3400	3350	3160	2960	2780	2600	2440	2290	2140		
1016x305x249 +  $M_{c,y,Rd} = 3010$ $M_{c,z,Rd} = 330$  Class = 1	1.00	3010	2820	2460	2140	1860	1630	1430	1280	1140	1040	945	868	803	481000	
	1.13	3010	2960	2620	2310	2030	1790	1580	1410	1260	1140	1030	950	881		
	1.35	3010	3010	2840	2550	2280	2030	1810	1620	1460	1320	1200	1090	1000		
	1.50	3010	3010	2960	2690	2420	2180	1960	1760	1590	1440	1310	1200	1100		
	1.77	3010	3010	3010	2890	2650	2420	2200	2000	1820	1660	1520	1390	1280		
	2.00	3010	3010	3010	3010	2820	2600	2380	2190	2000	1840	1690	1550	1430		
	2.50	3010	3010	3010	3010	3010	2900	2710	2530	2350	2180	2030	1880	1750		
1016x305x222 +  $M_{c,y,Rd} = 2600$ $M_{c,z,Rd} = 270$  Class = 1	1.00	2600	2400	2080	1790	1540	1340	1170	1030	919	826	750	686	632	408000	
	1.13	2600	2520	2210	1930	1680	1470	1290	1140	1010	904	820	752	694		
	1.35	2600	2600	2410	2140	1900	1680	1480	1310	1170	1050	942	857	793		
	1.50	2600	2600	2520	2270	2030	1810	1610	1430	1280	1150	1030	936	856		
	1.77	2600	2600	2600	2450	2230	2020	1820	1630	1470	1330	1200	1090	993		
	2.00	2600	2600	2600	2580	2370	2170	1970	1790	1620	1470	1340	1220	1120		
	2.50	2600	2600	2600	2600	2600	2440	2260	2090	1920	1770	1630	1500	1380		
914x419x388  $M_{c,y,Rd} = 4680$ $M_{c,z,Rd} = 885$  Class = 1	1.00	4680	4680	4650	4400	4150	3910	3670	3440	3220	3020	2830	2660	2500	720000	
	1.13	4680	4680	4680	4590	4360	4140	3920	3700	3480	3280	3090	2910	2750		
	1.35	4680	4680	4680	4680	4650	4460	4260	4060	3870	3680	3490	3310	3140		
	1.50	4680	4680	4680	4680	4680	4630	4460	4270	4090	3910	3730	3550	3390		
	1.77	4680	4680	4680	4680	4680	4680	4680	4680	4590	4430	4260	4100	3940		3780
	2.00	4680	4680	4680	4680	4680	4680	4680	4680	4680	4660	4510	4360	4210		4060
	2.50	4680	4680	4680	4680	4680	4680	4680	4680	4680	4680	4680	4680	4680		4560
914x419x343  $M_{c,y,Rd} = 4100$ $M_{c,z,Rd} = 766$  Class = 1	1.00	4100	4100	4060	3830	3610	3380	3160	2950	2740	2560	2380	2230	2090	626000	
	1.13	4100	4100	4100	4000	3790	3590	3380	3170	2980	2790	2610	2450	2290		
	1.35	4100	4100	4100	4100	4050	3870	3690	3500	3320	3130	2960	2790	2630		
	1.50	4100	4100	4100	4100	4100	4030	3860	3690	3510	3340	3170	3000	2850		
	1.77	4100	4100	4100	4100	4100	4100	4100	4100	3970	3820	3660	3500	3350		3190
	2.00	4100	4100	4100	4100	4100	4100	4100	4100	4100	4030	3880	3740	3590		3450
	2.50	4100	4100	4100	4100	4100	4100	4100	4100	4100	4100	4100	4100	4030		3900

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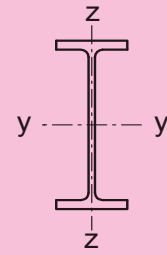
+ These sections are in addition to the range of BS 4 sections.

<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8.

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

UNIVERSAL BEAMS  
Advance® UKB



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)												Second Moment of Area y-y axis $I_y$ $cm^4$
				2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	
914x305x289  $M_{c,y,Rd} = 3330$ $M_{c,z,Rd} = 424$  Class = 1	1.00	3330	3250	2990	2730	2470	2230	2010	1820	1660	1520	1390	1290	1200	504000	
	1.13	3330	3330	3130	2890	2650	2420	2200	2000	1830	1670	1540	1420	1320		
	1.35	3330	3330	3330	3130	2910	2700	2480	2280	2100	1930	1780	1650	1530		
	1.50	3330	3330	3330	3260	3060	2860	2650	2460	2270	2100	1940	1800	1680		
	1.77	3330	3330	3330	3330	3280	3100	2920	2730	2550	2380	2220	2070	1940		
	2.00	3330	3330	3330	3330	3330	3270	3110	2930	2760	2600	2440	2290	2150		
	2.50	3330	3330	3330	3330	3330	3330	3330	3330	3280	3140	2990	2840	2700		2560
914x305x253  $M_{c,y,Rd} = 2900$ $M_{c,z,Rd} = 363$  Class = 1	1.00	2900	2820	2580	2340	2110	1890	1690	1520	1370	1240	1140	1050	967	436000	
	1.13	2900	2900	2710	2490	2270	2050	1850	1670	1510	1370	1250	1150	1060		
	1.35	2900	2900	2890	2700	2500	2300	2100	1910	1740	1590	1450	1330	1230		
	1.50	2900	2900	2900	2810	2630	2440	2250	2060	1890	1730	1590	1460	1350		
	1.77	2900	2900	2900	2900	2830	2660	2480	2310	2140	1970	1830	1690	1570		
	2.00	2900	2900	2900	2900	2900	2810	2650	2480	2320	2160	2010	1870	1740		
	2.50	2900	2900	2900	2900	2900	2900	2900	2900	2800	2660	2510	2370	2230		2100
914x305x224  $M_{c,y,Rd} = 2530$ $M_{c,z,Rd} = 308$  Class = 1	1.00	2530	2440	2230	2010	1800	1590	1420	1260	1130	1020	924	845	778	376000	
	1.13	2530	2530	2340	2140	1940	1740	1550	1390	1240	1120	1010	927	856		
	1.35	2530	2530	2500	2320	2140	1950	1770	1590	1440	1300	1180	1070	979		
	1.50	2530	2530	2530	2430	2260	2080	1900	1720	1560	1420	1290	1180	1080		
	1.77	2530	2530	2530	2530	2430	2270	2110	1940	1780	1630	1490	1370	1260		
	2.00	2530	2530	2530	2530	2530	2410	2260	2100	1940	1790	1650	1520	1410		
	2.50	2530	2530	2530	2530	2530	2530	2530	2510	2380	2240	2100	1970	1840		1710
914x305x201  $M_{c,y,Rd} = 2210$ $M_{c,z,Rd} = 260$  Class = 1	1.00	2210	2120	1930	1730	1530	1350	1190	1050	931	834	754	686	628	325000	
	1.13	2210	2210	2030	1850	1660	1470	1300	1150	1030	917	827	754	693		
	1.35	2210	2210	2170	2010	1840	1660	1490	1330	1190	1060	957	863	795		
	1.50	2210	2210	2210	2100	1940	1770	1600	1440	1300	1170	1050	950	861		
	1.77	2210	2210	2210	2210	2100	1950	1790	1630	1480	1340	1220	1110	1010		
	2.00	2210	2210	2210	2210	2210	2070	1920	1770	1630	1490	1360	1240	1130		
	2.50	2210	2210	2210	2210	2210	2210	2210	2160	2030	1900	1760	1630	1510		1390
838x292x226  $M_{c,y,Rd} = 2430$ $M_{c,z,Rd} = 321$  Class = 1	1.00	2430	2340	2140	1930	1740	1550	1390	1250	1120	1020	935	861	798	340000	
	1.13	2430	2430	2250	2060	1870	1690	1520	1370	1240	1130	1030	944	876		
	1.35	2430	2430	2400	2240	2070	1890	1730	1570	1430	1300	1190	1100	1010		
	1.50	2430	2430	2430	2330	2180	2010	1850	1700	1550	1420	1310	1200	1110		
	1.77	2430	2430	2430	2430	2340	2200	2050	1900	1760	1630	1500	1390	1290		
	2.00	2430	2430	2430	2430	2430	2330	2190	2050	1920	1790	1660	1550	1440		
	2.50	2430	2430	2430	2430	2430	2430	2430	2430	2320	2200	2080	1960	1850		1740

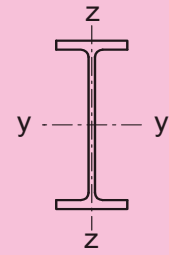
Advance® and UKB are trademarks of Tata Steel. A fuller description of the relationship between Universal Beams (UB) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8.

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

**UNIVERSAL BEAMS**  
**Advance® UKB**



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)												Second Moment of Area y-y axis $I_y$ $cm^4$
				2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	
838x292x194  $M_{c,y,Rd} = 2020$ $M_{c,z,Rd} = 258$  Class = 1	1.00	2020	1940	1760	1580	1400	1240	1090	970	866	780	708	647	596	279000	
	1.13	2020	2010	1850	1680	1510	1350	1200	1070	954	858	776	711	656		
	1.35	2020	2020	1980	1840	1680	1520	1370	1230	1110	996	900	817	752		
	1.50	2020	2020	2020	1920	1780	1620	1480	1330	1210	1090	988	899	820		
	1.77	2020	2020	2020	2020	1920	1780	1640	1510	1380	1250	1140	1050	958		
	2.00	2020	2020	2020	2020	2020	1900	1770	1640	1510	1390	1270	1170	1080		
	2.50	2020	2020	2020	2020	2020	2020	1980	1870	1750	1640	1520	1420	1320		
838x292x176  $M_{c,y,Rd} = 1800$ $M_{c,z,Rd} = 223$  Class = 1	1.00	1800	1710	1550	1380	1220	1070	937	825	733	656	593	539	494	246000	
	1.13	1800	1780	1640	1480	1320	1170	1030	910	807	720	651	594	546		
	1.35	1800	1800	1750	1620	1470	1320	1180	1050	936	836	750	680	627		
	1.50	1800	1800	1800	1690	1560	1410	1270	1140	1020	917	825	744	679		
	1.77	1800	1800	1800	1800	1690	1560	1430	1300	1170	1060	959	869	789		
	2.00	1800	1800	1800	1800	1780	1660	1540	1410	1290	1180	1070	974	889		
	2.50	1800	1800	1800	1800	1800	1800	1730	1620	1510	1400	1290	1190	1100		
762x267x197  $M_{c,y,Rd} = 1900$ $M_{c,z,Rd} = 254$  Class = 1	1.00	1900	1790	1610	1440	1280	1140	1010	907	819	745	683	630	584	240000	
	1.13	1900	1860	1710	1550	1390	1240	1110	999	902	819	748	691	643		
	1.35	1900	1900	1830	1690	1550	1400	1270	1150	1040	951	869	798	735		
	1.50	1900	1900	1900	1770	1640	1500	1370	1250	1140	1040	954	877	809		
	1.77	1900	1900	1900	1890	1780	1650	1530	1410	1300	1200	1100	1020	943		
	2.00	1900	1900	1900	1900	1870	1760	1650	1530	1420	1320	1220	1140	1060		
	2.50	1900	1900	1900	1900	1900	1900	1850	1750	1650	1550	1460	1370	1290		
762x267x173  $M_{c,y,Rd} = 1640$ $M_{c,z,Rd} = 214$  Class = 1	1.00	1640	1530	1380	1220	1070	943	831	737	660	596	543	498	460	205000	
	1.13	1640	1600	1460	1310	1170	1030	914	813	727	654	596	548	508		
	1.35	1640	1640	1570	1440	1300	1170	1050	939	843	760	688	627	583		
	1.50	1640	1640	1630	1510	1390	1260	1130	1020	922	833	756	688	630		
	1.77	1640	1640	1640	1620	1510	1390	1270	1160	1060	963	878	803	737		
	2.00	1640	1640	1640	1640	1590	1490	1380	1270	1160	1070	980	900	829		
	2.50	1640	1640	1640	1640	1640	1640	1560	1460	1370	1270	1180	1100	1020		
762x267x147  $M_{c,y,Rd} = 1370$ $M_{c,z,Rd} = 171$  Class = 1	1.00	1370	1260	1130	989	859	744	647	568	504	451	408	371	341	169000	
	1.13	1370	1320	1200	1060	935	817	713	626	553	495	449	410	377		
	1.35	1370	1370	1290	1170	1050	932	822	726	642	571	514	471	435		
	1.50	1370	1370	1340	1240	1120	1000	892	792	704	628	562	510	472		
	1.77	1370	1370	1370	1330	1230	1120	1010	906	813	730	656	592	536		
	2.00	1370	1370	1370	1370	1300	1200	1100	995	900	814	736	667	606		
	2.50	1370	1370	1370	1370	1370	1340	1250	1160	1070	982	901	825	757		

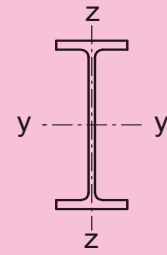
Advance® and UKB are trademarks of Tata Steel. A fuller description of the relationship between Universal Beams (UB) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8.

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

**UNIVERSAL BEAMS**  
**Advance® UKB**



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)												Second Moment of Area y-y axis $I_y$ $cm^4$	
				2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0		14.0
762x267x134  $M_{c,y,Rd} = 1280$ $M_{c,z,Rd} = 157$  Class = 1			1.00	1280	1170	1030	897	770	660	569	496	437	389	350	317	289	151000
			1.13	1280	1220	1100	968	841	726	627	545	479	428	386	351	322	
			1.35	1280	1280	1190	1070	950	832	726	633	555	489	443	405	372	
			1.50	1280	1280	1240	1130	1010	899	790	693	609	537	480	439	404	
			1.77	1280	1280	1280	1220	1120	1010	898	797	707	627	558	498	459	
			2.00	1280	1280	1280	1280	1190	1090	981	880	786	703	628	564	507	
			2.50	1280	1280	1280	1280	1280	1230	1130	1040	945	857	777	704	639	
686x254x170  $M_{c,y,Rd} = 1490$ $M_{c,z,Rd} = 215$  Class = 1			1.00	1490	1390	1250	1110	987	874	778	697	630	574	527	487	453	170000
			1.13	1490	1450	1320	1200	1070	956	855	769	694	631	578	535	498	
			1.35	1490	1490	1420	1310	1200	1080	980	887	805	733	671	616	570	
			1.50	1490	1490	1480	1380	1270	1160	1060	963	878	803	736	677	625	
			1.77	1490	1490	1490	1470	1380	1280	1180	1090	1000	924	852	788	730	
			2.00	1490	1490	1490	1490	1460	1370	1280	1190	1100	1020	947	879	818	
			2.50	1490	1490	1490	1490	1490	1490	1440	1360	1280	1200	1130	1060	998	
686x254x152  $M_{c,y,Rd} = 1330$ $M_{c,z,Rd} = 188$  Class = 1			1.00	1330	1230	1100	973	854	750	662	589	529	479	438	403	373	150000
			1.13	1330	1280	1170	1050	929	822	729	649	582	526	481	443	411	
			1.35	1330	1330	1260	1150	1040	935	838	751	676	611	555	507	472	
			1.50	1330	1330	1310	1210	1110	1000	906	818	739	670	610	557	511	
			1.77	1330	1330	1330	1300	1210	1110	1020	930	848	774	708	650	597	
			2.00	1330	1330	1330	1330	1280	1190	1100	1020	934	859	790	728	672	
			2.50	1330	1330	1330	1330	1330	1320	1250	1170	1100	1020	954	888	828	
686x254x140  $M_{c,y,Rd} = 1210$ $M_{c,z,Rd} = 169$  Class = 1			1.00	1210	1110	993	874	763	666	584	516	461	416	379	347	320	136000
			1.13	1210	1160	1050	941	831	730	643	569	507	456	416	383	354	
			1.35	1210	1210	1140	1040	933	832	740	659	589	529	477	439	407	
			1.50	1210	1210	1180	1090	993	895	803	719	645	581	525	476	441	
			1.77	1210	1210	1210	1170	1090	995	905	820	743	673	612	557	509	
			2.00	1210	1210	1210	1210	1150	1070	982	899	821	749	684	626	574	
			2.50	1210	1210	1210	1210	1210	1190	1120	1040	970	899	832	769	712	
686x254x125  $M_{c,y,Rd} = 1060$ $M_{c,z,Rd} = 144$  Class = 1			1.00	1060	968	858	749	647	559	485	426	378	339	306	280	257	118000
			1.13	1060	1010	912	808	706	614	535	469	414	372	338	309	284	
			1.35	1060	1060	987	893	796	702	618	544	481	428	387	355	328	
			1.50	1060	1060	1030	942	850	758	672	595	528	470	421	385	356	
			1.77	1060	1060	1060	1020	933	846	761	682	611	547	492	444	404	
			2.00	1060	1060	1060	1060	992	912	830	751	678	612	553	501	455	
			2.50	1060	1060	1060	1060	1060	1030	954	881	809	741	679	621	570	

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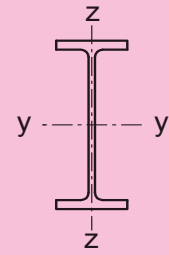
<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8.

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.



UNIVERSAL BEAMS  
Advance® UKB



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)												Second Moment of Area y-y axis $I_y$ $cm^4$
				2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	
610x305x238  $M_{c,y,Rd} = 1980$ $M_{c,z,Rd} = 417$  Class = 1	1.00	1980	1980	1840	1720	1590	1480	1370	1280	1190	1110	1050	983	928	209000	
	1.13	1980	1980	1920	1810	1700	1590	1490	1390	1300	1220	1150	1080	1020		
	1.35	1980	1980	1980	1940	1840	1740	1650	1560	1470	1390	1310	1240	1180		
	1.50	1980	1980	1980	1980	1920	1830	1740	1650	1570	1490	1420	1350	1280		
	1.77	1980	1980	1980	1980	1980	1960	1880	1810	1730	1660	1580	1520	1450		
	2.00	1980	1980	1980	1980	1980	1980	1980	1980	1910	1840	1770	1710	1640		1580
	2.50	1980	1980	1980	1980	1980	1980	1980	1980	1980	1980	1980	1920	1860		1810
610x305x179  $M_{c,y,Rd} = 1470$ $M_{c,z,Rd} = 303$  Class = 1	1.00	1470	1450	1350	1240	1140	1040	947	866	794	732	677	630	588	153000	
	1.13	1470	1470	1410	1310	1210	1120	1030	947	872	806	747	694	648		
	1.35	1470	1470	1470	1410	1320	1240	1150	1070	996	926	862	804	752		
	1.50	1470	1470	1470	1460	1390	1310	1230	1150	1070	1000	937	877	822		
	1.77	1470	1470	1470	1470	1470	1410	1340	1270	1200	1130	1060	1000	943		
	2.00	1470	1470	1470	1470	1470	1470	1420	1350	1280	1220	1160	1100	1040		
	2.50	1470	1470	1470	1470	1470	1470	1470	1470	1470	1440	1380	1330	1270		1220
610x305x149  $M_{c,y,Rd} = 1220$ $M_{c,z,Rd} = 248$  Class = 1	1.00	1220	1200	1100	1010	920	832	751	680	617	563	517	477	443	126000	
	1.13	1220	1220	1160	1070	985	900	819	745	679	621	570	525	486		
	1.35	1220	1220	1220	1160	1080	1000	923	848	779	717	660	609	564		
	1.50	1220	1220	1220	1200	1130	1060	984	912	843	779	720	667	619		
	1.77	1220	1220	1220	1220	1210	1150	1080	1010	946	882	822	767	715		
	2.00	1220	1220	1220	1220	1220	1210	1150	1080	1020	961	901	845	793		
	2.50	1220	1220	1220	1220	1220	1220	1220	1210	1160	1100	1050	995	944		
610x229x140  $M_{c,y,Rd} = 1100$ $M_{c,z,Rd} = 162$  Class = 1	1.00	1100	991	880	774	678	597	529	474	429	391	359	332	309	112000	
	1.13	1100	1040	937	835	740	655	583	522	471	428	394	366	341		
	1.35	1100	1100	1020	924	832	748	671	605	547	497	455	418	391		
	1.50	1100	1100	1060	975	888	805	728	659	599	546	500	459	423		
	1.77	1100	1100	1100	1050	974	896	821	752	689	632	581	536	495		
	2.00	1100	1100	1100	1100	1030	963	891	823	760	701	648	600	557		
	2.50	1100	1100	1100	1100	1100	1080	1020	955	895	837	783	733	686		
610x229x125  $M_{c,y,Rd} = 974$ $M_{c,z,Rd} = 142$  Class = 1	1.00	974	874	771	672	583	509	447	398	357	324	296	273	253	98600	
	1.13	974	917	822	727	638	559	493	438	392	356	326	301	280		
	1.35	974	974	893	806	720	640	569	508	455	411	373	346	322		
	1.50	974	974	933	853	770	691	619	555	499	451	410	374	349		
	1.77	974	974	974	922	848	773	701	636	577	524	478	437	401		
	2.00	974	974	974	970	903	833	764	699	639	584	536	492	453		
	2.50	974	974	974	974	974	939	879	818	760	705	653	606	563		

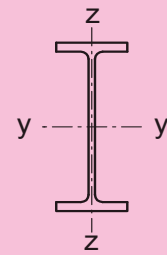
Advance® and UKB are trademarks of Tata Steel. A fuller description of the relationship between Universal Beams (UB) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8.

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

UNIVERSAL BEAMS  
Advance® UKB



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)												Second Moment of Area y-y axis $I_y$ $cm^4$
				2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	
610x229x113  $M_{c,y,Rd} = 869$ $M_{c,z,Rd} = 124$  Class = 1	1.00	869	774	679	587	505	436	380	336	300	270	246	226	209	87300	
	1.13	869	813	725	636	552	480	419	369	328	297	271	250	231		
	1.35	869	866	789	708	626	551	485	428	381	340	311	287	267		
	1.50	869	869	826	750	671	596	528	469	418	374	337	312	290		
	1.77	869	869	869	813	742	670	602	540	485	436	394	358	329		
	2.00	869	869	869	857	792	725	658	596	539	489	444	404	369		
	2.50	869	869	869	869	869	822	762	703	647	594	546	502	463		
610x229x101  $M_{c,y,Rd} = 792$ $M_{c,z,Rd} = 110$  Class = 1	1.00	785	694	601	511	433	369	319	279	247	221	200	182	165	75800	
	1.13	792	730	643	556	476	407	351	305	271	244	221	203	187		
	1.35	792	780	704	623	542	470	407	354	311	280	255	234	216		
	1.50	792	792	738	662	584	510	445	389	342	303	277	255	236		
	1.77	792	792	789	722	649	577	510	450	399	354	316	289	268		
	2.00	792	792	792	764	697	628	562	501	446	398	357	321	295		
	2.50	792	792	792	792	780	721	659	599	542	491	445	404	367		
610x178x100 +  $M_{c,y,Rd} = 738$ $M_{c,z,Rd} = 78.4$  Class = 1	1.00	660	524	417	339	282	241	209	186	167	151	139	128	119	72500	
	1.13	696	565	457	373	310	263	229	204	183	167	153	142	132		
	1.35	738	624	517	429	360	305	263	232	210	192	177	164	153		
	1.50	738	658	554	465	392	335	288	251	227	208	192	178	166		
	1.77	738	709	612	524	449	386	335	293	259	235	217	202	189		
	2.00	738	738	654	569	493	429	374	329	291	260	237	221	207		
	2.50	738	738	728	651	578	513	455	405	363	326	294	266	244		
610x178x92 +  $M_{c,y,Rd} = 691$ $M_{c,z,Rd} = 71.0$  Class = 1	1.00	604	472	370	297	244	206	179	157	141	127	116	107	99.4	64600	
	1.13	639	511	406	327	268	226	196	173	155	140	129	119	110		
	1.35	685	567	462	377	311	260	223	198	178	162	148	137	128		
	1.50	691	599	497	410	340	286	243	214	193	176	161	149	139		
	1.77	691	649	552	464	391	331	283	244	218	199	183	170	159		
	2.00	691	683	592	507	432	369	318	275	240	218	201	187	175		
	2.50	691	691	663	585	511	446	390	342	302	268	239	221	207		
610x178x82 +  $M_{c,y,Rd} = 603$ $M_{c,z,Rd} = 60.0$  Class = 1	1.00	522	403	312	247	201	169	145	127	113	101	92.4	84.8	78.5	55900	
	1.13	552	437	343	272	221	185	159	140	124	112	102	94.0	87.1		
	1.35	593	486	391	315	256	211	182	160	143	130	118	109	101		
	1.50	603	515	421	343	280	232	196	174	155	141	129	119	110		
	1.77	603	559	470	390	323	270	227	196	176	160	147	136	126		
	2.00	603	590	506	427	358	302	256	218	193	176	161	149	139		
	2.50	603	603	569	496	427	367	316	273	238	208	190	177	165		

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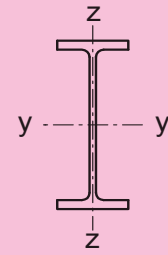
+ These sections are in addition to the range of BS 4 sections.

<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8.

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

UNIVERSAL BEAMS  
Advance® UKB



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)												Second Moment of Area y-y axis $I_y$ $cm^4$	
				2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0		14.0
533x312x272 +  $M_{c,y,Rd} = 2080$ $M_{c,z,Rd} = 526$  Class = 1	1.00	2080	2080	2020	1930	1850	1770	1690	1620	1550	1480	1410	1350	1290	199000		
	1.13	2080	2080	2080	2020	1940	1870	1800	1730	1660	1590	1530	1470	1410			
	1.35	2080	2080	2080	2080	2070	2010	1950	1890	1830	1770	1710	1650	1590			
	1.50	2080	2080	2080	2080	2080	2080	2030	1980	1920	1870	1810	1760	1700			
	1.77	2080	2080	2080	2080	2080	2080	2080	2080	2080	2060	2020	1970	1920		1870	
	2.00	2080	2080	2080	2080	2080	2080	2080	2080	2080	2080	2080	2080	2040		1990	
	2.50	2080	2080	2080	2080	2080	2080	2080	2080	2080	2080	2080	2080	2080		2080	
533x312x219 +  $M_{c,y,Rd} = 1620$ $M_{c,z,Rd} = 401$  Class = 1	1.00	1620	1620	1550	1480	1400	1330	1250	1180	1110	1050	989	935	885	151000		
	1.13	1620	1620	1610	1540	1480	1410	1340	1270	1210	1140	1080	1030	974			
	1.35	1620	1620	1620	1620	1580	1520	1460	1400	1340	1280	1230	1170	1120			
	1.50	1620	1620	1620	1620	1620	1590	1530	1480	1420	1370	1310	1260	1210			
	1.77	1620	1620	1620	1620	1620	1620	1620	1620	1590	1540	1500	1450	1400		1350	
	2.00	1620	1620	1620	1620	1620	1620	1620	1620	1620	1620	1620	1580	1540		1500	1450
	2.50	1620	1620	1620	1620	1620	1620	1620	1620	1620	1620	1620	1620	1620		1620	1620
533x312x182 +  $M_{c,y,Rd} = 1330$ $M_{c,z,Rd} = 328$  Class = 1	1.00	1330	1330	1270	1200	1130	1060	992	925	862	803	751	703	661	123000		
	1.13	1330	1330	1320	1260	1200	1130	1070	1000	939	880	825	775	729			
	1.35	1330	1330	1330	1330	1290	1230	1170	1110	1060	998	943	891	842			
	1.50	1330	1330	1330	1330	1330	1290	1230	1180	1120	1070	1020	964	915			
	1.77	1330	1330	1330	1330	1330	1330	1320	1280	1230	1180	1130	1080	1030			
	2.00	1330	1330	1330	1330	1330	1330	1330	1330	1300	1260	1210	1170	1120			
	2.50	1330	1330	1330	1330	1330	1330	1330	1330	1330	1330	1330	1330	1320		1280	
533x312x150 +  $M_{c,y,Rd} = 1100$ $M_{c,z,Rd} = 267$  Class = 1	1.00	1100	1090	1040	978	916	851	786	724	666	615	569	528	492	101000		
	1.13	1100	1100	1080	1030	970	910	849	788	730	676	627	583	543			
	1.35	1100	1100	1100	1090	1050	994	939	883	827	773	722	675	631			
	1.50	1100	1100	1100	1100	1090	1040	991	939	886	833	782	734	689			
	1.77	1100	1100	1100	1100	1100	1100	1100	1070	1020	977	928	880	833		788	
	2.00	1100	1100	1100	1100	1100	1100	1100	1100	1080	1040	997	952	907		863	
	2.50	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100	1100	1080	1040		1000	
533x210x138 +  $M_{c,y,Rd} = 957$ $M_{c,z,Rd} = 151$  Class = 1	1.00	951	850	755	667	590	526	472	427	390	359	333	310	290	86100		
	1.13	957	894	805	721	644	577	520	471	430	394	365	340	319			
	1.35	957	952	876	799	725	658	598	545	499	458	423	392	365			
	1.50	957	957	915	844	774	708	647	593	545	502	464	431	400			
	1.77	957	957	957	911	849	787	728	674	624	579	538	501	467			
	2.00	957	957	957	957	902	845	789	736	687	641	598	559	524			
	2.50	957	957	957	957	957	944	897	850	804	759	717	677	640			

Advance® and UKB are trademarks of Tata Steel. A fuller description of the relationship between Universal Beams (UB) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

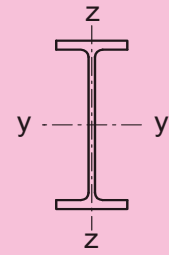
+ These sections are in addition to the range of BS 4 sections.

<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8.

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

UNIVERSAL BEAMS  
Advance® UKB



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)												Second Moment of Area y-y axis $I_y$ $cm^4$
				2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	
533x210x122  $M_{c,y,Rd} = 847$ $M_{c,z,Rd} = 133$  Class = 1	1.00	839	747	658	576	504	445	396	356	324	296	273	254	237	76000	
	1.13	847	786	703	623	551	489	436	392	356	325	300	279	261		
	1.35	847	838	766	693	623	560	504	455	413	377	345	320	300		
	1.50	847	847	802	734	667	604	547	497	452	414	380	350	324		
	1.77	847	847	847	795	735	675	619	567	521	479	442	409	379		
	2.00	847	847	847	838	783	727	673	622	576	533	494	458	426		
	2.50	847	847	847	847	847	819	772	725	680	638	598	560	526		
533x210x109  $M_{c,y,Rd} = 750$ $M_{c,z,Rd} = 116$  Class = 1	1.00	739	655	572	496	429	375	331	295	267	243	223	206	192	66800	
	1.13	750	690	613	538	470	413	365	325	292	267	246	228	212		
	1.35	750	737	670	600	534	474	422	377	340	307	281	262	245		
	1.50	750	750	702	637	573	513	460	413	373	338	308	283	265		
	1.77	750	750	749	693	634	576	523	474	431	393	359	330	304		
	2.00	750	750	750	732	678	624	572	523	479	439	403	371	343		
	2.50	750	750	750	750	750	707	661	615	572	531	493	459	427		
533x210x101  $M_{c,y,Rd} = 692$ $M_{c,z,Rd} = 106$  Class = 1	1.00	681	602	523	450	387	336	295	262	236	214	196	181	168	61500	
	1.13	692	634	561	489	425	370	325	288	259	236	216	200	186		
	1.35	692	678	614	547	483	426	377	335	300	270	248	230	215		
	1.50	692	692	644	581	519	462	411	367	329	297	269	250	233		
	1.77	692	692	688	634	576	521	469	423	382	346	314	287	264		
	2.00	692	692	692	670	618	565	514	467	425	387	354	324	298		
	2.50	692	692	692	692	689	643	598	553	511	471	435	402	373		
533x210x92  $M_{c,y,Rd} = 649$ $M_{c,z,Rd} = 97.6$  Class = 1	1.00	634	556	478	406	344	296	257	227	203	183	167	154	140	55200	
	1.13	649	587	513	442	379	326	283	249	223	202	185	170	158		
	1.35	649	629	564	497	433	376	328	288	255	232	213	196	183		
	1.50	649	649	593	530	467	409	359	317	281	251	231	213	199		
	1.77	649	649	636	580	521	464	412	367	327	293	264	242	226		
	2.00	649	649	649	616	561	506	455	408	366	330	298	270	248		
	2.50	649	649	649	649	630	583	534	488	445	406	371	340	312		
533x210x82  $M_{c,y,Rd} = 566$ $M_{c,z,Rd} = 82.5$  Class = 1	1.00	549	479	407	341	286	243	209	183	163	146	132	119	109	47500	
	1.13	566	506	438	373	315	267	230	201	179	161	147	135	123		
	1.35	566	544	484	421	361	310	267	232	205	186	170	156	144		
	1.50	566	565	510	450	391	338	292	254	223	201	184	170	157		
	1.77	566	566	548	495	439	385	338	296	261	231	209	193	180		
	2.00	566	566	566	527	474	422	374	331	293	261	233	212	197		
	2.50	566	566	566	566	537	490	444	400	360	324	293	265	240		

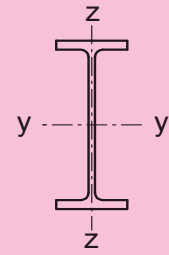
Advance® and UKB are trademarks of Tata Steel. A fuller description of the relationship between Universal Beams (UB) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8.

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

**UNIVERSAL BEAMS**  
**Advance® UKB**



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)												Second Moment of Area y-y axis $I_y$ $cm^4$	
				2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0		14.0
533x165x85 +  $M_{c,y,Rd} = 558$ $M_{c,z,Rd} = 64.4$  Class = 1			1.00	487	383	304	247	207	178	155	138	125	114	105	97.0	90.4	48500
			1.13	514	414	333	273	228	194	170	152	137	125	116	107	100	
			1.35	552	459	379	314	264	225	195	173	157	144	133	124	116	
			1.50	558	485	407	341	288	247	214	187	170	156	144	134	126	
			1.77	558	525	451	385	330	285	248	218	193	176	164	153	143	
			2.00	558	553	483	419	364	317	278	245	218	195	179	167	157	
			2.50	558	558	540	482	428	380	338	302	271	244	221	201	185	
533x165x74 +  $M_{c,y,Rd} = 497$ $M_{c,z,Rd} = 55.0$  Class = 1			1.00	422	325	253	202	166	141	122	108	96.6	87.6	80.2	74.1	68.8	41100
			1.13	447	353	277	222	182	154	134	119	107	96.9	88.8	82.1	76.3	
			1.35	482	393	317	257	211	177	153	136	123	112	103	95.0	88.5	
			1.50	497	417	342	280	231	194	165	147	133	121	112	103	96.5	
			1.77	497	454	382	319	267	225	192	166	151	138	127	118	110	
			2.00	497	480	411	349	296	252	216	187	165	151	139	130	121	
			2.50	497	497	464	406	352	306	267	234	206	182	164	153	144	
533x165x66 +  $M_{c,y,Rd} = 429$ $M_{c,z,Rd} = 45.7$  Class = 1			1.00	359	272	209	164	134	112	96.6	84.8	75.6	68.2	62.2	57.3	53.1	35000
			1.13	381	296	229	181	146	123	106	93.5	83.5	75.5	69.0	63.5	58.9	
			1.35	411	331	263	209	169	140	122	108	96.3	87.3	79.9	73.7	68.4	
			1.50	428	352	284	229	186	153	132	117	105	95.0	87.0	80.4	74.7	
			1.77	429	385	319	261	215	178	150	132	119	108	99.3	91.9	85.5	
			2.00	429	408	345	287	239	200	169	144	130	119	109	101	94.3	
			2.50	429	429	391	337	287	245	210	181	157	140	129	120	112	

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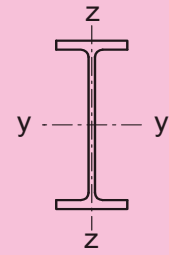
+ These sections are in addition to the range of BS 4 sections.

<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8.

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

UNIVERSAL BEAMS  
Advance® UKB



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)												Second Moment of Area y-y axis $I_y$ $cm^4$
				2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	
457x191x161 +  $M_{c,y,Rd} = 1000$ $M_{c,z,Rd} = 178$  Class = 1	1.00	995	901	819	746	682	627	578	536	499	466	437	412	389	79800	
	1.13	1000	945	870	801	739	683	633	588	549	514	482	454	428		
	1.35	1000	1000	940	879	821	767	718	672	631	593	558	526	497		
	1.50	1000	1000	979	923	869	818	770	725	683	644	608	575	544		
	1.77	1000	1000	1000	988	941	895	851	808	767	729	692	658	626		
	2.00	1000	1000	1000	1000	991	950	909	869	831	793	757	723	691		
	2.50	1000	1000	1000	1000	1000	1000	1000	1000	976	943	910	877	845		814
457x191x133 +  $M_{c,y,Rd} = 814$ $M_{c,z,Rd} = 142$  Class = 1	1.00	801	718	642	575	517	468	426	391	360	335	312	292	275	63800	
	1.13	814	755	685	620	563	512	468	430	397	368	343	321	302		
	1.35	814	805	745	686	631	581	536	496	459	427	398	373	349		
	1.50	814	814	778	724	672	623	579	538	500	467	436	409	384		
	1.77	814	814	814	781	735	690	647	607	569	534	502	473	445		
	2.00	814	814	814	814	778	737	697	659	622	587	555	524	496		
	2.50	814	814	814	814	814	814	814	785	752	719	687	655	625		597
457x191x106 +  $M_{c,y,Rd} = 633$ $M_{c,z,Rd} = 107$  Class = 1	1.00	617	545	479	419	368	327	293	265	242	222	206	192	180	48900	
	1.13	633	576	513	454	403	359	322	292	266	244	226	211	198		
	1.35	633	616	561	507	457	412	372	338	309	283	261	242	227		
	1.50	633	633	589	538	489	445	405	369	338	311	286	265	246		
	1.77	633	633	629	585	541	498	458	422	389	360	333	309	288		
	2.00	633	633	633	618	578	537	499	463	430	400	372	347	324		
	2.50	633	633	633	633	633	607	573	540	508	478	450	423	398		
457x191x98  $M_{c,y,Rd} = 591$ $M_{c,z,Rd} = 100$  Class = 1	1.00	575	507	443	386	337	297	265	239	218	200	185	172	161	45700	
	1.13	591	536	475	419	369	327	292	263	239	219	203	189	177		
	1.35	591	574	521	468	419	376	338	305	278	254	233	217	204		
	1.50	591	591	547	498	450	407	368	334	304	278	256	236	221		
	1.77	591	591	585	542	498	457	418	383	351	323	298	276	256		
	2.00	591	591	591	573	533	494	456	421	389	360	334	310	288		
	2.50	591	591	591	591	591	560	526	494	463	433	406	380	357		

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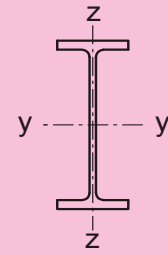
+ These sections are in addition to the range of BS 4 sections.

<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8.

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

UNIVERSAL BEAMS  
Advance® UKB



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)												Second Moment of Area y-y axis $I_y$ $cm^4$
				2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	
457x191x89  $M_{c,y,Rd} = 534$ $M_{c,z,Rd} = 89.6$  Class = 1	1.00	517	454	393	339	293	256	227	204	185	169	155	144	135	41000	
	1.13	534	480	422	369	322	283	250	224	202	186	171	159	149		
	1.35	534	515	464	414	367	325	290	260	235	213	196	183	171		
	1.50	534	534	488	440	395	353	316	285	258	234	214	198	186		
	1.77	534	534	523	481	439	398	361	328	299	273	250	230	212		
	2.00	534	534	534	510	471	432	396	362	332	305	281	259	239		
	2.50	534	534	534	534	527	493	460	428	398	370	344	320	299		
457x191x82  $M_{c,y,Rd} = 504$ $M_{c,z,Rd} = 83.6$  Class = 1	1.00	484	421	360	305	261	226	199	177	159	145	133	123	114	37100	
	1.13	503	445	388	334	287	249	218	194	175	160	147	136	127		
	1.35	504	480	428	376	329	288	254	225	201	183	169	157	147		
	1.50	504	499	451	402	355	313	277	247	221	199	183	171	160		
	1.77	504	504	486	442	398	356	319	286	258	233	212	193	181		
	2.00	504	504	504	470	429	389	351	318	288	262	239	218	200		
	2.50	504	504	504	504	484	448	413	380	350	322	296	273	252		
457x191x74  $M_{c,y,Rd} = 455$ $M_{c,z,Rd} = 74.8$  Class = 1	1.00	435	377	320	269	228	195	171	151	135	123	112	103	94.5	33300	
	1.13	453	399	345	294	251	215	187	166	149	136	124	115	107		
	1.35	455	431	382	333	288	249	218	191	171	156	143	133	124		
	1.50	455	448	403	356	311	272	238	210	187	169	156	144	135		
	1.77	455	455	435	393	350	310	275	244	218	196	176	164	153		
	2.00	455	455	455	419	379	340	304	272	245	221	199	181	168		
	2.50	455	455	455	455	429	395	360	329	299	273	249	228	210		
457x191x67  $M_{c,y,Rd} = 405$ $M_{c,z,Rd} = 65.2$  Class = 1	1.00	385	331	278	231	194	165	143	125	112	101	91.6	82.9	75.8	29400	
	1.13	401	352	301	254	214	181	156	138	123	112	102	93.7	85.7		
	1.35	405	380	334	288	246	211	182	158	142	129	118	109	101		
	1.50	405	396	353	309	267	230	199	174	154	140	128	119	110		
	1.77	405	405	382	342	301	264	231	203	179	159	146	135	126		
	2.00	405	405	402	366	327	290	256	227	201	180	161	148	139		
	2.50	405	405	405	405	373	339	306	276	249	224	203	184	167		

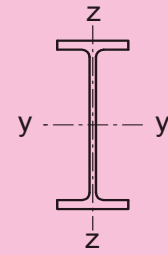
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Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

UNIVERSAL BEAMS  
Advance® UKB



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)												Second Moment of Area y-y axis $I_y$ $cm^4$
				1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	
457x152x82  $M_{c,y,Rd} = 480$ $M_{c,z,Rd} = 63.6$  Class = 1	1.00	480	472	436	401	367	335	306	257	220	191	169	152	138	36600	
	1.13	480	480	457	425	393	362	333	283	242	211	186	167	152		
	1.35	480	480	480	458	429	401	374	323	280	244	216	192	174		
	1.50	480	480	480	476	450	424	398	348	304	267	237	211	189		
	1.77	480	480	480	480	480	458	434	388	345	307	274	246	221		
	2.00	480	480	480	480	480	480	460	417	376	338	304	275	249		
	2.50	480	480	480	480	480	480	480	468	432	397	364	333	306		
457x152x74  $M_{c,y,Rd} = 431$ $M_{c,z,Rd} = 56.4$  Class = 1	1.00	431	422	389	356	325	294	267	221	187	162	142	127	115	32700	
	1.13	431	431	408	378	348	319	291	244	206	178	156	140	127		
	1.35	431	431	431	408	381	354	328	279	239	206	180	160	146		
	1.50	431	431	431	424	400	375	349	302	260	226	198	175	158		
	1.77	431	431	431	431	428	406	383	338	297	261	230	204	183		
	2.00	431	431	431	431	431	427	407	365	325	289	257	229	206		
	2.50	431	431	431	431	431	431	431	412	377	342	310	281	255		
457x152x67  $M_{c,y,Rd} = 400$ $M_{c,z,Rd} = 51.4$  Class = 1	1.00	400	388	355	323	291	261	235	191	159	136	119	106	94.9	28900	
	1.13	400	400	373	343	313	284	257	211	175	149	131	117	105		
	1.35	400	400	398	372	345	317	291	243	204	173	150	134	121		
	1.50	400	400	400	388	363	337	311	263	223	190	164	145	132		
	1.77	400	400	400	400	390	367	343	297	256	221	191	168	149		
	2.00	400	400	400	400	400	388	366	323	282	245	215	189	167		
	2.50	400	400	400	400	400	400	400	369	331	295	263	235	210		
457x152x60  $M_{c,y,Rd} = 354$ $M_{c,z,Rd} = 44.8$  Class = 1	1.00	354	342	313	283	253	226	201	162	133	113	97.9	86.3	76.3	25500	
	1.13	354	354	329	301	273	246	221	178	147	124	108	95.5	85.7		
	1.35	354	354	351	327	301	276	251	206	170	143	124	110	99.2		
	1.50	354	354	354	341	318	293	269	224	187	157	134	120	108		
	1.77	354	354	354	354	342	320	298	254	215	183	156	136	123		
	2.00	354	354	354	354	354	339	319	277	238	204	176	153	135		
	2.50	354	354	354	354	354	354	354	318	282	247	217	191	169		
457x152x52  $M_{c,y,Rd} = 301$ $M_{c,z,Rd} = 36.6$  Class = 1	1.00	301	289	263	236	209	185	163	128	104	87.1	74.8	64.5	56.3	21400	
	1.13	301	300	277	252	226	201	179	141	114	96.1	82.7	72.6	63.6		
	1.35	301	301	296	274	251	227	204	164	132	110	95.4	84.0	75.1		
	1.50	301	301	301	287	265	242	220	179	145	120	104	91.5	82.0		
	1.77	301	301	301	301	286	266	245	204	169	140	117	104	93.6		
	2.00	301	301	301	301	301	283	263	223	187	157	133	114	103		
	2.50	301	301	301	301	301	301	301	295	260	225	193	166	143		124

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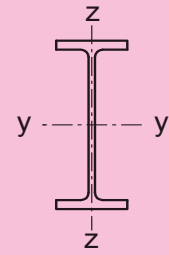
<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8.

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.



UNIVERSAL BEAMS  
Advance® UKB



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)												Second Moment of Area y-y axis $I_y$ $cm^4$
				1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	
406x178x85 +  $M_{c,y,Rd} = 459$ $M_{c,z,Rd} = 82.9$  Class = 1	1.00	459	459	441	413	387	361	336	292	255	225	202	182	166	31700	
	1.13	459	459	458	434	409	385	361	318	280	248	222	200	182		
	1.35	459	459	459	459	440	419	397	356	319	286	257	233	212		
	1.50	459	459	459	459	457	438	418	379	343	309	280	254	232		
	1.77	459	459	459	459	459	459	459	449	414	380	348	319	292		268
	2.00	459	459	459	459	459	459	459	459	439	408	377	349	322		298
	2.50	459	459	459	459	459	459	459	459	459	455	429	403	378		355
406x178x74  $M_{c,y,Rd} = 413$ $M_{c,z,Rd} = 73.4$  Class = 1	1.00	413	413	392	365	339	313	289	246	212	185	163	146	133	27300	
	1.13	413	413	408	384	360	336	312	269	233	203	180	160	146		
	1.35	413	413	413	409	389	367	346	304	267	235	209	186	168		
	1.50	413	413	413	413	404	385	365	325	289	256	228	204	184		
	1.77	413	413	413	413	413	411	394	358	323	291	262	237	214		
	2.00	413	413	413	413	413	413	413	382	349	318	289	263	239		
	2.50	413	413	413	413	413	413	413	413	395	367	340	314	290		
406x178x67  $M_{c,y,Rd} = 370$ $M_{c,z,Rd} = 65.2$  Class = 1	1.00	370	370	350	325	301	277	254	214	182	157	138	123	111	24300	
	1.13	370	370	364	342	319	297	275	234	200	173	152	135	122		
	1.35	370	370	370	365	346	325	305	265	230	201	176	156	140		
	1.50	370	370	370	370	360	342	323	285	249	219	193	171	153		
	1.77	370	370	370	370	370	366	349	315	281	250	223	199	179		
	2.00	370	370	370	370	370	370	368	336	304	274	246	222	200		
	2.50	370	370	370	370	370	370	370	370	346	319	292	267	245		
406x178x60  $M_{c,y,Rd} = 330$ $M_{c,z,Rd} = 57.5$  Class = 1	1.00	330	330	310	288	265	243	222	185	155	133	116	103	92.1	21600	
	1.13	330	330	324	303	282	261	240	202	171	146	127	113	102		
	1.35	330	330	330	324	306	287	268	230	197	170	148	129	117		
	1.50	330	330	330	330	319	302	284	248	214	186	162	142	126		
	1.77	330	330	330	330	330	324	308	275	242	213	187	166	147		
	2.00	330	330	330	330	330	330	325	294	264	234	208	185	166		
	2.50	330	330	330	330	330	330	330	328	302	275	249	226	204		
406x178x54  $M_{c,y,Rd} = 290$ $M_{c,z,Rd} = 49.0$  Class = 1	1.00	290	290	271	250	229	209	189	155	129	109	94.4	83.0	74.0	18700	
	1.13	290	290	283	264	245	225	206	171	142	120	104	91.5	81.8		
	1.35	290	290	290	283	266	248	230	195	164	139	119	105	94.3		
	1.50	290	290	290	290	278	261	244	210	179	153	131	114	102		
	1.77	290	290	290	290	290	281	266	234	204	176	153	133	117		
	2.00	290	290	290	290	290	290	281	252	222	195	170	150	132		
	2.50	290	290	290	290	290	290	290	290	283	257	231	206	184		164

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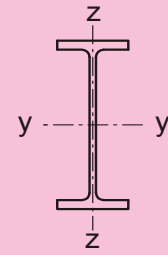
+ These sections are in addition to the range of BS 4 sections.

<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8.

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

**UNIVERSAL BEAMS**  
**Advance® UKB**



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm)											Second Moment of Area y-y axis $I_y$ $cm^4$	
				for Length between lateral restraints (m)												
				1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
406x140x53 +  $M_{c,y,Rd} = 284$ $M_{c,z,Rd} = 38.2$  Class = 1	1.00	284	270	245	221	197	175	156	126	105	89.2	77.8	69.0	61.3	18300	
	1.13	284	281	259	236	213	191	171	139	115	98.1	85.8	76.3	68.8		
	1.35	284	284	277	257	236	215	195	160	133	113	98.6	88.1	79.6		
	1.50	284	284	284	269	249	229	210	175	146	124	107	95.7	86.7		
	1.77	284	284	284	284	269	252	233	199	169	144	124	108	98.6		
	2.00	284	284	284	284	283	267	250	217	187	161	140	122	108		
2.50	284	284	284	284	284	284	284	280	251	222	196	173	153	136		
406x140x46  $M_{c,y,Rd} = 244$ $M_{c,z,Rd} = 32.5$  Class = 1	1.00	244	232	210	187	166	146	129	102	83.9	70.8	61.2	53.3	46.8	15700	
	1.13	244	241	221	200	180	160	142	113	92.0	78.0	67.7	59.7	52.9		
	1.35	244	244	237	219	200	180	162	131	107	89.4	78.0	69.2	62.2		
	1.50	244	244	244	229	211	193	175	143	117	97.3	84.6	75.3	67.8		
	1.77	244	244	244	244	229	212	195	163	136	114	96.3	85.6	77.4		
	2.00	244	244	244	244	241	226	210	179	151	128	109	93.8	85.1		
2.50	244	244	244	244	244	244	244	237	209	181	157	136	118	104		
406x140x39  $M_{c,y,Rd} = 199$ $M_{c,z,Rd} = 25.0$  Class = 1	1.00	199	186	167	148	129	112	97.4	75.5	60.8	50.5	42.6	36.4	31.7	12500	
	1.13	199	194	177	159	140	123	107	83.0	66.9	55.9	47.9	41.1	35.9		
	1.35	199	199	190	174	157	140	123	96.4	76.5	64.4	55.5	48.7	42.8		
	1.50	199	199	198	183	167	150	134	106	84.0	69.8	60.4	53.1	47.5		
	1.77	199	199	199	196	182	166	151	122	98.0	79.7	68.7	60.7	54.4		
	2.00	199	199	199	199	192	178	163	134	110	90.1	75.3	66.9	60.1		
2.50	199	199	199	199	199	199	198	186	159	134	112	94.5	80.1	71.4		
356x171x67  $M_{c,y,Rd} = 333$ $M_{c,z,Rd} = 66.8$  Class = 1	1.00	333	333	315	294	273	253	235	202	175	154	137	124	113	19500	
	1.13	333	333	328	309	290	271	253	220	193	170	151	136	124		
	1.35	333	333	333	330	313	297	280	249	220	196	175	158	143		
	1.50	333	333	333	333	326	311	296	266	238	213	192	173	157		
	1.77	333	333	333	333	333	332	319	292	266	241	219	200	182		
	2.00	333	333	333	333	333	333	333	311	286	263	241	221	203		
2.50	333	333	333	333	333	333	333	333	333	322	302	282	262	244		
356x171x57  $M_{c,y,Rd} = 278$ $M_{c,z,Rd} = 54.7$  Class = 1	1.00	278	278	260	242	223	205	188	159	135	117	103	92.4	83.5	16000	
	1.13	278	278	272	255	238	220	204	174	149	129	114	101	91.9		
	1.35	278	278	278	272	257	242	227	197	172	150	132	117	105		
	1.50	278	278	278	278	269	255	240	212	186	164	145	129	115		
	1.77	278	278	278	278	278	273	260	235	210	187	167	149	135		
	2.00	278	278	278	278	278	278	274	251	227	205	185	167	151		
2.50	278	278	278	278	278	278	278	278	278	259	238	219	201	184		

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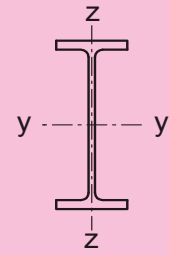
+ These sections are in addition to the range of BS 4 sections.

<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8.

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

**UNIVERSAL BEAMS**  
**Advance® UKB**



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)												Second Moment of Area y-y axis $I_y$ $cm^4$
				1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	
356x171x51  $M_{c,y,Rd} = 246$ $M_{c,z,Rd} = 47.9$  Class = 1	1.00	246	246	230	213	196	179	163	136	114	98.2	85.9	76.2	68.6	14100	
	1.13	246	246	240	224	208	192	177	149	126	108	94.1	83.9	75.6		
	1.35	246	246	246	240	226	212	197	170	145	125	109	96.0	86.8		
	1.50	246	246	246	246	236	223	209	183	158	137	120	106	94.0		
	1.77	246	246	246	246	246	240	228	203	179	158	139	123	110		
	2.00	246	246	246	246	246	246	241	218	195	174	154	138	123		
	2.50	246	246	246	246	246	246	246	243	224	204	185	168	152		
356x171x45  $M_{c,y,Rd} = 213$ $M_{c,z,Rd} = 40.4$  Class = 1	1.00	213	213	197	182	166	151	136	112	92.9	78.8	68.2	60.1	53.7	12100	
	1.13	213	213	206	192	177	163	148	123	102	86.5	75.0	66.3	59.4		
	1.35	213	213	213	206	193	180	166	141	118	101	86.2	76.1	68.5		
	1.50	213	213	213	213	202	190	177	152	129	110	94.8	82.3	74.3		
	1.77	213	213	213	213	213	205	193	170	147	127	110	96.3	84.7		
	2.00	213	213	213	213	213	213	205	183	161	141	123	108	95.7		
	2.50	213	213	213	213	213	213	213	206	186	167	149	133	119		
356x127x39  $M_{c,y,Rd} = 181$ $M_{c,z,Rd} = 24.5$  Class = 1	1.00	181	166	148	130	113	99.0	87.1	69.4	57.3	48.8	42.5	36.9	32.7	10200	
	1.13	181	174	157	140	123	109	96.0	76.2	63.0	53.9	47.1	41.7	36.9		
	1.35	181	181	170	154	139	124	111	88.6	72.3	61.9	54.4	48.5	43.8		
	1.50	181	181	177	163	148	133	120	97.0	79.5	67.1	59.1	52.9	47.8		
	1.77	181	181	181	175	162	148	135	112	92.6	77.7	67.1	60.2	54.7		
	2.00	181	181	181	181	172	159	147	123	104	87.6	74.8	66.1	60.2		
	2.50	181	181	181	181	181	178	168	146	126	108	94.0	81.9	71.9		
356x127x33  $M_{c,y,Rd} = 149$ $M_{c,z,Rd} = 19.3$  Class = 1	1.00	149	135	119	103	88.6	76.3	66.3	51.6	41.9	35.3	29.7	25.6	22.6	8250	
	1.13	149	141	127	111	96.9	84.0	73.0	56.6	46.3	39.0	33.6	29.0	25.5		
	1.35	149	149	137	124	110	96.3	84.4	65.6	53.1	45.1	39.2	34.6	30.5		
	1.50	149	149	144	131	117	104	92.0	72.0	57.4	49.0	42.7	37.9	33.9		
	1.77	149	149	149	141	129	117	105	83.5	67.1	55.6	48.7	43.4	39.1		
	2.00	149	149	149	149	138	126	114	92.9	75.5	62.1	53.5	47.8	43.2		
	2.50	149	149	149	149	149	142	132	111	93.1	78.0	65.8	56.6	51.5		
305x165x54  $M_{c,y,Rd} = 233$ $M_{c,z,Rd} = 53.9$  Class = 1	1.00	233	233	223	212	200	188	176	153	134	118	105	94.1	85.2	11700	
	1.13	233	233	231	221	211	200	189	167	147	130	115	104	94.1		
	1.35	233	233	233	233	226	217	207	187	167	150	134	121	109		
	1.50	233	233	233	233	233	226	217	199	180	162	147	133	120		
	1.77	233	233	233	233	233	233	233	217	200	183	167	153	140		
	2.00	233	233	233	233	233	233	233	229	214	199	183	169	156		
	2.50	233	233	233	233	233	233	233	233	233	226	213	199	187		

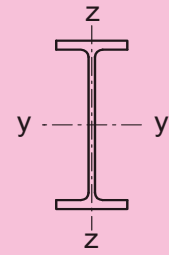
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<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8.

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

UNIVERSAL BEAMS  
Advance® UKB



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)												Second Moment of Area y-y axis $I_y$ $cm^4$
				1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	
305x165x46  $M_{c,y,Rd} = 198$ $M_{c,z,Rd} = 45.7$  Class = 1	1.00	198	198	189	179	168	157	146	125	107	92.7	81.6	72.5	63.9	9900	
	1.13	198	198	196	187	178	167	157	136	118	102	89.8	80.1	72.2		
	1.35	198	198	198	198	191	182	173	154	135	119	105	93.0	83.3		
	1.50	198	198	198	198	198	190	182	164	146	129	115	102	91.7		
	1.77	198	198	198	198	198	198	195	180	163	147	132	119	107		
	2.00	198	198	198	198	198	198	198	191	176	161	146	132	120		
	2.50	198	198	198	198	198	198	198	198	198	198	185	172	159		146
305x165x40  $M_{c,y,Rd} = 171$ $M_{c,z,Rd} = 39.1$  Class = 1	1.00	171	171	163	153	144	133	123	103	87.0	74.5	64.9	56.0	49.2	8500	
	1.13	171	171	169	161	152	142	132	113	95.9	82.2	71.4	63.3	55.6		
	1.35	171	171	171	171	164	155	147	128	111	95.6	83.1	72.9	65.8		
	1.50	171	171	171	171	170	163	155	137	120	105	91.4	80.3	71.5		
	1.77	171	171	171	171	171	171	167	152	135	120	106	93.9	83.6		
	2.00	171	171	171	171	171	171	171	162	147	132	118	105	94.3		
	2.50	171	171	171	171	171	171	171	171	167	154	140	128	116		
305x127x48  $M_{c,y,Rd} = 196$ $M_{c,z,Rd} = 31.9$  Class = 1	1.00	196	182	165	149	134	121	110	92.0	79.0	69.2	61.6	55.5	50.5	9580	
	1.13	196	190	174	159	145	132	120	101	87.0	75.8	67.7	61.2	55.9		
	1.35	196	196	187	174	161	149	137	117	101	88.0	77.6	70.2	64.3		
	1.50	196	196	195	183	170	158	147	127	110	96.6	85.4	76.0	69.7		
	1.77	196	196	196	195	184	174	163	144	126	112	99.5	89.0	80.0		
	2.00	196	196	196	196	194	184	175	156	139	124	111	100	90.3		
	2.50	196	196	196	196	196	196	195	179	163	148	135	123	112		
305x127x42  $M_{c,y,Rd} = 169$ $M_{c,z,Rd} = 27.0$  Class = 1	1.00	169	156	140	125	111	99.5	89.3	73.6	62.4	54.2	47.9	43.0	38.9	8200	
	1.13	169	163	148	134	121	109	98.2	81.1	68.6	59.6	52.9	47.5	43.2		
	1.35	169	169	160	147	135	123	112	93.9	79.6	68.5	60.7	54.8	50.0		
	1.50	169	169	166	155	143	132	121	102	87.3	75.3	65.7	59.4	54.3		
	1.77	169	169	169	166	156	145	135	117	101	87.7	76.9	67.9	61.7		
	2.00	169	169	169	169	165	155	146	128	112	97.9	86.4	76.7	68.4		
	2.50	169	169	169	169	169	169	169	164	148	133	119	106	95.6		86.1
305x127x37  $M_{c,y,Rd} = 148$ $M_{c,z,Rd} = 23.4$  Class = 1	1.00	148	136	121	108	94.9	84.0	74.7	60.7	51.0	43.9	38.6	34.5	30.6	7170	
	1.13	148	142	129	116	103	92.0	82.2	66.9	55.9	48.4	42.7	38.2	34.6		
	1.35	148	148	139	128	116	105	94.4	77.6	64.8	55.4	49.1	44.2	40.1		
	1.50	148	148	145	134	123	112	102	84.7	71.1	60.5	53.3	48.0	43.7		
	1.77	148	148	148	144	134	124	115	97.0	82.5	70.7	61.2	54.5	49.8		
	2.00	148	148	148	148	142	133	124	107	91.8	79.3	69.1	60.6	54.6		
	2.50	148	148	148	148	148	148	148	140	125	110	97.1	85.9	76.2		67.9

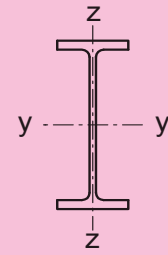
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<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8.

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

UNIVERSAL BEAMS  
Advance® UKB



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)											Second Moment of Area y-y axis $I_y$ $cm^4$	
				1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0		9.0
305x102x33  $M_{c,y,Rd} = 132$ $M_{c,z,Rd} = 16.5$  Class = 1	1.00	128	112	96.6	82.4	70.7	61.3	53.8	43.2	36.1	31.0	26.6	23.4	20.8	6500	
	1.13	132	119	104	89.8	77.6	67.5	59.3	47.4	39.8	34.3	30.1	26.4	23.5		
	1.35	132	127	114	101	88.7	77.9	68.8	54.7	45.8	39.7	35.1	31.4	28.1		
	1.50	132	132	120	108	95.6	84.7	75.2	60.1	49.5	43.1	38.2	34.3	31.2		
	1.77	132	132	129	118	107	95.9	86.1	69.9	57.5	48.9	43.6	39.3	35.8		
	2.00	132	132	132	125	115	104	94.7	78.0	64.8	54.5	47.8	43.3	39.5		
2.50	132	132	132	132	129	120	111	94.3	80.2	68.5	59.0	51.3	47.0			
305x102x28  $M_{c,y,Rd} = 111$ $M_{c,z,Rd} = 13.2$  Class = 1	1.00	106	92.2	78.2	65.5	55.2	47.2	40.9	32.2	26.6	22.1	18.9	16.5	14.7	5370	
	1.13	111	97.8	84.3	71.7	60.8	52.0	44.9	35.5	29.4	25.0	21.3	18.7	16.6		
	1.35	111	105	93.3	81.1	69.8	60.2	52.2	40.7	34.0	29.2	25.5	22.3	19.8		
	1.50	111	110	98.5	86.8	75.6	65.7	57.2	44.3	36.9	31.8	27.9	24.8	22.0		
	1.77	111	111	106	95.7	85.0	75.0	66.1	51.8	41.8	36.2	32.0	28.7	26.0		
	2.00	111	111	111	102	92.0	82.2	73.2	58.2	46.9	39.8	35.3	31.7	28.8		
2.50	111	111	111	111	104	95.6	86.9	71.4	58.9	49.0	41.8	37.8	34.4			
305x102x25  $M_{c,y,Rd} = 94.1$ $M_{c,z,Rd} = 10.7$  Class = 1	1.00	89.3	76.5	63.7	52.5	43.5	36.7	31.5	24.5	19.6	16.1	13.7	12.0	10.6	4460	
	1.13	93.0	81.3	69.0	57.6	48.0	40.4	34.6	27.0	22.1	18.2	15.5	13.5	12.0		
	1.35	94.1	87.9	76.8	65.5	55.4	46.9	40.0	31.1	25.6	21.8	18.5	16.2	14.3		
	1.50	94.1	91.6	81.3	70.4	60.2	51.3	44.0	33.7	27.9	23.8	20.6	18.0	15.9		
	1.77	94.1	94.1	88.2	78.2	68.2	59.0	51.0	38.7	31.8	27.3	23.9	21.2	18.8		
	2.00	94.1	94.1	92.9	83.8	74.2	65.1	56.9	43.7	34.9	30.1	26.4	23.6	21.2		
2.50	94.1	94.1	94.1	93.5	85.2	76.7	68.5	54.4	43.5	35.7	31.6	28.3	25.7			
254x146x43  $M_{c,y,Rd} = 156$ $M_{c,z,Rd} = 38.8$  Class = 1	1.00	156	154	146	138	129	121	113	97.9	85.5	75.5	67.4	60.9	54.8	6540	
	1.13	156	156	152	145	137	129	122	107	94.1	83.3	74.4	66.9	61.1		
	1.35	156	156	156	154	148	141	134	121	108	96.4	86.5	78.0	70.7		
	1.50	156	156	156	156	154	148	142	129	116	105	94.7	85.7	77.9		
	1.77	156	156	156	156	156	156	152	141	130	119	109	99.2	90.7		
	2.00	156	156	156	156	156	156	156	150	140	129	119	110	101		
2.50	156	156	156	156	156	156	156	156	156	156	148	139	130	122		
254x146x37  $M_{c,y,Rd} = 133$ $M_{c,z,Rd} = 32.7$  Class = 1	1.00	133	131	124	116	108	100	92.6	78.8	67.6	59.0	52.2	46.1	40.9	5540	
	1.13	133	133	129	122	115	108	100	86.4	74.6	65.0	57.4	51.5	46.2		
	1.35	133	133	133	130	125	118	111	98.1	86.0	75.6	66.9	59.6	53.9		
	1.50	133	133	133	133	130	124	118	105	93.3	82.6	73.4	65.6	58.9		
	1.77	133	133	133	133	133	133	133	128	116	105	94.5	84.9	76.5		69.1
	2.00	133	133	133	133	133	133	133	124	114	104	94.1	85.4	77.6		
2.50	133	133	133	133	133	133	133	133	133	129	120	112	103	95.1		

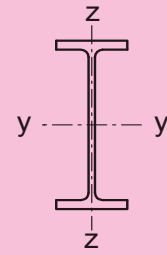
Advance® and UKB are trademarks of Tata Steel. A fuller description of the relationship between Universal Beams (UB) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8.

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

UNIVERSAL BEAMS  
Advance® UKB



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)											Second Moment of Area y-y axis $I_y$ $cm^4$
				1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	
254x146x31  $M_{c,y,Rd} = 108$ $M_{c,z,Rd} = 25.9$  Class = 1	1.00	108	106	99.5	92.7	85.5	78.2	71.1	58.8	49.4	42.3	36.2	31.4	27.7	4410
	1.13	108	108	104	97.9	91.3	84.3	77.4	64.7	54.5	46.5	40.8	35.5	31.3	
	1.35	108	108	108	105	99.3	93.2	86.8	74.2	63.2	54.2	47.0	41.9	37.4	
	1.50	108	108	108	108	104	98.2	92.3	80.1	69.0	59.6	51.8	45.5	41.3	
	1.77	108	108	108	108	108	106	101	89.6	78.7	68.9	60.5	53.3	47.3	
	2.00	108	108	108	108	108	108	106	96.5	86.1	76.4	67.7	60.1	53.6	
	2.50	108	108	108	108	108	108	108	108	99.6	90.6	82.0	74.1	66.9	
254x102x28  $M_{c,y,Rd} = 97.1$ $M_{c,z,Rd} = 15.1$  Class = 1	1.00	94.7	83.5	72.8	63.1	54.8	48.1	42.7	34.8	29.3	25.4	22.4	19.7	17.6	4010
	1.13	97.1	88.2	78.1	68.5	60.1	53.0	47.1	38.1	32.3	28.1	24.8	22.2	19.8	
	1.35	97.1	94.4	85.6	76.7	68.3	60.9	54.5	44.3	37.0	32.3	28.7	25.9	23.6	
	1.50	97.1	97.1	89.8	81.5	73.4	65.9	59.3	48.6	40.5	35.0	31.2	28.2	25.7	
	1.77	97.1	97.1	96.1	88.8	81.3	74.2	67.5	56.2	47.3	40.3	35.5	32.1	29.4	
	2.00	97.1	97.1	97.1	93.9	87.1	80.3	73.8	62.4	53.0	45.5	39.3	35.3	32.3	
	2.50	97.1	97.1	97.1	97.1	96.9	91.2	85.4	74.4	64.8	56.5	49.5	43.6	38.6	
254x102x25  $M_{c,y,Rd} = 84.2$ $M_{c,z,Rd} = 12.7$  Class = 1	1.00	81.5	71.3	61.3	52.3	44.9	38.9	34.2	27.4	22.9	19.7	16.9	14.8	13.2	3420
	1.13	84.2	75.4	66.0	57.1	49.3	42.9	37.6	30.1	25.3	21.8	19.1	16.8	14.9	
	1.35	84.2	81.0	72.6	64.2	56.3	49.5	43.7	34.7	29.1	25.2	22.3	20.0	17.9	
	1.50	84.2	84.0	76.4	68.4	60.7	53.8	47.7	38.2	31.5	27.4	24.3	21.8	19.8	
	1.77	84.2	84.2	82.1	75.0	67.8	60.9	54.7	44.4	36.5	31.1	27.7	25.0	22.7	
	2.00	84.2	84.2	84.2	79.6	72.9	66.3	60.2	49.5	41.2	34.6	30.4	27.5	25.1	
	2.50	84.2	84.2	84.2	84.2	81.9	76.2	70.5	59.9	50.9	43.5	37.5	32.6	29.9	
254x102x22  $M_{c,y,Rd} = 71.2$ $M_{c,z,Rd} = 10.2$  Class = 1	1.00	68.3	59.1	50.1	42.1	35.5	30.4	26.4	20.9	17.3	14.4	12.3	10.8	9.59	2840
	1.13	71.0	62.7	54.1	46.0	39.1	33.5	29.0	23.0	19.1	16.3	13.9	12.2	10.8	
	1.35	71.2	67.6	59.9	52.0	44.9	38.8	33.7	26.4	22.0	19.0	16.6	14.6	12.9	
	1.50	71.2	70.3	63.2	55.7	48.6	42.3	36.9	28.7	23.9	20.6	18.2	16.2	14.4	
	1.77	71.2	71.2	68.2	61.4	54.6	48.3	42.6	33.6	27.1	23.5	20.8	18.7	16.9	
	2.00	71.2	71.2	71.2	65.5	59.1	52.9	47.2	37.7	30.5	25.8	22.9	20.6	18.7	
	2.50	71.2	71.2	71.2	71.2	67.1	61.5	56.0	46.2	38.2	31.9	27.2	24.6	22.4	
203x133x30  $M_{c,y,Rd} = 86.4$ $M_{c,z,Rd} = 24.2$  Class = 1	1.00	86.4	83.9	79.0	73.8	68.7	63.6	58.7	50.2	43.5	38.2	34.0	30.2	26.9	2900
	1.13	86.4	86.4	82.5	78.0	73.2	68.4	63.7	55.1	47.9	42.1	37.4	33.7	30.4	
	1.35	86.4	86.4	86.4	83.6	79.6	75.4	71.1	62.8	55.3	48.9	43.6	39.0	35.4	
	1.50	86.4	86.4	86.4	86.4	83.1	79.3	75.4	67.5	60.1	53.5	47.8	43.0	38.8	
	1.77	86.4	86.4	86.4	86.4	86.4	85.2	81.8	74.8	67.8	61.2	55.3	50.1	45.4	
	2.00	86.4	86.4	86.4	86.4	86.4	86.4	86.3	80.0	73.5	67.2	61.3	55.9	51.0	
	2.50	86.4	86.4	86.4	86.4	86.4	86.4	86.4	86.4	83.6	78.1	72.6	67.4	62.4	

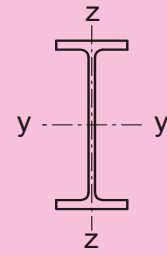
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<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8.

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

UNIVERSAL BEAMS  
Advance® UKB



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)											Second Moment of Area y-y axis $I_y$ $cm^4$
				1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	
203x133x25  $M_{c,y,Rd} = 71.0$ $M_{c,z,Rd} = 19.5$  Class = 1	1.00	71.0	68.5	64.1	59.4	54.6	49.8	45.3	37.8	32.0	27.7	24.0	20.9	18.6	2340
	1.13	71.0	71.0	67.1	62.9	58.4	53.9	49.4	41.6	35.4	30.5	27.0	23.7	21.0	
	1.35	71.0	71.0	71.0	67.7	63.9	59.8	55.7	47.8	41.1	35.5	31.1	27.9	25.1	
	1.50	71.0	71.0	71.0	70.4	67.0	63.2	59.3	51.7	44.8	39.0	34.2	30.3	27.6	
	1.77	71.0	71.0	71.0	71.0	71.0	68.4	65.0	58.0	51.2	45.2	40.0	35.5	31.7	
	2.00	71.0	71.0	71.0	71.0	71.0	71.0	68.9	62.5	56.1	50.1	44.7	40.0	35.9	
	2.50	71.0	71.0	71.0	71.0	71.0	71.0	71.0	70.4	65.0	59.4	54.1	49.2	44.8	
203x102x23  $M_{c,y,Rd} = 64.4$ $M_{c,z,Rd} = 13.8$  Class = 1	1.00	63.7	58.7	53.5	48.3	43.3	38.8	35.0	29.0	24.7	20.9	18.1	16.0	14.3	2110
	1.13	64.4	61.4	56.7	51.8	47.0	42.5	38.5	32.0	27.1	23.7	20.5	18.0	16.1	
	1.35	64.4	64.4	61.2	56.9	52.5	48.2	44.2	37.2	31.6	27.3	24.3	21.5	19.3	
	1.50	64.4	64.4	63.6	59.8	55.8	51.7	47.7	40.6	34.8	30.0	26.4	23.9	21.4	
	1.77	64.4	64.4	64.4	64.1	60.6	57.0	53.3	46.4	40.3	35.1	30.8	27.2	25.0	
	2.00	64.4	64.4	64.4	64.4	64.0	60.8	57.4	50.8	44.7	39.4	34.8	30.8	27.5	
	2.50	64.4	64.4	64.4	64.4	64.4	64.4	64.4	58.9	53.2	47.9	43.0	38.7	34.9	
178x102x19  $M_{c,y,Rd} = 47.0$ $M_{c,z,Rd} = 11.6$  Class = 1	1.00	46.6	42.9	39.1	35.2	31.6	28.3	25.5	21.1	17.9	15.2	13.1	11.6	10.3	1360
	1.13	47.0	44.9	41.4	37.8	34.3	31.0	28.1	23.3	19.7	17.2	14.8	13.1	11.7	
	1.35	47.0	47.0	44.7	41.6	38.3	35.2	32.2	27.0	23.0	19.8	17.7	15.6	14.0	
	1.50	47.0	47.0	46.5	43.7	40.7	37.7	34.8	29.5	25.3	21.8	19.2	17.3	15.5	
	1.77	47.0	47.0	47.0	46.8	44.3	41.6	38.9	33.8	29.3	25.5	22.3	19.8	18.1	
	2.00	47.0	47.0	47.0	47.0	46.7	44.4	41.9	37.0	32.5	28.6	25.2	22.4	19.9	
	2.50	47.0	47.0	47.0	47.0	47.0	47.0	47.0	42.9	38.7	34.8	31.2	28.1	25.3	
152x89x16  $M_{c,y,Rd} = 33.8$ $M_{c,z,Rd} = 8.53$  Class = 1	1.00	32.9	30.1	27.2	24.4	21.9	19.7	17.8	14.9	12.7	10.8	9.39	8.31	7.45	834
	1.13	33.8	31.6	28.9	26.3	23.8	21.6	19.6	16.4	14.0	12.2	10.6	9.39	8.41	
	1.35	33.8	33.6	31.4	29.1	26.8	24.6	22.6	19.1	16.3	14.1	12.7	11.2	10.1	
	1.50	33.8	33.8	32.8	30.7	28.5	26.4	24.4	20.8	17.9	15.5	13.8	12.5	11.2	
	1.77	33.8	33.8	33.8	33.0	31.2	29.3	27.4	23.9	20.8	18.2	16.0	14.2	13.1	
	2.00	33.8	33.8	33.8	33.8	33.0	31.3	29.6	26.2	23.1	20.4	18.1	16.1	14.4	
	2.50	33.8	33.8	33.8	33.8	33.8	33.8	33.4	30.5	27.6	24.9	22.4	20.2	18.2	
127x76x13  $M_{c,y,Rd} = 23.1$ $M_{c,z,Rd} = 6.33$  Class = 1	1.00	22.0	20.0	18.1	16.3	14.7	13.3	12.1	10.2	8.78	7.52	6.55	5.81	5.22	473
	1.13	22.9	21.1	19.3	17.6	16.0	14.6	13.3	11.2	9.66	8.50	7.40	6.56	5.89	
	1.35	23.1	22.6	21.1	19.5	18.0	16.6	15.3	13.1	11.2	9.78	8.79	7.84	7.04	
	1.50	23.1	23.1	22.0	20.6	19.2	17.9	16.6	14.3	12.4	10.8	9.55	8.69	7.82	
	1.77	23.1	23.1	23.1	22.3	21.1	19.8	18.6	16.3	14.3	12.6	11.1	9.91	9.10	
	2.00	23.1	23.1	23.1	23.1	22.4	21.3	20.1	17.9	15.9	14.1	12.6	11.2	10.1	
	2.50	23.1	23.1	23.1	23.1	23.1	23.1	22.8	20.9	19.0	17.2	15.5	14.1	12.7	

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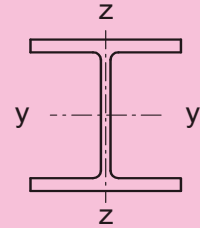
<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8.

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.



UNIVERSAL COLUMNS  
Advance® UKC



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)												Second Moment of Area y-y axis $I_y$ $cm^4$
				2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	
356x406x634  $M_{c,y,Rd} = 3490$ $M_{c,z,Rd} = 1740$  Class = 1	1.00	3490	3490	3490	3490	3490	3490	3490	3460	3420	3390	3350	3320	3280	3250	275000
	1.13	3490	3490	3490	3490	3490	3490	3490	3490	3490	3490	3470	3440	3420	3390	
	1.35	3490	3490	3490	3490	3490	3490	3490	3490	3490	3490	3490	3490	3490	3490	
	1.50	3490	3490	3490	3490	3490	3490	3490	3490	3490	3490	3490	3490	3490	3490	
	1.77	3490	3490	3490	3490	3490	3490	3490	3490	3490	3490	3490	3490	3490	3490	
	2.00	3490	3490	3490	3490	3490	3490	3490	3490	3490	3490	3490	3490	3490	3490	
	2.50	3490	3490	3490	3490	3490	3490	3490	3490	3490	3490	3490	3490	3490	3490	
356x406x551  $M_{c,y,Rd} = 2960$ $M_{c,z,Rd} = 1480$  Class = 1	1.00	2960	2960	2960	2960	2960	2950	2910	2870	2840	2810	2780	2750	2720	227000	
	1.13	2960	2960	2960	2960	2960	2960	2960	2960	2940	2920	2890	2860	2840		
	1.35	2960	2960	2960	2960	2960	2960	2960	2960	2960	2960	2960	2960	2960		
	1.50	2960	2960	2960	2960	2960	2960	2960	2960	2960	2960	2960	2960	2960		
	1.77	2960	2960	2960	2960	2960	2960	2960	2960	2960	2960	2960	2960	2960		
	2.00	2960	2960	2960	2960	2960	2960	2960	2960	2960	2960	2960	2960	2960		
	2.50	2960	2960	2960	2960	2960	2960	2960	2960	2960	2960	2960	2960	2960		
356x406x467  $M_{c,y,Rd} = 2550$ $M_{c,z,Rd} = 1280$  Class = 1	1.00	2550	2550	2550	2550	2540	2500	2470	2430	2400	2370	2340	2310	2280	183000	
	1.13	2550	2550	2550	2550	2550	2550	2550	2520	2500	2470	2440	2410	2390		
	1.35	2550	2550	2550	2550	2550	2550	2550	2550	2550	2550	2550	2550	2540		
	1.50	2550	2550	2550	2550	2550	2550	2550	2550	2550	2550	2550	2550	2550		
	1.77	2550	2550	2550	2550	2550	2550	2550	2550	2550	2550	2550	2550	2550		
	2.00	2550	2550	2550	2550	2550	2550	2550	2550	2550	2550	2550	2550	2550		
	2.50	2550	2550	2550	2550	2550	2550	2550	2550	2550	2550	2550	2550	2550		
356x406x393  $M_{c,y,Rd} = 2100$ $M_{c,z,Rd} = 1060$  Class = 1	1.00	2100	2100	2100	2100	2070	2030	2000	1970	1940	1910	1880	1850	1820	147000	
	1.13	2100	2100	2100	2100	2100	2100	2080	2050	2020	1990	1970	1940	1920		
	1.35	2100	2100	2100	2100	2100	2100	2100	2100	2100	2100	2090	2070	2050		
	1.50	2100	2100	2100	2100	2100	2100	2100	2100	2100	2100	2100	2100	2100		
	1.77	2100	2100	2100	2100	2100	2100	2100	2100	2100	2100	2100	2100	2100		
	2.00	2100	2100	2100	2100	2100	2100	2100	2100	2100	2100	2100	2100	2100		
	2.50	2100	2100	2100	2100	2100	2100	2100	2100	2100	2100	2100	2100	2100		
356x406x340  $M_{c,y,Rd} = 1780$ $M_{c,z,Rd} = 904$  Class = 1	1.00	1780	1780	1780	1780	1750	1710	1680	1650	1620	1590	1560	1540	1510	123000	
	1.13	1780	1780	1780	1780	1780	1780	1750	1720	1700	1670	1640	1620	1600		
	1.35	1780	1780	1780	1780	1780	1780	1780	1780	1780	1780	1760	1730	1710		
	1.50	1780	1780	1780	1780	1780	1780	1780	1780	1780	1780	1780	1780	1780		
	1.77	1780	1780	1780	1780	1780	1780	1780	1780	1780	1780	1780	1780	1780		
	2.00	1780	1780	1780	1780	1780	1780	1780	1780	1780	1780	1780	1780	1780		
	2.50	1780	1780	1780	1780	1780	1780	1780	1780	1780	1780	1780	1780	1780		

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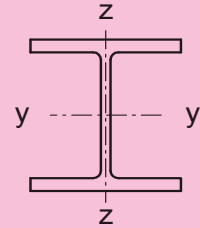
<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8.

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.



UNIVERSAL COLUMNS  
Advance® UKC



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)												Second Moment of Area y-y axis $I_y$ $cm^4$
				2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	
356x406x287  $M_{c,y,Rd} = 1540$ $M_{c,z,Rd} = 782$  Class = 1	1.00	1540	1540	1540	1520	1490	1450	1420	1390	1360	1330	1300	1270	1240	99900	
	1.13	1540	1540	1540	1540	1540	1510	1480	1450	1430	1400	1370	1350	1320		
	1.35	1540	1540	1540	1540	1540	1540	1540	1540	1540	1520	1500	1480	1460		1430
	1.50	1540	1540	1540	1540	1540	1540	1540	1540	1540	1540	1540	1530	1520		1500
	1.77	1540	1540	1540	1540	1540	1540	1540	1540	1540	1540	1540	1540	1540		1540
	2.00	1540	1540	1540	1540	1540	1540	1540	1540	1540	1540	1540	1540	1540		1540
2.50	1540	1540	1540	1540	1540	1540	1540	1540	1540	1540	1540	1540	1540	1540		
356x406x235  $M_{c,y,Rd} = 1240$ $M_{c,z,Rd} = 632$  Class = 1	1.00	1240	1240	1240	1220	1180	1150	1120	1090	1060	1030	1010	979	953	79100	
	1.13	1240	1240	1240	1240	1230	1200	1170	1150	1120	1100	1070	1050	1020		
	1.35	1240	1240	1240	1240	1240	1240	1240	1220	1200	1180	1160	1140	1120		
	1.50	1240	1240	1240	1240	1240	1240	1240	1240	1240	1230	1210	1190	1170		
	1.77	1240	1240	1240	1240	1240	1240	1240	1240	1240	1240	1240	1240	1240		
	2.00	1240	1240	1240	1240	1240	1240	1240	1240	1240	1240	1240	1240	1240		
2.50	1240	1240	1240	1240	1240	1240	1240	1240	1240	1240	1240	1240	1240	1240		
356x368x202  $M_{c,y,Rd} = 1050$ $M_{c,z,Rd} = 509$  Class = 1	1.00	1050	1050	1050	1020	987	956	927	898	870	842	815	789	764	66300	
	1.13	1050	1050	1050	1050	1030	1000	974	948	923	897	872	848	823		
	1.35	1050	1050	1050	1050	1050	1050	1040	1020	996	974	953	931	909		
	1.50	1050	1050	1050	1050	1050	1050	1050	1050	1040	1020	998	978	958		
	1.77	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1030		
	2.00	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050		
2.50	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050		
356x368x177  $M_{c,y,Rd} = 916$ $M_{c,z,Rd} = 443$  Class = 1	1.00	916	916	911	881	851	822	793	765	738	711	685	660	635	57100	
	1.13	916	916	916	913	887	861	836	810	785	760	736	712	688		
	1.35	916	916	916	916	916	915	894	873	852	830	808	787	766		
	1.50	916	916	916	916	916	916	916	907	888	869	850	830	810		
	1.77	916	916	916	916	916	916	916	916	916	916	910	894	877		
	2.00	916	916	916	916	916	916	916	916	916	916	916	916	916		
2.50	916	916	916	916	916	916	916	916	916	916	916	916	916	916		
356x368x153  $M_{c,y,Rd} = 786$ $M_{c,z,Rd} = 380$  Class = 1	1.00	786	786	779	751	723	696	668	641	615	589	564	540	518	48600	
	1.13	786	786	786	779	755	731	706	682	657	633	609	586	563		
	1.35	786	786	786	786	786	778	758	737	716	695	674	652	631		
	1.50	786	786	786	786	786	786	786	768	750	730	711	691	671		
	1.77	786	786	786	786	786	786	786	786	786	786	782	766	749		732
	2.00	786	786	786	786	786	786	786	786	786	786	786	786	786		774
2.50	786	786	786	786	786	786	786	786	786	786	786	786	786	786		

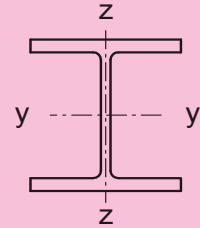
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<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8.

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

UNIVERSAL COLUMNS  
Advance® UKC



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)												Second Moment of Area y-y axis $I_y$ $cm^4$
				2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	
356x368x129  $M_{c,y,Rd} = 657$ $M_{c,z,Rd} = 318$  Class = 2	1.00	657	657	649	624	599	573	547	522	496	472	448	426	405	40200	
	1.13	657	657	657	648	626	603	580	556	533	509	486	464	443		
	1.35	657	657	657	657	657	644	625	605	584	563	542	522	501		
	1.50	657	657	657	657	657	657	650	632	614	594	575	556	536		
	1.77	657	657	657	657	657	657	657	657	656	641	624	607	590		
	2.00	657	657	657	657	657	657	657	657	657	657	657	643	628		
2.50	657	657	657	657	657	657	657	657	657	657	657	657	657	657		
305x305x283  $M_{c,y,Rd} = 1300$ $M_{c,z,Rd} = 597$  Class = 1	1.00	1300	1300	1300	1280	1250	1230	1200	1180	1160	1140	1120	1090	1070	78900	
	1.13	1300	1300	1300	1300	1300	1280	1260	1240	1220	1200	1180	1160	1140		
	1.35	1300	1300	1300	1300	1300	1300	1300	1300	1290	1280	1260	1250	1230		
	1.50	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	1290	1280		
	1.77	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300		
	2.00	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300		
2.50	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300		
305x305x240  $M_{c,y,Rd} = 1130$ $M_{c,z,Rd} = 517$  Class = 1	1.00	1130	1130	1120	1090	1060	1040	1010	991	968	946	924	903	882	64200	
	1.13	1130	1130	1130	1130	1110	1080	1060	1040	1020	1000	982	962	942		
	1.35	1130	1130	1130	1130	1130	1130	1130	1130	1110	1090	1080	1060	1040		1030
	1.50	1130	1130	1130	1130	1130	1130	1130	1130	1130	1120	1100	1090	1070		
	1.77	1130	1130	1130	1130	1130	1130	1130	1130	1130	1130	1130	1130	1130		
	2.00	1130	1130	1130	1130	1130	1130	1130	1130	1130	1130	1130	1130	1130		
2.50	1130	1130	1130	1130	1130	1130	1130	1130	1130	1130	1130	1130	1130	1130		
305x305x198  $M_{c,y,Rd} = 912$ $M_{c,z,Rd} = 419$  Class = 1	1.00	912	912	899	872	847	823	800	778	756	735	714	694	674	50900	
	1.13	912	912	912	904	883	862	841	821	802	782	763	744	726		
	1.35	912	912	912	912	912	912	898	881	865	848	832	815	799		
	1.50	912	912	912	912	912	912	912	912	900	885	870	855	840		
	1.77	912	912	912	912	912	912	912	912	912	912	912	912	902		
	2.00	912	912	912	912	912	912	912	912	912	912	912	912	912		
2.50	912	912	912	912	912	912	912	912	912	912	912	912	912	912		
305x305x158  $M_{c,y,Rd} = 710$ $M_{c,z,Rd} = 326$  Class = 1	1.00	710	710	693	668	645	622	601	580	559	539	520	501	483	38700	
	1.13	710	710	710	695	675	655	635	616	597	578	560	542	525		
	1.35	710	710	710	710	710	699	683	666	650	634	618	601	585		
	1.50	710	710	710	710	710	710	709	694	680	665	650	635	620		
	1.77	710	710	710	710	710	710	710	710	710	710	699	686	674		
	2.00	710	710	710	710	710	710	710	710	710	710	710	710	710		
2.50	710	710	710	710	710	710	710	710	710	710	710	710	710	710		

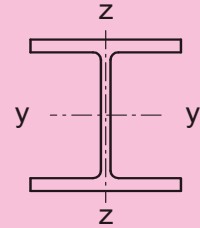
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<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8.

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

**UNIVERSAL COLUMNS**  
**Advance® UKC**



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)												Second Moment of Area y-y axis $I_y$ $cm^4$
				2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	
305x305x137  $M_{c,y,Rd} = 609$ $M_{c,z,Rd} = 279$  Class = 1	1.00	609	609	590	567	544	523	502	481	461	442	424	406	390	32800	
	1.13	609	609	609	591	571	552	532	513	495	477	459	442	425		
	1.35	609	609	609	609	607	591	575	559	543	526	510	494	479		
	1.50	609	609	609	609	609	609	598	584	569	555	540	525	510		
	1.77	609	609	609	609	609	609	609	609	609	609	597	584	571		558
	2.00	609	609	609	609	609	609	609	609	609	609	609	609	603		592
	2.50	609	609	609	609	609	609	609	609	609	609	609	609	609		609
305x305x118  $M_{c,y,Rd} = 519$ $M_{c,z,Rd} = 237$  Class = 1	1.00	519	519	500	478	457	436	416	396	377	358	341	325	310	27700	
	1.13	519	519	518	499	480	461	443	424	406	388	372	355	340		
	1.35	519	519	519	519	512	496	481	465	448	432	416	401	386		
	1.50	519	519	519	519	519	516	502	487	473	458	443	428	414		
	1.77	519	519	519	519	519	519	519	519	519	508	496	483	470		457
	2.00	519	519	519	519	519	519	519	519	519	519	519	511	499		488
	2.50	519	519	519	519	519	519	519	519	519	519	519	519	519		519
305x305x97  $M_{c,y,Rd} = 438$ $M_{c,z,Rd} = 200$  Class = 2	1.00	438	437	417	396	375	354	333	313	294	277	260	246	232	22200	
	1.13	438	438	433	415	396	377	357	338	320	302	285	270	256		
	1.35	438	438	438	438	424	408	391	374	357	341	324	309	294		
	1.50	438	438	438	438	438	426	411	395	379	363	348	333	318		
	1.77	438	438	438	438	438	438	438	426	412	399	384	370	357		
	2.00	438	438	438	438	438	438	438	438	438	435	423	411	398		385
	2.50	438	438	438	438	438	438	438	438	438	438	438	438	438		434

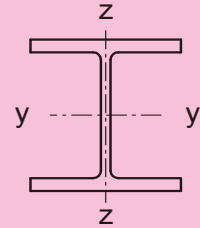
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Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

UNIVERSAL COLUMNS  
Advance® UKC



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)												Second Moment of Area y-y axis $I_y$ $cm^4$
				2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	
254x254x167  $M_{c,y,Rd} = 642$ $M_{c,z,Rd} = 301$  Class = 1	1.00	642	642	627	609	592	576	561	546	531	517	503	489	476	30000	
	1.13	642	642	642	633	618	604	590	577	563	550	537	524	512		
	1.35	642	642	642	642	642	641	630	619	608	597	586	574	563		
	1.50	642	642	642	642	642	642	642	642	633	623	613	603	592		
	1.77	642	642	642	642	642	642	642	642	642	642	642	642	642		636
	2.00	642	642	642	642	642	642	642	642	642	642	642	642	642		642
	2.50	642	642	642	642	642	642	642	642	642	642	642	642	642		642
254x254x132  $M_{c,y,Rd} = 495$ $M_{c,z,Rd} = 233$  Class = 1	1.00	495	495	476	460	444	429	415	401	387	374	361	348	336	22500	
	1.13	495	495	494	479	466	452	439	426	414	401	389	377	365		
	1.35	495	495	495	495	494	484	473	462	451	440	429	418	408		
	1.50	495	495	495	495	495	495	491	482	472	462	452	442	432		
	1.77	495	495	495	495	495	495	495	495	495	495	495	486	478		469
	2.00	495	495	495	495	495	495	495	495	495	495	495	495	495		495
	2.50	495	495	495	495	495	495	495	495	495	495	495	495	495		495
254x254x107  $M_{c,y,Rd} = 393$ $M_{c,z,Rd} = 185$  Class = 1	1.00	393	389	373	357	342	328	314	301	288	276	264	253	243	17500	
	1.13	393	393	387	374	361	348	335	323	310	299	287	276	266		
	1.35	393	393	393	393	385	375	364	353	342	332	321	311	300		
	1.50	393	393	393	393	393	389	380	370	360	351	341	331	321		
	1.77	393	393	393	393	393	393	393	393	387	379	371	362	353		
	2.00	393	393	393	393	393	393	393	393	393	393	391	384	376		
	2.50	393	393	393	393	393	393	393	393	393	393	393	393	393		
254x254x89  $M_{c,y,Rd} = 324$ $M_{c,z,Rd} = 152$  Class = 1	1.00	324	319	304	289	275	261	248	235	223	212	201	192	183	14300	
	1.13	324	324	316	303	291	278	266	254	242	231	220	210	201		
	1.35	324	324	324	323	312	302	291	280	270	259	249	239	229		
	1.50	324	324	324	324	324	315	305	295	286	276	266	256	247		
	1.77	324	324	324	324	324	324	324	318	309	301	292	284	275		
	2.00	324	324	324	324	324	324	324	324	324	319	311	303	295		
	2.50	324	324	324	324	324	324	324	324	324	324	324	324	324		
254x254x73  $M_{c,y,Rd} = 273$ $M_{c,z,Rd} = 128$  Class = 1	1.00	273	266	251	237	222	208	195	182	171	160	151	142	134	11400	
	1.13	273	273	262	249	236	223	210	198	187	176	166	157	148		
	1.35	273	273	273	267	256	244	233	222	211	200	190	180	171		
	1.50	273	273	273	273	266	256	246	235	225	215	205	195	186		
	1.77	273	273	273	273	273	273	265	256	247	238	228	219	211		
	2.00	273	273	273	273	273	273	273	271	262	254	246	237	229		
	2.50	273	273	273	273	273	273	273	273	273	273	273	268	261		

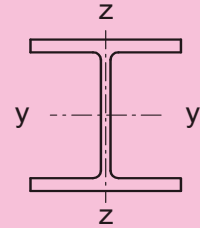
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FOR EXPLANATION OF TABLES SEE NOTE 8.

UNIVERSAL COLUMNS  
Advance® UKC



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)												Second Moment of Area y-y axis $I_y$ $cm^4$
				2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	
203x203x127 +  $M_{c,y,Rd} = 402$ $M_{c,z,Rd} = 187$  Class = 1	1.00	402	399	387	375	364	354	344	334	325	315	306	297	289	15400	
	1.13	402	402	401	391	381	372	363	354	346	337	328	320	312		
	1.35	402	402	402	402	402	397	389	382	375	367	360	352	345		
	1.50	402	402	402	402	402	402	402	397	391	384	377	370	364		
	1.77	402	402	402	402	402	402	402	402	402	402	402	402	398		392
	2.00	402	402	402	402	402	402	402	402	402	402	402	402	402		402
2.50	402	402	402	402	402	402	402	402	402	402	402	402	402	402		
203x203x113 +  $M_{c,y,Rd} = 352$ $M_{c,z,Rd} = 164$  Class = 1	1.00	352	347	335	324	314	304	295	285	276	267	258	250	242	13300	
	1.13	352	352	348	339	330	321	312	303	295	286	278	270	262		
	1.35	352	352	352	352	350	343	336	329	321	314	307	299	292		
	1.50	352	352	352	352	352	352	349	343	336	330	323	316	309		
	1.77	352	352	352	352	352	352	352	352	352	352	352	347	341		335
	2.00	352	352	352	352	352	352	352	352	352	352	352	352	352		352
2.50	352	352	352	352	352	352	352	352	352	352	352	352	352	352		
203x203x100 +  $M_{c,y,Rd} = 304$ $M_{c,z,Rd} = 142$  Class = 1	1.00	304	298	286	276	266	256	247	238	230	221	213	205	198	11300	
	1.13	304	304	298	289	280	271	263	255	246	238	230	223	215		
	1.35	304	304	304	304	299	292	285	277	270	263	256	249	242		
	1.50	304	304	304	304	304	303	297	290	284	277	271	264	257		
	1.77	304	304	304	304	304	304	304	304	304	298	293	287	281		
	2.00	304	304	304	304	304	304	304	304	304	304	304	304	303		298
2.50	304	304	304	304	304	304	304	304	304	304	304	304	304	304		
203x203x86  $M_{c,y,Rd} = 259$ $M_{c,z,Rd} = 121$  Class = 1	1.00	259	251	240	230	221	212	203	194	186	178	171	164	157	9450	
	1.13	259	259	251	242	233	225	217	209	201	193	186	179	172		
	1.35	259	259	259	257	250	243	236	229	222	215	208	201	195		
	1.50	259	259	259	259	259	253	247	241	234	228	221	215	208		
	1.77	259	259	259	259	259	259	259	259	258	252	247	241	236		230
	2.00	259	259	259	259	259	259	259	259	259	259	259	255	250		245
2.50	259	259	259	259	259	259	259	259	259	259	259	259	259	259		

Advance® and UKC are trademarks of Tata Steel. A fuller description of the relationship between Universal Columns (UC) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

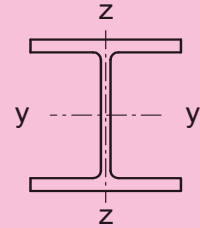
+ These sections are in addition to the range of BS 4 sections.

<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8.

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

**UNIVERSAL COLUMNS**  
**Advance® UKC**



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)											Second Moment of Area y-y axis $I_y$ $cm^4$	
				1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0		9.0
203x203x71  $M_{c,y,Rd} = 212$ $M_{c,z,Rd} = 99.0$  Class = 1	1.00	212	212	212	209	203	198	193	183	174	165	157	149	142	7620	
	1.13	212	212	212	212	211	206	202	193	185	177	169	161	154		
	1.35	212	212	212	212	212	212	212	212	207	200	193	186	179		172
	1.50	212	212	212	212	212	212	212	212	212	208	202	195	189		183
	1.77	212	212	212	212	212	212	212	212	212	212	212	210	204		199
	2.00	212	212	212	212	212	212	212	212	212	212	212	212	212		210
2.50	212	212	212	212	212	212	212	212	212	212	212	212	212	212		
203x203x60  $M_{c,y,Rd} = 180$ $M_{c,z,Rd} = 84.0$  Class = 1	1.00	180	180	180	176	171	165	160	150	141	132	124	116	109	6130	
	1.13	180	180	180	180	177	173	168	159	151	142	134	126	119		
	1.35	180	180	180	180	180	180	180	179	172	164	157	150	142		135
	1.50	180	180	180	180	180	180	180	180	179	172	165	158	152		145
	1.77	180	180	180	180	180	180	180	180	180	180	178	172	166		160
	2.00	180	180	180	180	180	180	180	180	180	180	180	180	176		170
2.50	180	180	180	180	180	180	180	180	180	180	180	180	180	180		
203x203x52  $M_{c,y,Rd} = 156$ $M_{c,z,Rd} = 72.7$  Class = 1	1.00	156	156	156	151	146	142	137	127	118	109	102	94.4	88.0	5260	
	1.13	156	156	156	156	152	148	144	135	127	118	111	103	96.7		
	1.35	156	156	156	156	156	156	156	153	146	139	131	124	117		111
	1.50	156	156	156	156	156	156	156	156	152	146	139	132	126		119
	1.77	156	156	156	156	156	156	156	156	156	156	150	144	138		132
	2.00	156	156	156	156	156	156	156	156	156	156	156	153	148		142
2.50	156	156	156	156	156	156	156	156	156	156	156	156	156	156		
203x203x46  $M_{c,y,Rd} = 137$ $M_{c,z,Rd} = 63.5$  Class = 1	1.00	137	137	137	132	127	123	118	109	100	92.0	84.5	78.0	72.2	4570	
	1.13	137	137	137	137	133	129	125	116	108	99.9	92.5	85.7	79.5		
	1.35	137	137	137	137	137	137	137	133	126	119	112	105	97.8		91.5
	1.50	137	137	137	137	137	137	137	137	132	125	119	112	105		99.0
	1.77	137	137	137	137	137	137	137	137	137	135	129	123	117		111
	2.00	137	137	137	137	137	137	137	137	137	137	136	131	125		120
2.50	137	137	137	137	137	137	137	137	137	137	137	137	137	135		

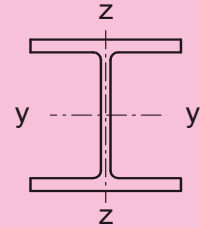
Advance® and UKC are trademarks of Tata Steel. A fuller description of the relationship between Universal Columns (UC) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8.

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

UNIVERSAL COLUMNS  
Advance® UKC



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)												Second Moment of Area y-y axis $I_y$ $cm^4$
				1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	
152x152x51 +  $M_{c,y,Rd} = 120$ $M_{c,z,Rd} = 54.7$  Class = 1	1.00	120	120	118	115	111	108	105	99.2	93.6	88.3	83.2	78.5	74.1	3230	
	1.13	120	120	120	119	116	113	111	105	100	95.1	90.2	85.5	81.0		
	1.35	120	120	120	120	120	120	118	114	109	105	100	96.0	91.7		
	1.50	120	120	120	120	120	120	120	118	114	110	106	102	98.1		
	1.77	120	120	120	120	120	120	120	120	120	120	119	115	112		108
	2.00	120	120	120	120	120	120	120	120	120	120	120	120	118		115
	2.50	120	120	120	120	120	120	120	120	120	120	120	120	120		120
152x152x44 +  $M_{c,y,Rd} = 102$ $M_{c,z,Rd} = 46.5$  Class = 1	1.00	102	102	99.8	96.4	93.2	90.1	87.1	81.4	76.0	71.0	66.3	62.1	58.2	2700	
	1.13	102	102	102	100	97.4	94.7	92.0	86.8	81.8	76.9	72.3	67.9	63.9		
	1.35	102	102	102	102	102	101	98.8	94.4	89.9	85.5	81.2	77.0	73.0		
	1.50	102	102	102	102	102	102	102	98.6	94.6	90.5	86.5	82.5	78.6		
	1.77	102	102	102	102	102	102	102	102	101	98.0	94.5	90.9	87.3		
	2.00	102	102	102	102	102	102	102	102	102	102	102	100	96.9		93.7
	2.50	102	102	102	102	102	102	102	102	102	102	102	102	102		102
152x152x37  $M_{c,y,Rd} = 84.9$ $M_{c,z,Rd} = 38.4$  Class = 1	1.00	84.9	84.9	82.1	78.9	75.9	72.9	70.0	64.6	59.5	54.8	50.6	46.9	43.7	2210	
	1.13	84.9	84.9	84.9	82.3	79.6	76.9	74.3	69.2	64.3	59.8	55.5	51.6	48.1		
	1.35	84.9	84.9	84.9	84.9	84.6	82.4	80.3	75.9	71.5	67.2	63.0	59.1	55.5		
	1.50	84.9	84.9	84.9	84.9	84.9	84.9	83.5	79.6	75.6	71.6	67.6	63.8	60.1		
	1.77	84.9	84.9	84.9	84.9	84.9	84.9	84.9	84.9	81.7	78.2	74.7	71.2	67.7		
	2.00	84.9	84.9	84.9	84.9	84.9	84.9	84.9	84.9	84.9	82.9	79.7	76.5	73.3		
	2.50	84.9	84.9	84.9	84.9	84.9	84.9	84.9	84.9	84.9	84.9	84.9	84.9	84.9		83.0
152x152x30  $M_{c,y,Rd} = 68.1$ $M_{c,z,Rd} = 30.7$  Class = 1	1.00	68.1	68.1	65.2	62.3	59.5	56.6	53.9	48.7	44.0	39.9	36.3	33.3	30.7	1750	
	1.13	68.1	68.1	67.7	65.1	62.6	60.0	57.5	52.6	47.9	43.7	40.0	36.7	33.9		
	1.35	68.1	68.1	68.1	68.1	66.8	64.7	62.6	58.2	53.9	49.8	46.0	42.5	39.4		
	1.50	68.1	68.1	68.1	68.1	68.1	67.3	65.4	61.4	57.4	53.5	49.7	46.2	43.0		
	1.77	68.1	68.1	68.1	68.1	68.1	68.1	68.1	66.2	62.8	59.2	55.7	52.3	49.1		
	2.00	68.1	68.1	68.1	68.1	68.1	68.1	68.1	68.1	66.5	63.3	60.1	56.9	53.8		
	2.50	68.1	68.1	68.1	68.1	68.1	68.1	68.1	68.1	68.1	68.1	68.1	67.7	65.0		62.3
152x152x23  $M_{c,y,Rd} = 45.1$ $M_{c,z,Rd} = 14.5$  Class = 3	1.00	45.1	45.1	43.2	41.1	39.0	36.8	34.8	30.8	27.3	24.4	21.9	19.9	18.2	1250	
	1.13	45.1	45.1	44.8	43.0	41.1	39.2	37.2	33.4	29.9	26.8	24.2	22.0	20.0		
	1.35	45.1	45.1	45.1	45.1	44.0	42.4	40.7	37.2	33.9	30.8	28.0	25.5	23.4		
	1.50	45.1	45.1	45.1	45.1	45.1	44.1	42.6	39.5	36.3	33.3	30.5	27.9	25.6		
	1.77	45.1	45.1	45.1	45.1	45.1	45.1	45.1	42.8	40.0	37.2	34.5	32.0	29.6		
	2.00	45.1	45.1	45.1	45.1	45.1	45.1	45.1	45.1	42.7	40.1	37.5	35.1	32.7		
	2.50	45.1	45.1	45.1	45.1	45.1	45.1	45.1	45.1	45.1	45.1	45.1	42.9	40.8		38.6

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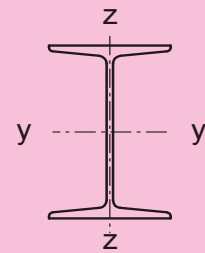
+ These sections are in addition to the range of BS 4 sections.

<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8.

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

JOISTS



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)												Second Moment of Area y-y axis $I_y$ cm <sup>4</sup>			
				1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0		10.0		
254x203x82	$M_{c,y,Rd} = 285$ $M_{c,z,Rd} = 98.3$	Class = 1	1.00	285	285	285	278	270	263	256	243	231	219	208	197	187	12000		
			1.13	285	285	285	285	281	275	269	257	246	235	224	213	203			
			1.35	285	285	285	285	285	285	285	285	276	266	257	247	237		228	
			1.50	285	285	285	285	285	285	285	285	285	278	269	260	251		243	
			1.77	285	285	285	285	285	285	285	285	285	285	285	285	280		273	265
			2.00	285	285	285	285	285	285	285	285	285	285	285	285	285		285	280
254x114x37	$M_{c,y,Rd} = 126$ $M_{c,z,Rd} = 21.8$	Class = 1	1.00	126	113	102	92.0	83.2	75.6	69.1	58.8	51.1	45.1	40.4	36.6	33.5	5080		
			1.13	126	119	109	99.0	90.3	82.6	75.9	64.8	56.2	49.5	44.4	40.4	37.0			
			1.35	126	126	118	109	101	93.3	86.5	74.7	65.2	57.5	51.1	46.3	42.6			
			1.50	126	126	123	115	107	99.8	93.1	81.2	71.3	63.0	56.1	50.3	46.1			
			1.77	126	126	126	123	116	110	104	91.9	81.7	72.9	65.4	58.9	53.2			
			2.00	126	126	126	126	123	117	111	100	89.9	80.9	73.0	66.1	60.0			
203x152x52	$M_{c,y,Rd} = 143$ $M_{c,z,Rd} = 46.6$	Class = 1	1.00	143	143	139	134	129	125	121	113	106	98.7	92.2	86.3	80.9	4800		
			1.13	143	143	143	139	136	132	128	121	114	107	101	94.5	88.9			
			1.35	143	143	143	143	143	141	138	131	125	119	113	107	102			
			1.50	143	143	143	143	143	143	143	137	132	126	121	115	109			
			1.77	143	143	143	143	143	143	143	143	142	137	132	127	122			
			2.00	143	143	143	143	143	143	143	143	143	143	143	140	135		131	
152x127x37	$M_{c,y,Rd} = 76.7$ $M_{c,z,Rd} = 27.4$	Class = 1	1.00	76.7	75.5	72.6	69.9	67.5	65.1	62.8	58.4	54.3	50.4	46.9	43.7	40.9	1820		
			1.13	76.7	76.7	75.4	73.1	71.0	68.8	66.7	62.6	58.7	54.9	51.3	48.1	45.0			
			1.35	76.7	76.7	76.7	76.7	75.7	73.9	72.1	68.6	65.1	61.5	58.1	54.9	51.8			
			1.50	76.7	76.7	76.7	76.7	76.7	76.7	75.1	72.0	68.7	65.5	62.2	59.0	56.0			
			1.77	76.7	76.7	76.7	76.7	76.7	76.7	76.7	76.7	74.2	71.4	68.5	65.6	62.7			
			2.00	76.7	76.7	76.7	76.7	76.7	76.7	76.7	76.7	76.7	76.7	75.5	73.0	70.3		67.7	
2.50	76.7	76.7	76.7	76.7	76.7	76.7	76.7	76.7	76.7	76.7	76.7	76.7	76.7	76.2					

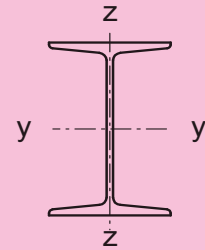
<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8.

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.



JOISTS



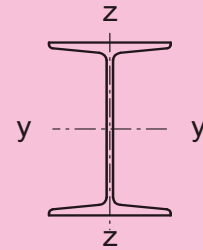
Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)											Second Moment of Area y-y axis $I_y$ cm <sup>4</sup>			
				1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0		9.0	10.0	
127x114x29	$M_{c,y,Rd} = 49.8$ $M_{c,z,Rd} = 19.5$	Class = 1	1.00	49.8	48.5	46.7	44.9	43.3	41.8	40.2	37.3	34.6	32.1	29.8	27.7	25.9	979	
			1.13	49.8	49.8	48.6	47.1	45.6	44.2	42.8	40.1	37.5	35.0	32.7	30.5	28.5		
			1.35	49.8	49.8	49.8	49.8	48.7	47.6	46.4	44.0	41.7	39.3	37.1	34.9	32.9		
			1.50	49.8	49.8	49.8	49.8	49.8	49.4	48.4	46.3	44.1	41.9	39.7	37.6	35.6		
			1.77	49.8	49.8	49.8	49.8	49.8	49.8	49.8	49.8	49.6	47.7	45.8	43.9	41.9		40.0
			2.00	49.8	49.8	49.8	49.8	49.8	49.8	49.8	49.8	49.8	49.8	48.6	46.8	45.1		43.3
127x114x27	$M_{c,y,Rd} = 47.3$ $M_{c,z,Rd} = 18.8$	Class = 1	1.00	47.3	46.0	44.1	42.3	40.7	39.1	37.6	34.7	32.0	29.5	27.3	25.3	23.6	946	
			1.13	47.3	47.3	45.9	44.4	42.9	41.5	40.1	37.3	34.7	32.2	30.0	27.9	26.0		
			1.35	47.3	47.3	47.3	47.2	46.0	44.8	43.6	41.2	38.7	36.4	34.1	32.0	30.0		
			1.50	47.3	47.3	47.3	47.3	47.3	46.6	45.5	43.3	41.1	38.9	36.7	34.6	32.6		
			1.77	47.3	47.3	47.3	47.3	47.3	47.3	47.3	47.3	46.6	44.7	42.7	40.7	38.8		36.8
			2.00	47.3	47.3	47.3	47.3	47.3	47.3	47.3	47.3	47.3	47.1	45.4	43.6	41.8		40.0
127x76x16	$M_{c,y,Rd} = 28.6$ $M_{c,z,Rd} = 7.26$	Class = 1	1.00	27.4	25.3	23.5	21.7	20.1	18.6	17.2	14.9	13.1	11.6	10.4	9.23	8.30	571	
			1.13	28.4	26.6	24.9	23.3	21.7	20.2	18.8	16.4	14.4	12.8	11.5	10.4	9.38		
			1.35	28.6	28.3	26.9	25.5	24.1	22.7	21.4	18.9	16.8	14.9	13.4	12.0	11.1		
			1.50	28.6	28.6	28.0	26.8	25.5	24.2	22.9	20.5	18.3	16.4	14.7	13.3	12.0		
			1.77	28.6	28.6	28.6	28.6	27.6	26.4	25.3	23.0	20.9	18.9	17.1	15.5	14.1		
			2.00	28.6	28.6	28.6	28.6	28.6	28.0	27.0	24.9	22.8	20.9	19.0	17.4	15.9		
114x114x27	$M_{c,y,Rd} = 41.5$ $M_{c,z,Rd} = 18.1$	Class = 1	1.00	41.5	40.7	39.3	38.0	36.7	35.5	34.4	32.1	30.0	28.0	26.2	24.5	23.0	736	
			1.13	41.5	41.5	40.8	39.7	38.6	37.5	36.5	34.4	32.4	30.4	28.6	26.9	25.3		
			1.35	41.5	41.5	41.5	41.5	41.1	40.2	39.3	37.6	35.8	34.0	32.2	30.5	28.9		
			1.50	41.5	41.5	41.5	41.5	41.5	41.5	40.9	39.4	37.7	36.1	34.4	32.8	31.2		
			1.77	41.5	41.5	41.5	41.5	41.5	41.5	41.5	41.5	40.6	39.2	37.7	36.3	34.8		
			2.00	41.5	41.5	41.5	41.5	41.5	41.5	41.5	41.5	41.5	41.5	41.4	40.1	38.8		37.4

<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8.

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

JOISTS



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm)											Second Moment of Area y-y axis $I_y$ $cm^4$			
				for Length between lateral restraints (m)														
				1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0		
102x102x23	$M_{c,y,Rd} = 31.1$ $M_{c,z,Rd} = 13.9$	Class = 1	1.00	31.1	30.3	29.2	28.2	27.2	26.3	25.4	23.7	22.1	20.5	19.1	17.9	16.7	486	
			1.13	31.1	31.1	30.4	29.5	28.6	27.8	27.0	25.4	23.8	22.3	20.9	19.6	18.4		
			1.35	31.1	31.1	31.1	31.1	30.6	29.9	29.2	27.8	26.4	25.0	23.7	22.4	21.1		
			1.50	31.1	31.1	31.1	31.1	31.1	31.0	30.4	29.2	27.9	26.6	25.3	24.1	22.9		
			1.77	31.1	31.1	31.1	31.1	31.1	31.1	31.1	31.1	31.1	30.1	29.0	27.9	26.7		25.6
			2.00	31.1	31.1	31.1	31.1	31.1	31.1	31.1	31.1	31.1	31.1	30.7	29.7	28.6		27.6
102x44x7	$M_{c,y,Rd} = 9.74$ $M_{c,z,Rd} = 1.66$	Class = 1	1.00	7.39	6.05	5.07	4.35	3.80	3.38	3.03	2.53	2.14	1.83	1.60	1.42	1.28	153	
			1.13	7.92	6.60	5.58	4.79	4.18	3.70	3.34	2.79	2.40	2.07	1.81	1.61	1.45		
			1.35	8.66	7.42	6.39	5.54	4.86	4.29	3.82	3.21	2.78	2.44	2.16	1.92	1.73		
			1.50	9.08	7.91	6.90	6.04	5.32	4.71	4.20	3.48	3.02	2.66	2.39	2.14	1.92		
			1.77	9.70	8.67	7.72	6.86	6.11	5.46	4.90	4.00	3.43	3.04	2.73	2.48	2.27		
			2.00	9.74	9.21	8.32	7.49	6.74	6.07	5.48	4.51	3.76	3.35	3.01	2.74	2.51		
89x89x19	$M_{c,y,Rd} = 22.7$ $M_{c,z,Rd} = 10.5$	Class = 1	1.00	22.7	22.1	21.3	20.5	19.9	19.2	18.5	17.3	16.1	15.0	14.0	13.0	12.2	307	
			1.13	22.7	22.7	22.1	21.5	20.9	20.3	19.7	18.5	17.4	16.3	15.3	14.3	13.4		
			1.35	22.7	22.7	22.7	22.7	22.3	21.8	21.3	20.3	19.3	18.3	17.3	16.3	15.4		
			1.50	22.7	22.7	22.7	22.7	22.7	22.7	22.2	21.3	20.4	19.4	18.5	17.6	16.7		
			1.77	22.7	22.7	22.7	22.7	22.7	22.7	22.7	22.7	22.0	21.2	20.4	19.5	18.7		
			2.00	22.7	22.7	22.7	22.7	22.7	22.7	22.7	22.7	22.7	22.4	21.7	20.9	20.1		
76x76x15	$M_{c,y,Rd} = 14.9$ $M_{c,z,Rd} = 7.10$	Class = 1	1.00	14.9	14.3	13.7	13.2	12.8	12.3	11.8	10.9	10.1	9.37	8.68	8.07	7.53	172	
			1.13	14.9	14.8	14.3	13.9	13.5	13.0	12.6	11.8	11.0	10.2	9.53	8.89	8.30		
			1.35	14.9	14.9	14.9	14.8	14.4	14.1	13.7	13.0	12.3	11.5	10.9	10.2	9.58		
			1.50	14.9	14.9	14.9	14.9	14.9	14.7	14.3	13.7	13.0	12.3	11.7	11.0	10.4		
			1.77	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.7	14.1	13.5	12.9	12.3	11.7		
			2.00	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.4	13.8	13.3	12.7		
76x76x13	$M_{c,y,Rd} = 13.4$ $M_{c,z,Rd} = 6.16$	Class = 1	1.00	13.2	12.6	12.0	11.5	11.0	10.5	10.0	9.15	8.34	7.63	7.00	6.46	5.98	158	
			1.13	13.4	13.1	12.6	12.2	11.7	11.2	10.8	9.93	9.12	8.38	7.72	7.13	6.60		
			1.35	13.4	13.4	13.4	13.0	12.6	12.2	11.8	11.1	10.3	9.57	8.88	8.25	7.67		
			1.50	13.4	13.4	13.4	13.4	13.1	12.8	12.5	11.7	11.0	10.3	9.62	8.98	8.38		
			1.77	13.4	13.4	13.4	13.4	13.4	13.4	13.3	12.7	12.1	11.4	10.8	10.2	9.58		
			2.00	13.4	13.4	13.4	13.4	13.4	13.4	13.4	13.4	12.9	12.3	11.7	11.1	10.5		

<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8.

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

# BENDING

## **HOT-FINISHED HOLLOW SECTIONS - S275**

There are no resistance tables given for hot finished hollow sections in S275, because hot finished hollow sections are normally available in S355 only.

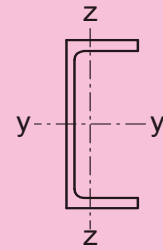
S355 resistance tables are given for hot finished hollow sections in part D (pages D - 103 to D - 119). However, to maintain consistent page numbering between S275 resistance tables and S355 resistance tables, pages C - 103 to C - 119 are omitted here.

## **COLD-FORMED HOLLOW SECTIONS - S275**

There are no resistance tables given for cold-formed hollow sections in S275, because cold-formed hollow sections are normally available in S235 and S355 only. No resistance tables are given for S235 either, because sections available may not be manufactured to BS EN 10219-2: 2006.

S355 resistance tables are given for cold formed hollow sections in part D (pages D - 120 to D - 129). However, to maintain consistent page numbering between S275 resistance tables and S355 resistance tables, pages C - 120 to C - 129 are omitted here.

PARALLEL FLANGE CHANNELS  
Advance® UKPFC



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)											Second Moment of Area y-y axis $I_y$ $cm^4$
				1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	
430x100x64  $M_{c,y,Rd} = 324$ $M_{c,z,Rd} = 46.6$ Class = 1	1.00	324	297	260	229	204	182	165	138	119	105	94.0	85.2	78.0	21900
	1.13	324	312	277	247	221	200	181	153	131	115	103	93.4	85.7	
	1.35	324	324	301	273	248	226	207	176	152	133	118	106	97.9	
	1.50	324	324	315	288	264	242	223	191	166	146	130	116	106	
	1.77	324	324	324	311	288	268	249	217	191	169	151	135	122	
	2.00	324	324	324	324	306	286	269	237	210	187	168	152	138	
	2.50	324	324	324	324	324	319	303	273	247	224	204	186	170	
380x100x54  $M_{c,y,Rd} = 247$ $M_{c,z,Rd} = 42.7$ Class = 1	1.00	247	228	200	177	158	142	129	109	94.0	83.0	74.4	67.5	61.8	15000
	1.13	247	239	213	191	172	155	142	120	103	91.0	81.3	74.0	67.9	
	1.35	247	247	232	211	192	176	161	138	120	105	93.9	84.3	77.5	
	1.50	247	247	242	222	204	188	174	150	131	116	103	92.5	83.7	
	1.77	247	247	247	239	223	207	194	170	150	133	119	108	97.6	
	2.00	247	247	247	247	236	221	208	185	165	148	133	120	110	
	2.50	247	247	247	247	247	246	234	212	193	176	161	147	135	
300x100x46  $M_{c,y,Rd} = 170$ $M_{c,z,Rd} = 39.2$ Class = 1	1.00	170	159	141	126	114	104	95.8	82.4	72.4	64.6	58.4	53.4	49.2	8230
	1.13	170	166	150	136	124	114	105	90.6	79.7	71.1	64.1	58.4	53.8	
	1.35	170	170	162	149	138	128	119	104	92.0	82.4	74.4	67.6	61.8	
	1.50	170	170	169	157	146	136	127	112	100	89.9	81.4	74.1	67.8	
	1.77	170	170	170	168	158	149	141	126	113	103	93.7	85.7	78.8	
	2.00	170	170	170	170	167	158	150	136	124	113	104	95.3	87.9	
	2.50	170	170	170	170	170	170	167	155	143	133	123	114	107	
300x90x41  $M_{c,y,Rd} = 156$ $M_{c,z,Rd} = 31.4$ Class = 1	1.00	156	138	121	106	95.0	85.7	78.1	66.3	57.7	51.2	46.1	41.9	38.5	7220
	1.13	156	146	129	115	104	93.9	85.8	73.1	63.5	56.1	50.4	46.0	42.3	
	1.35	156	156	141	128	116	107	98.2	84.3	73.6	65.0	58.0	52.3	48.3	
	1.50	156	156	148	135	124	114	106	91.7	80.4	71.2	63.7	57.3	52.1	
	1.77	156	156	156	146	136	127	118	104	92.1	82.2	73.9	66.7	60.6	
	2.00	156	156	156	154	145	136	128	114	102	91.2	82.4	74.8	68.1	
	2.50	156	156	156	156	156	152	145	131	119	109	99.7	91.4	84.1	

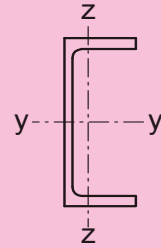
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<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8.

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

PARALLEL FLANGE CHANNELS  
Advance® UKPFC



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)											Second Moment of Area y-y axis $I_y$ $cm^4$
				1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	
260x90x35  $M_{c,y,Rd} = 117$ $M_{c,z,Rd} = 28.1$ Class = 1	1.00	117	104	91.1	80.8	72.4	65.6	59.9	51.1	44.7	39.7	35.8	32.6	30.0	4730
	1.13	117	109	97.4	87.3	78.8	71.8	65.8	56.3	49.2	43.6	39.1	35.7	32.9	
	1.35	117	117	106	96.7	88.5	81.3	75.1	64.9	56.9	50.5	45.3	40.9	37.5	
	1.50	117	117	111	102	94.2	87.2	81.0	70.5	62.1	55.3	49.6	44.8	40.8	
	1.77	117	117	117	111	103	96.4	90.3	79.8	71.1	63.7	57.5	52.1	47.5	
	2.00	117	117	117	116	109	103	97.3	87.0	78.1	70.6	64.0	58.3	53.3	
	2.50	117	117	117	117	117	115	110	100	91.6	83.9	77.1	71.0	65.5	
260x75x28  $M_{c,y,Rd} = 90.2$ $M_{c,z,Rd} = 17.1$ Class = 1	1.00	86.3	72.5	61.6	53.1	46.6	41.4	37.3	31.2	26.9	23.7	21.2	19.2	17.6	3620
	1.13	90.2	77.3	66.6	58.0	51.1	45.6	41.1	34.3	29.4	26.0	23.3	21.2	19.4	
	1.35	90.2	83.9	73.9	65.4	58.3	52.5	47.5	39.7	33.9	29.6	26.7	24.3	22.3	
	1.50	90.2	87.7	78.2	69.9	62.8	56.8	51.7	43.5	37.2	32.3	28.8	26.3	24.2	
	1.77	90.2	90.2	84.6	76.9	70.1	64.1	58.8	50.0	43.2	37.6	33.1	29.7	27.4	
	2.00	90.2	90.2	89.1	82.0	75.4	69.6	64.3	55.3	48.1	42.2	37.3	33.2	29.9	
	2.50	90.2	90.2	90.2	90.2	84.9	79.5	74.6	65.7	58.2	51.7	46.2	41.5	37.5	
230x90x32  $M_{c,y,Rd} = 97.6$ $M_{c,z,Rd} = 27.2$ Class = 1	1.00	97.6	87.6	77.5	69.4	62.8	57.3	52.7	45.5	40.1	35.8	32.4	29.7	27.3	3520
	1.13	97.6	92.3	82.7	74.8	68.2	62.6	57.8	50.1	44.1	39.4	35.6	32.4	29.9	
	1.35	97.6	97.6	90.0	82.6	76.2	70.6	65.7	57.5	51.0	45.7	41.2	37.5	34.3	
	1.50	97.6	97.6	94.1	87.1	80.9	75.5	70.6	62.3	55.5	49.9	45.1	41.1	37.6	
	1.77	97.6	97.6	97.6	93.9	88.2	83.1	78.4	70.2	63.2	57.2	52.1	47.6	43.7	
	2.00	97.6	97.6	97.6	97.6	93.4	88.6	84.1	76.1	69.1	63.1	57.7	53.0	48.9	
	2.50	97.6	97.6	97.6	97.6	97.6	97.6	94.1	86.8	80.3	74.3	68.9	64.0	59.5	
230x75x26  $M_{c,y,Rd} = 76.5$ $M_{c,z,Rd} = 17.4$ Class = 1	1.00	73.8	62.7	54.0	47.3	42.0	37.8	34.3	29.1	25.3	22.5	20.2	18.4	16.8	2750
	1.13	76.5	66.7	58.3	51.5	46.0	41.5	37.8	32.1	27.8	24.6	22.1	20.2	18.6	
	1.35	76.5	72.2	64.4	57.8	52.3	47.6	43.6	37.1	32.2	28.3	25.2	23.1	21.3	
	1.50	76.5	75.3	67.9	61.6	56.1	51.4	47.3	40.5	35.2	31.0	27.6	24.9	23.0	
	1.77	76.5	76.5	73.3	67.4	62.2	57.5	53.4	46.4	40.7	36.0	32.1	28.8	26.0	
	2.00	76.5	76.5	76.5	71.5	66.6	62.1	58.0	51.0	45.1	40.2	36.0	32.4	29.3	
	2.50	76.5	76.5	76.5	76.5	74.3	70.3	66.6	59.8	53.8	48.6	44.1	40.1	36.6	

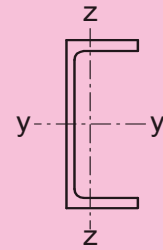
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<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8.

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

PARALLEL FLANGE CHANNELS  
Advance® UKPFC



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)											Second Moment of Area y-y axis $I_y$ $cm^4$			
				1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0		9.0	10.0	
200x90x30	80.0	26.0	1	1.00	80.0	72.7	65.0	58.9	53.8	49.5	45.9	40.1	35.6	32.1	29.2	26.8	24.8	2520
				1.13	80.0	76.5	69.2	63.3	58.2	53.9	50.2	44.1	39.3	35.4	32.1	29.4	27.1	
				1.35	80.0	80.0	75.1	69.5	64.7	60.5	56.8	50.4	45.2	40.9	37.2	34.1	31.4	
				1.50	80.0	80.0	78.4	73.2	68.6	64.5	60.8	54.4	49.1	44.6	40.7	37.3	34.4	
				1.77	80.0	80.0	80.0	78.5	74.4	70.6	67.1	60.8	55.5	50.8	46.7	43.1	39.8	
				2.00	80.0	80.0	80.0	80.0	78.4	74.9	71.6	65.6	60.4	55.7	51.5	47.7	44.3	
				2.50	80.0	80.0	80.0	80.0	80.0	80.0	79.4	74.2	69.3	64.8	60.7	56.9	53.3	
200x75x23	62.4	16.7	1	1.00	60.6	52.0	45.5	40.3	36.2	32.9	30.1	25.8	22.7	20.2	18.2	16.6	15.3	1960
				1.13	62.4	55.3	48.9	43.8	39.6	36.1	33.1	28.5	24.9	22.1	20.0	18.3	16.8	
				1.35	62.4	59.7	53.8	48.9	44.7	41.1	38.0	32.9	28.9	25.6	23.0	20.8	19.2	
				1.50	62.4	62.2	56.7	51.9	47.8	44.2	41.1	35.8	31.6	28.1	25.2	22.7	20.7	
				1.77	62.4	62.4	60.9	56.6	52.7	49.2	46.1	40.7	36.2	32.4	29.2	26.5	24.1	
				2.00	62.4	62.4	62.4	59.8	56.2	52.9	49.9	44.5	39.9	36.0	32.6	29.7	27.1	
				2.50	62.4	62.4	62.4	62.4	62.3	59.4	56.6	51.6	47.1	43.1	39.5	36.3	33.5	
180x90x26	63.8	23.0	1	1.00	63.8	58.0	51.9	47.0	42.9	39.5	36.7	32.0	28.5	25.7	23.4	21.4	19.8	1820
				1.13	63.8	61.0	55.2	50.5	46.5	43.0	40.1	35.2	31.4	28.3	25.7	23.5	21.7	
				1.35	63.8	63.8	59.9	55.5	51.7	48.3	45.3	40.3	36.1	32.7	29.8	27.3	25.1	
				1.50	63.8	63.8	62.5	58.4	54.7	51.4	48.5	43.5	39.2	35.6	32.5	29.9	27.5	
				1.77	63.8	63.8	63.8	62.6	59.3	56.3	53.5	48.6	44.3	40.6	37.3	34.4	31.9	
				2.00	63.8	63.8	63.8	63.8	62.6	59.8	57.1	52.4	48.2	44.5	41.1	38.1	35.4	
				2.50	63.8	63.8	63.8	63.8	63.8	63.8	63.4	59.2	55.3	51.8	48.5	45.4	42.6	
180x75x20	48.4	14.2	1	1.00	46.9	40.2	35.0	31.0	27.8	25.2	23.0	19.7	17.3	15.4	13.9	12.6	11.6	1370
				1.13	48.4	42.7	37.7	33.7	30.4	27.6	25.3	21.7	19.0	16.8	15.2	13.9	12.8	
				1.35	48.4	46.2	41.5	37.6	34.3	31.5	29.1	25.1	22.0	19.5	17.4	15.8	14.6	
				1.50	48.4	48.1	43.7	40.0	36.8	33.9	31.5	27.3	24.0	21.3	19.1	17.2	15.8	
				1.77	48.4	48.4	47.1	43.6	40.6	37.8	35.4	31.1	27.6	24.7	22.2	20.1	18.2	
				2.00	48.4	48.4	48.4	46.2	43.3	40.7	38.3	34.1	30.5	27.4	24.8	22.5	20.5	
				2.50	48.4	48.4	48.4	48.4	48.0	45.7	43.6	39.6	36.0	32.9	30.1	27.6	25.4	

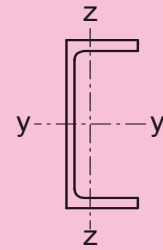
Advance® and UKPFC are trademarks of Tata Steel. A fuller description of the relationship between Parallel Flange Channels and the Advance® range of sections manufactured by Tata Steel is given in note 12.

<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8.

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

PARALLEL FLANGE CHANNELS  
Advance® UKPFC



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)											Second Moment of Area y-y axis $I_y$ $cm^4$		
				1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0		9.0	10.0
150x90x24	$M_{c,y,Rd} = 49.2$ $M_{c,z,Rd} = 21.1$ Class = 1		1.00	49.2	45.4	41.1	37.6	34.8	32.3	30.2	26.7	24.0	21.7	19.9	18.4	17.0	1160
			1.13	49.2	47.7	43.6	40.3	37.5	35.0	32.9	29.3	26.4	24.0	21.9	20.2	18.7	
			1.35	49.2	49.2	47.1	44.1	41.4	39.1	36.9	33.3	30.2	27.6	25.4	23.4	21.7	
			1.50	49.2	49.2	49.1	46.2	43.7	41.4	39.4	35.8	32.7	30.0	27.6	25.6	23.7	
			1.77	49.2	49.2	49.2	49.2	47.1	45.1	43.1	39.7	36.6	33.9	31.5	29.3	27.3	
			2.00	49.2	49.2	49.2	49.2	49.2	47.6	45.8	42.5	39.6	36.9	34.5	32.2	30.2	
			2.50	49.2	49.2	49.2	49.2	49.2	49.2	49.2	47.5	44.9	42.4	40.1	37.9	35.9	
150x75x18	$M_{c,y,Rd} = 36.3$ $M_{c,z,Rd} = 13.0$ Class = 1		1.00	35.5	30.7	27.1	24.3	22.0	20.1	18.5	16.0	14.2	12.7	11.5	10.5	9.69	861
			1.13	36.3	32.6	29.1	26.3	24.0	22.0	20.4	17.7	15.6	13.9	12.6	11.5	10.6	
			1.35	36.3	35.1	31.9	29.3	27.0	25.0	23.3	20.4	18.0	16.1	14.6	13.2	12.1	
			1.50	36.3	36.3	33.6	31.0	28.8	26.8	25.1	22.1	19.7	17.7	16.0	14.5	13.2	
			1.77	36.3	36.3	36.0	33.6	31.6	29.7	28.0	25.0	22.5	20.3	18.5	16.8	15.4	
			2.00	36.3	36.3	36.3	35.5	33.6	31.8	30.1	27.2	24.7	22.5	20.5	18.8	17.3	
			2.50	36.3	36.3	36.3	36.3	36.3	35.4	34.0	31.3	28.8	26.6	24.6	22.8	21.2	
125x65x15	$M_{c,y,Rd} = 24.7$ $M_{c,z,Rd} = 9.13$ Class = 1		1.00	23.3	20.3	18.0	16.2	14.7	13.5	12.5	10.9	9.62	8.64	7.84	7.18	6.63	483
			1.13	24.5	21.6	19.3	17.6	16.1	14.8	13.7	12.0	10.6	9.49	8.58	7.86	7.26	
			1.35	24.7	23.4	21.3	19.6	18.1	16.8	15.7	13.8	12.3	11.0	9.93	9.03	8.27	
			1.50	24.7	24.4	22.4	20.8	19.3	18.1	16.9	15.0	13.4	12.0	10.9	9.91	9.06	
			1.77	24.7	24.7	24.1	22.6	21.3	20.0	18.9	17.0	15.3	13.8	12.6	11.5	10.6	
			2.00	24.7	24.7	24.7	23.9	22.6	21.5	20.4	18.5	16.8	15.3	14.0	12.8	11.8	
			2.50	24.7	24.7	24.7	24.7	24.7	24.0	23.0	21.2	19.6	18.1	16.8	15.6	14.5	
100x50x10	$M_{c,y,Rd} = 13.4$ $M_{c,z,Rd} = 4.81$ Class = 1		1.00	11.8	10.2	8.99	8.05	7.29	6.67	6.14	5.31	4.68	4.18	3.79	3.46	3.19	208
			1.13	12.5	10.9	9.74	8.78	8.00	7.33	6.77	5.85	5.14	4.57	4.15	3.80	3.50	
			1.35	13.4	12.0	10.8	9.89	9.09	8.39	7.78	6.77	5.96	5.30	4.75	4.33	4.01	
			1.50	13.4	12.6	11.5	10.6	9.76	9.06	8.44	7.38	6.52	5.81	5.21	4.70	4.33	
			1.77	13.4	13.4	12.5	11.6	10.8	10.1	9.51	8.42	7.50	6.72	6.06	5.48	4.99	
			2.00	13.4	13.4	13.1	12.3	11.6	10.9	10.3	9.23	8.29	7.47	6.77	6.15	5.61	
			2.50	13.4	13.4	13.4	13.4	13.0	12.4	11.8	10.8	9.83	8.99	8.24	7.56	6.96	

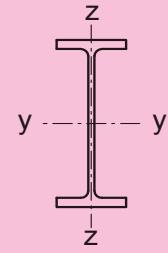
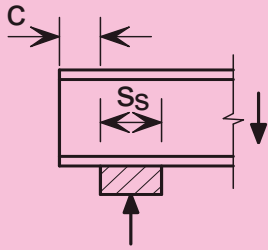
Advance® and UKPFC are trademarks of Tata Steel. A fuller description of the relationship between Parallel Flange Channels and the Advance® range of sections manufactured by Tata Steel is given in note 12.

<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8.

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

UNIVERSAL BEAMS  
Advance® UKB



Unstiffened webs

Section Designation	Design Shear Resistance $V_{c,Rd}$ kN	Position of Stiff Bearing	Design resistance of unstiffened web, $F_{Rd}$ (kN) and limiting length, $c_{lim}$ (mm)												
			Stiff bearing length, $s_s$ (mm)												
			0	10	20	30	40	50	75	100	150	200	250	300	350
1016x305x487 +	4930	$F_{Rd} (c = 0)$	938	1020	1100	1200	1290	1400	1670	1980	2480	2860	3240	3620	4010
		$c_{lim} (mm)$	620	610	600	590	580	570	550	520	470	420	370	320	290
		$F_{Rd} (c \geq c_{lim})$	3480	3560	3640	3710	3790	3870	4060	4250	4630	5010	5400	5780	6160
1016x305x437 +	4420	$F_{Rd} (c = 0)$	801	872	950	1030	1120	1210	1470	1740	2160	2500	2850	3190	3530
		$c_{lim} (mm)$	620	610	600	590	580	570	550	520	470	420	370	320	270
		$F_{Rd} (c \geq c_{lim})$	2940	3010	3070	3140	3210	3280	3450	3620	3970	4310	4650	5000	5340
1016x305x393 +	3990	$F_{Rd} (c = 0)$	681	746	816	892	974	1060	1290	1540	1900	2470	2750	3020	3290
		$c_{lim} (mm)$	620	610	600	590	580	570	550	520	470	420	370	320	300
		$F_{Rd} (c \geq c_{lim})$	2470	2530	2600	2660	2720	2780	2940	3090	3410	3720	4530	4680	4830
1016x305x349 +	3610	$F_{Rd} (c = 0)$	598	996	1040	1090	1140	1190	1320	1450	1670	1880	2090	2300	2510
		$c_{lim} (mm)$	620	610	600	590	580	570	550	520	470	420	370	320	290
		$F_{Rd} (c \geq c_{lim})$	2140	2200	2250	2310	2890	2920	2990	3050	3180	3310	3420	3540	3650
1016x305x314 +	3260	$F_{Rd} (c = 0)$	771	807	845	883	923	964	1070	1180	1350	1530	1700	1870	2040
		$c_{lim} (mm)$	620	610	600	590	580	570	550	520	470	420	370	320	270
		$F_{Rd} (c \geq c_{lim})$	2220	2250	2270	2300	2320	2340	2400	2450	2560	2660	2760	2860	2950
1016x305x272 +	2830	$F_{Rd} (c = 0)$	568	595	623	652	682	713	792	870	999	1130	1260	1380	1510
		$c_{lim} (mm)$	620	610	600	590	580	570	550	520	470	420	370	320	270
		$F_{Rd} (c \geq c_{lim})$	1620	1630	1650	1670	1690	1710	1750	1790	1870	1950	2030	2100	2170
1016x305x249 +	2770	$F_{Rd} (c = 0)$	553	580	609	638	669	700	781	848	978	1110	1240	1360	1490
		$c_{lim} (mm)$	620	610	600	590	580	570	550	520	470	420	370	320	270
		$F_{Rd} (c \geq c_{lim})$	1540	1560	1580	1600	1620	1640	1680	1720	1810	1890	1970	2040	2120
1016x305x222 +	2640	$F_{Rd} (c = 0)$	509	535	562	590	619	648	718	780	902	1020	1150	1270	1390
		$c_{lim} (mm)$	620	610	600	590	580	570	550	520	470	420	370	320	270
		$F_{Rd} (c \geq c_{lim})$	1390	1410	1420	1440	1460	1480	1520	1570	1650	1730	1800	1870	1940
914x419x388	3240	$F_{Rd} (c = 0)$	651	710	774	843	916	993	1420	1570	1830	2060	2300	2530	2770
		$c_{lim} (mm)$	570	560	550	540	530	520	500	470	420	370	320	280	280
		$F_{Rd} (c \geq c_{lim})$	2260	2310	2370	2430	2480	2540	2680	2820	3410	3550	3680	3800	3920
914x419x343	2920	$F_{Rd} (c = 0)$	817	858	900	943	988	1030	1150	1280	1480	1670	1870	2060	2250
		$c_{lim} (mm)$	570	560	550	540	530	520	500	470	420	370	320	270	260
		$F_{Rd} (c \geq c_{lim})$	1860	1910	1960	2440	2470	2500	2560	2620	2740	2850	2960	3060	3160

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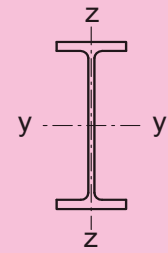
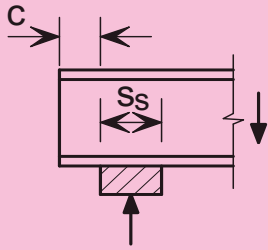
+ These sections are in addition to the range of BS 4 sections

If  $c < c_{lim}$ , then use  $F_{Rd}$  value for  $c = 0$ .

FOR EXPLANATION OF TABLES SEE NOTE 9.



UNIVERSAL BEAMS  
Advance® UKB



Unstiffened webs

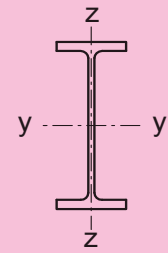
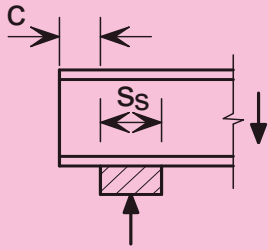
Section Designation	Design Shear Resistance $V_{c,Rd}$ kN	Position of Stiff Bearing	Design resistance of unstiffened web, $F_{Rd}$ (kN) and limiting length, $c_{lim}$ (mm)													
			Stiff bearing length, $s_s$ (mm)													
			0	10	20	30	40	50	75	100	150	200	250	300	350	
914x305x289	2900	$F_{Rd}$ (c = 0)	464	519	881	925	970	1020	1140	1250	1440	1640	1830	2020	2210	
		$c_{lim}$ (mm)	580	570	560	550	540	530	510	480	430	380	330	280	250	
		$F_{Rd}$ (c ≥ $c_{lim}$ )	1640	1700	1750	1800	1850	1900	2490	2550	2670	2790	2900	3000	3110	
914x305x253	2570	$F_{Rd}$ (c = 0)	619	652	685	720	756	792	888	971	1120	1280	1430	1580	1730	
		$c_{lim}$ (mm)	580	570	560	550	540	530	510	480	430	380	330	280	230	
		$F_{Rd}$ (c ≥ $c_{lim}$ )	1750	1780	1800	1820	1840	1860	1910	1960	2060	2150	2240	2330	2410	
914x305x224	2350	$F_{Rd}$ (c = 0)	514	542	571	600	631	662	742	807	937	1070	1190	1320	1450	
		$c_{lim}$ (mm)	580	570	560	550	540	530	510	480	430	380	330	280	230	
		$F_{Rd}$ (c ≥ $c_{lim}$ )	1430	1450	1470	1490	1510	1530	1570	1620	1700	1780	1860	1930	2000	
914x305x201	2210	$F_{Rd}$ (c = 0)	456	481	507	534	562	590	657	716	833	949	1070	1180	1300	
		$c_{lim}$ (mm)	580	570	560	550	540	530	510	480	430	380	330	280	230	
		$F_{Rd}$ (c ≥ $c_{lim}$ )	1250	1270	1280	1300	1320	1340	1380	1420	1500	1570	1640	1710	1770	
838x292x226	2220	$F_{Rd}$ (c = 0)	541	572	603	636	669	704	794	870	1010	1160	1300	1440	1580	
		$c_{lim}$ (mm)	540	530	520	510	500	490	460	440	390	340	290	240	220	
		$F_{Rd}$ (c ≥ $c_{lim}$ )	1540	1560	1580	1600	1620	1640	1690	1730	1820	1910	1990	2070	2140	
838x292x194	2000	$F_{Rd}$ (c = 0)	440	465	492	519	548	577	648	708	828	947	1070	1180	1300	
		$c_{lim}$ (mm)	540	530	520	510	500	490	460	440	390	340	290	240	200	
		$F_{Rd}$ (c ≥ $c_{lim}$ )	1220	1240	1260	1280	1290	1310	1350	1390	1470	1540	1610	1680	1740	
838x292x176	1890	$F_{Rd}$ (c = 0)	393	416	441	466	492	518	579	634	742	850	958	1070	1170	
		$c_{lim}$ (mm)	540	530	520	510	500	490	460	440	390	340	290	240	190	
		$F_{Rd}$ (c ≥ $c_{lim}$ )	1080	1100	1110	1130	1140	1160	1200	1230	1310	1370	1440	1500	1560	
762x267x197	1950	$F_{Rd}$ (c = 0)	510	541	574	609	644	680	774	849	997	1150	1290	1440	1590	
		$c_{lim}$ (mm)	480	470	460	450	440	430	410	380	330	280	230	200	200	
		$F_{Rd}$ (c ≥ $c_{lim}$ )	1080	1120	1500	1520	1540	1560	1610	1660	1750	1830	1920	2000	2070	
762x267x173	1760	$F_{Rd}$ (c = 0)	420	447	475	504	534	565	638	701	826	950	1070	1200	1320	
		$c_{lim}$ (mm)	480	470	460	450	440	430	410	380	330	280	230	190	190	
		$F_{Rd}$ (c ≥ $c_{lim}$ )	1180	1200	1220	1240	1250	1270	1310	1350	1430	1510	1580	1650	1710	
762x267x147	1560	$F_{Rd}$ (c = 0)	330	351	374	397	422	447	501	551	651	751	851	951	1050	
		$c_{lim}$ (mm)	480	470	460	450	440	430	410	380	330	280	230	180	170	
		$F_{Rd}$ (c ≥ $c_{lim}$ )	907	922	937	952	967	981	1020	1050	1120	1180	1230	1290	1340	
762x267x134	1520	$F_{Rd}$ (c = 0)	292	312	332	353	375	398	444	489	579	668	758	847	936	
		$c_{lim}$ (mm)	480	470	460	450	440	430	410	380	330	280	230	180	160	
		$F_{Rd}$ (c ≥ $c_{lim}$ )	795	809	823	836	850	863	895	926	984	1040	1090	1140	1150	

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If  $c < c_{lim}$ , then use  $F_{Rd}$  value for  $c = 0$ .

FOR EXPLANATION OF TABLES SEE NOTE 9.

UNIVERSAL BEAMS  
Advance® UKB



Unstiffened webs

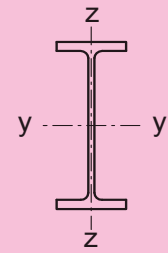
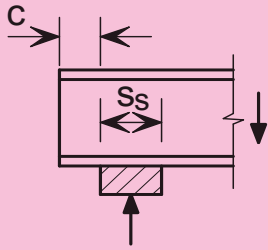
Section Designation	Design Shear Resistance $V_{c,Rd}$ kN	Position of Stiff Bearing	Design resistance of unstiffened web, $F_{Rd}$ (kN) and limiting length, $c_{lim}$ (mm)												
			Stiff bearing length, $s_s$ (mm)												
			0	10	20	30	40	50	75	100	150	200	250	300	350
686x254x170	1630	$F_{Rd} (c = 0)$	270	475	507	540	574	609	697	768	911	1050	1200	1340	1480
		$c_{lim} (mm)$	440	430	420	410	400	390	360	340	290	240	190	190	190
		$F_{Rd} (c \geq c_{lim})$	947	986	1020	1060	1360	1380	1420	1470	1550	1630	1710	1780	1850
686x254x152	1470	$F_{Rd} (c = 0)$	363	389	415	443	471	501	570	630	748	866	983	1100	1220
		$c_{lim} (mm)$	440	430	420	410	400	390	360	340	290	240	190	180	180
		$F_{Rd} (c \geq c_{lim})$	1030	1050	1070	1080	1100	1110	1150	1190	1260	1330	1400	1460	1520
686x254x140	1370	$F_{Rd} (c = 0)$	317	340	363	388	413	439	498	550	655	759	863	967	1070
		$c_{lim} (mm)$	440	430	420	410	400	390	360	340	290	240	190	170	170
		$F_{Rd} (c \geq c_{lim})$	891	907	922	937	951	965	1000	1030	1100	1160	1220	1270	1330
686x254x125	1280	$F_{Rd} (c = 0)$	277	297	318	340	363	387	435	482	575	668	761	853	946
		$c_{lim} (mm)$	440	430	420	410	400	390	360	340	290	240	190	160	160
		$F_{Rd} (c \geq c_{lim})$	766	780	794	808	821	834	866	897	956	1010	1060	1110	1160
610x305x238	1890	$F_{Rd} (c = 0)$	445	497	553	615	681	752	942	1120	1360	1610	1850	2090	2340
		$c_{lim} (mm)$	390	380	370	360	350	340	310	290	240	200	200	200	200
		$F_{Rd} (c \geq c_{lim})$	1570	1620	1660	1710	1760	1810	1930	2050	2300	2540	2790	3110	3230
610x305x179	1440	$F_{Rd} (c = 0)$	291	331	375	541	577	614	711	789	940	1090	1240	1390	1540
		$c_{lim} (mm)$	390	380	370	360	350	340	310	290	240	190	190	190	190
		$F_{Rd} (c \geq c_{lim})$	999	1040	1070	1110	1150	1190	1430	1480	1560	1640	1720	1790	1860
610x305x149	1210	$F_{Rd} (c = 0)$	302	324	348	373	398	425	490	543	649	755	861	966	1070
		$c_{lim} (mm)$	390	380	370	360	350	340	310	290	240	190	170	170	170
		$F_{Rd} (c \geq c_{lim})$	869	883	898	912	926	939	972	1010	1070	1120	1180	1230	1280
610x229x140	1300	$F_{Rd} (c = 0)$	227	394	423	454	486	519	596	661	792	923	1050	1180	1310
		$c_{lim} (mm)$	390	380	370	360	350	340	310	290	240	190	170	170	170
		$F_{Rd} (c \geq c_{lim})$	797	831	866	901	1130	1150	1190	1230	1300	1380	1440	1510	1570
610x229x125	1170	$F_{Rd} (c = 0)$	298	321	345	371	397	425	486	540	648	756	863	971	1080
		$c_{lim} (mm)$	390	380	370	360	350	340	310	290	240	190	160	160	160
		$F_{Rd} (c \geq c_{lim})$	851	866	881	896	911	925	960	994	1060	1120	1180	1230	1280
610x229x113	1090	$F_{Rd} (c = 0)$	255	275	297	319	342	366	417	464	558	652	745	839	933
		$c_{lim} (mm)$	390	380	370	360	350	340	310	290	240	190	150	150	150
		$F_{Rd} (c \geq c_{lim})$	720	733	747	760	773	786	817	847	904	957	1010	1060	1100
610x229x101	1060	$F_{Rd} (c = 0)$	228	247	267	287	308	330	373	416	502	588	673	759	844
		$c_{lim} (mm)$	390	380	370	360	350	340	310	290	240	190	140	140	140
		$F_{Rd} (c \geq c_{lim})$	633	646	659	671	683	695	724	752	806	855	902	947	951

Advance® and UKB are trademarks of Tata Steel. A fuller description of the relationship between Universal Beams (UB) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

If  $c < c_{lim}$ , then use  $F_{Rd}$  value for  $c = 0$ .

FOR EXPLANATION OF TABLES SEE NOTE 9.

UNIVERSAL BEAMS  
Advance® UKB



Unstiffened webs

Section Designation	Design Shear Resistance $V_{c,Rd}$ kN	Position of Stiff Bearing	Design resistance of unstiffened web, $F_{Rd}$ (kN) and limiting length, $c_{lim}$ (mm)													
			Stiff bearing length, $s_s$ (mm)													
			0	10	20	30	40	50	75	100	150	200	250	300	350	
610x178x100 +	1110	$F_{Rd}$ (c = 0)	259	281	303	326	350	375	424	473	571	668	765	863	959	
		$c_{lim}$ (mm)	390	380	370	360	350	340	310	290	240	190	150	150	150	
		$F_{Rd}$ (c ≥ $c_{lim}$ )	726	741	755	769	783	796	829	861	921	977	1030	1080	1130	
610x178x92 +	1090	$F_{Rd}$ (c = 0)	242	262	284	306	329	350	396	443	536	628	721	813	905	
		$c_{lim}$ (mm)	390	380	370	360	350	340	310	290	240	190	140	140	140	
		$F_{Rd}$ (c ≥ $c_{lim}$ )	668	683	696	710	724	737	769	799	857	911	963	1010	1050	
610x178x82 +	1000	$F_{Rd}$ (c = 0)	202	219	237	256	275	290	330	369	448	525	603	681	758	
		$c_{lim}$ (mm)	390	380	370	360	350	340	310	290	240	190	140	130	130	
		$F_{Rd}$ (c ≥ $c_{lim}$ )	548	560	572	584	595	606	634	660	710	756	800	822	822	
533x312x272 +	1910	$F_{Rd}$ (c = 0)	579	638	702	771	844	923	1130	1360	1660	1940	2220	2500	2780	
		$c_{lim}$ (mm)	340	330	320	310	300	290	260	240	230	230	230	230	230	
		$F_{Rd}$ (c ≥ $c_{lim}$ )	2060	2110	2170	2230	2280	2340	2480	2620	2900	3180	3460	3740	4020	
533x312x219 +	1630	$F_{Rd}$ (c = 0)	417	468	525	587	654	725	917	1080	1320	1560	1800	2050	2290	
		$c_{lim}$ (mm)	340	330	320	310	300	290	260	240	190	190	190	190	190	
		$F_{Rd}$ (c ≥ $c_{lim}$ )	1460	1510	1560	1610	1660	1710	1830	1950	2190	2430	2680	2920	3160	
533x312x182 +	1340	$F_{Rd}$ (c = 0)	316	359	407	459	516	576	739	850	1050	1250	1450	1660	1860	
		$c_{lim}$ (mm)	340	330	320	310	300	290	260	240	190	160	160	160	160	
		$F_{Rd}$ (c ≥ $c_{lim}$ )	1090	1130	1170	1210	1250	1290	1390	1490	1700	1900	2080	2170	2260	
533x312x150 +	1120	$F_{Rd}$ (c = 0)	239	275	316	361	488	523	610	680	819	959	1100	1240	1360	
		$c_{lim}$ (mm)	340	330	320	310	300	290	260	240	190	170	170	170	170	
		$F_{Rd}$ (c ≥ $c_{lim}$ )	814	848	881	915	949	982	1190	1230	1300	1380	1450	1510	1570	
533x210x138 +	1290	$F_{Rd}$ (c = 0)	248	290	338	391	449	510	643	740	935	1130	1330	1520	1800	
		$c_{lim}$ (mm)	340	330	320	310	300	290	260	240	190	140	140	140	170	
		$F_{Rd}$ (c ≥ $c_{lim}$ )	885	924	963	1000	1040	1080	1180	1280	1470	1660	1870	1960	2090	
533x210x122	1120	$F_{Rd}$ (c = 0)	207	243	285	331	478	514	593	664	804	943	1080	1220	1340	
		$c_{lim}$ (mm)	340	330	320	310	300	290	260	240	190	160	160	160	160	
		$F_{Rd}$ (c ≥ $c_{lim}$ )	729	763	796	830	864	897	981	1200	1280	1350	1420	1490	1550	
533x210x109	1020	$F_{Rd}$ (c = 0)	174	312	338	366	395	425	488	547	664	780	897	1010	1110	
		$c_{lim}$ (mm)	340	330	320	310	300	290	260	240	190	150	150	150	150	
		$F_{Rd}$ (c ≥ $c_{lim}$ )	608	639	670	701	889	904	941	976	1040	1110	1170	1220	1280	
533x210x101	952	$F_{Rd}$ (c = 0)	246	268	291	315	341	367	420	471	572	674	775	876	962	
		$c_{lim}$ (mm)	340	330	320	310	300	290	260	240	190	140	140	140	140	
		$F_{Rd}$ (c ≥ $c_{lim}$ )	539	719	733	747	760	774	806	837	896	951	1000	1050	1100	
533x210x92	909	$F_{Rd}$ (c = 0)	216	236	257	278	301	324	370	415	506	596	686	776	853	
		$c_{lim}$ (mm)	340	330	320	310	300	290	260	240	190	140	140	140	140	
		$F_{Rd}$ (c ≥ $c_{lim}$ )	612	625	638	651	663	675	704	733	786	836	883	927	957	
533x210x82	865	$F_{Rd}$ (c = 0)	191	209	228	248	269	287	328	369	451	533	614	696	765	
		$c_{lim}$ (mm)	340	330	320	310	300	290	260	240	190	140	130	130	130	
		$F_{Rd}$ (c ≥ $c_{lim}$ )	532	544	556	568	579	591	618	644	693	739	783	824	824	

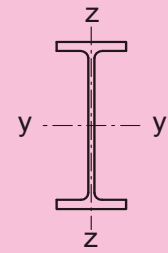
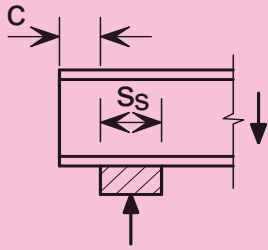
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+ These sections are in addition to the range of BS 4 sections

If  $c < c_{lim}$ , then use  $F_{Rd}$  value for  $c = 0$ .

FOR EXPLANATION OF TABLES SEE NOTE 9.

UNIVERSAL BEAMS  
Advance® UKB



Unstiffened webs

Section Designation	Design Shear Resistance $V_{c,Rd}$ kN	Position of Stiff Bearing	Design resistance of unstiffened web, $F_{Rd}$ (kN) and limiting length, $c_{lim}$ (mm)													
			Stiff bearing length, $s_s$ (mm)													
			0	10	20	30	40	50	75	100	150	200	250	300	350	
533x165x85 +	902	$F_{Rd}$ (c = 0)	219	239	260	282	306	328	374	421	513	606	698	790	868	
		$c_{lim}$ (mm)	340	330	320	310	300	290	260	240	190	140	140	140	140	
		$F_{Rd}$ (c ≥ $c_{lim}$ )	619	633	646	659	671	684	714	743	798	849	897	943	987	
533x165x74 +	871	$F_{Rd}$ (c = 0)	193	211	231	251	272	289	332	374	457	541	624	707	778	
		$c_{lim}$ (mm)	340	330	320	310	300	290	260	240	190	140	120	120	120	
		$F_{Rd}$ (c ≥ $c_{lim}$ )	535	548	560	572	584	596	624	651	702	749	794	836	846	
533x165x66 +	793	$F_{Rd}$ (c = 0)	160	176	192	209	225	240	275	311	382	452	522	592	652	
		$c_{lim}$ (mm)	340	330	320	310	300	290	260	240	190	140	110	110	110	
		$F_{Rd}$ (c ≥ $c_{lim}$ )	436	447	458	469	479	489	513	537	580	621	659	661	661	
457x191x161 +	1390	$F_{Rd}$ (c = 0)	359	410	467	530	598	670	865	985	1220	1460	1700	1940	2180	
		$c_{lim}$ (mm)	290	280	270	260	250	240	220	190	180	180	180	180	180	
		$F_{Rd}$ (c ≥ $c_{lim}$ )	1320	1370	1420	1460	1510	1560	1680	1800	2040	2280	2510	2750	2990	
457x191x133 +	1160	$F_{Rd}$ (c = 0)	270	314	363	418	477	541	686	788	991	1190	1400	1600	1800	
		$c_{lim}$ (mm)	290	280	270	260	250	240	220	190	150	150	150	150	150	
		$F_{Rd}$ (c ≥ $c_{lim}$ )	978	1020	1060	1100	1140	1180	1280	1380	1590	1790	1990	2190	2420	
457x191x106 +	947	$F_{Rd}$ (c = 0)	191	227	269	316	366	421	520	604	771	938	1110	1330	1410	
		$c_{lim}$ (mm)	290	280	270	260	250	240	220	190	140	130	130	150	150	
		$F_{Rd}$ (c ≥ $c_{lim}$ )	677	711	744	778	811	844	928	1010	1180	1370	1450	1550	1620	
457x191x98	852	$F_{Rd}$ (c = 0)	172	205	243	285	331	443	515	581	713	845	977	1090	1160	
		$c_{lim}$ (mm)	290	280	270	260	250	240	220	190	150	150	150	150	150	
		$F_{Rd}$ (c ≥ $c_{lim}$ )	605	636	666	696	726	756	832	1010	1080	1140	1210	1270	1320	
457x191x89	789	$F_{Rd}$ (c = 0)	149	179	215	316	344	373	432	488	600	712	824	920	976	
		$c_{lim}$ (mm)	290	280	270	260	250	240	220	190	140	140	140	140	140	
		$F_{Rd}$ (c ≥ $c_{lim}$ )	520	547	575	603	631	772	806	838	899	957	1010	1060	1110	
457x191x82	756	$F_{Rd}$ (c = 0)	135	236	259	284	309	335	386	437	539	640	742	829	880	
		$c_{lim}$ (mm)	290	280	270	260	250	240	220	190	140	130	130	130	130	
		$F_{Rd}$ (c ≥ $c_{lim}$ )	470	497	645	658	671	684	716	745	802	855	905	952	997	
457x191x74	693	$F_{Rd}$ (c = 0)	175	193	212	233	254	275	317	359	443	527	611	683	725	
		$c_{lim}$ (mm)	290	280	270	260	250	240	220	190	140	120	120	120	120	
		$F_{Rd}$ (c ≥ $c_{lim}$ )	500	512	523	535	546	556	583	608	655	699	741	780	791	
457x191x67	650	$F_{Rd}$ (c = 0)	153	169	187	205	224	241	278	316	391	466	541	605	643	
		$c_{lim}$ (mm)	290	280	270	260	250	240	220	190	140	120	120	120	120	
		$F_{Rd}$ (c ≥ $c_{lim}$ )	432	442	453	463	474	484	508	530	573	614	651	670	670	

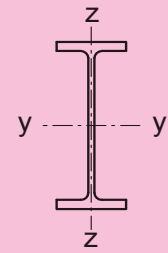
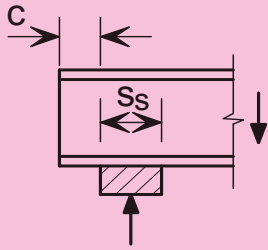
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+ These sections are in addition to the range of BS 4 sections

If  $c < c_{lim}$ , then use  $F_{Rd}$  value for  $c = 0$ .

FOR EXPLANATION OF TABLES SEE NOTE 9.

UNIVERSAL BEAMS  
Advance® UKB



Unstiffened webs

Section Designation	Design Shear Resistance $V_{c,Rd}$ kN	Position of Stiff Bearing	Design resistance of unstiffened web, $F_{Rd}$ (kN) and limiting length, $c_{lim}$ (mm)												
			Stiff bearing length, $s_s$ (mm)												
			0	10	20	30	40	50	75	100	150	200	250	300	350
457x152x82	798	$F_{Rd}$ (c = 0)	143	174	209	314	343	372	429	485	597	709	821	918	974
		$c_{lim}$ (mm)	290	280	270	260	250	240	220	190	140	140	140	140	140
		$F_{Rd}$ (c $\geq$ $c_{lim}$ )	510	538	565	593	621	769	803	835	897	954	1010	1060	1110
457x152x74	721	$F_{Rd}$ (c = 0)	196	216	238	261	284	308	355	402	496	590	683	764	811
		$c_{lim}$ (mm)	290	280	270	260	250	240	220	190	140	130	130	130	130
		$F_{Rd}$ (c $\geq$ $c_{lim}$ )	433	459	594	606	618	630	659	687	739	788	834	877	919
457x152x67	697	$F_{Rd}$ (c = 0)	173	191	210	231	252	271	313	356	440	524	608	680	722
		$c_{lim}$ (mm)	290	280	270	260	250	240	220	190	140	120	120	120	120
		$F_{Rd}$ (c $\geq$ $c_{lim}$ )	493	505	517	528	539	550	577	602	650	694	736	776	788
457x152x60	624	$F_{Rd}$ (c = 0)	138	153	169	186	203	217	252	286	354	422	490	549	583
		$c_{lim}$ (mm)	290	280	270	260	250	240	220	190	140	120	120	120	120
		$F_{Rd}$ (c $\geq$ $c_{lim}$ )	390	400	410	419	428	437	459	480	519	556	584	584	584
457x152x52	578	$F_{Rd}$ (c = 0)	119	132	146	161	175	187	217	247	308	368	427	479	485
		$c_{lim}$ (mm)	290	280	270	260	250	240	220	190	140	100	100	100	100
		$F_{Rd}$ (c $\geq$ $c_{lim}$ )	328	337	346	355	363	372	392	411	446	479	485	485	485
406x178x85 +	742	$F_{Rd}$ (c = 0)	152	183	220	261	306	354	431	504	648	835	971	1050	1110
		$c_{lim}$ (mm)	260	250	240	230	220	210	180	160	120	130	130	130	130
		$F_{Rd}$ (c $\geq$ $c_{lim}$ )	535	564	592	621	650	679	751	824	991	1080	1140	1200	1260
406x178x74	664	$F_{Rd}$ (c = 0)	128	157	248	274	300	327	380	432	537	642	747	804	855
		$c_{lim}$ (mm)	260	250	240	230	220	210	180	160	120	120	120	120	120
		$F_{Rd}$ (c $\geq$ $c_{lim}$ )	447	473	499	525	643	656	687	717	773	825	874	920	965
406x178x67	612	$F_{Rd}$ (c = 0)	170	189	210	232	255	276	322	367	457	547	637	687	730
		$c_{lim}$ (mm)	260	250	240	230	220	210	180	160	120	120	120	120	120
		$F_{Rd}$ (c $\geq$ $c_{lim}$ )	381	405	516	527	539	550	577	603	652	698	740	781	819
406x178x60	549	$F_{Rd}$ (c = 0)	135	151	168	186	205	220	257	293	366	439	511	551	586
		$c_{lim}$ (mm)	260	250	240	230	220	210	180	160	110	110	110	110	110
		$F_{Rd}$ (c $\geq$ $c_{lim}$ )	387	397	407	417	426	436	458	479	519	556	591	603	603
406x178x54	529	$F_{Rd}$ (c = 0)	125	140	157	174	191	205	239	274	343	412	481	520	553
		$c_{lim}$ (mm)	260	250	240	230	220	210	180	160	110	100	100	100	100
		$F_{Rd}$ (c $\geq$ $c_{lim}$ )	352	362	372	381	391	400	422	442	481	517	551	557	557

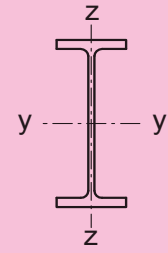
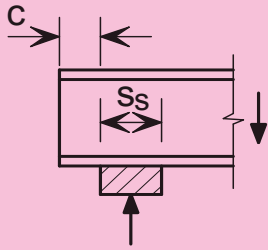
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+ These sections are in addition to the range of BS 4 sections

If  $c < c_{lim}$ , then use  $F_{Rd}$  value for  $c = 0$ .

FOR EXPLANATION OF TABLES SEE NOTE 9.

UNIVERSAL BEAMS  
Advance® UKB



Unstiffened webs

Section Designation	Design Shear Resistance $V_{c,Rd}$ kN	Position of Stiff Bearing	Design resistance of unstiffened web, $F_{Rd}$ (kN) and limiting length, $c_{lim}$ (mm)													
			Stiff bearing length, $s_s$ (mm)													
			0	10	20	30	40	50	75	100	150	200	250	300	350	
406x140x53 +	549	$F_{Rd} (c = 0)$	133	149	166	184	202	217	253	290	363	435	508	548	583	
		$c_{lim} (mm)$	260	250	240	230	220	210	180	160	110	110	110	110	110	110
		$F_{Rd} (c \geq c_{lim})$	379	389	399	409	419	428	451	472	513	550	585	601	601	601
406x140x46	473	$F_{Rd} (c = 0)$	97.3	109	122	135	148	159	186	213	267	321	375	393	393	
		$c_{lim} (mm)$	260	250	240	230	220	210	180	160	110	100	100	100	100	100
		$F_{Rd} (c \geq c_{lim})$	274	282	289	297	304	311	328	344	375	393	393	393	393	393
406x140x39	438	$F_{Rd} (c = 0)$	83.6	94.2	106	117	127	137	161	185	233	281	325	328	328	
		$c_{lim} (mm)$	260	250	240	230	220	210	180	160	110	90	90	90	90	90
		$F_{Rd} (c \geq c_{lim})$	228	236	243	250	257	263	279	294	322	328	328	328	328	328
356x171x67	568	$F_{Rd} (c = 0)$	121	149	181	218	294	322	377	432	543	653	732	785	835	
		$c_{lim} (mm)$	230	220	210	200	190	180	150	130	120	120	120	120	120	120
		$F_{Rd} (c \geq c_{lim})$	421	446	471	496	521	547	662	692	748	800	849	895	939	939
356x171x57	501	$F_{Rd} (c = 0)$	94.4	119	185	207	230	248	292	336	424	511	574	617	656	
		$c_{lim} (mm)$	230	220	210	200	190	180	150	130	110	110	110	110	110	110
		$F_{Rd} (c \geq c_{lim})$	325	347	369	459	470	480	506	530	576	618	658	695	731	731
356x171x51	455	$F_{Rd} (c = 0)$	120	136	153	171	190	204	241	278	351	424	477	512	546	
		$c_{lim} (mm)$	230	220	210	200	190	180	150	130	100	100	100	100	100	100
		$F_{Rd} (c \geq c_{lim})$	272	354	364	374	383	392	414	435	473	509	543	563	563	563
356x171x45	425	$F_{Rd} (c = 0)$	104	119	134	151	166	179	212	245	310	375	423	455	478	
		$c_{lim} (mm)$	230	220	210	200	190	180	150	130	90	90	90	90	90	90
		$F_{Rd} (c \geq c_{lim})$	294	304	313	322	330	339	359	378	414	447	477	478	478	478
356x127x39	408	$F_{Rd} (c = 0)$	92.4	105	119	134	147	158	188	217	275	333	375	404	404	
		$c_{lim} (mm)$	230	220	210	200	190	180	150	130	90	90	90	90	90	90
		$F_{Rd} (c \geq c_{lim})$	262	270	278	286	294	301	319	336	368	397	404	404	404	404
356x127x33	366	$F_{Rd} (c = 0)$	74.3	85.0	96.6	108	118	128	152	176	225	273	307	307	307	
		$c_{lim} (mm)$	230	220	210	200	190	180	150	130	80	80	80	80	80	80
		$F_{Rd} (c \geq c_{lim})$	206	213	220	227	233	240	255	270	297	307	307	307	307	307
305x165x54	422	$F_{Rd} (c = 0)$	96.7	121	149	182	239	261	310	359	456	543	590	634	675	
		$c_{lim} (mm)$	190	180	170	160	150	140	120	110	110	110	110	110	110	110
		$F_{Rd} (c \geq c_{lim})$	333	355	377	398	420	442	520	545	592	636	677	715	752	752
305x165x46	357	$F_{Rd} (c = 0)$	103	118	135	152	170	185	220	255	325	388	422	454	483	
		$c_{lim} (mm)$	190	180	170	160	150	140	120	100	100	100	100	100	100	100
		$F_{Rd} (c \geq c_{lim})$	303	312	321	330	338	346	366	384	419	451	480	491	491	491
305x165x40	319	$F_{Rd} (c = 0)$	81.0	93.2	106	121	135	146	174	202	259	309	336	358	358	
		$c_{lim} (mm)$	190	180	170	160	150	140	120	90	90	90	90	90	90	90
		$F_{Rd} (c \geq c_{lim})$	234	242	249	256	263	270	286	301	329	356	358	358	358	358

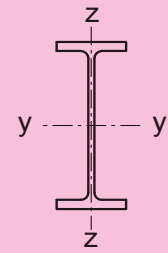
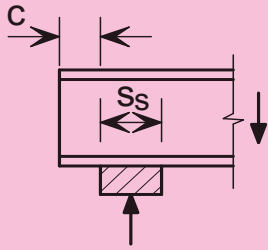
Advance® and UKB are trademarks of Tata Steel. A fuller description of the relationship between Universal Beams (UB) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

+ These sections are in addition to the range of BS 4 sections

If  $c < c_{lim}$ , then use  $F_{Rd}$  value for  $c = 0$ .

FOR EXPLANATION OF TABLES SEE NOTE 9.

UNIVERSAL BEAMS  
Advance® UKB



Unstiffened webs

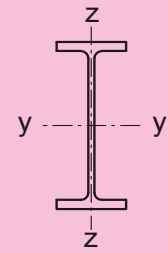
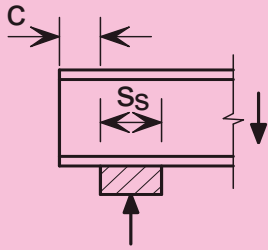
Section Designation	Design Shear Resistance $V_{c,Rd}$ kN	Position of Stiff Bearing	Design resistance of unstiffened web, $F_{Rd}$ (kN) and limiting length, $c_{lim}$ (mm)												
			Stiff bearing length, $s_s$ (mm)												
			0	10	20	30	40	50	75	100	150	200	250	300	350
305x127x48	474	$F_{Rd} (c = 0)$	91.4	119	153	192	228	253	315	377	501	624	756	813	867
		$c_{lim} (mm)$	190	180	170	160	150	140	120	90	90	90	100	100	100
		$F_{Rd} (c \geq c_{lim})$	328	353	377	402	427	452	514	575	731	791	860	911	960
305x127x42	420	$F_{Rd} (c = 0)$	74.2	99.4	130	165	193	215	270	355	455	544	594	639	682
		$c_{lim} (mm)$	190	180	170	160	150	140	120	90	90	90	90	90	90
		$F_{Rd} (c \geq c_{lim})$	263	285	307	329	351	373	428	530	581	627	671	712	750
305x127x37	372	$F_{Rd} (c = 0)$	61.6	84.1	145	166	182	198	238	277	356	427	466	502	536
		$c_{lim} (mm)$	190	180	170	160	150	140	120	90	90	90	90	90	90
		$F_{Rd} (c \geq c_{lim})$	216	236	255	275	294	366	389	411	452	489	523	556	572
305x102x33	350	$F_{Rd} (c = 0)$	54.6	108	124	141	154	167	201	234	300	363	396	427	452
		$c_{lim} (mm)$	200	190	180	170	160	150	120	100	90	90	90	90	90
		$F_{Rd} (c \geq c_{lim})$	194	212	285	294	302	311	331	349	384	416	445	452	452
305x102x28	315	$F_{Rd} (c = 0)$	74.9	87.2	101	113	124	136	163	191	246	297	325	343	343
		$c_{lim} (mm)$	200	190	180	170	160	150	120	100	80	80	80	80	80
		$F_{Rd} (c \geq c_{lim})$	149	218	226	234	241	248	265	281	310	337	343	343	343
305x102x25	299	$F_{Rd} (c = 0)$	68.2	79.8	92.5	103	114	124	150	176	227	276	302	309	309
		$c_{lim} (mm)$	200	190	180	170	160	150	120	100	70	70	70	70	70
		$F_{Rd} (c \geq c_{lim})$	116	195	202	210	217	224	240	255	283	309	309	309	309
254x146x43	321	$F_{Rd} (c = 0)$	80.4	103	129	159	192	213	262	312	411	488	532	572	610
		$c_{lim} (mm)$	160	150	140	130	120	110	90	90	90	100	100	100	100
		$F_{Rd} (c \geq c_{lim})$	278	298	317	337	357	377	426	472	517	566	604	640	674
254x146x37	280	$F_{Rd} (c = 0)$	64.4	84.0	127	146	164	179	217	254	329	371	405	436	465
		$c_{lim} (mm)$	160	150	140	130	120	110	90	90	90	90	90	90	90
		$F_{Rd} (c \geq c_{lim})$	220	237	254	304	312	321	340	359	394	426	456	484	486
254x146x31	260	$F_{Rd} (c = 0)$	49.5	68.7	112	129	143	157	191	225	293	331	362	391	417
		$c_{lim} (mm)$	160	150	140	130	120	110	90	80	80	80	80	80	80
		$F_{Rd} (c \geq c_{lim})$	168	185	201	218	267	275	294	311	344	374	402	419	419

Advance® and UKB are trademarks of Tata Steel. A fuller description of the relationship between Universal Beams (UB) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

If  $c < c_{lim}$ , then use  $F_{Rd}$  value for  $c = 0$ .

FOR EXPLANATION OF TABLES SEE NOTE 9.

UNIVERSAL BEAMS  
Advance® UKB



Unstiffened webs

Section Designation	Design Shear Resistance $V_{c,Rd}$ kN	Position of Stiff Bearing	Design resistance of unstiffened web, $F_{Rd}$ (kN) and limiting length, $c_{lim}$ (mm)												
			Stiff bearing length, $s_s$ (mm)												
			0	10	20	30	40	50	75	100	150	200	250	300	350
254x102x28	283	$F_{Rd} (c = 0)$	49.3	69.6	94.9	139	154	169	205	242	315	359	393	424	454
		$c_{lim}$ (mm)	170	160	150	140	130	120	90	80	80	80	80	80	80
		$F_{Rd} (c \geq c_{lim})$	174	192	209	226	244	299	320	339	375	408	438	466	469
254x102x25	265	$F_{Rd} (c = 0)$	40.4	60.1	108	123	136	150	183	216	283	323	354	383	406
		$c_{lim}$ (mm)	170	160	150	140	130	120	90	70	70	70	70	70	70
		$F_{Rd} (c \geq c_{lim})$	142	158	175	191	208	262	282	300	333	363	391	406	406
254x102x22	248	$F_{Rd} (c = 0)$	31.8	51.1	95.8	108	120	132	162	193	252	289	318	343	348
		$c_{lim}$ (mm)	170	160	150	140	130	120	90	70	60	60	60	60	60
		$F_{Rd} (c \geq c_{lim})$	111	127	143	158	221	229	247	263	294	322	347	348	348
203x133x30	231	$F_{Rd} (c = 0)$	54.6	75.0	100	129	148	165	209	253	341	419	458	495	529
		$c_{lim}$ (mm)	130	120	110	100	90	80	70	70	70	80	80	80	80
		$F_{Rd} (c \geq c_{lim})$	188	206	224	241	259	276	320	364	429	474	509	542	574
203x133x25	204	$F_{Rd} (c = 0)$	41.8	60.3	83.6	106	122	137	177	216	293	329	360	390	417
		$c_{lim}$ (mm)	130	120	110	100	90	80	60	60	70	70	70	70	70
		$F_{Rd} (c \geq c_{lim})$	143	158	174	190	205	221	260	296	336	367	396	423	441
203x102x23	197	$F_{Rd} (c = 0)$	42.4	59.8	81.5	105	119	134	181	216	267	298	327	354	378
		$c_{lim}$ (mm)	130	120	110	100	90	80	70	70	70	70	70	70	70
		$F_{Rd} (c \geq c_{lim})$	148	162	177	192	207	243	261	278	308	336	362	384	384
178x102x19	157	$F_{Rd} (c = 0)$	33.9	49.5	69.3	87.5	101	114	155	186	222	249	274	296	307
		$c_{lim}$ (mm)	110	100	90	80	70	60	60	60	60	60	60	60	60
		$F_{Rd} (c \geq c_{lim})$	117	130	143	156	169	196	212	227	254	278	300	307	307
152x89x16	130	$F_{Rd} (c = 0)$	29.9	44.7	63.6	79.4	91.8	104	135	166	210	236	260	281	297
		$c_{lim}$ (mm)	100	90	80	70	60	50	50	50	60	60	60	60	60
		$F_{Rd} (c \geq c_{lim})$	104	116	128	141	153	166	196	210	239	262	283	297	297
127x76x13	102	$F_{Rd} (c = 0)$	25.8	39.0	55.9	69.4	80.4	91.4	119	146	183	206	226	245	255
		$c_{lim}$ (mm)	80	70	60	50	50	50	50	50	60	60	60	60	60
		$F_{Rd} (c \geq c_{lim})$	89.6	101	112	123	134	145	169	182	206	227	246	255	255

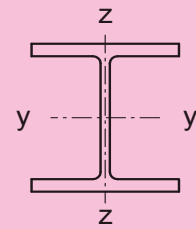
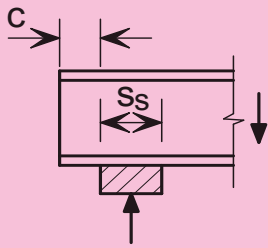
Advance® and UKB are trademarks of Tata Steel. A fuller description of the relationship between Universal Beams (UB) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

If  $c < c_{lim}$ , then use  $F_{Rd}$  value for  $c = 0$ .

FOR EXPLANATION OF TABLES SEE NOTE 9.



UNIVERSAL COLUMNS  
Advance® UKC



Unstiffened webs

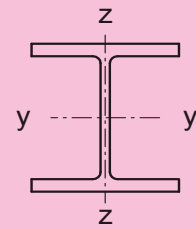
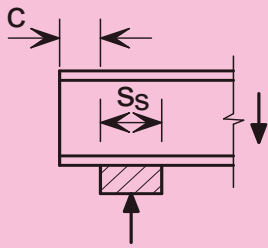
Section Designation	Design Shear Resistance $V_{c,Rd}$ kN	Position of Stiff Bearing	Design resistance of unstiffened web, $F_{Rd}$ (kN) and limiting length, $c_{lim}$ (mm)													
			Stiff bearing length, $s_s$ (mm)													
			0	10	20	30	40	50	75	100	150	200	250	300	350	
356x406x634	3040	$F_{Rd}$ ( $c = 0$ )	1900	2020	2140	2280	2420	2570	2960	3390	4330	5010	5600	6180	6760	
		$c_{lim}$ (mm)	390	390	390	390	390	390	390	390	390	390	390	390	390	390
		$F_{Rd}$ ( $c \geq c_{lim}$ )	7160	7270	7390	7510	7620	7740	8030	8320	8910	9490	10100	10700	11200	11200
356x406x551	2630	$F_{Rd}$ ( $c = 0$ )	1550	1660	1770	1890	2020	2150	2510	2900	3740	4260	4770	5290	5810	
		$c_{lim}$ (mm)	350	350	350	350	350	350	350	350	350	350	350	350	350	350
		$F_{Rd}$ ( $c \geq c_{lim}$ )	5780	5890	5990	6090	6200	6300	6560	6810	7330	7850	8360	8880	9390	9390
356x406x467	2290	$F_{Rd}$ ( $c = 0$ )	1270	1370	1470	1570	1690	1810	2130	2480	3170	3620	4080	4540	4990	
		$c_{lim}$ (mm)	320	320	320	320	320	320	320	320	320	320	320	320	320	320
		$F_{Rd}$ ( $c \geq c_{lim}$ )	4650	4740	4840	4930	5020	5110	5340	5570	6020	6480	6940	7390	7850	7850
356x406x393	1920	$F_{Rd}$ ( $c = 0$ )	990	1070	1160	1250	1350	1450	1740	2040	2570	2960	3350	3740	4130	
		$c_{lim}$ (mm)	280	280	280	280	280	280	280	280	280	280	280	280	280	280
		$F_{Rd}$ ( $c \geq c_{lim}$ )	3570	3650	3720	3800	3880	3960	4150	4350	4740	5130	5520	5910	6300	6300
356x406x340	1640	$F_{Rd}$ ( $c = 0$ )	801	872	948	1030	1120	1210	1460	1730	2150	2490	2830	3170	3510	
		$c_{lim}$ (mm)	260	260	260	260	260	260	260	260	260	260	260	260	260	260
		$F_{Rd}$ ( $c \geq c_{lim}$ )	2850	2920	2980	3050	3120	3190	3360	3530	3870	4200	4540	4880	5220	5220
356x406x287	1440	$F_{Rd}$ ( $c = 0$ )	649	712	780	854	932	1020	1240	1480	1820	2120	2420	2720	3020	
		$c_{lim}$ (mm)	230	230	230	230	230	230	230	230	230	230	230	230	230	230
		$F_{Rd}$ ( $c \geq c_{lim}$ )	2270	2330	2390	2450	2510	2570	2720	2870	3170	3470	3770	4070	4370	4370
356x406x235	1150	$F_{Rd}$ ( $c = 0$ )	482	534	590	650	715	784	971	1170	1410	1660	1900	2150	2390	
		$c_{lim}$ (mm)	220	210	210	210	210	210	210	210	210	210	210	210	210	210
		$F_{Rd}$ ( $c \geq c_{lim}$ )	1660	1710	1760	1810	1850	1900	2020	2150	2390	2630	2880	3120	3370	3370
356x368x202	1030	$F_{Rd}$ ( $c = 0$ )	398	444	495	550	609	673	843	1000	1220	1440	1660	1870	2090	
		$c_{lim}$ (mm)	220	210	200	190	190	190	190	190	190	190	190	190	190	190
		$F_{Rd}$ ( $c \geq c_{lim}$ )	1360	1410	1450	1490	1540	1580	1690	1800	2020	2240	2450	2670	2890	2890
356x368x177	907	$F_{Rd}$ ( $c = 0$ )	327	367	412	461	513	569	721	844	1030	1230	1420	1610	1800	
		$c_{lim}$ (mm)	220	210	200	190	180	170	170	170	170	170	170	170	170	170
		$F_{Rd}$ ( $c \geq c_{lim}$ )	1110	1140	1180	1220	1260	1300	1390	1490	1680	1870	2060	2250	2440	2440
356x368x153	772	$F_{Rd}$ ( $c = 0$ )	262	296	335	377	423	471	603	696	859	1020	1190	1350	1510	
		$c_{lim}$ (mm)	220	210	200	190	180	170	160	160	160	160	160	160	160	160
		$F_{Rd}$ ( $c \geq c_{lim}$ )	876	908	941	973	1010	1040	1120	1200	1360	1530	1680	1760	1830	1830
356x368x129	645	$F_{Rd}$ ( $c = 0$ )	203	232	266	302	341	383	494	563	701	838	998	1070	1130	
		$c_{lim}$ (mm)	220	210	200	190	180	170	140	140	140	140	150	150	150	150
		$F_{Rd}$ ( $c \geq c_{lim}$ )	671	698	726	753	781	809	877	946	1050	1110	1190	1240	1300	1300

Advance® and UKC are trademarks of Tata Steel. A fuller description of the relationship between Universal Columns (UC) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

If  $c < c_{lim}$ , then use  $F_{Rd}$  value for  $c = 0$ .

FOR EXPLANATION OF TABLES SEE NOTE 9.

UNIVERSAL COLUMNS  
Advance® UKC



Unstiffened webs

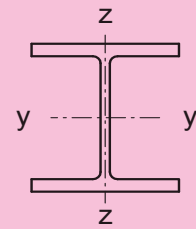
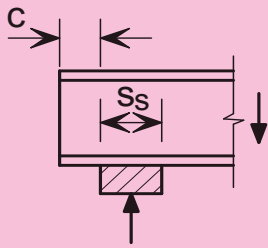
Section Designation	Design Shear Resistance $V_{c,Rd}$ kN	Position of Stiff Bearing	Design resistance of unstiffened web, $F_{Rd}$ (kN) and limiting length, $c_{lim}$ (mm)													
			Stiff bearing length, $s_s$ (mm)													
			0	10	20	30	40	50	75	100	150	200	250	300	350	
305x305x283	1490	$F_{Rd}$ ( $c = 0$ )	739	810	888	972	1060	1160	1410	1690	2070	2410	2750	3100	3440	
		$c_{lim}$ (mm)	250	250	250	250	250	250	250	250	250	250	250	250	250	250
		$F_{Rd}$ ( $c \geq c_{lim}$ )	2690	2760	2830	2900	2970	3030	3210	3380	3720	4060	4400	4740	5090	
305x305x240	1320	$F_{Rd}$ ( $c = 0$ )	605	669	739	814	896	982	1220	1460	1770	2070	2380	2680	2990	
		$c_{lim}$ (mm)	220	220	220	220	220	220	220	220	220	220	220	220	220	220
		$F_{Rd}$ ( $c \geq c_{lim}$ )	2170	2230	2290	2350	2410	2470	2630	2780	3080	3390	3690	4000	4300	
305x305x198	1070	$F_{Rd}$ ( $c = 0$ )	456	509	568	632	701	775	973	1150	1400	1660	1910	2160	2420	
		$c_{lim}$ (mm)	200	200	200	200	200	200	200	200	200	200	200	200	200	200
		$F_{Rd}$ ( $c \geq c_{lim}$ )	1610	1660	1710	1760	1810	1860	1990	2110	2370	2620	2870	3130	3380	
305x305x158	871	$F_{Rd}$ ( $c = 0$ )	328	373	423	477	536	599	768	883	1090	1300	1510	1720	1930	
		$c_{lim}$ (mm)	190	180	170	170	170	170	170	170	170	170	170	170	170	170
		$F_{Rd}$ ( $c \geq c_{lim}$ )	1140	1180	1220	1260	1310	1350	1450	1560	1770	1980	2190	2400	2600	
305x305x137	756	$F_{Rd}$ ( $c = 0$ )	266	305	349	397	450	505	650	741	924	1110	1290	1470	1660	
		$c_{lim}$ (mm)	190	180	170	160	150	150	150	150	150	150	150	150	150	150
		$F_{Rd}$ ( $c \geq c_{lim}$ )	910	947	983	1020	1060	1090	1180	1280	1460	1640	1820	2010	2190	
305x305x118	657	$F_{Rd}$ ( $c = 0$ )	213	247	286	329	375	425	539	619	778	937	1100	1260	1410	
		$c_{lim}$ (mm)	190	180	170	160	150	140	140	140	140	140	140	140	140	140
		$F_{Rd}$ ( $c \geq c_{lim}$ )	721	753	784	816	848	880	959	1040	1200	1360	1520	1680	1810	
305x305x97	558	$F_{Rd}$ ( $c = 0$ )	165	194	228	265	306	350	437	505	641	777	913	1030	1100	
		$c_{lim}$ (mm)	190	180	170	160	150	140	120	120	120	120	120	130	130	130
		$F_{Rd}$ ( $c \geq c_{lim}$ )	550	577	604	631	658	686	754	822	958	1050	1120	1180	1240	
254x254x167	903	$F_{Rd}$ ( $c = 0$ )	424	478	538	603	674	749	952	1110	1360	1620	1870	2130	2380	
		$c_{lim}$ (mm)	190	190	190	190	190	190	190	190	190	190	190	190	190	190
		$F_{Rd}$ ( $c \geq c_{lim}$ )	1520	1570	1620	1670	1730	1780	1900	2030	2290	2540	2790	3050	3300	
254x254x132	705	$F_{Rd}$ ( $c = 0$ )	300	343	392	445	503	565	728	829	1030	1240	1440	1640	1840	
		$c_{lim}$ (mm)	160	160	160	160	160	160	160	160	160	160	160	160	160	160
		$F_{Rd}$ ( $c \geq c_{lim}$ )	1050	1090	1130	1180	1220	1260	1360	1460	1660	1860	2070	2270	2470	
254x254x107	577	$F_{Rd}$ ( $c = 0$ )	221	258	299	345	395	448	567	652	821	991	1160	1330	1500	
		$c_{lim}$ (mm)	160	150	140	140	140	140	140	140	140	140	140	140	140	140
		$F_{Rd}$ ( $c \geq c_{lim}$ )	764	798	832	866	900	934	1020	1100	1270	1440	1610	1780	1950	
254x254x89	467	$F_{Rd}$ ( $c = 0$ )	167	196	230	267	308	352	440	509	645	781	918	1050	1190	
		$c_{lim}$ (mm)	160	150	140	130	130	130	130	130	130	130	130	130	130	130
		$F_{Rd}$ ( $c \geq c_{lim}$ )	566	593	620	647	675	702	770	838	975	1110	1250	1390	1450	
254x254x73	407	$F_{Rd}$ ( $c = 0$ )	129	155	185	218	255	293	360	419	537	656	774	851	905	
		$c_{lim}$ (mm)	160	150	140	130	120	110	110	110	110	110	110	120	120	120
		$F_{Rd}$ ( $c \geq c_{lim}$ )	433	456	480	504	527	551	610	669	801	858	911	968	1020	

Advance® and UKC are trademarks of Tata Steel. A fuller description of the relationship between Universal Columns (UC) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

If  $c < c_{lim}$ , then use  $F_{Rd}$  value for  $c = 0$ .

FOR EXPLANATION OF TABLES SEE NOTE 9.

UNIVERSAL COLUMNS  
Advance® UKC



Unstiffened webs

Section Designation	Design Shear Resistance $V_{c,Rd}$ kN	Position of Stiff Bearing	Design resistance of unstiffened web, $F_{Rd}$ (kN) and limiting length, $c_{lim}$ (mm)													
			Stiff bearing length, $s_s$ (mm)													
			0	10	20	30	40	50	75	100	150	200	250	300	350	
203x203x127 +	686	$F_{Rd}$ ( $c = 0$ )	351	402	460	523	592	665	856	976	1220	1460	1700	1940	2180	
		$c_{lim}$ (mm)	170	170	170	170	170	170	170	170	170	170	170	170	170	170
		$F_{Rd}$ ( $c \geq c_{lim}$ )	1280	1330	1380	1430	1470	1520	1640	1760	2000	2240	2480	2720	2960	
203x203x113 +	624	$F_{Rd}$ ( $c = 0$ )	296	343	395	453	516	583	743	851	1070	1280	1500	1720	1930	
		$c_{lim}$ (mm)	160	160	160	160	160	160	160	160	160	160	160	160	160	160
		$F_{Rd}$ ( $c \geq c_{lim}$ )	1070	1110	1160	1200	1240	1290	1400	1500	1720	1940	2150	2370	2580	
203x203x100 +	545	$F_{Rd}$ ( $c = 0$ )	245	287	334	386	443	504	635	731	923	1120	1310	1500	1690	
		$c_{lim}$ (mm)	140	140	140	140	140	140	140	140	140	140	140	140	140	140
		$F_{Rd}$ ( $c \geq c_{lim}$ )	876	914	953	991	1030	1070	1160	1260	1450	1640	1840	2030	2220	
203x203x86	475	$F_{Rd}$ ( $c = 0$ )	198	234	276	323	374	428	532	616	785	953	1120	1290	1460	
		$c_{lim}$ (mm)	130	130	130	130	130	130	130	130	130	130	130	130	130	130
		$F_{Rd}$ ( $c \geq c_{lim}$ )	698	732	765	799	833	866	950	1030	1200	1370	1540	1710	1880	
203x203x71	371	$F_{Rd}$ ( $c = 0$ )	147	176	210	247	287	331	407	473	606	738	871	1000	1140	
		$c_{lim}$ (mm)	130	120	120	120	120	120	120	120	120	120	120	120	120	120
		$F_{Rd}$ ( $c \geq c_{lim}$ )	508	535	561	588	614	641	707	773	906	1040	1170	1300	1440	
203x203x60	352	$F_{Rd}$ ( $c = 0$ )	121	150	184	222	263	301	366	430	560	689	818	947	1080	
		$c_{lim}$ (mm)	130	120	110	100	100	100	100	100	100	100	100	100	100	100
		$F_{Rd}$ ( $c \geq c_{lim}$ )	417	443	469	494	520	546	611	675	805	934	1060	1190	1320	
203x203x52	298	$F_{Rd}$ ( $c = 0$ )	97.7	122	150	183	218	247	301	355	464	573	681	786	838	
		$c_{lim}$ (mm)	130	120	110	100	90	90	90	90	90	90	90	100	100	100
		$F_{Rd}$ ( $c \geq c_{lim}$ )	331	352	374	396	417	439	493	548	656	774	826	880	926	
203x203x46	269	$F_{Rd}$ ( $c = 0$ )	81.9	104	131	161	193	215	264	314	413	512	602	649	692	
		$c_{lim}$ (mm)	130	120	110	100	90	90	90	90	90	90	90	90	90	90
		$F_{Rd}$ ( $c \geq c_{lim}$ )	275	295	315	335	354	374	424	473	572	631	680	721	760	
152x152x51 +	316	$F_{Rd}$ ( $c = 0$ )	127	161	201	247	296	331	407	482	633	785	936	1090	1240	
		$c_{lim}$ (mm)	100	100	100	100	100	100	100	100	100	100	100	100	100	100
		$F_{Rd}$ ( $c \geq c_{lim}$ )	454	485	515	545	575	606	681	757	908	1060	1210	1360	1510	
152x152x44 +	271	$F_{Rd}$ ( $c = 0$ )	102	131	167	207	248	275	340	405	536	666	797	928	1060	
		$c_{lim}$ (mm)	100	90	90	90	90	90	90	90	90	90	90	90	90	90
		$F_{Rd}$ ( $c \geq c_{lim}$ )	359	385	411	437	463	490	555	620	751	881	1010	1140	1270	
152x152x37	226	$F_{Rd}$ ( $c = 0$ )	78.6	104	134	169	199	221	276	331	441	551	661	771	881	
		$c_{lim}$ (mm)	100	90	80	80	80	80	80	80	80	80	80	80	80	80
		$F_{Rd}$ ( $c \geq c_{lim}$ )	273	295	317	339	361	383	438	493	603	713	823	933	1050	
152x152x30	184	$F_{Rd}$ ( $c = 0$ )	57.6	78.2	104	132	153	171	216	260	350	439	528	592	633	
		$c_{lim}$ (mm)	100	90	80	70	70	70	70	70	70	70	70	70	70	70
		$F_{Rd}$ ( $c \geq c_{lim}$ )	197	214	232	250	268	286	331	375	465	561	604	647	685	
152x152x23	158	$F_{Rd}$ ( $c = 0$ )	39.3	58.4	82.5	103	119	135	175	215	295	375	429	465	498	
		$c_{lim}$ (mm)	100	90	80	70	60	50	50	50	50	50	60	60	60	60
		$F_{Rd}$ ( $c \geq c_{lim}$ )	133	149	165	181	197	213	252	292	372	428	467	500	531	

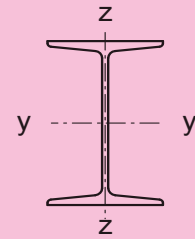
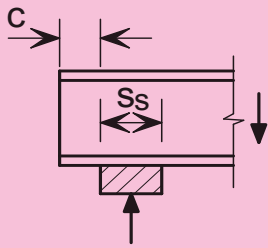
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+ These sections are in addition to the range of BS 4 sections

If  $c < c_{lim}$ , then use  $F_{Rd}$  value for  $c = 0$ .

FOR EXPLANATION OF TABLES SEE NOTE 9.

JOISTS



Unstiffened webs

Section Designation	Design Shear Resistance $V_{c,Rd}$ kN	Position of Stiff Bearing	Design resistance of unstiffened web, $F_{Rd}$ (kN) and limiting length, $c_{lim}$ (mm)													
			Stiff bearing length, $s_s$ (mm)													
			0	10	20	30	40	50	75	100	150	200	250	300	350	
254x203x82	520	$F_{Rd} (c = 0)$	170	199	232	269	309	352	443	510	646	781	916	1050	1190	
		$c_{lim} (mm)$	150	140	130	130	130	130	130	130	130	130	130	130	130	130
		$F_{Rd} (c \geq c_{lim})$	588	615	642	669	696	723	790	858	993	1130	1260	1410	1470	
254x114x37	352	$F_{Rd} (c = 0)$	73.4	97.2	126	159	187	208	260	313	417	522	593	640	683	
		$c_{lim} (mm)$	160	150	140	130	120	110	80	80	80	80	90	90	90	90
		$F_{Rd} (c \geq c_{lim})$	261	282	303	324	345	365	418	470	569	617	670	711	750	
203x152x52	350	$F_{Rd} (c = 0)$	114	140	170	205	242	279	338	397	515	633	751	869	987	
		$c_{lim} (mm)$	120	110	110	110	110	110	110	110	110	110	110	110	110	110
		$F_{Rd} (c \geq c_{lim})$	400	423	447	471	494	518	577	636	754	872	990	1110	1200	
152x127x37	300	$F_{Rd} (c = 0)$	93.3	126	167	213	246	275	346	418	561	704	847	990	1130	
		$c_{lim} (mm)$	90	80	80	80	80	80	80	80	80	80	80	80	80	80
		$F_{Rd} (c \geq c_{lim})$	339	368	397	425	454	482	554	625	768	911	1050	1200	1340	
127x114x29	231	$F_{Rd} (c = 0)$	76.4	109	151	192	220	248	318	388	529	669	809	949	1090	
		$c_{lim} (mm)$	70	70	70	70	70	70	70	70	70	70	70	70	70	70
		$F_{Rd} (c \geq c_{lim})$	280	309	337	365	393	421	491	561	701	841	982	1120	1260	
127x114x27	178	$F_{Rd} (c = 0)$	64.5	88.0	117	150	173	193	244	295	396	498	600	702	803	
		$c_{lim} (mm)$	70	70	70	70	70	70	70	70	70	70	70	70	70	70
		$F_{Rd} (c \geq c_{lim})$	229	249	269	290	310	330	381	432	534	636	737	839	941	
127x76x16	140	$F_{Rd} (c = 0)$	38.6	56.9	80.2	101	116	132	170	209	286	363	440	491	526	
		$c_{lim} (mm)$	80	70	60	60	60	60	60	60	60	60	60	60	60	60
		$F_{Rd} (c \geq c_{lim})$	139	154	169	185	200	216	254	293	370	447	494	531	563	
114x114x27	224	$F_{Rd} (c = 0)$	68.6	99.5	138	175	201	228	293	358	489	619	750	881	1010	
		$c_{lim} (mm)$	70	60	60	60	60	60	60	60	60	60	60	60	60	60
		$F_{Rd} (c \geq c_{lim})$	250	276	302	328	354	380	446	511	642	772	903	1030	1160	
102x102x23	185	$F_{Rd} (c = 0)$	62.2	93.6	134	166	192	219	284	349	480	610	741	872	1000	
		$c_{lim} (mm)$	60	60	60	60	60	60	60	60	60	60	60	60	60	60
		$F_{Rd} (c \geq c_{lim})$	230	256	282	308	334	360	426	491	622	752	883	1010	1140	
102x44x7	82.2	$F_{Rd} (c = 0)$	16.4	32.1	46.9	58.7	70.5	82.3	112	141	201	258	285	310	334	
		$c_{lim} (mm)$	60	50	40	40	40	40	40	40	40	40	40	40	40	40
		$F_{Rd} (c \geq c_{lim})$	60.8	72.7	84.5	96.3	108	120	150	179	238	278	303	327	349	
89x89x19	166	$F_{Rd} (c = 0)$	55.9	87.9	129	157	184	210	275	340	471	602	732	863	993	
		$c_{lim} (mm)$	60	60	60	60	60	60	60	60	60	60	60	60	60	60
		$F_{Rd} (c \geq c_{lim})$	210	236	262	288	314	341	406	471	602	732	863	994	1120	
76x76x15	127	$F_{Rd} (c = 0)$	43.6	74.5	111	135	160	184	245	306	429	551	674	796	918	
		$c_{lim} (mm)$	50	50	50	50	50	50	50	50	50	50	50	50	50	50
		$F_{Rd} (c \geq c_{lim})$	164	189	213	238	262	287	348	409	532	654	776	899	1020	
76x76x13	85.8	$F_{Rd} (c = 0)$	32.2	49.1	70.8	87.6	102	116	151	186	256	326	396	466	536	
		$c_{lim} (mm)$	50	50	50	50	50	50	50	50	50	50	50	50	50	50
		$F_{Rd} (c \geq c_{lim})$	115	129	143	157	171	185	220	255	325	395	465	535	606	

If  $c < c_{lim}$ , then use  $F_{Rd}$  value for  $c = 0$ .

FOR EXPLANATION OF TABLES SEE NOTE 9.

# WEB BEARING AND BUCKLING

## HOT-FINISHED HOLLOW SECTIONS - S275

There are no resistance tables given for hot-finished hollow sections in S275, because hot finished hollow sections are normally available in S355 only.

S355 resistance tables are given for hot-finished hollow sections in part D (pages D - 147 to D - 157). However, to maintain consistent page numbering between S275 resistance tables and S355 resistance tables, pages C - 147 to C - 157 are omitted here.

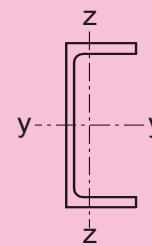
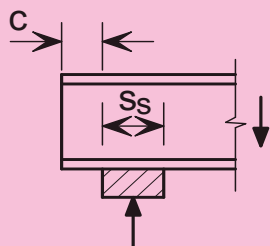
## COLD-FORMED HOLLOW SECTIONS - S275

There are no resistance tables given for cold-formed hollow sections in S275, because normally cold-formed hollow sections are normally available in S235 and S355 only. No resistance tables are given for S235 either, because sections available may not be manufactured to BS EN 10219-2: 2006.

S355 resistance tables are given for cold-formed hollow sections in part D (pages D - 158 to D - 164). However, to maintain consistent page numbering between S275 resistance tables and S355 resistance tables, pages C - 158 to C - 164 are omitted here.

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PARALLEL FLANGE CHANNELS  
Advance® UKPFC



Unstiffened webs

Section Designation	Design Shear Resistance $V_{c,Rd}$ kN	Position of Stiff Bearing	Design resistance of unstiffened web, $F_{Rd}$ (kN) and limiting length, $c_{lim}$ (mm)												
			Stiff bearing length, $s_s$ (mm)												
			0	10	20	30	40	50	75	100	150	200	250	300	350
430x100x64	750	$F_{Rd}$ (c = 0)	118	151	190	234	283	313	386	458	604	814	948	1030	1100
		$c_{lim}$ (mm)	270	260	250	240	230	220	190	170	120	120	120	120	120
		$F_{Rd}$ (c ≥ $c_{lim}$ )	445	474	503	532	561	591	663	736	978	1060	1120	1180	1240
380x100x54	581	$F_{Rd}$ (c = 0)	101	129	163	202	243	269	332	440	553	667	759	815	868
		$c_{lim}$ (mm)	230	220	210	200	190	180	160	130	110	110	110	110	110
		$F_{Rd}$ (c ≥ $c_{lim}$ )	374	399	424	450	475	500	563	711	771	826	878	927	974
300x100x46	443	$F_{Rd}$ (c = 0)	92.8	120	152	189	227	250	310	370	489	608	727	823	877
		$c_{lim}$ (mm)	180	170	160	150	140	130	110	90	90	90	90	100	100
		$F_{Rd}$ (c ≥ $c_{lim}$ )	341	365	389	413	436	460	520	580	699	809	864	928	976
300x90x41	445	$F_{Rd}$ (c = 0)	85.8	114	149	188	220	245	307	369	493	616	770	830	885
		$c_{lim}$ (mm)	180	170	160	150	140	130	110	90	90	90	100	100	100
		$F_{Rd}$ (c ≥ $c_{lim}$ )	319	344	369	394	418	443	505	567	691	806	878	930	980
260x90x35	349	$F_{Rd}$ (c = 0)	73.0	98.3	129	164	191	213	268	323	433	543	650	701	749
		$c_{lim}$ (mm)	160	150	140	130	120	110	80	80	80	80	90	90	90
		$F_{Rd}$ (c ≥ $c_{lim}$ )	268	290	312	334	356	378	433	488	598	676	735	780	823
260x75x28	308	$F_{Rd}$ (c = 0)	53.5	76.1	104	133	153	172	220	268	364	447	489	528	564
		$c_{lim}$ (mm)	160	150	140	130	120	110	90	70	70	80	80	80	80
		$F_{Rd}$ (c ≥ $c_{lim}$ )	197	217	236	255	274	294	342	413	458	509	547	582	615
230x90x32	294	$F_{Rd}$ (c = 0)	70.7	94.3	123	156	183	203	255	306	409	513	612	660	704
		$c_{lim}$ (mm)	140	130	120	110	100	90	80	80	80	80	90	90	90
		$F_{Rd}$ (c ≥ $c_{lim}$ )	258	278	299	320	340	361	412	464	567	637	691	733	774
230x75x26	258	$F_{Rd}$ (c = 0)	53.7	74.4	100	129	147	165	210	255	344	413	452	488	522
		$c_{lim}$ (mm)	140	130	120	110	100	90	70	70	80	80	80	80	80
		$F_{Rd}$ (c ≥ $c_{lim}$ )	196	214	232	250	268	286	331	385	427	472	506	539	570
200x90x30	244	$F_{Rd}$ (c = 0)	68.3	90.2	117	147	174	193	241	289	385	482	577	622	665
		$c_{lim}$ (mm)	120	110	100	90	80	80	80	80	80	80	90	90	90
		$F_{Rd}$ (c ≥ $c_{lim}$ )	247	266	286	305	324	343	392	440	536	603	651	692	730
200x75x23	213	$F_{Rd}$ (c = 0)	51.6	70.6	94.2	121	139	155	197	238	320	380	417	450	481
		$c_{lim}$ (mm)	120	110	100	90	80	70	70	70	70	80	80	80	80
		$F_{Rd}$ (c ≥ $c_{lim}$ )	187	204	220	237	253	270	311	356	395	434	466	496	524

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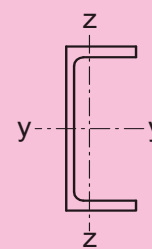
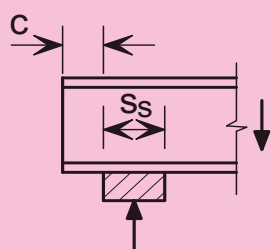
If  $c < c_{lim}$ , then use  $F_{Rd}$  value for  $c = 0$ .

Resistances assume no eccentricity of the applied force relative to the web.

FOR EXPLANATION OF TABLES SEE NOTE 9.

PARALLEL FLANGE CHANNELS

Advance® UKPFC



Unstiffened webs

Section Designation	Design Shear Resistance $V_{c,Rd}$ kN	Position of Stiff Bearing	Design resistance of unstiffened web, $F_{Rd}$ (kN) and limiting length, $c_{lim}$ (mm)												
			Stiff bearing length, $s_s$ (mm)												
			0	10	20	30	40	50	75	100	150	200	250	300	350
180x90x26	207	$F_{Rd} (c = 0)$	58.8	79.3	105	133	155	173	217	262	351	441	520	562	600
		$c_{lim} (mm)$	110	100	90	80	80	80	80	80	80	80	80	80	80
		$F_{Rd} (c \geq c_{lim})$	211	229	247	265	282	300	345	390	479	538	582	620	655
180x75x20	191	$F_{Rd} (c = 0)$	43.3	62.8	87.5	111	127	144	185	226	309	393	432	467	500
		$c_{lim} (mm)$	110	100	90	80	70	60	60	60	60	70	70	70	70
		$F_{Rd} (c \geq c_{lim})$	157	174	190	207	223	240	281	322	400	442	477	509	539
150x90x24	175	$F_{Rd} (c = 0)$	56.4	77.1	103	131	151	169	214	259	348	437	527	620	663
		$c_{lim} (mm)$	90	80	70	70	70	70	70	70	70	70	70	80	80
		$F_{Rd} (c \geq c_{lim})$	203	220	238	256	274	292	337	381	471	560	636	681	721
150x75x18	152	$F_{Rd} (c = 0)$	39.5	57.4	80.0	101	116	131	169	207	283	364	400	433	463
		$c_{lim} (mm)$	90	80	70	60	60	60	60	60	60	70	70	70	70
		$F_{Rd} (c \geq c_{lim})$	142	157	172	187	202	218	255	293	369	407	440	470	498
125x65x15	129	$F_{Rd} (c = 0)$	34.9	53.2	76.5	94.8	110	125	163	201	276	352	428	475	510
		$c_{lim} (mm)$	80	70	60	60	60	60	60	60	60	60	60	60	60
		$F_{Rd} (c \geq c_{lim})$	128	143	158	173	188	203	241	279	354	430	477	513	545
100x50x10	90.3	$F_{Rd} (c = 0)$	26.1	43.3	64.5	78.2	92.0	106	140	174	243	312	381	440	472
		$c_{lim} (mm)$	60	50	50	50	50	50	50	50	50	50	50	50	50
		$F_{Rd} (c \geq c_{lim})$	97.3	111	125	139	152	166	200	235	304	372	436	470	500

Advance® and UKPFC are trademarks of Tata Steel. A fuller description of the relationship between Parallel Flange Channels (PFC) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

If  $c < c_{lim}$ , then use  $F_{Rd}$  value for  $c = 0$ .

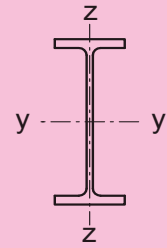
Resistances assume no eccentricity of the applied force relative to the web.

FOR EXPLANATION OF TABLES SEE NOTE 9.



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UNIVERSAL BEAMS  
Advance® UKB



Cross-section resistance check

Section Designation and Axial Force Resistance $N_{pl,Rd}$ (kN)	n Limit Class 3 Class 2	Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$											
		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
		$M_{c,y,Rd}$	$M_{c,z,Rd}$	$M_{N,y,Rd}$	$M_{N,z,Rd}$								
1016x305x487 + $N_{pl,Rd} = 15800$	n/a <b>1.00</b>	$M_{c,y,Rd}$	5920	5920	5920	5920	5920	5920	5920	5920	5920	5920	5920
		$M_{c,z,Rd}$	714	714	714	714	714	714	714	714	714	714	714
		$M_{N,y,Rd}$	5920	5920	5920	5390	4620	3850	3080	2310	1540	769	0
		$M_{N,z,Rd}$	714	714	714	714	714	710	667	574	432	241	0
1016x305x437 + $N_{pl,Rd} = 14200$	n/a <b>1.00</b>	$M_{c,y,Rd}$	5300	5300	5300	5300	5300	5300	5300	5300	5300	5300	5300
		$M_{c,z,Rd}$	629	629	629	629	629	629	629	629	629	629	629
		$M_{N,y,Rd}$	5300	5300	5300	4820	4130	3440	2760	2070	1380	689	0
		$M_{N,z,Rd}$	629	629	629	629	629	626	588	506	381	212	0
1016x305x393 + $N_{pl,Rd} = 12800$	n/a <b>1.00</b>	$M_{c,y,Rd}$	4730	4730	4730	4730	4730	4730	4730	4730	4730	4730	4730
		$M_{c,z,Rd}$	553	553	553	553	553	553	553	553	553	553	553
		$M_{N,y,Rd}$	4730	4730	4730	4320	3700	3090	2470	1850	1230	617	0
		$M_{N,z,Rd}$	553	553	553	553	553	551	519	447	337	188	0
1016x305x349 + $N_{pl,Rd} = 11800$	0.942 <b>0.313</b>	$M_{c,y,Rd}$	4400	4400	4400	4400	3800	3800	3800	3800	3800	3800	\$
		$M_{c,z,Rd}$	514	514	514	514	324	324	324	324	324	324	\$
		$M_{N,y,Rd}$	4400	4400	4400	3990	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	514	514	514	514	-	-	-	-	-	-	-
1016x305x314 + $N_{pl,Rd} = 10600$	0.805 <b>0.252</b>	$M_{c,y,Rd}$	3940	3940	3940	3410	3410	3410	3410	3410	3410	✘	\$
		$M_{c,z,Rd}$	454	454	454	287	287	287	287	287	287	✘	\$
		$M_{N,y,Rd}$	3940	3940	3940	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	454	454	454	-	-	-	-	-	-	-	-
1016x305x272 + $N_{pl,Rd} = 9200$	0.628 <b>0.169</b>	$M_{c,y,Rd}$	3400	3400	2970	2970	2970	2970	2970	✘	✘	✘	\$
		$M_{c,z,Rd}$	389	389	248	248	248	248	248	✘	✘	✘	\$
		$M_{N,y,Rd}$	3400	3400	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	389	389	-	-	-	-	-	-	-	-	-
1016x305x249 + $N_{pl,Rd} = 8400$	0.628 <b>0.185</b>	$M_{c,y,Rd}$	3010	3010	2600	2600	2600	2600	2600	✘	✘	✘	\$
		$M_{c,z,Rd}$	330	330	208	208	208	208	208	✘	✘	✘	\$
		$M_{N,y,Rd}$	3010	3010	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	330	330	-	-	-	-	-	-	-	-	-

Advance® and UKB are trademarks of Tata Steel. A fuller description of the relationship between Universal Beams (UB) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

+ These sections are in addition to the range of BS 4 sections

$N_{Ed}$  = Design value of the axial force.

$$n = N_{Ed} / N_{pl,Rd}$$

✘ Section becomes Class 4, see note 10.

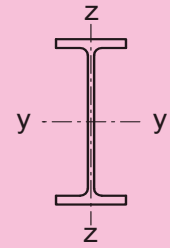
\$ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

- Not applicable for Class 3 and Class 4 sections.

The values in this table are conservative for tension as the more onerous compression section classification limits have been used.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL BEAMS  
Advance® UKB



Member buckling check

Section Designation and Resistances (kN, kNm)	n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm)													
		for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
		L (m)	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
1016x305x487 + $N_{pl,Rd} = 15800$ $f_y W_{el,y} = 5030$ $f_y W_{el,z} = 442$	1.00	$N_{b,y,Rd}$	15800	15800	15800	15800	15800	15800	15700	15600	15400	15200	15100	14900	14700
	1.00	$N_{b,z,Rd}$	14700	13300	11700	10000	8420	7000	5820	4870	4120	3520	3030	2640	2310
		$M_{b,Rd}$	5920	5820	5220	4710	4280	3900	3590	3310	3080	2870	2700	2540	2400
1016x305x437 + $N_{pl,Rd} = 14200$ $f_y W_{el,y} = 4520$ $f_y W_{el,z} = 391$	1.00	$N_{b,y,Rd}$	14200	14200	14200	14200	14200	14200	14100	14000	13800	13700	13500	13400	13200
	1.00	$N_{b,z,Rd}$	13200	11900	10400	8920	7460	6180	5140	4300	3630	3100	2670	2320	2030
		$M_{b,Rd}$	5300	5170	4620	4150	3740	3390	3100	2850	2630	2450	2290	2150	2020
1016x305x393 + $N_{pl,Rd} = 12800$ $f_y W_{el,y} = 4050$ $f_y W_{el,z} = 345$	1.00	$N_{b,y,Rd}$	12800	12800	12800	12800	12800	12800	12700	12500	12400	12300	12100	12000	11900
	1.00	$N_{b,z,Rd}$	11800	10600	9290	7910	6590	5450	4520	3770	3180	2710	2340	2030	1780
		$M_{b,Rd}$	4730	4580	4070	3640	3260	2940	2660	2430	2240	2070	1930	1800	1690
* 1016x305x349 + $N_{pl,Rd} = 11800$ $f_y W_{el,y} = 3800$ $f_y W_{el,z} = 324$	0.942	$N_{b,y,Rd}$	11800	11800	11800	11800	11800	11800	11700	11700	11600	11500	11400	11300	11300
	0.942	$N_{b,z,Rd}$	11100	10300	9230	7960	6640	5450	4480	3710	3100	2630	2250	1950	1700
		0.313	$M_{b,Rd}$	3800	3750	3350	3000	2700	2430	2210	2020	1850	1710	1590	1490
* 1016x305x314 + $N_{pl,Rd} = 10600$ $f_y W_{el,y} = 3410$ $f_y W_{el,z} = 287$	0.805	$N_{b,y,Rd}$	10600	10600	10600	10600	10600	10600	10500	10500	10400	10300	10300	10200	10100
	0.805	$N_{b,z,Rd}$	10000	9220	8250	7090	5900	4830	3960	3270	2740	2320	1980	1710	1500
		0.252	$M_{b,Rd}$	3410	3350	2980	2650	2370	2130	1920	1740	1590	1460	1350	1260
* 1016x305x272 + $N_{pl,Rd} = 9200$ $f_y W_{el,y} = 2970$ $f_y W_{el,z} = 248$	0.628	$N_{b,y,Rd}$	9200	9200	9200	9200	9200	9200	9140	9080	9030	8960	8900	8840	8770
	0.628	$N_{b,z,Rd}$	8670	7990	7140	6140	5100	4170	3420	2820	2360	2000	1710	1480	1290
		0.169	$M_{b,Rd}$	2970	2890	2570	2280	2020	1800	1610	1450	1320	1200	1110	1020
* 1016x305x249 + $N_{pl,Rd} = 8400$ $f_y W_{el,y} = 2600$ $f_y W_{el,z} = 208$	0.628	$N_{b,y,Rd}$	8400	8400	8400	8400	8400	8400	8340	8290	8230	8170	8110	8050	7990
	0.628	$N_{b,z,Rd}$	7870	7210	6380	5400	4430	3590	2920	2400	2010	1690	1450	1250	1090
		0.185	$M_{b,Rd}$	2600	2510	2220	1950	1720	1520	1350	1210	1090	990	906	836
		$N_{b,y,Rd}$	3010	2820	2460	2140	1860	1630	1430	1280	1140	1040	945	868	803

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+ These sections are in addition to the range of BS 4 sections

$$n = N_{Ed} / N_{pl,Rd}$$

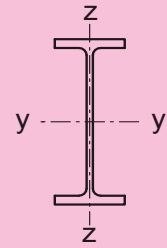
\* The section can become Class 4 under axial compression only. Under combined axial compression and bending the section becomes Class 4 when the Class 3  $N_{Ed} / N_{pl,Rd}$  limit is exceeded.

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit.

For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL BEAMS  
Advance® UKB



Cross-section resistance check

Section Designation and Axial Force Resistance $N_{pl,Rd}$ (kN)	n Limit Class 3 <b>Class 2</b>	Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$												
		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	
		$M_{c,y,Rd}$	$M_{c,z,Rd}$	$M_{N,y,Rd}$	$M_{N,z,Rd}$									
1016x305x222 + $N_{pl,Rd} = 7500$	0.593 <b>0.182</b>	$M_{c,y,Rd}$	2600	2600	2230	2230	2230	2230	2230	✘	✘	✘	\$	\$
		$M_{c,z,Rd}$	270	270	169	169	169	169	169	✘	✘	✘	\$	\$
		$M_{N,y,Rd}$	2600	2600	-	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	270	270	-	-	-	-	-	-	-	-	-	-
914x419x388 $N_{pl,Rd} = 13100$	1.00 <b>0.319</b>	$M_{c,y,Rd}$	4680	4680	4680	4680	4140	4140	4140	4140	4140	4140	4140	4140
		$M_{c,z,Rd}$	885	885	885	885	573	573	573	573	573	573	573	573
		$M_{N,y,Rd}$	4680	4680	4610	4040	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	885	885	885	885	-	-	-	-	-	-	-	-
914x419x343 $N_{pl,Rd} = 11600$	0.939 <b>0.269</b>	$M_{c,y,Rd}$	4100	4100	4100	3640	3640	3640	3640	3640	3640	3640	3640	\$
		$M_{c,z,Rd}$	766	766	766	496	496	496	496	496	496	496	496	\$
		$M_{N,y,Rd}$	4100	4100	4070	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	766	766	766	-	-	-	-	-	-	-	-	-
914x305x289 $N_{pl,Rd} = 9750$	0.903 <b>0.313</b>	$M_{c,y,Rd}$	3330	3330	3330	3330	2880	2880	2880	2880	2880	2880	2880	\$
		$M_{c,z,Rd}$	424	424	424	424	269	269	269	269	269	269	269	\$
		$M_{N,y,Rd}$	3330	3330	3330	3040	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	424	424	424	424	-	-	-	-	-	-	-	-
914x305x253 $N_{pl,Rd} = 8560$	0.745 <b>0.239</b>	$M_{c,y,Rd}$	2900	2900	2900	2520	2520	2520	2520	2520	✘	✘	\$	
		$M_{c,z,Rd}$	363	363	363	231	231	231	231	231	✘	✘	\$	
		$M_{N,y,Rd}$	2900	2900	2900	-	-	-	-	-	-	-	-	
		$M_{N,z,Rd}$	363	363	363	-	-	-	-	-	-	-	-	
914x305x224 $N_{pl,Rd} = 7580$	0.644 <b>0.196</b>	$M_{c,y,Rd}$	2530	2530	2190	2190	2190	2190	2190	2190	✘	✘	✘	\$
		$M_{c,z,Rd}$	308	308	196	196	196	196	196	196	✘	✘	✘	\$
		$M_{N,y,Rd}$	2530	2530	-	-	-	-	-	-	-	-	-	
		$M_{N,z,Rd}$	308	308	-	-	-	-	-	-	-	-	-	
914x305x201 $N_{pl,Rd} = 6780$	0.587 <b>0.177</b>	$M_{c,y,Rd}$	2210	2210	1910	1910	1910	1910	1910	✘	✘	✘	\$	\$
		$M_{c,z,Rd}$	260	260	165	165	165	165	165	✘	✘	✘	\$	\$
		$M_{N,y,Rd}$	2210	2210	-	-	-	-	-	-	-	-	-	
		$M_{N,z,Rd}$	260	260	-	-	-	-	-	-	-	-	-	

Advance® and UKB are trademarks of Tata Steel. A fuller description of the relationship between Universal Beams (UB) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

+ These sections are in addition to the range of BS 4 sections

$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

✘ Section becomes Class 4, see note 10.

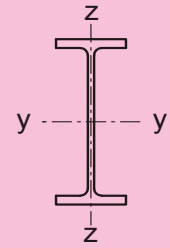
\$ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

- Not applicable for Class 3 and Class 4 sections.

The values in this table are conservative for tension as the more onerous compression section classification limits have been used.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL BEAMS  
Advance® UKB



Member buckling check

Section Designation and Resistances (kN, kNm)	n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm)													
		for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
		L (m)	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
* 1016x305x222 + $N_{pl,Rd} = 7500$ $f_y W_{el,y} = 2230$ $f_y W_{el,z} = 169$	0.593	$N_{b,y,Rd}$	7500	7500	7500	7500	7500	7490	7440	7390	7330	7280	7230	7170	7110
		$N_{b,z,Rd}$	6980	6340	5530	4610	3720	2980	2410	1980	1650	1390	1190	1020	893
	0.182	$M_{b,Rd}$	2230	2120	1860	1630	1420	1250	1100	976	875	790	720	660	610
		$M_{b,Rd}$	2600	2400	2080	1790	1540	1340	1170	1030	919	826	750	686	632
914x419x388 $N_{pl,Rd} = 13100$ $f_y W_{el,y} = 4140$ $f_y W_{el,z} = 573$	1.00	$N_{b,y,Rd}$	13100	13100	13100	13100	13100	13100	13000	12900	12800	12700	12600	12500	12400
		$N_{b,z,Rd}$	12900	12400	11700	11000	10200	9280	8290	7310	6410	5610	4910	4320	3820
	0.319	$M_{b,Rd}$	4140	4140	4140	3960	3760	3560	3360	3170	2990	2820	2660	2510	2380
		$M_{b,Rd}$	4680	4680	4650	4400	4150	3910	3670	3440	3220	3020	2830	2660	2500
* 914x419x343 $N_{pl,Rd} = 11600$ $f_y W_{el,y} = 3640$ $f_y W_{el,z} = 496$	0.939	$N_{b,y,Rd}$	11600	11600	11600	11600	11600	11600	11500	11400	11300	11200	11200	11100	11000
		$N_{b,z,Rd}$	11400	10900	10400	9710	8960	8120	7240	6370	5570	4860	4260	3740	3310
	0.269	$M_{b,Rd}$	3640	3640	3640	3460	3270	3090	2910	2730	2560	2400	2250	2110	1990
		$M_{b,Rd}$	4100	4100	4060	3830	3610	3380	3160	2950	2740	2560	2380	2230	2090
* 914x305x289 $N_{pl,Rd} = 9750$ $f_y W_{el,y} = 2880$ $f_y W_{el,z} = 269$	0.903	$N_{b,y,Rd}$	9750	9750	9750	9750	9750	9720	9660	9590	9520	9450	9370	9300	9220
		$N_{b,z,Rd}$	9230	8530	7670	6640	5560	4580	3760	3120	2610	2210	1900	1640	1430
	0.313	$M_{b,Rd}$	2880	2860	2650	2450	2240	2050	1870	1710	1570	1440	1330	1240	1150
		$M_{b,Rd}$	3330	3250	2990	2730	2470	2230	2010	1820	1660	1520	1390	1290	1200
* 914x305x253 $N_{pl,Rd} = 8560$ $f_y W_{el,y} = 2520$ $f_y W_{el,z} = 231$	0.745	$N_{b,y,Rd}$	8560	8560	8560	8560	8560	8530	8470	8410	8350	8290	8220	8160	8090
		$N_{b,z,Rd}$	8090	7460	6690	5770	4810	3940	3230	2680	2240	1900	1620	1400	1230
	0.239	$M_{b,Rd}$	2520	2490	2300	2110	1920	1740	1580	1430	1300	1190	1090	1010	935
		$M_{b,Rd}$	2900	2820	2580	2340	2110	1890	1690	1520	1370	1240	1140	1050	967
* 914x305x224 $N_{pl,Rd} = 7580$ $f_y W_{el,y} = 2190$ $f_y W_{el,z} = 196$	0.644	$N_{b,y,Rd}$	7580	7580	7580	7580	7580	7550	7500	7440	7390	7330	7270	7210	7150
		$N_{b,z,Rd}$	7130	6560	5850	5000	4140	3380	2760	2280	1900	1610	1380	1190	1040
	0.196	$M_{b,Rd}$	2190	2150	1980	1810	1640	1480	1330	1190	1070	975	889	816	754
		$M_{b,Rd}$	2530	2440	2230	2010	1800	1590	1420	1260	1130	1020	924	845	778
* 914x305x201 $N_{pl,Rd} = 6780$ $f_y W_{el,y} = 1910$ $f_y W_{el,z} = 165$	0.587	$N_{b,y,Rd}$	6780	6780	6780	6780	6780	6750	6700	6650	6600	6550	6500	6440	6380
		$N_{b,z,Rd}$	6360	5810	5140	4350	3560	2880	2350	1930	1610	1360	1160	1000	876
	0.177	$M_{b,Rd}$	1910	1870	1710	1560	1400	1250	1110	992	889	801	727	664	610
		$M_{b,Rd}$	2210	2120	1930	1730	1530	1350	1190	1050	931	834	754	686	628

Advance® and UKB are trademarks of Tata Steel. A fuller description of the relationship between Universal Beams (UB) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

+ These sections are in addition to the range of BS 4 sections

$$n = N_{Ed} / N_{pl,Rd}$$

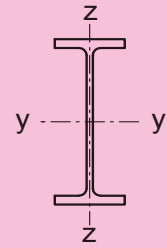
\* The section can become Class 4 under axial compression only. Under combined axial compression and bending the section becomes Class 4 when the Class 3  $N_{Ed} / N_{pl,Rd}$  limit is exceeded.

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit.

For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL BEAMS  
Advance® UKB



Cross-section resistance check

Section Designation and Axial Force Resistance $N_{pl,Rd}$ (kN)	n Limit Class 3 <b>Class 2</b>	Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$												
		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	
		$M_{c,y,Rd}$	$M_{c,z,Rd}$	$M_{N,y,Rd}$	$M_{N,z,Rd}$									
838x292x226 $N_{pl,Rd} = 7660$	0.754 <b>0.233</b>	2430	2430	2430	2120	2120	2120	2120	2120	2120	✘	✘	\$	
		321	321	321	205	205	205	205	205	205	✘	✘	\$	
		2430	2430	2430	-	-	-	-	-	-	-	-	-	
		321	321	321	-	-	-	-	-	-	-	-	-	
838x292x194 $N_{pl,Rd} = 6550$	0.645 <b>0.194</b>	2020	2020	1760	1760	1760	1760	1760	1760	1760	✘	✘	✘	\$
		258	258	164	164	164	164	164	164	164	✘	✘	✘	\$
		2020	2020	-	-	-	-	-	-	-	-	-	-	
		258	258	-	-	-	-	-	-	-	-	-	-	
838x292x176 $N_{pl,Rd} = 5940$	0.590 <b>0.175</b>	1800	1800	1560	1560	1560	1560	1560	✘	✘	✘	\$	\$	
		223	223	142	142	142	142	142	✘	✘	✘	\$	\$	
		1800	1800	-	-	-	-	-	-	-	-	-	-	
		223	223	-	-	-	-	-	-	-	-	-	-	
762x267x197 $N_{pl,Rd} = 6650$	0.849 <b>0.280</b>	1900	1900	1900	1650	1650	1650	1650	1650	1650	1650	✘	\$	
		254	254	254	162	162	162	162	162	162	162	✘	\$	
		1900	1900	1900	-	-	-	-	-	-	-	-	-	
		254	254	254	-	-	-	-	-	-	-	-	-	
762x267x173 $N_{pl,Rd} = 5830$	0.737 <b>0.237</b>	1640	1640	1640	1430	1430	1430	1430	1430	1430	✘	✘	\$	
		214	214	214	136	136	136	136	136	136	✘	✘	\$	
		1640	1640	1640	-	-	-	-	-	-	-	-	-	
		214	214	214	-	-	-	-	-	-	-	-	-	
762x267x147 $N_{pl,Rd} = 4960$	0.607 <b>0.181</b>	1370	1370	1180	1180	1180	1180	1180	✘	✘	✘	\$	\$	
		171	171	109	109	109	109	109	✘	✘	✘	\$	\$	
		1370	1370	-	-	-	-	-	-	-	-	-	-	
		171	171	-	-	-	-	-	-	-	-	-	-	
762x267x134 $N_{pl,Rd} = 4700$	0.519 <b>0.139</b>	1280	1280	1100	1100	1100	1100	1100	✘	✘	✘	\$	\$	
		157	157	99.6	99.6	99.6	99.6	99.6	✘	✘	✘	\$	\$	
		1280	1280	-	-	-	-	-	-	-	-	-	-	
		157	157	-	-	-	-	-	-	-	-	-	-	

Advance® and UKB are trademarks of Tata Steel. A fuller description of the relationship between Universal Beams (UB) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

✘ Section becomes Class 4, see note 10.

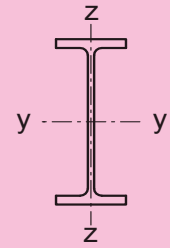
\$ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

- Not applicable for Class 3 and Class 4 sections.

The values in this table are conservative for tension as the more onerous compression section classification limits have been used.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL BEAMS  
Advance® UKB



Member buckling check

Section Designation and Resistances (kN, kNm)	n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm)													
		for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
		L (m)	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
* 838x292x226 $N_{pl,Rd} = 7660$ $f_y W_{el,y} = 2120$ $f_y W_{el,z} = 205$	0.754	$N_{b,y,Rd}$	7660	7660	7660	7660	7660	7610	7550	7490	7430	7370	7310	7240	7170
		$N_{b,z,Rd}$	7210	6630	5910	5050	4180	3410	2790	2300	1920	1630	1390	1200	1050
	0.754	$M_{b,Rd}$	2120	2080	1910	1750	1590	1440	1300	1180	1070	979	900	831	772
		<b>0.233</b>	$M_{b,Rd}$	2430	2340	2140	1930	1740	1550	1390	1250	1120	1020	935	861
* 838x292x194 $N_{pl,Rd} = 6550$ $f_y W_{el,y} = 1760$ $f_y W_{el,z} = 164$	0.645	$N_{b,y,Rd}$	6550	6550	6550	6550	6540	6490	6440	6390	6340	6290	6230	6170	6110
		$N_{b,z,Rd}$	6130	5610	4950	4190	3430	2770	2260	1860	1550	1310	1120	966	843
	0.645	$M_{b,Rd}$	1760	1710	1570	1430	1290	1150	1030	920	828	750	683	627	578
		<b>0.194</b>	$M_{b,Rd}$	2020	1940	1760	1580	1400	1240	1090	970	866	780	708	647
* 838x292x176 $N_{pl,Rd} = 5940$ $f_y W_{el,y} = 1560$ $f_y W_{el,z} = 142$	0.590	$N_{b,y,Rd}$	5940	5940	5940	5940	5930	5880	5840	5790	5740	5690	5640	5580	5530
		$N_{b,z,Rd}$	5540	5040	4420	3700	3000	2420	1960	1610	1340	1130	966	834	727
	0.590	$M_{b,Rd}$	1560	1510	1380	1250	1120	995	882	785	702	632	573	523	481
		<b>0.175</b>	$M_{b,Rd}$	1800	1710	1550	1380	1220	1070	937	825	733	656	593	539
* 762x267x197 $N_{pl,Rd} = 6650$ $f_y W_{el,y} = 1650$ $f_y W_{el,z} = 162$	0.849	$N_{b,y,Rd}$	6650	6650	6650	6650	6620	6570	6510	6460	6400	6330	6270	6200	6120
		$N_{b,z,Rd}$	6170	5590	4850	4010	3220	2580	2080	1710	1420	1190	1020	880	767
	0.849	$M_{b,Rd}$	1650	1590	1450	1310	1180	1060	954	861	783	715	658	609	567
		<b>0.280</b>	$M_{b,Rd}$	1900	1790	1610	1440	1280	1140	1010	907	819	745	683	630
* 762x267x173 $N_{pl,Rd} = 5830$ $f_y W_{el,y} = 1430$ $f_y W_{el,z} = 136$	0.737	$N_{b,y,Rd}$	5830	5830	5830	5830	5800	5750	5700	5650	5600	5540	5480	5420	5350
		$N_{b,z,Rd}$	5390	4860	4190	3430	2740	2180	1760	1440	1190	1000	857	739	644
	0.737	$M_{b,Rd}$	1430	1360	1240	1110	992	882	785	703	633	575	525	483	448
		<b>0.237</b>	$M_{b,Rd}$	1640	1530	1380	1220	1070	943	831	737	660	596	543	498
* 762x267x147 $N_{pl,Rd} = 4960$ $f_y W_{el,y} = 1180$ $f_y W_{el,z} = 109$	0.607	$N_{b,y,Rd}$	4960	4960	4960	4960	4930	4890	4840	4800	4750	4700	4650	4600	4540
		$N_{b,z,Rd}$	4550	4080	3470	2810	2220	1760	1410	1150	956	804	686	591	514
	0.607	$M_{b,Rd}$	1180	1120	1010	902	795	698	614	544	485	436	395	361	333
		<b>0.181</b>	$M_{b,Rd}$	1370	1260	1130	989	859	744	647	568	504	451	408	371
* 762x267x134 $N_{pl,Rd} = 4700$ $f_y W_{el,y} = 1100$ $f_y W_{el,z} = 99.6$	0.519	$N_{b,y,Rd}$	4700	4700	4700	4700	4670	4630	4590	4540	4500	4450	4400	4340	4280
		$N_{b,z,Rd}$	4290	3810	3200	2550	2000	1570	1260	1020	848	713	607	523	455
	0.519	$M_{b,Rd}$	1100	1030	927	819	715	622	542	476	421	377	340	309	283
		<b>0.139</b>	$M_{b,Rd}$	1280	1170	1030	897	770	660	569	496	437	389	350	317

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$$n = N_{Ed} / N_{pl,Rd}$$

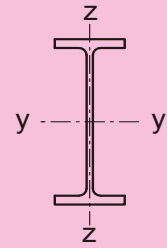
\* The section can become Class 4 under axial compression only. Under combined axial compression and bending the section becomes Class 4 when the Class 3  $N_{Ed} / N_{pl,Rd}$  limit is exceeded.

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit.

For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL BEAMS  
Advance® UKB



Cross-section resistance check

Section Designation and Axial Force Resistance $N_{pl,Rd}$ (kN)	n Limit Class 3 <b>Class 2</b>	Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$												
		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	
		686x254x170 $N_{pl,Rd} = 5750$	0.899 <b>0.292</b>	$M_{c,y,Rd}$	1490	1490	1490	1300	1300	1300	1300	1300	1300	1300
		$M_{c,z,Rd}$	215	215	215	137	137	137	137	137	137	137	✘	\$
		$M_{N,y,Rd}$	1490	1490	1490	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	215	215	215	-	-	-	-	-	-	-	-	-
686x254x152 $N_{pl,Rd} = 5140$	0.773 <b>0.239</b>	$M_{c,y,Rd}$	1330	1330	1330	1160	1160	1160	1160	1160	1160	✘	✘	\$
		$M_{c,z,Rd}$	188	188	188	121	121	121	121	121	121	✘	✘	\$
		$M_{N,y,Rd}$	1330	1330	1330	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	188	188	188	-	-	-	-	-	-	-	-	-
686x254x140 $N_{pl,Rd} = 4720$	0.696 <b>0.208</b>	$M_{c,y,Rd}$	1210	1210	1210	1060	1060	1060	1060	1060	✘	✘	✘	\$
		$M_{c,z,Rd}$	169	169	169	108	108	108	108	108	✘	✘	✘	\$
		$M_{N,y,Rd}$	1210	1210	1210	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	169	169	169	-	-	-	-	-	-	-	-	-
686x254x125 $N_{pl,Rd} = 4210$	0.628 <b>0.186</b>	$M_{c,y,Rd}$	1060	1060	922	922	922	922	922	922	✘	✘	✘	\$
		$M_{c,z,Rd}$	144	144	91.7	91.7	91.7	91.7	91.7	91.7	✘	✘	✘	\$
		$M_{N,y,Rd}$	1060	1060	-	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	144	144	-	-	-	-	-	-	-	-	-	-
610x305x238 $N_{pl,Rd} = 8030$	n/a <b>1.00</b>	$M_{c,y,Rd}$	1980	1980	1980	1980	1980	1980	1980	1980	1980	1980	1980	1980
		$M_{c,z,Rd}$	417	417	417	417	417	417	417	417	417	417	417	417
		$M_{N,y,Rd}$	1980	1980	1930	1690	1450	1210	965	723	482	241	0	0
		$M_{N,z,Rd}$	417	417	417	417	415	396	357	298	218	119	0	0
610x305x179 $N_{pl,Rd} = 6040$	1.00 <b>0.293</b>	$M_{c,y,Rd}$	1470	1470	1470	1310	1310	1310	1310	1310	1310	1310	1310	1310
		$M_{c,z,Rd}$	303	303	303	197	197	197	197	197	197	197	197	197
		$M_{N,y,Rd}$	1470	1470	1440	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	303	303	303	-	-	-	-	-	-	-	-	-
610x305x149 $N_{pl,Rd} = 5040$	0.796 <b>0.200</b>	$M_{c,y,Rd}$	1220	1220	1220	1090	1090	1090	1090	1090	✘	✘	\$	
		$M_{c,z,Rd}$	248	248	248	162	162	162	162	162	✘	✘	\$	
		$M_{N,y,Rd}$	1220	1220	1190	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	248	248	248	-	-	-	-	-	-	-	-	-

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$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

✘ Section becomes Class 4, see note 10.

\$ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

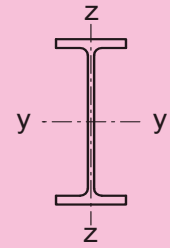
- Not applicable for Class 3 and Class 4 sections.

The values in this table are conservative for tension as the more onerous compression section classification limits have been used.

FOR EXPLANATION OF TABLES SEE NOTE 10.



UNIVERSAL BEAMS  
Advance® UKB



Member buckling check

Section Designation and Resistances (kN, kNm)	n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
		L (m)	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
		$N_{b,y,Rd}$	$N_{b,z,Rd}$	$M_{b,Rd}$											
* 686x254x170 $N_{pl,Rd} = 5750$ $f_y W_{el,y} = 1300$ $f_y W_{el,z} = 137$	0.899	$N_{b,y,Rd}$	5750	5750	5750	5750	5700	5640	5590	5530	5470	5410	5340	5270	5190
		$N_{b,z,Rd}$	5300	4770	4100	3350	2670	2120	1710	1390	1160	975	831	717	624
	0.292	$M_{b,Rd}$	1300	1240	1130	1020	913	818	735	664	604	553	509	472	440
		$M_{b,Rd}$	1490	1390	1250	1110	987	874	778	697	630	574	527	487	453
* 686x254x152 $N_{pl,Rd} = 5140$ $f_y W_{el,y} = 1160$ $f_y W_{el,z} = 121$	0.773	$N_{b,y,Rd}$	5140	5140	5140	5140	5090	5040	4990	4940	4890	4830	4770	4700	4630
		$N_{b,z,Rd}$	4730	4250	3630	2950	2340	1860	1490	1220	1010	851	726	626	545
	0.239	$M_{b,Rd}$	1160	1100	993	891	793	705	628	563	509	463	424	391	363
		$M_{b,Rd}$	1330	1230	1100	973	854	750	662	589	529	479	438	403	373
* 686x254x140 $N_{pl,Rd} = 4720$ $f_y W_{el,y} = 1060$ $f_y W_{el,z} = 108$	0.696	$N_{b,y,Rd}$	4720	4720	4720	4710	4670	4630	4580	4530	4480	4430	4370	4310	4240
		$N_{b,z,Rd}$	4330	3880	3300	2670	2110	1670	1340	1090	907	763	650	561	488
	0.208	$M_{b,Rd}$	1060	995	898	802	710	627	555	495	444	403	367	338	312
		$M_{b,Rd}$	1210	1110	993	874	763	666	584	516	461	416	379	347	320
* 686x254x125 $N_{pl,Rd} = 4210$ $f_y W_{el,y} = 922$ $f_y W_{el,z} = 91.7$	0.628	$N_{b,y,Rd}$	4210	4210	4210	4210	4170	4130	4090	4040	4000	3950	3900	3840	3780
		$N_{b,z,Rd}$	3850	3420	2880	2310	1810	1430	1140	930	770	647	551	475	413
	0.186	$M_{b,Rd}$	922	863	775	687	602	527	463	409	365	328	298	272	251
		$M_{b,Rd}$	1060	968	858	749	647	559	485	426	378	339	306	280	257
610x305x238 $N_{pl,Rd} = 8030$ $f_y W_{el,y} = 1750$ $f_y W_{el,z} = 270$	1.00	$N_{b,y,Rd}$	8030	8030	8030	8000	7930	7850	7760	7680	7590	7490	7380	7270	7140
		$N_{b,z,Rd}$	7700	7210	6620	5910	5110	4320	3620	3040	2570	2190	1880	1630	1430
	1.00	$M_{b,Rd}$	1980	1980	1840	1720	1590	1480	1370	1280	1190	1110	1050	983	928
610x305x179 $N_{pl,Rd} = 6040$ $f_y W_{el,y} = 1310$ $f_y W_{el,z} = 197$	1.00	$N_{b,y,Rd}$	6040	6040	6040	6020	5960	5900	5830	5770	5700	5620	5540	5450	5350
		$N_{b,z,Rd}$	5780	5400	4930	4380	3760	3160	2640	2210	1860	1580	1360	1180	1030
	0.293	$M_{b,Rd}$	1310	1310	1220	1130	1050	964	888	818	755	699	650	607	569
		$M_{b,Rd}$	1470	1450	1350	1240	1140	1040	947	866	794	732	677	630	588
* 610x305x149 $N_{pl,Rd} = 5040$ $f_y W_{el,y} = 1090$ $f_y W_{el,z} = 162$	0.796	$N_{b,y,Rd}$	5040	5040	5040	5010	4960	4910	4860	4800	4740	4680	4610	4530	4450
		$N_{b,z,Rd}$	4810	4490	4090	3620	3100	2600	2170	1810	1530	1300	1110	966	845
	0.200	$M_{b,Rd}$	1090	1090	1010	930	853	779	709	646	591	542	499	462	430
		$M_{b,Rd}$	1220	1200	1100	1010	920	832	751	680	617	563	517	477	443

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$$n = N_{Ed} / N_{pl,Rd}$$

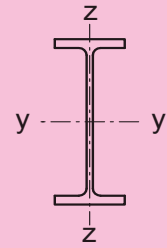
\* The section can become Class 4 under axial compression only. Under combined axial compression and bending the section becomes Class 4 when the Class 3  $N_{Ed} / N_{pl,Rd}$  limit is exceeded.

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit.

For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL BEAMS  
Advance® UKB



Cross-section resistance check

Section Designation and Axial Force Resistance $N_{pl,Rd}$ (kN)	n Limit Class 3 <b>Class 2</b>	Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$													
		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0		
		610x229x140 $N_{pl,Rd} = 4720$	0.919 <b>0.296</b>	$M_{c,y,Rd}$	1100	1100	1100	960	960	960	960	960	960	960	\$
		$M_{c,z,Rd}$	162	162	162	104	104	104	104	104	104	104	\$		
		$M_{N,y,Rd}$	1100	1100	1100	-	-	-	-	-	-	-	-		
		$M_{N,z,Rd}$	162	162	162	-	-	-	-	-	-	-	-		
610x229x125 $N_{pl,Rd} = 4210$	0.789 <b>0.242</b>	$M_{c,y,Rd}$	974	974	974	854	854	854	854	854	✗	✗	\$		
		$M_{c,z,Rd}$	142	142	142	90.9	90.9	90.9	90.9	90.9	✗	✗	\$		
		$M_{N,y,Rd}$	974	974	974	-	-	-	-	-	-	-	-		
		$M_{N,z,Rd}$	142	142	142	-	-	-	-	-	-	-	-		
610x229x113 $N_{pl,Rd} = 3820$	0.703 <b>0.208</b>	$M_{c,y,Rd}$	869	869	869	762	762	762	762	762	✗	✗	✗	\$	
		$M_{c,z,Rd}$	124	124	124	79.8	79.8	79.8	79.8	79.8	✗	✗	✗	\$	
		$M_{N,y,Rd}$	869	869	869	-	-	-	-	-	-	-	-		
		$M_{N,z,Rd}$	124	124	124	-	-	-	-	-	-	-	-		
610x229x101 $N_{pl,Rd} = 3550$	0.617 <b>0.177</b>	$M_{c,y,Rd}$	792	792	692	692	692	692	692	692	✗	✗	✗	\$	
		$M_{c,z,Rd}$	110	110	70.4	70.4	70.4	70.4	70.4	70.4	✗	✗	✗	\$	
		$M_{N,y,Rd}$	792	792	-	-	-	-	-	-	-	-	-		
		$M_{N,z,Rd}$	110	110	-	-	-	-	-	-	-	-	-		
610x178x100 + $N_{pl,Rd} = 3390$	0.724 <b>0.250</b>	$M_{c,y,Rd}$	738	738	738	633	633	633	633	633	633	✗	✗	\$	
		$M_{c,z,Rd}$	78.4	78.4	78.4	49.0	49.0	49.0	49.0	49.0	49.0	49.0	✗	\$	
		$M_{N,y,Rd}$	738	738	738	-	-	-	-	-	-	-	-		
		$M_{N,z,Rd}$	78.4	78.4	78.4	-	-	-	-	-	-	-	-		
610x178x92 + $N_{pl,Rd} = 3220$	0.659 <b>0.227</b>	$M_{c,y,Rd}$	691	691	691	589	589	589	589	589	589	✗	✗	✗	\$
		$M_{c,z,Rd}$	71.0	71.0	71.0	44.3	44.3	44.3	44.3	44.3	44.3	44.3	✗	\$	
		$M_{N,y,Rd}$	691	691	691	-	-	-	-	-	-	-	-		
		$M_{N,z,Rd}$	71.0	71.0	71.0	-	-	-	-	-	-	-	-		
610x178x82 + $N_{pl,Rd} = 2860$	0.564 <b>0.178</b>	$M_{c,y,Rd}$	603	603	513	513	513	513	513	✗	✗	✗	\$	\$	
		$M_{c,z,Rd}$	60.0	60.0	37.4	37.4	37.4	37.4	37.4	✗	✗	✗	\$	\$	
		$M_{N,y,Rd}$	603	603	-	-	-	-	-	-	-	-	-		
		$M_{N,z,Rd}$	60.0	60.0	-	-	-	-	-	-	-	-	-		

Advance® and UKB are trademarks of Tata Steel. A fuller description of the relationship between Universal Beams (UB) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

+ These sections are in addition to the range of BS 4 sections

$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

✗ Section becomes Class 4, see note 10.

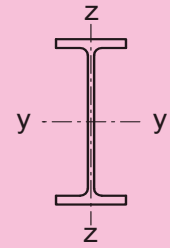
\$ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

- Not applicable for Class 3 and Class 4 sections.

The values in this table are conservative for tension as the more onerous compression section classification limits have been used.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL BEAMS  
Advance® UKB



Member buckling check

Section Designation and Resistances (kN, kNm)	n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
		L (m)	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
* 610x229x140 $N_{pl,Rd} = 4720$ $f_y W_{el,y} = 960$ $f_y W_{el,z} = 104$	0.919	$N_{b,y,Rd}$	4720	4720	4720	4690	4640	4590	4540	4490	4430	4360	4290	4220	4140
		$N_{b,z,Rd}$	4270	3760	3120	2460	1910	1490	1190	968	800	672	572	493	428
	0.296	$M_{b,Rd}$	960	887	798	711	632	563	503	454	412	377	348	323	301
		$M_{b,Rd}$	1100	991	880	774	678	597	529	474	429	391	359	332	309
* 610x229x125 $N_{pl,Rd} = 4210$ $f_y W_{el,y} = 854$ $f_y W_{el,z} = 90.9$	0.789	$N_{b,y,Rd}$	4210	4210	4210	4190	4150	4100	4050	4000	3950	3890	3830	3770	3690
		$N_{b,z,Rd}$	3810	3340	2760	2160	1670	1310	1040	846	699	587	500	430	374
	0.242	$M_{b,Rd}$	854	784	701	620	546	481	427	382	345	314	288	266	247
		$M_{b,Rd}$	974	874	771	672	583	509	447	398	357	324	296	273	253
* 610x229x113 $N_{pl,Rd} = 3820$ $f_y W_{el,y} = 762$ $f_y W_{el,z} = 79.8$	0.703	$N_{b,y,Rd}$	3820	3820	3820	3790	3750	3710	3670	3620	3570	3520	3460	3400	3330
		$N_{b,z,Rd}$	3430	3000	2460	1910	1470	1150	914	742	613	514	437	376	327
	0.208	$M_{b,Rd}$	762	695	618	543	473	414	364	323	290	262	240	221	204
		$M_{b,Rd}$	869	774	679	587	505	436	380	336	300	270	246	226	209
* 610x229x101 $N_{pl,Rd} = 3550$ $f_y W_{el,y} = 692$ $f_y W_{el,z} = 70.4$	0.617	$N_{b,y,Rd}$	3550	3550	3550	3520	3480	3440	3400	3350	3300	3250	3190	3130	3060
		$N_{b,z,Rd}$	3160	2720	2190	1670	1270	989	784	635	524	439	373	321	279
	0.177	$M_{b,Rd}$	692	622	547	474	408	352	306	269	239	215	195	179	165
		$M_{b,Rd}$	785	694	601	511	433	369	319	279	247	221	200	182	165
* 610x178x100 + $N_{pl,Rd} = 3390$ $f_y W_{el,y} = 633$ $f_y W_{el,z} = 49.0$	0.724	$N_{b,y,Rd}$	3390	3390	3390	3360	3330	3290	3250	3210	3160	3110	3060	3000	2930
		$N_{b,z,Rd}$	2790	2150	1520	1080	789	599	469	377	309	258	219	188	163
	0.250	$M_{b,Rd}$	586	475	386	318	268	230	201	179	161	147	135	125	116
		$M_{b,Rd}$	660	524	417	339	282	241	209	186	167	151	139	128	119
* 610x178x92 + $N_{pl,Rd} = 3220$ $f_y W_{el,y} = 589$ $f_y W_{el,z} = 44.3$	0.659	$N_{b,y,Rd}$	3220	3220	3220	3180	3150	3110	3070	3030	2980	2930	2870	2810	2740
		$N_{b,z,Rd}$	2600	1950	1350	945	689	522	408	328	269	224	190	163	141
	0.227	$M_{b,Rd}$	536	429	343	279	232	198	172	152	136	123	113	104	96.9
		$M_{b,Rd}$	604	472	370	297	244	206	179	157	141	127	116	107	99.4
* 610x178x82 + $N_{pl,Rd} = 2860$ $f_y W_{el,y} = 513$ $f_y W_{el,z} = 37.4$	0.564	$N_{b,y,Rd}$	2860	2860	2860	2830	2800	2760	2730	2690	2650	2600	2550	2490	2430
		$N_{b,z,Rd}$	2280	1680	1150	800	582	440	344	276	226	188	160	137	119
	0.178	$M_{b,Rd}$	462	366	290	233	192	162	140	123	109	98.6	89.9	82.7	76.6
		$M_{b,Rd}$	522	403	312	247	201	169	145	127	113	101	92.4	84.8	78.5

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+ These sections are in addition to the range of BS 4 sections

$$n = N_{Ed} / N_{pl,Rd}$$

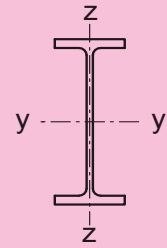
\* The section can become Class 4 under axial compression only. Under combined axial compression and bending the section becomes Class 4 when the Class 3  $N_{Ed} / N_{pl,Rd}$  limit is exceeded.

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit.

For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL BEAMS  
Advance® UKB



Cross-section resistance check

Section Designation and Axial Force Resistance $N_{pl,Rd}$ (kN)	n Limit Class 3 Class 2	Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$											
		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
		$M_{c,y,Rd}$	$M_{c,z,Rd}$	$M_{N,y,Rd}$	$M_{N,z,Rd}$								
533x312x272 + $N_{pl,Rd} = 9220$	n/a <b>1.00</b>	$M_{c,y,Rd}$	2080	2080	2080	2080	2080	2080	2080	2080	2080	2080	2080
		$M_{c,z,Rd}$	526	526	526	526	526	526	526	526	526	526	526
		$M_{N,y,Rd}$	2080	2080	1970	1730	1480	1230	986	739	493	246	0
		$M_{N,z,Rd}$	526	526	526	526	517	486	432	357	260	141	0
533x312x219 + $N_{pl,Rd} = 7390$	n/a <b>1.00</b>	$M_{c,y,Rd}$	1620	1620	1620	1620	1620	1620	1620	1620	1620	1620	1620
		$M_{c,z,Rd}$	401	401	401	401	401	401	401	401	401	401	401
		$M_{N,y,Rd}$	1620	1620	1560	1360	1170	974	779	584	390	195	0
		$M_{N,z,Rd}$	401	401	401	401	397	377	338	281	205	112	0
533x312x182 + $N_{pl,Rd} = 6120$	n/a <b>1.00</b>	$M_{c,y,Rd}$	1330	1330	1330	1330	1330	1330	1330	1330	1330	1330	1330
		$M_{c,z,Rd}$	328	328	328	328	328	328	328	328	328	328	328
		$M_{N,y,Rd}$	1330	1330	1280	1120	962	802	641	481	321	160	0
		$M_{N,z,Rd}$	328	328	328	328	325	308	276	229	168	91.3	0
533x312x150 + $N_{pl,Rd} = 5090$	1.00 <b>0.288</b>	$M_{c,y,Rd}$	1100	1100	1100	984	984	984	984	984	984	984	984
		$M_{c,z,Rd}$	267	267	267	175	175	175	175	175	175	175	175
		$M_{N,y,Rd}$	1100	1100	1060	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	267	267	267	-	-	-	-	-	-	-	-
533x210x138 + $N_{pl,Rd} = 4660$	n/a <b>1.00</b>	$M_{c,y,Rd}$	957	957	957	957	957	957	957	957	957	957	957
		$M_{c,z,Rd}$	151	151	151	151	151	151	151	151	151	151	151
		$M_{N,y,Rd}$	957	957	957	852	730	608	487	365	243	122	0
		$M_{N,z,Rd}$	151	151	151	151	151	148	137	116	86.7	47.9	0
533x210x122 $N_{pl,Rd} = 4110$	1.00 <b>0.357</b>	$M_{c,y,Rd}$	847	847	847	847	740	740	740	740	740	740	740
		$M_{c,z,Rd}$	133	133	133	133	84.8	84.8	84.8	84.8	84.8	84.8	84.8
		$M_{N,y,Rd}$	847	847	847	749	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	133	133	133	133	-	-	-	-	-	-	-
533x210x109 $N_{pl,Rd} = 3680$	0.944 <b>0.303</b>	$M_{c,y,Rd}$	750	750	750	750	656	656	656	656	656	656	\$
		$M_{c,z,Rd}$	116	116	116	116	73.9	73.9	73.9	73.9	73.9	73.9	\$
		$M_{N,y,Rd}$	750	750	750	668	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	116	116	116	116	-	-	-	-	-	-	-

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+ These sections are in addition to the range of BS 4 sections

$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

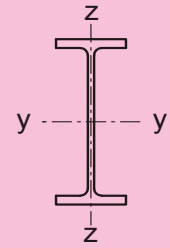
\$ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

- Not applicable for Class 3 and Class 4 sections.

The values in this table are conservative for tension as the more onerous compression section classification limits have been used.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL BEAMS  
Advance® UKB



Member buckling check

Section Designation and Resistances (kN, kNm)	n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
		L (m)	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
		$N_{b,y,Rd}$	$N_{b,z,Rd}$	$M_{b,Rd}$											
533x312x272 + $N_{pl,Rd} = 9220$ $f_y W_{el,y} = 1830$ $f_y W_{el,z} = 341$	1.00	$N_{b,y,Rd}$	9220	9220	9220	9150	9050	8950	8840	8720	8600	8460	8320	8150	7970
	1.00	$N_{b,z,Rd}$	8910	8390	7770	7040	6200	5330	4530	3830	3260	2790	2410	2090	1830
		$M_{b,Rd}$	2080	2080	2020	1930	1850	1770	1690	1620	1550	1480	1410	1350	1290
533x312x219 + $N_{pl,Rd} = 7390$ $f_y W_{el,y} = 1430$ $f_y W_{el,z} = 260$	1.00	$N_{b,y,Rd}$	7390	7390	7390	7320	7240	7160	7070	6970	6870	6750	6630	6490	6340
	1.00	$N_{b,z,Rd}$	7120	6690	6170	5550	4850	4140	3500	2950	2500	2130	1840	1600	1400
		$M_{b,Rd}$	1620	1620	1550	1480	1400	1330	1250	1180	1110	1050	989	935	885
533x312x182 + $N_{pl,Rd} = 6120$ $f_y W_{el,y} = 1190$ $f_y W_{el,z} = 214$	1.00	$N_{b,y,Rd}$	6120	6120	6120	6060	5990	5920	5850	5770	5680	5580	5480	5360	5230
	1.00	$N_{b,z,Rd}$	5890	5520	5090	4570	3980	3390	2850	2400	2030	1730	1490	1300	1140
		$M_{b,Rd}$	1330	1330	1270	1200	1130	1060	992	925	862	803	751	703	661
533x312x150 + $N_{pl,Rd} = 5090$ $f_y W_{el,y} = 984$ $f_y W_{el,z} = 175$	1.00	$N_{b,y,Rd}$	5090	5090	5090	5040	4980	4920	4850	4790	4710	4630	4540	4440	4330
	1.00	$N_{b,z,Rd}$	4890	4580	4210	3770	3280	2780	2340	1960	1660	1420	1220	1060	926
		0.288	$M_{b,Rd}$	984	984	941	893	841	788	735	683	634	588	547	510
533x210x138 + $N_{pl,Rd} = 4660$ $f_y W_{el,y} = 831$ $f_y W_{el,z} = 95.7$	1.00	$N_{b,y,Rd}$	4660	4660	4660	4610	4550	4490	4430	4370	4290	4210	4130	4030	3920
	1.00	$N_{b,z,Rd}$	4160	3590	2880	2210	1690	1310	1040	841	694	582	494	425	370
		$M_{b,Rd}$	951	850	755	667	590	526	472	427	390	359	333	310	290
533x210x122 $N_{pl,Rd} = 4110$ $f_y W_{el,y} = 740$ $f_y W_{el,z} = 84.8$	1.00	$N_{b,y,Rd}$	4110	4110	4100	4060	4010	3960	3900	3850	3780	3710	3630	3550	3450
	1.00	$N_{b,z,Rd}$	3660	3160	2530	1940	1480	1150	910	737	608	510	434	373	324
		0.357	$M_{b,Rd}$	740	670	598	531	472	420	377	342	312	286	265	246
* 533x210x109 $N_{pl,Rd} = 3680$ $f_y W_{el,y} = 656$ $f_y W_{el,z} = 73.9$	0.944	$N_{b,y,Rd}$	3680	3680	3680	3640	3590	3550	3500	3440	3390	3320	3250	3170	3080
	0.944	$N_{b,z,Rd}$	3270	2810	2240	1700	1290	1000	795	643	531	445	378	325	282
		0.303	$M_{b,Rd}$	656	589	522	459	403	356	317	284	258	236	217	201
		$M_{b,Rd}$	739	655	572	496	429	375	331	295	267	243	223	206	192

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+ These sections are in addition to the range of BS 4 sections

$$n = N_{Ed} / N_{pl,Rd}$$

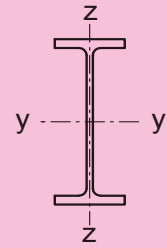
\* The section can become Class 4 under axial compression only. Under combined axial compression and bending the section becomes Class 4 when the Class 3  $N_{Ed} / N_{pl,Rd}$  limit is exceeded.

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit.

For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL BEAMS  
Advance® UKB



Cross-section resistance check

Section Designation and Axial Force Resistance $N_{pl,Rd}$ (kN)	n Limit Class 3 <b>Class 2</b>	Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$												
		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	
		$M_{c,y,Rd}$	$M_{c,z,Rd}$	$M_{N,y,Rd}$	$M_{N,z,Rd}$									
533x210x101 $N_{pl,Rd} = 3420$	0.845 <b>0.260</b>	$M_{c,y,Rd}$	692	692	692	607	607	607	607	607	607	607	✘	\$
		$M_{c,z,Rd}$	106	106	106	67.8	67.8	67.8	67.8	67.8	67.8	67.8	✘	\$
		$M_{N,y,Rd}$	692	692	692	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	106	106	106	-	-	-	-	-	-	-	-	-
533x210x92 $N_{pl,Rd} = 3220$	0.734 <b>0.217</b>	$M_{c,y,Rd}$	649	649	649	570	570	570	570	570	570	✘	✘	\$
		$M_{c,z,Rd}$	97.6	97.6	97.6	62.7	62.7	62.7	62.7	62.7	62.7	✘	✘	\$
		$M_{N,y,Rd}$	649	649	649	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	97.6	97.6	97.6	-	-	-	-	-	-	-	-	-
533x210x82 $N_{pl,Rd} = 2890$	0.673 <b>0.201</b>	$M_{c,y,Rd}$	566	566	566	495	495	495	495	495	✘	✘	✘	\$
		$M_{c,z,Rd}$	82.5	82.5	82.5	52.8	52.8	52.8	52.8	52.8	✘	✘	✘	\$
		$M_{N,y,Rd}$	566	566	566	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	82.5	82.5	82.5	-	-	-	-	-	-	-	-	-
533x165x85 + $N_{pl,Rd} = 2860$	0.782 <b>0.264</b>	$M_{c,y,Rd}$	558	558	558	481	481	481	481	481	✘	✘	✘	\$
		$M_{c,z,Rd}$	64.4	64.4	64.4	40.5	40.5	40.5	40.5	40.5	✘	✘	✘	\$
		$M_{N,y,Rd}$	558	558	558	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	64.4	64.4	64.4	-	-	-	-	-	-	-	-	-
533x165x74 + $N_{pl,Rd} = 2620$	0.686 <b>0.230</b>	$M_{c,y,Rd}$	497	497	497	427	427	427	427	427	✘	✘	✘	\$
		$M_{c,z,Rd}$	55.0	55.0	55.0	34.4	34.4	34.4	34.4	34.4	✘	✘	✘	\$
		$M_{N,y,Rd}$	497	497	497	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	55.0	55.0	55.0	-	-	-	-	-	-	-	-	-
533x165x66 + $N_{pl,Rd} = 2300$	0.588 <b>0.185</b>	$M_{c,y,Rd}$	429	429	367	367	367	367	367	✘	✘	✘	\$	\$
		$M_{c,z,Rd}$	45.7	45.7	28.6	28.6	28.6	28.6	28.6	✘	✘	✘	\$	\$
		$M_{N,y,Rd}$	429	429	-	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	45.7	45.7	-	-	-	-	-	-	-	-	-	-
457x191x161 + $N_{pl,Rd} = 5460$	n/a <b>1.00</b>	$M_{c,y,Rd}$	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	
		$M_{c,z,Rd}$	178	178	178	178	178	178	178	178	178	178	178	
		$M_{N,y,Rd}$	1000	1000	989	865	742	618	495	371	247	124	0	
		$M_{N,z,Rd}$	178	178	178	178	178	171	156	131	96.4	52.9	0	

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+ These sections are in addition to the range of BS 4 sections

$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

✘ Section becomes Class 4, see note 10.

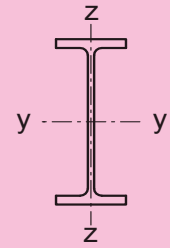
\$ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

- Not applicable for Class 3 and Class 4 sections.

The values in this table are conservative for tension as the more onerous compression section classification limits have been used.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL BEAMS  
Advance® UKB



Member buckling check

Section Designation and Resistances (kN, kNm)	n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
		L (m)	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
		$N_{b,y,Rd}$	$N_{b,z,Rd}$	$M_{b,Rd}$	$N_{b,y,Rd}$	$N_{b,z,Rd}$	$M_{b,Rd}$	$N_{b,y,Rd}$	$N_{b,z,Rd}$	$M_{b,Rd}$	$N_{b,y,Rd}$	$N_{b,z,Rd}$	$M_{b,Rd}$	$N_{b,y,Rd}$	$N_{b,z,Rd}$
* 533x210x101 $N_{pl,Rd} = 3420$ $f_y W_{el,y} = 607$ $f_y W_{el,z} = 67.8$	0.845	$N_{b,y,Rd}$	3420	3420	3410	3370	3330	3290	3250	3200	3140	3080	3020	2940	2860
		$N_{b,z,Rd}$	3030	2600	2060	1570	1190	921	729	590	487	408	346	298	259
	0.260	$M_{b,Rd}$	607	542	479	418	365	320	283	253	228	208	191	177	164
		$M_{b,Rd}$	681	602	523	450	387	336	295	262	236	214	196	181	168
* 533x210x92 $N_{pl,Rd} = 3220$ $f_y W_{el,y} = 570$ $f_y W_{el,z} = 62.7$	0.734	$N_{b,y,Rd}$	3220	3220	3210	3170	3130	3090	3040	3000	2940	2880	2820	2740	2660
		$N_{b,z,Rd}$	2830	2400	1880	1410	1060	820	649	524	432	362	307	264	229
	0.217	$M_{b,Rd}$	565	502	438	378	326	282	248	220	197	178	163	150	139
		$M_{b,Rd}$	634	556	478	406	344	296	257	227	203	183	167	154	140
* 533x210x82 $N_{pl,Rd} = 2890$ $f_y W_{el,y} = 495$ $f_y W_{el,z} = 52.8$	0.673	$N_{b,y,Rd}$	2890	2890	2880	2840	2810	2770	2730	2680	2630	2580	2510	2440	2370
		$N_{b,z,Rd}$	2520	2110	1630	1210	910	700	552	446	367	307	261	224	195
	0.201	$M_{b,Rd}$	488	431	373	319	271	232	202	177	158	142	130	119	109
		$M_{b,Rd}$	549	479	407	341	286	243	209	183	163	146	132	119	109
* 533x165x85 + $N_{pl,Rd} = 2860$ $f_y W_{el,y} = 481$ $f_y W_{el,z} = 40.5$	0.782	$N_{b,y,Rd}$	2860	2860	2850	2820	2780	2750	2710	2660	2610	2560	2500	2430	2360
		$N_{b,z,Rd}$	2310	1730	1200	842	614	465	364	292	239	200	169	145	126
	0.264	$M_{b,Rd}$	435	350	283	233	197	170	150	134	121	110	102	94.4	88.1
		$M_{b,Rd}$	487	383	304	247	207	178	155	138	125	114	105	97.0	90.4
* 533x165x74 + $N_{pl,Rd} = 2620$ $f_y W_{el,y} = 427$ $f_y W_{el,z} = 34.4$	0.686	$N_{b,y,Rd}$	2620	2620	2610	2570	2540	2500	2460	2420	2370	2320	2260	2190	2120
		$N_{b,z,Rd}$	2050	1490	1000	696	505	381	298	239	195	163	138	118	102
	0.230	$M_{b,Rd}$	377	297	236	191	159	135	118	104	93.8	85.2	78.2	72.2	67.2
		$M_{b,Rd}$	422	325	253	202	166	141	122	108	96.6	87.6	80.2	74.1	68.8
* 533x165x66 + $N_{pl,Rd} = 2300$ $f_y W_{el,y} = 367$ $f_y W_{el,z} = 28.6$	0.588	$N_{b,y,Rd}$	2300	2300	2290	2260	2230	2200	2160	2120	2080	2030	1980	1920	1850
		$N_{b,z,Rd}$	1780	1260	841	580	420	317	247	198	162	135	114	98.0	84.9
	0.185	$M_{b,Rd}$	320	249	195	156	128	108	93.4	82.2	73.4	66.4	60.7	55.9	51.9
		$M_{b,Rd}$	359	272	209	164	134	112	96.6	84.8	75.6	68.2	62.2	57.3	53.1
457x191x161 + $N_{pl,Rd} = 5460$ $f_y W_{el,y} = 859$ $f_y W_{el,z} = 113$	1.00	$N_{b,y,Rd}$	5460	5460	5420	5350	5280	5200	5110	5020	4910	4790	4660	4500	4330
		$N_{b,z,Rd}$	4830	4130	3280	2490	1890	1460	1160	935	771	646	549	472	410
		$M_{b,Rd}$	995	901	819	746	682	627	578	536	499	466	437	412	389

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+ These sections are in addition to the range of BS 4 sections

$$n = N_{Ed} / N_{pl,Rd}$$

\* The section can become Class 4 under axial compression only. Under combined axial compression and bending the section becomes Class 4 when the Class 3  $N_{Ed} / N_{pl,Rd}$  limit is exceeded.

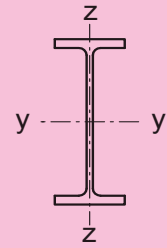
Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit.

For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

FOR EXPLANATION OF TABLES SEE NOTE 10.



UNIVERSAL BEAMS  
Advance® UKB



Cross-section resistance check

Section Designation and Axial Force Resistance $N_{pl,Rd}$ (kN)	n Limit Class 3 <b>Class 2</b>	Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$											
		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
		$M_{c,y,Rd}$	$M_{c,z,Rd}$	$M_{N,y,Rd}$	$M_{N,z,Rd}$								
457x191x133 + $N_{pl,Rd} = 4510$	n/a <b>1.00</b>	$M_{c,y,Rd}$	814	814	814	814	814	814	814	814	814	814	814
		$M_{c,z,Rd}$	142	142	142	142	142	142	142	142	142	142	142
		$M_{N,y,Rd}$	814	814	809	708	607	506	405	303	202	101	0
		$M_{N,z,Rd}$	142	142	142	142	142	137	125	105	77.9	42.8	0
457x191x106 + $N_{pl,Rd} = 3580$	n/a <b>1.00</b>	$M_{c,y,Rd}$	633	633	633	633	633	633	633	633	633	633	633
		$M_{c,z,Rd}$	107	107	107	107	107	107	107	107	107	107	107
		$M_{N,y,Rd}$	633	633	633	557	477	398	318	239	159	79.5	0
		$M_{N,z,Rd}$	107	107	107	107	107	105	96.0	81.2	60.3	33.2	0
457x191x98 $N_{pl,Rd} = 3310$	n/a <b>1.00</b>	$M_{c,y,Rd}$	591	591	591	591	591	591	591	591	591	591	591
		$M_{c,z,Rd}$	100	100	100	100	100	100	100	100	100	100	100
		$M_{N,y,Rd}$	591	591	590	516	442	369	295	221	147	73.7	0
		$M_{N,z,Rd}$	100	100	100	100	100	97.4	88.9	74.9	55.5	30.5	0
457x191x89 $N_{pl,Rd} = 3020$	1.00 <b>0.321</b>	$M_{c,y,Rd}$	534	534	534	534	469	469	469	469	469	469	469
		$M_{c,z,Rd}$	89.6	89.6	89.6	89.6	57.8	57.8	57.8	57.8	57.8	57.8	57.8
		$M_{N,y,Rd}$	534	534	534	468	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	89.6	89.6	89.6	89.6	-	-	-	-	-	-	-
457x191x82 $N_{pl,Rd} = 2860$	0.915 <b>0.283</b>	$M_{c,y,Rd}$	504	504	504	443	443	443	443	443	443	443	\$
		$M_{c,z,Rd}$	83.6	83.6	83.6	53.9	53.9	53.9	53.9	53.9	53.9	53.9	\$
		$M_{N,y,Rd}$	504	504	504	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	83.6	83.6	83.6	-	-	-	-	-	-	-	-
457x191x74 $N_{pl,Rd} = 2600$	0.786 <b>0.227</b>	$M_{c,y,Rd}$	455	455	455	401	401	401	401	401	✘	✘	\$
		$M_{c,z,Rd}$	74.8	74.8	74.8	48.4	48.4	48.4	48.4	48.4	✘	✘	\$
		$M_{N,y,Rd}$	455	455	455	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	74.8	74.8	74.8	-	-	-	-	-	-	-	-
457x191x67 $N_{pl,Rd} = 2350$	0.714 <b>0.205</b>	$M_{c,y,Rd}$	405	405	405	356	356	356	356	356	✘	✘	\$
		$M_{c,z,Rd}$	65.2	65.2	65.2	42.1	42.1	42.1	42.1	42.1	✘	✘	\$
		$M_{N,y,Rd}$	405	405	405	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	65.2	65.2	65.2	-	-	-	-	-	-	-	-

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+ These sections are in addition to the range of BS 4 sections

$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

✘ Section becomes Class 4, see note 10.

\$ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

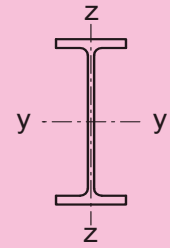
- Not applicable for Class 3 and Class 4 sections.

The values in this table are conservative for tension as the more onerous compression section classification limits have been used.

FOR EXPLANATION OF TABLES SEE NOTE 10.



UNIVERSAL BEAMS  
Advance® UKB



Member buckling check

Section Designation and Resistances (kN, kNm)	n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
		L (m)	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
		$N_{b,y,Rd}$	$N_{b,z,Rd}$	$M_{b,Rd}$											
457x191x133 + $N_{pl,Rd} = 4510$ $f_y W_{el,y} = 704$ $f_y W_{el,z} = 90.4$	1.00	$N_{b,y,Rd}$	4510	4510	4470	4410	4350	4280	4210	4130	4040	3940	3820	3690	3540
	1.00	$N_{b,z,Rd}$	3960	3360	2640	1980	1500	1150	913	738	608	509	432	372	323
		$M_{b,Rd}$	801	718	642	575	517	468	426	391	360	335	312	292	275
457x191x106 + $N_{pl,Rd} = 3580$ $f_y W_{el,y} = 552$ $f_y W_{el,z} = 68.6$	1.00	$N_{b,y,Rd}$	3580	3580	3550	3500	3450	3390	3330	3270	3190	3110	3010	2900	2780
	1.00	$N_{b,z,Rd}$	3130	2620	2030	1510	1140	874	690	557	459	384	326	280	243
		$M_{b,Rd}$	617	545	479	419	368	327	293	265	242	222	206	192	180
457x191x98 $N_{pl,Rd} = 3310$ $f_y W_{el,y} = 519$ $f_y W_{el,z} = 64.4$	1.00	$N_{b,y,Rd}$	3310	3310	3290	3240	3190	3140	3090	3030	2960	2880	2790	2690	2580
	1.00	$N_{b,z,Rd}$	2900	2430	1880	1400	1060	813	642	518	427	357	303	261	226
		$M_{b,Rd}$	575	507	443	386	337	297	265	239	218	200	185	172	161
457x191x89 $N_{pl,Rd} = 3020$ $f_y W_{el,y} = 469$ $f_y W_{el,z} = 57.8$	1.00	$N_{b,y,Rd}$	3020	3020	3000	2950	2910	2860	2810	2760	2690	2620	2540	2450	2340
	1.00	$N_{b,z,Rd}$	2630	2210	1700	1260	948	729	576	465	383	320	272	234	203
		0.321	$M_{b,Rd}$	462	410	361	316	277	244	218	197	179	164	151	141
* 457x191x82 $N_{pl,Rd} = 2860$ $f_y W_{el,y} = 443$ $f_y W_{el,z} = 53.9$	0.915	$N_{b,y,Rd}$	2860	2860	2830	2790	2750	2700	2650	2600	2530	2460	2380	2280	2180
	0.915	$N_{b,z,Rd}$	2470	2040	1550	1140	850	652	514	414	341	285	242	208	180
		0.283	$M_{b,Rd}$	433	381	332	286	248	216	191	171	155	141	130	120
* 457x191x74 $N_{pl,Rd} = 2600$ $f_y W_{el,y} = 401$ $f_y W_{el,z} = 48.4$	0.786	$N_{b,y,Rd}$	2600	2600	2580	2540	2500	2460	2410	2360	2300	2240	2160	2080	1980
	0.786	$N_{b,z,Rd}$	2240	1850	1400	1020	764	586	461	372	306	256	217	187	162
		0.227	$M_{b,Rd}$	390	343	296	253	217	188	165	147	132	120	110	102
* 457x191x67 $N_{pl,Rd} = 2350$ $f_y W_{el,y} = 356$ $f_y W_{el,z} = 42.1$	0.714	$N_{b,y,Rd}$	2350	2350	2330	2290	2260	2220	2170	2130	2070	2010	1940	1860	1770
	0.714	$N_{b,z,Rd}$	2020	1650	1230	899	669	512	403	324	267	223	189	163	141
		0.205	$M_{b,Rd}$	346	302	258	218	185	159	138	122	109	98.8	90.2	82.9
		$M_{b,Rd}$	385	331	278	231	194	165	143	125	112	101	91.6	82.9	75.8

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+ These sections are in addition to the range of BS 4 sections

$$n = N_{Ed} / N_{pl,Rd}$$

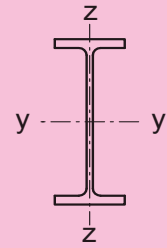
\* The section can become Class 4 under axial compression only. Under combined axial compression and bending the section becomes Class 4 when the Class 3  $N_{Ed} / N_{pl,Rd}$  limit is exceeded.

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit.

For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL BEAMS  
Advance® UKB



Cross-section resistance check

Section Designation and Axial Force Resistance $N_{pl,Rd}$ (kN)	n Limit Class 3 <b>Class 2</b>	Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$																																																			
		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0																																								
		457x152x82 $N_{pl,Rd} = 2780$	1.00 <b>0.349</b>	$M_{c,y,Rd}$	480	480	480	480	416	416	416	416	416	416	416	$M_{c,z,Rd}$	63.6	63.6	63.6	63.6	40.5	40.5	40.5	40.5	40.5	40.5	40.5	$M_{N,y,Rd}$	480	480	480	431	-	-	-	-	-	-	-	$M_{N,z,Rd}$	63.6	63.6	63.6	63.6	-	-	-	-	-	-	-		
457x152x74 $N_{pl,Rd} = 2500$	0.897 <b>0.294</b>	$M_{c,y,Rd}$	431	431	431	375	375	375	375	375	375	375	375	✘	\$	$M_{c,z,Rd}$	56.4	56.4	56.4	36.0	36.0	36.0	36.0	36.0	36.0	36.0	✘	\$	$M_{N,y,Rd}$	431	431	431	-	-	-	-	-	-	-	-	$M_{N,z,Rd}$	56.4	56.4	56.4	-	-	-	-	-	-	-	-	
457x152x67 $N_{pl,Rd} = 2350$	0.786 <b>0.251</b>	$M_{c,y,Rd}$	400	400	400	347	347	347	347	347	347	347	347	✘	✘	$M_{c,z,Rd}$	51.4	51.4	51.4	32.7	32.7	32.7	32.7	32.7	32.7	32.7	✘	✘	$M_{N,y,Rd}$	400	400	400	-	-	-	-	-	-	-	-	$M_{N,z,Rd}$	51.4	51.4	51.4	-	-	-	-	-	-	-	-	
457x152x60 $N_{pl,Rd} = 2100$	0.657 <b>0.192</b>	$M_{c,y,Rd}$	354	354	309	309	309	309	309	309	309	309	309	✘	✘	$M_{c,z,Rd}$	44.8	44.8	28.6	28.6	28.6	28.6	28.6	28.6	28.6	28.6	✘	✘	$M_{N,y,Rd}$	354	354	-	-	-	-	-	-	-	-	-	$M_{N,z,Rd}$	44.8	44.8	-	-	-	-	-	-	-	-	-	
457x152x52 $N_{pl,Rd} = 1830$	0.586 <b>0.169</b>	$M_{c,y,Rd}$	301	301	261	261	261	261	261	261	261	261	261	✘	✘	$M_{c,z,Rd}$	36.6	36.6	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	✘	✘	$M_{N,y,Rd}$	301	301	-	-	-	-	-	-	-	-	-	$M_{N,z,Rd}$	36.6	36.6	-	-	-	-	-	-	-	-	-	
406x178x85 + $N_{pl,Rd} = 2890$	n/a <b>1.00</b>	$M_{c,y,Rd}$	459	459	459	459	459	459	459	459	459	459	459	459	459	$M_{c,z,Rd}$	82.9	82.9	82.9	82.9	82.9	82.9	82.9	82.9	82.9	82.9	82.9	82.9	82.9	$M_{N,y,Rd}$	459	459	457	400	343	286	229	171	114	57.1	0	$M_{N,z,Rd}$	82.9	82.9	82.9	82.9	82.9	80.3	73.3	61.7	45.6	25.1	0
406x178x74 $N_{pl,Rd} = 2600$	1.00 <b>0.313</b>	$M_{c,y,Rd}$	413	413	413	413	364	364	364	364	364	364	364	364	364	$M_{c,z,Rd}$	73.4	73.4	73.4	73.4	47.3	47.3	47.3	47.3	47.3	47.3	47.3	47.3	47.3	$M_{N,y,Rd}$	413	413	411	359	-	-	-	-	-	-	-	$M_{N,z,Rd}$	73.4	73.4	73.4	73.4	-	-	-	-	-	-	-

Advance® and UKB are trademarks of Tata Steel. A fuller description of the relationship between Universal Beams (UB) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

+ These sections are in addition to the range of BS 4 sections

$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

✘ Section becomes Class 4, see note 10.

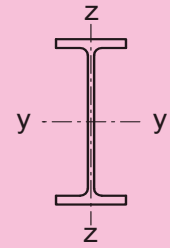
\$ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

- Not applicable for Class 3 and Class 4 sections.

The values in this table are conservative for tension as the more onerous compression section classification limits have been used.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL BEAMS  
Advance® UKB



Member buckling check

Section Designation and Resistances (kN, kNm)	n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
		L (m)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
457x152x82 $N_{pl,Rd} = 2780$ $f_y W_{el,y} = 416$ $f_y W_{el,z} = 40.5$	1.00	$N_{b,y,Rd}$	2780	2780	2780	2780	2780	2780	2760	2720	2680	2630	2590	2530	2470
		$N_{b,z,Rd}$	2650	2460	2230	1950	1650	1370	1130	791	576	436	341	273	224
	0.349	$M_{b,Rd}$	416	416	388	360	333	307	283	242	209	183	163	147	134
		$M_{b,Rd}$	480	472	436	401	367	335	306	257	220	191	169	152	138
* 457x152x74 $N_{pl,Rd} = 2500$ $f_y W_{el,y} = 375$ $f_y W_{el,z} = 36.0$	0.897	$N_{b,y,Rd}$	2500	2500	2500	2500	2500	2500	2480	2450	2410	2370	2330	2280	2220
		$N_{b,z,Rd}$	2380	2200	1990	1740	1470	1210	1000	698	507	384	300	240	197
	0.294	$M_{b,Rd}$	375	373	347	321	295	271	248	209	179	156	138	123	112
		$M_{b,Rd}$	431	422	389	356	325	294	267	221	187	162	142	127	115
* 457x152x67 $N_{pl,Rd} = 2350$ $f_y W_{el,y} = 347$ $f_y W_{el,z} = 32.7$	0.786	$N_{b,y,Rd}$	2350	2350	2350	2350	2350	2340	2330	2290	2260	2220	2180	2130	2070
		$N_{b,z,Rd}$	2220	2050	1840	1590	1320	1080	889	616	447	337	263	211	173
	0.251	$M_{b,Rd}$	347	343	317	291	266	241	219	181	153	132	115	103	92.7
		$M_{b,Rd}$	400	388	355	323	291	261	235	191	159	136	119	106	94.9
* 457x152x60 $N_{pl,Rd} = 2100$ $f_y W_{el,y} = 309$ $f_y W_{el,z} = 28.6$	0.657	$N_{b,y,Rd}$	2100	2100	2100	2100	2100	2090	2070	2040	2010	1970	1930	1890	1840
		$N_{b,z,Rd}$	1980	1820	1630	1400	1160	948	777	537	389	293	229	183	150
	0.192	$M_{b,Rd}$	309	304	280	256	232	210	189	154	128	109	95.3	84.3	75.6
		$M_{b,Rd}$	354	342	313	283	253	226	201	162	133	113	97.9	86.3	76.3
* 457x152x52 $N_{pl,Rd} = 1830$ $f_y W_{el,y} = 261$ $f_y W_{el,z} = 23.4$	0.586	$N_{b,y,Rd}$	1830	1830	1830	1830	1830	1820	1810	1780	1750	1720	1680	1640	1600
		$N_{b,z,Rd}$	1720	1570	1390	1180	968	785	639	439	317	239	186	149	122
	0.169	$M_{b,Rd}$	261	255	234	213	192	171	153	123	101	84.6	72.9	64.0	56.3
		$M_{b,Rd}$	301	289	263	236	209	185	163	128	104	87.1	74.8	64.5	56.3
406x178x85 + $N_{pl,Rd} = 2890$ $f_y W_{el,y} = 403$ $f_y W_{el,z} = 53.3$	1.00	$N_{b,y,Rd}$	2890	2890	2890	2890	2890	2870	2850	2800	2750	2700	2640	2580	2500
		$N_{b,z,Rd}$	2810	2660	2490	2280	2050	1790	1540	1130	844	647	509	411	338
		$M_{b,Rd}$	459	459	441	413	387	361	336	292	255	225	202	182	166
406x178x74 $N_{pl,Rd} = 2600$ $f_y W_{el,y} = 364$ $f_y W_{el,z} = 47.3$	1.00	$N_{b,y,Rd}$	2600	2600	2600	2600	2600	2580	2560	2520	2470	2420	2370	2300	2230
		$N_{b,z,Rd}$	2520	2380	2210	2020	1790	1550	1330	964	715	546	429	346	284
	0.313	$M_{b,Rd}$	364	364	351	330	308	287	267	231	201	177	157	142	129
		$M_{b,Rd}$	413	413	392	365	339	313	289	246	212	185	163	146	133

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+ These sections are in addition to the range of BS 4 sections

$$n = N_{Ed} / N_{pl,Rd}$$

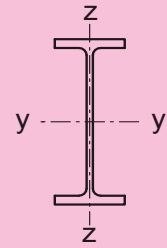
\* The section can become Class 4 under axial compression only. Under combined axial compression and bending the section becomes Class 4 when the Class 3  $N_{Ed} / N_{pl,Rd}$  limit is exceeded.

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit.

For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL BEAMS  
Advance® UKB



Cross-section resistance check

Section Designation and Axial Force Resistance $N_{pl,Rd}$ (kN)	n Limit Class 3 <b>Class 2</b>	Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$												
		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	
		$M_{c,y,Rd}$	$M_{c,z,Rd}$	$M_{N,y,Rd}$	$M_{N,z,Rd}$									
406x178x67 $N_{pl,Rd} = 2350$	0.922 <b>0.274</b>	370	65.2	370	65.2	370	65.2	327	42.1	327	42.1	327	42.1	\$
406x178x60 $N_{pl,Rd} = 2100$	0.777 <b>0.214</b>	330	57.5	330	57.5	292	37.1	292	37.1	292	37.1	292	37.1	\$
406x178x54 $N_{pl,Rd} = 1900$	0.744 <b>0.217</b>	290	49.0	290	49.0	256	31.6	256	31.6	256	31.6	256	31.6	\$
406x140x53 + $N_{pl,Rd} = 1870$	0.777 <b>0.241</b>	284	38.2	284	38.2	247	24.5	247	24.5	247	24.5	247	24.5	\$
406x140x46 $N_{pl,Rd} = 1610$	0.599 <b>0.158</b>	244	32.5	244	20.9	214	20.9	214	20.9	214	20.9	214	20.9	\$
406x140x39 $N_{pl,Rd} = 1370$	0.534 <b>0.142</b>	199	25.0	199	16.0	173	16.0	173	16.0	173	16.0	173	16.0	\$

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+ These sections are in addition to the range of BS 4 sections

$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

✘ Section becomes Class 4, see note 10.

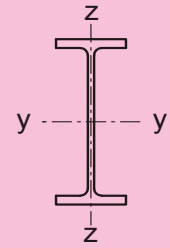
\$ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

- Not applicable for Class 3 and Class 4 sections.

The values in this table are conservative for tension as the more onerous compression section classification limits have been used.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL BEAMS  
Advance® UKB



Member buckling check

Section Designation and Resistances (kN, kNm)	n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm)													
		for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
		L (m)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
* 406x178x67 $N_{pl,Rd} = 2350$ $f_y W_{el,y} = 327$ $f_y W_{el,z} = 42.1$	0.922	$N_{b,y,Rd}$	2350	2350	2350	2350	2350	2330	2310	2280	2230	2190	2140	2080	2010
		$N_{b,z,Rd}$	2280	2150	1990	1810	1610	1390	1180	855	633	483	380	306	251
	0.922	$M_{b,Rd}$	327	327	314	294	274	255	236	202	173	151	133	119	108
		<b>0.274</b>	$M_{b,Rd}$	370	370	350	325	301	277	254	214	182	157	138	123
* 406x178x60 $N_{pl,Rd} = 2100$ $f_y W_{el,y} = 292$ $f_y W_{el,z} = 37.1$	0.777	$N_{b,y,Rd}$	2100	2100	2100	2100	2100	2090	2070	2030	2000	1960	1910	1860	1800
		$N_{b,z,Rd}$	2040	1920	1780	1620	1430	1240	1050	759	562	429	337	271	223
	0.777	$M_{b,Rd}$	292	292	280	261	243	224	207	175	149	128	112	99.9	89.9
		<b>0.214</b>	$M_{b,Rd}$	330	330	310	288	265	243	222	185	155	133	116	103
* 406x178x54 $N_{pl,Rd} = 1900$ $f_y W_{el,y} = 256$ $f_y W_{el,z} = 31.6$	0.744	$N_{b,y,Rd}$	1900	1900	1900	1900	1890	1880	1860	1830	1800	1760	1720	1670	1610
		$N_{b,z,Rd}$	1830	1720	1590	1430	1260	1080	910	652	480	366	287	231	190
	0.744	$M_{b,Rd}$	256	256	243	227	209	193	176	147	124	106	91.7	80.9	72.4
		<b>0.217</b>	$M_{b,Rd}$	290	290	271	250	229	209	189	155	129	109	94.4	83.0
* 406x140x53 + $N_{pl,Rd} = 1870$ $f_y W_{el,y} = 247$ $f_y W_{el,z} = 24.5$	0.777	$N_{b,y,Rd}$	1870	1870	1870	1870	1860	1850	1830	1800	1770	1730	1690	1640	1580
		$N_{b,z,Rd}$	1750	1600	1410	1190	967	781	635	435	314	237	184	148	121
	0.777	$M_{b,Rd}$	247	240	220	200	181	163	147	120	101	86.5	75.7	67.4	60.7
		<b>0.241</b>	$M_{b,Rd}$	284	270	245	221	197	175	156	126	105	89.2	77.8	69.0
* 406x140x46 $N_{pl,Rd} = 1610$ $f_y W_{el,y} = 214$ $f_y W_{el,z} = 20.9$	0.599	$N_{b,y,Rd}$	1610	1610	1610	1610	1610	1600	1580	1560	1530	1490	1460	1410	1360
		$N_{b,z,Rd}$	1500	1370	1210	1010	824	665	539	369	266	200	156	125	102
	0.599	$M_{b,Rd}$	214	207	189	171	153	137	122	98.2	81.2	68.9	59.8	52.8	46.8
		<b>0.158</b>	$M_{b,Rd}$	244	232	210	187	166	146	129	102	83.9	70.8	61.2	53.3
* 406x140x39 $N_{pl,Rd} = 1370$ $f_y W_{el,y} = 173$ $f_y W_{el,z} = 16.0$	0.534	$N_{b,y,Rd}$	1370	1370	1370	1370	1360	1350	1340	1320	1290	1260	1230	1190	1140
		$N_{b,z,Rd}$	1260	1140	988	813	650	519	418	284	204	154	120	95.6	78.2
	0.534	$M_{b,Rd}$	173	165	150	134	119	105	92.3	72.6	58.9	49.3	42.3	36.4	31.7
		<b>0.142</b>	$M_{b,Rd}$	199	186	167	148	129	112	97.4	75.5	60.8	50.5	42.6	36.4

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+ These sections are in addition to the range of BS 4 sections

$$n = N_{Ed} / N_{pl,Rd}$$

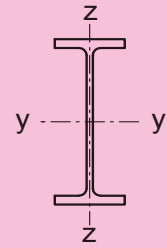
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Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit.

For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL BEAMS  
Advance® UKB



Cross-section resistance check

Section Designation and Axial Force Resistance $N_{pl,Rd}$ (kN)	n Limit Class 3 <b>Class 2</b>	Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$											
		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
		$M_{c,y,Rd}$	$M_{c,z,Rd}$	$M_{N,y,Rd}$	$M_{N,z,Rd}$								
356x171x67 $N_{pl,Rd} = 2350$	n/a <b>1.00</b>	$M_{c,y,Rd}$	333	333	333	333	333	333	333	333	333	333	333
		$M_{c,z,Rd}$	66.8	66.8	66.8	66.8	66.8	66.8	66.8	66.8	66.8	66.8	66.8
		$M_{N,y,Rd}$	333	333	326	285	244	204	163	122	81.4	40.7	0
		$M_{N,z,Rd}$	66.8	66.8	66.8	66.8	66.6	63.8	57.6	48.2	35.4	19.4	0
356x171x57 $N_{pl,Rd} = 2000$	1.00 <b>0.292</b>	$M_{c,y,Rd}$	278	278	278	246	246	246	246	246	246	246	246
		$M_{c,z,Rd}$	54.7	54.7	54.7	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5
		$M_{N,y,Rd}$	278	278	275	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	54.7	54.7	54.7	-	-	-	-	-	-	-	-
356x171x51 $N_{pl,Rd} = 1780$	0.883 <b>0.247</b>	$M_{c,y,Rd}$	246	246	246	219	219	219	219	219	219	✘	\$
		$M_{c,z,Rd}$	47.9	47.9	47.9	31.1	31.1	31.1	31.1	31.1	31.1	✘	\$
		$M_{N,y,Rd}$	246	246	245	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	47.9	47.9	47.9	-	-	-	-	-	-	-	-
356x171x45 $N_{pl,Rd} = 1580$	0.808 <b>0.232</b>	$M_{c,y,Rd}$	213	213	213	189	189	189	189	189	189	✘	\$
		$M_{c,z,Rd}$	40.4	40.4	40.4	26.1	26.1	26.1	26.1	26.1	26.1	✘	\$
		$M_{N,y,Rd}$	213	213	213	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	40.4	40.4	40.4	-	-	-	-	-	-	-	-
356x127x39 $N_{pl,Rd} = 1370$	0.734 <b>0.218</b>	$M_{c,y,Rd}$	181	181	181	158	158	158	158	158	✘	✘	\$
		$M_{c,z,Rd}$	24.5	24.5	24.5	15.7	15.7	15.7	15.7	15.7	✘	✘	\$
		$M_{N,y,Rd}$	181	181	181	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	24.5	24.5	24.5	-	-	-	-	-	-	-	-
356x127x33 $N_{pl,Rd} = 1160$	0.621 <b>0.179</b>	$M_{c,y,Rd}$	149	149	130	130	130	130	130	✘	✘	✘	\$
		$M_{c,z,Rd}$	19.3	19.3	12.4	12.4	12.4	12.4	12.4	✘	✘	✘	\$
		$M_{N,y,Rd}$	149	149	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	19.3	19.3	-	-	-	-	-	-	-	-	-

Advance® and UKB are trademarks of Tata Steel. A fuller description of the relationship between Universal Beams (UB) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

✘ Section becomes Class 4, see note 10.

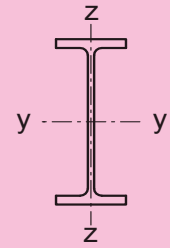
\$ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

- Not applicable for Class 3 and Class 4 sections.

The values in this table are conservative for tension as the more onerous compression section classification limits have been used.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL BEAMS  
Advance® UKB



Member buckling check

Section Designation and Resistances (kN, kNm)	n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
		L (m)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
356x171x67 $N_{pl,Rd} = 2350$ $f_y W_{el,y} = 295$ $f_y W_{el,z} = 43.2$	1.00	$N_{b,y,Rd}$	2350	2350	2350	2350	2340	2320	2300	2250	2200	2150	2080	2010	1920
	1.00	$N_{b,z,Rd}$	2280	2150	1990	1810	1610	1390	1180	855	633	483	380	306	251
		$M_{b,Rd}$	333	333	315	294	273	253	235	202	175	154	137	124	113
356x171x57 $N_{pl,Rd} = 2000$ $f_y W_{el,y} = 246$ $f_y W_{el,z} = 35.5$	1.00	$N_{b,y,Rd}$	2000	2000	2000	2000	1980	1970	1950	1910	1870	1820	1760	1700	1620
	1.00	$N_{b,z,Rd}$	1930	1810	1680	1520	1340	1150	978	703	519	396	311	250	205
		$M_{b,Rd}$	246	246	235	220	204	190	175	150	129	113	100	89.8	81.4
* 356x171x51 $N_{pl,Rd} = 1780$ $f_y W_{el,y} = 219$ $f_y W_{el,z} = 31.1$	0.883	$N_{b,y,Rd}$	1780	1780	1780	1780	1770	1760	1740	1710	1670	1620	1570	1510	1440
	0.883	$N_{b,z,Rd}$	1720	1620	1500	1350	1190	1020	859	616	454	346	271	218	179
		$M_{b,Rd}$	219	219	208	194	180	166	152	129	110	94.9	83.4	74.3	67.0
* 356x171x45 $N_{pl,Rd} = 1580$ $f_y W_{el,y} = 189$ $f_y W_{el,z} = 26.1$	0.808	$N_{b,y,Rd}$	1580	1580	1580	1580	1560	1550	1530	1500	1470	1430	1380	1320	1260
	0.808	$N_{b,z,Rd}$	1520	1420	1310	1170	1020	870	732	521	383	291	228	183	151
		$M_{b,Rd}$	189	189	178	165	153	140	128	106	89.3	76.3	66.4	58.7	52.6
* 356x127x39 $N_{pl,Rd} = 1370$ $f_y W_{el,y} = 158$ $f_y W_{el,z} = 15.7$	0.734	$N_{b,y,Rd}$	1370	1370	1370	1370	1360	1340	1330	1300	1270	1240	1190	1140	1090
	0.734	$N_{b,z,Rd}$	1250	1110	941	754	592	466	373	252	181	135	105	84.0	68.7
		$M_{b,Rd}$	158	148	134	119	105	93.3	82.9	66.8	55.6	47.6	41.6	36.9	32.7
* 356x127x33 $N_{pl,Rd} = 1160$ $f_y W_{el,y} = 130$ $f_y W_{el,z} = 12.4$	0.621	$N_{b,y,Rd}$	1160	1160	1160	1160	1150	1130	1120	1100	1070	1040	1000	958	906
	0.621	$N_{b,z,Rd}$	1050	927	771	608	473	371	296	199	142	107	82.7	66.1	54.0
		$M_{b,Rd}$	130	120	108	94.8	82.8	72.2	63.2	49.9	40.8	34.5	29.7	25.6	22.6
	0.179	$M_{b,Rd}$	149	135	119	103	88.6	76.3	66.3	51.6	41.9	35.3	29.7	25.6	22.6

Advance® and UKB are trademarks of Tata Steel. A fuller description of the relationship between Universal Beams (UB) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

$$n = N_{Ed} / N_{pl,Rd}$$

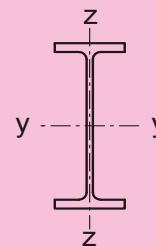
\* The section can become Class 4 under axial compression only. Under combined axial compression and bending the section becomes Class 4 when the Class 3  $N_{Ed} / N_{pl,Rd}$  limit is exceeded.

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit.

For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL BEAMS  
Advance® UKB



Cross-section resistance check

Section Designation and Axial Force Resistance $N_{pl,Rd}$ (kN)	n Limit Class 3 <b>Class 2</b>	Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$											
		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
		$M_{c,y,Rd}$	$M_{c,z,Rd}$	$M_{N,y,Rd}$	$M_{N,z,Rd}$								
305x165x54 $N_{pl,Rd} = 1890$	n/a <b>1.00</b>	$M_{c,y,Rd}$	233	233	233	233	233	233	233	233	233	233	233
		$M_{c,z,Rd}$	53.9	53.9	53.9	53.9	53.9	53.9	53.9	53.9	53.9	53.9	53.9
		$M_{N,y,Rd}$	233	233	224	196	168	140	112	83.9	55.9	28.0	0
		$M_{N,z,Rd}$	53.9	53.9	53.9	53.9	53.4	50.6	45.4	37.7	27.6	15.0	0
305x165x46 $N_{pl,Rd} = 1610$	0.971 <b>0.240</b>	$M_{c,y,Rd}$	198	198	198	178	178	178	178	178	178	178	\$
		$M_{c,z,Rd}$	45.7	45.7	45.7	29.7	29.7	29.7	29.7	29.7	29.7	29.7	\$
		$M_{N,y,Rd}$	198	198	190	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	45.7	45.7	45.7	-	-	-	-	-	-	-	-
305x165x40 $N_{pl,Rd} = 1410$	0.818 <b>0.193</b>	$M_{c,y,Rd}$	171	171	154	154	154	154	154	154	154	✘	\$
		$M_{c,z,Rd}$	39.1	39.1	25.6	25.6	25.6	25.6	25.6	25.6	25.6	✘	\$
		$M_{N,y,Rd}$	171	171	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	39.1	39.1	-	-	-	-	-	-	-	-	-
305x127x48 $N_{pl,Rd} = 1680$	n/a <b>1.00</b>	$M_{c,y,Rd}$	196	196	196	196	196	196	196	196	196	196	196
		$M_{c,z,Rd}$	31.9	31.9	31.9	31.9	31.9	31.9	31.9	31.9	31.9	31.9	31.9
		$M_{N,y,Rd}$	196	196	196	174	149	124	99.4	74.6	49.7	24.9	0
		$M_{N,z,Rd}$	31.9	31.9	31.9	31.9	31.9	31.4	29.0	24.7	18.4	10.2	0
305x127x42 $N_{pl,Rd} = 1470$	n/a <b>1.00</b>	$M_{c,y,Rd}$	169	169	169	169	169	169	169	169	169	169	169
		$M_{c,z,Rd}$	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0	27.0
		$M_{N,y,Rd}$	169	169	169	151	130	108	86.4	64.8	43.2	21.6	0
		$M_{N,z,Rd}$	27.0	27.0	27.0	27.0	27.0	26.6	24.7	21.1	15.7	8.72	0
305x127x37 $N_{pl,Rd} = 1300$	1.00 <b>0.355</b>	$M_{c,y,Rd}$	148	148	148	148	130	130	130	130	130	130	130
		$M_{c,z,Rd}$	23.4	23.4	23.4	23.4	14.9	14.9	14.9	14.9	14.9	14.9	14.9
		$M_{N,y,Rd}$	148	148	148	133	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	23.4	23.4	23.4	23.4	-	-	-	-	-	-	-

Advance® and UKB are trademarks of Tata Steel. A fuller description of the relationship between Universal Beams (UB) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

$N_{Ed}$  = Design value of the axial force.

$$n = N_{Ed} / N_{pl,Rd}$$

✘ Section becomes Class 4, see note 10.

\$ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

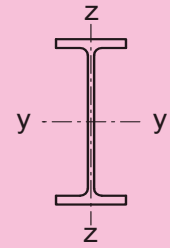
- Not applicable for Class 3 and Class 4 sections.

The values in this table are conservative for tension as the more onerous compression section classification limits have been used.

FOR EXPLANATION OF TABLES SEE NOTE 10.



UNIVERSAL BEAMS  
Advance® UKB



Member buckling check

Section Designation and Resistances (kN, kNm)	n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm)													
		for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
		L (m)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
305x165x54 $N_{pl,Rd} = 1890$ $f_y W_{el,y} = 207$ $f_y W_{el,z} = 34.9$	1.00	$N_{b,y,Rd}$	1890	1890	1890	1880	1860	1840	1820	1780	1730	1670	1600	1510	1410
	1.00	$N_{b,z,Rd}$	1830	1720	1600	1450	1280	1100	933	672	496	379	297	239	196
		$M_{b,Rd}$	233	233	223	212	200	188	176	153	134	118	105	94.1	85.2
* 305x165x46 $N_{pl,Rd} = 1610$ $f_y W_{el,y} = 178$ $f_y W_{el,z} = 29.7$	0.971	$N_{b,y,Rd}$	1610	1610	1610	1610	1590	1570	1560	1520	1480	1420	1360	1290	1200
	0.971 0.240	$N_{b,z,Rd}$	1560	1470	1360	1230	1080	929	788	566	418	319	250	201	165
		$M_{b,Rd}$	178	178	171	163	154	145	136	118	103	89.7	79.4	71.1	63.9
		$M_{b,Rd}$	198	198	189	179	168	157	146	125	107	92.7	81.6	72.5	63.9
* 305x165x40 $N_{pl,Rd} = 1410$ $f_y W_{el,y} = 154$ $f_y W_{el,z} = 25.6$	0.818	$N_{b,y,Rd}$	1410	1410	1410	1400	1390	1370	1360	1330	1290	1240	1190	1120	1040
	0.818 0.193	$N_{b,z,Rd}$	1360	1280	1180	1070	937	803	679	487	359	273	214	173	142
		$M_{b,Rd}$	154	154	148	140	132	124	115	98.2	83.9	72.4	63.4	56.0	49.2
		$M_{b,Rd}$	171	171	163	153	144	133	123	103	87.0	74.5	64.9	56.0	49.2
305x127x48 $N_{pl,Rd} = 1680$ $f_y W_{el,y} = 169$ $f_y W_{el,z} = 20.4$	1.00	$N_{b,y,Rd}$	1680	1680	1680	1670	1650	1640	1620	1580	1530	1470	1400	1310	1210
	1.00	$N_{b,z,Rd}$	1540	1380	1180	951	751	594	477	322	231	173	135	108	88.0
		$M_{b,Rd}$	196	182	165	149	134	121	110	92.0	79.0	69.2	61.6	55.5	50.5
305x127x42 $N_{pl,Rd} = 1470$ $f_y W_{el,y} = 147$ $f_y W_{el,z} = 17.3$	1.00	$N_{b,y,Rd}$	1470	1470	1470	1460	1440	1430	1410	1370	1330	1280	1210	1140	1050
	1.00	$N_{b,z,Rd}$	1340	1200	1010	816	641	506	406	274	196	147	114	91.4	74.7
		$M_{b,Rd}$	169	156	140	125	111	99.5	89.3	73.6	62.4	54.2	47.9	43.0	38.9
305x127x37 $N_{pl,Rd} = 1300$ $f_y W_{el,y} = 130$ $f_y W_{el,z} = 14.9$	1.00	$N_{b,y,Rd}$	1300	1300	1300	1290	1270	1260	1250	1210	1170	1130	1070	1000	921
	1.00 0.355	$N_{b,z,Rd}$	1190	1050	889	711	558	439	352	237	170	127	99.0	79.1	64.6
		$M_{b,Rd}$	130	121	110	98.6	88.1	78.8	70.8	58.3	49.3	42.7	37.7	33.7	30.6
		$M_{b,Rd}$	148	136	121	108	94.9	84.0	74.7	60.7	51.0	43.9	38.6	34.5	30.6

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$$n = N_{Ed} / N_{pl,Rd}$$

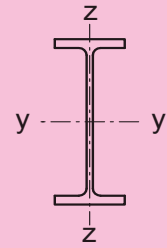
\* The section can become Class 4 under axial compression only. Under combined axial compression and bending the section becomes Class 4 when the Class 3  $N_{Ed} / N_{pl,Rd}$  limit is exceeded.

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit.

For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL BEAMS  
Advance® UKB



Cross-section resistance check

Section Designation and Axial Force Resistance $N_{pl,Rd}$ (kN)	n Limit Class 3 <b>Class 2</b>	Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$											
		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
		$M_{c,y,Rd}$	$M_{c,z,Rd}$	$M_{N,y,Rd}$	$M_{N,z,Rd}$								
305x102x33 $N_{pl,Rd} = 1150$	0.893 <b>0.307</b>	132	132	132	132	114	114	114	114	114	114	✘	\$
		16.5	16.5	16.5	16.5	10.5	10.5	10.5	10.5	10.5	10.5	✘	\$
		132	132	132	121	-	-	-	-	-	-	-	-
		16.5	16.5	16.5	16.5	-	-	-	-	-	-	-	-
305x102x28 $N_{pl,Rd} = 987$	0.767 <b>0.260</b>	111	111	111	95.7	95.7	95.7	95.7	95.7	95.7	✘	✘	\$
		13.2	13.2	13.2	8.53	8.53	8.53	8.53	8.53	8.53	✘	✘	\$
		111	111	111	-	-	-	-	-	-	-	-	-
		13.2	13.2	13.2	-	-	-	-	-	-	-	-	-
305x102x25 $N_{pl,Rd} = 869$	0.724 <b>0.262</b>	94.1	94.1	94.1	80.3	80.3	80.3	80.3	80.3	80.3	✘	✘	\$
		10.7	10.7	10.7	6.60	6.60	6.60	6.60	6.60	6.60	✘	✘	\$
		94.1	94.1	94.1	-	-	-	-	-	-	-	-	-
		10.7	10.7	10.7	-	-	-	-	-	-	-	-	-
254x146x43 $N_{pl,Rd} = 1510$	n/a <b>1.00</b>	156	156	156	156	156	156	156	156	156	156	156	156
		38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8	38.8
		156	156	148	129	111	92.5	74.0	55.5	37.0	18.5	0	0
		38.8	38.8	38.8	38.8	38.2	36.0	32.1	26.6	19.4	10.5	0	0
254x146x37 $N_{pl,Rd} = 1300$	n/a <b>1.00</b>	133	133	133	133	133	133	133	133	133	133	133	133
		32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7
		133	133	127	111	95.1	79.2	63.4	47.5	31.7	15.8	0	0
		32.7	32.7	32.7	32.7	32.3	30.5	27.3	22.6	16.5	8.96	0	0
254x146x31 $N_{pl,Rd} = 1090$	1.00 <b>0.308</b>	108	108	108	108	96.5	96.5	96.5	96.5	96.5	96.5	96.5	96.5
		25.9	25.9	25.9	25.9	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8
		108	108	106	92.7	-	-	-	-	-	-	-	-
		25.9	25.9	25.9	25.9	-	-	-	-	-	-	-	-
254x102x28 $N_{pl,Rd} = 993$	1.00 <b>0.380</b>	97.1	97.1	97.1	97.1	84.7	84.7	84.7	84.7	84.7	84.7	84.7	84.7
		15.1	15.1	15.1	15.1	9.63	9.63	9.63	9.63	9.63	9.63	9.63	9.63
		97.1	97.1	97.1	86.8	-	-	-	-	-	-	-	-
		15.1	15.1	15.1	15.1	-	-	-	-	-	-	-	-

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$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

✘ Section becomes Class 4, see note 10.

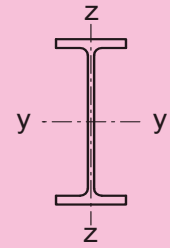
\$ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

- Not applicable for Class 3 and Class 4 sections.

The values in this table are conservative for tension as the more onerous compression section classification limits have been used.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL BEAMS  
Advance® UKB



Member buckling check

Section Designation and Resistances (kN, kNm)	n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
		L (m)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
		$N_{b,y,Rd}$	$N_{b,z,Rd}$	$M_{b,Rd}$	$M_{b,Rd}$										
* 305x102x33 $N_{pl,Rd} = 1150$ $f_y W_{el,y} = 114$ $f_y W_{el,z} = 10.5$	0.893  0.893 <b>0.307</b>	$N_{b,y,Rd}$ $N_{b,z,Rd}$ $M_{b,Rd}$ $M_{b,Rd}$	1150 998 113 128	1150 830 100 112	1150 635 87.8 96.6	1140 469 76.3 82.4	1130 351 66.4 70.7	1120 270 58.2 61.3	1100 213 51.5 53.8	1080 141 41.8 43.2	1040 100 35.1 36.1	1000 74.8 30.3 31.0	954 57.9 26.6 26.6	895 46.2 23.4 23.4	827 37.7 20.8 20.8
* 305x102x28 $N_{pl,Rd} = 987$ $f_y W_{el,y} = 95.7$ $f_y W_{el,z} = 8.53$	0.767  0.767 <b>0.260</b>	$N_{b,y,Rd}$ $N_{b,z,Rd}$ $M_{b,Rd}$ $M_{b,Rd}$	987 849 93.7 106	987 696 82.5 92.2	987 524 71.3 78.2	979 383 60.9 65.5	969 285 52.1 55.2	958 219 45.0 47.2	946 172 39.4 40.9	921 114 31.3 32.2	891 80.9 25.9 26.6	854 60.3 22.1 22.1	810 46.7 18.9 18.9	756 37.2 16.5 16.5	695 30.3 14.7 14.7
* 305x102x25 $N_{pl,Rd} = 869$ $f_y W_{el,y} = 80.3$ $f_y W_{el,z} = 6.60$	0.724  0.724 <b>0.262</b>	$N_{b,y,Rd}$ $N_{b,z,Rd}$ $M_{b,Rd}$ $M_{b,Rd}$	869 734 78.0 89.3	869 587 68.0 76.5	869 430 58.0 63.7	861 310 48.8 52.5	851 229 41.1 43.5	841 175 35.1 36.7	831 137 30.4 31.5	807 90.7 23.8 24.5	780 64.2 19.5 19.6	746 47.9 16.1 16.1	704 37.0 13.7 13.7	654 29.5 12.0 12.0	598 24.0 10.6 10.6
254x146x43 $N_{pl,Rd} = 1510$ $f_y W_{el,y} = 139$ $f_y W_{el,z} = 25.3$	1.00  1.00	$N_{b,y,Rd}$ $N_{b,z,Rd}$ $M_{b,Rd}$	1510 1440 156	1510 1340 154	1500 1220 146	1490 1070 138	1470 917 129	1450 766 121	1430 637 113	1380 447 97.9	1320 326 85.5	1250 247 75.5	1160 193 67.4	1050 155 60.9	943 127 54.8
254x146x37 $N_{pl,Rd} = 1300$ $f_y W_{el,y} = 119$ $f_y W_{el,z} = 21.5$	1.00  1.00	$N_{b,y,Rd}$ $N_{b,z,Rd}$ $M_{b,Rd}$	1300 1240 133	1300 1150 131	1290 1040 124	1280 918 116	1260 781 108	1250 650 100	1230 539 92.6	1190 378 78.8	1130 275 67.6	1070 208 59.0	991 163 52.2	900 131 46.1	803 107 40.9
254x146x31 $N_{pl,Rd} = 1090$ $f_y W_{el,y} = 96.5$ $f_y W_{el,z} = 16.8$	1.00  1.00 <b>0.308</b>	$N_{b,y,Rd}$ $N_{b,z,Rd}$ $M_{b,Rd}$ $M_{b,Rd}$	1090 1040 96.5 108	1090 958 95.5 106	1090 864 90.3 99.5	1070 752 84.7 92.7	1060 632 78.9 85.5	1040 522 72.9 78.2	1030 430 67.0 71.1	992 299 56.3 58.8	946 217 47.8 49.4	888 164 41.2 42.3	817 128 36.2 36.2	736 103 31.4 31.4	653 84.3 27.7 27.7
254x102x28 $N_{pl,Rd} = 993$ $f_y W_{el,y} = 84.7$ $f_y W_{el,z} = 9.63$	1.00  1.00 <b>0.380</b>	$N_{b,y,Rd}$ $N_{b,z,Rd}$ $M_{b,Rd}$ $M_{b,Rd}$	993 869 84.0 94.7	993 732 75.0 83.5	989 569 66.4 72.8	976 425 58.4 63.1	964 320 51.5 54.8	950 246 45.6 48.1	935 195 40.8 42.7	902 129 33.6 34.8	860 92.0 28.5 29.3	808 68.7 24.8 25.4	743 53.2 21.9 22.4	669 42.4 19.7 19.7	594 34.6 17.6 17.6

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$$n = N_{Ed} / N_{pl,Rd}$$

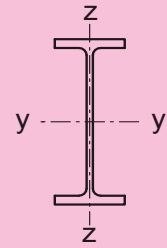
\* The section can become Class 4 under axial compression only. Under combined axial compression and bending the section becomes Class 4 when the Class 3  $N_{Ed} / N_{pl,Rd}$  limit is exceeded.

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit.

For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL BEAMS  
Advance® UKB



Cross-section resistance check

Section Designation and Axial Force Resistance $N_{pl,Rd}$ (kN)	n Limit Class 3 Class 2	Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$											
		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
		$M_{c,y,Rd}$	$M_{c,z,Rd}$	$M_{N,y,Rd}$	$M_{N,z,Rd}$								
254x102x25 $N_{pl,Rd} = 880$	1.00 <b>0.372</b>	84.2	84.2	84.2	84.2	73.2	73.2	73.2	73.2	73.2	73.2	73.2	73.2
254x102x22 $N_{pl,Rd} = 770$	0.974 <b>0.365</b>	71.2	71.2	71.2	71.2	61.6	61.6	61.6	61.6	61.6	61.6	61.6	\$
203x133x30 $N_{pl,Rd} = 1050$	n/a <b>1.00</b>	86.4	86.4	86.4	86.4	86.4	86.4	86.4	86.4	86.4	86.4	86.4	86.4
203x133x25 $N_{pl,Rd} = 880$	n/a <b>1.00</b>	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0	71.0
203x102x23 $N_{pl,Rd} = 809$	n/a <b>1.00</b>	64.4	64.4	64.4	64.4	64.4	64.4	64.4	64.4	64.4	64.4	64.4	64.4
178x102x19 $N_{pl,Rd} = 668$	n/a <b>1.00</b>	47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0	47.0
152x89x16 $N_{pl,Rd} = 558$	n/a <b>1.00</b>	33.8	33.8	33.8	33.8	33.8	33.8	33.8	33.8	33.8	33.8	33.8	33.8
127x76x13 $N_{pl,Rd} = 454$	n/a <b>1.00</b>	23.1	23.1	23.1	23.1	23.1	23.1	23.1	23.1	23.1	23.1	23.1	23.1

Advance® and UKB are trademarks of Tata Steel. A fuller description of the relationship between Universal Beams (UB) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

$N_{Ed}$  = Design value of the axial force.

$$n = N_{Ed} / N_{pl,Rd}$$

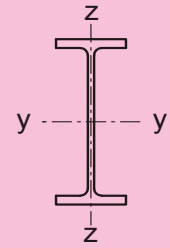
\$ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

- Not applicable for Class 3 and Class 4 sections.

The values in this table are conservative for tension as the more onerous compression section classification limits have been used.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL BEAMS  
Advance® UKB



Member buckling check

Section Designation and Resistances (kN, kNm)	n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
		L (m)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
		$N_{b,y,Rd}$	$N_{b,z,Rd}$	$M_{b,Rd}$	$N_{b,y,Rd}$	$N_{b,z,Rd}$	$M_{b,Rd}$	$N_{b,y,Rd}$	$N_{b,z,Rd}$	$M_{b,Rd}$	$N_{b,y,Rd}$	$N_{b,z,Rd}$	$M_{b,Rd}$	$N_{b,y,Rd}$	$N_{b,z,Rd}$
254x102x25 $N_{pl,Rd} = 880$ $f_y W_{el,y} = 73.2$ $f_y W_{el,z} = 7.98$	1.00	$N_{b,y,Rd}$	880	880	875	864	853	840	827	796	758	709	649	582	513
	1.00	$N_{b,z,Rd}$	764	635	486	359	269	207	163	108	76.8	57.3	44.4	35.4	28.8
	0.372	$M_{b,Rd}$	72.1	63.9	56.0	48.6	42.2	37.0	32.8	26.6	22.3	19.2	16.9	14.8	13.2
		$M_{b,Rd}$	81.5	71.3	61.3	52.3	44.9	38.9	34.2	27.4	22.9	19.7	16.9	14.8	13.2
* 254x102x22 $N_{pl,Rd} = 770$ $f_y W_{el,y} = 61.6$ $f_y W_{el,z} = 6.33$	0.974	$N_{b,y,Rd}$	770	770	765	755	745	734	722	694	658	613	559	498	438
	0.974	$N_{b,z,Rd}$	660	539	404	295	219	168	132	87.4	62.0	46.2	35.7	28.5	23.2
	0.365	$M_{b,Rd}$	60.2	53.0	45.8	39.1	33.5	29.0	25.4	20.2	16.8	14.4	12.3	10.8	9.59
		$M_{b,Rd}$	68.3	59.1	50.1	42.1	35.5	30.4	26.4	20.9	17.3	14.4	12.3	10.8	9.59
203x133x30 $N_{pl,Rd} = 1050$ $f_y W_{el,y} = 77.0$ $f_y W_{el,z} = 15.7$	1.00	$N_{b,y,Rd}$	1050	1050	1040	1020	1000	983	961	909	840	753	657	563	481
	1.00	$N_{b,z,Rd}$	988	907	807	689	568	463	378	260	188	142	111	88.7	72.6
	1.00	$M_{b,Rd}$	86.4	83.9	79.0	73.8	68.7	63.6	58.7	50.2	43.5	38.2	34.0	30.2	26.9
		$M_{b,Rd}$	86.4	83.9	79.0	73.8	68.7	63.6	58.7	50.2	43.5	38.2	34.0	30.2	26.9
203x133x25 $N_{pl,Rd} = 880$ $f_y W_{el,y} = 63.3$ $f_y W_{el,z} = 12.7$	1.00	$N_{b,y,Rd}$	880	880	866	853	838	821	803	757	696	621	539	460	392
	1.00	$N_{b,z,Rd}$	825	755	668	565	463	375	306	210	152	114	89.0	71.3	58.3
	1.00	$M_{b,Rd}$	71.0	68.5	64.1	59.4	54.6	49.8	45.3	37.8	32.0	27.7	24.0	20.9	18.6
		$M_{b,Rd}$	71.0	68.5	64.1	59.4	54.6	49.8	45.3	37.8	32.0	27.7	24.0	20.9	18.6
203x102x23 $N_{pl,Rd} = 809$ $f_y W_{el,y} = 56.9$ $f_y W_{el,z} = 8.80$	1.00	$N_{b,y,Rd}$	809	808	795	783	769	753	736	693	635	564	488	416	353
	1.00	$N_{b,z,Rd}$	719	619	495	378	288	223	177	118	84.1	62.9	48.7	38.9	31.7
	1.00	$M_{b,Rd}$	63.7	58.7	53.5	48.3	43.3	38.8	35.0	29.0	24.7	20.9	18.1	16.0	14.3
		$M_{b,Rd}$	63.7	58.7	53.5	48.3	43.3	38.8	35.0	29.0	24.7	20.9	18.1	16.0	14.3
178x102x19 $N_{pl,Rd} = 668$ $f_y W_{el,y} = 42.1$ $f_y W_{el,z} = 7.43$	1.00	$N_{b,y,Rd}$	668	664	652	639	625	609	591	543	480	408	341	284	238
	1.00	$N_{b,z,Rd}$	595	513	411	314	239	186	147	98.3	70.1	52.4	40.6	32.4	26.4
	1.00	$M_{b,Rd}$	46.6	42.9	39.1	35.2	31.6	28.3	25.5	21.1	17.9	15.2	13.1	11.6	10.3
		$M_{b,Rd}$	46.6	42.9	39.1	35.2	31.6	28.3	25.5	21.1	17.9	15.2	13.1	11.6	10.3
152x89x16 $N_{pl,Rd} = 558$ $f_y W_{el,y} = 30.0$ $f_y W_{el,z} = 5.50$	1.00	$N_{b,y,Rd}$	558	550	538	524	509	491	468	410	341	276	223	183	151
	1.00	$N_{b,z,Rd}$	481	396	300	220	164	126	99.0	65.6	46.6	34.7	26.9	21.4	17.5
	1.00	$M_{b,Rd}$	32.9	30.1	27.2	24.4	21.9	19.7	17.8	14.9	12.7	10.8	9.39	8.31	7.45
		$M_{b,Rd}$	32.9	30.1	27.2	24.4	21.9	19.7	17.8	14.9	12.7	10.8	9.39	8.31	7.45
127x76x13 $N_{pl,Rd} = 454$ $f_y W_{el,y} = 20.6$ $f_y W_{el,z} = 4.13$	1.00	$N_{b,y,Rd}$	452	441	429	414	396	373	344	278	215	168	133	107	88.2
	1.00	$N_{b,z,Rd}$	374	289	204	145	106	80.7	63.2	41.6	29.5	21.9	16.9	13.5	11.0
	1.00	$M_{b,Rd}$	22.0	20.0	18.1	16.3	14.7	13.3	12.1	10.2	8.78	7.52	6.55	5.81	5.22
		$M_{b,Rd}$	22.0	20.0	18.1	16.3	14.7	13.3	12.1	10.2	8.78	7.52	6.55	5.81	5.22

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$$n = N_{Ed} / N_{pl,Rd}$$

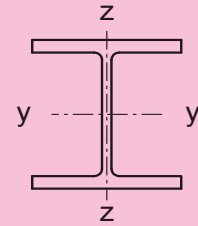
\* The section can become Class 4 under axial compression only. Under combined axial compression and bending the section becomes Class 4 when the Class 3  $N_{Ed} / N_{pl,Rd}$  limit is exceeded.

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit.

For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL COLUMNS  
Advance® UKC



Cross-section resistance check

Section Designation and Axial Force Resistance $N_{pl,Rd}$ (kN)	n Limit Class 3 <b>Class 2</b>	Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$											
		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
		$M_{c,y,Rd}$	$M_{c,z,Rd}$	$M_{N,y,Rd}$	$M_{N,z,Rd}$								
356x406x634 $N_{pl,Rd} = 19800$	n/a <b>1.00</b>	$M_{c,y,Rd}$	3490	3490	3490	3490	3490	3490	3490	3490	3490	3490	3490
		$M_{c,z,Rd}$	1740	1740	1740	1740	1740	1740	1740	1740	1740	1740	1740
		$M_{N,y,Rd}$	3490	3470	3090	2700	2310	1930	1540	1160	772	386	0
		$M_{N,z,Rd}$	1740	1740	1740	1710	1630	1490	1300	1050	755	404	0
356x406x551 $N_{pl,Rd} = 17200$	n/a <b>1.00</b>	$M_{c,y,Rd}$	2960	2960	2960	2960	2960	2960	2960	2960	2960	2960	2960
		$M_{c,z,Rd}$	1480	1480	1480	1480	1480	1480	1480	1480	1480	1480	1480
		$M_{N,y,Rd}$	2960	2950	2620	2300	1970	1640	1310	984	656	328	0
		$M_{N,z,Rd}$	1480	1480	1480	1460	1390	1270	1110	900	646	346	0
356x406x467 $N_{pl,Rd} = 15200$	n/a <b>1.00</b>	$M_{c,y,Rd}$	2550	2550	2550	2550	2550	2550	2550	2550	2550	2550	2550
		$M_{c,z,Rd}$	1280	1280	1280	1280	1280	1280	1280	1280	1280	1280	1280
		$M_{N,y,Rd}$	2550	2550	2260	1980	1700	1410	1130	849	566	283	0
		$M_{N,z,Rd}$	1280	1280	1280	1260	1200	1100	960	780	559	300	0
356x406x393 $N_{pl,Rd} = 12800$	n/a <b>1.00</b>	$M_{c,y,Rd}$	2100	2100	2100	2100	2100	2100	2100	2100	2100	2100	2100
		$M_{c,z,Rd}$	1060	1060	1060	1060	1060	1060	1060	1060	1060	1060	1060
		$M_{N,y,Rd}$	2100	2100	1860	1630	1400	1170	932	699	466	233	0
		$M_{N,z,Rd}$	1060	1060	1060	1040	993	911	795	646	464	248	0
356x406x340 $N_{pl,Rd} = 11000$	n/a <b>1.00</b>	$M_{c,y,Rd}$	1780	1780	1780	1780	1780	1780	1780	1780	1780	1780	1780
		$M_{c,z,Rd}$	904	904	904	904	904	904	904	904	904	904	904
		$M_{N,y,Rd}$	1780	1780	1590	1390	1190	992	794	595	397	198	0
		$M_{N,z,Rd}$	904	904	904	890	848	777	679	551	396	212	0
356x406x287 $N_{pl,Rd} = 9700$	n/a <b>1.00</b>	$M_{c,y,Rd}$	1540	1540	1540	1540	1540	1540	1540	1540	1540	1540	1540
		$M_{c,z,Rd}$	782	782	782	782	782	782	782	782	782	782	782
		$M_{N,y,Rd}$	1540	1540	1370	1200	1030	858	686	515	343	172	0
		$M_{N,z,Rd}$	782	782	782	770	734	674	588	478	343	184	0
356x406x235 $N_{pl,Rd} = 7920$	n/a <b>1.00</b>	$M_{c,y,Rd}$	1240	1240	1240	1240	1240	1240	1240	1240	1240	1240	1240
		$M_{c,z,Rd}$	632	632	632	632	632	632	632	632	632	632	632
		$M_{N,y,Rd}$	1240	1240	1110	967	829	691	553	415	276	138	0
		$M_{N,z,Rd}$	632	632	632	622	593	544	475	386	277	148	0

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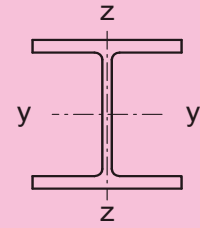
$N_{Ed}$  = Design value of the axial force.

$$n = N_{Ed} / N_{pl,Rd}$$

The values in this table are conservative for tension as the more onerous compression section classification limits have been used.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL COLUMNS  
Advance® UKC



Member buckling check

Section Designation and Resistances (kN, kNm)	n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
		L (m)	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
		$N_{b,y,Rd}$	$N_{b,z,Rd}$	$M_{b,Rd}$											
356x406x634 $N_{pl,Rd} = 19800$ $f_y W_{el,y} = 2840$ $f_y W_{el,z} = 1130$	1.00	$N_{b,y,Rd}$	19800	19800	19500	19100	18700	18200	17700	17200	16700	16100	15400	14700	14000
	1.00	$N_{b,z,Rd}$	19800	18800	17800	16800	15600	14400	13200	12000	10800	9720	8720	7820	7030
		$M_{b,Rd}$	3490	3490	3490	3490	3490	3490	3460	3420	3390	3350	3320	3280	3250
356x406x551 $N_{pl,Rd} = 17200$ $f_y W_{el,y} = 2440$ $f_y W_{el,z} = 968$	1.00	$N_{b,y,Rd}$	17200	17200	16900	16600	16200	15800	15300	14900	14400	13800	13200	12600	12000
	1.00	$N_{b,z,Rd}$	17200	16300	15400	14500	13500	12500	11400	10300	9310	8350	7480	6710	6030
		$M_{b,Rd}$	2960	2960	2960	2960	2960	2950	2910	2870	2840	2810	2780	2750	2720
356x406x467 $N_{pl,Rd} = 15200$ $f_y W_{el,y} = 2140$ $f_y W_{el,z} = 839$	1.00	$N_{b,y,Rd}$	15200	15200	14900	14500	14200	13800	13400	12900	12400	11900	11400	10800	10200
	1.00	$N_{b,z,Rd}$	15100	14300	13500	12600	11700	10800	9770	8790	7870	7030	6270	5600	5020
		$M_{b,Rd}$	2550	2550	2550	2550	2540	2500	2470	2430	2400	2370	2340	2310	2280
356x406x393 $N_{pl,Rd} = 12800$ $f_y W_{el,y} = 1780$ $f_y W_{el,z} = 694$	1.00	$N_{b,y,Rd}$	12800	12800	12500	12200	11900	11500	11200	10800	10400	9910	9420	8910	8380
	1.00	$N_{b,z,Rd}$	12700	12000	11300	10600	9770	8940	8100	7270	6490	5780	5140	4590	4110
		$M_{b,Rd}$	2100	2100	2100	2100	2070	2030	2000	1970	1940	1910	1880	1850	1820
356x406x340 $N_{pl,Rd} = 11000$ $f_y W_{el,y} = 1540$ $f_y W_{el,z} = 593$	1.00	$N_{b,y,Rd}$	11000	11000	10800	10500	10200	9940	9620	9270	8900	8490	8050	7590	7130
	1.00	$N_{b,z,Rd}$	11000	10400	9750	9100	8410	7680	6940	6220	5550	4930	4390	3910	3500
		$M_{b,Rd}$	1780	1780	1780	1780	1750	1710	1680	1650	1620	1590	1560	1540	1510
356x406x287 $N_{pl,Rd} = 9700$ $f_y W_{el,y} = 1340$ $f_y W_{el,z} = 514$	1.00	$N_{b,y,Rd}$	9700	9680	9440	9200	8940	8660	8360	8040	7680	7300	6890	6470	6040
	1.00	$N_{b,z,Rd}$	9600	9060	8500	7910	7270	6610	5950	5300	4710	4170	3700	3290	2940
		$M_{b,Rd}$	1540	1540	1540	1520	1490	1450	1420	1390	1360	1330	1300	1270	1240
356x406x235 $N_{pl,Rd} = 7920$ $f_y W_{el,y} = 1100$ $f_y W_{el,z} = 416$	1.00	$N_{b,y,Rd}$	7920	7900	7700	7500	7290	7060	6810	6530	6240	5920	5580	5230	4880
	1.00	$N_{b,z,Rd}$	7840	7390	6930	6430	5910	5370	4820	4290	3800	3360	2980	2650	2360
		$M_{b,Rd}$	1240	1240	1240	1220	1180	1150	1120	1090	1060	1030	1010	979	953

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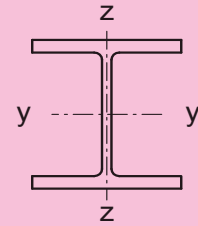
$$n = N_{Ed} / N_{pl,Rd}$$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit.

For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL COLUMNS  
Advance® UKC



Cross-section resistance check

Section Designation and Axial Force Resistance $N_{pl,Rd}$ (kN)	n Limit Class 3 <b>Class 2</b>	Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$											
		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
		$M_{c,y,Rd}$	$M_{c,z,Rd}$	$M_{N,y,Rd}$	$M_{N,z,Rd}$								
356x368x202 $N_{pl,Rd} = 6810$	n/a <b>1.00</b>	$M_{c,y,Rd}$	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050
		$M_{c,z,Rd}$	509	509	509	509	509	509	509	509	509	509	509
		$M_{N,y,Rd}$	1050	1050	942	824	707	589	471	353	236	118	0
		$M_{N,z,Rd}$	509	509	509	502	480	441	386	314	226	121	0
356x368x177 $N_{pl,Rd} = 5990$	n/a <b>1.00</b>	$M_{c,y,Rd}$	916	916	916	916	916	916	916	916	916	916	916
		$M_{c,z,Rd}$	443	443	443	443	443	443	443	443	443	443	443
		$M_{N,y,Rd}$	916	916	821	718	616	513	410	308	205	103	0
		$M_{N,z,Rd}$	443	443	443	438	418	384	336	274	197	106	0
356x368x153 $N_{pl,Rd} = 5170$	n/a <b>1.00</b>	$M_{c,y,Rd}$	786	786	786	786	786	786	786	786	786	786	786
		$M_{c,z,Rd}$	380	380	380	380	380	380	380	380	380	380	380
		$M_{N,y,Rd}$	786	786	704	616	528	440	352	264	176	88.0	0
		$M_{N,z,Rd}$	380	380	380	376	359	330	288	235	169	90.5	0
356x368x129 $N_{pl,Rd} = 4350$	n/a <b>1.00</b>	$M_{c,y,Rd}$	657	657	657	657	657	657	657	657	657	657	657
		$M_{c,z,Rd}$	318	318	318	318	318	318	318	318	318	318	318
		$M_{N,y,Rd}$	657	657	588	515	441	368	294	221	147	73.6	0
		$M_{N,z,Rd}$	318	318	318	314	300	276	241	196	141	75.7	0
305x305x283 $N_{pl,Rd} = 9180$	n/a <b>1.00</b>	$M_{c,y,Rd}$	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300
		$M_{c,z,Rd}$	597	597	597	597	597	597	597	597	597	597	597
		$M_{N,y,Rd}$	1300	1300	1160	1020	873	728	582	437	291	146	0
		$M_{N,z,Rd}$	597	597	597	590	563	517	452	368	264	142	0
305x305x240 $N_{pl,Rd} = 8110$	n/a <b>1.00</b>	$M_{c,y,Rd}$	1130	1130	1130	1130	1130	1130	1130	1130	1130	1130	1130
		$M_{c,z,Rd}$	517	517	517	517	517	517	517	517	517	517	517
		$M_{N,y,Rd}$	1130	1130	1010	883	757	631	505	378	252	126	0
		$M_{N,z,Rd}$	517	517	517	511	488	449	393	320	230	123	0
305x305x198 $N_{pl,Rd} = 6680$	n/a <b>1.00</b>	$M_{c,y,Rd}$	912	912	912	912	912	912	912	912	912	912	912
		$M_{c,z,Rd}$	419	419	419	419	419	419	419	419	419	419	419
		$M_{N,y,Rd}$	912	912	818	716	613	511	409	307	204	102	0
		$M_{N,z,Rd}$	419	419	419	414	396	364	318	259	186	100	0

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$N_{Ed}$  = Design value of the axial force.

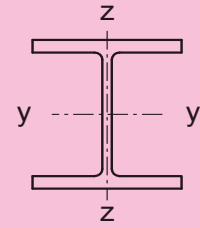
$n = N_{Ed} / N_{pl,Rd}$

The values in this table are conservative for tension as the more onerous compression section classification limits have been used.

FOR EXPLANATION OF TABLES SEE NOTE 10.



UNIVERSAL COLUMNS  
Advance® UKC



Member buckling check

Section Designation and Resistances (kN, kNm)	n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
		L (m)	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
		$N_{b,y,Rd}$	$N_{b,z,Rd}$	$M_{b,Rd}$											
356x368x202 $N_{pl,Rd} = 6810$ $f_y W_{el,y} = 937$ $f_y W_{el,z} = 335$	1.00	$N_{b,y,Rd}$	6810	6780	6610	6440	6250	6050	5830	5590	5330	5050	4750	4450	4140
	1.00	$N_{b,z,Rd}$	6690	6280	5850	5390	4910	4400	3910	3440	3030	2660	2340	2070	1840
		$M_{b,Rd}$	1050	1050	1050	1020	987	956	927	898	870	842	815	789	764
356x368x177 $N_{pl,Rd} = 5990$ $f_y W_{el,y} = 822$ $f_y W_{el,z} = 292$	1.00	$N_{b,y,Rd}$	5990	5960	5810	5650	5480	5300	5100	4890	4660	4400	4140	3860	3590
	1.00	$N_{b,z,Rd}$	5880	5510	5130	4730	4300	3850	3420	3010	2640	2320	2040	1810	1610
		$M_{b,Rd}$	916	916	911	881	851	822	793	765	738	711	685	660	635
356x368x153 $N_{pl,Rd} = 5170$ $f_y W_{el,y} = 711$ $f_y W_{el,z} = 251$	1.00	$N_{b,y,Rd}$	5170	5140	5010	4870	4720	4570	4400	4210	4000	3780	3550	3320	3080
	1.00	$N_{b,z,Rd}$	5070	4750	4420	4070	3700	3310	2930	2580	2260	1990	1750	1550	1370
		$M_{b,Rd}$	786	786	779	751	723	696	668	641	615	589	564	540	518
356x368x129 $N_{pl,Rd} = 4350$ $f_y W_{el,y} = 600$ $f_y W_{el,z} = 210$	1.00	$N_{b,y,Rd}$	4350	4320	4210	4090	3960	3830	3680	3520	3340	3160	2960	2750	2550
	1.00	$N_{b,z,Rd}$	4260	3990	3710	3410	3100	2770	2450	2150	1890	1660	1460	1290	1140
		$M_{b,Rd}$	657	657	649	624	599	573	547	522	496	472	448	426	405
305x305x283 $N_{pl,Rd} = 9180$ $f_y W_{el,y} = 1100$ $f_y W_{el,z} = 390$	1.00	$N_{b,y,Rd}$	9180	9100	8850	8590	8320	8020	7690	7320	6930	6510	6070	5630	5200
	1.00	$N_{b,z,Rd}$	8860	8230	7550	6820	6050	5290	4580	3950	3410	2960	2580	2270	2000
		$M_{b,Rd}$	1300	1300	1300	1280	1250	1230	1200	1180	1160	1140	1120	1090	1070
305x305x240 $N_{pl,Rd} = 8110$ $f_y W_{el,y} = 965$ $f_y W_{el,z} = 338$	1.00	$N_{b,y,Rd}$	8110	8010	7780	7540	7280	7000	6690	6350	5970	5580	5170	4770	4380
	1.00	$N_{b,z,Rd}$	7790	7210	6580	5910	5200	4510	3880	3330	2870	2480	2160	1890	1670
		$M_{b,Rd}$	1130	1130	1120	1090	1060	1040	1010	991	968	946	924	903	882
305x305x198 $N_{pl,Rd} = 6680$ $f_y W_{el,y} = 794$ $f_y W_{el,z} = 275$	1.00	$N_{b,y,Rd}$	6680	6590	6390	6190	5970	5730	5460	5170	4850	4520	4180	3840	3510
	1.00	$N_{b,z,Rd}$	6400	5910	5390	4830	4240	3670	3150	2690	2320	2000	1740	1530	1350
		$M_{b,Rd}$	912	912	899	872	847	823	800	778	756	735	714	694	674

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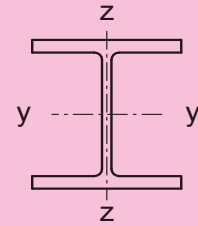
$$n = N_{Ed} / N_{pl,Rd}$$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit.

For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL COLUMNS  
Advance® UKC



Cross-section resistance check

Section Designation and Axial Force Resistance $N_{pl,Rd}$ (kN)	n Limit Class 3 <b>Class 2</b>	Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$											
		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
		$M_{c,y,Rd}$	$M_{c,z,Rd}$	$M_{N,y,Rd}$	$M_{N,z,Rd}$								
305x305x158 $N_{pl,Rd} = 5330$	n/a <b>1.00</b>	$M_{c,y,Rd}$	710	710	710	710	710	710	710	710	710	710	710
		$M_{c,z,Rd}$	326	326	326	326	326	326	326	326	326	326	326
		$M_{N,y,Rd}$	710	710	641	561	480	400	320	240	160	80.1	0
		$M_{N,z,Rd}$	326	326	326	323	309	285	250	204	147	78.8	0
305x305x137 $N_{pl,Rd} = 4610$	n/a <b>1.00</b>	$M_{c,y,Rd}$	609	609	609	609	609	609	609	609	609	609	609
		$M_{c,z,Rd}$	279	279	279	279	279	279	279	279	279	279	279
		$M_{N,y,Rd}$	609	609	550	481	412	344	275	206	137	68.7	0
		$M_{N,z,Rd}$	279	279	279	277	265	244	214	175	126	67.6	0
305x305x118 $N_{pl,Rd} = 3980$	n/a <b>1.00</b>	$M_{c,y,Rd}$	519	519	519	519	519	519	519	519	519	519	519
		$M_{c,z,Rd}$	237	237	237	237	237	237	237	237	237	237	237
		$M_{N,y,Rd}$	519	519	470	411	352	294	235	176	117	58.7	0
		$M_{N,z,Rd}$	237	237	237	235	226	209	183	149	108	57.9	0
305x305x97 $N_{pl,Rd} = 3380$	n/a <b>1.00</b>	$M_{c,y,Rd}$	438	438	438	438	438	438	438	438	438	438	438
		$M_{c,z,Rd}$	200	200	200	200	200	200	200	200	200	200	200
		$M_{N,y,Rd}$	438	438	397	347	298	248	199	149	99.3	49.6	0
		$M_{N,z,Rd}$	200	200	200	198	190	176	154	126	90.8	48.8	0
254x254x167 $N_{pl,Rd} = 5640$	n/a <b>1.00</b>	$M_{c,y,Rd}$	642	642	642	642	642	642	642	642	642	642	642
		$M_{c,z,Rd}$	301	301	301	301	301	301	301	301	301	301	301
		$M_{N,y,Rd}$	642	642	574	503	431	359	287	215	144	71.8	0
		$M_{N,z,Rd}$	301	301	301	297	284	261	228	186	133	71.5	0
254x254x132 $N_{pl,Rd} = 4450$	n/a <b>1.00</b>	$M_{c,y,Rd}$	495	495	495	495	495	495	495	495	495	495	495
		$M_{c,z,Rd}$	233	233	233	233	233	233	233	233	233	233	233
		$M_{N,y,Rd}$	495	495	444	388	333	277	222	166	111	55.4	0
		$M_{N,z,Rd}$	233	233	233	230	220	202	176	144	103	55.4	0
254x254x107 $N_{pl,Rd} = 3600$	n/a <b>1.00</b>	$M_{c,y,Rd}$	393	393	393	393	393	393	393	393	393	393	393
		$M_{c,z,Rd}$	185	185	185	185	185	185	185	185	185	185	185
		$M_{N,y,Rd}$	393	393	354	309	265	221	177	133	88.4	44.2	0
		$M_{N,z,Rd}$	185	185	185	183	175	161	141	115	82.6	44.3	0

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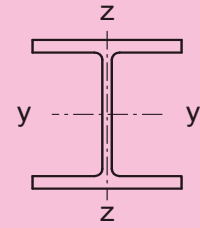
$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

The values in this table are conservative for tension as the more onerous compression section classification limits have been used.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL COLUMNS  
Advance® UKC



Member buckling check

Section Designation and Resistances (kN, kNm)	n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
		L (m)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
		$N_{b,y,Rd}$	$N_{b,z,Rd}$	$M_{b,Rd}$											
305x305x158 $N_{pl,Rd} = 5330$ $f_y W_{el,y} = 628$ $f_y W_{el,z} = 214$	1.00  1.00	$N_{b,y,Rd}$ $N_{b,z,Rd}$ $M_{b,Rd}$	5330 5330 710	5330 5290 710	5330 5090 710	5320 4900 710	5240 4700 710	5160 4490 706	5090 4270 693	4920 3810 668	4740 3330 645	4540 2870 622	4320 2450 601	4080 2100 580	3810 1800 559
305x305x137 $N_{pl,Rd} = 4610$ $f_y W_{el,y} = 543$ $f_y W_{el,z} = 183$	1.00  1.00	$N_{b,y,Rd}$ $N_{b,z,Rd}$ $M_{b,Rd}$	4610 4610 609	4610 4570 609	4610 4400 609	4600 4230 609	4530 4060 609	4460 3870 602	4390 3680 590	4250 3280 567	4090 2860 544	3910 2460 523	3710 2100 502	3500 1790 481	3270 1540 461
305x305x118 $N_{pl,Rd} = 3980$ $f_y W_{el,y} = 466$ $f_y W_{el,z} = 156$	1.00  1.00	$N_{b,y,Rd}$ $N_{b,z,Rd}$ $M_{b,Rd}$	3980 3980 519	3980 3940 519	3980 3790 519	3960 3640 519	3910 3490 511	3850 3330 511	3780 3160 500	3660 2810 478	3520 2450 457	3360 2100 436	3190 1790 416	3000 1530 396	2800 1310 377
305x305x97 $N_{pl,Rd} = 3380$ $f_y W_{el,y} = 397$ $f_y W_{el,z} = 132$	1.00  1.00	$N_{b,y,Rd}$ $N_{b,z,Rd}$ $M_{b,Rd}$	3380 3380 438	3380 3340 438	3380 3210 438	3360 3080 438	3310 2950 437	3260 2810 427	3210 2660 417	3090 2350 396	2970 2030 375	2830 1730 354	2670 1470 333	2500 1250 313	2320 1070 294
254x254x167 $N_{pl,Rd} = 5640$ $f_y W_{el,y} = 550$ $f_y W_{el,z} = 197$	1.00  1.00	$N_{b,y,Rd}$ $N_{b,z,Rd}$ $M_{b,Rd}$	5640 5640 642	5640 5500 642	5640 5260 642	5570 5020 642	5470 4760 642	5370 4500 637	5270 4210 627	5050 3630 609	4810 3060 592	4530 2550 576	4230 2130 561	3890 1790 546	3550 1510 531
254x254x132 $N_{pl,Rd} = 4450$ $f_y W_{el,y} = 432$ $f_y W_{el,z} = 153$	1.00  1.00	$N_{b,y,Rd}$ $N_{b,z,Rd}$ $M_{b,Rd}$	4450 4450 495	4450 4330 495	4450 4140 495	4380 3940 495	4300 3740 495	4220 3520 485	4140 3290 476	3960 2820 460	3760 2370 444	3530 1970 429	3280 1640 415	3010 1370 401	2730 1160 387
254x254x107 $N_{pl,Rd} = 3600$ $f_y W_{el,y} = 348$ $f_y W_{el,z} = 121$	1.00  1.00	$N_{b,y,Rd}$ $N_{b,z,Rd}$ $M_{b,Rd}$	3600 3600 393	3600 3500 393	3600 3340 393	3540 3180 393	3470 3010 389	3410 2830 381	3340 2640 373	3190 2260 357	3020 1880 342	2820 1560 328	2610 1300 314	2380 1080 301	2150 915 288

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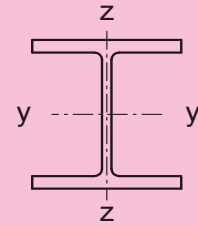
$$n = N_{Ed} / N_{pl,Rd}$$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit.

For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL COLUMNS  
Advance® UKC



Cross-section resistance check

Section Designation and Axial Force Resistance $N_{pl,Rd}$ (kN)	n Limit Class 3 <b>Class 2</b>	Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$											
		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
		$M_{c,y,Rd}$	$M_{c,z,Rd}$	$M_{N,y,Rd}$	$M_{N,z,Rd}$								
254x254x89 $N_{pl,Rd} = 2990$	n/a <b>1.00</b>	$M_{c,y,Rd}$	324	324	324	324	324	324	324	324	324	324	324
		$M_{c,z,Rd}$	152	152	152	152	152	152	152	152	152	152	152
		$M_{N,y,Rd}$	324	324	291	254	218	182	145	109	72.7	36.3	0
		$M_{N,z,Rd}$	152	152	152	151	144	132	116	94.3	67.8	36.4	0
254x254x73 $N_{pl,Rd} = 2560$	n/a <b>1.00</b>	$M_{c,y,Rd}$	273	273	273	273	273	273	273	273	273	273	273
		$M_{c,z,Rd}$	128	128	128	128	128	128	128	128	128	128	128
		$M_{N,y,Rd}$	273	273	246	215	184	154	123	92.1	61.4	30.7	0
		$M_{N,z,Rd}$	128	128	128	127	121	112	97.9	79.8	57.4	30.8	0
203x203x127 + $N_{pl,Rd} = 4290$	n/a <b>1.00</b>	$M_{c,y,Rd}$	402	402	402	402	402	402	402	402	402	402	402
		$M_{c,z,Rd}$	187	187	187	187	187	187	187	187	187	187	187
		$M_{N,y,Rd}$	402	402	358	314	269	224	179	134	89.6	44.8	0
		$M_{N,z,Rd}$	187	187	187	184	175	161	141	114	82.1	44.0	0
203x203x113 + $N_{pl,Rd} = 3840$	n/a <b>1.00</b>	$M_{c,y,Rd}$	352	352	352	352	352	352	352	352	352	352	352
		$M_{c,z,Rd}$	164	164	164	164	164	164	164	164	164	164	164
		$M_{N,y,Rd}$	352	352	315	276	237	197	158	118	78.8	39.4	0
		$M_{N,z,Rd}$	164	164	164	162	155	142	124	101	72.7	39.0	0
203x203x100 + $N_{pl,Rd} = 3370$	n/a <b>1.00</b>	$M_{c,y,Rd}$	304	304	304	304	304	304	304	304	304	304	304
		$M_{c,z,Rd}$	142	142	142	142	142	142	142	142	142	142	142
		$M_{N,y,Rd}$	304	304	273	239	205	170	136	102	68.2	34.1	0
		$M_{N,z,Rd}$	142	142	142	140	134	123	107	87.5	62.9	33.8	0
203x203x86 $N_{pl,Rd} = 2920$	n/a <b>1.00</b>	$M_{c,y,Rd}$	259	259	259	259	259	259	259	259	259	259	259
		$M_{c,z,Rd}$	121	121	121	121	121	121	121	121	121	121	121
		$M_{N,y,Rd}$	259	259	233	204	175	146	116	87.3	58.2	29.1	0
		$M_{N,z,Rd}$	121	121	121	120	114	105	92.2	75.1	54.1	29.0	0
203x203x71 $N_{pl,Rd} = 2400$	n/a <b>1.00</b>	$M_{c,y,Rd}$	212	212	212	212	212	212	212	212	212	212	212
		$M_{c,z,Rd}$	99.0	99.0	99.0	99.0	99.0	99.0	99.0	99.0	99.0	99.0	99.0
		$M_{N,y,Rd}$	212	212	189	166	142	118	94.6	71.0	47.3	23.7	0
		$M_{N,z,Rd}$	99.0	99.0	99.0	97.7	93.3	85.7	74.9	60.9	43.8	23.5	0

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+ These sections are in addition to the range of BS 4 sections

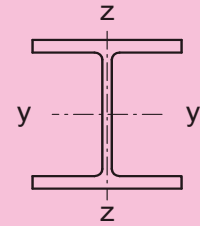
$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

The values in this table are conservative for tension as the more onerous compression section classification limits have been used.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL COLUMNS  
Advance® UKC



Member buckling check

Section Designation and Resistances (kN, kNm)	n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
		L (m)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
		$N_{b,y,Rd}$	$N_{b,z,Rd}$	$M_{b,Rd}$											
254x254x89 $N_{pl,Rd} = 2990$ $f_y W_{el,y} = 291$ $f_y W_{el,z} = 100$	1.00  <b>1.00</b>	$N_{b,y,Rd}$ $N_{b,z,Rd}$ $M_{b,Rd}$	2990 2990 324	2990 2900 324	2990 2770 324	2940 2640 324	2880 2490 319	2830 2340 311	2770 2190 304	2640 1860 289	2500 1560 275	2340 1290 261	2150 1070 248	1960 891 235	1770 752 223
254x254x73 $N_{pl,Rd} = 2560$ $f_y W_{el,y} = 247$ $f_y W_{el,z} = 84.4$	1.00  <b>1.00</b>	$N_{b,y,Rd}$ $N_{b,z,Rd}$ $M_{b,Rd}$	2560 2560 273	2560 2470 273	2550 2360 273	2510 2240 273	2460 2110 266	2410 1980 258	2360 1840 251	2240 1550 237	2110 1290 222	1970 1060 208	1810 873 195	1640 728 182	1470 613 171
203x203x127 + $N_{pl,Rd} = 4290$ $f_y W_{el,y} = 339$ $f_y W_{el,z} = 122$	1.00  <b>1.00</b>	$N_{b,y,Rd}$ $N_{b,z,Rd}$ $M_{b,Rd}$	4290 4280 402	4290 4060 402	4240 3830 402	4150 3590 402	4060 3330 399	3970 3060 393	3860 2780 387	3640 2250 375	3370 1790 364	3080 1440 354	2760 1170 344	2440 961 334	2150 803 325
203x203x113 + $N_{pl,Rd} = 3840$ $f_y W_{el,y} = 300$ $f_y W_{el,z} = 107$	1.00  <b>1.00</b>	$N_{b,y,Rd}$ $N_{b,z,Rd}$ $M_{b,Rd}$	3840 3830 352	3840 3630 352	3790 3420 352	3710 3200 352	3630 2970 347	3540 2720 341	3440 2470 335	3240 1990 324	2990 1590 314	2720 1270 304	2430 1030 295	2150 847 285	1880 707 276
203x203x100 + $N_{pl,Rd} = 3370$ $f_y W_{el,y} = 262$ $f_y W_{el,z} = 92.8$	1.00  <b>1.00</b>	$N_{b,y,Rd}$ $N_{b,z,Rd}$ $M_{b,Rd}$	3370 3350 304	3370 3170 304	3320 2980 304	3250 2790 304	3170 2580 298	3090 2370 292	3010 2150 286	2820 1720 276	2600 1370 266	2360 1090 256	2100 886 247	1850 728 238	1610 608 230
203x203x86 $N_{pl,Rd} = 2920$ $f_y W_{el,y} = 225$ $f_y W_{el,z} = 79.2$	1.00  <b>1.00</b>	$N_{b,y,Rd}$ $N_{b,z,Rd}$ $M_{b,Rd}$	2920 2900 259	2920 2740 259	2870 2580 259	2810 2410 257	2740 2230 251	2670 2040 246	2590 1840 240	2430 1480 230	2230 1170 221	2010 934 212	1790 755 203	1570 621 194	1360 518 186
203x203x71 $N_{pl,Rd} = 2400$ $f_y W_{el,y} = 187$ $f_y W_{el,z} = 65.2$	1.00  <b>1.00</b>	$N_{b,y,Rd}$ $N_{b,z,Rd}$ $M_{b,Rd}$	2400 2380 212	2400 2250 212	2360 2120 212	2300 1970 209	2250 1820 203	2190 1670 198	2130 1510 193	1990 1200 183	1820 952 174	1640 758 165	1450 613 157	1270 504 149	1100 420 142

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+ These sections are in addition to the range of BS 4 sections

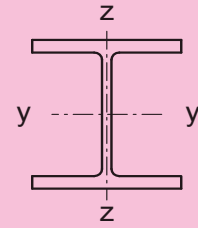
$$n = N_{Ed} / N_{pl,Rd}$$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit.

For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL COLUMNS  
Advance® UKC



Cross-section resistance check

Section Designation and Axial Force Resistance $N_{pl,Rd}$ (kN)	n Limit Class 3 Class 2	Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$											
		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
		$M_{c,y,Rd}$	$M_{c,z,Rd}$	$M_{N,y,Rd}$	$M_{N,z,Rd}$								
203x203x60 $N_{pl,Rd} = 2100$	n/a 1.00	$M_{c,y,Rd}$	180	180	180	180	180	180	180	180	180	180	180
		$M_{c,z,Rd}$	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0	84.0
		$M_{N,y,Rd}$	180	180	164	143	123	102	81.8	61.3	40.9	20.4	0
		$M_{N,z,Rd}$	84.0	84.0	84.0	83.3	80.0	73.9	64.8	52.9	38.2	20.5	0
203x203x52 $N_{pl,Rd} = 1820$	n/a 1.00	$M_{c,y,Rd}$	156	156	156	156	156	156	156	156	156	156	156
		$M_{c,z,Rd}$	72.7	72.7	72.7	72.7	72.7	72.7	72.7	72.7	72.7	72.7	72.7
		$M_{N,y,Rd}$	156	156	141	123	106	88.1	70.5	52.9	35.3	17.6	0
		$M_{N,z,Rd}$	72.7	72.7	72.7	72.0	69.1	63.7	55.9	45.6	32.8	17.6	0
203x203x46 $N_{pl,Rd} = 1610$	n/a 1.00	$M_{c,y,Rd}$	137	137	137	137	137	137	137	137	137	137	137
		$M_{c,z,Rd}$	63.5	63.5	63.5	63.5	63.5	63.5	63.5	63.5	63.5	63.5	63.5
		$M_{N,y,Rd}$	137	137	124	109	93.1	77.6	62.1	46.6	31.0	15.5	0
		$M_{N,z,Rd}$	63.5	63.5	63.5	63.0	60.6	55.9	49.1	40.1	28.9	15.5	0
152x152x51 + $N_{pl,Rd} = 1790$	n/a 1.00	$M_{c,y,Rd}$	120	120	120	120	120	120	120	120	120	120	120
		$M_{c,z,Rd}$	54.7	54.7	54.7	54.7	54.7	54.7	54.7	54.7	54.7	54.7	54.7
		$M_{N,y,Rd}$	120	120	110	95.9	82.2	68.5	54.8	41.1	27.4	13.7	0
		$M_{N,z,Rd}$	54.7	54.7	54.7	54.4	52.3	48.4	42.5	34.7	25.1	13.5	0
152x152x44 + $N_{pl,Rd} = 1540$	n/a 1.00	$M_{c,y,Rd}$	102	102	102	102	102	102	102	102	102	102	102
		$M_{c,z,Rd}$	46.5	46.5	46.5	46.5	46.5	46.5	46.5	46.5	46.5	46.5	46.5
		$M_{N,y,Rd}$	102	102	93.2	81.6	69.9	58.3	46.6	35.0	23.3	11.7	0
		$M_{N,z,Rd}$	46.5	46.5	46.5	46.2	44.5	41.1	36.2	29.6	21.3	11.5	0
152x152x37 $N_{pl,Rd} = 1300$	n/a 1.00	$M_{c,y,Rd}$	84.9	84.9	84.9	84.9	84.9	84.9	84.9	84.9	84.9	84.9	84.9
		$M_{c,z,Rd}$	38.4	38.4	38.4	38.4	38.4	38.4	38.4	38.4	38.4	38.4	38.4
		$M_{N,y,Rd}$	84.9	84.9	77.5	67.8	58.1	48.4	38.7	29.0	19.4	9.68	0
		$M_{N,z,Rd}$	38.4	38.4	38.4	38.2	36.8	34.0	29.9	24.5	17.7	9.51	0
152x152x30 $N_{pl,Rd} = 1050$	n/a 1.00	$M_{c,y,Rd}$	68.1	68.1	68.1	68.1	68.1	68.1	68.1	68.1	68.1	68.1	68.1
		$M_{c,z,Rd}$	30.7	30.7	30.7	30.7	30.7	30.7	30.7	30.7	30.7	30.7	30.7
		$M_{N,y,Rd}$	68.1	68.1	62.3	54.5	46.7	38.9	31.1	23.3	15.6	7.78	0
		$M_{N,z,Rd}$	30.7	30.7	30.7	30.5	29.4	27.3	24.0	19.6	14.2	7.63	0
152x152x23 $N_{pl,Rd} = 803$	1.00 0.00	$M_{c,y,Rd}$	45.1	45.1	45.1	45.1	45.1	45.1	45.1	45.1	45.1	45.1	45.1
		$M_{c,z,Rd}$	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5
		$M_{N,y,Rd}$	-	-	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-

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+ These sections are in addition to the range of BS 4 sections

$N_{Ed}$  = Design value of the axial force.

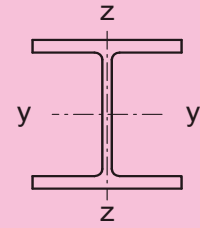
$n = N_{Ed} / N_{pl,Rd}$

- Not applicable for Class 3 and Class 4 sections.

The values in this table are conservative for tension as the more onerous compression section classification limits have been used.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL COLUMNS  
Advance® UKC



Member buckling check

Section Designation and Resistances (kN, kNm)	n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
		L (m)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
		$N_{b,y,Rd}$	$N_{b,z,Rd}$	$M_{b,Rd}$											
203x203x60 $N_{pl,Rd} = 2100$ $f_y W_{el,y} = 161$ $f_y W_{el,z} = 55.2$	1.00	$N_{b,y,Rd}$	2100	2100	2060	2010	1960	1900	1840	1710	1560	1390	1220	1050	911
	1.00	$N_{b,z,Rd}$	2080	1960	1840	1710	1570	1420	1280	1010	791	627	506	414	345
		$M_{b,Rd}$	180	180	180	176	171	165	160	150	141	132	124	116	109
203x203x52 $N_{pl,Rd} = 1820$ $f_y W_{el,y} = 140$ $f_y W_{el,z} = 47.9$	1.00	$N_{b,y,Rd}$	1820	1820	1790	1740	1700	1650	1600	1480	1350	1200	1050	908	785
	1.00	$N_{b,z,Rd}$	1800	1700	1590	1480	1360	1230	1110	871	683	541	436	357	297
		$M_{b,Rd}$	156	156	156	151	146	142	137	127	118	109	102	94.4	88.0
203x203x46 $N_{pl,Rd} = 1610$ $f_y W_{el,y} = 124$ $f_y W_{el,z} = 41.8$	1.00	$N_{b,y,Rd}$	1610	1610	1580	1540	1500	1460	1410	1310	1190	1050	918	794	684
	1.00	$N_{b,z,Rd}$	1590	1500	1410	1300	1200	1080	970	762	596	472	380	311	259
		$M_{b,Rd}$	137	137	137	132	127	123	118	109	100	92.0	84.5	78.0	72.2
152x152x51 + $N_{pl,Rd} = 1790$ $f_y W_{el,y} = 104$ $f_y W_{el,z} = 35.8$	1.00	$N_{b,y,Rd}$	1790	1760	1710	1650	1590	1520	1450	1280	1090	912	758	632	532
	1.00	$N_{b,z,Rd}$	1710	1570	1430	1270	1110	949	809	591	442	341	270	219	180
		$M_{b,Rd}$	120	120	118	115	111	108	105	99.2	93.6	88.3	83.2	78.5	74.1
152x152x44 + $N_{pl,Rd} = 1540$ $f_y W_{el,y} = 89.7$ $f_y W_{el,z} = 30.3$	1.00	$N_{b,y,Rd}$	1540	1520	1470	1420	1370	1310	1240	1090	925	770	638	531	447
	1.00	$N_{b,z,Rd}$	1470	1350	1220	1080	943	808	687	501	374	288	228	185	152
		$M_{b,Rd}$	102	102	99.8	96.4	93.2	90.1	87.1	81.4	76.0	71.0	66.3	62.1	58.2
152x152x37 $N_{pl,Rd} = 1300$ $f_y W_{el,y} = 75.1$ $f_y W_{el,z} = 25.2$	1.00	$N_{b,y,Rd}$	1300	1270	1230	1190	1140	1090	1030	905	766	635	525	437	367
	1.00	$N_{b,z,Rd}$	1230	1130	1020	903	782	668	568	412	308	237	187	151	125
		$M_{b,Rd}$	84.9	84.9	82.1	78.9	75.9	72.9	70.0	64.6	59.5	54.8	50.6	46.9	43.7
152x152x30 $N_{pl,Rd} = 1050$ $f_y W_{el,y} = 61.0$ $f_y W_{el,z} = 20.2$	1.00	$N_{b,y,Rd}$	1050	1030	999	964	926	883	836	729	614	508	419	348	292
	1.00	$N_{b,z,Rd}$	999	916	826	729	630	537	455	330	246	189	149	121	99.7
		$M_{b,Rd}$	68.1	68.1	65.2	62.3	59.5	56.6	53.9	48.7	44.0	39.9	36.3	33.3	30.7
152x152x23 $N_{pl,Rd} = 803$ $f_y W_{el,y} = 45.1$ $f_y W_{el,z} = 14.5$	1.00	$N_{b,y,Rd}$	803	785	759	731	700	665	627	541	451	370	303	251	210
	1.00	$N_{b,z,Rd}$	758	692	620	543	465	393	331	238	177	136	107	86.5	71.3
		$M_{b,Rd}$	45.1	45.1	43.2	41.1	39.0	36.8	34.8	30.8	27.3	24.4	21.9	19.9	18.2

Advance® and UKC are trademarks of Tata Steel. A fuller description of the relationship between Universal Columns (UC) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

+ These sections are in addition to the range of BS 4 sections

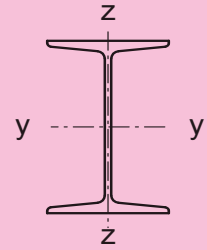
$$n = N_{Ed} / N_{pl,Rd}$$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit.

For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

FOR EXPLANATION OF TABLES SEE NOTE 10.

JOISTS



Cross-section resistance check

Section Designation and Axial Force Resistance $N_{pl,Rd}$ (kN)	n Limit Class 3 <b>Class 2</b>	Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$											
		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
		$M_{c,y,Rd}$	$M_{c,z,Rd}$	$M_{N,y,Rd}$	$M_{N,z,Rd}$								
254x203x82 $N_{pl,Rd} = 2780$	n/a <b>1.00</b>	$M_{c,y,Rd}$	285	285	285	285	285	285	285	285	285	285	285
		$M_{c,z,Rd}$	98.3	98.3	98.3	98.3	98.3	98.3	98.3	98.3	98.3	98.3	98.3
		$M_{N,y,Rd}$	285	285	258	226	193	161	129	96.7	64.5	32.2	0
		$M_{N,z,Rd}$	98.3	98.3	98.3	97.5	93.5	86.2	75.6	61.7	44.4	23.9	0
254x114x37 $N_{pl,Rd} = 1300$	n/a <b>1.00</b>	$M_{c,y,Rd}$	126	126	126	126	126	126	126	126	126	126	126
		$M_{c,z,Rd}$	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8
		$M_{N,y,Rd}$	126	126	125	109	93.6	78.0	62.4	46.8	31.2	15.6	0
		$M_{N,z,Rd}$	21.8	21.8	21.8	21.8	21.7	21.0	19.0	16.0	11.8	6.46	0
203x152x52 $N_{pl,Rd} = 1760$	n/a <b>1.00</b>	$M_{c,y,Rd}$	143	143	143	143	143	143	143	143	143	143	143
		$M_{c,z,Rd}$	46.6	46.6	46.6	46.6	46.6	46.6	46.6	46.6	46.6	46.6	46.6
		$M_{N,y,Rd}$	143	143	131	114	98.0	81.7	65.3	49.0	32.7	16.3	0
		$M_{N,z,Rd}$	46.6	46.6	46.6	46.4	44.7	41.3	36.3	29.7	21.4	11.5	0
152x127x37 $N_{pl,Rd} = 1310$	n/a <b>1.00</b>	$M_{c,y,Rd}$	76.7	76.7	76.7	76.7	76.7	76.7	76.7	76.7	76.7	76.7	76.7
		$M_{c,z,Rd}$	27.4	27.4	27.4	27.4	27.4	27.4	27.4	27.4	27.4	27.4	27.4
		$M_{N,y,Rd}$	76.7	76.7	72.0	63.0	54.0	45.0	36.0	27.0	18.0	9.00	0
		$M_{N,z,Rd}$	27.4	27.4	27.4	27.4	26.8	25.1	22.3	18.4	13.3	7.23	0
127x114x29 $N_{pl,Rd} = 1030$	n/a <b>1.00</b>	$M_{c,y,Rd}$	49.8	49.8	49.8	49.8	49.8	49.8	49.8	49.8	49.8	49.8	49.8
		$M_{c,z,Rd}$	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5	19.5
		$M_{N,y,Rd}$	49.8	49.8	46.8	40.9	35.1	29.2	23.4	17.5	11.7	5.85	0
		$M_{N,z,Rd}$	19.5	19.5	19.5	19.5	19.1	17.8	15.9	13.1	9.50	5.15	0
127x114x27 $N_{pl,Rd} = 941$	n/a <b>1.00</b>	$M_{c,y,Rd}$	47.3	47.3	47.3	47.3	47.3	47.3	47.3	47.3	47.3	47.3	47.3
		$M_{c,z,Rd}$	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8
		$M_{N,y,Rd}$	47.3	47.3	43.0	37.6	32.2	26.8	21.5	16.1	10.7	5.37	0
		$M_{N,z,Rd}$	18.8	18.8	18.8	18.6	17.9	16.5	14.5	11.9	8.55	4.60	0
127x76x16 $N_{pl,Rd} = 580$	n/a <b>1.00</b>	$M_{c,y,Rd}$	28.6	28.6	28.6	28.6	28.6	28.6	28.6	28.6	28.6	28.6	28.6
		$M_{c,z,Rd}$	7.26	7.26	7.26	7.26	7.26	7.26	7.26	7.26	7.26	7.26	7.26
		$M_{N,y,Rd}$	28.6	28.6	27.0	23.6	20.3	16.9	13.5	10.1	6.76	3.38	0
		$M_{N,z,Rd}$	7.26	7.26	7.26	7.26	7.13	6.70	5.96	4.92	3.58	1.94	0

$N_{Ed}$  = Design value of the axial force.

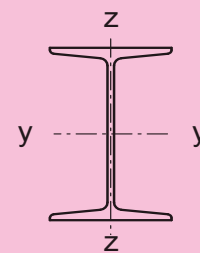
$n = N_{Ed} / N_{pl,Rd}$

The values in this table are conservative for tension as the more onerous compression section classification limits have been used.

FOR EXPLANATION OF TABLES SEE NOTE 10.



JOISTS



Member buckling check

Section Designation and Resistances (kN, kNm)	n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm)													
		for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
		L (m)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
254x203x82 $N_{pl,Rd} = 2780$ $f_y W_{el,y} = 251$ $f_y W_{el,z} = 59.4$	1.00	$N_{b,y,Rd}$	2780	2780	2780	2740	2710	2670	2630	2550	2440	2300	2140	1950	1740
	1.00	$N_{b,z,Rd}$	2740	2620	2480	2320	2140	1930	1720	1310	1000	777	617	500	412
		$M_{b,Rd}$	285	285	285	278	270	263	256	243	231	219	208	197	187
254x114x37 $N_{pl,Rd} = 1300$ $f_y W_{el,y} = 110$ $f_y W_{el,z} = 13.0$	1.00	$N_{b,y,Rd}$	1300	1300	1290	1280	1260	1240	1220	1180	1120	1050	966	869	768
	1.00	$N_{b,z,Rd}$	1160	1000	806	618	472	366	291	194	139	104	80.3	64.1	52.3
		$M_{b,Rd}$	126	113	102	92.0	83.2	75.6	69.1	58.8	51.1	45.1	40.4	36.6	33.5
203x152x52 $N_{pl,Rd} = 1760$ $f_y W_{el,y} = 125$ $f_y W_{el,z} = 28.4$	1.00	$N_{b,y,Rd}$	1760	1760	1740	1710	1680	1650	1610	1520	1410	1260	1090	937	799
	1.00	$N_{b,z,Rd}$	1690	1570	1440	1270	1090	912	760	535	391	296	232	186	153
		$M_{b,Rd}$	143	143	139	134	129	125	121	113	106	98.7	92.2	86.3	80.9
152x127x37 $N_{pl,Rd} = 1310$ $f_y W_{el,y} = 65.7$ $f_y W_{el,z} = 16.4$	1.00	$N_{b,y,Rd}$	1310	1270	1220	1170	1120	1060	990	838	686	556	452	372	311
	1.00	$N_{b,z,Rd}$	1170	1020	851	689	551	442	359	247	179	136	106	85.1	69.9
		$M_{b,Rd}$	76.7	75.5	72.6	69.9	67.5	65.1	62.8	58.4	54.3	50.4	46.9	43.7	40.9
127x114x29 $N_{pl,Rd} = 1030$ $f_y W_{el,y} = 42.4$ $f_y W_{el,z} = 11.6$	1.00	$N_{b,y,Rd}$	1020	977	932	880	820	753	680	535	415	325	259	211	174
	1.00	$N_{b,z,Rd}$	893	758	612	480	375	296	238	162	117	88.1	68.7	55.1	45.1
		$M_{b,Rd}$	49.8	48.5	46.7	44.9	43.3	41.8	40.2	37.3	34.6	32.1	29.8	27.7	25.9
127x114x27 $N_{pl,Rd} = 941$ $f_y W_{el,y} = 41.0$ $f_y W_{el,z} = 11.4$	1.00	$N_{b,y,Rd}$	934	897	857	811	759	701	636	506	395	311	248	202	167
	1.00	$N_{b,z,Rd}$	825	706	578	458	360	286	231	158	114	85.9	67.1	53.8	44.1
		$M_{b,Rd}$	47.3	46.0	44.1	42.3	40.7	39.1	37.6	34.7	32.0	29.5	27.3	25.3	23.6
127x76x16 $N_{pl,Rd} = 580$ $f_y W_{el,y} = 24.8$ $f_y W_{el,z} = 4.40$	1.00	$N_{b,y,Rd}$	578	563	546	526	502	470	432	344	264	205	162	131	107
	1.00	$N_{b,z,Rd}$	462	340	233	162	118	89.3	69.8	45.8	32.4	24.1	18.6	14.8	12.0
		$M_{b,Rd}$	27.4	25.3	23.5	21.7	20.1	18.6	17.2	14.9	13.1	11.6	10.4	9.23	8.30

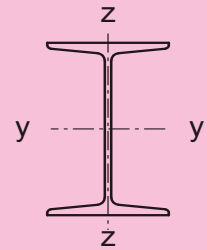
$n = N_{Ed} / N_{pl,Rd}$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit.

For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

FOR EXPLANATION OF TABLES SEE NOTE 10.

JOISTS



Cross-section resistance check

Section Designation and Axial Force Resistance $N_{pl,Rd}$ (kN)	n Limit Class 3 <b>Class 2</b>	Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$											
		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
		$M_{c,y,Rd}$	$M_{c,z,Rd}$	$M_{N,y,Rd}$	$M_{N,z,Rd}$								
114x114x27 $N_{pl,Rd} = 949$	n/a <b>1.00</b>	$M_{c,y,Rd}$	41.5	41.5	41.5	41.5	41.5	41.5	41.5	41.5	41.5	41.5	41.5
		$M_{c,z,Rd}$	18.1	18.1	18.1	18.1	18.1	18.1	18.1	18.1	18.1	18.1	18.1
		$M_{N,y,Rd}$	41.5	41.5	38.9	34.0	29.2	24.3	19.4	14.6	9.72	4.86	0
		$M_{N,z,Rd}$	18.1	18.1	18.1	18.1	17.7	16.5	14.7	12.1	8.77	4.74	0
102x102x23 $N_{pl,Rd} = 806$	n/a <b>1.00</b>	$M_{c,y,Rd}$	31.1	31.1	31.1	31.1	31.1	31.1	31.1	31.1	31.1	31.1	31.1
		$M_{c,z,Rd}$	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.9
		$M_{N,y,Rd}$	31.1	31.1	29.0	25.4	21.8	18.1	14.5	10.9	7.25	3.63	0
		$M_{N,z,Rd}$	13.9	13.9	13.9	13.9	13.6	12.7	11.2	9.23	6.70	3.62	0
102x44x7 $N_{pl,Rd} = 261$	n/a <b>1.00</b>	$M_{c,y,Rd}$	9.74	9.74	9.74	9.74	9.74	9.74	9.74	9.74	9.74	9.74	9.74
		$M_{c,z,Rd}$	1.66	1.66	1.66	1.66	1.66	1.66	1.66	1.66	1.66	1.66	1.66
		$M_{N,y,Rd}$	9.74	9.74	9.74	8.67	7.43	6.19	4.96	3.72	2.48	1.24	0
		$M_{N,z,Rd}$	1.66	1.66	1.66	1.66	1.66	1.63	1.51	1.28	0.958	0.530	0
89x89x19 $N_{pl,Rd} = 685$	n/a <b>1.00</b>	$M_{c,y,Rd}$	22.7	22.7	22.7	22.7	22.7	22.7	22.7	22.7	22.7	22.7	22.7
		$M_{c,z,Rd}$	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5
		$M_{N,y,Rd}$	22.7	22.7	21.3	18.7	16.0	13.3	10.7	7.99	5.33	2.66	0
		$M_{N,z,Rd}$	10.5	10.5	10.5	10.4	10.2	9.55	8.48	6.99	5.08	2.75	0
76x76x15 $N_{pl,Rd} = 525$	n/a <b>1.00</b>	$M_{c,y,Rd}$	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9
		$M_{c,z,Rd}$	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10
		$M_{N,y,Rd}$	14.9	14.9	14.0	12.2	10.5	8.75	7.00	5.25	3.50	1.75	0
		$M_{N,z,Rd}$	7.10	7.10	7.10	7.09	6.94	6.50	5.77	4.76	3.46	1.87	0
76x76x13 $N_{pl,Rd} = 446$	n/a <b>1.00</b>	$M_{c,y,Rd}$	13.4	13.4	13.4	13.4	13.4	13.4	13.4	13.4	13.4	13.4	13.4
		$M_{c,z,Rd}$	6.16	6.16	6.16	6.16	6.16	6.16	6.16	6.16	6.16	6.16	6.16
		$M_{N,y,Rd}$	13.4	13.4	12.0	10.5	8.98	7.48	5.98	4.49	2.99	1.50	0
		$M_{N,z,Rd}$	6.16	6.16	6.16	6.08	5.80	5.33	4.66	3.79	2.72	1.46	0

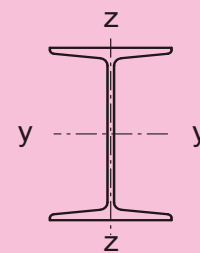
$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

The values in this table are conservative for tension as the more onerous compression section classification limits have been used.

FOR EXPLANATION OF TABLES SEE NOTE 10.

JOISTS



Member buckling check

Section Designation and Resistances (kN, kNm)	n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm)													
		for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
		L (m)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
114x114x27 $N_{pl,Rd} = 949$ $f_y W_{el,y} = 35.5$ $f_y W_{el,z} = 10.8$	1.00	$N_{b,y,Rd}$	932	888	839	783	717	644	568	430	326	252	200	162	133
	1.00	$N_{b,z,Rd}$	825	701	567	445	347	275	221	151	109	81.9	63.9	51.2	41.9
		$M_{b,Rd}$	41.5	40.7	39.3	38.0	36.7	35.5	34.4	32.1	30.0	28.0	26.2	24.5	23.0
102x102x23 $N_{pl,Rd} = 806$ $f_y W_{el,y} = 26.3$ $f_y W_{el,z} = 8.33$	1.00	$N_{b,y,Rd}$	782	738	688	628	559	486	416	302	224	172	135	109	89.3
	1.00	$N_{b,z,Rd}$	678	556	432	328	251	196	156	106	75.8	56.9	44.3	35.5	29.0
		$M_{b,Rd}$	31.1	30.3	29.2	28.2	27.2	26.3	25.4	23.7	22.1	20.5	19.1	17.9	16.7
102x44x7 $N_{pl,Rd} = 261$ $f_y W_{el,y} = 8.28$ $f_y W_{el,z} = 0.965$	1.00	$N_{b,y,Rd}$	256	247	235	219	198	173	147	105	76.3	57.6	44.9	36.0	29.4
	1.00	$N_{b,z,Rd}$	115	59.6	35.4	23.3	16.5	12.3	9.49	6.15	4.31	3.18	2.45	1.94	1.58
		$M_{b,Rd}$	7.39	6.05	5.07	4.35	3.80	3.38	3.03	2.53	2.14	1.83	1.60	1.42	1.28
89x89x19 $N_{pl,Rd} = 685$ $f_y W_{el,y} = 19.0$ $f_y W_{el,z} = 6.27$	1.00	$N_{b,y,Rd}$	653	608	553	487	416	347	288	202	147	112	87.3	70.1	57.5
	1.00	$N_{b,z,Rd}$	550	430	317	233	175	135	107	71.5	51.0	38.2	29.7	23.7	19.4
		$M_{b,Rd}$	22.7	22.1	21.3	20.5	19.9	19.2	18.5	17.3	16.1	15.0	14.0	13.0	12.2
76x76x15 $N_{pl,Rd} = 525$ $f_y W_{el,y} = 12.4$ $f_y W_{el,z} = 4.18$	1.00	$N_{b,y,Rd}$	490	446	391	327	265	213	173	118	85.2	64.1	49.9	40.0	32.7
	1.00	$N_{b,z,Rd}$	398	293	205	147	108	82.9	65.3	43.4	30.9	23.1	17.9	14.3	11.7
		$M_{b,Rd}$	14.9	14.3	13.7	13.2	12.8	12.3	11.8	10.9	10.1	9.37	8.68	8.07	7.53
76x76x13 $N_{pl,Rd} = 446$ $f_y W_{el,y} = 11.4$ $f_y W_{el,z} = 3.74$	1.00	$N_{b,y,Rd}$	418	383	339	288	236	192	156	107	77.6	58.5	45.6	36.5	29.9
	1.00	$N_{b,z,Rd}$	338	250	176	125	92.8	71.0	56.0	37.2	26.5	19.8	15.4	12.2	10.0
		$M_{b,Rd}$	13.2	12.6	12.0	11.5	11.0	10.5	10.0	9.15	8.34	7.63	7.00	6.46	5.98

$n = N_{Ed} / N_{pl,Rd}$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit.

For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

FOR EXPLANATION OF TABLES SEE NOTE 10.

# AXIAL FORCE & BENDING

## HOT-FINISHED HOLLOW SECTIONS - S275

There are no resistance tables given for hot-finished hollow sections in S275, because hot finished hollow sections are normally available in S355 only.

S355 resistance tables are given for hot-finished hollow sections in part D (pages D - 210 to D - 311). However, to maintain consistent page numbering between S275 resistance tables and S355 resistance tables, pages C - 210 to C - 311 are omitted here.

# AXIAL FORCE & BENDING

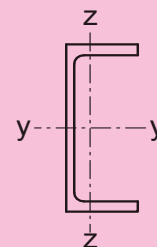
## **COLD-FORMED HOLLOW SECTIONS - S275**

There are no resistance tables given for cold-formed hollow sections in S275, because cold-formed hollow sections are normally available in S235 and S355 only. No resistance tables

S355 resistance tables are given for cold-formed hollow sections in part D (pages D - 312 to D - 375). However, to maintain consistent page numbering between S275 resistance tables and S355 resistance tables, pages C - 312 to C - 375 are omitted here.

PARALLEL FLANGE CHANNEL

Advance® UKPFC



Cross-section resistance check

Section Designation and Axial Force Resistance $N_{pl,Rd}$ (kN)	n Limit Class 3 <b>Class 2</b>	Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$											
		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
		$M_{c,y,Rd}$	$M_{c,z,Rd}$	$M_{N,y,Rd}$	$M_{N,z,Rd}$								
430x100x64 $N_{pl,Rd} = 2180$	n/a <b>1.00</b>	$M_{c,y,Rd}$	324	324	324	324	324	324	324	324	324	324	324
		$M_{c,z,Rd}$	46.6	46.6	46.6	46.6	46.6	46.6	46.6	46.6	46.6	46.6	46.6
		$M_{N,y,Rd}$											
		$M_{N,z,Rd}$											
380x100x54 $N_{pl,Rd} = 1820$	n/a <b>1.00</b>	$M_{c,y,Rd}$	247	247	247	247	247	247	247	247	247	247	247
		$M_{c,z,Rd}$	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7	42.7
		$M_{N,y,Rd}$											
		$M_{N,z,Rd}$											
300x100x46 $N_{pl,Rd} = 1540$	n/a <b>1.00</b>	$M_{c,y,Rd}$	170	170	170	170	170	170	170	170	170	170	170
		$M_{c,z,Rd}$	39.2	39.2	39.2	39.2	39.2	39.2	39.2	39.2	39.2	39.2	39.2
		$M_{N,y,Rd}$											
		$M_{N,z,Rd}$											
300x90x41 $N_{pl,Rd} = 1450$	n/a <b>1.00</b>	$M_{c,y,Rd}$	156	156	156	156	156	156	156	156	156	156	156
		$M_{c,z,Rd}$	31.4	31.4	31.4	31.4	31.4	31.4	31.4	31.4	31.4	31.4	31.4
		$M_{N,y,Rd}$											
		$M_{N,z,Rd}$											
260x90x35 $N_{pl,Rd} = 1220$	n/a <b>1.00</b>	$M_{c,y,Rd}$	117	117	117	117	117	117	117	117	117	117	117
		$M_{c,z,Rd}$	28.1	28.1	28.1	28.1	28.1	28.1	28.1	28.1	28.1	28.1	28.1
		$M_{N,y,Rd}$											
		$M_{N,z,Rd}$											
260x75x28 $N_{pl,Rd} = 965$	n/a <b>1.00</b>	$M_{c,y,Rd}$	90.2	90.2	90.2	90.2	90.2	90.2	90.2	90.2	90.2	90.2	90.2
		$M_{c,z,Rd}$	17.1	17.1	17.1	17.1	17.1	17.1	17.1	17.1	17.1	17.1	17.1
		$M_{N,y,Rd}$											
		$M_{N,z,Rd}$											
230x90x32 $N_{pl,Rd} = 1130$	n/a <b>1.00</b>	$M_{c,y,Rd}$	97.6	97.6	97.6	97.6	97.6	97.6	97.6	97.6	97.6	97.6	97.6
		$M_{c,z,Rd}$	27.2	27.2	27.2	27.2	27.2	27.2	27.2	27.2	27.2	27.2	27.2
		$M_{N,y,Rd}$											
		$M_{N,z,Rd}$											
230x75x26 $N_{pl,Rd} = 899$	n/a <b>1.00</b>	$M_{c,y,Rd}$	76.5	76.5	76.5	76.5	76.5	76.5	76.5	76.5	76.5	76.5	76.5
		$M_{c,z,Rd}$	17.4	17.4	17.4	17.4	17.4	17.4	17.4	17.4	17.4	17.4	17.4
		$M_{N,y,Rd}$											
		$M_{N,z,Rd}$											

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$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

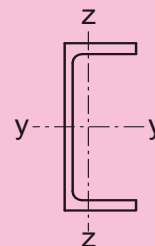
The values in this table are conservative for tension as the more onerous compression section classification limits have been used.

Reduced moment resistance  $M_{N,y,Rd}$  and  $M_{N,z,Rd}$  are not calculated for channels.

FOR EXPLANATION OF TABLES SEE NOTE 10.

PARALLEL FLANGE CHANNEL

Advance® UKPFC



Member buckling check

Section Designation and Resistances (kN, kNm)	n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
		L (m)	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
430x100x64 $N_{pl,Rd} = 2180$ $f_y W_{el,y} = 270$ $f_y W_{el,z} = 25.9$	1.00	$N_{b,y,Rd}$	2180	2170	2090	2010	1930	1850	1770	1680	1590	1490	1400	1300	1210
		$N_{b,z,Rd}$	1490	1010	668	464	338	257	201	162	133	111	94.1	80.8	70.1
	1.00	$M_{b,Rd}$	260	204	165	138	119	105	94.0	85.2	78.0	71.9	66.8	62.4	58.5
380x100x54 $N_{pl,Rd} = 1820$ $f_y W_{el,y} = 210$ $f_y W_{el,z} = 23.6$	1.00	$N_{b,y,Rd}$	1820	1790	1720	1650	1580	1500	1420	1330	1250	1160	1070	990	911
		$N_{b,z,Rd}$	1270	873	586	409	298	227	178	143	118	98.3	83.3	71.6	62.1
	1.00	$M_{b,Rd}$	200	158	129	109	94.0	83.0	74.4	67.5	61.8	57.1	53.1	49.6	46.6
300x100x46 $N_{pl,Rd} = 1540$ $f_y W_{el,y} = 145$ $f_y W_{el,z} = 21.7$	1.00	$N_{b,y,Rd}$	1540	1470	1400	1320	1230	1150	1060	964	875	790	712	641	578
		$N_{b,z,Rd}$	1090	758	512	358	262	199	156	126	104	86.6	73.4	63.1	54.8
	1.00	$M_{b,Rd}$	141	114	95.8	82.4	72.4	64.6	58.4	53.4	49.2	45.6	42.5	39.9	37.5
300x90x41 $N_{pl,Rd} = 1450$ $f_y W_{el,y} = 132$ $f_y W_{el,z} = 17.4$	1.00	$N_{b,y,Rd}$	1450	1380	1310	1230	1150	1060	971	882	795	715	642	576	518
		$N_{b,z,Rd}$	931	597	387	266	193	146	114	91.4	74.9	62.5	53.0	45.5	39.5
	1.00	$M_{b,Rd}$	121	95.0	78.1	66.3	57.7	51.2	46.1	41.9	38.5	35.6	33.1	31.0	29.1
260x90x35 $N_{pl,Rd} = 1220$ $f_y W_{el,y} = 100$ $f_y W_{el,z} = 15.5$	1.00	$N_{b,y,Rd}$	1210	1140	1060	988	907	822	736	655	579	512	454	403	359
		$N_{b,z,Rd}$	795	515	336	231	168	127	99.1	79.6	65.3	54.5	46.2	39.7	34.4
	1.00	$M_{b,Rd}$	91.1	72.4	59.9	51.1	44.7	39.7	35.8	32.6	30.0	27.8	25.9	24.2	22.8
260x75x28 $N_{pl,Rd} = 965$ $f_y W_{el,y} = 76.5$ $f_y W_{el,z} = 9.46$	1.00	$N_{b,y,Rd}$	951	895	837	775	709	640	572	506	447	394	348	309	275
		$N_{b,z,Rd}$	520	303	189	127	91.5	68.8	53.5	42.8	35.1	29.2	24.7	21.2	18.4
	1.00	$M_{b,Rd}$	61.6	46.6	37.3	31.2	26.9	23.7	21.2	19.2	17.6	16.2	15.0	14.0	13.2
230x90x32 $N_{pl,Rd} = 1130$ $f_y W_{el,y} = 84.2$ $f_y W_{el,z} = 15.1$	1.00	$N_{b,y,Rd}$	1100	1030	952	871	785	697	613	535	467	408	358	316	280
		$N_{b,z,Rd}$	743	485	317	219	159	120	94.0	75.5	61.9	51.7	43.8	37.6	32.6
	1.00	$M_{b,Rd}$	77.5	62.8	52.7	45.5	40.1	35.8	32.4	29.7	27.3	25.4	23.7	22.2	20.9
230x75x26 $N_{pl,Rd} = 899$ $f_y W_{el,y} = 65.7$ $f_y W_{el,z} = 9.57$	1.00	$N_{b,y,Rd}$	876	818	757	691	622	551	483	421	367	320	281	247	219
		$N_{b,z,Rd}$	496	292	182	123	88.7	66.7	51.9	41.6	34.0	28.4	24.0	20.6	17.8
	1.00	$M_{b,Rd}$	54.0	42.0	34.3	29.1	25.3	22.5	20.2	18.4	16.8	15.6	14.5	13.6	12.7

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$n = N_{Ed} / N_{pl,Rd}$

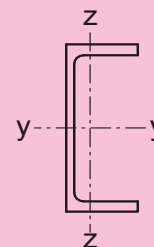
Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit.

For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

FOR EXPLANATION OF TABLES SEE NOTE 10.

PARALLEL FLANGE CHANNEL

Advance® UKPFC



Cross-section resistance check

Section Designation and Axial Force Resistance $N_{pl,Rd}$ (kN)	n Limit Class 3 <b>Class 2</b>	Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$											
		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
		$M_{c,y,Rd}$	$M_{c,z,Rd}$	$M_{N,y,Rd}$	$M_{N,z,Rd}$								
200x90x30 $N_{pl,Rd} = 1040$	n/a <b>1.00</b>	$M_{c,y,Rd}$	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0	80.0
		$M_{c,z,Rd}$	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0
		$M_{N,y,Rd}$											
		$M_{N,z,Rd}$											
200x75x23 $N_{pl,Rd} = 822$	n/a <b>1.00</b>	$M_{c,y,Rd}$	62.4	62.4	62.4	62.4	62.4	62.4	62.4	62.4	62.4	62.4	62.4
		$M_{c,z,Rd}$	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7
		$M_{N,y,Rd}$											
		$M_{N,z,Rd}$											
180x90x26 $N_{pl,Rd} = 913$	n/a <b>1.00</b>	$M_{c,y,Rd}$	63.8	63.8	63.8	63.8	63.8	63.8	63.8	63.8	63.8	63.8	63.8
		$M_{c,z,Rd}$	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0	23.0
		$M_{N,y,Rd}$											
		$M_{N,z,Rd}$											
180x75x20 $N_{pl,Rd} = 712$	n/a <b>1.00</b>	$M_{c,y,Rd}$	48.4	48.4	48.4	48.4	48.4	48.4	48.4	48.4	48.4	48.4	48.4
		$M_{c,z,Rd}$	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2
		$M_{N,y,Rd}$											
		$M_{N,z,Rd}$											
150x90x24 $N_{pl,Rd} = 836$	n/a <b>1.00</b>	$M_{c,y,Rd}$	49.2	49.2	49.2	49.2	49.2	49.2	49.2	49.2	49.2	49.2	49.2
		$M_{c,z,Rd}$	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1
		$M_{N,y,Rd}$											
		$M_{N,z,Rd}$											
150x75x18 $N_{pl,Rd} = 627$	n/a <b>1.00</b>	$M_{c,y,Rd}$	36.3	36.3	36.3	36.3	36.3	36.3	36.3	36.3	36.3	36.3	36.3
		$M_{c,z,Rd}$	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0
		$M_{N,y,Rd}$											
		$M_{N,z,Rd}$											
125x65x15 $N_{pl,Rd} = 517$	n/a <b>1.00</b>	$M_{c,y,Rd}$	24.7	24.7	24.7	24.7	24.7	24.7	24.7	24.7	24.7	24.7	24.7
		$M_{c,z,Rd}$	9.13	9.13	9.13	9.13	9.13	9.13	9.13	9.13	9.13	9.13	9.13
		$M_{N,y,Rd}$											
		$M_{N,z,Rd}$											
100x50x10 $N_{pl,Rd} = 358$	n/a <b>1.00</b>	$M_{c,y,Rd}$	13.4	13.4	13.4	13.4	13.4	13.4	13.4	13.4	13.4	13.4	13.4
		$M_{c,z,Rd}$	4.81	4.81	4.81	4.81	4.81	4.81	4.81	4.81	4.81	4.81	4.81
		$M_{N,y,Rd}$											
		$M_{N,z,Rd}$											

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$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

The values in this table are conservative for tension as the more onerous compression section classification limits have been used.

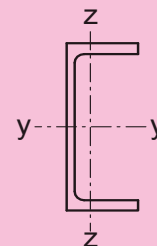
Reduced moment resistance  $M_{N,y,Rd}$  and  $M_{N,z,Rd}$  are not calculated for channels.

FOR EXPLANATION OF TABLES SEE NOTE 10.



PARALLEL FLANGE CHANNEL

Advance® UKPFC



Member buckling check

Section Designation and Resistances (kN, kNm)	n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
		L (m)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
200x90x30 $N_{pl,Rd} = 1040$ $f_y W_{el,y} = 69.3$ $f_y W_{el,z} = 14.7$	1.00	$N_{b,y,Rd}$	1040	1040	999	961	922	882	840	751	659	570	489	418	359
		$N_{b,z,Rd}$	935	819	690	563	452	364	296	204	149	112	88.0	70.7	58.0
	1.00	$M_{b,Rd}$	80.0	72.7	65.0	58.9	53.8	49.5	45.9	40.1	35.6	32.1	29.2	26.8	24.8
200x75x23 $N_{pl,Rd} = 822$ $f_y W_{el,y} = 53.9$ $f_y W_{el,z} = 9.30$	1.00	$N_{b,y,Rd}$	822	817	787	757	726	694	661	591	518	447	383	327	281
		$N_{b,z,Rd}$	701	584	461	355	274	215	172	116	83.6	62.9	49.0	39.2	32.1
	1.00	$M_{b,Rd}$	60.6	52.0	45.5	40.3	36.2	32.9	30.1	25.8	22.7	20.2	18.2	16.6	15.3
180x90x26 $N_{pl,Rd} = 913$ $f_y W_{el,y} = 55.6$ $f_y W_{el,z} = 13.0$	1.00	$N_{b,y,Rd}$	913	897	861	824	786	746	705	617	529	447	377	318	271
		$N_{b,z,Rd}$	820	718	606	495	398	320	261	180	131	99.1	77.6	62.3	51.1
	1.00	$M_{b,Rd}$	63.8	58.0	51.9	47.0	42.9	39.5	36.7	32.0	28.5	25.7	23.4	21.4	19.8
180x75x20 $N_{pl,Rd} = 712$ $f_y W_{el,y} = 41.8$ $f_y W_{el,z} = 7.92$	1.00	$N_{b,y,Rd}$	712	699	670	641	610	578	545	475	405	341	287	242	206
		$N_{b,z,Rd}$	607	505	398	306	235	185	148	100.0	71.9	54.1	42.1	33.7	27.6
	1.00	$M_{b,Rd}$	46.9	40.2	35.0	31.0	27.8	25.2	23.0	19.7	17.3	15.4	13.9	12.6	11.6
150x90x24 $N_{pl,Rd} = 836$ $f_y W_{el,y} = 42.6$ $f_y W_{el,z} = 12.2$	1.00	$N_{b,y,Rd}$	836	802	762	720	677	630	582	485	397	323	265	220	185
		$N_{b,z,Rd}$	751	658	555	453	364	293	239	165	120	90.8	71.0	57.1	46.8
	1.00	$M_{b,Rd}$	49.2	45.4	41.1	37.6	34.8	32.3	30.2	26.7	24.0	21.7	19.9	18.4	17.0
150x75x18 $N_{pl,Rd} = 627$ $f_y W_{el,y} = 31.6$ $f_y W_{el,z} = 7.32$	1.00	$N_{b,y,Rd}$	627	601	571	540	506	471	435	362	296	241	198	164	138
		$N_{b,z,Rd}$	536	447	353	272	210	165	132	89.3	64.3	48.3	37.7	30.2	24.7
	1.00	$M_{b,Rd}$	35.5	30.7	27.1	24.3	22.0	20.1	18.5	16.0	14.2	12.7	11.5	10.5	9.69
125x65x15 $N_{pl,Rd} = 517$ $f_y W_{el,y} = 21.3$ $f_y W_{el,z} = 5.17$	1.00	$N_{b,y,Rd}$	510	480	449	416	381	344	307	241	188	148	119	97.6	81.2
		$N_{b,z,Rd}$	418	330	245	181	136	105	83.5	55.9	40.0	30.0	23.3	18.6	15.2
	1.00	$M_{b,Rd}$	23.3	20.3	18.0	16.2	14.7	13.5	12.5	10.9	9.62	8.64	7.84	7.18	6.63
100x50x10 $N_{pl,Rd} = 358$ $f_y W_{el,y} = 11.4$ $f_y W_{el,z} = 2.72$	1.00	$N_{b,y,Rd}$	342	315	286	255	222	191	163	120	89.7	69.2	54.8	44.4	36.6
		$N_{b,z,Rd}$	253	174	117	82.1	60.0	45.6	35.8	23.7	16.8	12.5	9.70	7.73	6.30
	1.00	$M_{b,Rd}$	11.8	10.2	8.99	8.05	7.29	6.67	6.14	5.31	4.68	4.18	3.79	3.46	3.19

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$$n = N_{Ed} / N_{pl,Rd}$$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit.

For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

FOR EXPLANATION OF TABLES SEE NOTE 10.

Non Preloaded bolts

Property Class 4.6 hexagon head bolts

Diameter of Bolt d mm	Tensile Stress Area $A_s$ mm <sup>2</sup>	Tension Resistance $F_{t,Rd}$ kN	Shear Resistance		Bolts in tension Min thickness for punching shear $t_{min}$ mm
			Single Shear $F_{v,Rd}$ kN	Double Shear $2 \times F_{v,Rd}$ kN	
12	84.3	24.3	16.2	32.4	2.1
16	157	45.2	30.1	60.3	3.1
20	245	70.6	47.0	94.1	3.9
24	353	102	67.8	136	4.7
30	561	162	108	215	5.8

Diameter of Bolt d mm	Minimum				Bearing Resistance (kN)										
	Edge distance $e_2$ mm	End distance $e_1$ mm	Pitch $p_1$ mm	Gauge $p_2$ mm	Thickness in mm of ply, t.										
	5	6	7	8	9	10	12	15	20	25	30				
12	20	25	35	40	26.4	31.7	37	42.2	47.5	52.8	63.4	79.2	106	132	158
16	25	35	50	50	37.2	44.7	52.1	59.6	67	74.5	89.3	112	149	186	223
20	30	40	60	60	<b>42.1</b>	50.5	58.9	67.4	75.8	84.2	101	126	168	211	253
24	35	50	70	70	<b>52.2</b>	<b>62.6</b>	73.1	83.5	94	104	125	157	209	261	313
30	45	60	85	90	<b>63.2</b>	<b>75.8</b>	<b>88.4</b>	<b>101</b>	114	126	152	189	253	316	379

See clause 3.7(1) of BS EN 1993-1-8: 2005 for calculation of the design resistance of a group of fasteners.

Values of bearing resistance in **bold** are less than the single shear resistance of the bolt.

Values of bearing resistance in *italic* are greater than the double shear resistance of the bolt.

Bearing values assume standard clearance holes.

If oversize or short slotted holes are used, bearing values should be multiplied by 0.8.

If long slotted or kidney shaped holes are used, bearing values should be multiplied by 0.6.

In single lap joints with only one bolt row, the design bearing resistance for each bolt should be limited to  $1.5f_u d t/\gamma_{M2}$

FOR EXPLANATION OF TABLES SEE NOTE 11.

Non Preloaded bolts

Property Class 8.8 hexagon head bolts

Diameter of Bolt d mm	Tensile Stress Area $A_s$ mm <sup>2</sup>	Tension Resistance $F_{t,Rd}$ kN	Shear Resistance		Bolts in tension Min thickness for punching shear $t_{min}$ mm
			Single Shear $F_{v,Rd}$ kN	Double Shear $2 \times F_{v,Rd}$ kN	
12	84.3	48.6	27.5	55.0	4.2
16	157	90.4	60.3	121	6.3
20	245	141	94.1	188	7.8
24	353	203	136	271	9.4
30	561	323	215	431	11.6

Diameter of Bolt d mm	Minimum				Bearing Resistance (kN)										
	Edge distance $e_2$ mm	End distance $e_1$ mm	Pitch $p_1$ mm	Gauge $p_2$ mm	Thickness in mm of ply, t.										
	5	6	7	8	9	10	12	15	20	25	30				
12	20	25	35	40	<b>26.4</b>	31.7	37	42.2	47.5	52.8	63.4	79.2	106	132	158
16	25	35	50	50	<b>37.2</b>	<b>44.7</b>	<b>52.1</b>	<b>59.6</b>	67	74.5	89.3	112	149	186	223
20	30	40	60	60	<b>42.1</b>	<b>50.5</b>	<b>58.9</b>	<b>67.4</b>	<b>75.8</b>	<b>84.2</b>	101	126	168	211	253
24	35	50	70	70	<b>52.2</b>	<b>62.6</b>	<b>73.1</b>	<b>83.5</b>	<b>94</b>	<b>104</b>	<b>125</b>	157	209	261	313
30	45	60	85	90	<b>63.2</b>	<b>75.8</b>	<b>88.4</b>	<b>101</b>	<b>114</b>	<b>126</b>	<b>152</b>	<b>189</b>	253	316	379

Diameter of Bolt d mm	Minimum				Bearing Resistance (kN)										
	Edge distance $e_2$ mm	End distance $e_1$ mm	Pitch $p_1$ mm	Gauge $p_2$ mm	Thickness in mm of ply, t.										
	5	6	7	8	9	10	12	15	20	25	30				
12	25	40	50	45	46.3	55.5	64.8	74	83.3	92.5	111	139	185	231	278
16	30	50	65	55	60.7	72.9	85	97.2	109	121	146	182	243	304	364
20	35	60	80	70	<b>74.5</b>	<b>89.5</b>	104	119	134	149	179	224	298	373	447
24	40	75	95	80	<b>94.6</b>	<b>114</b>	<b>132</b>	151	170	189	227	284	378	473	568
30	50	90	115	100	<b>112</b>	<b>134</b>	<b>157</b>	<b>179</b>	<b>201</b>	224	268	335	447	559	671

For M12 bolts the design shear resistance  $F_{v,Rd}$  has been calculated as 0.85 times the value given in BS EN 1993-1-8, Table 3.4 (§3.6.1(5))

See clause 3.7(1) of BS EN 1993-1-8: 2005 for calculation of the design resistance of a group of fasteners.

Values of bearing resistance in **bold** are less than the single shear resistance of the bolt.

Values of bearing resistance in *italic* are greater than the double shear resistance of the bolt.

Bearing values assume standard clearance holes.

If oversize or short slotted holes are used, bearing values should be multiplied by 0.8.

If long slotted or kidney shaped holes are used, bearing values should be multiplied by 0.6.

In single lap joints with only one bolt row, the design bearing resistance for each bolt should be limited to  $1.5f_u d t/\gamma_{M2}$

FOR EXPLANATION OF TABLES SEE NOTE 11.

## Non Preloaded bolts

### Property Class 10.9 hexagon head bolts

Diameter of Bolt d mm	Tensile Stress Area $A_s$ mm <sup>2</sup>	Tension Resistance $F_{t,Rd}$ kN	Shear Resistance		Bolts in tension Min thickness for punching shear $t_{min}$ mm
			Single Shear $F_{v,Rd}$ kN	Double Shear $2 \times F_{v,Rd}$ kN	
12	84.3	60.7	28.7	57.3	5.3
16	157	113	62.8	126	7.9
20	245	176	98.0	196	9.8
24	353	254	141	282	11.7
30	561	404	224	449	14.5

Diameter of Bolt d mm	Minimum				Bearing Resistance (kN)										
	Edge distance $e_2$ mm	End distance $e_1$ mm	Pitch $p_1$ mm	Gauge $p_2$ mm	Thickness in mm of ply, t.										
	5	6	7	8	9	10	12	15	20	25	30				
12	20	25	35	40	<b>26.4</b>	31.7	37	42.2	47.5	52.8	63.4	79.2	106	132	158
16	25	35	50	50	<b>37.2</b>	<b>44.7</b>	<b>52.1</b>	<b>59.6</b>	67	74.5	89.3	112	149	186	223
20	30	40	60	60	<b>42.1</b>	<b>50.5</b>	<b>58.9</b>	<b>67.4</b>	<b>75.8</b>	<b>84.2</b>	101	126	168	211	253
24	35	50	70	70	<b>52.2</b>	<b>62.6</b>	<b>73.1</b>	<b>83.5</b>	<b>94</b>	<b>104</b>	<b>125</b>	157	209	261	313
30	45	60	85	90	<b>63.2</b>	<b>75.8</b>	<b>88.4</b>	<b>101</b>	<b>114</b>	<b>126</b>	<b>152</b>	<b>189</b>	253	316	379

Diameter of Bolt d mm	Minimum				Bearing Resistance (kN)										
	Edge distance $e_2$ mm	End distance $e_1$ mm	Pitch $p_1$ mm	Gauge $p_2$ mm	Thickness in mm of ply, t.										
	5	6	7	8	9	10	12	15	20	25	30				
12	25	40	50	45	46.3	55.5	64.8	74	83.3	92.5	111	139	185	231	278
16	30	50	65	55	<b>60.7</b>	72.9	85	97.2	109	121	146	182	243	304	364
20	35	60	80	70	<b>74.5</b>	<b>89.5</b>	104	119	134	149	179	224	298	373	447
24	40	75	95	80	<b>94.6</b>	<b>114</b>	<b>132</b>	151	170	189	227	284	378	473	568
30	50	90	115	100	<b>112</b>	<b>134</b>	<b>157</b>	<b>179</b>	<b>201</b>	224	268	335	447	559	671

For M12 bolts the design shear resistance  $F_{v,Rd}$  has been calculated as 0.85 times the value given in BS EN 1993-1-8, Table 3.4 (§3.6.1(5))

See clause 3.7(1) of BS EN 1993-1-8: 2005 for calculation of the design resistance of a group of fasteners.

Values of bearing resistance in **bold** are less than the single shear resistance of the bolt.

Values of bearing resistance in *italic* are greater than the double shear resistance of the bolt.

Bearing values assume standard clearance holes.

If oversize or short slotted holes are used, bearing values should be multiplied by 0.8.

If long slotted or kidney shaped holes are used, bearing values should be multiplied by 0.6.

In single lap joints with only one bolt row, the design bearing resistance for each bolt should be limited to  $1.5f_u d t/\gamma_{M2}$

FOR EXPLANATION OF TABLES SEE NOTE 11.

Non Preloaded bolts

Property Class 4.6 countersunk bolts

Diameter of Bolt	Tensile Stress Area	Tension Resistance	Shear Resistance		Bolts in tension
			Single Shear	Double Shear	
d mm	A <sub>s</sub> mm <sup>2</sup>	F <sub>t,Rd</sub> kN	F <sub>v,Rd</sub> kN	2 x F <sub>v,Rd</sub> kN	Min thickness for punching shear t <sub>min</sub> mm
12	84.3	17.0	16.2	32.4	1.5
16	157	31.7	30.1	60.3	2.2
20	245	49.4	47.0	94.1	2.7
24	353	71.2	67.8	136	3.3
30	561	113	108	215	4.1

Diameter of Bolt	Minimum				Bearing Resistance (kN)										
	Edge distance	End distance	Pitch	Gauge	Thickness in mm of ply, t.										
d mm	e <sub>2</sub> mm	e <sub>1</sub> mm	p <sub>1</sub> mm	p <sub>2</sub> mm	5	6	7	8	9	10	12	15	20	25	30
12	20	25	35	40	<b>10.6</b>	<b>15.8</b>	21.1	26.4	31.7	37.0	47.5	63.4	89.8	116	143
16	25	35	50	50	<b>7.4</b>	<b>14.9</b>	<b>22.3</b>	<b>29.8</b>	37.2	44.7	59.6	81.9	119	156	194
20	30	40	60	60	<b>0</b>	<b>8.4</b>	<b>16.8</b>	<b>25.3</b>	<b>33.7</b>	<b>42.1</b>	58.9	84.2	126	168	211
24	35	50	70	70	<b>0</b>	<b>0</b>	<b>10.4</b>	<b>20.9</b>	<b>31.3</b>	<b>41.8</b>	<b>62.6</b>	94.0	146	198	251
30	45	60	85	90	<b>0</b>	<b>0</b>	<b>0</b>	<b>6.3</b>	<b>18.9</b>	<b>31.6</b>	<b>56.8</b>	<b>94.7</b>	158	221	284

See clause 3.7(1) of BS EN 1993-1-8: 2005 for calculation of the design resistance of a group of fasteners.

Values of bearing resistance in **bold** are less than the single shear resistance of the bolt.

Values of bearing resistance in *italic* are greater than the double shear resistance of the bolt.

Bearing values assume standard clearance holes.

If oversize or short slotted holes are used, bearing values should be multiplied by 0.8.

If long slotted or kidney shaped holes are used, bearing values should be multiplied by 0.6.

In single lap joints with only one bolt row, the design bearing resistance for each bolt should be limited to  $1.5f_u d t/\gamma_{M2}$

FOR EXPLANATION OF TABLES SEE NOTE 11

Non Preloaded bolts

Property Class 8.8 countersunk bolts

Diameter of Bolt d mm	Tensile Stress Area $A_s$ mm <sup>2</sup>	Tension Resistance $F_{t,Rd}$ kN	Shear Resistance		Bolts in tension Min thickness for punching shear $t_{min}$ mm
			Single Shear $F_{v,Rd}$ kN	Double Shear $2 \times F_{v,Rd}$ kN	
12	84.3	34.0	27.5	55.0	3.0
16	157	63.3	60.3	121	4.4
20	245	98.8	94.1	188	5.5
24	353	142	136	271	6.6
30	561	226	215	431	8.1

Diameter of Bolt d mm	Minimum				Bearing Resistance (kN)										
	Edge distance $e_2$ mm	End distance $e_1$ mm	Pitch $p_1$ mm	Gauge $p_2$ mm	Thickness in mm of ply, t.										
	5	6	7	8	9	10	12	15	20	25	30				
12	20	25	35	40	<b>10.6</b>	<b>15.8</b>	<b>21.1</b>	<b>26.4</b>	31.7	37.0	47.5	63.4	89.8	116	143
16	25	35	50	50	<b>7.4</b>	<b>14.9</b>	<b>22.3</b>	<b>29.8</b>	<b>37.2</b>	<b>44.7</b>	<b>59.6</b>	81.9	119	156	194
20	30	40	60	60	<b>0</b>	<b>8.4</b>	<b>16.8</b>	<b>25.3</b>	<b>33.7</b>	<b>42.1</b>	<b>58.9</b>	<b>84.2</b>	126	168	211
24	35	50	70	70	<b>0</b>	<b>0</b>	<b>10.4</b>	<b>20.9</b>	<b>31.3</b>	<b>41.8</b>	<b>62.6</b>	<b>94.0</b>	146	198	251
30	45	60	85	90	<b>0</b>	<b>0</b>	<b>0</b>	<b>6.3</b>	<b>18.9</b>	<b>31.6</b>	<b>56.8</b>	<b>94.7</b>	<b>158</b>	221	284

Diameter of Bolt d mm	Minimum				Bearing Resistance (kN)										
	Edge distance $e_2$ mm	End distance $e_1$ mm	Pitch $p_1$ mm	Gauge $p_2$ mm	Thickness in mm of ply, t.										
	5	6	7	8	9	10	12	15	20	25	30				
12	25	40	50	45	<b>18.5</b>	27.8	37.0	46.3	55.5	64.8	83.3	<i>111</i>	<i>157</i>	<i>204</i>	<i>250</i>
16	30	50	65	55	<b>12.1</b>	<b>24.3</b>	<b>36.4</b>	<b>48.6</b>	60.7	72.9	97	<i>134</i>	<i>194</i>	<i>255</i>	<i>316</i>
20	35	60	80	70	<b>0</b>	<b>14.9</b>	<b>29.8</b>	<b>44.7</b>	<b>59.6</b>	<b>74.5</b>	104	149	224	298	373
24	40	75	95	80	<b>0</b>	<b>0</b>	<b>18.9</b>	<b>37.8</b>	<b>56.8</b>	<b>75.7</b>	<b>114</b>	170	265	360	454
30	50	90	115	100	<b>0</b>	<b>0</b>	<b>0</b>	<b>11.2</b>	<b>33.5</b>	<b>55.9</b>	<b>101</b>	<b>168</b>	280	391	503

For M12 bolts the design shear resistance  $F_{v,Rd}$  has been calculated as 0.85 times the value given in BS EN 1993-1-8, Table 3.4 (§3.6.1(5))

See clause 3.7(1) of BS EN 1993-1-8: 2005 for calculation of the design resistance of a group of fasteners.

Values of bearing resistance in **bold** are less than the single shear resistance of the bolt.

Values of bearing resistance in *italic* are greater than the double shear resistance of the bolt.

Bearing values assume standard clearance holes.

If oversize or short slotted holes are used, bearing values should be multiplied by 0.8.

If long slotted or kidney shaped holes are used, bearing values should be multiplied by 0.6.

In single lap joints with only one bolt row, the design bearing resistance for each bolt should be limited to  $1.5f_u d t/\gamma_{M2}$

FOR EXPLANATION OF TABLES SEE NOTE 11

Non Preloaded bolts

Property Class 10.9 countersunk bolts

Diameter of Bolt d mm	Tensile Stress Area $A_s$ mm <sup>2</sup>	Tension Resistance $F_{t,Rd}$ kN	Shear Resistance		Bolts in tension Min thickness for punching shear $t_{min}$ mm
			Single Shear $F_{v,Rd}$ kN	Double Shear $2 \times F_{v,Rd}$ kN	
12	84.3	42.5	28.7	57.3	3.7
16	157	79.1	62.8	126	5.5
20	245	123	98.0	196	6.8
24	353	178	141	282	8.2
30	561	283	224	449	10.1

Diameter of Bolt d mm	Minimum				Bearing Resistance (kN)										
	Edge distance $e_2$ mm	End distance $e_1$ mm	Pitch $p_1$ mm	Gauge $p_2$ mm	Thickness in mm of ply, t.										
	5	6	7	8	9	10	12	15	20	25	30				
12	20	25	35	40	<b>10.6</b>	<b>15.8</b>	<b>21.1</b>	<b>26.4</b>	31.7	37.0	47.5	63.4	89.8	116	143
16	25	35	50	50	<b>7.4</b>	<b>14.9</b>	<b>22.3</b>	<b>29.8</b>	<b>37.2</b>	<b>44.7</b>	<b>59.6</b>	81.9	119	156	194
20	30	40	60	60	<b>0</b>	<b>8.4</b>	<b>16.8</b>	<b>25.3</b>	<b>33.7</b>	<b>42.1</b>	<b>58.9</b>	<b>84.2</b>	126	168	211
24	35	50	70	70	<b>0</b>	<b>0</b>	<b>10.4</b>	<b>20.9</b>	<b>31.3</b>	<b>41.8</b>	<b>62.6</b>	<b>94.0</b>	146	198	251
30	45	60	85	90	<b>0</b>	<b>0</b>	<b>0</b>	<b>6.3</b>	<b>18.9</b>	<b>31.6</b>	<b>56.8</b>	<b>94.7</b>	<b>158</b>	<b>221</b>	284

Diameter of Bolt d mm	Minimum				Bearing Resistance (kN)										
	Edge distance $e_2$ mm	End distance $e_1$ mm	Pitch $p_1$ mm	Gauge $p_2$ mm	Thickness in mm of ply, t.										
	5	6	7	8	9	10	12	15	20	25	30				
12	25	40	50	45	<b>18.5</b>	<b>27.8</b>	37.0	46.3	55.5	64.8	83.3	<i>111</i>	<i>157</i>	<i>204</i>	<i>250</i>
16	30	50	65	55	<b>12.1</b>	<b>24.3</b>	<b>36.4</b>	<b>48.6</b>	<b>60.7</b>	72.9	97	<i>134</i>	<i>194</i>	<i>255</i>	<i>316</i>
20	35	60	80	70	<b>0</b>	<b>14.9</b>	<b>29.8</b>	<b>44.7</b>	<b>59.6</b>	<b>74.5</b>	104	149	224	298	373
24	40	75	95	80	<b>0</b>	<b>0</b>	<b>18.9</b>	<b>37.8</b>	<b>56.8</b>	<b>75.7</b>	<b>114</b>	170	265	360	454
30	50	90	115	100	<b>0</b>	<b>0</b>	<b>0</b>	<b>11.2</b>	<b>33.5</b>	<b>55.9</b>	<b>101</b>	<b>168</b>	280	391	503

For M12 bolts the design shear resistance  $F_{v,Rd}$  has been calculated as 0.85 times the value given in BS EN 1993-1-8, Table 3.4 (§3.6.1(5))

See clause 3.7(1) of BS EN 1993-1-8: 2005 for calculation of the design resistance of a group of fasteners.

Values of bearing resistance in **bold** are less than the single shear resistance of the bolt.

Values of bearing resistance in *italic* are greater than the double shear resistance of the bolt.

Bearing values assume standard clearance holes.

If oversize or short slotted holes are used, bearing values should be multiplied by 0.8.

If long slotted or kidney shaped holes are used, bearing values should be multiplied by 0.6.

In single lap joints with only one bolt row, the design bearing resistance for each bolt should be limited to  $1.5f_u d t/\gamma_{M2}$

FOR EXPLANATION OF TABLES SEE NOTE 11

Preloaded bolts at serviceability limit state (Category B)

Property Class 8.8 hexagon head bolts

Diameter of Bolt  <i>d</i> mm	Tensile Stress Area  <i>A<sub>s</sub></i> mm <sup>2</sup>	Shear Resistance		Slip resistance, <i>F<sub>s,Rd,ser</sub></i>							
		Single Shear <i>F<sub>v,Rd</sub></i> kN	Double Shear <i>2 × F<sub>v,Rd</sub></i> kN	<i>μ</i> = 0.2		<i>μ</i> = 0.3		<i>μ</i> = 0.4		<i>μ</i> = 0.5	
				Single Shear kN	Double Shear kN	Single Shear kN	Double Shear kN	Single Shear kN	Double Shear kN	Single Shear kN	Double Shear kN
12	84.3	27.5	55.0	8.6	17.2	12.9	25.7	17.2	34.3	21.5	42.9
16	157	60.3	121	16.0	32.0	24.0	48.0	32.0	63.9	40.0	79.9
20	245	94.1	188	24.9	49.9	37.4	74.8	49.9	100	62.4	125
24	353	136	271	35.9	71.9	53.9	108	71.9	144	89.9	180
30	561	215	431	57.1	114	85.7	171	114	228	143	286

Bearing resistances may be taken from the tables for non-preloaded bolts

For M12 bolts the design shear resistance  $F_{v,Rd}$  has been calculated as 0.85 times the value given in BS EN 1993-1-8, Table 3.4 (§3.6.1(5))

See clause 3.7(1) of BS EN 1993-1-8: 2005 for calculation of the design resistance of a group of fasteners.

The shear resistances are ULS values

The slip resistances are SLS values

Values have been calculated assuming  $k_s=1$ . See BS EN 1993-1-8, section 3.9 for other values of  $k_s$ .

Preloaded bolts in tension (Category E)

Property Class 8.8 hexagon head bolts

Diameter of bolt  <i>d</i> mm	Tensile Stress Area  <i>A<sub>s</sub></i> mm <sup>2</sup>	Tension Resistance  <i>F<sub>t,Rd</sub></i> kN	Min. thickness for punching shear  <i>t<sub>min</sub></i> mm
12	84.3	48.6	3.7
16	157	90.4	5.4
20	245	141	7.1
24	353	203	8
30	561	323	10.5

The minimum thickness is such that the design punching shear resistance  $B_{p,Rd}$  is equal to the design tension resistance  $F_{t,Rd}$ .

FOR EXPLANATION OF TABLES SEE NOTE 11



Preloaded bolts at serviceability limit state (Category B)

Property Class 10.9 hexagon head bolts

Diameter of Bolt  $d$ mm	Tensile Stress Area  $A_s$ mm <sup>2</sup>	Shear Resistance		Slip resistance, $F_{s,Rd,ser}$							
		Single Shear $F_{v,Rd}$ kN	Double Shear $2 \times F_{v,Rd}$ kN	$\mu = 0.2$		$\mu = 0.3$		$\mu = 0.4$		$\mu = 0.5$	
				Single Shear kN	Double Shear kN	Single Shear kN	Double Shear kN	Single Shear kN	Double Shear kN	Single Shear kN	Double Shear kN
16	157	62.8	126	20.0	40.0	30.0	59.9	40.0	79.9	50.0	99.9
20	245	98.0	196	31.2	62.4	46.8	93.5	62.4	125	78.0	156
24	353	141	282	44.9	89.9	67.4	135	89.9	180	112	225
30	561	224	449	71.4	143	107	214	143	286	179	357

Bearing resistances may be taken from the tables for non-preloaded bolts

For M12 bolts the design shear resistance  $F_{v,Rd}$  has been calculated as 0.85 times the value given in BS EN 1993-1-8, Table 3.4 (§3.6.1(5))

See clause 3.7(1) of BS EN 1993-1-8: 2005 for calculation of the design resistance of a group of fasteners.

The shear resistances are ULS values

The slip resistances are SLS values

Values have been calculated assuming  $k_s=1$ . See BS EN 1993-1-8, section 3.9 for other values of  $k_s$ .

Preloaded bolts in tension (Category E)

Property Class 10.9 hexagon head bolts

Diameter of bolt $d$ mm	Tensile Stress Area $A_s$ mm <sup>2</sup>	Tension Resistance $F_{t,Rd}$ kN	Min. thickness for punching shear $t_{min}$ mm
16	157	113	6.8
20	245	176	8.9
24	353	254	10.0
30	561	404	13.1

The minimum thickness is such that the design punching shear resistance  $B_{p,Rd}$  is equal to the design tension resistance  $F_{t,Rd}$ .

FOR EXPLANATION OF TABLES SEE NOTE 11

Preloaded bolts at ultimate limit state (Category C)

Property Class 8.8 hexagon head bolts

Diameter of Bolt $d$ mm	Tensile Stress Area $A_s$ mm <sup>2</sup>	Slip Resistance							
		$\mu = 0.2$		$\mu = 0.3$		$\mu = 0.4$		$\mu = 0.5$	
		Single Shear kN	Double Shear kN	Single Shear kN	Double Shear kN	Single Shear kN	Double Shear kN	Single Shear kN	Double Shear kN
12	84.3	7.55	15.1	11.3	22.7	15.1	30.2	18.9	37.8
16	157	14.1	28.1	21.1	42.2	28.1	56.3	35.2	70.3
20	245	22.0	43.9	32.9	65.9	43.9	87.8	54.9	110
24	353	31.6	63.3	47.4	94.9	63.3	127	79.1	158
30	561	50.3	101	75.4	151	101	201	126	251

Bearing resistances may be taken from the tables for non-preloaded bolts

Shear resistances may be taken from the tables for Category B joints

FOR EXPLANATION OF TABLES SEE NOTE 11

Preloaded bolts at ultimate limit state (Category C)

Property Class 10.9 hexagon head bolts

Diameter of Bolt $d$ mm	Tensile Stress Area $A_s$ mm <sup>2</sup>	Slip Resistance							
		$\mu = 0.2$		$\mu = 0.3$		$\mu = 0.4$		$\mu = 0.5$	
		Single Shear kN	Double Shear kN	Single Shear kN	Double Shear kN	Single Shear kN	Double Shear kN	Single Shear kN	Double Shear kN
16	157	17.6	35.2	26.4	52.8	35.2	70.3	44.0	87.9
20	245	27.4	54.9	41.2	82.3	54.9	110	68.6	137
24	353	39.5	79.1	59.3	119	79.1	158	98.8	198
30	561	62.8	126	94.2	188	126	251	157	314

Bearing resistances may be taken from the tables for non-preloaded bolts

Shear resistances may be taken from the tables for Category B joints

FOR EXPLANATION OF TABLES SEE NOTE 11

Preloaded bolts at serviceability limit state (Category B)

Property Class 8.8 countersunk bolts

Diameter of Bolt  $d$ mm	Tensile Stress Area  $A_s$ mm <sup>2</sup>	Shear Resistance		Slip resistance, $F_{s,Rd,ser}$							
		Single Shear  $F_{v,Rd}$ kN	Double Shear  $2 \times F_{v,Rd}$ kN	$\mu = 0.2$		$\mu = 0.3$		$\mu = 0.4$		$\mu = 0.5$	
				Single Shear kN	Double Shear kN	Single Shear kN	Double Shear kN	Single Shear kN	Double Shear kN	Single Shear kN	Double Shear kN
12	84.3	27.5	55.0	8.6	17.2	12.9	25.7	17.2	34.3	21.5	42.9
16	157	60.3	121	16.0	32.0	24.0	48.0	32.0	63.9	40.0	79.9
20	245	94.1	188	24.9	49.9	37.4	74.8	49.9	100	62.4	125
24	353	136	271	35.9	71.9	53.9	108	71.9	144	89.9	180
30	561	215	431	57.1	114	85.7	171	114	228	143	286

Bearing resistances may be taken from the tables for non-preloaded countersunk bolts

For M12 bolts the design shear resistance  $F_{v,Rd}$  has been calculated as 0.85 times the value given in BS EN 1993-1-8, Table 3.4 (§3.6.1(5))

See clause 3.7(1) of BS EN 1993-1-8: 2005 for calculation of the design resistance of a group of fasteners.

The shear resistances are ULS values

The slip resistances are SLS values

Values have been calculated assuming  $k_s=1$ . See BS EN 1993-1-8, section 3.9 for other values of  $k_s$ .

Preloaded bolts in tension (Category E)

Property Class 8.8 countersunk bolts

Diameter of bolt  $d$ mm	Tensile Stress Area  $A_s$ mm <sup>2</sup>	Tension Resistance  $F_{t,Rd}$ kN	Min. thickness for punching shear  $t_{min}$ mm
12	84.3	34.0	2.6
16	157	63.3	3.8
20	245	98.8	5
24	353	142	5.6
30	561	226	7.3

The minimum thickness is such that the design punching shear resistance  $B_{p,Rd}$  is equal to the design tension resistance  $F_{t,Rd}$ .

FOR EXPLANATION OF TABLES SEE NOTE 11

## Preloaded bolts at serviceability limit state (Category B)

### Property Class 10.9 countersunk bolts

Diameter of Bolt  $d$ mm	Tensile Stress Area  $A_s$ mm <sup>2</sup>	Shear Resistance		Slip resistance, $F_{s,Rd,ser}$							
		Single Shear $F_{v,Rd}$ kN	Double Shear $2 \times F_{v,Rd}$ kN	$\mu = 0.2$		$\mu = 0.3$		$\mu = 0.4$		$\mu = 0.5$	
				Single Shear kN	Double Shear kN	Single Shear kN	Double Shear kN	Single Shear kN	Double Shear kN	Single Shear kN	Double Shear kN
16	157	62.8	126	20.0	40.0	30.0	59.9	40.0	79.9	50.0	99.9
20	245	98.0	196	31.2	62.4	46.8	93.5	62.4	125	78.0	156
24	353	141	282	44.9	89.9	67.4	135	89.9	180	112	225
30	561	224	449	71.4	143	107	214	143	286	179	357

Bearing resistances may be taken from the tables for non-preloaded countersunk bolts

See clause 3.7(1) of BS EN 1993-1-8: 2005 for calculation of the design resistance of a group of fasteners.

The shear resistances are ULS values

The slip resistances are SLS values

Values have been calculated assuming  $k_s=1$ . See BS EN 1993-1-8, section 3.9 for other values of  $k_s$ .

## Preloaded bolts in tension (Category E)

### Property Class 10.9 countersunk bolts

Diameter of bolt  $d$ mm	Tensile Stress Area  $A_s$ mm <sup>2</sup>	Tension Resistance  $F_{t,Rd}$ kN	Min. thickness for punching shear  $t_{min}$ mm
16	157	79.1	4.7
20	245	124	6.2
24	353	178	7.0
30	561	283	9.1

The minimum thickness is such that the design punching shear resistance  $B_{p,Rd}$  is equal to the design tension resistance  $F_{t,Rd}$ .

FOR EXPLANATION OF TABLES SEE NOTE 11

Preloaded bolts at ultimate limit state (Category C)

Property Class 8.8 countersunk bolts

Diameter of Bolt $d$ mm	Tensile Stress Area $A_s$ mm <sup>2</sup>	Slip Resistance							
		$\mu = 0.2$		$\mu = 0.3$		$\mu = 0.4$		$\mu = 0.5$	
		Single Shear kN	Double Shear kN	Single Shear kN	Double Shear kN	Single Shear kN	Double Shear kN	Single Shear kN	Double Shear kN
12	84.3	7.55	15.1	11.3	22.7	15.1	30.2	18.9	37.8
16	157	14.1	28.1	21.1	42.2	28.1	56.3	35.2	70.3
20	245	22.0	43.9	32.9	65.9	43.9	87.8	54.9	110
24	353	31.6	63.3	47.4	94.9	63.3	127	79.1	158
30	561	50.3	101	75.4	151	101	201	126	251

Bearing resistances may be taken from the tables for non-preloaded countersunk bolts

Shear resistances may be taken from the tables for Category B joints

FOR EXPLANATION OF TABLES SEE NOTE 11

Preloaded bolts at ultimate limit state (Category C)

Property Class 10.9 countersunk bolts

Diameter of Bolt $d$ mm	Tensile Stress Area $A_s$ mm <sup>2</sup>	Slip Resistance							
		$\mu = 0.2$		$\mu = 0.3$		$\mu = 0.4$		$\mu = 0.5$	
		Single Shear kN	Double Shear kN	Single Shear kN	Double Shear kN	Single Shear kN	Double Shear kN	Single Shear kN	Double Shear kN
16	157	17.6	35.2	26.4	52.8	35.2	70.3	44.0	87.9
20	245	27.4	54.9	41.2	82.3	54.9	110	68.6	137
24	353	39.5	79.1	59.3	119	79.1	158	98.8	198
30	561	62.8	126	94.2	188	126	251	157	314

Bearing resistances may be taken from the tables for non-preloaded countersunk bolts

Shear resistances may be taken from the tables for Category B joints

FOR EXPLANATION OF TABLES SEE NOTE 11

## Design weld resistances

Leg Length	Throat Thickness	Longitudinal resistance	Transverse resistance
s mm	a mm	$F_{w,L,Rd}$ kN/mm	$F_{w,T,Rd}$ kN/mm
3.0	2.1	0.47	0.57
4.0	2.8	0.62	0.76
5.0	3.5	0.78	0.96
6.0	4.2	0.94	1.15
8.0	5.6	1.25	1.53
10.0	7.0	1.56	1.91
12.0	8.4	1.87	2.29
15.0	10.5	2.34	2.87
18.0	12.6	2.81	3.44
20.0	14.0	3.12	3.82
22.0	15.4	3.43	4.20
25.0	17.5	3.90	4.78

FOR EXPLANATION OF TABLES SEE NOTE 11.2



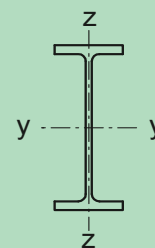
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## **D. MEMBER RESISTANCES**

**S355**

UNIVERSAL BEAMS  
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Section Designation	Axis	Compression resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ , $N_{b,T,Rd}$ (kN)												
		for												
		Buckling lengths (m)												
		2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
1016x305x487 +	$N_{b,y,Rd}$	20800	20800	20800	20800	20800	20600	20400	20200	19900	19700	19400	19200	18900
	$N_{b,z,Rd}$	18800	16500	14100	11600	9400	7610	6220	5140	4310	3660	3140	2720	2380
	$N_{b,T,Rd}$	19600	18200	17000	15900	15100	14400	13800	13400	13000	12800	12500	12400	12200
1016x305x437 +	$N_{b,y,Rd}$	18700	18700	18700	18700	18700	18500	18300	18100	17900	17700	17400	17200	17000
	$N_{b,z,Rd}$	16800	14800	12500	10300	8320	6720	5480	4530	3790	3220	2760	2390	2090
	$N_{b,T,Rd}$	17600	16200	15100	14000	13100	12400	11800	11400	11000	10700	10500	10300	10100
* 1016x305x393 +	$N_{b,y,Rd}$	16500	16500	16500	16500	16500	16500	16400	16200	16000	15800	15600	15400	15200
	$N_{b,z,Rd}$	15100	13200	11100	9110	7330	5910	4810	3970	3320	2820	2420	2090	1830
	$N_{b,T,Rd}$	15400	14200	13100	12100	11200	10500	9950	9490	9130	8830	8590	8400	8240
* 1016x305x349 +	$N_{b,y,Rd}$	14400	14400	14400	14400	14400	14400	14300	14200	14100	14000	13800	13700	13600
	$N_{b,z,Rd}$	13400	12200	11100	9150	7320	5840	4710	3860	3210	2700	2300	1990	1730
	$N_{b,T,Rd}$	13800	13000	12200	11300	10600	9870	9280	8790	8380	8050	7780	7560	7370
* 1016x305x314 +	$N_{b,y,Rd}$	12600	12600	12600	12600	12600	12600	12500	12400	12300	12200	12100	12000	11900
	$N_{b,z,Rd}$	11800	10700	9350	8130	6480	5160	4160	3400	2830	2380	2030	1750	1520
	$N_{b,T,Rd}$	12100	11400	10600	9840	9090	8420	7840	7350	6950	6630	6360	6150	5960
* 1016x305x272 +	$N_{b,y,Rd}$	10600	10600	10600	10600	10600	10500	10500	10400	10300	10200	10200	10100	10000
	$N_{b,z,Rd}$	9860	8990	7890	6620	5600	4460	3590	2940	2440	2050	1750	1510	1320
	$N_{b,T,Rd}$	10100	9520	8860	8160	7470	6830	6280	5810	5430	5120	4860	4650	4480
* 1016x305x249 +	$N_{b,y,Rd}$	9530	9530	9530	9530	9530	9500	9440	9370	9300	9230	9160	9080	9000
	$N_{b,z,Rd}$	8850	8010	6960	5760	4820	3810	3060	2490	2070	1740	1480	1280	1110
	$N_{b,T,Rd}$	9120	8540	7910	7240	6550	5920	5370	4910	4540	4240	3990	3790	3620
* 1016x305x222 +	$N_{b,y,Rd}$	8320	8320	8320	8320	8320	8290	8230	8170	8110	8050	7980	7920	7840
	$N_{b,z,Rd}$	7680	6900	5930	4840	4020	3150	2520	2050	1690	1420	1210	1040	908
	$N_{b,T,Rd}$	7940	7420	6840	6200	5560	4960	4440	4010	3670	3390	3160	2980	2830
* 914x419x388	$N_{b,y,Rd}$	16500	16500	16500	16500	16500	16400	16300	16100	16000	15900	15700	15600	15400
	$N_{b,z,Rd}$	16100	15300	14800	13600	12300	10800	9360	8050	6910	5960	5170	4510	3970
	$N_{b,T,Rd}$	16300	15700	15000	14300	13600	12900	12200	11600	11000	10500	10100	9710	9380
* 914x419x343	$N_{b,y,Rd}$	14300	14300	14300	14300	14300	14200	14100	14000	13900	13700	13600	13500	13400
	$N_{b,z,Rd}$	14000	13200	12400	11500	10700	9440	8150	6990	5990	5160	4470	3900	3430
	$N_{b,T,Rd}$	14100	13500	13000	12300	11700	11000	10400	9770	9220	8720	8280	7900	7570

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+ These sections are in addition to the range of BS 4 sections.

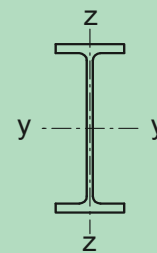
\* Section may be Class 4 under axial compression.

Values in italic type indicate that the section is a Class 4 section in pure compression and allowance has been made in calculating the resistance.

For values of the compression cross-sectional resistance  $N_{c,Rd}$ , see the values of  $N_{pl,Rd}$  in the tables for axial force and bending.

FOR EXPLANATION OF TABLES SEE NOTE 6.

UNIVERSAL BEAMS  
Advance® UKB



Section Designation	Axis	Compression resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ , $N_{b,T,Rd}$ (kN)												
		for												
		Buckling lengths (m)												
		2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
* 914x305x289	$N_{b,y,Rd}$	11800	11800	11800	11800	11800	11700	11600	11500	11400	11300	11200	11100	11000
	$N_{b,z,Rd}$	11000	10000	9250	7650	6140	4910	3970	3250	2700	2280	1940	1680	1460
	$N_{b,T,Rd}$	11300	10600	9940	9200	8480	7820	7250	6760	6370	6040	5770	5550	5370
* 914x305x253	$N_{b,y,Rd}$	10000	10000	10000	10000	10000	9940	9870	9790	9710	9630	9550	9460	9360
	$N_{b,z,Rd}$	9350	8520	7490	6590	5290	4220	3400	2780	2310	1950	1660	1430	1250
	$N_{b,T,Rd}$	9610	9030	8400	7730	7060	6440	5890	5430	5060	4750	4490	4280	4110
* 914x305x224	$N_{b,y,Rd}$	8620	8620	8620	8620	8620	8560	8490	8430	8360	8290	8220	8140	8060
	$N_{b,z,Rd}$	8030	7310	6410	5360	4530	3600	2900	2370	1960	1650	1410	1220	1060
	$N_{b,T,Rd}$	8260	7760	7200	6590	5970	5380	4860	4430	4070	3780	3550	3350	3190
* 914x305x201	$N_{b,y,Rd}$	7530	7530	7530	7530	7530	7470	7420	7360	7300	7240	7170	7100	7030
	$N_{b,z,Rd}$	6990	6340	5520	4580	3880	3060	2450	2000	1660	1390	1190	1020	891
	$N_{b,T,Rd}$	7210	6760	6250	5690	5110	4560	4070	3670	3340	3070	2860	2680	2530
* 838x292x226	$N_{b,y,Rd}$	9020	9020	9020	9020	8990	8920	8840	8770	8690	8610	8520	8430	8330
	$N_{b,z,Rd}$	8380	7610	6630	5770	4580	3640	2930	2390	1980	1670	1420	1230	1070
	$N_{b,T,Rd}$	8610	8070	7490	6870	6260	5710	5230	4840	4510	4250	4040	3860	3720
* 838x292x194	$N_{b,y,Rd}$	7460	7460	7460	7460	7430	7370	7310	7250	7180	7120	7040	6970	6890
	$N_{b,z,Rd}$	6910	6250	5420	4470	3730	2950	2360	1930	1600	1340	1140	985	857
	$N_{b,T,Rd}$	7120	6650	6140	5590	5030	4510	4060	3690	3390	3150	2960	2800	2670
* 838x292x176	$N_{b,y,Rd}$	6620	6620	6620	6620	6590	6540	6490	6430	6370	6310	6250	6180	6110
	$N_{b,z,Rd}$	6120	5520	4760	3900	3250	2560	2050	1670	1380	1160	987	850	739
	$N_{b,T,Rd}$	6310	5890	5430	4910	4380	3890	3480	3130	2850	2620	2440	2290	2170
* 762x267x197	$N_{b,y,Rd}$	7980	7980	7980	7980	7910	7840	7760	7680	7600	7510	7420	7320	7220
	$N_{b,z,Rd}$	7280	6470	5700	4480	3470	2720	2170	1760	1460	1220	1040	896	779
	$N_{b,T,Rd}$	7520	6990	6420	5830	5290	4820	4430	4120	3880	3680	3530	3400	3300
* 762x267x173	$N_{b,y,Rd}$	6800	6800	6800	6800	6740	6680	6620	6550	6480	6410	6330	6240	6150
	$N_{b,z,Rd}$	6190	5490	4600	3810	2940	2290	1820	1480	1220	1030	873	752	654
	$N_{b,T,Rd}$	6410	5940	5420	4880	4370	3920	3550	3260	3030	2850	2700	2580	2480
* 762x267x147	$N_{b,y,Rd}$	5560	5560	5560	5560	5510	5460	5410	5360	5300	5240	5180	5110	5030
	$N_{b,z,Rd}$	5050	4460	3720	3030	2370	1840	1460	1190	979	821	698	601	522
	$N_{b,T,Rd}$	5240	4840	4390	3910	3440	3040	2710	2440	2230	2070	1940	1830	1750
* 762x267x134	$N_{b,y,Rd}$	5090	5090	5090	5090	5040	5000	4950	4900	4850	4790	4730	4670	4600
	$N_{b,z,Rd}$	4610	4050	3350	2630	2120	1640	1300	1050	867	727	618	531	462
	$N_{b,T,Rd}$	4780	4410	3980	3510	3060	2660	2350	2100	1900	1750	1630	1530	1450

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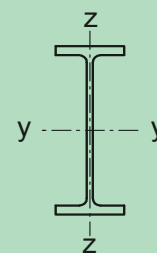
\* Section may be Class 4 under axial compression.

Values in italic type indicate that the section is a Class 4 section in pure compression and allowance has been made in calculating the resistance.

For values of the compression cross-sectional resistance  $N_{c,Rd}$ , see the values of  $N_{pl,Rd}$  in the tables for axial force and bending.

FOR EXPLANATION OF TABLES SEE NOTE 6.

UNIVERSAL BEAMS  
Advance® UKB



Section Designation	Axis	Compression resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ , $N_{b,T,Rd}$ (kN)												
		for												
		Buckling lengths (m)												
		2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
* 686x254x170	$N_{b,y,Rd}$	6980	6980	6980	6950	6880	6810	6730	6650	6570	6480	6380	6270	6150
	$N_{b,z,Rd}$	6320	5570	4790	3720	2860	2230	1770	1440	1190	996	847	729	634
	$N_{b,T,Rd}$	6540	6050	5530	5010	4540	4140	3830	3580	3380	3230	3100	3000	2920
* 686x254x152	$N_{b,y,Rd}$	6090	6090	6090	6060	6000	5940	5870	5800	5730	5650	5560	5470	5370
	$N_{b,z,Rd}$	5510	4850	4120	3270	2500	1950	1550	1260	1040	870	740	636	553
	$N_{b,T,Rd}$	5700	5260	4780	4300	3850	3470	3170	2930	2740	2590	2470	2370	2300
* 686x254x140	$N_{b,y,Rd}$	5480	5480	5480	5450	5400	5340	5290	5220	5160	5090	5010	4930	4840
	$N_{b,z,Rd}$	4960	4360	3610	2950	2250	1750	1390	1130	929	779	662	570	495
	$N_{b,T,Rd}$	5130	4730	4290	3820	3400	3030	2740	2510	2330	2190	2070	1980	1910
* 686x254x125	$N_{b,y,Rd}$	4780	4780	4780	4760	4710	4660	4610	4560	4500	4440	4370	4300	4220
	$N_{b,z,Rd}$	4310	3780	3100	2530	1920	1490	1180	955	788	660	561	483	419
	$N_{b,T,Rd}$	4470	4110	3700	3270	2870	2530	2250	2040	1870	1740	1630	1550	1480
610x305x238	$N_{b,y,Rd}$	10500	10500	10500	10300	10200	10100	9980	9840	9690	9530	9350	9150	8930
	$N_{b,z,Rd}$	9860	9080	8110	6960	5780	4730	3870	3200	2670	2260	1940	1670	1460
	$N_{b,T,Rd}$	10000	9500	8970	8480	8030	7640	7320	7050	6830	6650	6500	6380	6280
* 610x305x179	$N_{b,y,Rd}$	7590	7590	7590	7510	7430	7340	7250	7150	7040	6920	6790	6750	6680
	$N_{b,z,Rd}$	7150	6750	6030	5140	4230	3440	2810	2320	1940	1640	1400	1210	1060
	$N_{b,T,Rd}$	7280	6850	6410	5950	5510	5110	4770	4480	4240	4050	3890	3750	3650
* 610x305x149	$N_{b,y,Rd}$	6100	6100	6100	6040	5980	5910	5830	5750	5670	5570	5470	5360	5230
	$N_{b,z,Rd}$	5760	5300	4740	4170	3480	2830	2310	1900	1590	1340	1150	990	863
	$N_{b,T,Rd}$	5850	5500	5120	4720	4310	3940	3610	3340	3110	2920	2770	2650	2540
* 610x229x140	$N_{b,y,Rd}$	5760	5760	5760	5690	5630	5560	5490	5410	5320	5230	5120	5010	4880
	$N_{b,z,Rd}$	5100	4560	3570	2670	2020	1550	1230	993	818	685	582	500	434
	$N_{b,T,Rd}$	5310	4860	4390	3950	3580	3280	3050	2870	2730	2630	2540	2470	2420
* 610x229x125	$N_{b,y,Rd}$	5010	5010	5010	4960	4900	4850	4780	4710	4640	4560	4470	4370	4270
	$N_{b,z,Rd}$	4440	3800	3140	2350	1770	1360	1070	868	714	598	508	437	379
	$N_{b,T,Rd}$	4620	4210	3780	3360	2990	2700	2480	2310	2180	2080	1990	1930	1880
* 610x229x113	$N_{b,y,Rd}$	4450	4450	4450	4400	4350	4300	4240	4180	4120	4040	3970	3880	3780
	$N_{b,z,Rd}$	3930	3360	2750	2070	1550	1190	941	760	626	524	444	382	332
	$N_{b,T,Rd}$	4100	3720	3310	2910	2560	2280	2070	1900	1780	1680	1600	1540	1490
* 610x229x101	$N_{b,y,Rd}$	3990	3990	3990	3950	3900	3850	3800	3750	3690	3620	3550	3460	3370
	$N_{b,z,Rd}$	3510	2960	2310	1790	1330	1020	805	649	534	447	379	325	283
	$N_{b,T,Rd}$	3660	3310	2920	2520	2180	1910	1710	1550	1430	1340	1270	1210	1160

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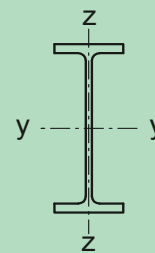
\* Section may be Class 4 under axial compression.

Values in italic type indicate that the section is a Class 4 section in pure compression and allowance has been made in calculating the resistance.

For values of the compression cross-sectional resistance  $N_{c,Rd}$ , see the values of  $N_{pl,Rd}$  in the tables for axial force and bending.

FOR EXPLANATION OF TABLES SEE NOTE 6.

UNIVERSAL BEAMS  
Advance® UKB



Section Designation	Axis	Compression resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ , $N_{b,T,Rd}$ (kN)												
		for												
		Buckling lengths (m)												
		2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
* 610x178x100 +	$N_{b,y,Rd}$	3910	3910	3900	3860	3810	3770	3710	3660	3600	3530	3460	3380	3290
	$N_{b,z,Rd}$	3120	2430	1620	1120	812	613	478	383	314	261	221	190	164
	$N_{b,T,Rd}$	3410	2960	2510	2150	1890	1700	1570	1470	1400	1350	1300	1270	1240
* 610x178x92 +	$N_{b,y,Rd}$	3590	3590	3580	3540	3500	3450	3400	3350	3290	3230	3160	3080	2990
	$N_{b,z,Rd}$	2820	2160	1430	980	707	533	415	332	272	227	192	164	142
	$N_{b,T,Rd}$	3120	2680	2230	1880	1620	1440	1320	1230	1160	1110	1070	1030	1010
* 610x178x82 +	$N_{b,y,Rd}$	3080	3080	3080	3040	3010	2970	2930	2880	2840	2780	2720	2660	2580
	$N_{b,z,Rd}$	2410	1730	1210	828	596	449	349	280	229	191	161	138	120
	$N_{b,T,Rd}$	2670	2270	1870	1540	1310	1140	1030	947	886	840	804	775	753
533x312x272 +	$N_{b,y,Rd}$	12000	12000	12000	11800	11700	11500	11300	11100	10900	10700	10500	10200	9840
	$N_{b,z,Rd}$	11400	10600	9600	8410	7120	5910	4890	4060	3410	2900	2480	2150	1880
	$N_{b,T,Rd}$	11600	11100	10600	10200	9860	9590	9380	9210	9070	8960	8870	8800	8740
533x312x219 +	$N_{b,y,Rd}$	9630	9630	9580	9460	9340	9200	9060	8900	8730	8530	8310	8070	7790
	$N_{b,z,Rd}$	9120	8440	7600	6600	5530	4560	3760	3110	2610	2210	1900	1640	1430
	$N_{b,T,Rd}$	9260	8780	8320	7890	7500	7180	6900	6680	6500	6350	6220	6120	6040
533x312x182 +	$N_{b,y,Rd}$	7970	7970	7930	7830	7720	7610	7490	7360	7210	7050	6860	6660	6420
	$N_{b,z,Rd}$	7540	6960	6260	5410	4530	3720	3060	2530	2120	1800	1540	1330	1160
	$N_{b,T,Rd}$	7650	7220	6790	6360	5960	5600	5300	5040	4830	4660	4520	4410	4310
* 533x312x150 +	$N_{b,y,Rd}$	6430	6430	6400	6320	6230	6140	6050	5940	5870	5840	5690	5510	5310
	$N_{b,z,Rd}$	6080	5770	5170	4460	3720	3050	2500	2070	1730	1470	1250	1090	948
	$N_{b,T,Rd}$	6170	5810	5430	5040	4650	4300	4000	3740	3530	3350	3210	3090	3000
533x210x138 +	$N_{b,y,Rd}$	6070	6070	6030	5950	5860	5770	5670	5560	5440	5300	5150	4970	4770
	$N_{b,z,Rd}$	5230	4300	3240	2370	1770	1350	1070	860	707	591	502	431	374
	$N_{b,T,Rd}$	5520	5030	4580	4190	3880	3660	3490	3360	3260	3180	3120	3080	3040
* 533x210x122	$N_{b,y,Rd}$	5150	5150	5120	5050	4980	4910	4830	4740	4740	4670	4530	4380	4200
	$N_{b,z,Rd}$	4600	3780	2850	2080	1550	1190	936	754	620	519	440	378	328
	$N_{b,T,Rd}$	4680	4250	3830	3460	3160	2940	2770	2640	2550	2470	2410	2370	2330
* 533x210x109	$N_{b,y,Rd}$	4520	4520	4490	4430	4370	4300	4230	4160	4070	3970	3860	3730	3670
	$N_{b,z,Rd}$	3900	3350	2500	1830	1360	1040	816	658	541	452	384	329	286
	$N_{b,T,Rd}$	4100	3700	3290	2930	2630	2410	2240	2120	2020	1950	1890	1850	1810
* 533x210x101	$N_{b,y,Rd}$	4120	4120	4100	4040	3990	3930	3870	3800	3720	3630	3530	3420	3290
	$N_{b,z,Rd}$	3560	3020	2300	1680	1240	952	749	603	496	415	352	302	262
	$N_{b,T,Rd}$	3730	3360	2970	2610	2320	2100	1940	1820	1730	1660	1600	1560	1520
* 533x210x92	$N_{b,y,Rd}$	3760	3760	3730	3680	3630	3580	3520	3450	3380	3300	3210	3100	2980
	$N_{b,z,Rd}$	3230	2660	2080	1500	1110	846	665	535	439	367	311	267	232
	$N_{b,T,Rd}$	3400	3040	2650	2300	2020	1800	1640	1530	1440	1370	1310	1270	1240
* 533x210x82	$N_{b,y,Rd}$	3310	3310	3280	3240	3190	3150	3090	3030	2970	2890	2810	2720	2610
	$N_{b,z,Rd}$	2830	2300	1790	1280	946	721	565	455	373	312	264	227	197
	$N_{b,T,Rd}$	2980	2650	2280	1940	1670	1470	1320	1210	1130	1060	1010	974	942

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+ These sections are in addition to the range of BS 4 sections.

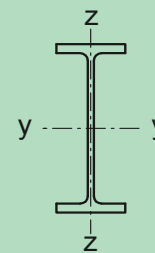
\* Section may be Class 4 under axial compression.

Values in italic type indicate that the section is a Class 4 section in pure compression and allowance has been made in calculating the resistance.

For values of the compression cross-sectional resistance  $N_{c,Rd}$ , see the values of  $N_{pl,Rd}$  in the tables for axial force and bending.

FOR EXPLANATION OF TABLES SEE NOTE 6.

UNIVERSAL BEAMS  
Advance® UKB



Section Designation	Axis	Compression resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ , $N_{b,T,Rd}$ (kN)												
		for												
		Buckling lengths (m)												
		2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
* 533x165x85 +	$N_{b,y,Rd}$	3370	3370	3340	3300	3250	3200	3150	3090	3020	2950	2860	2770	2660
	$N_{b,z,Rd}$	2610	1940	1270	874	631	475	370	296	243	202	171	146	127
	$N_{b,T,Rd}$	2890	2480	2110	1820	1620	1480	1380	1310	1260	1220	1190	1170	1150
* 533x165x74 +	$N_{b,y,Rd}$	2960	2960	2940	2900	2860	2810	2760	2710	2650	2580	2500	2410	2310
	$N_{b,z,Rd}$	2250	1630	1060	719	517	389	302	242	198	165	139	119	103
	$N_{b,T,Rd}$	2520	2120	1750	1470	1270	1140	1050	985	937	900	872	850	832
* 533x165x66 +	$N_{b,y,Rd}$	2520	2520	2500	2470	2430	2390	2350	2300	2250	2190	2130	2050	1970
	$N_{b,z,Rd}$	1900	1360	881	598	429	322	251	200	164	136	115	98.8	85.6
	$N_{b,T,Rd}$	2130	1770	1430	1180	1000	885	803	744	701	669	644	624	608
457x191x161 +	$N_{b,y,Rd}$	7110	7110	7010	6900	6780	6660	6510	6350	6170	5950	5710	5440	5140
	$N_{b,z,Rd}$	6060	4920	3660	2660	1970	1510	1190	955	785	657	557	478	415
	$N_{b,T,Rd}$	6500	6100	5800	5590	5450	5350	5270	5220	5180	5150	5130	5110	5090
457x191x133 +	$N_{b,y,Rd}$	5870	5870	5780	5690	5590	5480	5360	5220	5060	4880	4670	4440	4180
	$N_{b,z,Rd}$	4960	3980	2930	2110	1560	1190	936	753	619	517	439	377	327
	$N_{b,T,Rd}$	5300	4890	4560	4310	4130	4000	3910	3840	3780	3740	3710	3690	3670
457x191x106 +	$N_{b,y,Rd}$	4660	4650	4580	4510	4430	4340	4240	4130	3990	3840	3670	3470	3260
	$N_{b,z,Rd}$	3900	3090	2240	1610	1180	901	707	569	467	390	331	284	246
	$N_{b,T,Rd}$	4160	3760	3400	3110	2890	2740	2620	2540	2470	2420	2380	2350	2330
* 457x191x98	$N_{b,y,Rd}$	4200	4200	4140	4120	4100	4020	3930	3820	3700	3560	3400	3230	3030
	$N_{b,z,Rd}$	3620	2870	2080	1490	1100	838	657	529	434	363	308	264	229
	$N_{b,T,Rd}$	3760	3390	3040	2760	2550	2390	2280	2190	2130	2080	2040	2010	1990
* 457x191x89	$N_{b,y,Rd}$	3770	3770	3710	3650	3590	3520	3440	3350	3300	3240	3100	2930	2750
	$N_{b,z,Rd}$	3290	2590	1870	1340	987	751	589	474	389	325	276	236	205
	$N_{b,T,Rd}$	3360	3000	2660	2380	2160	2010	1890	1810	1750	1700	1660	1630	1600
* 457x191x82	$N_{b,y,Rd}$	3470	3470	3420	3360	3300	3240	3160	3080	2980	2870	2750	2700	2520
	$N_{b,z,Rd}$	2900	2370	1690	1200	882	670	525	422	346	289	245	210	182
	$N_{b,T,Rd}$	3080	2730	2390	2100	1880	1730	1610	1530	1460	1420	1380	1350	1320
* 457x191x74	$N_{b,y,Rd}$	3090	3090	3040	2990	2940	2880	2820	2750	2660	2570	2450	2330	2190
	$N_{b,z,Rd}$	2590	2120	1520	1080	792	602	471	379	311	259	220	189	164
	$N_{b,T,Rd}$	2730	2410	2080	1800	1590	1440	1330	1240	1180	1140	1100	1070	1050
* 457x191x67	$N_{b,y,Rd}$	2740	2740	2700	2650	2610	2560	2500	2430	2360	2270	2170	2060	1940
	$N_{b,z,Rd}$	2290	1800	1340	946	692	525	411	330	271	226	192	164	143
	$N_{b,T,Rd}$	2420	2120	1810	1540	1340	1190	1090	1010	952	908	874	847	825

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+ These sections are in addition to the range of BS 4 sections.

\* Section may be Class 4 under axial compression.

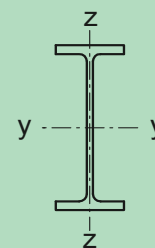
Values in italic type indicate that the section is a Class 4 section in pure compression and allowance has been made in calculating the resistance.

For values of the compression cross-sectional resistance  $N_{c,Rd}$ , see the values of  $N_{pl,Rd}$  in the tables for axial force and bending.

FOR EXPLANATION OF TABLES SEE NOTE 6.



UNIVERSAL BEAMS  
Advance® UKB



Section Designation	Axis	Compression resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ , $N_{b,T,Rd}$ (kN)												
		for												
		Buckling lengths (m)												
		1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
* 457x152x82	$N_{b,y,Rd}$	3460	3460	3460	3460	3450	3430	3400	3350	3290	3220	3150	3070	3040
	$N_{b,z,Rd}$	3240	3040	2700	2260	1840	1480	1200	820	591	445	346	277	227
	$N_{b,T,Rd}$	3320	3130	2940	2740	2560	2390	2250	2030	1880	1780	1710	1660	1620
* 457x152x74	$N_{b,y,Rd}$	3040	3040	3040	3040	3040	3020	2990	2950	2890	2840	2770	2700	2620
	$N_{b,z,Rd}$	2840	2600	2360	2010	1630	1310	1060	722	520	391	305	244	199
	$N_{b,T,Rd}$	2920	2750	2570	2390	2210	2050	1910	1700	1550	1450	1380	1330	1290
* 457x152x67	$N_{b,y,Rd}$	2770	2770	2770	2770	2760	2740	2720	2680	2630	2580	2520	2450	2370
	$N_{b,z,Rd}$	2580	2350	2070	1810	1450	1160	935	636	457	343	267	214	175
	$N_{b,T,Rd}$	2650	2490	2320	2140	1960	1790	1650	1430	1280	1190	1120	1070	1030
* 457x152x60	$N_{b,y,Rd}$	2390	2390	2390	2390	2390	2370	2360	2320	2280	2230	2180	2120	2060
	$N_{b,z,Rd}$	2230	2040	1790	1500	1270	1010	815	554	398	299	232	186	152
	$N_{b,T,Rd}$	2290	2150	2000	1840	1670	1510	1380	1170	1030	938	874	827	793
* 457x152x52	$N_{b,y,Rd}$	2030	2030	2030	2030	2030	2020	2000	1970	1930	1890	1850	1800	1740
	$N_{b,z,Rd}$	1890	1720	1500	1250	1050	833	668	452	324	243	189	151	123
	$N_{b,T,Rd}$	1950	1820	1690	1540	1380	1240	1110	920	793	707	648	607	576
406x178x85 +	$N_{b,y,Rd}$	3760	3760	3760	3760	3740	3710	3670	3610	3530	3440	3340	3220	3090
	$N_{b,z,Rd}$	3610	3370	3090	2760	2390	2020	1690	1200	876	665	521	418	343
	$N_{b,T,Rd}$	3670	3490	3310	3140	2960	2800	2660	2420	2250	2130	2050	1980	1930
* 406x178x74	$N_{b,y,Rd}$	3220	3220	3220	3220	3200	3180	3150	3090	3020	2950	2860	2850	2730
	$N_{b,z,Rd}$	3090	2880	2720	2410	2060	1730	1440	1010	739	560	438	352	289
	$N_{b,T,Rd}$	3140	2980	2820	2660	2490	2330	2190	1950	1780	1660	1570	1510	1460
* 406x178x67	$N_{b,y,Rd}$	2860	2860	2860	2860	2850	2820	2800	2750	2690	2620	2550	2460	2350
	$N_{b,z,Rd}$	2740	2560	2340	2160	1840	1540	1280	897	654	496	388	311	255
	$N_{b,T,Rd}$	2790	2650	2500	2350	2190	2030	1890	1660	1490	1370	1280	1220	1170
* 406x178x60	$N_{b,y,Rd}$	2500	2500	2500	2500	2490	2470	2440	2400	2350	2290	2230	2150	2060
	$N_{b,z,Rd}$	2400	2240	2050	1830	1640	1370	1130	795	580	439	344	276	226
	$N_{b,T,Rd}$	2430	2310	2180	2040	1890	1750	1610	1390	1230	1110	1030	970	926
* 406x178x54	$N_{b,y,Rd}$	2230	2230	2230	2230	2210	2190	2170	2130	2090	2040	1980	1910	1820
	$N_{b,z,Rd}$	2130	1980	1810	1600	1430	1180	978	681	495	375	293	235	192
	$N_{b,T,Rd}$	2160	2050	1930	1800	1660	1520	1390	1170	1010	902	824	768	726

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+ These sections are in addition to the range of BS 4 sections.

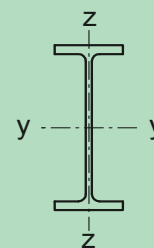
\* Section may be Class 4 under axial compression.

Values in italic type indicate that the section is a Class 4 section in pure compression and allowance has been made in calculating the resistance.

For values of the compression cross-sectional resistance  $N_{c,Rd}$ , see the values of  $N_{pl,Rd}$  in the tables for axial force and bending.

FOR EXPLANATION OF TABLES SEE NOTE 6.

UNIVERSAL BEAMS  
Advance® UKB



Section Designation	Axis	Compression resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ , $N_{b,T,Rd}$ (kN)												
		for												
		Buckling lengths (m)												
		1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
* 406x140x53 +	$N_{b,y,Rd}$	2200	2200	2200	2200	2180	2160	2140	2100	2060	2010	1950	1880	1790
	$N_{b,z,Rd}$	2030	1820	1570	1330	1050	827	663	448	321	241	187	149	122
	$N_{b,T,Rd}$	2090	1950	1800	1640	1490	1350	1240	1070	964	892	842	807	781
* 406x140x46	$N_{b,y,Rd}$	1820	1820	1820	1820	1810	1800	1780	1750	1710	1670	1620	1570	1500
	$N_{b,z,Rd}$	1690	1520	1310	1080	892	703	563	380	272	204	158	126	103
	$N_{b,T,Rd}$	1730	1620	1490	1350	1210	1080	979	825	724	658	613	581	557
* 406x140x39	$N_{b,y,Rd}$	1500	1500	1500	1500	1490	1470	1460	1430	1400	1370	1330	1280	1230
	$N_{b,z,Rd}$	1370	1230	1050	846	698	545	434	292	208	156	121	96.7	78.9
	$N_{b,T,Rd}$	1420	1320	1200	1080	952	839	743	605	517	459	420	392	372
* 356x171x67	$N_{b,y,Rd}$	3030	3030	3030	3020	2990	2960	2930	2860	2790	2690	2580	2450	2290
	$N_{b,z,Rd}$	2890	2690	2450	2160	1840	1540	1280	897	654	496	388	311	255
	$N_{b,T,Rd}$	2890	2750	2600	2450	2300	2170	2050	1860	1730	1630	1570	1520	1480
* 356x171x57	$N_{b,y,Rd}$	2470	2470	2470	2460	2440	2420	2390	2340	2270	2200	2150	2060	1930
	$N_{b,z,Rd}$	2360	2200	2060	1810	1530	1270	1050	736	536	405	317	254	208
	$N_{b,T,Rd}$	2400	2270	2140	2000	1860	1730	1610	1420	1280	1190	1120	1070	1040
* 356x171x51	$N_{b,y,Rd}$	2170	2170	2170	2160	2140	2120	2100	2050	1990	1930	1850	1760	1650
	$N_{b,z,Rd}$	2070	1920	1750	1600	1350	1120	923	644	468	354	277	222	182
	$N_{b,T,Rd}$	2100	1990	1870	1740	1610	1480	1360	1180	1050	955	890	844	809
* 356x171x45	$N_{b,y,Rd}$	1880	1880	1880	1870	1850	1840	1820	1770	1730	1670	1600	1520	1420
	$N_{b,z,Rd}$	1790	1660	1510	1330	1160	952	783	543	394	298	233	186	153
	$N_{b,T,Rd}$	1820	1720	1610	1490	1370	1250	1140	961	836	750	689	646	613
* 356x127x39	$N_{b,y,Rd}$	1600	1600	1600	1590	1580	1560	1540	1510	1470	1420	1360	1290	1200
	$N_{b,z,Rd}$	1440	1260	1040	825	628	487	386	258	184	137	106	84.9	69.3
	$N_{b,T,Rd}$	1490	1370	1240	1110	991	892	813	704	637	593	563	543	527
* 356x127x33	$N_{b,y,Rd}$	1310	1310	1310	1300	1290	1270	1260	1230	1200	1160	1110	1050	980
	$N_{b,z,Rd}$	1170	1010	823	661	500	386	305	203	145	108	83.7	66.7	54.4
	$N_{b,T,Rd}$	1220	1110	998	878	768	677	606	507	447	408	382	364	350

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+ These sections are in addition to the range of BS 4 sections.

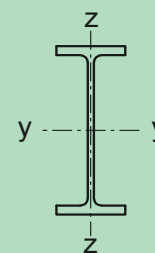
\* Section may be Class 4 under axial compression.

Values in italic type indicate that the section is a Class 4 section in pure compression and allowance has been made in calculating the resistance.

For values of the compression cross-sectional resistance  $N_{c,Rd}$ , see the values of  $N_{pl,Rd}$  in the tables for axial force and bending.

FOR EXPLANATION OF TABLES SEE NOTE 6.

UNIVERSAL BEAMS  
Advance® UKB



Section Designation	Axis	Compression resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ , $N_{b,T,Rd}$ (kN)												
		for												
		Buckling lengths (m)												
		1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
305x165x54	$N_{b,y,Rd}$	2440	2440	2440	2410	2390	2360	2330	2250	2170	2060	1940	1780	1610
	$N_{b,z,Rd}$	2320	2160	1960	1720	1460	1210	1010	703	512	388	303	243	199
	$N_{b,T,Rd}$	2360	2230	2100	1980	1860	1750	1650	1500	1400	1320	1270	1240	1210
* 305x165x46	$N_{b,y,Rd}$	2000	2000	2000	1980	1960	1930	1910	1850	1790	1700	1650	1520	1380
	$N_{b,z,Rd}$	1910	1770	1660	1460	1240	1030	848	592	431	326	255	205	168
	$N_{b,T,Rd}$	1930	1830	1720	1600	1490	1390	1290	1140	1040	971	921	885	859
* 305x165x40	$N_{b,y,Rd}$	1710	1710	1710	1690	1670	1650	1630	1590	1530	1460	1370	1270	1190
	$N_{b,z,Rd}$	1630	1520	1380	1220	1070	884	730	509	370	280	219	175	144
	$N_{b,T,Rd}$	1650	1560	1460	1360	1250	1150	1060	912	812	744	695	661	635
305x127x48	$N_{b,y,Rd}$	2170	2170	2170	2140	2120	2090	2060	1990	1910	1810	1680	1530	1370
	$N_{b,z,Rd}$	1940	1680	1360	1050	800	621	493	330	235	176	136	109	88.9
	$N_{b,T,Rd}$	2020	1880	1740	1610	1510	1420	1360	1270	1210	1180	1150	1140	1120
305x127x42	$N_{b,y,Rd}$	1900	1900	1890	1870	1850	1820	1790	1740	1660	1570	1460	1330	1190
	$N_{b,z,Rd}$	1690	1460	1170	894	682	529	419	280	200	149	116	92.4	75.4
	$N_{b,T,Rd}$	1760	1620	1480	1350	1240	1150	1080	985	927	889	864	846	833
* 305x127x37	$N_{b,y,Rd}$	1610	1610	1610	1590	1570	1550	1530	1480	1460	1380	1280	1160	1040
	$N_{b,z,Rd}$	1460	1280	1020	778	592	459	363	243	173	129	100	79.9	65.2
	$N_{b,T,Rd}$	1490	1370	1250	1120	1020	934	868	777	721	685	660	643	631
* 305x102x33	$N_{b,y,Rd}$	1380	1380	1380	1360	1350	1330	1310	1270	1220	1160	1090	1050	939
	$N_{b,z,Rd}$	1160	969	695	496	365	277	218	144	102	75.6	58.5	46.6	37.9
	$N_{b,T,Rd}$	1240	1110	979	866	778	712	664	601	564	541	525	514	506
* 305x102x28	$N_{b,y,Rd}$	1150	1150	1150	1130	1120	1110	1090	1060	1020	965	903	830	783
	$N_{b,z,Rd}$	962	783	570	404	296	224	176	116	81.9	61.0	47.1	37.5	30.5
	$N_{b,T,Rd}$	1030	912	792	684	601	539	493	434	400	378	364	353	346
* 305x102x25	$N_{b,y,Rd}$	988	988	986	975	963	951	938	908	872	827	771	706	648
	$N_{b,z,Rd}$	815	648	464	324	236	179	140	92.0	65.0	48.3	37.3	29.7	24.2
	$N_{b,T,Rd}$	879	772	657	556	477	420	379	326	296	276	263	255	248

Advance® and UKB are trademarks of Tata Steel. A fuller description of the relationship between Universal Beams (UB) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

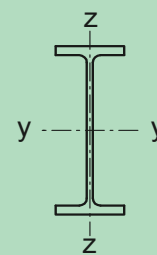
\* Section may be Class 4 under axial compression.

Values in italic type indicate that the section is a Class 4 section in pure compression and allowance has been made in calculating the resistance.

For values of the compression cross-sectional resistance  $N_{c,Rd}$ , see the values of  $N_{pl,Rd}$  in the tables for axial force and bending.

FOR EXPLANATION OF TABLES SEE NOTE 6.

UNIVERSAL BEAMS  
Advance® UKB



Section Designation	Axis	Compression resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ , $N_{b,T,Rd}$ (kN)												
		for												
		Buckling lengths (m)												
		1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
254x146x43	$N_{b,y,Rd}$	1950	1950	1930	1900	1870	1840	1810	1730	1630	1500	1350	1190	1030
	$N_{b,z,Rd}$	1820	1670	1480	1250	1020	829	675	463	335	252	197	157	129
	$N_{b,T,Rd}$	1850	1740	1640	1530	1440	1370	1310	1210	1150	1110	1090	1070	1050
* 254x146x37	$N_{b,y,Rd}$	1650	1650	1630	1630	1610	1590	1560	1490	1400	1290	1150	1010	875
	$N_{b,z,Rd}$	1570	1430	1260	1060	869	702	571	391	282	213	166	133	109
	$N_{b,T,Rd}$	1570	1470	1370	1270	1180	1100	1040	938	874	832	802	781	765
* 254x146x31	$N_{b,y,Rd}$	1370	1370	1360	1340	1320	1290	1270	1240	1160	1060	941	819	707
	$N_{b,z,Rd}$	1280	1190	1040	865	698	560	453	309	223	168	130	104	85.3
	$N_{b,T,Rd}$	1300	1210	1120	1020	934	853	785	685	621	578	548	528	512
* 254x102x28	$N_{b,y,Rd}$	1240	1240	1230	1210	1200	1200	1190	1130	1060	963	855	745	642
	$N_{b,z,Rd}$	1080	860	627	451	333	254	199	132	93.3	69.5	53.7	42.8	34.9
	$N_{b,T,Rd}$	1120	1010	899	808	738	687	649	599	569	551	538	530	523
* 254x102x25	$N_{b,y,Rd}$	1090	1090	1080	1060	1040	1030	1010	983	927	842	743	644	553
	$N_{b,z,Rd}$	946	741	532	380	279	212	167	110	77.8	57.9	44.8	35.6	29.0
	$N_{b,T,Rd}$	972	867	761	670	600	549	511	463	434	416	404	395	389
* 254x102x22	$N_{b,y,Rd}$	934	934	924	910	896	880	863	821	793	725	636	548	470
	$N_{b,z,Rd}$	793	623	439	310	227	172	135	88.7	62.7	46.7	36.1	28.7	23.4
	$N_{b,T,Rd}$	829	731	629	541	474	426	391	345	319	303	292	284	278
203x133x30	$N_{b,y,Rd}$	1360	1350	1330	1300	1270	1240	1210	1120	994	853	717	599	503
	$N_{b,z,Rd}$	1250	1120	961	782	620	493	396	268	193	145	112	89.9	73.5
	$N_{b,T,Rd}$	1270	1190	1100	1020	958	904	861	801	763	738	721	709	700
203x133x25	$N_{b,y,Rd}$	1140	1130	1110	1090	1060	1040	1010	926	821	700	586	488	409
	$N_{b,z,Rd}$	1040	931	791	639	504	398	319	216	155	116	90.3	72.1	58.9
	$N_{b,T,Rd}$	1060	982	900	820	750	692	646	582	541	515	497	485	475
203x102x23	$N_{b,y,Rd}$	1040	1040	1020	998	976	951	921	846	746	634	529	440	369
	$N_{b,z,Rd}$	897	735	553	404	301	230	181	120	85.3	63.6	49.2	39.2	32.0
	$N_{b,T,Rd}$	940	854	776	714	667	632	607	573	554	541	533	527	522
178x102x19	$N_{b,y,Rd}$	863	851	833	813	790	764	731	647	544	444	361	295	245
	$N_{b,z,Rd}$	742	610	459	336	251	192	151	100	71.1	53.0	41.0	32.7	26.6
	$N_{b,T,Rd}$	774	701	635	581	541	511	490	461	445	434	427	422	418
152x89x16	$N_{b,y,Rd}$	720	703	685	664	638	606	566	469	371	291	232	188	155
	$N_{b,z,Rd}$	595	460	327	232	170	129	101	66.7	47.2	35.1	27.1	21.6	17.6
	$N_{b,T,Rd}$	634	575	528	495	472	456	444	429	421	415	412	409	408
127x76x13	$N_{b,y,Rd}$	580	563	543	519	487	446	399	302	226	173	136	109	89.5
	$N_{b,z,Rd}$	455	325	218	151	109	82.4	64.3	42.2	29.8	22.1	17.1	13.6	11.1
	$N_{b,T,Rd}$	507	468	442	426	416	409	404	398	395	392	391	390	389

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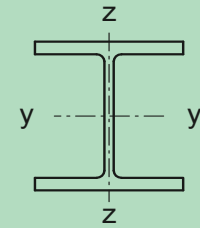
\* Section may be Class 4 under axial compression.

Values in italic type indicate that the section is a Class 4 section in pure compression and allowance has been made in calculating the resistance.

For values of the compression cross-sectional resistance  $N_{c,Rd}$ , see the values of  $N_{pl,Rd}$  in the tables for axial force and bending.

FOR EXPLANATION OF TABLES SEE NOTE 6.

UNIVERSAL COLUMNS  
Advance® UKC



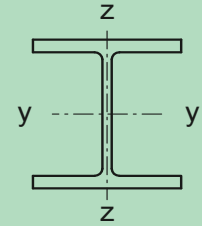
Section Designation	Axis	Compression resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ , $N_{b,T,Rd}$ (kN) for Buckling lengths (m)												
		2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
		356x406x634	$N_{b,y,Rd}$	26300	26200	25600	24900	24200	23500	22700	21800	20900	19800	18800
	$N_{b,z,Rd}$	25900	24400	22800	21100	19300	17400	15600	13800	12200	10800	9510	8430	7510
	$N_{b,T,Rd}$	26300	25700	25300	25100	24900	24800	24800	24700	24700	24600	24600	24600	24600
356x406x551	$N_{b,y,Rd}$	22800	22700	22200	21600	21000	20300	19600	18800	17900	17000	16000	15000	14000
	$N_{b,z,Rd}$	22500	21100	19700	18300	16700	15000	13400	11900	10500	9230	8150	7220	6430
	$N_{b,T,Rd}$	22700	22100	21700	21500	21300	21200	21100	21100	21000	21000	21000	21000	20900
356x406x467	$N_{b,y,Rd}$	19900	19800	19300	18700	18200	17500	16900	16100	15300	14400	13500	12600	11700
	$N_{b,z,Rd}$	19600	18300	17100	15700	14300	12800	11300	9980	8760	7690	6770	5990	5320
	$N_{b,T,Rd}$	19700	19100	18600	18400	18200	18100	18000	17900	17900	17800	17800	17800	17800
356x406x393	$N_{b,y,Rd}$	16800	16600	16200	15700	15200	14700	14100	13400	12700	12000	11200	10400	9590
	$N_{b,z,Rd}$	16400	15400	14300	13100	11900	10600	9370	8220	7190	6300	5540	4890	4340
	$N_{b,T,Rd}$	16500	15900	15400	15100	14900	14800	14700	14600	14600	14500	14500	14500	14400
356x406x340	$N_{b,y,Rd}$	14500	14400	14000	13600	13100	12600	12100	11500	10900	10200	9510	8810	8120
	$N_{b,z,Rd}$	14200	13300	12300	11300	10200	9100	8020	7020	6140	5370	4720	4170	3700
	$N_{b,T,Rd}$	14200	13600	13200	12800	12600	12500	12300	12200	12200	12100	12100	12100	12000
356x406x287	$N_{b,y,Rd}$	12600	12500	12100	11700	11300	10900	10400	9870	9290	8670	8040	7410	6800
	$N_{b,z,Rd}$	12300	11500	10600	9720	8740	7750	6800	5930	5170	4510	3960	3490	3090
	$N_{b,T,Rd}$	12300	11700	11200	10900	10600	10400	10300	10200	10100	10000	9940	9900	9860
356x406x235	$N_{b,y,Rd}$	10300	10200	9880	9570	9230	8870	8460	8010	7530	7010	6490	5970	5470
	$N_{b,z,Rd}$	10000	9370	8660	7900	7100	6280	5500	4790	4170	3630	3180	2810	2490
	$N_{b,T,Rd}$	10000	9440	8990	8620	8330	8100	7920	7790	7680	7590	7520	7460	7410
356x368x202	$N_{b,y,Rd}$	8870	8740	8480	8210	7910	7590	7230	6840	6420	5970	5510	5060	4630
	$N_{b,z,Rd}$	8560	7940	7290	6580	5830	5100	4410	3810	3290	2850	2490	2180	1930
	$N_{b,T,Rd}$	8530	8030	7600	7240	6960	6740	6560	6420	6310	6220	6150	6090	6040
356x368x177	$N_{b,y,Rd}$	7800	7680	7450	7200	6940	6650	6330	5970	5590	5190	4780	4390	4010
	$N_{b,z,Rd}$	7520	6970	6390	5760	5110	4450	3850	3320	2860	2480	2170	1900	1680
	$N_{b,T,Rd}$	7490	7010	6600	6240	5950	5710	5510	5360	5230	5130	5050	4980	4920
356x368x153	$N_{b,y,Rd}$	6730	6620	6420	6210	5980	5730	5450	5140	4800	4460	4100	3760	3430
	$N_{b,z,Rd}$	6480	6010	5500	4960	4390	3820	3300	2840	2450	2130	1850	1630	1440
	$N_{b,T,Rd}$	6440	6010	5620	5270	4970	4710	4510	4340	4200	4090	4000	3920	3860
356x368x129	$N_{b,y,Rd}$	5660	5560	5390	5210	5010	4790	4550	4290	4000	3710	3400	3110	2840
	$N_{b,z,Rd}$	5450	5050	4620	4160	3670	3200	2760	2370	2040	1770	1540	1350	1190
	$N_{b,T,Rd}$	5410	5030	4670	4330	4040	3780	3560	3380	3240	3120	3020	2940	2870

Advance® and UKC are trademarks of Tata Steel. A fuller description of the relationship between Universal Columns (UC) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

For values of the compression cross-sectional resistance  $N_{c,Rd}$ , see the values of  $N_{pl,Rd}$  in the tables for axial force and bending.

FOR EXPLANATION OF TABLES SEE NOTE 6.

UNIVERSAL COLUMNS  
Advance® UKC



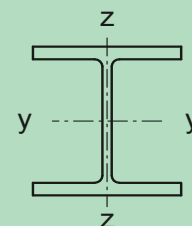
Section Designation	Axis	Compression resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ , $N_{b,T,Rd}$ (kN) for Buckling lengths (m)												
		2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
		305x305x283	$N_{b,y,Rd}$	12100	11800	11400	11000	10600	10100	9540	8930	8290	7620	6960
	$N_{b,z,Rd}$	11400	10400	9360	8220	7070	5990	5060	4280	3650	3130	2710	2370	2080
	$N_{b,T,Rd}$	11700	11200	11000	10800	10700	10700	10600	10600	10600	10500	10500	10500	10500
305x305x240	$N_{b,y,Rd}$	10600	10300	9960	9580	9170	8710	8200	7640	7050	6440	5860	5300	4790
	$N_{b,z,Rd}$	9930	9050	8080	7050	6010	5070	4260	3590	3050	2610	2260	1970	1730
	$N_{b,T,Rd}$	10100	9660	9380	9190	9070	8980	8930	8880	8850	8830	8810	8790	8780
305x305x198	$N_{b,y,Rd}$	8690	8470	8180	7860	7510	7120	6680	6200	5700	5190	4700	4250	3830
	$N_{b,z,Rd}$	8160	7420	6610	5740	4880	4100	3440	2900	2460	2110	1820	1590	1390
	$N_{b,T,Rd}$	8260	7830	7520	7310	7170	7070	6990	6940	6900	6870	6840	6820	6810
305x305x158	$N_{b,y,Rd}$	6930	6740	6500	6240	5950	5630	5260	4870	4460	4050	3650	3290	2960
	$N_{b,z,Rd}$	6490	5880	5220	4520	3830	3200	2680	2250	1910	1630	1410	1230	1080
	$N_{b,T,Rd}$	6530	6120	5800	5560	5390	5260	5170	5090	5040	4990	4960	4930	4910
305x305x137	$N_{b,y,Rd}$	6000	5830	5610	5380	5130	4840	4520	4170	3810	3450	3110	2790	2510
	$N_{b,z,Rd}$	5610	5080	4500	3880	3280	2740	2290	1920	1630	1390	1200	1050	918
	$N_{b,T,Rd}$	5630	5240	4920	4670	4480	4340	4230	4140	4080	4030	3990	3950	3930
305x305x118	$N_{b,y,Rd}$	5180	5020	4830	4630	4410	4160	3880	3570	3260	2950	2650	2380	2140
	$N_{b,z,Rd}$	4830	4370	3860	3330	2800	2340	1950	1640	1390	1180	1020	889	780
	$N_{b,T,Rd}$	4830	4460	4150	3890	3680	3520	3400	3300	3230	3170	3120	3080	3050
305x305x97	$N_{b,y,Rd}$	4370	4220	4060	3880	3690	3460	3210	2950	2670	2400	2150	1930	1730
	$N_{b,z,Rd}$	4050	3650	3220	2750	2300	1910	1590	1330	1120	959	826	719	630
	$N_{b,T,Rd}$	4050	3700	3390	3120	2900	2720	2580	2470	2380	2310	2250	2210	2170
254x254x167	$N_{b,y,Rd}$	7300	7020	6710	6360	5960	5510	5010	4500	4000	3540	3130	2780	2470
	$N_{b,z,Rd}$	6680	5910	5060	4200	3420	2780	2270	1880	1580	1340	1150	1000	875
	$N_{b,T,Rd}$	6900	6610	6440	6340	6280	6230	6210	6180	6170	6160	6150	6140	6140
254x254x132	$N_{b,y,Rd}$	5750	5520	5260	4980	4650	4270	3870	3460	3060	2700	2380	2100	1870
	$N_{b,z,Rd}$	5240	4630	3940	3250	2640	2130	1740	1440	1210	1030	881	764	668
	$N_{b,T,Rd}$	5370	5070	4880	4750	4670	4620	4580	4550	4530	4510	4500	4490	4480
254x254x107	$N_{b,y,Rd}$	4640	4450	4240	3990	3720	3400	3060	2720	2400	2100	1850	1630	1450
	$N_{b,z,Rd}$	4230	3720	3160	2590	2090	1690	1380	1140	955	810	694	602	526
	$N_{b,T,Rd}$	4300	4000	3790	3650	3550	3480	3430	3390	3360	3340	3320	3310	3300
254x254x89	$N_{b,y,Rd}$	3860	3690	3510	3310	3070	2810	2520	2240	1970	1730	1520	1340	1180
	$N_{b,z,Rd}$	3510	3080	2610	2140	1720	1390	1130	938	785	665	571	494	432
	$N_{b,T,Rd}$	3540	3250	3030	2870	2760	2670	2610	2560	2530	2500	2480	2460	2450
254x254x73	$N_{b,y,Rd}$	3260	3120	2960	2780	2580	2340	2090	1850	1620	1420	1240	1090	966
	$N_{b,z,Rd}$	2960	2580	2170	1770	1410	1140	925	762	637	540	463	401	350
	$N_{b,T,Rd}$	2960	2680	2440	2260	2120	2020	1950	1890	1840	1810	1780	1760	1750

Advance® and UKC are trademarks of Tata Steel. A fuller description of the relationship between Universal Columns (UC) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

For values of the compression cross-sectional resistance  $N_{c,Rd}$ , see the values of  $N_{pl,Rd}$  in the tables for axial force and bending.

FOR EXPLANATION OF TABLES SEE NOTE 6.

UNIVERSAL COLUMNS  
Advance® UKC



Section Designation	Axis	Compression resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ , $N_{b,T,Rd}$ (kN) for Buckling lengths (m)												
		1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
		203x203x127 +	$N_{b,y,Rd}$	5590	5590	5460	5320	5180	5030	4870	4500	4070	3600	3130
203x203x113 +	$N_{b,z,Rd}$	5490	5160	4810	4430	4040	3630	3220	2500	1940	1520	1220	998	829
	$N_{b,T,Rd}$	5540	5340	5210	5120	5060	5020	4980	4950	4920	4910	4900	4890	4890
	$N_{b,y,Rd}$	5000	5000	4880	4760	4630	4490	4340	4000	3600	3170	2750	2360	2030
203x203x100 +	$N_{b,z,Rd}$	4910	4610	4290	3950	3590	3220	2860	2210	1710	1340	1080	879	730
	$N_{b,T,Rd}$	4940	4750	4610	4520	4450	4400	4370	4320	4290	4280	4270	4260	4250
	$N_{b,y,Rd}$	4380	4370	4270	4160	4040	3920	3780	3470	3120	2740	2360	2020	1740
203x203x86	$N_{b,z,Rd}$	4290	4030	3750	3450	3130	2800	2480	1910	1470	1160	926	755	627
	$N_{b,T,Rd}$	4310	4130	3990	3890	3820	3770	3730	3680	3650	3630	3610	3600	3590
	$N_{b,y,Rd}$	3800	3780	3690	3590	3490	3380	3260	2980	2670	2330	2000	1710	1460
203x203x71	$N_{b,z,Rd}$	3710	3480	3230	2970	2690	2400	2120	1630	1260	986	789	644	534
	$N_{b,T,Rd}$	3720	3550	3410	3310	3230	3170	3120	3060	3020	3000	2980	2970	2960
	$N_{b,y,Rd}$	3120	3110	3030	2950	2860	2770	2670	2440	2170	1890	1620	1390	1180
203x203x60	$N_{b,z,Rd}$	3050	2860	2650	2430	2200	1960	1730	1330	1020	801	640	522	433
	$N_{b,T,Rd}$	3050	2890	2760	2650	2570	2500	2450	2370	2330	2290	2270	2260	2250
	$N_{b,y,Rd}$	2710	2690	2620	2550	2470	2380	2290	2080	1830	1580	1340	1140	968
203x203x52	$N_{b,z,Rd}$	2640	2470	2280	2080	1870	1660	1450	1100	844	659	526	428	355
	$N_{b,T,Rd}$	2640	2480	2350	2240	2150	2070	2010	1910	1850	1810	1780	1760	1740
	$N_{b,y,Rd}$	2350	2340	2270	2210	2140	2070	1980	1800	1580	1360	1160	980	833
203x203x46	$N_{b,z,Rd}$	2290	2140	1980	1800	1620	1430	1260	952	728	568	453	369	306
	$N_{b,T,Rd}$	2280	2150	2020	1910	1810	1730	1670	1570	1500	1450	1420	1390	1370
	$N_{b,y,Rd}$	2080	2070	2010	1950	1890	1820	1750	1580	1390	1190	1010	855	726
152x152x51 +	$N_{b,z,Rd}$	2030	1890	1740	1590	1430	1260	1100	832	635	495	395	321	266
	$N_{b,T,Rd}$	2020	1890	1770	1670	1570	1490	1420	1310	1240	1190	1150	1120	1100
	$N_{b,y,Rd}$	2310	2250	2170	2080	1990	1880	1760	1490	1220	986	803	661	551
152x152x44 +	$N_{b,z,Rd}$	2160	1960	1730	1490	1260	1050	879	625	461	352	277	224	184
	$N_{b,T,Rd}$	2190	2080	2000	1950	1910	1880	1870	1840	1830	1820	1810	1810	1810
	$N_{b,y,Rd}$	1990	1930	1860	1790	1700	1600	1500	1260	1030	831	675	555	463
152x152x37	$N_{b,z,Rd}$	1860	1680	1480	1280	1070	894	745	529	390	297	234	189	155
	$N_{b,T,Rd}$	1880	1770	1680	1620	1580	1550	1530	1500	1480	1470	1470	1460	1460
	$N_{b,y,Rd}$	1670	1620	1560	1490	1420	1340	1250	1050	849	684	555	456	380
152x152x30	$N_{b,z,Rd}$	1550	1400	1240	1060	889	738	614	435	320	244	192	155	127
	$N_{b,T,Rd}$	1570	1460	1380	1310	1270	1230	1200	1170	1150	1130	1120	1120	1110
	$N_{b,y,Rd}$	1360	1320	1270	1210	1150	1080	1010	839	679	545	442	362	302
152x152x23	$N_{b,z,Rd}$	1260	1140	999	854	714	592	492	347	256	195	153	123	102
	$N_{b,T,Rd}$	1260	1170	1080	1020	963	922	891	847	820	802	790	782	775
	$N_{b,y,Rd}$	1040	999	960	916	867	812	751	618	495	395	319	261	217
152x152x23	$N_{b,z,Rd}$	955	856	746	632	524	431	356	250	183	140	110	88.3	72.6
	$N_{b,T,Rd}$	957	873	795	727	671	626	590	541	510	489	475	465	458

Advance® and UKC are trademarks of Tata Steel. A fuller description of the relationship between Universal Columns (UC) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

+ These sections are in addition to the range of BS 4 sections.

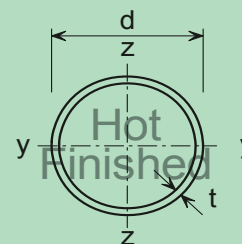
For values of the compression cross-sectional resistance  $N_{c,Rd}$ , see the values of  $N_{pl,Rd}$  in the tables for axial force and bending.

FOR EXPLANATION OF TABLES SEE NOTE 6.



HOT-FINISHED  
CIRCULAR HOLLOW SECTIONS

Celsius® CHS



Designation		Mass per Metre kg/m	Compression resistance $N_{b,Rd}$ (kN) for Buckling lengths (m)													
Outside Diameter d mm	Wall Thk t mm		$N_{b,T,Rd}$ kN	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
21.3	2.6 #	1.20	54.3	12.6	5.85	3.35	2.17	1.52	1.12	0.861	0.554	0.386	0.284	0.218	0.173	0.140
	2.9 #	1.32	59.6	13.5	6.26	3.59	2.32	1.62	1.20	0.921	0.592	0.413	0.304	0.233	0.184	0.150
	3.2	1.43	64.6	14.2	6.60	3.78	2.45	1.71	1.26	0.971	0.624	0.435	0.320	0.246	0.194	0.158
26.9	2.6 #	1.56	70.3	25.7	12.3	7.14	4.64	3.25	2.41	1.85	1.19	0.832	0.613	0.470	0.372	0.302
	2.9 #	1.72	77.7	28.0	13.4	7.74	5.03	3.52	2.61	2.00	1.29	0.901	0.664	0.510	0.403	0.327
	3.2	1.87	84.5	29.8	14.3	8.24	5.35	3.75	2.77	2.13	1.37	0.959	0.707	0.542	0.429	0.348
	3.6 #	2.07	93.7	32.3	15.4	8.90	5.78	4.05	2.99	2.30	1.48	1.03	0.762	0.585	0.463	0.376
33.7	2.6 #	1.99	90.2	48.4	24.7	14.5	9.49	6.68	4.95	3.81	2.46	1.72	1.27	0.974	0.771	0.626
	2.9 #	2.20	99.8	52.8	26.9	15.8	10.3	7.26	5.38	4.14	2.67	1.87	1.38	1.06	0.838	0.680
	3.2	2.41	109	56.9	28.9	17.0	11.1	7.79	5.77	4.44	2.87	2.00	1.48	1.13	0.899	0.729
	3.6 #	2.67	121	62.2	31.5	18.4	12.0	8.47	6.27	4.83	3.12	2.18	1.61	1.23	0.977	0.793
	4.0	2.93	132	67.3	34.0	19.9	13.0	9.12	6.76	5.21	3.36	2.35	1.73	1.33	1.05	0.854
	4.5 #	3.24	147	72.5	36.3	21.2	13.9	9.74	7.21	5.55	3.58	2.50	1.85	1.42	1.12	0.911
	5.0 #	3.54	160	78.0	39.0	22.8	14.8	10.4	7.73	5.95	3.84	2.68	1.98	1.52	1.20	0.975
42.4	2.6 #	2.55	115	82.5	48.6	29.5	19.5	13.8	10.2	7.91	5.12	3.58	2.65	2.03	1.61	1.31
	2.9 #	2.82	128	90.8	53.3	32.2	21.3	15.1	11.2	8.64	5.60	3.92	2.89	2.22	1.76	1.43
	3.2	3.09	140	98.7	57.6	34.8	23.0	16.3	12.1	9.33	6.04	4.23	3.12	2.40	1.90	1.54
	3.6 #	3.44	156	109	63.4	38.3	25.3	17.9	13.3	10.3	6.64	4.64	3.43	2.63	2.09	1.70
	4.0	3.79	171	119	68.1	41.0	27.0	19.1	14.2	11.0	7.09	4.96	3.66	2.82	2.23	1.81
	4.5 #	4.21	190	131	74.7	44.9	29.6	20.9	15.5	12.0	7.76	5.43	4.01	3.08	2.44	1.98
48.3	2.6 #	2.93	132	105	69.2	43.4	29.0	20.6	15.4	11.9	7.71	5.40	3.99	3.07	2.43	1.98
	2.9 #	3.25	147	116	76.1	47.6	31.8	22.6	16.8	13.0	8.45	5.92	4.38	3.37	2.67	2.17
	3.2	3.56	161	126	82.5	51.5	34.4	24.4	18.2	14.1	9.14	6.40	4.73	3.64	2.89	2.34
	3.6 #	3.97	180	141	91.3	56.9	38.0	27.0	20.1	15.5	10.1	7.06	5.22	4.01	3.18	2.59
	4.0	4.37	198	153	98.7	61.3	40.8	29.0	21.6	16.7	10.8	7.58	5.61	4.31	3.42	2.78
	4.5 #	4.86	220	170	109	67.3	44.8	31.8	23.7	18.3	11.9	8.32	6.15	4.73	3.75	3.05
	5.0	5.34	241	185	117	72.3	48.1	34.1	25.4	19.6	12.7	8.92	6.59	5.07	4.02	3.26
	5.6 #	5.90	267	202	127	78.0	51.8	36.8	27.4	21.2	13.7	9.60	7.09	5.45	4.32	3.51
	6.3	6.53	295	222	137	84.3	56.0	39.7	29.5	22.8	14.8	10.3	7.65	5.88	4.66	3.78
60.3	2.6 #	3.70	167	146	116	80.2	55.5	40.0	30.0	23.3	15.2	10.7	7.92	6.10	4.84	3.93
	2.9 #	4.11	186	162	128	88.4	61.1	44.0	33.0	25.7	16.7	11.8	8.71	6.71	5.32	4.33
	3.2	4.51	204	177	140	96.3	66.4	47.9	35.9	27.9	18.2	12.8	9.46	7.29	5.78	4.70
	3.6 #	5.03	228	198	155	107	73.6	53.0	39.8	30.9	20.1	14.1	10.5	8.06	6.40	5.20
	4.0	5.55	251	218	170	117	80.4	57.9	43.4	33.7	22.0	15.4	11.4	8.80	6.99	5.68
	4.5 #	6.19	280	242	188	128	88.2	63.4	47.6	36.9	24.1	16.9	12.5	9.63	7.64	6.21
	5.0	6.82	308	266	205	139	95.4	68.5	51.4	39.9	26.0	18.2	13.5	10.4	8.25	6.71
	5.6 #	7.55	342	293	224	151	104	74.5	55.8	43.3	28.2	19.8	14.7	11.3	8.95	7.28
	6.3	8.39	380	325	247	166	113	81.2	60.9	47.2	30.8	21.6	16.0	12.3	9.76	7.93
	8.0 #	10.3	465	394	293	194	132	94.7	70.9	55.0	35.8	25.1	18.6	14.3	11.3	9.22

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Circular Hollow Sections (HFCHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

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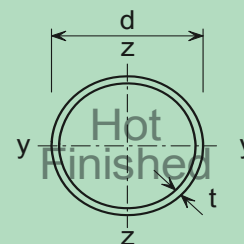
For values of the compression cross-sectional resistance  $N_{c,Rd}$ , see the values of  $N_{pl,Rd}$  in the tables for axial force and bending.

FOR EXPLANATION OF TABLES SEE NOTE 6.



HOT-FINISHED  
CIRCULAR HOLLOW SECTIONS

Celsius® CHS



Designation		Mass per Metre kg/m	Compression resistance $N_{b,Rd}$ (kN) for Buckling lengths (m)													
Outside Diameter d mm	Wall Thk t mm		$N_{b,T,Rd}$ kN	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
76.1	2.9	5.24	237	218	194	156	116	86.6	66.0	51.7	34.0	24.0	17.8	13.8	10.9	8.90
	3.2	5.75	260	240	213	171	127	94.5	72.1	56.5	37.1	26.2	19.5	15.0	11.9	9.71
	3.6 #	6.44	291	268	237	190	141	105	80.1	62.7	41.2	29.1	21.6	16.7	13.2	10.8
	4.0	7.11	322	296	261	208	154	115	87.2	68.3	44.9	31.7	23.5	18.1	14.4	11.7
	4.5 #	7.95	359	330	291	231	171	127	96.5	75.6	49.7	35.0	26.0	20.1	15.9	13.0
	5.0	8.77	398	365	321	254	187	139	106	82.6	54.3	38.3	28.4	21.9	17.4	14.2
	5.6 #	9.74	440	404	354	278	205	151	115	90.1	59.2	41.7	31.0	23.9	19.0	15.4
	6.3	10.8	490	448	392	307	225	166	126	98.8	64.8	45.7	33.9	26.2	20.8	16.9
8.0	13.4	607	553	479	369	268	197	150	117	76.7	54.0	40.1	30.9	24.6	20.0	
88.9	2.9 #	6.15	278	263	243	211	170	132	103	81.4	54.1	38.4	28.6	22.1	17.6	14.3
	3.2 #	6.76	306	289	266	232	187	145	112	89.0	59.1	41.9	31.2	24.1	19.2	15.6
	3.6 #	7.57	343	323	298	259	208	161	125	99.0	65.8	46.6	34.7	26.8	21.4	17.4
	4.0	8.38	380	358	330	286	229	177	137	109	72.0	51.1	38.0	29.4	23.4	19.0
	4.5 #	9.37	422	398	366	317	253	196	152	120	79.6	56.4	42.0	32.5	25.8	21.0
	5.0	10.3	469	441	405	350	279	215	166	131	87.2	61.8	46.0	35.5	28.3	23.0
	5.6 #	11.5	522	491	451	387	308	237	183	145	95.9	67.9	50.6	39.1	31.1	25.3
	6.3	12.8	579	544	498	427	338	259	201	158	105	74.4	55.3	42.7	34.0	27.7
8.0	16.0	721	676	616	523	410	313	241	190	126	89.0	66.2	51.1	40.7	33.1	
10.0 #	19.5	880	823	747	628	487	369	284	223	148	104	77.7	60.0	47.7	38.8	
101.6	3.2 #	7.77	351	337	317	289	248	202	162	130	87.6	62.5	46.7	36.2	28.8	23.5
	3.6 #	8.70	394	378	356	323	278	226	181	145	97.8	69.8	52.1	40.4	32.2	26.2
	4.0 #	9.63	437	418	394	357	306	249	199	159	107	76.5	57.1	44.2	35.2	28.7
	4.5 #	10.8	486	466	438	397	340	276	220	177	119	84.7	63.3	49.0	39.0	31.8
	5.0 #	11.9	540	517	485	440	375	304	242	194	130	93.0	69.4	53.7	42.8	34.9
	5.6 #	13.3	600	574	539	487	415	335	267	214	143	102	76.3	59.1	47.1	38.4
	6.3 #	14.8	671	642	602	543	461	372	295	237	159	113	84.4	65.3	52.0	42.4
	8.0 #	18.5	834	796	745	669	564	451	357	285	191	136	101	78.5	62.5	50.9
10.0 #	22.6	1020	974	909	812	678	539	425	338	226	161	120	92.8	73.9	60.2	
114.3	3.2 #	8.77	398	386	368	343	309	265	219	180	123	88.8	66.6	51.7	41.2	33.7
	3.6	9.83	444	430	410	383	344	295	244	200	137	98.6	73.9	57.4	45.8	37.4
	4.0	10.9	493	478	456	425	381	326	270	221	151	109	81.4	63.2	50.4	41.2
	4.5 #	12.2	550	533	508	473	424	363	299	245	168	121	90.4	70.1	56.0	45.7
	5.0	13.5	611	591	563	524	469	400	330	270	185	132	99.3	77.1	61.5	50.2
	5.6 #	15.0	678	656	625	581	519	442	364	297	203	146	109	84.7	67.6	55.2
	6.3	16.8	760	735	699	649	579	491	403	329	224	161	121	93.5	74.6	60.9
	8.0	21.0	948	916	870	806	715	603	493	401	273	196	147	114	90.8	74.1
10.0 #	25.7	1160	1120	1060	983	866	725	590	478	325	232	174	135	108	87.7	

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Circular Hollow Sections (HFCHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

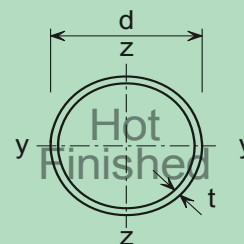
# Check availability

For values of the compression cross-sectional resistance  $N_{c,Rd}$ , see the values of  $N_{pl,Rd}$  in the tables for axial force and bending.

FOR EXPLANATION OF TABLES SEE NOTE 6.

HOT-FINISHED  
CIRCULAR HOLLOW SECTIONS

Celsius® CHS



Designation		Mass per Metre kg/m	Compression resistance $N_{b,Rd}$ (kN) for Buckling lengths (m)													
Outside Diameter d mm	Wall Thk t mm		$N_{b,T,Rd}$ kN	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
139.7	3.2 #	10.8	486	479	463	443	417	383	341	295	214	158	119	93.3	74.8	61.2
	3.6 #	12.1	547	538	520	497	468	430	382	330	239	176	133	104	83.4	68.3
	4.0 #	13.4	607	597	577	552	520	477	423	366	265	195	147	115	92.2	75.5
	4.5 #	15.0	678	667	644	616	580	531	471	406	294	216	163	128	102	83.6
	5.0	16.6	753	740	715	684	643	589	522	450	325	239	181	141	113	92.5
	5.6 #	18.5	838	824	795	760	715	654	578	498	359	264	200	156	125	102
	6.3	20.7	937	921	889	849	797	728	643	553	398	292	221	172	138	113
	8.0	26.0	1180	1150	1110	1060	995	905	796	682	489	357	270	211	169	138
	10.0	32.0	1440	1420	1370	1300	1220	1100	966	824	588	429	324	253	203	166
12.5 #	39.2	1780	1740	1670	1590	1480	1340	1160	988	702	511	386	301	241	197	
168.3	5.0	20.1	912	907	883	856	823	782	730	666	524	400	309	244	196	161
	5.6 #	22.5	1020	1010	983	952	915	869	811	739	580	443	342	269	217	178
	6.3	25.2	1140	1130	1100	1070	1030	974	907	826	647	493	380	300	241	198
	8.0	31.6	1430	1420	1380	1340	1290	1220	1130	1030	800	608	469	369	297	244
	10.0	39.0	1760	1750	1700	1650	1580	1500	1390	1260	973	737	567	446	359	295
	12.5	48.0	2170	2160	2090	2030	1940	1830	1690	1530	1170	887	681	535	431	354
193.7	5.0	23.3	1050	1050	1030	1000	974	940	897	845	713	572	453	362	294	243
	5.6 #	26.0	1180	1180	1150	1120	1090	1050	1000	943	795	637	504	403	327	270
	6.3	29.1	1320	1320	1290	1260	1220	1180	1120	1060	888	711	562	449	364	301
	8.0	36.6	1660	1660	1620	1580	1530	1480	1410	1320	1110	884	697	556	451	372
	10.0	45.3	2050	2050	2000	1950	1890	1820	1730	1620	1350	1080	846	674	547	451
	12.5	55.9	2530	2530	2470	2400	2330	2240	2130	1990	1650	1300	1020	814	660	544
	16.0 #	70.1	3170	3160	3090	3010	2910	2790	2650	2470	2030	1590	1250	991	802	660
219.1	4.5 #	23.8	1080	1080	1060	1040	1020	988	956	917	816	690	565	460	378	314
	5.0 #	26.4	1190	1190	1180	1150	1130	1100	1060	1020	903	763	624	508	417	347
	5.6 #	29.5	1330	1330	1320	1290	1260	1230	1180	1140	1010	851	696	566	465	386
	6.3	33.1	1490	1490	1470	1440	1410	1370	1330	1270	1130	950	776	631	518	430
	8.0	41.6	1890	1890	1860	1820	1780	1730	1670	1600	1410	1190	968	786	644	535
	10.0	51.6	2330	2330	2300	2250	2200	2130	2060	1970	1740	1450	1180	958	784	650
	12.5	63.7	2880	2880	2840	2770	2710	2630	2530	2420	2120	1770	1430	1160	950	787
	14.2 #	71.8	3240	3240	3190	3120	3050	2960	2850	2720	2380	1970	1600	1290	1050	874
	16.0	80.1	3620	3620	3560	3480	3400	3290	3170	3020	2640	2180	1760	1420	1160	961
244.5	5.0 #	29.5	1330	1330	1330	1300	1280	1250	1220	1180	1080	955	812	677	564	472
	5.6 #	33.0	1490	1490	1480	1450	1430	1390	1360	1320	1210	1070	905	754	627	526
	6.3 #	37.0	1670	1670	1660	1630	1600	1560	1520	1470	1350	1190	1010	841	699	586
	8.0 #	46.7	2110	2110	2090	2050	2010	1970	1920	1860	1700	1490	1260	1050	874	731
	10.0 #	57.8	2620	2620	2600	2550	2500	2440	2370	2300	2100	1840	1550	1290	1070	894
	12.5	71.5	3230	3230	3210	3150	3080	3010	2930	2830	2580	2250	1890	1570	1300	1080
	14.2 #	80.6	3660	3660	3620	3560	3480	3400	3310	3190	2910	2530	2120	1750	1450	1210
	16.0	90.2	4080	4080	4040	3970	3890	3790	3680	3560	3230	2800	2350	1940	1600	1340

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Circular Hollow Sections (HFCHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

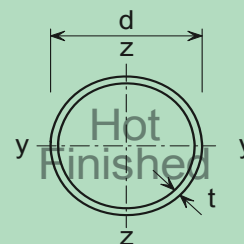
# Check availability

For values of the compression cross-sectional resistance  $N_{c,Rd}$ , see the values of  $N_{pl,Rd}$  in the tables for axial force and bending.

FOR EXPLANATION OF TABLES SEE NOTE 6.

HOT-FINISHED  
CIRCULAR HOLLOW SECTIONS

Celsius® CHS



Designation		Mass per Metre kg/m	Compression resistance $N_{b,Rd}$ (kN) for Buckling lengths (m)													
Outside Diameter d mm	Wall Thk t mm		$N_{b,T,Rd}$ kN	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
273	5.0 #	33.0	1490	1490	1490	1470	1440	1420	1390	1360	1270	1160	1030	886	753	639
	5.6 #	36.9	1670	1670	1670	1640	1610	1580	1550	1510	1420	1300	1150	987	838	711
	6.3 #	41.4	1870	1870	1870	1840	1810	1780	1740	1700	1590	1460	1280	1100	937	794
	8.0 #	52.3	2360	2360	2360	2320	2280	2240	2190	2140	2010	1830	1610	1380	1170	992
	10.0	64.9	2930	2930	2930	2880	2830	2780	2720	2650	2480	2260	1980	1700	1440	1220
	12.5	80.3	3620	3620	3610	3550	3490	3420	3350	3270	3050	2770	2430	2070	1750	1480
	14.2 #	90.6	4080	4080	4070	4000	3930	3860	3770	3680	3430	3110	2720	2310	1950	1650
	16.0	101	4580	4580	4560	4490	4410	4320	4230	4120	3840	3470	3030	2570	2170	1830
323.9	5.0 * #	39.3	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$
	5.6 #	44.0	1990	1990	1990	1970	1950	1920	1890	1860	1780	1690	1570	1420	1260	1110
	6.3 #	49.3	2230	2230	2230	2220	2190	2160	2120	2090	2000	1890	1750	1590	1410	1230
	8.0 #	62.3	2820	2820	2820	2800	2760	2720	2680	2630	2530	2390	2210	2000	1770	1550
	10.0	77.4	3500	3500	3500	3470	3430	3380	3320	3270	3130	2950	2730	2470	2180	1900
	12.5	96.0	4330	4330	4330	4290	4240	4170	4110	4030	3860	3640	3360	3030	2670	2320
	14.2 #	108	4900	4900	4900	4860	4790	4720	4650	4560	4370	4120	3800	3420	3020	2630
	16.0	121	5500	5500	5500	5450	5380	5300	5210	5120	4900	4610	4250	3810	3350	2910
355.6	6.3 #	54.3	2450	2450	2450	2450	2420	2390	2360	2320	2250	2150	2030	1890	1720	1540
	8.0 #	68.6	3100	3100	3100	3090	3060	3020	2980	2930	2840	2710	2560	2370	2160	1930
	10.0 #	85.2	3870	3870	3870	3860	3810	3760	3710	3660	3530	3380	3180	2940	2670	2380
	12.5 #	106	4790	4790	4790	4780	4720	4660	4590	4520	4370	4170	3930	3620	3280	2920
	14.2 #	120	5400	5400	5400	5380	5310	5240	5170	5090	4920	4700	4420	4080	3690	3280
	16.0	134	6070	6070	6070	6050	5970	5890	5810	5720	5520	5270	4950	4560	4120	3660
406.4	6.3 * #	62.2	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$
	8.0 #	78.6	3550	3550	3550	3550	3520	3490	3450	3410	3320	3210	3090	2940	2750	2540
	10.0	97.8	4440	4440	4440	4440	4400	4360	4310	4260	4140	4010	3850	3660	3420	3150
	12.5 #	121	5500	5500	5500	5500	5460	5400	5340	5280	5130	4970	4770	4520	4220	3880
	14.2 #	137	6210	6210	6210	6210	6160	6100	6030	5960	5800	5610	5380	5100	4770	4390
457	6.3 * #	70.0	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$
	8.0 #	88.6	4010	4010	4010	4010	4010	3970	3930	3890	3810	3720	3610	3480	3320	3140
	10.0	110	4970	4970	4970	4970	4960	4920	4870	4820	4720	4600	4460	4300	4100	3870
	12.5 #	137	6210	6210	6210	6210	6200	6140	6080	6020	5890	5740	5570	5360	5110	4820
	14.2 #	155	7030	7030	7030	7030	7020	6950	6880	6810	6670	6500	6300	6060	5780	5450
	16.0	174	7880	7880	7880	7880	7860	7790	7720	7640	7470	7280	7050	6780	6460	6090
508	6.3 * #	77.9	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$
	8.0 * #	98.6	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$
	10.0 #	123	5540	5540	5540	5540	5540	5510	5460	5420	5320	5210	5080	4940	4770	4580
	12.5	153	6920	6920	6920	6920	6920	6890	6830	6770	6640	6500	6350	6170	5950	5700
	14.2 #	173	7810	7810	7810	7810	7810	7770	7700	7640	7490	7340	7160	6960	6720	6440
	16.0	194	8770	8770	8770	8770	8770	8720	8650	8570	8410	8230	8030	7800	7530	7210

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\* Section is Class 4 under axial compression.

\$ indicates that the section is Class 4 and no compression resistance is calculated.

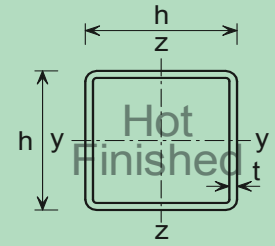
# Check availability

For values of the compression cross-sectional resistance  $N_{c,Rd}$ , see the values of  $N_{pl,Rd}$  in the tables for axial force and bending.

FOR EXPLANATION OF TABLES SEE NOTE 6.

HOT-FINISHED SQUARE HOLLOW SECTIONS

Celsius® SHS



Designation		Mass per Metre kg/m	Compression resistance $N_{b,Rd}$ (kN)														
Size h x h mm	Wall Thk t mm		$N_{b,T,Rd}$ kN	for Buckling lengths (m)													
				1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0	
40x40	3.0 #	3.41	154	116	71.7	44.0	29.2	20.7	15.4	11.9	7.72	5.40	3.99	3.07	2.43	1.98	
	3.2	3.61	163	122	75.2	46.1	30.6	21.7	16.1	12.5	8.08	5.65	4.18	3.21	2.55	2.07	
	3.6 #	4.01	181	134	81.6	49.9	33.1	23.4	17.4	13.5	8.72	6.10	4.51	3.47	2.75	2.23	
	4.0	4.39	198	145	87.5	53.3	35.3	25.0	18.6	14.4	9.31	6.51	4.81	3.70	2.93	2.38	
	5.0	5.28	239	171	101	61.0	40.3	28.5	21.2	16.4	10.6	7.42	5.48	4.21	3.34	2.71	
50x50	3.0 #	4.35	197	168	127	85.1	58.1	41.7	31.2	24.2	15.8	11.1	8.19	6.30	5.00	4.06	
	3.2	4.62	209	178	134	89.5	61.1	43.8	32.8	25.4	16.6	11.6	8.60	6.62	5.25	4.27	
	3.6 #	5.14	232	197	147	97.9	66.6	47.8	35.8	27.7	18.0	12.7	9.37	7.21	5.72	4.65	
	4.0	5.64	255	216	160	106	71.9	51.5	38.5	29.9	19.4	13.6	10.1	7.77	6.16	5.01	
	5.0	6.85	310	260	189	124	83.9	60.0	44.9	34.8	22.6	15.9	11.7	9.03	7.17	5.82	
	6.3	8.31	376	311	220	142	95.9	68.4	51.1	39.6	25.7	18.0	13.3	10.3	8.15	6.62	
	7.1 #	9.14	412	337	234	150	101	71.7	53.6	41.5	26.9	18.9	14.0	10.7	8.52	6.92	
8.0 #	10.0	454	367	250	159	106	75.7	56.5	43.7	28.4	19.9	14.7	11.3	8.98	7.29		
60x60	3.0 #	5.29	239	216	184	138	98.8	72.2	54.6	42.6	27.9	19.6	14.6	11.2	8.91	7.25	
	3.2	5.62	254	229	195	146	104	76.1	57.5	44.9	29.4	20.7	15.3	11.8	9.39	7.64	
	3.6 #	6.27	283	255	216	161	114	83.5	63.1	49.2	32.2	22.7	16.8	13.0	10.3	8.37	
	4.0	6.90	312	280	236	175	124	90.6	68.4	53.3	34.9	24.5	18.2	14.0	11.1	9.06	
	5.0	8.42	380	340	284	208	147	107	80.6	62.8	41.0	28.9	21.4	16.5	13.1	10.6	
	6.3	10.3	465	413	340	245	172	124	93.8	73.0	47.7	33.5	24.8	19.1	15.2	12.4	
	7.1 #	11.4	515	455	370	264	184	133	100	78.0	50.9	35.8	26.5	20.4	16.2	13.2	
8.0	12.5	568	500	402	283	197	142	107	83.0	54.2	38.1	28.2	21.7	17.2	14.0		
70x70	3.0 #	6.24	282	262	236	196	150	113	86.4	67.9	44.8	31.6	23.5	18.2	14.4	11.7	
	3.2	6.63	300	279	251	207	158	119	91.2	71.7	47.3	33.4	24.8	19.2	15.2	12.4	
	3.6 #	7.40	334	311	279	230	175	131	100	78.9	52.0	36.7	27.3	21.1	16.8	13.6	
	4.0	8.15	369	343	307	252	191	143	109	85.9	56.6	40.0	29.7	22.9	18.2	14.8	
	5.0	9.99	451	417	373	303	228	170	130	102	67.2	47.5	35.2	27.2	21.6	17.6	
	6.3	12.3	554	511	453	363	271	201	153	120	79.0	55.8	41.4	32.0	25.4	20.7	
	7.1 #	13.6	614	565	498	396	293	217	165	129	85.1	60.0	44.6	34.4	27.3	22.2	
	8.0	15.0	682	625	548	431	317	235	178	139	91.6	64.6	47.9	37.0	29.4	23.9	
	8.8 #	16.3	735	672	586	456	333	246	187	146	95.8	67.5	50.1	38.6	30.7	25.0	
80x80	3.0 #	7.18	324	308	285	251	206	161	126	100.0	66.6	47.3	35.2	27.2	21.7	17.7	
	3.2	7.63	345	327	303	267	219	171	134	106	70.8	50.3	37.5	29.0	23.1	18.8	
	3.6 #	8.53	387	367	340	298	243	190	149	118	78.5	55.7	41.5	32.1	25.5	20.8	
	4.0	9.41	426	403	373	327	266	207	162	128	85.4	60.6	45.1	34.9	27.8	22.6	
	5.0	11.6	522	493	455	397	321	249	194	154	102	72.4	53.9	41.7	33.2	27.0	
	6.3	14.2	643	606	557	482	385	297	231	182	121	85.8	63.9	49.4	39.3	32.0	
	7.1 #	15.8	717	675	619	532	423	325	252	199	132	93.3	69.5	53.7	42.7	34.8	
	8.0	17.5	795	747	683	584	461	353	273	215	142	101	75.0	58.0	46.1	37.5	
	8.8 #	19.0	859	805	735	624	489	373	287	227	150	106	78.9	61.0	48.5	39.5	
	10.0 #	21.1	955	893	811	683	530	403	310	244	161	114	84.8	65.5	52.1	42.4	
	12.5 #	25.2	1140	1060	951	783	595	447	342	269	177	125	93.1	71.8	57.1	46.5	

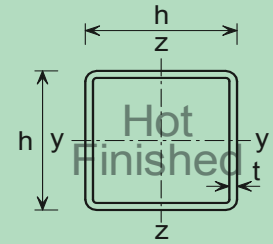
Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Square Hollow Sections (HFSHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 6.

HOT-FINISHED SQUARE HOLLOW SECTIONS

Celsius® SHS



Designation		Mass per Metre kg/m	N <sub>b,T,Rd</sub> kN	Compression resistance N <sub>b,Rd</sub> (kN) for Buckling lengths (m)												
Size h x h mm	Wall Thk t mm			2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
90x90	3.6 #	9.66	437	361	256	165	111	79.4	59.3	46.0	36.6	29.9	24.8	20.9	17.9	15.5
	4.0	10.7	483	398	281	181	122	86.9	64.9	50.3	40.1	32.7	27.1	22.9	19.6	16.9
	5.0	13.1	593	485	338	216	146	104	77.5	60.0	47.8	39.0	32.4	27.3	23.4	20.2
	6.3	16.2	735	597	411	262	176	125	93.5	72.4	57.6	47.0	39.0	32.9	28.2	24.4
	7.1 #	18.1	817	659	449	285	191	136	102	78.6	62.6	51.0	42.4	35.8	30.6	26.4
	8.0	20.1	909	729	492	311	208	148	110	85.5	68.1	55.5	46.1	38.9	33.2	28.7
	8.8 #	21.8	987	786	525	330	221	157	117	90.7	72.2	58.8	48.9	41.2	35.2	30.5
	10.0 #	24.3	1100	866	571	357	239	170	126	97.8	77.9	63.5	52.7	44.5	38.0	32.9
	12.5 #	29.1	1320	1020	648	401	267	190	141	109	86.9	70.8	58.8	49.6	42.4	36.6
100x100	3.6	10.8	486	419	323	219	150	108	81.0	62.9	50.2	41.0	34.1	28.8	24.6	21.3
	4.0	11.9	540	465	358	242	166	119	89.5	69.5	55.4	45.2	37.6	31.8	27.2	23.5
	5.0	14.7	664	569	434	292	200	143	107	83.4	66.5	54.3	45.1	38.1	32.6	28.2
	6.3	18.2	824	702	529	353	241	173	129	100	80.1	65.3	54.3	45.9	39.2	33.9
	7.1 #	20.3	916	779	583	388	264	189	142	110	87.7	71.6	59.5	50.2	43.0	37.2
	8.0	22.6	1020	866	643	425	289	207	155	120	95.9	78.2	65.0	54.9	47.0	40.6
	8.8 #	24.5	1110	937	690	454	308	221	165	128	102	83.3	69.2	58.4	50.0	43.2
	10.0	27.4	1240	1040	757	495	335	240	179	139	111	90.4	75.2	63.4	54.3	46.9
	12.5 #	33.0	1490	1230	875	565	381	272	203	157	125	102	84.9	71.7	61.3	53.0
120x120	4.0 #	14.4	653	592	508	385	277	203	154	120	96.1	78.7	65.5	55.4	47.4	41.1
	5.0	17.8	806	729	623	470	337	247	187	146	117	95.5	79.5	67.2	57.6	49.9
	6.3	22.2	1000	903	767	574	410	300	227	177	141	116	96.4	81.5	69.8	60.4
	7.1 #	24.7	1120	1010	853	636	453	331	250	195	156	128	106	89.8	76.9	66.6
	8.0	27.6	1250	1120	947	702	499	364	275	214	172	140	117	98.7	84.5	73.2
	8.8 #	30.1	1360	1220	1020	755	535	390	294	229	184	150	125	106	90.4	78.3
	10.0	33.7	1520	1360	1140	833	589	428	323	252	201	165	137	116	99.1	85.8
	12.5	40.9	1850	1640	1350	973	683	495	373	290	232	190	158	133	114	98.8
	140x140	5.0	21.0	948	883	797	662	508	383	294	231	186	153	127	108	92.5
6.3		26.1	1180	1100	990	818	624	470	360	283	227	186	156	132	113	97.9
7.1 #		29.2	1320	1230	1100	907	690	518	397	312	250	205	171	145	124	108
8.0		32.6	1480	1370	1230	1010	763	572	438	344	276	227	189	160	137	119
8.8 #		35.6	1610	1490	1340	1090	826	619	473	371	298	245	204	173	148	128
10.0		40.0	1810	1670	1490	1210	911	680	520	408	327	268	224	189	162	141
12.5		48.7	2200	2030	1800	1440	1080	801	611	478	384	315	262	222	190	165

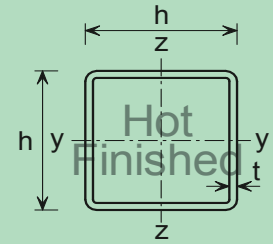
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# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 6.

HOT-FINISHED SQUARE HOLLOW SECTIONS

Celsius® SHS



Designation		Mass per Metre kg/m	Compression resistance $N_{b,Rd}$ (kN) for Buckling lengths (m)													
Size $h \times h$ mm	Wall Thk $t$ mm		$N_{b,T,Rd}$ kN	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
150x150	5.0	22.6	1020	959	880	756	601	462	358	282	228	187	156	133	114	98.7
	6.3	28.1	1270	1190	1090	937	741	568	440	347	280	230	192	163	140	121
	7.1 #	31.4	1420	1330	1220	1040	821	628	485	383	309	254	212	180	154	134
	8.0	35.1	1590	1490	1360	1160	911	696	537	423	341	280	234	198	170	148
	8.8 #	38.4	1740	1630	1480	1260	987	753	581	458	369	303	253	214	184	159
	10.0	43.1	1950	1820	1660	1400	1090	831	640	504	406	334	279	236	202	175
	12.5	52.7	2380	2220	2010	1680	1300	984	756	595	479	393	328	278	238	207
	14.2 #	58.9	2660	2480	2240	1860	1420	1070	824	648	521	427	357	302	259	224
16.0 # r	65.2	2950	2740	2460	2030	1540	1160	888	698	561	460	384	325	279	241	
160x160	5.0 #	24.1	1090	1030	961	848	697	548	429	341	276	227	190	161	138	120
	6.3	30.1	1360	1290	1200	1050	862	675	528	419	339	279	234	198	170	148
	7.1 #	33.7	1520	1440	1340	1170	958	749	585	464	375	309	258	219	188	163
	8.0	37.6	1700	1610	1490	1310	1060	830	647	513	415	342	286	242	208	180
	8.8 #	41.1	1860	1760	1630	1420	1150	897	699	554	448	368	308	261	224	195
	10.0	46.3	2090	1980	1820	1590	1280	996	775	614	496	408	341	289	248	215
	12.5	56.6	2560	2410	2220	1920	1540	1180	919	727	587	482	403	342	293	254
	14.2 #	63.3	2860	2700	2470	2130	1690	1300	1010	794	641	527	440	373	320	278
16.0 #	70.2	3170	2980	2730	2330	1840	1410	1090	858	692	569	475	403	345	299	
180x180	5.0 #	27.3	1230	1180	1120	1020	889	733	590	475	388	321	270	229	197	171
	6.3	34.0	1540	1480	1390	1270	1100	905	726	585	477	395	331	282	242	211
	7.1 #	38.1	1730	1660	1560	1430	1230	1010	810	652	531	440	369	314	270	234
	8.0	42.7	1930	1850	1750	1590	1370	1120	899	723	589	487	409	347	299	260
	8.8 #	46.7	2110	2020	1900	1730	1490	1220	973	781	636	526	442	375	323	280
	10.0	52.5	2370	2280	2140	1950	1670	1360	1080	869	708	585	491	417	359	311
	12.5	64.4	2910	2790	2620	2370	2020	1630	1300	1040	844	697	584	497	427	371
	14.2 #	72.2	3270	3120	2930	2640	2230	1800	1420	1140	926	764	641	544	468	406
16.0	80.2	3620	3460	3230	2900	2450	1960	1550	1240	1000	829	695	590	507	440	
200x200	5.0 *	30.4	1250	1220	1170	1100	1010	882	746	619	514	430	364	311	268	234
	6.3	38.0	1720	1670	1590	1480	1340	1150	953	782	645	537	453	386	333	290
	7.1 #	42.6	1920	1870	1780	1660	1490	1280	1060	869	716	596	503	429	369	321
	8.0	47.7	2160	2090	1990	1860	1670	1430	1180	967	796	663	559	476	410	357
	8.8 #	52.2	2360	2290	2180	2030	1820	1560	1280	1050	865	720	607	517	446	388
	10.0	58.8	2660	2570	2450	2280	2040	1740	1430	1170	962	800	674	574	495	430
	12.5	72.3	3270	3160	3010	2790	2480	2100	1720	1410	1150	959	807	687	592	515
	14.2 #	81.1	3660	3530	3360	3110	2760	2330	1900	1550	1270	1050	887	756	651	566
16.0	90.3	4080	3940	3740	3460	3060	2570	2090	1700	1390	1160	972	827	712	619	

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\* Section may be Class 4 under axial compression.

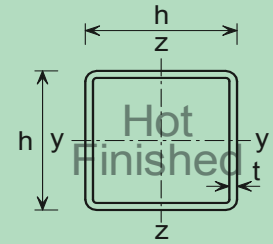
# Check availability

Values in italic type indicate that the section is a Class 4 section in pure compression and allowance has been made in calculating the resistance.

FOR EXPLANATION OF TABLES SEE NOTE 6.

HOT-FINISHED SQUARE HOLLOW SECTIONS

Celsius® SHS



Designation		Mass per Metre kg/m	Compression resistance $N_{b,Rd}$ (kN) for Buckling lengths (m)													
Size h x h mm	Wall Thk t mm		$N_{b,T,Rd}$ kN	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
250x250	5.0 * #	38.3	1350	1340	1300	1260	1210	1150	1060	966	858	751	655	571	500	440
	6.3 *	47.9	1980	1960	1900	1830	1740	1620	1480	1310	1130	976	841	727	633	555
	7.1 #	53.7	2430	2390	2320	2220	2100	1940	1740	1520	1300	1110	953	821	713	624
	8.0	60.3	2730	2690	2600	2490	2360	2170	1950	1700	1450	1240	1060	915	795	695
	8.8 #	66.0	2990	2940	2840	2730	2580	2380	2130	1850	1580	1350	1160	995	864	756
	10.0	74.5	3370	3320	3210	3070	2900	2670	2390	2070	1770	1510	1290	1110	966	845
	12.5	91.9	4150	4090	3950	3780	3560	3270	2910	2520	2150	1830	1560	1350	1170	1020
	14.2 #	103	4690	4610	4450	4260	4010	3670	3260	2820	2400	2040	1740	1500	1300	1130
16.0	115	5220	5130	4950	4740	4450	4070	3600	3100	2640	2240	1910	1640	1420	1240	
260x260	6.3 * #	49.9	2010	1990	1940	1870	1790	1680	1550	1390	1230	1070	923	802	700	615
	7.1 #	56.0	2530	2500	2420	2330	2220	2070	1880	1660	1430	1230	1060	917	797	699
	8.0 #	62.8	2840	2810	2720	2620	2490	2320	2100	1860	1610	1380	1190	1030	895	784
	8.8 #	68.8	3110	3070	2980	2860	2720	2530	2290	2010	1740	1490	1280	1110	963	843
	10.0 #	77.7	3510	3470	3360	3230	3070	2850	2580	2270	1960	1680	1450	1250	1090	952
	12.5 #	95.8	4330	4270	4140	3980	3770	3500	3160	2770	2390	2050	1760	1520	1320	1150
	14.2 #	108	4860	4800	4640	4460	4220	3910	3510	3070	2640	2260	1940	1670	1450	1270
16.0 #	120	5430	5350	5180	4970	4700	4350	3900	3400	2920	2490	2130	1840	1600	1400	
300x300	6.3 * #	57.8	2110	2110	2060	2010	1960	1890	1800	1700	1570	1430	1290	1150	1020	911
	7.1 * #	64.9	2570	2570	2510	2440	2370	2270	2160	2010	1840	1660	1480	1310	1150	1020
	8.0 *	72.8	3120	3110	3040	2950	2850	2730	2570	2380	2160	1920	1700	1490	1320	1160
	8.8 #	79.8	3620	3610	3510	3410	3290	3130	2940	2700	2440	2160	1900	1660	1460	1290
	10.0	90.2	4080	4060	3960	3840	3700	3520	3300	3030	2720	2410	2110	1850	1620	1430
	12.5	112	5040	5010	4880	4740	4560	4340	4060	3720	3330	2940	2580	2250	1980	1740
	14.2 #	126	5680	5650	5500	5330	5130	4870	4550	4160	3720	3280	2870	2510	2200	1940
	16.0	141	6350	6320	6150	5960	5730	5440	5070	4620	4120	3620	3170	2760	2420	2130
350x350	8.0 *	85.4	3320	3320	3270	3200	3130	3040	2940	2820	2670	2500	2300	2100	1900	1720
	8.8 * #	93.6	3860	3860	3800	3720	3620	3520	3390	3230	3050	2830	2600	2350	2120	1900
	10.0	106	4790	4790	4700	4600	4470	4330	4150	3940	3680	3380	3070	2760	2470	2210
	12.5	131	5930	5930	5810	5680	5520	5330	5110	4830	4500	4130	3730	3350	2990	2670
	14.2 #	148	6710	6710	6580	6420	6250	6040	5780	5470	5100	4670	4230	3790	3380	3020
16.0	166	7490	7490	7340	7170	6970	6730	6440	6090	5660	5180	4680	4190	3730	3330	
400x400	8.0 * #	97.9	3460	3460	3440	3390	3330	3260	3190	3110	3010	2890	2760	2610	2450	2270
	8.8 * #	107	4060	4060	4040	3970	3890	3810	3720	3610	3480	3340	3170	2970	2770	2550
	10.0 *	122	5010	5010	4970	4880	4780	4670	4550	4400	4230	4030	3790	3530	3260	2990
	12.5	151	6820	6820	6740	6610	6470	6310	6120	5890	5630	5310	4950	4560	4170	3790
	14.2 #	170	7700	7700	7620	7470	7310	7120	6900	6650	6340	5980	5570	5130	4680	4240
	16.0	191	8630	8630	8530	8360	8170	7960	7720	7430	7080	6670	6200	5700	5200	4710
	20.0 ^	235	10400	10400	10200	10000	9810	9560	9260	8910	8500	8000	7450	6850	6240	5660

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\* Section may be Class 4 under axial compression.

# Check availability

Values in italic type indicate that the section is a Class 4 section in pure compression and allowance has been made in calculating the resistance.

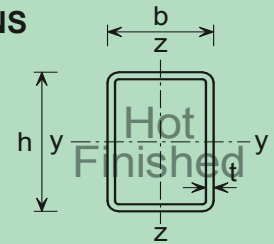
^ SAW process (single longitudinal seam weld, slightly proud).

FOR EXPLANATION OF TABLES SEE NOTE 6.



HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Designation		Mass per Metre kg/m	$N_{b,T,Rd}$ kN	Axis	Compression resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) for Buckling lengths (m)												
Size	Wall Thk t mm				1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
h x b mm																	
50x30	3.0 #	3.41	154	y	128	90.9	58.8	39.7	28.3	21.2	16.4	10.7	7.47	5.53	4.25	3.37	2.74
				z	89.9	47.2	27.9	18.3	12.9	9.53	7.35	4.75	3.32	2.45	1.88	1.49	1.21
	3.2	3.61	163	y	135	95.6	61.7	41.6	29.7	22.2	17.2	11.2	7.83	5.79	4.46	3.54	2.87
				z	94.2	49.3	29.1	19.0	13.4	9.94	7.66	4.95	3.46	2.55	1.96	1.55	1.26
	3.6 #	4.01	181	y	149	104	67.1	45.2	32.2	24.1	18.6	12.1	8.49	6.28	4.83	3.83	3.11
				z	102	53.0	31.2	20.4	14.4	10.6	8.21	5.30	3.70	2.73	2.10	1.66	1.35
	4.0	4.39	198	y	162	113	72.1	48.5	34.6	25.8	20.0	13.0	9.10	6.73	5.18	4.11	3.34
				z	111	57.1	33.6	22.0	15.5	11.5	8.84	5.71	3.99	2.94	2.26	1.79	1.45
	5.0	5.28	239	y	192	130	82.5	55.3	39.4	29.4	22.7	14.8	10.3	7.65	5.88	4.66	3.79
				z	125	63.4	37.2	24.3	17.1	12.6	9.74	6.29	4.39	3.24	2.49	1.97	1.60
60x40	3.0 #	4.35	197	y	175	144	104	73.2	53.1	40.0	31.1	20.3	14.3	10.6	8.17	6.48	5.27
				z	153	99.1	61.6	41.1	29.2	21.7	16.8	10.9	7.64	5.65	4.34	3.44	2.80
	3.2	4.62	209	y	186	153	111	77.6	56.3	42.4	33.0	21.6	15.2	11.3	8.67	6.88	5.60
				z	162	104	64.7	43.1	30.6	22.8	17.6	11.4	8.01	5.92	4.55	3.61	2.93
	3.6 #	5.14	232	y	206	169	121	85.0	61.6	46.4	36.1	23.6	16.6	12.3	9.47	7.52	6.11
				z	179	115	71.1	47.4	33.6	25.0	19.4	12.6	8.79	6.50	5.00	3.96	3.22
	4.0	5.64	255	y	226	184	132	92.0	66.6	50.1	39.0	25.5	17.9	13.3	10.2	8.11	6.60
				z	196	124	76.4	50.8	36.1	26.9	20.8	13.5	9.43	6.97	5.36	4.25	3.45
	5.0	6.85	310	y	273	219	154	107	77.5	58.3	45.3	29.6	20.8	15.4	11.9	9.41	7.65
				z	233	144	88.5	58.8	41.7	31.0	24.0	15.5	10.9	8.03	6.18	4.90	3.98
6.3	8.31	376	y	328	258	178	123	88.4	66.4	51.5	33.6	23.6	17.5	13.5	10.7	8.68	
			z	274	164	99.9	66.1	46.8	34.8	26.9	17.4	12.2	9.00	6.92	5.48	4.45	
80x40	3.0 #	5.29	239	y	224	204	172	134	102	78.6	61.9	40.9	29.0	21.5	16.6	13.2	10.8
				z	190	126	79.2	53.0	37.7	28.1	21.7	14.1	9.88	7.30	5.62	4.45	3.62
	3.2	5.62	254	y	238	216	182	142	108	83.0	65.4	43.2	30.6	22.7	17.6	14.0	11.4
				z	202	134	84.1	56.3	40.0	29.8	23.1	15.0	10.5	7.76	5.97	4.73	3.84
	3.6 #	6.27	283	y	265	240	202	157	119	91.3	71.9	47.5	33.6	25.0	19.3	15.3	12.5
				z	223	147	91.8	61.3	43.6	32.5	25.1	16.3	11.4	8.44	6.49	5.15	4.18
	4.0	6.90	312	y	291	264	221	171	129	99.4	78.2	51.6	36.5	27.1	21.0	16.7	13.6
				z	244	159	98.9	66.0	46.9	34.9	27.0	17.5	12.3	9.07	6.97	5.53	4.49
	5.0	8.42	380	y	354	319	265	203	153	117	92.1	60.8	42.9	31.9	24.6	19.6	15.9
				z	292	186	115	76.6	54.3	40.5	31.3	20.3	14.2	10.5	8.07	6.40	5.20
	6.3	10.3	465	y	431	386	316	239	179	137	107	70.8	50.0	37.2	28.7	22.8	18.6
				z	348	214	131	87.1	61.7	45.9	35.5	23.0	16.1	11.9	9.15	7.25	5.89
	7.1 #	11.4	515	y	476	425	344	259	193	148	116	76.2	53.8	40.0	30.8	24.5	19.9
				z	379	230	140	92.8	65.7	48.9	37.8	24.5	17.1	12.6	9.72	7.71	6.26
8.0	12.5	568	y	524	464	372	277	206	157	123	81.1	57.2	42.5	32.8	26.0	21.2	
			z	409	242	147	97.2	68.8	51.1	39.5	25.6	17.9	13.2	10.2	8.05	6.54	

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

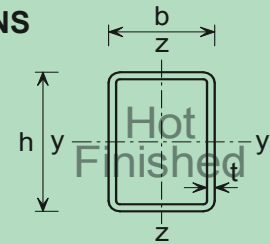
# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 6.



HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Designation		Mass per Metre kg/m	$N_{b,T,Rd}$ kN	Axis	Compression resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) for Buckling lengths (m)												
Size	Wall Thk t mm				1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
h x b mm																	
90x50	3.0 #	6.24	282	y	268	251	224	187	149	117	93.3	62.4	44.4	33.1	25.6	20.4	16.6
				z	247	196	136	94.3	68.0	51.1	39.7	25.9	18.2	13.5	10.4	8.24	6.70
	3.2	6.63	300	y	285	266	237	198	157	124	98.7	65.9	46.9	35.0	27.0	21.5	17.5
				z	262	207	144	99.4	71.7	53.8	41.8	27.3	19.2	14.2	10.9	8.67	7.05
	3.6 #	7.40	334	y	318	297	264	220	174	137	109	72.8	51.7	38.6	29.8	23.7	19.4
				z	292	230	159	110	79.3	59.5	46.2	30.1	21.2	15.7	12.1	9.59	7.79
	4.0	8.15	369	y	351	327	290	241	190	149	119	79.4	56.4	42.1	32.5	25.9	21.1
				z	321	252	173	119	85.9	64.5	50.1	32.7	22.9	17.0	13.1	10.4	8.44
	5.0	9.99	451	y	428	398	351	289	227	178	141	94.2	66.9	49.8	38.5	30.7	25.0
				z	389	301	205	141	101	75.8	58.9	38.4	26.9	19.9	15.4	12.2	9.90
	6.3	12.3	554	y	524	486	426	347	271	212	168	112	79.2	59.0	45.6	36.3	29.6
				z	473	358	240	164	117	87.9	68.2	44.4	31.2	23.1	17.7	14.1	11.4
	7.1 #	13.6	614	y	581	536	468	379	295	229	182	121	85.7	63.8	49.3	39.3	32.0
				z	522	390	259	176	126	94.6	73.4	47.7	33.5	24.8	19.1	15.1	12.3
	8.0	15.0	682	y	643	592	514	412	319	248	196	130	92.2	68.6	53.0	42.2	34.4
				z	574	422	277	188	135	101	78.1	50.8	35.6	26.4	20.3	16.1	13.1
100x50	3.0 #	6.71	303	y	292	275	252	220	181	146	118	79.7	56.9	42.5	33.0	26.3	21.4
				z	266	214	150	104	75.1	56.5	43.9	28.6	20.1	14.9	11.5	9.12	7.41
	3.2	7.13	322	y	310	293	268	233	192	155	125	84.3	60.2	45.0	34.9	27.8	22.7
				z	283	226	158	110	79.2	59.5	46.3	30.2	21.2	15.7	12.1	9.60	7.80
	3.6 #	7.96	359	y	345	325	297	258	212	171	137	92.8	66.2	49.5	38.4	30.6	24.9
				z	314	249	173	120	86.5	65.0	50.5	32.9	23.1	17.1	13.2	10.5	8.52
	4.0	8.78	398	y	382	360	329	285	234	187	151	102	72.7	54.3	42.1	33.5	27.3
				z	347	274	189	131	94.2	70.8	55.0	35.8	25.2	18.6	14.4	11.4	9.26
	5.0	10.8	486	y	466	439	400	344	280	224	180	121	86.6	64.7	50.1	39.9	32.5
				z	422	328	225	154	111	83.4	64.8	42.2	29.6	21.9	16.9	13.4	10.9
	6.3	13.3	600	y	574	540	489	417	338	269	216	145	103	77.2	59.7	47.6	38.8
				z	515	392	264	180	130	97.1	75.3	49.1	34.4	25.5	19.6	15.6	12.7
	7.1 #	14.7	664	y	635	596	538	457	368	292	234	157	112	83.5	64.6	51.5	42.0
				z	566	426	285	194	139	104	80.9	52.7	37.0	27.4	21.1	16.7	13.6
	8.0	16.3	738	y	705	660	593	500	401	317	254	170	121	90.3	69.8	55.6	45.3
				z	625	463	306	208	149	111	86.4	56.2	39.4	29.2	22.5	17.8	14.5
	8.8 #	17.6	799	y	761	712	638	535	427	337	269	180	128	95.4	73.8	58.8	47.9
				z	670	488	319	216	155	116	89.7	58.3	40.9	30.3	23.3	18.5	15.0
	10.0 #	19.6	884	y	841	783	697	578	458	360	286	191	136	101	78.4	62.4	50.8
				z	732	521	337	228	162	121	94.1	61.1	42.9	31.7	24.4	19.3	15.7

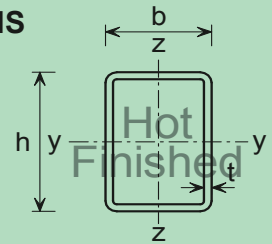
Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 6.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Designation		Mass per Metre kg/m	$N_{b,T,Rd}$ kN	Axis	Compression resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) for Buckling lengths (m)												
Size	Wall Thk t mm				1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
h x b mm																	
100x60	3.0 #	7.18	324	y	313	296	273	240	201	163	132	89.6	64.1	48.0	37.2	29.7	24.2
				z	297	259	202	148	109	83.0	64.9	42.6	30.0	22.3	17.2	13.7	11.1
	3.2	7.63	345	y	333	315	290	255	213	173	140	94.8	67.8	50.8	39.3	31.4	25.6
				z	315	275	214	157	115	87.7	68.5	45.0	31.7	23.5	18.1	14.4	11.7
	3.6 #	8.53	387	y	373	353	325	285	237	192	155	105	75.3	56.3	43.7	34.8	28.4
				z	353	307	238	173	128	96.9	75.7	49.7	35.0	26.0	20.0	15.9	12.9
	4.0	9.41	426	y	410	388	357	312	259	210	169	115	82.1	61.4	47.6	37.9	30.9
				z	388	337	261	190	140	106	82.7	54.2	38.2	28.4	21.9	17.4	14.1
	5.0	11.6	522	y	502	474	434	378	312	251	203	137	97.9	73.2	56.7	45.2	36.9
				z	474	408	311	225	165	125	97.4	63.9	45.0	33.4	25.7	20.4	16.6
	6.3	14.2	643	y	617	582	531	459	376	302	243	164	117	87.3	67.6	53.9	43.9
				z	581	495	373	267	195	148	115	75.5	53.2	39.4	30.4	24.1	19.6
	7.1 #	15.8	717	y	688	648	589	507	414	331	266	179	128	95.3	73.8	58.8	48.0
				z	646	546	406	290	211	160	125	81.5	57.4	42.5	32.8	26.0	21.2
	8.0	17.5	795	y	762	716	650	556	452	360	289	194	138	103	80.1	63.8	52.0
				z	713	598	440	312	227	171	134	87.4	61.5	45.6	35.1	27.9	22.7
	8.8 #	19.0	859	y	822	772	698	594	480	382	306	205	146	109	84.6	67.4	54.9
				z	768	639	467	330	240	181	141	92.0	64.7	48.0	37.0	29.4	23.9
10.0 #	21.1	955	y	912	854	767	647	519	411	328	220	156	117	90.3	71.9	58.6	
			z	848	695	499	350	253	191	149	97.0	68.2	50.6	38.9	30.9	25.1	
120x60	3.0 * #	8.12	343	y	336	324	324	300	267	229	192	134	97.5	73.4	57.1	45.7	37.3
				z	317	282	227	170	126	96.5	75.6	49.7	35.1	26.1	20.1	16.0	13.0
	3.2 * #	8.64	377	y	381	366	347	320	284	243	204	143	104	78.1	60.7	48.6	39.7
				z	347	306	244	181	135	103	80.3	52.8	37.2	27.7	21.3	17.0	13.8
	3.6 #	9.66	437	y	426	409	387	357	317	271	227	159	115	86.5	67.3	53.8	44.0
				z	400	350	275	202	149	113	88.7	58.2	41.1	30.5	23.5	18.7	15.2
	4.0	10.7	483	y	471	452	428	394	349	298	249	174	126	94.9	73.8	59.0	48.2
				z	442	386	301	220	163	124	96.6	63.4	44.7	33.2	25.6	20.3	16.5
	5.0	13.1	593	y	578	554	523	480	424	360	300	209	151	114	88.6	70.8	57.8
				z	541	469	363	264	194	147	115	75.5	53.2	39.5	30.4	24.2	19.7
	6.3	16.2	735	y	716	685	646	590	518	437	363	252	182	137	106	85.0	69.4
				z	667	572	436	314	230	174	136	89.2	62.8	46.6	35.9	28.5	23.2
	7.1 #	18.1	817	y	795	760	715	652	570	480	398	276	199	149	116	92.7	75.7
				z	739	631	476	342	250	189	148	96.7	68.1	50.5	38.9	30.9	25.2
	8.0	20.1	909	y	884	845	794	722	629	528	436	301	217	163	127	101	82.7
				z	819	694	518	370	270	204	159	104	73.3	54.4	41.9	33.3	27.1
	8.8 #	21.8	987	y	959	916	859	780	676	565	466	322	232	174	135	108	88.1
				z	887	747	553	393	286	216	169	110	77.6	57.6	44.4	35.2	28.6
	10.0 #	24.3	1100	y	1060	1020	950	857	738	614	505	347	249	187	145	116	94.7
				z	979	813	592	418	303	229	178	116	81.9	60.7	46.8	37.1	30.2
	12.5 #	29.1	1320	y	1270	1210	1130	1010	856	704	575	393	282	211	164	131	107
				z	1160	940	665	463	335	252	196	128	89.9	66.6	51.3	40.7	33.1

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\* Section may be Class 4 under axial compression.

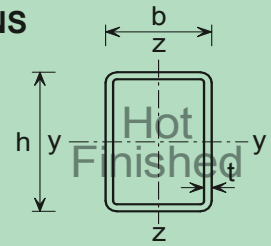
Values in italic type indicate that the section is Class 4 in pure compression and allowance has been made in calculating the resistance.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 6.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Designation		Mass per Metre kg/m	$N_{b,T,Rd}$ kN	Axis	Compression resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) for Buckling lengths (m)												
Size	Wall Thk t mm				1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
h x b mm																	
120x80	3.6 #	10.8	486	y	476	458	436	405	364	316	268	189	138	104	81.0	64.8	53.0
				z	463	433	387	323	258	203	162	108	77.0	57.4	44.4	35.4	28.8
	4.0	11.9	540	y	528	508	483	449	403	349	295	209	152	114	89.2	71.3	58.3
				z	514	479	428	357	283	223	178	119	84.4	63.0	48.7	38.8	31.6
	5.0	14.7	664	y	650	625	593	550	492	425	358	253	184	138	108	86.2	70.5
				z	631	588	522	433	342	269	214	143	101	75.6	58.5	46.6	38.0
	6.3	18.2	824	y	805	773	733	678	604	519	436	306	222	167	130	104	85.2
				z	781	726	640	526	413	323	257	171	121	90.5	70.0	55.7	45.4
	7.1 #	20.3	916	y	895	859	813	750	667	571	479	335	243	183	142	114	93.1
				z	868	805	708	578	453	354	281	187	133	98.8	76.4	60.8	49.5
	8.0	22.6	1020	y	998	957	905	833	737	628	525	367	266	200	156	124	102
				z	967	895	783	636	495	386	306	204	144	108	83.2	66.2	53.9
8.8 #	24.5	1110	y	1080	1040	981	902	796	677	565	394	285	215	167	133	109	
			z	1050	969	843	680	528	411	325	216	153	114	88.2	70.1	57.1	
10.0	27.4	1240	y	1210	1160	1090	998	877	742	617	429	310	233	181	145	118	
			z	1170	1070	929	743	574	445	352	234	165	123	95.2	75.7	61.7	
12.5 #	33.0	1490	y	1450	1390	1300	1180	1030	859	709	489	353	265	206	164	134	
			z	1400	1280	1090	854	652	503	397	263	186	138	107	84.9	69.2	
150x100	4.0 * #	15.1	660	y	672	658	637	611	579	537	487	378	287	220	174	140	115
				z	643	616	580	531	467	395	328	228	165	124	96.3	76.9	62.8
	5.0	18.6	841	y	835	812	785	753	712	659	596	461	349	268	211	170	139
				z	818	782	734	668	581	487	402	278	200	150	117	93.3	76.2
	6.3	23.1	1050	y	1040	1010	976	935	882	815	734	565	426	327	257	207	170
				z	1020	971	910	824	712	594	489	337	243	182	141	113	92.2
	7.1 #	25.9	1170	y	1160	1130	1090	1040	981	905	814	623	470	360	283	228	187
				z	1130	1080	1010	913	786	654	537	369	266	199	155	124	101
	8.0	28.9	1310	y	1290	1260	1210	1160	1090	1010	904	690	519	398	312	251	206
				z	1270	1210	1130	1020	873	724	594	408	293	220	171	136	111
	8.8 #	31.5	1420	y	1410	1370	1320	1260	1190	1090	978	744	559	428	336	270	221
				z	1380	1310	1230	1100	941	778	637	436	313	235	182	146	119
10.0	35.3	1590	y	1580	1530	1480	1410	1320	1210	1080	819	614	469	368	296	243	
			z	1540	1470	1370	1220	1040	855	698	477	343	257	199	159	130	
12.5	42.8	1940	y	1920	1860	1790	1700	1590	1450	1290	963	718	548	430	345	283	
			z	1870	1780	1640	1450	1220	997	810	551	395	296	229	183	149	

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\* Section may be Class 4 under axial compression.

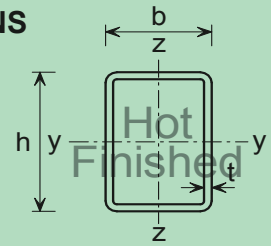
Values in italic type indicate that the section is Class 4 in pure compression and allowance has been made in calculating the resistance.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 6.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Designation		Mass per Metre kg/m	$N_{b,T,Rd}$ kN	Axis	Compression resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) for Buckling lengths (m)													
Size	Wall Thk t mm				1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0	
h x b mm																		
150x100	4.0 * #	15.1	660	y	672	658	637	611	579	537	487	378	287	220	174	140	115	
				z	643	616	580	531	467	395	328	228	165	124	96.3	76.9	62.8	
	5.0	18.6	841	y	835	812	785	753	712	659	596	461	349	268	211	170	139	
				z	818	782	734	668	581	487	402	278	200	150	117	93.3	76.2	
	6.3	23.1	1050	y	1040	1010	976	935	882	815	734	565	426	327	257	207	170	
				z	1020	971	910	824	712	594	489	337	243	182	141	113	92.2	
	7.1 #	25.9	1170	y	1160	1130	1090	1040	981	905	814	623	470	360	283	228	187	
				z	1130	1080	1010	913	786	654	537	369	266	199	155	124	101	
	8.0	28.9	1310	y	1290	1260	1210	1160	1090	1010	904	690	519	398	312	251	206	
				z	1270	1210	1130	1020	873	724	594	408	293	220	171	136	111	
	8.8 #	31.5	1420	y	1410	1370	1320	1260	1190	1090	978	744	559	428	336	270	221	
				z	1380	1310	1230	1100	941	778	637	436	313	235	182	146	119	
	10.0	35.3	1590	y	1580	1530	1480	1410	1320	1210	1080	819	614	469	368	296	243	
				z	1540	1470	1370	1220	1040	855	698	477	343	257	199	159	130	
	12.5	42.8	1940	y	1920	1860	1790	1700	1590	1450	1290	963	718	548	430	345	283	
				z	1870	1780	1640	1450	1220	997	810	551	395	296	229	183	149	
	160x80	4.0 * #	14.4	614	y	611	595	578	578	560	522	476	374	286	221	174	140	115
					z	588	553	503	431	351	280	225	151	108	80.5	62.4	49.7	40.5
5.0		17.8	806	y	801	779	755	725	688	641	583	456	348	268	211	170	140	
				z	769	719	645	543	434	343	274	183	131	97.4	75.4	60.0	48.9	
6.3		22.2	1000	y	994	967	937	899	852	791	718	559	425	327	257	207	170	
				z	953	890	795	664	528	416	331	222	158	117	90.9	72.4	59.0	
7.1 #		24.7	1120	y	1110	1080	1050	1000	949	880	797	618	469	361	284	228	188	
				z	1060	991	881	732	579	455	362	242	172	128	99.1	78.9	64.3	
8.0		27.6	1250	y	1240	1210	1170	1120	1060	978	884	682	516	397	312	251	206	
				z	1190	1100	977	806	635	498	396	264	188	140	108	86.1	70.1	
8.8 #		30.1	1360	y	1350	1310	1270	1210	1150	1060	955	735	555	426	335	270	221	
				z	1290	1200	1060	868	682	533	424	282	201	149	116	92.0	74.9	
10.0		33.7	1520	y	1510	1470	1420	1360	1280	1180	1060	811	611	468	368	296	243	
				z	1440	1340	1170	954	745	582	461	307	218	162	125	99.9	81.4	
12.5		40.9	1850	y	1830	1780	1720	1640	1540	1410	1260	951	712	545	428	344	282	
				z	1740	1600	1390	1110	856	664	525	349	247	184	142	113	92.1	
180x60		4.0 * #	14.4	574	y	574	561	547	531	511	487	471	406	317	247	196	158	130
					z	534	481	399	305	230	176	138	91.2	64.5	47.9	37.0	29.4	23.9

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\* Section may be Class 4 under axial compression.

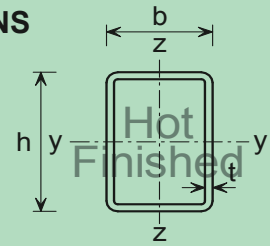
Values in italic type indicate that the section is Class 4 in pure compression and allowance has been made in calculating the resistance.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 6.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Designation		Mass per Metre kg/m	$N_{b,T,Rd}$ kN	Axis	Compression resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) for Buckling lengths (m)												
Size	Wall Thk t mm				1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
h x b mm																	
180x100	4.0 * #	16.9	688	y	688	675	660	642	621	596	566	516	412	326	260	211	174
				z	673	647	614	570	510	441	372	262	191	144	112	89.5	73.2
	5.0 #	21.0	948	y	948	927	903	877	844	805	756	633	505	399	318	258	213
				z	923	884	832	760	666	562	467	324	234	176	137	109	89.1
	6.3 #	26.1	1180	y	1180	1150	1130	1090	1050	999	937	781	620	489	389	316	260
				z	1150	1100	1030	941	820	688	569	394	284	213	166	132	108
	7.1 #	29.2	1320	y	1320	1290	1260	1220	1170	1110	1040	868	688	542	431	350	288
				z	1280	1230	1150	1050	909	762	629	434	313	235	183	146	119
	8.0 #	32.6	1480	y	1480	1440	1400	1360	1310	1240	1160	963	761	598	476	385	318
				z	1430	1370	1280	1160	1010	841	693	477	344	258	200	160	131
	8.8 #	35.6	1610	y	1610	1570	1530	1480	1420	1350	1260	1040	823	646	514	416	343
				z	1560	1490	1400	1260	1090	905	744	512	368	276	215	171	140
10.0 #	40.0	1810	y	1800	1760	1710	1660	1590	1510	1410	1160	910	713	566	458	378	
			z	1750	1670	1560	1400	1200	997	818	561	403	303	235	187	153	
12.5 #	48.7	2200	y	2200	2150	2090	2020	1930	1830	1700	1380	1080	842	668	540	444	
			z	2130	2030	1880	1680	1420	1170	954	651	467	350	271	217	177	
200x100	4.0 * #	18.2	701	y	701	693	680	665	648	629	605	545	486	405	328	268	222
				z	688	663	632	590	535	468	399	285	208	157	123	98.1	80.2
	5.0 *	22.6	957	y	957	943	924	902	902	893	851	743	615	496	401	327	271
				z	935	898	850	784	697	597	501	351	254	192	149	119	97.4
	6.3	28.1	1270	y	1270	1250	1220	1190	1150	1110	1060	920	759	611	493	402	333
				z	1240	1180	1110	1020	891	752	624	432	312	235	182	146	119
	7.1 #	31.4	1420	y	1420	1400	1360	1330	1290	1240	1180	1020	842	677	546	445	368
				z	1380	1320	1240	1130	987	830	686	475	343	257	200	160	130
	8.0	35.1	1590	y	1590	1560	1530	1490	1440	1380	1320	1140	934	750	604	492	407
				z	1550	1480	1390	1260	1090	917	757	523	377	283	220	176	143
	8.8 #	38.4	1740	y	1740	1710	1670	1620	1570	1510	1430	1240	1010	811	653	532	440
				z	1690	1610	1510	1370	1190	991	817	564	406	305	237	189	154
	10.0	43.1	1950	y	1950	1910	1870	1820	1760	1690	1600	1380	1120	899	722	588	486
				z	1890	1810	1690	1530	1320	1090	900	619	445	334	259	207	169
	12.5	52.7	2380	y	2380	2340	2280	2220	2140	2050	1940	1660	1340	1070	857	697	576
				z	2310	2200	2050	1830	1560	1290	1050	720	517	387	301	240	196
	14.2 #	58.9	2660	y	2660	2610	2550	2470	2390	2280	2150	1830	1470	1170	936	761	628
				z	2570	2450	2270	2020	1710	1400	1140	779	558	418	325	259	211
16.0 # r	65.2	2950	y	2950	2880	2810	2730	2630	2510	2370	2000	1600	1270	1010	822	678	
			z	2840	2700	2490	2200	1850	1500	1220	830	594	445	345	275	224	

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\* Section may be Class 4 under axial compression.

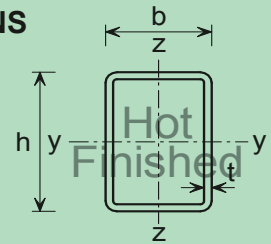
Values in italic type indicate that the section is Class 4 in pure compression and allowance has been made in calculating the resistance.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 6.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Designation		Mass per Metre kg/m	$N_{b,T,Rd}$ kN	Axis	Compression resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) for Buckling lengths (m)												
Size	Wall Thk t mm				2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
h x b mm																	
200x120	5.0 * #	24.1	1030	y	994	965	920	811	679	552	448	366	304	256	218	187	163
				z	947	837	669	497	369	281	220	177	145	121	102	87.7	75.9
	6.3	30.1	1360	y	1310	1240	1140	1010	839	680	551	451	374	314	267	230	200
				z	1240	1080	844	617	455	345	270	216	177	148	125	107	92.7
	7.1 #	33.7	1520	y	1470	1390	1280	1120	933	756	611	500	414	348	296	255	222
				z	1390	1210	938	684	504	383	299	240	196	163	138	118	103
	8.0	37.6	1700	y	1640	1550	1430	1250	1040	839	678	554	459	386	328	282	245
				z	1550	1350	1040	756	556	422	329	264	216	180	152	130	113
	8.8 #	41.1	1860	y	1790	1690	1550	1360	1120	908	733	599	496	417	355	305	265
				z	1690	1460	1130	817	600	455	356	285	233	194	164	141	122
	10.0	46.3	2090	y	2010	1900	1740	1520	1250	1010	815	665	551	463	393	339	294
				z	1900	1630	1250	900	660	500	390	313	256	213	180	154	134
	12.5 #	56.6	2560	y	2460	2320	2110	1830	1500	1200	967	788	652	547	465	400	348
				z	2310	1970	1480	1060	778	589	459	368	301	250	212	181	157
	14.2 #	63.3	2860	y	2750	2590	2350	2030	1650	1320	1060	865	715	600	510	438	381
				z	2580	2180	1620	1160	845	638	498	398	326	271	229	196	170
	16.0 #	70.2	3170	y	3040	2860	2590	2220	1800	1430	1150	936	773	649	551	474	412
				z	2850	2390	1760	1250	907	684	533	427	349	290	245	210	182
200x150	5.0 * #	26.5	1130	y	1100	1060	1020	911	773	635	518	425	353	297	253	218	190
				z	1080	999	881	722	567	443	352	285	235	196	167	143	124
	6.3 #	33.0	1490	y	1440	1370	1270	1130	957	784	638	524	435	366	312	269	234
				z	1410	1300	1130	913	708	551	436	352	290	242	205	176	153
	7.1 #	37.0	1670	y	1620	1530	1420	1260	1070	872	710	582	483	407	346	298	259
				z	1580	1450	1260	1010	784	609	482	389	320	268	227	195	169
	8.0	41.4	1870	y	1810	1720	1590	1410	1190	968	787	645	536	450	384	330	287
				z	1770	1630	1410	1130	870	675	534	431	354	296	251	216	187
	8.8 #	45.3	2050	y	1980	1880	1740	1540	1290	1050	854	700	581	489	416	358	311
				z	1930	1770	1530	1220	943	731	578	467	384	321	272	233	202
	10.0	51.0	2300	y	2220	2110	1950	1720	1440	1170	948	776	644	542	461	397	345
				z	2170	1990	1710	1360	1050	811	641	517	425	355	301	258	224
	12.5 #	62.5	2830	y	2720	2580	2370	2080	1730	1400	1130	928	769	646	550	473	411
				z	2650	2430	2070	1630	1250	963	760	612	503	420	356	305	265
	14.2 #	70.0	3170	y	3050	2880	2650	2310	1910	1550	1250	1020	845	710	604	519	451
				z	2970	2700	2290	1790	1370	1050	830	669	549	459	389	333	289
	16.0 #	77.7	3510	y	3380	3190	2920	2540	2090	1680	1360	1110	916	770	654	563	489
				z	3290	2990	2510	1950	1480	1140	898	723	593	496	420	360	312

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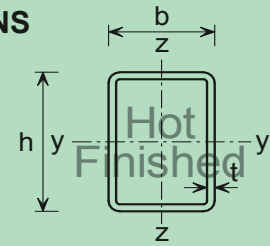
Values in italic type indicate that the section is Class 4 in pure compression and allowance has been made in calculating the resistance.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 6.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Designation		Mass per Metre kg/m	$N_{b,T,Rd}$ kN	Axis	Compression resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) for Buckling lengths (m)												
Size	Wall Thk t mm				2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
h x b mm																	
220x120	5.0 * #	25.7	1050	y	1020	982	927	871	793	663	547	452	377	318	271	234	204
				z	972	868	706	532	398	304	238	192	157	131	111	95.0	82.4
	6.3 #	32.0	1450	y	1410	1340	1260	1140	983	819	674	557	464	392	334	288	251
				z	1330	1160	912	670	495	376	294	236	193	161	136	117	101
	7.1 #	35.9	1620	y	1570	1500	1410	1270	1090	911	749	618	515	435	371	320	278
				z	1480	1300	1010	741	547	415	325	260	213	178	150	129	111
	8.0 #	40.2	1820	y	1760	1680	1570	1420	1220	1010	831	685	571	481	411	354	308
				z	1660	1440	1120	819	604	458	358	287	235	196	166	142	123
	8.8 #	43.9	1980	y	1920	1830	1710	1540	1320	1100	900	742	618	521	444	383	333
				z	1810	1570	1220	886	652	495	387	310	254	211	179	153	133
	10.0 #	49.4	2230	y	2160	2060	1920	1730	1480	1220	1000	826	687	579	494	426	370
				z	2030	1760	1350	977	718	544	425	341	279	232	196	168	146
	12.5 #	60.5	2740	y	2650	2520	2340	2090	1780	1470	1200	983	818	689	587	505	440
				z	2480	2120	1610	1160	848	642	501	401	328	273	231	198	171
	14.2 #	67.8	3060	y	2960	2820	2610	2330	1970	1620	1320	1080	898	756	644	555	483
				z	2770	2350	1760	1260	921	696	543	435	356	296	250	214	186
	16.0 #	75.2	3400	y	3290	3120	2890	2560	2160	1760	1430	1180	976	821	699	602	524
				z	3060	2580	1910	1360	991	749	583	467	382	318	269	230	199
250x100	5.0 * #	26.5	1000	y	989	955	914	860	789	707	642	537	452	383	328	284	247
				z	909	775	584	419	307	232	181	145	119	98.7	83.5	71.5	61.9
	6.3 * #	33.0	1400	y	1370	1340	1330	1230	1100	943	793	663	557	472	404	349	305
				z	1250	1030	742	521	378	285	222	177	145	121	102	87.2	75.5
	7.1 #	37.0	1670	y	1630	1570	1490	1370	1220	1050	881	736	618	524	448	388	338
				z	1470	1190	835	581	420	316	245	196	160	133	113	96.4	83.4
	8.0 #	41.4	1870	y	1830	1760	1660	1540	1360	1170	979	818	686	581	498	430	375
				z	1650	1320	923	641	462	348	270	216	176	147	124	106	91.8
	8.8 #	45.3	2050	y	2000	1920	1820	1670	1490	1270	1060	887	744	630	539	466	406
				z	1790	1430	998	691	499	375	291	233	190	158	133	114	98.9
	10.0 #	51.0	2300	y	2250	2160	2040	1880	1660	1420	1180	986	827	700	599	517	451
				z	2010	1590	1100	758	546	410	319	254	208	173	146	125	108
	12.5 #	62.5	2830	y	2750	2640	2490	2280	2010	1700	1420	1180	988	836	714	617	537
				z	2450	1900	1290	890	640	480	373	297	243	202	170	146	126
	14.2 #	70.0	3170	y	3080	2950	2780	2540	2230	1880	1560	1300	1080	917	783	676	589
				z	2720	2080	1400	961	690	517	402	320	262	217	184	157	136
	16.0 #	77.7	3510	y	3420	3270	3080	2800	2450	2060	1710	1410	1180	998	852	735	640
				z	3000	2260	1510	1030	737	552	428	342	279	232	196	167	145

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\* Section may be Class 4 under axial compression.

Values in italic type indicate that the section is Class 4 in pure compression and allowance has been made in calculating the resistance.

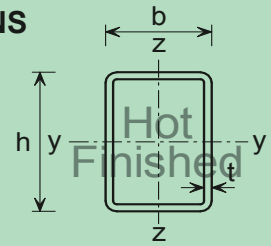
# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 6.



HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Designation		Mass per Metre kg/m	$N_{b,T,Rd}$ kN	Axis	Compression resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) for Buckling lengths (m)												
Size	Wall Thk t mm				2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
$h \times b$ mm																	
250x150	5.0 * #	30.4	1180	y	1170	1130	1080	1030	952	858	796	673	570	486	417	361	315
				z	1130	1060	958	814	657	522	418	340	280	235	200	172	149
	6.3 *	38.0	1630	y	1600	1540	1540	1450	1320	1150	987	834	706	601	516	446	390
				z	1550	1440	1280	1060	833	654	520	421	347	291	247	212	184
	7.1 #	42.6	1920	y	1890	1820	1740	1620	1470	1290	1100	929	786	669	574	497	434
				z	1820	1690	1480	1200	939	733	581	470	387	324	274	236	204
	8.0	47.7	2160	y	2120	2040	1940	1820	1640	1440	1230	1030	874	743	638	552	482
				z	2040	1890	1650	1340	1040	813	644	521	429	359	304	261	226
	8.8 #	52.2	2360	y	2310	2230	2120	1980	1790	1570	1330	1120	949	807	692	599	523
				z	2230	2060	1800	1460	1130	882	699	565	465	389	330	283	245
	10.0	58.8	2660	y	2610	2510	2390	2230	2010	1750	1490	1250	1060	900	772	668	583
				z	2510	2320	2010	1620	1260	977	773	625	514	430	364	313	271
	12.5	72.3	3270	y	3200	3080	2930	2720	2450	2120	1800	1510	1270	1080	927	801	699
				z	3080	2830	2450	1950	1510	1170	923	745	612	512	434	372	323
	14.2 #	81.1	3660	y	3580	3440	3270	3030	2720	2350	1980	1660	1400	1190	1020	880	768
				z	3440	3150	2710	2150	1650	1280	1010	812	668	558	473	406	352
	16.0	90.3	4080	y	3990	3840	3640	3370	3010	2600	2190	1830	1540	1310	1120	966	843
				z	3830	3500	2990	2350	1800	1390	1100	884	727	607	514	441	383
260x140	5.0 * #	30.4	1150	y	1140	1110	1070	1010	948	863	764	700	594	507	436	378	330
				z	1100	1020	910	756	599	471	375	304	250	210	178	153	133
	6.3 * #	38.0	1600	y	1570	1520	1460	1440	1340	1180	1020	867	736	628	539	468	409
				z	1510	1390	1210	977	758	590	467	377	310	259	220	189	164
	7.1 #	42.6	1920	y	1890	1830	1740	1640	1500	1320	1140	965	818	698	600	520	454
				z	1810	1650	1410	1110	853	659	520	419	345	288	244	209	182
	8.0 #	47.7	2160	y	2120	2050	1950	1830	1670	1470	1270	1070	910	776	666	577	504
				z	2030	1850	1580	1240	947	731	577	465	382	319	270	232	201
	8.8 #	52.2	2360	y	2320	2240	2140	2000	1830	1610	1380	1170	990	844	725	628	548
				z	2210	2020	1720	1350	1030	792	625	503	413	345	293	251	218
	10.0 #	58.8	2660	y	2610	2520	2400	2250	2050	1800	1540	1300	1100	940	807	699	610
				z	2490	2270	1920	1500	1140	879	692	558	458	383	324	278	241
	12.5 #	72.3	3270	y	3210	3090	2950	2750	2490	2180	1860	1570	1330	1130	968	838	731
				z	3050	2770	2320	1790	1360	1040	822	661	543	453	384	329	285
	14.2 #	81.1	3660	y	3580	3450	3290	3070	2770	2420	2050	1730	1460	1240	1070	922	805
				z	3410	3080	2560	1970	1490	1140	898	723	593	495	419	359	312
	16.0 #	90.3	4080	y	4000	3850	3660	3410	3070	2670	2260	1900	1600	1360	1170	1010	882
				z	3800	3420	2820	2160	1620	1240	976	785	644	537	455	390	338

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\* Section may be Class 4 under axial compression.

Values in italic type indicate that the section is Class 4 in pure compression and allowance has been made in calculating the resistance.

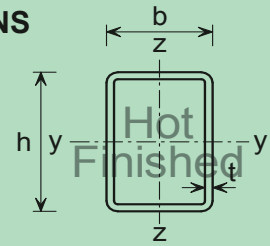
# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 6.



HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Designation		Mass per Metre kg/m	$N_{b,T,Rd}$ kN	Axis	Compression resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) for Buckling lengths (m)												
Size	Wall Thk t mm				2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
h x b mm																	
300x100	5.0 * #	30.4	1040	y	1030	1010	976	940	896	840	772	695	615	549	497	433	379
				z	950	833	655	482	356	271	212	170	139	116	98.1	84.1	72.8
	6.3 * #	38.0	1470	y	1460	1420	1370	1310	1240	1150	1110	973	837	720	622	541	474
				z	1320	1130	847	606	443	335	261	209	171	143	121	103	89.4
	7.1 * #	42.6	1740	y	1730	1680	1620	1550	1550	1410	1240	1080	923	793	685	596	522
				z	1560	1300	955	675	491	371	289	231	189	157	133	114	98.4
	8.0 *	47.7	2070	y	2130	2060	1990	1890	1750	1590	1400	1210	1040	890	769	668	585
				z	1840	1500	1070	752	545	410	319	255	208	173	147	125	109
	8.8 #	52.2	2360	y	2330	2260	2170	2060	1910	1720	1510	1300	1120	958	826	718	629
				z	2080	1670	1180	817	590	444	345	276	225	187	158	135	117
	10.0	58.8	2660	y	2620	2540	2440	2320	2150	1940	1700	1470	1260	1080	931	809	708
				z	2330	1860	1300	901	650	489	380	303	248	206	174	149	129
	12.5 #	72.3	3270	y	3220	3120	2990	2830	2620	2350	2050	1760	1510	1290	1110	967	846
				z	2840	2230	1530	1060	761	571	444	354	289	241	203	174	150
	14.2 #	81.1	3660	y	3600	3490	3340	3160	2920	2610	2270	1950	1660	1420	1230	1060	931
				z	3160	2440	1660	1140	820	615	478	381	311	259	218	187	162
	16.0 #	90.3	4080	y	4020	3890	3720	3510	3240	2890	2510	2140	1830	1560	1340	1170	1020
				z	3500	2680	1800	1230	886	664	515	411	336	279	236	202	174
300x150	8.0 * # r	54.0	2360	y	2410	2350	2270	2170	2040	1870	1680	1470	1280	1100	958	836	734
				z	2240	2080	1850	1530	1200	945	752	609	502	420	356	306	266
	8.8 # rr	59.1	2670	y	2650	2570	2480	2370	2230	2050	1840	1610	1400	1210	1050	915	803
				z	2530	2350	2060	1680	1320	1030	817	661	544	455	386	331	288
	10.0 # rr	66.7	3010	y	2980	2900	2800	2670	2510	2300	2050	1790	1550	1340	1160	1020	891
				z	2850	2640	2310	1880	1470	1140	908	734	604	505	429	368	319
	12.5 # rr	82.1	3730	y	3690	3580	3450	3290	3090	2820	2510	2190	1900	1640	1420	1230	1080
				z	3520	3250	2830	2280	1770	1370	1090	878	722	604	512	440	381
	14.2 # rr	92.3	4190	y	4140	4020	3870	3690	3450	3150	2800	2430	2100	1810	1570	1370	1200
				z	3950	3640	3150	2520	1950	1510	1200	966	794	664	563	483	419
	16.0 # rr	103	4650	y	4600	4460	4290	4090	3810	3470	3070	2670	2300	1980	1710	1490	1310
				z	4380	4020	3460	2750	2120	1640	1300	1050	860	719	609	523	453

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\* Section may be Class 4 under axial compression.

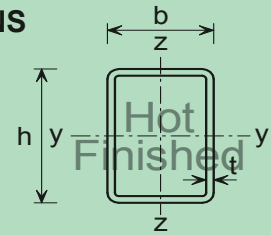
Values in italic type indicate that the section is Class 4 in pure compression and allowance has been made in calculating the resistance.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 6.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Designation		Mass per Metre kg/m	$N_{b,T,Rd}$ kN	Axis	Compression resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN)													
Size h x b mm	Wall Thk t mm				for Buckling lengths (m)													
					2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	
300x200	5.0 * #	38.3	1330	y	1330	1300	1270	1230	1180	1120	1050	970	878	785	698	619	549	
				z	1310	1260	1210	1130	1040	920	793	674	572	488	420	364	318	
	6.3 *	47.9	1910	y	1910	1860	1800	1740	1660	1560	1440	1380	1210	1050	916	801	705	
				z	1870	1800	1710	1580	1420	1220	1030	863	726	615	527	456	397	
	7.1 * #	53.7	2250	y	2240	2180	2110	2040	1960	1920	1740	1540	1350	1180	1030	898	790	
				z	2200	2110	1990	1840	1630	1390	1160	971	814	690	590	509	444	
	8.0 *	60.3	2640	y	2690	2630	2550	2450	2320	2150	1950	1730	1520	1320	1150	1010	887	
				z	2570	2460	2320	2130	1870	1580	1310	1090	912	771	659	569	496	
	8.8 #	66.0	2990	y	2960	2880	2790	2670	2530	2340	2120	1880	1640	1430	1240	1090	957	
				z	2900	2780	2610	2380	2070	1740	1440	1190	995	840	717	619	539	
	10.0	74.5	3370	y	3340	3250	3150	3020	2850	2650	2390	2120	1850	1610	1400	1230	1080	
				z	3280	3130	2940	2670	2320	1950	1610	1330	1110	938	800	690	601	
	12.5	91.9	4150	y	4120	4000	3870	3700	3490	3220	2900	2560	2230	1930	1680	1470	1290	
				z	4030	3850	3610	3270	2820	2360	1940	1600	1340	1130	962	830	722	
	14.2 #	103	4690	y	4650	4520	4370	4180	3940	3640	3280	2890	2510	2180	1900	1660	1450	
				z	4550	4340	4060	3670	3160	2630	2160	1780	1490	1250	1070	921	802	
	16.0	115	5220	y	5170	5030	4850	4640	4370	4030	3620	3180	2760	2390	2080	1810	1590	
				z	5060	4830	4510	4060	3480	2890	2370	1950	1620	1370	1170	1010	876	
300x250	5.0 * #	42.2	1380	y	1380	1350	1320	1280	1240	1190	1130	1050	964	872	783	699	624	
				z	1370	1340	1300	1250	1200	1120	1040	934	830	730	641	564	498	
	6.3 * #	52.8	2040	y	2040	1990	1940	1880	1800	1710	1590	1460	1310	1170	1030	911	807	
				z	2030	1970	1910	1820	1720	1590	1430	1260	1100	955	830	725	637	
	7.1 * #	59.3	2500	y	2490	2430	2360	2280	2170	2150	1960	1750	1550	1350	1180	1040	913	
				z	2470	2400	2310	2200	2060	1870	1660	1450	1250	1070	929	809	709	
	8.0 *	66.5	2920	y	2970	2920	2830	2720	2580	2410	2200	1970	1740	1520	1330	1160	1030	
				z	2890	2800	2690	2560	2380	2160	1900	1650	1410	1210	1050	913	800	
	8.8 #	72.9	3300	y	3280	3190	3100	2980	2830	2640	2410	2160	1900	1660	1450	1280	1120	
				z	3250	3150	3030	2870	2670	2400	2110	1820	1560	1340	1150	1000	879	
	10.0 #	82.4	3730	y	3700	3610	3490	3360	3190	2970	2710	2420	2130	1860	1620	1420	1250	
				z	3680	3560	3420	3240	3000	2700	2360	2030	1730	1490	1280	1110	975	
	12.5 #	102	4620	y	4580	4460	4320	4150	3940	3660	3330	2960	2600	2270	1980	1730	1530	
				z	4550	4400	4220	3990	3690	3310	2880	2470	2110	1810	1560	1350	1180	
	14.2 #	115	5180	y	5150	5010	4850	4650	4410	4090	3710	3300	2890	2510	2190	1920	1690	
				z	5110	4940	4740	4470	4120	3690	3210	2750	2340	2010	1730	1500	1310	
	16.0 #	128	5790	y	5740	5590	5410	5180	4900	4540	4110	3640	3180	2770	2410	2110	1850	
				z	5700	5510	5280	4980	4580	4090	3550	3030	2580	2210	1900	1650	1440	

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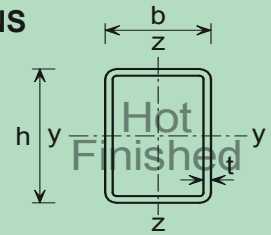
Values in italic type indicate that the section is Class 4 in pure compression and allowance has been made in calculating the resistance.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 6.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Designation		Mass per Metre kg/m	$N_{b,T,Rd}$ kN	Axis	Compression resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN)												
Size	Wall Thk t				for												
h x b mm	mm				Buckling lengths (m)												
					2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
340x100	10.0	65.1	2940	y	2920	2840	2750	2640	2500	2320	2110	1870	1640	1430	1240	1090	958
				z	2590	2070	1450	1010	729	548	426	340	278	231	195	167	145
350x150	5.0 * #	38.3	1240	y	1240	1220	1190	1160	1130	1090	1040	985	919	845	769	694	625
				z	1200	1140	1060	944	802	660	539	443	368	310	264	227	198
	6.3 * #	47.9	1730	y	1730	1700	1660	1620	1570	1500	1430	1340	1230	1120	1030	947	838
				z	1670	1580	1450	1260	1040	840	678	554	459	385	328	282	245
	7.1 * #	53.7	2060	y	2060	2020	1970	1910	1850	1770	1670	1550	1470	1350	1190	1050	927
				z	1980	1860	1690	1450	1190	948	761	620	513	430	366	314	273
	8.0 * #	60.3	2450	y	2450	2400	2330	2260	2180	2080	2070	1910	1710	1510	1330	1180	1040
				z	2340	2190	1980	1670	1340	1070	852	692	572	479	407	350	304
	8.8 * #	66.0	2800	y	2800	2730	2670	2610	2460	2280	2070	1850	1640	1440	1270	1120	
				z	2670	2490	2230	1860	1480	1170	931	755	623	522	443	380	330
	10.0 #	74.5	3370	y	3360	3280	3190	3080	2950	2780	2580	2340	2090	1850	1630	1440	1270
				z	3190	2960	2610	2140	1680	1310	1040	842	694	580	492	423	367
	12.5 #	91.9	4150	y	4140	4040	3920	3790	3620	3420	3160	2860	2550	2250	1980	1750	1540
				z	3930	3640	3180	2590	2020	1570	1250	1010	830	694	589	505	439
	14.2 #	103	4690	y	4670	4550	4420	4270	4080	3840	3540	3210	2850	2510	2210	1940	1720
				z	4430	4090	3560	2870	2230	1740	1370	1110	914	764	648	556	483
16.0 #	115	5220	y	5200	5070	4920	4750	4530	4260	3920	3540	3140	2770	2430	2140	1890	
			z	4920	4530	3930	3150	2430	1890	1500	1210	993	830	704	604	524	
350x250	6.3 * #	57.8	2090	y	2090	2060	2020	1970	1920	1850	1770	1680	1570	1450	1320	1200	1080
				z	2080	2020	1960	1890	1800	1680	1530	1370	1210	1060	925	812	715
	7.1 * #	64.9	2570	y	2570	2520	2470	2400	2330	2240	2140	2010	1860	1780	1610	1430	1270
				z	2540	2470	2390	2290	2160	1990	1800	1580	1380	1200	1040	908	798
	8.0 * #	72.8	3020	y	3020	2960	2890	2820	2730	2610	2500	2450	2230	2000	1790	1590	1410
				z	2990	2900	2800	2680	2520	2310	2070	1810	1570	1360	1180	1030	901
	8.8 * #	79.8	3440	y	3440	3370	3290	3240	3240	3090	2910	2690	2450	2200	1960	1750	1550
				z	3400	3300	3180	3030	2830	2580	2290	1990	1720	1480	1280	1110	977
	10.0 #	90.2	4080	y	4080	3990	3890	3780	3640	3470	3260	3020	2740	2460	2190	1950	1730
				z	4030	3910	3760	3570	3320	3000	2640	2280	1960	1680	1450	1260	1110
	12.5 #	112	5040	y	5040	4930	4800	4660	4490	4270	4010	3700	3360	3010	2670	2370	2110
				z	4970	4820	4630	4390	4070	3680	3230	2780	2380	2040	1760	1530	1340
	14.2 #	126	5680	y	5680	5550	5410	5240	5050	4800	4500	4150	3750	3360	2980	2640	2350
				z	5600	5420	5210	4930	4570	4110	3590	3090	2640	2270	1950	1700	1490
	16.0 #	141	6350	y	6350	6200	6040	5860	5630	5360	5010	4610	4160	3720	3300	2920	2590
				z	6260	6060	5820	5500	5090	4570	3990	3420	2920	2510	2160	1880	1640

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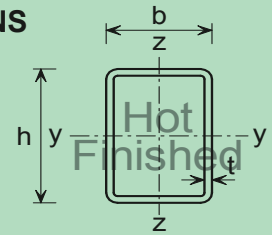
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# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 6.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Designation		Mass per Metre kg/m	$N_{b,T,Rd}$ kN	Axis	Compression resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN)												
Size h x b mm	Wall Thk t mm				for Buckling lengths (m)												
					2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
400x150	6.3 * #	52.8	1770	y	1770	1750	1720	1680	1640	1600	1540	1480	1400	1320	1220	1120	1020
				z	1710	1620	1510	1340	1130	925	753	618	513	432	368	317	276
	7.1 * #	59.3	2110	y	2110	2090	2050	2000	1950	1890	1820	1740	1640	1530	1410	1290	1240
				z	2030	1920	1770	1550	1290	1050	846	691	573	482	410	353	307
	8.0 * #	66.5	2520	y	2520	2490	2440	2380	2320	2240	2150	2040	1910	1780	1730	1550	1390
				z	2420	2280	2080	1800	1470	1180	949	774	640	537	457	393	341
	8.8 * #	72.9	2900	y	2900	2850	2790	2730	2650	2560	2450	2330	2330	2110	1900	1700	1520
				z	2770	2600	2360	2010	1630	1300	1040	845	698	585	497	428	371
	10.0 * #	82.4	3480	y	3480	3420	3350	3300	3300	3220	3050	2850	2610	2370	2130	1900	1700
				z	3320	3100	2780	2330	1860	1460	1170	948	782	655	556	478	415
	12.5 #	102	4620	y	4620	4530	4420	4300	4150	3980	3760	3510	3210	2910	2610	2330	2080
				z	4370	4050	3570	2910	2280	1780	1410	1140	942	788	668	574	498
	14.2 #	115	5180	y	5180	5080	4960	4820	4660	4460	4210	3920	3590	3240	2900	2580	2300
				z	4900	4540	3970	3220	2510	1960	1550	1250	1030	864	732	629	546
16.0	128	5790	y	5790	5670	5530	5380	5190	4960	4680	4350	3970	3580	3200	2850	2540	
			z	5470	5050	4400	3550	2760	2140	1700	1370	1130	944	800	687	596	
400x200	6.3 * #	57.8	1990	y	1990	1980	1940	1900	1860	1810	1750	1680	1600	1510	1410	1300	1190
				z	1960	1900	1820	1720	1580	1410	1230	1050	897	767	661	574	502
	7.1 * #	64.9	2360	y	2360	2340	2300	2250	2200	2130	2060	1970	1870	1760	1630	1500	1370
				z	2320	2240	2140	2010	1840	1630	1400	1190	1010	862	741	642	561
	8.0 *	72.8	2800	y	2800	2770	2720	2660	2590	2510	2420	2310	2180	2030	1950	1800	1620
				z	2750	2650	2530	2360	2140	1870	1590	1350	1140	968	830	719	627
	8.8 * #	79.8	3220	y	3220	3180	3120	3050	2960	2870	2760	2620	2560	2430	2200	1980	1780
				z	3150	3030	2880	2680	2410	2090	1770	1490	1250	1060	911	788	687
	10.0 *	90.2	3840	y	3840	3780	3700	3610	3610	3580	3410	3210	2970	2720	2460	2210	1980
				z	3750	3600	3410	3140	2800	2400	2010	1680	1410	1190	1020	883	769
	12.5	112	5040	y	5040	4960	4850	4720	4580	4410	4190	3940	3650	3330	3010	2700	2420
				z	4910	4700	4420	4040	3540	2980	2470	2050	1720	1450	1240	1070	931
	14.2 #	126	5680	y	5680	5580	5460	5320	5150	4950	4710	4420	4090	3730	3360	3020	2700
				z	5530	5290	4970	4530	3950	3320	2750	2280	1900	1610	1370	1190	1030
16.0	141	6350	y	6350	6240	6100	5940	5750	5530	5250	4920	4540	4140	3730	3340	2990	
			z	6180	5910	5540	5040	4380	3670	3030	2510	2090	1770	1510	1300	1130	

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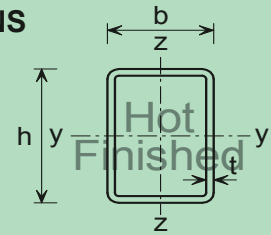
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# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 6.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Designation		Mass per Metre kg/m	$N_{b,T,Rd}$ kN	Axis	Compression resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) for Buckling lengths (m)												
Size	Wall Thk t				2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
h x b mm	mm																
400x300	8.0 * #	85.4	3290	y	3290	3270	3210	3140	3070	2990	2900	2780	2650	2500	2330	2150	1970
				z	3290	3220	3140	3050	2940	2810	2650	2450	2230	2010	1790	1590	1420
	8.8 * #	93.6	3820	y	3820	3790	3710	3640	3550	3440	3320	3180	3010	2980	2730	2480	2250
				z	3820	3730	3640	3530	3390	3230	3020	2780	2510	2240	1990	1760	1570
	10.0 * #	106	4550	y	4550	4490	4410	4310	4240	4240	4100	3890	3650	3390	3100	2820	2550
				z	4540	4430	4310	4170	4000	3780	3520	3210	2880	2560	2260	1990	1770
	12.5 #	131	5930	y	5930	5850	5730	5600	5450	5270	5060	4800	4500	4160	3810	3450	3120
				z	5910	5760	5600	5400	5160	4860	4480	4060	3610	3180	2790	2460	2170
	14.2 #	148	6710	y	6710	6620	6480	6330	6160	5950	5710	5410	5070	4680	4280	3880	3500
				z	6690	6520	6330	6110	5840	5500	5070	4590	4080	3600	3160	2780	2460
	16.0 #	166	7490	y	7490	7390	7230	7060	6870	6640	6360	6020	5630	5190	4740	4290	3870
				z	7460	7270	7060	6810	6500	6110	5630	5080	4510	3970	3490	3070	2710
450x250	8.0 *	85.4	3150	y	3150	3140	3090	3040	2980	2910	2840	2750	2650	2540	2400	2260	2110
				z	3130	3050	2960	2850	2710	2540	2330	2090	1850	1620	1420	1240	1100
	8.8 * #	93.6	3580	y	3580	3570	3510	3450	3380	3300	3210	3110	2990	2850	2700	2520	2390
				z	3560	3460	3350	3220	3060	2840	2590	2300	2020	1760	1540	1350	1180
	10.0 *	106	4300	y	4300	4270	4200	4120	4030	3940	3820	3690	3530	3450	3350	3080	2820
				z	4260	4140	4010	3840	3630	3350	3030	2670	2330	2020	1760	1540	1350
	12.5	131	5930	y	5930	5880	5770	5650	5520	5370	5190	4970	4720	4440	4120	3790	3460
				z	5860	5680	5470	5210	4860	4420	3920	3400	2930	2520	2180	1900	1660
	14.2 #	148	6710	y	6710	6650	6520	6390	6240	6060	5860	5610	5330	5000	4640	4260	3890
				z	6630	6430	6180	5880	5480	4970	4390	3800	3270	2810	2430	2110	1850
	16.0	166	7490	y	7490	7420	7280	7130	6960	6760	6530	6250	5930	5550	5140	4720	4310
				z	7400	7170	6890	6540	6090	5510	4850	4190	3590	3090	2670	2320	2030

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

\* Section may be Class 4 under axial compression.

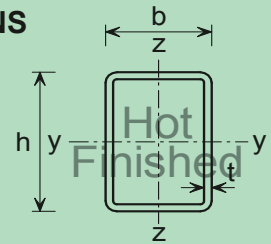
Values in italic type indicate that the section is Class 4 in pure compression and allowance has been made in calculating the resistance.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 6.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Designation		Mass per Metre kg/m	$N_{b,T,Rd}$ kN	Axis	Compression resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) for Buckling lengths (m)													
Size	Wall Thk t mm				2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	
$h \times b$ mm																		
500x200	8.0 * #	85.4	2910	y	2910	2910	2870	2830	2780	2730	2680	2610	2540	2460	2360	2260	2140	
				z	2870	2770	2660	2520	2330	2100	1830	1580	1350	1160	997	866	758	
	8.8 * #	93.6	3330	y	3330	3330	3280	3230	3170	3110	3050	2970	2890	2790	2670	2540	2400	
				z	3270	3170	3030	2860	2630	2340	2030	1730	1480	1260	1090	942	824	
	10.0 * #	106	4030	y	4030	4020	3960	3900	3830	3750	3660	3560	3450	3310	3160	2990	2830	
				z	3950	3810	3640	3410	3110	2730	2340	1980	1680	1430	1230	1060	930	
	12.5 * #	131	5540	y	5540	5520	5430	5330	5250	5250	5250	5100	4890	4640	4360	4060	3750	
				z	5420	5210	4930	4560	4070	3500	2940	2460	2070	1750	1500	1300	1130	
	14.2 #	148	6710	y	6710	6670	6560	6430	6300	6140	5970	5760	5510	5230	4910	4570	4220	
				z	6540	6260	5910	5410	4760	4030	3350	2790	2330	1970	1680	1450	1270	
	16.0 #	166	7490	y	7490	7450	7320	7180	7030	6850	6650	6420	6140	5820	5460	5070	4680	
				z	7290	6980	6580	6010	5260	4440	3690	3060	2560	2160	1850	1590	1390	
	500x300	8.0 * #	97.9	3390	y	3390	3390	3350	3310	3260	3200	3140	3080	3000	2910	2820	2710	2580
					z	3390	3330	3260	3180	3080	2970	2830	2660	2470	2260	2040	1840	1650
8.8 * #		107	3970	y	3970	3970	3920	3860	3800	3730	3660	3570	3480	3370	3250	3110	2950	
				z	3970	3890	3800	3700	3580	3440	3260	3050	2810	2550	2290	2050	1840	
10.0 *		122	4740	y	4740	4740	4670	4600	4520	4440	4340	4240	4120	3970	3810	3630	3430	
				z	4740	4640	4530	4400	4250	4070	3850	3580	3270	2950	2640	2360	2100	
12.5 * #		151	6430	y	6430	6420	6320	6220	6100	6030	6030	5970	5750	5510	5220	4910	4580	
				z	6420	6280	6110	5930	5700	5410	5070	4650	4200	3750	3330	2950	2610	
14.2 #		170	7700	y	7700	7680	7560	7430	7280	7130	6940	6730	6490	6210	5880	5530	5150	
				z	7680	7500	7290	7050	6760	6380	5930	5390	4830	4280	3770	3330	2940	
16.0		191	8630	y	8630	8600	8460	8310	8150	7970	7770	7530	7250	6930	6560	6160	5730	
				z	8600	8390	8160	7880	7550	7120	6600	6000	5350	4730	4170	3680	3250	
20.0 ^		235	10400	y	10400	10300	10200	9980	9790	9580	9340	9060	8730	8350	7920	7450	6940	
				z	10300	10100	9790	9460	9050	8540	7910	7180	6410	5660	4990	4400	3890	

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

\* Section may be Class 4 under axial compression.

Values in italic type indicate that the section is Class 4 in pure compression and allowance has been made in calculating the resistance.

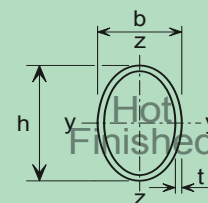
# Check availability

^ SAW process (single longitudinal seam weld, slightly proud).

FOR EXPLANATION OF TABLES SEE NOTE 6.

HOT-FINISHED ELLIPTICAL HOLLOW SECTIONS

Celsius® OHS



Designation		Mass per Metre kg/m	Axis	Compression resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN)													
Size h x b mm	Wall Thk t mm			for Buckling lengths $L_{cr}$ (m)													
				1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0	
150x75	4.0 *	10.7	y	424	411	394	373	345	310	271	199	147	112	87.4	70.1	57.4	
			z	404	368	313	246	188	145	114	75.7	53.5	39.8	30.8	24.5	19.9	
	5.0 *	13.3	y	587	566	541	507	461	406	348	249	182	138	108	86.2	70.5	
			z	555	499	410	311	234	179	141	92.7	65.5	48.6	37.5	29.8	24.3	
	6.3	16.5	y	732	705	673	629	571	501	428	306	223	169	132	105	86.2	
			z	690	616	501	377	282	215	169	111	78.5	58.3	45.0	35.8	29.1	
200x100	5.0 *	17.9	y	698	684	668	649	626	599	565	480	387	307	246	200	165	
			z	677	645	602	541	464	384	315	216	155	116	90.3	72.0	58.8	
	6.3 *	22.3	y	975	952	927	897	861	817	762	627	493	386	307	248	205	
			z	941	891	821	720	600	486	393	267	191	143	111	88.2	72.0	
	8.0	28.0	y	1260	1230	1200	1160	1110	1050	972	790	616	480	381	308	253	
			z	1220	1150	1050	910	747	600	483	326	233	174	135	107	87.6	
	10.0	34.5	y	1560	1520	1480	1430	1360	1280	1190	960	746	580	460	371	306	
			z	1500	1410	1280	1100	897	717	576	388	277	207	160	127	104	
	12.5	42.4	y	1910	1860	1810	1740	1670	1570	1440	1160	897	696	551	445	366	
			z	1830	1720	1560	1320	1070	848	679	456	325	242	188	150	122	
	250x125	6.3 *	28.2	y	1100	1100	1080	1060	1030	1000	973	893	786	667	556	462	387
				z	1090	1050	1010	951	877	783	680	496	365	277	217	174	142
8.0 *		35.4	y	1560	1550	1520	1480	1450	1400	1350	1220	1040	865	710	585	487	
			z	1530	1480	1410	1310	1180	1030	877	623	454	343	268	214	175	
10.0		43.8	y	1980	1960	1920	1870	1830	1770	1700	1520	1290	1060	870	715	595	
			z	1940	1860	1770	1640	1470	1270	1070	754	548	413	322	257	210	
12.5		53.9	y	2440	2410	2360	2300	2240	2170	2080	1860	1570	1290	1050	865	719	
			z	2380	2290	2170	2000	1780	1530	1280	900	653	492	383	306	250	

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Oval Hollow Sections (HFOHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

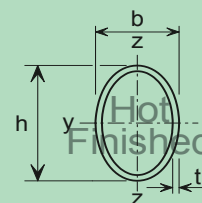
For values of the compression cross-sectional resistance,  $N_{c,Rd}$ , see values of  $N_{pl,Rd}$  in the tables for axial force and bending.

\* Section may be Class 4 under axial compression and allowance has been made in calculating the compression resistance

FOR EXPLANATION OF TABLES SEE NOTE 6.

HOT-FINISHED ELLIPTICAL HOLLOW SECTIONS

Celsius® OHS



Designation		Mass per Metre kg/m	Axis	Compression resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN)												
Size h x b mm	Wall Thk t mm			for Buckling lengths $L_{cr}$ (m)												
				1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
300x150	8.0 *	42.8	y	1720	1720	1700	1670	1650	1610	1580	1490	1380	1240	1080	931	796
			z	1710	1670	1620	1550	1480	1380	1260	986	753	581	458	369	303
	10.0 *	53.0	y	2390	2380	2340	2310	2260	2210	2160	2020	1840	1620	1390	1180	996
			z	2360	2300	2220	2120	1990	1830	1630	1240	931	713	559	450	369
	12.5	65.5	y	2960	2950	2910	2860	2800	2740	2670	2500	2270	1990	1700	1430	1210
			z	2930	2840	2740	2610	2450	2240	1990	1500	1120	857	673	540	443
	16.0	82.5	y	3730	3710	3650	3590	3520	3440	3350	3130	2830	2470	2100	1770	1500
			z	3680	3570	3440	3270	3050	2770	2450	1830	1360	1040	812	652	534
400x200	8.0 *	57.6	y	2010	2010	2010	2000	1980	1960	1930	1890	1830	1760	1680	1580	1460
			z	2010	2000	1960	1920	1880	1830	1770	1620	1420	1210	1000	833	697
	10.0 *	71.5	y	2790	2790	2790	2760	2730	2700	2670	2590	2500	2390	2250	2090	1910
			z	2790	2760	2710	2650	2580	2500	2410	2160	1850	1530	1260	1040	862
	12.5 *	88.6	y	3870	3870	3870	3820	3780	3730	3680	3560	3420	3240	3030	2770	2500
			z	3870	3810	3730	3640	3530	3410	3250	2860	2380	1930	1560	1280	1060
	16.0	112	y	5080	5080	5060	5000	4940	4870	4800	4640	4440	4190	3880	3530	3150
			z	5080	4990	4880	4750	4600	4420	4200	3640	2990	2400	1930	1580	1300
500x250	10.0 *	90.0	y	3150	3150	3150	3150	3140	3110	3090	3030	2970	2900	2830	2730	2630
			z	3150	3150	3120	3070	3020	2970	2910	2770	2590	2360	2100	1820	1570
	12.5 *	112	y	4350	4350	4350	4350	4320	4280	4240	4160	4070	3960	3840	3690	3520
			z	4350	4350	4290	4220	4140	4060	3970	3750	3460	3090	2690	2300	1960
	16.0 *	142	y	6240	6240	6240	6230	6170	6110	6050	5920	5770	5600	5390	5150	4860
			z	6240	6220	6120	6010	5890	5760	5610	5230	4720	4120	3500	2950	2490

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Oval Hollow Sections (HFOHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

For values of the compression cross-sectional resistance,  $N_{c,Rd}$ , see values of  $N_{pl,Rd}$  in the tables for axial force and bending.

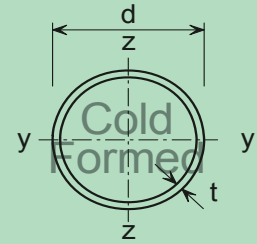
\* Section may be Class 4 under axial compression and allowance has been made in calculating the compression resistance

FOR EXPLANATION OF TABLES SEE NOTE 6.



COLD FORMED CIRCULAR HOLLOW SECTIONS

Hybox® CHS



Designation		Mass per Metre kg/m	$N_{b,T,Rd}$ kN	Compression resistance $N_{b,Rd}$ (kN) for Buckling lengths (m)												
Outside Diameter d mm	Wall Thk t mm			1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
33.7	3.0	2.27	103	44.5	24.0	14.6	9.74	6.95	5.20	4.04	2.63	1.85	1.37	1.06	0.841	0.684
42.4	3.0	2.91	132	76.2	45.9	29.0	19.7	14.2	10.7	8.32	5.46	3.85	2.86	2.21	1.76	1.43
48.3	3.0	3.35	152	99.1	64.4	42.0	28.9	21.0	15.9	12.4	8.18	5.79	4.31	3.33	2.66	2.16
	4.0 #	4.37	198	127	81.1	52.6	36.1	26.2	19.8	15.5	10.2	7.20	5.36	4.14	3.30	2.69
60.3	3.0 #	4.24	192	145	107	75.4	53.8	39.8	30.5	24.0	16.0	11.4	8.49	6.58	5.25	4.29
	4.0	5.55	251	189	138	96.6	68.8	50.8	38.9	30.6	20.3	14.5	10.8	8.38	6.68	5.46
76.1	3.0	5.41	245	205	168	131	99.0	75.7	59.1	47.1	31.8	22.8	17.1	13.3	10.7	8.73
	4.0	7.11	322	269	219	169	127	97.1	75.7	60.3	40.6	29.1	21.9	17.0	13.6	11.1
88.9	3.0	6.36	288	253	218	179	143	113	89.8	72.5	49.7	35.9	27.1	21.2	17.0	13.9
	3.5 #	7.37	333	293	252	207	164	130	103	83.2	56.9	41.1	31.0	24.2	19.4	15.9
	4.0	8.38	380	333	286	234	186	146	116	93.8	64.1	46.3	35.0	27.3	21.9	17.9
	5.0	10.3	469	410	351	286	226	178	141	114	77.7	56.1	42.3	33.0	26.5	21.7
	6.3	12.8	579	505	430	349	275	215	171	137	93.7	67.6	51.0	39.8	31.9	26.1
114.3	3.0 #	8.23	373	348	315	278	240	202	168	140	99.8	73.6	56.2	44.2	35.7	29.4
	3.5	9.56	433	404	365	322	277	233	194	162	115	84.7	64.7	50.9	41.1	33.8
	4.0 #	10.9	493	459	415	366	315	264	220	183	130	95.7	73.0	57.5	46.3	38.1
	5.0	13.5	611	568	512	451	387	325	270	224	159	117	89.2	70.1	56.5	46.5
	6.0	16.0	724	672	605	532	455	381	315	262	185	136	104	81.6	65.8	54.1
	6.3	16.8	760	704	634	557	476	398	330	274	193	142	108	85.2	68.7	56.5
139.7	3.0 #	10.1	458	441	409	375	338	299	261	226	168	127	98.3	78.1	63.4	52.4
	4.0 #	13.4	607	585	542	496	447	395	344	297	220	166	129	102	83.1	68.7
	5.0	16.6	753	724	671	614	552	487	424	365	271	204	158	126	102	84.2
	6.0	19.8	895	860	796	727	653	575	500	430	318	240	185	147	119	98.6
	6.3	20.7	937	900	833	761	683	602	522	449	332	250	193	154	125	103
	8.0	26.0	1180	1130	1040	949	850	747	646	554	408	307	237	188	153	126
	10.0	32.0	1440	1380	1280	1160	1040	908	784	671	493	370	285	226	183	151
	168.3	4.0	16.2	731	722	680	636	590	541	490	438	344	269	213	171	140
4.5 #		18.2	824	813	765	716	664	608	550	492	386	301	238	192	157	131
5.0		20.1	912	900	847	793	735	673	608	544	426	333	263	212	173	144
6.0		24.0	1090	1070	1010	942	872	798	721	644	503	392	310	249	204	170
6.3		25.2	1140	1120	1060	988	914	836	755	674	527	411	324	261	213	177
8.0		31.6	1430	1410	1320	1240	1140	1040	940	838	653	508	400	321	263	218
10.0		39.0	1760	1730	1630	1520	1400	1280	1150	1020	794	616	485	389	318	264
12.5		48.0	2170	2130	2000	1860	1720	1560	1400	1240	960	743	584	468	382	317

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Circular Hollow Sections (CFCHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

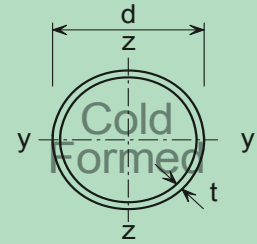
# Check availability

For values of the compression cross-sectional resistance  $N_{c,Rd}$ , see the values of  $N_{pl,Rd}$  in the tables for axial force and bending.

FOR EXPLANATION OF TABLES SEE NOTE 6.

COLD FORMED CIRCULAR HOLLOW SECTIONS

Hybox® CHS



Designation		Mass per Metre kg/m	Compression resistance $N_{b,Rd}$ (kN)													
Outside Diameter d mm	Wall Thk t mm		for Buckling lengths (m)													
			$N_{b,T,Rd}$ kN	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
193.7	4.0 #	18.7	845	845	805	763	718	671	621	570	468	379	306	250	207	173
	4.5 #	21.0	948	948	903	855	805	752	696	638	524	423	342	279	231	193
	5.0	23.3	1050	1050	1000	947	891	832	770	706	579	467	377	308	254	213
	6.0	27.8	1260	1260	1200	1130	1060	993	919	841	689	556	448	365	302	253
	6.3	29.1	1320	1320	1250	1190	1110	1040	962	881	721	581	469	382	316	264
	8.0	36.6	1660	1660	1570	1490	1400	1300	1200	1100	899	723	582	474	391	327
	10.0	45.3	2050	2050	1940	1840	1720	1600	1480	1350	1100	880	708	576	475	397
	12.5	55.9	2530	2520	2390	2260	2120	1970	1810	1650	1340	1070	858	697	574	480
219.1	4.5 #	23.8	1080	1080	1040	996	947	896	843	786	670	559	463	384	321	271
	5.0	26.4	1190	1190	1160	1100	1050	993	933	871	742	618	512	424	354	299
	6.0	31.5	1430	1430	1380	1320	1250	1190	1110	1040	884	737	609	504	421	355
	6.3	33.1	1490	1490	1450	1380	1310	1240	1170	1090	925	770	636	527	440	371
	8.0	41.6	1890	1890	1820	1740	1650	1560	1470	1370	1160	963	794	657	548	462
	10.0	51.6	2330	2330	2250	2150	2040	1930	1810	1680	1420	1180	970	802	668	563
	12.0 #	61.3	2770	2770	2680	2550	2420	2280	2140	1980	1680	1390	1140	939	782	659
	12.5	63.7	2880	2880	2780	2650	2510	2370	2220	2060	1740	1440	1180	974	811	683
244.5	5.0 #	29.5	1330	1330	1310	1260	1210	1150	1090	1030	907	778	659	556	471	401
	6.0	35.3	1600	1600	1570	1510	1440	1380	1310	1230	1080	927	785	662	559	476
	6.3	37.0	1670	1670	1640	1580	1510	1440	1370	1290	1130	970	820	691	584	497
	8.0	46.7	2110	2110	2070	1990	1900	1810	1720	1620	1420	1220	1030	865	731	621
	10.0	57.8	2620	2620	2570	2460	2360	2240	2130	2010	1750	1500	1260	1060	895	761
	12.0 #	68.8	3110	3110	3050	2930	2800	2660	2520	2380	2070	1760	1490	1250	1050	893
	12.5	71.5	3230	3230	3170	3040	2900	2770	2620	2470	2150	1830	1540	1290	1090	924
	16.0	90.2	4080	4080	3990	3830	3650	3480	3290	3090	2680	2280	1910	1600	1350	1140
273	4.0 * #	26.5	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$
	4.5 * #	29.8	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$
	5.0 #	33.0	1490	1490	1490	1440	1380	1330	1270	1220	1090	963	836	720	619	533
	6.0	39.5	1790	1790	1780	1720	1650	1590	1520	1450	1300	1150	995	856	735	633
	6.3	41.4	1870	1870	1870	1800	1730	1670	1590	1520	1370	1200	1040	897	770	663
	8.0	52.3	2360	2360	2350	2270	2180	2100	2010	1910	1720	1510	1310	1120	963	828
	10.0	64.9	2930	2930	2920	2810	2710	2600	2480	2370	2120	1860	1610	1380	1180	1020
	12.0 #	77.2	3490	3490	3470	3350	3220	3090	2950	2810	2510	2200	1900	1630	1400	1200
	12.5	80.3	3620	3620	3600	3470	3330	3200	3060	2910	2600	2280	1970	1690	1440	1240
	16.0	101	4580	4580	4540	4380	4210	4030	3850	3660	3260	2850	2450	2100	1790	1540

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Circular Hollow Sections (CFCHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

\* Section is Class 4 under axial compression.

\$ indicates that the section is Class 4 and no compression resistance is calculated.

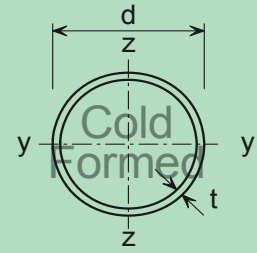
# Check availability

For values of the compression cross-sectional resistance  $N_{c,Rd}$ , see the values of  $N_{pl,Rd}$  in the tables for axial force and bending.

FOR EXPLANATION OF TABLES SEE NOTE 6.

COLD FORMED CIRCULAR HOLLOW SECTIONS

Hybox® CHS



Designation		Mass per Metre kg/m	Compression resistance $N_{b,Rd}$ (kN) for Buckling lengths (m)													
Outside Diameter d mm	Wall Thk t mm		$N_{b,T,Rd}$ kN	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
323.9	5.0 * #	39.3	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$
	6.0	47.0	2130	2090	1960	1830	1690	1540	1380	1230	1090	955	840	741	656	583
	6.3 #	49.3	2230	2190	2060	1920	1770	1620	1450	1290	1140	1000	882	778	689	612
	8.0	62.3	2820	2770	2600	2430	2240	2040	1830	1630	1440	1270	1110	982	869	773
	10.0	77.4	3500	3440	3230	3010	2770	2520	2260	2010	1770	1550	1370	1200	1060	946
	12.0 #	92.3	4190	4110	3850	3590	3300	3000	2690	2380	2090	1840	1610	1420	1260	1120
	12.5	96.0	4330	4250	3980	3710	3410	3100	2780	2460	2170	1900	1670	1470	1300	1150
16.0	121	5500	5390	5050	4700	4320	3920	3500	3100	2720	2380	2090	1840	1630	1440	
355.6	5.0 * #	43.2	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$
	6.0	51.7	2340	2330	2200	2070	1940	1790	1640	1480	1330	1190	1060	943	841	753
	6.3 #	54.3	2450	2440	2310	2170	2030	1880	1720	1560	1400	1250	1110	989	882	789
	8.0	68.6	3100	3080	2910	2740	2560	2370	2160	1950	1750	1560	1390	1240	1100	986
	10.0	85.2	3870	3840	3630	3410	3180	2940	2680	2420	2170	1930	1720	1530	1360	1210
	12.0 #	102	4620	4580	4330	4070	3800	3500	3200	2890	2590	2300	2050	1820	1620	1450
	12.5	106	4790	4750	4490	4220	3930	3620	3300	2980	2660	2370	2100	1870	1660	1490
16.0	134	6070	6010	5680	5330	4960	4570	4160	3740	3340	2970	2630	2340	2080	1860	
406.4	6.0 * #	59.2	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$
	6.3 * #	62.2	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$
	8.0	78.6	3550	3550	3410	3240	3060	2880	2680	2480	2270	2070	1870	1690	1530	1380
	10.0	97.8	4440	4440	4260	4040	3820	3590	3340	3080	2820	2570	2320	2100	1890	1710
	12.0 #	117	5290	5290	5070	4820	4550	4280	3980	3680	3360	3060	2770	2500	2260	2040
	12.5	121	5500	5500	5270	5010	4730	4430	4130	3800	3480	3160	2860	2580	2320	2100
	16.0	154	6960	6960	6660	6320	5960	5590	5200	4790	4370	3970	3580	3230	2910	2620
457	6.0 * #	66.7	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$
	6.3 * #	70.0	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$
	8.0	88.6	4010	4010	3920	3750	3570	3400	3210	3010	2800	2600	2390	2190	2010	1830
	10.0	110	4970	4970	4850	4640	4420	4200	3960	3720	3460	3200	2950	2700	2470	2250
	12.0 #	132	5960	5960	5810	5560	5300	5030	4740	4440	4130	3820	3520	3220	2940	2680
	12.5	137	6210	6210	6050	5790	5520	5240	4940	4630	4310	3980	3660	3350	3060	2790
	16.0	174	7880	7880	7670	7340	6990	6630	6250	5850	5440	5030	4620	4220	3860	3520
508	6.0 * #	74.3	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$
	6.3 * #	77.9	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$
	8.0 * #	98.6	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$
	10.0	123	5540	5540	5470	5260	5050	4830	4600	4370	4120	3860	3600	3350	3100	2860
	12.0 #	147	6640	6640	6560	6300	6050	5780	5510	5220	4920	4610	4300	3990	3690	3410
	12.5	153	6920	6920	6840	6570	6310	6030	5740	5440	5130	4810	4480	4160	3850	3550
	16.0 #	194	8770	8770	8650	8320	7980	7630	7260	6880	6480	6070	5650	5250	4850	4470

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Circular Hollow Sections (CFCHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

\* Section is Class 4 under axial compression.

\$ indicates that the section is Class 4 and no compression resistance is calculated.

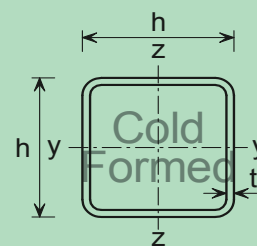
# Check availability

For values of the compression cross-sectional resistance  $N_{c,Rd}$ , see the values of  $N_{pl,Rd}$  in the tables for axial force and bending.

FOR EXPLANATION OF TABLES SEE NOTE 6.

COLD FORMED SQUARE HOLLOW SECTIONS

Hybox® SHS



Designation		Mass per Metre kg/m	Compression resistance $N_{b,Rd}$ (kN)														
Size h x h mm	Wall Thk t mm		$N_{b,T,Rd}$ kN	for Buckling lengths (m)													
				1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0	
25x25	2.0 #	1.36	61.8	21.2	10.9	6.52	4.32	3.07	2.29	1.77	1.15	0.809	0.599	0.461	0.366	0.298	
	2.5	1.64	74.2	24.4	12.5	7.45	4.93	3.50	2.61	2.02	1.31	0.921	0.682	0.525	0.417	0.339	
30x30	2.0 #	1.68	76.0	34.5	18.9	11.5	7.71	5.50	4.12	3.20	2.09	1.47	1.09	0.841	0.668	0.543	
	2.5 #	2.03	91.9	40.3	21.9	13.3	8.88	6.33	4.74	3.68	2.40	1.69	1.25	0.965	0.767	0.624	
	3.0	2.36	107	45.7	24.6	15.0	9.98	7.11	5.32	4.13	2.69	1.89	1.40	1.08	0.860	0.699	
40x40	2.0 #	2.31	104	65.8	41.7	26.9	18.4	13.3	10.1	7.87	5.18	3.66	2.73	2.11	1.68	1.37	
	2.5	2.82	127	79.1	49.5	31.8	21.8	15.7	11.9	9.27	6.09	4.31	3.20	2.48	1.97	1.61	
	3.0	3.30	149	91.6	57.0	36.5	24.9	18.0	13.6	10.6	6.97	4.92	3.66	2.83	2.25	1.84	
	4.0	4.20	190	113	69.0	43.8	29.8	21.5	16.2	12.6	8.30	5.86	4.36	3.37	2.68	2.18	
50x50	2.5	3.60	163	120	85.9	59.2	41.8	30.8	23.5	18.4	12.2	8.69	6.49	5.03	4.01	3.27	
	3.0	4.25	192	140	100	68.7	48.5	35.6	27.1	21.3	14.1	10.0	7.50	5.81	4.63	3.78	
	4.0	5.45	247	178	125	84.8	59.6	43.7	33.2	26.1	17.3	12.3	9.16	7.09	5.65	4.61	
	5.0	6.56	297	210	145	97.9	68.5	50.1	38.1	29.9	19.8	14.0	10.5	8.09	6.45	5.26	
60x60	3.0	5.19	235	189	148	110	80.5	60.5	46.7	37.0	24.8	17.7	13.3	10.3	8.23	6.73	
	4.0	6.71	304	242	188	138	101	75.5	58.2	46.1	30.8	22.0	16.5	12.8	10.2	8.35	
	5.0	8.13	369	292	224	163	118	88.5	68.1	53.8	36.0	25.6	19.2	14.9	11.9	9.73	
	6.0 #	9.45	426	333	253	182	132	98.3	75.5	59.6	39.8	28.4	21.2	16.5	13.1	10.7	
70x70	3.0	6.13	277	236	197	155	119	92.0	72.1	57.7	39.1	28.1	21.1	16.5	13.2	10.8	
	3.5	7.06	319	271	225	177	136	105	82.0	65.6	44.4	31.9	24.0	18.7	15.0	12.2	
	4.0	7.97	359	304	252	198	151	116	91.0	72.8	49.2	35.4	26.6	20.7	16.6	13.6	
	5.0	9.70	440	371	305	238	181	139	108	86.5	58.4	41.9	31.5	24.5	19.6	16.1	
	6.0 #	11.3	511	428	350	271	205	156	122	97.2	65.5	47.0	35.3	27.5	22.0	18.0	
80x80	3.0	7.07	320	284	246	204	164	130	104	84.2	57.8	41.9	31.6	24.7	19.8	16.3	
	3.5	8.16	369	327	283	234	188	149	119	96.2	66.0	47.8	36.1	28.2	22.6	18.5	
	4.0	9.22	415	367	316	261	209	165	132	106	73.0	52.8	39.9	31.1	25.0	20.5	
	5.0	11.3	511	450	387	318	253	200	159	128	87.8	63.5	47.9	37.4	30.0	24.6	
	6.0	13.2	596	523	447	366	289	227	181	146	99.4	71.8	54.2	42.3	33.9	27.8	
90x90	3.0	8.01	362	330	294	253	211	173	141	116	80.8	59.0	44.8	35.2	28.3	23.2	
	3.5	9.26	419	382	339	292	243	199	162	133	92.6	67.6	51.3	40.2	32.4	26.6	
	4.0	10.5	472	430	381	327	272	222	180	148	103	75.0	57.0	44.7	35.9	29.5	
	5.0	12.8	582	528	467	399	330	268	218	178	124	90.2	68.4	53.6	43.1	35.4	
	6.0 #	15.1	682	617	544	463	382	310	251	205	142	103	78.4	61.4	49.4	40.5	

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Square Hollow Sections (CFSHS) and the Hybox® range of sections manufactured by Tata Steel is given in section 12.

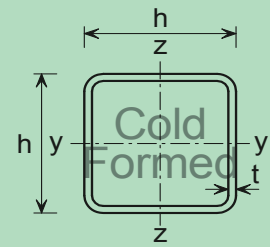
# Check availability

For values of the compression cross-sectional resistance,  $N_{c,Rd}$ , see values of  $N_{pl,Rd}$  in the tables for axial force and bending.

FOR EXPLANATION OF TABLES SEE NOTE 6.

COLD FORMED SQUARE HOLLOW SECTIONS

Hybox® SHS



Designation		Mass per Metre kg/m	Compression resistance $N_{b,Rd}$ (kN)														
Size h x h mm	Wall Thk t mm		$N_{b,T,Rd}$ kN	for Buckling lengths (m)													
				2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	
100x100	3.0	8.96	405	302	219	153	108	79.9	61.0	48.0	38.7	31.9	26.7	22.7	19.5	16.9	
	4.0	11.7	529	392	283	196	139	102	77.9	61.3	49.4	40.7	34.1	28.9	24.9	21.6	
	5.0	14.4	653	481	344	237	168	123	94.1	74.0	59.6	49.0	41.0	34.8	30.0	26.0	
	6.0	17.0	767	560	398	273	193	142	108	84.8	68.3	56.2	47.0	39.9	34.3	29.8	
	8.0	21.4	966	692	483	328	230	168	128	101	81.1	66.6	55.7	47.3	40.6	35.3	
120x120	3.0 * #	10.8	445	369	299	228	171	130	101	80.5	65.4	54.1	45.5	38.8	33.4	29.1	
	4.0	14.2	643	521	412	307	227	171	132	105	85.0	70.3	59.0	50.2	43.3	37.7	
	5.0	17.5	795	642	505	375	276	208	161	127	103	85.3	71.6	61.0	52.5	45.7	
	6.0	20.7	937	754	590	436	321	241	186	147	119	98.6	82.7	70.4	60.6	52.8	
	8.0	26.4	1190	949	734	537	392	293	226	179	145	120	100	85.3	73.5	63.9	
	10.0	31.8	1440	1130	868	628	456	340	262	207	167	138	116	98.4	84.7	73.7	
140x140	4.0	16.8	756	648	543	431	333	258	203	162	133	110	92.8	79.2	68.4	59.6	
	5.0	20.7	937	802	670	531	409	316	248	199	162	135	114	96.9	83.6	72.9	
	6.0	24.5	1110	945	787	621	478	368	289	231	189	157	132	113	97.2	84.7	
	8.0	31.4	1420	1200	993	777	593	455	356	284	232	192	162	138	119	104	
	10.0	38.1	1730	1450	1190	925	702	537	419	335	272	226	190	162	140	122	
150x150	4.0 * #	18.0	770	679	584	481	384	303	241	195	160	133	113	96.5	83.5	72.9	
	5.0	22.3	1010	881	751	612	482	378	300	241	198	165	139	119	103	89.7	
	6.0	26.4	1190	1040	885	718	565	442	350	282	231	192	162	138	120	104	
	8.0	33.9	1530	1330	1120	904	706	550	434	349	285	237	200	171	148	129	
	10.0	41.3	1870	1610	1350	1080	840	652	514	412	337	280	236	201	174	152	
160x160	4.0 * #	19.3	791	712	625	530	434	350	283	230	190	159	135	116	100	87.8	
	5.0	23.8	1080	959	832	693	558	444	355	288	237	198	167	143	124	108	
	6.0	28.3	1280	1130	982	816	656	521	416	337	277	232	196	168	145	127	
	8.0	36.5	1650	1450	1250	1030	825	652	520	420	345	288	243	208	180	157	
	10.0	44.4	2010	1770	1510	1240	987	777	618	499	409	341	288	246	213	186	
180x180	5.0	27.0	1220	1120	993	857	717	588	481	395	328	276	234	202	175	153	
	6.0	32.1	1450	1320	1170	1010	845	692	565	464	385	323	275	236	205	179	
	6.3 #	33.3	1510	1370	1220	1050	874	715	583	479	397	334	283	244	211	185	
	8.0	41.5	1870	1700	1510	1290	1080	877	713	584	484	406	345	296	257	225	
	10.0	50.7	2290	2080	1840	1570	1300	1050	854	699	579	485	412	353	306	268	
	12.0 #	58.5	2640	2380	2100	1780	1460	1180	952	777	642	537	456	391	339	296	
	12.5	60.5	2730	2460	2160	1830	1500	1210	977	797	658	551	467	401	347	304	

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Square Hollow Sections (CFSHS) and the Hybox® range of sections manufactured by Tata Steel is given in section 12.

\* Section may be Class 4 under axial compression.

Values in italic type indicate that the section is Class 4 in pure compression and allowance has been made in

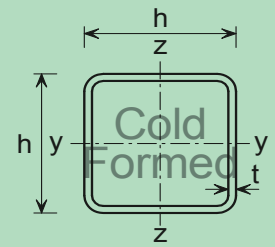
# Check availability

For values of the compression cross-sectional resistance,  $N_{c,Rd}$ , see values of  $N_{pl,Rd}$  in the tables for axial force and bending.

FOR EXPLANATION OF TABLES SEE NOTE 6.

COLD FORMED SQUARE HOLLOW SECTIONS

Hybox® SHS



Designation		Mass per Metre kg/m	Compression resistance $N_{b,Rd}$ (kN)													
Size h x h mm	Wall Thk t mm		$N_{b,T,Rd}$ kN	for Buckling lengths (m)												
				2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
200x200	5.0 *	30.1	1240	<i>1170</i>	<i>1060</i>	<i>952</i>	<i>831</i>	<i>710</i>	<i>599</i>	<i>504</i>	<i>425</i>	<i>362</i>	<i>310</i>	<i>268</i>	<i>234</i>	<i>205</i>
	6.0	35.8	1620	1510	1370	1210	1040	877	732	610	512	433	370	319	278	244
	6.3 #	37.2	1680	1570	1420	1250	1080	908	757	631	529	448	382	330	287	252
	8.0	46.5	2100	1950	1760	1560	1330	1120	931	775	649	549	468	404	351	308
	10.0	57.0	2580	2390	2150	1890	1620	1350	1120	930	778	657	561	483	420	369
	12.0 #	66.0	2990	2760	2480	2170	1840	1530	1260	1050	874	737	628	541	470	412
	12.5	68.3	3090	2850	2560	2240	1900	1580	1300	1080	898	757	645	556	483	423
250x250	6.0 *	45.2	1810	<i>1770</i>	<i>1650</i>	<i>1530</i>	<i>1400</i>	<i>1260</i>	<i>1120</i>	<i>984</i>	<i>860</i>	<i>750</i>	<i>656</i>	<i>575</i>	<i>507</i>	<i>450</i>
	6.3 * #	47.1	1950	<i>1890</i>	<i>1770</i>	<i>1630</i>	<i>1490</i>	<i>1340</i>	<i>1180</i>	<i>1040</i>	<i>903</i>	<i>786</i>	<i>686</i>	<i>601</i>	<i>529</i>	<i>469</i>
	8.0	59.1	2670	2580	2390	2200	1990	1770	1540	1340	1160	999	867	757	665	587
	10.0	72.7	3290	3170	2940	2700	2430	2160	1880	1630	1400	1210	1050	917	805	711
	12.0 #	84.8	3830	3690	3420	3130	2810	2480	2160	1860	1600	1380	1200	1040	914	807
	12.5	88.0	3980	3820	3540	3240	2910	2570	2230	1930	1660	1430	1230	1080	943	833
300x300	6.0 *	54.7	1920	<i>1920</i>	<i>1830</i>	<i>1740</i>	<i>1640</i>	<i>1530</i>	<i>1420</i>	<i>1310</i>	<i>1190</i>	<i>1080</i>	<i>974</i>	<i>876</i>	<i>788</i>	<i>710</i>
	6.3 * #	57.0	2070	<i>2070</i>	<i>1970</i>	<i>1870</i>	<i>1760</i>	<i>1640</i>	<i>1510</i>	<i>1390</i>	<i>1260</i>	<i>1140</i>	<i>1020</i>	<i>916</i>	<i>822</i>	<i>739</i>
	8.0 *	71.6	3060	<i>3040</i>	<i>2870</i>	<i>2700</i>	<i>2510</i>	<i>2320</i>	<i>2110</i>	<i>1910</i>	<i>1710</i>	<i>1520</i>	<i>1350</i>	<i>1200</i>	<i>1070</i>	<i>953</i>
	10.0	88.4	4010	3960	3730	3500	3250	2980	2700	2420	2150	1900	1680	1490	1320	1180
	12.0 #	104	4690	4620	4360	4080	3780	3460	3130	2800	2490	2200	1940	1720	1530	1360
	12.5	108	4860	4800	4520	4230	3920	3590	3250	2910	2580	2280	2020	1780	1580	1410
350x350	6.0 * #	64.1	2000	<i>2000</i>	<i>1960</i>	<i>1880</i>	<i>1800</i>	<i>1720</i>	<i>1630</i>	<i>1540</i>	<i>1450</i>	<i>1350</i>	<i>1250</i>	<i>1160</i>	<i>1070</i>	<i>981</i>
	6.3 * #	66.9	2160	<i>2160</i>	<i>2120</i>	<i>2040</i>	<i>1950</i>	<i>1850</i>	<i>1760</i>	<i>1660</i>	<i>1550</i>	<i>1450</i>	<i>1340</i>	<i>1230</i>	<i>1130</i>	<i>1040</i>
	8.0 *	84.2	3250	<i>3250</i>	<i>3150</i>	<i>3000</i>	<i>2850</i>	<i>2700</i>	<i>2530</i>	<i>2360</i>	<i>2180</i>	<i>2010</i>	<i>1830</i>	<i>1670</i>	<i>1520</i>	<i>1380</i>
	10.0	104	4720	<i>4720</i>	<i>4520</i>	<i>4290</i>	<i>4050</i>	<i>3790</i>	<i>3530</i>	<i>3250</i>	<i>2970</i>	<i>2690</i>	<i>2430</i>	<i>2190</i>	<i>1980</i>	<i>1780</i>
	12.0 #	123	5540	5540	5290	5010	4730	4420	4100	3770	3440	3110	2810	2520	2270	2050
	12.5	127	5750	5750	5490	5210	4910	4590	4260	3920	3570	3230	2910	2620	2360	2120
400x400	6.0 * #	73.5	2050	<i>2050</i>	<i>2050</i>	<i>1990</i>	<i>1930</i>	<i>1860</i>	<i>1790</i>	<i>1710</i>	<i>1640</i>	<i>1560</i>	<i>1480</i>	<i>1400</i>	<i>1310</i>	<i>1230</i>
	6.3 * #	76.8	2230	<i>2230</i>	<i>2230</i>	<i>2160</i>	<i>2080</i>	<i>2010</i>	<i>1930</i>	<i>1850</i>	<i>1760</i>	<i>1680</i>	<i>1590</i>	<i>1490</i>	<i>1400</i>	<i>1310</i>
	8.0 *	96.7	3390	3390	3360	3230	3110	2980	2840	2700	2550	2400	2250	2090	1940	1800
	10.0 *	120	4940	<i>4940</i>	<i>4840</i>	<i>4650</i>	<i>4440</i>	<i>4230</i>	<i>4010</i>	<i>3780</i>	<i>3540</i>	<i>3300</i>	<i>3060</i>	<i>2820</i>	<i>2590</i>	<i>2380</i>
	12.0 #	141	6390	6390	6230	5960	5680	5390	5080	4760	4430	4100	3770	3450	3150	2870
	12.5	147	6640	6640	6470	6190	5900	5600	5280	4950	4600	4260	3910	3580	3270	2990

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Square Hollow Sections (CFSHS) and the Hybox® range of sections manufactured by Tata Steel is given in section 12.

\* Section may be Class 4 under axial compression.

Values in italic type indicate that the section is Class 4 in pure compression and allowance has been made in

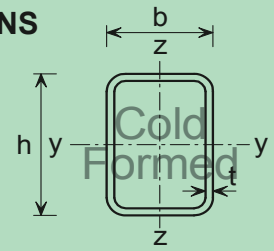
# Check availability

For values of the compression cross-sectional resistance,  $N_{c,Rd}$ , see values of  $N_{pl,Rd}$  in the tables for axial force and bending.

FOR EXPLANATION OF TABLES SEE NOTE 6.

COLD FORMED RECTANGULAR HOLLOW SECTIONS

Hybox® RHS



Designation		Mass per Metre kg/m	$N_{b,T,Rd}$ kN	Axis	Compression resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) for Buckling lengths (m)												
Size	Wall Thk t mm				1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
h x b mm																	
50x25	2.0 #	2.15	97.3	y	67.6	46.0	30.7	21.4	15.6	11.9	9.30	6.14	4.35	3.25	2.51	2.00	1.63
				z	38.0	20.0	12.1	8.03	5.71	4.27	3.31	2.16	1.51	1.12	0.864	0.686	0.558
	2.5	2.62	119	y	81.4	54.9	36.5	25.3	18.5	14.0	11.0	7.25	5.14	3.83	2.96	2.36	1.92
				z	45.1	23.6	14.2	9.44	6.72	5.02	3.89	2.53	1.78	1.32	1.02	0.806	0.656
	3.0	3.07	139	y	94.1	62.8	41.5	28.8	21.0	15.9	12.4	8.21	5.82	4.33	3.35	2.67	2.18
				z	51.1	26.6	16.0	10.6	7.54	5.63	4.36	2.84	1.99	1.48	1.14	0.903	0.734
50x30	2.0 #	2.31	104	y	73.9	51.1	34.4	24.1	17.6	13.4	10.5	6.95	4.93	3.68	2.85	2.27	1.85
				z	51.6	29.0	17.9	12.0	8.58	6.44	5.01	3.27	2.31	1.71	1.32	1.05	0.854
	2.5	2.82	127	y	89.2	61.1	41.0	28.6	20.9	15.9	12.4	8.22	5.83	4.35	3.36	2.68	2.19
				z	61.7	34.5	21.2	14.2	10.2	7.62	5.92	3.87	2.73	2.02	1.56	1.24	1.01
	3.0	3.30	149	y	104	70.6	47.2	32.9	24.0	18.2	14.3	9.44	6.69	4.99	3.86	3.08	2.51
				z	70.1	38.8	23.8	15.9	11.4	8.52	6.62	4.32	3.04	2.26	1.74	1.38	1.13
4.0	4.20	190	y	129	85.9	56.8	39.4	28.7	21.7	17.0	11.2	7.96	5.93	4.59	3.65	2.98	
			z	85.3	46.5	28.4	19.0	13.5	10.1	7.87	5.13	3.61	2.68	2.07	1.64	1.34	
60x40	2.5 #	3.60	163	y	128	98.1	71.0	51.6	38.5	29.6	23.4	15.6	11.1	8.33	6.47	5.16	4.22
				z	106	68.6	44.7	30.8	22.3	16.9	13.2	8.69	6.15	4.58	3.54	2.82	2.30
	3.0	4.25	192	y	150	115	82.7	59.9	44.6	34.3	27.1	18.1	12.9	9.65	7.49	5.98	4.88
				z	124	79.5	51.6	35.5	25.7	19.4	15.2	10.0	7.08	5.27	4.07	3.24	2.64
	4.0	5.45	247	y	191	143	102	73.7	54.7	42.0	33.1	22.1	15.7	11.8	9.12	7.28	5.95
				z	155	97.7	62.9	43.1	31.2	23.5	18.4	12.1	8.55	6.36	4.92	3.92	3.19
5.0	6.56	297	y	227	168	119	85.3	63.2	48.4	38.2	25.4	18.1	13.5	10.5	8.36	6.83	
			z	181	112	71.6	48.9	35.3	26.6	20.8	13.7	9.65	7.18	5.55	4.42	3.60	
70x40	3.0	4.72	213	y	177	143	109	81.7	62.1	48.2	38.4	25.8	18.5	13.9	10.8	8.64	7.07
				z	140	90.6	59.1	40.7	29.5	22.4	17.5	11.5	8.15	6.07	4.69	3.74	3.05
	4.0	6.08	275	y	226	181	137	102	77.5	60.1	47.8	32.1	23.0	17.2	13.4	10.7	8.76
				z	175	112	72.4	49.7	36.0	27.2	21.3	14.0	9.90	7.37	5.69	4.53	3.69
	5.0	7.34	332	y	271	215	161	119	89.9	69.6	55.2	37.1	26.5	19.9	15.4	12.3	10.1
				z	207	130	83.8	57.4	41.5	31.3	24.5	16.1	11.4	8.46	6.54	5.21	4.24
70x50	3.0 #	5.19	235	y	197	161	125	94.4	72.2	56.3	44.9	30.3	21.7	16.3	12.7	10.2	8.32
				z	176	129	89.7	63.8	47.1	36.0	28.4	18.8	13.4	10.0	7.76	6.19	5.05
	4.0	6.71	304	y	253	206	158	119	90.5	70.5	56.1	37.8	27.1	20.4	15.8	12.7	10.4
				z	225	162	112	79.2	58.3	44.5	35.0	23.2	16.5	12.3	9.56	7.62	6.22
	5.0	8.13	369	y	305	246	188	141	107	82.9	66.0	44.4	31.8	23.8	18.5	14.8	12.1
				z	270	192	132	93.1	68.4	52.2	41.0	27.2	19.3	14.4	11.2	8.91	7.27

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Rectangular Hollow Sections (CFRHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

# Check availability

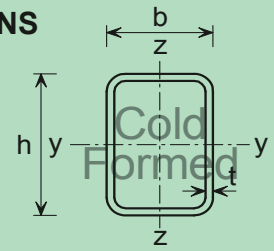
For values of the compression cross-sectional resistance,  $N_{c,Rd}$ , see values of  $N_{pl,Rd}$  in the tables for axial force and bending.

FOR EXPLANATION OF TABLES SEE NOTE 6.



COLD FORMED RECTANGULAR HOLLOW SECTIONS

Hybox® RHS



Designation		Mass per Metre kg/m	$N_{b,T,Rd}$ kN	Axis	Compression resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) for Buckling lengths (m)												
Size	Wall Thk t mm				1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
h x b mm																	
80x40	3.0	5.19	235	y	202	170	136	106	82.2	64.7	51.9	35.3	25.4	19.1	14.9	11.9	9.79
				z	155	101	66.3	45.7	33.2	25.1	19.7	13.0	9.18	6.83	5.29	4.21	3.43
	4.0	6.71	304	y	260	217	172	133	103	80.8	64.8	43.9	31.6	23.8	18.5	14.8	12.1
				z	197	127	82.4	56.7	41.1	31.1	24.3	16.0	11.3	8.43	6.52	5.19	4.23
	5.0	8.13	369	y	314	261	205	157	121	94.9	75.9	51.3	36.9	27.8	21.6	17.3	14.2
				z	233	148	95.2	65.2	47.2	35.7	27.9	18.3	13.0	9.64	7.45	5.93	4.83
80x50	3.0	5.66	256	y	223	189	154	121	94.3	74.6	60.1	40.9	29.5	22.3	17.4	13.9	11.4
				z	194	142	100.0	71.3	52.7	40.3	31.8	21.1	15.0	11.2	8.71	6.95	5.67
	4.0	7.34	332	y	288	243	196	153	119	94.2	75.7	51.5	37.1	28.0	21.8	17.5	14.3
				z	248	181	126	89.6	66.1	50.5	39.7	26.4	18.8	14.0	10.9	8.67	7.08
	5.0	8.91	405	y	348	293	234	182	141	111	89.0	60.5	43.5	32.8	25.6	20.5	16.8
				z	299	214	148	105	77.1	58.8	46.3	30.7	21.8	16.3	12.6	10.1	8.21
80x60	3.0	6.13	277	y	243	209	171	136	107	84.8	68.4	46.8	33.8	25.5	19.9	16.0	13.1
				z	227	180	136	101	76.0	58.9	46.8	31.4	22.5	16.8	13.1	10.5	8.56
	3.5	7.06	319	y	279	239	195	154	121	96.1	77.5	52.9	38.2	28.8	22.5	18.0	14.8
				z	260	206	154	114	85.8	66.4	52.7	35.3	25.3	18.9	14.7	11.8	9.62
	4.0	7.97	359	y	313	267	217	171	134	106	85.6	58.4	42.1	31.8	24.8	19.9	16.3
				z	291	229	171	126	95.0	73.5	58.3	39.1	27.9	20.9	16.3	13.0	10.6
5.0	9.70	440	y	383	325	262	206	161	127	102	69.5	50.2	37.8	29.5	23.6	19.4	
			z	354	278	206	151	113	87.6	69.4	46.5	33.2	24.9	19.3	15.4	12.6	
90x50	3.0 #	6.13	277	y	248	217	182	148	119	95.4	77.6	53.5	38.8	29.4	23.0	18.5	15.1
				z	211	157	111	79.1	58.6	44.8	35.3	23.5	16.7	12.5	9.70	7.74	6.32
	4.0 #	7.97	359	y	320	278	232	188	150	120	97.3	67.0	48.5	36.7	28.7	23.0	18.9
				z	270	197	138	98.3	72.6	55.5	43.7	29.0	20.7	15.4	12.0	9.55	7.79
	5.0	9.70	440	y	390	338	281	225	179	143	116	79.5	57.6	43.5	34.0	27.3	22.4
				z	328	237	165	117	86.1	65.8	51.7	34.3	24.4	18.2	14.1	11.3	9.20
100x40	3.0	6.13	277	y	252	223	190	158	128	104	85.3	59.2	43.2	32.8	25.7	20.6	16.9
				z	186	124	81.4	56.3	41.0	31.1	24.3	16.0	11.4	8.46	6.54	5.21	4.25
	4.0	7.97	359	y	324	286	243	200	162	131	107	74.3	54.1	41.0	32.1	25.8	21.2
				z	236	153	100	69.2	50.2	38.0	29.7	19.6	13.9	10.3	7.98	6.36	5.18
	5.0 #	9.70	440	y	396	348	294	241	194	156	127	88.1	64.0	48.5	38.0	30.5	25.0
				z	284	182	118	81.3	58.9	44.6	34.8	22.9	16.2	12.1	9.34	7.43	6.06
100x50	3.0	6.60	299	y	273	243	210	176	144	118	96.8	67.6	49.4	37.5	29.4	23.7	19.5
				z	229	170	121	86.5	64.1	49.1	38.7	25.8	18.3	13.7	10.6	8.49	6.93
	4.0	8.59	387	y	353	313	269	224	183	149	122	85.1	62.1	47.2	37.0	29.7	24.4
				z	294	216	152	109	80.4	61.5	48.5	32.2	22.9	17.1	13.3	10.6	8.66
	5.0	10.5	476	y	432	382	327	271	220	179	146	102	74.1	56.2	44.0	35.4	29.1
				z	356	259	181	128	94.7	72.3	57.0	37.8	26.9	20.1	15.6	12.4	10.1
6.0	12.3	554	y	501	441	376	309	251	203	166	115	83.6	63.4	49.6	39.9	32.8	
			z	410	295	204	145	106	81.2	63.9	42.4	30.1	22.5	17.4	13.9	11.3	

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Rectangular Hollow Sections (CFRHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

# Check availability

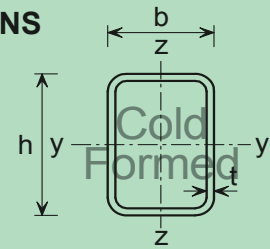
For values of the compression cross-sectional resistance,  $N_{c,Rd}$ , see values of  $N_{pl,Rd}$  in the tables for axial force and bending.

FOR EXPLANATION OF TABLES SEE NOTE 6.



COLD FORMED RECTANGULAR HOLLOW SECTIONS

Hybox® RHS



Designation		Mass per Metre kg/m	$N_{b,T,Rd}$ kN	Axis	Compression resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) for Buckling lengths (m)													
Size	Wall Thk t mm				1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0	
h x b mm																		
100x60	3.0	7.07	320	y	294	263	229	193	160	131	108	75.8	55.5	42.3	33.2	26.7	22.0	
				z	264	212	161	120	91.2	70.9	56.3	37.9	27.1	20.4	15.8	12.7	10.3	
	3.5	8.16	369	y	339	303	263	221	182	150	123	86.3	63.2	48.1	37.7	30.4	25.0	
				z	304	243	184	137	104	80.7	64.1	43.1	30.8	23.1	18.0	14.4	11.8	
	4.0	9.22	415	y	381	339	294	247	203	166	137	95.8	70.1	53.3	41.8	33.6	27.6	
				z	341	272	205	153	115	89.5	71.1	47.7	34.2	25.6	19.9	15.9	13.0	
	5.0	11.3	511	y	467	416	359	300	246	201	165	115	84.2	63.9	50.1	40.3	33.1	
				z	416	329	246	182	137	106	84.4	56.6	40.5	30.3	23.6	18.8	15.4	
	6.0	13.2	596	y	543	481	414	344	281	229	188	131	95.3	72.3	56.7	45.6	37.5	
				z	482	379	281	207	156	120	95.5	64.0	45.7	34.3	26.6	21.3	17.4	
	100x80	3.0 #	8.01	362	y	336	302	266	227	190	157	130	92.1	67.7	51.7	40.6	32.7	26.9
					z	324	282	237	192	154	123	100	69.1	50.1	37.9	29.7	23.8	19.5
4.0		10.5	472	y	437	392	344	293	244	201	167	118	86.3	65.8	51.7	41.7	34.3	
				z	420	365	305	246	196	157	128	87.7	63.6	48.1	37.6	30.2	24.7	
5.0		12.8	582	y	537	482	421	357	296	244	202	142	104	79.2	62.2	50.1	41.2	
				z	516	447	371	298	237	189	153	105	76.2	57.6	45.0	36.1	29.6	
6.0		15.1	682	y	627	561	488	412	341	280	231	162	119	90.5	71.1	57.2	47.0	
				z	603	520	430	344	272	217	176	120	87.1	65.8	51.4	41.3	33.8	
120x40		3.0 * #	7.07	298	y	283	272	242	210	178	150	125	89.5	66.2	50.6	39.9	32.2	26.5
					z	207	141	94.2	65.6	47.9	36.4	28.5	18.8	13.4	9.95	7.70	6.14	5.01
		4.0 #	9.22	415	y	388	352	312	270	228	191	159	113	83.7	64.0	50.4	40.7	33.5
					z	277	182	120	82.7	60.1	45.5	35.6	23.5	16.6	12.4	9.58	7.63	6.22
	5.0 #	11.3	511	y	476	431	381	327	276	230	191	136	100.0	76.4	60.1	48.5	39.9	
				z	333	215	140	96.5	70.0	53.0	41.4	27.3	19.3	14.4	11.1	8.85	7.21	
120x60	3.0 *	8.01	340	y	323	314	282	249	214	182	154	111	82.9	63.7	50.3	40.7	33.5	
				z	285	234	181	138	105	82.1	65.5	44.2	31.7	23.8	18.5	14.8	12.1	
	3.5	9.26	419	y	396	363	326	287	247	210	177	128	95.1	73.0	57.7	46.6	38.4	
				z	347	280	214	160	122	94.7	75.4	50.7	36.3	27.3	21.2	17.0	13.9	
	4.0	10.5	472	y	446	408	366	322	276	234	198	143	106	81.3	64.2	51.9	42.8	
				z	390	314	239	179	136	105	83.8	56.3	40.3	30.3	23.5	18.8	15.4	
	5.0	12.8	582	y	549	501	449	392	336	284	239	172	128	97.8	77.2	62.3	51.4	
				z	477	381	288	214	162	125	99.7	66.9	47.9	35.9	27.9	22.3	18.3	
	6.0	15.1	682	y	641	584	522	455	388	327	274	197	146	112	88.0	71.1	58.6	
				z	555	441	330	244	184	143	113	76.0	54.4	40.8	31.7	25.3	20.7	

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\* Section may be Class 4 under axial compression.

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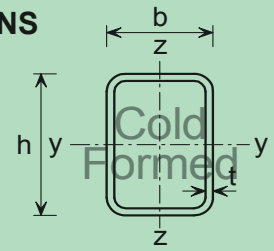
# Check availability

For values of the compression cross-sectional resistance,  $N_{c,Rd}$ , see values of  $N_{pl,Rd}$  in the tables for axial force and bending.

FOR EXPLANATION OF TABLES SEE NOTE 6.

COLD FORMED RECTANGULAR HOLLOW SECTIONS

Hybox® RHS



Designation		Mass per Metre kg/m	$N_{b,T,Rd}$ kN	Axis	Compression resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) for Buckling lengths (m)													
Size	Wall Thk t mm				1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0	
h x b mm																		
120x80	3.0 *	8.96	382	y	366	355	322	286	249	214	182	133	99.5	76.7	60.7	49.1	40.6	
				z	346	305	260	214	173	140	115	79.5	57.9	43.9	34.4	27.6	22.7	
	4.0	11.7	529	y	503	463	419	371	322	276	235	171	128	98.3	77.8	62.9	51.9	
				z	474	414	348	283	226	182	148	102	74.1	56.0	43.8	35.2	28.9	
	5.0	14.4	653	y	621	570	514	455	394	336	286	207	155	119	94.1	76.1	62.8	
				z	583	508	425	344	275	221	179	123	89.4	67.7	52.9	42.5	34.8	
	6.0	17.0	767	y	727	666	600	529	457	389	329	238	178	136	108	87.2	71.9	
				z	682	592	493	397	316	253	205	141	102	77.2	60.3	48.4	39.7	
	8.0	21.4	966	y	910	830	743	650	556	470	395	284	211	162	127	103	84.8	
				z	851	732	602	480	379	302	244	167	121	91.0	71.1	57.0	46.8	
	140x80	3.0 * #	9.90	395	y	387	363	338	311	301	271	237	180	137	107	85.3	69.4	57.5
					z	361	321	278	233	191	156	128	89.6	65.5	49.8	39.0	31.4	25.8
4.0		13.0	586	y	569	530	489	445	399	352	307	232	177	138	110	89.4	74.0	
				z	527	462	390	319	257	207	169	117	84.7	64.2	50.2	40.3	33.1	
5.0 #		16.0	724	y	702	654	603	547	489	430	375	282	215	167	133	108	89.6	
				z	649	568	478	389	313	251	205	141	103	77.6	60.7	48.8	40.0	
6.0		18.9	852	y	825	767	706	640	570	501	435	326	248	193	153	125	103	
				z	761	663	556	451	360	289	235	162	117	88.8	69.4	55.7	45.7	
8.0		23.9	1080	y	1040	964	883	796	705	614	531	394	298	231	183	149	123	
				z	956	826	685	549	435	347	281	193	140	105	82.4	66.1	54.2	
10.0		28.7	1300	y	1250	1150	1050	943	830	719	618	456	343	265	210	171	141	
				z	1140	980	804	638	503	400	322	220	159	120	93.9	75.3	61.7	
150x100	3.0 * #	11.3	442	y	439	415	390	363	335	306	298	232	180	142	114	93.3	77.6	
				z	421	387	351	311	271	232	198	144	108	82.9	65.6	53.1	43.8	
	4.0 *	14.9	649	y	659	619	578	533	486	437	388	301	234	184	148	121	100	
				z	612	558	499	436	373	315	265	190	141	108	85.2	68.9	56.7	
	5.0	18.3	831	y	816	766	713	658	598	537	476	369	286	225	180	147	122	
				z	779	707	629	546	463	389	326	232	172	131	104	83.6	68.9	
	6.0	21.7	980	y	961	901	839	772	702	629	557	430	332	261	209	171	142	
				z	917	832	738	639	541	453	379	270	199	152	120	96.8	79.7	
	8.0	27.7	1250	y	1220	1140	1060	973	879	783	690	528	406	318	254	207	172	
				z	1160	1050	928	797	670	557	464	329	242	185	146	117	96.6	
	10.0	33.4	1510	y	1470	1380	1270	1160	1050	928	814	618	473	370	295	240	199	
				z	1400	1260	1110	943	788	652	541	382	280	214	168	135	111	

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Values in italic type indicate that the section is Class 4 in pure compression and allowance has been made in

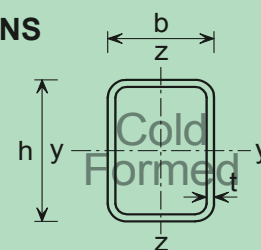
# Check availability

For values of the compression cross-sectional resistance,  $N_{c,Rd}$ , see values of  $N_{pl,Rd}$  in the tables for axial force and bending.

FOR EXPLANATION OF TABLES SEE NOTE 6.

COLD FORMED RECTANGULAR HOLLOW SECTIONS

Hybox® RHS



Designation		Mass per Metre kg/m	$N_{b,T,Rd}$ kN	Axis	Compression resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) for Buckling lengths (m)													
Size	Wall Thk t mm				1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0	
h x b mm																		
160x80	3.0 * #	10.8	404	y	403	382	360	338	314	288	262	230	180	142	114	93.6	77.9	
				z	373	335	292	248	206	170	141	99.0	72.6	55.3	43.4	35.0	28.8	
	4.0 *	14.2	603	y	597	569	557	516	472	426	381	298	232	183	147	121	100	
				z	548	485	416	345	281	228	187	130	94.8	71.9	56.4	45.3	37.2	
	5.0	17.5	795	y	783	736	688	636	581	523	466	364	283	223	179	147	122	
				z	715	627	530	433	349	281	229	158	115	87.1	68.2	54.8	45.0	
	6.0	20.7	937	y	922	866	808	746	680	612	544	423	328	258	207	170	141	
				z	840	735	619	504	405	325	265	183	133	100	78.6	63.1	51.8	
	8.0	26.4	1190	y	1170	1100	1020	937	850	761	673	518	400	314	251	205	170	
				z	1060	922	769	620	494	395	321	220	160	121	94.4	75.8	62.1	
	10.0 #	31.8	1440	y	1410	1320	1220	1120	1010	899	792	605	465	364	291	237	196	
				z	1270	1100	904	722	571	455	368	252	182	138	107	86.2	70.7	
	180x80	3.0 *	11.8	411	y	411	397	378	358	338	316	294	248	213	181	147	121	101
					z	383	346	305	262	221	184	153	108	79.8	61.0	48.0	38.7	31.8
4.0 *		15.5	620	y	620	592	561	528	504	498	453	367	293	235	190	157	131	
				z	568	507	439	369	303	248	205	143	105	79.5	62.4	50.2	41.3	
5.0		19.1	866	y	863	817	770	721	669	614	557	449	358	286	232	191	160	
				z	781	687	582	478	386	312	254	176	128	97.0	75.9	61.0	50.1	
6.0 #		22.6	1020	y	1020	963	907	848	786	720	653	525	417	333	270	222	185	
				z	919	806	681	557	448	362	295	204	148	112	87.7	70.4	57.8	
8.0		28.9	1310	y	1300	1220	1150	1070	990	903	815	649	513	408	330	271	226	
				z	1170	1020	850	688	550	441	358	247	179	135	106	85.0	69.7	
10.0 #		35.0	1580	y	1570	1480	1390	1290	1190	1080	968	765	601	477	384	315	262	
				z	1400	1210	1000	805	638	510	412	283	205	155	121	97.0	79.5	
180x100		4.0 * #	16.8	677	y	677	649	616	582	546	545	503	411	331	267	217	179	150
					z	644	591	535	473	411	351	298	217	162	125	98.6	79.8	65.9
	5.0	20.7	937	y	937	889	841	789	735	678	620	505	405	326	265	219	183	
				z	882	803	718	626	535	451	379	272	201	154	122	98.2	80.9	
	6.0	24.5	1110	y	1110	1050	992	931	866	798	728	592	474	381	310	255	214	
				z	1040	947	844	735	626	526	442	316	234	179	141	114	93.9	
	8.0	31.4	1420	y	1410	1340	1260	1180	1100	1010	915	738	588	471	382	314	262	
				z	1330	1200	1070	922	780	652	545	388	286	219	172	139	114	
	10.0	38.1	1730	y	1720	1620	1530	1430	1320	1210	1090	875	694	554	448	368	307	
				z	1610	1450	1280	1100	922	767	638	452	333	254	200	161	133	

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\* Section may be Class 4 under axial compression.

Values in italic type indicate that the section is Class 4 in pure compression and allowance has been made in

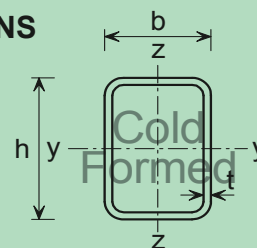
# Check availability

For values of the compression cross-sectional resistance,  $N_{c,Rd}$ , see values of  $N_{pl,Rd}$  in the tables for axial force and bending.

FOR EXPLANATION OF TABLES SEE NOTE 6.

COLD FORMED RECTANGULAR HOLLOW SECTIONS

Hybox® RHS



Designation		Mass per Metre kg/m	$N_{b,T,Rd}$ kN	Axis	Compression resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) for Buckling lengths (m)												
Size	Wall Thk t mm				2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
h x b mm																	
200x100	4.0 *	18.0	690	y	643	582	514	480	400	328	270	224	189	161	138	120	105
				z	554	433	320	235	176	136	108	87.2	72.0	60.5	51.5	44.3	38.6
	5.0 *	22.3	946	y	893	823	712	597	491	402	330	275	231	196	169	147	128
				z	740	563	406	294	219	168	133	107	88.5	74.2	63.1	54.3	47.2
	6.0	26.4	1190	y	1090	971	838	701	576	470	387	321	270	230	197	171	150
				z	914	680	482	346	256	196	155	125	103	86.3	73.3	63.1	54.8
	8.0	33.9	1530	y	1390	1240	1060	881	719	585	479	397	333	283	243	211	185
				z	1160	853	599	427	316	242	190	154	127	106	90.0	77.4	67.3
	10.0	41.3	1870	y	1690	1490	1270	1050	854	693	566	469	393	334	286	248	217
				z	1390	1010	704	500	368	281	222	179	147	123	105	89.9	78.1
200x120	4.0 *	19.3	747	y	699	634	563	514	441	364	301	251	211	180	155	135	118
				z	637	530	418	321	248	194	155	127	105	88.6	75.6	65.3	56.9
	5.0 *	23.8	1020	y	955	890	775	655	543	446	369	307	259	220	190	165	144
				z	851	695	536	405	309	241	192	156	129	109	92.8	80.0	69.7
	6.0	28.3	1280	y	1180	1050	914	771	638	524	432	360	303	258	222	193	169
				z	1050	849	645	482	366	284	226	184	152	128	109	93.7	81.6
	8.0	36.5	1650	y	1510	1340	1160	975	802	656	540	449	377	321	276	239	210
				z	1350	1080	810	602	455	352	280	227	188	158	134	116	101
	10.0	44.4	2010	y	1830	1630	1400	1170	956	780	640	531	446	379	326	283	248
				z	1630	1290	963	712	536	415	329	267	221	185	158	136	118
200x150	4.0 * #	21.2	811	y	764	696	623	544	465	392	330	279	237	203	176	153	135
				z	731	643	545	448	362	292	238	197	165	140	120	104	90.9
	5.0 * #	26.2	1120	y	1050	989	869	741	619	513	426	356	300	256	221	192	168
				z	998	865	720	579	461	368	299	246	205	174	149	129	112
	6.0	31.1	1410	y	1300	1170	1030	873	728	602	499	417	352	300	258	224	197
				z	1240	1060	875	696	549	437	353	290	241	204	174	151	132
	8.0	40.2	1820	y	1680	1500	1310	1110	923	760	628	524	442	376	324	282	247
				z	1590	1360	1110	880	692	549	443	363	302	255	218	189	165
	10.0	49.1	2220	y	2040	1830	1590	1340	1110	909	750	624	526	448	385	334	293
				z	1940	1650	1340	1050	825	653	526	431	359	303	259	224	195

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Values in italic type indicate that the section is Class 4 in pure compression and allowance has been made in

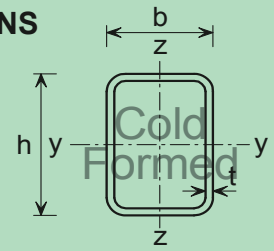
# Check availability

For values of the compression cross-sectional resistance,  $N_{c,Rd}$ , see values of  $N_{pl,Rd}$  in the tables for axial force and bending.

FOR EXPLANATION OF TABLES SEE NOTE 6.

COLD FORMED RECTANGULAR HOLLOW SECTIONS

Hybox® RHS



Designation		Mass per Metre kg/m	$N_{b,T,Rd}$ kN	Axis	Compression resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) for Buckling lengths (m)													
Size	Wall Thk t mm				2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	
h x b mm																		
200x150	4.0 * #	21.2	811	y	764	696	623	544	465	392	330	279	237	203	176	153	135	
				z	731	643	545	448	362	292	238	197	165	140	120	104	90.9	
	5.0 * #	26.2	1120	y	1050	989	869	741	619	513	426	356	300	256	221	192	168	
				z	998	865	720	579	461	368	299	246	205	174	149	129	112	
	6.0	31.1	1410	y	1300	1170	1030	873	728	602	499	417	352	300	258	224	197	
				z	1240	1060	875	696	549	437	353	290	241	204	174	151	132	
	8.0	40.2	1820	y	1680	1500	1310	1110	923	760	628	524	442	376	324	282	247	
				z	1590	1360	1110	880	692	549	443	363	302	255	218	189	165	
	10.0	49.1	2220	y	2040	1830	1590	1340	1110	909	750	624	526	448	385	334	293	
				z	1940	1650	1340	1050	825	653	526	431	359	303	259	224	195	
	250x150	5.0 *	30.1	1170	y	1140	1060	973	882	805	746	640	548	471	407	354	310	273
					z	1060	934	795	655	530	429	351	290	243	206	177	153	134
6.0 *		35.8	1500	y	1450	1340	1300	1160	1020	881	755	646	555	479	416	365	322	
				z	1340	1170	985	800	641	515	419	345	289	245	210	181	159	
6.3 * #		37.2	1590	y	1530	1490	1350	1210	1060	910	779	666	572	494	429	376	331	
				z	1420	1230	1030	835	666	534	434	357	298	253	216	187	164	
8.0		46.5	2100	y	2010	1850	1680	1500	1310	1120	960	819	702	606	526	461	406	
				z	1850	1600	1320	1050	832	663	536	440	367	310	266	230	201	
10.0		57.0	2580	y	2460	2260	2050	1820	1580	1360	1160	986	844	727	632	552	487	
				z	2260	1940	1590	1270	997	793	640	525	437	370	316	273	239	
12.0		66.0	2990	y	2840	2600	2350	2080	1800	1540	1300	1110	946	814	706	617	543	
				z	2610	2230	1810	1430	1120	890	717	587	489	413	353	305	266	
12.5	68.3	3090	y	2930	2690	2430	2140	1850	1580	1340	1140	972	836	725	633	557		
			z	2700	2300	1870	1470	1150	913	735	602	501	423	362	313	273		
300x100	8.0 *	46.5	2020	y	2040	1890	1740	1580	1410	1240	1080	934	809	704	615	541	478	
				z	1570	1190	854	617	459	353	279	225	186	156	132	114	99.0	
	10.0	57.0	2580	y	2490	2320	2130	1930	1720	1510	1310	1130	978	850	742	652	577	
				z	1970	1460	1030	738	547	419	330	266	220	184	156	134	117	
300x200	6.0 *	45.2	1770	y	1760	1660	1560	1450	1340	1220	1190	1050	929	818	722	639	569	
				z	1680	1550	1400	1240	1080	927	789	672	575	495	430	376	331	
	6.3 * #	47.1	1880	y	1860	1760	1650	1540	1420	1380	1240	1100	967	852	752	666	593	
				z	1790	1640	1480	1310	1140	971	825	701	599	516	447	391	344	
	8.0 *	59.1	2580	y	2620	2460	2300	2120	1930	1740	1540	1360	1200	1050	930	823	732	
				z	2430	2220	1980	1730	1480	1250	1050	888	755	647	560	488	429	
	10.0	72.7	3290	y	3230	3030	2820	2600	2370	2120	1890	1660	1460	1280	1130	1000	889	
				z	3080	2800	2490	2160	1830	1540	1290	1080	918	786	679	591	519	
	12.0 #	84.8	3830	y	3760	3520	3270	3010	2730	2440	2160	1900	1660	1460	1280	1130	1010	
				z	3580	3250	2880	2490	2100	1760	1470	1230	1040	892	770	670	588	
	12.5	88.0	3980	y	3890	3640	3390	3110	2810	2510	2220	1940	1700	1490	1310	1160	1030	
				z	3710	3360	2980	2570	2170	1810	1510	1270	1080	921	795	692	607	

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Rectangular Hollow Sections (CFRHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

\* Section may be Class 4 under axial compression.

Values in italic type indicate that the section is Class 4 in pure compression and allowance has been made in

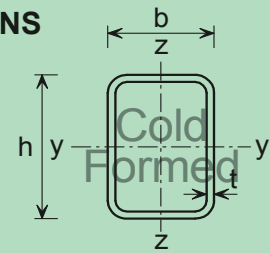
# Check availability

For values of the compression cross-sectional resistance,  $N_{c,Rd}$ , see values of  $N_{pl,Rd}$  in the tables for axial force and bending.

FOR EXPLANATION OF TABLES SEE NOTE 6.

COLD FORMED RECTANGULAR HOLLOW SECTIONS

Hybox® RHS



Designation		Mass per Metre kg/m	$N_{b,T,Rd}$ kN	Axis	Compression resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) for Buckling lengths (m)												
Size	Wall Thk t mm				2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
h x b mm																	
400x200	6.0 * #	54.7	1840	y	1840	1810	1730	1660	1580	1510	1420	1340	1250	1160	1070	986	907
				z	1780	1650	1520	1380	1230	1070	933	807	699	607	530	466	412
	6.3 * #	57.0	1960	y	1960	1920	1840	1760	1680	1590	1500	1410	1310	1220	1120	1030	946
				z	1890	1750	1610	1460	1290	1130	979	846	731	634	554	486	430
	8.0 *	71.6	2750	y	2750	2680	2560	2440	2310	2180	2040	1910	1910	1750	1580	1430	1300
				z	2630	2420	2210	1970	1720	1490	1270	1090	933	805	700	613	540
	10.0 *	88.4	3760	y	3760	3640	3550	3480	3270	3050	2830	2600	2370	2150	1950	1760	1590
				z	3570	3270	2940	2590	2230	1900	1610	1360	1160	1000	867	757	666
	12.0 #	104	4690	y	4690	4500	4280	4040	3800	3540	3270	3000	2730	2470	2230	2020	1820
				z	4410	4010	3580	3120	2660	2240	1880	1590	1350	1150	998	870	764
	12.5	108	4860	y	4860	4670	4440	4200	3940	3670	3400	3110	2830	2570	2320	2090	1890
				z	4570	4160	3710	3230	2750	2320	1950	1640	1390	1190	1030	899	790
450x250	6.0 * #	64.1	1950	y	1950	1950	1900	1830	1770	1700	1630	1560	1480	1410	1330	1250	1170
				z	1950	1850	1750	1640	1520	1400	1280	1160	1040	930	832	745	668
	6.3 * #	66.9	2110	y	2110	2110	2040	1970	1900	1830	1750	1670	1580	1500	1410	1320	1240
				z	2110	1990	1880	1760	1640	1500	1360	1230	1100	984	879	785	704
	8.0 * #	84.2	3080	y	3080	3060	2940	2830	2720	2590	2470	2340	2200	2070	1930	1790	1760
				z	3040	2860	2680	2490	2280	2070	1850	1640	1450	1290	1140	1010	901
	10.0 * #	104	4230	y	4230	4170	4010	3840	3670	3490	3400	3370	3130	2900	2670	2450	2240
				z	4140	3890	3620	3330	3020	2710	2400	2110	1850	1630	1430	1270	1120
	12.0 * #	123	5340	y	5460	5420	5190	4960	4720	4460	4200	3920	3640	3360	3090	2830	2590
				z	5210	4870	4510	4120	3710	3290	2890	2520	2200	1920	1680	1480	1320
	12.5 #	127	5750	y	5750	5630	5390	5150	4900	4630	4360	4070	3780	3490	3210	2940	2690
				z	5590	5220	4820	4390	3940	3490	3050	2650	2310	2010	1760	1550	1380
500x300	6.0 * #	73.5	2030	y	2030	2030	2010	1950	1900	1840	1780	1720	1660	1590	1530	1460	1390
				z	2030	1980	1900	1820	1730	1630	1540	1440	1340	1230	1130	1040	953
	6.3 * #	76.8	2200	y	2200	2200	2170	2110	2050	1980	1920	1850	1780	1710	1640	1560	1480
				z	2200	2150	2050	1960	1860	1760	1650	1540	1430	1320	1210	1100	1010
	8.0 * #	96.7	3320	y	3320	3320	3240	3140	3030	2920	2810	2700	2580	2460	2330	2200	2070
				z	3320	3200	3040	2880	2720	2540	2350	2170	1980	1800	1630	1480	1340
	10.0 * #	120	4670	y	4670	4670	4520	4360	4200	4040	3870	3690	3510	3320	3210	3190	2960
				z	4670	4450	4220	3970	3710	3440	3160	2880	2600	2340	2100	1890	1700
	12.0 * #	141	5920	y	5920	5900	5690	5480	5280	5280	5120	4850	4570	4280	4000	3720	3450
				z	5910	5600	5290	4960	4620	4250	3870	3500	3140	2810	2510	2250	2020
	12.5 * #	147	6250	y	6250	6230	6010	5880	5850	5590	5320	5040	4750	4450	4150	3860	3580
				z	6240	5910	5580	5230	4860	4460	4060	3670	3290	2940	2630	2350	2110

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\* Section may be Class 4 under axial compression.

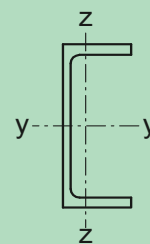
Values in italic type indicate that the section is Class 4 in pure compression and allowance has been made in

# Check availability

For values of the compression cross-sectional resistance,  $N_{c,Rd}$ , see values of  $N_{pl,Rd}$  in the tables for axial force and bending.

FOR EXPLANATION OF TABLES SEE NOTE 6.

PARALLEL FLANGE CHANNELS  
Advance® UKPFC



Subject to concentric axial compression

Section Designation	Axis	Compression resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ , $N_{b,T,Rd}$ (kN)												
		for												
		Buckling lengths (m)												
		1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
430x100x64	$N_{b,y,Rd}$	2830	2830	2830	2830	2780	2720	2660	2550	2430	2300	2170	2030	1890
	$N_{b,z,Rd}$	2490	2140	1750	1390	1100	872	704	481	348	263	205	164	135
	$N_{b,T,Rd}$	2520	2250	2010	1810	1660	1540	1460	1340	1270	1220	1180	1150	1130
380x100x54	$N_{b,y,Rd}$	2370	2370	2370	2350	2300	2240	2190	2080	1970	1850	1720	1590	1460
	$N_{b,z,Rd}$	2100	1820	1500	1210	957	764	619	424	307	232	181	146	119
	$N_{b,T,Rd}$	2100	1870	1660	1490	1370	1270	1200	1110	1040	1000	969	941	914
300x100x46	$N_{b,y,Rd}$	2000	2000	1980	1930	1870	1820	1760	1640	1510	1380	1240	1110	986
	$N_{b,z,Rd}$	1780	1550	1290	1050	834	668	542	373	270	204	160	128	105
	$N_{b,T,Rd}$	1750	1560	1400	1290	1200	1130	1080	1010	959	912	865	816	762
300x90x41	$N_{b,y,Rd}$	1870	1870	1850	1800	1740	1690	1630	1510	1390	1260	1130	1000	887
	$N_{b,z,Rd}$	1610	1350	1070	828	641	504	404	274	197	149	116	92.7	75.9
	$N_{b,T,Rd}$	1600	1410	1260	1140	1060	1010	963	902	859	821	782	740	693
260x90x35	$N_{b,y,Rd}$	1580	1580	1530	1480	1430	1380	1320	1200	1080	956	836	727	633
	$N_{b,z,Rd}$	1360	1150	918	714	555	437	351	238	172	129	101	80.8	66.2
	$N_{b,T,Rd}$	1330	1170	1040	944	877	829	792	737	693	651	606	559	510
260x75x28	$N_{b,y,Rd}$	1250	1250	1210	1170	1130	1080	1040	943	843	742	647	561	487
	$N_{b,z,Rd}$	1000	783	579	425	319	246	195	131	93.3	69.9	54.3	43.4	35.4
	$N_{b,T,Rd}$	1010	863	752	676	625	589	563	526	500	475	450	421	389
230x90x32	$N_{b,y,Rd}$	1460	1450	1390	1340	1290	1230	1170	1050	921	796	682	584	502
	$N_{b,z,Rd}$	1260	1070	859	671	523	413	332	226	163	123	95.6	76.6	62.8
	$N_{b,T,Rd}$	1220	1070	955	877	821	779	746	690	638	585	530	475	423
230x75x26	$N_{b,y,Rd}$	1160	1150	1110	1070	1020	979	932	831	728	627	537	459	394
	$N_{b,z,Rd}$	941	743	554	409	308	238	189	126	90.4	67.8	52.7	42.1	34.4
	$N_{b,T,Rd}$	935	806	715	655	613	584	561	525	491	456	417	376	336

Advance® and UKPFC are trademarks of Tata Steel. A fuller description of the relationship between Parallel Flange Channels and the Advance® range of sections manufactured by Tata Steel is given in note 12.

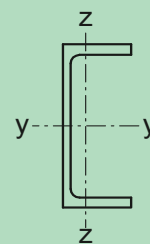
$N_{b,T,Rd}$  is the lower of the torsional and the torsional-flexural buckling resistance.

For values of the compression cross-sectional resistance,  $N_{c,Rd}$ , see values of  $N_{pl,Rd}$  in the tables for axial force and bending.

FOR EXPLANATION OF TABLES SEE NOTE 6.



PARALLEL FLANGE CHANNELS  
Advance® UKPFC



Subject to concentric axial compression

Section Designation	Axis	Compression resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ , $N_{b,T,Rd}$ (kN)												
		for												
		Buckling lengths (m)												
		1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
200x90x30	$N_{b,y,Rd}$	1350	1320	1260	1210	1150	1090	1020	889	756	635	533	449	381
	$N_{b,z,Rd}$	1170	990	800	626	489	386	310	211	152	115	89.6	71.8	58.8
	$N_{b,T,Rd}$	1110	973	879	814	766	728	693	629	564	499	438	382	333
200x75x23	$N_{b,y,Rd}$	1060	1040	995	950	904	856	805	698	593	497	417	351	298
	$N_{b,z,Rd}$	866	689	517	383	289	224	178	119	85.3	64.0	49.7	39.8	32.5
	$N_{b,T,Rd}$	845	735	662	613	579	553	530	487	442	394	347	303	264
180x90x26	$N_{b,y,Rd}$	1180	1140	1090	1030	973	912	849	718	595	490	405	338	285
	$N_{b,z,Rd}$	1020	869	703	551	430	340	273	186	134	101	79.0	63.3	51.8
	$N_{b,T,Rd}$	947	822	735	675	629	593	560	499	439	383	331	287	248
180x75x20	$N_{b,y,Rd}$	919	887	844	800	754	706	655	551	455	373	308	256	216
	$N_{b,z,Rd}$	749	594	445	330	249	193	153	103	73.3	55.0	42.7	34.2	27.9
	$N_{b,T,Rd}$	720	617	548	502	469	444	421	380	337	295	256	221	191
150x90x24	$N_{b,y,Rd}$	1070	1010	955	892	825	754	683	547	433	346	280	230	192
	$N_{b,z,Rd}$	938	796	643	504	394	311	250	170	123	92.7	72.3	58.0	47.5
	$N_{b,T,Rd}$	839	728	653	598	554	515	477	406	341	286	240	203	173
150x75x18	$N_{b,y,Rd}$	804	760	715	668	617	564	510	408	323	257	208	171	143
	$N_{b,z,Rd}$	661	527	396	294	222	172	137	91.6	65.6	49.2	38.2	30.6	25.0
	$N_{b,T,Rd}$	614	526	469	431	400	374	349	300	254	214	180	152	130
125x65x15	$N_{b,y,Rd}$	648	603	556	506	453	399	348	262	200	155	124	101	83.4
	$N_{b,z,Rd}$	510	379	268	192	142	109	85.8	57.1	40.6	30.4	23.6	18.8	15.4
	$N_{b,T,Rd}$	493	434	395	364	334	304	275	220	175	141	115	94.7	79.3
100x50x10	$N_{b,y,Rd}$	432	391	347	300	254	213	178	127	93.5	71.5	56.3	45.4	37.4
	$N_{b,z,Rd}$	297	191	124	85.2	61.8	46.7	36.5	24.0	17.0	12.7	9.79	7.79	6.35
	$N_{b,T,Rd}$	332	299	271	242	211	183	157	116	87.8	68.2	54.3	44.1	36.5

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$N_{b,T,Rd}$  is the lower of the torsional and the torsional-flexural buckling resistance.

For values of the compression cross-sectional resistance,  $N_{c,Rd}$ , see values of  $N_{pl,Rd}$  in the tables for axial force and bending.

FOR EXPLANATION OF TABLES SEE NOTE 6.

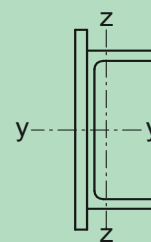
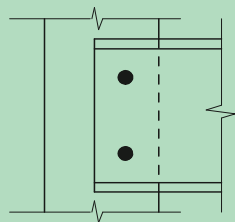


PARALLEL FLANGE CHANNELS

Advance® UKPFC

Connected through web

One row of fasteners with  
two or more fasteners across the web



Section Designation	Axis	Compression resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ , $N_{b,T,Rd}$ (kN)												
		for												
		Length between intersections, L (m)												
		1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
430x100x64	$N_{b,y,Rd}$	2830	2830	2830	2830	2780	2720	2660	2550	2430	2300	2170	2030	1890
	$N_{b,z,Rd}$	1870	1600	1360	1150	976	834	704	481	348	263	205	164	135
	$N_{b,T,Rd}$	2520	2250	2010	1810	1660	1540	1460	1340	1270	1220	1180	1150	1130
380x100x54	$N_{b,y,Rd}$	2370	2370	2370	2350	2300	2240	2190	2080	1970	1850	1720	1590	1460
	$N_{b,z,Rd}$	1580	1360	1160	986	841	721	619	424	307	232	181	146	119
	$N_{b,T,Rd}$	2100	1870	1660	1490	1370	1270	1200	1110	1040	1000	969	941	914
300x100x46	$N_{b,y,Rd}$	2000	2000	1980	1930	1870	1820	1760	1640	1510	1380	1240	1110	986
	$N_{b,z,Rd}$	1340	1160	994	848	725	623	539	373	270	204	160	128	105
	$N_{b,T,Rd}$	1750	1560	1400	1290	1200	1130	1080	1010	959	912	865	816	762
300x90x41	$N_{b,y,Rd}$	1870	1870	1850	1800	1740	1690	1630	1510	1390	1260	1130	1000	887
	$N_{b,z,Rd}$	1200	1010	847	707	593	502	404	274	197	149	116	92.7	75.9
	$N_{b,T,Rd}$	1600	1410	1260	1140	1060	1010	963	902	859	821	782	740	693
260x90x35	$N_{b,y,Rd}$	1580	1580	1530	1480	1430	1380	1320	1200	1080	956	836	727	633
	$N_{b,z,Rd}$	1020	863	723	605	509	432	351	238	172	129	101	80.8	66.2
	$N_{b,T,Rd}$	1330	1170	1040	944	877	829	792	737	693	651	606	559	510
260x75x28	$N_{b,y,Rd}$	1250	1250	1210	1170	1130	1080	1040	943	843	742	647	561	487
	$N_{b,z,Rd}$	749	605	486	394	319	246	195	131	93.3	69.9	54.3	43.4	35.4
	$N_{b,T,Rd}$	1010	863	752	676	625	589	563	526	500	475	450	421	389
230x90x32	$N_{b,y,Rd}$	1460	1450	1390	1340	1290	1230	1170	1050	921	796	682	584	502
	$N_{b,z,Rd}$	945	802	674	565	477	405	332	226	163	123	95.6	76.6	62.8
	$N_{b,T,Rd}$	1220	1070	955	877	821	779	746	690	638	585	530	475	423
230x75x26	$N_{b,y,Rd}$	1160	1150	1110	1070	1020	979	932	831	728	627	537	459	394
	$N_{b,z,Rd}$	704	572	461	375	308	238	189	126	90.4	67.8	52.7	42.1	34.4
	$N_{b,T,Rd}$	935	806	715	655	613	584	561	525	491	456	417	376	336

Advance® and UKPFC are trademarks of Tata Steel. A fuller description of the relationship between Parallel Flange Channels and the Advance® range of sections manufactured by Tata Steel is given in note 12.

$N_{b,T,Rd}$  is the lower of the torsional and the torsional-flexural buckling resistance.

For values of the compression cross-sectional resistance,  $N_{c,Rd}$ , see values of  $N_{pl,Rd}$  in the tables for axial force and bending.

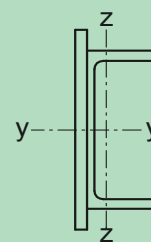
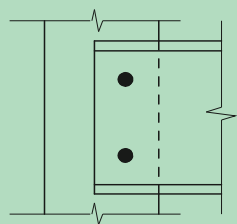
FOR EXPLANATION OF TABLES SEE NOTE 6.

PARALLEL FLANGE CHANNELS

Advance® UKPFC

Connected through web

One row of fasteners with  
two or more fasteners across the web



Section Designation	Axis	Compression resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ , $N_{b,T,Rd}$ (kN)												
		for												
		Length between intersections, L (m)												
		1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
200x90x30	$N_{b,y,Rd}$	1350	1320	1260	1210	1150	1090	1020	889	756	635	533	449	381
	$N_{b,z,Rd}$	876	744	626	526	444	377	310	211	152	115	89.6	71.8	58.8
	$N_{b,T,Rd}$	1110	973	879	814	766	728	693	629	564	499	438	382	333
200x75x23	$N_{b,y,Rd}$	1060	1040	995	950	904	856	805	698	593	497	417	351	298
	$N_{b,z,Rd}$	648	528	428	349	287	224	178	119	85.3	64.0	49.7	39.8	32.5
	$N_{b,T,Rd}$	845	735	662	613	579	553	530	487	442	394	347	303	264
180x90x26	$N_{b,y,Rd}$	1180	1140	1090	1030	973	912	849	718	595	490	405	338	285
	$N_{b,z,Rd}$	768	653	550	462	390	332	273	186	134	101	79.0	63.3	51.8
	$N_{b,T,Rd}$	947	822	735	675	629	593	560	499	439	383	331	287	248
180x75x20	$N_{b,y,Rd}$	919	887	844	800	754	706	655	551	455	373	308	256	216
	$N_{b,z,Rd}$	560	456	369	301	248	193	153	103	73.3	55.0	42.7	34.2	27.9
	$N_{b,T,Rd}$	720	617	548	502	469	444	421	380	337	295	256	221	191
150x90x24	$N_{b,y,Rd}$	1070	1010	955	892	825	754	683	547	433	346	280	230	192
	$N_{b,z,Rd}$	703	598	503	423	357	304	250	170	123	92.7	72.3	58.0	47.5
	$N_{b,T,Rd}$	839	728	653	598	554	515	477	406	341	286	240	203	173
150x75x18	$N_{b,y,Rd}$	804	760	715	668	617	564	510	408	323	257	208	171	143
	$N_{b,z,Rd}$	495	404	327	267	220	172	137	91.6	65.6	49.2	38.2	30.6	25.0
	$N_{b,T,Rd}$	614	526	469	431	400	374	349	300	254	214	180	152	130
125x65x15	$N_{b,y,Rd}$	648	603	556	506	453	399	348	262	200	155	124	101	83.4
	$N_{b,z,Rd}$	382	300	236	187	142	109	85.8	57.1	40.6	30.4	23.6	18.8	15.4
	$N_{b,T,Rd}$	493	434	395	364	334	304	275	220	175	141	115	94.7	79.3
100x50x10	$N_{b,y,Rd}$	432	391	347	300	254	213	178	127	93.5	71.5	56.3	45.4	37.4
	$N_{b,z,Rd}$	228	166	124	85.2	61.8	46.7	36.5	24.0	17.0	12.7	9.79	7.79	6.35
	$N_{b,T,Rd}$	332	299	271	242	211	183	157	116	87.8	68.2	54.3	44.1	36.5

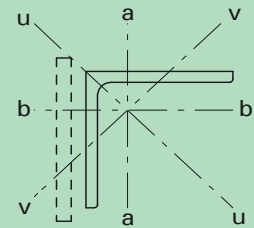
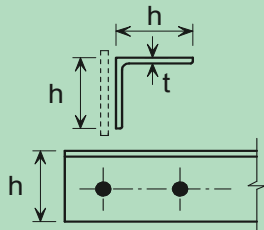
Advance® and UKPFC are trademarks of Tata Steel. A fuller description of the relationship between Parallel Flange Channels and the Advance® range of sections manufactured by Tata Steel is given in note 12.

$N_{b,T,Rd}$  is the lower of the torsional and the torsional-flexural buckling resistance.

For values of the compression cross-sectional resistance,  $N_{c,Rd}$ , see values of  $N_{pl,Rd}$  in the tables for axial force and bending.

FOR EXPLANATION OF TABLES SEE NOTE 6.

EQUAL ANGLES  
Advance® UKA - Equal Angles



Two or more bolts in line  
or equivalent welded at each end

Section Designation		Area cm <sup>2</sup>	Radius of Gyration			Buckling mode	Flexural buckling resistance (F) and torsional buckling resistance (T) (kN) for System length L (m)													
h x h mm	t mm		Axis a-a cm	Axis b-b cm	Axis v-v cm		1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0	
200x200	24	90.6	6.06	6.06	3.90		F	2540	2410	2240	2010	1780	1560	1370	1060	836	672	550	459	388
						T	2770	2770	2770	2770	2770	2770	2770	2770	2770	2770	2770	2770	2770	2770
	* 20	76.3	6.11	6.11	3.92	F	2140	2030	1890	1700	1500	1320	1160	899	709	570	467	389	329	
						T	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200	2200
	* 18	69.1	6.13	6.13	3.90	F	1940	1840	1710	1530	1360	1190	1050	809	637	512	420	350	296	
						T	1910	1910	1910	1910	1910	1910	1910	1910	1910	1910	1910	1910	1910	1910
	* 16	61.8	6.16	6.16	3.94	F	1670	1590	1480	1340	1190	1050	927	721	571	460	378	315	267	
						T	1560	1560	1560	1560	1560	1560	1560	1560	1560	1560	1560	1560	1560	1560
	150x150	18 +	51.2	4.55	4.55	2.93	F	1390	1270	1090	924	776	653	554	408	312	245	198	163	136
							T	1570	1570	1570	1570	1570	1570	1570	1570	1570	1570	1570	1570	1570
		* 15	43.0	4.57	4.57	2.93	F	1200	1090	935	788	660	555	470	346	264	207	167	137	115
							T	1280	1280	1280	1280	1280	1280	1280	1280	1280	1280	1280	1280	1280
* 12		34.8	4.60	4.60	2.95	F	909	836	725	617	521	440	374	277	212	167	135	111	93.1	
						T	887	887	887	887	887	887	887	887	887	887	887	887	887	887
* 10		29.3	4.62	4.62	2.97	F	673	630	556	481	412	352	301	226	174	138	112	92.4	77.6	
						T	608	608	608	608	608	608	608	608	608	608	608	608	608	608
120x120		15 +	34.0	3.63	3.63	2.34	F	909	769	622	499	402	329	273	195	146	113	90.5	73.9	61.4
							T	1080	1080	1080	1080	1080	1080	1080	1080	1080	1080	1080	1080	1080
		* 12	27.5	3.65	3.65	2.35	F	736	624	505	405	327	268	222	159	119	92.4	73.8	60.2	50.1
							T	817	817	817	817	817	817	817	817	817	817	817	817	817
	* 10	23.2	3.67	3.67	2.36	F	600	513	419	337	273	224	186	134	100	78.0	62.3	50.9	42.3	
						T	618	618	618	618	618	618	618	618	618	618	618	618	618	618
	* 8 +	18.8	3.71	3.71	2.38	F	419	369	309	254	209	173	145	105	79.7	62.3	49.9	40.9	34.1	
						T	389	389	389	389	389	389	389	389	389	389	389	389	389	389
	100x100	15 +	28.0	2.99	2.99	1.94	F	706	557	427	329	259	208	170	119	88.4	68.0	53.9	43.7	36.2
							T	923	923	923	923	923	923	923	923	923	923	923	923	923
		12	22.7	3.02	3.02	1.94	F	573	452	346	267	210	168	138	96.8	71.6	55.1	43.7	35.5	29.4
							T	715	715	715	715	715	715	715	715	715	715	715	715	715
* 10		19.2	3.04	3.04	1.95	F	485	384	294	227	179	143	117	82.6	61.1	47.0	37.3	30.3	25.1	
						T	573	573	573	573	573	573	573	573	573	573	573	573	573	573
* 8		15.5	3.06	3.06	1.96	F	372	298	231	180	142	115	94.0	66.3	49.2	37.9	30.1	24.5	20.3	
						T	398	398	398	398	398	398	398	398	398	398	398	398	398	398

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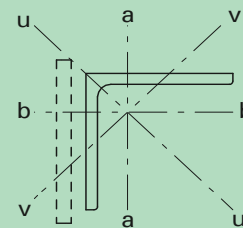
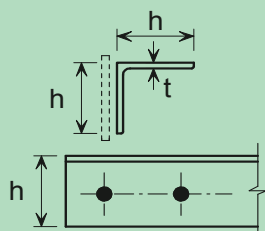
+ These sections are in addition to the range of BS EN 10056-1 sections.

\* Section is Class 4 under axial compression.

Values in italic type indicate that the section is Class 4 in pure compression and allowance has been made in calculating the resistance

FOR EXPLANATION OF TABLES SEE NOTE 6.

EQUAL ANGLES  
Advance® UKA - Equal Angles



Two or more bolts in line  
or equivalent welded at each end

Section Designation		Area cm <sup>2</sup>	Radius of Gyration			Buckling mode	Flexural buckling resistance (F) and torsional buckling resistance (T) (kN) for System length L (m)												
h x h mm	t mm		Axis a-a cm	Axis b-b cm	Axis v-v cm		1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
90x90	12 +	20.3	2.71	2.71	1.75	F	489	371	276	209	162	129	105	73.1	53.8	41.2	32.5	26.4	21.8
						T	655	655	655	655	655	655	655	655	655	655	655	655	655
	10	17.1	2.72	2.72	1.75	F	412	312	232	176	137	109	88.4	61.6	45.3	34.7	27.4	22.2	18.3
						T	528	528	528	528	528	528	528	528	528	528	528	528	528
	* 8	13.9	2.74	2.74	1.76	F	336	255	190	144	112	89.1	72.5	50.5	37.2	28.5	22.5	18.2	15.1
						T	396	396	396	396	396	396	396	396	396	396	396	396	396
* 7	12.2	2.75	2.75	1.77	F	276	214	162	124	96.5	77.2	63.0	44.1	32.5	25.0	19.8	16.0	13.3	
					T	305	305	305	305	305	305	305	305	305	305	305	305	305	305
80x80	10	15.1	2.41	2.41	1.55	F	340	246	177	132	101	79.6	64.3	44.4	32.4	24.7	19.5	15.7	13.0
						T	480	480	480	480	480	480	480	480	480	480	480	480	480
	* 8	12.3	2.43	2.43	1.56	F	278	202	146	108	83.0	65.5	52.9	36.5	26.7	20.4	16.1	13.0	10.7
						T	367	367	367	367	367	367	367	367	367	367	367	367	367
75x75	* 8	11.4	2.27	2.27	1.46	F	247	174	124	91.2	69.5	54.6	44.0	30.3	22.1	16.8	13.2	10.6	8.77
						T	347	347	347	347	347	347	347	347	347	347	347	347	347
	* 6	8.73	2.29	2.29	1.47	F	182	130	93.4	69.2	52.9	41.7	33.7	23.2	17.0	12.9	10.2	8.21	6.77
						T	224	224	224	224	224	224	224	224	224	224	224	224	224
70x70	* 7	9.40	2.12	2.12	1.36	F	194	133	93.0	67.8	51.4	40.2	32.3	22.1	16.1	12.2	9.57	7.71	6.34
						T	281	281	281	281	281	281	281	281	281	281	281	281	281
	* 6	8.13	2.13	2.13	1.37	F	167	115	80.7	59.0	44.8	35.0	28.2	19.3	14.0	10.7	8.37	6.75	5.55
						T	225	225	225	225	225	225	225	225	225	225	225	225	225
65x65	7	8.73	1.96	1.96	1.26	F	170	113	77.8	56.2	42.3	32.9	26.4	18.0	13.0	9.86	7.73	6.22	5.11
						T	264	264	264	264	264	264	264	264	264	264	264	264	264
60x60	8	9.03	1.80	1.80	1.16	F	164	106	71.5	51.2	38.3	29.7	23.7	16.1	11.6	8.77	6.86	5.51	4.53
						T	292	292	292	292	292	292	292	292	292	292	292	292	292
	* 6	6.91	1.82	1.82	1.17	F	127	81.8	55.4	39.7	29.7	23.1	18.4	12.5	9.02	6.82	5.33	4.29	3.52
						T	207	207	207	207	207	207	207	207	207	207	207	207	207
	* 5	5.82	1.82	1.82	1.17	F	104	67.9	46.2	33.1	24.8	19.3	15.4	10.5	7.57	5.72	4.48	3.60	2.96
						T	157	157	157	157	157	157	157	157	157	157	157	157	157
50x50	6	5.69	1.50	1.50	0.968	F	86.6	52.4	34.4	24.2	17.9	13.8	10.9	7.33	5.26	3.96	3.09	2.47	2.03
						T	180	180	180	180	180	180	180	180	180	180	180	180	180
	* 5	4.80	1.51	1.51	0.973	F	73.4	44.5	29.3	20.6	15.2	11.7	9.28	6.24	4.48	3.37	2.63	2.11	1.73
						T	144	144	144	144	144	144	144	144	144	144	144	144	144
	* 4	3.89	1.52	1.52	0.979	F	58.0	35.6	23.6	16.6	12.3	9.50	7.54	5.08	3.65	2.75	2.15	1.72	1.41
						T	101	101	101	101	101	101	101	101	101	101	101	101	101

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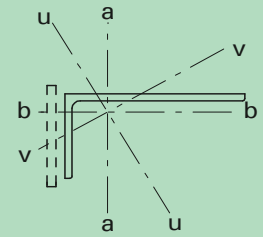
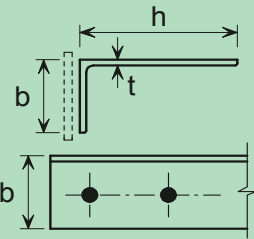
+ These sections are in addition to the range of BS EN 10056-1 sections.

\* Section is Class 4 under axial compression.

Values in italic type indicate that the section is Class 4 in pure compression and allowance has been made in calculating the resistance

FOR EXPLANATION OF TABLES SEE NOTE 6.

UNEQUAL ANGLES  
Advance® UKA - Unequal Angles



Short leg attached

Two or more bolts in line  
or equivalent welded at each end

Section Designation		Area cm <sup>2</sup>	Radius of Gyration			Buckling mode	Flexural buckling resistance (F) and torsional buckling resistance (T) (kN) for System length L (m)												
h x b mm	t mm		Axis a-a cm	Axis b-b cm	Axis v-v cm		1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
200x150	* 18 +	60.1	6.30	4.38	3.22	F	1620	1490	1350	1170	1000	854	731	547	422	334	270	223	187
						T	1710	1710	1710	1710	1710	1710	1710	1710	1710	1710	1710	1710	1710
	* 15	50.5	6.33	4.40	3.23	F	1250	1160	1060	933	804	691	595	449	348	276	224	186	156
						T	1240	1240	1240	1240	1240	1240	1240	1240	1240	1240	1240	1240	1240
	* 12	40.8	6.36	4.44	3.25	F	860	805	745	674	591	515	449	344	270	216	176	146	124
						T	767	767	767	767	767	767	767	767	767	767	767	767	767
200x100	* 15	43.0	6.40	2.64	2.12	F	960	818	675	536	430	350	289	206	154	119	95.0	77.5	64.3
						T	1070	1070	1070	1070	1070	1070	1070	1070	1070	1070	1070	1070	1070
	* 12	34.8	6.43	2.67	2.14	F	669	582	497	405	329	271	226	163	122	95.3	76.2	62.3	51.8
						T	671	671	671	671	671	671	671	671	671	671	671	671	671
	* 10	29.2	6.46	2.68	2.15	F	491	434	377	316	261	217	182	132	100	78.4	62.9	51.5	43.0
						T	446	446	446	446	446	446	446	446	446	446	446	446	446
150x90	15	33.9	4.74	2.46	1.93	F	817	672	514	396	311	249	204	143	106	81.5	64.6	52.5	43.4
						T	1040	1040	1040	1040	1040	1040	1040	1040	1040	1040	1040	1040	1040
	* 12	27.5	4.77	2.49	1.94	F	628	524	406	315	249	200	164	116	85.8	66.1	52.4	42.6	35.3
						T	733	733	733	733	733	733	733	733	733	733	733	733	733
	* 10	23.2	4.80	2.51	1.95	F	472	402	321	253	202	164	135	95.7	71.3	55.1	43.8	35.7	29.6
						T	507	507	507	507	507	507	507	507	507	507	507	507	507
150x75	15	31.7	4.75	1.94	1.58	F	692	526	381	284	218	172	139	96.2	70.4	53.7	42.3	34.2	28.2
						T	974	974	974	974	974	974	974	974	974	974	974	974	974
	* 12	25.7	4.78	1.97	1.59	F	536	414	303	227	175	139	112	78.0	57.2	43.7	34.5	27.9	23.0
						T	686	686	686	686	686	686	686	686	686	686	686	686	686
	* 10	21.7	4.81	1.99	1.60	F	407	326	244	185	144	114	93.2	65.0	47.9	36.7	29.0	23.5	19.4
						T	475	475	475	475	475	475	475	475	475	475	475	475	475
125x75	12	22.7	3.95	2.05	1.61	F	508	384	279	209	160	127	103	71.1	52.1	39.8	31.4	25.3	20.9
						T	688	688	688	688	688	688	688	688	688	688	688	688	688
	* 10	19.1	3.97	2.07	1.61	F	407	311	229	172	133	105	85.3	59.2	43.4	33.2	26.2	21.2	17.5
						T	509	509	509	509	509	509	509	509	509	509	509	509	509
	* 8	15.5	4.00	2.09	1.63	F	289	232	175	134	104	83.4	68.0	47.6	35.1	26.9	21.3	17.3	14.3
						T	323	323	323	323	323	323	323	323	323	323	323	323	323

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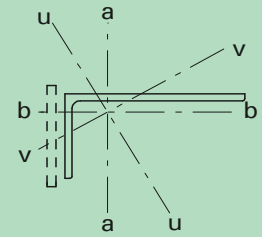
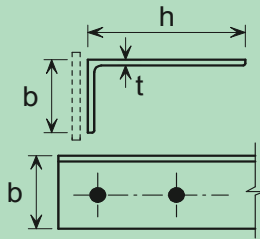
+ These sections are in addition to the range of BS EN 10056-1 sections.

\* Section is Class 4 under axial compression.

Values in italic type indicate that the section is Class 4 in pure compression and allowance has been made in calculating the resistance

FOR EXPLANATION OF TABLES SEE NOTE 6.

UNEQUAL ANGLES  
Advance® UKA - Unequal Angles



Short leg attached

Two or more bolts in line  
or equivalent welded at each end

Section Designation		Area cm <sup>2</sup>	Radius of Gyration			Buckling mode	Flexural buckling resistance (F) and torsional buckling resistance (T) (kN) for System length L (m)													
h x b mm	t mm		Axis a-a cm	Axis b-b cm	Axis v-v cm		1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0	
100x75	12	19.7	3.10	2.14	1.59	F	450	329	239	178	137	108	87.4	60.4	44.2	33.8	26.6	21.5	17.7	
						T	630	630	630	630	630	630	630	630	630	630	630	630	630	630
	* 8	10	16.6	3.12	2.16	1.59	F	380	277	201	150	115	91.0	73.6	50.9	37.3	28.5	22.4	18.1	14.9
							T	505	505	505	505	505	505	505	505	505	505	505	505	505
		* 8	13.5	3.14	2.18	1.60	F	294	219	160	120	92.9	73.6	59.7	41.4	30.4	23.2	18.3	14.8	12.2
							T	356	356	356	356	356	356	356	356	356	356	356	356	356
100x65	10 +	15.6	3.14	1.81	1.39	F	327	226	159	116	88.2	69.1	55.5	38.1	27.7	21.0	16.5	13.3	11.0	
						T	478	478	478	478	478	478	478	478	478	478	478	478	478	478
	* 8 +	12.7	3.16	1.83	1.40	F	256	180	128	93.8	71.5	56.1	45.2	31.1	22.6	17.2	13.5	10.9	9.00	
						T	338	338	338	338	338	338	338	338	338	338	338	338	338	338
		* 7 +	11.2	3.17	1.83	1.40	F	209	151	109	80.4	61.6	48.5	39.1	27.0	19.7	15.0	11.8	9.55	7.87
							T	259	259	259	259	259	259	259	259	259	259	259	259	259
100x50	* 8	11.4	3.19	1.31	1.06	F	184	116	77.7	55.3	41.2	31.9	25.4	17.2	12.4	9.33	7.29	5.85	4.80	
						T	304	304	304	304	304	304	304	304	304	304	304	304	304	304
	* 6	8.71	3.21	1.33	1.07	F	124	82.5	56.5	40.7	30.6	23.8	19.1	13.0	9.40	7.11	5.57	4.48	3.68	
						T	168	168	168	168	168	168	168	168	168	168	168	168	168	168
80x60	* 7	9.38	2.51	1.74	1.28	F	185	124	85.3	61.7	46.6	36.3	29.1	19.8	14.4	10.9	8.54	6.87	5.65	
						T	270	270	270	270	270	270	270	270	270	270	270	270	270	270
80x40	8	9.01	2.53	1.03	0.838	F	116	67.6	43.5	30.2	22.2	16.9	13.4	8.93	6.39	4.79	3.73	2.98	2.44	
						T	277	277	277	277	277	277	277	277	277	277	277	277	277	277
	* 6	6.89	2.55	1.05	0.845	F	85.6	50.6	32.9	23.0	16.9	13.0	10.2	6.86	4.92	3.69	2.88	2.30	1.88	
						T	172	172	172	172	172	172	172	172	172	172	172	172	172	172
75x50	8	9.41	2.35	1.40	1.07	F	159	99.3	66.2	47.0	35.0	27.0	21.5	14.5	10.4	7.88	6.16	4.94	4.05	
						T	293	293	293	293	293	293	293	293	293	293	293	293	293	293
	* 6	7.19	2.37	1.42	1.08	F	118	74.9	50.4	35.9	26.8	20.7	16.5	11.2	8.07	6.09	4.76	3.82	3.14	
						T	191	191	191	191	191	191	191	191	191	191	191	191	191	191
70x50	* 6	6.89	2.20	1.43	1.07	F	115	72.2	48.2	34.3	25.5	19.7	15.7	10.6	7.64	5.76	4.50	3.61	2.96	
						T	195	195	195	195	195	195	195	195	195	195	195	195	195	195
65x50	* 5	5.54	2.05	1.47	1.07	F	88.7	56.5	38.0	27.1	20.2	15.7	12.5	8.45	6.10	4.60	3.60	2.89	2.37	
						T	139	139	139	139	139	139	139	139	139	139	139	139	139	139
	* 5	5.68	1.88	1.12	0.855	F	75.1	43.9	28.3	19.7	14.5	11.1	8.74	5.84	4.18	3.14	2.44	1.95	1.60	
						T	174	174	174	174	174	174	174	174	174	174	174	174	174	174
* 5	4.79	1.89	1.13	0.860	F	62.8	36.9	23.9	16.7	12.3	9.38	7.41	4.96	3.55	2.67	2.08	1.66	1.36		
					T	133	133	133	133	133	133	133	133	133	133	133	133	133	133	133

Advance® and UKA are trademarks of Tata Steel. A fuller description of the relationship between Angles and the Advance® range of sections manufactured by Tata Steel is given in section 12

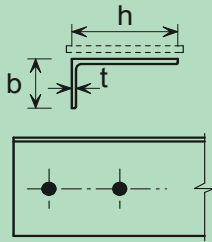
+ These sections are in addition to the range of BS EN 10056-1 sections.

\* Section is Class 4 under axial compression.

Values in italic type indicate that the section is Class 4 in pure compression and allowance has been made in calculating the resistance

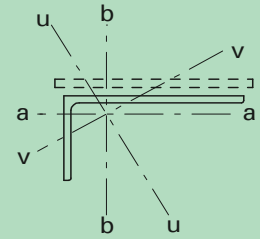
FOR EXPLANATION OF TABLES SEE NOTE 6.

UNEQUAL ANGLES  
Advance® UKA - Unequal Angles



Long leg attached

Two or more bolts in line  
or equivalent welded at each end



Section Designation		Area cm <sup>2</sup>	Radius of Gyration			Buckling mode	Flexural buckling resistance (F) and torsional buckling resistance (T) (kN) for System length L (m)												
h x b mm	t mm		Axis a-a cm	Axis b-b cm	Axis v-v cm		1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
200x150	* 18 +	60.1	4.38	6.30	3.22	F	1620	1490	1350	1170	1000	854	731	547	422	334	270	223	187
						T	1710	1710	1710	1710	1710	1710	1710	1710	1710	1710	1710	1710	1710
	* 15	50.5	4.40	6.33	3.23	F	1250	1160	1060	933	804	691	595	449	348	276	224	186	156
						T	1240	1240	1240	1240	1240	1240	1240	1240	1240	1240	1240	1240	1240
	* 12	40.8	4.44	6.36	3.25	F	860	805	745	674	591	515	449	344	270	216	176	146	124
						T	767	767	767	767	767	767	767	767	767	767	767	767	767
200x100	* 15	43.0	2.64	6.40	2.12	F	960	818	675	536	430	350	289	206	154	119	95.0	77.5	64.3
						T	1070	1070	1070	1070	1070	1070	1070	1070	1070	1070	1070	1070	1070
	* 12	34.8	2.67	6.43	2.14	F	669	582	497	405	329	271	226	163	122	95.3	76.2	62.3	51.8
						T	671	671	671	671	671	671	671	671	671	671	671	671	671
	* 10	29.2	2.68	6.46	2.15	F	491	434	377	316	261	217	182	132	100	78.4	62.9	51.5	43.0
						T	446	446	446	446	446	446	446	446	446	446	446	446	446
150x90	15	33.9	2.46	4.74	1.93	F	817	672	514	396	311	249	204	143	106	81.5	64.6	52.5	43.4
						T	1040	1040	1040	1040	1040	1040	1040	1040	1040	1040	1040	1040	1040
	* 12	27.5	2.49	4.77	1.94	F	628	524	406	315	249	200	164	116	85.8	66.1	52.4	42.6	35.3
						T	733	733	733	733	733	733	733	733	733	733	733	733	733
	* 10	23.2	2.51	4.80	1.95	F	472	402	321	253	202	164	135	95.7	71.3	55.1	43.8	35.7	29.6
						T	507	507	507	507	507	507	507	507	507	507	507	507	507
150x75	15	31.7	1.94	4.75	1.58	F	692	526	381	284	218	172	139	96.2	70.4	53.7	42.3	34.2	28.2
						T	974	974	974	974	974	974	974	974	974	974	974	974	974
	* 12	25.7	1.97	4.78	1.59	F	536	414	303	227	175	139	112	78.0	57.2	43.7	34.5	27.9	23.0
						T	686	686	686	686	686	686	686	686	686	686	686	686	686
	* 10	21.7	1.99	4.81	1.60	F	407	326	244	185	144	114	93.2	65.0	47.9	36.7	29.0	23.5	19.4
						T	475	475	475	475	475	475	475	475	475	475	475	475	475
125x75	12	22.7	2.05	3.95	1.61	F	508	384	279	209	160	127	103	71.1	52.1	39.8	31.4	25.3	20.9
						T	688	688	688	688	688	688	688	688	688	688	688	688	688
	* 10	19.1	2.07	3.97	1.61	F	407	311	229	172	133	105	85.3	59.2	43.4	33.2	26.2	21.2	17.5
						T	509	509	509	509	509	509	509	509	509	509	509	509	509
	* 8	15.5	2.09	4.00	1.63	F	289	232	175	134	104	83.4	68.0	47.6	35.1	26.9	21.3	17.3	14.3
						T	323	323	323	323	323	323	323	323	323	323	323	323	323

Advance® and UKA are trademarks of Tata Steel. A fuller description of the relationship between Angles and the Advance® range of sections manufactured by Tata Steel is given in section 12

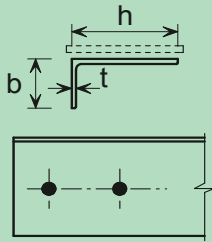
+ These sections are in addition to the range of BS EN 10056-1 sections.

\* Section is Class 4 under axial compression.

Values in italic type indicate that the section is Class 4 in pure compression and allowance has been made in calculating the resistance

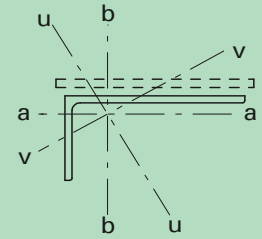
FOR EXPLANATION OF TABLES SEE NOTE 6.

UNEQUAL ANGLES  
Advance® UKA - Unequal Angles



Long leg attached

Two or more bolts in line  
or equivalent welded at each end



Section Designation		Area cm <sup>2</sup>	Radius of Gyration			Buckling mode	Flexural buckling resistance (F) and torsional buckling resistance (T) (kN) for System length L (m)												
h x b mm	t mm		Axis a-a cm	Axis b-b cm	Axis v-v cm		1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
100x75	12	19.7	2.14	3.10	1.59	F	450	329	239	178	137	108	87.4	60.4	44.2	33.8	26.6	21.5	17.7
						T	630	630	630	630	630	630	630	630	630	630	630	630	630
	10	16.6	2.16	3.12	1.59	F	380	277	201	150	115	91.0	73.6	50.9	37.3	28.5	22.4	18.1	14.9
						T	505	505	505	505	505	505	505	505	505	505	505	505	505
	* 8	13.5	2.18	3.14	1.60	F	294	219	160	120	92.9	73.6	59.7	41.4	30.4	23.2	18.3	14.8	12.2
						T	356	356	356	356	356	356	356	356	356	356	356	356	356
100x65	10 +	15.6	1.81	3.14	1.39	F	327	226	159	116	88.2	69.1	55.5	38.1	27.7	21.0	16.5	13.3	11.0
						T	478	478	478	478	478	478	478	478	478	478	478	478	478
	* 8 +	12.7	1.83	3.16	1.40	F	256	180	128	93.8	71.5	56.1	45.2	31.1	22.6	17.2	13.5	10.9	9.00
						T	338	338	338	338	338	338	338	338	338	338	338	338	338
	* 7 +	11.2	1.83	3.17	1.40	F	209	151	109	80.4	61.6	48.5	39.1	27.0	19.7	15.0	11.8	9.55	7.87
						T	259	259	259	259	259	259	259	259	259	259	259	259	259
100x50	* 8	11.4	1.31	3.19	1.06	F	184	116	77.7	55.3	41.2	31.9	25.4	17.2	12.4	9.33	7.29	5.85	4.80
						T	304	304	304	304	304	304	304	304	304	304	304	304	304
	* 6	8.71	1.33	3.21	1.07	F	124	82.5	56.5	40.7	30.6	23.8	19.1	13.0	9.40	7.11	5.57	4.48	3.68
						T	168	168	168	168	168	168	168	168	168	168	168	168	168
80x60	* 7	9.38	1.74	2.51	1.28	F	185	124	85.3	61.7	46.6	36.3	29.1	19.8	14.4	10.9	8.54	6.87	5.65
						T	270	270	270	270	270	270	270	270	270	270	270	270	270
80x40	8	9.01	1.03	2.53	0.838	F	116	67.6	43.5	30.2	22.2	16.9	13.4	8.93	6.39	4.79	3.73	2.98	2.44
						T	277	277	277	277	277	277	277	277	277	277	277	277	277
	* 6	6.89	1.05	2.55	0.845	F	85.6	50.6	32.9	23.0	16.9	13.0	10.2	6.86	4.92	3.69	2.88	2.30	1.88
						T	172	172	172	172	172	172	172	172	172	172	172	172	172
75x50	8	9.41	1.40	2.35	1.07	F	159	99.3	66.2	47.0	35.0	27.0	21.5	14.5	10.4	7.88	6.16	4.94	4.05
						T	293	293	293	293	293	293	293	293	293	293	293	293	293
	* 6	7.19	1.42	2.37	1.08	F	118	74.9	50.4	35.9	26.8	20.7	16.5	11.2	8.07	6.09	4.76	3.82	3.14
						T	191	191	191	191	191	191	191	191	191	191	191	191	191
70x50	* 6	6.89	1.43	2.20	1.07	F	115	72.2	48.2	34.3	25.5	19.7	15.7	10.6	7.64	5.76	4.50	3.61	2.96
						T	195	195	195	195	195	195	195	195	195	195	195	195	195
65x50	* 5	5.54	1.47	2.05	1.07	F	88.7	56.5	38.0	27.1	20.2	15.7	12.5	8.45	6.10	4.60	3.60	2.89	2.37
						T	139	139	139	139	139	139	139	139	139	139	139	139	139
60x40	6	5.68	1.12	1.88	0.855	F	75.1	43.9	28.3	19.7	14.5	11.1	8.74	5.84	4.18	3.14	2.44	1.95	1.60
						T	174	174	174	174	174	174	174	174	174	174	174	174	174
	* 5	4.79	1.13	1.89	0.860	F	62.8	36.9	23.9	16.7	12.3	9.38	7.41	4.96	3.55	2.67	2.08	1.66	1.36
						T	133	133	133	133	133	133	133	133	133	133	133	133	133

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+ These sections are in addition to the range of BS EN 10056-1 sections.

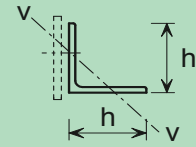
\* Section is Class 4 under axial compression.

Values in italic type indicate that the section is Class 4 in pure compression and allowance has been made in calculating the resistance

FOR EXPLANATION OF TABLES SEE NOTE 6.



EQUAL ANGLES  
Advance® UKA - Equal Angles



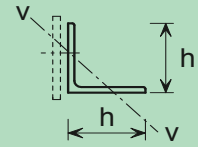
Section Designation		Mass per Metre kg/m	Radius of Gyration Axis v-v cm	Gross Area cm <sup>2</sup>	Bolt Size	Holes Deducted From Angle		Tension Resistance N <sub>u,Rd</sub> kN
h x h mm	t mm					No.	Diameter mm	
200x200	24	71.1	3.90	90.6	Weld	0	-	2680
					M24	1	26	2320
					M24	2	26	2080
					M20	3	22	1960
	20	59.9	3.92	76.3	Weld	0	-	2260
					M24	1	26	1950
					M24	2	26	1750
					M20	3	22	1640
	18	54.3	3.90	69.1	Weld	0	-	2040
					M24	1	26	1760
					M24	2	26	1580
					M20	3	22	1490
	16	48.5	3.94	61.8	Weld	0	-	1880
					M24	1	26	1620
					M24	2	26	1450
					M20	3	22	1370
150x150	18 +	40.1	2.93	51.2	Weld	0	-	1520
					M24	1	26	1260
					M20	2	22	1140
	15	33.8	2.93	43.0	Weld	0	-	1310
					M24	1	26	1090
					M20	2	22	985
	12	27.3	2.95	34.8	Weld	0	-	1060
					M24	1	26	879
					M20	2	22	795
	10	23.0	2.97	29.3	Weld	0	-	888
					M24	1	26	738
					M20	2	22	668
120x120	15 +	26.6	2.34	34.0	Weld	0	-	1040
					M24	1	26	835
					M20	1	22	858
	12	21.6	2.35	27.5	Weld	0	-	837
					M24	1	26	673
					M20	1	22	692
	10	18.2	2.36	23.2	Weld	0	-	704
					M24	1	26	566
					M20	1	22	581
	8 +	14.7	2.38	18.8	Weld	0	-	569
					M24	1	26	457
					M20	1	22	469

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+ These sections are in addition to the range in BS EN 10056-1.

FOR EXPLANATION OF TABLES SEE NOTE 7.

EQUAL ANGLES  
Advance® UKA - Equal Angles



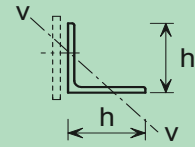
Section Designation		Mass per Metre kg/m	Radius of Gyration Axis v-v cm	Gross Area cm <sup>2</sup>	Bolt Size	Holes Deducted From Angle		Tension Resistance N <sub>u,Rd</sub> kN
h x h mm	t mm					No.	Diameter mm	
100x100	15 +	21.9	1.94	28.0	Weld	0	-	856
					M24	1	26	664
					M20	1	22	688
	12	17.8	1.94	22.7	Weld	0	-	692
					M24	1	26	537
					M20	1	22	555
	10	15.0	1.95	19.2	Weld	0	-	584
					M24	1	26	452
					M20	1	22	468
	8	12.2	1.96	15.5	Weld	0	-	470
					M24	1	26	364
					M20	1	22	377
90x90	12 +	15.9	1.75	20.3	Weld	0	-	619
					M20	1	22	487
					M16	1	18	506
	10	13.4	1.75	17.1	Weld	0	-	521
					M20	1	22	409
					M16	1	18	425
	8	10.9	1.76	13.9	Weld	0	-	422
					M20	1	22	331
					M16	1	18	344
	7	9.61	1.77	12.2	Weld	0	-	370
					M20	1	22	291
					M16	1	18	302
80x80	10	11.9	1.55	15.1	Weld	0	-	460
					M20	1	22	353
					M16	1	18	368
	8	9.63	1.56	12.3	Weld	0	-	374
					M20	1	22	286
					M16	1	18	298
75x75	8	8.99	1.46	11.4	Weld	0	-	347
					M20	1	22	261
					M16	1	18	274
	6	6.85	1.47	8.73	Weld	0	-	265
					M20	1	22	199
					M16	1	18	209

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FOR EXPLANATION OF TABLES SEE NOTE 7.

EQUAL ANGLES  
Advance® UKA - Equal Angles

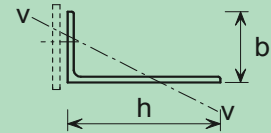


Section Designation		Mass per Metre kg/m	Radius of Gyration Axis v-v cm	Gross Area cm <sup>2</sup>	Bolt Size	Holes Deducted From Angle		Tension Resistance N <sub>u,Rd</sub> kN
h x h mm	t mm					No.	Diameter mm	
70x70	7	7.38	1.36	9.40	Weld	0	-	286
					M20	1	22	211
					M16	1	18	222
	6	6.38	1.37	8.13	Weld	0	-	247
					M20	1	22	182
					M16	1	18	192
65x65	7	6.83	1.26	8.73	Weld	0	-	265
					M20	1	22	192
					M16	1	18	203
60x60	8	7.09	1.16	9.03	Weld	0	-	276
					M16	1	18	206
	6	5.42	1.17	6.91	Weld	0	-	210
					M16	1	18	157
	5	4.57	1.17	5.82	Weld	0	-	177
					M16	1	18	132
50x50	6	4.47	0.968	5.69	Weld	0	-	173
					M12	1	14	132
	5	3.77	0.973	4.80	Weld	0	-	146
					M12	1	14	111
	4	3.06	0.979	3.89	Weld	0	-	118
					M12	1	14	89.8
45x45	4.5	3.06	0.870	3.90	Weld	0	-	118
					M12	1	14	87.8
40x40	5	2.97	0.773	3.79	Weld	0	-	115
					M12	1	14	82.5
	4	2.42	0.777	3.08	Weld	0	-	93.6
					M12	1	14	66.9
35x35	4	2.09	0.678	2.67	Weld	0	-	81.3
					M12	1	14	55.3
30x30	4	1.78	0.577	2.27	Weld	0	-	69.2
					M12	1	14	44.0
	3	1.36	0.581	1.74	Weld	0	-	52.8
					M12	1	14	33.7
25x25	4	1.45	0.482	1.85	Weld	0	-	56.6
					M12	1	14	32.3
	3	1.12	0.484	1.42	Weld	0	-	43.3
					M12	1	14	24.8
20x20	3	0.882	0.383	1.12	Weld	0	-	34.2
					M12	1	14	16.3

Advance® and UKA are trademarks of Tata Steel. A fuller description of the relationship between Angles and the Advance® range of sections manufactured by Tata Steel is given in note 12.

FOR EXPLANATION OF TABLES SEE NOTE 7.

UNEQUAL ANGLES  
Advance® UKA - Unequal Angles



Short leg attached

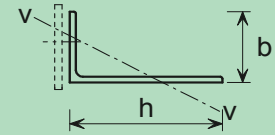
Section Designation		Mass per Metre kg/m	Radius of Gyration Axis v-v cm	Gross Area cm <sup>2</sup>	Bolt Size	Holes Deducted From Angle		Tension Resistance N <sub>u,Rd</sub> kN
h x b mm	t mm					No.	Diameter mm	
200x150	18 +	47.1	3.22	60.1	Weld	0	-	1730
					M24	1	26	1420
					M20	2	22	1300
	15	39.6	3.23	50.5	Weld	0	-	1490
					M24	1	26	1220
					M20	2	22	1120
	12	32.0	3.25	40.8	Weld	0	-	1210
					M24	1	26	986
					M20	2	22	901
200x100	15	33.8	2.12	43.0	Weld	0	-	1230
					M24	1	26	930
					M20	1	22	954
	12	27.3	2.14	34.8	Weld	0	-	993
					M24	1	26	751
					M20	1	22	770
	10	23.0	2.15	29.2	Weld	0	-	832
					M24	1	26	630
					M20	1	22	645
150x90	15	26.6	1.93	33.9	Weld	0	-	986
					M20	1	22	760
					M16	1	18	784
	12	21.6	1.94	27.5	Weld	0	-	798
					M20	1	22	615
					M16	1	18	634
	10	18.2	1.95	23.2	Weld	0	-	672
					M20	1	22	518
					M16	1	18	533
150x75	15	24.8	1.58	31.7	Weld	0	-	908
					M20	1	22	673
					M16	1	18	697
	12	20.2	1.59	25.7	Weld	0	-	734
					M20	1	22	545
					M16	1	18	564
	10	17.0	1.60	21.7	Weld	0	-	619
					M20	1	22	459
					M16	1	18	475

Advance® and UKA are trademarks of Tata Steel. A fuller description of the relationship between Angles and the Advance® range of sections manufactured by Tata Steel is given in note 12.

+ These sections are in addition to the range in BS EN 10056-1.

FOR EXPLANATION OF TABLES SEE NOTE 7.

UNEQUAL ANGLES  
Advance® UKA - Unequal Angles



Short leg attached

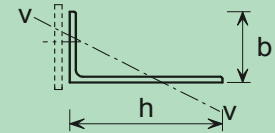
Section Designation		Mass per Metre kg/m	Radius of Gyration Axis v-v cm	Gross Area cm <sup>2</sup>	Bolt Size	Holes Deducted From Angle		Tension Resistance N <sub>u,Rd</sub> kN
h x b mm	t mm					No.	Diameter mm	
125x75	12	17.8	1.61	22.7	Weld	0	-	660
					M20	1	22	492
					M16	1	18	510
	10	15.0	1.61	19.1	Weld	0	-	555
					M20	1	22	413
					M16	1	18	428
	8	12.2	1.63	15.5	Weld	0	-	449
					M20	1	22	334
					M16	1	18	347
100x75	12	15.4	1.59	19.7	Weld	0	-	585
					M20	1	22	438
					M16	1	18	457
	10	13.0	1.59	16.6	Weld	0	-	492
					M20	1	22	368
					M16	1	18	384
	8	10.6	1.60	13.5	Weld	0	-	399
					M20	1	22	299
					M16	1	18	311
100x65	10 +	12.3	1.39	15.6	Weld	0	-	457
					M20	1	22	329
					M16	1	18	345
	8 +	9.94	1.40	12.7	Weld	0	-	371
					M20	1	22	267
					M16	1	18	280
	7 +	8.77	1.40	11.2	Weld	0	-	327
					M20	1	22	236
					M16	1	18	247
100x50	8	8.97	1.06	11.4	Weld	0	-	326
					M12	1	14	244
	6	6.84	1.07	8.71	Weld	0	-	248
				M12	1	14	186	
80x60	7	7.36	1.28	9.38	Weld	0	-	278
					M16	1	18	207

Advance® and UKA are trademarks of Tata Steel. A fuller description of the relationship between Angles and the Advance® range of sections manufactured by Tata Steel is given in note 12.

+ These sections are in addition to the range in BS EN 10056-1.

FOR EXPLANATION OF TABLES SEE NOTE 7.

UNEQUAL ANGLES  
Advance® UKA - Unequal Angles



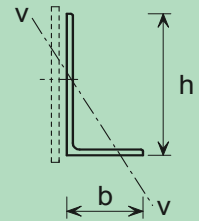
Short leg attached

Section Designation		Mass per Metre kg/m	Radius of Gyration Axis v-v cm	Gross Area cm <sup>2</sup>	Bolt Size	Holes Deducted From Angle		Tension Resistance N <sub>u,Rd</sub> kN
h x b mm	t mm					No.	Diameter mm	
80x40	8	7.07	0.838	9.01	Weld	0	-	258
					M12	1	14	184
80x40	6	5.41	0.845	6.89	Weld	0	-	197
					M12	1	14	141
75x50	8	7.39	1.07	9.41	Weld	0	-	276
					M12	1	14	208
75x50	6	5.65	1.08	7.19	Weld	0	-	211
					M12	1	14	159
70x50	6	5.41	1.07	6.89	Weld	0	-	203
					M12	1	14	153
65x50	5	4.35	1.07	5.54	Weld	0	-	164
					M12	1	14	124
60x40	6	4.46	0.855	5.68	Weld	0	-	167
					M12	1	14	119
60x40	5	3.76	0.860	4.79	Weld	0	-	140
					M12	1	14	100
60x30	5	3.36	0.633	4.28	Weld	0	-	122
					M12	1	14	80.6
50x30	5	2.96	0.639	3.78	Weld	0	-	110
					M12	1	14	71.7
45x30	4	2.25	0.640	2.87	Weld	0	-	84.1
					M12	1	14	54.6
40x25	4	1.93	0.534	2.46	Weld	0	-	71.8
					M12	1	14	43.1
40x20	4	1.77	0.417	2.26	Weld	0	-	64.7
					M12	1	14	35.3
30x20	4	1.46	0.421	1.86	Weld	0	-	54.7
					M12	1	14	28.2
	3	1.12	0.424	1.43	Weld	0	-	41.9
					M12	1	14	21.8

Advance® and UKA are trademarks of Tata Steel. A fuller description of the relationship between Angles and the Advance® range of sections manufactured by Tata Steel is given in note 12.

FOR EXPLANATION OF TABLES SEE NOTE 7.

UNEQUAL ANGLES  
Advance® UKA - Unequal Angles



Long leg attached

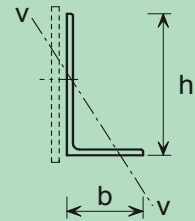
Section Designation		Mass per Metre kg/m	Radius of Gyration Axis v-v cm	Gross Area cm <sup>2</sup>	Bolt Size	Holes Deducted From Angle		Tension Resistance N <sub>u,Rd</sub> kN
h x b mm	t mm					No.	Diameter mm	
200x150	18 +	47.1	3.22	60.1	Weld	0	-	1820
					M24	1	26	1600
					M24	2	26	1430
					M20	3	22	1330
	15	39.6	3.23	50.5	Weld	0	-	1570
					M24	1	26	1380
					M24	2	26	1230
					M20	3	22	1150
	12	32.0	3.25	40.8	Weld	0	-	1270
					M24	1	26	1110
					M24	2	26	992
					M20	3	22	926
200x100	15	33.8	2.12	43.0	Weld	0	-	1390
					M24	1	26	1250
					M24	2	26	1100
					M20	3	22	1020
	12	27.3	2.14	34.8	Weld	0	-	1120
					M24	1	26	1010
					M24	2	26	885
					M20	3	22	820
	10	23.0	2.15	29.2	Weld	0	-	939
					M24	1	26	843
					M24	2	26	741
					M20	3	22	687
150x90	15	26.6	1.93	33.9	Weld	0	-	1080
					M24	1	26	929
					M20	2	22	823
	12	21.6	1.94	27.5	Weld	0	-	875
					M24	1	26	750
					M20	2	22	665
	10	18.2	1.95	23.2	Weld	0	-	736
					M24	1	26	630
					M20	2	22	559
150x75	15	24.8	1.58	31.7	Weld	0	-	1030
					M24	1	26	890
					M20	2	22	784
	12	20.2	1.59	25.7	Weld	0	-	830
					M24	1	26	718
					M20	2	22	633
	10	17.0	1.60	21.7	Weld	0	-	699
					M24	1	26	603
					M20	2	22	533

Advance® and UKA are trademarks of Tata Steel. A fuller description of the relationship between Angles and the Advance® range of sections manufactured by Tata Steel is given in note 12.

+ These sections are in addition to the range in BS EN 10056-1.

FOR EXPLANATION OF TABLES SEE NOTE 7.

UNEQUAL ANGLES  
Advance® UKA - Unequal Angles



Long leg attached

Section Designation		Mass per Metre kg/m	Radius of Gyration Axis v-v cm	Gross Area cm <sup>2</sup>	Bolt Size	Holes Deducted From Angle		Tension Resistance N <sub>u,Rd</sub> kN
h x b mm	t mm					No.	Diameter mm	
125x75	12	17.8	1.61	22.7	Weld	0	-	724
					M24	1	26	601
					M20	2	22	516
	10	15.0	1.61	19.1	Weld	0	-	608
					M24	1	26	504
					M20	2	22	433
	8	12.2	1.63	15.5	Weld	0	-	492
					M24	1	26	407
					M20	2	22	351
100x75	12	15.4	1.59	19.7	Weld	0	-	617
					M24	1	26	483
					M20	1	22	502
	10	13.0	1.59	16.6	Weld	0	-	519
					M24	1	26	406
					M20	1	22	422
	8	10.6	1.60	13.5	Weld	0	-	421
					M24	1	26	329
					M20	1	22	341
100x65	10 +	12.3	1.39	15.6	Weld	0	-	494
					M24	1	26	388
					M20	1	22	404
	8 +	9.94	1.40	12.7	Weld	0	-	401
					M24	1	26	315
					M20	1	22	327
	7 +	8.77	1.40	11.2	Weld	0	-	353
					M24	1	26	277
					M20	1	22	288
100x50	8	8.97	1.06	11.4	Weld	0	-	368
					M24	1	26	292
					M20	1	22	304
	6	6.84	1.07	8.71	Weld	0	-	280
					M24	1	26	221
					M20	1	22	231
80x60	7	7.36	1.28	9.38	Weld	0	-	293
					M20	1	22	226
					M16	1	18	237

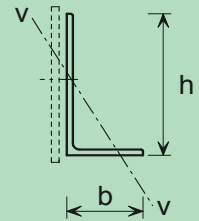
Advance® and UKA are trademarks of Tata Steel. A fuller description of the relationship between Angles and the Advance® range of sections manufactured by Tata Steel is given in note 12.

+ These sections are in addition to the range in BS EN 10056-1.

FOR EXPLANATION OF TABLES SEE NOTE 7.



UNEQUAL ANGLES  
Advance® UKA - Unequal Angles



Long leg attached

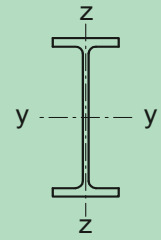
Section Designation		Mass per Metre kg/m	Radius of Gyration Axis v-v cm	Gross Area cm <sup>2</sup>	Bolt Size	Holes Deducted From Angle		Tension Resistance N <sub>u,Rd</sub> kN
h x b mm	t mm					No.	Diameter mm	
80x40	8	7.07	0.838	9.01	Weld	0	-	292
					M20	1	22	228
					M16	1	18	240
	6	5.41	0.845	6.89	Weld	0	-	222
					M20	1	22	173
					M16	1	18	182
75x50	8	7.39	1.07	9.41	Weld	0	-	298
					M20	1	22	226
					M16	1	18	239
	6	5.65	1.08	7.19	Weld	0	-	227
					M20	1	22	172
					M16	1	18	181
70x50	6	5.41	1.07	6.89	Weld	0	-	216
					M20	1	22	160
					M16	1	18	170
65x50	5	4.35	1.07	5.54	Weld	0	-	172
					M20	1	22	125
					M16	1	18	132
60x40	6	4.46	0.855	5.68	Weld	0	-	179
					M16	1	18	135
	5	3.76	0.860	4.79	Weld	0	-	151
					M16	1	18	114
60x30	5	3.36	0.633	4.28	Weld	0	-	138
					M16	1	18	105
50x30	5	2.96	0.639	3.78	Weld	0	-	121
					M12	1	14	93.0
45x30	4	2.25	0.640	2.87	Weld	0	-	90.5
					M12	1	14	67.4
40x25	4	1.93	0.534	2.46	Weld	0	-	78.2
					M12	1	14	55.9
40x20	4	1.77	0.417	2.26	Weld	0	-	73.2
					M12	1	14	52.3
30x20	4	1.46	0.421	1.86	Weld	0	-	59.0
					M12	1	14	36.7
	3	1.12	0.424	1.43	Weld	0	-	45.1
					M12	1	14	28.2

Advance® and UKA are trademarks of Tata Steel. A fuller description of the relationship between Angles and the Advance® range of sections manufactured by Tata Steel is given in note 12.

FOR EXPLANATION OF TABLES SEE NOTE 7.

UNIVERSAL BEAMS

Advance® UKB



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)											Second Moment of Area y-y axis $I_y$ $cm^4$
				2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	
1016x305x487 +  $M_{c,y,Rd} = 7770$ $M_{c,z,Rd} = 938$  Class = 1	1.00	7770	7240	6380	5650	5030	4520	4090	3740	3440	3190	2970	2780	2620	1020000
	1.13	7770	7600	6780	6070	5460	4940	4490	4120	3790	3510	3270	3060	2870	
	1.35	7770	7770	7350	6690	6100	5580	5120	4720	4370	4060	3790	3540	3330	
	1.50	7770	7770	7660	7040	6480	5970	5510	5100	4740	4420	4130	3880	3640	
	1.77	7770	7770	7770	7570	7050	6570	6130	5730	5360	5030	4730	4450	4200	
	2.00	7770	7770	7770	7770	7460	7010	6590	6200	5840	5500	5200	4910	4650	
1016x305x437 +  $M_{c,y,Rd} = 6960$ $M_{c,z,Rd} = 826$  Class = 1	1.00	6960	6430	5630	4950	4380	3910	3520	3200	2930	2700	2510	2340	2200	910000
	1.13	6960	6750	6000	5330	4760	4280	3870	3520	3230	2970	2760	2570	2400	
	1.35	6960	6960	6510	5890	5340	4850	4420	4050	3720	3440	3190	2980	2780	
	1.50	6960	6960	6790	6210	5680	5190	4770	4390	4050	3750	3490	3260	3050	
	1.77	6960	6960	6960	6690	6200	5740	5320	4940	4600	4290	4010	3760	3530	
	2.00	6960	6960	6960	6960	6570	6140	5740	5370	5020	4710	4420	4160	3920	
1016x305x393 +  $M_{c,y,Rd} = 6210$ $M_{c,z,Rd} = 726$  Class = 1	1.00	6210	5690	4950	4320	3800	3360	3010	2720	2480	2270	2100	1960	1830	808000
	1.13	6210	5980	5280	4670	4140	3690	3310	2990	2730	2500	2310	2140	2000	
	1.35	6210	6210	5750	5170	4650	4190	3800	3450	3150	2900	2670	2480	2310	
	1.50	6210	6210	6010	5460	4960	4500	4100	3750	3440	3170	2930	2720	2530	
	1.77	6210	6210	6210	5900	5430	5000	4600	4240	3920	3630	3370	3140	2930	
	2.00	6210	6210	6210	6200	5770	5360	4980	4620	4300	4000	3740	3490	3270	
1016x305x349 +  $M_{c,y,Rd} = 5720$ $M_{c,z,Rd} = 669$  Class = 1	1.00	5720	5190	4500	3900	3400	2980	2650	2380	2150	1970	1810	1680	1560	723000
	1.13	5720	5470	4800	4220	3710	3280	2920	2620	2370	2160	1980	1840	1710	
	1.35	5720	5720	5240	4680	4180	3740	3350	3030	2740	2500	2290	2110	1950	
	1.50	5720	5720	5480	4950	4460	4020	3630	3290	3000	2740	2510	2320	2140	
	1.77	5720	5720	5720	5360	4910	4480	4090	3740	3430	3150	2910	2690	2490	
	2.00	5720	5720	5720	5650	5230	4820	4440	4090	3770	3490	3230	3000	2790	
1016x305x314 +  $M_{c,y,Rd} = 5120$ $M_{c,z,Rd} = 591$  Class = 1	1.00	5120	4610	3980	3420	2960	2590	2280	2030	1830	1670	1530	1410	1310	644000
	1.13	5120	4860	4250	3710	3240	2840	2510	2240	2020	1830	1670	1550	1440	
	1.35	5120	5120	4640	4130	3660	3250	2900	2590	2340	2120	1930	1770	1640	
	1.50	5120	5120	4860	4370	3920	3500	3140	2830	2550	2320	2110	1940	1780	
	1.77	5120	5120	5120	4750	4320	3920	3550	3220	2930	2680	2450	2250	2080	
	2.00	5120	5120	5120	5010	4610	4220	3860	3530	3240	2970	2730	2520	2330	
2.50	5120	5120	5120	5120	5100	4770	4440	4120	3830	3550	3300	3080	2870		

Advance® and UKB are trademarks of Tata Steel. A fuller description of the relationship between Universal Beams (UB) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

+ These sections are in addition to the range of BS 4 sections.

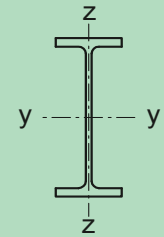
<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

UNIVERSAL BEAMS

Advance® UKB



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)											Second Moment of Area y-y axis $I_y$ $cm^4$	
				2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0		13.0
1016x305x272 +  $M_{c,y,Rd} = 4430$ $M_{c,z,Rd} = 507$  Class = 1	1.00	4430	3970	3400	2910	2500	2170	1900	1680	1500	1360	1240	1140	1050	554000	
	1.13	4430	4180	3640	3160	2740	2380	2090	1850	1650	1480	1360	1250	1160		
	1.35	4430	4430	3980	3520	3100	2730	2410	2140	1910	1720	1550	1420	1320		
	1.50	4430	4430	4170	3740	3320	2950	2620	2340	2090	1880	1700	1550	1430		
	1.77	4430	4430	4430	4060	3670	3310	2970	2670	2410	2180	1980	1800	1650		
	2.00	4430	4430	4430	4290	3930	3570	3240	2940	2670	2430	2210	2020	1860		
1016x305x249 +  $M_{c,y,Rd} = 3920$ $M_{c,z,Rd} = 429$  Class = 1	1.00	3920	3460	2940	2500	2130	1820	1580	1390	1240	1110	1010	924	851	481000	
	1.13	3920	3650	3160	2710	2330	2010	1750	1530	1350	1220	1110	1020	938		
	1.35	3920	3910	3460	3040	2650	2310	2020	1770	1570	1400	1260	1160	1070		
	1.50	3920	3920	3630	3230	2840	2500	2200	1940	1720	1530	1370	1250	1160		
	1.77	3920	3920	3890	3520	3160	2810	2500	2230	1990	1780	1600	1440	1310		
	2.00	3920	3920	3920	3730	3380	3050	2740	2460	2210	1990	1800	1630	1480		
1016x305x222 +  $M_{c,y,Rd} = 3380$ $M_{c,z,Rd} = 352$  Class = 1	1.00	3380	2930	2470	2080	1750	1490	1280	1120	989	884	798	726	667	408000	
	1.13	3380	3100	2660	2260	1920	1640	1410	1230	1080	969	877	800	736		
	1.35	3380	3330	2930	2540	2190	1890	1630	1420	1240	1100	1000	918	846		
	1.50	3380	3380	3080	2710	2360	2050	1780	1560	1360	1200	1080	993	917		
	1.77	3380	3380	3310	2970	2630	2320	2040	1800	1580	1400	1250	1120	1040		
	2.00	3380	3380	3380	3150	2830	2530	2250	1990	1770	1570	1400	1260	1130		
914x419x388  $M_{c,y,Rd} = 6090$ $M_{c,z,Rd} = 1150$  Class = 1	1.00	6090	6090	5860	5470	5100	4720	4360	4020	3710	3430	3180	2950	2760	720000	
	1.13	6090	6090	6090	5740	5400	5050	4700	4370	4050	3760	3490	3250	3040		
	1.35	6090	6090	6090	6090	5810	5500	5190	4870	4570	4280	4000	3750	3510		
	1.50	6090	6090	6090	6090	6040	5760	5470	5170	4880	4590	4320	4060	3820		
	1.77	6090	6090	6090	6090	6090	6090	6090	5890	5630	5360	5090	4830	4580		4340
	2.00	6090	6090	6090	6090	6090	6090	6090	6090	5940	5700	5460	5210	4970		4730
914x419x343  $M_{c,y,Rd} = 5340$ $M_{c,z,Rd} = 997$  Class = 1	1.00	5340	5340	5110	4760	4420	4070	3740	3430	3140	2890	2660	2460	2280	626000	
	1.13	5340	5340	5310	5000	4680	4360	4040	3730	3440	3170	2930	2710	2510		
	1.35	5340	5340	5340	5320	5050	4770	4470	4180	3890	3620	3360	3130	2910		
	1.50	5340	5340	5340	5340	5260	5000	4720	4440	4170	3900	3640	3400	3180		
	1.77	5340	5340	5340	5340	5340	5330	5100	4850	4600	4340	4090	3850	3620		
	2.00	5340	5340	5340	5340	5340	5340	5340	5340	5140	4900	4670	4430	4200		3970
2.50	5340	5340	5340	5340	5340	5340	5340	5340	5340	5340	5230	5030	4820	4610		

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+ These sections are in addition to the range of BS 4 sections.

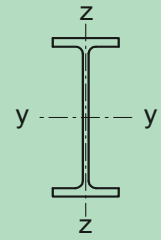
<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

UNIVERSAL BEAMS

Advance® UKB



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)											Second Moment of Area y-y axis $I_y$ $cm^4$		
				2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0		13.0	14.0
914x305x289  $M_{c,y,Rd} = 4340$ $M_{c,z,Rd} = 552$  Class = 1			1.00	4340	4080	3680	3280	2900	2560	2260	2010	1810	1640	1490	1370	1270	504000
			1.13	4340	4250	3890	3510	3140	2800	2490	2220	1990	1800	1640	1510	1400	
			1.35	4340	4340	4170	3840	3500	3160	2850	2560	2310	2090	1900	1730	1600	
			1.50	4340	4340	4330	4030	3710	3390	3070	2780	2520	2290	2090	1910	1750	
			1.77	4340	4340	4340	4310	4030	3740	3440	3150	2880	2640	2420	2220	2040	
			2.00	4340	4340	4340	4340	4250	3990	3710	3430	3170	2920	2690	2480	2290	
914x305x253  $M_{c,y,Rd} = 3770$ $M_{c,z,Rd} = 473$  Class = 1			1.00	3770	3530	3170	2810	2460	2150	1890	1670	1490	1340	1210	1110	1020	436000
			1.13	3770	3680	3350	3010	2670	2360	2080	1840	1630	1460	1330	1220	1130	
			1.35	3770	3770	3610	3310	2990	2680	2390	2120	1900	1700	1530	1400	1300	
			1.50	3770	3770	3750	3470	3180	2870	2580	2310	2080	1870	1680	1530	1400	
			1.77	3770	3770	3770	3720	3460	3180	2900	2630	2380	2160	1960	1780	1630	
			2.00	3770	3770	3770	3770	3660	3400	3140	2880	2630	2400	2190	2000	1830	
914x305x224  $M_{c,y,Rd} = 3290$ $M_{c,z,Rd} = 401$  Class = 1			1.00	3290	3050	2730	2400	2080	1800	1570	1370	1220	1090	980	891	817	376000
			1.13	3290	3190	2890	2580	2270	1980	1730	1510	1330	1190	1080	984	904	
			1.35	3290	3290	3120	2840	2550	2260	1990	1760	1550	1380	1240	1130	1040	
			1.50	3290	3290	3240	2990	2710	2430	2160	1920	1700	1510	1350	1220	1130	
			1.77	3290	3290	3290	3210	2960	2700	2440	2190	1960	1760	1580	1420	1280	
			2.00	3290	3290	3290	3290	3140	2900	2650	2400	2170	1960	1770	1600	1450	
914x305x201  $M_{c,y,Rd} = 2880$ $M_{c,z,Rd} = 339$  Class = 1			1.00	2880	2650	2350	2050	1770	1520	1310	1140	999	887	796	721	654	325000
			1.13	2880	2770	2500	2210	1930	1670	1440	1250	1090	976	878	797	728	
			1.35	2880	2880	2700	2440	2170	1910	1660	1450	1270	1120	1010	919	842	
			1.50	2880	2880	2820	2580	2320	2060	1810	1590	1390	1230	1090	997	916	
			1.77	2880	2880	2880	2780	2550	2300	2050	1820	1620	1430	1270	1130	1040	
			2.00	2880	2880	2880	2880	2710	2480	2240	2010	1800	1600	1430	1280	1150	
838x292x226  $M_{c,y,Rd} = 3160$ $M_{c,z,Rd} = 418$  Class = 1			1.00	3160	2930	2620	2310	2020	1760	1540	1360	1220	1100	996	912	841	340000
			1.13	3160	3060	2780	2480	2200	1930	1700	1500	1340	1200	1090	1000	928	
			1.35	3160	3160	2990	2730	2460	2200	1960	1740	1550	1390	1260	1150	1070	
			1.50	3160	3160	3110	2880	2620	2360	2120	1900	1700	1530	1380	1250	1160	
			1.77	3160	3160	3160	3090	2860	2620	2390	2160	1960	1770	1610	1460	1340	
			2.00	3160	3160	3160	3160	3030	2810	2590	2370	2160	1970	1800	1640	1510	
Class = 1			2.50	3160	3160	3160	3160	3160	3140	2950	2750	2550	2360	2190	2020	1870	

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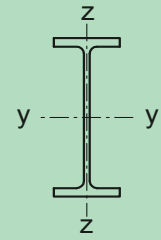
<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

UNIVERSAL BEAMS

Advance® UKB



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)											Second Moment of Area y-y axis $I_y$ $cm^4$		
				2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0		13.0	14.0
838x292x194  $M_{c,y,Rd} = 2640$ $M_{c,z,Rd} = 336$  Class = 1			1.00	2640	2420	2150	1870	1620	1390	1200	1050	930	831	749	681	624	279000
			1.13	2640	2530	2280	2020	1760	1530	1330	1160	1020	913	826	753	691	
			1.35	2640	2640	2470	2230	1990	1750	1530	1340	1180	1050	947	867	798	
			1.50	2640	2640	2570	2350	2120	1890	1670	1470	1300	1150	1030	940	867	
			1.77	2640	2640	2640	2540	2330	2110	1890	1690	1500	1340	1200	1080	984	
			2.00	2640	2640	2640	2640	2470	2270	2060	1860	1670	1500	1350	1220	1100	
838x292x176  $M_{c,y,Rd} = 2350$ $M_{c,z,Rd} = 290$  Class = 1			1.00	2350	2140	1890	1630	1400	1200	1030	892	784	696	625	566	510	246000
			1.13	2350	2240	2010	1770	1530	1310	1130	980	860	767	690	626	573	
			1.35	2350	2350	2180	1960	1730	1510	1310	1140	993	878	793	723	663	
			1.50	2350	2350	2270	2070	1850	1630	1430	1250	1090	959	860	785	721	
			1.77	2350	2350	2350	2230	2040	1830	1630	1440	1270	1120	993	890	821	
			2.00	2350	2350	2350	2350	2170	1980	1780	1590	1410	1260	1120	1000	899	
762x267x197  $M_{c,y,Rd} = 2470$ $M_{c,z,Rd} = 331$  Class = 1			1.00	2470	2220	1960	1700	1470	1280	1110	985	880	794	723	664	614	240000
			1.13	2470	2330	2090	1840	1610	1400	1230	1080	964	873	797	733	679	
			1.35	2470	2470	2270	2040	1820	1610	1420	1260	1120	1000	913	843	783	
			1.50	2470	2470	2370	2160	1950	1740	1540	1380	1230	1100	995	913	850	
			1.77	2470	2470	2470	2340	2140	1940	1750	1580	1420	1280	1160	1060	964	
			2.00	2470	2470	2470	2460	2280	2100	1910	1740	1580	1430	1310	1190	1090	
762x267x173  $M_{c,y,Rd} = 2140$ $M_{c,z,Rd} = 278$  Class = 1			1.00	2140	1910	1670	1430	1220	1050	908	795	705	632	572	523	478	205000
			1.13	2140	2000	1780	1550	1340	1160	1000	873	774	696	632	579	533	
			1.35	2140	2130	1940	1730	1520	1330	1160	1010	893	798	727	668	617	
			1.50	2140	2140	2030	1840	1630	1440	1260	1110	981	871	787	725	671	
			1.77	2140	2140	2140	1990	1810	1620	1440	1280	1140	1020	911	821	763	
			2.00	2140	2140	2140	2100	1930	1760	1580	1420	1270	1140	1030	926	839	
762x267x147  $M_{c,y,Rd} = 1780$ $M_{c,z,Rd} = 223$  Class = 1			1.00	1770	1570	1360	1150	971	821	702	609	535	475	427	383	345	169000
			1.13	1780	1650	1450	1250	1070	905	773	668	589	525	473	430	390	
			1.35	1780	1760	1590	1400	1220	1040	897	773	674	604	546	498	458	
			1.50	1780	1780	1660	1490	1310	1140	981	849	738	654	593	542	499	
			1.77	1780	1780	1780	1620	1460	1290	1130	985	862	756	673	617	569	
			2.00	1780	1780	1780	1720	1560	1400	1240	1100	966	853	755	676	626	
Class = 1			2.50	1780	1780	1780	1780	1750	1610	1460	1320	1180	1060	947	850	764	

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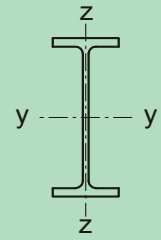
<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

UNIVERSAL BEAMS

Advance® UKB



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)											Second Moment of Area y-y axis $I_y$ $cm^4$		
				2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0		13.0	14.0
762x267x134  $M_{c,y,Rd} = 1650$ $M_{c,z,Rd} = 202$  Class = 1			1.00	1630	1430	1230	1030	861	722	612	527	461	408	361	321	289	151000
			1.13	1650	1510	1320	1130	947	795	672	580	508	451	404	363	326	
			1.35	1650	1620	1450	1270	1080	920	781	666	583	520	468	425	389	
			1.50	1650	1650	1520	1350	1170	1000	856	732	631	564	509	463	425	
			1.77	1650	1650	1630	1480	1310	1140	988	853	737	640	579	529	486	
			2.00	1650	1650	1650	1570	1410	1250	1090	953	829	723	635	581	535	
686x254x170  $M_{c,y,Rd} = 1940$ $M_{c,z,Rd} = 280$  Class = 1			1.00	1940	1730	1510	1310	1130	976	854	755	676	611	558	513	475	170000
			1.13	1940	1810	1620	1420	1230	1070	941	831	741	672	615	567	526	
			1.35	1940	1930	1760	1580	1400	1230	1090	965	860	771	705	652	606	
			1.50	1940	1940	1840	1670	1500	1330	1190	1060	944	848	766	707	658	
			1.77	1940	1940	1940	1810	1660	1500	1350	1210	1090	988	896	815	746	
			2.00	1940	1940	1940	1910	1770	1620	1480	1340	1220	1110	1010	919	842	
686x254x152  $M_{c,y,Rd} = 1730$ $M_{c,z,Rd} = 245$  Class = 1			1.00	1720	1520	1330	1140	971	833	723	635	565	508	462	423	388	150000
			1.13	1730	1600	1420	1230	1060	918	796	697	621	560	510	468	432	
			1.35	1730	1710	1550	1380	1210	1060	923	810	715	641	586	540	500	
			1.50	1730	1730	1620	1460	1300	1150	1010	888	786	700	635	586	544	
			1.77	1730	1730	1730	1590	1440	1290	1150	1030	914	818	734	664	618	
			2.00	1730	1730	1730	1680	1540	1400	1260	1140	1020	918	828	749	681	
686x254x140  $M_{c,y,Rd} = 1570$ $M_{c,z,Rd} = 220$  Class = 1			1.00	1560	1380	1200	1020	864	736	635	555	491	440	398	362	329	136000
			1.13	1570	1450	1280	1110	948	811	698	608	540	485	440	403	371	
			1.35	1570	1550	1400	1240	1080	935	810	706	619	557	507	465	430	
			1.50	1570	1570	1470	1320	1160	1020	886	775	680	603	550	506	468	
			1.77	1570	1570	1570	1440	1290	1150	1020	897	793	704	627	574	533	
			2.00	1570	1570	1570	1520	1390	1250	1120	996	887	792	709	637	585	
686x254x125  $M_{c,y,Rd} = 1380$ $M_{c,z,Rd} = 187$  Class = 1			1.00	1360	1200	1030	868	728	614	525	455	400	356	320	286	259	118000
			1.13	1380	1260	1100	945	800	677	577	500	441	394	355	324	292	
			1.35	1380	1350	1210	1060	915	782	670	576	506	454	411	375	345	
			1.50	1380	1380	1270	1130	987	852	734	633	550	492	446	408	376	
			1.77	1380	1380	1360	1240	1100	968	845	736	643	564	507	465	430	
			2.00	1380	1380	1380	1310	1190	1060	934	821	722	637	563	510	473	
Class = 1			2.50	1380	1380	1380	1380	1340	1220	1100	991	886	792	709	635	572	

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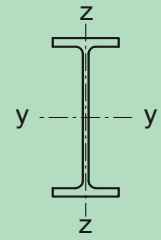
<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

UNIVERSAL BEAMS

Advance® UKB



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)											Second Moment of Area y-y axis $I_y$ $cm^4$
				2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	
610x305x238  $M_{c,y,Rd} = 2580$ $M_{c,z,Rd} = 543$  Class = 1	1.00	2580	2490	2290	2090	1910	1740	1590	1450	1340	1240	1150	1070	1010	209000
	1.13	2580	2580	2410	2220	2050	1880	1730	1590	1470	1360	1270	1180	1110	
	1.35	2580	2580	2560	2410	2250	2100	1950	1810	1680	1570	1460	1370	1280	
	1.50	2580	2580	2580	2510	2370	2220	2080	1950	1820	1700	1590	1500	1410	
	1.77	2580	2580	2580	2580	2540	2410	2280	2160	2040	1920	1810	1710	1620	
	2.00	2580	2580	2580	2580	2580	2540	2430	2310	2200	2090	1980	1880	1780	
2.50	2580	2580	2580	2580	2580	2580	2580	2580	2570	2480	2380	2290	2190	2100	
610x305x179  $M_{c,y,Rd} = 1910$ $M_{c,z,Rd} = 395$  Class = 1	1.00	1910	1830	1660	1500	1350	1200	1080	968	876	798	733	677	628	153000
	1.13	1910	1900	1750	1600	1450	1310	1180	1060	965	879	805	741	690	
	1.35	1910	1910	1880	1740	1610	1470	1340	1220	1110	1020	935	861	796	
	1.50	1910	1910	1910	1820	1700	1570	1440	1320	1210	1110	1020	945	874	
	1.77	1910	1910	1910	1910	1830	1720	1600	1480	1370	1270	1180	1090	1020	
	2.00	1910	1910	1910	1910	1910	1820	1710	1600	1500	1400	1300	1220	1130	
2.50	1910	1910	1910	1910	1910	1910	1910	1910	1820	1720	1630	1540	1450	1370	
610x305x149  $M_{c,y,Rd} = 1580$ $M_{c,z,Rd} = 323$  Class = 1	1.00	1580	1510	1360	1220	1080	957	847	753	675	610	555	509	470	126000
	1.13	1580	1570	1440	1310	1170	1050	930	830	743	670	608	559	517	
	1.35	1580	1580	1540	1430	1300	1180	1060	956	861	778	706	643	592	
	1.50	1580	1580	1580	1490	1380	1260	1150	1040	940	852	775	707	647	
	1.77	1580	1580	1580	1580	1490	1390	1280	1170	1070	981	898	823	756	
	2.00	1580	1580	1580	1580	1570	1480	1380	1270	1180	1080	998	919	848	
2.50	1580	1580	1580	1580	1580	1580	1580	1540	1460	1370	1280	1190	1110	1040	
610x229x140  $M_{c,y,Rd} = 1430$ $M_{c,z,Rd} = 211$  Class = 1	1.00	1390	1220	1050	896	764	659	575	509	457	414	378	349	321	112000
	1.13	1430	1290	1130	976	840	726	633	558	502	456	418	386	358	
	1.35	1430	1380	1240	1100	959	838	735	649	577	523	481	445	414	
	1.50	1430	1430	1310	1170	1030	911	803	712	634	568	521	483	451	
	1.77	1430	1430	1400	1280	1150	1030	921	824	738	665	601	548	512	
	2.00	1430	1430	1430	1360	1240	1120	1010	914	825	747	678	617	564	
2.50	1430	1430	1430	1430	1390	1290	1190	1090	1000	917	841	773	712		
610x229x125  $M_{c,y,Rd} = 1270$ $M_{c,z,Rd} = 185$  Class = 1	1.00	1230	1080	919	775	654	558	484	425	379	342	311	284	259	98600
	1.13	1270	1140	989	845	719	615	531	467	417	377	344	317	292	
	1.35	1270	1220	1090	953	824	712	617	539	478	434	397	366	340	
	1.50	1270	1270	1150	1020	890	775	676	593	523	470	431	398	370	
	1.77	1270	1270	1230	1120	997	882	779	688	610	544	488	453	422	
	2.00	1270	1270	1270	1190	1080	965	860	767	685	613	552	498	463	
2.50	1270	1270	1270	1270	1220	1120	1020	924	837	759	690	628	574		

Advance® and UKB are trademarks of Tata Steel. A fuller description of the relationship between Universal Beams (UB) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

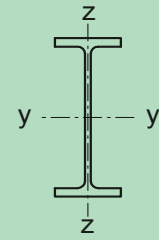
<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

UNIVERSAL BEAMS

Advance® UKB



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)											Second Moment of Area y-y axis $I_y$ $cm^4$		
				2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0		13.0	14.0
610x229x113  $M_{c,y,Rd} = 1130$ $M_{c,z,Rd} = 162$  Class = 1			1.00	1100	952	807	673	563	476	409	357	317	284	256	231	210	87300
			1.13	1130	1010	869	736	619	524	449	393	349	314	285	261	237	
			1.35	1130	1080	960	832	712	608	521	451	401	362	330	303	280	
			1.50	1130	1130	1010	890	771	663	572	496	434	393	359	330	306	
			1.77	1130	1130	1090	981	866	758	661	577	507	447	408	376	349	
			2.00	1130	1130	1130	1050	938	832	733	646	570	505	450	413	384	
610x229x101  $M_{c,y,Rd} = 1020$ $M_{c,z,Rd} = 142$  Class = 1			1.00	980	843	705	579	477	399	340	294	259	229	203	182	165	75800
			1.13	1020	895	762	635	526	439	373	324	286	256	230	206	187	
			1.35	1020	966	846	721	607	510	431	372	330	296	268	245	223	
			1.50	1020	1000	894	775	659	558	473	404	358	322	292	268	247	
			1.77	1020	1020	968	858	746	641	550	472	408	366	333	306	283	
			2.00	1020	1020	1020	919	812	707	613	531	461	403	366	337	312	
610x178x100 +  $M_{c,y,Rd} = 961$ $M_{c,z,Rd} = 102$  Class = 1			1.00	803	611	470	372	305	258	223	196	175	159	145	134	124	72500
			1.13	852	664	517	410	334	282	245	216	194	176	161	149	138	
			1.35	921	743	592	475	387	321	280	248	223	203	186	172	160	
			1.50	959	790	640	518	424	352	303	269	242	221	203	188	175	
			1.77	961	862	717	592	490	410	347	304	275	251	231	214	200	
			2.00	961	913	775	650	545	459	391	336	301	275	254	236	220	
610x178x92 +  $M_{c,y,Rd} = 891$ $M_{c,z,Rd} = 91.6$  Class = 1			1.00	728	545	413	323	262	220	189	165	147	133	121	111	103	64600
			1.13	774	594	455	355	287	241	208	183	163	147	134	124	115	
			1.35	839	667	523	412	330	275	238	210	188	170	156	144	133	
			1.50	876	711	566	450	362	297	258	228	205	185	170	157	146	
			1.77	891	780	638	517	420	346	291	259	233	212	194	179	167	
			2.00	891	828	692	570	469	389	325	283	255	233	214	198	184	
610x178x82 +  $M_{c,y,Rd} = 779$ $M_{c,z,Rd} = 77.4$  Class = 1			1.00	627	464	347	268	216	179	153	133	118	106	96.0	87.9	80.2	55900
			1.13	668	506	382	295	236	197	168	147	130	117	107	97.7	90.3	
			1.35	726	570	440	342	270	225	194	170	151	136	124	114	105	
			1.50	758	609	478	374	296	243	210	184	164	148	135	124	115	
			1.77	779	669	540	430	344	278	238	209	187	169	155	143	132	
			2.00	779	713	587	476	385	314	259	230	206	187	171	157	146	
2.50	779	779	674	565	469	390	325	274	243	221	203	188	175				

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+ These sections are in addition to the range of BS 4 sections.

<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8

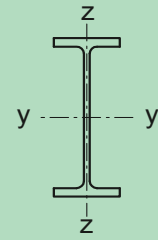
Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.



UNIVERSAL BEAMS

Advance® UKB



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)											Second Moment of Area y-y axis $I_y$ $cm^4$	
				2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0		13.0
533x312x272 +  $M_{c,y,Rd} = 2710$ $M_{c,z,Rd} = 685$  Class = 1	1.00	2710	2680	2550	2410	2280	2150	2030	1910	1790	1690	1590	1510	1430	199000	
	1.13	2710	2710	2650	2530	2420	2300	2180	2060	1950	1850	1750	1660	1570		
	1.35	2710	2710	2710	2700	2600	2500	2390	2290	2190	2090	1990	1900	1810		
	1.50	2710	2710	2710	2710	2700	2610	2520	2420	2330	2230	2140	2050	1960		
	1.77	2710	2710	2710	2710	2710	2710	2700	2620	2530	2450	2370	2280	2200		
	2.00	2710	2710	2710	2710	2710	2710	2710	2710	2710	2680	2600	2530	2450		2380
2.50	2710	2710	2710	2710	2710	2710	2710	2710	2710	2710	2710	2710	2710	2680		
533x312x219 +  $M_{c,y,Rd} = 2110$ $M_{c,z,Rd} = 522$  Class = 1	1.00	2110	2070	1950	1830	1710	1590	1470	1360	1260	1180	1100	1020	962	151000	
	1.13	2110	2110	2040	1930	1820	1710	1600	1490	1390	1290	1210	1130	1060		
	1.35	2110	2110	2110	2070	1970	1870	1770	1670	1570	1480	1390	1310	1230		
	1.50	2110	2110	2110	2110	2060	1970	1870	1780	1690	1590	1510	1420	1340		
	1.77	2110	2110	2110	2110	2110	2110	2110	2030	1950	1860	1780	1690	1610		1530
	2.00	2110	2110	2110	2110	2110	2110	2110	2110	2060	1990	1910	1830	1750		1680
2.50	2110	2110	2110	2110	2110	2110	2110	2110	2110	2110	2110	2070	2010	1940		
533x312x182 +  $M_{c,y,Rd} = 1740$ $M_{c,z,Rd} = 427$  Class = 1	1.00	1740	1700	1600	1490	1370	1260	1150	1050	965	887	819	760	709	123000	
	1.13	1740	1740	1670	1570	1470	1360	1250	1150	1060	978	904	839	780		
	1.35	1740	1740	1740	1680	1600	1500	1400	1310	1210	1130	1050	975	909		
	1.50	1740	1740	1740	1740	1670	1580	1490	1400	1310	1220	1140	1070	997		
	1.77	1740	1740	1740	1740	1740	1700	1630	1540	1460	1380	1300	1220	1150		
	2.00	1740	1740	1740	1740	1740	1740	1720	1650	1570	1490	1420	1340	1270		
2.50	1740	1740	1740	1740	1740	1740	1740	1740	1740	1740	1690	1630	1560	1500		
533x312x150 +  $M_{c,y,Rd} = 1430$ $M_{c,z,Rd} = 348$  Class = 1	1.00	1430	1390	1300	1210	1100	1000	903	815	737	670	613	565	520	101000	
	1.13	1430	1430	1360	1280	1180	1080	986	895	813	740	676	621	576		
	1.35	1430	1430	1430	1370	1290	1200	1110	1020	936	858	787	724	668		
	1.50	1430	1430	1430	1430	1350	1270	1190	1100	1010	935	862	795	735		
	1.77	1430	1430	1430	1430	1430	1380	1300	1220	1140	1060	989	919	855		
	2.00	1430	1430	1430	1430	1430	1430	1380	1310	1240	1160	1090	1020	952		
2.50	1430	1430	1430	1430	1430	1430	1430	1430	1430	1400	1340	1270	1210	1140		
533x210x138 +  $M_{c,y,Rd} = 1250$ $M_{c,z,Rd} = 196$  Class = 1	1.00	1200	1040	899	771	665	581	514	461	417	382	352	326	304	86100	
	1.13	1240	1110	968	840	731	640	566	506	458	420	388	360	337		
	1.35	1250	1190	1070	946	835	739	657	588	529	480	445	415	388		
	1.50	1250	1240	1120	1010	900	802	717	644	582	528	481	450	422		
	1.77	1250	1250	1210	1110	1000	908	821	744	676	616	563	517	478		
	2.00	1250	1250	1250	1180	1080	988	902	824	753	690	634	584	539		
2.50	1250	1250	1250	1250	1210	1130	1050	978	907	841	780	725	675			

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+ These sections are in addition to the range of BS 4 sections.

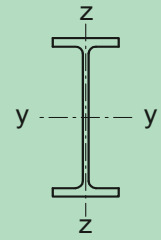
<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

UNIVERSAL BEAMS

Advance® UKB



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)											Second Moment of Area y-y axis $I_y$ $cm^4$		
				2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0		13.0	14.0
533x210x122	$M_{c,y,Rd} = 1100$ $M_{c,z,Rd} = 173$	Class = 1	1.00	1060	916	781	662	565	489	429	382	344	313	288	266	246	76000
			1.13	1100	971	842	723	621	538	472	419	379	346	318	294	274	
			1.35	1100	1050	931	817	712	623	548	486	434	396	366	340	317	
			1.50	1100	1090	982	873	770	678	600	533	477	429	397	369	345	
			1.77	1100	1100	1060	961	863	771	690	618	556	502	456	418	392	
			2.00	1100	1100	1100	1020	932	843	761	687	622	565	515	470	431	
533x210x109	$M_{c,y,Rd} = 976$ $M_{c,z,Rd} = 150$	Class = 1	1.00	930	801	676	566	478	409	356	315	282	256	234	213	196	66800
			1.13	967	851	731	620	526	451	391	346	311	283	259	239	221	
			1.35	976	919	810	703	605	522	454	398	357	325	299	277	258	
			1.50	976	956	857	753	656	570	498	438	388	353	325	301	281	
			1.77	976	976	926	832	738	652	575	510	454	406	368	343	320	
			2.00	976	976	974	889	800	715	638	569	510	458	413	375	352	
533x210x101	$M_{c,y,Rd} = 901$ $M_{c,z,Rd} = 138$	Class = 1	1.00	856	735	617	513	429	366	317	279	249	225	204	185	169	61500
			1.13	891	781	667	562	473	403	347	307	275	249	227	209	191	
			1.35	901	845	741	638	545	467	403	351	316	287	263	243	226	
			1.50	901	880	784	685	592	510	442	386	342	311	286	265	246	
			1.77	901	901	849	759	668	585	512	450	398	354	325	301	281	
			2.00	901	901	894	812	726	644	569	504	448	400	359	331	309	
533x210x92	$M_{c,y,Rd} = 838$ $M_{c,z,Rd} = 126$	Class = 1	1.00	790	672	557	456	378	319	274	240	213	190	170	154	140	55200
			1.13	823	715	604	501	416	350	301	264	235	212	192	174	159	
			1.35	838	776	673	572	481	407	347	303	271	245	224	206	190	
			1.50	838	809	714	615	524	445	381	329	294	266	244	225	208	
			1.77	838	838	776	685	595	513	443	384	336	303	278	257	239	
			2.00	838	838	820	736	649	567	494	432	379	335	305	282	263	
533x210x82	$M_{c,y,Rd} = 731$ $M_{c,z,Rd} = 107$	Class = 1	1.00	684	577	472	381	312	260	222	193	170	149	132	119	109	47500
			1.13	713	615	513	419	344	285	244	213	188	168	150	135	123	
			1.35	731	669	574	480	398	331	279	245	217	196	178	161	147	
			1.50	731	699	610	518	434	363	306	265	236	213	194	178	163	
			1.77	731	731	666	580	496	421	357	306	268	243	222	204	189	
			2.00	731	731	705	625	543	467	401	345	298	267	244	225	209	
Class = 1			2.50	731	731	731	704	631	558	489	428	375	330	292	267	249	

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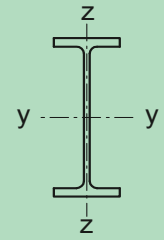
<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

UNIVERSAL BEAMS

Advance® UKB



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)											Second Moment of Area y-y axis $I_y$ cm <sup>4</sup>		
				2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0		13.0	14.0
533x165x85 +  $M_{c,y,Rd} = 726$ $M_{c,z,Rd} = 83.8$  Class = 1			1.00	589	444	341	271	224	190	165	146	131	119	109	101	94.2	48500
			1.13	627	484	375	298	244	208	182	161	145	132	121	112	104	
			1.35	681	544	431	346	283	237	208	185	167	153	140	130	121	
			1.50	710	580	467	378	310	259	225	201	182	166	153	142	132	
			1.77	726	635	525	432	359	301	256	227	206	189	174	162	151	
			2.00	726	675	569	476	399	338	289	249	225	207	191	178	167	
2.50	726	726	649	560	481	415	359	313	275	244	226	211	198				
533x165x74 +  $M_{c,y,Rd} = 642$ $M_{c,z,Rd} = 71.0$  Class = 1			1.00	506	372	280	219	178	149	129	113	101	91.4	83.5	76.9	71.1	41100
			1.13	540	407	308	240	195	164	142	125	112	101	92.6	85.4	79.3	
			1.35	588	460	355	278	223	188	163	144	129	117	108	99.3	92.3	
			1.50	615	492	386	305	244	203	177	157	141	128	117	108	101	
			1.77	642	542	437	351	284	233	200	178	160	146	134	124	116	
			2.00	642	578	476	388	318	262	219	195	176	161	148	137	128	
2.50	642	640	549	462	387	326	276	235	208	190	176	163	153				
533x165x66 +  $M_{c,y,Rd} = 554$ $M_{c,z,Rd} = 58.9$  Class = 1			1.00	428	311	230	177	143	119	102	88.7	78.8	70.9	64.6	58.8	53.8	35000
			1.13	458	340	253	194	157	131	112	98.2	87.3	78.7	71.7	65.9	60.8	
			1.35	501	386	293	225	178	150	129	113	101	91.4	83.4	76.8	71.2	
			1.50	525	413	319	247	194	162	140	123	110	99.7	91.1	83.9	77.9	
			1.77	554	457	362	285	226	183	159	141	126	114	104	96.4	89.5	
			2.00	554	489	396	317	254	205	174	154	139	126	115	107	99.0	
2.50	554	544	459	379	312	257	213	182	164	150	138	127	119				

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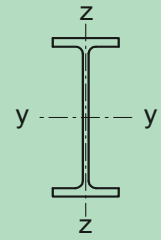
<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

UNIVERSAL BEAMS

Advance® UKB



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm)											Second Moment of Area y-y axis $I_y$ cm <sup>4</sup>		
				for													
				Length between lateral restraints (m)													
				2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	
457x191x161 +  $M_{c,y,Rd} = 1300$ $M_{c,z,Rd} = 232$  Class = 1	1.00	1250	1110	985	876	785	708	644	590	544	505	471	441	415	79800		
	1.13	1300	1170	1060	950	857	777	709	650	599	555	516	484	456			
	1.35	1300	1260	1160	1060	968	887	815	751	694	644	600	560	524			
	1.50	1300	1300	1210	1120	1030	955	882	817	758	705	658	615	576			
	1.77	1300	1300	1300	1220	1140	1060	993	927	867	811	760	713	671			
	2.00	1300	1300	1300	1280	1210	1140	1080	1010	952	896	843	795	750			
2.50	1300	1300	1300	1300	1300	1280	1220	1170	1110	1060	1010	956	909				
457x191x133 +  $M_{c,y,Rd} = 1060$ $M_{c,z,Rd} = 185$  Class = 1	1.00	1010	880	765	667	586	521	468	424	388	358	332	310	291	63800		
	1.13	1050	933	824	726	643	573	515	467	426	393	365	341	321			
	1.35	1060	1010	908	816	732	659	596	542	495	454	419	391	368			
	1.50	1060	1050	956	869	788	714	650	593	543	499	460	426	399			
	1.77	1060	1060	1030	951	875	804	739	680	627	579	537	498	464			
	2.00	1060	1060	1060	1010	939	871	808	749	695	645	600	559	522			
2.50	1060	1060	1060	1060	1050	991	934	879	826	776	730	686	645				
457x191x106 +  $M_{c,y,Rd} = 824$ $M_{c,z,Rd} = 140$  Class = 1	1.00	774	665	564	478	411	358	317	284	257	235	217	201	187	48900		
	1.13	807	707	610	524	452	394	348	311	283	259	240	223	208			
	1.35	824	766	678	594	519	457	404	361	324	298	276	257	241			
	1.50	824	799	717	636	562	498	443	396	356	323	299	279	262			
	1.77	824	824	777	703	632	567	509	459	415	377	344	316	297			
	2.00	824	824	818	751	684	621	563	511	465	424	388	357	328			
2.50	824	824	824	824	776	719	665	613	565	522	482	446	414				
457x191x98  $M_{c,y,Rd} = 770$ $M_{c,z,Rd} = 131$  Class = 1	1.00	721	618	521	439	375	325	286	256	231	211	194	180	165	45700		
	1.13	753	658	564	481	412	358	314	281	254	233	215	199	186			
	1.35	770	713	628	546	475	415	365	324	291	267	247	230	215			
	1.50	770	744	665	586	515	452	400	356	319	290	268	250	234			
	1.77	770	770	721	649	580	517	462	414	372	337	306	284	267			
	2.00	770	770	760	695	629	567	511	461	417	379	345	316	292			
2.50	770	770	770	770	716	660	606	556	510	469	431	397	367				

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+ These sections are in addition to the range of BS 4 sections.

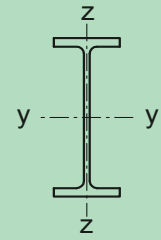
<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

UNIVERSAL BEAMS

Advance® UKB



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)											Second Moment of Area y-y axis $I_y$ $cm^4$
				2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	
457x191x89  $M_{c,y,Rd} = 695$ $M_{c,z,Rd} = 117$  Class = 1	1.00	648	551	460	384	324	279	244	217	195	177	163	148	136	41000
	1.13	676	587	499	421	357	307	267	238	215	196	180	167	154	
	1.35	695	638	557	479	412	356	310	273	247	226	208	193	180	
	1.50	695	667	591	516	447	389	341	300	267	245	226	210	197	
	1.77	695	695	643	573	506	446	394	350	312	280	257	240	224	
	2.00	695	695	679	615	551	492	438	392	351	317	286	263	247	
2.50	695	695	695	687	632	577	524	476	433	394	360	329	302		
457x191x82  $M_{c,y,Rd} = 650$ $M_{c,z,Rd} = 108$  Class = 1	1.00	601	506	416	342	285	243	211	187	167	152	136	124	114	37100
	1.13	628	540	453	376	315	267	232	206	185	168	154	140	129	
	1.35	650	589	507	430	364	310	267	236	213	194	178	165	154	
	1.50	650	616	540	464	397	340	294	256	231	211	194	180	168	
	1.77	650	650	589	519	451	392	342	300	265	239	221	205	192	
	2.00	650	650	624	559	494	434	382	337	299	267	243	226	211	
2.50	650	650	650	629	571	515	462	414	372	335	303	275	250		
457x191x74  $M_{c,y,Rd} = 587$ $M_{c,z,Rd} = 96.6$  Class = 1	1.00	540	452	368	300	248	210	181	159	142	126	114	103	94.5	33300
	1.13	565	483	401	330	273	230	199	176	157	142	128	117	107	
	1.35	587	528	451	378	316	267	228	202	181	164	151	139	128	
	1.50	587	552	480	409	345	293	250	219	197	179	164	152	141	
	1.77	587	587	526	458	395	339	292	253	223	204	187	174	162	
	2.00	587	587	558	495	433	376	327	286	251	223	206	191	178	
2.50	587	587	587	560	504	449	398	353	314	281	251	226	212		
457x191x67  $M_{c,y,Rd} = 522$ $M_{c,z,Rd} = 84.1$  Class = 1	1.00	478	397	319	257	210	176	151	132	116	102	91.6	82.9	75.8	29400
	1.13	500	425	349	283	231	193	166	146	129	116	103	93.7	85.7	
	1.35	522	465	393	325	268	223	190	168	150	135	123	112	102	
	1.50	522	487	419	352	293	245	207	182	163	148	135	124	114	
	1.77	522	520	461	396	336	285	242	207	185	168	154	142	132	
	2.00	522	522	490	430	370	317	272	234	203	185	170	157	146	
2.50	522	522	522	489	434	382	334	292	257	226	201	187	174		

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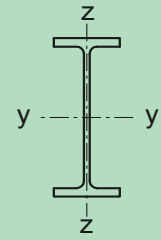
<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

UNIVERSAL BEAMS

Advance® UKB



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)											Second Moment of Area y-y axis $I_y$ $cm^4$
				1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	
457x152x82  $M_{c,y,Rd} = 625$ $M_{c,z,Rd} = 82.8$  Class = 1	1.00	625	593	539	485	434	388	347	283	238	204	179	160	144	36600
	1.13	625	618	568	518	469	423	381	312	261	224	198	177	160	
	1.35	625	625	609	565	520	476	434	361	303	259	227	204	185	
	1.50	625	625	625	591	549	507	466	392	332	284	246	221	201	
	1.77	625	625	625	625	594	556	518	445	383	330	288	252	228	
	2.00	625	625	625	625	624	590	555	486	423	369	323	285	253	
2.50	625	625	625	625	625	625	625	620	559	500	446	397	355	318	
457x152x74  $M_{c,y,Rd} = 561$ $M_{c,z,Rd} = 73.5$  Class = 1	1.00	561	530	480	430	382	339	301	243	201	172	150	133	118	32700
	1.13	561	553	507	460	413	370	331	267	221	189	166	147	133	
	1.35	561	561	544	502	460	417	378	309	257	216	191	170	154	
	1.50	561	561	561	526	487	446	407	337	281	238	206	185	168	
	1.77	561	561	561	561	527	491	454	385	326	277	239	210	191	
	2.00	561	561	561	561	555	522	488	421	361	311	269	235	209	
2.50	561	561	561	561	561	561	561	548	489	431	379	333	295	261	
457x152x67  $M_{c,y,Rd} = 516$ $M_{c,z,Rd} = 66.4$  Class = 1	1.00	516	483	434	385	338	297	261	207	170	144	125	108	95.1	28900
	1.13	516	503	459	413	367	325	287	228	187	159	138	122	107	
	1.35	516	516	494	453	411	369	330	264	215	182	159	141	127	
	1.50	516	516	513	476	436	396	357	289	237	197	173	154	139	
	1.77	516	516	516	509	475	438	400	332	275	230	196	175	159	
	2.00	516	516	516	516	501	468	433	365	307	259	220	192	174	
2.50	516	516	516	516	516	516	516	490	429	370	319	276	240	210	
457x152x60  $M_{c,y,Rd} = 457$ $M_{c,z,Rd} = 57.9$  Class = 1	1.00	457	425	381	336	293	255	223	174	142	119	101	87.0	76.3	25500
	1.13	457	444	404	361	319	280	246	192	156	131	113	98.3	86.2	
	1.35	457	457	435	397	358	319	283	223	178	151	131	116	103	
	1.50	457	457	452	418	380	342	306	244	196	164	143	126	113	
	1.77	457	457	457	448	415	380	345	281	229	188	162	144	130	
	2.00	457	457	457	457	439	407	374	310	256	212	178	158	143	
2.50	457	457	457	457	457	454	426	367	311	264	225	192	170		
457x152x52  $M_{c,y,Rd} = 389$ $M_{c,z,Rd} = 47.2$  Class = 1	1.00	389	359	319	279	241	207	179	137	110	91.1	75.6	64.5	56.3	21400
	1.13	389	375	339	300	262	227	197	150	121	101	85.4	72.9	63.6	
	1.35	389	389	366	331	295	260	228	175	139	117	100	87.1	76.0	
	1.50	389	389	381	349	315	280	247	192	150	127	109	95.9	84.5	
	1.77	389	389	389	376	345	313	280	222	176	144	125	110	98.3	
	2.00	389	389	389	389	367	337	306	247	198	160	137	121	109	
2.50	389	389	389	389	389	378	351	295	244	201	167	144	130		

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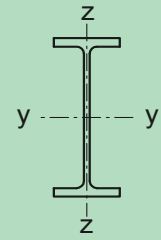
<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

UNIVERSAL BEAMS

Advance® UKB



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)											Second Moment of Area y-y axis $I_y$ $cm^4$
				1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	
406x178x85 +  $M_{c,y,Rd} = 598$ $M_{c,z,Rd} = 108$  Class = 1	1.00	598	594	552	509	468	429	393	330	282	246	217	194	176	31700
	1.13	598	598	577	538	500	462	426	363	311	270	238	214	194	
	1.35	598	598	598	578	544	510	476	413	359	314	276	246	222	
	1.50	598	598	598	598	569	537	506	444	389	343	303	270	242	
	1.77	598	598	598	598	598	578	550	494	440	392	350	314	283	
	2.00	598	598	598	598	598	598	581	530	479	431	389	351	318	
2.50	598	598	598	598	598	598	598	598	592	548	504	463	424	390	
406x178x74  $M_{c,y,Rd} = 533$ $M_{c,z,Rd} = 94.8$  Class = 1	1.00	533	525	485	445	406	368	333	275	231	199	174	155	139	27300
	1.13	533	533	508	471	434	398	363	302	255	218	191	170	154	
	1.35	533	533	533	508	475	441	408	347	295	253	220	195	177	
	1.50	533	533	533	528	498	467	435	374	322	278	242	213	192	
	1.77	533	533	533	533	532	505	476	419	367	320	281	248	221	
	2.00	533	533	533	533	533	531	505	453	401	355	314	279	249	
2.50	533	533	533	533	533	533	533	533	511	465	421	380	343	310	
406x178x67  $M_{c,y,Rd} = 478$ $M_{c,z,Rd} = 84.1$  Class = 1	1.00	478	470	433	396	359	323	291	237	198	168	146	129	116	24300
	1.13	478	478	454	419	385	350	318	261	218	184	161	143	128	
	1.35	478	478	478	452	422	390	358	300	252	214	184	164	148	
	1.50	478	478	478	471	442	413	383	325	276	235	202	178	161	
	1.77	478	478	478	478	473	448	420	366	315	272	236	206	182	
	2.00	478	478	478	478	478	472	447	396	346	302	264	232	205	
2.50	478	478	478	478	478	478	478	478	449	405	362	322	288	257	
406x178x60  $M_{c,y,Rd} = 426$ $M_{c,z,Rd} = 74.2$  Class = 1	1.00	426	418	384	350	316	283	253	204	168	142	122	108	95.5	21600
	1.13	426	426	403	371	339	307	277	225	185	156	135	119	107	
	1.35	426	426	426	401	372	343	313	259	215	180	155	137	123	
	1.50	426	426	426	417	391	363	335	281	235	198	168	149	134	
	1.77	426	426	426	426	419	395	369	317	270	230	197	170	152	
	2.00	426	426	426	426	426	417	393	344	297	256	221	192	168	
2.50	426	426	426	426	426	426	426	426	393	350	309	271	239	212	
406x178x54  $M_{c,y,Rd} = 375$ $M_{c,z,Rd} = 63.2$  Class = 1	1.00	375	365	334	303	272	242	215	170	139	116	99.3	86.6	75.3	18700
	1.13	375	375	351	322	293	263	235	188	152	128	110	96.1	85.1	
	1.35	375	375	374	349	322	294	267	217	177	146	126	111	99.2	
	1.50	375	375	375	364	339	313	286	236	194	161	137	121	108	
	1.77	375	375	375	375	365	341	317	268	224	187	158	137	123	
	2.00	375	375	375	375	375	361	339	292	248	210	178	152	135	
2.50	375	375	375	375	375	375	375	375	336	294	255	221	192	167	

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+ These sections are in addition to the range of BS 4 sections.

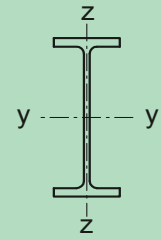
<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

UNIVERSAL BEAMS

Advance® UKB



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)											Second Moment of Area y-y axis $I_y$ $cm^4$
				1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	
406x140x53 +  $M_{c,y,Rd} = 366$ $M_{c,z,Rd} = 49.3$  Class = 1	1.00	366	335	298	261	226	197	172	135	111	93.7	80.3	69.5	61.3	18300
	1.13	366	351	316	281	247	216	189	149	122	104	90.0	78.5	69.2	
	1.35	366	366	342	310	278	247	219	173	140	119	104	92.5	82.7	
	1.50	366	366	357	327	296	266	237	189	153	129	113	101	90.9	
	1.77	366	366	366	353	325	296	268	218	179	148	129	115	104	
	2.00	366	366	366	366	345	319	292	242	200	167	141	127	115	
406x140x46  $M_{c,y,Rd} = 315$ $M_{c,z,Rd} = 41.9$  Class = 1	1.00	315	287	254	220	190	163	141	110	88.5	74.0	62.0	53.3	46.8	15700
	1.13	315	301	270	238	207	180	156	120	97.6	82.0	70.0	60.2	52.9	
	1.35	315	315	293	264	234	206	180	139	112	94.7	82.0	72.0	63.2	
	1.50	315	315	305	279	250	222	196	153	121	103	89.3	78.9	70.2	
	1.77	315	315	315	301	275	249	223	177	142	117	102	90.4	81.3	
	2.00	315	315	315	315	293	268	243	197	159	130	112	99.7	89.8	
406x140x39  $M_{c,y,Rd} = 257$ $M_{c,z,Rd} = 32.3$  Class = 1	1.00	257	230	201	172	146	124	106	80.2	63.7	51.3	42.6	36.4	31.7	12500
	1.13	257	242	215	187	160	136	117	88.2	70.5	58.0	48.1	41.1	35.9	
	1.35	257	257	234	208	182	157	135	101	81.3	67.7	57.5	49.1	42.8	
	1.50	257	257	245	221	195	170	148	111	88.2	73.8	63.3	54.6	47.6	
	1.77	257	257	257	239	216	192	169	130	100	84.1	72.5	63.7	56.2	
	2.00	257	257	257	253	231	209	186	145	113	92.4	80.0	70.4	63.0	
356x171x67  $M_{c,y,Rd} = 430$ $M_{c,z,Rd} = 86.3$  Class = 1	1.00	430	422	390	358	327	297	271	226	192	166	147	131	119	19500
	1.13	430	430	409	379	350	322	295	248	212	183	161	144	131	
	1.35	430	430	430	409	383	357	331	284	245	212	186	165	151	
	1.50	430	430	430	425	401	377	353	307	266	233	205	181	163	
	1.77	430	430	430	430	429	408	386	343	303	268	237	212	190	
	2.00	430	430	430	430	430	429	409	369	331	295	264	237	214	
356x171x57  $M_{c,y,Rd} = 359$ $M_{c,z,Rd} = 70.6$  Class = 1	1.00	359	350	322	294	266	239	215	176	147	126	110	97.3	87.5	16000
	1.13	359	359	338	312	285	259	235	194	162	138	121	107	96.8	
	1.35	359	359	359	337	313	289	266	223	188	160	138	123	112	
	1.50	359	359	359	351	329	307	284	241	205	175	152	134	121	
	1.77	359	359	359	359	353	333	313	272	235	203	177	155	137	
	2.00	359	359	359	359	359	351	333	295	258	226	198	175	155	
2.50	359	359	359	359	359	359	359	335	302	270	242	216	194		

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+ These sections are in addition to the range of BS 4 sections.

<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8

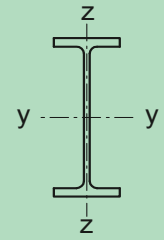
Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.



UNIVERSAL BEAMS

Advance® UKB



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)											Second Moment of Area y-y axis $I_y$ $cm^4$		
				1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0		9.0	10.0
356x171x51  $M_{c,y,Rd} = 318$ $M_{c,z,Rd} = 61.8$  Class = 1			1.00	318	310	284	258	232	208	186	150	124	105	90.7	80.0	71.0	14100
			1.13	318	318	298	274	250	226	203	165	136	115	100.0	88.4	79.3	
			1.35	318	318	317	297	275	252	230	190	158	133	115	102	91.8	
			1.50	318	318	318	309	289	268	246	206	173	146	124	111	99.8	
			1.77	318	318	318	318	310	292	272	233	199	169	145	126	113	
			2.00	318	318	318	318	318	308	291	254	219	189	163	142	125	
356x171x45  $M_{c,y,Rd} = 275$ $M_{c,z,Rd} = 52.2$  Class = 2			1.00	275	266	243	220	196	174	154	122	99.7	83.5	71.7	62.5	54.5	12100
			1.13	275	275	256	234	211	189	169	135	109	91.9	79.2	69.6	61.6	
			1.35	275	275	273	254	234	213	192	156	127	105	91.2	80.5	72.0	
			1.50	275	275	275	265	246	227	207	170	139	115	98.9	87.5	78.4	
			1.77	275	275	275	275	265	248	229	193	161	135	114	99.4	89.5	
			2.00	275	275	275	275	275	263	246	211	179	151	128	110	98.3	
356x127x39  $M_{c,y,Rd} = 234$ $M_{c,z,Rd} = 31.6$  Class = 1			1.00	231	204	176	150	128	109	94.4	73.7	60.2	50.2	42.5	36.9	32.7	10200
			1.13	234	215	189	163	140	120	104	81.0	66.5	56.4	48.1	41.7	36.9	
			1.35	234	230	207	183	160	139	121	93.0	76.6	65.3	57.0	49.8	44.1	
			1.50	234	234	217	195	172	151	132	102	83.1	71.1	62.2	55.3	49.0	
			1.77	234	234	232	213	191	171	151	119	95.2	80.9	71.1	63.4	57.3	
			2.00	234	234	234	225	206	186	166	133	107	88.7	78.2	70.0	63.4	
356x127x33  $M_{c,y,Rd} = 193$ $M_{c,z,Rd} = 24.9$  Class = 1			1.00	189	165	141	118	98.9	83.3	71.2	54.5	43.5	35.3	29.7	25.6	22.6	8250
			1.13	193	174	152	129	109	91.8	78.2	60.1	48.5	39.9	33.6	29.0	25.5	
			1.35	193	187	167	145	125	106	90.8	68.9	56.1	47.3	40.1	34.6	30.5	
			1.50	193	193	176	155	135	116	99.6	74.6	61.0	51.6	44.5	38.5	33.9	
			1.77	193	193	189	170	151	132	115	87.2	69.3	58.9	51.2	45.3	40.0	
			2.00	193	193	193	181	163	145	127	98.1	76.5	64.9	56.6	50.2	45.1	
305x165x54  $M_{c,y,Rd} = 300$ $M_{c,z,Rd} = 69.6$  Class = 1			1.00	300	296	279	261	242	223	205	172	146	126	111	96.3	85.2	11700
			1.13	300	300	291	275	258	240	222	189	161	139	122	109	96.3	
			1.35	300	300	300	294	280	264	248	216	187	162	142	126	114	
			1.50	300	300	300	300	292	278	263	232	203	178	156	138	124	
			1.77	300	300	300	300	300	298	285	258	230	204	181	162	145	
			2.00	300	300	300	300	300	300	300	276	250	225	202	182	164	
2.50	300	300	300	300	300	300	300	300	300	286	264	242	221	202			

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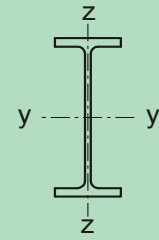
<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

UNIVERSAL BEAMS

Advance® UKB



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)											Second Moment of Area y-y axis $I_y$ $cm^4$		
				1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0		9.0	10.0
305x165x46	$M_{c,y,Rd} = 256$ $M_{c,z,Rd} = 58.9$	Class = 1	1.00	256	251	236	220	203	185	168	138	116	98.7	83.9	72.5	63.9	9900
			1.13	256	256	246	232	216	200	183	152	128	108	94.8	81.9	72.2	
			1.35	256	256	256	248	235	221	205	175	148	126	109	97.3	86.2	
			1.50	256	256	256	256	246	233	218	189	162	139	120	106	95.7	
			1.77	256	256	256	256	256	250	238	211	185	161	140	123	109	
			2.00	256	256	256	256	256	256	252	228	202	179	157	139	124	
305x165x40	$M_{c,y,Rd} = 221$ $M_{c,z,Rd} = 50.4$	Class = 1	1.00	221	216	203	188	173	156	141	114	93.4	78.0	65.2	56.0	49.2	8500
			1.13	221	221	212	199	185	169	153	125	103	86.9	73.7	63.3	55.6	
			1.35	221	221	221	214	201	187	173	144	120	101	86.8	75.7	66.4	
			1.50	221	221	221	221	211	198	184	156	131	111	94.2	83.7	73.8	
			1.77	221	221	221	221	221	214	202	176	151	129	111	95.6	86.1	
			2.00	221	221	221	221	221	221	214	191	166	144	125	108	94.8	
305x127x48	$M_{c,y,Rd} = 252$ $M_{c,z,Rd} = 41.2$	Class = 1	1.00	251	224	199	175	154	136	121	99.5	84.3	73.1	64.6	57.8	51.5	9580
			1.13	252	236	212	189	168	149	134	109	92.5	80.6	71.5	64.2	58.2	
			1.35	252	251	230	209	189	170	154	127	107	92.4	82.3	74.3	67.7	
			1.50	252	252	241	221	202	184	167	139	117	100	89.3	80.7	73.7	
			1.77	252	252	252	239	222	205	188	160	136	117	102	91.7	84.0	
			2.00	252	252	252	252	236	220	205	176	152	132	115	102	92.2	
305x127x42	$M_{c,y,Rd} = 218$ $M_{c,z,Rd} = 34.8$	Class = 1	1.00	216	192	168	146	127	111	97.9	79.0	66.2	57.0	49.9	43.7	38.9	8200
			1.13	218	202	180	158	139	122	108	86.7	72.9	63.0	55.5	49.4	44.0	
			1.35	218	215	196	176	157	140	125	101	83.3	72.5	64.2	57.6	52.3	
			1.50	218	218	205	187	168	151	136	110	91.5	78.6	69.8	62.8	57.1	
			1.77	218	218	218	203	186	170	154	128	107	90.3	79.2	71.6	65.3	
			2.00	218	218	218	214	199	183	168	142	120	102	87.8	78.6	71.9	
305x127x37	$M_{c,y,Rd} = 191$ $M_{c,z,Rd} = 30.2$	Class = 1	1.00	189	167	145	125	107	92.9	81.4	64.8	53.8	46.0	39.4	34.5	30.6	7170
			1.13	191	176	156	136	118	102	89.7	71.1	59.3	50.9	44.6	38.9	34.6	
			1.35	191	188	170	152	134	118	104	82.3	68.1	58.8	51.7	46.2	41.3	
			1.50	191	191	178	161	144	128	113	90.4	73.6	63.8	56.3	50.5	45.8	
			1.77	191	191	191	176	160	144	129	105	86.1	72.3	64.2	57.7	52.5	
			2.00	191	191	191	186	171	156	142	117	96.9	81.2	70.4	63.5	57.9	
305x127x37	$M_{c,y,Rd} = 191$ $M_{c,z,Rd} = 30.2$	Class = 1	2.50	191	191	191	191	191	178	165	141	119	102	87.5	75.8	68.8	7170

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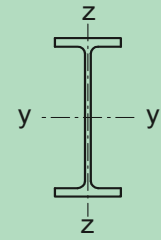
<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

UNIVERSAL BEAMS

Advance® UKB



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)											Second Moment of Area y-y axis $I_y$ $cm^4$		
				1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0		9.0	10.0
305x102x33	$M_{c,y,Rd} = 171$ $M_{c,z,Rd} = 21.3$	Class = 1	1.00	159	135	112	92.7	77.6	66.1	57.5	45.4	37.2	31.0	26.6	23.4	20.8	6500
			1.13	166	144	122	102	85.5	72.7	63.1	50.2	41.7	35.0	30.1	26.4	23.5	
			1.35	171	157	136	116	98.8	84.5	72.9	57.7	48.3	41.6	35.9	31.5	28.1	
			1.50	171	164	145	125	107	92.5	80.1	62.5	52.6	45.4	39.9	35.0	31.2	
			1.77	171	171	157	139	122	106	93.0	72.2	59.8	51.9	45.8	41.1	36.8	
			2.00	171	171	166	150	133	117	104	81.5	65.5	57.1	50.6	45.5	41.4	
305x102x28	$M_{c,y,Rd} = 143$ $M_{c,z,Rd} = 17.0$	Class = 1	1.00	132	111	90.2	73.1	60.1	50.5	43.4	33.7	26.7	22.1	18.9	16.5	14.7	5370
			1.13	138	118	98.2	80.4	66.2	55.4	47.8	37.3	30.2	25.0	21.3	18.7	16.6	
			1.35	143	129	110	92.2	76.7	64.3	54.6	43.1	35.6	29.8	25.5	22.3	19.8	
			1.50	143	135	117	99.6	83.8	70.6	59.9	46.9	38.9	33.2	28.3	24.8	22.0	
			1.77	143	143	129	112	95.7	81.7	70.0	53.2	44.4	38.1	33.4	29.2	26.0	
			2.00	143	143	136	121	105	90.7	78.4	59.4	48.8	42.1	37.0	33.0	29.3	
305x102x25	$M_{c,y,Rd} = 121$ $M_{c,z,Rd} = 13.8$	Class = 1	1.00	111	91.3	72.9	58.0	47.0	39.1	33.2	25.0	19.6	16.1	13.7	12.0	10.6	4460
			1.13	116	97.9	79.6	63.9	51.7	42.9	36.7	28.2	22.1	18.2	15.5	13.5	12.0	
			1.35	121	107	90.0	73.6	60.0	49.4	42.1	32.8	26.5	21.8	18.5	16.2	14.3	
			1.50	121	113	96.2	79.9	65.7	54.3	45.6	35.7	29.2	24.2	20.6	18.0	15.9	
			1.77	121	120	106	90.2	75.6	63.2	53.0	40.7	33.5	28.6	24.3	21.2	18.8	
			2.00	121	121	113	98.0	83.4	70.6	59.7	44.6	37.0	31.6	27.5	23.9	21.2	
254x146x43	$M_{c,y,Rd} = 201$ $M_{c,z,Rd} = 50.1$	Class = 1	1.00	201	194	181	168	155	142	130	109	92.8	80.7	70.5	61.6	54.8	6540
			1.13	201	201	190	178	166	153	141	120	102	88.8	78.6	69.7	62.0	
			1.35	201	201	201	192	181	170	159	137	119	103	90.9	81.4	74.0	
			1.50	201	201	201	199	190	180	169	148	130	114	100	88.9	80.6	
			1.77	201	201	201	201	201	194	185	166	148	131	117	104	93.5	
			2.00	201	201	201	201	201	201	196	179	161	145	130	117	106	
254x146x37	$M_{c,y,Rd} = 171$ $M_{c,z,Rd} = 42.2$	Class = 1	1.00	171	165	154	141	129	117	105	86.5	72.7	62.1	52.9	46.1	40.9	5540
			1.13	171	171	161	150	138	127	115	95.4	80.1	68.8	59.8	52.1	46.2	
			1.35	171	171	171	162	152	141	130	110	93.2	79.8	69.7	62.2	55.2	
			1.50	171	171	171	169	160	150	139	120	102	87.8	76.2	68.0	61.3	
			1.77	171	171	171	171	171	163	153	135	117	102	89.3	78.6	70.5	
			2.00	171	171	171	171	171	171	163	146	129	114	100	88.9	79.1	
2.50	171	171	171	171	171	171	171	166	151	137	123	111	99.6				

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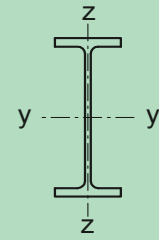
<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

UNIVERSAL BEAMS

Advance® UKB



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)											Second Moment of Area y-y axis $I_y$ $cm^4$		
				1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0		9.0	10.0
254x146x31	$M_{c,y,Rd} = 140$ $M_{c,z,Rd} = 33.4$	Class = 1	1.00	140	133	123	112	101	89.8	79.7	63.7	52.4	42.9	36.2	31.4	27.7	4410
			1.13	140	138	130	120	109	97.9	87.6	70.3	57.7	48.4	40.9	35.5	31.3	
			1.35	140	140	138	130	120	110	99.9	81.6	67.1	56.5	48.9	42.4	37.4	
			1.50	140	140	140	135	127	117	108	89.1	73.8	61.8	53.8	47.1	41.6	
			1.77	140	140	140	140	136	128	119	102	85.6	72.4	61.8	54.8	49.1	
			2.00	140	140	140	140	140	136	128	111	95.2	81.4	70.0	60.6	54.7	
254x102x28	$M_{c,y,Rd} = 125$ $M_{c,z,Rd} = 19.5$	Class = 1	1.00	118	101	85.2	71.5	60.7	52.3	45.9	36.8	30.8	26.0	22.4	19.7	17.6	4010
			1.13	123	108	92.2	78.3	66.8	57.6	50.4	40.5	34.0	29.4	25.3	22.2	19.8	
			1.35	125	117	103	89.0	76.9	66.8	58.5	46.4	39.3	34.0	30.1	26.6	23.7	
			1.50	125	122	109	95.5	83.4	73.0	64.2	50.6	42.6	37.1	32.8	29.5	26.3	
			1.77	125	125	118	106	94.0	83.4	74.1	59.2	48.3	42.2	37.5	33.8	30.8	
			2.00	125	125	124	113	102	91.6	82.1	66.4	54.5	46.3	41.3	37.3	34.1	
254x102x25	$M_{c,y,Rd} = 109$ $M_{c,z,Rd} = 16.3$	Class = 1	1.00	101	86.0	71.3	58.9	49.2	42.0	36.5	28.9	23.6	19.7	16.9	14.8	13.2	3420
			1.13	106	91.7	77.4	64.6	54.3	46.2	40.0	31.9	26.5	22.3	19.1	16.8	14.9	
			1.35	109	99.6	86.5	73.8	62.7	53.6	46.3	36.7	30.7	26.4	22.8	20.0	17.9	
			1.50	109	104	91.8	79.4	68.2	58.7	50.8	39.7	33.4	28.8	25.4	22.3	19.8	
			1.77	109	109	99.9	88.5	77.4	67.5	59.0	45.9	38.0	33.0	29.1	26.1	23.4	
			2.00	109	109	106	95.1	84.4	74.5	65.8	51.7	41.6	36.3	32.2	28.9	26.3	
254x102x22	$M_{c,y,Rd} = 91.9$ $M_{c,z,Rd} = 13.1$	Class = 1	1.00	84.8	71.0	57.8	46.9	38.6	32.5	28.0	21.8	17.4	14.4	12.3	10.8	9.59	2840
			1.13	88.7	75.9	62.9	51.6	42.5	35.7	30.8	24.2	19.6	16.3	13.9	12.2	10.8	
			1.35	91.9	82.8	70.7	59.2	49.3	41.4	35.3	27.9	23.1	19.4	16.6	14.6	12.9	
			1.50	91.9	86.7	75.3	63.9	53.8	45.5	38.7	30.3	25.2	21.6	18.5	16.2	14.4	
			1.77	91.9	91.9	82.4	71.7	61.5	52.6	45.2	34.4	28.8	24.8	21.8	19.1	17.0	
			2.00	91.9	91.9	87.5	77.5	67.5	58.4	50.6	38.5	31.7	27.4	24.1	21.6	19.2	
203x133x30	$M_{c,y,Rd} = 111$ $M_{c,z,Rd} = 31.2$	Class = 1	1.00	111	105	97.6	89.4	81.1	73.3	66.3	55.0	46.6	40.2	34.5	30.2	26.9	2900
			1.13	111	110	103	95.2	87.4	79.8	72.7	60.6	51.4	44.5	39.0	34.2	30.4	
			1.35	111	111	110	103	96.5	89.5	82.6	70.1	59.8	51.6	45.4	40.8	36.4	
			1.50	111	111	111	108	102	95.2	88.6	76.2	65.6	56.8	49.7	44.5	40.4	
			1.77	111	111	111	111	109	104	97.9	86.2	75.4	66.1	58.2	51.5	46.3	
			2.00	111	111	111	111	111	110	105	93.7	83.2	73.7	65.4	58.2	52.1	

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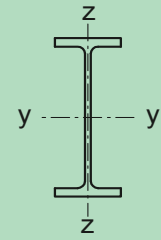
<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

UNIVERSAL BEAMS

Advance® UKB



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)											Second Moment of Area y-y axis $I_y$ $cm^4$		
				1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0		9.0	10.0
203x133x25	$M_{c,y,Rd} = 91.6$ $M_{c,z,Rd} = 25.2$	Class = 1	1.00	91.6	85.9	78.9	71.4	63.8	56.7	50.5	40.8	34.0	28.1	24.0	20.9	18.6	2340
			1.13	91.6	89.5	83.2	76.3	69.1	62.0	55.5	45.0	37.4	31.7	27.1	23.7	21.0	
			1.35	91.6	91.6	89.1	83.3	76.8	70.1	63.6	52.3	43.5	37.1	32.4	28.3	25.1	
			1.50	91.6	91.6	91.6	87.2	81.2	74.9	68.6	57.2	47.8	40.5	35.6	31.4	27.9	
			1.77	91.6	91.6	91.6	91.6	87.9	82.4	76.6	65.4	55.6	47.5	40.9	36.4	32.9	
			2.00	91.6	91.6	91.6	91.6	91.6	87.6	82.4	71.7	61.8	53.4	46.3	40.4	36.5	
203x102x23	$M_{c,y,Rd} = 83.1$ $M_{c,z,Rd} = 17.8$	Class = 1	1.00	80.4	72.5	64.2	56.0	48.8	42.8	37.9	30.7	24.9	20.9	18.1	16.0	14.3	2110
			1.13	83.1	76.4	68.7	60.8	53.5	47.2	41.8	33.9	28.1	23.7	20.5	18.0	16.1	
			1.35	83.1	81.5	75.1	67.9	60.9	54.3	48.6	39.4	33.0	28.3	24.4	21.5	19.3	
			1.50	83.1	83.1	78.6	72.1	65.4	58.9	53.0	43.3	35.9	31.3	27.2	23.9	21.4	
			1.77	83.1	83.1	83.1	78.4	72.4	66.3	60.5	50.3	42.1	35.7	31.8	28.2	25.3	
			2.00	83.1	83.1	83.1	82.7	77.4	71.7	66.2	56.0	47.4	40.5	35.0	31.7	28.5	
178x102x19	$M_{c,y,Rd} = 60.7$ $M_{c,z,Rd} = 14.9$	Class = 1	1.00	58.7	53.0	46.9	40.9	35.5	31.1	27.6	22.3	18.1	15.2	13.1	11.6	10.3	1360
			1.13	60.7	55.8	50.2	44.4	39.0	34.3	30.4	24.6	20.4	17.2	14.8	13.1	11.7	
			1.35	60.7	59.6	54.8	49.6	44.4	39.6	35.4	28.6	24.0	20.5	17.7	15.6	14.0	
			1.50	60.7	60.7	57.4	52.6	47.7	42.9	38.6	31.5	26.1	22.7	19.7	17.3	15.5	
			1.77	60.7	60.7	60.7	57.2	52.8	48.3	44.0	36.6	30.6	25.9	23.1	20.5	18.3	
			2.00	60.7	60.7	60.7	60.4	56.5	52.3	48.2	40.7	34.5	29.4	25.4	23.0	20.7	
152x89x16	$M_{c,y,Rd} = 43.7$ $M_{c,z,Rd} = 11.0$	Class = 1	1.00	41.3	36.8	32.2	28.0	24.4	21.5	19.2	15.6	12.8	10.8	9.39	8.31	7.45	834
			1.13	42.9	39.0	34.7	30.5	26.9	23.8	21.2	17.3	14.4	12.2	10.6	9.39	8.41	
			1.35	43.7	41.9	38.2	34.4	30.7	27.5	24.6	20.1	17.0	14.6	12.7	11.2	10.1	
			1.50	43.7	43.5	40.2	36.6	33.1	29.8	26.9	22.1	18.5	16.2	14.1	12.5	11.2	
			1.77	43.7	43.7	43.1	40.1	36.9	33.8	30.8	25.7	21.7	18.5	16.6	14.7	13.2	
			2.00	43.7	43.7	43.7	42.5	39.6	36.7	33.8	28.7	24.4	20.9	18.2	16.5	14.9	
127x76x13	$M_{c,y,Rd} = 29.8$ $M_{c,z,Rd} = 8.17$	Class = 1	1.00	27.5	24.3	21.2	18.6	16.3	14.5	13.0	10.7	8.83	7.52	6.55	5.81	5.22	473
			1.13	28.7	25.8	23.0	20.3	18.0	16.0	14.4	11.9	9.98	8.50	7.40	6.56	5.89	
			1.35	29.8	28.0	25.4	22.9	20.6	18.5	16.7	13.8	11.7	10.2	8.84	7.84	7.04	
			1.50	29.8	29.1	26.8	24.5	22.2	20.1	18.3	15.2	12.8	11.2	9.83	8.71	7.82	
			1.77	29.8	29.8	29.0	26.9	24.8	22.8	20.9	17.6	15.0	12.8	11.5	10.3	9.23	
			2.00	29.8	29.8	29.8	28.6	26.7	24.8	23.0	19.7	16.9	14.5	12.6	11.5	10.4	
2.50	29.8	29.8	29.8	29.8	29.8	28.4	26.8	23.6	20.7	18.2	16.0	14.1	12.6				

Advance® and UKB are trademarks of Tata Steel. A fuller description of the relationship between Universal Beams (UB) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

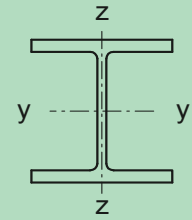
<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

UNIVERSAL COLUMNS

Advance® UKC



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)											Second Moment of Area y-y axis $I_y$ $cm^4$	
				2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0		13.0
356x406x634  $M_{c,y,Rd} = 4630$ $M_{c,z,Rd} = 2310$  Class = 1	1.00	4630	4630	4630	4630	4610	4540	4470	4410	4350	4300	4240	4190	4130	275000	
	1.13	4630	4630	4630	4630	4630	4630	4630	4630	4580	4530	4480	4430	4380		4340
	1.35	4630	4630	4630	4630	4630	4630	4630	4630	4630	4630	4630	4630	4630		4610
	1.50	4630	4630	4630	4630	4630	4630	4630	4630	4630	4630	4630	4630	4630		4630
	1.77	4630	4630	4630	4630	4630	4630	4630	4630	4630	4630	4630	4630	4630		4630
	2.00	4630	4630	4630	4630	4630	4630	4630	4630	4630	4630	4630	4630	4630		4630
356x406x551  $M_{c,y,Rd} = 3920$ $M_{c,z,Rd} = 1970$  Class = 1	1.00	3920	3920	3920	3920	3880	3810	3750	3690	3640	3590	3530	3480	3430	227000	
	1.13	3920	3920	3920	3920	3920	3920	3920	3890	3840	3800	3750	3700	3660		3610
	1.35	3920	3920	3920	3920	3920	3920	3920	3920	3920	3920	3920	3920	3890		3860
	1.50	3920	3920	3920	3920	3920	3920	3920	3920	3920	3920	3920	3920	3920		3920
	1.77	3920	3920	3920	3920	3920	3920	3920	3920	3920	3920	3920	3920	3920		3920
	2.00	3920	3920	3920	3920	3920	3920	3920	3920	3920	3920	3920	3920	3920		3920
356x406x467  $M_{c,y,Rd} = 3350$ $M_{c,z,Rd} = 1690$  Class = 1	1.00	3350	3350	3350	3330	3260	3200	3140	3090	3030	2980	2930	2880	2830	183000	
	1.13	3350	3350	3350	3350	3350	3320	3270	3220	3180	3130	3080	3040	2990		
	1.35	3350	3350	3350	3350	3350	3350	3350	3350	3350	3350	3330	3290	3250		3220
	1.50	3350	3350	3350	3350	3350	3350	3350	3350	3350	3350	3350	3350	3350		3340
	1.77	3350	3350	3350	3350	3350	3350	3350	3350	3350	3350	3350	3350	3350		3350
	2.00	3350	3350	3350	3350	3350	3350	3350	3350	3350	3350	3350	3350	3350		3350
356x406x393  $M_{c,y,Rd} = 2750$ $M_{c,z,Rd} = 1390$  Class = 1	1.00	2750	2750	2750	2710	2650	2590	2540	2490	2430	2380	2340	2290	2240	147000	
	1.13	2750	2750	2750	2750	2750	2700	2650	2600	2560	2510	2470	2430	2380		
	1.35	2750	2750	2750	2750	2750	2750	2750	2750	2750	2720	2690	2650	2620		2580
	1.50	2750	2750	2750	2750	2750	2750	2750	2750	2750	2750	2750	2750	2720		2690
	1.77	2750	2750	2750	2750	2750	2750	2750	2750	2750	2750	2750	2750	2750		2750
	2.00	2750	2750	2750	2750	2750	2750	2750	2750	2750	2750	2750	2750	2750		2750
356x406x340  $M_{c,y,Rd} = 2340$ $M_{c,z,Rd} = 1190$  Class = 1	1.00	2340	2340	2340	2290	2230	2180	2130	2070	2030	1980	1930	1890	1840	123000	
	1.13	2340	2340	2340	2340	2320	2270	2220	2180	2140	2090	2050	2010	1970		
	1.35	2340	2340	2340	2340	2340	2340	2340	2340	2320	2290	2250	2210	2180		2140
	1.50	2340	2340	2340	2340	2340	2340	2340	2340	2340	2340	2340	2300	2270		2240
	1.77	2340	2340	2340	2340	2340	2340	2340	2340	2340	2340	2340	2340	2340		2340
	2.00	2340	2340	2340	2340	2340	2340	2340	2340	2340	2340	2340	2340	2340		2340

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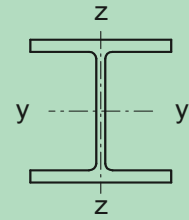
<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8.

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

UNIVERSAL COLUMNS

Advance® UKC



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)											Second Moment of Area y-y axis $I_y$ $cm^4$			
				2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0		13.0	14.0	
356x406x287	$M_{c,y,Rd} = 2010$ $M_{c,z,Rd} = 1020$	Class = 1	1.00	2010	2010	2000	1930	1880	1820	1770	1720	1670	1620	1570	1530	1480	99900	
			1.13	2010	2010	2010	2000	1950	1910	1860	1810	1770	1730	1680	1640	1600		
			1.35	2010	2010	2010	2010	2010	2010	2010	1980	1940	1910	1870	1830	1790		1760
			1.50	2010	2010	2010	2010	2010	2010	2010	2010	2010	1980	1950	1920	1880		1850
			1.77	2010	2010	2010	2010	2010	2010	2010	2010	2010	2010	2010	2010	2010		1980
			2.00	2010	2010	2010	2010	2010	2010	2010	2010	2010	2010	2010	2010	2010		2010
356x406x235	$M_{c,y,Rd} = 1620$ $M_{c,z,Rd} = 822$	Class = 1	1.00	1620	1620	1600	1540	1490	1440	1390	1340	1290	1250	1200	1160	1120	79100	
			1.13	1620	1620	1620	1600	1560	1510	1470	1420	1380	1340	1290	1250	1210		
			1.35	1620	1620	1620	1620	1620	1610	1570	1530	1500	1460	1420	1390	1350		
			1.50	1620	1620	1620	1620	1620	1620	1620	1600	1560	1530	1500	1460	1430		
			1.77	1620	1620	1620	1620	1620	1620	1620	1620	1620	1620	1620	1600	1580		1550
			2.00	1620	1620	1620	1620	1620	1620	1620	1620	1620	1620	1620	1620	1620		1620
356x368x202	$M_{c,y,Rd} = 1370$ $M_{c,z,Rd} = 662$	Class = 1	1.00	1370	1370	1340	1290	1240	1190	1140	1090	1050	1000	960	920	881	66300	
			1.13	1370	1370	1370	1340	1300	1250	1210	1160	1120	1080	1040	999	961		
			1.35	1370	1370	1370	1370	1370	1340	1300	1270	1230	1190	1150	1120	1080		
			1.50	1370	1370	1370	1370	1370	1370	1350	1320	1290	1250	1220	1190	1150		
			1.77	1370	1370	1370	1370	1370	1370	1370	1370	1370	1350	1320	1290	1260		
			2.00	1370	1370	1370	1370	1370	1370	1370	1370	1370	1370	1370	1360	1340		
356x368x177	$M_{c,y,Rd} = 1190$ $M_{c,z,Rd} = 576$	Class = 1	1.00	1190	1190	1160	1110	1060	1020	970	924	880	838	797	760	724	57100	
			1.13	1190	1190	1190	1160	1120	1070	1030	989	947	906	867	829	793		
			1.35	1190	1190	1190	1190	1190	1150	1120	1080	1040	1010	969	933	899		
			1.50	1190	1190	1190	1190	1190	1190	1160	1130	1100	1060	1030	996	962		
			1.77	1190	1190	1190	1190	1190	1190	1190	1190	1190	1180	1150	1120	1090		1060
			2.00	1190	1190	1190	1190	1190	1190	1190	1190	1190	1190	1190	1180	1160		1130
356x368x153	$M_{c,y,Rd} = 1020$ $M_{c,z,Rd} = 495$	Class = 2	1.00	1020	1020	990	946	902	857	812	769	727	687	649	614	582	48600	
			1.13	1020	1020	1020	987	948	908	867	826	785	746	709	673	640		
			1.35	1020	1020	1020	1020	1010	977	942	906	870	834	798	764	730		
			1.50	1020	1020	1020	1020	1020	1020	984	952	919	885	852	819	786		
			1.77	1020	1020	1020	1020	1020	1020	1020	1020	1020	992	963	933	904		874
			2.00	1020	1020	1020	1020	1020	1020	1020	1020	1020	1020	1020	991	964		937
2.50	1020	1020	1020	1020	1020	1020	1020	1020	1020	1020	1020	1020	1020	1020				

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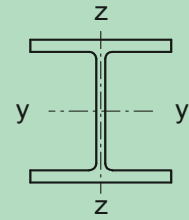
<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8.

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

UNIVERSAL COLUMNS

Advance® UKC



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)											Second Moment of Area y-y axis $I_y$ cm <sup>4</sup>	
				2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0		13.0
356x368x129  $M_{c,y,Rd} = 781$ $M_{c,z,Rd} = 274$  Class = 3	1.00	781	781	760	726	691	656	621	586	551	519	489	461	435	40200	
	1.13	781	781	781	757	726	695	662	629	596	565	534	505	479		
	1.35	781	781	781	781	773	747	720	691	661	632	603	575	548		
	1.50	781	781	781	781	781	776	752	726	699	671	644	617	590		
	1.77	781	781	781	781	781	781	781	781	777	755	731	707	683		658
	2.00	781	781	781	781	781	781	781	781	781	781	773	751	729		707
2.50	781	781	781	781	781	781	781	781	781	781	781	781	781	781	781	
305x305x283  $M_{c,y,Rd} = 1710$ $M_{c,z,Rd} = 785$  Class = 1	1.00	1710	1710	1680	1640	1590	1550	1510	1480	1440	1400	1370	1330	1300	78900	
	1.13	1710	1710	1710	1700	1660	1630	1590	1560	1520	1490	1460	1430	1390		
	1.35	1710	1710	1710	1710	1710	1710	1690	1670	1640	1610	1580	1560	1530		
	1.50	1710	1710	1710	1710	1710	1710	1710	1710	1700	1680	1650	1630	1600		
	1.77	1710	1710	1710	1710	1710	1710	1710	1710	1710	1710	1710	1710	1710		
	2.00	1710	1710	1710	1710	1710	1710	1710	1710	1710	1710	1710	1710	1710		
2.50	1710	1710	1710	1710	1710	1710	1710	1710	1710	1710	1710	1710	1710	1710		
305x305x240  $M_{c,y,Rd} = 1470$ $M_{c,z,Rd} = 673$  Class = 1	1.00	1470	1470	1430	1380	1340	1300	1260	1220	1180	1150	1110	1080	1040	64200	
	1.13	1470	1470	1470	1430	1400	1360	1330	1290	1260	1220	1190	1160	1130		
	1.35	1470	1470	1470	1470	1470	1450	1420	1390	1360	1330	1310	1280	1250		
	1.50	1470	1470	1470	1470	1470	1470	1470	1450	1420	1400	1370	1340	1320		
	1.77	1470	1470	1470	1470	1470	1470	1470	1470	1470	1470	1470	1440	1420		
	2.00	1470	1470	1470	1470	1470	1470	1470	1470	1470	1470	1470	1470	1470		
2.50	1470	1470	1470	1470	1470	1470	1470	1470	1470	1470	1470	1470	1470	1470		
305x305x198  $M_{c,y,Rd} = 1190$ $M_{c,z,Rd} = 545$  Class = 1	1.00	1190	1190	1140	1100	1060	1020	982	946	911	877	844	813	783	50900	
	1.13	1190	1190	1180	1150	1110	1080	1040	1010	976	944	912	882	852		
	1.35	1190	1190	1190	1190	1180	1150	1120	1100	1070	1040	1010	982	955		
	1.50	1190	1190	1190	1190	1190	1190	1170	1140	1120	1090	1070	1040	1020		
	1.77	1190	1190	1190	1190	1190	1190	1190	1190	1190	1190	1170	1150	1130		1110
	2.00	1190	1190	1190	1190	1190	1190	1190	1190	1190	1190	1190	1190	1190		
2.50	1190	1190	1190	1190	1190	1190	1190	1190	1190	1190	1190	1190	1190	1190		
305x305x158  $M_{c,y,Rd} = 925$ $M_{c,z,Rd} = 424$  Class = 1	1.00	925	918	877	838	801	764	729	694	662	631	601	574	548	38700	
	1.13	925	925	911	877	844	811	778	746	715	684	655	628	601		
	1.35	925	925	925	925	903	875	847	819	791	763	736	709	683		
	1.50	925	925	925	925	925	910	886	860	835	809	783	758	733		
	1.77	925	925	925	925	925	925	925	925	921	900	878	856	833		811
	2.00	925	925	925	925	925	925	925	925	925	925	925	906	886		866
2.50	925	925	925	925	925	925	925	925	925	925	925	925	925	925		

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<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8.

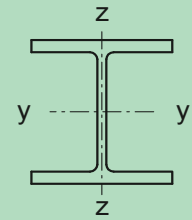
Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.



UNIVERSAL COLUMNS

Advance® UKC



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)											Second Moment of Area y-y axis $I_y$ $cm^4$			
				2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0		13.0	14.0	
305x305x137	$M_{c,y,Rd} = 792$ $M_{c,z,Rd} = 363$	Class = 1	1.00	792	783	746	709	673	637	603	570	539	510	484	459	436	32800	
			1.13	792	792	776	743	711	679	647	615	585	557	529	504	480		
			1.35	792	792	792	790	763	736	708	681	653	626	599	574	550		
			1.50	792	792	792	792	792	768	743	718	692	667	642	617	593		
			1.77	792	792	792	792	792	792	792	792	773	752	729	707	684		662
			2.00	792	792	792	792	792	792	792	792	792	792	773	753	733		712
305x305x118	$M_{c,y,Rd} = 675$ $M_{c,z,Rd} = 309$	Class = 1	1.00	675	665	630	596	562	528	495	464	435	408	384	362	342	27700	
			1.13	675	675	657	626	595	564	533	503	474	447	422	399	377		
			1.35	675	675	675	667	642	615	588	560	533	507	482	458	435		
			1.50	675	675	675	675	667	644	619	593	568	543	519	495	472		
			1.77	675	675	675	675	675	675	665	643	621	599	576	554	533		
			2.00	675	675	675	675	675	675	675	675	658	639	618	598	577		
305x305x97	$M_{c,y,Rd} = 513$ $M_{c,z,Rd} = 170$	Class = 3	1.00	513	506	479	451	423	395	367	342	318	296	277	260	244	22200	
			1.13	513	513	499	474	449	423	397	371	348	325	305	286	269		
			1.35	513	513	513	506	485	462	439	416	393	371	350	330	312		
			1.50	513	513	513	513	505	484	463	442	420	399	378	358	340		
			1.77	513	513	513	513	513	513	499	481	462	442	423	404	386		
			2.00	513	513	513	513	513	513	513	508	491	474	456	438	421		
305x305x97	$M_{c,y,Rd} = 513$ $M_{c,z,Rd} = 170$	Class = 3	2.50	513	513	513	513	513	513	513	513	513	512	498	483			
			2.50	513	513	513	513	513	513	513	513	513	513	512	498	483		

Advance® and UKC are trademarks of Tata Steel. A fuller description of the relationship between Universal Columns (UC) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

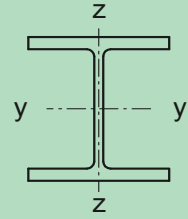
<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8.

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

UNIVERSAL COLUMNS

Advance® UKC



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)											Second Moment of Area y-y axis $I_y$ $cm^4$			
				2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0		13.0	14.0	
254x254x167	$M_{c,y,Rd} = 836$ $M_{c,z,Rd} = 392$	Class = 1	1.00	836	826	794	765	738	712	687	663	639	616	594	573	552	30000	
			1.13	836	836	825	800	776	753	730	707	685	663	642	621	601		
			1.35	836	836	836	836	827	808	788	769	750	731	711	692	673		
			1.50	836	836	836	836	836	836	821	804	787	769	751	734	716		
			1.77	836	836	836	836	836	836	836	836	836	836	826	811	796		780
			2.00	836	836	836	836	836	836	836	836	836	836	836	836	836		825
254x254x132	$M_{c,y,Rd} = 645$ $M_{c,z,Rd} = 303$	Class = 1	1.00	645	630	601	574	549	525	501	479	457	436	417	399	381	22500	
			1.13	645	645	626	603	580	558	536	515	494	474	454	436	418		
			1.35	645	645	645	641	622	604	585	566	548	529	511	493	475		
			1.50	645	645	645	645	645	629	613	596	578	561	544	527	510		
			1.77	645	645	645	645	645	645	645	639	624	610	595	580	564		
			2.00	645	645	645	645	645	645	645	645	645	645	643	630	617		603
254x254x107	$M_{c,y,Rd} = 512$ $M_{c,z,Rd} = 240$	Class = 1	1.00	512	495	469	444	419	396	374	353	334	315	299	283	269	17500	
			1.13	512	512	490	467	446	424	403	383	363	345	328	312	297		
			1.35	512	512	512	500	482	463	445	426	408	390	373	357	341		
			1.50	512	512	512	512	502	485	468	451	434	418	401	385	370		
			1.77	512	512	512	512	512	512	503	489	474	459	444	430	415		
			2.00	512	512	512	512	512	512	512	512	502	489	475	462	448		
254x254x89	$M_{c,y,Rd} = 422$ $M_{c,z,Rd} = 198$	Class = 1	1.00	422	405	381	357	334	312	291	272	254	238	224	211	199	14300	
			1.13	422	420	399	378	356	335	315	296	278	262	247	233	220		
			1.35	422	422	422	406	388	369	351	333	316	299	283	269	255		
			1.50	422	422	422	421	405	389	372	355	338	322	307	292	278		
			1.77	422	422	422	422	422	417	403	388	373	359	344	330	316		
			2.00	422	422	422	422	422	422	422	412	398	385	371	358	345		
254x254x73	$M_{c,y,Rd} = 352$ $M_{c,z,Rd} = 165$	Class = 2	1.00	352	334	311	288	265	243	223	205	189	176	164	153	144	11400	
			1.13	352	347	327	306	284	263	243	225	209	194	181	169	158		
			1.35	352	352	348	331	312	293	274	256	239	224	209	196	184		
			1.50	352	352	352	344	328	310	293	275	259	243	228	215	202		
			1.77	352	352	352	352	351	336	321	305	290	275	260	246	233		
			2.00	352	352	352	352	352	352	341	327	312	298	284	271	257		
		2.50	352	352	352	352	352	352	352	352	351	339	327	315	303			

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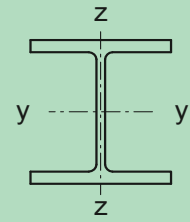
<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8.

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

UNIVERSAL COLUMNS

Advance® UKC



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)											Second Moment of Area y-y axis $I_y$ cm <sup>4</sup>
				2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	
203x203x127 +  $M_{c,y,Rd} = 523$ $M_{c,z,Rd} = 243$  Class = 1	1.00	523	508	488	469	452	435	419	403	388	373	359	345	332	15400
	1.13	523	523	508	492	477	461	446	432	417	403	389	376	362	
	1.35	523	523	523	523	510	497	485	472	459	446	433	421	408	
	1.50	523	523	523	523	523	517	506	495	483	471	459	447	436	
	1.77	523	523	523	523	523	523	523	523	518	508	498	488	477	
	2.00	523	523	523	523	523	523	523	523	523	523	523	516	507	
2.50	523	523	523	523	523	523	523	523	523	523	523	523	523	523	
203x203x113 +  $M_{c,y,Rd} = 459$ $M_{c,z,Rd} = 213$  Class = 1	1.00	459	441	422	404	388	371	356	341	326	312	299	287	275	13300
	1.13	459	457	441	425	410	395	381	366	352	339	326	313	301	
	1.35	459	459	459	453	441	428	416	403	390	378	366	354	342	
	1.50	459	459	459	459	457	446	435	424	412	401	389	378	366	
	1.77	459	459	459	459	459	459	459	455	445	435	425	415	405	
	2.00	459	459	459	459	459	459	459	459	459	459	459	441	432	
2.50	459	459	459	459	459	459	459	459	459	459	459	459	459	459	
203x203x100 +  $M_{c,y,Rd} = 396$ $M_{c,z,Rd} = 184$  Class = 1	1.00	396	377	359	342	326	311	296	282	268	255	243	232	222	11300
	1.13	396	392	376	361	346	332	318	304	291	278	266	255	244	
	1.35	396	396	396	386	374	362	349	337	325	313	301	290	279	
	1.50	396	396	396	396	389	378	367	356	345	333	322	311	300	
	1.77	396	396	396	396	396	396	394	384	374	365	355	345	335	
	2.00	396	396	396	396	396	396	396	396	395	386	378	369	359	
2.50	396	396	396	396	396	396	396	396	396	396	396	396	396	396	
203x203x86  $M_{c,y,Rd} = 337$ $M_{c,z,Rd} = 157$  Class = 1	1.00	337	318	300	284	269	254	240	226	214	203	192	182	173	9450
	1.13	337	331	315	301	286	272	259	246	234	222	211	201	191	
	1.35	337	337	335	323	311	299	287	275	263	252	241	230	220	
	1.50	337	337	337	336	325	314	303	292	281	270	259	249	239	
	1.77	337	337	337	337	337	336	327	317	308	298	288	278	269	
	2.00	337	337	337	337	337	337	337	337	335	327	318	309	291	
2.50	337	337	337	337	337	337	337	337	337	337	337	337	337	330	

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+ These sections are in addition to the range of BS 4 sections.

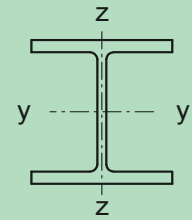
<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8.

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

UNIVERSAL COLUMNS

Advance® UKC



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)											Second Moment of Area y-y axis $I_y$ $cm^4$	
				1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0		9.0
203x203x71  $M_{c,y,Rd} = 276$ $M_{c,z,Rd} = 129$  Class = 1	1.00	276	276	274	265	256	248	240	224	209	195	182	171	160	7620	
	1.13	276	276	276	275	267	260	253	238	225	211	199	187	175		
	1.35	276	276	276	276	276	276	270	258	246	234	222	211	200		
	1.50	276	276	276	276	276	276	276	269	258	247	236	225	215		
	1.77	276	276	276	276	276	276	276	276	276	276	267	258	248		238
	2.00	276	276	276	276	276	276	276	276	276	276	276	272	264		255
2.50	276	276	276	276	276	276	276	276	276	276	276	276	276	276		
203x203x60  $M_{c,y,Rd} = 233$ $M_{c,z,Rd} = 108$  Class = 1	1.00	233	233	230	221	213	205	196	181	166	152	140	129	120	6130	
	1.13	233	233	233	230	222	215	208	193	179	166	153	142	132		
	1.35	233	233	233	233	233	229	223	211	198	186	174	163	152		
	1.50	233	233	233	233	233	233	232	221	210	198	187	176	165		
	1.77	233	233	233	233	233	233	233	233	226	216	206	196	186		
	2.00	233	233	233	233	233	233	233	233	233	229	220	210	201		
2.50	233	233	233	233	233	233	233	233	233	233	233	233	233	228		
203x203x52  $M_{c,y,Rd} = 201$ $M_{c,z,Rd} = 93.8$  Class = 1	1.00	201	201	198	190	182	174	167	151	137	125	114	104	95.8	5260	
	1.13	201	201	201	198	191	184	177	163	149	136	125	115	106		
	1.35	201	201	201	201	201	197	191	179	166	154	143	132	122		
	1.50	201	201	201	201	201	201	198	188	176	165	154	143	133		
	1.77	201	201	201	201	201	201	201	201	191	181	171	161	152		
	2.00	201	201	201	201	201	201	201	201	201	193	184	174	165		
2.50	201	201	201	201	201	201	201	201	201	201	201	197	190			
203x203x46  $M_{c,y,Rd} = 177$ $M_{c,z,Rd} = 81.9$  Class = 2	1.00	177	177	173	166	158	151	144	129	115	104	93.5	85.1	77.9	4570	
	1.13	177	177	177	172	166	159	153	139	126	114	103	93.9	85.9		
	1.35	177	177	177	177	176	171	165	153	141	129	118	109	99.9		
	1.50	177	177	177	177	177	177	172	161	150	139	128	118	109		
	1.77	177	177	177	177	177	177	177	174	164	154	144	134	125		
	2.00	177	177	177	177	177	177	177	177	173	164	155	146	137		
2.50	177	177	177	177	177	177	177	177	177	177	175	167	160			

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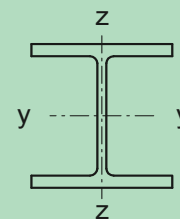
<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8.

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

UNIVERSAL COLUMNS

Advance® UKC



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)											Second Moment of Area y-y axis $I_y$ cm <sup>4</sup>		
				1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0		9.0	10.0
152x152x51 +	$M_{c,y,Rd} = 155$ $M_{c,z,Rd} = 70.6$	Class = 1	1.00	155	155	149	143	138	133	128	119	110	102	94.4	87.8	81.9	3230
			1.13	155	155	155	150	145	140	136	127	119	111	103	96.5	90.2	
			1.35	155	155	155	155	154	151	147	139	132	124	117	110	104	
			1.50	155	155	155	155	155	155	153	146	139	132	125	119	112	
			1.77	155	155	155	155	155	155	155	155	150	144	138	132	126	
			2.00	155	155	155	155	155	155	155	155	155	153	147	142	136	
152x152x44 +	$M_{c,y,Rd} = 132$ $M_{c,z,Rd} = 60.0$	Class = 1	1.00	132	131	125	120	115	110	105	96.2	88.0	80.6	74.1	68.4	63.4	2700
			1.13	132	132	130	126	121	117	112	104	95.7	88.2	81.5	75.4	70.0	
			1.35	132	132	132	132	129	126	122	114	107	99.9	93.2	86.9	81.1	
			1.50	132	132	132	132	132	131	127	121	114	107	100	94.1	88.2	
			1.77	132	132	132	132	132	132	132	130	124	118	112	106	100	
			2.00	132	132	132	132	132	132	132	132	131	125	120	115	109	
152x152x37	$M_{c,y,Rd} = 110$ $M_{c,z,Rd} = 49.5$	Class = 1	1.00	110	108	103	98.0	93.1	88.4	83.8	75.2	67.7	61.2	55.7	51.0	47.0	2210
			1.13	110	110	107	103	98.4	94.1	89.8	81.6	74.0	67.3	61.4	56.3	51.8	
			1.35	110	110	110	109	106	102	98.3	90.9	83.7	77.0	70.8	65.2	60.3	
			1.50	110	110	110	110	110	106	103	96.3	89.5	83.0	76.8	71.2	66.0	
			1.77	110	110	110	110	110	110	110	104	98.5	92.5	86.6	81.0	75.7	
			2.00	110	110	110	110	110	110	110	110	105	99.3	93.9	88.5	83.3	
152x152x30	$M_{c,y,Rd} = 87.9$ $M_{c,z,Rd} = 39.6$	Class = 1	1.00	87.9	86.2	81.6	77.0	72.4	67.9	63.6	55.7	49.1	43.7	39.3	35.6	32.5	1750
			1.13	87.9	87.9	85.1	81.1	76.9	72.7	68.6	60.8	54.0	48.2	43.3	39.2	35.9	
			1.35	87.9	87.9	87.9	86.5	83.0	79.4	75.8	68.5	61.8	55.7	50.3	45.7	41.7	
			1.50	87.9	87.9	87.9	87.9	86.4	83.2	79.9	73.1	66.6	60.5	55.0	50.1	45.8	
			1.77	87.9	87.9	87.9	87.9	87.9	87.9	86.0	80.2	74.2	68.4	62.9	57.8	53.2	
			2.00	87.9	87.9	87.9	87.9	87.9	87.9	87.9	85.1	79.7	74.2	68.9	63.9	59.3	
152x152x23	$M_{c,y,Rd} = 58.2$ $M_{c,z,Rd} = 18.7$	Class = 3	1.00	58.2	57.2	54.0	50.7	47.3	43.9	40.7	34.8	30.1	26.4	23.4	20.9	18.6	1250
			1.13	58.2	58.2	56.3	53.4	50.3	47.2	44.0	38.2	33.2	29.1	25.8	23.2	21.0	
			1.35	58.2	58.2	58.2	57.0	54.5	51.7	48.9	43.3	38.2	33.8	30.1	26.9	24.3	
			1.50	58.2	58.2	58.2	58.2	56.8	54.3	51.7	46.4	41.4	36.9	33.0	29.6	26.7	
			1.77	58.2	58.2	58.2	58.2	58.2	58.1	56.0	51.3	46.6	42.1	38.1	34.5	31.3	
			2.00	58.2	58.2	58.2	58.2	58.2	58.2	58.2	54.8	50.4	46.1	42.1	38.4	35.1	
2.50	58.2	58.2	58.2	58.2	58.2	58.2	58.2	58.2	57.1	53.4	49.7	46.2	42.8				

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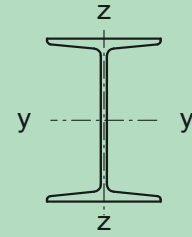
+ These sections are in addition to the range of BS 4 sections.

<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8.

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

JOISTS



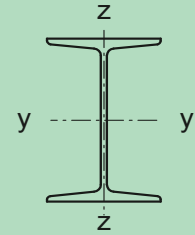
Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)												Second Moment of Area y-y axis $I_y$ cm <sup>4</sup>
				1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	
254x203x82  $M_{c,y,Rd} = 372$ $M_{c,z,Rd} = 128$  Class = 1	1.00	372	372	364	352	340	328	317	296	276	257	240	224	210	12000	
	1.13	372	372	372	365	355	345	335	315	297	278	261	245	230		
	1.35	372	372	372	372	372	367	359	343	326	310	294	278	263		
	1.50	372	372	372	372	372	372	372	372	358	343	328	313	298		284
	1.77	372	372	372	372	372	372	372	372	372	368	355	342	329		316
	2.00	372	372	372	372	372	372	372	372	372	372	372	372	363		351
2.50	372	372	372	372	372	372	372	372	372	372	372	372	372	372	372	
254x114x37  $M_{c,y,Rd} = 163$ $M_{c,z,Rd} = 28.1$  Class = 1	1.00	157	139	122	107	94.6	84.5	76.1	63.5	54.5	47.7	42.5	38.3	34.4	5080	
	1.13	163	146	131	116	104	92.9	83.9	69.8	59.8	52.6	46.9	42.4	38.7		
	1.35	163	157	143	130	117	106	96.8	81.1	69.1	60.2	54.0	49.0	44.9		
	1.50	163	163	150	138	126	115	105	88.7	75.9	65.6	58.6	53.3	48.8		
	1.77	163	163	161	150	139	129	119	102	88.1	76.7	67.3	60.4	55.6		
	2.00	163	163	163	158	148	139	129	113	98.2	86.1	76.0	67.4	61.0		
2.50	163	163	163	163	163	163	157	148	133	118	106	94.4	84.7	76.2		
203x152x52  $M_{c,y,Rd} = 187$ $M_{c,z,Rd} = 60.7$  Class = 1	1.00	187	183	175	168	160	153	147	134	123	112	103	95.3	88.4	4800	
	1.13	187	187	182	176	169	163	157	145	133	123	114	105	97.5		
	1.35	187	187	187	186	181	176	171	160	150	140	130	121	113		
	1.50	187	187	187	187	187	183	178	169	159	150	140	131	123		
	1.77	187	187	187	187	187	187	187	187	182	174	165	156	148		140
	2.00	187	187	187	187	187	187	187	187	187	184	176	168	160		153
2.50	187	187	187	187	187	187	187	187	187	187	187	187	182	175		
152x127x37  $M_{c,y,Rd} = 99.0$ $M_{c,z,Rd} = 35.4$  Class = 1	1.00	99.0	95.0	90.5	86.4	82.4	78.6	74.9	68.1	61.9	56.5	51.8	47.7	44.2	1820	
	1.13	99.0	98.5	94.6	90.9	87.3	83.8	80.4	73.8	67.7	62.1	57.1	52.7	48.7		
	1.35	99.0	99.0	99.0	97.1	94.1	91.2	88.2	82.2	76.4	70.9	65.7	61.0	56.6		
	1.50	99.0	99.0	99.0	99.0	97.9	95.3	92.6	87.1	81.6	76.3	71.2	66.4	61.9		
	1.77	99.0	99.0	99.0	99.0	99.0	99.0	99.0	99.0	94.4	89.6	84.7	79.9	75.3		70.8
	2.00	99.0	99.0	99.0	99.0	99.0	99.0	99.0	99.0	99.0	95.2	90.8	86.4	82.0		77.6
2.50	99.0	99.0	99.0	99.0	99.0	99.0	99.0	99.0	99.0	99.0	99.0	97.6	93.9	90.1		

<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8.

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

JOISTS



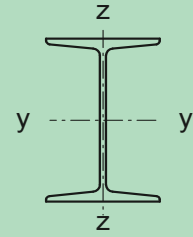
Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)											Second Moment of Area y-y axis $I_y$ $cm^4$
				1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	
127x114x29  $M_{c,y,Rd} = 64.3$ $M_{c,z,Rd} = 25.1$  Class = 1	1.00	64.3	61.0	58.1	55.3	52.7	50.2	47.8	43.3	39.3	35.8	32.8	30.2	27.9	979
	1.13	64.3	63.4	60.8	58.4	56.0	53.7	51.4	47.0	43.0	39.4	36.1	33.3	30.8	
	1.35	64.3	64.3	64.3	62.5	60.5	58.5	56.5	52.6	48.7	45.1	41.7	38.6	35.8	
	1.50	64.3	64.3	64.3	64.3	63.0	61.2	59.4	55.8	52.1	48.6	45.2	42.1	39.2	
	1.77	64.3	64.3	64.3	64.3	64.3	64.3	63.7	60.6	57.4	54.1	50.9	47.8	44.9	
	2.00	64.3	64.3	64.3	64.3	64.3	64.3	64.3	64.0	61.1	58.2	55.2	52.2	49.3	
2.50	64.3	64.3	64.3	64.3	64.3	64.3	64.3	64.3	64.3	64.3	64.3	62.6	60.1	57.5	
127x114x27  $M_{c,y,Rd} = 61.1$ $M_{c,z,Rd} = 24.2$  Class = 1	1.00	61.1	57.7	54.8	52.0	49.4	46.8	44.4	39.9	36.0	32.7	29.8	27.4	25.2	946
	1.13	61.1	60.0	57.4	54.9	52.5	50.2	47.9	43.5	39.5	36.0	32.9	30.2	27.8	
	1.35	61.1	61.1	61.0	58.9	56.9	54.9	52.8	48.8	44.9	41.3	38.0	35.1	32.4	
	1.50	61.1	61.1	61.1	61.1	59.4	57.5	55.7	51.9	48.2	44.7	41.4	38.3	35.5	
	1.77	61.1	61.1	61.1	61.1	61.1	61.1	59.9	56.7	53.4	50.1	46.9	43.8	40.9	
	2.00	61.1	61.1	61.1	61.1	61.1	61.1	61.1	60.0	57.0	54.0	51.0	48.0	45.1	
2.50	61.1	61.1	61.1	61.1	61.1	61.1	61.1	61.1	61.1	61.1	60.8	58.2	55.7	53.1	
127x76x16  $M_{c,y,Rd} = 36.9$ $M_{c,z,Rd} = 9.37$  Class = 1	1.00	34.2	31.0	28.0	25.3	22.8	20.7	18.9	16.1	13.9	11.9	10.4	9.23	8.30	571
	1.13	35.7	32.8	30.0	27.4	25.0	22.8	20.9	17.7	15.3	13.5	11.8	10.4	9.38	
	1.35	36.9	35.3	32.9	30.5	28.2	26.1	24.1	20.6	17.8	15.5	14.0	12.5	11.2	
	1.50	36.9	36.7	34.6	32.4	30.2	28.1	26.1	22.5	19.6	17.1	15.2	13.8	12.5	
	1.77	36.9	36.9	36.9	35.1	33.2	31.3	29.4	25.8	22.7	20.0	17.7	15.8	14.5	
	2.00	36.9	36.9	36.9	36.9	35.3	33.6	31.8	28.4	25.2	22.4	20.0	17.9	16.0	
2.50	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.1	33.1	30.1	27.3	24.7	22.4	20.3	
114x114x27  $M_{c,y,Rd} = 53.6$ $M_{c,z,Rd} = 23.4$  Class = 1	1.00	53.6	51.3	49.0	46.9	44.9	43.0	41.2	37.7	34.5	31.6	29.1	26.9	24.9	736
	1.13	53.6	53.2	51.2	49.4	47.6	45.8	44.1	40.7	37.6	34.7	32.0	29.6	27.5	
	1.35	53.6	53.6	53.6	52.7	51.2	49.7	48.2	45.2	42.3	39.4	36.7	34.2	31.9	
	1.50	53.6	53.6	53.6	53.6	53.2	51.9	50.6	47.8	45.0	42.3	39.7	37.2	34.8	
	1.77	53.6	53.6	53.6	53.6	53.6	53.6	53.6	51.7	49.3	46.8	44.4	42.0	39.6	
	2.00	53.6	53.6	53.6	53.6	53.6	53.6	53.6	53.6	53.6	52.2	50.0	47.8	45.5	
2.50	53.6	53.6	53.6	53.6	53.6	53.6	53.6	53.6	53.6	53.6	53.6	51.8	49.9		

<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8.

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

JOISTS



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)											Second Moment of Area y-y axis $I_y$ cm <sup>4</sup>			
				1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0		9.0	10.0	
102x102x23	$M_{c,y,Rd} = 40.1$ $M_{c,z,Rd} = 18.0$	Class = 1	1.00	40.0	38.0	36.3	34.7	33.2	31.7	30.3	27.6	25.2	23.1	21.2	19.5	18.1	486	
			1.13	40.1	39.5	38.0	36.6	35.2	33.9	32.5	29.9	27.5	25.3	23.3	21.6	20.0		
			1.35	40.1	40.1	40.1	39.1	38.0	36.8	35.7	33.3	31.1	28.9	26.8	24.9	23.2		
			1.50	40.1	40.1	40.1	40.1	39.5	38.5	37.5	35.3	33.2	31.1	29.0	27.1	25.3		
			1.77	40.1	40.1	40.1	40.1	40.1	40.1	40.1	40.1	38.3	36.4	34.5	32.6	30.7		28.9
			2.00	40.1	40.1	40.1	40.1	40.1	40.1	40.1	40.1	40.1	38.7	36.9	35.2	33.4		31.7
102x44x7	$M_{c,y,Rd} = 12.6$ $M_{c,z,Rd} = 2.14$	Class = 1	1.00	8.68	6.80	5.55	4.68	4.05	3.56	3.19	2.58	2.14	1.83	1.60	1.42	1.28	153	
			1.13	9.38	7.47	6.12	5.14	4.45	3.93	3.52	2.91	2.42	2.07	1.81	1.61	1.45		
			1.35	10.4	8.53	7.08	5.97	5.11	4.51	4.06	3.38	2.89	2.48	2.16	1.92	1.73		
			1.50	11.0	9.18	7.71	6.54	5.62	4.88	4.40	3.68	3.17	2.75	2.41	2.14	1.92		
			1.77	11.9	10.2	8.77	7.55	6.54	5.71	5.02	4.20	3.63	3.20	2.84	2.52	2.27		
			2.00	12.5	11.0	9.59	8.36	7.31	6.42	5.67	4.61	4.00	3.53	3.16	2.85	2.56		
89x89x19	$M_{c,y,Rd} = 29.4$ $M_{c,z,Rd} = 13.5$	Class = 1	1.00	29.1	27.7	26.4	25.3	24.2	23.1	22.1	20.1	18.4	16.8	15.4	14.2	13.2	307	
			1.13	29.4	28.8	27.7	26.7	25.7	24.7	23.7	21.8	20.1	18.5	17.0	15.7	14.6		
			1.35	29.4	29.4	29.4	28.6	27.7	26.9	26.0	24.3	22.7	21.1	19.6	18.2	16.9		
			1.50	29.4	29.4	29.4	29.4	28.9	28.1	27.3	25.8	24.2	22.7	21.2	19.8	18.5		
			1.77	29.4	29.4	29.4	29.4	29.4	29.4	29.3	28.0	26.6	25.2	23.8	22.4	21.1		
			2.00	29.4	29.4	29.4	29.4	29.4	29.4	29.4	29.4	28.2	27.0	25.7	24.4	23.1		
76x76x15	$M_{c,y,Rd} = 19.2$ $M_{c,z,Rd} = 9.16$	Class = 1	1.00	18.8	17.9	17.0	16.2	15.4	14.7	14.0	12.6	11.4	10.4	9.51	8.74	8.08	172	
			1.13	19.2	18.6	17.9	17.2	16.5	15.8	15.1	13.7	12.5	11.5	10.5	9.64	8.90		
			1.35	19.2	19.2	19.1	18.5	17.9	17.2	16.6	15.4	14.2	13.1	12.1	11.2	10.4		
			1.50	19.2	19.2	19.2	19.2	18.6	18.1	17.5	16.4	15.3	14.2	13.2	12.2	11.4		
			1.77	19.2	19.2	19.2	19.2	19.2	19.2	19.2	18.9	17.9	16.9	15.9	14.9	14.0		13.1
			2.00	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	18.9	18.0	17.1	16.2	15.3		14.4
76x76x13	$M_{c,y,Rd} = 17.3$ $M_{c,z,Rd} = 7.95$	Class = 1	1.00	16.7	15.7	14.8	14.0	13.2	12.4	11.7	10.4	9.24	8.32	7.55	6.90	6.32	158	
			1.13	17.3	16.4	15.6	14.9	14.1	13.4	12.7	11.3	10.2	9.18	8.32	7.59	6.98		
			1.35	17.3	17.3	16.8	16.1	15.5	14.8	14.1	12.9	11.7	10.6	9.68	8.84	8.11		
			1.50	17.3	17.3	17.3	16.8	16.2	15.6	15.0	13.8	12.6	11.6	10.6	9.71	8.92		
			1.77	17.3	17.3	17.3	17.3	17.3	16.8	16.3	15.2	14.2	13.1	12.1	11.2	10.4		
			2.00	17.3	17.3	17.3	17.3	17.3	17.3	17.2	16.3	15.3	14.3	13.3	12.4	11.6		
76x76x13	$M_{c,y,Rd} = 17.3$ $M_{c,z,Rd} = 7.95$	Class = 1	2.50	17.3	17.3	17.3	17.3	17.3	17.3	17.3	17.3	17.2	16.4	15.5	14.7	13.8		

<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8.

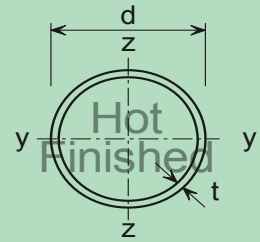
Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.



**HOT-FINISHED  
CIRCULAR HOLLOW SECTIONS**

**Celsius® CHS**



Moment resistance and shear resistance

Section Designation		Mass per Metre kg/m	Section Classification	Moment Resistance $M_{c,Rd}$ kNm	Second Moment Of Area $I_y$ cm <sup>4</sup>	Shear Resistance $V_{c,Rd}$ kN
d mm	t mm					
26.9	2.6 #	1.56	1	0.547	1.48	25.8
	2.9 #	1.72	1	0.596	1.60	28.6
	3.2	1.87	1	0.643	1.70	31.1
	3.6 #	2.07	1	0.699	1.83	34.4
33.7	2.6 #	1.99	1	0.895	3.09	33.1
	2.9 #	2.20	1	0.980	3.36	36.7
	3.2	2.41	1	1.06	3.60	40.1
	3.6 #	2.67	1	1.16	3.91	44.4
	4.0	2.93	1	1.26	4.19	48.7
	4.5 #	3.24	1	1.37	4.50	53.9
42.4	5.0 #	3.54	1	1.48	4.78	58.8
	2.6 #	2.55	1	1.46	6.46	42.4
	2.9 #	2.82	1	1.61	7.06	47.0
	3.2	3.09	1	1.75	7.62	51.4
	3.6 #	3.44	1	1.93	8.33	57.3
	4.0	3.79	1	2.10	8.99	63.0
48.3	4.5 #	4.21	1	2.30	9.76	69.9
	5.0 #	4.61	1	2.50	10.5	76.6
	2.6 #	2.93	1	1.93	9.78	48.7
	2.9 #	3.25	1	2.13	10.7	54.0
	3.2	3.56	1	2.31	11.6	59.1
	3.6 #	3.97	1	2.56	12.7	66.0
	4.0	4.37	1	2.79	13.8	72.7
	4.5 #	4.86	1	3.07	15.0	80.8
60.3	5.0	5.34	1	3.34	16.2	88.7
	5.6 #	5.90	1	3.66	17.4	98.0
	6.3	6.53	1	3.98	18.7	108
	2.6 #	3.70	1	3.07	19.7	61.5
	2.9 #	4.11	1	3.39	21.6	68.2
	3.2	4.51	1	3.69	23.5	74.9
	3.6 #	5.03	1	4.12	25.9	83.6
	4.0	5.55	1	4.51	28.2	92.3
4.5 #	6.19	1	4.97	30.9	103	
60.3	5.0	6.82	1	5.43	33.5	113
	5.6 #	7.55	1	5.96	36.4	126
	6.3	8.39	1	6.57	39.5	140
	8.0 #	10.3	1	7.85	46.0	171

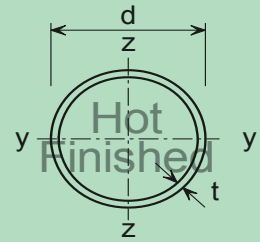
Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Circular Hollow Sections (HFCHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 8.

**HOT-FINISHED  
CIRCULAR HOLLOW SECTIONS**

**Celsius® CHS**



Moment resistance and shear resistance

Section Designation		Mass per Metre kg/m	Section Classification	Moment Resistance $M_{c,Rd}$ kNm	Second Moment Of Area $I_y$ cm <sup>4</sup>	Shear Resistance $V_{c,Rd}$ kN
d mm	t mm					
76.1	2.9	5.24	1	5.50	44.7	87.0
	3.2	5.75	1	6.04	48.8	95.6
	3.6 #	6.44	1	6.71	54.0	107
	4.0	7.11	1	7.38	59.1	118
	4.5 #	7.95	1	8.20	65.1	132
	5.0	8.77	1	8.98	70.9	146
	5.6 #	9.74	1	9.90	77.5	162
	6.3	10.8	1	10.9	84.8	180
88.9	8.0	13.4	1	13.2	101	223
	2.9 #	6.15	1	7.63	72.5	102
	3.2 #	6.76	1	8.34	79.2	112
	3.6 #	7.57	1	9.30	87.9	126
	4.0	8.38	1	10.3	96.3	140
	4.5 #	9.37	1	11.4	107	155
	5.0	10.3	1	12.5	116	172
	5.6 #	11.5	1	13.8	128	192
	6.3	12.8	1	15.3	140	213
8.0	16.0	1	18.6	168	265	
101.6	10.0 #	19.5	1	22.2	196	324
	3.2 #	7.77	1	11.0	120	129
	3.6 #	8.70	1	12.3	133	145
	4.0 #	9.63	1	13.5	146	160
	4.5 #	10.8	1	15.1	162	179
	5.0 #	11.9	1	16.6	177	198
	5.6 #	13.3	1	18.4	195	221
	6.3 #	14.8	1	20.3	215	247
8.0 #	18.5	1	25.0	260	307	
114.3	10.0 #	22.6	1	29.9	305	376
	3.2 #	8.77	2	14.0	172	146
	3.6	9.83	1	15.7	192	163
	4.0	10.9	1	17.3	211	181
	4.5 #	12.2	1	19.3	234	202
	5.0	13.5	1	21.2	257	224
	5.6 #	15.0	1	23.5	283	249
	6.3	16.8	1	26.1	313	279
	8.0	21.0	1	32.2	379	348
10.0 #	25.7	1	38.7	450	428	

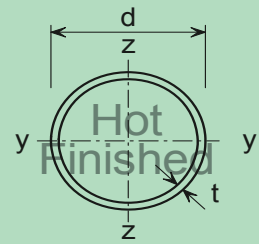
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# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 8.

**HOT-FINISHED  
CIRCULAR HOLLOW SECTIONS**

**Celsius® CHS**



Moment resistance and shear resistance

Section Designation		Mass per Metre kg/m	Section Classification	Moment Resistance $M_{c,Rd}$ kNm	Second Moment Of Area $I_y$ cm <sup>4</sup>	Shear Resistance $V_{c,Rd}$ kN
d mm	t mm					
139.7	3.2 #	10.8	2	21.2	320	179
	3.6 #	12.1	2	23.7	357	201
	4.0 #	13.4	2	26.2	393	223
	4.5 #	15.0	1	29.2	437	249
	5.0	16.6	1	32.2	481	277
	5.6 #	18.5	1	35.9	531	308
	6.3	20.7	1	39.8	589	344
	8.0	26.0	1	49.3	720	432
	10.0	32.0	1	60.0	862	531
	12.5 #	39.2	1	72.1	1020	652
168.3	5.0	20.1	2	47.2	856	335
	5.6 #	22.5	1	52.5	948	373
	6.3	25.2	1	58.6	1050	419
	8.0	31.6	1	73.1	1300	526
	10.0	39.0	1	89.1	1560	648
	12.5	48.0	1	108	1870	799
193.7	5.0	23.3	2	63.2	1320	386
	5.6 #	26.0	2	70.3	1470	432
	6.3	29.1	1	78.5	1630	484
	8.0	36.6	1	98.0	2020	609
	10.0	45.3	1	120	2440	753
	12.5	55.9	1	146	2930	929
	16.0 #	70.1	1	180	3550	1170
219.1	4.5 #	23.8	3	56.4	1750	395
	5.0 #	26.4	2	81.3	1930	438
	5.6 #	29.5	2	90.5	2140	491
	6.3	33.1	2	101	2390	549
	8.0	41.6	1	127	2960	693
	10.0	51.6	1	155	3600	857
	12.5	63.7	1	190	4350	1060
	14.2 #	71.8	1	212	4820	1190
	16.0	80.1	1	235	5300	1330

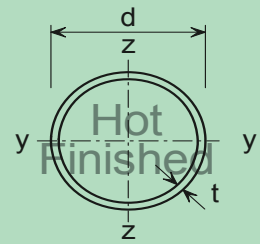
Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Circular Hollow Sections (HFCHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 8.

**HOT-FINISHED  
CIRCULAR HOLLOW SECTIONS**

**Celsius® CHS**



Moment resistance and shear resistance

Section Designation		Mass per Metre kg/m	Section Classification	Moment Resistance $M_{c,Rd}$ kNm	Second Moment Of Area $I_y$ cm <sup>4</sup>	Shear Resistance $V_{c,Rd}$ kN
d mm	t mm					
244.5	5.0 #	29.5	3	78.5	2700	491
	5.6 #	33.0	2	114	3000	548
	6.3 #	37.0	2	127	3350	615
	8.0 #	46.7	1	159	4160	775
	10.0 #	57.8	1	195	5070	962
	12.5	71.5	1	239	6150	1190
	14.2 #	80.6	1	268	6840	1340
	16.0	90.2	1	297	7530	1500
273	5.0 #	33.0	3	98.3	3780	549
	5.6 #	36.9	3	109	4210	613
	6.3 #	41.4	2	159	4700	689
	8.0 #	52.3	2	200	5850	869
	10.0	64.9	1	246	7150	1080
	12.5	80.3	1	301	8700	1330
	14.2 #	90.6	1	338	9700	1500
	16.0	101	1	376	10700	1680
323.9	5.0 #	39.3	4	\$	6370	654
	5.6 #	44.0	3	155	7090	731
	6.3 #	49.3	3	174	7930	821
	8.0 #	62.3	2	284	9910	1040
	10.0	77.4	1	350	12200	1290
	12.5	96.0	1	431	14800	1590
	14.2 #	108	1	484	16600	1800
	16.0	121	1	539	18400	2020
355.6	6.3 #	54.3	3	211	10500	902
	8.0 #	68.6	2	343	13200	1140
	10.0 #	85.2	2	424	16200	1420
	12.5 #	106	1	523	19900	1760
	14.2 #	120	1	588	22200	1980
	16.0	134	1	656	24700	2230

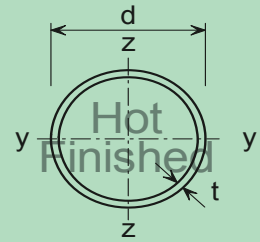
Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Circular Hollow Sections (HFCHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

\$ Compression resistance for a class 4 section is not calculated

FOR EXPLANATION OF TABLES SEE NOTE 8.

**HOT-FINISHED  
CIRCULAR HOLLOW SECTIONS**

**Celsius® CHS**



Moment resistance and shear resistance

Section Designation		Mass per Metre kg/m	Section Classification	Moment Resistance $M_{c,Rd}$ kNm	Second Moment Of Area $I_y$ cm <sup>4</sup>	Shear Resistance $V_{c,Rd}$ kN
d mm	t mm					
406.4	6.3 #	62.2	4	\$	15800	1030
	8.0 #	78.6	3	347	19900	1300
	10.0	97.8	2	558	24500	1630
	12.5 #	121	1	689	30000	2020
	14.2 #	137	1	776	33700	2280
	16.0	154	1	866	37400	2560
457	6.3 #	70.0	4	\$	22700	1160
	8.0 #	88.6	3	442	28400	1470
	10.0	110	2	709	35100	1830
	12.5 #	137	2	877	43100	2280
	14.2 #	155	1	989	48500	2580
	16.0	174	1	1110	54000	2900
508	6.3 #	77.9	4	\$	31200	1300
	8.0 #	98.6	4	\$	39300	1640
	10.0 #	123	3	678	48500	2040
	12.5	153	2	1090	59800	2540
	14.2 #	173	2	1230	67200	2870
	16.0	194	1	1380	74900	3220

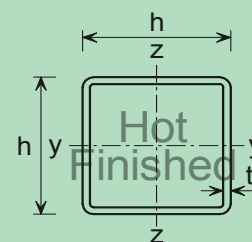
Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Circular Hollow Sections (HFCHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

\$ Compression resistance for a class 4 section is not calculated

FOR EXPLANATION OF TABLES SEE NOTE 8.

**HOT-FINISHED  
SQUARE HOLLOW SECTIONS**

**Celsius® SHS**



Design moment resistance and design shear resistance

Section Designation		Mass per Metre kg/m	Section Classification	Moment Resistance $M_{c,Rd}$ kNm	Second Moment Of Area $I_y$ cm <sup>4</sup>	Shear Resistance $V_{c,Rd}$ kN
h x h mm	t mm					
40x40	3.0 #	3.41	1	2.12	9.78	44.5
	3.2	3.61	1	2.23	10.2	47.1
	3.6 #	4.01	1	2.44	11.1	52.3
	4.0	4.39	1	2.64	11.8	57.3
	5.0	5.28	1	3.07	13.4	69.0
50x50	3.0 #	4.35	1	3.44	20.2	56.8
	3.2	4.62	1	3.62	21.2	60.3
	3.6 #	5.14	1	4.01	23.2	67.0
	4.0	5.64	1	4.37	25.0	73.7
	5.0	6.85	1	5.15	28.9	89.5
	6.3	8.31	1	6.04	32.8	109
	7.1 #	9.14	1	6.50	34.5	119
8.0 #	10.0	1	6.92	36.0	131	
60x60	3.0 #	5.29	1	5.08	36.2	69.1
	3.2	5.62	1	5.40	38.2	73.4
	3.6 #	6.27	1	5.96	41.9	81.8
	4.0	6.90	1	6.50	45.4	90.1
	5.0	8.42	1	7.77	53.3	110
	6.3	10.3	1	9.23	61.6	134
	7.1 #	11.4	1	10.0	65.8	149
	8.0	12.5	1	10.8	69.7	164
70x70	3.0 #	6.24	1	7.06	59.0	81.4
	3.2	6.63	1	7.46	62.3	86.5
	3.6 #	7.40	1	8.27	68.6	96.5
	4.0	8.15	1	9.05	74.7	107
	5.0	9.99	1	10.9	88.5	130
	6.3	12.3	1	13.1	104	160
	7.1 #	13.6	1	14.3	112	177
	8.0	15.0	1	15.5	120	197
	8.8 #	16.3	1	16.5	126	212
80x80	3.0 #	7.18	1	9.34	89.8	93.7
	3.2	7.63	1	9.90	95.0	99.6
	3.6 #	8.53	1	11.0	105	112
	4.0	9.41	1	12.1	114	123
	5.0	11.6	1	14.6	137	151
	6.3	14.2	1	17.6	162	185
	7.1 #	15.8	1	19.3	176	207
	8.0	17.5	1	21.1	189	230
	8.8 #	19.0	1	22.6	200	248
	10.0 #	21.1	1	24.6	214	276
	12.5 #	25.2	1	28.0	234	329

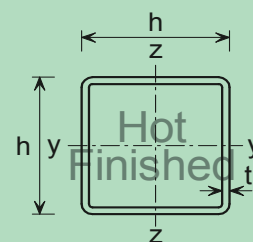
Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Square Hollow Sections (HFSHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 8.

**HOT-FINISHED  
SQUARE HOLLOW SECTIONS**

**Celsius® SHS**



Design moment resistance and design shear resistance

Section Designation		Mass per Metre kg/m	Section Classification	Moment Resistance $M_{c,Rd}$ kNm	Second Moment Of Area $I_y$ cm <sup>4</sup>	Shear Resistance $V_{c,Rd}$ kN
h x h mm	t mm					
90x90	3.6 #	9.66	1	14.1	152	126
	4.0	10.7	1	15.5	166	139
	5.0	13.1	1	18.8	200	171
	6.3	16.2	1	22.8	238	212
	7.1 #	18.1	1	25.1	260	236
	8.0	20.1	1	27.5	281	262
	8.8 #	21.8	1	29.6	299	285
	10.0 #	24.3	1	32.4	322	317
	12.5 #	29.1	1	37.3	359	380
100x100	3.6	10.8	1	17.6	212	140
	4.0	11.9	1	19.3	232	156
	5.0	14.7	1	23.6	279	192
	6.3	18.2	1	28.7	336	238
	7.1 #	20.3	1	31.7	367	264
	8.0	22.6	1	34.9	400	295
	8.8 #	24.5	1	37.6	426	321
	10.0	27.4	1	41.2	462	358
	12.5 #	33.0	1	47.9	522	431
120x120	4.0 #	14.4	2	28.3	410	189
	5.0	17.8	1	34.6	498	233
	6.3	22.2	1	42.6	603	289
	7.1 #	24.7	1	47.2	663	323
	8.0	27.6	1	51.8	726	361
	8.8 #	30.1	1	56.1	779	392
	10.0	33.7	1	62.1	852	440
	12.5	40.9	1	73.5	982	534
140x140	5.0	21.0	1	47.9	807	274
	6.3	26.1	1	58.9	984	341
	7.1 #	29.2	1	65.3	1090	381
	8.0	32.6	1	72.4	1200	426
	8.8 #	35.6	1	78.5	1290	465
	10.0	40.0	1	87.3	1420	522
	12.5	48.7	1	104	1650	636

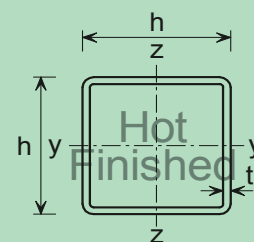
Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Square Hollow Sections (HFSHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 8.

**HOT-FINISHED  
SQUARE HOLLOW SECTIONS**

**Celsius® SHS**



Design moment resistance and design shear resistance

Section Designation		Mass per Metre kg/m	Section Classification	Moment Resistance $M_{c,Rd}$ kNm	Second Moment Of Area $I_y$ cm <sup>4</sup>	Shear Resistance $V_{c,Rd}$ kN
h x h mm	t mm					
150x150	5.0	22.6	2	55.4	1000	294
	6.3	28.1	1	68.2	1220	367
	7.1 #	31.4	1	75.6	1350	410
	8.0	35.1	1	84.1	1490	459
	8.8 #	38.4	1	91.2	1610	501
	10.0	43.1	1	102	1770	563
	12.5	52.7	1	121	2080	688
	14.2 #	58.9	1	134	2260	769
	16.0 # r	65.2	1	146	2430	851
160x160	5.0 #	24.1	2	63.2	1230	315
	6.3	30.1	1	78.1	1500	392
	7.1 #	33.7	1	87.0	1660	440
	8.0	37.6	1	96.6	1830	492
	8.8 #	41.1	1	105	1980	537
	10.0	46.3	1	117	2190	604
	12.5	56.6	1	140	2580	739
	14.2 #	63.3	1	155	2810	827
	16.0 #	70.2	1	169	3030	916
180x180	5.0 #	27.3	3	69.6	1770	356
	6.3	34.0	1	99.8	2170	444
	7.1 #	38.1	1	111	2400	498
	8.0	42.7	1	124	2660	557
	8.8 #	46.7	1	135	2880	609
	10.0	52.5	1	151	3190	686
	12.5	64.4	1	181	3790	841
	14.2 #	72.2	1	201	4150	943
200x200	5.0	30.4	4	81.9	2450	397
	6.3	38.0	2	124	3010	496
	7.1 #	42.6	1	139	3350	555
	8.0	47.7	1	155	3710	623
	8.8 #	52.2	1	168	4020	681
	10.0	58.8	1	189	4470	768
	12.5	72.3	1	228	5340	944
	14.2 #	81.1	1	253	5870	1060
	16.0	90.3	1	279	6390	1180

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Square Hollow Sections (HFSHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

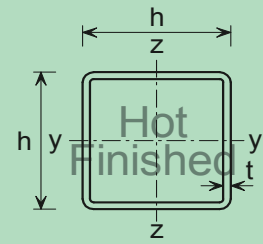
# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 8.



**HOT-FINISHED  
SQUARE HOLLOW SECTIONS**

**Celsius® SHS**



Design moment resistance and design shear resistance

Section Designation		Mass per Metre kg/m	Section Classification	Moment Resistance $M_{c,Rd}$ kNm	Second Moment Of Area $I_y$ cm <sup>4</sup>	Shear Resistance $V_{c,Rd}$ kN
h x h mm	t mm					
250x250	5.0 #	38.3	4	119	4860	499
	6.3	47.9	4	162	6010	625
	7.1 #	53.7	3	190	6700	701
	8.0	60.3	2	246	7460	787
	8.8 #	66.0	1	269	8110	862
	10.0	74.5	1	302	9060	973
	12.5	91.9	1	368	10900	1200
	14.2 #	103	1	411	12100	1350
	16.0	115	1	454	13300	1510
260x260	6.3 #	49.9	4	173	6790	651
	7.1 #	56.0	3	207	7570	731
	8.0 #	62.8	2	267	8420	820
	8.8 #	68.8	1	292	9160	898
	10.0 #	77.7	1	328	10200	1010
	12.5 #	95.8	1	400	12400	1250
	14.2 #	108	1	447	13700	1400
	16.0 #	120	1	495	15100	1570
300x300	6.3 #	57.8	4	220	10500	754
	7.1 #	64.9	4	258	11800	846
	8.0	72.8	4	301	13100	951
	8.8 #	79.8	3	339	14300	1050
	10.0	90.2	2	442	16000	1180
	12.5	112	1	541	19400	1460
	14.2 #	126	1	606	21600	1640
	16.0	141	1	673	23900	1830
350x350	8.0	85.4	4	391	21100	1120
	8.8 #	93.6	4	443	23100	1220
	10.0	106	3	525	25900	1380
	12.5	131	1	748	31500	1710
	14.2 #	148	1	839	35200	1940
	16.0	166	1	934	38900	2160
400x400	8.0 #	97.9	4	488	31900	1280
	8.8 #	107	4	554	34800	1400
	10.0	122	4	656	39100	1590
	12.5	151	2	988	47800	1970
	14.2 #	170	1	1110	53500	2220
	16.0	191	1	1240	59300	2490
	20.0 ^	235	1	1470	71500	2990

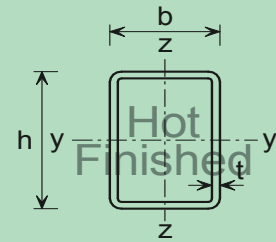
Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Square Hollow Sections (HFSHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 8.

**HOT-FINISHED  
RECTANGULAR HOLLOW SECTIONS**

**Celsius® RHS**



Design moment resistance, design shear resistance and limiting length

Section		Mass per Metre	Classification		Moment resistance		Limiting Length	Second Moment Of Area		Shear Resistance
Designation			y-y	z-z	$M_{c,y,Rd}$ kNm	$M_{c,z,Rd}$ kNm		y-y Axis cm <sup>4</sup>	z-z Axis cm <sup>4</sup>	
h x b mm	t mm	kg/m					$L_c$ m			$V_{c,Rd}$ kN
50x30	3.0 #	3.41	1	1	2.44	1.69	2.40	13.6	5.94	55.6
	3.2	3.61	1	1	2.57	1.78	2.39	14.2	6.20	58.9
	3.6 #	4.01	1	1	2.82	1.94	2.35	15.4	6.67	65.3
	4.0	4.39	1	1	3.05	2.09	2.33	16.5	7.08	71.6
	5.0	5.28	1	1	3.55	2.41	2.26	18.7	7.89	86.2
60x40	3.0 #	4.35	1	1	3.87	2.91	3.41	26.5	13.9	68.1
	3.2	4.62	1	1	4.08	3.07	3.40	27.8	14.6	72.3
	3.6 #	5.14	1	1	4.51	3.37	3.37	30.4	15.9	80.4
	4.0	5.64	1	1	4.90	3.66	3.34	32.8	17.0	88.4
	5.0	6.85	1	1	5.82	4.33	3.26	38.1	19.5	107
	6.3	8.31	1	1	6.82	5.04	3.16	43.4	21.9	130
80x40	3.0 #	5.29	1	1	6.07	3.69	3.03	54.2	18.0	92.1
	3.2	5.62	1	1	6.39	3.91	3.03	57.2	18.9	97.8
	3.6 #	6.27	1	1	7.10	4.30	2.98	62.8	20.6	109
	4.0	6.90	1	1	7.74	4.69	2.96	68.2	22.2	120
	5.0	8.42	1	1	9.27	5.57	2.89	80.3	25.7	146
	6.3	10.3	1	1	11.0	6.53	2.79	93.3	29.2	179
	7.1 #	11.4	1	1	12.0	7.03	2.72	99.8	30.7	198
	8.0	12.5	1	1	13.0	7.53	2.65	106	32.1	219
90x50	3.0 #	6.24	1	2	8.24	5.43	4.02	84.4	33.5	105
	3.2	6.63	1	1	8.73	5.75	4.01	89.1	35.3	111
	3.6 #	7.40	1	1	9.66	6.39	3.99	98.3	38.7	124
	4.0	8.15	1	1	10.6	6.96	3.96	107	41.9	137
	5.0	9.99	1	1	12.8	8.34	3.87	127	49.2	167
	6.3	12.3	1	1	15.3	9.94	3.79	150	57.0	206
	7.1 #	13.6	1	1	16.8	10.8	3.72	162	60.9	228
	8.0	15.0	1	1	18.2	11.7	3.65	174	64.6	253
100x50	3.0 #	6.71	1	2	9.69	5.96	3.85	110	36.8	117
	3.2	7.13	1	2	10.3	6.28	3.84	116	38.8	124
	3.6 #	7.96	1	1	11.4	6.96	3.81	128	42.6	138
	4.0	8.78	1	1	12.5	7.63	3.79	140	46.2	153
	5.0	10.8	1	1	15.1	9.16	3.71	167	54.3	187
	6.3	13.3	1	1	18.2	10.9	3.61	197	63.0	231
	7.1 #	14.7	1	1	20.0	11.9	3.54	214	67.5	256
	8.0	16.3	1	1	21.8	12.9	3.47	230	71.7	284
	8.8 #	17.6	1	1	23.3	13.7	3.41	243	74.8	307
	10.0 #	19.6	1	1	25.3	14.7	3.32	259	78.4	340

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

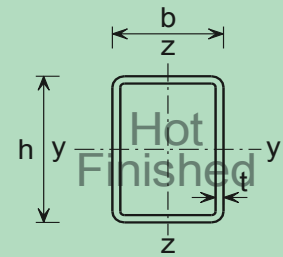
# Check availability

$L_c$  is calculated based on  $C_1$  equal to 1.0. For other values of  $C_1$  multiply  $L_c$  by  $C_1$ .  
Lengths above the limiting length  $L_c$  should be checked for lateral torsional buckling.

FOR EXPLANATION OF TABLES SEE NOTE 8.

**HOT-FINISHED  
RECTANGULAR HOLLOW SECTIONS**

**Celsius® RHS**



Design moment resistance, design shear resistance and limiting length

Section		Mass per Metre	Classification		Moment resistance		Limiting Length	Second Moment Of Area		Shear Resistance
Designation			y-y	z-z	$M_{c,y,Rd}$ kNm	$M_{c,z,Rd}$ kNm		y-y Axis cm <sup>4</sup>	z-z Axis cm <sup>4</sup>	
h x b mm	t mm	kg/m					$L_c$ m			$V_{c,Rd}$ kN
100x60	3.0 #	7.18	1	2	10.7	7.53	5.01	124	55.7	117
	3.2	7.63	1	2	11.4	7.95	5.02	131	58.8	125
	3.6 #	8.53	1	1	12.6	8.84	4.97	145	64.8	140
	4.0	9.41	1	1	13.9	9.69	4.95	158	70.5	154
	5.0	11.6	1	1	16.8	11.7	4.88	189	83.6	188
	6.3	14.2	1	1	20.3	14.0	4.77	225	98.1	232
	7.1 #	15.8	1	1	22.3	15.3	4.72	244	106	259
	8.0	17.5	1	1	24.4	16.7	4.64	264	113	287
	8.8 #	19.0	1	1	26.1	17.8	4.59	279	119	310
	10.0 #	21.1	1	1	28.5	19.3	4.50	299	126	345
120x60	3.0 #	8.12	1	4	14.2	7.22	4.66	194	65.5	141
	3.2 #	8.64	1	4	15.1	7.86	4.65	205	69.2	150
	3.6 #	9.66	1	2	16.8	10.3	4.62	227	76.3	168
	4.0	10.7	1	2	18.4	11.3	4.59	249	83.1	186
	5.0	13.1	1	1	22.4	13.6	4.52	299	98.8	228
	6.3	16.2	1	1	27.2	16.4	4.41	358	116	283
	7.1 #	18.1	1	1	30.0	18.0	4.37	391	126	314
	8.0	20.1	1	1	32.9	19.7	4.29	425	135	350
	8.8 #	21.8	1	1	35.4	21.0	4.22	452	142	380
		10.0 #	24.3	1	1	38.7	22.9	4.15	488	152
	12.5 #	29.1	1	1	44.7	26.0	3.95	546	165	507
120x80	3.6 #	10.8	1	2	19.7	14.9	6.98	276	147	168
	4.0	11.9	1	2	21.7	16.4	6.95	303	161	187
	5.0	14.7	1	1	26.5	19.9	6.88	365	193	230
	6.3	18.2	1	1	32.3	24.2	6.78	440	230	285
	7.1 #	20.3	1	1	35.5	26.7	6.76	482	251	317
	8.0	22.6	1	1	39.4	29.3	6.65	525	273	354
	8.8 #	24.5	1	1	42.2	31.5	6.62	561	290	385
		10.0	27.4	1	1	46.5	34.5	6.53	609	313
	12.5 #	33.0	1	1	54.3	40.1	6.32	692	349	518
150x100	4.0 #	15.1	1	4	34.6	22.2	8.76	607	324	236
	5.0	18.6	1	2	42.2	32.0	8.72	739	392	291
	6.3	23.1	1	1	52.2	39.1	8.58	898	474	363
	7.1 #	25.9	1	1	57.9	43.3	8.52	990	520	405
	8.0	28.9	1	1	63.9	47.9	8.48	1090	569	453
	8.8 #	31.5	1	1	69.2	51.8	8.41	1170	610	493
		10.0	35.3	1	1	76.7	57.2	8.33	1280	665
	12.5	42.8	1	1	90.9	67.5	8.15	1490	763	671

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# Check availability

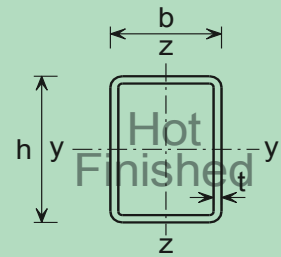
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Lengths above the limiting length  $L_c$  should be checked for lateral torsional buckling.

FOR EXPLANATION OF TABLES SEE NOTE 8.

**HOT-FINISHED  
RECTANGULAR HOLLOW SECTIONS**

**Celsius® RHS**



Design moment resistance, design shear resistance and limiting length

Section		Mass per Metre	Classification		Moment resistance		Limiting Length	Second Moment Of Area		Shear Resistance
Designation			y-y	z-z	$M_{c,y,Rd}$ kNm	$M_{c,z,Rd}$ kNm		y-y Axis cm <sup>4</sup>	z-z Axis cm <sup>4</sup>	
h x b mm	t mm	kg/m					$L_c$ m			$V_{c,Rd}$ kN
160x80	4.0 #	14.4	1	4	33.6	17.1	6.22	612	207	251
	5.0	17.8	1	2	41.2	25.2	6.14	744	249	310
	6.3	22.2	1	1	50.4	30.8	6.07	903	299	385
	7.1 #	24.7	1	1	56.1	34.0	5.98	994	327	430
	8.0	27.6	1	1	62.1	37.6	5.91	1090	356	481
	8.8 #	30.1	1	1	67.1	40.5	5.85	1170	379	523
	10.0	33.7	1	1	74.2	44.4	5.77	1280	411	586
	12.5	40.9	1	1	87.7	51.8	5.59	1490	465	712
180x60	4.0 #	14.4	1	4	35.4	12.5	3.75	697	121	283
	5.0 #	17.8	1	3	43.3	17.1	3.68	846	144	349
	6.3 #	22.2	1	1	53.3	23.6	3.58	1030	171	433
	7.1 #	24.7	1	1	58.9	26.0	3.53	1130	186	484
	8.0 #	27.6	1	1	65.3	28.5	3.45	1240	201	541
	8.8 #	30.1	1	1	70.6	30.6	3.39	1330	212	589
	10.0 #	33.7	1	1	78.1	33.5	3.31	1460	228	659
	12.5 #	40.9	1	1	92.3	38.7	3.12	1680	251	801
180x100	4.0 #	16.9	1	4	45.4	23.7	8.19	945	379	285
	5.0 #	21.0	1	3	55.7	32.7	8.13	1150	460	352
	6.3 #	26.1	1	1	68.9	45.4	8.02	1410	557	439
	7.1 #	29.2	1	1	76.3	50.4	7.98	1560	613	490
	8.0 #	32.6	1	1	84.8	55.7	7.89	1710	671	548
	8.8 #	35.6	1	1	91.9	60.4	7.84	1850	720	598
	10.0 #	40.0	1	1	102	66.7	7.75	2040	787	671
	12.5 #	48.7	1	1	122	79.2	7.56	2390	908	818
200x100	4.0 #	18.2	1	4	53.3	24.6	7.86	1220	416	317
	5.0	22.6	1	4	65.7	33.4	7.77	1500	505	392
	6.3	28.1	1	2	80.9	49.7	7.69	1830	613	489
	7.1 #	31.4	1	1	90.2	55.0	7.62	2020	674	547
	8.0	35.1	1	1	100	61.1	7.55	2230	739	612
	8.8 #	38.4	1	1	109	66.0	7.49	2410	793	668
	10.0	43.1	1	1	121	73.1	7.40	2660	869	750
	12.5	52.7	1	1	145	87.0	7.22	3140	1000	917
	14.2 #	58.9	1	1	160	95.1	7.09	3420	1080	1020
16.0 # r	65.2	1	1	174	103	6.95	3680	1150	1130	

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# Check availability

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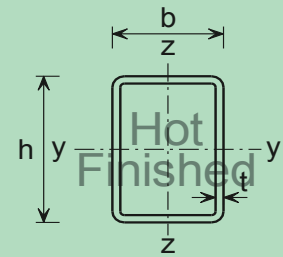
Lengths above the limiting length  $L_c$  should be checked for lateral torsional buckling.

r External corner radius  $> 2t$  but  $\leq 3t$

FOR EXPLANATION OF TABLES SEE NOTE 8.

**HOT-FINISHED  
RECTANGULAR HOLLOW SECTIONS**

**Celsius® RHS**



Design moment resistance, design shear resistance and limiting length

Section		Mass per Metre	Classification		Moment resistance		Limiting Length	Second Moment Of Area		Shear Resistance
Designation			y-y	z-z	$M_{c,y,Rd}$ kNm	$M_{c,z,Rd}$ kNm		y-y Axis cm <sup>4</sup>	z-z Axis cm <sup>4</sup>	
h x b mm	t mm	kg/m					$L_c$ m			$V_{c,Rd}$ kN
200x120	5.0 #	24.1	1	4	72.8	42.1	10.1	1690	762	393
	6.3	30.1	1	2	89.8	62.8	10.0	2070	929	491
	7.1 #	33.7	1	1	99.8	69.9	9.97	2290	1030	550
	8.0	37.6	1	1	111	77.4	9.88	2530	1130	615
	8.8 #	41.1	1	1	121	84.1	9.83	2730	1220	671
	10.0	46.3	1	1	135	93.4	9.75	3030	1340	755
	12.5 #	56.6	1	1	162	111	9.57	3580	1560	924
	14.2 #	63.3	1	1	179	123	9.44	3910	1690	1030
	16.0 #	70.2	1	1	195	134	9.30	4220	1810	1150
200x150	5.0 #	26.5	2	4	83.1	56.2	13.7	1970	1270	395
	6.3 #	33.0	1	2	103	84.1	13.6	2420	1550	493
	7.1 #	37.0	1	1	114	93.7	13.6	2690	1720	552
	8.0	41.4	1	1	127	104	13.5	2970	1890	618
	8.8 #	45.3	1	1	138	113	13.5	3220	2050	676
	10.0	51.0	1	1	155	126	13.4	3570	2260	760
	12.5 #	62.5	1	1	186	152	13.2	4240	2670	932
	14.2 #	70.0	1	1	207	168	13.1	4640	2920	1040
	16.0 #	77.7	1	1	226	184	13.0	5040	3150	1160
220x120	5.0 #	25.7	1	4	83.8	43.7	9.76	2130	829	434
	6.3 #	32.0	1	3	104	59.6	9.66	2610	1010	541
	7.1 #	35.9	1	2	116	75.6	9.58	2900	1120	606
	8.0 #	40.2	1	1	129	83.8	9.53	3200	1230	679
	8.8 #	43.9	1	1	140	90.9	9.47	3470	1320	741
	10.0 #	49.4	1	1	156	101	9.38	3840	1460	834
	12.5 #	60.5	1	1	188	121	9.19	4560	1710	1020
	14.2 #	67.8	1	1	208	133	9.07	5000	1850	1140
	16.0 #	75.2	1	1	228	146	8.93	5410	1990	1270
250x100	5.0 #	26.5	1	4	93.4	36.2	7.01	2610	618	493
	6.3 #	33.0	1	4	116	49.7	6.90	3210	751	616
	7.1 #	37.0	1	3	129	58.6	6.85	3560	827	690
	8.0 #	41.4	1	2	143	74.2	6.78	3940	909	773
	8.8 #	45.3	1	1	156	80.2	6.73	4270	977	845
	10.0 #	51.0	1	1	174	89.1	6.63	4730	1070	950
	12.5 #	62.5	1	1	210	106	6.44	5620	1250	1170
	14.2 #	70.0	1	1	233	117	6.32	6170	1340	1310
	16.0 #	77.7	1	1	255	127	6.18	6690	1430	1450

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# Check availability

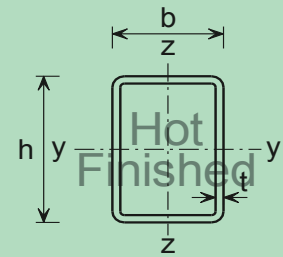
$L_c$  is calculated based on  $C_1$  equal to 1.0. For other values of  $C_1$  multiply  $L_c$  by  $C_1$ .

Lengths above the limiting length  $L_c$  should be checked for lateral torsional buckling.

FOR EXPLANATION OF TABLES SEE NOTE 8.

**HOT-FINISHED  
RECTANGULAR HOLLOW SECTIONS**

**Celsius® RHS**



Design moment resistance, design shear resistance and limiting length

Section		Mass per Metre	Classification		Moment resistance		Limiting Length	Second Moment Of Area		Shear Resistance
Designation			y-y	z-z	$M_{c,y,Rd}$ kNm	$M_{c,z,Rd}$ kNm		y-y Axis cm <sup>4</sup>	z-z Axis cm <sup>4</sup>	
h x b mm	t mm	kg/m					$L_c$ m			$V_{c,Rd}$ kN
250x150	5.0 #	30.4	2	4	115	60.7	12.7	3360	1530	496
	6.3	38.0	1	4	143	83.2	12.6	4140	1870	620
	7.1 #	42.6	1	3	159	98.3	12.6	4610	2080	694
	8.0	47.7	1	2	178	124	12.5	5110	2300	779
	8.8 #	52.2	1	1	193	135	12.5	5550	2490	852
	10.0	58.8	1	1	217	151	12.4	6170	2760	959
	12.5	72.3	1	1	263	182	12.2	7390	3270	1180
	14.2 #	81.1	1	1	292	202	12.1	8140	3580	1320
260x140	5.0 #	30.4	1	4	118	56.2	11.4	3530	1350	516
	6.3 #	38.0	1	4	146	77.4	11.3	4360	1660	645
	7.1 #	42.6	1	3	163	93.4	11.2	4840	1840	722
	8.0 #	47.7	1	2	181	118	11.2	5370	2030	810
	8.8 #	52.2	1	1	198	128	11.1	5830	2200	886
	10.0 #	58.8	1	1	222	143	11.0	6490	2430	998
	12.5 #	72.3	1	1	268	172	10.8	7770	2880	1230
	14.2 #	81.1	1	1	298	191	10.7	8560	3140	1370
300x100	5.0 #	30.4	1	4	126	38.1	6.36	4150	731	595
	6.3 #	38.0	1	4	156	53.3	6.27	5110	890	744
	7.1 #	42.6	1	4	174	62.7	6.21	5680	981	833
	8.0	47.7	1	4	194	73.3	6.14	6310	1080	935
	8.8 #	52.2	1	3	211	82.4	6.09	6840	1160	1020
	10.0	58.8	1	2	236	105	5.99	7610	1280	1150
	12.5 #	72.3	1	1	286	126	5.82	9100	1490	1420
	14.2 #	81.1	1	1	318	138	5.69	10000	1610	1580
300x150	8.0 # rr	54.0	1	4	235	123	11.6	8010	2700	940
	8.8 # rr	59.1	1	3	257	138	11.6	8710	2930	1030
	10.0 # rr	66.7	1	2	288	176	11.5	9720	3250	1160
	12.5 # rr	82.1	1	1	350	213	11.3	11700	3860	1430
	14.2 # rr	92.3	1	1	390	236	11.2	12900	4230	1610
	16.0 # rr	103	1	1	431	260	11.0	14200	4600	1790

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# Check availability

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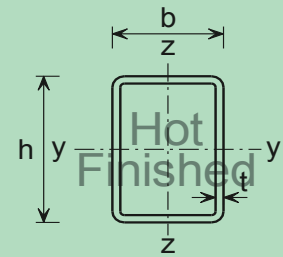
Lengths above the limiting length  $L_c$  should be checked for lateral torsional buckling.

rr External corner radius > 3t (Not compliant with bS EN 10210-2)

FOR EXPLANATION OF TABLES SEE NOTE 8.

**HOT-FINISHED  
RECTANGULAR HOLLOW SECTIONS**

**Celsius® RHS**



Design moment resistance, design shear resistance and limiting length

Section		Mass per Metre	Classification		Moment resistance		Limiting Length	Second Moment Of Area		Shear Resistance
Designation			y-y	z-z	$M_{c,y,Rd}$ kNm	$M_{c,z,Rd}$ kNm		y-y Axis cm <sup>4</sup>	z-z Axis cm <sup>4</sup>	
h x b mm	t mm	kg/m					$L_c$ m			$V_{c,Rd}$ kN
300x200	5.0 #	38.3	4	4	142	92.9	22.1	6320	3400	599
	6.3	47.9	2	4	222	129	17.6	7830	4190	750
	7.1 #	53.7	1	4	248	151	17.6	8730	4670	841
	8.0	60.3	1	4	277	177	17.5	9720	5180	944
	8.8 #	66.0	1	3	302	200	17.4	10600	5630	1030
	10.0	74.5	1	2	339	256	17.4	11800	6280	1170
	12.5	91.9	1	1	414	311	17.2	14300	7540	1440
	14.2 #	103	1	1	462	347	17.1	15800	8330	1620
	16.0	115	1	1	512	383	16.9	17400	9110	1810
300x250	5.0 #	42.2	4	4	153	125	31.7	7410	5610	600
	6.3 #	52.8	4	4	207	172	29.1	9190	6950	752
	7.1 #	59.3	3	4	242	202	27.7	10300	7750	844
	8.0	66.5	2	4	318	237	23.6	11400	8630	948
	8.8 #	72.9	1	3	348	267	23.5	12400	9390	1040
	10.0 #	82.4	1	2	391	345	23.4	13900	10500	1170
	12.5 #	102	1	1	477	421	23.3	16900	12700	1450
	14.2 #	115	1	1	534	470	23.1	18700	14100	1630
	16.0 #	128	1	1	592	521	23.0	20600	15500	1820
340x100	10.0	65.1	1	3	292	102	5.57	10600	1440	1310
350x150	5.0 #	38.3	2	4	193	66.3	11.1	7660	2050	699
	6.3 #	47.9	1	4	240	93.2	11.0	9480	2530	875
	7.1 #	53.7	1	4	268	111	10.9	10600	2800	981
	8.0 #	60.3	1	4	300	131	10.8	11800	3110	1100
	8.8 #	66.0	1	4	327	149	10.8	12800	3360	1210
	10.0 #	74.5	1	3	367	177	10.7	14300	3740	1360
	12.5 #	91.9	1	1	448	244	10.5	17300	4450	1680
	14.2 #	103	1	1	501	271	10.4	19200	4890	1890
	16.0 #	115	1	1	554	298	10.2	21100	5320	2110
350x250	6.3 #	57.8	4	4	255	180	28.1	13200	7890	880
	7.1 #	64.9	3	4	299	213	26.8	14700	8800	988
	8.0 #	72.8	2	4	397	251	22.5	16400	9800	1110
	8.8 #	79.8	1	4	434	285	22.5	17900	10700	1220
	10.0 #	90.2	1	3	488	339	22.4	20100	11900	1370
	12.5 #	112	1	1	598	474	22.2	24400	14400	1700
	14.2 #	126	1	1	670	530	22.1	27200	16000	1910
	16.0 #	141	1	1	744	588	22.0	30000	17700	2140

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# Check availability

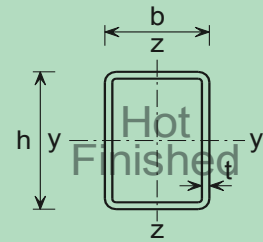
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Lengths above the limiting length  $L_c$  should be checked for lateral torsional buckling.

FOR EXPLANATION OF TABLES SEE NOTE 8.

**HOT-FINISHED  
RECTANGULAR HOLLOW SECTIONS**

**Celsius® RHS**



Design moment resistance, design shear resistance and limiting length

Section		Mass per Metre	Classification		Moment resistance		Limiting Length	Second Moment Of Area		Shear Resistance
Designation			y-y	z-z	$M_{c,y,Rd}$ kNm	$M_{c,z,Rd}$ kNm		y-y Axis cm <sup>4</sup>	z-z Axis cm <sup>4</sup>	
h x b mm	t mm	kg/m					$L_c$ m			$V_{c,Rd}$ kN
400x150	6.3 #	52.8	2	4	297	96.5	10.3	13300	2850	1000
	7.1 #	59.3	1	4	332	115	10.2	14800	3170	1130
	8.0 #	66.5	1	4	371	137	10.1	16500	3510	1260
	8.8 #	72.9	1	4	406	156	10.1	18000	3800	1380
	10.0 #	82.4	1	4	456	186	9.99	20100	4230	1570
	12.5 #	102	1	2	558	274	9.80	24400	5040	1940
	14.2 #	115	1	1	624	305	9.67	27100	5550	2180
400x200	6.3 #	57.8	2	4	341	140	15.8	15700	5380	1010
	7.1 #	64.9	1	4	382	166	15.8	17500	5990	1130
	8.0	72.8	1	4	427	197	15.7	19600	6660	1270
	8.8 #	79.8	1	4	467	225	15.6	21300	7240	1390
	10.0	90.2	1	4	525	268	15.5	23900	8080	1570
	12.5	112	1	2	644	394	15.4	29100	9740	1940
	14.2 #	126	1	1	721	441	15.2	32400	10800	2190
400x300	8.0 #	85.4	4	4	443	332	33.5	25700	16500	1280
	8.8 #	93.6	3	4	498	379	32.5	28100	18000	1390
	10.0 #	106	2	4	664	450	27.4	31500	20200	1580
	12.5 #	131	1	2	816	669	27.2	38500	24600	1960
	14.2 #	148	1	1	916	750	27.1	43000	27400	2210
	16.0 #	166	1	1	1020	834	27.0	47500	30300	2470
450x250	8.0	85.4	2	4	576	271	20.6	30100	12100	1440
	8.8 #	93.6	1	4	630	311	20.6	32800	13200	1570
	10.0	106	1	4	710	371	20.5	36900	14800	1780
	12.5	131	1	3	873	510	20.3	45000	18000	2200
	14.2 #	148	1	2	979	649	20.2	50300	20000	2490
	16.0	166	1	1	1090	720	20.0	55700	22000	2780
500x200	8.0 #	85.4	2	4	606	210	14.2	34000	8140	1600
	8.8 #	93.6	1	4	663	241	14.1	37200	8850	1740
	10.0 #	106	1	4	747	290	14.0	41800	9890	1980
	12.5 #	131	1	4	918	394	13.8	51000	11900	2440
	14.2 #	148	1	3	1030	470	13.7	56900	13200	2770
	16.0 #	166	1	2	1150	592	13.6	63000	14500	3090
500x300	8.0 #	97.9	4	4	604	354	31.6	43700	20000	1600
	8.8 #	107	3	4	678	405	30.7	47800	21800	1750
	10.0	122	2	4	921	486	25.4	53800	24400	1990
	12.5 #	151	1	4	1130	659	25.3	65800	29800	2460
	14.2 #	170	1	3	1280	787	25.2	73700	33200	2780
	16.0	191	1	2	1420	995	25.0	81800	36800	3110
20.0 ^	235	1	1	1690	1180	25.5	98800	44100	3730	

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

^ SAW process (single longitudinal seam weld, slightly proud)

$L_c$  is calculated based on  $C_1$  equal to 1.0. For other values of  $C_1$  multiply  $L_c$  by  $C_1$ .

Lengths above the limiting length  $L_c$  should be checked for lateral torsional buckling.

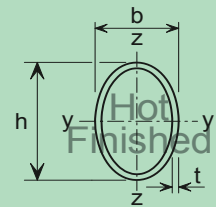
# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 8.



**HOT-FINISHED  
ELLIPTICAL HOLLOW SECTIONS**

**Celsius® OHS**



Design moment resistance, design shear resistance and limiting length

Section Designation		Mass per Metre kg/m	Classification		Moment resistance		Limiting Length L <sub>c</sub> m	Second Moment Of Area		Shear Resistance V <sub>c,Rd</sub> kN
h x b mm	t mm		y-y	z-z	M <sub>c,y,Rd</sub> kNm	M <sub>c,z,Rd</sub> kNm		y-y Axis cm <sup>4</sup>	z-z Axis cm <sup>4</sup>	
150 x 75	4.0	10.7	1	4	19.9	7.59	5.75	301	101	239
	5.0	13.3	1	4	24.5	11.5	5.66	367	122	297
	6.3	16.5	1	3	30.1	13.9	5.54	448	147	371
200 x 100	5.0	17.9	1	4	44.4	16.0	7.71	897	302	400
	6.3	22.3	1	4	55.0	24.5	7.59	1100	368	500
	8.0	28.0	1	3	68.5	31.7	7.41	1360	446	630
	10.0	34.5	1	2	83.4	50.1	7.23	1640	529	779
250 x 125	12.5	42.4	1	1	101	60.0	7.02	1950	619	961
	6.3	28.2	1	4	87.3	31.7	9.63	2210	742	629
	8.0	35.4	1	4	109	49.1	9.47	2730	909	794
	10.0	43.8	1	3	133	61.8	9.28	3320	1090	984
300 x 150	12.5	53.9	1	2	163	98.0	9.06	4000	1290	1220
	8.0	42.8	1	4	159	60.6	11.5	4810	1620	958
	10.0	53.0	1	4	196	91.6	11.3	5870	1950	1190
	12.5	65.5	1	3	239	110	11.1	7120	2330	1470
400 x 200	16.0	82.5	1	2	297	179	10.8	8730	2810	1860
	8.0	57.6	2	4	288	84.0	15.6	11700	3970	1290
	10.0	71.5	1	4	355	128	15.4	14300	4830	1600
	12.5	88.6	1	4	437	193	15.2	17500	5840	1990
500 x 250	16.0	112	1	3	547	253	14.8	21700	7140	2520
	10.0	90.0	2	4	563	164	19.5	28500	9680	2010
	12.5	112	1	4	694	249	19.2	35000	11800	2500
	16.0	142	1	4	873	394	18.9	43700	14500	3170

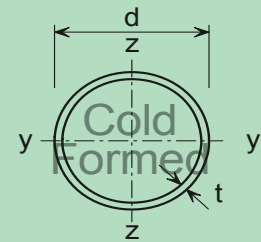
Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

L<sub>c</sub> is calculated based on C<sub>1</sub> equal to 1.0. For other values of C<sub>1</sub> multiply L<sub>c</sub> by C<sub>1</sub>.  
Lengths above the limiting length L<sub>c</sub> should be checked for lateral torsional buckling.

FOR EXPLANATION OF TABLES SEE NOTE 8.

COLD-FORMED  
CIRCULAR HOLLOW SECTIONS

Hybox® CHS



Design moment resistance and design shear resistance

Section Designation		Mass per Metre kg/m	Section Classification	Moment Resistance $M_{c,Rd}$ kNm	Second Moment Of Area $I_y$ cm <sup>4</sup>	Shear Resistance $V_{c,Rd}$ kN
d mm	t mm					
33.7	3.0	2.27	1	1.01	3.44	37.7
42.4	3.0	2.91	1	1.66	7.25	48.4
48.3	3.0	3.35	1	2.19	11.0	55.7
	4.0 #	4.37	1	2.79	13.8	72.7
60.3	3.0 #	4.24	1	3.50	22.2	70.5
	4.0	5.55	1	4.51	28.2	92.3
76.1	3.0	5.41	1	5.68	46.1	89.9
	4.0	7.11	1	7.38	59.1	118
88.9	3.0	6.36	1	7.85	74.8	106
	3.5 #	7.37	1	9.05	85.7	123
	4.0	8.38	1	10.3	96.3	140
	5.0	10.3	1	12.5	116	172
114.3	6.3	12.8	1	15.3	140	213
	3.0 #	8.23	2	13.2	163	137
	3.5	9.56	1	15.3	187	159
	4.0 #	10.9	1	17.3	211	181
139.7	5.0	13.5	1	21.2	257	224
	6.0	16.0	1	25.0	300	266
	6.3	16.8	1	26.1	313	279
	3.0 #	10.1	3	15.3	301	168
	4.0 #	13.4	2	26.2	393	223
168.3	5.0	16.6	1	32.2	481	277
	6.0	19.8	1	38.0	564	329
	6.3	20.7	1	39.8	589	344
	8.0	26.0	1	49.3	720	432
	10.0	32.0	1	60.0	862	531
168.3	4.0	16.2	2	38.3	697	269
	4.5 #	18.2	2	43.0	777	303
	5.0	20.1	2	47.2	856	335
	6.0	24.0	1	56.1	1010	399
	6.3	25.2	1	58.6	1050	419
	8.0	31.6	1	73.1	1300	526
	10.0	39.0	1	89.1	1560	648
12.5	48.0	1	108	1870	799	

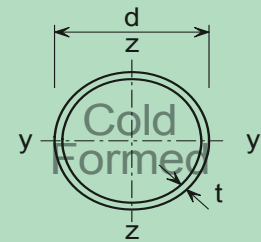
Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Circular Hollow Sections (CFCHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 8.

**COLD-FORMED  
CIRCULAR HOLLOW SECTIONS**

**Hybox® CHS**



Design moment resistance and design shear resistance

Section Designation		Mass per Metre kg/m	Section Classification	Moment Resistance $M_{c,Rd}$ kNm	Second Moment Of Area $I_y$ cm <sup>4</sup>	Shear Resistance $V_{c,Rd}$ kN
d mm	t mm					
193.7	4.0 #	18.7	3	39.4	1070	311
	4.5 #	21.0	2	57.2	1200	348
	5.0	23.3	2	63.2	1320	386
	6.0	27.8	1	74.9	1560	462
	6.3	29.1	1	78.5	1630	484
	8.0	36.6	1	98.0	2020	609
	10.0	45.3	1	120	2440	753
	12.5	55.9	1	146	2930	929
219.1	4.5 #	23.8	3	56.4	1750	395
	5.0	26.4	2	81.3	1930	438
	6.0	31.5	2	96.9	2280	525
	6.3	33.1	2	101	2390	549
	8.0	41.6	1	127	2960	693
	10.0	51.6	1	155	3600	857
	12.0 #	61.3	1	183	4200	1020
	12.5	63.7	1	190	4350	1060
244.5	5.0 #	29.5	3	78.5	2700	491
	6.0	35.3	2	121	3200	587
	6.3	37.0	2	127	3350	615
	8.0	46.7	1	159	4160	775
	10.0	57.8	1	195	5070	962
	12.0 #	68.8	1	230	5940	1140
	12.5	71.5	1	239	6150	1190
	16.0	90.2	1	297	7530	1500
273	4.0 #	26.5	4	\$	3060	441
	4.5 #	29.8	4	\$	3420	496
	5.0 #	33.0	3	98.3	3780	549
	6.0	39.5	2	152	4490	656
	6.3	41.4	2	159	4700	689
	8.0	52.3	2	200	5850	869
	10.0	64.9	1	246	7150	1080
	12.0 #	77.2	1	290	8400	1280
	12.5	80.3	1	301	8700	1330
	16.0	101	1	376	10700	1680

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Circular Hollow Sections (CFCHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

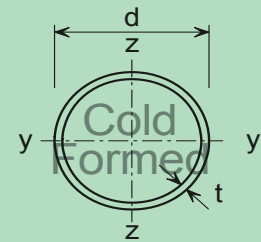
\$ Moment resistance for a Class 4 section is not calculated

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 8.

COLD-FORMED  
CIRCULAR HOLLOW SECTIONS

Hybox® CHS



Design moment resistance and design shear resistance

Section Designation		Mass per Metre kg/m	Section Classification	Moment Resistance $M_{c,Rd}$ kNm	Second Moment Of Area $I_y$ cm <sup>4</sup>	Shear Resistance $V_{c,Rd}$ kN
d mm	t mm					
323.9	5.0 #	39.3	4	\$	6370	654
	6.0	47.0	3	166	7570	782
	6.3 #	49.3	3	174	7930	821
	8.0	62.3	2	284	9910	1040
	10.0	77.4	1	350	12200	1290
	12.0 #	92.3	1	415	14300	1540
	12.5	96.0	1	431	14800	1590
	16.0	121	1	539	18400	2020
355.6	5.0 #	43.2	4	\$	8460	719
	6.0	51.7	3	201	10100	860
	6.3 #	54.3	3	211	10500	902
	8.0	68.6	2	343	13200	1140
	10.0	85.2	2	424	16200	1420
	12.0 #	102	1	503	19100	1700
	12.5	106	1	523	19900	1760
	16.0	134	1	656	24700	2230
406.4	6.0 #	59.2	4	\$	15100	985
	6.3 #	62.2	4	\$	15800	1030
	8.0	78.6	3	347	19900	1300
	10.0	97.8	2	558	24500	1630
	12.0 #	117	2	663	28900	1940
	12.5	121	1	689	30000	2020
	16.0	154	1	866	37400	2560
457	6.0 #	66.7	4	\$	21600	1110
	6.3 #	70.0	4	\$	22700	1160
	8.0	88.6	3	442	28400	1470
	10.0	110	2	709	35100	1830
	12.0 #	132	2	844	41600	2190
	12.5	137	2	877	43100	2280
	16.0	174	1	1110	54000	2900
508	6.0 #	74.3	4	\$	29800	1230
	6.3 #	77.9	4	\$	31200	1300
	8.0 #	98.6	4	\$	39300	1640
	10.0	123	3	678	48500	2040
	12.0 #	147	2	1050	57500	2440
	12.5	153	2	1090	59800	2540
	16.0 #	194	1	1380	74900	3220

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Circular Hollow Sections (CFCHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

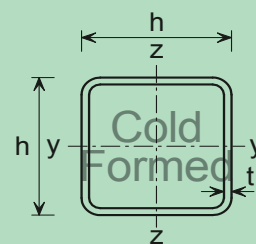
\$ Moment resistance for a Class 4 section is not calculated

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 8.

COLD-FORMED  
SQUARE HOLLOW SECTIONS

Hybox® SHS



Design moment resistance and design shear resistance

Section Designation		Mass per Metre kg/m	Section Classification	Moment Resistance $M_{c,Rd}$ kNm	Second Moment Of Area $I_y$ cm <sup>4</sup>	Shear Resistance $V_{c,Rd}$ kN
h x h mm	t mm					
25x25	2.0 #	1.36	1	0.522	1.48	17.8
	2.5	1.64	1	0.607	1.69	21.4
30x30	2.0 #	1.68	1	0.785	2.72	21.9
	2.5 #	2.03	1	0.927	3.16	26.5
	3.0	2.36	1	1.05	3.50	30.8
40x40	2.0 #	2.31	1	1.47	6.94	30.1
	2.5	2.82	1	1.76	8.22	36.8
	3.0	3.30	1	2.03	9.32	43.1
	4.0	4.20	1	2.49	11.1	54.8
50x50	2.5	3.60	1	2.86	16.9	47.0
	3.0	4.25	1	3.33	19.5	55.4
	4.0	5.45	1	4.15	23.7	71.2
	5.0	6.56	1	4.86	27.0	85.7
60x60	3.0	5.19	1	4.97	35.1	67.7
	4.0	6.71	1	6.25	43.6	87.6
	5.0	8.13	1	7.42	50.5	107
	6.0 #	9.45	1	8.41	56.1	123
70x70	3.0	6.13	1	6.89	57.5	80.0
	3.5	7.06	1	7.88	65.1	92.1
	4.0	7.97	1	8.80	72.1	104
	5.0	9.70	1	10.5	84.6	127
	6.0 #	11.3	1	12.0	95.2	148
80x80	3.0	7.07	1	9.16	87.8	92.3
	3.5	8.16	1	10.5	99.8	107
	4.0	9.22	1	11.8	111	120
	5.0	11.3	1	14.1	131	148
	6.0	13.2	1	16.3	149	172
90x90	3.0	8.01	2	11.7	127	105
	3.5	9.26	1	13.5	145	121
	4.0	10.5	1	15.1	162	136
	5.0	12.8	1	18.2	193	168
	6.0 #	15.1	1	21.1	220	197

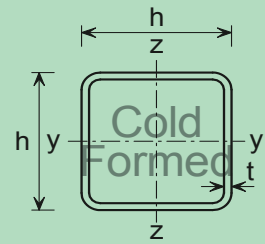
Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Square Hollow Sections (CFSHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 8.

**COLD-FORMED  
SQUARE HOLLOW SECTIONS**

**Hybox® SHS**



Design moment resistance and design shear resistance

Section Designation		Mass per Metre kg/m	Section Classification	Moment Resistance $M_{c,Rd}$ kNm	Second Moment Of Area $I_y$ cm <sup>4</sup>	Shear Resistance $V_{c,Rd}$ kN
h x h mm	t mm					
100x100	3.0	8.96	2	14.6	177	117
	4.0	11.7	1	18.9	226	153
	5.0	14.4	1	22.9	271	189
	6.0	17.0	1	26.7	311	221
	8.0	21.4	1	32.3	366	279
120x120	3.0 #	10.8	4	17.4	312	141
	4.0	14.2	2	27.8	402	185
	5.0	17.5	1	33.9	485	230
	6.0	20.7	1	39.8	562	271
	8.0	26.4	1	49.0	677	344
140x140	4.0	16.8	3	33.1	652	218
	5.0	20.7	1	46.9	791	271
	6.0	24.5	1	55.0	920	320
	8.0	31.4	1	68.9	1130	410
	10.0	38.1	1	81.7	1310	498
150x150	4.0 #	18.0	4	37.0	808	235
	5.0	22.3	2	54.3	982	291
	6.0	26.4	1	63.9	1150	344
	8.0	33.9	1	80.2	1410	443
	10.0	41.3	1	95.5	1650	539
160x160	4.0 #	19.3	4	41.3	987	251
	5.0	23.8	2	62.1	1200	312
	6.0	28.3	1	73.1	1410	369
	8.0	36.5	1	92.3	1740	476
	10.0	44.4	1	110	2050	580
180x180	5.0	27.0	3	68.5	1740	353
	6.0	32.1	2	93.7	2040	418
	6.3 #	33.3	1	96.9	2100	435
	8.0	41.5	1	119	2550	541
	10.0	50.7	1	143	3020	662
	12.0 #	58.5	1	161	3320	763
	12.5	60.5	1	166	3410	789

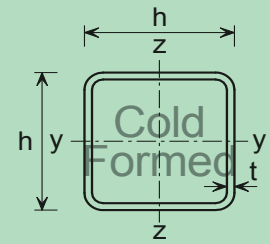
Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Square Hollow Sections (CFSHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 8.

COLD-FORMED  
SQUARE HOLLOW SECTIONS

Hybox® SHS



Design moment resistance and design shear resistance

Section Designation		Mass per Metre kg/m	Section Classification	Moment Resistance $M_{c,Rd}$ kNm	Second Moment Of Area $I_y$ cm <sup>4</sup>	Shear Resistance $V_{c,Rd}$ kN
h x h mm	t mm					
200x200	5.0	30.1	4	80.7	2410	394
	6.0	35.8	2	117	2830	467
	6.3 #	37.2	2	121	2920	486
	8.0	46.5	1	149	3570	607
	10.0	57.0	1	180	4250	744
	12.0 #	66.0	1	204	4730	862
	12.5	68.3	1	211	4860	892
250x250	6.0	45.2	4	150	5670	590
	6.3 #	47.1	4	158	5870	615
	8.0	59.1	2	240	7230	771
	10.0	72.7	1	292	8710	949
	12.0 #	84.8	1	335	9860	1110
	12.5	88.0	1	346	10200	1150
300x300	6.0	54.7	4	203	9960	713
	6.3 #	57.0	4	215	10300	744
	8.0	71.6	4	293	12800	935
	10.0	88.4	2	430	15500	1160
	12.0 #	104	1	498	17800	1350
	12.5	108	1	515	18300	1400
350x350	6.0 #	64.1	4	262	16000	836
	6.3 #	66.9	4	278	16600	873
	8.0	84.2	4	382	20700	1100
	10.0	104	3	511	25200	1360
	12.0 #	123	1	692	29100	1600
	12.5	127	1	717	30000	1660
400x400	6.0 #	73.5	4	326	24100	959
	6.3 #	76.8	4	346	25100	1000
	8.0	96.7	4	477	31300	1260
	10.0	120	4	640	38200	1570
	12.0 #	141	2	918	44300	1840
	12.5	147	2	952	45900	1920

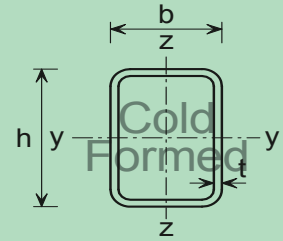
Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Square Hollow Sections (CFSHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 8.

COLD-FORMED  
RECTANGULAR HOLLOW SECTIONS

Hybox® RHS



Design moment resistance, design shear resistance and limiting length

Section		Mass per Metre	Classification		Moment resistance		Limiting Length	Second Moment Of Area		Shear Resistance
Designation			y-y	z-z	$M_{c,y,Rd}$ kNm	$M_{c,z,Rd}$ kNm		y-y Axis cm <sup>4</sup>	z-z Axis cm <sup>4</sup>	
h x b mm	t mm	kg/m					$L_c$ m			$V_{c,Rd}$ kN
50x25	2.0 #	2.15	1	1	1.51	0.930	1.93	8.38	2.81	37.4
	2.5	2.62	1	1	1.81	1.11	1.90	9.89	3.28	45.6
	3.0	3.07	1	1	2.08	1.26	1.87	11.2	3.67	53.4
50x30	2.0 #	2.31	1	1	1.68	1.18	2.52	9.54	4.29	37.7
	2.5	2.82	1	1	2.02	1.41	2.49	11.3	5.05	46.0
	3.0	3.30	1	1	2.33	1.63	2.46	12.8	5.70	53.9
	4.0	4.20	1	1	2.86	1.98	2.41	15.3	6.69	68.5
60x40	2.5 #	3.60	1	1	3.22	2.43	3.49	22.1	11.7	56.4
	3.0	4.25	1	1	3.73	2.82	3.48	25.4	13.4	66.5
	4.0	5.45	1	1	4.69	3.51	3.42	31.0	16.3	85.5
	5.0	6.56	1	1	5.47	4.08	3.36	35.3	18.4	103
70x40	3.0	4.72	1	1	4.76	3.21	3.27	37.3	15.5	78.4
	4.0	6.08	1	1	5.96	4.01	3.23	46.0	18.9	101
	5.0	7.34	1	1	7.03	4.72	3.17	52.9	21.5	122
70x50	3.0 #	5.19	1	1	5.47	4.33	4.48	44.1	26.1	79.0
	4.0	6.71	1	1	6.92	5.47	4.43	54.7	32.2	102
	5.0	8.13	1	1	8.20	6.46	4.38	63.5	37.2	124
80x40	3.0	5.19	1	1	5.86	3.62	3.11	52.3	17.6	90.3
	4.0	6.71	1	1	7.42	4.54	3.04	64.8	21.5	117
	5.0	8.13	1	1	8.77	5.33	2.99	75.1	24.6	142
80x50	3.0	5.66	1	1	6.67	4.83	4.29	61.1	29.4	90.9
	4.0	7.34	1	1	8.52	6.11	4.22	76.4	36.5	118
	5.0	8.91	1	1	10.1	7.28	4.17	89.2	42.3	144
80x60	3.0	6.13	1	1	7.53	6.18	5.48	70.0	44.9	91.5
	3.5	7.06	1	1	8.56	7.03	5.48	79.3	50.7	105
	4.0	7.97	1	1	9.59	7.85	5.44	87.9	56.1	118
	5.0	9.70	1	1	11.4	9.37	5.41	103	65.7	145
90x50	3.0 #	6.13	1	2	8.02	5.33	4.09	81.9	32.7	103
	4.0 #	7.97	1	1	10.2	6.78	4.04	103	40.7	133
	5.0	9.70	1	1	12.2	8.06	3.97	121	47.4	163
100x40	3.0	6.13	1	2	8.41	4.40	2.78	92.3	21.7	114
	4.0	7.97	1	1	10.8	5.57	2.71	116	26.7	148
	5.0 #	9.70	1	1	12.8	6.57	2.66	136	30.8	182

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Rectangular Hollow Sections (CFRHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

$L_c$  is calculated based on  $C_1$  equal to 1.0. For other values of  $C_1$  multiply  $L_c$  by  $C_1$ .

Lengths above the limiting length  $L_c$  should be checked for lateral torsional buckling.

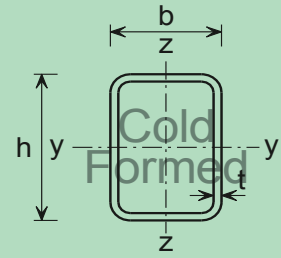
# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 8.



**COLD-FORMED  
RECTANGULAR HOLLOW SECTIONS**

**Hybox® RHS**



Design moment resistance, design shear resistance and limiting length

Section		Mass per Metre kg/m	Classification		Moment resistance		Limiting Length L <sub>c</sub> m	Second Moment Of Area		Shear Resistance V <sub>c,Rd</sub> kN
Designation			y-y	z-z	M <sub>c,y,Rd</sub> kNm	M <sub>c,z,Rd</sub> kNm		y-y Axis cm <sup>4</sup>	z-z Axis cm <sup>4</sup>	
h x b mm	t mm									
100x50	3.0	6.60	1	2	9.48	5.82	3.91	106	36.1	115
	4.0	8.59	1	1	12.1	7.42	3.85	134	44.9	149
	5.0	10.5	1	1	14.5	8.88	3.81	158	52.5	183
	6.0	12.3	1	1	16.6	10.1	3.74	179	58.7	213
100x60	3.0	7.07	1	2	10.5	7.38	5.08	121	54.6	115
	3.5	8.16	1	1	12.0	8.45	5.06	137	61.9	133
	4.0	9.22	1	1	13.5	9.44	5.04	153	68.7	150
	5.0	11.3	1	1	16.2	11.3	4.98	181	80.8	184
	6.0	13.2	1	1	18.6	13.0	4.93	205	91.2	215
100x80	3.0 #	8.01	1	2	12.6	10.8	7.51	149	106	116
	4.0	10.5	1	1	16.2	13.9	7.46	189	134	151
	5.0	12.8	1	1	19.6	16.8	7.43	226	160	187
	6.0	15.1	1	1	22.6	19.4	7.37	258	182	219
120x40	3.0 #	7.07	1	4	11.4	4.24	2.51	148	25.8	139
	4.0 #	9.22	1	2	14.6	6.57	2.45	187	31.9	180
	5.0 #	11.3	1	1	17.5	7.81	2.39	221	36.9	221
120x60	3.0	8.01	1	4	13.9	7.10	4.72	189	64.4	139
	3.5	9.26	1	3	15.9	8.66	4.70	216	73.1	161
	4.0	10.5	1	2	17.9	11.0	4.67	241	81.2	182
	5.0	12.8	1	1	21.6	13.3	4.62	287	96.0	224
	6.0	15.1	1	1	25.1	15.3	4.56	328	109	262
120x80	3.0	8.96	1	4	16.4	10.2	7.07	230	123	140
	4.0	11.7	1	2	21.2	16.0	7.03	295	157	183
	5.0	14.4	1	1	25.7	19.4	7.00	353	188	226
	6.0	17.0	1	1	29.9	22.5	6.95	406	215	266
	8.0	21.4	1	1	36.2	27.3	6.94	476	252	334
140x80	3.0 #	9.90	1	4	20.7	10.8	6.70	334	141	164
	4.0	13.0	1	3	26.8	16.0	6.65	430	180	215
	5.0 #	16.0	1	1	32.6	22.1	6.61	517	216	266
	6.0	18.9	1	1	38.0	25.7	6.56	597	248	313
	8.0	23.9	1	1	46.5	31.4	6.51	708	293	397
	10.0	28.7	1	1	54.0	36.6	6.43	804	330	477

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L<sub>c</sub> is calculated based on C<sub>1</sub> equal to 1.0. For other values of C<sub>1</sub> multiply L<sub>c</sub> by C<sub>1</sub>.

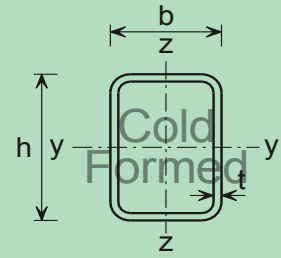
Lengths above the limiting length L<sub>c</sub> should be checked for lateral torsional buckling.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 8.

**COLD-FORMED  
RECTANGULAR HOLLOW SECTIONS**

**Hybox® RHS**



Design moment resistance, design shear resistance and limiting length

Section		Mass per Metre kg/m	Classification		Moment resistance		Limiting Length L <sub>c</sub> m	Second Moment Of Area		Shear Resistance V <sub>c,Rd</sub> kN
Designation			y-y	z-z	M <sub>c,y,Rd</sub> kNm	M <sub>c,z,Rd</sub> kNm		y-y Axis cm <sup>4</sup>	z-z Axis cm <sup>4</sup>	
h x b mm	t mm									
150x100	3.0 #	11.3	2	4	26.1	14.8	8.90	461	248	177
	4.0	14.9	1	4	34.0	21.8	8.85	595	319	232
	5.0	18.3	1	2	41.5	31.3	8.78	719	384	288
	6.0	21.7	1	1	48.6	36.6	8.73	835	444	339
	8.0	27.7	1	1	60.0	45.4	8.77	1010	536	433
	10.0	33.4	1	1	70.6	53.3	8.67	1160	614	524
160x80	3.0 #	10.8	1	4	25.3	11.3	6.35	464	159	189
	4.0	14.2	1	4	33.0	16.9	6.30	598	204	247
	5.0	17.5	1	2	40.1	24.7	6.25	722	244	306
	6.0	20.7	1	1	46.9	28.9	6.20	836	281	361
	8.0	26.4	1	1	57.9	35.5	6.15	1000	335	459
	10.0 #	31.8	1	1	67.8	41.5	6.04	1150	380	555
180x80	3.0	11.8	1	4	30.5	11.7	6.03	621	177	213
	4.0	15.5	1	4	39.8	17.6	5.96	802	227	280
	5.0	19.1	1	3	48.6	24.2	5.89	971	272	346
	6.0 #	22.6	1	2	56.8	32.0	5.86	1130	314	409
	8.0	28.9	1	1	70.3	39.4	5.82	1360	377	522
	10.0 #	35.0	1	1	83.1	46.5	5.69	1570	429	633
180x100	4.0 #	16.8	1	4	44.7	23.4	8.27	926	374	281
	5.0	20.7	1	3	54.7	32.1	8.23	1120	452	348
	6.0	24.5	1	2	64.3	42.6	8.17	1310	524	411
	8.0	31.4	1	1	80.2	53.3	8.15	1600	637	527
	10.0	38.1	1	1	95.1	62.8	8.05	1860	736	640
200x100	4.0	18.0	1	4	52.5	24.2	7.93	1200	411	313
	5.0	22.3	1	4	64.3	32.9	7.89	1460	497	388
	6.0	26.4	1	2	75.6	46.9	7.83	1700	577	459
	8.0	33.9	1	1	94.8	58.6	7.80	2090	705	590
	10.0	41.3	1	1	113	69.2	7.70	2440	818	719
200x120	4.0	19.3	2	4	58.2	30.6	10.3	1350	618	314
	5.0	23.8	1	4	71.4	41.4	10.2	1650	750	389
	6.0	28.3	1	2	84.1	58.9	10.1	1930	874	461
	8.0	36.5	1	1	106	74.2	10.2	2390	1080	594
	10.0	44.4	1	1	126	88.8	10.1	2810	1260	725
200x150	4.0 #	21.2	4	4	54.6	40.9	16.9	1580	1020	315
	5.0 #	26.2	2	4	81.7	55.3	13.8	1940	1250	391
	6.0	31.1	1	2	96.2	79.2	13.8	2270	1460	464
	8.0	40.2	1	1	122	100	13.8	2830	1820	600
	10.0	49.1	1	1	147	120	13.8	3350	2140	733

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Rectangular Hollow Sections (CFRHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

L<sub>c</sub> is calculated based on C<sub>1</sub> equal to 1.0. For other values of C<sub>1</sub> multiply L<sub>c</sub> by C<sub>1</sub>.

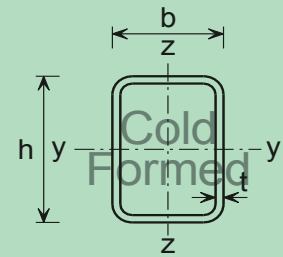
Lengths above the limiting length L<sub>c</sub> should be checked for lateral torsional buckling.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 8.

**COLD-FORMED  
RECTANGULAR HOLLOW SECTIONS**

**Hybox® RHS**



Design moment resistance, design shear resistance and limiting length

Section		Mass per Metre	Classification		Moment resistance		Limiting Length	Second Moment Of Area		Shear Resistance
Designation			y-y	z-z	$M_{c,y,Rd}$ kNm	$M_{c,z,Rd}$ kNm		y-y Axis cm <sup>4</sup>	z-z Axis cm <sup>4</sup>	
h x b mm	t mm	kg/m					$L_c$ m			$V_{c,Rd}$ kN
250x150	5.0	30.1	2	4	114	59.8	12.8	3300	1510	492
	6.0	35.8	1	4	134	76.7	12.8	3890	1770	584
	6.3 #	37.2	1	4	139	80.9	12.9	4000	1830	607
	8.0	46.5	1	2	171	121	12.8	4890	2220	758
	10.0	57.0	1	1	207	145	12.7	5830	2630	930
	12.0	66.0	1	1	234	164	12.8	6460	2930	1080
	12.5	68.3	1	1	241	169	12.7	6630	3000	1110
300x100	8.0	46.5	1	4	186	70.9	6.33	5980	1050	910
	10.0	57.0	1	2	224	101	6.20	7110	1220	1120
300x200	6.0	45.2	2	4	209	118	17.8	7370	3960	708
	6.3 #	47.1	2	4	217	125	17.9	7620	4100	738
	8.0	59.1	1	4	269	172	17.8	9390	5040	925
	10.0	72.7	1	2	327	248	17.8	11300	6060	1140
	12.0 #	84.8	1	1	375	284	17.8	12800	6850	1330
	12.5	88.0	1	1	387	294	17.8	13200	7060	1380
400x200	6.0 #	54.7	2	4	322	128	16.0	14800	5090	951
	6.3 #	57.0	2	4	334	136	16.0	15300	5290	992
	8.0	71.6	1	4	416	192	16.0	19000	6520	1250
	10.0	88.4	1	4	509	260	15.9	23000	7860	1540
	12.0 #	104	1	2	588	365	15.9	26200	8980	1800
	12.5	108	1	2	608	377	15.9	27100	9260	1870
450x250	6.0 #	64.1	4	4	338	177	26.7	22700	9250	1080
	6.3 #	66.9	4	4	357	188	26.5	23600	9620	1120
	8.0 #	84.2	2	4	564	265	20.9	29300	11900	1410
	10.0 #	104	1	4	692	362	20.8	35700	14500	1750
	12.0 #	123	1	4	804	454	20.9	41100	16700	2060
	12.5 #	127	1	3	833	489	20.9	42500	17200	2130
500x300	6.0 #	73.5	4	4	416	231	34.9	33000	15200	1200
	6.3 #	76.8	4	4	440	246	34.5	34300	15800	1250
	8.0 #	96.7	4	4	591	346	32.1	42800	19600	1580
	10.0 #	120	2	4	901	474	25.8	52300	23900	1960
	12.0 #	141	1	4	1050	600	25.9	60600	27700	2310
	12.5 #	147	1	4	1090	633	25.9	62700	28700	2400

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Rectangular Hollow Sections (CFRHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

$L_c$  is calculated based on  $C_1$  equal to 1.0. For other values of  $C_1$  multiply  $L_c$  by  $C_1$ .

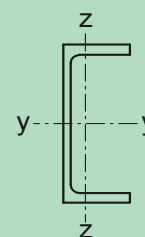
Lengths above the limiting length  $L_c$  should be checked for lateral torsional buckling.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 8.

PARALLEL FLANGE CHANNELS

Advance® UKPFC



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)											Second Moment of Area y-y axis $I_y$ $cm^4$		
				1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0		9.0	10.0
430x100x64	$M_{c,y,Rd} = 422$ $M_{c,z,Rd} = 33.8$ Class = 1		1.00	422	362	310	267	233	205	183	151	129	113	100	90.2	82.2	21900
			1.13	422	383	333	290	255	226	202	166	141	123	110	99.4	90.8	
			1.35	422	413	366	325	289	259	233	193	163	140	126	114	104	
			1.50	422	422	385	346	310	280	253	211	179	154	136	123	113	
			1.77	422	422	414	377	344	314	287	242	207	179	157	139	128	
			2.00	422	422	422	400	368	339	312	267	230	201	176	156	140	
			2.50	422	422	422	422	411	385	360	315	278	246	218	195	175	
380x100x54	$M_{c,y,Rd} = 322$ $M_{c,z,Rd} = 30.8$ Class = 1		1.00	322	279	239	207	181	160	144	119	102	89.0	79.3	71.6	65.3	15000
			1.13	322	295	257	225	198	176	158	131	111	97.5	87.1	78.8	72.1	
			1.35	322	317	282	251	225	202	182	152	129	111	99.5	90.3	82.8	
			1.50	322	322	297	267	241	218	198	166	141	122	107	97.7	89.7	
			1.77	322	322	318	291	266	244	224	190	163	142	125	111	101	
			2.00	322	322	322	308	285	263	243	209	182	159	140	125	112	
			2.50	322	322	322	322	317	297	279	246	218	194	173	156	140	
300x100x46	$M_{c,y,Rd} = 221$ $M_{c,z,Rd} = 51.1$ Class = 1		1.00	221	194	169	149	132	119	108	91.1	79.0	69.9	62.8	57.0	52.3	8230
			1.13	221	205	181	161	144	130	119	100	86.9	76.5	68.7	62.6	57.5	
			1.35	221	220	198	179	162	148	136	116	101	88.6	78.8	71.3	65.8	
			1.50	221	221	208	189	173	159	147	126	110	97.1	86.4	77.6	71.0	
			1.77	221	221	221	206	190	177	165	144	126	112	100	90.4	81.8	
			2.00	221	221	221	217	203	190	178	157	140	125	112	101	92.1	
			2.50	221	221	221	221	221	212	202	182	165	150	136	125	114	
300x90x41	$M_{c,y,Rd} = 202$ $M_{c,z,Rd} = 40.5$ Class = 1		1.00	197	166	142	123	108	95.9	86.4	72.2	62.2	54.7	49.0	44.4	40.6	7220
			1.13	202	177	153	134	118	106	95.1	79.4	67.9	60.0	53.8	48.8	44.8	
			1.35	202	191	169	150	134	121	110	92.0	78.6	68.3	61.5	56.0	51.4	
			1.50	202	199	179	160	145	131	119	101	86.2	75.0	66.4	60.6	55.7	
			1.77	202	202	193	176	161	147	135	116	99.9	87.3	77.0	68.4	63.0	
			2.00	202	202	202	187	173	159	148	127	111	97.7	86.5	77.2	69.2	
			2.50	202	202	202	202	193	181	170	151	134	119	107	96.3	87.0	

Advance® and UKPFC are trademarks of Tata Steel. A fuller description of the relationship between Parallel Flange Channels and the Advance® range of sections manufactured by Tata Steel is given in note 12.

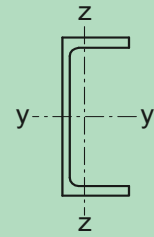
<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8.

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

PARALLEL FLANGE CHANNELS

Advance® UKPFC



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)											Second Moment of Area y-y axis $I_y$ $cm^4$
				1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	
260x90x35  $M_{c,y,Rd} = 151$ $M_{c,z,Rd} = 36.2$ Class = 1	1.00	148	125	107	93.4	82.3	73.5	66.4	55.8	48.2	42.6	38.1	34.6	31.7	4730
	1.13	151	133	116	102	90.2	80.9	73.2	61.4	52.8	46.6	41.9	38.1	34.9	
	1.35	151	144	128	114	102	92.7	84.4	71.1	61.2	53.4	47.8	43.6	40.1	
	1.50	151	150	135	122	110	100	91.6	77.7	67.0	58.6	51.7	47.1	43.4	
	1.77	151	151	145	133	122	112	104	89.1	77.5	68.1	60.3	53.8	49.0	
	2.00	151	151	151	141	131	121	113	98.1	86.1	76.1	67.7	60.6	54.6	
	2.50	151	151	151	151	146	138	130	115	103	92.5	83.3	75.3	68.4	
260x75x28  $M_{c,y,Rd} = 116$ $M_{c,z,Rd} = 22.0$ Class = 1	1.00	106	86.0	71.0	59.9	51.7	45.4	40.5	33.5	28.6	25.1	22.3	20.1	18.4	3620
	1.13	111	92.3	77.4	65.8	56.9	50.0	44.5	36.6	31.4	27.6	24.6	22.3	20.3	
	1.35	116	101	87.0	75.1	65.6	57.9	51.6	42.1	35.9	31.7	28.3	25.7	23.5	
	1.50	116	107	92.8	80.9	71.2	63.1	56.5	46.2	38.7	34.3	30.7	27.9	25.6	
	1.77	116	115	102	90.3	80.5	72.1	65.0	53.6	45.1	38.6	34.8	31.7	29.1	
	2.00	116	116	108	97.2	87.6	79.2	71.8	59.9	50.6	43.4	38.1	34.8	32.0	
	2.50	116	116	116	109	101	92.5	85.2	72.7	62.5	54.2	47.4	41.7	37.7	
230x90x32  $M_{c,y,Rd} = 126$ $M_{c,z,Rd} = 35.1$ Class = 1	1.00	124	106	91.7	80.6	71.7	64.6	58.8	49.9	43.5	38.6	34.7	31.6	29.0	3520
	1.13	126	112	98.7	87.5	78.5	71.0	64.8	55.0	47.7	42.1	38.0	34.7	31.9	
	1.35	126	121	109	97.9	88.8	81.0	74.4	63.6	55.3	48.8	43.4	39.6	36.5	
	1.50	126	126	114	104	95.1	87.3	80.6	69.4	60.6	53.5	47.6	42.8	39.5	
	1.77	126	126	123	113	105	97.5	90.7	79.1	69.7	61.9	55.4	49.9	45.1	
	2.00	126	126	126	120	112	105	98.3	86.8	77.1	69.0	62.0	56.0	50.8	
	2.50	126	126	126	126	125	118	112	101	91.6	83.1	75.6	69.0	63.2	
230x75x26  $M_{c,y,Rd} = 98.7$ $M_{c,z,Rd} = 22.4$ Class = 1	1.00	90.3	74.6	62.7	53.7	47.0	41.7	37.6	31.4	27.1	23.9	21.4	19.3	17.7	2750
	1.13	94.9	80.0	68.1	58.9	51.7	46.0	41.4	34.4	29.7	26.2	23.5	21.3	19.5	
	1.35	98.7	87.6	76.2	66.9	59.3	53.1	47.9	39.9	33.9	30.0	27.0	24.5	22.5	
	1.50	98.7	92.0	81.1	71.9	64.2	57.7	52.3	43.7	37.2	32.3	29.2	26.6	24.5	
	1.77	98.7	98.4	88.5	79.7	72.1	65.5	59.8	50.5	43.2	37.5	32.9	30.1	27.8	
	2.00	98.7	98.7	93.7	85.5	78.1	71.6	65.8	56.1	48.4	42.1	37.0	32.9	30.4	
	2.50	98.7	98.7	98.7	95.5	88.9	82.7	77.1	67.3	59.0	52.1	46.2	41.3	37.0	

Advance® and UKPFC are trademarks of Tata Steel. A fuller description of the relationship between Parallel Flange Channels and the Advance® range of sections manufactured by Tata Steel is given in note 12.

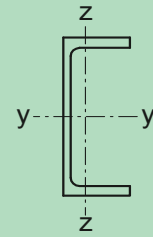
<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8.

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

PARALLEL FLANGE CHANNELS

Advance® UKPFC



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)											Second Moment of Area y-y axis $I_y$ cm <sup>4</sup>		
				1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0		9.0	10.0
200x90x30	$M_{c,y,Rd} = 103$ $M_{c,z,Rd} = 33.5$ Class = 1		1.00	102	88.1	77.3	68.7	61.9	56.3	51.6	44.4	39.0	34.8	31.5	28.7	26.4	2520
			1.13	103	93.3	82.9	74.5	67.5	61.7	56.8	48.9	42.9	38.2	34.4	31.5	29.0	
			1.35	103	101	91.0	82.9	76.0	70.1	64.9	56.4	49.7	44.2	39.7	35.9	33.1	
			1.50	103	103	95.6	87.9	81.1	75.3	70.1	61.3	54.3	48.4	43.6	39.4	35.9	
			1.77	103	103	102	95.4	89.1	83.5	78.4	69.5	62.1	55.8	50.5	45.9	41.9	
			2.00	103	103	103	101	94.8	89.5	84.6	75.8	68.3	61.8	56.2	51.3	47.0	
			2.50	103	103	103	103	103	100.0	95.6	87.5	80.2	73.7	67.8	62.5	57.8	
200x75x23	$M_{c,y,Rd} = 80.6$ $M_{c,z,Rd} = 21.5$ Class = 1		1.00	74.3	62.1	53.0	46.1	40.8	36.6	33.2	28.1	24.4	21.6	19.4	17.6	16.1	1960
			1.13	78.0	66.5	57.5	50.4	44.8	40.3	36.6	30.8	26.6	23.7	21.3	19.4	17.8	
			1.35	80.6	72.6	64.1	57.0	51.2	46.4	42.3	35.7	30.8	26.9	24.3	22.2	20.5	
			1.50	80.6	76.1	67.9	61.0	55.2	50.3	46.0	39.1	33.8	29.5	26.3	24.1	22.2	
			1.77	80.6	80.6	73.9	67.4	61.7	56.7	52.3	45.0	39.1	34.4	30.4	27.1	25.1	
			2.00	80.6	80.6	78.0	72.0	66.5	61.6	57.2	49.7	43.6	38.5	34.2	30.6	27.5	
			2.50	80.6	80.6	80.6	79.9	75.1	70.6	66.4	59.0	52.6	47.1	42.3	38.2	34.6	
180x90x26	$M_{c,y,Rd} = 82.4$ $M_{c,z,Rd} = 29.6$ Class = 1		1.00	81.3	70.2	61.6	54.8	49.4	44.9	41.2	35.5	31.2	27.8	25.1	23.0	21.1	1820
			1.13	82.4	74.4	66.1	59.4	53.9	49.3	45.3	39.1	34.3	30.5	27.5	25.2	23.2	
			1.35	82.4	80.1	72.6	66.1	60.7	56.0	51.9	45.1	39.7	35.4	31.8	28.8	26.5	
			1.50	82.4	82.4	76.2	70.1	64.8	60.1	55.9	49.0	43.4	38.7	34.8	31.6	28.7	
			1.77	82.4	82.4	81.7	76.1	71.1	66.6	62.6	55.5	49.6	44.6	40.4	36.7	33.5	
			2.00	82.4	82.4	82.4	80.3	75.7	71.4	67.5	60.6	54.6	49.4	45.0	41.0	37.6	
			2.50	82.4	82.4	82.4	82.4	82.4	79.8	76.3	69.8	64.1	58.9	54.2	50.0	46.2	
180x75x20	$M_{c,y,Rd} = 62.5$ $M_{c,z,Rd} = 18.4$ Class = 1		1.00	57.5	48.0	40.8	35.4	31.2	28.0	25.3	21.4	18.5	16.4	14.7	13.4	12.2	1370
			1.13	60.4	51.4	44.3	38.7	34.3	30.8	27.9	23.5	20.3	18.0	16.2	14.7	13.5	
			1.35	62.5	56.1	49.4	43.8	39.3	35.5	32.3	27.2	23.4	20.5	18.5	16.9	15.5	
			1.50	62.5	58.9	52.4	47.0	42.4	38.5	35.1	29.8	25.6	22.4	20.0	18.3	16.8	
			1.77	62.5	62.5	57.0	51.9	47.4	43.5	40.0	34.3	29.7	26.0	23.0	20.6	19.1	
			2.00	62.5	62.5	60.3	55.5	51.1	47.3	43.8	37.9	33.2	29.2	25.9	23.1	20.8	
			2.50	62.5	62.5	62.5	61.6	57.8	54.3	51.0	45.1	40.1	35.8	32.1	28.9	26.1	

Advance® and UKPFC are trademarks of Tata Steel. A fuller description of the relationship between Parallel Flange Channels and the Advance® range of sections manufactured by Tata Steel is given in note 12.

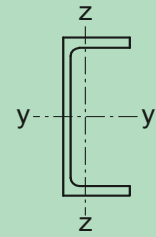
<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8.

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

PARALLEL FLANGE CHANNELS

Advance® UKPFC



Designation	Cross section resistance (kNm)	Classification	$C_1^{(1)}$	Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Length between lateral restraints (m)											Second Moment of Area y-y axis $I_y$ cm <sup>4</sup>
				1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	
150x90x24  $M_{c,y,Rd} = 63.5$ $M_{c,z,Rd} = 27.3$ Class = 1	1.00	63.1	55.2	49.1	44.2	40.3	37.0	34.3	29.8	26.4	23.8	21.6	19.8	18.3	1160
	1.13	63.5	58.3	52.5	47.8	43.8	40.5	37.6	32.8	29.1	26.1	23.7	21.6	20.0	
	1.35	63.5	62.7	57.4	52.9	49.0	45.7	42.7	37.7	33.7	30.3	27.5	25.1	23.0	
	1.50	63.5	63.5	60.1	55.9	52.1	48.9	45.9	40.8	36.6	33.1	30.1	27.5	25.2	
	1.77	63.5	63.5	63.5	60.3	56.9	53.8	51.0	45.9	41.6	37.9	34.6	31.8	29.3	
	2.00	63.5	63.5	63.5	63.5	60.3	57.4	54.7	49.8	45.5	41.7	38.3	35.4	32.7	
	2.50	63.5	63.5	63.5	63.5	63.5	63.5	61.2	56.8	52.7	49.0	45.6	42.5	39.7	
150x75x18  $M_{c,y,Rd} = 46.9$ $M_{c,z,Rd} = 16.8$ Class = 1	1.00	43.5	36.8	31.8	27.9	24.9	22.5	20.6	17.5	15.3	13.6	12.3	11.2	10.3	861
	1.13	45.6	39.3	34.4	30.5	27.3	24.8	22.6	19.3	16.8	14.9	13.4	12.3	11.3	
	1.35	46.9	42.8	38.2	34.3	31.1	28.4	26.1	22.3	19.4	17.1	15.3	14.0	12.9	
	1.50	46.9	44.8	40.4	36.7	33.5	30.7	28.3	24.4	21.3	18.8	16.7	15.2	14.0	
	1.77	46.9	46.9	43.8	40.3	37.2	34.5	32.1	28.0	24.6	21.8	19.5	17.5	15.8	
	2.00	46.9	46.9	46.1	42.9	40.0	37.3	34.9	30.8	27.3	24.3	21.8	19.7	17.8	
	2.50	46.9	46.9	46.9	46.9	44.8	42.4	40.2	36.2	32.6	29.5	26.8	24.4	22.2	
125x65x15  $M_{c,y,Rd} = 31.9$ $M_{c,z,Rd} = 11.8$ Class = 1	1.00	28.5	24.1	21.0	18.6	16.7	15.1	13.9	11.9	10.4	9.27	8.37	7.63	7.01	483
	1.13	30.0	25.9	22.7	20.3	18.3	16.6	15.3	13.1	11.4	10.1	9.18	8.38	7.72	
	1.35	31.9	28.3	25.4	22.9	20.9	19.1	17.6	15.1	13.2	11.7	10.5	9.58	8.85	
	1.50	31.9	29.7	26.9	24.5	22.4	20.7	19.1	16.5	14.5	12.8	11.4	10.3	9.57	
	1.77	31.9	31.8	29.2	27.0	25.0	23.2	21.7	18.9	16.7	14.9	13.3	12.0	10.8	
	2.00	31.9	31.9	30.9	28.8	26.9	25.2	23.6	20.9	18.5	16.6	14.9	13.4	12.2	
	2.50	31.9	31.9	31.9	31.9	30.2	28.7	27.2	24.5	22.2	20.1	18.3	16.6	15.2	
100x50x10  $M_{c,y,Rd} = 17.4$ $M_{c,z,Rd} = 6.21$ Class = 1	1.00	14.3	12.0	10.3	9.11	8.14	7.37	6.73	5.75	5.02	4.46	4.02	3.66	3.36	208
	1.13	15.2	12.9	11.3	10.00	8.97	8.12	7.41	6.30	5.49	4.89	4.42	4.03	3.70	
	1.35	16.4	14.3	12.7	11.4	10.3	9.37	8.58	7.30	6.31	5.58	5.06	4.62	4.26	
	1.50	17.1	15.1	13.6	12.3	11.1	10.2	9.36	8.00	6.92	6.06	5.46	5.01	4.62	
	1.77	17.4	16.4	14.9	13.7	12.5	11.6	10.7	9.23	8.04	7.07	6.26	5.65	5.23	
	2.00	17.4	17.2	15.9	14.7	13.6	12.6	11.7	10.2	8.98	7.93	7.05	6.30	5.72	
	2.50	17.4	17.4	17.4	16.5	15.5	14.6	13.7	12.2	10.9	9.74	8.75	7.89	7.14	

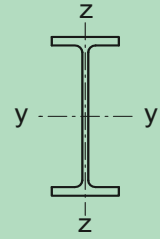
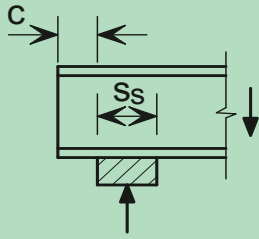
Advance® and UKPFC are trademarks of Tata Steel. A fuller description of the relationship between Parallel Flange Channels and the Advance® range of sections manufactured by Tata Steel is given in note 12.

<sup>(1)</sup>  $C_1$  is the factor dependent on the loading and end restraints; see note 8.

Section classification given applies to members subject to bending about the y-y axis only.

FOR EXPLANATION OF TABLES SEE NOTE 8.

UNIVERSAL BEAMS  
Advance® UKB



Unstiffened webs

Section Designation	Design Shear Resistance $V_{c,Rd}$ kN	Position of Stiff Bearing	Design resistance of unstiffened web, $F_{Rd}$ (kN) and limiting length, $c_{lim}$ (mm)												
			Stiff bearing length, $s_s$ (mm)												
			0	10	20	30	40	50	75	100	150	200	250	300	350
1016x305x487 +	6480	$F_{Rd}$ (c = 0)	1230	1340	1450	1570	1700	1830	2200	2600	3250	3750	4260	4760	5260
		$c_{lim}$ (mm)	620	610	600	590	580	570	550	520	470	420	370	320	290
		$F_{Rd}$ (c ≥ $c_{lim}$ )	4570	4680	4780	4880	4980	5080	5330	5580	6080	6580	7090	8330	8390
1016x305x437 +	5810	$F_{Rd}$ (c = 0)	1050	1150	1250	1360	1470	1600	1930	2670	3090	3480	3860	4240	4620
		$c_{lim}$ (mm)	620	610	600	590	580	570	550	520	470	420	370	320	310
		$F_{Rd}$ (c ≥ $c_{lim}$ )	3860	3950	4040	4130	4220	4310	4540	4760	5990	6210	6420	6630	6830
1016x305x393 +	5240	$F_{Rd}$ (c = 0)	894	980	1070	1640	1720	1790	1980	2180	2520	2830	3150	3460	3780
		$c_{lim}$ (mm)	620	610	600	590	580	570	550	520	470	420	370	320	300
		$F_{Rd}$ (c ≥ $c_{lim}$ )	3250	3330	3410	3490	3570	4440	4540	4640	4830	5020	5190	5370	5530
1016x305x349 +	4700	$F_{Rd}$ (c = 0)	1090	1140	1190	1240	1300	1350	1500	1650	1900	2140	2380	2620	2860
		$c_{lim}$ (mm)	620	610	600	590	580	570	550	520	470	420	370	320	290
		$F_{Rd}$ (c ≥ $c_{lim}$ )	3170	3200	3230	3270	3300	3330	3410	3480	3630	3770	3910	4040	4170
1016x305x314 +	4240	$F_{Rd}$ (c = 0)	879	921	964	1010	1050	1100	1220	1350	1540	1740	1940	2130	2330
		$c_{lim}$ (mm)	620	610	600	590	580	570	550	520	470	420	370	320	270
		$F_{Rd}$ (c ≥ $c_{lim}$ )	2540	2570	2590	2620	2650	2670	2740	2800	2920	3040	3150	3260	3370
1016x305x272 +	3680	$F_{Rd}$ (c = 0)	648	679	711	744	778	813	904	993	1140	1290	1430	1580	1730
		$c_{lim}$ (mm)	620	610	600	590	580	570	550	520	470	420	370	320	270
		$F_{Rd}$ (c ≥ $c_{lim}$ )	1840	1860	1880	1910	1930	1950	2000	2040	2140	2230	2310	2380	2380
1016x305x249 +	3600	$F_{Rd}$ (c = 0)	631	662	695	728	763	799	891	968	1120	1260	1410	1560	1700
		$c_{lim}$ (mm)	620	610	600	590	580	570	550	520	470	420	370	320	270
		$F_{Rd}$ (c ≥ $c_{lim}$ )	1760	1780	1800	1820	1850	1870	1920	1970	2060	2160	2250	2330	2350
1016x305x222 +	3440	$F_{Rd}$ (c = 0)	580	610	641	673	706	740	820	890	1030	1170	1310	1440	1580
		$c_{lim}$ (mm)	620	610	600	590	580	570	550	520	470	420	370	320	270
		$F_{Rd}$ (c ≥ $c_{lim}$ )	1580	1600	1620	1650	1670	1690	1740	1790	1880	1970	2060	2140	2140
914x419x388	4220	$F_{Rd}$ (c = 0)	1160	1210	1270	1330	1390	1460	1620	1790	2080	2350	2620	2890	3160
		$c_{lim}$ (mm)	570	560	550	540	530	520	500	470	420	370	320	280	280
		$F_{Rd}$ (c ≥ $c_{lim}$ )	3400	3430	3470	3500	3540	3570	3650	3740	3890	4050	4190	4340	4470
914x419x343	3800	$F_{Rd}$ (c = 0)	932	978	1030	1080	1130	1180	1320	1460	1690	1910	2130	2350	2570
		$c_{lim}$ (mm)	570	560	550	540	530	520	500	470	420	370	320	270	260
		$F_{Rd}$ (c ≥ $c_{lim}$ )	2700	2730	2760	2790	2820	2850	2920	2990	3120	3250	3370	3490	3610

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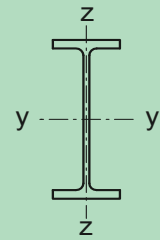
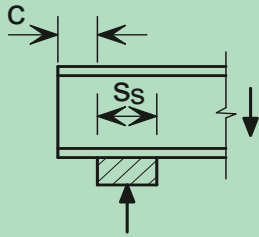
+ These sections are in addition to the range of BS 4 sections

If  $c < c_{lim}$ , then use  $F_{Rd}$  value for  $c = 0$ .

FOR EXPLANATION OF TABLES SEE NOTE 9.



UNIVERSAL BEAMS  
Advance® UKB



Unstiffened webs

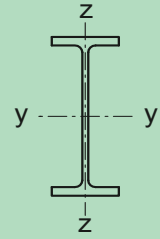
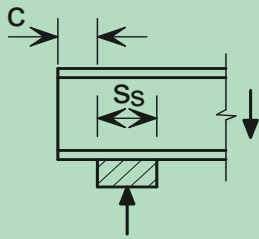
Section Designation	Design Shear Resistance $V_{c,Rd}$ kN	Position of Stiff Bearing	Design resistance of unstiffened web, $F_{Rd}$ (kN) and limiting length, $c_{lim}$ (mm)												
			Stiff bearing length, $s_s$ (mm)												
			0	10	20	30	40	50	75	100	150	200	250	300	350
914x305x289	3780	$F_{Rd}$ (c = 0)	910	957	1010	1060	1110	1160	1300	1430	1650	1870	2090	2310	2530
		$c_{lim}$ (mm)	580	570	560	550	540	530	510	480	430	380	330	280	250
		$F_{Rd}$ (c ≥ $c_{lim}$ )	2610	2640	2680	2710	2740	2770	2840	2910	3050	3180	3310	3430	3550
914x305x253	3350	$F_{Rd}$ (c = 0)	707	744	782	822	862	904	1010	1110	1280	1460	1630	1800	1970
		$c_{lim}$ (mm)	580	570	560	550	540	530	510	480	430	380	330	280	230
		$F_{Rd}$ (c ≥ $c_{lim}$ )	2000	2030	2050	2080	2100	2120	2180	2240	2350	2460	2560	2660	2750
914x305x224	3060	$F_{Rd}$ (c = 0)	587	618	651	685	720	755	847	921	1070	1220	1360	1510	1650
		$c_{lim}$ (mm)	580	570	560	550	540	530	510	480	430	380	330	280	230
		$F_{Rd}$ (c ≥ $c_{lim}$ )	1640	1660	1680	1700	1720	1740	1790	1840	1940	2030	2120	2200	2250
914x305x201	2870	$F_{Rd}$ (c = 0)	520	549	578	609	641	673	750	817	950	1080	1220	1350	1480
		$c_{lim}$ (mm)	580	570	560	550	540	530	510	480	430	380	330	280	230
		$F_{Rd}$ (c ≥ $c_{lim}$ )	1420	1450	1470	1490	1510	1520	1570	1620	1710	1790	1870	1930	1930
838x292x226	2900	$F_{Rd}$ (c = 0)	618	652	688	725	764	803	906	993	1160	1320	1480	1640	1800
		$c_{lim}$ (mm)	540	530	520	510	500	490	460	440	390	340	290	240	220
		$F_{Rd}$ (c ≥ $c_{lim}$ )	1760	1780	1800	1830	1850	1870	1930	1980	2080	2180	2270	2360	2440
838x292x194	2610	$F_{Rd}$ (c = 0)	502	531	561	593	625	658	740	808	944	1080	1220	1350	1490
		$c_{lim}$ (mm)	540	530	520	510	500	490	460	440	390	340	290	240	200
		$F_{Rd}$ (c ≥ $c_{lim}$ )	1400	1420	1440	1460	1480	1500	1540	1590	1680	1760	1840	1920	1920
838x292x176	2460	$F_{Rd}$ (c = 0)	448	475	503	531	561	592	661	723	847	970	1090	1220	1330
		$c_{lim}$ (mm)	540	530	520	510	500	490	460	440	390	340	290	240	190
		$F_{Rd}$ (c ≥ $c_{lim}$ )	1230	1250	1270	1290	1300	1320	1370	1410	1490	1570	1640	1670	1670
762x267x197	2530	$F_{Rd}$ (c = 0)	582	618	655	694	735	776	883	968	1140	1310	1480	1640	1810
		$c_{lim}$ (mm)	480	470	460	450	440	430	410	380	330	280	230	200	200
		$F_{Rd}$ (c ≥ $c_{lim}$ )	1660	1690	1710	1740	1760	1780	1840	1890	1990	2090	2190	2280	2360
762x267x173	2290	$F_{Rd}$ (c = 0)	479	510	542	575	609	644	728	800	942	1080	1230	1370	1510
		$c_{lim}$ (mm)	480	470	460	450	440	430	410	380	330	280	230	190	190
		$F_{Rd}$ (c ≥ $c_{lim}$ )	1350	1370	1390	1410	1430	1450	1500	1540	1630	1720	1800	1880	1930
762x267x147	2040	$F_{Rd}$ (c = 0)	376	401	427	453	481	510	571	629	743	857	971	1090	1190
		$c_{lim}$ (mm)	480	470	460	450	440	430	410	380	330	280	230	180	170
		$F_{Rd}$ (c ≥ $c_{lim}$ )	1040	1050	1070	1090	1100	1120	1160	1200	1270	1340	1410	1410	1410
762x267x134	1970	$F_{Rd}$ (c = 0)	332	354	377	401	426	452	504	555	658	760	852	924	996
		$c_{lim}$ (mm)	480	470	460	450	440	430	410	380	330	280	230	180	160
		$F_{Rd}$ (c ≥ $c_{lim}$ )	903	919	935	950	965	980	1020	1050	1120	1180	1180	1180	1180

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If  $c < c_{lim}$ , then use  $F_{Rd}$  value for  $c = 0$ .

FOR EXPLANATION OF TABLES SEE NOTE 9.

UNIVERSAL BEAMS  
Advance® UKB



Unstiffened webs

Section Designation	Design Shear Resistance $V_{c,Rd}$ kN	Position of Stiff Bearing	Design resistance of unstiffened web, $F_{Rd}$ (kN) and limiting length, $c_{lim}$ (mm)												
			Stiff bearing length, $s_s$ (mm)												
			0	10	20	30	40	50	75	100	150	200	250	300	350
686x254x170	2120	$F_{Rd}$ (c = 0)	507	542	578	616	655	695	795	877	1040	1200	1360	1530	1690
		$c_{lim}$ (mm)	440	430	420	410	400	390	360	340	290	240	190	190	190
		$F_{Rd}$ (c ≥ $c_{lim}$ )	1460	1480	1500	1530	1550	1570	1620	1670	1770	1860	1950	2030	2120
686x254x152	1920	$F_{Rd}$ (c = 0)	415	444	474	505	538	571	651	718	853	988	1120	1260	1390
		$c_{lim}$ (mm)	440	430	420	410	400	390	360	340	290	240	190	180	180
		$F_{Rd}$ (c ≥ $c_{lim}$ )	1180	1200	1220	1240	1250	1270	1320	1360	1440	1520	1590	1660	1690
686x254x140	1790	$F_{Rd}$ (c = 0)	362	387	414	442	471	501	568	628	747	866	984	1100	1220
		$c_{lim}$ (mm)	440	430	420	410	400	390	360	340	290	240	190	170	170
		$F_{Rd}$ (c ≥ $c_{lim}$ )	1020	1040	1050	1070	1090	1100	1140	1180	1250	1320	1390	1420	1420
686x254x125	1670	$F_{Rd}$ (c = 0)	316	339	363	388	414	441	497	550	657	762	868	974	1070
		$c_{lim}$ (mm)	440	430	420	410	400	390	360	340	290	240	190	160	160
		$F_{Rd}$ (c ≥ $c_{lim}$ )	874	890	906	922	937	952	988	1020	1090	1150	1200	1200	1200
610x305x238	2460	$F_{Rd}$ (c = 0)	580	647	721	801	887	978	1230	1580	1880	2170	2460	2750	3050
		$c_{lim}$ (mm)	390	380	370	360	350	340	310	290	240	220	220	220	220
		$F_{Rd}$ (c ≥ $c_{lim}$ )	2040	2100	2170	2230	2290	2360	2520	2670	3180	3330	3480	3620	3750
610x305x179	1880	$F_{Rd}$ (c = 0)	503	539	577	617	658	701	811	901	1070	1250	1420	1590	1760
		$c_{lim}$ (mm)	390	380	370	360	350	340	310	290	240	190	190	190	190
		$F_{Rd}$ (c ≥ $c_{lim}$ )	1470	1490	1520	1540	1560	1580	1630	1690	1780	1870	1960	2050	2130
610x305x149	1570	$F_{Rd}$ (c = 0)	345	370	397	425	454	485	560	620	741	862	982	1100	1220
		$c_{lim}$ (mm)	390	380	370	360	350	340	310	290	240	190	170	170	170
		$F_{Rd}$ (c ≥ $c_{lim}$ )	991	1010	1020	1040	1060	1070	1110	1150	1220	1280	1350	1380	1380
610x229x140	1690	$F_{Rd}$ (c = 0)	418	450	483	518	554	592	680	755	904	1050	1200	1350	1500
		$c_{lim}$ (mm)	390	380	370	360	350	340	310	290	240	190	170	170	170
		$F_{Rd}$ (c ≥ $c_{lim}$ )	1210	1230	1250	1270	1290	1310	1360	1400	1490	1570	1650	1720	1790
610x229x125	1530	$F_{Rd}$ (c = 0)	340	366	394	423	453	484	554	616	739	862	985	1110	1230
		$c_{lim}$ (mm)	390	380	370	360	350	340	310	290	240	190	160	160	160
		$F_{Rd}$ (c ≥ $c_{lim}$ )	971	989	1010	1020	1040	1060	1100	1130	1210	1280	1340	1400	1400
610x229x113	1420	$F_{Rd}$ (c = 0)	291	314	339	364	391	418	475	529	637	744	851	957	1060
		$c_{lim}$ (mm)	390	380	370	360	350	340	310	290	240	190	150	150	150
		$F_{Rd}$ (c ≥ $c_{lim}$ )	821	837	852	867	882	896	932	966	1030	1090	1140	1140	1140
610x229x101	1370	$F_{Rd}$ (c = 0)	259	281	303	326	350	375	424	473	571	668	765	854	930
		$c_{lim}$ (mm)	390	380	370	360	350	340	310	290	240	190	140	140	140
		$F_{Rd}$ (c ≥ $c_{lim}$ )	719	734	748	763	776	790	823	855	915	972	978	978	978

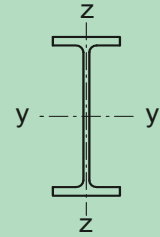
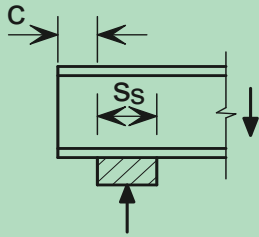
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If  $c < c_{lim}$ , then use  $F_{Rd}$  value for  $c = 0$ .

FOR EXPLANATION OF TABLES SEE NOTE 9.

UNIVERSAL BEAMS

Advance® UKB



Unstiffened webs

Section Designation	Design Shear Resistance $V_{c,Rd}$ kN	Position of Stiff Bearing	Design resistance of unstiffened web, $F_{Rd}$ (kN) and limiting length, $c_{lim}$ (mm)												
			Stiff bearing length, $s_s$ (mm)												
			0	10	20	30	40	50	75	100	150	200	250	300	350
610x178x100 +	1450	$F_{Rd}$ (c = 0)	296	320	346	372	400	427	484	540	651	762	873	984	1100
		$c_{lim}$ (mm)	390	380	370	360	350	340	310	290	240	190	150	150	150
		$F_{Rd}$ (c ≥ $c_{lim}$ )	828	845	861	877	893	909	946	982	1050	1120	1180	1200	1200
610x178x92 +	1410	$F_{Rd}$ (c = 0)	275	298	322	348	374	397	450	503	609	714	819	923	1030
		$c_{lim}$ (mm)	390	380	370	360	350	340	310	290	240	190	140	140	140
		$F_{Rd}$ (c ≥ $c_{lim}$ )	759	775	791	807	822	837	873	908	974	1040	1080	1080	1080
610x178x82 +	1290	$F_{Rd}$ (c = 0)	229	248	269	290	312	330	375	420	508	597	674	739	804
		$c_{lim}$ (mm)	390	380	370	360	350	340	310	290	240	190	140	130	130
		$F_{Rd}$ (c ≥ $c_{lim}$ )	622	636	650	663	676	689	720	750	807	846	846	846	846
533x312x272 +	2480	$F_{Rd}$ (c = 0)	754	830	913	1000	1100	1200	1480	1780	2160	2520	2890	3250	3610
		$c_{lim}$ (mm)	340	330	320	310	300	290	260	240	230	230	230	230	230
		$F_{Rd}$ (c ≥ $c_{lim}$ )	2680	2750	2830	2900	2970	3040	3230	3410	3770	4140	4500	4860	5320
533x312x219 +	2120	$F_{Rd}$ (c = 0)	543	610	684	764	851	944	1190	1400	1720	2030	2350	2660	2980
		$c_{lim}$ (mm)	340	330	320	310	300	290	260	240	190	190	190	190	190
		$F_{Rd}$ (c ≥ $c_{lim}$ )	1900	1970	2030	2090	2160	2220	2380	2540	2850	3170	3530	3680	3830
533x312x182 +	1740	$F_{Rd}$ (c = 0)	412	467	530	598	672	867	1010	1130	1360	1590	1820	2040	2240
		$c_{lim}$ (mm)	340	330	320	310	300	290	260	240	190	190	190	190	190
		$F_{Rd}$ (c ≥ $c_{lim}$ )	1420	1470	1530	1580	1630	1680	2010	2070	2190	2310	2420	2520	2620
533x312x150 +	1460	$F_{Rd}$ (c = 0)	412	446	481	518	557	596	696	776	935	1090	1250	1410	1550
		$c_{lim}$ (mm)	340	330	320	310	300	290	260	240	190	170	170	170	170
		$F_{Rd}$ (c ≥ $c_{lim}$ )	1210	1230	1250	1270	1290	1310	1350	1400	1490	1570	1650	1720	1800
533x210x138 +	1680	$F_{Rd}$ (c = 0)	323	378	440	509	584	788	913	1020	1230	1450	1660	1870	2060
		$c_{lim}$ (mm)	340	330	320	310	300	290	260	240	190	170	170	170	170
		$F_{Rd}$ (c ≥ $c_{lim}$ )	1150	1200	1250	1310	1360	1410	1530	1850	1970	2080	2190	2290	2390
533x210x122	1450	$F_{Rd}$ (c = 0)	398	433	469	506	545	586	677	757	917	1080	1240	1400	1530
		$c_{lim}$ (mm)	340	330	320	310	300	290	260	240	190	160	160	160	160
		$F_{Rd}$ (c ≥ $c_{lim}$ )	1160	1190	1210	1230	1250	1270	1320	1360	1450	1540	1620	1700	1770
533x210x109	1330	$F_{Rd}$ (c = 0)	327	355	386	417	450	485	557	624	757	890	1020	1160	1270
		$c_{lim}$ (mm)	340	330	320	310	300	290	260	240	190	150	150	150	150
		$F_{Rd}$ (c ≥ $c_{lim}$ )	942	961	979	997	1020	1030	1070	1110	1190	1260	1330	1400	1450
533x210x101	1240	$F_{Rd}$ (c = 0)	281	306	332	360	389	418	479	537	653	769	884	999	1100
		$c_{lim}$ (mm)	340	330	320	310	300	290	260	240	190	140	140	140	140
		$F_{Rd}$ (c ≥ $c_{lim}$ )	804	820	836	852	867	883	919	955	1020	1090	1140	1180	1180
533x210x92	1170	$F_{Rd}$ (c = 0)	246	268	292	316	342	368	420	472	575	677	780	882	969
		$c_{lim}$ (mm)	340	330	320	310	300	290	260	240	190	140	140	140	140
		$F_{Rd}$ (c ≥ $c_{lim}$ )	696	711	725	739	753	767	800	832	893	949	981	981	981
533x210x82	1120	$F_{Rd}$ (c = 0)	217	238	259	282	305	326	373	419	513	605	698	790	846
		$c_{lim}$ (mm)	340	330	320	310	300	290	260	240	190	140	130	130	130
		$F_{Rd}$ (c ≥ $c_{lim}$ )	604	618	632	645	658	671	702	732	788	840	846	846	846

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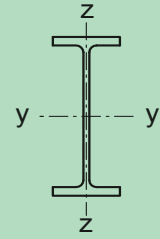
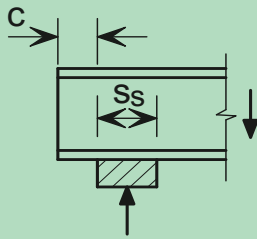
+ These sections are in addition to the range of BS 4 sections

If  $c < c_{lim}$ , then use  $F_{Rd}$  value for  $c = 0$ .

FOR EXPLANATION OF TABLES SEE NOTE 9.

UNIVERSAL BEAMS

Advance® UKB



Unstiffened webs

Section Designation	Design Shear Resistance $V_{c,Rd}$ kN	Position of Stiff Bearing	Design resistance of unstiffened web, $F_{Rd}$ (kN) and limiting length, $c_{lim}$ (mm)												
			Stiff bearing length, $s_s$ (mm)												
			0	10	20	30	40	50	75	100	150	200	250	300	350
533x165x85 +	1170	$F_{Rd}$ (c = 0)	249	272	297	322	349	374	427	480	586	691	796	901	991
		$c_{lim}$ (mm)	340	330	320	310	300	290	260	240	190	140	140	140	140
		$F_{Rd}$ (c ≥ $c_{lim}$ )	706	722	737	752	766	780	815	848	910	969	1020	1030	1030
533x165x74 +	1120	$F_{Rd}$ (c = 0)	219	240	262	285	309	329	377	424	520	614	709	803	867
		$c_{lim}$ (mm)	340	330	320	310	300	290	260	240	190	140	120	120	120
		$F_{Rd}$ (c ≥ $c_{lim}$ )	608	623	637	650	664	677	709	740	798	851	867	867	867
533x165x66 +	1020	$F_{Rd}$ (c = 0)	182	200	218	238	256	272	313	353	433	513	578	637	679
		$c_{lim}$ (mm)	340	330	320	310	300	290	260	240	190	140	110	110	110
		$F_{Rd}$ (c ≥ $c_{lim}$ )	496	508	521	533	544	556	583	610	659	679	679	679	679
457x191x161 +	1810	$F_{Rd}$ (c = 0)	468	534	608	690	778	872	1130	1280	1590	1900	2210	2520	2840
		$c_{lim}$ (mm)	290	280	270	260	250	240	220	190	180	180	180	180	180
		$F_{Rd}$ (c ≥ $c_{lim}$ )	1720	1780	1840	1910	1970	2030	2190	2340	2650	2960	3270	3580	3930
457x191x133 +	1510	$F_{Rd}$ (c = 0)	352	409	473	544	622	704	894	1030	1290	1550	1820	2080	2410
		$c_{lim}$ (mm)	290	280	270	260	250	240	220	190	150	150	150	150	170
		$F_{Rd}$ (c ≥ $c_{lim}$ )	1270	1330	1380	1430	1480	1540	1670	1800	2070	2400	2530	2650	2800
457x191x106 +	1230	$F_{Rd}$ (c = 0)	248	296	350	411	570	618	718	810	994	1180	1360	1520	1610
		$c_{lim}$ (mm)	290	280	270	260	250	240	220	190	150	150	150	150	150
		$F_{Rd}$ (c ≥ $c_{lim}$ )	882	925	969	1010	1060	1100	1350	1410	1510	1600	1690	1770	1850
457x191x98	1110	$F_{Rd}$ (c = 0)	224	359	393	429	467	505	587	663	814	964	1120	1240	1320
		$c_{lim}$ (mm)	290	280	270	260	250	240	220	190	150	150	150	150	150
		$F_{Rd}$ (c ≥ $c_{lim}$ )	788	984	1000	1020	1040	1060	1100	1150	1230	1300	1380	1450	1510
457x191x89	1030	$F_{Rd}$ (c = 0)	273	301	330	361	393	426	493	557	685	813	940	1050	1110
		$c_{lim}$ (mm)	290	280	270	260	250	240	220	190	140	140	140	140	140
		$F_{Rd}$ (c ≥ $c_{lim}$ )	798	815	832	849	865	881	919	956	1030	1090	1150	1210	1260
457x191x82	976	$F_{Rd}$ (c = 0)	243	268	294	322	351	381	439	497	612	728	843	942	1000
		$c_{lim}$ (mm)	290	280	270	260	250	240	220	190	140	130	130	130	130
		$F_{Rd}$ (c ≥ $c_{lim}$ )	701	717	733	748	763	777	813	847	911	971	1030	1060	1060
457x191x74	895	$F_{Rd}$ (c = 0)	199	219	241	264	289	312	360	408	503	599	694	776	811
		$c_{lim}$ (mm)	290	280	270	260	250	240	220	190	140	120	120	120	120
		$F_{Rd}$ (c ≥ $c_{lim}$ )	568	581	595	607	620	632	662	691	744	794	811	811	811
457x191x67	839	$F_{Rd}$ (c = 0)	174	192	212	233	255	273	316	359	444	529	614	687	687
		$c_{lim}$ (mm)	290	280	270	260	250	240	220	190	140	120	120	120	120
		$F_{Rd}$ (c ≥ $c_{lim}$ )	490	503	515	527	538	549	577	603	652	687	687	687	687

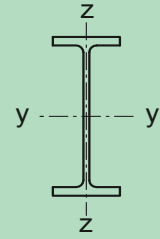
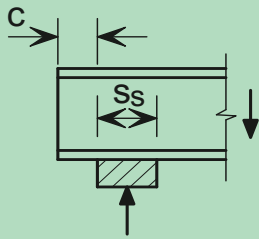
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+ These sections are in addition to the range of BS 4 sections

If  $c < c_{lim}$ , then use  $F_{Rd}$  value for  $c = 0$ .

FOR EXPLANATION OF TABLES SEE NOTE 9.

UNIVERSAL BEAMS  
Advance® UKB



Unstiffened webs

Section Designation	Design Shear Resistance $V_{c,Rd}$ kN	Position of Stiff Bearing	Design resistance of unstiffened web, $F_{Rd}$ (kN) and limiting length, $c_{lim}$ (mm)													
			Stiff bearing length, $s_s$ (mm)													
			0	10	20	30	40	50	75	100	150	200	250	300	350	
457x152x82	1040	$F_{Rd}$ (c = 0)	271	299	328	359	391	424	489	554	682	809	937	1050	1110	
		$c_{lim}$ (mm)	290	280	270	260	250	240	220	190	140	140	140	140	140	140
		$F_{Rd}$ (c ≥ $c_{lim}$ )	794	811	828	845	861	877	916	953	1020	1090	1150	1210	1250	1250
457x152x74	938	$F_{Rd}$ (c = 0)	224	247	271	297	324	351	405	459	566	673	779	871	925	
		$c_{lim}$ (mm)	290	280	270	260	250	240	220	190	140	130	130	130	130	130
		$F_{Rd}$ (c ≥ $c_{lim}$ )	648	663	677	691	705	719	752	784	843	899	951	970	970	970
457x152x67	899	$F_{Rd}$ (c = 0)	196	217	239	262	287	308	356	404	500	595	690	772	807	
		$c_{lim}$ (mm)	290	280	270	260	250	240	220	190	140	120	120	120	120	120
		$F_{Rd}$ (c ≥ $c_{lim}$ )	560	574	587	600	613	625	655	684	738	789	807	807	807	807
457x152x60	806	$F_{Rd}$ (c = 0)	157	174	192	211	231	247	286	325	402	479	556	600	600	
		$c_{lim}$ (mm)	290	280	270	260	250	240	220	190	140	120	120	120	120	120
		$F_{Rd}$ (c ≥ $c_{lim}$ )	443	454	465	476	487	497	522	545	590	600	600	600	600	600
457x152x52	747	$F_{Rd}$ (c = 0)	135	150	166	183	199	212	247	281	350	411	463	499	499	
		$c_{lim}$ (mm)	290	280	270	260	250	240	220	190	140	100	100	100	100	100
		$F_{Rd}$ (c ≥ $c_{lim}$ )	373	383	393	403	413	422	445	466	499	499	499	499	499	499
406x178x85 +	966	$F_{Rd}$ (c = 0)	198	239	287	407	446	486	566	644	798	953	1110	1190	1270	
		$c_{lim}$ (mm)	260	250	240	230	220	210	180	160	130	130	130	130	130	130
		$F_{Rd}$ (c ≥ $c_{lim}$ )	696	734	771	809	971	989	1030	1080	1160	1230	1310	1370	1440	1440
406x178x74	858	$F_{Rd}$ (c = 0)	229	254	282	311	341	371	431	491	610	730	849	914	971	
		$c_{lim}$ (mm)	260	250	240	230	220	210	180	160	120	120	120	120	120	120
		$F_{Rd}$ (c ≥ $c_{lim}$ )	669	685	700	716	731	745	780	814	878	937	993	1050	1050	1050
406x178x67	790	$F_{Rd}$ (c = 0)	193	215	239	264	290	314	366	417	519	622	724	780	829	
		$c_{lim}$ (mm)	260	250	240	230	220	210	180	160	120	120	120	120	120	120
		$F_{Rd}$ (c ≥ $c_{lim}$ )	558	572	586	599	612	625	656	686	741	793	840	840	840	840
406x178x60	709	$F_{Rd}$ (c = 0)	154	172	191	211	232	250	292	333	416	499	581	619	619	
		$c_{lim}$ (mm)	260	250	240	230	220	210	180	160	110	110	110	110	110	110
		$F_{Rd}$ (c ≥ $c_{lim}$ )	440	451	463	474	484	495	520	544	590	619	619	619	619	619
406x178x54	683	$F_{Rd}$ (c = 0)	142	159	178	198	217	232	272	311	390	468	547	571	571	
		$c_{lim}$ (mm)	260	250	240	230	220	210	180	160	110	100	100	100	100	100
		$F_{Rd}$ (c ≥ $c_{lim}$ )	400	411	422	433	444	454	479	503	547	571	571	571	571	571

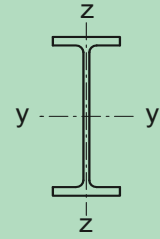
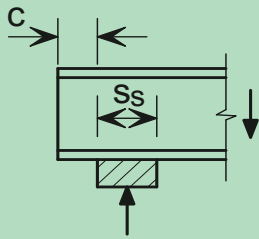
Advance® and UKB are trademarks of Tata Steel. A fuller description of the relationship between Universal Beams (UB) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

+ These sections are in addition to the range of BS 4 sections

If  $c < c_{lim}$ , then use  $F_{Rd}$  value for  $c = 0$ .

FOR EXPLANATION OF TABLES SEE NOTE 9.

UNIVERSAL BEAMS  
Advance® UKB



Unstiffened webs

Section Designation	Design Shear Resistance $V_{c,Rd}$ kN	Position of Stiff Bearing	Design resistance of unstiffened web, $F_{Rd}$ (kN) and limiting length, $c_{lim}$ (mm)												
			Stiff bearing length, $s_s$ (mm)												
			0	10	20	30	40	50	75	100	150	200	250	300	350
406x140x53 +	709	$F_{Rd}$ (c = 0)	151	169	188	209	230	246	288	329	412	495	577	615	615
		$c_{lim}$ (mm)	260	250	240	230	220	210	180	160	110	110	110	110	110
		$F_{Rd}$ (c ≥ $c_{lim}$ )	430	442	453	465	476	486	512	537	583	615	615	615	615
406x140x46	611	$F_{Rd}$ (c = 0)	111	124	138	154	168	181	212	242	304	355	401	405	405
		$c_{lim}$ (mm)	260	250	240	230	220	210	180	160	110	100	100	100	100
		$F_{Rd}$ (c ≥ $c_{lim}$ )	311	320	329	337	345	353	373	391	405	405	405	405	405
406x140x39	566	$F_{Rd}$ (c = 0)	94.9	107	120	133	144	156	183	210	258	297	335	338	338
		$c_{lim}$ (mm)	260	250	240	230	220	210	180	160	110	90	90	90	90
		$F_{Rd}$ (c ≥ $c_{lim}$ )	260	268	276	284	292	299	317	334	338	338	338	338	338
356x171x67	733	$F_{Rd}$ (c = 0)	216	243	272	302	334	366	429	491	617	742	832	892	949
		$c_{lim}$ (mm)	230	220	210	200	190	180	150	130	120	120	120	120	120
		$F_{Rd}$ (c ≥ $c_{lim}$ )	544	657	672	688	703	717	753	786	850	909	964	1020	1050
356x171x57	646	$F_{Rd}$ (c = 0)	166	187	211	235	261	282	332	382	481	581	652	701	746
		$c_{lim}$ (mm)	230	220	210	200	190	180	150	130	110	110	110	110	110
		$F_{Rd}$ (c ≥ $c_{lim}$ )	482	496	509	521	534	546	575	603	655	703	746	746	746
356x171x51	587	$F_{Rd}$ (c = 0)	136	154	174	194	216	232	274	316	399	482	542	576	576
		$c_{lim}$ (mm)	230	220	210	200	190	180	150	130	100	100	100	100	100
		$F_{Rd}$ (c ≥ $c_{lim}$ )	391	402	414	424	435	445	470	494	538	576	576	576	576
356x171x45	549	$F_{Rd}$ (c = 0)	119	135	153	171	188	203	241	278	352	427	480	489	489
		$c_{lim}$ (mm)	230	220	210	200	190	180	150	130	90	90	90	90	90
		$F_{Rd}$ (c ≥ $c_{lim}$ )	334	345	355	366	375	385	408	430	470	489	489	489	489
356x127x39	527	$F_{Rd}$ (c = 0)	105	119	135	152	167	180	213	246	313	379	415	415	415
		$c_{lim}$ (mm)	230	220	210	200	190	180	150	130	90	90	90	90	90
		$F_{Rd}$ (c ≥ $c_{lim}$ )	298	307	316	325	334	342	363	382	415	415	415	415	415
356x127x33	472	$F_{Rd}$ (c = 0)	84.4	96.6	110	123	134	145	173	200	255	298	316	316	316
		$c_{lim}$ (mm)	230	220	210	200	190	180	150	130	80	80	80	80	80
		$F_{Rd}$ (c ≥ $c_{lim}$ )	234	242	250	258	265	272	290	306	316	316	316	316	316
305x165x54	545	$F_{Rd}$ (c = 0)	166	190	216	243	271	297	352	408	518	617	671	720	767
		$c_{lim}$ (mm)	190	180	170	160	150	140	120	110	110	110	110	110	110
		$F_{Rd}$ (c ≥ $c_{lim}$ )	495	508	522	535	548	560	590	619	673	722	769	803	803
305x165x46	461	$F_{Rd}$ (c = 0)	117	135	153	173	194	210	250	290	370	441	480	503	503
		$c_{lim}$ (mm)	190	180	170	160	150	140	120	100	100	100	100	100	100
		$F_{Rd}$ (c ≥ $c_{lim}$ )	345	355	365	374	384	393	415	436	476	503	503	503	503
305x165x40	411	$F_{Rd}$ (c = 0)	92.0	106	121	137	153	166	198	230	294	351	367	367	367
		$c_{lim}$ (mm)	190	180	170	160	150	140	120	90	90	90	90	90	90
		$F_{Rd}$ (c ≥ $c_{lim}$ )	266	275	283	291	299	307	325	342	367	367	367	367	367

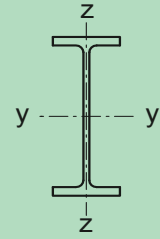
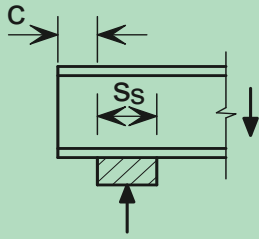
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+ These sections are in addition to the range of BS 4 sections

If  $c < c_{lim}$ , then use  $F_{Rd}$  value for  $c = 0$ .

FOR EXPLANATION OF TABLES SEE NOTE 9.

UNIVERSAL BEAMS  
Advance® UKB



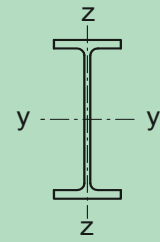
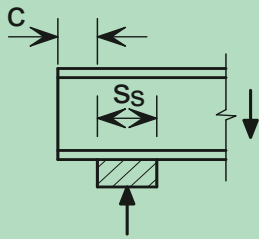
Unstiffened webs

Section Designation	Design Shear Resistance $V_{c,Rd}$ kN	Position of Stiff Bearing	Design resistance of unstiffened web, $F_{Rd}$ (kN) and limiting length, $c_{lim}$ (mm)													
			Stiff bearing length, $s_s$ (mm)													
			0	10	20	30	40	50	75	100	150	200	250	300	350	
305x127x48	612	$F_{Rd}$ (c = 0)	118	154	198	248	295	327	443	515	659	788	858	924	985	
		$c_{lim}$ (mm)	190	180	170	160	150	140	120	100	100	100	100	100	100	100
		$F_{Rd}$ (c ≥ $c_{lim}$ )	423	455	487	519	551	583	740	778	850	916	978	1040	1090	
305x127x42	542	$F_{Rd}$ (c = 0)	95.8	128	212	240	266	289	346	403	517	618	674	726	775	
		$c_{lim}$ (mm)	190	180	170	160	150	140	120	90	90	90	90	90	90	90
		$F_{Rd}$ (c ≥ $c_{lim}$ )	340	368	396	425	524	538	571	602	660	713	762	808	822	
305x127x37	481	$F_{Rd}$ (c = 0)	124	144	165	188	207	225	270	315	405	485	529	570	583	
		$c_{lim}$ (mm)	190	180	170	160	150	140	120	90	90	90	90	90	90	90
		$F_{Rd}$ (c ≥ $c_{lim}$ )	279	370	382	393	405	416	442	467	513	555	583	583	583	
305x102x33	452	$F_{Rd}$ (c = 0)	106	122	140	160	175	190	228	266	341	412	450	462	462	
		$c_{lim}$ (mm)	200	190	180	170	160	150	120	100	90	90	90	90	90	90
		$F_{Rd}$ (c ≥ $c_{lim}$ )	303	314	324	334	344	353	376	397	436	462	462	462	462	
305x102x28	407	$F_{Rd}$ (c = 0)	85.1	99.0	114	129	141	154	185	217	279	338	351	351	351	
		$c_{lim}$ (mm)	200	190	180	170	160	150	120	100	80	80	80	80	80	80
		$F_{Rd}$ (c ≥ $c_{lim}$ )	239	248	257	265	274	282	301	319	351	351	351	351	351	
305x102x25	386	$F_{Rd}$ (c = 0)	77.5	90.7	105	117	129	141	170	200	258	313	316	316	316	
		$c_{lim}$ (mm)	200	190	180	170	160	150	120	100	70	70	70	70	70	70
		$F_{Rd}$ (c ≥ $c_{lim}$ )	212	221	230	238	246	254	273	290	316	316	316	316	316	
254x146x43	415	$F_{Rd}$ (c = 0)	104	132	192	219	248	271	327	382	493	555	604	650	693	
		$c_{lim}$ (mm)	160	150	140	130	120	110	100	100	100	100	100	100	100	100
		$F_{Rd}$ (c ≥ $c_{lim}$ )	359	384	453	466	478	490	519	546	596	643	686	727	728	
254x146x37	361	$F_{Rd}$ (c = 0)	106	124	144	166	187	204	246	289	374	421	460	495	496	
		$c_{lim}$ (mm)	160	150	140	130	120	110	90	90	90	90	90	90	90	90
		$F_{Rd}$ (c ≥ $c_{lim}$ )	314	325	335	345	355	364	387	408	448	484	496	496	496	
254x146x31	336	$F_{Rd}$ (c = 0)	91.1	108	127	147	162	178	217	255	332	376	411	427	427	
		$c_{lim}$ (mm)	160	150	140	130	120	110	90	80	80	80	80	80	80	80
		$F_{Rd}$ (c ≥ $c_{lim}$ )	264	274	284	294	303	312	334	354	391	425	427	427	427	

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If  $c < c_{lim}$ , then use  $F_{Rd}$  value for  $c = 0$ .

FOR EXPLANATION OF TABLES SEE NOTE 9.

UNIVERSAL BEAMS  
Advance® UKB



Unstiffened webs

Section Designation	Design Shear Resistance $V_{c,Rd}$ kN	Position of Stiff Bearing	Design resistance of unstiffened web, $F_{Rd}$ (kN) and limiting length, $c_{lim}$ (mm)													
			Stiff bearing length, $s_s$ (mm)													
			0	10	20	30	40	50	75	100	150	200	250	300	350	
254x102x28	365	$F_{Rd}$ ( $c = 0$ )	98.7	117	137	158	175	191	233	275	358	408	447	477	477	
		$c_{lim}$ (mm)	170	160	150	140	130	120	90	80	80	80	80	80	80	80
		$F_{Rd}$ ( $c \geq c_{lim}$ )	225	299	310	320	330	340	364	386	426	463	477	477	477	477
254x102x25	341	$F_{Rd}$ ( $c = 0$ )	87.0	104	123	140	155	170	208	246	321	367	402	413	413	
		$c_{lim}$ (mm)	170	160	150	140	130	120	90	70	70	70	70	70	70	70
		$F_{Rd}$ ( $c \geq c_{lim}$ )	183	259	269	279	289	298	320	341	378	413	413	413	413	413
254x102x22	320	$F_{Rd}$ ( $c = 0$ )	76.4	91.8	109	123	137	150	185	219	287	329	354	354	354	
		$c_{lim}$ (mm)	170	160	150	140	130	120	90	70	60	60	60	60	60	60
		$F_{Rd}$ ( $c \geq c_{lim}$ )	144	223	233	242	251	260	280	299	334	354	354	354	354	354
203x133x30	299	$F_{Rd}$ ( $c = 0$ )	70.5	96.8	129	166	191	213	270	343	426	476	521	562	601	
		$c_{lim}$ (mm)	130	120	110	100	90	80	70	80	80	80	80	80	80	80
		$F_{Rd}$ ( $c \geq c_{lim}$ )	243	266	289	311	334	357	413	447	495	538	578	616	628	628
203x133x25	263	$F_{Rd}$ ( $c = 0$ )	54.0	77.9	125	146	163	181	224	268	333	373	409	443	447	
		$c_{lim}$ (mm)	130	120	110	100	90	80	70	70	70	70	70	70	70	70
		$F_{Rd}$ ( $c \geq c_{lim}$ )	184	204	225	245	289	299	322	343	382	418	447	447	447	447
203x102x23	254	$F_{Rd}$ ( $c = 0$ )	54.7	94.7	114	134	150	166	205	245	303	339	372	390	390	
		$c_{lim}$ (mm)	130	120	110	100	90	80	70	70	70	70	70	70	70	70
		$F_{Rd}$ ( $c \geq c_{lim}$ )	190	210	250	259	268	276	297	316	350	382	390	390	390	390
178x102x19	203	$F_{Rd}$ ( $c = 0$ )	43.7	77.3	94.9	112	126	140	176	212	252	283	311	312	312	
		$c_{lim}$ (mm)	110	100	90	80	70	60	60	60	60	60	60	60	60	60
		$F_{Rd}$ ( $c \geq c_{lim}$ )	151	168	200	208	216	224	241	258	288	312	312	312	312	312
152x89x16	167	$F_{Rd}$ ( $c = 0$ )	38.6	57.8	90.6	107	122	137	174	205	239	268	295	301	301	
		$c_{lim}$ (mm)	100	90	80	70	60	60	60	60	60	60	60	60	60	60
		$F_{Rd}$ ( $c \geq c_{lim}$ )	134	150	166	193	201	208	226	242	271	298	301	301	301	301
127x76x13	131	$F_{Rd}$ ( $c = 0$ )	33.3	50.4	72.1	89.6	104	118	154	177	207	234	257	259	259	
		$c_{lim}$ (mm)	80	70	60	50	50	50	50	60	60	60	60	60	60	60
		$F_{Rd}$ ( $c \geq c_{lim}$ )	116	130	144	163	170	176	192	208	234	258	259	259	259	259

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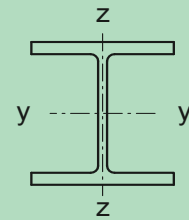
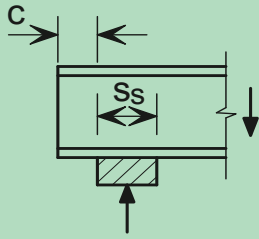
If  $c < c_{lim}$ , then use  $F_{Rd}$  value for  $c = 0$ .

FOR EXPLANATION OF TABLES SEE NOTE 9.



UNIVERSAL COLUMNS

Advance® UKC



Unstiffened webs

Section Designation	Design Shear Resistance $V_{c,Rd}$ kN	Position of Stiff Bearing	Design resistance of unstiffened web, $F_{Rd}$ (kN) and limiting length, $c_{lim}$ (mm)													
			Stiff bearing length, $s_s$ (mm)													
			0	10	20	30	40	50	75	100	150	200	250	300	350	
356x406x634	4040	$F_{Rd}$ (c = 0)	2510	2670	2840	3020	3210	3400	3930	4500	5740	6650	7420	8200	8970	
		$c_{lim}$ (mm)	390	390	390	390	390	390	390	390	390	390	390	390	390	390
		$F_{Rd}$ (c ≥ $c_{lim}$ )	9490	9650	9800	9960	10100	10300	10700	11000	11800	12600	13400	14100	14900	14900
356x406x551	3490	$F_{Rd}$ (c = 0)	2060	2200	2350	2510	2680	2850	3330	3840	4960	5650	6330	7020	7700	
		$c_{lim}$ (mm)	350	350	350	350	350	350	350	350	350	350	350	350	350	350
		$F_{Rd}$ (c ≥ $c_{lim}$ )	7670	7810	7950	8080	8220	8360	8700	9040	9720	10400	11100	11800	12500	12500
356x406x467	3000	$F_{Rd}$ (c = 0)	1670	1790	1930	2070	2220	2370	2800	3250	4160	4760	5360	5960	6560	
		$c_{lim}$ (mm)	320	320	320	320	320	320	320	320	320	320	320	320	320	320
		$F_{Rd}$ (c ≥ $c_{lim}$ )	6110	6230	6350	6470	6590	6710	7010	7310	7910	8510	9110	9710	10300	10300
356x406x393	2520	$F_{Rd}$ (c = 0)	1300	1410	1520	1640	1770	1910	2280	2680	3380	3890	4400	4920	5430	
		$c_{lim}$ (mm)	280	280	280	280	280	280	280	280	280	280	280	280	280	280
		$F_{Rd}$ (c ≥ $c_{lim}$ )	4690	4790	4890	5000	5100	5200	5460	5710	6230	6740	7250	7760	8280	8280
356x406x340	2160	$F_{Rd}$ (c = 0)	1050	1150	1250	1350	1470	1590	1920	2270	2830	3270	3720	4160	4610	
		$c_{lim}$ (mm)	260	260	260	260	260	260	260	260	260	260	260	260	260	260
		$F_{Rd}$ (c ≥ $c_{lim}$ )	3740	3830	3920	4010	4100	4190	4410	4630	5080	5520	5970	6410	6860	6860
356x406x287	1870	$F_{Rd}$ (c = 0)	846	927	1020	1110	1210	1320	1610	1930	2370	2760	3150	3540	3930	
		$c_{lim}$ (mm)	230	230	230	230	230	230	230	230	230	230	230	230	230	230
		$F_{Rd}$ (c ≥ $c_{lim}$ )	2960	3040	3120	3200	3270	3350	3550	3740	4130	4520	4910	5300	5690	5690
356x406x235	1500	$F_{Rd}$ (c = 0)	628	695	768	847	931	1020	1260	1520	1840	2160	2480	2790	3110	
		$c_{lim}$ (mm)	220	210	210	210	210	210	210	210	210	210	210	210	210	210
		$F_{Rd}$ (c ≥ $c_{lim}$ )	2160	2220	2290	2350	2410	2480	2640	2790	3110	3430	3750	4060	4380	4380
356x368x202	1340	$F_{Rd}$ (c = 0)	518	578	644	716	793	876	1100	1300	1590	1870	2160	2440	2730	
		$c_{lim}$ (mm)	220	210	200	190	190	190	190	190	190	190	190	190	190	190
		$F_{Rd}$ (c ≥ $c_{lim}$ )	1770	1830	1890	1940	2000	2060	2200	2340	2630	2910	3200	3480	3770	3770
356x368x177	1180	$F_{Rd}$ (c = 0)	425	478	536	600	668	741	938	1100	1350	1600	1840	2090	2340	
		$c_{lim}$ (mm)	220	210	200	190	180	170	170	170	170	170	170	170	170	170
		$F_{Rd}$ (c ≥ $c_{lim}$ )	1440	1490	1540	1590	1640	1690	1810	1940	2190	2430	2680	2800	2920	2920
356x368x153	1010	$F_{Rd}$ (c = 0)	341	386	436	491	551	614	785	906	1120	1330	1540	1720	1820	
		$c_{lim}$ (mm)	220	210	200	190	180	170	160	160	160	160	160	160	170	170
		$F_{Rd}$ (c ≥ $c_{lim}$ )	1140	1180	1230	1270	1310	1350	1460	1560	1730	1830	1920	2020	2110	2110
356x368x129	839	$F_{Rd}$ (c = 0)	264	303	346	430	470	512	618	701	868	1040	1140	1220	1290	
		$c_{lim}$ (mm)	220	210	200	190	180	170	150	150	150	150	150	150	150	150
		$F_{Rd}$ (c ≥ $c_{lim}$ )	873	909	1000	1020	1040	1060	1100	1140	1210	1280	1350	1420	1480	1480

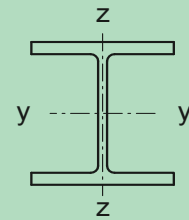
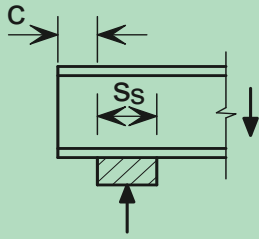
Advance® and UKC are trademarks of Tata Steel. A fuller description of the relationship between Universal Columns (UC) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

If  $c < c_{lim}$ , then use  $F_{Rd}$  value for  $c = 0$ .

FOR EXPLANATION OF TABLES SEE NOTE 9.

UNIVERSAL COLUMNS

Advance® UKC



Unstiffened webs

Section Designation	Design Shear Resistance $V_{c,Rd}$ kN	Position of Stiff Bearing	Design resistance of unstiffened web, $F_{Rd}$ (kN) and limiting length, $c_{lim}$ (mm)													
			Stiff bearing length, $s_s$ (mm)													
			0	10	20	30	40	50	75	100	150	200	250	300	350	
305x305x283	1950	$F_{Rd}$ (c = 0)	971	1070	1170	1280	1390	1520	1860	2220	2720	3170	3620	4070	4520	
		$c_{lim}$ (mm)	250	250	250	250	250	250	250	250	250	250	250	250	250	250
		$F_{Rd}$ (c ≥ $c_{lim}$ )	3540	3630	3720	3810	3900	3990	4210	4440	4880	5330	5780	6230	6680	6680
305x305x240	1710	$F_{Rd}$ (c = 0)	787	870	962	1060	1170	1280	1580	1910	2300	2700	3100	3490	3890	
		$c_{lim}$ (mm)	220	220	220	220	220	220	220	220	220	220	220	220	220	220
		$F_{Rd}$ (c ≥ $c_{lim}$ )	2820	2900	2980	3060	3140	3220	3420	3620	4020	4410	4810	5210	5600	5600
305x305x198	1400	$F_{Rd}$ (c = 0)	594	663	740	823	913	1010	1270	1500	1830	2160	2490	2820	3150	
		$c_{lim}$ (mm)	200	200	200	200	200	200	200	200	200	200	200	200	200	200
		$F_{Rd}$ (c ≥ $c_{lim}$ )	2090	2160	2230	2290	2360	2420	2590	2750	3080	3410	3740	4070	4400	4400
305x305x158	1130	$F_{Rd}$ (c = 0)	428	486	550	621	698	780	1000	1150	1420	1700	1970	2240	2510	
		$c_{lim}$ (mm)	190	180	170	170	170	170	170	170	170	170	170	170	170	170
		$F_{Rd}$ (c ≥ $c_{lim}$ )	1480	1540	1590	1650	1700	1760	1890	2030	2300	2570	2850	3120	3390	3390
305x305x137	984	$F_{Rd}$ (c = 0)	346	397	454	517	585	658	846	965	1200	1440	1680	1920	2160	
		$c_{lim}$ (mm)	190	180	170	160	150	150	150	150	150	150	150	150	150	150
		$F_{Rd}$ (c ≥ $c_{lim}$ )	1190	1230	1280	1330	1380	1420	1540	1660	1900	2140	2380	2610	2790	2790
305x305x118	856	$F_{Rd}$ (c = 0)	277	322	372	428	488	553	702	806	1010	1220	1430	1630	1820	
		$c_{lim}$ (mm)	190	180	170	160	150	140	140	140	140	140	140	140	140	140
		$F_{Rd}$ (c ≥ $c_{lim}$ )	939	980	1020	1060	1100	1150	1250	1350	1560	1780	1880	1980	2080	2080
305x305x97	721	$F_{Rd}$ (c = 0)	213	251	294	343	395	451	564	652	828	1010	1100	1170	1250	
		$c_{lim}$ (mm)	190	180	170	160	150	140	120	120	120	130	130	130	130	130
		$F_{Rd}$ (c ≥ $c_{lim}$ )	709	745	780	815	850	885	998	1040	1120	1210	1280	1350	1410	1410
254x254x167	1180	$F_{Rd}$ (c = 0)	552	622	700	785	877	975	1240	1440	1770	2110	2440	2770	3100	
		$c_{lim}$ (mm)	190	190	190	190	190	190	190	190	190	190	190	190	190	190
		$F_{Rd}$ (c ≥ $c_{lim}$ )	1980	2050	2110	2180	2250	2310	2480	2640	2970	3310	3640	3970	4300	4300
254x254x132	918	$F_{Rd}$ (c = 0)	390	447	510	580	655	735	948	1080	1340	1610	1870	2140	2400	
		$c_{lim}$ (mm)	160	160	160	160	160	160	160	160	160	160	160	160	160	160
		$F_{Rd}$ (c ≥ $c_{lim}$ )	1370	1420	1480	1530	1580	1640	1770	1900	2160	2430	2690	2950	3220	3220
254x254x107	751	$F_{Rd}$ (c = 0)	288	335	389	449	514	584	738	849	1070	1290	1510	1730	1950	
		$c_{lim}$ (mm)	160	150	140	140	140	140	140	140	140	140	140	140	140	140
		$F_{Rd}$ (c ≥ $c_{lim}$ )	995	1040	1080	1130	1170	1220	1330	1440	1660	1880	2100	2320	2540	2540
254x254x89	607	$F_{Rd}$ (c = 0)	217	255	299	348	401	458	573	662	840	1020	1200	1380	1470	
		$c_{lim}$ (mm)	160	150	140	130	130	130	130	130	130	130	130	130	130	130
		$F_{Rd}$ (c ≥ $c_{lim}$ )	736	772	807	843	878	914	1000	1090	1270	1420	1500	1590	1670	1670
254x254x73	525	$F_{Rd}$ (c = 0)	167	200	239	282	329	379	465	541	694	832	902	967	1030	
		$c_{lim}$ (mm)	160	150	140	130	120	110	110	110	110	120	120	120	120	120
		$F_{Rd}$ (c ≥ $c_{lim}$ )	558	589	620	650	681	711	803	840	910	982	1040	1100	1150	1150

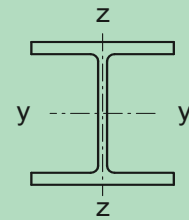
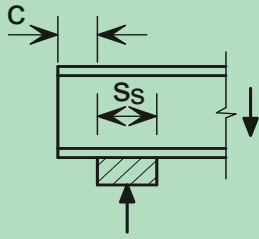
Advance® and UKC are trademarks of Tata Steel. A fuller description of the relationship between Universal Columns (UC) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

If  $c < c_{lim}$ , then use  $F_{Rd}$  value for  $c = 0$ .

FOR EXPLANATION OF TABLES SEE NOTE 9.

UNIVERSAL COLUMNS

Advance® UKC



Unstiffened webs

Section Designation	Design Shear Resistance $V_{c,Rd}$ kN	Position of Stiff Bearing	Design resistance of unstiffened web, $F_{Rd}$ (kN) and limiting length, $c_{lim}$ (mm)													
			Stiff bearing length, $s_s$ (mm)													
			0	10	20	30	40	50	75	100	150	200	250	300	350	
203x203x127 +	893	$F_{Rd}$ (c = 0)	457	524	599	681	770	866	1110	1270	1580	1900	2210	2520	2830	
		$c_{lim}$ (mm)	170	170	170	170	170	170	170	170	170	170	170	170	170	170
		$F_{Rd}$ (c ≥ $c_{lim}$ )	1670	1730	1790	1860	1920	1980	2140	2290	2610	2920	3230	3540	3850	
203x203x113 +	812	$F_{Rd}$ (c = 0)	386	446	514	590	672	759	967	1110	1390	1670	1950	2230	2510	
		$c_{lim}$ (mm)	160	160	160	160	160	160	160	160	160	160	160	160	160	160
		$F_{Rd}$ (c ≥ $c_{lim}$ )	1390	1450	1510	1560	1620	1680	1820	1960	2240	2520	2800	3080	3360	
203x203x100 +	709	$F_{Rd}$ (c = 0)	319	373	435	503	577	656	827	952	1200	1450	1700	1950	2200	
		$c_{lim}$ (mm)	140	140	140	140	140	140	140	140	140	140	140	140	140	140
		$F_{Rd}$ (c ≥ $c_{lim}$ )	1140	1190	1240	1290	1340	1390	1520	1640	1890	2140	2390	2640	2890	
203x203x86	619	$F_{Rd}$ (c = 0)	258	305	360	421	487	557	693	803	1020	1240	1460	1680	1900	
		$c_{lim}$ (mm)	130	130	130	130	130	130	130	130	130	130	130	130	130	130
		$F_{Rd}$ (c ≥ $c_{lim}$ )	909	952	996	1040	1080	1130	1240	1350	1570	1790	2000	2220	2440	
203x203x71	483	$F_{Rd}$ (c = 0)	192	229	273	321	374	430	530	616	789	961	1130	1310	1480	
		$c_{lim}$ (mm)	130	120	120	120	120	120	120	120	120	120	120	120	120	120
		$F_{Rd}$ (c ≥ $c_{lim}$ )	662	696	731	765	800	834	920	1010	1180	1350	1520	1640	1720	
203x203x60	455	$F_{Rd}$ (c = 0)	157	194	237	286	339	389	472	555	722	889	1060	1220	1350	
		$c_{lim}$ (mm)	130	120	110	100	100	100	100	100	100	100	100	100	100	100
		$F_{Rd}$ (c ≥ $c_{lim}$ )	538	572	605	638	672	705	788	872	1040	1210	1340	1420	1500	
203x203x52	385	$F_{Rd}$ (c = 0)	126	157	194	236	281	318	389	459	599	739	830	893	952	
		$c_{lim}$ (mm)	130	120	110	100	90	90	90	90	90	90	90	100	100	100
		$F_{Rd}$ (c ≥ $c_{lim}$ )	427	455	483	511	539	567	637	707	815	879	944	1000	1050	
203x203x46	347	$F_{Rd}$ (c = 0)	106	134	169	207	249	277	341	405	533	628	684	737	786	
		$c_{lim}$ (mm)	130	120	110	100	90	90	90	90	90	90	90	90	90	90
		$F_{Rd}$ (c ≥ $c_{lim}$ )	355	381	406	432	457	483	547	604	663	723	772	819	864	
152x152x51 +	408	$F_{Rd}$ (c = 0)	164	208	260	319	383	427	525	622	818	1010	1210	1400	1600	
		$c_{lim}$ (mm)	100	100	100	100	100	100	100	100	100	100	100	100	100	100
		$F_{Rd}$ (c ≥ $c_{lim}$ )	586	625	665	704	743	782	879	977	1170	1370	1560	1760	1950	
152x152x44 +	350	$F_{Rd}$ (c = 0)	131	169	215	267	321	354	439	523	692	860	1030	1200	1370	
		$c_{lim}$ (mm)	100	90	90	90	90	90	90	90	90	90	90	90	90	90
		$F_{Rd}$ (c ≥ $c_{lim}$ )	463	497	531	565	598	632	716	801	969	1140	1310	1480	1640	
152x152x37	292	$F_{Rd}$ (c = 0)	101	134	173	218	257	285	356	427	569	711	853	995	1100	
		$c_{lim}$ (mm)	100	90	80	80	80	80	80	80	80	80	80	80	80	80
		$F_{Rd}$ (c ≥ $c_{lim}$ )	352	381	409	437	466	494	565	636	778	920	1060	1130	1200	
152x152x30	238	$F_{Rd}$ (c = 0)	74.4	101	134	171	198	221	278	336	451	568	623	673	719	
		$c_{lim}$ (mm)	100	90	80	70	70	70	70	70	70	70	70	70	70	70
		$F_{Rd}$ (c ≥ $c_{lim}$ )	254	277	300	323	346	369	427	485	585	642	690	736	778	
152x152x23	204	$F_{Rd}$ (c = 0)	50.7	75.3	107	133	154	175	226	278	381	444	488	528	566	
		$c_{lim}$ (mm)	100	90	80	70	60	50	50	50	50	60	60	60	60	60
		$F_{Rd}$ (c ≥ $c_{lim}$ )	171	192	213	233	254	274	326	377	442	491	531	568	603	

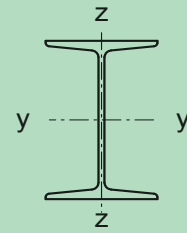
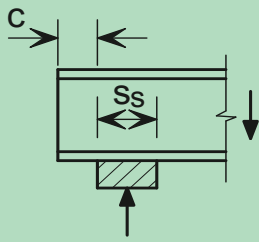
Advance® and UKC are trademarks of Tata Steel. A fuller description of the relationship between Universal Columns (UC) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

+ These sections are in addition to the range of BS 4 sections

If  $c < c_{lim}$ , then use  $F_{Rd}$  value for  $c = 0$ .

FOR EXPLANATION OF TABLES SEE NOTE 9.

JOISTS



Unstiffened webs

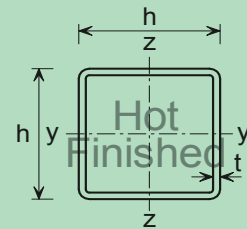
Section Designation	Design Shear Resistance $V_{c,Rd}$ kN	Position of Stiff Bearing	Design resistance of unstiffened web, $F_{Rd}$ (kN) and limiting length, $c_{lim}$ (mm)													
			Stiff bearing length, $s_s$ (mm)													
			0	10	20	30	40	50	75	100	150	200	250	300	350	
254x203x82	676	$F_{Rd}$ (c = 0)	221	259	302	351	403	458	576	664	840	1020	1190	1370	1480	
		$c_{lim}$ (mm)	150	140	130	130	130	130	130	130	130	130	130	130	130	140
		$F_{Rd}$ (c $\geq$ $c_{lim}$ )	765	800	836	871	906	941	1030	1120	1290	1450	1530	1610	1690	
254x114x37	455	$F_{Rd}$ (c = 0)	94.7	125	163	206	242	269	361	425	552	617	674	727	776	
		$c_{lim}$ (mm)	160	150	140	130	120	110	90	90	90	90	90	90	90	
		$F_{Rd}$ (c $\geq$ $c_{lim}$ )	337	364	391	418	445	472	567	599	657	711	761	808	852	
203x152x52	456	$F_{Rd}$ (c = 0)	148	182	222	267	315	363	440	517	670	824	977	1130	1230	
		$c_{lim}$ (mm)	120	110	110	110	110	110	110	110	110	110	110	110	110	
		$F_{Rd}$ (c $\geq$ $c_{lim}$ )	521	551	582	613	643	674	751	828	981	1140	1240	1310	1380	
152x127x37	388	$F_{Rd}$ (c = 0)	120	163	215	274	318	355	447	540	724	909	1090	1280	1460	
		$c_{lim}$ (mm)	90	80	80	80	80	80	80	80	80	80	80	80	80	
		$F_{Rd}$ (c $\geq$ $c_{lim}$ )	438	475	512	549	586	623	715	807	992	1180	1360	1550	1730	
127x114x29	298	$F_{Rd}$ (c = 0)	98.6	141	195	248	284	320	411	501	683	864	1050	1230	1410	
		$c_{lim}$ (mm)	70	70	70	70	70	70	70	70	70	70	70	70	70	
		$F_{Rd}$ (c $\geq$ $c_{lim}$ )	362	398	434	471	507	543	634	724	905	1090	1270	1450	1630	
127x114x27	230	$F_{Rd}$ (c = 0)	83.2	114	151	193	223	249	315	380	512	643	774	906	1040	
		$c_{lim}$ (mm)	70	70	70	70	70	70	70	70	70	70	70	70	70	
		$F_{Rd}$ (c $\geq$ $c_{lim}$ )	295	322	348	374	400	427	492	558	689	821	952	1080	1160	
127x76x16	181	$F_{Rd}$ (c = 0)	49.8	73.5	103	130	150	170	219	269	369	468	515	558	597	
		$c_{lim}$ (mm)	80	70	60	60	60	60	60	60	60	60	60	60	60	
		$F_{Rd}$ (c $\geq$ $c_{lim}$ )	179	199	219	239	258	278	328	378	473	522	564	603	640	
114x114x27	289	$F_{Rd}$ (c = 0)	88.5	128	179	226	260	294	378	462	631	800	968	1140	1310	
		$c_{lim}$ (mm)	70	60	60	60	60	60	60	60	60	60	60	60	60	
		$F_{Rd}$ (c $\geq$ $c_{lim}$ )	323	356	390	424	457	491	575	660	828	997	1170	1330	1500	
102x102x23	238	$F_{Rd}$ (c = 0)	80.3	121	172	215	248	282	367	451	619	788	957	1130	1290	
		$c_{lim}$ (mm)	60	60	60	60	60	60	60	60	60	60	60	60	60	
		$F_{Rd}$ (c $\geq$ $c_{lim}$ )	297	330	364	398	432	465	550	634	803	971	1140	1310	1480	
102x44x7	106	$F_{Rd}$ (c = 0)	21.2	41.4	60.5	75.8	91.0	106	144	183	258	293	324	353	379	
		$c_{lim}$ (mm)	60	50	40	40	40	40	40	40	40	40	40	40	40	
		$F_{Rd}$ (c $\geq$ $c_{lim}$ )	78.5	93.8	109	124	140	155	193	231	284	316	345	372	388	
89x89x19	214	$F_{Rd}$ (c = 0)	72.2	113	166	203	237	271	355	439	608	777	945	1110	1280	
		$c_{lim}$ (mm)	60	60	60	60	60	60	60	60	60	60	60	60	60	
		$F_{Rd}$ (c $\geq$ $c_{lim}$ )	271	305	338	372	406	440	524	608	777	946	1110	1280	1450	
76x76x15	164	$F_{Rd}$ (c = 0)	56.3	96.1	143	174	206	238	317	396	553	711	869	1030	1190	
		$c_{lim}$ (mm)	50	50	50	50	50	50	50	50	50	50	50	50	50	
		$F_{Rd}$ (c $\geq$ $c_{lim}$ )	212	244	275	307	339	370	449	528	686	844	1000	1160	1320	
76x76x13	111	$F_{Rd}$ (c = 0)	41.6	63.4	91.3	113	131	149	195	240	330	421	511	602	663	
		$c_{lim}$ (mm)	50	50	50	50	50	50	50	50	50	50	50	50	60	
		$F_{Rd}$ (c $\geq$ $c_{lim}$ )	148	166	184	202	220	239	284	329	420	510	601	662	705	

If  $c < c_{lim}$ , then use  $F_{Rd}$  value for  $c = 0$ .

FOR EXPLANATION OF TABLES SEE NOTE 9.

HOT-FINISHED  
SQUARE HOLLOW SECTIONS

Celsius® SHS



Unstiffened webs

Designation		Mass per Metre	Bearing				Buckling				Shear Resistance $V_{c,Rd}$ kN
Size h x b mm	Wall Thickness t mm		End Bearing		Continuous Over Bearing		End Bearing or Continuous Over Bearing				
			Beam Factor C1 kN	Stiff Bearing Factor C2 kN/mm	Beam Factor C1 kN	Stiff Bearing Factor C2 kN/mm	Without Welded Flange Plate		With Welded Flange Plate		
							Beam Factor C1 kN	Stiff Bearing Factor C2 kN/mm	Beam Factor C1 kN	Stiff Bearing Factor C2 kN/mm	
40 x 40	3 #	3.4	12.8	2.13	32.0	2.13	29.3	0.732	77.1	1.93	44.5
	3.2	3.6	14.5	2.27	36.4	2.27	31.9	0.797	83.6	2.09	47.1
	3.6 #	4.0	18.4	2.56	46.0	2.56	37.2	0.931	96.5	2.41	52.3
	4.0	4.4	22.7	2.84	56.8	2.84	42.7	1.07	109	2.74	57.3
	5.0	5.3	35.5	3.55	88.8	3.55	56.9	1.42	142	3.54	69.0
50 x 50	3 #	4.4	12.8	2.13	32.0	2.13	33.8	0.676	89.9	1.80	56.8
	3.2	4.6	14.5	2.27	36.4	2.27	36.9	0.739	98.1	1.96	60.3
	3.6 #	5.1	18.4	2.56	46.0	2.56	43.3	0.866	114	2.29	67.0
	4.0	5.6	22.7	2.84	56.8	2.84	49.8	0.997	131	2.61	73.7
	5.0	6.9	35.5	3.55	88.8	3.55	66.7	1.33	171	3.42	89.5
	6.3	8.3	56.4	4.47	141	4.47	89.8	1.80	223	4.47	109
	7.1 #	9.1	71.6	5.04	179	5.04	105	2.10	256	5.11	119
8 #	10.0	90.9	5.68	227	5.68	122	2.45	292	5.84	131	
60 x 60	3 #	5.3	12.8	2.13	32.0	2.13	37.5	0.626	99.5	1.66	69.1
	3.2	5.6	14.5	2.27	36.4	2.27	41.2	0.687	110	1.83	73.4
	3.6 #	6.3	18.4	2.56	46.0	2.56	48.6	0.811	129	2.16	81.8
	4.0	6.9	22.7	2.84	56.8	2.84	56.2	0.937	149	2.48	90.1
	5.0	8.4	35.5	3.55	88.8	3.55	75.7	1.26	198	3.30	110
	6.3	10.3	56.4	4.47	141	4.47	102	1.70	261	4.35	134
	7.1 #	11.4	71.6	5.04	179	5.04	119	1.99	299	4.99	149
	8.0	12.5	90.9	5.68	227	5.68	139	2.32	343	5.72	164
70 x 70	3 #	6.2	12.8	2.13	32.0	2.13	40.5	0.579	106	1.51	81.4
	3.2	6.6	14.5	2.27	36.4	2.27	44.7	0.639	118	1.68	86.5
	3.6 #	7.4	18.4	2.56	46.0	2.56	53.2	0.760	141	2.02	96.5
	4.0	8.2	22.7	2.84	56.8	2.84	61.9	0.884	165	2.35	107
	5.0	10.0	35.5	3.55	88.8	3.55	84.0	1.20	222	3.17	130
	6.3	12.3	56.4	4.47	141	4.47	114	1.63	296	4.22	160
	7.1 #	13.6	71.6	5.04	179	5.04	133	1.90	341	4.87	177
	8.0	15.0	90.9	5.68	227	5.68	155	2.22	392	5.59	197
	8.8 #	16.3	110	6.25	275	6.25	176	2.51	437	6.24	212
80 x 80	3 #	7.2	12.8	2.13	32.0	2.13	42.8	0.535	109	1.36	93.7
	3.2	7.6	14.5	2.27	36.4	2.27	47.5	0.594	122	1.53	99.6
	3.6 #	8.5	18.4	2.56	46.0	2.56	57.0	0.713	150	1.87	112
	4.0	9.4	22.7	2.84	56.8	2.84	66.7	0.834	177	2.21	123
	5.0	11.6	35.5	3.55	88.8	3.55	91.5	1.14	243	3.04	151
	6.3	14.2	56.4	4.47	141	4.47	125	1.56	328	4.10	185
	7.1 #	15.8	71.6	5.04	179	5.04	146	1.83	380	4.75	207
	8.0	17.5	90.9	5.68	227	5.68	171	2.13	438	5.47	230
	8.8 #	19.0	110	6.25	275	6.25	193	2.41	489	6.12	248
	10 #	21.1	142	7.10	355	7.10	228	2.85	567	7.09	276
	12.5 #	25.2	222	8.88	555	8.88	304	3.80	728	9.11	329

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Square Hollow Sections (HFSHS) and the Celsius® range of sections manufactured by Tata Steel is given in section 12.

For bearing or buckling the web capacity =  $C1 + b_1 C2$  where  $b_1$  is the stiff bearing length.

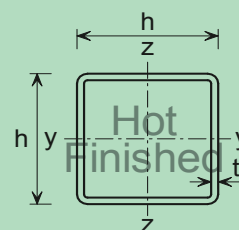
The beam component for end bearing assumes a sealing plate (thickness at least equal to the wall of the section) is welded to the end of the section by a continuous fillet weld.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 9.

HOT-FINISHED  
SQUARE HOLLOW SECTIONS

Celsius® SHS



Unstiffened webs

Designation		Mass per Metre	Bearing				Buckling				Shear Resistance  $V_{c,Rd}$ kN
Size  h x b mm	Wall Thickness  t mm		End Bearing		Continuous Over Bearing		End Bearing or Continuous Over Bearing				
			Beam Factor  C1 kN	Stiff Bearing Factor  C2 kN/mm	Beam Factor  C1 kN	Stiff Bearing Factor  C2 kN/mm	Without Welded Flange Plate		With Welded Flange Plate		
							Beam Factor C1 kN	Stiff Bearing Factor C2 kN/mm	Beam Factor C1 kN	Stiff Bearing Factor C2 kN/mm	
90 x 90	3.6 #	9.7	18.4	2.56	46.0	2.56	60.1	0.668	155	1.72	126
	4.0	10.7	22.7	2.84	56.8	2.84	70.8	0.787	186	2.06	139
	5.0	13.1	35.5	3.55	88.8	3.55	98.3	1.09	261	2.90	171
	6.3	16.2	56.4	4.47	141	4.47	135	1.50	357	3.97	212
	7.1 #	18.1	71.6	5.04	179	5.04	159	1.76	416	4.62	236
	8.0	20.1	90.9	5.68	227	5.68	185	2.06	481	5.35	262
	8.8 #	21.8	110	6.25	275	6.25	210	2.33	540	5.99	285
	10 #	24.3	142	7.10	355	7.10	248	2.75	627	6.96	317
12.5 #	29.1	222	8.88	555	8.88	330	3.67	808	8.98	380	
100 x 100	3.6	10.8	18.4	2.56	46.0	2.56	62.5	0.625	157	1.57	140
	4.0	11.9	22.7	2.84	56.8	2.84	74.2	0.742	191	1.91	156
	5.0	14.7	35.5	3.55	88.8	3.55	104	1.04	276	2.76	192
	6.3	18.2	56.4	4.47	141	4.47	145	1.45	384	3.84	238
	7.1 #	20.3	71.6	5.04	179	5.04	170	1.70	449	4.49	264
	8.0	22.6	90.9	5.68	227	5.68	199	1.99	522	5.22	295
	8.8 #	24.5	110	6.25	275	6.25	226	2.26	587	5.87	321
	10.0	27.4	142	7.10	355	7.10	267	2.67	684	6.84	358
12.5 #	33.0	222	8.88	555	8.88	356	3.56	886	8.86	431	
120 x 120	4 #	14.4	22.7	2.84	56.8	2.84	79.0	0.658	194	1.61	189
	5.0	17.8	35.5	3.55	88.8	3.55	114	0.950	296	2.47	233
	6.3	22.2	56.4	4.47	141	4.47	161	1.34	428	3.57	289
	7.1 #	24.7	71.6	5.04	179	5.04	191	1.59	508	4.23	323
	8.0	27.6	90.9	5.68	227	5.68	225	1.87	596	4.97	361
	8.8 #	30.1	110	6.25	275	6.25	256	2.13	674	5.62	392
	10.0	33.7	142	7.10	355	7.10	303	2.52	791	6.59	440
12.5	40.9	222	8.88	555	8.88	405	3.37	1030	8.61	534	
140 x 140	5.0	21.0	35.5	3.55	88.8	3.55	121	0.864	303	2.16	274
	6.3	26.1	56.4	4.47	141	4.47	175	1.25	459	3.28	341
	7.1 #	29.2	71.6	5.04	179	5.04	209	1.49	553	3.95	381
	8.0	32.6	90.9	5.68	227	5.68	247	1.77	658	4.70	426
	8.8 #	35.6	110	6.25	275	6.25	282	2.02	751	5.36	465
	10.0	40.0	142	7.10	355	7.10	336	2.40	888	6.34	522
12.5	48.7	222	8.88	555	8.88	451	3.22	1170	8.37	636	

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For bearing or buckling the web capacity =  $C1 + b_1 C2$  where  $b_1$  is the stiff bearing length.

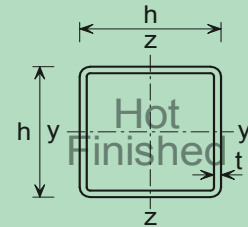
The beam component for end bearing assumes a sealing plate (thickness at least equal to the wall of the section) is welded to the end of the section by a continuous fillet weld.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 9.

HOT-FINISHED  
SQUARE HOLLOW SECTIONS

Celsius® SHS



Unstiffened webs

Designation		Mass per Metre	Bearing				Buckling				Shear Resistance  $V_{c,Rd}$ kN
Size  h x b mm	Wall Thickness  t mm		End Bearing		Continuous Over Bearing		End Bearing or Continuous Over Bearing				
			Beam Factor  C1 kN	Stiff Bearing Factor  C2 kN/mm	Beam Factor  C1 kN	Stiff Bearing Factor  C2 kN/mm	Without Welded Flange Plate		With Welded Flange Plate		
							Beam Factor C1 kN	Stiff Bearing Factor C2 kN/mm	Beam Factor C1 kN	Stiff Bearing Factor C2 kN/mm	
150 x 150	5.0	22.6	35.5	3.55	88.8	3.55	123	0.823	303	2.02	294
	6.3	28.1	56.4	4.47	141	4.47	180	1.20	469	3.13	367
	7.1 #	31.4	71.6	5.04	179	5.04	216	1.44	571	3.81	410
	8.0	35.1	90.9	5.68	227	5.68	258	1.72	684	4.56	459
	8.8 #	38.4	110	6.25	275	6.25	295	1.96	784	5.23	501
	10.0	43.1	142	7.10	355	7.10	351	2.34	932	6.21	563
	12.5	52.7	222	8.88	555	8.88	473	3.16	1240	8.24	688
	14.2 #	58.9	286	10.1	716	10.1	559	3.73	1440	9.61	769
16 # r	65.2	364	11.4	909	11.4	652	4.35	1660	11.1	851	
160 x 160	5 #	24.1	35.5	3.55	88.8	3.55	125	0.783	300	1.88	315
	6.3	30.1	56.4	4.47	141	4.47	185	1.16	476	2.97	392
	7.1 #	33.7	71.6	5.04	179	5.04	223	1.40	585	3.66	440
	8.0	37.6	90.9	5.68	227	5.68	267	1.67	707	4.42	492
	8.8 #	41.1	110	6.25	275	6.25	306	1.91	814	5.09	537
	10.0	46.3	142	7.10	355	7.10	366	2.29	973	6.08	604
	12.5	56.6	222	8.88	555	8.88	495	3.09	1300	8.12	739
	14.2 #	63.3	286	10.1	716	10.1	585	3.66	1520	9.49	827
16 #	70.2	364	11.4	909	11.4	683	4.27	1750	10.9	916	
180 x 180	5 #	27.3	35.5	3.55	88.8	3.55	128	0.709	291	1.62	356
	6.3	34.0	56.4	4.47	141	4.47	193	1.07	481	2.67	444
	7.1 #	38.1	71.6	5.04	179	5.04	235	1.31	604	3.36	498
	8.0	42.7	90.9	5.68	227	5.68	283	1.57	743	4.13	557
	8.8 #	46.7	110	6.25	275	6.25	327	1.82	865	4.80	609
	10.0	52.5	142	7.10	355	7.10	393	2.18	1050	5.81	686
	12.5	64.4	222	8.88	555	8.88	535	2.97	1420	7.86	841
	14.2 #	72.2	286	10.1	716	10.1	634	3.52	1660	9.24	943
16.0	80.2	364	11.4	909	11.4	742	4.12	1930	10.7	1050	
200 x 200	5.0	30.4	35.5	3.55	88.8	3.55	128	0.642	278	1.39	397
	6.3	38.0	56.4	4.47	141	4.47	199	0.993	477	2.39	496
	7.1 #	42.6	71.6	5.04	179	5.04	244	1.22	611	3.06	555
	8.0	47.7	90.9	5.68	227	5.68	297	1.48	765	3.83	623
	8.8 #	52.2	110	6.25	275	6.25	345	1.72	902	4.51	681
	10.0	58.8	142	7.10	355	7.10	417	2.09	1110	5.53	768
	12.5	72.3	222	8.88	555	8.88	572	2.86	1520	7.60	944
	14.2 #	81.1	286	10.1	716	10.1	680	3.40	1800	8.99	1060
16.0	90.3	364	11.4	909	11.4	797	3.99	2090	10.4	1180	

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For bearing or buckling the web capacity =  $C1 + b_1 C2$  where  $b_1$  is the stiff bearing length.

The beam component for end bearing assumes a sealing plate (thickness at least equal to the wall of the section) is welded to the end of the section by a continuous fillet weld.

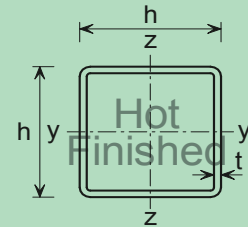
# Check availability

r External corner radius > 2t but ≤ 3t

FOR EXPLANATION OF TABLES SEE NOTE 9.

HOT-FINISHED  
SQUARE HOLLOW SECTIONS

Celsius® SHS



Unstiffened webs

Designation		Mass per Metre	Bearing				Buckling				Shear Resistance $V_{c,Rd}$ kN
Size h x b mm	Wall Thickness t mm		End Bearing		Continuous Over Bearing		End Bearing or Continuous Over Bearing				
			Beam Factor C1 kN	Stiff Bearing Factor C2 kN/mm	Beam Factor C1 kN	Stiff Bearing Factor C2 kN/mm	Without Welded Flange Plate		With Welded Flange Plate		
							Beam Factor C1 kN	Stiff Bearing Factor C2 kN/mm	Beam Factor C1 kN	Stiff Bearing Factor C2 kN/mm	
250 x 250	5 #	38.3	35.5	3.55	88.8	3.55	126	0.505	244	0.977	499
	6.3	47.9	56.4	4.47	141	4.47	204	0.816	444	1.77	625
	7.1 #	53.7	71.6	5.04	179	5.04	257	1.03	591	2.36	701
	8.0	60.3	90.9	5.68	227	5.68	319	1.28	771	3.08	787
	8.8 #	66.0	110	6.25	275	6.25	376	1.50	939	3.76	862
	10.0	74.5	142	7.10	355	7.10	464	1.86	1200	4.78	973
	12.5	91.9	222	8.88	555	8.88	652	2.61	1730	6.91	1200
	14.2 #	103	286	10.1	716	10.1	782	3.13	2080	8.32	1350
260 x 260	6.3 #	49.9	56.4	4.47	141	4.47	204	0.784	435	1.67	651
	7.1 #	56.0	71.6	5.04	179	5.04	258	0.992	583	2.24	731
	8 #	62.8	90.9	5.68	227	5.68	322	1.24	766	2.95	820
	8.8 #	68.8	110	6.25	275	6.25	381	1.46	938	3.61	898
	10 #	77.7	142	7.10	355	7.10	471	1.81	1200	4.63	1010
	12.5 #	95.8	222	8.88	555	8.88	665	2.56	1760	6.76	1250
	14.2 #	108	286	10.1	716	10.1	800	3.08	2130	8.19	1400
	16 #	120	364	11.4	909	11.4	946	3.64	2520	9.67	1570
300 x 300	6.3 #	57.8	56.4	4.47	141	4.47	202	0.673	401	1.34	754
	7.1 #	64.9	71.6	5.04	179	5.04	259	0.863	546	1.82	846
	8.0	72.8	90.9	5.68	227	5.68	328	1.09	733	2.44	951
	8.8 #	79.8	110	6.25	275	6.25	393	1.31	917	3.06	1050
	10.0	90.2	142	7.10	355	7.10	494	1.65	1210	4.03	1180
	12.5	112	222	8.88	555	8.88	713	2.38	1850	6.17	1460
	14.2 #	126	286	10.1	716	10.1	865	2.88	2280	7.61	1640
	16.0	141	364	11.4	909	11.4	1030	3.43	2740	9.13	1830
350 x 350	8.0	85.4	90.9	5.68	227	5.68	328	0.938	680	1.94	1120
	8.8 #	93.6	110	6.25	275	6.25	398	1.14	865	2.47	1220
	10.0	106	142	7.10	355	7.10	509	1.45	1180	3.36	1380
	12.5	131	222	8.88	555	8.88	756	2.16	1890	5.41	1710
	14.2 #	148	286	10.1	716	10.1	930	2.66	2400	6.87	1940
	16.0	166	364	11.4	909	11.4	1120	3.19	2940	8.40	2160
400 x 400	8 #	97.9	90.9	5.68	227	5.68	323	0.808	626	1.56	1280
	8.8 #	107	110	6.25	275	6.25	396	0.990	805	2.01	1400
	10.0	122	142	7.10	355	7.10	514	1.28	1110	2.78	1590
	12.5	151	222	8.88	555	8.88	783	1.96	1880	4.69	1970
	14.2 #	170	286	10.1	716	10.1	977	2.44	2440	6.11	2220
	16.0	191	364	11.4	909	11.4	1190	2.97	3060	7.65	2490
	20 ^	235	552	13.8	1380	13.8	1630	4.06	4320	10.8	2990

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For bearing or buckling the web capacity =  $C1 + b_1 C2$  where  $b_1$  is the stiff bearing length.

The beam component for end bearing assumes a sealing plate (thickness at least equal to the wall of the section) is welded to the end of the section by a continuous fillet weld.

# Check availability

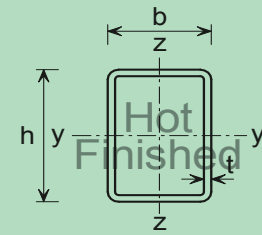
^ SAW process (single longitudinal seam weld, slightly proud)

FOR EXPLANATION OF TABLES SEE NOTE 9.



HOT-FINISHED  
RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Unstiffened webs

Designation		Mass per Metre kg/m	Bearing				Buckling				Shear Resistance $V_{c,Rd}$ kN
Size h x b mm	Wall Thickness t mm		End Bearing		Continuous Over Bearing		End Bearing or Continuous Over Bearing				
			Beam Factor C1 kN	Stiff Bearing Factor C2 kN/mm	Beam Factor C1 kN	Stiff Bearing Factor C2 kN/mm	Without Welded Flange Plate		With Welded Flange Plate		
							Beam Factor C1 kN	Stiff Bearing Factor C2 kN/mm	Beam Factor C1 kN	Stiff Bearing Factor C2 kN/mm	
50 x 30	3 #	3.4	12.8	2.13	32.0	2.13	44.1	0.883	89.9	1.80	55.6
	3.2	3.6	14.5	2.27	36.4	2.27	48.2	0.964	98.1	1.96	58.9
	3.6 #	4.0	18.4	2.56	46.0	2.56	56.5	1.13	114	2.29	65.3
	4.0	4.4	22.7	2.84	56.8	2.84	64.9	1.30	131	2.61	71.6
	5.0	5.3	35.5	3.55	88.8	3.55	87.2	1.74	171	3.42	86.2
60 x 40	3 #	4.4	12.8	2.13	32.0	2.13	46.6	0.777	99.5	1.66	68.1
	3.2	4.6	14.5	2.27	36.4	2.27	51.1	0.852	110	1.83	72.3
	3.6 #	5.1	18.4	2.56	46.0	2.56	60.3	1.00	129	2.16	80.4
	4.0	5.6	22.7	2.84	56.8	2.84	69.5	1.16	149	2.48	88.4
	5.0	6.9	35.5	3.55	88.8	3.55	93.5	1.56	198	3.30	107
80 x 40	3 #	5.3	12.8	2.13	32.0	2.13	61.0	0.763	109	1.36	92.1
	3.2	5.6	14.5	2.27	36.4	2.27	67.9	0.848	122	1.53	97.8
	3.6 #	6.3	18.4	2.56	46.0	2.56	81.6	1.02	150	1.87	109
	4.0	6.9	22.7	2.84	56.8	2.84	95.4	1.19	177	2.21	120
	5.0	8.4	35.5	3.55	88.8	3.55	131	1.63	243	3.04	146
	6.3	10.3	56.4	4.47	141	4.47	179	2.23	328	4.10	179
	7.1 #	11.4	71.6	5.04	179	5.04	209	2.62	380	4.75	198
90 x 50	3 #	6.2	12.8	2.13	32.0	2.13	60.1	0.668	109	1.21	105
	3.2	6.6	14.5	2.27	36.4	2.27	67.3	0.748	124	1.38	111
	3.6 #	7.4	18.4	2.56	46.0	2.56	81.8	0.909	155	1.72	124
	4.0	8.2	22.7	2.84	56.8	2.84	96.4	1.07	186	2.06	137
	5.0	10.0	35.5	3.55	88.8	3.55	133	1.48	261	2.90	167
	6.3	12.3	56.4	4.47	141	4.47	183	2.03	357	3.97	206
	7.1 #	13.6	71.6	5.04	179	5.04	215	2.39	416	4.62	228
	8.0	15.0	90.9	5.68	227	5.68	252	2.80	481	5.35	253
100 x 50	3 #	6.7	12.8	2.13	32.0	2.13	64.0	0.640	107	1.07	117
	3.2	7.1	14.5	2.27	36.4	2.27	72.2	0.722	123	1.23	124
	3.6 #	8.0	18.4	2.56	46.0	2.56	89.0	0.890	157	1.57	138
	4.0	8.8	22.7	2.84	56.8	2.84	106	1.06	191	1.91	153
	5.0	10.8	35.5	3.55	88.8	3.55	149	1.49	276	2.76	187
	6.3	13.3	56.4	4.47	141	4.47	206	2.06	384	3.84	231
	7.1 #	14.7	71.6	5.04	179	5.04	243	2.43	449	4.49	256
	8.0	16.3	90.9	5.68	227	5.68	285	2.85	522	5.22	284
	8.8 #	17.6	110	6.25	275	6.25	324	3.24	587	5.87	307
10 #	19.6	142	7.10	355	7.10	384	3.84	684	6.84	340	

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

For bearing or buckling the web capacity =  $C1 + b_1 C2$  where  $b_1$  is the stiff bearing length.

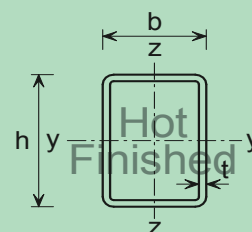
The beam component for end bearing assumes a sealing plate (thickness at least equal to the wall of the section) is welded to the end of the section by a continuous fillet weld.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 9.

HOT-FINISHED  
RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Unstiffened webs

Designation		Mass per Metre kg/m	Bearing				Buckling				Shear Resistance $V_{c,Rd}$ kN	
Size h x b mm	Wall Thickness t mm		End Bearing		Continuous Over Bearing		End Bearing or Continuous Over Bearing					
			Beam Factor C1 kN	Stiff Bearing Factor C2 kN/mm	Beam Factor C1 kN	Stiff Bearing Factor C2 kN/mm	Without Welded Flange Plate		With Welded Flange Plate			
							Beam Factor C1 kN	Stiff Bearing Factor C2 kN/mm	Beam Factor C1 kN	Stiff Bearing Factor C2 kN/mm		
100 x 60		3 #	7.2	12.8	2.13	32.0	2.13	59.1	0.591	107	1.07	117
		3.2	7.6	14.5	2.27	36.4	2.27	66.6	0.666	123	1.23	125
		3.6 #	8.5	18.4	2.56	46.0	2.56	81.8	0.818	157	1.57	140
		4.0	9.4	22.7	2.84	56.8	2.84	97.3	0.973	191	1.91	154
		5.0	11.6	35.5	3.55	88.8	3.55	137	1.37	276	2.76	188
		6.3	14.2	56.4	4.47	141	4.47	189	1.89	384	3.84	232
		7.1 #	15.8	71.6	5.04	179	5.04	222	2.22	449	4.49	259
		8.0	17.5	90.9	5.68	227	5.68	260	2.60	522	5.22	287
		8.8 #	19.0	110	6.25	275	6.25	295	2.95	587	5.87	310
120 x 60		10 #	21.1	142	7.10	355	7.10	349	3.49	684	6.84	345
		3 #	8.1	12.8	2.13	32.0	2.13	64.0	0.533	100	0.835	141
		3.2 #	8.6	14.5	2.27	36.4	2.27	73.1	0.609	117	0.978	150
		3.6 #	9.7	18.4	2.56	46.0	2.56	92.2	0.768	154	1.29	168
		4.0	10.7	22.7	2.84	56.8	2.84	112	0.934	194	1.61	186
		5.0	13.1	35.5	3.55	88.8	3.55	163	1.36	296	2.47	228
		6.3	16.2	56.4	4.47	141	4.47	230	1.92	428	3.57	283
		7.1 #	18.1	71.6	5.04	179	5.04	273	2.27	508	4.23	314
		8.0	20.1	90.9	5.68	227	5.68	321	2.67	596	4.97	350
120 x 80		8.8 #	21.8	110	6.25	275	6.25	365	3.04	674	5.62	380
		10 #	24.3	142	7.10	355	7.10	433	3.61	791	6.59	422
		12.5 #	29.1	222	8.88	555	8.88	585	4.87	1030	8.61	507
		3.6 #	10.8	18.4	2.56	46.0	2.56	81.0	0.675	154	1.29	168
		4.0	11.9	22.7	2.84	56.8	2.84	98.0	0.817	194	1.61	187
		5.0	14.7	35.5	3.55	88.8	3.55	142	1.18	296	2.47	230
		6.3	18.2	56.4	4.47	141	4.47	200	1.67	428	3.57	285
		7.1 #	20.3	71.6	5.04	179	5.04	236	1.97	508	4.23	317
		8.0	22.6	90.9	5.68	227	5.68	278	2.32	596	4.97	354
150 x 100		8.8 #	24.5	110	6.25	275	6.25	316	2.63	674	5.62	385
		10.0	27.4	142	7.10	355	7.10	374	3.12	791	6.59	429
		12.5 #	33.0	222	8.88	555	8.88	501	4.17	1030	8.61	518
		4 #	15.1	22.7	2.84	56.8	2.84	101	0.673	183	1.22	236
		5.0	18.6	35.5	3.55	88.8	3.55	153	1.02	303	2.02	291
		6.3	23.1	56.4	4.47	141	4.47	224	1.50	469	3.13	363
		7.1 #	25.9	71.6	5.04	179	5.04	269	1.79	571	3.81	405
		8.0	28.9	90.9	5.68	227	5.68	320	2.13	684	4.56	453
		8.8 #	31.5	110	6.25	275	6.25	365	2.43	784	5.23	493
150 x 100		10.0	35.3	142	7.10	355	7.10	435	2.90	932	6.21	552
		12.5	42.8	222	8.88	555	8.88	584	3.90	1240	8.24	671

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For bearing or buckling the web capacity =  $C1 + b_1 C2$  where  $b_1$  is the stiff bearing length.

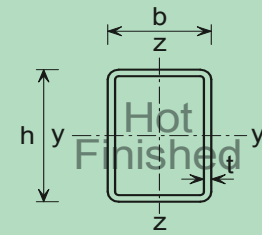
The beam component for end bearing assumes a sealing plate (thickness at least equal to the wall of the section) is welded to the end of the section by a continuous fillet weld.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 9.

HOT-FINISHED  
RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Unstiffened webs

Designation		Mass per Metre kg/m	Bearing				Buckling				Shear Resistance  $V_{c,Rd}$ kN
Size  h x b mm	Wall Thickness  t mm		End Bearing		Continuous Over Bearing		End Bearing or Continuous Over Bearing				
			Beam Factor  C1 kN	Stiff Bearing Factor  C2 kN/mm	Beam Factor  C1 kN	Stiff Bearing Factor  C2 kN/mm	Without Welded Flange Plate		With Welded Flange Plate		
							Beam Factor C1 kN	Stiff Bearing Factor C2 kN/mm	Beam Factor C1 kN	Stiff Bearing Factor C2 kN/mm	
160 x 80	4 #	14.4	22.7	2.84	56.8	2.84	114	0.711	178	1.11	251
	5.0	17.8	35.5	3.55	88.8	3.55	177	1.11	300	1.88	310
	6.3	22.2	56.4	4.47	141	4.47	265	1.65	476	2.97	385
	7.1 #	24.7	71.6	5.04	179	5.04	319	2.00	585	3.66	430
	8.0	27.6	90.9	5.68	227	5.68	382	2.39	707	4.42	481
	8.8 #	30.1	110	6.25	275	6.25	437	2.73	814	5.09	523
	10.0	33.7	142	7.10	355	7.10	523	3.27	973	6.08	586
180 x 60	4 #	14.4	22.7	2.84	56.8	2.84	127	0.704	167	0.929	283
	5 #	17.8	35.5	3.55	88.8	3.55	207	1.15	291	1.62	349
	6.3 #	22.2	56.4	4.47	141	4.47	323	1.80	481	2.67	433
	7.1 #	24.7	71.6	5.04	179	5.04	398	2.21	604	3.36	484
	8 #	27.6	90.9	5.68	227	5.68	483	2.68	743	4.13	541
	8.8 #	30.1	110	6.25	275	6.25	559	3.10	865	4.80	589
	10 #	33.7	142	7.10	355	7.10	675	3.75	1050	5.81	659
180 x 100	4 #	16.9	22.7	2.84	56.8	2.84	107	0.596	167	0.929	285
	5 #	21.0	35.5	3.55	88.8	3.55	171	0.949	291	1.62	352
	6.3 #	26.1	56.4	4.47	141	4.47	262	1.46	481	2.67	439
	7.1 #	29.2	71.6	5.04	179	5.04	320	1.78	604	3.36	490
	8 #	32.6	90.9	5.68	227	5.68	386	2.14	743	4.13	548
	8.8 #	35.6	110	6.25	275	6.25	445	2.47	865	4.80	598
	10 #	40.0	142	7.10	355	7.10	534	2.97	1050	5.81	671
200 x 100	4 #	18.2	22.7	2.84	56.8	2.84	108	0.542	156	0.782	317
	5.0	22.6	35.5	3.55	88.8	3.55	178	0.888	278	1.39	392
	6.3	28.1	56.4	4.47	141	4.47	281	1.40	477	2.39	489
	7.1 #	31.4	71.6	5.04	179	5.04	348	1.74	611	3.06	547
	8.0	35.1	90.9	5.68	227	5.68	424	2.12	765	3.83	612
	8.8 #	38.4	110	6.25	275	6.25	493	2.46	902	4.51	668
	10.0	43.1	142	7.10	355	7.10	596	2.98	1110	5.53	750
	12.5	52.7	222	8.88	555	8.88	817	4.08	1520	7.60	917
	14.2 #	58.9	286	10.1	716	10.1	971	4.85	1800	8.99	1030
16 # r	65.2	364	11.4	909	11.4	1140	5.70	2090	10.4	1130	

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

For bearing or buckling the web capacity =  $C1 + b_1 C2$  where  $b_1$  is the stiff bearing length.

The beam component for end bearing assumes a sealing plate (thickness at least equal to the wall of the section) is welded to the end of the section by a continuous fillet weld.

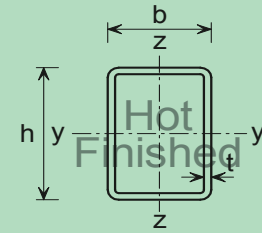
# Check availability

r External corner radius  $> 2t$  but  $\leq 3t$

FOR EXPLANATION OF TABLES SEE NOTE 9.

HOT-FINISHED  
RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Unstiffened webs

Designation		Mass per Metre	Bearing				Buckling				Shear Resis- tance  $V_{c,Rd}$ kN	
Size  $h \times b$ mm	Wall Thickness  t mm		End Bearing		Continuous Over Bearing		End Bearing or Continuous Over Bearing					
			Beam Factor  C1 kN	Stiff Bearing Factor C2 kN/mm	Beam Factor  C1 kN	Stiff Bearing Factor C2 kN/mm	Without Welded Flange Plate		With Welded Flange Plate			
							Beam Factor C1 kN	Stiff Bearing Factor C2 kN/mm	Beam Factor C1 kN	Stiff Bearing Factor C2 kN/mm		
200 x 120		5 #	24.1	35.5	3.55	88.8	3.55	165	0.825	278	1.39	393
		6.3 #	30.1	56.4	4.47	141	4.47	259	1.29	477	2.39	491
		7.1 #	33.7	71.6	5.04	179	5.04	320	1.60	611	3.06	550
		8.0 #	37.6	90.9	5.68	227	5.68	389	1.95	765	3.83	615
		8.8 #	41.1	110	6.25	275	6.25	452	2.26	902	4.51	671
		10.0 #	46.3	142	7.10	355	7.10	546	2.73	1110	5.53	755
		12.5 #	56.6	222	8.88	555	8.88	747	3.73	1520	7.60	924
		14.2 #	63.3	286	10.1	716	10.1	887	4.43	1800	8.99	1030
200 x 150		5 #	26.5	35.5	3.55	88.8	3.55	149	0.745	278	1.39	395
		6.3 #	33.0	56.4	4.47	141	4.47	232	1.16	477	2.39	493
		7.1 #	37.0	71.6	5.04	179	5.04	286	1.43	611	3.06	552
		8.0 #	41.4	90.9	5.68	227	5.68	348	1.74	765	3.83	618
		8.8 #	45.3	110	6.25	275	6.25	403	2.02	902	4.51	676
		10.0 #	51.0	142	7.10	355	7.10	487	2.44	1110	5.53	760
		12.5 #	62.5	222	8.88	555	8.88	666	3.33	1520	7.60	932
		14.2 #	70.0	286	10.1	716	10.1	791	3.96	1800	8.99	1050
220 x 120		5 #	25.7	35.5	3.55	88.8	3.55	169	0.770	265	1.20	434
		6.3 #	32.0	56.4	4.47	141	4.47	273	1.24	466	2.12	541
		7.1 #	35.9	71.6	5.04	179	5.04	342	1.55	608	2.76	606
		8 #	40.2	90.9	5.68	227	5.68	421	1.92	775	3.52	679
		8.8 #	43.9	110	6.25	275	6.25	493	2.24	926	4.21	741
		10 #	49.4	142	7.10	355	7.10	601	2.73	1150	5.23	834
		12.5 #	60.5	222	8.88	555	8.88	830	3.77	1610	7.33	1020
		14.2 #	67.8	286	10.1	716	10.1	990	4.50	1920	8.73	1150
250 x 100		5 #	26.5	35.5	3.55	88.8	3.55	182	0.726	244	0.977	493
		6.3 #	33.0	56.4	4.47	141	4.47	306	1.22	444	1.77	616
		7.1 #	37.0	71.6	5.04	179	5.04	392	1.57	591	2.36	690
		8 #	41.4	90.9	5.68	227	5.68	494	1.98	771	3.08	773
		8.8 #	45.3	110	6.25	275	6.25	588	2.35	939	3.76	845
		10 #	51.0	142	7.10	355	7.10	730	2.92	1200	4.78	950
		12.5 #	62.5	222	8.88	555	8.88	1030	4.12	1730	6.91	1170
		14.2 #	70.0	286	10.1	716	10.1	1240	4.96	2080	8.32	1310
16 #		77.7	364	11.4	909	11.4	1470	5.86	2450	9.81	1450	

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For bearing or buckling the web capacity =  $C1 + b_1 C2$  where  $b_1$  is the stiff bearing length.

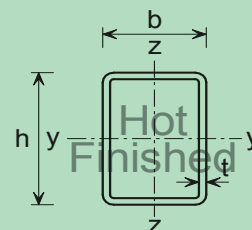
The beam component for end bearing assumes a sealing plate (thickness at least equal to the wall of the section) is welded to the end of the section by a continuous fillet weld.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 9.

HOT-FINISHED  
RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Unstiffened webs

Designation		Mass per Metre kg/m	Bearing				Buckling				Shear Resistance  $V_{c,Rd}$ kN
Size  h x b mm	Wall Thickness  t mm		End Bearing		Continuous Over Bearing		End Bearing or Continuous Over Bearing				
			Beam Factor  C1 kN	Stiff Bearing Factor  C2 kN/mm	Beam Factor  C1 kN	Stiff Bearing Factor  C2 kN/mm	Without Welded Flange Plate		With Welded Flange Plate		
							Beam Factor C1 kN	Stiff Bearing Factor C2 kN/mm	Beam Factor C1 kN	Stiff Bearing Factor C2 kN/mm	
250 x 150	5 #	30.4	35.5	3.55	88.8	3.55	159	0.635	244	0.977	496
	6.3	38.0	56.4	4.47	141	4.47	262	1.05	444	1.77	620
	7.1 #	42.6	71.6	5.04	179	5.04	333	1.33	591	2.36	694
	8.0	47.7	90.9	5.68	227	5.68	416	1.66	771	3.08	779
	8.8 #	52.2	110	6.25	275	6.25	492	1.97	939	3.76	852
	10.0	58.8	142	7.10	355	7.10	608	2.43	1200	4.78	959
	12.5	72.3	222	8.88	555	8.88	853	3.41	1730	6.91	1180
	14.2 #	81.1	286	10.1	716	10.1	1020	4.09	2080	8.32	1320
260 x 140	5 #	30.4	35.5	3.55	88.8	3.55	163	0.628	238	0.915	516
	6.3 #	38.0	56.4	4.47	141	4.47	273	1.05	435	1.67	645
	7.1 #	42.6	71.6	5.04	179	5.04	349	1.34	583	2.24	722
	8 #	47.7	90.9	5.68	227	5.68	440	1.69	766	2.95	810
	8.8 #	52.2	110	6.25	275	6.25	523	2.01	938	3.61	886
	10 #	58.8	142	7.10	355	7.10	650	2.50	1200	4.63	998
	12.5 #	72.3	222	8.88	555	8.88	919	3.53	1760	6.76	1230
	14.2 #	81.1	286	10.1	716	10.1	1100	4.25	2130	8.19	1370
300 x 100	5 #	30.4	35.5	3.55	88.8	3.55	175	0.583	214	0.713	595
	6.3 #	38.0	56.4	4.47	141	4.47	308	1.03	401	1.34	744
	7.1 #	42.6	71.6	5.04	179	5.04	406	1.35	546	1.82	833
	8.0	47.7	90.9	5.68	227	5.68	527	1.76	733	2.44	935
	8.8 #	52.2	110	6.25	275	6.25	642	2.14	917	3.06	1020
	10.0	58.8	142	7.10	355	7.10	821	2.74	1210	4.03	1150
	12.5 #	72.3	222	8.88	555	8.88	1210	4.03	1850	6.17	1420
	14.2 #	81.1	286	10.1	716	10.1	1480	4.93	2280	7.61	1580
300 x 150	8 # rr	54.0	90.9	5.68	227	5.68	457	1.52	733	2.44	940
	8.8 # rr	59.1	110	6.25	275	6.25	552	1.84	917	3.06	1030
	10 # rr	66.7	142	7.10	355	7.10	700	2.33	1210	4.03	1160
	12.5 # rr	82.1	222	8.88	555	8.88	1020	3.39	1850	6.17	1440
	14.2 # rr	92.3	286	10.1	716	10.1	1240	4.13	2280	7.61	1610
	16 # rr	103	364	11.4	909	11.4	1470	4.91	2740	9.13	1790

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For bearing or buckling the web capacity =  $C1 + b_1 C2$  where  $b_1$  is the stiff bearing length.

The beam component for end bearing assumes a sealing plate (thickness at least equal to the wall of the section) is welded to the end of the section by a continuous fillet weld.

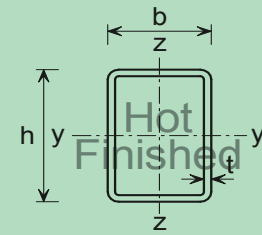
# Check availability

rr External corner radius > 3t (Not compliant with BS EN 10210-2)

FOR EXPLANATION OF TABLES SEE NOTE 9.

HOT-FINISHED  
RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Unstiffened webs

Designation		Mass per Metre kg/m	Bearing				Buckling				Shear Resistance $V_{c,Rd}$ kN
Size h x b mm	Wall Thickness t mm		End Bearing		Continuous Over Bearing		End Bearing or Continuous Over Bearing				
			Beam Factor C1 kN	Stiff Bearing Factor C2 kN/mm	Beam Factor C1 kN	Stiff Bearing Factor C2 kN/mm	Without Welded Flange Plate		With Welded Flange Plate		
							Beam Factor C1 kN	Stiff Bearing Factor C2 kN/mm	Beam Factor C1 kN	Stiff Bearing Factor C2 kN/mm	
300 x 200	5 #	38.3	35.5	3.55	88.8	3.55	144	0.480	214	0.713	599
	6.3 #	47.9	56.4	4.47	141	4.47	245	0.815	401	1.34	750
	7.1 #	53.7	71.6	5.04	179	5.04	316	1.05	546	1.82	841
	8.0 #	60.3	90.9	5.68	227	5.68	404	1.35	733	2.44	944
	8.8 #	66.0	110	6.25	275	6.25	485	1.62	917	3.06	1030
	10.0 #	74.5	142	7.10	355	7.10	613	2.04	1210	4.03	1170
	12.5 #	91.9	222	8.88	555	8.88	886	2.95	1850	6.17	1440
	14.2 #	103	286	10.1	716	10.1	1080	3.59	2280	7.61	1620
	16.0	115	364	11.4	909	11.4	1280	4.26	2740	9.13	1810
300 x 250	5 #	42.2	35.5	3.55	88.8	3.55	132	0.439	214	0.713	600
	6.3 #	52.8	56.4	4.47	141	4.47	221	0.738	401	1.34	752
	7.1 #	59.3	71.6	5.04	179	5.04	285	0.949	546	1.82	844
	8.0 #	66.5	90.9	5.68	227	5.68	362	1.21	733	2.44	948
	8.8 #	72.9	110	6.25	275	6.25	434	1.45	917	3.06	1040
	10 #	82.4	142	7.10	355	7.10	546	1.82	1210	4.03	1170
	12.5 #	102	222	8.88	555	8.88	789	2.63	1850	6.17	1450
	14.2 #	115	286	10.1	716	10.1	957	3.19	2280	7.61	1630
	16 #	128	364	11.4	909	11.4	1140	3.79	2740	9.13	1820
340 x 100	10.0	65.1	142	7.10	355	7.10	862	2.54	1180	3.48	1310
350 x 150	5 #	38.3	35.5	3.55	88.8	3.55	152	0.435	189	0.541	699
	6.3 #	47.9	56.4	4.47	141	4.47	271	0.775	360	1.03	875
	7.1 #	53.7	71.6	5.04	179	5.04	361	1.03	497	1.42	981
	8 #	60.3	90.9	5.68	227	5.68	473	1.35	680	1.94	1100
	8.8 #	66.0	110	6.25	275	6.25	583	1.66	865	2.47	1210
	10 #	74.5	142	7.10	355	7.10	758	2.17	1180	3.36	1360
	12.5 #	91.9	222	8.88	555	8.88	1150	3.28	1890	5.41	1680
	14.2 #	103	286	10.1	716	10.1	1420	4.06	2400	6.87	1890
	16 #	115	364	11.4	909	11.4	1720	4.90	2940	8.40	2110
350 x 250	6.3 #	57.8	56.4	4.47	141	4.47	228	0.653	360	1.03	880
	7.1 #	64.9	71.6	5.04	179	5.04	299	0.856	497	1.42	988
	8 #	72.8	90.9	5.68	227	5.68	388	1.11	680	1.94	1110
	8.8 #	79.8	110	6.25	275	6.25	473	1.35	865	2.47	1220
	10 #	90.2	142	7.10	355	7.10	608	1.74	1180	3.36	1380
	12.5 #	112	222	8.88	555	8.88	907	2.59	1890	5.41	1700
	14.2 #	126	286	10.1	716	10.1	1120	3.19	2400	6.87	1910
	16 #	141	364	11.4	909	11.4	1340	3.83	2940	8.40	2140

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

For bearing or buckling the web capacity =  $C1 + b_1 C2$  where  $b_1$  is the stiff bearing length.

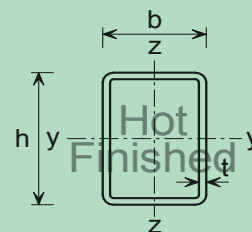
The beam component for end bearing assumes a sealing plate (thickness at least equal to the wall of the section) is welded to the end of the section by a continuous fillet weld.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 9.

HOT-FINISHED  
RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Unstiffened webs

Designation		Mass per Metre kg/m	Bearing				Buckling				Shear Resistance  $V_{c,Rd}$ kN
Size  h x b mm	Wall Thickness  t mm		End Bearing		Continuous Over Bearing		End Bearing or Continuous Over Bearing				
			Beam Factor  C1 kN	Stiff Bearing Factor  C2 kN/mm	Beam Factor  C1 kN	Stiff Bearing Factor  C2 kN/mm	Without Welded Flange Plate		With Welded Flange Plate		
							Beam Factor C1 kN	Stiff Bearing Factor C2 kN/mm	Beam Factor C1 kN	Stiff Bearing Factor C2 kN/mm	
400 x 150	6.3 #	52.8	56.4	4.47	141	4.47	263	0.657	325	0.813	1000
	7.1 #	59.3	71.6	5.04	179	5.04	355	0.886	453	1.13	1130
	8 #	66.5	90.9	5.68	227	5.68	473	1.18	626	1.56	1260
	8.8 #	72.9	110	6.25	275	6.25	591	1.48	805	2.01	1390
	10 #	82.4	142	7.10	355	7.10	786	1.97	1110	2.78	1570
	12.5 #	102	222	8.88	555	8.88	1240	3.10	1880	4.69	1940
	14.2 #	115	286	10.1	716	10.1	1570	3.92	2440	6.11	2180
	16.0	128	364	11.4	909	11.4	1920	4.80	3060	7.65	2430
400 x 200	6.3 #	57.8	56.4	4.47	141	4.47	245	0.612	325	0.813	1010
	7.1 #	64.9	71.6	5.04	179	5.04	328	0.819	453	1.13	1130
	8.0	72.8	90.9	5.68	227	5.68	434	1.08	626	1.56	1270
	8.8 #	79.8	110	6.25	275	6.25	539	1.35	805	2.01	1390
	10.0	90.2	142	7.10	355	7.10	711	1.78	1110	2.78	1570
	12.5	112	222	8.88	555	8.88	1110	2.77	1880	4.69	1940
	14.2 #	126	286	10.1	716	10.1	1390	3.48	2440	6.11	2190
	16.0	141	364	11.4	909	11.4	1700	4.24	3060	7.65	2450
400 x 300	8 #	85.4	90.9	5.68	227	5.68	371	0.928	626	1.56	1280
	8.8 #	93.6	110	6.25	275	6.25	457	1.14	805	2.01	1390
	10 #	106	142	7.10	355	7.10	596	1.49	1110	2.78	1580
	12.5 #	131	222	8.88	555	8.88	915	2.29	1880	4.69	1960
	14.2 #	148	286	10.1	716	10.1	1140	2.86	2440	6.11	2210
	16 #	166	364	11.4	909	11.4	1390	3.48	3060	7.65	2470
450 x 250	8.0	85.4	90.9	5.68	227	5.68	402	0.894	575	1.28	1440
	8.8 #	93.6	110	6.25	275	6.25	503	1.12	745	1.66	1570
	10.0	106	142	7.10	355	7.10	670	1.49	1050	2.32	1780
	12.5	131	222	8.88	555	8.88	1070	2.37	1820	4.04	2200
	14.2 #	148	286	10.1	716	10.1	1360	3.03	2430	5.39	2490
	16.0	166	364	11.4	909	11.4	1680	3.74	3100	6.90	2780
500 x 200	8 #	85.4	90.9	5.68	227	5.68	421	0.842	531	1.06	1600
	8.8 #	93.6	110	6.25	275	6.25	534	1.07	691	1.38	1740
	10 #	106	142	7.10	355	7.10	726	1.45	977	1.95	1980
	12.5 #	131	222	8.88	555	8.88	1200	2.41	1740	3.48	2450
	14.2 #	148	286	10.1	716	10.1	1570	3.14	2360	4.73	2770
	16 #	166	364	11.4	909	11.4	1980	3.95	3090	6.17	3090
500 x 300	8 #	97.9	90.9	5.68	227	5.68	376	0.752	531	1.06	1600
	8.8 #	107	110	6.25	275	6.25	472	0.945	691	1.38	1760
	10.0	122	142	7.10	355	7.10	635	1.27	977	1.95	1990
	12.5 #	151	222	8.88	555	8.88	1030	2.06	1740	3.48	2460
	14.2 #	170	286	10.1	716	10.1	1330	2.66	2360	4.73	2780
	16.0	191	364	11.4	909	11.4	1670	3.33	3090	6.17	3110
	20 ^	235	552	13.8	1380	13.8	2380	4.75	4700	9.39	3740

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

For bearing or buckling the web capacity =  $C1 + b_1 C2$  where  $b_1$  is the stiff bearing length.

The beam component for end bearing assumes a sealing plate (thickness at least equal to the wall of the section) is welded to the end of the section by a continuous fillet weld.

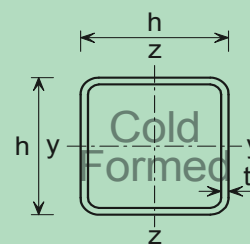
# Check availability

^ SAW process (single longitudinal seam weld, slightly proud)

FOR EXPLANATION OF TABLES SEE NOTE 9.

COLD FORMED  
SQUARE HOLLOW SECTIONS

Hybox® SHS



Unstiffened webs

Designation		Mass per Metre kg/m	Bearing				Buckling				Shear Resistance $V_{c,Rd}$ kN
Size h x b mm	Wall Thickness t mm		End Bearing		Continuous Over Bearing		End Bearing or Continuous Over Bearing				
			Beam Factor C1 kN	Stiff Bearing Factor C2 kN/mm	Beam Factor C1 kN	Stiff Bearing Factor C2 kN/mm	Without Welded Flange Plate		With Welded Flange Plate		
Beam Factor C1 kN	Stiff Bearing Factor C2 kN/mm						Beam Factor C1 kN	Stiff Bearing Factor C2 kN/mm	Beam Factor C1 kN	Stiff Bearing Factor C2 kN/mm	
25 x 25	2 #	1.4	5.7	1.42	14.2	1.42	12.5	0.498	32.7	1.31	17.8
	2.5	1.6	8.9	1.78	22.2	1.78	16.7	0.667	42.8	1.71	21.4
30 x 30	2 #	1.7	5.7	1.42	14.2	1.42	14.1	0.469	37.3	1.24	21.9
	2.5 #	2.0	8.9	1.78	22.2	1.78	18.9	0.631	49.4	1.65	26.5
	3.0	2.4	12.8	2.13	32.0	2.13	24.0	0.800	61.6	2.05	30.8
40 x 40	2 #	2.3	5.7	1.42	14.2	1.42	16.7	0.417	44.2	1.11	30.1
	2.5	2.8	8.9	1.78	22.2	1.78	22.9	0.572	60.8	1.52	36.8
	3.0	3.3	12.8	2.13	32.0	2.13	29.3	0.732	77.1	1.93	43.1
	4.0	4.2	22.7	2.84	56.8	2.84	42.7	1.07	109	2.74	54.8
50 x 50	2.5	3.6	8.9	1.78	22.2	1.78	26.1	0.521	69.1	1.38	47.0
	3.0	4.3	12.8	2.13	32.0	2.13	33.8	0.676	89.9	1.80	55.4
	4.0	5.5	22.7	2.84	56.8	2.84	49.8	0.997	131	2.61	71.2
	5.0	6.6	35.5	3.55	88.8	3.55	66.7	1.33	171	3.42	85.7
60 x 60	3.0	5.2	12.8	2.13	32.0	2.13	37.5	0.626	99.5	1.66	67.7
	4.0	6.7	22.7	2.84	56.8	2.84	56.2	0.937	149	2.48	87.6
	5.0	8.1	35.5	3.55	88.8	3.55	75.7	1.26	198	3.30	107
	6 #	9.5	51.1	4.26	128	4.26	96.0	1.60	246	4.10	123
70 x 70	3.0	6.1	12.8	2.13	32.0	2.13	40.5	0.579	106	1.51	80.0
	3.5	7.1	17.4	2.49	43.5	2.49	51.1	0.730	135	1.93	92.1
	4.0	8.0	22.7	2.84	56.8	2.84	61.9	0.884	165	2.35	104
	5.0	9.7	35.5	3.55	88.8	3.55	84.0	1.20	222	3.17	127
	6 #	11.3	51.1	4.26	128	4.26	107	1.53	279	3.98	148
80 x 80	3.0	7.1	12.8	2.13	32.0	2.13	42.8	0.535	109	1.36	92.3
	3.5	8.2	17.4	2.49	43.5	2.49	54.6	0.683	143	1.79	107
	4.0	9.2	22.7	2.84	56.8	2.84	66.7	0.834	177	2.21	120
	5.0	11.3	35.5	3.55	88.8	3.55	91.5	1.14	243	3.04	148
	6.0	13.2	51.1	4.26	128	4.26	117	1.46	308	3.86	172
90 x 90	3.0	8.0	12.8	2.13	32.0	2.13	44.4	0.494	109	1.21	105
	3.5	9.3	17.4	2.49	43.5	2.49	57.5	0.639	147	1.64	121
	4.0	10.5	22.7	2.84	56.8	2.84	70.8	0.787	186	2.06	136
	5.0	12.8	35.5	3.55	88.8	3.55	98.3	1.09	261	2.90	168
	6 #	15.1	51.1	4.26	128	4.26	127	1.41	335	3.73	197

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Square Hollow Sections (CFSHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

For bearing or buckling the web capacity =  $C1 + b_1 C2$  where  $b_1$  is the stiff bearing length.

The beam component for end bearing assumes a sealing plate (thickness at least equal to the wall of the section) is welded to the end of the section by a continuous fillet weld.

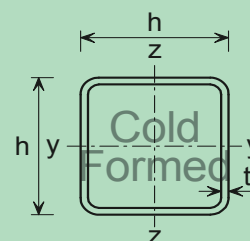
# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 9.



COLD FORMED  
SQUARE HOLLOW SECTIONS

Hybox® SHS



Unstiffened webs

Designation		Mass per Metre	Bearing				Buckling				Shear Resis- tance  $V_{c,Rd}$ kN
Size	Wall Thickness		End Bearing		Continuous Over Bearing		End Bearing or Continuous Over Bearing				
			Beam Factor	Stiff Bearing Factor	Beam Factor	Stiff Bearing Factor	Without Welded Flange Plate		With Welded Flange Plate		
C1 kN	C2 kN/mm						C1 kN	C2 kN/mm	Beam Factor	Stiff Bearing Factor	
$h \times b$ mm	t mm	kg/m	C1 kN	C2 kN/mm	C1 kN	C2 kN/mm	C1 kN	C2 kN/mm	C1 kN	C2 kN/mm	$V_{c,Rd}$ kN
100 x 100	3.0	9.0	12.8	2.13	32.0	2.13	45.5	0.455	107	1.07	117
	4.0	11.7	22.7	2.84	56.8	2.84	74.2	0.742	191	1.91	153
	5.0	14.4	35.5	3.55	88.8	3.55	104	1.04	276	2.76	189
	6.0	17.0	51.1	4.26	128	4.26	135	1.35	359	3.59	221
	8.0	21.4	90.9	5.68	227	5.68	199	1.99	522	5.22	279
120 x 120	3 #	10.8	12.8	2.13	32.0	2.13	46.2	0.385	100	0.835	141
	4.0	14.2	22.7	2.84	56.8	2.84	79.0	0.658	194	1.61	185
	5.0	17.5	35.5	3.55	88.8	3.55	114	0.950	296	2.47	230
	6.0	20.7	51.1	4.26	128	4.26	150	1.25	398	3.32	271
	8.0	26.4	90.9	5.68	227	5.68	225	1.87	596	4.97	344
	10.0	31.8	142	7.10	355	7.10	303	2.52	791	6.59	416
140 x 140	4.0	16.8	22.7	2.84	56.8	2.84	81.4	0.582	188	1.34	218
	5.0	20.7	35.5	3.55	88.8	3.55	121	0.864	303	2.16	271
	6.0	24.5	51.1	4.26	128	4.26	162	1.16	423	3.02	320
	8.0	31.4	90.9	5.68	227	5.68	247	1.77	658	4.70	410
	10.0	38.1	142	7.10	355	7.10	336	2.40	888	6.34	498
150 x 150	4 #	18.0	22.7	2.84	56.8	2.84	82.0	0.547	183	1.22	235
	5.0	22.3	35.5	3.55	88.8	3.55	123	0.823	303	2.02	291
	6.0	26.4	51.1	4.26	128	4.26	167	1.11	430	2.87	344
	8.0	33.9	90.9	5.68	227	5.68	258	1.72	684	4.56	443
	10.0	41.3	142	7.10	355	7.10	351	2.34	932	6.21	539
160 x 160	4 #	19.3	22.7	2.84	56.8	2.84	82.2	0.514	178	1.11	251
	5.0	23.8	35.5	3.55	88.8	3.55	125	0.783	300	1.88	312
	6.0	28.3	51.1	4.26	128	4.26	171	1.07	435	2.72	369
	8.0	36.5	90.9	5.68	227	5.68	267	1.67	707	4.42	476
	10.0	44.4	142	7.10	355	7.10	366	2.29	973	6.08	580
180 x 180	5.0	27.0	35.5	3.55	88.8	3.55	128	0.709	291	1.62	353
	6.0	32.1	51.1	4.26	128	4.26	178	0.987	436	2.42	418
	6.3 #	33.3	56.4	4.47	141	4.47	193	1.07	481	2.67	435
	8.0	41.5	90.9	5.68	227	5.68	283	1.57	743	4.13	541
	10.0	50.7	142	7.10	355	7.10	393	2.18	1050	5.81	662
	12 #	58.5	204	8.52	511	8.52	506	2.81	1340	7.45	763
	12.5	60.5	222	8.88	555	8.88	535	2.97	1420	7.86	789

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Square Hollow Sections (CFSHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

For bearing or buckling the web capacity =  $C1 + b_1 C2$  where  $b_1$  is the stiff bearing length.

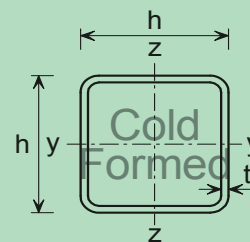
The beam component for end bearing assumes a sealing plate (thickness at least equal to the wall of the section) is welded to the end of the section by a continuous fillet weld.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 9.

COLD FORMED  
SQUARE HOLLOW SECTIONS

Hybox® SHS



Unstiffened webs

Designation		Mass per Metre	Bearing				Buckling				Shear Resistance  $V_{c,Rd}$ kN
Size  h x b mm	Wall Thickness  t mm		End Bearing		Continuous Over Bearing		End Bearing or Continuous Over Bearing				
			Beam Factor  C1 kN	Stiff Bearing Factor  C2 kN/mm	Beam Factor  C1 kN	Stiff Bearing Factor  C2 kN/mm	Without Welded Flange Plate		With Welded Flange Plate		
							Beam Factor C1 kN	Stiff Bearing Factor C2 kN/mm	Beam Factor C1 kN	Stiff Bearing Factor C2 kN/mm	
200 x 200	5.0	30.1	35.5	3.55	88.8	3.55	128	0.642	278	1.39	394
	6.0	35.8	51.1	4.26	128	4.26	182	0.909	429	2.14	467
	6.3 #	37.2	56.4	4.47	141	4.47	199	0.993	477	2.39	486
	8.0	46.5	90.9	5.68	227	5.68	297	1.48	765	3.83	607
	10.0	57.0	142	7.10	355	7.10	417	2.09	1110	5.53	744
	12 #	66.0	204	8.52	511	8.52	541	2.70	1440	7.19	862
	12.5	68.3	222	8.88	555	8.88	572	2.86	1520	7.60	892
250 x 250	6.0	45.2	51.1	4.26	128	4.26	185	0.740	393	1.57	590
	6.3 #	47.1	56.4	4.47	141	4.47	204	0.816	444	1.77	615
	8.0	59.1	90.9	5.68	227	5.68	319	1.28	771	3.08	771
	10.0	72.7	142	7.10	355	7.10	464	1.86	1200	4.78	949
	12 #	84.8	204	8.52	511	8.52	614	2.45	1620	6.49	1110
	12.5	88.0	222	8.88	555	8.88	652	2.61	1730	6.91	1150
300 x 300	6.0	54.7	51.1	4.26	128	4.26	182	0.606	352	1.17	713
	6.3 #	57.0	56.4	4.47	141	4.47	202	0.673	401	1.34	744
	8.0	71.6	90.9	5.68	227	5.68	328	1.09	733	2.44	935
	10.0	88.4	142	7.10	355	7.10	494	1.65	1210	4.03	1160
	12 #	104	204	8.52	511	8.52	668	2.23	1720	5.74	1350
	12.5	108	222	8.88	555	8.88	713	2.38	1850	6.17	1400
350 x 350	6 #	64.1	51.1	4.26	128	4.26	176	0.503	315	0.900	836
	6.3 #	66.9	56.4	4.47	141	4.47	196	0.561	360	1.03	873
	8.0	84.2	90.9	5.68	227	5.68	328	0.938	680	1.94	1100
	10.0	104	142	7.10	355	7.10	509	1.45	1180	3.36	1360
	12 #	123	204	8.52	511	8.52	705	2.01	1750	4.99	1600
	12.5	127	222	8.88	555	8.88	756	2.16	1890	5.41	1660
400 x 400	6 #	73.5	51.1	4.26	128	4.26	169	0.422	284	0.709	959
	6.3 #	76.8	56.4	4.47	141	4.47	189	0.473	325	0.813	1000
	8.0	96.7	90.9	5.68	227	5.68	323	0.808	626	1.56	1260
	10.0	120	142	7.10	355	7.10	514	1.28	1110	2.78	1570
	12 #	141	204	8.52	511	8.52	727	1.82	1710	4.29	1850
	12.5	147	222	8.88	555	8.88	783	1.96	1880	4.69	1920

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Square Hollow Sections (CFSHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

For bearing or buckling the web capacity =  $C1 + b_1 C2$  where  $b_1$  is the stiff bearing length.

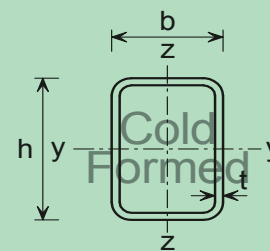
The beam component for end bearing assumes a sealing plate (thickness at least equal to the wall of the section) is welded to the end of the section by a continuous fillet weld.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 9.

COLD FORMED  
RECTANGULAR HOLLOW SECTIONS

Hybox® RHS



Unstiffened webs

Designation		Mass per Metre	Bearing				Buckling				Shear Resistance $V_{c,Rd}$ kN
Size h x b mm	Wall Thickness t mm		End Bearing		Continuous Over Bearing		End Bearing or Continuous Over Bearing				
			Beam Factor C1 kN	Stiff Bearing Factor C2 kN/mm	Beam Factor C1 kN	Stiff Bearing Factor C2 kN/mm	Without Welded Flange Plate		With Welded Flange Plate		
							Beam Factor C1 kN	Stiff Bearing Factor C2 kN/mm	Beam Factor C1 kN	Stiff Bearing Factor C2 kN/mm	
50 x 25	2 #	2.2	5.7	1.42	14.2	1.42	26.5	0.530	47.8	0.956	37.4
	2.5	2.6	8.9	1.78	22.2	1.78	37.3	0.745	69.1	1.38	45.6
	3.0	3.1	12.8	2.13	32.0	2.13	48.2	0.965	89.9	1.80	53.4
50 x 30	2 #	2.3	5.7	1.42	14.2	1.42	24.3	0.487	47.8	0.956	37.7
	2.5	2.8	8.9	1.78	22.2	1.78	34.1	0.683	69.1	1.38	46.0
	3.0	3.3	12.8	2.13	32.0	2.13	44.1	0.883	89.9	1.80	53.9
	4.0	4.2	22.7	2.84	56.8	2.84	64.9	1.30	131	2.61	68.5
60 x 40	2.5 #	3.6	8.9	1.78	22.2	1.78	35.5	0.591	74.0	1.23	56.4
	3.0	4.3	12.8	2.13	32.0	2.13	46.6	0.777	99.5	1.66	66.5
	4.0	5.5	22.7	2.84	56.8	2.84	69.5	1.16	149	2.48	85.5
	5.0	6.6	35.5	3.55	88.8	3.55	93.5	1.56	198	3.30	103
70 x 40	3.0	4.7	12.8	2.13	32.0	2.13	54.4	0.777	106	1.51	78.4
	4.0	6.1	22.7	2.84	56.8	2.84	82.8	1.18	165	2.35	101
	5.0	7.3	35.5	3.55	88.8	3.55	112	1.60	222	3.17	122
70 x 50	3 #	5.2	12.8	2.13	32.0	2.13	48.7	0.695	106	1.51	79.0
	4.0	6.7	22.7	2.84	56.8	2.84	74.0	1.06	165	2.35	102
	5.0	8.1	35.5	3.55	88.8	3.55	100	1.43	222	3.17	124
80 x 40	3.0	5.2	12.8	2.13	32.0	2.13	61.0	0.763	109	1.36	90.3
	4.0	6.7	22.7	2.84	56.8	2.84	95.4	1.19	177	2.21	117
	5.0	8.1	35.5	3.55	88.8	3.55	131	1.63	243	3.04	142
80 x 50	3.0	5.7	12.8	2.13	32.0	2.13	55.0	0.687	109	1.36	90.9
	4.0	7.3	22.7	2.84	56.8	2.84	85.6	1.07	177	2.21	118
	5.0	8.9	35.5	3.55	88.8	3.55	117	1.46	243	3.04	144
80 x 60	3.0	6.1	12.8	2.13	32.0	2.13	50.1	0.627	109	1.36	91.5
	3.5	7.1	17.4	2.49	43.5	2.49	64.0	0.800	143	1.79	105
	4.0	8.0	22.7	2.84	56.8	2.84	78.0	0.975	177	2.21	118
	5.0	9.7	35.5	3.55	88.8	3.55	107	1.33	243	3.04	145
90 x 50	3 #	6.1	12.8	2.13	32.0	2.13	60.1	0.668	109	1.21	103
	4 #	8.0	22.7	2.84	56.8	2.84	96.4	1.07	186	2.06	133
	5.0	9.7	35.5	3.55	88.8	3.55	133	1.48	261	2.90	163
100 x 40	3.0	6.1	12.8	2.13	32.0	2.13	69.9	0.699	107	1.07	114
	4.0	8.0	22.7	2.84	56.8	2.84	117	1.17	191	1.91	148
	5 #	9.7	35.5	3.55	88.8	3.55	165	1.65	276	2.76	182

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Rectangular Hollow Sections (CFRHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

For bearing or buckling the web capacity =  $C1 + b_1 C2$  where  $b_1$  is the stiff bearing length.

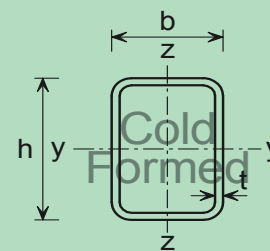
The beam component for end bearing assumes a sealing plate (thickness at least equal to the wall of the section) is welded to the end of the section by a continuous fillet weld.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 9.

COLD FORMED  
RECTANGULAR HOLLOW SECTIONS

Hybox® RHS



Unstiffened webs

Designation		Mass per Metre	Bearing				Buckling				Shear Resistance $V_{c,Rd}$ kN
Size h x b mm	Wall Thickness t mm		End Bearing		Continuous Over Bearing		End Bearing or Continuous Over Bearing				
			Beam Factor C1 kN	Stiff Bearing Factor C2 kN/mm	Beam Factor C1 kN	Stiff Bearing Factor C2 kN/mm	Without Welded Flange Plate		With Welded Flange Plate		
							Beam Factor C1 kN	Stiff Bearing Factor C2 kN/mm	Beam Factor C1 kN	Stiff Bearing Factor C2 kN/mm	
100 x 50	3.0	6.6	12.8	2.13	32.0	2.13	64.0	0.640	107	1.07	115
	4.0	8.6	22.7	2.84	56.8	2.84	106	1.06	191	1.91	149
	5.0	10.5	35.5	3.55	88.8	3.55	149	1.49	276	2.76	183
	6.0	12.3	51.1	4.26	128	4.26	193	1.93	359	3.59	213
100 x 60	3.0	7.1	12.8	2.13	32.0	2.13	59.1	0.591	107	1.07	115
	3.5	8.2	17.4	2.49	43.5	2.49	78.0	0.780	149	1.49	133
	4.0	9.2	22.7	2.84	56.8	2.84	97.3	0.973	191	1.91	150
	5.0	11.3	35.5	3.55	88.8	3.55	137	1.37	276	2.76	184
	6.0	13.2	51.1	4.26	128	4.26	177	1.77	359	3.59	215
100 x 80	3 #	8.0	12.8	2.13	32.0	2.13	51.3	0.513	107	1.07	116
	4.0	10.5	22.7	2.84	56.8	2.84	84.0	0.840	191	1.91	151
	5.0	12.8	35.5	3.55	88.8	3.55	118	1.18	276	2.76	187
	6.0	15.1	51.1	4.26	128	4.26	152	1.52	359	3.59	219
120 x 40	3 #	7.1	12.8	2.13	32.0	2.13	73.4	0.611	100	0.835	139
	4 #	9.2	22.7	2.84	56.8	2.84	131	1.10	194	1.61	180
	5 #	11.3	35.5	3.55	88.8	3.55	193	1.61	296	2.47	221
120 x 60	3.0	8.0	12.8	2.13	32.0	2.13	64.0	0.533	100	0.835	139
	3.5	9.3	17.4	2.49	43.5	2.49	87.3	0.728	145	1.21	161
	4.0	10.5	22.7	2.84	56.8	2.84	112	0.934	194	1.61	182
	5.0	12.8	35.5	3.55	88.8	3.55	163	1.36	296	2.47	224
	6.0	15.1	51.1	4.26	128	4.26	215	1.79	398	3.32	262
120 x 80	3.0	9.0	12.8	2.13	32.0	2.13	56.7	0.472	100	0.835	140
	4.0	11.7	22.7	2.84	56.8	2.84	98.0	0.817	194	1.61	183
	5.0	14.4	35.5	3.55	88.8	3.55	142	1.18	296	2.47	226
	6.0	17.0	51.1	4.26	128	4.26	186	1.55	398	3.32	266
	8.0	21.4	90.9	5.68	227	5.68	278	2.32	596	4.97	334
140 x 80	3 #	9.9	12.8	2.13	32.0	2.13	59.2	0.423	92.0	0.657	164
	4.0	13.0	22.7	2.84	56.8	2.84	108	0.771	188	1.34	215
	5 #	16.0	35.5	3.55	88.8	3.55	162	1.16	303	2.16	266
	6.0	18.9	51.1	4.26	128	4.26	218	1.55	423	3.02	313
	8.0	23.9	90.9	5.68	227	5.68	331	2.37	658	4.70	397
	10.0	28.7	142	7.10	355	7.10	449	3.21	888	6.34	477

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Rectangular Hollow Sections (CFRHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

For bearing or buckling the web capacity =  $C1 + b_1 C2$  where  $b_1$  is the stiff bearing length.

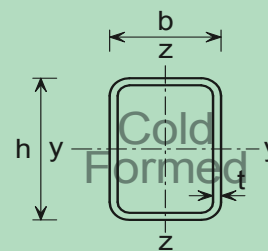
The beam component for end bearing assumes a sealing plate (thickness at least equal to the wall of the section) is welded to the end of the section by a continuous fillet weld.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 9.

COLD FORMED  
RECTANGULAR HOLLOW SECTIONS

Hybox® RHS



Unstiffened webs

Designation		Mass per Metre	Bearing				Buckling				Shear Resistance $V_{c,Rd}$ kN
Size	Wall Thickness		End Bearing		Continuous Over Bearing		End Bearing or Continuous Over Bearing				
			Beam Factor	Stiff Bearing Factor	Beam Factor	Stiff Bearing Factor	Without Welded Flange Plate		With Welded Flange Plate		
C1 kN	C2 kN/mm						C1 kN	C2 kN/mm	Beam Factor	Stiff Bearing Factor	
150 x 100	3 #	11.3	12.8	2.13	32.0	2.13	54.8	0.366	88.0	0.586	177
	4.0	14.9	22.7	2.84	56.8	2.84	101	0.673	183	1.22	232
	5.0	18.3	35.5	3.55	88.8	3.55	153	1.02	303	2.02	288
	6.0	21.7	51.1	4.26	128	4.26	208	1.39	430	2.87	339
	8.0	27.7	90.9	5.68	227	5.68	320	2.13	684	4.56	433
	10.0	33.4	142	7.10	355	7.10	435	2.90	932	6.21	524
160 x 80	3 #	10.8	12.8	2.13	32.0	2.13	59.7	0.373	84.1	0.526	189
	4.0	14.2	22.7	2.84	56.8	2.84	114	0.711	178	1.11	247
	5.0	17.5	35.5	3.55	88.8	3.55	177	1.11	300	1.88	306
	6.0	20.7	51.1	4.26	128	4.26	244	1.53	435	2.72	361
	8.0	26.4	90.9	5.68	227	5.68	382	2.39	707	4.42	459
	10 #	31.8	142	7.10	355	7.10	523	3.27	973	6.08	555
180 x 80	3.0	11.8	12.8	2.13	32.0	2.13	58.9	0.327	77.0	0.428	213
	4.0	15.5	22.7	2.84	56.8	2.84	116	0.645	167	0.929	280
	5.0	19.1	35.5	3.55	88.8	3.55	187	1.04	291	1.62	346
	6 #	22.6	51.1	4.26	128	4.26	265	1.47	436	2.42	409
	8.0	28.9	90.9	5.68	227	5.68	427	2.37	743	4.13	522
	10 #	35.0	142	7.10	355	7.10	593	3.30	1050	5.81	633
180 x 100	4 #	16.8	22.7	2.84	56.8	2.84	107	0.596	167	0.929	281
	5.0	20.7	35.5	3.55	88.8	3.55	171	0.949	291	1.62	348
	6.0	24.5	51.1	4.26	128	4.26	241	1.34	436	2.42	411
	8.0	31.4	90.9	5.68	227	5.68	386	2.14	743	4.13	527
	10.0	38.1	142	7.10	355	7.10	534	2.97	1050	5.81	640
	200 x 100	4.0	18.0	22.7	2.84	56.8	2.84	108	0.542	156	0.782
5.0		22.3	35.5	3.55	88.8	3.55	178	0.888	278	1.39	388
6.0		26.4	51.1	4.26	128	4.26	256	1.28	429	2.14	459
8.0		33.9	90.9	5.68	227	5.68	424	2.12	765	3.83	590
10.0		41.3	142	7.10	355	7.10	596	2.98	1110	5.53	719
200 x 120		4.0	19.3	22.7	2.84	56.8	2.84	102	0.508	156	0.782
	5.0	23.8	35.5	3.55	88.8	3.55	165	0.825	278	1.39	389
	6.0	28.3	51.1	4.26	128	4.26	236	1.18	429	2.14	461
	8.0	36.5	90.9	5.68	227	5.68	389	1.95	765	3.83	594
	10.0	44.4	142	7.10	355	7.10	546	2.73	1110	5.53	725
	200 x 150	4 #	21.2	22.7	2.84	56.8	2.84	92.8	0.464	156	0.782
5 #		26.2	35.5	3.55	88.8	3.55	149	0.745	278	1.39	391
6.0		31.1	51.1	4.26	128	4.26	212	1.06	429	2.14	464
8.0		40.2	90.9	5.68	227	5.68	348	1.74	765	3.83	600
10.0		49.1	142	7.10	355	7.10	487	2.44	1110	5.53	733

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Rectangular Hollow Sections (CFRHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

For bearing or buckling the web capacity =  $C1 + b_1 C2$  where  $b_1$  is the stiff bearing length.

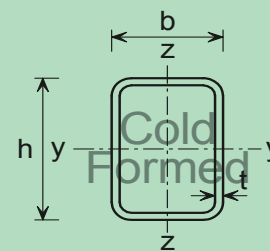
The beam component for end bearing assumes a sealing plate (thickness at least equal to the wall of the section) is welded to the end of the section by a continuous fillet weld.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 9.

COLD FORMED  
RECTANGULAR HOLLOW SECTIONS

Hybox® RHS



Unstiffened webs

Designation		Mass per Metre	Bearing				Buckling				Shear Resistance $V_{c,Rd}$ kN
Size h x b mm	Wall Thickness t mm		End Bearing		Continuous Over Bearing		End Bearing or Continuous Over Bearing				
			Beam Factor C1 kN	Stiff Bearing Factor C2 kN/mm	Beam Factor C1 kN	Stiff Bearing Factor C2 kN/mm	Without Welded Flange Plate		With Welded Flange Plate		
							Beam Factor C1 kN	Stiff Bearing Factor C2 kN/mm	Beam Factor C1 kN	Stiff Bearing Factor C2 kN/mm	
250 x 150	5.0	30.1	35.5	3.55	88.8	3.55	159	0.635	244	0.977	492
	6.0	35.8	51.1	4.26	128	4.26	237	0.947	393	1.57	584
	6.3 #	37.2	56.4	4.47	141	4.47	262	1.05	444	1.77	607
	8.0	46.5	90.9	5.68	227	5.68	416	1.66	771	3.08	758
	10.0	57.0	142	7.10	355	7.10	608	2.43	1200	4.78	930
	12.0	66.0	204	8.52	511	8.52	804	3.22	1620	6.49	1080
	12.5	68.3	222	8.88	555	8.88	853	3.41	1730	6.91	1110
300 x 100	8.0	46.5	90.9	5.68	227	5.68	527	1.76	733	2.44	910
	10.0	57.0	142	7.10	355	7.10	821	2.74	1210	4.03	1120
300 x 200	6.0	45.2	51.1	4.26	128	4.26	219	0.731	352	1.17	708
	6.3 #	47.1	56.4	4.47	141	4.47	245	0.815	401	1.34	738
	8.0	59.1	90.9	5.68	227	5.68	404	1.35	733	2.44	925
	10.0	72.7	142	7.10	355	7.10	613	2.04	1210	4.03	1140
	12 #	84.8	204	8.52	511	8.52	831	2.77	1720	5.74	1330
400 x 200	6 #	54.7	51.1	4.26	128	4.26	217	0.542	284	0.709	951
	6.3 #	57.0	56.4	4.47	141	4.47	245	0.612	325	0.813	992
	8.0	71.6	90.9	5.68	227	5.68	434	1.08	626	1.56	1250
	10.0	88.4	142	7.10	355	7.10	711	1.78	1110	2.78	1540
	12 #	104	204	8.52	511	8.52	1020	2.56	1710	4.29	1800
450 x 250	6 #	64.1	51.1	4.26	128	4.26	198	0.439	257	0.572	1080
	6.3 #	66.9	56.4	4.47	141	4.47	224	0.497	295	0.656	1120
	8 #	84.2	90.9	5.68	227	5.68	402	0.894	575	1.28	1410
	10 #	104	142	7.10	355	7.10	670	1.49	1050	2.32	1750
	12 #	123	204	8.52	511	8.52	984	2.19	1650	3.67	2060
500 x 300	6 #	73.5	51.1	4.26	128	4.26	182	0.365	235	0.470	1200
	6.3 #	76.8	56.4	4.47	141	4.47	207	0.414	270	0.541	1250
	8 #	96.7	90.9	5.68	227	5.68	376	0.752	531	1.06	1580
	10 #	120	142	7.10	355	7.10	635	1.27	977	1.95	1960
	12 #	141	204	8.52	511	8.52	947	1.89	1570	3.14	2310
500 x 300	12.5 #	147	222	8.88	555	8.88	1030	2.06	1740	3.48	2400

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For bearing or buckling the web capacity =  $C1 + b_1 C2$  where  $b_1$  is the stiff bearing length.

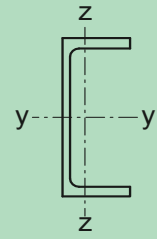
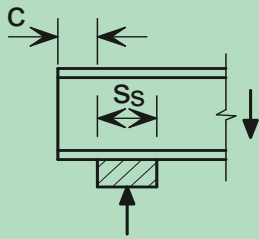
The beam component for end bearing assumes a sealing plate (thickness at least equal to the wall of the section) is welded to the end of the section by a continuous fillet weld.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 9.

PARALLEL FLANGE CHANNELS

Advance® UKPFC



Unstiffened webs

Section Designation	Design Shear Resistance $V_{c,Rd}$ kN	Position of Stiff Bearing	Design resistance of unstiffened web, $F_{Rd}$ (kN) and limiting length, $c_{lim}$ (mm)													
			Stiff bearing length, $s_s$ (mm)													
			0	10	20	30	40	50	75	100	150	200	250	300	350	
430x100x64	977	$F_{Rd}$ ( $c = 0$ )	154	196	247	396	436	467	545	622	775	928	1080	1180	1250	
		$c_{lim}$ (mm)	270	260	250	240	230	220	190	170	120	120	120	120	120	120
		$F_{Rd}$ ( $c \geq c_{lim}$ )	579	617	655	693	731	769	998	1040	1130	1210	1280	1350	1410	
380x100x54	757	$F_{Rd}$ ( $c = 0$ )	132	168	279	311	345	371	437	502	632	761	866	930	990	
		$c_{lim}$ (mm)	230	220	210	200	190	180	160	130	110	110	110	110	110	110
		$F_{Rd}$ ( $c \geq c_{lim}$ )	487	520	552	585	720	736	774	811	879	943	1000	1060	1110	
300x100x46	577	$F_{Rd}$ ( $c = 0$ )	121	156	198	246	295	326	404	481	637	801	872	939	1000	
		$c_{lim}$ (mm)	180	170	160	150	140	130	110	90	90	100	100	100	100	100
		$F_{Rd}$ ( $c \geq c_{lim}$ )	444	475	506	537	568	599	677	782	856	938	1000	1060	1110	
300x90x41	575	$F_{Rd}$ ( $c = 0$ )	111	147	192	242	284	316	396	476	636	802	875	943	1010	
		$c_{lim}$ (mm)	180	170	160	150	140	130	110	90	90	100	100	100	100	100
		$F_{Rd}$ ( $c \geq c_{lim}$ )	412	444	476	508	540	572	652	771	847	934	997	1060	1110	
260x90x35	451	$F_{Rd}$ ( $c = 0$ )	94.3	127	167	212	247	275	346	417	559	676	739	797	851	
		$c_{lim}$ (mm)	160	150	140	130	120	110	80	80	80	90	90	90	90	90
		$F_{Rd}$ ( $c \geq c_{lim}$ )	346	375	403	431	460	488	559	642	708	780	835	887	936	
260x75x28	397	$F_{Rd}$ ( $c = 0$ )	69.0	98.2	135	196	217	238	290	343	447	508	556	600	641	
		$c_{lim}$ (mm)	160	150	140	130	120	110	90	80	80	80	80	80	80	80
		$F_{Rd}$ ( $c \geq c_{lim}$ )	255	280	305	329	414	426	455	482	533	579	621	656	656	
230x90x32	380	$F_{Rd}$ ( $c = 0$ )	91.3	122	159	201	236	262	329	395	528	636	695	749	800	
		$c_{lim}$ (mm)	140	130	120	110	100	90	80	80	80	90	90	90	90	90
		$F_{Rd}$ ( $c \geq c_{lim}$ )	333	359	386	413	439	466	532	606	668	733	785	833	879	
230x75x26	333	$F_{Rd}$ ( $c = 0$ )	69.3	96.1	129	185	206	226	278	330	420	469	514	555	593	
		$c_{lim}$ (mm)	140	130	120	110	100	90	80	80	80	80	80	80	80	80
		$F_{Rd}$ ( $c \geq c_{lim}$ )	254	277	300	323	384	395	422	447	493	536	575	605	605	

Advance® and UKPFC are trademarks of Tata Steel. A fuller description of the relationship between Parallel Flange Channels (PFC) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

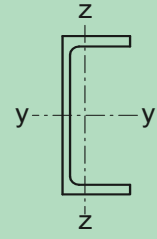
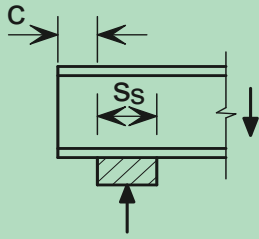
If  $c < c_{lim}$ , then use  $F_{Rd}$  value for  $c = 0$ .

Resistances assume no eccentricity of the applied force relative to the web.

FOR EXPLANATION OF TABLES SEE NOTE 9.

PARALLEL FLANGE CHANNELS

Advance® UKPFC



Unstiffened webs

Section Designation	Design Shear Resistance $V_{c,Rd}$ (kN)	Position of Stiff Bearing	Design resistance of unstiffened web, $F_{Rd}$ (kN) and limiting length, $c_{lim}$ (mm)												
			Stiff bearing length, $s_s$ (mm)												
			0	10	20	30	40	50	75	100	150	200	250	300	350
200x90x30	315	$F_{Rd}$ (c = 0)	88.2	116	151	190	224	249	311	373	497	599	655	707	755
		$c_{lim}$ (mm)	120	110	100	90	80	80	80	80	80	90	90	90	90
		$F_{Rd}$ (c $\geq$ $c_{lim}$ )	319	344	369	394	418	443	505	573	632	691	740	786	829
200x75x23	275	$F_{Rd}$ (c = 0)	66.6	91.2	122	156	179	201	267	319	387	432	473	511	546
		$c_{lim}$ (mm)	120	110	100	90	80	70	80	80	80	80	80	80	80
		$F_{Rd}$ (c $\geq$ $c_{lim}$ )	242	263	284	305	352	356	387	411	454	493	530	557	557
180x90x26	267	$F_{Rd}$ (c = 0)	75.9	102	135	172	200	223	280	338	453	540	591	638	682
		$c_{lim}$ (mm)	110	100	90	80	80	80	80	80	80	80	80	80	80
		$F_{Rd}$ (c $\geq$ $c_{lim}$ )	272	295	318	342	365	388	445	508	562	616	662	704	744
180x75x20	247	$F_{Rd}$ (c = 0)	55.9	81.1	113	143	164	186	239	292	398	447	491	531	568
		$c_{lim}$ (mm)	110	100	90	80	70	60	60	60	70	70	70	70	70
		$F_{Rd}$ (c $\geq$ $c_{lim}$ )	203	224	245	267	288	309	363	407	460	502	542	578	604
150x90x24	226	$F_{Rd}$ (c = 0)	72.9	99.5	132	170	195	218	276	334	449	565	652	704	753
		$c_{lim}$ (mm)	90	80	70	70	70	70	70	70	70	70	80	80	80
		$F_{Rd}$ (c $\geq$ $c_{lim}$ )	261	285	308	331	354	377	435	492	608	672	726	774	819
150x75x18	196	$F_{Rd}$ (c = 0)	51.0	74.1	103	131	150	170	219	267	368	413	454	492	526
		$c_{lim}$ (mm)	90	80	70	60	60	60	60	60	70	70	70	70	70
		$F_{Rd}$ (c $\geq$ $c_{lim}$ )	183	203	222	242	261	281	330	375	423	463	500	534	566
125x65x15	166	$F_{Rd}$ (c = 0)	45.1	68.7	98.7	122	142	161	210	259	357	453	498	540	579
		$c_{lim}$ (mm)	80	70	60	60	60	60	60	60	60	60	60	60	60
		$F_{Rd}$ (c $\geq$ $c_{lim}$ )	165	184	204	223	243	262	311	360	454	503	544	583	619
100x50x10	117	$F_{Rd}$ (c = 0)	33.7	55.9	83.2	101	119	136	181	225	314	403	460	500	536
		$c_{lim}$ (mm)	60	50	50	50	50	50	50	50	50	50	50	50	50
		$F_{Rd}$ (c $\geq$ $c_{lim}$ )	126	143	161	179	197	214	259	303	392	455	497	534	568

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If  $c < c_{lim}$ , then use  $F_{Rd}$  value for  $c = 0$ .

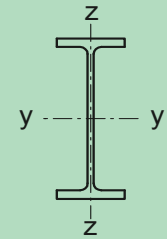
Resistances assume no eccentricity of the applied force relative to the web.

FOR EXPLANATION OF TABLES SEE NOTE 9.



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UNIVERSAL BEAMS  
Advance® UKB



Cross-section resistance check

Section Designation and Axial Force Resistance $N_{pl,Rd}$ (kN)	n Limit Class 3 Class 2	Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$											
		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
		$M_{c,y,Rd}$	$M_{c,z,Rd}$	$M_{N,y,Rd}$	$M_{N,z,Rd}$								
1016x305x487 + $N_{pl,Rd} = 20800$	n/a <b>1.00</b>	$M_{c,y,Rd}$	7770	7770	7770	7770	7770	7770	7770	7770	7770	7770	7770
		$M_{c,z,Rd}$	938	938	938	938	938	938	938	938	938	938	938
		$M_{N,y,Rd}$	7770	7770	7770	7080	6060	5050	4040	3030	2020	1010	0
		$M_{N,z,Rd}$	938	938	938	938	938	933	876	754	567	316	0
1016x305x437 + $N_{pl,Rd} = 18700$	1.00 <b>0.409</b>	$M_{c,y,Rd}$	6960	6960	6960	6960	6960	5940	5940	5940	5940	5940	5940
		$M_{c,z,Rd}$	826	826	826	826	826	514	514	514	514	514	514
		$M_{N,y,Rd}$	6960	6960	6960	6340	5430	-	-	-	-	-	-
		$M_{N,z,Rd}$	826	826	826	826	826	-	-	-	-	-	-
1016x305x393 + $N_{pl,Rd} = 16800$	0.983 <b>0.341</b>	$M_{c,y,Rd}$	6210	6210	6210	6210	5330	5330	5330	5330	5330	5330	\$
		$M_{c,z,Rd}$	726	726	726	726	453	453	453	453	453	453	\$
		$M_{N,y,Rd}$	6210	6210	6210	5670	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	726	726	726	726	-	-	-	-	-	-	-
1016x305x349 + $N_{pl,Rd} = 15400$	0.764 <b>0.231</b>	$M_{c,y,Rd}$	5720	5720	5720	4950	4950	4950	4950	4950	×	×	\$
		$M_{c,z,Rd}$	669	669	669	422	422	422	422	422	×	×	\$
		$M_{N,y,Rd}$	5720	5720	5720	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	669	669	669	-	-	-	-	-	-	-	-
1016x305x314 + $N_{pl,Rd} = 13800$	0.644 <b>0.177</b>	$M_{c,y,Rd}$	5120	5120	4440	4440	4440	4440	4440	×	×	×	\$
		$M_{c,z,Rd}$	591	591	373	373	373	373	373	×	×	×	\$
		$M_{N,y,Rd}$	5120	5120	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	591	591	-	-	-	-	-	-	-	-	-
1016x305x272 + $N_{pl,Rd} = 12000$	0.488 <b>0.105</b>	$M_{c,y,Rd}$	4430	4430	3860	3860	3860	×	×	×	×	\$	\$
		$M_{c,z,Rd}$	507	507	322	322	322	×	×	×	×	\$	\$
		$M_{N,y,Rd}$	4430	4430	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	507	507	-	-	-	-	-	-	-	-	-
1016x305x249 + $N_{pl,Rd} = 10900$	0.488 <b>0.115</b>	$M_{c,y,Rd}$	3920	3920	3390	3390	3390	×	×	×	×	\$	\$
		$M_{c,z,Rd}$	429	429	270	270	270	×	×	×	×	\$	\$
		$M_{N,y,Rd}$	3920	3920	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	429	429	-	-	-	-	-	-	-	-	-

Advance® and UKB are trademarks of Tata Steel. A fuller description of the relationship between Universal Beams (UB) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

+ These sections are in addition to the range of BS 4 sections

$N_{Ed}$  = Design value of the axial force.

$$n = N_{Ed} / N_{pl,Rd}$$

× Section becomes Class 4, see note 10.

\$ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

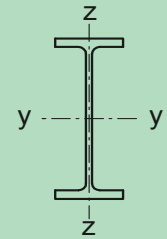
- Not applicable for Class 3 and Class 4 sections.

The values in this table are conservative for tension as the more onerous compression section classification limits have been used.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL BEAMS

Advance® UKB



Member buckling check

Section Designation and Resistances (kN, kNm)	n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
		L (m)	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
1016x305x487 + $N_{pl,Rd} = 20800$ $f_y W_{el,y} = 6610$ $f_y W_{el,z} = 580$	1.00	$N_{b,y,Rd}$	20800	20800	20800	20800	20800	20600	20400	20200	19900	19700	19400	19200	18900
	1.00	$N_{b,z,Rd}$	18800	16500	14100	11600	9400	7610	6220	5140	4310	3660	3140	2720	2380
		$M_{b,Rd}$	7770	7240	6380	5650	5030	4520	4090	3740	3440	3190	2970	2780	2620
1016x305x437 + $N_{pl,Rd} = 18700$ $f_y W_{el,y} = 5940$ $f_y W_{el,z} = 514$	1.00	$N_{b,y,Rd}$	18700	18700	18700	18700	18700	18500	18300	18100	17900	17700	17400	17200	17000
	1.00	$N_{b,z,Rd}$	16800	14800	12500	10300	8320	6720	5480	4530	3790	3220	2760	2390	2090
		0.409	$M_{b,Rd}$	5940	5670	5030	4480	4010	3610	3280	3000	2760	2560	2380	2230
* 1016x305x393 + $N_{pl,Rd} = 16800$ $f_y W_{el,y} = 5330$ $f_y W_{el,z} = 453$	0.983	$N_{b,y,Rd}$	16800	16800	16800	16800	16800	16600	16400	16200	16000	15800	15600	15400	15200
	0.983	$N_{b,z,Rd}$	15100	13200	11100	9110	7330	5910	4810	3970	3320	2820	2420	2090	1830
		0.341	$M_{b,Rd}$	5330	5040	4440	3930	3490	3120	2820	2560	2340	2160	2010	1870
* 1016x305x349 + $N_{pl,Rd} = 15400$ $f_y W_{el,y} = 4950$ $f_y W_{el,z} = 422$	0.764	$N_{b,y,Rd}$	15400	15400	15400	15400	15400	15300	15200	15000	14900	14800	14700	14600	14400
	0.764	$N_{b,z,Rd}$	14200	12800	11100	9150	7320	5840	4710	3860	3210	2700	2300	1990	1730
		0.231	$M_{b,Rd}$	4950	4640	4070	3570	3140	2790	2500	2250	2050	1880	1740	1610
* 1016x305x314 + $N_{pl,Rd} = 13800$ $f_y W_{el,y} = 4440$ $f_y W_{el,z} = 373$	0.644	$N_{b,y,Rd}$	13800	13800	13800	13800	13800	13700	13600	13500	13400	13300	13200	13100	13000
	0.644	$N_{b,z,Rd}$	12800	11500	9910	8130	6480	5160	4160	3400	2830	2380	2030	1750	1520
		0.177	$M_{b,Rd}$	4440	4130	3610	3150	2750	2430	2160	1940	1750	1600	1470	1360
* 1016x305x272 + $N_{pl,Rd} = 12000$ $f_y W_{el,y} = 3860$ $f_y W_{el,z} = 322$	0.488	$N_{b,y,Rd}$	12000	12000	12000	12000	12000	11900	11800	11700	11600	11500	11400	11300	11200
	0.488	$N_{b,z,Rd}$	11100	9960	8580	7030	5600	4460	3590	2940	2440	2050	1750	1510	1320
		0.105	$M_{b,Rd}$	3860	3570	3100	2690	2340	2040	1800	1600	1440	1310	1200	1100
* 1016x305x249 + $N_{pl,Rd} = 10900$ $f_y W_{el,y} = 3390$ $f_y W_{el,z} = 270$	0.488	$N_{b,y,Rd}$	10900	10900	10900	10900	10900	10900	10800	10700	10600	10500	10400	10300	10200
	0.488	$N_{b,z,Rd}$	10000	8950	7600	6120	4820	3810	3060	2490	2070	1740	1480	1280	1110
		0.115	$M_{b,Rd}$	3390	3100	2670	2300	1980	1720	1500	1330	1190	1070	975	894
		$M_{b,Rd}$	3920	3460	2940	2500	2130	1820	1580	1390	1240	1110	1010	924	851

Advance® and UKB are trademarks of Tata Steel. A fuller description of the relationship between Universal Beams (UB) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

+ These sections are in addition to the range of BS 4 sections

$$n = N_{Ed} / N_{pl,Rd}$$

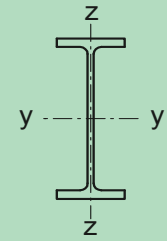
\* The section can become Class 4 under axial compression only. Under combined axial compression and bending the section becomes Class 4 when the Class 3  $N_{Ed} / N_{pl,Rd}$  limit is exceeded.

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit.

For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL BEAMS  
Advance® UKB



Cross-section resistance check

Section Designation and Axial Force Resistance $N_{pl,Rd}$ (kN)	n Limit Class 3 Class 2	Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$											
		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
		1016x305x222 + $N_{pl,Rd} = 9760$	0.458 <b>0.108</b>	$M_{c,y,Rd}$	3380	3380	2900	2900	2900	✗	✗	✗	✗
		$M_{c,z,Rd}$	352	352	219	219	219	✗	✗	✗	✗	\$	\$
		$M_{N,y,Rd}$	3380	3380	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	352	352	-	-	-	-	-	-	-	-	-
914x419x388 $N_{pl,Rd} = 17000$	0.892 <b>0.244</b>	$M_{c,y,Rd}$	6090	6090	6090	5390	5390	5390	5390	5390	5390	✗	\$
		$M_{c,z,Rd}$	1150	1150	1150	746	746	746	746	746	746	✗	\$
		$M_{N,y,Rd}$	6090	6090	6010	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	1150	1150	1150	-	-	-	-	-	-	-	-
914x419x343 $N_{pl,Rd} = 15100$	0.762 <b>0.198</b>	$M_{c,y,Rd}$	5340	5340	4740	4740	4740	4740	4740	4740	✗	✗	\$
		$M_{c,z,Rd}$	997	997	645	645	645	645	645	645	✗	✗	\$
		$M_{N,y,Rd}$	5340	5340	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	997	997	-	-	-	-	-	-	-	-	-
914x305x289 $N_{pl,Rd} = 12700$	0.730 <b>0.229</b>	$M_{c,y,Rd}$	4340	4340	4340	3750	3750	3750	3750	3750	✗	✗	\$
		$M_{c,z,Rd}$	552	552	552	350	350	350	350	350	✗	✗	\$
		$M_{N,y,Rd}$	4340	4340	4340	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	552	552	552	-	-	-	-	-	-	-	-
914x305x253 $N_{pl,Rd} = 11100$	0.591 <b>0.163</b>	$M_{c,y,Rd}$	3770	3770	3280	3280	3280	3280	✗	✗	✗	\$	\$
		$M_{c,z,Rd}$	473	473	300	300	300	300	✗	✗	✗	\$	\$
		$M_{N,y,Rd}$	3770	3770	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	473	473	-	-	-	-	-	-	-	-	-
914x305x224 $N_{pl,Rd} = 9870$	0.503 <b>0.124</b>	$M_{c,y,Rd}$	3290	3290	2850	2850	2850	✗	✗	✗	✗	\$	\$
		$M_{c,z,Rd}$	401	401	255	255	255	✗	✗	✗	✗	\$	\$
		$M_{N,y,Rd}$	3290	3290	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	401	401	-	-	-	-	-	-	-	-	-
914x305x201 $N_{pl,Rd} = 8830$	0.452 <b>0.104</b>	$M_{c,y,Rd}$	2880	2880	2490	2490	2490	✗	✗	✗	✗	\$	\$
		$M_{c,z,Rd}$	339	339	214	214	214	✗	✗	✗	✗	\$	\$
		$M_{N,y,Rd}$	2880	2880	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	339	339	-	-	-	-	-	-	-	-	-

Advance® and UKB are trademarks of Tata Steel. A fuller description of the relationship between Universal Beams (UB) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

+ These sections are in addition to the range of BS 4 sections

$N_{Ed}$  = Design value of the axial force.

$$n = N_{Ed} / N_{pl,Rd}$$

✗ Section becomes Class 4, see note 10.

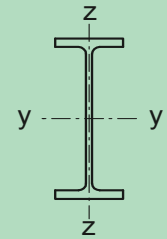
\$ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

- Not applicable for Class 3 and Class 4 sections.

The values in this table are conservative for tension as the more onerous compression section classification limits have been used.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL BEAMS  
Advance® UKB



Member buckling check

Section Designation and Resistances (kN, kNm)	n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
		L (m)	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
* 1016x305x222 + $N_{pl,Rd} = 9760$ $f_y W_{el,y} = 2900$ $f_y W_{el,z} = 219$	0.458	$N_{b,y,Rd}$	9760	9760	9760	9760	9760	9680	9610	9530	9450	9370	9280	9190	9100
		$N_{b,z,Rd}$	8870	7830	6530	5160	4020	3150	2520	2050	1690	1420	1210	1040	908
	0.458	$M_{b,Rd}$	2900	2610	2240	1910	1630	1400	1220	1070	949	851	770	703	647
		<b>0.108</b>	$M_{b,Rd}$	3380	2930	2470	2080	1750	1490	1280	1120	989	884	798	726
* 914x419x388 $N_{pl,Rd} = 17000$ $f_y W_{el,y} = 5390$ $f_y W_{el,z} = 746$	0.892	$N_{b,y,Rd}$	17000	17000	17000	17000	17000	16900	16800	16600	16500	16400	16200	16100	15900
		$N_{b,z,Rd}$	16600	15800	14800	13600	12300	10800	9360	8050	6910	5960	5170	4510	3970
	0.892	$M_{b,Rd}$	5390	5390	5260	4950	4640	4330	4040	3750	3490	3240	3020	2820	2640
		<b>0.244</b>	$M_{b,Rd}$	6090	6090	5860	5470	5100	4720	4360	4020	3710	3430	3180	2950
* 914x419x343 $N_{pl,Rd} = 15100$ $f_y W_{el,y} = 4740$ $f_y W_{el,z} = 645$	0.762	$N_{b,y,Rd}$	15100	15100	15100	15100	15100	14900	14800	14700	14600	14500	14300	14200	14000
		$N_{b,z,Rd}$	14700	13900	13000	12000	10700	9440	8150	6990	5990	5160	4470	3900	3430
	0.762	$M_{b,Rd}$	4740	4740	4600	4320	4030	3750	3470	3210	2960	2740	2540	2360	2200
		<b>0.198</b>	$M_{b,Rd}$	5340	5340	5110	4760	4420	4070	3740	3430	3140	2890	2660	2460
* 914x305x289 $N_{pl,Rd} = 12700$ $f_y W_{el,y} = 3750$ $f_y W_{el,z} = 350$	0.730	$N_{b,y,Rd}$	12700	12700	12700	12700	12700	12600	12500	12400	12300	12200	12000	11900	11800
		$N_{b,z,Rd}$	11800	10700	9250	7650	6140	4910	3970	3250	2700	2280	1940	1680	1460
	0.730	$M_{b,Rd}$	3750	3600	3290	2970	2660	2380	2130	1910	1730	1570	1440	1330	1230
		<b>0.229</b>	$M_{b,Rd}$	4340	4080	3680	3280	2900	2560	2260	2010	1810	1640	1490	1370
* 914x305x253 $N_{pl,Rd} = 11100$ $f_y W_{el,y} = 3280$ $f_y W_{el,z} = 300$	0.591	$N_{b,y,Rd}$	11100	11100	11100	11100	11100	11000	10900	10900	10800	10700	10600	10400	10300
		$N_{b,z,Rd}$	10300	9310	8050	6620	5290	4220	3400	2780	2310	1950	1660	1430	1250
	0.591	$M_{b,Rd}$	3280	3130	2840	2550	2270	2010	1780	1590	1430	1290	1170	1080	993
		<b>0.163</b>	$M_{b,Rd}$	3770	3530	3170	2810	2460	2150	1890	1670	1490	1340	1210	1110
* 914x305x224 $N_{pl,Rd} = 9870$ $f_y W_{el,y} = 2850$ $f_y W_{el,z} = 255$	0.503	$N_{b,y,Rd}$	9870	9870	9870	9870	9840	9760	9680	9600	9510	9420	9330	9230	9130
		$N_{b,z,Rd}$	9090	8170	7010	5710	4530	3600	2900	2370	1960	1650	1410	1220	1060
	0.503	$M_{b,Rd}$	2850	2710	2450	2190	1930	1690	1490	1310	1170	1050	951	867	797
		<b>0.124</b>	$M_{b,Rd}$	3290	3050	2730	2400	2080	1800	1570	1370	1220	1090	980	891
* 914x305x201 $N_{pl,Rd} = 8830$ $f_y W_{el,y} = 2490$ $f_y W_{el,z} = 214$	0.452	$N_{b,y,Rd}$	8830	8830	8830	8830	8800	8730	8660	8580	8500	8420	8330	8240	8150
		$N_{b,z,Rd}$	8090	7220	6120	4930	3880	3060	2450	2000	1660	1390	1190	1020	891
	0.452	$M_{b,Rd}$	2490	2340	2110	1870	1640	1420	1240	1090	962	859	773	702	642
		<b>0.104</b>	$M_{b,Rd}$	2880	2650	2350	2050	1770	1520	1310	1140	999	887	796	721

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+ These sections are in addition to the range of BS 4 sections

$$n = N_{Ed} / N_{pl,Rd}$$

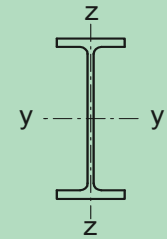
\* The section can become Class 4 under axial compression only. Under combined axial compression and bending the section becomes Class 4 when the Class 3  $N_{Ed} / N_{pl,Rd}$  limit is exceeded.

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit.

For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL BEAMS  
Advance® UKB



Cross-section resistance check

Section Designation and Axial Force Resistance $N_{pl,Rd}$ (kN)	n Limit Class 3 Class 2	Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$												
		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	
		$M_{c,y,Rd}$	$M_{c,z,Rd}$	$M_{N,y,Rd}$	$M_{N,z,Rd}$									
838x292x226 $N_{pl,Rd} = 9970$	0.599 <b>0.160</b>	$M_{c,y,Rd}$	3160	3160	2750	2750	2750	2750	2750	×	×	×	×	\$
		$M_{c,z,Rd}$	418	418	267	267	267	267	267	×	×	×	×	\$
		$M_{N,y,Rd}$	3160	3160	-	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	418	418	-	-	-	-	-	-	-	-	-	-
838x292x194 $N_{pl,Rd} = 8520$	0.503 <b>0.123</b>	$M_{c,y,Rd}$	2640	2640	2290	2290	2290	2290	×	×	×	×	\$	\$
		$M_{c,z,Rd}$	336	336	214	214	214	214	×	×	×	×	\$	\$
		$M_{N,y,Rd}$	2640	2640	-	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	336	336	-	-	-	-	-	-	-	-	-	-
838x292x176 $N_{pl,Rd} = 7730$	0.456 <b>0.104</b>	$M_{c,y,Rd}$	2350	2350	2030	2030	2030	2030	×	×	×	×	\$	\$
		$M_{c,z,Rd}$	290	290	185	185	185	185	×	×	×	×	\$	\$
		$M_{N,y,Rd}$	2350	2350	-	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	290	290	-	-	-	-	-	-	-	-	-	-
762x267x197 $N_{pl,Rd} = 8660$	0.682 <b>0.201</b>	$M_{c,y,Rd}$	2470	2470	2470	2150	2150	2150	2150	×	×	×	×	\$
		$M_{c,z,Rd}$	331	331	331	210	210	210	210	×	×	×	×	\$
		$M_{N,y,Rd}$	2470	2470	2470	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	331	331	331	-	-	-	-	-	-	-	-	-
762x267x173 $N_{pl,Rd} = 7590$	0.584 <b>0.161</b>	$M_{c,y,Rd}$	2140	2140	1860	1860	1860	1860	1860	×	×	×	\$	\$
		$M_{c,z,Rd}$	278	278	177	177	177	177	177	×	×	×	\$	\$
		$M_{N,y,Rd}$	2140	2140	-	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	278	278	-	-	-	-	-	-	-	-	-	-
762x267x147 $N_{pl,Rd} = 6450$	0.470 <b>0.110</b>	$M_{c,y,Rd}$	1780	1780	1540	1540	1540	1540	1540	×	×	×	×	\$
		$M_{c,z,Rd}$	223	223	142	142	142	142	142	×	×	×	×	\$
		$M_{N,y,Rd}$	1780	1780	-	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	223	223	-	-	-	-	-	-	-	-	-	-
762x267x134 $N_{pl,Rd} = 6070$	0.397 <b>0.073</b>	$M_{c,y,Rd}$	1650	1430	1430	1430	×	×	×	×	×	×	\$	\$
		$M_{c,z,Rd}$	202	129	129	129	×	×	×	×	×	×	\$	\$
		$M_{N,y,Rd}$	1650	-	-	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	202	-	-	-	-	-	-	-	-	-	-	-

Advance® and UKB are trademarks of Tata Steel. A fuller description of the relationship between Universal Beams (UB) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

$N_{Ed}$  = Design value of the axial force.

$$n = N_{Ed} / N_{pl,Rd}$$

× Section becomes Class 4, see note 10.

\$ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

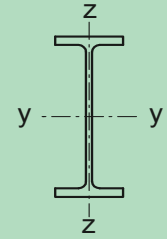
- Not applicable for Class 3 and Class 4 sections.

The values in this table are conservative for tension as the more onerous compression section classification limits have been used.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL BEAMS

Advance® UKB



Member buckling check

Section Designation and Resistances (kN, kNm)	n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
		L (m)	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
* 838x292x226 $N_{pl,Rd} = 9970$ $f_y W_{el,y} = 2750$ $f_y W_{el,z} = 267$	0.599	$N_{b,y,Rd}$	9970	9970	9970	9970	9910	9830	9740	9650	9560	9460	9360	9250	9130
		$N_{b,z,Rd}$	9190	8260	7080	5770	4580	3640	2930	2390	1980	1670	1420	1230	1070
	0.599	$M_{b,Rd}$	2750	2610	2360	2110	1870	1660	1470	1310	1170	1060	966	887	819
		<b>0.160</b> $M_{b,Rd}$	3160	2930	2620	2310	2020	1760	1540	1360	1220	1100	996	912	841
* 838x292x194 $N_{pl,Rd} = 8520$ $f_y W_{el,y} = 2290$ $f_y W_{el,z} = 214$	0.503	$N_{b,y,Rd}$	8520	8520	8520	8520	8460	8390	8320	8240	8150	8070	7980	7880	7770
		$N_{b,z,Rd}$	7800	6960	5900	4740	3730	2950	2360	1930	1600	1340	1140	985	857
	0.503	$M_{b,Rd}$	2290	2150	1930	1710	1500	1310	1150	1010	898	805	728	664	610
		<b>0.123</b> $M_{b,Rd}$	2640	2420	2150	1870	1620	1390	1200	1050	930	831	749	681	624
* 838x292x176 $N_{pl,Rd} = 7730$ $f_y W_{el,y} = 2030$ $f_y W_{el,z} = 185$	0.456	$N_{b,y,Rd}$	7730	7730	7730	7730	7670	7600	7530	7460	7380	7300	7220	7130	7030
		$N_{b,z,Rd}$	7040	6240	5230	4170	3250	2560	2050	1670	1380	1160	987	850	739
	0.456	$M_{b,Rd}$	2030	1900	1700	1500	1300	1130	979	857	757	675	608	552	505
		<b>0.104</b> $M_{b,Rd}$	2350	2140	1890	1630	1400	1200	1030	892	784	696	625	566	510
* 762x267x197 $N_{pl,Rd} = 8660$ $f_y W_{el,y} = 2150$ $f_y W_{el,z} = 210$	0.682	$N_{b,y,Rd}$	8660	8660	8660	8640	8560	8480	8390	8300	8210	8110	8000	7880	7760
		$N_{b,z,Rd}$	7840	6890	5700	4480	3470	2720	2170	1760	1460	1220	1040	896	779
	0.682	$M_{b,Rd}$	2150	1980	1770	1570	1370	1200	1060	945	849	769	703	647	599
		<b>0.201</b> $M_{b,Rd}$	2470	2220	1960	1700	1470	1280	1110	985	880	794	723	664	614
* 762x267x173 $N_{pl,Rd} = 7590$ $f_y W_{el,y} = 1860$ $f_y W_{el,z} = 177$	0.584	$N_{b,y,Rd}$	7590	7590	7590	7570	7500	7430	7350	7270	7180	7090	7000	6890	6780
		$N_{b,z,Rd}$	6830	5980	4900	3810	2940	2290	1820	1480	1220	1030	873	752	654
	0.584	$M_{b,Rd}$	1860	1700	1510	1320	1150	994	868	766	682	614	557	510	471
		<b>0.161</b> $M_{b,Rd}$	2140	1910	1670	1430	1220	1050	908	795	705	632	572	523	478
* 762x267x147 $N_{pl,Rd} = 6450$ $f_y W_{el,y} = 1540$ $f_y W_{el,z} = 142$	0.470	$N_{b,y,Rd}$	6450	6450	6450	6430	6370	6300	6240	6170	6090	6020	5930	5840	5740
		$N_{b,z,Rd}$	5770	4990	4030	3100	2370	1840	1460	1190	979	821	698	601	522
	0.470	$M_{b,Rd}$	1540	1400	1230	1060	911	781	674	588	519	463	417	379	345
		<b>0.110</b> $M_{b,Rd}$	1770	1570	1360	1150	971	821	702	609	535	475	427	383	345
* 762x267x134 $N_{pl,Rd} = 6070$ $f_y W_{el,y} = 1430$ $f_y W_{el,z} = 129$	0.397	$N_{b,y,Rd}$	6070	6070	6070	6040	5980	5920	5860	5790	5720	5640	5550	5460	5360
		$N_{b,z,Rd}$	5380	4610	3670	2790	2120	1640	1300	1050	867	727	618	531	462
	0.397	$M_{b,Rd}$	1430	1280	1120	956	811	688	589	510	448	397	357	321	289
		<b>0.073</b> $M_{b,Rd}$	1630	1430	1230	1030	861	722	612	527	461	408	361	321	289

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$$n = N_{Ed} / N_{pl,Rd}$$

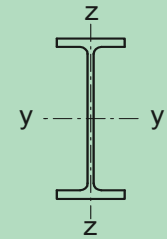
\* The section can become Class 4 under axial compression only. Under combined axial compression and bending the section becomes Class 4 when the Class 3  $N_{Ed} / N_{pl,Rd}$  limit is exceeded.

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit.

For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL BEAMS  
Advance® UKB



Cross-section resistance check

Section Designation and Axial Force Resistance $N_{pl,Rd}$ (kN)	n Limit Class 3 Class 2	Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$												
		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	
		$M_{c,y,Rd}$	$M_{c,z,Rd}$	$M_{N,y,Rd}$	$M_{N,z,Rd}$									
686x254x170 $N_{pl,Rd} = 7490$	0.726 <b>0.213</b>	$M_{c,y,Rd}$	1940	1940	1940	1700	1700	1700	1700	1700	1700	✗	✗	\$
		$M_{c,z,Rd}$	280	280	280	179	179	179	179	179	179	✗	✗	\$
		$M_{N,y,Rd}$	1940	1940	1940	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	280	280	280	-	-	-	-	-	-	-	-	-
686x254x152 $N_{pl,Rd} = 6690$	0.616 <b>0.166</b>	$M_{c,y,Rd}$	1730	1730	1510	1510	1510	1510	1510	1510	✗	✗	✗	\$
		$M_{c,z,Rd}$	245	245	157	157	157	157	157	157	✗	✗	✗	\$
		$M_{N,y,Rd}$	1730	1730	-	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	245	245	-	-	-	-	-	-	-	-	-	-
686x254x140 $N_{pl,Rd} = 6140$	0.548 <b>0.138</b>	$M_{c,y,Rd}$	1570	1570	1380	1380	1380	1380	✗	✗	✗	✗	\$	\$
		$M_{c,z,Rd}$	220	220	141	141	141	141	✗	✗	✗	✗	\$	\$
		$M_{N,y,Rd}$	1570	1570	-	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	220	220	-	-	-	-	-	-	-	-	-	-
686x254x125 $N_{pl,Rd} = 5490$	0.489 <b>0.115</b>	$M_{c,y,Rd}$	1380	1380	1200	1200	1200	✗	✗	✗	✗	✗	\$	\$
		$M_{c,z,Rd}$	187	187	119	119	119	✗	✗	✗	✗	✗	\$	\$
		$M_{N,y,Rd}$	1380	1380	-	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	187	187	-	-	-	-	-	-	-	-	-	-
610x305x238 $N_{pl,Rd} = 10500$	n/a <b>1.00</b>	$M_{c,y,Rd}$	2580	2580	2580	2580	2580	2580	2580	2580	2580	2580	2580	2580
		$M_{c,z,Rd}$	543	543	543	543	543	543	543	543	543	543	543	543
		$M_{N,y,Rd}$	2580	2580	2510	2200	1880	1570	1260	942	628	314	0	0
		$M_{N,z,Rd}$	543	543	543	543	540	515	465	387	284	155	0	0
610x305x179 $N_{pl,Rd} = 7870$	0.858 <b>0.222</b>	$M_{c,y,Rd}$	1910	1910	1910	1700	1700	1700	1700	1700	1700	✗	✗	\$
		$M_{c,z,Rd}$	395	395	395	256	256	256	256	256	256	✗	✗	\$
		$M_{N,y,Rd}$	1910	1910	1870	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	395	395	395	-	-	-	-	-	-	-	-	-
610x305x149 $N_{pl,Rd} = 6560$	0.636 <b>0.141</b>	$M_{c,y,Rd}$	1580	1580	1420	1420	1420	1420	1420	✗	✗	✗	✗	\$
		$M_{c,z,Rd}$	323	323	211	211	211	211	211	✗	✗	✗	✗	\$
		$M_{N,y,Rd}$	1580	1580	-	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	323	323	-	-	-	-	-	-	-	-	-	-

Advance® and UKB are trademarks of Tata Steel. A fuller description of the relationship between Universal Beams (UB) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

$N_{Ed}$  = Design value of the axial force.

$$n = N_{Ed} / N_{pl,Rd}$$

✗ Section becomes Class 4, see note 10.

\$ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

- Not applicable for Class 3 and Class 4 sections.

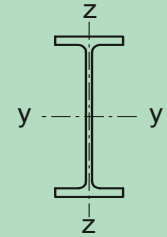
The values in this table are conservative for tension as the more onerous compression section classification limits have been used.

FOR EXPLANATION OF TABLES SEE NOTE 10.



UNIVERSAL BEAMS

Advance® UKB



Member buckling check

Section Designation and Resistances (kN, kNm)	n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
		L (m)	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
* 686x254x170 $N_{pl,Rd} = 7490$ $f_y W_{el,y} = 1700$ $f_y W_{el,z} = 179$	0.726	$N_{b,y,Rd}$	7490	7490	7490	7440	7360	7280	7190	7100	7010	6900	6790	6670	6530
		$N_{b,z,Rd}$	6730	5870	4790	3720	2860	2230	1770	1440	1190	996	847	729	634
	0.726	$M_{b,Rd}$	1700	1550	1370	1210	1060	925	816	727	654	593	543	500	464
		<b>0.213</b> $M_{b,Rd}$	1940	1730	1510	1310	1130	976	854	755	676	611	558	513	475
* 686x254x152 $N_{pl,Rd} = 6690$ $f_y W_{el,y} = 1510$ $f_y W_{el,z} = 157$	0.616	$N_{b,y,Rd}$	6690	6690	6690	6650	6580	6500	6430	6350	6260	6160	6060	5950	5820
		$N_{b,z,Rd}$	6000	5210	4230	3270	2500	1950	1550	1260	1040	870	740	636	553
	0.616	$M_{b,Rd}$	1510	1370	1210	1050	913	792	693	613	548	494	450	413	382
		<b>0.166</b> $M_{b,Rd}$	1720	1520	1330	1140	971	833	723	635	565	508	462	423	388
* 686x254x140 $N_{pl,Rd} = 6140$ $f_y W_{el,y} = 1380$ $f_y W_{el,z} = 141$	0.548	$N_{b,y,Rd}$	6140	6140	6140	6100	6030	5960	5890	5820	5740	5650	5550	5450	5330
		$N_{b,z,Rd}$	5490	4750	3830	2950	2250	1750	1390	1130	929	779	662	570	495
	0.548	$M_{b,Rd}$	1380	1240	1090	946	814	701	610	536	477	428	389	355	328
		<b>0.138</b> $M_{b,Rd}$	1560	1380	1200	1020	864	736	635	555	491	440	398	362	329
* 686x254x125 $N_{pl,Rd} = 5490$ $f_y W_{el,y} = 1200$ $f_y W_{el,z} = 119$	0.489	$N_{b,y,Rd}$	5490	5490	5490	5440	5380	5320	5260	5190	5110	5030	4940	4850	4740
		$N_{b,z,Rd}$	4870	4180	3330	2530	1920	1490	1180	955	788	660	561	483	419
	0.489	$M_{b,Rd}$	1200	1070	938	806	686	586	505	440	389	347	314	286	259
		<b>0.115</b> $M_{b,Rd}$	1360	1200	1030	868	728	614	525	455	400	356	320	286	259
610x305x238 $N_{pl,Rd} = 10500$ $f_y W_{el,y} = 2270$ $f_y W_{el,z} = 351$	1.00	$N_{b,y,Rd}$	10500	10500	10500	10300	10200	10100	9980	9840	9690	9530	9350	9150	8930
		$N_{b,z,Rd}$	9860	9080	8110	6960	5780	4730	3870	3200	2670	2260	1940	1670	1460
		$M_{b,Rd}$	2580	2490	2290	2090	1910	1740	1590	1450	1340	1240	1150	1070	1010
* 610x305x179 $N_{pl,Rd} = 7870$ $f_y W_{el,y} = 1700$ $f_y W_{el,z} = 256$	0.858	$N_{b,y,Rd}$	7870	7870	7870	7780	7690	7600	7500	7390	7270	7150	7010	6850	6680
		$N_{b,z,Rd}$	7390	6780	6030	5140	4230	3440	2810	2320	1940	1640	1400	1210	1060
	0.858	$M_{b,Rd}$	1700	1650	1520	1380	1250	1130	1020	924	841	770	709	657	611
		<b>0.222</b> $M_{b,Rd}$	1910	1830	1660	1500	1350	1200	1080	968	876	798	733	677	628
* 610x305x149 $N_{pl,Rd} = 6560$ $f_y W_{el,y} = 1420$ $f_y W_{el,z} = 211$	0.636	$N_{b,y,Rd}$	6560	6560	6550	6480	6410	6330	6240	6150	6050	5950	5830	5700	5550
		$N_{b,z,Rd}$	6150	5640	5000	4240	3480	2830	2310	1900	1590	1340	1150	990	863
	0.636	$M_{b,Rd}$	1420	1370	1250	1130	1010	905	808	723	652	591	540	496	459
		<b>0.141</b> $M_{b,Rd}$	1580	1510	1360	1220	1080	957	847	753	675	610	555	509	470

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$$n = N_{Ed} / N_{pl,Rd}$$

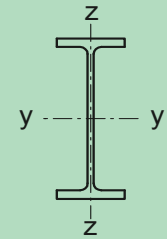
\* The section can become Class 4 under axial compression only. Under combined axial compression and bending the section becomes Class 4 when the Class 3  $N_{Ed} / N_{pl,Rd}$  limit is exceeded.

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit.

For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL BEAMS  
Advance® UKB



Cross-section resistance check

Section Designation and Axial Force Resistance $N_{pl,Rd}$ (kN)	n Limit Class 3 Class 2	Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$												
		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	
		$M_{c,y,Rd}$	$M_{c,z,Rd}$	$M_{N,y,Rd}$	$M_{N,z,Rd}$									
610x229x140 $N_{pl,Rd} = 6140$	0.744 <b>0.217</b>	$M_{c,y,Rd}$	1430	1430	1430	1250	1250	1250	1250	1250	1250	✗	✗	\$
		$M_{c,z,Rd}$	211	211	211	135	135	135	135	135	135	✗	✗	\$
		$M_{N,y,Rd}$	1430	1430	1430	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	211	211	211	-	-	-	-	-	-	-	-	-
610x229x125 $N_{pl,Rd} = 5490$	0.630 <b>0.169</b>	$M_{c,y,Rd}$	1270	1270	1110	1110	1110	1110	1110	1110	✗	✗	✗	\$
		$M_{c,z,Rd}$	185	185	118	118	118	118	118	118	✗	✗	✗	\$
		$M_{N,y,Rd}$	1270	1270	-	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	185	185	-	-	-	-	-	-	-	-	-	-
610x229x113 $N_{pl,Rd} = 4970$	0.554 <b>0.138</b>	$M_{c,y,Rd}$	1130	1130	992	992	992	992	992	✗	✗	✗	\$	\$
		$M_{c,z,Rd}$	162	162	104	104	104	104	104	✗	✗	✗	\$	\$
		$M_{N,y,Rd}$	1130	1130	-	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	162	162	-	-	-	-	-	-	-	-	-	-
610x229x101 $N_{pl,Rd} = 4580$	0.483 <b>0.111</b>	$M_{c,y,Rd}$	1020	1020	893	893	893	893	✗	✗	✗	✗	\$	\$
		$M_{c,z,Rd}$	142	142	90.9	90.9	90.9	90.9	✗	✗	✗	✗	\$	\$
		$M_{N,y,Rd}$	1020	1020	-	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	142	142	-	-	-	-	-	-	-	-	-	-
610x178x100 + $N_{pl,Rd} = 4420$	0.573 <b>0.169</b>	$M_{c,y,Rd}$	961	961	824	824	824	824	824	✗	✗	✗	\$	\$
		$M_{c,z,Rd}$	102	102	63.8	63.8	63.8	63.8	63.8	✗	✗	✗	\$	\$
		$M_{N,y,Rd}$	961	961	-	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	102	102	-	-	-	-	-	-	-	-	-	-
610x178x92 + $N_{pl,Rd} = 4150$	0.520 <b>0.148</b>	$M_{c,y,Rd}$	891	891	760	760	760	760	760	✗	✗	✗	\$	\$
		$M_{c,z,Rd}$	91.6	91.6	57.2	57.2	57.2	57.2	57.2	✗	✗	✗	\$	\$
		$M_{N,y,Rd}$	891	891	-	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	91.6	91.6	-	-	-	-	-	-	-	-	-	-
610x178x82 + $N_{pl,Rd} = 3690$	0.436 <b>0.103</b>	$M_{c,y,Rd}$	779	779	663	663	663	663	✗	✗	✗	✗	\$	\$
		$M_{c,z,Rd}$	77.4	77.4	48.3	48.3	48.3	48.3	✗	✗	✗	✗	\$	\$
		$M_{N,y,Rd}$	779	779	-	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	77.4	77.4	-	-	-	-	-	-	-	-	-	-

Advance® and UKB are trademarks of Tata Steel. A fuller description of the relationship between Universal Beams (UB) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

+ These sections are in addition to the range of BS 4 sections

$N_{Ed}$  = Design value of the axial force.

$$n = N_{Ed} / N_{pl,Rd}$$

✗ Section becomes Class 4, see note 10.

\$ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

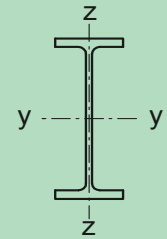
- Not applicable for Class 3 and Class 4 sections.

The values in this table are conservative for tension as the more onerous compression section classification limits have been used.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL BEAMS

Advance® UKB



Member buckling check

Section Designation and Resistances (kN, kNm)	n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
		L (m)	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
* 610x229x140 $N_{pl,Rd} = 6140$ $f_y W_{el,y} = 1250$ $f_y W_{el,z} = 135$	0.744	$N_{b,y,Rd}$	6140	6140	6130	6060	5990	5910	5830	5740	5640	5540	5420	5290	5140
		$N_{b,z,Rd}$	5390	4560	3570	2670	2020	1550	1230	993	818	685	582	500	434
	0.744	$M_{b,Rd}$	1240	1100	963	834	721	628	553	492	443	403	369	341	316
		<b>0.217</b>	$M_{b,Rd}$	1390	1220	1050	896	764	659	575	509	457	414	378	349
* 610x229x125 $N_{pl,Rd} = 5490$ $f_y W_{el,y} = 1110$ $f_y W_{el,z} = 118$	0.630	$N_{b,y,Rd}$	5490	5490	5480	5410	5350	5280	5210	5130	5040	4940	4840	4720	4580
		$N_{b,z,Rd}$	4800	4040	3140	2350	1770	1360	1070	868	714	598	508	437	379
	0.630	$M_{b,Rd}$	1100	971	844	724	619	534	466	412	369	333	304	280	259
		<b>0.169</b>	$M_{b,Rd}$	1230	1080	919	775	654	558	484	425	379	342	311	284
* 610x229x113 $N_{pl,Rd} = 4970$ $f_y W_{el,y} = 992$ $f_y W_{el,z} = 104$	0.554	$N_{b,y,Rd}$	4970	4970	4960	4900	4840	4780	4710	4630	4550	4460	4360	4250	4130
		$N_{b,z,Rd}$	4330	3620	2790	2070	1550	1190	941	760	626	524	444	382	332
	0.554	$M_{b,Rd}$	976	859	742	630	534	457	395	347	308	277	252	231	210
		<b>0.138</b>	$M_{b,Rd}$	1100	952	807	673	563	476	409	357	317	284	256	231
* 610x229x101 $N_{pl,Rd} = 4580$ $f_y W_{el,y} = 893$ $f_y W_{el,z} = 90.9$	0.483	$N_{b,y,Rd}$	4580	4580	4560	4510	4450	4390	4320	4250	4170	4080	3990	3880	3750
		$N_{b,z,Rd}$	3940	3240	2440	1790	1330	1020	805	649	534	447	379	325	283
	0.483	$M_{b,Rd}$	871	761	649	544	455	384	329	286	253	226	203	182	165
		<b>0.111</b>	$M_{b,Rd}$	980	843	705	579	477	399	340	294	259	229	203	182
* 610x178x100 + $N_{pl,Rd} = 4420$ $f_y W_{el,y} = 824$ $f_y W_{el,z} = 63.8$	0.573	$N_{b,y,Rd}$	4420	4420	4400	4350	4290	4230	4170	4100	4020	3940	3840	3730	3610
		$N_{b,z,Rd}$	3420	2430	1620	1120	812	613	478	383	314	261	221	190	164
	0.573	$M_{b,Rd}$	717	560	439	353	292	248	215	190	170	155	142	131	122
		<b>0.169</b>	$M_{b,Rd}$	803	611	470	372	305	258	223	196	175	159	145	134
* 610x178x92 + $N_{pl,Rd} = 4150$ $f_y W_{el,y} = 760$ $f_y W_{el,z} = 57.2$	0.520	$N_{b,y,Rd}$	4150	4150	4130	4080	4020	3970	3900	3830	3760	3670	3580	3470	3340
		$N_{b,z,Rd}$	3140	2170	1430	980	707	533	415	332	272	227	192	164	142
	0.520	$M_{b,Rd}$	649	500	387	307	251	212	182	160	143	129	118	109	101
		<b>0.148</b>	$M_{b,Rd}$	728	545	413	323	262	220	189	165	147	133	121	111
* 610x178x82 + $N_{pl,Rd} = 3690$ $f_y W_{el,y} = 663$ $f_y W_{el,z} = 48.3$	0.436	$N_{b,y,Rd}$	3690	3690	3670	3620	3580	3520	3470	3400	3330	3260	3170	3070	2960
		$N_{b,z,Rd}$	2740	1860	1210	828	596	449	349	280	229	191	161	138	120
	0.436	$M_{b,Rd}$	559	426	325	255	207	173	148	129	115	103	93.7	86.0	79.5
		<b>0.103</b>	$M_{b,Rd}$	627	464	347	268	216	179	153	133	118	106	96.0	87.9

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+ These sections are in addition to the range of BS 4 sections

$$n = N_{Ed} / N_{pl,Rd}$$

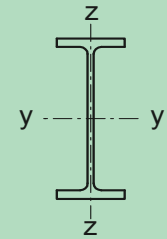
\* The section can become Class 4 under axial compression only. Under combined axial compression and bending the section becomes Class 4 when the Class 3  $N_{Ed} / N_{pl,Rd}$  limit is exceeded.

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit.

For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL BEAMS  
Advance® UKB



Cross-section resistance check

Section Designation and Axial Force Resistance $N_{pl,Rd}$ (kN)	n Limit Class 3 Class 2	Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$																					
		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0										
		533x312x272 + $N_{pl,Rd} = 12000$	n/a <b>1.00</b>	$M_{c,y,Rd}$	2710	2710	2710	2710	2710	2710	2710	2710	2710	2710	2710								
		$M_{c,z,Rd}$	685	685	685	685	685	685	685	685	685	685	685	685	685	685	685	685	685	685	685	685	685
		$M_{N,y,Rd}$	2710	2710	2570	2250	1920	1600	1280	962	642	321	0										
		$M_{N,z,Rd}$	685	685	685	685	673	632	563	465	339	184	0										
533x312x219 + $N_{pl,Rd} = 9630$	n/a <b>1.00</b>	$M_{c,y,Rd}$	2110	2110	2110	2110	2110	2110	2110	2110	2110	2110	2110	2110	2110	2110	2110	2110	2110	2110	2110	2110	2110
		$M_{c,z,Rd}$	522	522	522	522	522	522	522	522	522	522	522	522	522	522	522	522	522	522	522	522	522
		$M_{N,y,Rd}$	2110	2110	2030	1770	1520	1270	1010	761	507	254	0										
		$M_{N,z,Rd}$	522	522	522	522	517	490	440	365	267	145	0										
533x312x182 + $N_{pl,Rd} = 7970$	n/a <b>1.00</b>	$M_{c,y,Rd}$	1740	1740	1740	1740	1740	1740	1740	1740	1740	1740	1740	1740	1740	1740	1740	1740	1740	1740	1740	1740	1740
		$M_{c,z,Rd}$	427	427	427	427	427	427	427	427	427	427	427	427	427	427	427	427	427	427	427	427	427
		$M_{N,y,Rd}$	1740	1740	1670	1460	1250	1040	835	626	418	209	0										
		$M_{N,z,Rd}$	427	427	427	427	423	401	359	298	218	119	0										
533x312x150 + $N_{pl,Rd} = 6620$	0.886 <b>0.220</b>	$M_{c,y,Rd}$	1430	1430	1430	1280	1280	1280	1280	1280	1280	1280	1280	1280	1280	1280	1280	1280	1280	1280	1280	1280	1280
		$M_{c,z,Rd}$	348	348	348	227	227	227	227	227	227	227	227	227	227	227	227	227	227	227	227	227	227
		$M_{N,y,Rd}$	1430	1430	1380	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	348	348	348	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
533x210x138 + $N_{pl,Rd} = 6070$	1.00 <b>0.374</b>	$M_{c,y,Rd}$	1250	1250	1250	1250	1080	1080	1080	1080	1080	1080	1080	1080	1080	1080	1080	1080	1080	1080	1080	1080	1080
		$M_{c,z,Rd}$	196	196	196	196	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125
		$M_{N,y,Rd}$	1250	1250	1250	1110	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	196	196	196	196	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
533x210x122 $N_{pl,Rd} = 5350$	0.886 <b>0.272</b>	$M_{c,y,Rd}$	1100	1100	1100	964	964	964	964	964	964	964	964	964	964	964	964	964	964	964	964	964	964
		$M_{c,z,Rd}$	173	173	173	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110	110
		$M_{N,y,Rd}$	1100	1100	1100	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	173	173	173	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
533x210x109 $N_{pl,Rd} = 4800$	0.766 <b>0.224</b>	$M_{c,y,Rd}$	976	976	976	855	855	855	855	855	855	855	855	855	855	855	855	855	855	855	855	855	855
		$M_{c,z,Rd}$	150	150	150	96.3	96.3	96.3	96.3	96.3	96.3	96.3	96.3	96.3	96.3	96.3	96.3	96.3	96.3	96.3	96.3	96.3	96.3
		$M_{N,y,Rd}$	976	976	976	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	150	150	150	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Advance® and UKB are trademarks of Tata Steel. A fuller description of the relationship between Universal Beams (UB) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

+ These sections are in addition to the range of BS 4 sections

$N_{Ed}$  = Design value of the axial force.

$$n = N_{Ed} / N_{pl,Rd}$$

✘ Section becomes Class 4, see note 10.

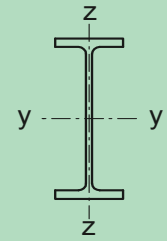
\$ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

- Not applicable for Class 3 and Class 4 sections.

The values in this table are conservative for tension as the more onerous compression section classification limits have been used.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL BEAMS  
Advance® UKB



Member buckling check

Section Designation and Resistances (kN, kNm)	n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm)													
		for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
		L (m)	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
533x312x272 + $N_{pl,Rd} = 12000$ $f_y W_{el,y} = 2380$ $f_y W_{el,z} = 444$	1.00	$N_{b,y,Rd}$	12000	12000	12000	11800	11700	11500	11300	11100	10900	10700	10500	10200	9840
	1.00	$N_{b,z,Rd}$	11400	10600	9600	8410	7120	5910	4890	4060	3410	2900	2480	2150	1880
		$M_{b,Rd}$	2710	2680	2550	2410	2280	2150	2030	1910	1790	1690	1590	1510	1430
533x312x219 + $N_{pl,Rd} = 9630$ $f_y W_{el,y} = 1860$ $f_y W_{el,z} = 339$	1.00	$N_{b,y,Rd}$	9630	9630	9580	9460	9340	9200	9060	8900	8730	8530	8310	8070	7790
	1.00	$N_{b,z,Rd}$	9120	8440	7600	6600	5530	4560	3760	3110	2610	2210	1900	1640	1430
		$M_{b,Rd}$	2110	2070	1950	1830	1710	1590	1470	1360	1260	1180	1100	1020	962
533x312x182 + $N_{pl,Rd} = 7970$ $f_y W_{el,y} = 1550$ $f_y W_{el,z} = 278$	1.00	$N_{b,y,Rd}$	7970	7970	7930	7830	7720	7610	7490	7360	7210	7050	6860	6660	6420
	1.00	$N_{b,z,Rd}$	7540	6960	6260	5410	4530	3720	3060	2530	2120	1800	1540	1330	1160
		$M_{b,Rd}$	1740	1700	1600	1490	1370	1260	1150	1050	965	887	819	760	709
* 533x312x150 + $N_{pl,Rd} = 6620$ $f_y W_{el,y} = 1280$ $f_y W_{el,z} = 227$	0.886	$N_{b,y,Rd}$	6620	6620	6590	6500	6410	6320	6220	6110	5980	5840	5690	5510	5310
	0.886	$N_{b,z,Rd}$	6260	5770	5170	4460	3720	3050	2500	2070	1730	1470	1250	1090	948
		$M_{b,Rd}$	1280	1260	1190	1110	1020	939	856	778	709	649	596	550	511
		0.220	$M_{b,Rd}$	1430	1390	1300	1210	1100	1000	903	815	737	670	613	565
533x210x138 + $N_{pl,Rd} = 6070$ $f_y W_{el,y} = 1080$ $f_y W_{el,z} = 125$	1.00	$N_{b,y,Rd}$	6070	6070	6030	5950	5860	5770	5670	5560	5440	5300	5150	4970	4770
	1.00	$N_{b,z,Rd}$	5230	4300	3240	2370	1770	1350	1070	860	707	591	502	431	374
		$M_{b,Rd}$	1060	937	821	715	626	552	492	444	403	370	342	318	297
		0.374	$M_{b,Rd}$	1200	1040	899	771	665	581	514	461	417	382	352	326
* 533x210x122 $N_{pl,Rd} = 5350$ $f_y W_{el,y} = 964$ $f_y W_{el,z} = 110$	0.886	$N_{b,y,Rd}$	5350	5350	5310	5240	5160	5080	5000	4900	4790	4670	4530	4380	4200
	0.886	$N_{b,z,Rd}$	4600	3780	2850	2080	1550	1190	936	754	620	519	440	378	328
		$M_{b,Rd}$	939	827	717	618	535	467	413	369	334	305	281	260	242
		0.272	$M_{b,Rd}$	1060	916	781	662	565	489	429	382	344	313	288	266
* 533x210x109 $N_{pl,Rd} = 4800$ $f_y W_{el,y} = 855$ $f_y W_{el,z} = 96.3$	0.766	$N_{b,y,Rd}$	4800	4800	4760	4690	4630	4550	4470	4390	4290	4180	4050	3910	3750
	0.766	$N_{b,z,Rd}$	4110	3350	2500	1830	1360	1040	816	658	541	452	384	329	286
		$M_{b,Rd}$	829	725	623	531	454	392	344	306	275	250	229	211	196
		0.224	$M_{b,Rd}$	930	801	676	566	478	409	356	315	282	256	234	213

Advance® and UKB are trademarks of Tata Steel. A fuller description of the relationship between Universal Beams (UB) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

+ These sections are in addition to the range of BS 4 sections

$$n = N_{Ed} / N_{pl,Rd}$$

\* The section can become Class 4 under axial compression only. Under combined axial compression and bending the section becomes Class 4 when the Class 3  $N_{Ed} / N_{pl,Rd}$  limit is exceeded.

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit.

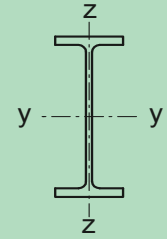
For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

FOR EXPLANATION OF TABLES SEE NOTE 10.



UNIVERSAL BEAMS

Advance® UKB



Member buckling check

Section Designation and Resistances (kN, kNm)	n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
		L (m)	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
* 533x210x101 $N_{pl,Rd} = 4450$ $f_y W_{el,y} = 791$ $f_y W_{el,z} = 88.3$	0.678	$N_{b,y,Rd}$	4450	4450	4420	4360	4290	4230	4150	4070	3980	3880	3760	3630	3480
		$N_{b,z,Rd}$	3800	3090	2300	1680	1240	952	749	603	496	415	352	302	262
	0.678	$M_{b,Rd}$	765	667	570	482	409	352	307	271	243	220	201	185	169
		<b>0.186</b> $M_{b,Rd}$	856	735	617	513	429	366	317	279	249	225	204	185	169
* 533x210x92 $N_{pl,Rd} = 4150$ $f_y W_{el,y} = 736$ $f_y W_{el,z} = 80.9$	0.586	$N_{b,y,Rd}$	4150	4150	4120	4060	4000	3930	3860	3780	3690	3590	3470	3340	3200
		$N_{b,z,Rd}$	3520	2820	2080	1500	1110	846	665	535	439	367	311	267	232
	0.586	$M_{b,Rd}$	706	611	516	431	361	307	266	233	208	187	170	154	140
		<b>0.150</b> $M_{b,Rd}$	790	672	557	456	378	319	274	240	213	190	170	154	140
* 533x210x82 $N_{pl,Rd} = 3730$ $f_y W_{el,y} = 639$ $f_y W_{el,z} = 68.2$	0.533	$N_{b,y,Rd}$	3730	3730	3690	3640	3580	3520	3450	3380	3300	3200	3090	2970	2830
		$N_{b,z,Rd}$	3120	2470	1790	1280	946	721	565	455	373	312	264	227	197
	0.533	$M_{b,Rd}$	610	524	438	361	299	251	215	188	166	149	132	119	109
		<b>0.132</b> $M_{b,Rd}$	684	577	472	381	312	260	222	193	170	149	132	119	109
* 533x165x85 + $N_{pl,Rd} = 3730$ $f_y W_{el,y} = 627$ $f_y W_{el,z} = 52.8$	0.624	$N_{b,y,Rd}$	3730	3730	3690	3640	3580	3520	3460	3390	3300	3210	3100	2980	2850
		$N_{b,z,Rd}$	2810	1940	1270	874	631	475	370	296	243	202	171	146	127
	0.624	$M_{b,Rd}$	530	410	321	258	215	183	160	142	128	116	107	98.9	92.1
		<b>0.184</b> $M_{b,Rd}$	589	444	341	271	224	190	165	146	131	119	109	101	94.2
* 533x165x74 + $N_{pl,Rd} = 3380$ $f_y W_{el,y} = 551$ $f_y W_{el,z} = 44.4$	0.543	$N_{b,y,Rd}$	3380	3380	3340	3290	3240	3180	3120	3050	2970	2880	2770	2650	2520
		$N_{b,z,Rd}$	2460	1630	1060	719	517	389	302	242	198	165	139	119	103
	0.543	$M_{b,Rd}$	455	344	264	209	171	144	125	110	98.4	89.2	81.6	75.2	69.9
		<b>0.153</b> $M_{b,Rd}$	506	372	280	219	178	149	129	113	101	91.4	83.5	76.9	71.1
* 533x165x66 + $N_{pl,Rd} = 2970$ $f_y W_{el,y} = 474$ $f_y W_{el,z} = 36.9$	0.457	$N_{b,y,Rd}$	2970	2970	2930	2890	2840	2790	2740	2670	2600	2520	2420	2310	2190
		$N_{b,z,Rd}$	2120	1380	881	598	429	322	251	200	164	136	115	98.8	85.6
	0.457	$M_{b,Rd}$	385	287	217	170	137	115	98.6	86.4	76.9	69.3	63.2	58.1	53.8
		<b>0.111</b> $M_{b,Rd}$	428	311	230	177	143	119	102	88.7	78.8	70.9	64.6	58.8	53.8
457x191x161 + $N_{pl,Rd} = 7110$ $f_y W_{el,y} = 1120$ $f_y W_{el,z} = 147$	1.00	$N_{b,y,Rd}$	7110	7110	7010	6900	6780	6660	6510	6350	6170	5950	5710	5440	5140
		$N_{b,z,Rd}$	6060	4920	3660	2660	1970	1510	1190	955	785	657	557	478	415
		$M_{b,Rd}$	1250	1110	985	876	785	708	644	590	544	505	471	441	415

Advance® and UKB are trademarks of Tata Steel. A fuller description of the relationship between Universal Beams (UB) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

+ These sections are in addition to the range of BS 4 sections

$$n = N_{Ed} / N_{pl,Rd}$$

\* The section can become Class 4 under axial compression only. Under combined axial compression and bending the section becomes Class 4 when the Class 3  $N_{Ed} / N_{pl,Rd}$  limit is exceeded.

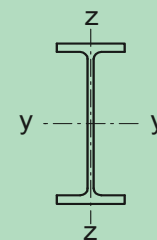
Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit.

For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL BEAMS

Advance® UKB



Cross-section resistance check

Section Designation and Axial Force Resistance $N_{pl,Rd}$ (kN)	n Limit Class 3 Class 2	Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$											
		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
		$M_{c,y,Rd}$	$M_{c,z,Rd}$	$M_{N,y,Rd}$	$M_{N,z,Rd}$								
457x191x133 + $N_{pl,Rd} = 5870$	n/a <b>1.00</b>	$M_{c,y,Rd}$	1060	1060	1060	1060	1060	1060	1060	1060	1060	1060	1060
		$M_{c,z,Rd}$	185	185	185	185	185	185	185	185	185	185	185
		$M_{N,y,Rd}$	1060	1060	1050	922	790	658	527	395	263	132	0
		$M_{N,z,Rd}$	185	185	185	185	185	179	163	137	101	55.7	0
457x191x106 + $N_{pl,Rd} = 4660$	1.00 <b>0.359</b>	$M_{c,y,Rd}$	824	824	824	824	719	719	719	719	719	719	719
		$M_{c,z,Rd}$	140	140	140	140	89.4	89.4	89.4	89.4	89.4	89.4	89.4
		$M_{N,y,Rd}$	824	824	824	725	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	140	140	140	140	-	-	-	-	-	-	-
457x191x98 $N_{pl,Rd} = 4310$	0.954 <b>0.287</b>	$M_{c,y,Rd}$	770	770	770	675	675	675	675	675	675	675	\$
		$M_{c,z,Rd}$	131	131	131	83.8	83.8	83.8	83.8	83.8	83.8	83.8	\$
		$M_{N,y,Rd}$	770	770	768	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	131	131	131	-	-	-	-	-	-	-	-
457x191x89 $N_{pl,Rd} = 3930$	0.839 <b>0.242</b>	$M_{c,y,Rd}$	695	695	695	611	611	611	611	611	611	×	\$
		$M_{c,z,Rd}$	117	117	117	75.2	75.2	75.2	75.2	75.2	75.2	×	\$
		$M_{N,y,Rd}$	695	695	695	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	117	117	117	-	-	-	-	-	-	-	-
457x191x82 $N_{pl,Rd} = 3690$	0.745 <b>0.210</b>	$M_{c,y,Rd}$	650	650	650	572	572	572	572	572	×	×	\$
		$M_{c,z,Rd}$	108	108	108	69.6	69.6	69.6	69.6	69.6	×	×	\$
		$M_{N,y,Rd}$	650	650	650	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	108	108	108	-	-	-	-	-	-	-	-
457x191x74 $N_{pl,Rd} = 3360$	0.632 <b>0.161</b>	$M_{c,y,Rd}$	587	587	518	518	518	518	518	×	×	×	\$
		$M_{c,z,Rd}$	96.6	96.6	62.5	62.5	62.5	62.5	62.5	×	×	×	\$
		$M_{N,y,Rd}$	587	587	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	96.6	96.6	-	-	-	-	-	-	-	-	-
457x191x67 $N_{pl,Rd} = 3040$	0.569 <b>0.139</b>	$M_{c,y,Rd}$	522	522	460	460	460	460	×	×	×	×	\$
		$M_{c,z,Rd}$	84.1	84.1	54.3	54.3	54.3	54.3	×	×	×	×	\$
		$M_{N,y,Rd}$	522	522	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	84.1	84.1	-	-	-	-	-	-	-	-	-

Advance® and UKB are trademarks of Tata Steel. A fuller description of the relationship between Universal Beams (UB) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

+ These sections are in addition to the range of BS 4 sections

$N_{Ed}$  = Design value of the axial force.

$$n = N_{Ed} / N_{pl,Rd}$$

× Section becomes Class 4, see note 10.

\$ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

- Not applicable for Class 3 and Class 4 sections.

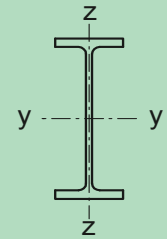
The values in this table are conservative for tension as the more onerous compression section classification limits have been used.

FOR EXPLANATION OF TABLES SEE NOTE 10.



UNIVERSAL BEAMS

Advance® UKB



Member buckling check

Section Designation and Resistances (kN, kNm)	n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm)													
		for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
		L (m)	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
457x191x133 + $N_{pl,Rd} = 5870$ $f_y W_{el,y} = 917$ $f_y W_{el,z} = 118$	1.00	$N_{b,y,Rd}$	5870	5870	5780	5690	5590	5480	5360	5220	5060	4880	4670	4440	4180
	1.00	$N_{b,z,Rd}$	4960	3980	2930	2110	1560	1190	936	753	619	517	439	377	327
		$M_{b,Rd}$	1010	880	765	667	586	521	468	424	388	358	332	310	291
457x191x106 + $N_{pl,Rd} = 4660$ $f_y W_{el,y} = 719$ $f_y W_{el,z} = 89.4$	1.00	$N_{b,y,Rd}$	4660	4650	4580	4510	4430	4340	4240	4130	3990	3840	3670	3470	3260
	1.00	$N_{b,z,Rd}$	3900	3090	2240	1610	1180	901	707	569	467	390	331	284	246
		0.359	$M_{b,Rd}$	688	601	519	448	389	342	305	274	249	229	211	197
* 457x191x98 $N_{pl,Rd} = 4310$ $f_y W_{el,y} = 675$ $f_y W_{el,z} = 83.8$	0.954	$N_{b,y,Rd}$	4310	4310	4250	4180	4100	4020	3930	3820	3700	3560	3400	3230	3030
	0.954	$N_{b,z,Rd}$	3620	2870	2080	1490	1100	838	657	529	434	363	308	264	229
		0.287	$M_{b,Rd}$	645	561	482	413	356	312	276	248	225	206	190	176
* 457x191x89 $N_{pl,Rd} = 3930$ $f_y W_{el,y} = 611$ $f_y W_{el,z} = 75.2$	0.839	$N_{b,y,Rd}$	3930	3930	3870	3810	3740	3660	3580	3480	3370	3240	3100	2930	2750
	0.839	$N_{b,z,Rd}$	3290	2590	1870	1340	987	751	589	474	389	325	276	236	205
		0.242	$M_{b,Rd}$	581	502	427	362	309	268	236	211	190	173	159	148
* 457x191x82 $N_{pl,Rd} = 3690$ $f_y W_{el,y} = 572$ $f_y W_{el,z} = 69.6$	0.745	$N_{b,y,Rd}$	3690	3680	3630	3570	3500	3430	3340	3250	3140	3010	2860	2700	2520
	0.745	$N_{b,z,Rd}$	3060	2370	1690	1200	882	670	525	422	346	289	245	210	182
		0.210	$M_{b,Rd}$	539	462	388	324	274	235	205	182	164	149	136	124
* 457x191x74 $N_{pl,Rd} = 3360$ $f_y W_{el,y} = 518$ $f_y W_{el,z} = 62.5$	0.632	$N_{b,y,Rd}$	3360	3350	3300	3240	3180	3120	3040	2950	2850	2740	2600	2450	2290
	0.632	$N_{b,z,Rd}$	2770	2140	1520	1080	792	602	471	379	311	259	220	189	164
		0.161	$M_{b,Rd}$	486	414	345	285	238	203	176	155	139	126	114	103
* 457x191x67 $N_{pl,Rd} = 3040$ $f_y W_{el,y} = 460$ $f_y W_{el,z} = 54.3$	0.569	$N_{b,y,Rd}$	3040	3030	2980	2930	2870	2810	2740	2660	2560	2450	2330	2190	2040
	0.569	$N_{b,z,Rd}$	2490	1900	1340	946	692	525	411	330	271	226	192	164	143
		0.139	$M_{b,Rd}$	430	364	299	245	202	171	147	129	114	102	91.6	82.9

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+ These sections are in addition to the range of BS 4 sections

$$n = N_{Ed} / N_{pl,Rd}$$

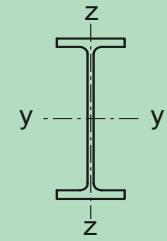
\* The section can become Class 4 under axial compression only. Under combined axial compression and bending the section becomes Class 4 when the Class 3  $N_{Ed} / N_{pl,Rd}$  limit is exceeded.

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit.

For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL BEAMS  
Advance® UKB



Cross-section resistance check

Section Designation and Axial Force Resistance $N_{pl,Rd}$ (kN)	n Limit Class 3 Class 2	Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$												
		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	
		$M_{c,y,Rd}$	$M_{c,z,Rd}$	$M_{N,y,Rd}$	$M_{N,z,Rd}$									
457x152x82 $N_{pl,Rd} = 3620$	0.839 <b>0.263</b>	$M_{c,y,Rd}$	625	625	625	542	542	542	542	542	542	542	✗	\$
		$M_{c,z,Rd}$	82.8	82.8	82.8	52.8	52.8	52.8	52.8	52.8	52.8	52.8	✗	\$
		$M_{N,y,Rd}$	625	625	625	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	82.8	82.8	82.8	-	-	-	-	-	-	-	-	-
457x152x74 $N_{pl,Rd} = 3260$	0.725 <b>0.214</b>	$M_{c,y,Rd}$	561	561	561	488	488	488	488	488	488	✗	✗	\$
		$M_{c,z,Rd}$	73.5	73.5	73.5	46.9	46.9	46.9	46.9	46.9	46.9	✗	✗	\$
		$M_{N,y,Rd}$	561	561	561	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	73.5	73.5	73.5	-	-	-	-	-	-	-	-	-
457x152x67 $N_{pl,Rd} = 3040$	0.632 <b>0.177</b>	$M_{c,y,Rd}$	516	516	448	448	448	448	448	448	✗	✗	✗	\$
		$M_{c,z,Rd}$	66.4	66.4	42.2	42.2	42.2	42.2	42.2	42.2	✗	✗	✗	\$
		$M_{N,y,Rd}$	516	516	-	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	66.4	66.4	-	-	-	-	-	-	-	-	-	-
457x152x60 $N_{pl,Rd} = 2710$	0.519 <b>0.125</b>	$M_{c,y,Rd}$	457	457	398	398	398	398	398	✗	✗	✗	\$	\$
		$M_{c,z,Rd}$	57.9	57.9	36.9	36.9	36.9	36.9	36.9	✗	✗	✗	\$	\$
		$M_{N,y,Rd}$	457	457	-	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	57.9	57.9	-	-	-	-	-	-	-	-	-	-
457x152x52 $N_{pl,Rd} = 2360$	0.456 <b>0.101</b>	$M_{c,y,Rd}$	389	389	337	337	337	✗	✗	✗	✗	\$	\$	
		$M_{c,z,Rd}$	47.2	47.2	30.2	30.2	30.2	✗	✗	✗	✗	\$	\$	
		$M_{N,y,Rd}$	389	389	-	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	47.2	47.2	-	-	-	-	-	-	-	-	-	-
406x178x85 + $N_{pl,Rd} = 3760$	1.00 <b>0.326</b>	$M_{c,y,Rd}$	598	598	598	598	524	524	524	524	524	524	524	524
		$M_{c,z,Rd}$	108	108	108	108	69.3	69.3	69.3	69.3	69.3	69.3	69.3	69.3
		$M_{N,y,Rd}$	598	598	595	521	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	108	108	108	108	-	-	-	-	-	-	-	-
406x178x74 $N_{pl,Rd} = 3350$	0.851 <b>0.239</b>	$M_{c,y,Rd}$	533	533	533	470	470	470	470	470	470	470	✗	\$
		$M_{c,z,Rd}$	94.8	94.8	94.8	61.1	61.1	61.1	61.1	61.1	61.1	61.1	✗	\$
		$M_{N,y,Rd}$	533	533	530	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	94.8	94.8	94.8	-	-	-	-	-	-	-	-	-

Advance® and UKB are trademarks of Tata Steel. A fuller description of the relationship between Universal Beams (UB) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

+ These sections are in addition to the range of BS 4 sections

$N_{Ed}$  = Design value of the axial force.

$$n = N_{Ed} / N_{pl,Rd}$$

✗ Section becomes Class 4, see note 10.

\$ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

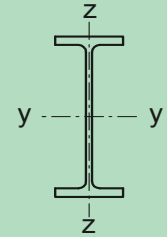
- Not applicable for Class 3 and Class 4 sections.

The values in this table are conservative for tension as the more onerous compression section classification limits have been used.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL BEAMS

Advance® UKB



Member buckling check

Section Designation and Resistances (kN, kNm)	n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
		L (m)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
* 457x152x82 $N_{pl,Rd} = 3620$ $f_y W_{el,y} = 542$ $f_y W_{el,z} = 52.8$	0.839	$N_{b,y,Rd}$	3620	3620	3620	3620	3620	3590	3560	3500	3440	3370	3290	3190	3090
		$N_{b,z,Rd}$	3380	3080	2700	2260	1840	1480	1200	820	591	445	346	277	227
	0.839	$M_{b,Rd}$	542	525	481	439	398	359	325	270	228	198	174	156	141
		<b>0.263</b> $M_{b,Rd}$	625	593	539	485	434	388	347	283	238	204	179	160	144
* 457x152x74 $N_{pl,Rd} = 3260$ $f_y W_{el,y} = 488$ $f_y W_{el,z} = 46.9$	0.725	$N_{b,y,Rd}$	3260	3260	3260	3260	3250	3230	3200	3150	3090	3030	2950	2870	2770
		$N_{b,z,Rd}$	3040	2760	2410	2010	1630	1310	1060	722	520	391	305	244	199
	0.725	$M_{b,Rd}$	488	470	430	390	351	315	283	232	194	167	146	130	117
		<b>0.214</b> $M_{b,Rd}$	561	530	480	430	382	339	301	243	201	172	150	133	118
* 457x152x67 $N_{pl,Rd} = 3040$ $f_y W_{el,y} = 448$ $f_y W_{el,z} = 42.2$	0.632	$N_{b,y,Rd}$	3040	3040	3040	3040	3030	3010	2980	2930	2870	2810	2740	2660	2560
		$N_{b,z,Rd}$	2810	2540	2200	1810	1450	1160	935	636	457	343	267	214	175
	0.632	$M_{b,Rd}$	448	428	389	350	312	278	247	199	164	140	122	108	95.1
		<b>0.177</b> $M_{b,Rd}$	516	483	434	385	338	297	261	207	170	144	125	108	95.1
* 457x152x60 $N_{pl,Rd} = 2710$ $f_y W_{el,y} = 398$ $f_y W_{el,z} = 36.9$	0.519	$N_{b,y,Rd}$	2710	2710	2710	2710	2700	2670	2650	2610	2560	2500	2440	2360	2270
		$N_{b,z,Rd}$	2500	2250	1940	1590	1270	1010	815	554	398	299	232	186	152
	0.519	$M_{b,Rd}$	398	379	343	307	272	240	212	168	137	116	99.9	87.0	76.3
		<b>0.125</b> $M_{b,Rd}$	457	425	381	336	293	255	223	174	142	119	101	87.0	76.3
* 457x152x52 $N_{pl,Rd} = 2360$ $f_y W_{el,y} = 337$ $f_y W_{el,z} = 30.2$	0.456	$N_{b,y,Rd}$	2360	2360	2360	2360	2350	2330	2320	2270	2230	2180	2120	2050	1970
		$N_{b,z,Rd}$	2170	1940	1650	1330	1050	833	668	452	324	243	189	151	123
	0.456	$M_{b,Rd}$	337	318	287	254	223	195	170	132	107	89.0	75.6	64.5	56.3
		<b>0.101</b> $M_{b,Rd}$	389	359	319	279	241	207	179	137	110	91.1	75.6	64.5	56.3
406x178x85 + $N_{pl,Rd} = 3760$ $f_y W_{el,y} = 524$ $f_y W_{el,z} = 69.3$	1.00	$N_{b,y,Rd}$	3760	3760	3760	3760	3740	3710	3670	3610	3530	3440	3340	3220	3090
		$N_{b,z,Rd}$	3610	3370	3090	2760	2390	2020	1690	1200	876	665	521	418	343
	1.00	$M_{b,Rd}$	524	524	494	460	427	395	364	312	269	236	210	189	171
		<b>0.326</b> $M_{b,Rd}$	598	594	552	509	468	429	393	330	282	246	217	194	176
* 406x178x74 $N_{pl,Rd} = 3350$ $f_y W_{el,y} = 470$ $f_y W_{el,z} = 61.1$	0.851	$N_{b,y,Rd}$	3350	3350	3350	3350	3330	3300	3270	3210	3140	3060	2970	2850	2730
		$N_{b,z,Rd}$	3200	2990	2720	2410	2060	1730	1440	1010	739	560	438	352	289
	0.851	$M_{b,Rd}$	470	470	437	404	372	341	312	261	222	192	169	151	136
		<b>0.239</b> $M_{b,Rd}$	533	525	485	445	406	368	333	275	231	199	174	155	139

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+ These sections are in addition to the range of BS 4 sections

$$n = N_{Ed} / N_{pl,Rd}$$

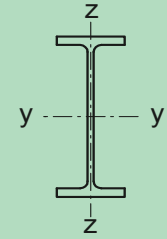
\* The section can become Class 4 under axial compression only. Under combined axial compression and bending the section becomes Class 4 when the Class 3  $N_{Ed} / N_{pl,Rd}$  limit is exceeded.

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit.

For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL BEAMS  
Advance® UKB



Cross-section resistance check

Section Designation and Axial Force Resistance $N_{pl,Rd}$ (kN)	n Limit Class 3 Class 2	Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$												
		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	
		$M_{c,y,Rd}$	$M_{c,z,Rd}$	$M_{N,y,Rd}$	$M_{N,z,Rd}$									
406x178x67 $N_{pl,Rd} = 3040$	0.752 <b>0.203</b>	$M_{c,y,Rd}$	478	478	478	422	422	422	422	422	422	✘	✘	\$
		$M_{c,z,Rd}$	84.1	84.1	84.1	54.3	54.3	54.3	54.3	54.3	54.3	✘	✘	\$
		$M_{N,y,Rd}$	478	478	478	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	84.1	84.1	84.1	-	-	-	-	-	-	-	-	-
406x178x60 $N_{pl,Rd} = 2720$	0.624 <b>0.151</b>	$M_{c,y,Rd}$	426	426	377	377	377	377	377	377	✘	✘	✘	\$
		$M_{c,z,Rd}$	74.2	74.2	47.9	47.9	47.9	47.9	47.9	47.9	✘	✘	✘	\$
		$M_{N,y,Rd}$	426	426	-	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	74.2	74.2	-	-	-	-	-	-	-	-	-	-
406x178x54 $N_{pl,Rd} = 2450$	0.595 <b>0.150</b>	$M_{c,y,Rd}$	375	375	330	330	330	330	330	✘	✘	✘	✘	\$
		$M_{c,z,Rd}$	63.2	63.2	40.8	40.8	40.8	40.8	40.8	✘	✘	✘	✘	\$
		$M_{N,y,Rd}$	375	375	-	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	63.2	63.2	-	-	-	-	-	-	-	-	-	-
406x140x53 + $N_{pl,Rd} = 2410$	0.624 <b>0.170</b>	$M_{c,y,Rd}$	366	366	319	319	319	319	319	319	✘	✘	✘	\$
		$M_{c,z,Rd}$	49.3	49.3	31.6	31.6	31.6	31.6	31.6	31.6	✘	✘	✘	\$
		$M_{N,y,Rd}$	366	366	-	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	49.3	49.3	-	-	-	-	-	-	-	-	-	-
406x140x46 $N_{pl,Rd} = 2080$	0.467 <b>0.097</b>	$M_{c,y,Rd}$	315	276	276	276	276	276	✘	✘	✘	✘	\$	\$
		$M_{c,z,Rd}$	41.9	27.0	27.0	27.0	27.0	27.0	✘	✘	✘	✘	\$	\$
		$M_{N,y,Rd}$	315	-	-	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	41.9	-	-	-	-	-	-	-	-	-	-	-
406x140x39 $N_{pl,Rd} = 1760$	0.410 <b>0.078</b>	$M_{c,y,Rd}$	257	223	223	223	223	223	✘	✘	✘	✘	\$	\$
		$M_{c,z,Rd}$	32.3	20.6	20.6	20.6	20.6	20.6	✘	✘	✘	✘	\$	\$
		$M_{N,y,Rd}$	257	-	-	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	32.3	-	-	-	-	-	-	-	-	-	-	-

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+ These sections are in addition to the range of BS 4 sections

$N_{Ed}$  = Design value of the axial force.

$$n = N_{Ed} / N_{pl,Rd}$$

✘ Section becomes Class 4, see note 10.

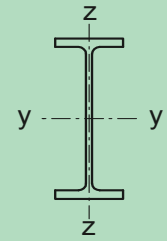
\$ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

- Not applicable for Class 3 and Class 4 sections.

The values in this table are conservative for tension as the more onerous compression section classification limits have been used.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL BEAMS  
Advance® UKB



Member buckling check

Section Designation and Resistances (kN, kNm)	n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
		L (m)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
* 406x178x67 $N_{pl,Rd} = 3040$ $f_y W_{el,y} = 422$ $f_y W_{el,z} = 54.3$	0.752	$N_{b,y,Rd}$	3040	3040	3040	3040	3010	2990	2960	2900	2840	2760	2680	2580	2460
		$N_{b,z,Rd}$	2890	2690	2450	2160	1840	1540	1280	897	654	496	388	311	255
	0.752	$M_{b,Rd}$	422	421	391	360	330	301	273	226	190	163	142	126	114
		<b>0.203</b> $M_{b,Rd}$	478	470	433	396	359	323	291	237	198	168	146	129	116
* 406x178x60 $N_{pl,Rd} = 2720$ $f_y W_{el,y} = 377$ $f_y W_{el,z} = 47.9$	0.624	$N_{b,y,Rd}$	2720	2720	2720	2720	2700	2670	2650	2590	2540	2470	2390	2300	2190
		$N_{b,z,Rd}$	2590	2410	2190	1930	1640	1370	1130	795	580	439	344	276	226
	0.624	$M_{b,Rd}$	377	375	347	319	291	264	239	195	162	138	120	105	94.3
		<b>0.151</b> $M_{b,Rd}$	426	418	384	350	316	283	253	204	168	142	122	108	95.5
* 406x178x54 $N_{pl,Rd} = 2450$ $f_y W_{el,y} = 330$ $f_y W_{el,z} = 40.8$	0.595	$N_{b,y,Rd}$	2450	2450	2450	2450	2430	2410	2380	2340	2280	2220	2150	2060	1960
		$N_{b,z,Rd}$	2330	2160	1950	1700	1430	1180	978	681	495	375	293	235	192
	0.595	$M_{b,Rd}$	330	327	302	276	251	226	202	163	134	113	97.0	85.0	75.3
		<b>0.150</b> $M_{b,Rd}$	375	365	334	303	272	242	215	170	139	116	99.3	86.6	75.3
* 406x140x53 + $N_{pl,Rd} = 2410$ $f_y W_{el,y} = 319$ $f_y W_{el,z} = 31.6$	0.624	$N_{b,y,Rd}$	2410	2410	2410	2410	2390	2370	2350	2300	2240	2180	2110	2020	1920
		$N_{b,z,Rd}$	2210	1970	1660	1330	1050	827	663	448	321	241	187	149	122
	0.624	$M_{b,Rd}$	319	299	269	239	211	185	164	130	108	91.4	79.4	69.5	61.3
		<b>0.170</b> $M_{b,Rd}$	366	335	298	261	226	197	172	135	111	93.7	80.3	69.5	61.3
* 406x140x46 $N_{pl,Rd} = 2080$ $f_y W_{el,y} = 276$ $f_y W_{el,z} = 27.0$	0.467	$N_{b,y,Rd}$	2080	2080	2080	2080	2060	2040	2020	1980	1940	1880	1820	1750	1660
		$N_{b,z,Rd}$	1900	1690	1420	1140	892	703	563	380	272	204	158	126	103
	0.467	$M_{b,Rd}$	276	257	230	203	177	155	135	106	86.2	72.4	62.0	53.3	46.8
		<b>0.097</b> $M_{b,Rd}$	315	287	254	220	190	163	141	110	88.5	74.0	62.0	53.3	46.8
* 406x140x39 $N_{pl,Rd} = 1760$ $f_y W_{el,y} = 223$ $f_y W_{el,z} = 20.6$	0.410	$N_{b,y,Rd}$	1760	1760	1760	1760	1750	1730	1710	1680	1630	1590	1530	1460	1380
		$N_{b,z,Rd}$	1590	1400	1150	903	698	545	434	292	208	156	121	96.7	78.9
	0.410	$M_{b,Rd}$	223	205	182	159	137	117	101	77.7	62.1	51.3	42.6	36.4	31.7
		<b>0.078</b> $M_{b,Rd}$	257	230	201	172	146	124	106	80.2	63.7	51.3	42.6	36.4	31.7

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+ These sections are in addition to the range of BS 4 sections

$$n = N_{Ed} / N_{pl,Rd}$$

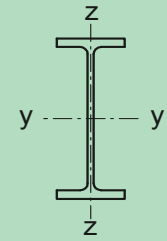
\* The section can become Class 4 under axial compression only. Under combined axial compression and bending the section becomes Class 4 when the Class 3  $N_{Ed} / N_{pl,Rd}$  limit is exceeded.

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit.

For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL BEAMS  
Advance® UKB



Cross-section resistance check

Section Designation and Axial Force Resistance $N_{pl,Rd}$ (kN)	n Limit Class 3 Class 2	Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$												
		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	
356x171x67 $N_{pl,Rd} = 3040$	0.997 <b>0.272</b>	$M_{c,y,Rd}$	430	430	430	380	380	380	380	380	380	380	\$	
		$M_{c,z,Rd}$	86.3	86.3	86.3	55.7	55.7	55.7	55.7	55.7	55.7	55.7	\$	
		$M_{N,y,Rd}$	430	430	420	-	-	-	-	-	-	-	-	
		$M_{N,z,Rd}$	86.3	86.3	86.3	-	-	-	-	-	-	-	-	
356x171x57 $N_{pl,Rd} = 2580$	0.832 <b>0.222</b>	$M_{c,y,Rd}$	359	359	359	318	318	318	318	318	318	318	×	\$
		$M_{c,z,Rd}$	70.6	70.6	70.6	45.8	45.8	45.8	45.8	45.8	45.8	45.8	×	\$
		$M_{N,y,Rd}$	359	359	355	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	70.6	70.6	70.6	-	-	-	-	-	-	-	-	-
356x171x51 $N_{pl,Rd} = 2300$	0.717 <b>0.181</b>	$M_{c,y,Rd}$	318	318	283	283	283	283	283	283	283	×	×	\$
		$M_{c,z,Rd}$	61.8	61.8	40.1	40.1	40.1	40.1	40.1	40.1	40.1	×	×	\$
		$M_{N,y,Rd}$	318	318	-	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	61.8	61.8	-	-	-	-	-	-	-	-	-	-
356x171x45 $N_{pl,Rd} = 2030$	0.651 <b>0.166</b>	$M_{c,y,Rd}$	275	275	244	244	244	244	244	244	×	×	×	\$
		$M_{c,z,Rd}$	52.2	52.2	33.7	33.7	33.7	33.7	33.7	33.7	×	×	×	\$
		$M_{N,y,Rd}$	275	275	-	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	52.2	52.2	-	-	-	-	-	-	-	-	-	-
356x127x39 $N_{pl,Rd} = 1770$	0.586 <b>0.150</b>	$M_{c,y,Rd}$	234	234	204	204	204	204	×	×	×	×	×	\$
		$M_{c,z,Rd}$	31.6	31.6	20.2	20.2	20.2	20.2	×	×	×	×	×	\$
		$M_{N,y,Rd}$	234	234	-	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	31.6	31.6	-	-	-	-	-	-	-	-	-	-
356x127x33 $N_{pl,Rd} = 1490$	0.487 <b>0.112</b>	$M_{c,y,Rd}$	193	193	168	168	168	×	×	×	×	×	\$	\$
		$M_{c,z,Rd}$	24.9	24.9	16.0	16.0	16.0	×	×	×	×	×	\$	\$
		$M_{N,y,Rd}$	193	193	-	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	24.9	24.9	-	-	-	-	-	-	-	-	-	-

Advance® and UKB are trademarks of Tata Steel. A fuller description of the relationship between Universal Beams (UB) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

$N_{Ed}$  = Design value of the axial force.

$$n = N_{Ed} / N_{pl,Rd}$$

× Section becomes Class 4, see note 10.

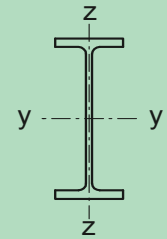
\$ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

- Not applicable for Class 3 and Class 4 sections.

The values in this table are conservative for tension as the more onerous compression section classification limits have been used.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL BEAMS  
Advance® UKB



Member buckling check

Section Designation and Resistances (kN, kNm)	n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
		L (m)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
* 356x171x67 $N_{pl,Rd} = 3040$ $f_y W_{el,y} = 380$ $f_y W_{el,z} = 55.7$	0.997	$N_{b,y,Rd}$	3040	3040	3040	3020	2990	2960	2930	2860	2790	2690	2580	2450	2290
		$N_{b,z,Rd}$	2890	2690	2450	2160	1840	1540	1280	897	654	496	388	311	255
	0.997	$M_{b,Rd}$	380	379	352	326	300	276	253	215	184	161	142	128	116
		<b>0.272</b> $M_{b,Rd}$	430	422	390	358	327	297	271	226	192	166	147	131	119
* 356x171x57 $N_{pl,Rd} = 2580$ $f_y W_{el,y} = 318$ $f_y W_{el,z} = 45.8$	0.832	$N_{b,y,Rd}$	2580	2580	2580	2570	2540	2510	2490	2430	2360	2280	2180	2060	1930
		$N_{b,z,Rd}$	2450	2280	2060	1810	1530	1270	1050	736	536	405	317	254	208
	0.832	$M_{b,Rd}$	318	315	292	268	245	223	203	168	142	122	107	95.1	85.7
		<b>0.222</b> $M_{b,Rd}$	359	350	322	294	266	239	215	176	147	126	110	97.3	87.5
* 356x171x51 $N_{pl,Rd} = 2300$ $f_y W_{el,y} = 283$ $f_y W_{el,z} = 40.1$	0.717	$N_{b,y,Rd}$	2300	2300	2300	2290	2270	2250	2220	2170	2110	2030	1940	1840	1710
		$N_{b,z,Rd}$	2190	2030	1830	1600	1350	1120	923	644	468	354	277	222	182
	0.717	$M_{b,Rd}$	283	279	258	236	215	194	175	143	119	102	88.5	78.3	70.2
		<b>0.181</b> $M_{b,Rd}$	318	310	284	258	232	208	186	150	124	105	90.7	80.0	71.0
* 356x171x45 $N_{pl,Rd} = 2030$ $f_y W_{el,y} = 244$ $f_y W_{el,z} = 33.7$	0.651	$N_{b,y,Rd}$	2030	2030	2030	2020	2000	1980	1960	1910	1850	1780	1700	1600	1490
		$N_{b,z,Rd}$	1920	1780	1600	1380	1160	952	783	543	394	298	233	186	153
	0.651	$M_{b,Rd}$	244	240	221	201	182	163	146	117	96.6	81.4	70.2	61.6	54.5
		<b>0.166</b> $M_{b,Rd}$	275	266	243	220	196	174	154	122	99.7	83.5	71.7	62.5	54.5
* 356x127x39 $N_{pl,Rd} = 1770$ $f_y W_{el,y} = 204$ $f_y W_{el,z} = 20.2$	0.586	$N_{b,y,Rd}$	1770	1770	1770	1760	1740	1720	1700	1660	1610	1540	1470	1380	1280
		$N_{b,z,Rd}$	1570	1350	1080	825	628	487	386	258	184	137	106	84.9	69.3
	0.586	$M_{b,Rd}$	204	183	161	139	120	104	90.7	71.5	58.7	49.8	42.5	36.9	32.7
		<b>0.150</b> $M_{b,Rd}$	231	204	176	150	128	109	94.4	73.7	60.2	50.2	42.5	36.9	32.7
* 356x127x33 $N_{pl,Rd} = 1490$ $f_y W_{el,y} = 168$ $f_y W_{el,z} = 16.0$	0.487	$N_{b,y,Rd}$	1490	1490	1490	1480	1470	1450	1430	1400	1350	1300	1230	1150	1060
		$N_{b,z,Rd}$	1320	1120	878	661	500	386	305	203	145	108	83.7	66.7	54.4
	0.487	$M_{b,Rd}$	167	148	129	110	93.5	79.7	68.6	53.0	42.8	35.3	29.7	25.6	22.6
		<b>0.112</b> $M_{b,Rd}$	189	165	141	118	98.9	83.3	71.2	54.5	43.5	35.3	29.7	25.6	22.6

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$$n = N_{Ed} / N_{pl,Rd}$$

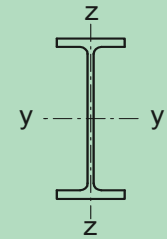
\* The section can become Class 4 under axial compression only. Under combined axial compression and bending the section becomes Class 4 when the Class 3  $N_{Ed} / N_{pl,Rd}$  limit is exceeded.

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit.

For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL BEAMS  
Advance® UKB



Cross-section resistance check

Section Designation and Axial Force Resistance $N_{pl,Rd}$ (kN)	n Limit Class 3 Class 2	Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$											
		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
		$M_{c,y,Rd}$	$M_{c,z,Rd}$	$M_{N,y,Rd}$	$M_{N,z,Rd}$								
305x165x54 $N_{pl,Rd} = 2440$	1.00 <b>0.260</b>	$M_{c,y,Rd}$	300	300	300	268	268	268	268	268	268	268	268
		$M_{c,z,Rd}$	69.6	69.6	69.6	45.1	45.1	45.1	45.1	45.1	45.1	45.1	45.1
		$M_{N,y,Rd}$	300	300	289	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	69.6	69.6	69.6	-	-	-	-	-	-	-	-
305x165x46 $N_{pl,Rd} = 2080$	0.795 <b>0.180</b>	$M_{c,y,Rd}$	256	256	229	229	229	229	229	229	229	✗	✗
		$M_{c,z,Rd}$	58.9	58.9	38.3	38.3	38.3	38.3	38.3	38.3	38.3	✗	✗
		$M_{N,y,Rd}$	256	256	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	58.9	58.9	-	-	-	-	-	-	-	-	-
305x165x40 $N_{pl,Rd} = 1820$	0.660 <b>0.138</b>	$M_{c,y,Rd}$	221	221	199	199	199	199	199	199	199	✗	✗
		$M_{c,z,Rd}$	50.4	50.4	33.0	33.0	33.0	33.0	33.0	33.0	33.0	✗	✗
		$M_{N,y,Rd}$	221	221	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	50.4	50.4	-	-	-	-	-	-	-	-	-
305x127x48 $N_{pl,Rd} = 2170$	n/a <b>1.00</b>	$M_{c,y,Rd}$	252	252	252	252	252	252	252	252	252	252	252
		$M_{c,z,Rd}$	41.2	41.2	41.2	41.2	41.2	41.2	41.2	41.2	41.2	41.2	41.2
		$M_{N,y,Rd}$	252	252	252	225	193	160	128	96.3	64.2	32.1	0
		$M_{N,z,Rd}$	41.2	41.2	41.2	41.2	41.2	40.5	37.4	31.8	23.7	13.1	0
305x127x42 $N_{pl,Rd} = 1900$	1.00 <b>0.348</b>	$M_{c,y,Rd}$	218	218	218	218	190	190	190	190	190	190	190
		$M_{c,z,Rd}$	34.8	34.8	34.8	34.8	22.4	22.4	22.4	22.4	22.4	22.4	22.4
		$M_{N,y,Rd}$	218	218	218	195	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	34.8	34.8	34.8	34.8	-	-	-	-	-	-	-
305x127x37 $N_{pl,Rd} = 1680$	0.872 <b>0.272</b>	$M_{c,y,Rd}$	191	191	191	167	167	167	167	167	167	167	✗
		$M_{c,z,Rd}$	30.2	30.2	30.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	✗
		$M_{N,y,Rd}$	191	191	191	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	30.2	30.2	30.2	-	-	-	-	-	-	-	-

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$N_{Ed}$  = Design value of the axial force.

$$n = N_{Ed} / N_{pl,Rd}$$

✗ Section becomes Class 4, see note 10.

\$ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

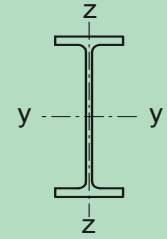
- Not applicable for Class 3 and Class 4 sections.

The values in this table are conservative for tension as the more onerous compression section classification limits have been used.

FOR EXPLANATION OF TABLES SEE NOTE 10.



UNIVERSAL BEAMS  
Advance® UKB



Member buckling check

Section Designation and Resistances (kN, kNm)	n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
		L (m)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
305x165x54 $N_{pl,Rd} = 2440$ $f_y W_{el,y} = 268$ $f_y W_{el,z} = 45.1$	1.00	$N_{b,y,Rd}$	2440	2440	2440	2410	2390	2360	2330	2250	2170	2060	1940	1780	1610
		$N_{b,z,Rd}$	2320	2160	1960	1720	1460	1210	1010	703	512	388	303	243	199
	1.00	$M_{b,Rd}$	268	266	252	238	223	207	192	164	141	123	108	96.3	85.2
	<b>0.260</b>	$M_{b,Rd}$	300	296	279	261	242	223	205	172	146	126	111	96.3	85.2
* 305x165x46 $N_{pl,Rd} = 2080$ $f_y W_{el,y} = 229$ $f_y W_{el,z} = 38.3$	0.795	$N_{b,y,Rd}$	2080	2080	2080	2060	2040	2010	1980	1920	1850	1760	1650	1520	1380
		$N_{b,z,Rd}$	1980	1840	1670	1460	1240	1030	848	592	431	326	255	205	168
	0.795	$M_{b,Rd}$	229	227	215	202	188	173	159	133	112	96.3	83.9	72.5	63.9
	<b>0.180</b>	$M_{b,Rd}$	256	251	236	220	203	185	168	138	116	98.7	83.9	72.5	63.9
* 305x165x40 $N_{pl,Rd} = 1820$ $f_y W_{el,y} = 199$ $f_y W_{el,z} = 33.0$	0.660	$N_{b,y,Rd}$	1820	1820	1820	1800	1780	1760	1730	1680	1610	1530	1440	1320	1190
		$N_{b,z,Rd}$	1730	1600	1450	1260	1070	884	730	509	370	280	219	175	144
	0.660	$M_{b,Rd}$	199	196	185	173	160	147	133	109	90.9	77.1	65.2	56.0	49.2
	<b>0.138</b>	$M_{b,Rd}$	221	216	203	188	173	156	141	114	93.4	78.0	65.2	56.0	49.2
305x127x48 $N_{pl,Rd} = 2170$ $f_y W_{el,y} = 219$ $f_y W_{el,z} = 26.3$	1.00	$N_{b,y,Rd}$	2170	2170	2170	2140	2120	2090	2060	1990	1910	1810	1680	1530	1370
		$N_{b,z,Rd}$	1940	1680	1360	1050	800	621	493	330	235	176	136	109	88.9
	<b>1.00</b>	$M_{b,Rd}$	251	224	199	175	154	136	121	99.5	84.3	73.1	64.6	57.8	51.5
305x127x42 $N_{pl,Rd} = 1900$ $f_y W_{el,y} = 190$ $f_y W_{el,z} = 22.4$	1.00	$N_{b,y,Rd}$	1900	1900	1890	1870	1850	1820	1790	1740	1660	1570	1460	1330	1190
		$N_{b,z,Rd}$	1690	1460	1170	894	682	529	419	280	200	149	116	92.4	75.4
	1.00	$M_{b,Rd}$	190	171	152	134	118	105	93.4	76.2	64.2	55.5	49.0	43.7	38.9
	<b>0.348</b>	$M_{b,Rd}$	216	192	168	146	127	111	97.9	79.0	66.2	57.0	49.9	43.7	38.9
* 305x127x37 $N_{pl,Rd} = 1680$ $f_y W_{el,y} = 167$ $f_y W_{el,z} = 19.2$	0.872	$N_{b,y,Rd}$	1680	1680	1670	1650	1630	1610	1580	1530	1470	1380	1280	1160	1040
		$N_{b,z,Rd}$	1490	1280	1020	778	592	459	363	243	173	129	100	79.9	65.2
	0.872	$M_{b,Rd}$	167	150	132	116	101	88.3	78.0	62.7	52.3	44.9	39.4	34.5	30.6
	<b>0.272</b>	$M_{b,Rd}$	189	167	145	125	107	92.9	81.4	64.8	53.8	46.0	39.4	34.5	30.6

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$$n = N_{Ed} / N_{pl,Rd}$$

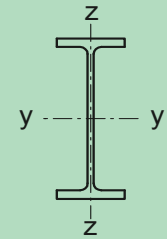
\* The section can become Class 4 under axial compression only. Under combined axial compression and bending the section becomes Class 4 when the Class 3  $N_{Ed} / N_{pl,Rd}$  limit is exceeded.

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit.

For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL BEAMS  
Advance® UKB



Cross-section resistance check

Section Designation and Axial Force Resistance $N_{pl,Rd}$ (kN)	n Limit Class 3 Class 2	Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$												
		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	
		$M_{c,y,Rd}$	$M_{c,z,Rd}$	$M_{N,y,Rd}$	$M_{N,z,Rd}$									
305x102x33 $N_{pl,Rd} = 1480$	0.726 <b>0.226</b>	$M_{c,y,Rd}$	171	171	171	148	148	148	148	148	148	✗	✗	\$
		$M_{c,z,Rd}$	21.3	21.3	21.3	13.5	13.5	13.5	13.5	13.5	13.5	✗	✗	\$
		$M_{N,y,Rd}$	171	171	171	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	21.3	21.3	21.3	-	-	-	-	-	-	-	-	-
305x102x28 $N_{pl,Rd} = 1270$	0.615 <b>0.182</b>	$M_{c,y,Rd}$	143	143	124	124	124	124	124	124	✗	✗	\$	\$
		$M_{c,z,Rd}$	17.0	17.0	11.0	11.0	11.0	11.0	11.0	11.0	✗	✗	\$	\$
		$M_{N,y,Rd}$	143	143	-	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	17.0	17.0	-	-	-	-	-	-	-	-	-	-
305x102x25 $N_{pl,Rd} = 1120$	0.578 <b>0.179</b>	$M_{c,y,Rd}$	121	121	104	104	104	104	104	✗	✗	✗	\$	\$
		$M_{c,z,Rd}$	13.8	13.8	8.52	8.52	8.52	8.52	8.52	✗	✗	✗	\$	\$
		$M_{N,y,Rd}$	121	121	-	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	13.8	13.8	-	-	-	-	-	-	-	-	-	-
254x146x43 $N_{pl,Rd} = 1950$	n/a <b>1.00</b>	$M_{c,y,Rd}$	201	201	201	201	201	201	201	201	201	201	201	201
		$M_{c,z,Rd}$	50.1	50.1	50.1	50.1	50.1	50.1	50.1	50.1	50.1	50.1	50.1	50.1
		$M_{N,y,Rd}$	201	201	191	167	143	119	95.5	71.6	47.8	23.9	0	0
		$M_{N,z,Rd}$	50.1	50.1	50.1	50.1	49.3	46.5	41.5	34.3	25.0	13.6	0	0
254x146x37 $N_{pl,Rd} = 1680$	0.975 <b>0.233</b>	$M_{c,y,Rd}$	171	171	171	154	154	154	154	154	154	154	154	\$
		$M_{c,z,Rd}$	42.2	42.2	42.2	27.7	27.7	27.7	27.7	27.7	27.7	27.7	27.7	\$
		$M_{N,y,Rd}$	171	171	164	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	42.2	42.2	42.2	-	-	-	-	-	-	-	-	-
254x146x31 $N_{pl,Rd} = 1410$	0.904 <b>0.238</b>	$M_{c,y,Rd}$	140	140	140	125	125	125	125	125	125	125	125	\$
		$M_{c,z,Rd}$	33.4	33.4	33.4	21.7	21.7	21.7	21.7	21.7	21.7	21.7	21.7	\$
		$M_{N,y,Rd}$	140	140	137	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	33.4	33.4	33.4	-	-	-	-	-	-	-	-	-
254x102x28 $N_{pl,Rd} = 1280$	0.934 <b>0.295</b>	$M_{c,y,Rd}$	125	125	125	109	109	109	109	109	109	109	109	\$
		$M_{c,z,Rd}$	19.5	19.5	19.5	12.4	12.4	12.4	12.4	12.4	12.4	12.4	12.4	\$
		$M_{N,y,Rd}$	125	125	125	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	19.5	19.5	19.5	-	-	-	-	-	-	-	-	-

Advance® and UKB are trademarks of Tata Steel. A fuller description of the relationship between Universal Beams (UB) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

$N_{Ed}$  = Design value of the axial force.

$$n = N_{Ed} / N_{pl,Rd}$$

✗ Section becomes Class 4, see note 10.

\$ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

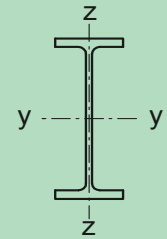
- Not applicable for Class 3 and Class 4 sections.

The values in this table are conservative for tension as the more onerous compression section classification limits have been used.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL BEAMS

Advance® UKB



Member buckling check

Section Designation and Resistances (kN, kNm)	n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
		L (m)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
* 305x102x33 $N_{pl,Rd} = 1480$ $f_y W_{el,y} = 148$ $f_y W_{el,z} = 13.5$	0.726	$N_{b,y,Rd}$	1480	1480	1480	1460	1450	1430	1410	1360	1300	1230	1150	1050	939
		$N_{b,z,Rd}$	1240	969	695	496	365	277	218	144	102	75.6	58.5	46.6	37.9
	0.726	$M_{b,Rd}$	141	122	103	87.0	73.8	63.5	55.5	44.2	36.8	31.0	26.6	23.4	20.8
		<b>0.226</b> $M_{b,Rd}$	159	135	112	92.7	77.6	66.1	57.5	45.4	37.2	31.0	26.6	23.4	20.8
* 305x102x28 $N_{pl,Rd} = 1270$ $f_y W_{el,y} = 124$ $f_y W_{el,z} = 11.0$	0.615	$N_{b,y,Rd}$	1270	1270	1270	1260	1240	1220	1200	1160	1110	1050	970	879	783
		$N_{b,z,Rd}$	1050	807	570	404	296	224	176	116	81.9	61.0	47.1	37.5	30.5
	0.615	$M_{b,Rd}$	117	99.9	83.3	68.8	57.4	48.7	42.0	32.9	26.7	22.1	18.9	16.5	14.7
		<b>0.182</b> $M_{b,Rd}$	132	111	90.2	73.1	60.1	50.5	43.4	33.7	26.7	22.1	18.9	16.5	14.7
* 305x102x25 $N_{pl,Rd} = 1120$ $f_y W_{el,y} = 104$ $f_y W_{el,z} = 8.52$	0.578	$N_{b,y,Rd}$	1120	1120	1120	1100	1090	1070	1060	1020	971	911	838	755	669
		$N_{b,z,Rd}$	901	672	464	324	236	179	140	92.0	65.0	48.3	37.3	29.7	24.2
	0.578	$M_{b,Rd}$	97.0	82.0	67.3	54.7	44.9	37.7	32.2	24.9	19.6	16.1	13.7	12.0	10.6
		<b>0.179</b> $M_{b,Rd}$	111	91.3	72.9	58.0	47.0	39.1	33.2	25.0	19.6	16.1	13.7	12.0	10.6
254x146x43 $N_{pl,Rd} = 1950$ $f_y W_{el,y} = 179$ $f_y W_{el,z} = 32.7$	1.00	$N_{b,y,Rd}$	1950	1950	1930	1900	1870	1840	1810	1730	1630	1500	1350	1190	1030
		$N_{b,z,Rd}$	1820	1670	1480	1250	1020	829	675	463	335	252	197	157	129
		$M_{b,Rd}$	201	194	181	168	155	142	130	109	92.8	80.7	70.5	61.6	54.8
* 254x146x37 $N_{pl,Rd} = 1680$ $f_y W_{el,y} = 154$ $f_y W_{el,z} = 27.7$	0.975	$N_{b,y,Rd}$	1680	1680	1660	1640	1610	1590	1560	1490	1400	1290	1150	1010	875
		$N_{b,z,Rd}$	1570	1430	1260	1060	869	702	571	391	282	213	166	133	109
	0.975	$M_{b,Rd}$	154	149	140	130	120	110	100	83.4	70.6	61.1	52.9	46.1	40.9
		<b>0.233</b> $M_{b,Rd}$	171	165	154	141	129	117	105	86.5	72.7	62.1	52.9	46.1	40.9
* 254x146x31 $N_{pl,Rd} = 1410$ $f_y W_{el,y} = 125$ $f_y W_{el,z} = 21.7$	0.904	$N_{b,y,Rd}$	1410	1410	1390	1370	1350	1330	1300	1240	1160	1060	941	819	707
		$N_{b,z,Rd}$	1310	1190	1040	865	698	560	453	309	223	168	130	104	85.3
	0.904	$M_{b,Rd}$	125	120	112	103	94.1	84.8	76.0	61.6	51.2	42.9	36.2	31.4	27.7
		<b>0.238</b> $M_{b,Rd}$	140	133	123	112	101	89.8	79.7	63.7	52.4	42.9	36.2	31.4	27.7
* 254x102x28 $N_{pl,Rd} = 1280$ $f_y W_{el,y} = 109$ $f_y W_{el,z} = 12.4$	0.934	$N_{b,y,Rd}$	1280	1280	1270	1250	1230	1210	1190	1130	1060	963	855	745	642
		$N_{b,z,Rd}$	1080	860	627	451	333	254	199	132	93.3	69.5	53.7	42.8	34.9
	0.934	$M_{b,Rd}$	105	91.5	78.5	67.1	57.6	50.2	44.3	35.8	30.0	25.9	22.4	19.7	17.6
		<b>0.295</b> $M_{b,Rd}$	118	101	85.2	71.5	60.7	52.3	45.9	36.8	30.8	26.0	22.4	19.7	17.6

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$$n = N_{Ed} / N_{pl,Rd}$$

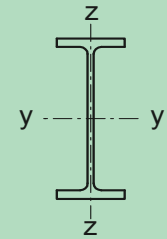
\* The section can become Class 4 under axial compression only. Under combined axial compression and bending the section becomes Class 4 when the Class 3  $N_{Ed} / N_{pl,Rd}$  limit is exceeded.

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit.

For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL BEAMS  
Advance® UKB



Cross-section resistance check

Section Designation and Axial Force Resistance $N_{pl,Rd}$ (kN)	n Limit Class 3 Class 2	Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$													
		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0		
		$M_{c,y,Rd}$	$M_{c,z,Rd}$	$M_{N,y,Rd}$	$M_{N,z,Rd}$										
254x102x25 $N_{pl,Rd} = 1140$	0.866 <b>0.285</b>	$M_{c,y,Rd}$	109	109	109	94.4	94.4	94.4	94.4	94.4	94.4	94.4	✘	\$	
		$M_{c,z,Rd}$	16.3	16.3	16.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	✘	\$	
		$M_{N,y,Rd}$	109	109	109	-	-	-	-	-	-	-	-	-	
		$M_{N,z,Rd}$	16.3	16.3	16.3	-	-	-	-	-	-	-	-	-	
254x102x22 $N_{pl,Rd} = 994$	0.797 <b>0.274</b>	$M_{c,y,Rd}$	91.9	91.9	91.9	79.5	79.5	79.5	79.5	79.5	79.5	79.5	✘	✘	\$
		$M_{c,z,Rd}$	13.1	13.1	13.1	8.17	8.17	8.17	8.17	8.17	8.17	8.17	✘	✘	\$
		$M_{N,y,Rd}$	91.9	91.9	91.9	-	-	-	-	-	-	-	-	-	
		$M_{N,z,Rd}$	13.1	13.1	13.1	-	-	-	-	-	-	-	-	-	
203x133x30 $N_{pl,Rd} = 1360$	n/a <b>1.00</b>	$M_{c,y,Rd}$	111	111	111	111	111	111	111	111	111	111	111	111	
		$M_{c,z,Rd}$	31.2	31.2	31.2	31.2	31.2	31.2	31.2	31.2	31.2	31.2	31.2	31.2	
		$M_{N,y,Rd}$	111	111	107	93.3	80.0	66.6	53.3	40.0	26.7	13.3	0	0	
		$M_{N,z,Rd}$	31.2	31.2	31.2	31.2	30.9	29.2	26.1	21.6	15.8	8.59	0	0	
203x133x25 $N_{pl,Rd} = 1140$	n/a <b>1.00</b>	$M_{c,y,Rd}$	91.6	91.6	91.6	91.6	91.6	91.6	91.6	91.6	91.6	91.6	91.6	91.6	
		$M_{c,z,Rd}$	25.2	25.2	25.2	25.2	25.2	25.2	25.2	25.2	25.2	25.2	25.2	25.2	
		$M_{N,y,Rd}$	91.6	91.6	88.8	77.7	66.6	55.5	44.4	33.3	22.2	11.1	0	0	
		$M_{N,z,Rd}$	25.2	25.2	25.2	25.2	25.1	23.9	21.5	17.9	13.1	7.17	0	0	
203x102x23 $N_{pl,Rd} = 1040$	1.00 <b>0.303</b>	$M_{c,y,Rd}$	83.1	83.1	83.1	83.1	73.5	73.5	73.5	73.5	73.5	73.5	73.5	73.5	
		$M_{c,z,Rd}$	17.8	17.8	17.8	17.8	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	
		$M_{N,y,Rd}$	83.1	83.1	80.8	70.7	-	-	-	-	-	-	-	-	
		$M_{N,z,Rd}$	17.8	17.8	17.8	17.8	-	-	-	-	-	-	-	-	
178x102x19 $N_{pl,Rd} = 863$	n/a <b>1.00</b>	$M_{c,y,Rd}$	60.7	60.7	60.7	60.7	60.7	60.7	60.7	60.7	60.7	60.7	60.7	60.7	
		$M_{c,z,Rd}$	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	
		$M_{N,y,Rd}$	60.7	60.7	58.6	51.3	43.9	36.6	29.3	22.0	14.6	7.32	0	0	
		$M_{N,z,Rd}$	14.9	14.9	14.9	14.9	14.8	14.1	12.6	10.5	7.69	4.19	0	0	
152x89x16 $N_{pl,Rd} = 721$	n/a <b>1.00</b>	$M_{c,y,Rd}$	43.7	43.7	43.7	43.7	43.7	43.7	43.7	43.7	43.7	43.7	43.7	43.7	
		$M_{c,z,Rd}$	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	
		$M_{N,y,Rd}$	43.7	43.7	41.8	36.5	31.3	26.1	20.9	15.7	10.4	5.22	0	0	
		$M_{N,z,Rd}$	11.0	11.0	11.0	11.0	10.9	10.3	9.19	7.63	5.57	3.03	0	0	
127x76x13 $N_{pl,Rd} = 586$	n/a <b>1.00</b>	$M_{c,y,Rd}$	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	29.8	
		$M_{c,z,Rd}$	8.17	8.17	8.17	8.17	8.17	8.17	8.17	8.17	8.17	8.17	8.17	8.17	
		$M_{N,y,Rd}$	29.8	29.8	28.1	24.6	21.0	17.5	14.0	10.5	7.02	3.51	0	0	
		$M_{N,z,Rd}$	8.17	8.17	8.17	8.16	8.00	7.50	6.66	5.50	4.00	2.17	0	0	

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$N_{Ed}$  = Design value of the axial force.

$$n = N_{Ed} / N_{pl,Rd}$$

✘ Section becomes Class 4, see note 10.

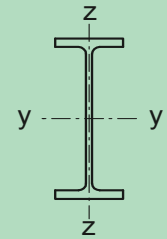
\$ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

- Not applicable for Class 3 and Class 4 sections.

The values in this table are conservative for tension as the more onerous compression section classification limits have been used.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL BEAMS  
Advance® UKB



Member buckling check

Section Designation and Resistances (kN, kNm)	n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
		L (m)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
* 254x102x25 $N_{pl,Rd} = 1140$ $f_y W_{el,y} = 94.4$ $f_y W_{el,z} = 10.3$	0.866	$N_{b,y,Rd}$	1140	1140	1120	1110	1090	1070	1050	995	927	842	743	644	553
		$N_{b,z,Rd}$	946	741	532	380	279	212	167	110	77.8	57.9	44.8	35.6	29.0
	0.866	$M_{b,Rd}$	90.0	77.7	65.8	55.3	46.9	40.3	35.3	28.1	23.4	19.7	16.9	14.8	13.2
		<b>0.285</b> $M_{b,Rd}$	101	86.0	71.3	58.9	49.2	42.0	36.5	28.9	23.6	19.7	16.9	14.8	13.2
* 254x102x22 $N_{pl,Rd} = 994$ $f_y W_{el,y} = 79.5$ $f_y W_{el,z} = 8.17$	0.797	$N_{b,y,Rd}$	994	994	981	966	950	932	913	866	803	725	636	548	470
		$N_{b,z,Rd}$	814	623	439	310	227	172	135	88.7	62.7	46.7	36.1	28.7	23.4
	0.797	$M_{b,Rd}$	75.1	64.1	53.4	44.2	36.9	31.4	27.1	21.3	17.4	14.4	12.3	10.8	9.59
		<b>0.274</b> $M_{b,Rd}$	84.8	71.0	57.8	46.9	38.6	32.5	28.0	21.8	17.4	14.4	12.3	10.8	9.59
203x133x30 $N_{pl,Rd} = 1360$ $f_y W_{el,y} = 99.4$ $f_y W_{el,z} = 20.2$	1.00	$N_{b,y,Rd}$	1360	1350	1330	1300	1270	1240	1210	1120	994	853	717	599	503
		$N_{b,z,Rd}$	1250	1120	961	782	620	493	396	268	193	145	112	89.9	73.5
	<b>1.00</b>	$M_{b,Rd}$	111	105	97.6	89.4	81.1	73.3	66.3	55.0	46.6	40.2	34.5	30.2	26.9
203x133x25 $N_{pl,Rd} = 1140$ $f_y W_{el,y} = 81.7$ $f_y W_{el,z} = 16.3$	1.00	$N_{b,y,Rd}$	1140	1130	1110	1090	1060	1040	1010	926	821	700	586	488	409
		$N_{b,z,Rd}$	1040	931	791	639	504	398	319	216	155	116	90.3	72.1	58.9
	<b>1.00</b>	$M_{b,Rd}$	91.6	85.9	78.9	71.4	63.8	56.7	50.5	40.8	34.0	28.1	24.0	20.9	18.6
203x102x23 $N_{pl,Rd} = 1040$ $f_y W_{el,y} = 73.5$ $f_y W_{el,z} = 11.4$	1.00	$N_{b,y,Rd}$	1040	1040	1020	998	976	951	921	846	746	634	529	440	369
		$N_{b,z,Rd}$	897	735	553	404	301	230	181	120	85.3	63.6	49.2	39.2	32.0
	1.00	$M_{b,Rd}$	71.9	65.6	59.0	52.3	46.2	41.0	36.6	30.0	24.9	20.9	18.1	16.0	14.3
		<b>0.303</b> $M_{b,Rd}$	80.4	72.5	64.2	56.0	48.8	42.8	37.9	30.7	24.9	20.9	18.1	16.0	14.3
178x102x19 $N_{pl,Rd} = 863$ $f_y W_{el,y} = 54.3$ $f_y W_{el,z} = 9.59$	1.00	$N_{b,y,Rd}$	863	851	833	813	790	764	731	647	544	444	361	295	245
		$N_{b,z,Rd}$	742	610	459	336	251	192	151	100	71.1	53.0	41.0	32.7	26.6
	<b>1.00</b>	$M_{b,Rd}$	58.7	53.0	46.9	40.9	35.5	31.1	27.6	22.3	18.1	15.2	13.1	11.6	10.3
152x89x16 $N_{pl,Rd} = 721$ $f_y W_{el,y} = 38.7$ $f_y W_{el,z} = 7.10$	1.00	$N_{b,y,Rd}$	720	703	685	664	638	606	566	469	371	291	232	188	155
		$N_{b,z,Rd}$	595	460	327	232	170	129	101	66.7	47.2	35.1	27.1	21.6	17.6
	<b>1.00</b>	$M_{b,Rd}$	41.3	36.8	32.2	28.0	24.4	21.5	19.2	15.6	12.8	10.8	9.39	8.31	7.45
127x76x13 $N_{pl,Rd} = 586$ $f_y W_{el,y} = 26.6$ $f_y W_{el,z} = 5.33$	1.00	$N_{b,y,Rd}$	580	563	543	519	487	446	399	302	226	173	136	109	89.5
		$N_{b,z,Rd}$	455	325	218	151	109	82.4	64.3	42.2	29.8	22.1	17.1	13.6	11.1
	<b>1.00</b>	$M_{b,Rd}$	27.5	24.3	21.2	18.6	16.3	14.5	13.0	10.7	8.83	7.52	6.55	5.81	5.22

Advance® and UKB are trademarks of Tata Steel. A fuller description of the relationship between Universal Beams (UB) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

$$n = N_{Ed} / N_{pl,Rd}$$

\* The section can become Class 4 under axial compression only. Under combined axial compression and bending the section becomes Class 4 when the Class 3  $N_{Ed} / N_{pl,Rd}$  limit is exceeded.

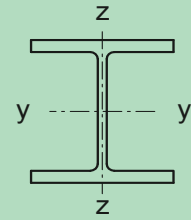
Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit.

For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL COLUMNS

Advance® UKC



Cross-section resistance check

Section Designation and Axial Force Resistance $N_{pl,Rd}$ (kN)	n Limit Class 3 <b>Class 2</b>	Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$																																														
		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0																																			
		356x406x634 $N_{pl,Rd} = 26300$	n/a <b>1.00</b>	$M_{c,y,Rd}$	4630	4630	4630	4630	4630	4630	4630	4630	4630	4630	4630	$M_{c,z,Rd}$	2310	2310	2310	2310	2310	2310	2310	2310	2310	2310	$M_{N,y,Rd}$	4630	4610	4090	3580	3070	2560	2050	1540	1020	512	0	$M_{N,z,Rd}$	2310	2310	2310	2270	2160	1970	1720	1400	1000
356x406x551 $N_{pl,Rd} = 22800$	n/a <b>1.00</b>	$M_{c,y,Rd}$	3920	3920	3920	3920	3920	3920	3920	3920	3920	3920	3920	$M_{c,z,Rd}$	1970	1970	1970	1970	1970	1970	1970	1970	1970	1970	$M_{N,y,Rd}$	3920	3910	3480	3040	2610	2170	1740	1300	870	435	0	$M_{N,z,Rd}$	1970	1970	1970	1940	1840	1690	1470	1190	857	459	0
356x406x467 $N_{pl,Rd} = 19900$	n/a <b>1.00</b>	$M_{c,y,Rd}$	3350	3350	3350	3350	3350	3350	3350	3350	3350	3350	3350	$M_{c,z,Rd}$	1690	1690	1690	1690	1690	1690	1690	1690	1690	1690	$M_{N,y,Rd}$	3350	3340	2970	2600	2230	1860	1490	1110	743	372	0	$M_{N,z,Rd}$	1690	1690	1690	1660	1580	1450	1260	1020	735	394	0
356x406x393 $N_{pl,Rd} = 16800$	n/a <b>1.00</b>	$M_{c,y,Rd}$	2750	2750	2750	2750	2750	2750	2750	2750	2750	2750	2750	$M_{c,z,Rd}$	1390	1390	1390	1390	1390	1390	1390	1390	1390	1390	$M_{N,y,Rd}$	2750	2750	2450	2140	1840	1530	1220	919	612	306	0	$M_{N,z,Rd}$	1390	1390	1390	1370	1300	1200	1040	848	609	326	0
356x406x340 $N_{pl,Rd} = 14500$	n/a <b>1.00</b>	$M_{c,y,Rd}$	2340	2340	2340	2340	2340	2340	2340	2340	2340	2340	2340	$M_{c,z,Rd}$	1190	1190	1190	1190	1190	1190	1190	1190	1190	1190	$M_{N,y,Rd}$	2340	2340	2090	1830	1560	1300	1040	782	521	261	0	$M_{N,z,Rd}$	1190	1190	1190	1170	1110	1020	891	724	520	279	0
356x406x287 $N_{pl,Rd} = 12600$	n/a <b>1.00</b>	$M_{c,y,Rd}$	2010	2010	2010	2010	2010	2010	2010	2010	2010	2010	2010	$M_{c,z,Rd}$	1020	1020	1020	1020	1020	1020	1020	1020	1020	1020	$M_{N,y,Rd}$	2010	2010	1790	1560	1340	1120	893	670	447	223	0	$M_{N,z,Rd}$	1020	1020	1020	1000	956	877	766	623	447	240	0
356x406x235 $N_{pl,Rd} = 10300$	n/a <b>1.00</b>	$M_{c,y,Rd}$	1620	1620	1620	1620	1620	1620	1620	1620	1620	1620	1620	$M_{c,z,Rd}$	822	822	822	822	822	822	822	822	822	822	$M_{N,y,Rd}$	1620	1620	1440	1260	1080	900	720	540	360	180	0	$M_{N,z,Rd}$	822	822	822	810	772	708	618	502	361	193	0

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$N_{Ed}$  = Design value of the axial force.

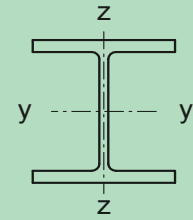
$$n = N_{Ed} / N_{pl,Rd}$$

The values in this table are conservative for tension as the more onerous compression section classification limits have been used.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL COLUMNS

Advance® UKC



Member buckling check

Section Designation and Resistances (kN, kNm)	n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
		L (m)	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
		$N_{b,y,Rd}$	$N_{b,z,Rd}$	$M_{b,Rd}$											
356x406x634 $N_{pl,Rd} = 26300$ $f_y W_{el,y} = 3760$ $f_y W_{el,z} = 1500$	1.00	$N_{b,y,Rd}$	26300	26200	25600	24900	24200	23500	22700	21800	20900	19800	18800	17600	16500
	1.00	$N_{b,z,Rd}$	25900	24400	22800	21100	19300	17400	15600	13800	12200	10800	9510	8430	7510
		$M_{b,Rd}$	4630	4630	4630	4630	4610	4540	4470	4410	4350	4300	4240	4190	4130
356x406x551 $N_{pl,Rd} = 22800$ $f_y W_{el,y} = 3240$ $f_y W_{el,z} = 1280$	1.00	$N_{b,y,Rd}$	22800	22700	22200	21600	21000	20300	19600	18800	17900	17000	16000	15000	14000
	1.00	$N_{b,z,Rd}$	22500	21100	19700	18300	16700	15000	13400	11900	10500	9230	8150	7220	6430
		$M_{b,Rd}$	3920	3920	3920	3920	3880	3810	3750	3690	3640	3590	3530	3480	3430
356x406x467 $N_{pl,Rd} = 19900$ $f_y W_{el,y} = 2810$ $f_y W_{el,z} = 1100$	1.00	$N_{b,y,Rd}$	19900	19800	19300	18700	18200	17500	16900	16100	15300	14400	13500	12600	11700
	1.00	$N_{b,z,Rd}$	19600	18300	17100	15700	14300	12800	11300	9980	8760	7690	6770	5990	5320
		$M_{b,Rd}$	3350	3350	3350	3330	3260	3200	3140	3090	3030	2980	2930	2880	2830
356x406x393 $N_{pl,Rd} = 16800$ $f_y W_{el,y} = 2340$ $f_y W_{el,z} = 911$	1.00	$N_{b,y,Rd}$	16800	16600	16200	15700	15200	14700	14100	13400	12700	12000	11200	10400	9590
	1.00	$N_{b,z,Rd}$	16400	15400	14300	13100	11900	10600	9370	8220	7190	6300	5540	4890	4340
		$M_{b,Rd}$	2750	2750	2750	2710	2650	2590	2540	2490	2430	2380	2340	2290	2240
356x406x340 $N_{pl,Rd} = 14500$ $f_y W_{el,y} = 2020$ $f_y W_{el,z} = 779$	1.00	$N_{b,y,Rd}$	14500	14400	14000	13600	13100	12600	12100	11500	10900	10200	9510	8810	8120
	1.00	$N_{b,z,Rd}$	14200	13300	12300	11300	10200	9100	8020	7020	6140	5370	4720	4170	3700
		$M_{b,Rd}$	2340	2340	2340	2290	2230	2180	2130	2070	2030	1980	1930	1890	1840
356x406x287 $N_{pl,Rd} = 12600$ $f_y W_{el,y} = 1750$ $f_y W_{el,z} = 669$	1.00	$N_{b,y,Rd}$	12600	12500	12100	11700	11300	10900	10400	9870	9290	8670	8040	7410	6800
	1.00	$N_{b,z,Rd}$	12300	11500	10600	9720	8740	7750	6800	5930	5170	4510	3960	3490	3090
		$M_{b,Rd}$	2010	2010	2000	1930	1880	1820	1770	1720	1670	1620	1570	1530	1480
356x406x235 $N_{pl,Rd} = 10300$ $f_y W_{el,y} = 1430$ $f_y W_{el,z} = 542$	1.00	$N_{b,y,Rd}$	10300	10200	9880	9570	9230	8870	8460	8010	7530	7010	6490	5970	5470
	1.00	$N_{b,z,Rd}$	10000	9370	8660	7900	7100	6280	5500	4790	4170	3630	3180	2810	2490
		$M_{b,Rd}$	1620	1620	1600	1540	1490	1440	1390	1340	1290	1250	1200	1160	1120

Advance® and UKC are trademarks of Tata Steel. A fuller description of the relationship between Universal Columns (UC) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

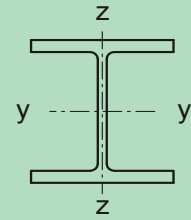
$$n = N_{Ed} / N_{pl,Rd}$$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit.

For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

UNIVERSAL COLUMNS

Advance® UKC



Cross-section resistance check

Section Designation and Axial Force Resistance $N_{pl,Rd}$ (kN)	n Limit Class 3 <b>Class 2</b>	Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$											
		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
		$M_{c,y,Rd}$	$M_{c,z,Rd}$	$M_{N,y,Rd}$	$M_{N,z,Rd}$								
356x368x202 $N_{pl,Rd} = 8870$	n/a <b>1.00</b>	$M_{c,y,Rd}$	1370	1370	1370	1370	1370	1370	1370	1370	1370	1370	1370
		$M_{c,z,Rd}$	662	662	662	662	662	662	662	662	662	662	662
		$M_{N,y,Rd}$	1370	1370	1230	1070	920	767	613	460	307	153	0
		$M_{N,z,Rd}$	662	662	662	654	625	574	502	409	294	158	0
356x368x177 $N_{pl,Rd} = 7800$	n/a <b>1.00</b>	$M_{c,y,Rd}$	1190	1190	1190	1190	1190	1190	1190	1190	1190	1190	1190
		$M_{c,z,Rd}$	576	576	576	576	576	576	576	576	576	576	576
		$M_{N,y,Rd}$	1190	1190	1070	935	802	668	534	401	267	134	0
		$M_{N,z,Rd}$	576	576	576	570	544	500	438	356	256	138	0
356x368x153 $N_{pl,Rd} = 6730$	n/a <b>1.00</b>	$M_{c,y,Rd}$	1020	1020	1020	1020	1020	1020	1020	1020	1020	1020	1020
		$M_{c,z,Rd}$	495	495	495	495	495	495	495	495	495	495	495
		$M_{N,y,Rd}$	1020	1020	916	802	687	573	458	344	229	115	0
		$M_{N,z,Rd}$	495	495	495	489	467	429	375	306	220	118	0
356x368x129 $N_{pl,Rd} = 5660$	1.00 <b>0.00</b>	$M_{c,y,Rd}$	781	781	781	781	781	781	781	781	781	781	781
		$M_{c,z,Rd}$	274	274	274	274	274	274	274	274	274	274	274
		$M_{N,y,Rd}$	-	-	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-
305x305x283 $N_{pl,Rd} = 12100$	n/a <b>1.00</b>	$M_{c,y,Rd}$	1710	1710	1710	1710	1710	1710	1710	1710	1710	1710	1710
		$M_{c,z,Rd}$	785	785	785	785	785	785	785	785	785	785	785
		$M_{N,y,Rd}$	1710	1710	1530	1340	1150	956	765	573	382	191	0
		$M_{N,z,Rd}$	785	785	785	775	739	679	594	483	347	186	0
305x305x240 $N_{pl,Rd} = 10600$	n/a <b>1.00</b>	$M_{c,y,Rd}$	1470	1470	1470	1470	1470	1470	1470	1470	1470	1470	1470
		$M_{c,z,Rd}$	673	673	673	673	673	673	673	673	673	673	673
		$M_{N,y,Rd}$	1470	1470	1310	1150	985	821	657	493	328	164	0
		$M_{N,z,Rd}$	673	673	673	665	636	584	511	416	299	161	0
305x305x198 $N_{pl,Rd} = 8690$	n/a <b>1.00</b>	$M_{c,y,Rd}$	1190	1190	1190	1190	1190	1190	1190	1190	1190	1190	1190
		$M_{c,z,Rd}$	545	545	545	545	545	545	545	545	545	545	545
		$M_{N,y,Rd}$	1190	1190	1060	932	798	665	532	399	266	133	0
		$M_{N,z,Rd}$	545	545	545	539	515	474	415	338	243	130	0

Advance® and UKC are trademarks of Tata Steel. A fuller description of the relationship between Universal Columns (UC) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

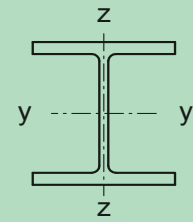
- Not applicable for Class 3 and Class 4 sections.

The values in this table are conservative for tension as the more onerous compression section classification limits have been used.

FOR EXPLANATION OF TABLES SEE NOTE 10.



UNIVERSAL COLUMNS  
Advance® UKC



Member buckling check

Section Designation and Resistances (kN, kNm)	n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
		L (m)	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
		$N_{b,y,Rd}$	$N_{b,z,Rd}$	$M_{b,Rd}$											
356x368x202 $N_{pl,Rd} = 8870$ $f_y W_{el,y} = 1220$ $f_y W_{el,z} = 436$	1.00	$N_{b,y,Rd}$	8870	8740	8480	8210	7910	7590	7230	6840	6420	5970	5510	5060	4630
	1.00	$N_{b,z,Rd}$	8560	7940	7290	6580	5830	5100	4410	3810	3290	2850	2490	2180	1930
		$M_{b,Rd}$	1370	1370	1340	1290	1240	1190	1140	1090	1050	1000	960	920	881
356x368x177 $N_{pl,Rd} = 7800$ $f_y W_{el,y} = 1070$ $f_y W_{el,z} = 380$	1.00	$N_{b,y,Rd}$	7800	7680	7450	7200	6940	6650	6330	5970	5590	5190	4780	4390	4010
	1.00	$N_{b,z,Rd}$	7520	6970	6390	5760	5110	4450	3850	3320	2860	2480	2170	1900	1680
		$M_{b,Rd}$	1190	1190	1160	1110	1060	1020	970	924	880	838	797	760	724
356x368x153 $N_{pl,Rd} = 6730$ $f_y W_{el,y} = 926$ $f_y W_{el,z} = 327$	1.00	$N_{b,y,Rd}$	6730	6620	6420	6210	5980	5730	5450	5140	4800	4460	4100	3760	3430
	1.00	$N_{b,z,Rd}$	6480	6010	5500	4960	4390	3820	3300	2840	2450	2130	1850	1630	1440
		$M_{b,Rd}$	1020	1020	990	946	902	857	812	769	727	687	649	614	582
356x368x129 $N_{pl,Rd} = 5660$ $f_y W_{el,y} = 781$ $f_y W_{el,z} = 274$	1.00	$N_{b,y,Rd}$	5660	5560	5390	5210	5010	4790	4550	4290	4000	3710	3400	3110	2840
	1.00	$N_{b,z,Rd}$	5450	5050	4620	4160	3670	3200	2760	2370	2040	1770	1540	1350	1190
		$M_{b,Rd}$	781	781	760	726	691	656	621	586	551	519	489	461	435
305x305x283 $N_{pl,Rd} = 12100$ $f_y W_{el,y} = 1450$ $f_y W_{el,z} = 512$	1.00	$N_{b,y,Rd}$	12100	11800	11400	11000	10600	10100	9540	8930	8290	7620	6960	6330	5750
	1.00	$N_{b,z,Rd}$	11400	10400	9360	8220	7070	5990	5060	4280	3650	3130	2710	2370	2080
		$M_{b,Rd}$	1710	1710	1680	1640	1590	1550	1510	1480	1440	1400	1370	1330	1300
305x305x240 $N_{pl,Rd} = 10600$ $f_y W_{el,y} = 1260$ $f_y W_{el,z} = 440$	1.00	$N_{b,y,Rd}$	10600	10300	9960	9580	9170	8710	8200	7640	7050	6440	5860	5300	4790
	1.00	$N_{b,z,Rd}$	9930	9050	8080	7050	6010	5070	4260	3590	3050	2610	2260	1970	1730
		$M_{b,Rd}$	1470	1470	1430	1380	1340	1300	1260	1220	1180	1150	1110	1080	1040
305x305x198 $N_{pl,Rd} = 8690$ $f_y W_{el,y} = 1030$ $f_y W_{el,z} = 358$	1.00	$N_{b,y,Rd}$	8690	8470	8180	7860	7510	7120	6680	6200	5700	5190	4700	4250	3830
	1.00	$N_{b,z,Rd}$	8160	7420	6610	5740	4880	4100	3440	2900	2460	2110	1820	1590	1390
		$M_{b,Rd}$	1190	1190	1140	1100	1060	1020	982	946	911	877	844	813	783

Advance® and UKC are trademarks of Tata Steel. A fuller description of the relationship between Universal Columns (UC) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

$$n = N_{Ed} / N_{pl,Rd}$$

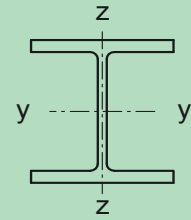
Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit.

For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL COLUMNS

Advance® UKC



Cross-section resistance check

Section Designation and Axial Force Resistance $N_{pl,Rd}$ (kN)	n Limit Class 3 <b>Class 2</b>	Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$											
		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
305x305x158 $N_{pl,Rd} = 6930$	n/a <b>1.00</b>	$M_{c,y,Rd}$	925	925	925	925	925	925	925	925	925	925	925
		$M_{c,z,Rd}$	424	424	424	424	424	424	424	424	424	424	424
		$M_{N,y,Rd}$	925	925	834	730	626	521	417	313	209	104	0
		$M_{N,z,Rd}$	424	424	424	420	403	371	325	265	191	103	0
305x305x137 $N_{pl,Rd} = 6000$	n/a <b>1.00</b>	$M_{c,y,Rd}$	792	792	792	792	792	792	792	792	792	792	792
		$M_{c,z,Rd}$	363	363	363	363	363	363	363	363	363	363	363
		$M_{N,y,Rd}$	792	792	716	626	537	447	358	268	179	89.5	0
		$M_{N,z,Rd}$	363	363	363	360	345	318	279	228	164	88.1	0
305x305x118 $N_{pl,Rd} = 5180$	n/a <b>1.00</b>	$M_{c,y,Rd}$	675	675	675	675	675	675	675	675	675	675	675
		$M_{c,z,Rd}$	309	309	309	309	309	309	309	309	309	309	309
		$M_{N,y,Rd}$	675	675	612	535	459	382	306	229	153	76.5	0
		$M_{N,z,Rd}$	309	309	309	307	294	272	238	194	140	75.3	0
305x305x97 $N_{pl,Rd} = 4370$	1.00 <b>0.00</b>	$M_{c,y,Rd}$	513	513	513	513	513	513	513	513	513	513	513
		$M_{c,z,Rd}$	170	170	170	170	170	170	170	170	170	170	170
		$M_{N,y,Rd}$	-	-	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-
254x254x167 $N_{pl,Rd} = 7350$	n/a <b>1.00</b>	$M_{c,y,Rd}$	836	836	836	836	836	836	836	836	836	836	836
		$M_{c,z,Rd}$	392	392	392	392	392	392	392	392	392	392	392
		$M_{N,y,Rd}$	836	836	748	654	561	467	374	280	187	93.5	0
		$M_{N,z,Rd}$	392	392	392	387	370	340	297	242	174	93.1	0
254x254x132 $N_{pl,Rd} = 5800$	n/a <b>1.00</b>	$M_{c,y,Rd}$	645	645	645	645	645	645	645	645	645	645	645
		$M_{c,z,Rd}$	303	303	303	303	303	303	303	303	303	303	303
		$M_{N,y,Rd}$	645	645	577	505	433	361	289	217	144	72.2	0
		$M_{N,z,Rd}$	303	303	303	299	286	263	230	187	134	72.1	0
254x254x107 $N_{pl,Rd} = 4690$	n/a <b>1.00</b>	$M_{c,y,Rd}$	512	512	512	512	512	512	512	512	512	512	512
		$M_{c,z,Rd}$	240	240	240	240	240	240	240	240	240	240	240
		$M_{N,y,Rd}$	512	512	460	403	345	288	230	173	115	57.5	0
		$M_{N,z,Rd}$	240	240	240	238	228	209	183	149	107	57.7	0

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$N_{Ed}$  = Design value of the axial force.

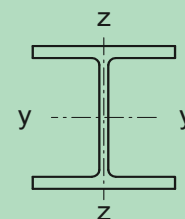
$$n = N_{Ed} / N_{pl,Rd}$$

- Not applicable for Class 3 and Class 4 sections.

The values in this table are conservative for tension as the more onerous compression section classification limits have been used.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL COLUMNS  
Advance® UKC



Member buckling check

Section Designation and Resistances (kN, kNm)	n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
		L (m)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
		$N_{b,y,Rd}$	$N_{b,z,Rd}$	$M_{b,Rd}$											
305x305x158 $N_{pl,Rd} = 6930$ $f_y W_{el,y} = 817$ $f_y W_{el,z} = 279$	1.00  <b>1.00</b>	$N_{b,y,Rd}$ $N_{b,z,Rd}$ $M_{b,Rd}$	6930 6930 925	6930 6780 925	6930 6490 925	6860 6190 925	6740 5880 918	6620 5560 897	6500 5220 877	6240 4520 838	5950 3830 801	5630 3200 764	5260 2680 729	4870 2250 694	4460 1910 662
305x305x137 $N_{pl,Rd} = 6000$ $f_y W_{el,y} = 706$ $f_y W_{el,z} = 239$	1.00  <b>1.00</b>	$N_{b,y,Rd}$ $N_{b,z,Rd}$ $M_{b,Rd}$	6000 6000 792	6000 5860 792	6000 5610 792	5930 5350 792	5830 5080 783	5720 4800 764	5610 4500 746	5380 3880 709	5130 3280 673	4840 2740 637	4520 2290 603	4170 1920 570	3810 1630 539
305x305x118 $N_{pl,Rd} = 5180$ $f_y W_{el,y} = 607$ $f_y W_{el,z} = 203$	1.00  <b>1.00</b>	$N_{b,y,Rd}$ $N_{b,z,Rd}$ $M_{b,Rd}$	5180 5180 675	5180 5050 675	5180 4830 675	5110 4600 675	5020 4370 665	4930 4120 648	4830 3860 630	4630 3330 596	4410 2800 562	4160 2340 528	3880 1950 495	3570 1640 464	3260 1390 435
305x305x97 $N_{pl,Rd} = 4370$ $f_y W_{el,y} = 513$ $f_y W_{el,z} = 170$	1.00  <b>1.00</b>	$N_{b,y,Rd}$ $N_{b,z,Rd}$ $M_{b,Rd}$	4370 4370 513	4370 4240 513	4370 4050 513	4300 3860 513	4220 3650 506	4140 3440 492	4060 3220 479	3880 2750 451	3690 2300 423	3460 1910 395	3210 1590 367	2950 1330 342	2670 1120 318
254x254x167 $N_{pl,Rd} = 7350$ $f_y W_{el,y} = 716$ $f_y W_{el,z} = 257$	1.00  <b>1.00</b>	$N_{b,y,Rd}$ $N_{b,z,Rd}$ $M_{b,Rd}$	7350 7350 836	7350 7030 836	7300 6680 836	7160 6300 836	7020 5910 826	6860 5490 809	6710 5060 794	6360 4200 765	5960 3420 738	5510 2780 712	5010 2270 687	4500 1880 663	4000 1580 639
254x254x132 $N_{pl,Rd} = 5800$ $f_y W_{el,y} = 563$ $f_y W_{el,z} = 199$	1.00  <b>1.00</b>	$N_{b,y,Rd}$ $N_{b,z,Rd}$ $M_{b,Rd}$	5800 5800 645	5800 5530 645	5750 5240 645	5630 4940 645	5520 4630 630	5390 4290 615	5260 3940 601	4980 3250 574	4650 2640 549	4270 2130 525	3870 1740 501	3460 1440 479	3060 1210 457
254x254x107 $N_{pl,Rd} = 4690$ $f_y W_{el,y} = 453$ $f_y W_{el,z} = 158$	1.00  <b>1.00</b>	$N_{b,y,Rd}$ $N_{b,z,Rd}$ $M_{b,Rd}$	4690 4690 512	4690 4470 512	4640 4230 512	4550 3980 509	4450 3720 495	4350 3440 482	4240 3160 469	3990 2590 444	3720 2090 419	3400 1690 396	3060 1380 374	2720 1140 353	2400 955 334

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$$n = N_{Ed} / N_{pl,Rd}$$

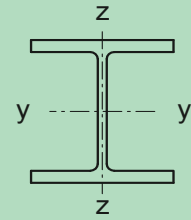
Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit.

For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL COLUMNS

Advance® UKC



Cross-section resistance check

Section Designation and Axial Force Resistance $N_{pl,Rd}$ (kN)	n Limit Class 3 <b>Class 2</b>	Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$											
		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
		$M_{c,y,Rd}$	$M_{c,z,Rd}$	$M_{N,y,Rd}$	$M_{N,z,Rd}$								
254x254x89 $N_{pl,Rd} = 3900$	n/a <b>1.00</b>	$M_{c,y,Rd}$	422	422	422	422	422	422	422	422	422	422	422
		$M_{c,z,Rd}$	198	198	198	198	198	198	198	198	198	198	198
		$M_{N,y,Rd}$	422	422	379	331	284	237	189	142	94.6	47.3	0
		$M_{N,z,Rd}$	198	198	198	196	187	172	151	123	88.3	47.4	0
254x254x73 $N_{pl,Rd} = 3310$	n/a <b>1.00</b>	$M_{c,y,Rd}$	352	352	352	352	352	352	352	352	352	352	352
		$M_{c,z,Rd}$	165	165	165	165	165	165	165	165	165	165	165
		$M_{N,y,Rd}$	352	352	317	278	238	198	159	119	79.3	39.6	0
		$M_{N,z,Rd}$	165	165	165	164	157	144	126	103	74.1	39.8	0
203x203x127 + $N_{pl,Rd} = 5590$	n/a <b>1.00</b>	$M_{c,y,Rd}$	523	523	523	523	523	523	523	523	523	523	523
		$M_{c,z,Rd}$	243	243	243	243	243	243	243	243	243	243	243
		$M_{N,y,Rd}$	523	523	467	408	350	292	233	175	117	58.3	0
		$M_{N,z,Rd}$	243	243	243	240	228	210	183	149	107	57.3	0
203x203x113 + $N_{pl,Rd} = 5000$	n/a <b>1.00</b>	$M_{c,y,Rd}$	459	459	459	459	459	459	459	459	459	459	459
		$M_{c,z,Rd}$	213	213	213	213	213	213	213	213	213	213	213
		$M_{N,y,Rd}$	459	459	411	359	308	257	205	154	103	51.3	0
		$M_{N,z,Rd}$	213	213	213	211	201	185	162	132	94.6	50.7	0
203x203x100 + $N_{pl,Rd} = 4380$	n/a <b>1.00</b>	$M_{c,y,Rd}$	396	396	396	396	396	396	396	396	396	396	396
		$M_{c,z,Rd}$	184	184	184	184	184	184	184	184	184	184	184
		$M_{N,y,Rd}$	396	396	355	311	266	222	178	133	88.8	44.4	0
		$M_{N,z,Rd}$	184	184	184	182	174	160	140	114	81.9	44.0	0
203x203x86 $N_{pl,Rd} = 3800$	n/a <b>1.00</b>	$M_{c,y,Rd}$	337	337	337	337	337	337	337	337	337	337	337
		$M_{c,z,Rd}$	157	157	157	157	157	157	157	157	157	157	157
		$M_{N,y,Rd}$	337	337	303	265	227	189	152	114	75.8	37.9	0
		$M_{N,z,Rd}$	157	157	157	156	149	137	120	97.8	70.4	37.8	0
203x203x71 $N_{pl,Rd} = 3120$	n/a <b>1.00</b>	$M_{c,y,Rd}$	276	276	276	276	276	276	276	276	276	276	276
		$M_{c,z,Rd}$	129	129	129	129	129	129	129	129	129	129	129
		$M_{N,y,Rd}$	276	276	246	216	185	154	123	92.4	61.6	30.8	0
		$M_{N,z,Rd}$	129	129	129	127	121	112	97.5	79.3	57.0	30.6	0

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+ These sections are in addition to the range of BS 4 sections

$N_{Ed}$  = Design value of the axial force.

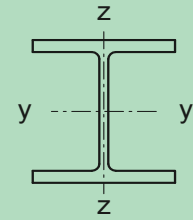
$n = N_{Ed} / N_{pl,Rd}$

The values in this table are conservative for tension as the more onerous compression section classification limits have been used.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL COLUMNS

Advance® UKC



Member buckling check

Section Designation and Resistances (kN, kNm)	n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
		L (m)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
254x254x89 $N_{pl,Rd} = 3900$ $f_y W_{el,y} = 378$ $f_y W_{el,z} = 131$	1.00	$N_{b,y,Rd}$	3900	3900	3860	3780	3690	3610	3510	3310	3070	2810	2520	2240	1970
	1.00	$N_{b,z,Rd}$	3900	3710	3510	3300	3080	2850	2610	2140	1720	1390	1130	938	785
		$M_{b,Rd}$	422	422	422	417	405	393	381	357	334	312	291	272	254
254x254x73 $N_{pl,Rd} = 3310$ $f_y W_{el,y} = 319$ $f_y W_{el,z} = 109$	1.00	$N_{b,y,Rd}$	3310	3310	3260	3190	3120	3040	2960	2780	2580	2340	2090	1850	1620
	1.00	$N_{b,z,Rd}$	3300	3130	2960	2780	2580	2380	2170	1770	1410	1140	925	762	637
		$M_{b,Rd}$	352	352	352	345	334	322	311	288	265	243	223	205	189
203x203x127 + $N_{pl,Rd} = 5590$ $f_y W_{el,y} = 441$ $f_y W_{el,z} = 159$	1.00	$N_{b,y,Rd}$	5590	5590	5460	5320	5180	5030	4870	4500	4070	3600	3130	2700	2320
	1.00	$N_{b,z,Rd}$	5490	5160	4810	4430	4040	3630	3220	2500	1940	1520	1220	998	829
		$M_{b,Rd}$	523	523	523	519	508	497	488	469	452	435	419	403	388
203x203x113 + $N_{pl,Rd} = 5000$ $f_y W_{el,y} = 391$ $f_y W_{el,z} = 139$	1.00	$N_{b,y,Rd}$	5000	5000	4880	4760	4630	4490	4340	4000	3600	3170	2750	2360	2030
	1.00	$N_{b,z,Rd}$	4910	4610	4290	3950	3590	3220	2860	2210	1710	1340	1080	879	730
		$M_{b,Rd}$	459	459	459	452	441	431	422	404	388	371	356	341	326
203x203x100 + $N_{pl,Rd} = 4380$ $f_y W_{el,y} = 341$ $f_y W_{el,z} = 121$	1.00	$N_{b,y,Rd}$	4380	4370	4270	4160	4040	3920	3780	3470	3120	2740	2360	2020	1740
	1.00	$N_{b,z,Rd}$	4290	4030	3750	3450	3130	2800	2480	1910	1470	1160	926	755	627
		$M_{b,Rd}$	396	396	396	387	377	368	359	342	326	311	296	282	268
203x203x86 $N_{pl,Rd} = 3800$ $f_y W_{el,y} = 293$ $f_y W_{el,z} = 103$	1.00	$N_{b,y,Rd}$	3800	3780	3690	3590	3490	3380	3260	2980	2670	2330	2000	1710	1460
	1.00	$N_{b,z,Rd}$	3710	3480	3230	2970	2690	2400	2120	1630	1260	986	789	644	534
		$M_{b,Rd}$	337	337	337	327	318	309	300	284	269	254	240	226	214
203x203x71 $N_{pl,Rd} = 3120$ $f_y W_{el,y} = 244$ $f_y W_{el,z} = 84.8$	1.00	$N_{b,y,Rd}$	3120	3110	3030	2950	2860	2770	2670	2440	2170	1890	1620	1390	1180
	1.00	$N_{b,z,Rd}$	3050	2860	2650	2430	2200	1960	1730	1330	1020	801	640	522	433
		$M_{b,Rd}$	276	276	274	265	256	248	240	224	209	195	182	171	160

Advance® and UKC are trademarks of Tata Steel. A fuller description of the relationship between Universal Columns (UC) and the Advance® range of sections manufactured by Tata Steel is given in note 12.

+ These sections are in addition to the range of BS 4 sections

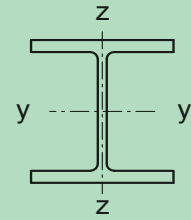
$$n = N_{Ed} / N_{pl,Rd}$$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit.

For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

UNIVERSAL COLUMNS

Advance® UKC



Cross-section resistance check

Section Designation and Axial Force Resistance $N_{pl,Rd}$ (kN)	n Limit Class 3 <b>Class 2</b>	Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$											
		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
		$M_{c,y,Rd}$	$M_{c,z,Rd}$	$M_{N,y,Rd}$	$M_{N,z,Rd}$								
203x203x60 $N_{pl,Rd} = 2710$	n/a <b>1.00</b>	$M_{c,y,Rd}$	233	233	233	233	233	233	233	233	233	233	233
		$M_{c,z,Rd}$	108	108	108	108	108	108	108	108	108	108	108
		$M_{N,y,Rd}$	233	233	211	185	158	132	106	79.2	52.8	26.4	0
		$M_{N,z,Rd}$	108	108	108	108	103	95.4	83.7	68.3	49.3	26.5	0
203x203x52 $N_{pl,Rd} = 2350$	n/a <b>1.00</b>	$M_{c,y,Rd}$	201	201	201	201	201	201	201	201	201	201	201
		$M_{c,z,Rd}$	93.8	93.8	93.8	93.8	93.8	93.8	93.8	93.8	93.8	93.8	93.8
		$M_{N,y,Rd}$	201	201	182	159	137	114	91.0	68.3	45.5	22.8	0
		$M_{N,z,Rd}$	93.8	93.8	93.8	93.0	89.2	82.2	72.1	58.8	42.4	22.8	0
203x203x46 $N_{pl,Rd} = 2080$	n/a <b>1.00</b>	$M_{c,y,Rd}$	177	177	177	177	177	177	177	177	177	177	177
		$M_{c,z,Rd}$	81.9	81.9	81.9	81.9	81.9	81.9	81.9	81.9	81.9	81.9	81.9
		$M_{N,y,Rd}$	177	177	160	140	120	100	80.1	60.1	40.1	20.0	0
		$M_{N,z,Rd}$	81.9	81.9	81.9	81.4	78.2	72.2	63.4	51.8	37.3	20.1	0
152x152x51 + $N_{pl,Rd} = 2310$	n/a <b>1.00</b>	$M_{c,y,Rd}$	155	155	155	155	155	155	155	155	155	155	155
		$M_{c,z,Rd}$	70.6	70.6	70.6	70.6	70.6	70.6	70.6	70.6	70.6	70.6	70.6
		$M_{N,y,Rd}$	155	155	142	124	106	88.4	70.8	53.1	35.4	17.7	0
		$M_{N,z,Rd}$	70.6	70.6	70.6	70.2	67.6	62.5	54.9	44.9	32.4	17.4	0
152x152x44 + $N_{pl,Rd} = 1990$	n/a <b>1.00</b>	$M_{c,y,Rd}$	132	132	132	132	132	132	132	132	132	132	132
		$M_{c,z,Rd}$	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0
		$M_{N,y,Rd}$	132	132	120	105	90.3	75.2	60.2	45.1	30.1	15.0	0
		$M_{N,z,Rd}$	60.0	60.0	60.0	59.7	57.4	53.1	46.7	38.2	27.5	14.8	0
152x152x37 $N_{pl,Rd} = 1670$	n/a <b>1.00</b>	$M_{c,y,Rd}$	110	110	110	110	110	110	110	110	110	110	110
		$M_{c,z,Rd}$	49.5	49.5	49.5	49.5	49.5	49.5	49.5	49.5	49.5	49.5	49.5
		$M_{N,y,Rd}$	110	110	100.0	87.5	75.0	62.5	50.0	37.5	25.0	12.5	0
		$M_{N,z,Rd}$	49.5	49.5	49.5	49.3	47.5	43.9	38.6	31.6	22.8	12.3	0
152x152x30 $N_{pl,Rd} = 1360$	n/a <b>1.00</b>	$M_{c,y,Rd}$	87.9	87.9	87.9	87.9	87.9	87.9	87.9	87.9	87.9	87.9	87.9
		$M_{c,z,Rd}$	39.6	39.6	39.6	39.6	39.6	39.6	39.6	39.6	39.6	39.6	39.6
		$M_{N,y,Rd}$	87.9	87.9	80.4	70.3	60.3	50.2	40.2	30.1	20.1	10.0	0
		$M_{N,z,Rd}$	39.6	39.6	39.6	39.4	38.0	35.2	31.0	25.3	18.3	9.85	0
152x152x23 $N_{pl,Rd} = 1040$	1.00 <b>0.00</b>	$M_{c,y,Rd}$	58.2	58.2	58.2	58.2	58.2	58.2	58.2	58.2	58.2	58.2	58.2
		$M_{c,z,Rd}$	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7	18.7
		$M_{N,y,Rd}$	-	-	-	-	-	-	-	-	-	-	-
		$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-

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+ These sections are in addition to the range of BS 4 sections

$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

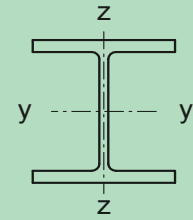
- Not applicable for Class 3 and Class 4 sections.

The values in this table are conservative for tension as the more onerous compression section classification limits have been used.

FOR EXPLANATION OF TABLES SEE NOTE 10.

UNIVERSAL COLUMNS

Advance® UKC



Member buckling check

Section Designation and Resistances (kN, kNm)	n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
		L (m)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
		$N_{b,y,Rd}$	$N_{b,z,Rd}$	$M_{b,Rd}$											
203x203x60 $N_{pl,Rd} = 2710$ $f_y W_{el,y} = 207$ $f_y W_{el,z} = 71.2$	1.00	$N_{b,y,Rd}$	2710	2690	2620	2550	2470	2380	2290	2080	1830	1580	1340	1140	968
	1.00	$N_{b,z,Rd}$	2640	2470	2280	2080	1870	1660	1450	1100	844	659	526	428	355
		$M_{b,Rd}$	233	233	230	221	213	205	196	181	166	152	140	129	120
203x203x52 $N_{pl,Rd} = 2350$ $f_y W_{el,y} = 181$ $f_y W_{el,z} = 61.8$	1.00	$N_{b,y,Rd}$	2350	2340	2270	2210	2140	2070	1980	1800	1580	1360	1160	980	833
	1.00	$N_{b,z,Rd}$	2290	2140	1980	1800	1620	1430	1260	952	728	568	453	369	306
		$M_{b,Rd}$	201	201	198	190	182	174	167	151	137	125	114	104	95.8
203x203x46 $N_{pl,Rd} = 2080$ $f_y W_{el,y} = 160$ $f_y W_{el,z} = 54.0$	1.00	$N_{b,y,Rd}$	2080	2070	2010	1950	1890	1820	1750	1580	1390	1190	1010	855	726
	1.00	$N_{b,z,Rd}$	2030	1890	1740	1590	1430	1260	1100	832	635	495	395	321	266
		$M_{b,Rd}$	177	177	173	166	158	151	144	129	115	104	93.5	85.1	77.9
152x152x51 + $N_{pl,Rd} = 2310$ $f_y W_{el,y} = 135$ $f_y W_{el,z} = 46.2$	1.00	$N_{b,y,Rd}$	2310	2250	2170	2080	1990	1880	1760	1490	1220	986	803	661	551
	1.00	$N_{b,z,Rd}$	2160	1960	1730	1490	1260	1050	879	625	461	352	277	224	184
		$M_{b,Rd}$	155	155	149	143	138	133	128	119	110	102	94.4	87.8	81.9
152x152x44 + $N_{pl,Rd} = 1990$ $f_y W_{el,y} = 116$ $f_y W_{el,z} = 39.1$	1.00	$N_{b,y,Rd}$	1990	1930	1860	1790	1700	1600	1500	1260	1030	831	675	555	463
	1.00	$N_{b,z,Rd}$	1860	1680	1480	1280	1070	894	745	529	390	297	234	189	155
		$M_{b,Rd}$	132	131	125	120	115	110	105	96.2	88.0	80.6	74.1	68.4	63.4
152x152x37 $N_{pl,Rd} = 1670$ $f_y W_{el,y} = 97.0$ $f_y W_{el,z} = 32.5$	1.00	$N_{b,y,Rd}$	1670	1620	1560	1490	1420	1340	1250	1050	849	684	555	456	380
	1.00	$N_{b,z,Rd}$	1550	1400	1240	1060	889	738	614	435	320	244	192	155	127
		$M_{b,Rd}$	110	108	103	98.0	93.1	88.4	83.8	75.2	67.7	61.2	55.7	51.0	47.0
152x152x30 $N_{pl,Rd} = 1360$ $f_y W_{el,y} = 78.8$ $f_y W_{el,z} = 26.0$	1.00	$N_{b,y,Rd}$	1360	1320	1270	1210	1150	1080	1010	839	679	545	442	362	302
	1.00	$N_{b,z,Rd}$	1260	1140	999	854	714	592	492	347	256	195	153	123	102
		$M_{b,Rd}$	87.9	86.2	81.6	77.0	72.4	67.9	63.6	55.7	49.1	43.7	39.3	35.6	32.5
152x152x23 $N_{pl,Rd} = 1040$ $f_y W_{el,y} = 58.2$ $f_y W_{el,z} = 18.7$	1.00	$N_{b,y,Rd}$	1040	999	960	916	867	812	751	618	495	395	319	261	217
	1.00	$N_{b,z,Rd}$	955	856	746	632	524	431	356	250	183	140	110	88.3	72.6
		$M_{b,Rd}$	58.2	57.2	54.0	50.7	47.3	43.9	40.7	34.8	30.1	26.4	23.4	20.9	18.6

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+ These sections are in addition to the range of BS 4 sections

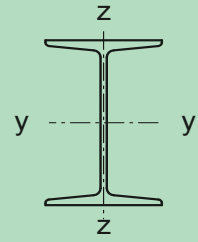
$$n = N_{Ed} / N_{pl,Rd}$$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit.

For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

FOR EXPLANATION OF TABLES SEE NOTE 10.

JOISTS



Cross-section resistance check

Section Designation and Axial Force Resistance $N_{pl,Rd}$ (kN)	n Limit Class 3 Class 2	Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$											
		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
		$M_{c,y,Rd}$	$M_{c,z,Rd}$	$M_{N,y,Rd}$	$M_{N,z,Rd}$								
254x203x82 $N_{pl,Rd} = 3620$	n/a <b>1.00</b>	$M_{c,y,Rd}$	372	372	372	372	372	372	372	372	372	372	372
		$M_{c,z,Rd}$	128	128	128	128	128	128	128	128	128	128	128
		$M_{N,y,Rd}$	372	372	336	294	252	210	168	126	84.0	42.0	0
		$M_{N,z,Rd}$	128	128	128	127	122	112	98.4	80.3	57.8	31.1	0
254x114x37 $N_{pl,Rd} = 1680$	n/a <b>1.00</b>	$M_{c,y,Rd}$	163	163	163	163	163	163	163	163	163	163	163
		$M_{c,z,Rd}$	28.1	28.1	28.1	28.1	28.1	28.1	28.1	28.1	28.1	28.1	28.1
		$M_{N,y,Rd}$	163	163	161	141	121	101	80.5	60.4	40.3	20.1	0
		$M_{N,z,Rd}$	28.1	28.1	28.1	28.1	28.1	27.0	24.6	20.6	15.2	8.34	0
203x152x52 $N_{pl,Rd} = 2300$	n/a <b>1.00</b>	$M_{c,y,Rd}$	187	187	187	187	187	187	187	187	187	187	187
		$M_{c,z,Rd}$	60.7	60.7	60.7	60.7	60.7	60.7	60.7	60.7	60.7	60.7	60.7
		$M_{N,y,Rd}$	187	187	170	149	128	106	85.1	63.8	42.5	21.3	0
		$M_{N,z,Rd}$	60.7	60.7	60.7	60.4	58.2	53.8	47.3	38.7	27.9	15.0	0
152x127x37 $N_{pl,Rd} = 1690$	n/a <b>1.00</b>	$M_{c,y,Rd}$	99.0	99.0	99.0	99.0	99.0	99.0	99.0	99.0	99.0	99.0	99.0
		$M_{c,z,Rd}$	35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4
		$M_{N,y,Rd}$	99.0	99.0	92.9	81.3	69.7	58.1	46.4	34.8	23.2	11.6	0
		$M_{N,z,Rd}$	35.4	35.4	35.4	35.4	34.6	32.4	28.8	23.7	17.2	9.33	0
127x114x29 $N_{pl,Rd} = 1330$	n/a <b>1.00</b>	$M_{c,y,Rd}$	64.3	64.3	64.3	64.3	64.3	64.3	64.3	64.3	64.3	64.3	64.3
		$M_{c,z,Rd}$	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1
		$M_{N,y,Rd}$	64.3	64.3	60.4	52.8	45.3	37.7	30.2	22.6	15.1	7.55	0
		$M_{N,z,Rd}$	25.1	25.1	25.1	25.1	24.6	23.0	20.5	16.9	12.3	6.64	0
127x114x27 $N_{pl,Rd} = 1210$	n/a <b>1.00</b>	$M_{c,y,Rd}$	61.1	61.1	61.1	61.1	61.1	61.1	61.1	61.1	61.1	61.1	61.1
		$M_{c,z,Rd}$	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2
		$M_{N,y,Rd}$	61.1	61.1	55.4	48.5	41.6	34.7	27.7	20.8	13.9	6.93	0
		$M_{N,z,Rd}$	24.2	24.2	24.2	24.1	23.1	21.3	18.7	15.3	11.0	5.94	0
127x76x16 $N_{pl,Rd} = 749$	n/a <b>1.00</b>	$M_{c,y,Rd}$	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9	36.9
		$M_{c,z,Rd}$	9.37	9.37	9.37	9.37	9.37	9.37	9.37	9.37	9.37	9.37	9.37
		$M_{N,y,Rd}$	36.9	36.9	34.9	30.5	26.2	21.8	17.4	13.1	8.72	4.36	0
		$M_{N,z,Rd}$	9.37	9.37	9.37	9.37	9.20	8.64	7.69	6.36	4.63	2.51	0

$N_{Ed}$  = Design value of the axial force.

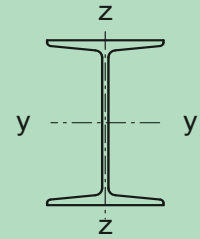
$n = N_{Ed} / N_{pl,Rd}$

The values in this table are conservative for tension as the more onerous compression section classification limits have been used.

FOR EXPLANATION OF TABLES SEE NOTE 10.



JOISTS



Member buckling check

Section Designation and Resistances (kN, kNm)	n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
		L (m)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
254x203x82 $N_{pl,Rd} = 3620$ $f_y W_{el,y} = 327$ $f_y W_{el,z} = 77.3$	1.00	$N_{b,y,Rd}$	3620	3620	3590	3540	3490	3430	3370	3220	3030	2790	2500	2200	1910
	1.00	$N_{b,z,Rd}$	3520	3330	3120	2860	2560	2240	1930	1410	1050	805	634	511	420
		$M_{b,Rd}$	372	372	364	352	340	328	317	296	276	257	240	224	210
254x114x37 $N_{pl,Rd} = 1680$ $f_y W_{el,y} = 142$ $f_y W_{el,z} = 16.7$	1.00	$N_{b,y,Rd}$	1680	1680	1660	1640	1610	1580	1550	1480	1380	1250	1110	964	830
	1.00	$N_{b,z,Rd}$	1450	1190	903	663	495	379	299	198	141	105	81.2	64.7	52.7
		$M_{b,Rd}$	157	139	122	107	94.6	84.5	76.1	63.5	54.5	47.7	42.5	38.3	34.4
203x152x52 $N_{pl,Rd} = 2300$ $f_y W_{el,y} = 163$ $f_y W_{el,z} = 36.9$	1.00	$N_{b,y,Rd}$	2300	2280	2240	2200	2150	2100	2040	1880	1670	1430	1190	997	837
	1.00	$N_{b,z,Rd}$	2160	1980	1750	1490	1220	992	808	556	402	303	236	189	155
		$M_{b,Rd}$	187	183	175	168	160	153	147	134	123	112	103	95.3	88.4
152x127x37 $N_{pl,Rd} = 1690$ $f_y W_{el,y} = 84.8$ $f_y W_{el,z} = 21.2$	1.00	$N_{b,y,Rd}$	1680	1620	1550	1470	1380	1280	1170	946	746	590	473	386	320
	1.00	$N_{b,z,Rd}$	1450	1230	982	764	594	468	375	255	184	138	108	86.5	70.8
		$M_{b,Rd}$	99.0	95.0	90.5	86.4	82.4	78.6	74.9	68.1	61.9	56.5	51.8	47.7	44.2
127x114x29 $N_{pl,Rd} = 1330$ $f_y W_{el,y} = 54.7$ $f_y W_{el,z} = 15.0$	1.00	$N_{b,y,Rd}$	1300	1240	1170	1080	989	882	774	581	438	338	267	216	178
	1.00	$N_{b,z,Rd}$	1110	902	694	523	398	310	247	167	119	89.7	69.8	55.8	45.7
		$M_{b,Rd}$	64.3	61.0	58.1	55.3	52.7	50.2	47.8	43.3	39.3	35.8	32.8	30.2	27.9
127x114x27 $N_{pl,Rd} = 1210$ $f_y W_{el,y} = 52.9$ $f_y W_{el,z} = 14.7$	1.00	$N_{b,y,Rd}$	1190	1140	1070	1000	919	825	728	552	419	324	256	207	171
	1.00	$N_{b,z,Rd}$	1030	845	659	502	385	301	240	162	116	87.5	68.1	54.5	44.6
		$M_{b,Rd}$	61.1	57.7	54.8	52.0	49.4	46.8	44.4	39.9	36.0	32.7	29.8	27.4	25.2
127x76x16 $N_{pl,Rd} = 749$ $f_y W_{el,y} = 32.0$ $f_y W_{el,z} = 5.68$	1.00	$N_{b,y,Rd}$	741	718	692	658	615	560	496	371	277	211	165	133	109
	1.00	$N_{b,z,Rd}$	556	377	246	168	121	91.0	70.9	46.4	32.7	24.3	18.7	14.9	12.1
		$M_{b,Rd}$	34.2	31.0	28.0	25.3	22.8	20.7	18.9	16.1	13.9	11.9	10.4	9.23	8.30

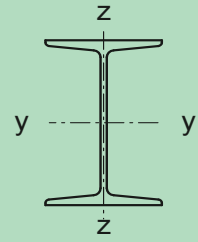
$n = N_{Ed} / N_{pl,Rd}$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit.

For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

FOR EXPLANATION OF TABLES SEE NOTE 10.

JOISTS



Cross-section resistance check

Section Designation and Axial Force Resistance $N_{pl,Rd}$ (kN)	n Limit Class 3 <b>Class 2</b>	Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$											
		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
		$M_{c,y,Rd}$	$M_{c,z,Rd}$	$M_{N,y,Rd}$	$M_{N,z,Rd}$								
114x114x27 $N_{pl,Rd} = 1220$	n/a <b>1.00</b>	$M_{c,y,Rd}$	53.6	53.6	53.6	53.6	53.6	53.6	53.6	53.6	53.6	53.6	53.6
		$M_{c,z,Rd}$	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4	23.4
		$M_{N,y,Rd}$	53.6	53.6	50.2	43.9	37.6	31.4	25.1	18.8	12.5	6.27	0
		$M_{N,z,Rd}$	23.4	23.4	23.4	23.4	22.8	21.3	18.9	15.6	11.3	6.12	0
102x102x23 $N_{pl,Rd} = 1040$	n/a <b>1.00</b>	$M_{c,y,Rd}$	40.1	40.1	40.1	40.1	40.1	40.1	40.1	40.1	40.1	40.1	40.1
		$M_{c,z,Rd}$	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0
		$M_{N,y,Rd}$	40.1	40.1	37.4	32.8	28.1	23.4	18.7	14.0	9.36	4.68	0
		$M_{N,z,Rd}$	18.0	18.0	18.0	18.0	17.5	16.3	14.5	11.9	8.65	4.68	0
102x44x7 $N_{pl,Rd} = 337$	n/a <b>1.00</b>	$M_{c,y,Rd}$	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6
		$M_{c,z,Rd}$	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14	2.14
		$M_{N,y,Rd}$	12.6	12.6	12.6	11.2	9.60	8.00	6.40	4.80	3.20	1.60	0
		$M_{N,z,Rd}$	2.14	2.14	2.14	2.14	2.14	2.11	1.95	1.66	1.24	0.684	0
89x89x19 $N_{pl,Rd} = 884$	n/a <b>1.00</b>	$M_{c,y,Rd}$	29.4	29.4	29.4	29.4	29.4	29.4	29.4	29.4	29.4	29.4	29.4
		$M_{c,z,Rd}$	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5
		$M_{N,y,Rd}$	29.4	29.4	27.5	24.1	20.6	17.2	13.8	10.3	6.88	3.44	0
		$M_{N,z,Rd}$	13.5	13.5	13.5	13.5	13.2	12.3	10.9	9.02	6.55	3.55	0
76x76x15 $N_{pl,Rd} = 678$	n/a <b>1.00</b>	$M_{c,y,Rd}$	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2
		$M_{c,z,Rd}$	9.16	9.16	9.16	9.16	9.16	9.16	9.16	9.16	9.16	9.16	9.16
		$M_{N,y,Rd}$	19.2	19.2	18.1	15.8	13.6	11.3	9.04	6.78	4.52	2.26	0
		$M_{N,z,Rd}$	9.16	9.16	9.16	9.16	8.96	8.39	7.45	6.14	4.47	2.42	0
76x76x13 $N_{pl,Rd} = 575$	n/a <b>1.00</b>	$M_{c,y,Rd}$	17.3	17.3	17.3	17.3	17.3	17.3	17.3	17.3	17.3	17.3	17.3
		$M_{c,z,Rd}$	7.95	7.95	7.95	7.95	7.95	7.95	7.95	7.95	7.95	7.95	7.95
		$M_{N,y,Rd}$	17.3	17.3	15.5	13.5	11.6	9.66	7.73	5.79	3.86	1.93	0
		$M_{N,z,Rd}$	7.95	7.95	7.95	7.85	7.49	6.88	6.01	4.89	3.52	1.89	0

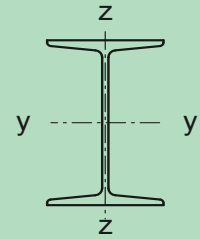
$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

The values in this table are conservative for tension as the more onerous compression section classification limits have been used.

FOR EXPLANATION OF TABLES SEE NOTE 10.

JOISTS



Member buckling check

Section Designation and Resistances (kN, kNm)	n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
		L (m)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
114x114x27 $N_{pl,Rd} = 1220$ $f_y W_{el,y} = 45.8$ $f_y W_{el,z} = 13.9$	1.00	$N_{b,y,Rd}$	1190	1120	1050	954	849	738	632	459	341	260	205	165	136
	1.00	$N_{b,z,Rd}$	1020	834	643	485	370	288	230	155	111	83.3	64.9	51.9	42.4
		$M_{b,Rd}$	53.6	51.3	49.0	46.9	44.9	43.0	41.2	37.7	34.5	31.6	29.1	26.9	24.9
102x102x23 $N_{pl,Rd} = 1040$ $f_y W_{el,y} = 33.9$ $f_y W_{el,z} = 10.8$	1.00	$N_{b,y,Rd}$	995	928	847	751	644	541	451	318	232	176	138	111	90.7
	1.00	$N_{b,z,Rd}$	834	651	480	352	264	204	162	108	77.2	57.8	44.9	35.9	29.3
		$M_{b,Rd}$	40.0	38.0	36.3	34.7	33.2	31.7	30.3	27.6	25.2	23.1	21.2	19.5	18.1
102x44x7 $N_{pl,Rd} = 337$ $f_y W_{el,y} = 10.7$ $f_y W_{el,z} = 1.25$	1.00	$N_{b,y,Rd}$	328	313	293	265	229	191	158	109	78.1	58.6	45.5	36.4	29.7
	1.00	$N_{b,z,Rd}$	123	61.3	36.1	23.6	16.7	12.4	9.56	6.19	4.33	3.20	2.46	1.95	1.58
		$M_{b,Rd}$	8.68	6.80	5.55	4.68	4.05	3.56	3.19	2.58	2.14	1.83	1.60	1.42	1.28
89x89x19 $N_{pl,Rd} = 884$ $f_y W_{el,y} = 24.5$ $f_y W_{el,z} = 8.09$	1.00	$N_{b,y,Rd}$	828	757	669	566	463	375	305	210	151	114	88.8	71.1	58.2
	1.00	$N_{b,z,Rd}$	669	492	345	246	182	139	110	72.9	51.9	38.8	30.1	24.0	19.6
		$M_{b,Rd}$	29.1	27.7	26.4	25.3	24.2	23.1	22.1	20.1	18.4	16.8	15.4	14.2	13.2
76x76x15 $N_{pl,Rd} = 678$ $f_y W_{el,y} = 16.0$ $f_y W_{el,z} = 5.40$	1.00	$N_{b,y,Rd}$	618	548	460	367	287	225	180	122	87.0	65.2	50.6	40.4	33.0
	1.00	$N_{b,z,Rd}$	476	327	220	153	112	85.2	66.9	44.2	31.3	23.4	18.1	14.4	11.8
		$M_{b,Rd}$	18.8	17.9	17.0	16.2	15.4	14.7	14.0	12.6	11.4	10.4	9.51	8.74	8.08
76x76x13 $N_{pl,Rd} = 575$ $f_y W_{el,y} = 14.7$ $f_y W_{el,z} = 4.83$	1.00	$N_{b,y,Rd}$	528	473	403	326	257	204	163	111	79.3	59.5	46.3	37.0	30.2
	1.00	$N_{b,z,Rd}$	406	279	188	131	96.1	73.0	57.3	37.9	26.9	20.0	15.5	12.4	10.1
		$M_{b,Rd}$	16.7	15.7	14.8	14.0	13.2	12.4	11.7	10.4	9.24	8.32	7.55	6.90	6.32

$n = N_{Ed} / N_{pl,Rd}$

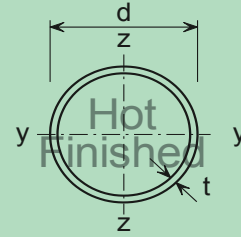
Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit.

For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED CIRCULAR HOLLOW SECTIONS

Celsius® CHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial resistance $N_{pl,Rd}$ kN	Moment Resistance $M_{c,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$												
d mm	t mm			n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	
21.3	2.6 #	1.20	54.3	$M_{c,Rd}$	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	0.325	
				$M_{N,Rd}$	0.325	0.318	0.304	0.283	0.256	0.225	0.189	0.148	0.103	0.053	0	
	2.9 #	1.32	59.6	$M_{c,Rd}$	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	0.351	
				$M_{N,Rd}$	0.351	0.344	0.329	0.306	0.277	0.243	0.204	0.160	0.111	0.058	0	
	3.2	1.43	64.6	$M_{c,Rd}$	0.376	0.376	0.376	0.376	0.376	0.376	0.376	0.376	0.376	0.376	0.376	
				$M_{N,Rd}$	0.376	0.369	0.352	0.328	0.297	0.260	0.218	0.171	0.119	0.062	0	
26.9	2.6 #	1.56	70.3	$M_{c,Rd}$	0.547	0.547	0.547	0.547	0.547	0.547	0.547	0.547	0.547	0.547	0.547	
				$M_{N,Rd}$	0.547	0.536	0.511	0.476	0.432	0.378	0.317	0.249	0.173	0.090	0	
	2.9 #	1.72	77.7	$M_{c,Rd}$	0.596	0.596	0.596	0.596	0.596	0.596	0.596	0.596	0.596	0.596	0.596	
				$M_{N,Rd}$	0.596	0.585	0.558	0.519	0.471	0.413	0.346	0.271	0.188	0.098	0	
	3.2	1.87	84.5	$M_{c,Rd}$	0.643	0.643	0.643	0.643	0.643	0.643	0.643	0.643	0.643	0.643	0.643	
				$M_{N,Rd}$	0.643	0.630	0.601	0.560	0.507	0.445	0.373	0.292	0.203	0.105	0	
	3.6 #	2.07	93.7	$M_{c,Rd}$	0.699	0.699	0.699	0.699	0.699	0.699	0.699	0.699	0.699	0.699	0.699	
				$M_{N,Rd}$	0.699	0.685	0.654	0.609	0.552	0.484	0.406	0.318	0.221	0.115	0	
	33.7	2.6 #	1.99	90.2	$M_{c,Rd}$	0.895	0.895	0.895	0.895	0.895	0.895	0.895	0.895	0.895	0.895	0.895
					$M_{N,Rd}$	0.895	0.877	0.837	0.779	0.706	0.619	0.519	0.407	0.282	0.147	0
		2.9 #	2.20	99.8	$M_{c,Rd}$	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980	0.980
					$M_{N,Rd}$	0.980	0.960	0.916	0.853	0.773	0.678	0.569	0.445	0.309	0.161	0
3.2		2.41	109	$M_{c,Rd}$	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	1.06	
				$M_{N,Rd}$	1.06	1.04	0.993	0.924	0.838	0.735	0.616	0.483	0.335	0.174	0	
3.6 #		2.67	121	$M_{c,Rd}$	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	1.16	
				$M_{N,Rd}$	1.16	1.14	1.09	1.01	0.919	0.806	0.676	0.529	0.368	0.191	0	
4.0		2.93	132	$M_{c,Rd}$	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.26	
				$M_{N,Rd}$	1.26	1.24	1.18	1.10	0.995	0.872	0.731	0.573	0.398	0.207	0	
4.5 #		3.24	147	$M_{c,Rd}$	1.37	1.37	1.37	1.37	1.37	1.37	1.37	1.37	1.37	1.37	1.37	
				$M_{N,Rd}$	1.37	1.35	1.28	1.20	1.08	0.951	0.797	0.625	0.434	0.225	0	
5.0 #	3.54	160	$M_{c,Rd}$	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48	1.48		
			$M_{N,Rd}$	1.48	1.45	1.38	1.29	1.17	1.02	0.857	0.671	0.466	0.242	0		
42.4	2.6 #	2.55	115	$M_{c,Rd}$	1.46	1.46	1.46	1.46	1.46	1.46	1.46	1.46	1.46	1.46	1.46	
				$M_{N,Rd}$	1.46	1.43	1.37	1.27	1.15	1.01	0.849	0.665	0.462	0.240	0	
	2.9 #	2.82	128	$M_{c,Rd}$	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61	1.61	
				$M_{N,Rd}$	1.61	1.58	1.50	1.40	1.27	1.11	0.933	0.731	0.508	0.264	0	
	3.2	3.09	140	$M_{c,Rd}$	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	1.75	
				$M_{N,Rd}$	1.75	1.72	1.64	1.52	1.38	1.21	1.02	0.796	0.553	0.287	0	
	3.6 #	3.44	156	$M_{c,Rd}$	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	
				$M_{N,Rd}$	1.93	1.89	1.81	1.68	1.52	1.34	1.12	0.878	0.610	0.317	0	
	4.0	3.79	171	$M_{c,Rd}$	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	2.10	
				$M_{N,Rd}$	2.10	2.06	1.97	1.83	1.66	1.45	1.22	0.956	0.663	0.345	0	
	4.5 #	4.21	190	$M_{c,Rd}$	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	2.30	
				$M_{N,Rd}$	2.30	2.26	2.15	2.01	1.82	1.59	1.34	1.05	0.727	0.378	0	
5.0 #	4.61	208	$M_{c,Rd}$	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50	2.50		
			$M_{N,Rd}$	2.50	2.45	2.34	2.18	1.97	1.73	1.45	1.14	0.789	0.410	0		

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Circular Hollow Sections (HFCHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

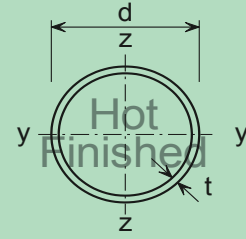
$N_{pl,Rd}$  is the axial force resistance

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED CIRCULAR HOLLOW SECTIONS

Celsius® CHS



Member buckling check

Section Designation & Resistance (kNm)		Mass per Metre kg/m	Compression Resistance $N_{b,Rd}$ (kN)												
d mm	t mm		for Varying buckling lengths (m)												
			1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
21.3	2.6 # $f_y W_{el} = 0.227$	1.20	12.6	5.85	3.35	2.17	1.52	1.12	0.861	0.554	0.386	0.284	0.218	0.173	0.140
	2.9 # $f_y W_{el} = 0.242$	1.32	13.5	6.26	3.59	2.32	1.62	1.20	0.921	0.592	0.413	0.304	0.233	0.184	0.150
	3.2 $f_y W_{el} = 0.256$	1.43	14.2	6.60	3.78	2.45	1.71	1.26	0.971	0.624	0.435	0.320	0.246	0.194	0.158
26.9	2.6 # $f_y W_{el} = 0.391$	1.56	25.7	12.3	7.14	4.64	3.25	2.41	1.85	1.19	0.832	0.613	0.470	0.372	0.302
	2.9 # $f_y W_{el} = 0.422$	1.72	28.0	13.4	7.74	5.03	3.52	2.61	2.00	1.29	0.901	0.664	0.510	0.403	0.327
	3.2 $f_y W_{el} = 0.451$	1.87	29.8	14.3	8.24	5.35	3.75	2.77	2.13	1.37	0.959	0.707	0.542	0.429	0.348
	3.6 # $f_y W_{el} = 0.483$	2.07	32.3	15.4	8.90	5.78	4.05	2.99	2.30	1.48	1.03	0.762	0.585	0.463	0.376
33.7	2.6 # $f_y W_{el} = 0.653$	1.99	48.4	24.7	14.5	9.49	6.68	4.95	3.81	2.46	1.72	1.27	0.974	0.771	0.626
	2.9 # $f_y W_{el} = 0.706$	2.20	52.8	26.9	15.8	10.3	7.26	5.38	4.14	2.67	1.87	1.38	1.06	0.838	0.680
	3.2 $f_y W_{el} = 0.760$	2.41	56.9	28.9	17.0	11.1	7.79	5.77	4.44	2.87	2.00	1.48	1.13	0.899	0.729
	3.6 # $f_y W_{el} = 0.824$	2.67	62.2	31.5	18.4	12.0	8.47	6.27	4.83	3.12	2.18	1.61	1.23	0.977	0.793
	4.0 $f_y W_{el} = 0.884$	2.93	67.3	34.0	19.9	13.0	9.12	6.76	5.21	3.36	2.35	1.73	1.33	1.05	0.854
	4.5 # $f_y W_{el} = 0.948$	3.24	72.5	36.3	21.2	13.9	9.74	7.21	5.55	3.58	2.50	1.85	1.42	1.12	0.911
	5.0 # $f_y W_{el} = 1.01$	3.54	78.0	39.0	22.8	14.8	10.4	7.73	5.95	3.84	2.68	1.98	1.52	1.20	0.975
42.4	2.6 # $f_y W_{el} = 1.08$	2.55	82.5	48.6	29.5	19.5	13.8	10.2	7.91	5.12	3.58	2.65	2.03	1.61	1.31
	2.9 # $f_y W_{el} = 1.18$	2.82	90.8	53.3	32.2	21.3	15.1	11.2	8.64	5.60	3.92	2.89	2.22	1.76	1.43
	3.2 $f_y W_{el} = 1.27$	3.09	98.7	57.6	34.8	23.0	16.3	12.1	9.33	6.04	4.23	3.12	2.40	1.90	1.54
	3.6 # $f_y W_{el} = 1.40$	3.44	109	63.4	38.3	25.3	17.9	13.3	10.3	6.64	4.64	3.43	2.63	2.09	1.70
	4.0 $f_y W_{el} = 1.51$	3.79	119	68.1	41.0	27.0	19.1	14.2	11.0	7.09	4.96	3.66	2.82	2.23	1.81
	4.5 # $f_y W_{el} = 1.63$	4.21	131	74.7	44.9	29.6	20.9	15.5	12.0	7.76	5.43	4.01	3.08	2.44	1.98
	5.0 # $f_y W_{el} = 1.75$	4.61	141	79.7	47.8	31.5	22.3	16.5	12.8	8.25	5.77	4.26	3.28	2.60	2.11

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$M_{b,Rd}$  should be taken as equal to  $M_{c,Rd}$ .

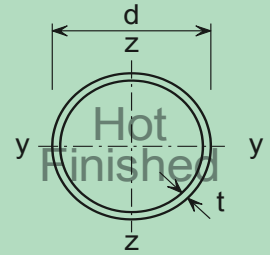
$n = N_{Ed} / N_{pl,Rd}$

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED CIRCULAR HOLLOW SECTIONS

Celsius® CHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial resistance $N_{pl,Rd}$ kN	Moment Resistance $M_{c,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$												
d mm	t mm			n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	
48.3	2.6 #	2.93	132	$M_{c,Rd}$	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	1.93	
				$M_{N,Rd}$	1.93	1.89	1.81	1.68	1.52	1.34	1.12	0.878	0.610	0.317	0	
	2.9 #	3.25	147	$M_{c,Rd}$	2.13	2.13	2.13	2.13	2.13	2.13	2.13	2.13	2.13	2.13	2.13	
				$M_{N,Rd}$	2.13	2.08	1.99	1.85	1.68	1.47	1.23	0.967	0.671	0.349	0	
	3.2	3.56	161	$M_{c,Rd}$	2.31	2.31	2.31	2.31	2.31	2.31	2.31	2.31	2.31	2.31	2.31	
				$M_{N,Rd}$	2.31	2.27	2.16	2.02	1.83	1.60	1.34	1.05	0.731	0.380	0	
	3.6 #	3.97	180	$M_{c,Rd}$	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	2.56	
				$M_{N,Rd}$	2.56	2.51	2.39	2.23	2.02	1.77	1.49	1.16	0.808	0.420	0	
	4.0	4.37	198	$M_{c,Rd}$	2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79	
				$M_{N,Rd}$	2.79	2.74	2.61	2.43	2.21	1.93	1.62	1.27	0.882	0.458	0	
4.5 #	4.86	220	$M_{c,Rd}$	3.07	3.07	3.07	3.07	3.07	3.07	3.07	3.07	3.07	3.07	3.07		
			$M_{N,Rd}$	3.07	3.01	2.88	2.68	2.43	2.13	1.78	1.40	0.971	0.504	0		
5.0	5.34	241	$M_{c,Rd}$	3.34	3.34	3.34	3.34	3.34	3.34	3.34	3.34	3.34	3.34	3.34		
			$M_{N,Rd}$	3.34	3.28	3.13	2.91	2.64	2.31	1.94	1.52	1.06	0.548	0		
5.6 #	5.90	267	$M_{c,Rd}$	3.66	3.66	3.66	3.66	3.66	3.66	3.66	3.66	3.66	3.66	3.66		
			$M_{N,Rd}$	3.66	3.58	3.42	3.18	2.89	2.53	2.12	1.66	1.15	0.600	0		
6.3	6.53	295	$M_{c,Rd}$	3.98	3.98	3.98	3.98	3.98	3.98	3.98	3.98	3.98	3.98	3.98		
			$M_{N,Rd}$	3.98	3.90	3.72	3.46	3.14	2.75	2.31	1.81	1.26	0.652	0		
60.3	2.6 #	3.70	167	$M_{c,Rd}$	3.07	3.07	3.07	3.07	3.07	3.07	3.07	3.07	3.07	3.07		
				$M_{N,Rd}$	3.07	3.01	2.88	2.68	2.43	2.13	1.78	1.40	0.971	0.504	0	
	2.9 #	4.11	186	$M_{c,Rd}$	3.39	3.39	3.39	3.39	3.39	3.39	3.39	3.39	3.39	3.39		
				$M_{N,Rd}$	3.39	3.33	3.17	2.96	2.68	2.35	1.97	1.54	1.07	0.557	0	
	3.2	4.51	204	$M_{c,Rd}$	3.69	3.69	3.69	3.69	3.69	3.69	3.69	3.69	3.69	3.69		
				$M_{N,Rd}$	3.69	3.62	3.45	3.22	2.91	2.56	2.14	1.68	1.17	0.605	0	
	3.6 #	5.03	228	$M_{c,Rd}$	4.12	4.12	4.12	4.12	4.12	4.12	4.12	4.12	4.12	4.12		
				$M_{N,Rd}$	4.12	4.04	3.85	3.59	3.25	2.85	2.39	1.87	1.30	0.675	0	
	4.0	5.55	251	$M_{c,Rd}$	4.51	4.51	4.51	4.51	4.51	4.51	4.51	4.51	4.51	4.51		
				$M_{N,Rd}$	4.51	4.42	4.22	3.93	3.56	3.12	2.62	2.05	1.42	0.739	0	
4.5 #	6.19	280	$M_{c,Rd}$	4.97	4.97	4.97	4.97	4.97	4.97	4.97	4.97	4.97	4.97			
			$M_{N,Rd}$	4.97	4.87	4.65	4.33	3.92	3.44	2.88	2.26	1.57	0.815	0		
5.0	6.82	308	$M_{c,Rd}$	5.43	5.43	5.43	5.43	5.43	5.43	5.43	5.43	5.43	5.43			
			$M_{N,Rd}$	5.43	5.32	5.08	4.73	4.29	3.76	3.15	2.47	1.71	0.891	0		
5.6 #	7.55	342	$M_{c,Rd}$	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96			
			$M_{N,Rd}$	5.96	5.85	5.58	5.19	4.71	4.13	3.46	2.71	1.88	0.978	0		
6.3	8.39	380	$M_{c,Rd}$	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57			
			$M_{N,Rd}$	6.57	6.44	6.14	5.72	5.18	4.55	3.81	2.99	2.07	1.08	0		
8.0 #	10.3	465	$M_{c,Rd}$	7.85	7.85	7.85	7.85	7.85	7.85	7.85	7.85	7.85	7.85			
			$M_{N,Rd}$	7.85	7.69	7.34	6.83	6.19	5.43	4.55	3.57	2.48	1.29	0		

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$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

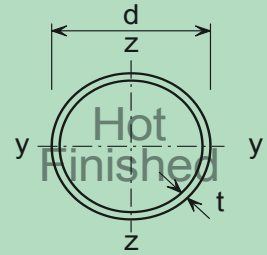
$N_{pl,Rd}$  is the axial force resistance

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED CIRCULAR HOLLOW SECTIONS

Celsius® CHS



Member buckling check

Section Designation & Resistance (kNm)		Mass per Metre kg/m	Compression Resistance $N_{b,Rd}$ (kN)												
d mm	t mm		for Varying buckling lengths (m)												
			1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
48.3	2.6 # $f_y W_{el} = 1.44$	2.93	105	69.2	43.4	29.0	20.6	15.4	11.9	7.71	5.40	3.99	3.07	2.43	1.98
	2.9 # $f_y W_{el} = 1.57$	3.25	116	76.1	47.6	31.8	22.6	16.8	13.0	8.45	5.92	4.38	3.37	2.67	2.17
	3.2 # $f_y W_{el} = 1.70$	3.56	126	82.5	51.5	34.4	24.4	18.2	14.1	9.14	6.40	4.73	3.64	2.89	2.34
	3.6 # $f_y W_{el} = 1.87$	3.97	141	91.3	56.9	38.0	27.0	20.1	15.5	10.1	7.06	5.22	4.01	3.18	2.59
	4.0 # $f_y W_{el} = 2.02$	4.37	153	98.7	61.3	40.8	29.0	21.6	16.7	10.8	7.58	5.61	4.31	3.42	2.78
	4.5 # $f_y W_{el} = 2.20$	4.86	170	109	67.3	44.8	31.8	23.7	18.3	11.9	8.32	6.15	4.73	3.75	3.05
	5.0 # $f_y W_{el} = 2.37$	5.34	185	117	72.3	48.1	34.1	25.4	19.6	12.7	8.92	6.59	5.07	4.02	3.26
	5.6 # $f_y W_{el} = 2.56$	5.90	202	127	78.0	51.8	36.8	27.4	21.2	13.7	9.60	7.09	5.45	4.32	3.51
	6.3 # $f_y W_{el} = 2.75$	6.53	222	137	84.3	56.0	39.7	29.5	22.8	14.8	10.3	7.65	5.88	4.66	3.78
60.3	2.6 # $f_y W_{el} = 2.31$	3.70	146	116	80.2	55.5	40.0	30.0	23.3	15.2	10.7	7.92	6.10	4.84	3.93
	2.9 # $f_y W_{el} = 2.54$	4.11	162	128	88.4	61.1	44.0	33.0	25.7	16.7	11.8	8.71	6.71	5.32	4.33
	3.2 # $f_y W_{el} = 2.76$	4.51	177	140	96.3	66.4	47.9	35.9	27.9	18.2	12.8	9.46	7.29	5.78	4.70
	3.6 # $f_y W_{el} = 3.05$	5.03	198	155	107	73.6	53.0	39.8	30.9	20.1	14.1	10.5	8.06	6.40	5.20
	4.0 # $f_y W_{el} = 3.32$	5.55	218	170	117	80.4	57.9	43.4	33.7	22.0	15.4	11.4	8.80	6.99	5.68
	4.5 # $f_y W_{el} = 3.62$	6.19	242	188	128	88.2	63.4	47.6	36.9	24.1	16.9	12.5	9.63	7.64	6.21
	5.0 # $f_y W_{el} = 3.94$	6.82	266	205	139	95.4	68.5	51.4	39.9	26.0	18.2	13.5	10.4	8.25	6.71
	5.6 # $f_y W_{el} = 4.30$	7.55	293	224	151	104	74.5	55.8	43.3	28.2	19.8	14.7	11.3	8.95	7.28
	6.3 # $f_y W_{el} = 4.65$	8.39	325	247	166	113	81.2	60.9	47.2	30.8	21.6	16.0	12.3	9.76	7.93
	8.0 # $f_y W_{el} = 5.43$	10.3	394	293	194	132	94.7	70.9	55.0	35.8	25.1	18.6	14.3	11.3	9.22

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$M_{b,Rd}$  should be taken as equal to  $M_{c,Rd}$ .

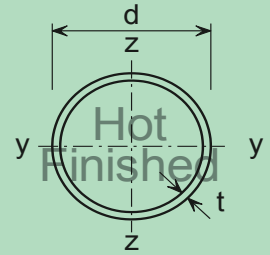
$n = N_{Ed} / N_{pl,Rd}$

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED CIRCULAR HOLLOW SECTIONS

Celsius® CHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial resistance $N_{pl,Rd}$ kN	Moment Resistance $M_{c,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$												
d mm	t mm			n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	
76.1	2.9	5.24	237	$M_{c,Rd}$	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50	5.50	
				$M_{N,Rd}$	5.50	5.39	5.15	4.79	4.34	3.81	3.19	2.50	1.74	0.902	0	
	3.2	5.75	260	$M_{c,Rd}$	6.04	6.04	6.04	6.04	6.04	6.04	6.04	6.04	6.04	6.04	6.04	
				$M_{N,Rd}$	6.04	5.91	5.64	5.26	4.76	4.18	3.50	2.74	1.91	0.990	0	
	3.6 #	6.44	291	$M_{c,Rd}$	6.71	6.71	6.71	6.71	6.71	6.71	6.71	6.71	6.71	6.71	6.71	
				$M_{N,Rd}$	6.71	6.58	6.27	5.84	5.30	4.64	3.89	3.05	2.12	1.10	0	
	4.0	7.11	322	$M_{c,Rd}$	7.38	7.38	7.38	7.38	7.38	7.38	7.38	7.38	7.38	7.38	7.38	
				$M_{N,Rd}$	7.38	7.24	6.91	6.43	5.83	5.11	4.29	3.36	2.33	1.21	0	
	4.5 #	7.95	359	$M_{c,Rd}$	8.20	8.20	8.20	8.20	8.20	8.20	8.20	8.20	8.20	8.20	8.20	
$M_{N,Rd}$				8.20	8.04	7.67	7.14	6.47	5.68	4.76	3.73	2.59	1.34	0		
5.0	8.77	398	$M_{c,Rd}$	8.98	8.98	8.98	8.98	8.98	8.98	8.98	8.98	8.98	8.98	8.98		
			$M_{N,Rd}$	8.98	8.80	8.40	7.82	7.09	6.22	5.21	4.08	2.84	1.47	0		
5.6 #	9.74	440	$M_{c,Rd}$	9.90	9.90	9.90	9.90	9.90	9.90	9.90	9.90	9.90	9.90	9.90		
			$M_{N,Rd}$	9.90	9.71	9.26	8.63	7.82	6.86	5.75	4.50	3.13	1.62	0		
6.3	10.8	490	$M_{c,Rd}$	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9		
			$M_{N,Rd}$	10.9	10.7	10.2	9.52	8.63	7.57	6.35	4.97	3.45	1.79	0		
8.0	13.4	607	$M_{c,Rd}$	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2		
			$M_{N,Rd}$	13.2	13.0	12.4	11.5	10.5	9.17	7.69	6.02	4.18	2.17	0		
88.9	2.9 #	6.15	278	$M_{c,Rd}$	7.63	7.63	7.63	7.63	7.63	7.63	7.63	7.63	7.63	7.63		
				$M_{N,Rd}$	7.63	7.48	7.14	6.65	6.02	5.28	4.43	3.47	2.41	1.25	0	
	3.2 #	6.76	306	$M_{c,Rd}$	8.34	8.34	8.34	8.34	8.34	8.34	8.34	8.34	8.34	8.34		
				$M_{N,Rd}$	8.34	8.18	7.80	7.27	6.59	5.77	4.84	3.79	2.63	1.37	0	
	3.6 #	7.57	343	$M_{c,Rd}$	9.30	9.30	9.30	9.30	9.30	9.30	9.30	9.30	9.30	9.30		
				$M_{N,Rd}$	9.30	9.12	8.70	8.10	7.34	6.44	5.40	4.23	2.94	1.53	0	
	4.0	8.38	380	$M_{c,Rd}$	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3		
				$M_{N,Rd}$	10.3	10.1	9.59	8.93	8.10	7.10	5.95	4.66	3.24	1.68	0	
	4.5 #	9.37	422	$M_{c,Rd}$	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4		
				$M_{N,Rd}$	11.4	11.2	10.7	9.92	9.00	7.89	6.61	5.18	3.60	1.87	0	
	5.0	10.3	469	$M_{c,Rd}$	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5		
				$M_{N,Rd}$	12.5	12.2	11.7	10.9	9.86	8.65	7.25	5.68	3.94	2.05	0	
5.6 #	11.5	522	$M_{c,Rd}$	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8			
			$M_{N,Rd}$	13.8	13.5	12.9	12.0	10.9	9.56	8.01	6.28	4.36	2.26	0		
6.3	12.8	579	$M_{c,Rd}$	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3			
			$M_{N,Rd}$	15.3	15.0	14.3	13.3	12.1	10.6	8.88	6.96	4.83	2.51	0		
8.0	16.0	721	$M_{c,Rd}$	18.6	18.6	18.6	18.6	18.6	18.6	18.6	18.6	18.6	18.6			
			$M_{N,Rd}$	18.6	18.3	17.4	16.2	14.7	12.9	10.8	8.47	5.88	3.06	0		
10.0 #	19.5	880	$M_{c,Rd}$	22.2	22.2	22.2	22.2	22.2	22.2	22.2	22.2	22.2	22.2			
			$M_{N,Rd}$	22.2	21.8	20.8	19.4	17.5	15.4	12.9	10.1	7.02	3.64	0		

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Circular Hollow Sections (HFCHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

$N_{pl,Rd}$  is the axial force resistance

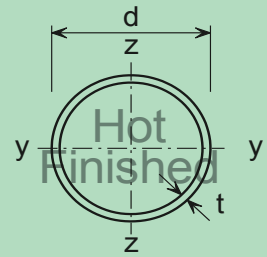
# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.



HOT-FINISHED CIRCULAR HOLLOW SECTIONS

Celsius® CHS



Member buckling check

Section Designation & Resistance (kNm)		Mass per Metre kg/m	Compression Resistance $N_{b,Rd}$ (kN)												
d mm	t mm		for Varying buckling lengths (m)												
			1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
76.1	2.9 $f_y W_{el} = 4.19$	5.24	218	194	156	116	86.6	66.0	51.7	34.0	24.0	17.8	13.8	10.9	8.90
	3.2 $f_y W_{el} = 4.54$	5.75	240	213	171	127	94.5	72.1	56.5	37.1	26.2	19.5	15.0	11.9	9.71
	3.6 # $f_y W_{el} = 5.04$	6.44	268	237	190	141	105	80.1	62.7	41.2	29.1	21.6	16.7	13.2	10.8
	4.0 $f_y W_{el} = 5.50$	7.11	296	261	208	154	115	87.2	68.3	44.9	31.7	23.5	18.1	14.4	11.7
	4.5 # $f_y W_{el} = 6.07$	7.95	330	291	231	171	127	96.5	75.6	49.7	35.0	26.0	20.1	15.9	13.0
	5.0 $f_y W_{el} = 6.60$	8.77	365	321	254	187	139	106	82.6	54.3	38.3	28.4	21.9	17.4	14.2
	5.6 # $f_y W_{el} = 7.24$	9.74	404	354	278	205	151	115	90.1	59.2	41.7	31.0	23.9	19.0	15.4
	6.3 $f_y W_{el} = 7.92$	10.8	448	392	307	225	166	126	98.8	64.8	45.7	33.9	26.2	20.8	16.9
	8.0 $f_y W_{el} = 9.37$	13.4	553	479	369	268	197	150	117	76.7	54.0	40.1	30.9	24.6	20.0
88.9	2.9 # $f_y W_{el} = 5.79$	6.15	263	243	211	170	132	103	81.4	54.1	38.4	28.6	22.1	17.6	14.3
	3.2 # $f_y W_{el} = 6.32$	6.76	289	266	232	187	145	112	89.0	59.1	41.9	31.2	24.1	19.2	15.6
	3.6 # $f_y W_{el} = 7.03$	7.57	323	298	259	208	161	125	99.0	65.8	46.6	34.7	26.8	21.4	17.4
	4.0 $f_y W_{el} = 7.70$	8.38	358	330	286	229	177	137	109	72.0	51.1	38.0	29.4	23.4	19.0
	4.5 # $f_y W_{el} = 8.52$	9.37	398	366	317	253	196	152	120	79.6	56.4	42.0	32.5	25.8	21.0
	5.0 $f_y W_{el} = 9.30$	10.3	441	405	350	279	215	166	131	87.2	61.8	46.0	35.5	28.3	23.0
	5.6 # $f_y W_{el} = 10.2$	11.5	491	451	387	308	237	183	145	95.9	67.9	50.6	39.1	31.1	25.3
	6.3 $f_y W_{el} = 11.2$	12.8	544	498	427	338	259	201	158	105	74.4	55.3	42.7	34.0	27.7
	8.0 $f_y W_{el} = 13.4$	16.0	676	616	523	410	313	241	190	126	89.0	66.2	51.1	40.7	33.1
	10.0 # $f_y W_{el} = 15.7$	19.5	823	747	628	487	369	284	223	148	104	77.7	60.0	47.7	38.8

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$M_{b,Rd}$  should be taken as equal to  $M_{c,Rd}$ .

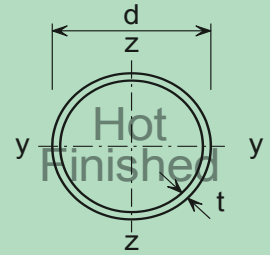
$n = N_{Ed} / N_{pl,Rd}$

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED CIRCULAR HOLLOW SECTIONS

Celsius® CHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial resistance $N_{pl,Rd}$ kN	Moment Resistance $M_{c,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$												
d mm	t mm			n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	
101.6	3.2 #	7.77	351	$M_{c,Rd}$	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	
				$M_{N,Rd}$	11.0	10.8	10.3	9.58	8.69	7.62	6.39	5.00	3.47	1.80	0	
	3.6 #	8.70	394	$M_{c,Rd}$	12.3	12.3	12.3	12.3	12.3	12.3	12.3	12.3	12.3	12.3	12.3	
				$M_{N,Rd}$	12.3	12.0	11.5	10.7	9.70	8.50	7.13	5.58	3.88	2.01	0	
	4.0 #	9.63	437	$M_{c,Rd}$	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	
				$M_{N,Rd}$	13.5	13.3	12.6	11.8	10.7	9.36	7.85	6.15	4.27	2.22	0	
	4.5 #	10.8	486	$M_{c,Rd}$	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.1	
				$M_{N,Rd}$	15.1	14.8	14.1	13.1	11.9	10.4	8.76	6.86	4.76	2.47	0	
	5.0 #	11.9	540	$M_{c,Rd}$	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	
				$M_{N,Rd}$	16.6	16.2	15.5	14.4	13.1	11.5	9.62	7.54	5.23	2.72	0	
	5.6 #	13.3	600	$M_{c,Rd}$	18.4	18.4	18.4	18.4	18.4	18.4	18.4	18.4	18.4	18.4	18.4	
				$M_{N,Rd}$	18.4	18.0	17.2	16.0	14.5	12.7	10.7	8.34	5.79	3.01	0	
	6.3 #	14.8	671	$M_{c,Rd}$	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	
				$M_{N,Rd}$	20.3	19.9	19.0	17.7	16.1	14.1	11.8	9.25	6.42	3.34	0	
	8.0 #	18.5	834	$M_{c,Rd}$	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	
				$M_{N,Rd}$	25.0	24.5	23.3	21.7	19.7	17.3	14.5	11.3	7.88	4.09	0	
	10.0 #	22.6	1020	$M_{c,Rd}$	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	
				$M_{N,Rd}$	29.9	29.3	28.0	26.0	23.6	20.7	17.3	13.6	9.44	4.90	0	
114.3	3.2 #	8.77	398	$M_{c,Rd}$	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0		
				$M_{N,Rd}$	14.0	13.7	13.1	12.2	11.1	9.71	8.14	6.38	4.43	2.30	0	
	3.6	9.83	444	$M_{c,Rd}$	15.7	15.7	15.7	15.7	15.7	15.7	15.7	15.7	15.7	15.7		
				$M_{N,Rd}$	15.7	15.3	14.6	13.6	12.4	10.8	9.09	7.12	4.94	2.57	0	
	4.0	10.9	493	$M_{c,Rd}$	17.3	17.3	17.3	17.3	17.3	17.3	17.3	17.3	17.3	17.3		
				$M_{N,Rd}$	17.3	16.9	16.2	15.1	13.6	12.0	10.0	7.86	5.46	2.84	0	
	4.5 #	12.2	550	$M_{c,Rd}$	19.3	19.3	19.3	19.3	19.3	19.3	19.3	19.3	19.3	19.3		
				$M_{N,Rd}$	19.3	18.9	18.0	16.8	15.2	13.3	11.2	8.76	6.09	3.16	0	
	5.0	13.5	611	$M_{c,Rd}$	21.2	21.2	21.2	21.2	21.2	21.2	21.2	21.2	21.2	21.2		
				$M_{N,Rd}$	21.2	20.8	19.9	18.5	16.8	14.7	12.3	9.65	6.70	3.48	0	
	5.6 #	15.0	678	$M_{c,Rd}$	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5	23.5		
				$M_{N,Rd}$	23.5	23.0	22.0	20.5	18.6	16.3	13.6	10.7	7.42	3.85	0	
	6.3	16.8	760	$M_{c,Rd}$	26.1	26.1	26.1	26.1	26.1	26.1	26.1	26.1	26.1	26.1		
				$M_{N,Rd}$	26.1	25.6	24.4	22.8	20.6	18.1	15.2	11.9	8.25	4.28	0	
	8.0	21.0	948	$M_{c,Rd}$	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2		
				$M_{N,Rd}$	32.2	31.5	30.1	28.0	25.4	22.3	18.7	14.6	10.2	5.27	0	
	10.0 #	25.7	1160	$M_{c,Rd}$	38.7	38.7	38.7	38.7	38.7	38.7	38.7	38.7	38.7	38.7		
				$M_{N,Rd}$	38.7	37.9	36.2	33.7	30.5	26.8	22.5	17.6	12.2	6.35	0	

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$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

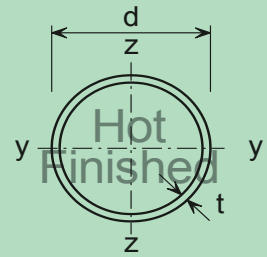
$N_{pl,Rd}$  is the axial force resistance

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED CIRCULAR HOLLOW SECTIONS

Celsius® CHS



Member buckling check

Section Designation & Resistance (kNm)		Mass per Metre kg/m	Compression Resistance $N_{b,Rd}$ (kN)												
d mm	t mm		for Varying buckling lengths (m)												
			1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
101.6	3.2 # $f_y W_{el} = 8.38$	7.77	337	317	289	248	202	162	130	87.6	62.5	46.7	36.2	28.8	23.5
	3.6 # $f_y W_{el} = 9.30$	8.70	378	356	323	278	226	181	145	97.8	69.8	52.1	40.4	32.2	26.2
	4.0 # $f_y W_{el} = 10.2$	9.63	418	394	357	306	249	199	159	107	76.5	57.1	44.2	35.2	28.7
	4.5 # $f_y W_{el} = 11.3$	10.8	466	438	397	340	276	220	177	119	84.7	63.3	49.0	39.0	31.8
	5.0 # $f_y W_{el} = 12.4$	11.9	517	485	440	375	304	242	194	130	93.0	69.4	53.7	42.8	34.9
	5.6 # $f_y W_{el} = 13.6$	13.3	574	539	487	415	335	267	214	143	102	76.3	59.1	47.1	38.4
	6.3 # $f_y W_{el} = 15.0$	14.8	642	602	543	461	372	295	237	159	113	84.4	65.3	52.0	42.4
	8.0 # $f_y W_{el} = 18.1$	18.5	796	745	669	564	451	357	285	191	136	101	78.5	62.5	50.9
	10.0 # $f_y W_{el} = 21.3$	22.6	974	909	812	678	539	425	338	226	161	120	92.8	73.9	60.2
114.3	3.2 # $f_y W_{el} = 10.7$	8.77	386	368	343	309	265	219	180	123	88.8	66.6	51.7	41.2	33.7
	3.6 $f_y W_{el} = 11.9$	9.83	430	410	383	344	295	244	200	137	98.6	73.9	57.4	45.8	37.4
	4.0 $f_y W_{el} = 13.1$	10.9	478	456	425	381	326	270	221	151	109	81.4	63.2	50.4	41.2
	4.5 # $f_y W_{el} = 14.6$	12.2	533	508	473	424	363	299	245	168	121	90.4	70.1	56.0	45.7
	5.0 $f_y W_{el} = 16.0$	13.5	591	563	524	469	400	330	270	185	132	99.3	77.1	61.5	50.2
	5.6 # $f_y W_{el} = 17.6$	15.0	656	625	581	519	442	364	297	203	146	109	84.7	67.6	55.2
	6.3 $f_y W_{el} = 19.4$	16.8	735	699	649	579	491	403	329	224	161	121	93.5	74.6	60.9
	8.0 $f_y W_{el} = 23.6$	21.0	916	870	806	715	603	493	401	273	196	147	114	90.8	74.1
	10.0 # $f_y W_{el} = 27.9$	25.7	1120	1060	983	866	725	590	478	325	232	174	135	108	87.7

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$M_{b,Rd}$  should be taken as equal to  $M_{c,Rd}$ .

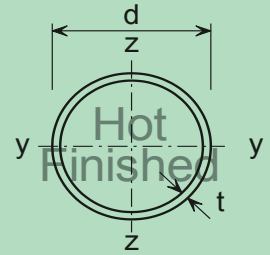
$$n = N_{Ed} / N_{pl,Rd}$$

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED CIRCULAR HOLLOW SECTIONS

Celsius® CHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial resistance $N_{pl,Rd}$ kN	Moment Resistance $M_{c,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$												
d mm	t mm			n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	
139.7	3.2 #	10.8	486	$M_{c,Rd}$	21.2	21.2	21.2	21.2	21.2	21.2	21.2	21.2	21.2	21.2	21.2	
				$M_{N,Rd}$	21.2	20.7	19.8	18.4	16.7	14.6	12.3	9.62	6.68	3.47	0	
	3.6 #	12.1	547	$M_{c,Rd}$	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	23.7	
				$M_{N,Rd}$	23.7	23.2	22.1	20.6	18.7	16.4	13.7	10.8	7.48	3.88	0	
	4.0 #	13.4	607	$M_{c,Rd}$	26.2	26.2	26.2	26.2	26.2	26.2	26.2	26.2	26.2	26.2	26.2	
				$M_{N,Rd}$	26.2	25.6	24.5	22.8	20.7	18.1	15.2	11.9	8.26	4.29	0	
	4.5 #	15.0	678	$M_{c,Rd}$	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	29.2	
				$M_{N,Rd}$	29.2	28.6	27.3	25.4	23.1	20.2	17.0	13.3	9.22	4.79	0	
	5.0	16.6	753	$M_{c,Rd}$	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	
				$M_{N,Rd}$	32.2	31.6	30.1	28.1	25.4	22.3	18.7	14.7	10.2	5.29	0	
5.6 #	18.5	838	$M_{c,Rd}$	35.9	35.9	35.9	35.9	35.9	35.9	35.9	35.9	35.9	35.9	35.9		
			$M_{N,Rd}$	35.9	35.1	33.5	31.2	28.3	24.8	20.8	16.3	11.3	5.88	0		
6.3	20.7	937	$M_{c,Rd}$	39.8	39.8	39.8	39.8	39.8	39.8	39.8	39.8	39.8	39.8	39.8		
			$M_{N,Rd}$	39.8	39.0	37.2	34.6	31.4	27.5	23.1	18.1	12.6	6.52	0		
8.0	26.0	1180	$M_{c,Rd}$	49.3	49.3	49.3	49.3	49.3	49.3	49.3	49.3	49.3	49.3	49.3		
			$M_{N,Rd}$	49.3	48.4	46.1	43.0	39.0	34.2	28.6	22.4	15.6	8.09	0		
10.0	32.0	1440	$M_{c,Rd}$	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0		
			$M_{N,Rd}$	60.0	58.8	56.1	52.2	47.4	41.5	34.8	27.3	18.9	9.84	0		
12.5 #	39.2	1780	$M_{c,Rd}$	72.1	72.1	72.1	72.1	72.1	72.1	72.1	72.1	72.1	72.1	72.1		
			$M_{N,Rd}$	72.1	70.6	67.4	62.8	56.9	49.9	41.8	32.8	22.8	11.8	0		
168.3	5.0	20.1	912	$M_{c,Rd}$	47.2	47.2	47.2	47.2	47.2	47.2	47.2	47.2	47.2	47.2		
				$M_{N,Rd}$	47.2	46.3	44.2	41.1	37.3	32.7	27.4	21.5	14.9	7.74	0	
	5.6 #	22.5	1020	$M_{c,Rd}$	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5	52.5		
				$M_{N,Rd}$	52.5	51.5	49.1	45.8	41.5	36.4	30.5	23.9	16.6	8.62	0	
	6.3	25.2	1140	$M_{c,Rd}$	58.6	58.6	58.6	58.6	58.6	58.6	58.6	58.6	58.6	58.6		
				$M_{N,Rd}$	58.6	57.4	54.8	51.0	46.2	40.5	34.0	26.6	18.5	9.61	0	
	8.0	31.6	1430	$M_{c,Rd}$	73.1	73.1	73.1	73.1	73.1	73.1	73.1	73.1	73.1	73.1		
				$M_{N,Rd}$	73.1	71.7	68.4	63.7	57.7	50.6	42.4	33.2	23.1	12.0	0	
	10.0	39.0	1760	$M_{c,Rd}$	89.1	89.1	89.1	89.1	89.1	89.1	89.1	89.1	89.1	89.1		
				$M_{N,Rd}$	89.1	87.3	83.3	77.6	70.3	61.7	51.7	40.5	28.1	14.6	0	
	12.5	48.0	2170	$M_{c,Rd}$	108	108	108	108	108	108	108	108	108	108		
				$M_{N,Rd}$	108	106	101	94.0	85.2	74.7	62.6	49.1	34.1	17.7	0	

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$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

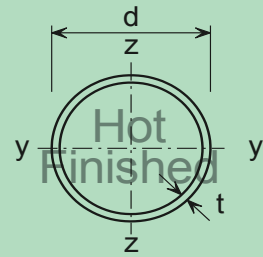
$N_{pl,Rd}$  is the axial force resistance

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED CIRCULAR HOLLOW SECTIONS

Celsius® CHS



Member buckling check

Section Designation & Resistance (kNm)		Mass per Metre kg/m	Compression Resistance $N_{b,Rd}$ (kN)												
d mm	t mm		for Varying buckling lengths (m)												
			1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
139.7	3.2 # $f_y W_{el} = 16.3$	10.8	479	463	443	417	383	341	295	214	158	119	93.3	74.8	61.2
	3.6 # $f_y W_{el} = 18.1$	12.1	538	520	497	468	430	382	330	239	176	133	104	83.4	68.3
	4.0 # $f_y W_{el} = 20.0$	13.4	597	577	552	520	477	423	366	265	195	147	115	92.2	75.5
	4.5 # $f_y W_{el} = 22.2$	15.0	667	644	616	580	531	471	406	294	216	163	128	102	83.6
	5.0 $f_y W_{el} = 24.4$	16.6	740	715	684	643	589	522	450	325	239	181	141	113	92.5
	5.6 # $f_y W_{el} = 27.0$	18.5	824	795	760	715	654	578	498	359	264	200	156	125	102
	6.3 $f_y W_{el} = 29.9$	20.7	921	889	849	797	728	643	553	398	292	221	172	138	113
	8.0 $f_y W_{el} = 36.6$	26.0	1150	1110	1060	995	905	796	682	489	357	270	211	169	138
	10.0 $f_y W_{el} = 43.7$	32.0	1420	1370	1300	1220	1100	966	824	588	429	324	253	203	166
	12.5 # $f_y W_{el} = 51.8$	39.2	1740	1670	1590	1480	1340	1160	988	702	511	386	301	241	197
168.3	5.0 $f_y W_{el} = 36.2$	20.1	907	883	856	823	782	730	666	524	400	309	244	196	161
	5.6 # $f_y W_{el} = 40.1$	22.5	1010	983	952	915	869	811	739	580	443	342	269	217	178
	6.3 $f_y W_{el} = 44.4$	25.2	1130	1100	1070	1030	974	907	826	647	493	380	300	241	198
	8.0 $f_y W_{el} = 54.7$	31.6	1420	1380	1340	1290	1220	1130	1030	800	608	469	369	297	244
	10.0 $f_y W_{el} = 66.0$	39.0	1750	1700	1650	1580	1500	1390	1260	973	737	567	446	359	295
	12.5 $f_y W_{el} = 78.8$	48.0	2160	2090	2030	1940	1830	1690	1530	1170	887	681	535	431	354

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Circular Hollow Sections (HFCHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

$M_{b,Rd}$  should be taken as equal to  $M_{c,Rd}$ .

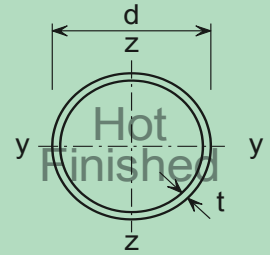
$n = N_{Ed} / N_{pl,Rd}$

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED CIRCULAR HOLLOW SECTIONS

Celsius® CHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial resistance $N_{pl,Rd}$ kN	Moment Resistance $M_{c,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$																								
d mm	t mm			n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0													
193.7	5.0	23.3	1050	$M_{c,Rd}$	63.2	63.2	63.2	63.2	63.2	63.2	63.2	63.2	63.2	63.2	63.2	$M_{N,Rd}$	63.2	61.9	59.1	55.0	49.9	43.7	36.7	28.7	19.9	10.4	0	
	5.6 #	26.0	1180	$M_{c,Rd}$	70.3	70.3	70.3	70.3	70.3	70.3	70.3	70.3	70.3	70.3	70.3	70.3	$M_{N,Rd}$	70.3	68.9	65.7	61.2	55.5	48.7	40.8	32.0	22.2	11.5	0
	6.3	29.1	1320	$M_{c,Rd}$	78.5	78.5	78.5	78.5	78.5	78.5	78.5	78.5	78.5	78.5	78.5	78.5	$M_{N,Rd}$	78.5	76.9	73.4	68.3	61.9	54.3	45.5	35.7	24.8	12.9	0
	8.0	36.6	1660	$M_{c,Rd}$	98.0	98.0	98.0	98.0	98.0	98.0	98.0	98.0	98.0	98.0	98.0	98.0	$M_{N,Rd}$	98.0	96.0	91.6	85.3	77.3	67.8	56.9	44.5	30.9	16.1	0
	10.0	45.3	2050	$M_{c,Rd}$	120	120	120	120	120	120	120	120	120	120	120	120	$M_{N,Rd}$	120	118	112	104	94.7	83.1	69.6	54.6	37.9	19.7	0
	12.5	55.9	2530	$M_{c,Rd}$	146	146	146	146	146	146	146	146	146	146	146	146	$M_{N,Rd}$	146	143	136	127	115	101	84.7	66.3	46.1	23.9	0
	16.0 #	70.1	3170	$M_{c,Rd}$	180	180	180	180	180	180	180	180	180	180	180	180	$M_{N,Rd}$	180	176	168	157	142	125	104	81.8	56.8	29.5	0
219.1	4.5 #	23.8	1080	$M_{c,Rd}$	56.4	56.4	56.4	56.4	56.4	56.4	56.4	56.4	56.4	56.4	56.4	56.4	$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-
	5.0 #	26.4	1190	$M_{c,Rd}$	81.3	81.3	81.3	81.3	81.3	81.3	81.3	81.3	81.3	81.3	81.3	81.3	$M_{N,Rd}$	81.3	79.7	76.0	70.8	64.2	56.3	47.2	37.0	25.7	13.3	0
	5.6 #	29.5	1330	$M_{c,Rd}$	90.5	90.5	90.5	90.5	90.5	90.5	90.5	90.5	90.5	90.5	90.5	90.5	$M_{N,Rd}$	90.5	88.7	84.7	78.8	71.5	62.7	52.5	41.2	28.6	14.8	0
	6.3	33.1	1490	$M_{c,Rd}$	101	101	101	101	101	101	101	101	101	101	101	101	$M_{N,Rd}$	101	99.2	94.6	88.1	79.9	70.0	58.7	46.0	31.9	16.6	0
	8.0	41.6	1890	$M_{c,Rd}$	127	127	127	127	127	127	127	127	127	127	127	127	$M_{N,Rd}$	127	124	119	110	100	87.7	73.6	57.6	40.0	20.8	0
	10.0	51.6	2330	$M_{c,Rd}$	155	155	155	155	155	155	155	155	155	155	155	155	$M_{N,Rd}$	155	152	145	135	123	108	90.2	70.7	49.1	25.5	0
	12.5	63.7	2880	$M_{c,Rd}$	190	190	190	190	190	190	190	190	190	190	190	190	$M_{N,Rd}$	190	186	177	165	150	131	110	86.2	59.8	31.1	0
	14.2 #	71.8	3240	$M_{c,Rd}$	212	212	212	212	212	212	212	212	212	212	212	212	$M_{N,Rd}$	212	208	198	185	167	147	123	96.4	66.9	34.8	0
	16.0	80.1	3620	$M_{c,Rd}$	235	235	235	235	235	235	235	235	235	235	235	235	$M_{N,Rd}$	235	230	219	204	185	162	136	107	74.1	38.5	0

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$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

$N_{pl,Rd}$  is the axial force resistance

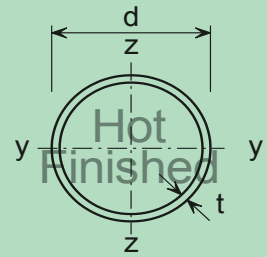
- Not applicable for Class 3 and Class 4 sections.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED CIRCULAR HOLLOW SECTIONS

Celsius® CHS



Member buckling check

Section Designation & Resistance (kNm)		Mass per Metre kg/m	Compression Resistance $N_{b,Rd}$ (kN)												
d mm	t mm		for Varying buckling lengths (m)												
			1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
193.7	5.0 $f_y W_{el} = 48.3$	23.3	1050	1030	1000	974	940	897	845	713	572	453	362	294	243
	5.6 # $f_y W_{el} = 53.6$	26.0	1180	1150	1120	1090	1050	1000	943	795	637	504	403	327	270
	6.3 $f_y W_{el} = 59.6$	29.1	1320	1290	1260	1220	1180	1120	1060	888	711	562	449	364	301
	8.0 $f_y W_{el} = 73.8$	36.6	1660	1620	1580	1530	1480	1410	1320	1110	884	697	556	451	372
	10.0 $f_y W_{el} = 89.5$	45.3	2050	2000	1950	1890	1820	1730	1620	1350	1080	846	674	547	451
	12.5 $f_y W_{el} = 108$	55.9	2530	2470	2400	2330	2240	2130	1990	1650	1300	1020	814	660	544
	16.0 # $f_y W_{el} = 130$	70.1	3160	3090	3010	2910	2790	2650	2470	2030	1590	1250	991	802	660
219.1	4.5 # $f_y W_{el} = 56.4$	23.8	1080	1060	1040	1020	988	956	917	816	690	565	460	378	314
	5.0 # $f_y W_{el} = 62.5$	26.4	1190	1180	1150	1130	1100	1060	1020	903	763	624	508	417	347
	5.6 # $f_y W_{el} = 69.2$	29.5	1330	1320	1290	1260	1230	1180	1140	1010	851	696	566	465	386
	6.3 $f_y W_{el} = 77.4$	33.1	1490	1470	1440	1410	1370	1330	1270	1130	950	776	631	518	430
	8.0 $f_y W_{el} = 95.9$	41.6	1890	1860	1820	1780	1730	1670	1600	1410	1190	968	786	644	535
	10.0 $f_y W_{el} = 116$	51.6	2330	2300	2250	2200	2130	2060	1970	1740	1450	1180	958	784	650
	12.5 $f_y W_{el} = 141$	63.7	2880	2840	2770	2710	2630	2530	2420	2120	1770	1430	1160	950	787
	14.2 # $f_y W_{el} = 156$	71.8	3240	3190	3120	3050	2960	2850	2720	2380	1970	1600	1290	1050	874
	16.0 $f_y W_{el} = 171$	80.1	3620	3560	3480	3400	3290	3170	3020	2640	2180	1760	1420	1160	961

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$M_{b,Rd}$  should be taken as equal to  $M_{c,Rd}$ .

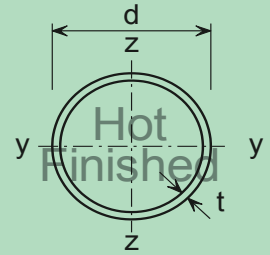
$n = N_{Ed} / N_{pl,Rd}$

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED CIRCULAR HOLLOW SECTIONS

Celsius® CHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial resistance $N_{pl,Rd}$ kN	Moment Resistance $M_{c,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$												
d mm	t mm			n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	
244.5	5.0 #	29.5	1330	$M_{c,Rd}$	78.5	78.5	78.5	78.5	78.5	78.5	78.5	78.5	78.5	78.5	78.5	
				$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-
	5.6 #	33.0	1490	$M_{c,Rd}$	114	114	114	114	114	114	114	114	114	114	114	
				$M_{N,Rd}$	114	111	106	98.9	89.7	78.6	65.9	51.6	35.9	18.6	0	
	6.3 #	37.0	1670	$M_{c,Rd}$	127	127	127	127	127	127	127	127	127	127	127	
				$M_{N,Rd}$	127	125	119	111	100	88.0	73.8	57.8	40.1	20.8	0	
	8.0 #	46.7	2110	$M_{c,Rd}$	159	159	159	159	159	159	159	159	159	159	159	
				$M_{N,Rd}$	159	156	149	138	126	110	92.3	72.3	50.2	26.1	0	
10.0 #	57.8	2620	$M_{c,Rd}$	195	195	195	195	195	195	195	195	195	195	195		
			$M_{N,Rd}$	195	191	183	170	154	135	113	88.8	61.6	32.0	0		
12.5	71.5	3230	$M_{c,Rd}$	239	239	239	239	239	239	239	239	239	239	239		
			$M_{N,Rd}$	239	234	223	208	189	165	139	109	75.4	39.2	0		
14.2 #	80.6	3660	$M_{c,Rd}$	268	268	268	268	268	268	268	268	268	268	268		
			$M_{N,Rd}$	268	262	250	233	211	185	155	122	84.5	43.9	0		
16.0	90.2	4080	$M_{c,Rd}$	297	297	297	297	297	297	297	297	297	297	297		
			$M_{N,Rd}$	297	291	278	259	235	206	172	135	93.8	48.7	0		
273	5.0 #	33.0	1490	$M_{c,Rd}$	98.3	98.3	98.3	98.3	98.3	98.3	98.3	98.3	98.3	98.3		
				$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-	
	5.6 #	36.9	1670	$M_{c,Rd}$	109	109	109	109	109	109	109	109	109	109		
				$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-	
	6.3 #	41.4	1870	$M_{c,Rd}$	159	159	159	159	159	159	159	159	159	159		
				$M_{N,Rd}$	159	156	149	138	126	110	92.3	72.3	50.2	26.1	0	
	8.0 #	52.3	2360	$M_{c,Rd}$	200	200	200	200	200	200	200	200	200	200		
				$M_{N,Rd}$	200	196	187	174	157	138	116	90.7	63.0	32.7	0	
10.0	64.9	2930	$M_{c,Rd}$	246	246	246	246	246	246	246	246	246	246			
			$M_{N,Rd}$	246	241	230	214	194	170	143	112	77.6	40.3	0		
12.5	80.3	3620	$M_{c,Rd}$	301	301	301	301	301	301	301	301	301	301			
			$M_{N,Rd}$	301	295	282	262	238	209	175	137	95.1	49.4	0		
14.2 #	90.6	4080	$M_{c,Rd}$	338	338	338	338	338	338	338	338	338	338			
			$M_{N,Rd}$	338	331	316	294	267	234	196	154	107	55.4	0		
16.0	101	4580	$M_{c,Rd}$	376	376	376	376	376	376	376	376	376	376			
			$M_{N,Rd}$	376	368	351	327	296	260	218	171	119	61.6	0		

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$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

$N_{pl,Rd}$  is the axial force resistance

- Not applicable for Class 3 and Class 4 sections.

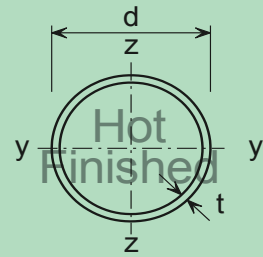
# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.



HOT-FINISHED CIRCULAR HOLLOW SECTIONS

Celsius® CHS



Member buckling check

Section Designation & Resistance (kNm)		Mass per Metre kg/m	Compression Resistance $N_{b,Rd}$ (kN)												
d mm	t mm		for Varying buckling lengths (m)												
			2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
244.5	5.0 # $f_y W_{el} = 78.5$	29.5	1300	1250	1180	1080	955	812	677	564	472	400	342	295	257
	5.6 # $f_y W_{el} = 87.0$	33.0	1450	1390	1320	1210	1070	905	754	627	526	445	380	328	286
	6.3 # $f_y W_{el} = 97.3$	37.0	1630	1560	1470	1350	1190	1010	841	699	586	495	423	366	319
	8.0 # $f_y W_{el} = 121$	46.7	2050	1970	1860	1700	1490	1260	1050	874	731	618	528	456	397
	10.0 # $f_y W_{el} = 147$	57.8	2550	2440	2300	2100	1840	1550	1290	1070	894	756	646	557	485
	12.5 # $f_y W_{el} = 179$	71.5	3150	3010	2830	2580	2250	1890	1570	1300	1080	916	782	675	588
	14.2 # $f_y W_{el} = 198$	80.6	3560	3400	3190	2910	2530	2120	1750	1450	1210	1020	874	754	657
	16.0 # $f_y W_{el} = 219$	90.2	3970	3790	3560	3230	2800	2350	1940	1600	1340	1130	963	831	723
273	5.0 # $f_y W_{el} = 98.3$	33.0	1470	1420	1360	1270	1160	1030	886	753	639	545	468	406	355
	5.6 # $f_y W_{el} = 109$	36.9	1640	1580	1510	1420	1300	1150	987	838	711	606	521	451	394
	6.3 # $f_y W_{el} = 122$	41.4	1840	1780	1700	1590	1460	1280	1100	937	794	677	582	504	441
	8.0 # $f_y W_{el} = 152$	52.3	2320	2240	2140	2010	1830	1610	1380	1170	992	845	726	629	549
	10.0 # $f_y W_{el} = 186$	64.9	2880	2780	2650	2480	2260	1980	1700	1440	1220	1040	890	771	673
	12.5 # $f_y W_{el} = 226$	80.3	3550	3420	3270	3050	2770	2430	2070	1750	1480	1260	1080	935	816
	14.2 # $f_y W_{el} = 252$	90.6	4000	3860	3680	3430	3110	2720	2310	1950	1650	1400	1200	1040	910
	16.0 # $f_y W_{el} = 278$	101	4490	4320	4120	3840	3470	3030	2570	2170	1830	1560	1330	1150	1010

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$M_{b,Rd}$  should be taken as equal to  $M_{c,Rd}$ .

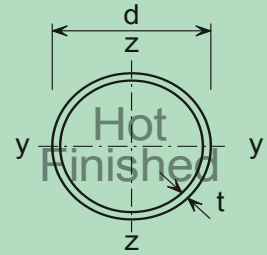
$n = N_{Ed} / N_{pl,Rd}$

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED CIRCULAR HOLLOW SECTIONS

Celsius® CHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial resistance $N_{pl,Rd}$ kN	Moment Resistance $M_{c,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$											
d mm	t mm			n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
323.9	* 5.0 #	39.3	1780	$M_{c,Rd}$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$
				$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-
	5.6 #	44.0	1990	$M_{c,Rd}$	155	155	155	155	155	155	155	155	155	155	155
				$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-
	6.3 #	49.3	2230	$M_{c,Rd}$	174	174	174	174	174	174	174	174	174	174	174
				$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-
	8.0 #	62.3	2820	$M_{c,Rd}$	284	284	284	284	284	284	284	284	284	284	284
				$M_{N,Rd}$	284	278	265	247	224	196	165	129	89.5	46.5	0
355.6	10.0	77.4	3500	$M_{c,Rd}$	350	350	350	350	350	350	350	350	350	350	350
				$M_{N,Rd}$	350	343	327	305	276	242	203	159	111	57.4	0
	12.5	96.0	4330	$M_{c,Rd}$	431	431	431	431	431	431	431	431	431	431	431
				$M_{N,Rd}$	431	422	403	375	340	298	250	196	136	70.6	0
	14.2 #	108	4900	$M_{c,Rd}$	484	484	484	484	484	484	484	484	484	484	484
				$M_{N,Rd}$	484	474	452	421	382	335	281	220	153	79.3	0
	16.0	121	5500	$M_{c,Rd}$	539	539	539	539	539	539	539	539	539	539	539
				$M_{N,Rd}$	539	528	504	469	425	373	313	245	170	88.4	0
355.6	6.3 #	54.3	2450	$M_{c,Rd}$	211	211	211	211	211	211	211	211	211	211	211
				$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-
	8.0 #	68.6	3100	$M_{c,Rd}$	343	343	343	343	343	343	343	343	343	343	343
				$M_{N,Rd}$	343	336	321	299	271	238	199	156	108	56.3	0
	10.0 #	85.2	3870	$M_{c,Rd}$	424	424	424	424	424	424	424	424	424	424	424
				$M_{N,Rd}$	424	416	397	369	335	294	246	193	134	69.6	0
355.6	12.5 #	106	4790	$M_{c,Rd}$	523	523	523	523	523	523	523	523	523	523	523
				$M_{N,Rd}$	523	512	489	455	412	362	303	238	165	85.7	0
	14.2 #	120	5400	$M_{c,Rd}$	588	588	588	588	588	588	588	588	588	588	588
				$M_{N,Rd}$	588	576	550	512	464	407	341	267	186	96.4	0
	16.0	134	6070	$M_{c,Rd}$	656	656	656	656	656	656	656	656	656	656	656
				$M_{N,Rd}$	656	643	613	571	518	454	381	298	207	108	0

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Circular Hollow Sections (HFCHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

\* The section is a Class 4 section.

$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

$N_{pl,Rd}$  is the axial force resistance

- Not applicable for Class 3 and Class 4 sections.

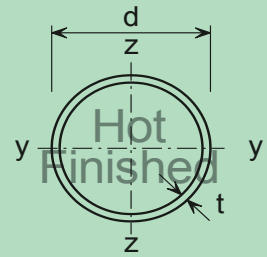
\$  $M_{c,Rd}$  is not calculated for Class 4 sections.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED CIRCULAR HOLLOW SECTIONS

Celsius® CHS



Member buckling check

Section Designation & Resistance (kNm)		Mass per Metre kg/m	Compression Resistance $N_{b,Rd}$ (kN)												
d mm	t mm		for Varying buckling lengths (m)												
			2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
323.9	* 5.0 # $f_y W_{el} = 140$	39.3	-	-	-	-	-	-	-	-	-	-	-	-	-
	5.6 # $f_y W_{el} = 155$	44.0	1970	1920	1860	1780	1690	1570	1420	1260	1110	964	841	736	647
	6.3 # $f_y W_{el} = 174$	49.3	2220	2160	2090	2000	1890	1750	1590	1410	1230	1070	931	814	716
	8.0 # $f_y W_{el} = 217$	62.3	2800	2720	2630	2530	2390	2210	2000	1770	1550	1350	1170	1030	903
	10.0 $f_y W_{el} = 267$	77.4	3470	3380	3270	3130	2950	2730	2470	2180	1900	1650	1440	1260	1100
	12.5 $f_y W_{el} = 326$	96.0	4290	4170	4030	3860	3640	3360	3030	2670	2320	2020	1750	1530	1340
	14.2 # $f_y W_{el} = 364$	108	4860	4720	4560	4370	4120	3800	3420	3020	2630	2280	1980	1730	1520
	16.0 $f_y W_{el} = 403$	121	5450	5300	5120	4900	4610	4250	3810	3350	2910	2520	2190	1910	1680
355.6	6.3 # $f_y W_{el} = 211$	54.3	2450	2390	2320	2250	2150	2030	1890	1720	1540	1360	1200	1060	937
	8.0 # $f_y W_{el} = 263$	68.6	3090	3020	2930	2840	2710	2560	2370	2160	1930	1700	1500	1320	1170
	10.0 # $f_y W_{el} = 324$	85.2	3860	3760	3660	3530	3380	3180	2940	2670	2380	2100	1850	1630	1440
	12.5 # $f_y W_{el} = 397$	106	4780	4660	4520	4370	4170	3930	3620	3280	2920	2570	2260	1990	1760
	14.2 # $f_y W_{el} = 444$	120	5380	5240	5090	4920	4700	4420	4080	3690	3280	2890	2540	2240	1980
	16.0 $f_y W_{el} = 492$	134	6050	5890	5720	5520	5270	4950	4560	4120	3660	3220	2820	2480	2190

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\* The section can become a Class 4 section.

$M_{b,Rd}$  should be taken as equal to  $M_{c,Rd}$ .

$$n = N_{Ed} / N_{pl,Rd}$$

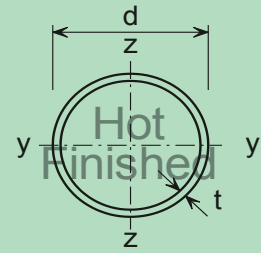
$N_{b,Rd}$  values for Class 4 sections are not calculated.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED CIRCULAR HOLLOW SECTIONS

Celsius® CHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial resistance $N_{pl,Rd}$ kN	Moment Resistance $M_{c,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$												
d mm	t mm			n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	
406.4	* 6.3 #	62.2	2810	$M_{c,Rd}$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	
				$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-
	8.0 #	78.6	3550	$M_{c,Rd}$	347	347	347	347	347	347	347	347	347	347	347	
				$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-
	10.0	97.8	4440	$M_{c,Rd}$	558	558	558	558	558	558	558	558	558	558	558	
				$M_{N,Rd}$	558	547	522	486	441	386	324	254	176	91.5	0	
	12.5 #	121	5500	$M_{c,Rd}$	689	689	689	689	689	689	689	689	689	689	689	
				$M_{N,Rd}$	689	675	644	600	544	477	400	313	217	113	0	
	14.2 #	137	6210	$M_{c,Rd}$	776	776	776	776	776	776	776	776	776	776	776	
				$M_{N,Rd}$	776	760	725	675	612	537	450	353	245	127	0	
	16.0	154	6960	$M_{c,Rd}$	866	866	866	866	866	866	866	866	866	866	866	
				$M_{N,Rd}$	866	849	810	754	684	600	503	394	273	142	0	
457	* 6.3 #	70.0	3170	$M_{c,Rd}$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$		
				$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-	
	8.0 #	88.6	4010	$M_{c,Rd}$	442	442	442	442	442	442	442	442	442	442		
				$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-	
	10.0	110	4970	$M_{c,Rd}$	709	709	709	709	709	709	709	709	709	709		
				$M_{N,Rd}$	709	695	663	618	560	491	412	322	224	116	0	
	12.5 #	137	6210	$M_{c,Rd}$	877	877	877	877	877	877	877	877	877	877		
				$M_{N,Rd}$	877	859	820	764	692	607	509	399	277	144	0	
	14.2 #	155	7030	$M_{c,Rd}$	989	989	989	989	989	989	989	989	989	989		
				$M_{N,Rd}$	989	969	925	861	780	684	574	450	312	162	0	
	16.0	174	7880	$M_{c,Rd}$	1110	1110	1110	1110	1110	1110	1110	1110	1110	1110		
				$M_{N,Rd}$	1110	1080	1030	962	872	765	641	502	349	181	0	
508	* 6.3 #	77.9	3530	$M_{c,Rd}$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$		
				$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-	
	* 8.0 #	98.6	4470	$M_{c,Rd}$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$		
				$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-	
	10.0 #	123	5540	$M_{c,Rd}$	678	678	678	678	678	678	678	678	678	678		
				$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-	
	12.5	153	6920	$M_{c,Rd}$	1090	1090	1090	1090	1090	1090	1090	1090	1090	1090		
				$M_{N,Rd}$	1090	1070	1020	949	860	754	633	496	344	179	0	
	14.2 #	173	7810	$M_{c,Rd}$	1230	1230	1230	1230	1230	1230	1230	1230	1230	1230		
				$M_{N,Rd}$	1230	1200	1150	1070	970	851	713	559	388	202	0	
	16.0	194	8770	$M_{c,Rd}$	1380	1380	1380	1380	1380	1380	1380	1380	1380	1380		
				$M_{N,Rd}$	1380	1350	1290	1200	1090	952	798	625	434	226	0	

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\* The section is a Class 4 section.

$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

$N_{pl,Rd}$  is the axial force resistance

- Not applicable for Class 3 and Class 4 sections.

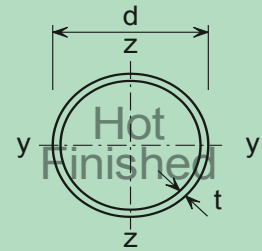
\$  $M_{c,Rd}$  is not calculated for Class 4 sections.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED CIRCULAR HOLLOW SECTIONS

Celsius® CHS



Member buckling check

Section Designation & Resistance (kNm)		Mass per Metre kg/m	Compression Resistance $N_{b,Rd}$ (kN) for Varying buckling lengths (m)												
d mm	t mm		2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
406.4	* 6.3 # $f_y W_{el} = 277$	62.2	-	-	-	-	-	-	-	-	-	-	-	-	-
	8.0 # $f_y W_{el} = 347$	78.6	3550	3490	3410	3320	3210	3090	2940	2750	2540	2310	2080	1870	1670
	10.0 $f_y W_{el} = 428$	97.8	4440	4360	4260	4140	4010	3850	3660	3420	3150	2870	2580	2310	2070
	12.5 # $f_y W_{el} = 525$	121	5500	5400	5280	5130	4970	4770	4520	4220	3880	3520	3170	2830	2530
	14.2 # $f_y W_{el} = 589$	137	6210	6100	5960	5800	5610	5380	5100	4770	4390	3980	3580	3200	2860
	16.0 $f_y W_{el} = 654$	154	6960	6830	6670	6490	6270	6010	5690	5310	4880	4420	3970	3550	3170
457	* 6.3 # $f_y W_{el} = 352$	70.0	-	-	-	-	-	-	-	-	-	-	-	-	-
	8.0 # $f_y W_{el} = 442$	88.6	4010	3970	3890	3810	3720	3610	3480	3320	3140	2930	2700	2470	2250
	10.0 $f_y W_{el} = 545$	110	4970	4920	4820	4720	4600	4460	4300	4100	3870	3610	3330	3040	2760
	12.5 # $f_y W_{el} = 670$	137	6210	6140	6020	5890	5740	5570	5360	5110	4820	4490	4130	3770	3420
	14.2 # $f_y W_{el} = 753$	155	7030	6950	6810	6670	6500	6300	6060	5780	5450	5080	4680	4270	3870
	16.0 $f_y W_{el} = 838$	174	7880	7790	7640	7470	7280	7050	6780	6460	6090	5660	5210	4750	4300
508	* 6.3 # $f_y W_{el} = 437$	77.9	-	-	-	-	-	-	-	-	-	-	-	-	-
	* 8.0 # $f_y W_{el} = 549$	98.6	-	-	-	-	-	-	-	-	-	-	-	-	-
	10.0 # $f_y W_{el} = 678$	123	5540	5510	5420	5320	5210	5080	4940	4770	4580	4350	4090	3810	3530
	12.5 $f_y W_{el} = 835$	153	6920	6890	6770	6640	6500	6350	6170	5950	5700	5420	5090	4740	4380
	14.2 # $f_y W_{el} = 939$	173	7810	7770	7640	7490	7340	7160	6960	6720	6440	6110	5740	5350	4940
	16.0 $f_y W_{el} = 1050$	194	8770	8720	8570	8410	8230	8030	7800	7530	7210	6840	6420	5970	5510

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\* The section can become a Class 4 section.

$M_{b,Rd}$  should be taken as equal to  $M_{c,Rd}$ .

$$n = N_{Ed} / N_{pl,Rd}$$

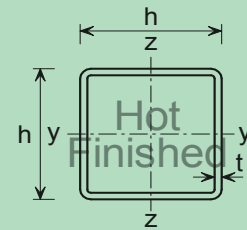
$N_{b,Rd}$  values for Class 4 sections are not calculated.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED SQUARE HOLLOW SECTIONS

Celsius® SHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n limit Class 3 Class 2	Moment Resistance $M_{c,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$													
h x h mm	t mm				n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0		
40x40	3.0 #	3.41	154	n/a 1.00	$M_{c,Rd}$	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.12	
					$M_{N,Rd}$	2.12	2.12	2.12	1.91	1.64	1.36	1.09	0.819	0.546	0.273	0		
	3.2	3.61	163	n/a 1.00	$M_{c,Rd}$	2.23	2.23	2.23	2.23	2.23	2.23	2.23	2.23	2.23	2.23	2.23		
					$M_{N,Rd}$	2.23	2.23	2.23	2.01	1.72	1.43	1.15	0.859	0.573	0.286	0		
	3.6 #	4.01	181	n/a 1.00	$M_{c,Rd}$	2.44	2.44	2.44	2.44	2.44	2.44	2.44	2.44	2.44	2.44	2.44		
					$M_{N,Rd}$	2.44	2.44	2.44	2.19	1.87	1.56	1.25	0.937	0.624	0.312	0		
	4.0	4.39	198	n/a 1.00	$M_{c,Rd}$	2.64	2.64	2.64	2.64	2.64	2.64	2.64	2.64	2.64	2.64	2.64		
					$M_{N,Rd}$	2.64	2.64	2.64	2.35	2.02	1.68	1.34	1.01	0.672	0.336	0		
	5.0	5.28	239	n/a 1.00	$M_{c,Rd}$	3.07	3.07	3.07	3.07	3.07	3.07	3.07	3.07	3.07	3.07	3.07		
					$M_{N,Rd}$	3.07	3.07	3.07	2.70	2.31	1.93	1.54	1.16	0.771	0.386	0		
50x50	3.0 #	4.35	197	n/a 1.00	$M_{c,Rd}$	3.44	3.44	3.44	3.44	3.44	3.44	3.44	3.44	3.44	3.44	3.44		
					$M_{N,Rd}$	3.44	3.44	3.44	3.13	2.68	2.23	1.79	1.34	0.894	0.447	0		
	3.2	4.62	209	n/a 1.00	$M_{c,Rd}$	3.62	3.62	3.62	3.62	3.62	3.62	3.62	3.62	3.62	3.62	3.62		
					$M_{N,Rd}$	3.62	3.62	3.62	3.28	2.81	2.34	1.88	1.41	0.938	0.469	0		
	3.6 #	5.14	232	n/a 1.00	$M_{c,Rd}$	4.01	4.01	4.01	4.01	4.01	4.01	4.01	4.01	4.01	4.01	4.01		
					$M_{N,Rd}$	4.01	4.01	4.01	3.62	3.10	2.59	2.07	1.55	1.03	0.517	0		
	4.0	5.64	255	n/a 1.00	$M_{c,Rd}$	4.37	4.37	4.37	4.37	4.37	4.37	4.37	4.37	4.37	4.37	4.37		
					$M_{N,Rd}$	4.37	4.37	4.37	3.93	3.37	2.81	2.24	1.68	1.12	0.561	0		
	5.0	6.85	310	n/a 1.00	$M_{c,Rd}$	5.15	5.15	5.15	5.15	5.15	5.15	5.15	5.15	5.15	5.15	5.15		
					$M_{N,Rd}$	5.15	5.15	5.15	4.58	3.93	3.27	2.62	1.96	1.31	0.655	0		
6.3	8.31	376	n/a 1.00	$M_{c,Rd}$	6.04	6.04	6.04	6.04	6.04	6.04	6.04	6.04	6.04	6.04	6.04			
				$M_{N,Rd}$	6.04	6.04	6.04	5.30	4.54	3.79	3.03	2.27	1.51	0.757	0			
7.1 #	9.14	412	n/a 1.00	$M_{c,Rd}$	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50			
				$M_{N,Rd}$	6.50	6.50	6.45	5.64	4.84	4.03	3.22	2.42	1.61	0.806	0			
8.0 #	10.0	454	n/a 1.00	$M_{c,Rd}$	6.92	6.92	6.92	6.92	6.92	6.92	6.92	6.92	6.92	6.92	6.92			
				$M_{N,Rd}$	6.92	6.92	6.82	5.96	5.11	4.26	3.41	2.56	1.70	0.852	0			
60x60	3.0 #	5.29	239	n/a 1.00	$M_{c,Rd}$	5.08	5.08	5.08	5.08	5.08	5.08	5.08	5.08	5.08	5.08	5.08		
					$M_{N,Rd}$	5.08	5.08	5.08	4.63	3.97	3.31	2.65	1.99	1.32	0.662	0		
	3.2	5.62	254	n/a 1.00	$M_{c,Rd}$	5.40	5.40	5.40	5.40	5.40	5.40	5.40	5.40	5.40	5.40	5.40		
					$M_{N,Rd}$	5.40	5.40	5.40	4.92	4.21	3.51	2.81	2.11	1.40	0.702	0		
	3.6 #	6.27	283	n/a 1.00	$M_{c,Rd}$	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96		
					$M_{N,Rd}$	5.96	5.96	5.96	5.42	4.64	3.87	3.10	2.32	1.55	0.774	0		
	4.0	6.90	312	n/a 1.00	$M_{c,Rd}$	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50	6.50		
					$M_{N,Rd}$	6.50	6.50	6.50	5.88	5.04	4.20	3.36	2.52	1.68	0.840	0		
	5.0	8.42	380	n/a 1.00	$M_{c,Rd}$	7.77	7.77	7.77	7.77	7.77	7.77	7.77	7.77	7.77	7.77	7.77		
					$M_{N,Rd}$	7.77	7.77	7.77	6.97	5.98	4.98	3.99	2.99	1.99	0.996	0		
6.3	10.3	465	n/a 1.00	$M_{c,Rd}$	9.23	9.23	9.23	9.23	9.23	9.23	9.23	9.23	9.23	9.23	9.23			
				$M_{N,Rd}$	9.23	9.23	9.23	8.19	7.02	5.85	4.68	3.51	2.34	1.17	0			
7.1 #	11.4	515	n/a 1.00	$M_{c,Rd}$	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0			
				$M_{N,Rd}$	10.0	10.0	10.0	8.83	7.57	6.31	5.04	3.78	2.52	1.26	0			
8.0	12.5	568	n/a 1.00	$M_{c,Rd}$	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8			
				$M_{N,Rd}$	10.8	10.8	10.8	9.44	8.09	6.75	5.40	4.05	2.70	1.35	0			

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Square Hollow Sections (HFSHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

$N_{Ed}$  = Design value of the axial force.

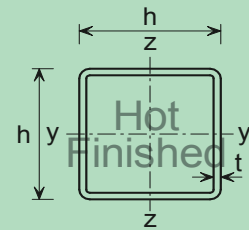
$n = N_{Ed} / N_{pl,Rd}$

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED SQUARE HOLLOW SECTIONS

Celsius® SHS



Member buckling check

Section Designation & Resistance (kNm)		n Limit	Compression Resistance $N_{b,Rd}$ (kN)												
h x h mm	t mm		for Varying buckling lengths (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$												
			1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
40x40	3.0 # $f_y W_{el} = 1.74$	1.00	116	71.7	44.0	29.2	20.7	15.4	11.9	7.72	5.40	3.99	3.07	2.43	1.98
	3.2 $f_y W_{el} = 1.81$	1.00	122	75.2	46.1	30.6	21.7	16.1	12.5	8.08	5.65	4.18	3.21	2.55	2.07
	3.6 # $f_y W_{el} = 1.97$	1.00	134	81.6	49.9	33.1	23.4	17.4	13.5	8.72	6.10	4.51	3.47	2.75	2.23
	4.0 $f_y W_{el} = 2.10$	1.00	145	87.5	53.3	35.3	25.0	18.6	14.4	9.31	6.51	4.81	3.70	2.93	2.38
	5.0 $f_y W_{el} = 2.37$	1.00	171	101	61.0	40.3	28.5	21.2	16.4	10.6	7.42	5.48	4.21	3.34	2.71
50x50	3.0 # $f_y W_{el} = 2.87$	1.00	168	127	85.1	58.1	41.7	31.2	24.2	15.8	11.1	8.19	6.30	5.00	4.06
	3.2 $f_y W_{el} = 3.01$	1.00	178	134	89.5	61.1	43.8	32.8	25.4	16.6	11.6	8.60	6.62	5.25	4.27
	3.6 # $f_y W_{el} = 3.29$	1.00	197	147	97.9	66.6	47.8	35.8	27.7	18.0	12.7	9.37	7.21	5.72	4.65
	4.0 $f_y W_{el} = 3.55$	1.00	216	160	106	71.9	51.5	38.5	29.9	19.4	13.6	10.1	7.77	6.16	5.01
	5.0 $f_y W_{el} = 4.12$	1.00	260	189	124	83.9	60.0	44.9	34.8	22.6	15.9	11.7	9.03	7.17	5.82
	6.3 $f_y W_{el} = 4.65$	1.00	311	220	142	95.9	68.4	51.1	39.6	25.7	18.0	13.3	10.3	8.15	6.62
	7.1 # $f_y W_{el} = 4.90$	1.00	337	234	150	101	71.7	53.6	41.5	26.9	18.9	14.0	10.7	8.52	6.92
	8.0 # $f_y W_{el} = 5.11$	1.00	367	250	159	106	75.7	56.5	43.7	28.4	19.9	14.7	11.3	8.98	7.29
60x60	3.0 # $f_y W_{el} = 4.30$	1.00	216	184	138	98.8	72.2	54.6	42.6	27.9	19.6	14.6	11.2	8.91	7.25
	3.2 $f_y W_{el} = 4.51$	1.00	229	195	146	104	76.1	57.5	44.9	29.4	20.7	15.3	11.8	9.39	7.64
	3.6 # $f_y W_{el} = 4.97$	1.00	255	216	161	114	83.5	63.1	49.2	32.2	22.7	16.8	13.0	10.3	8.37
	4.0 $f_y W_{el} = 5.36$	1.00	280	236	175	124	90.6	68.4	53.3	34.9	24.5	18.2	14.0	11.1	9.06
	5.0 $f_y W_{el} = 6.32$	1.00	340	284	208	147	107	80.6	62.8	41.0	28.9	21.4	16.5	13.1	10.6
	6.3 $f_y W_{el} = 7.28$	1.00	413	340	245	172	124	93.8	73.0	47.7	33.5	24.8	19.1	15.2	12.4
	7.1 # $f_y W_{el} = 7.77$	1.00	455	370	264	184	133	100	78.0	50.9	35.8	26.5	20.4	16.2	13.2
	8.0 $f_y W_{el} = 8.24$	1.00	500	402	283	197	142	107	83.0	54.2	38.1	28.2	21.7	17.2	14.0

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Square Hollow Sections (HFSHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

$$n = N_{Ed} / N_{pl,Rd}$$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

$M_{b,Rd}$  should be taken as equal to  $M_{c,Rd}$ .

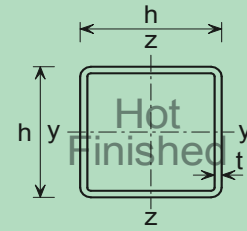
Axial force resistance  $N_{pl,Rd}$  which is equal to  $Af_y$  is given in the cross-section resistance check table opposite.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED SQUARE HOLLOW SECTIONS

Celsius® SHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n limit Class 3 Class 2	Moment Resistance $M_{c,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$													
h x h mm	t mm				n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0		
70x70	3.0 #	6.24	282	n/a 1.00	$M_{c,Rd}$	7.06	7.06	7.06	7.06	7.06	7.06	7.06	7.06	7.06	7.06	7.06	7.06	
					$M_{N,Rd}$	7.06	7.06	7.06	6.47	5.54	4.62	3.70	2.77	1.85	0.924	0		
	3.2	6.63	300	n/a 1.00	$M_{c,Rd}$	7.46	7.46	7.46	7.46	7.46	7.46	7.46	7.46	7.46	7.46	7.46		
					$M_{N,Rd}$	7.46	7.46	7.46	6.82	5.84	4.87	3.90	2.92	1.95	0.974	0		
	3.6 #	7.40	334	n/a 1.00	$M_{c,Rd}$	8.27	8.27	8.27	8.27	8.27	8.27	8.27	8.27	8.27	8.27	8.27		
					$M_{N,Rd}$	8.27	8.27	8.27	7.54	6.47	5.39	4.31	3.23	2.16	1.08	0		
	4.0	8.15	369	n/a 1.00	$M_{c,Rd}$	9.05	9.05	9.05	9.05	9.05	9.05	9.05	9.05	9.05	9.05	9.05		
					$M_{N,Rd}$	9.05	9.05	9.05	8.24	7.06	5.88	4.71	3.53	2.35	1.18	0		
	5.0	9.99	451	n/a 1.00	$M_{c,Rd}$	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9		
$M_{N,Rd}$					10.9	10.9	10.9	9.87	8.46	7.05	5.64	4.23	2.82	1.41	0			
6.3	12.3	554	n/a 1.00	$M_{c,Rd}$	13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.1			
				$M_{N,Rd}$	13.1	13.1	13.1	11.7	10.0	8.37	6.69	5.02	3.35	1.67	0			
7.1 #	13.6	614	n/a 1.00	$M_{c,Rd}$	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3	14.3			
				$M_{N,Rd}$	14.3	14.3	14.3	12.7	10.9	9.09	7.27	5.45	3.63	1.82	0			
8.0	15.0	682	n/a 1.00	$M_{c,Rd}$	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5			
				$M_{N,Rd}$	15.5	15.5	15.5	13.7	11.8	9.82	7.86	5.89	3.93	1.96	0			
8.8 #	16.3	735	n/a 1.00	$M_{c,Rd}$	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5	16.5			
				$M_{N,Rd}$	16.5	16.5	16.5	14.5	12.4	10.4	8.30	6.22	4.15	2.07	0			
80x80	3.0 #	7.18	324	n/a 1.00	$M_{c,Rd}$	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34	9.34		
					$M_{N,Rd}$	9.34	9.34	9.34	8.57	7.35	6.12	4.90	3.67	2.45	1.22	0		
	3.2	7.63	345	n/a 1.00	$M_{c,Rd}$	9.90	9.90	9.90	9.90	9.90	9.90	9.90	9.90	9.90	9.90	9.90		
					$M_{N,Rd}$	9.90	9.90	9.90	9.08	7.78	6.49	5.19	3.89	2.59	1.30	0		
	3.6 #	8.53	387	n/a 1.00	$M_{c,Rd}$	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0		
					$M_{N,Rd}$	11.0	11.0	11.0	10.1	8.64	7.20	5.76	4.32	2.88	1.44	0		
	4.0	9.41	426	n/a 1.00	$M_{c,Rd}$	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1		
					$M_{N,Rd}$	12.1	12.1	12.1	11.0	9.45	7.87	6.30	4.72	3.15	1.57	0		
	5.0	11.6	522	n/a 1.00	$M_{c,Rd}$	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6		
					$M_{N,Rd}$	14.6	14.6	14.6	13.2	11.3	9.45	7.56	5.67	3.78	1.89	0		
	6.3	14.2	643	n/a 1.00	$M_{c,Rd}$	17.6	17.6	17.6	17.6	17.6	17.6	17.6	17.6	17.6	17.6	17.6		
					$M_{N,Rd}$	17.6	17.6	17.6	15.9	13.6	11.3	9.07	6.80	4.53	2.27	0		
7.1 #	15.8	717	n/a 1.00	$M_{c,Rd}$	19.3	19.3	19.3	19.3	19.3	19.3	19.3	19.3	19.3	19.3	19.3			
				$M_{N,Rd}$	19.3	19.3	19.3	17.3	14.9	12.4	9.91	7.43	4.95	2.48	0			
8.0	17.5	795	n/a 1.00	$M_{c,Rd}$	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1			
				$M_{N,Rd}$	21.1	21.1	21.1	18.8	16.1	13.4	10.8	8.06	5.38	2.69	0			
8.8 #	19.0	859	n/a 1.00	$M_{c,Rd}$	22.6	22.6	22.6	22.6	22.6	22.6	22.6	22.6	22.6	22.6	22.6			
				$M_{N,Rd}$	22.6	22.6	22.6	20.0	17.2	14.3	11.4	8.58	5.72	2.86	0			
10.0 #	21.1	955	n/a 1.00	$M_{c,Rd}$	24.6	24.6	24.6	24.6	24.6	24.6	24.6	24.6	24.6	24.6	24.6			
				$M_{N,Rd}$	24.6	24.6	24.6	21.6	18.5	15.4	12.3	9.26	6.17	3.09	0			
12.5 #	25.2	1140	n/a 1.00	$M_{c,Rd}$	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0	28.0			
				$M_{N,Rd}$	28.0	28.0	27.6	24.2	20.7	17.3	13.8	10.4	6.90	3.45	0			

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Square Hollow Sections (HFSHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

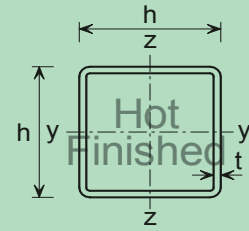
# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.



HOT-FINISHED SQUARE HOLLOW SECTIONS

Celsius® SHS



Member buckling check

Section Designation & Resistance (kNm)		n Limit	Compression Resistance $N_{b,Rd}$ (kN)												
h x h mm	t mm		for Varying buckling lengths (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$												
			1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
70x70	3.0 # $f_y W_{el} = 6.00$	1.00	262	236	196	150	113	86.4	67.9	44.8	31.6	23.5	18.2	14.4	11.7
	3.2 $f_y W_{el} = 6.32$	1.00	279	251	207	158	119	91.2	71.7	47.3	33.4	24.8	19.2	15.2	12.4
	3.6 # $f_y W_{el} = 6.96$	1.00	311	279	230	175	131	100	78.9	52.0	36.7	27.3	21.1	16.8	13.6
	4.0 $f_y W_{el} = 7.56$	1.00	343	307	252	191	143	109	85.9	56.6	40.0	29.7	22.9	18.2	14.8
	5.0 $f_y W_{el} = 8.98$	1.00	417	373	303	228	170	130	102	67.2	47.5	35.2	27.2	21.6	17.6
	6.3 $f_y W_{el} = 10.5$	1.00	511	453	363	271	201	153	120	79.0	55.8	41.4	32.0	25.4	20.7
	7.1 # $f_y W_{el} = 11.4$	1.00	565	498	396	293	217	165	129	85.1	60.0	44.6	34.4	27.3	22.2
	8.0 $f_y W_{el} = 12.1$	1.00	625	548	431	317	235	178	139	91.6	64.6	47.9	37.0	29.4	23.9
	8.8 # $f_y W_{el} = 12.7$	1.00	672	586	456	333	246	187	146	95.8	67.5	50.1	38.6	30.7	25.0
80x80	3.0 # $f_y W_{el} = 7.99$	1.00	308	285	251	206	161	126	100.0	66.6	47.3	35.2	27.2	21.7	17.7
	3.2 $f_y W_{el} = 8.41$	1.00	327	303	267	219	171	134	106	70.8	50.3	37.5	29.0	23.1	18.8
	3.6 # $f_y W_{el} = 9.30$	1.00	367	340	298	243	190	149	118	78.5	55.7	41.5	32.1	25.5	20.8
	4.0 $f_y W_{el} = 10.2$	1.00	403	373	327	266	207	162	128	85.4	60.6	45.1	34.9	27.8	22.6
	5.0 $f_y W_{el} = 12.1$	1.00	493	455	397	321	249	194	154	102	72.4	53.9	41.7	33.2	27.0
	6.3 $f_y W_{el} = 14.4$	1.00	606	557	482	385	297	231	182	121	85.8	63.9	49.4	39.3	32.0
	7.1 # $f_y W_{el} = 15.6$	1.00	675	619	532	423	325	252	199	132	93.3	69.5	53.7	42.7	34.8
	8.0 $f_y W_{el} = 16.8$	1.00	747	683	584	461	353	273	215	142	101	75.0	58.0	46.1	37.5
	8.8 # $f_y W_{el} = 17.8$	1.00	805	735	624	489	373	287	227	150	106	78.9	61.0	48.5	39.5
	10.0 # $f_y W_{el} = 19.0$	1.00	893	811	683	530	403	310	244	161	114	84.8	65.5	52.1	42.4
	12.5 # $f_y W_{el} = 20.8$	1.00	1060	951	783	595	447	342	269	177	125	93.1	71.8	57.1	46.5

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Square Hollow Sections (HFSHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

$$n = N_{Ed} / N_{pl,Rd}$$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

$M_{b,Rd}$  should be taken as equal to  $M_{c,Rd}$ .

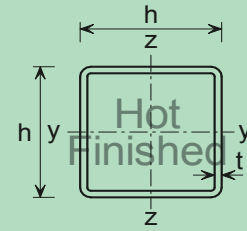
Axial force resistance  $N_{pl,Rd}$  which is equal to  $Af_y$  is given in the cross-section resistance check table opposite.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED SQUARE HOLLOW SECTIONS

Celsius® SHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n limit Class 3 Class 2	Moment Resistance $M_{c,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$													
h x h mm	t mm				n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0		
90x90	3.6 #	9.66	437	n/a 1.00	$M_{c,Rd}$	14.1	14.1	14.1	14.1	14.1	14.1	14.1	14.1	14.1	14.1	14.1	14.1	
					$M_{N,Rd}$	14.1	14.1	14.1	12.9	11.1	9.23	7.38	5.54	3.69	1.85	0		
	4.0	10.7	483	n/a 1.00	$M_{c,Rd}$	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	15.5	
					$M_{N,Rd}$	15.5	15.5	15.5	14.2	12.1	10.1	8.10	6.07	4.05	2.02	0		
	5.0	13.1	593	n/a 1.00	$M_{c,Rd}$	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	18.8	
					$M_{N,Rd}$	18.8	18.8	18.8	17.1	14.7	12.2	9.78	7.34	4.89	2.45	0		
	6.3	16.2	735	n/a 1.00	$M_{c,Rd}$	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	22.8	
					$M_{N,Rd}$	22.8	22.8	22.8	20.6	17.7	14.7	11.8	8.85	5.90	2.95	0		
	7.1 #	18.1	817	n/a 1.00	$M_{c,Rd}$	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	
$M_{N,Rd}$					25.1	25.1	25.1	22.6	19.4	16.2	12.9	9.69	6.46	3.23	0			
8.0	20.1	909	n/a 1.00	$M_{c,Rd}$	27.5	27.5	27.5	27.5	27.5	27.5	27.5	27.5	27.5	27.5	27.5	27.5		
				$M_{N,Rd}$	27.5	27.5	27.5	24.7	21.2	17.6	14.1	10.6	7.05	3.53	0			
8.8 #	21.8	987	n/a 1.00	$M_{c,Rd}$	29.6	29.6	29.6	29.6	29.6	29.6	29.6	29.6	29.6	29.6	29.6	29.6		
				$M_{N,Rd}$	29.6	29.6	29.6	26.4	22.6	18.9	15.1	11.3	7.54	3.77	0			
10.0 #	24.3	1100	n/a 1.00	$M_{c,Rd}$	32.4	32.4	32.4	32.4	32.4	32.4	32.4	32.4	32.4	32.4	32.4	32.4		
				$M_{N,Rd}$	32.4	32.4	32.4	28.7	24.6	20.5	16.4	12.3	8.19	4.10	0			
12.5 #	29.1	1320	n/a 1.00	$M_{c,Rd}$	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3		
				$M_{N,Rd}$	37.3	37.3	37.1	32.5	27.8	23.2	18.6	13.9	9.28	4.64	0			
100x100	3.6	10.8	486	n/a 1.00	$M_{c,Rd}$	17.6	17.6	17.6	17.6	17.6	17.6	17.6	17.6	17.6	17.6	17.6		
					$M_{N,Rd}$	17.6	17.6	17.6	16.1	13.8	11.5	9.22	6.91	4.61	2.30	0		
	4.0	11.9	540	n/a 1.00	$M_{c,Rd}$	19.3	19.3	19.3	19.3	19.3	19.3	19.3	19.3	19.3	19.3	19.3		
					$M_{N,Rd}$	19.3	19.3	19.3	17.7	15.2	12.7	10.1	7.59	5.06	2.53	0		
	5.0	14.7	664	n/a 1.00	$M_{c,Rd}$	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6		
					$M_{N,Rd}$	23.6	23.6	23.6	21.5	18.4	15.4	12.3	9.22	6.14	3.07	0		
	6.3	18.2	824	n/a 1.00	$M_{c,Rd}$	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7	28.7		
					$M_{N,Rd}$	28.7	28.7	28.7	26.1	22.3	18.6	14.9	11.2	7.44	3.72	0		
	7.1 #	20.3	916	n/a 1.00	$M_{c,Rd}$	31.7	31.7	31.7	31.7	31.7	31.7	31.7	31.7	31.7	31.7	31.7		
$M_{N,Rd}$					31.7	31.7	31.7	28.6	24.5	20.4	16.3	12.3	8.17	4.08	0			
8.0	22.6	1020	n/a 1.00	$M_{c,Rd}$	34.9	34.9	34.9	34.9	34.9	34.9	34.9	34.9	34.9	34.9	34.9			
				$M_{N,Rd}$	34.9	34.9	34.9	31.4	26.9	22.4	17.9	13.4	8.96	4.48	0			
8.8 #	24.5	1110	n/a 1.00	$M_{c,Rd}$	37.6	37.6	37.6	37.6	37.6	37.6	37.6	37.6	37.6	37.6	37.6			
				$M_{N,Rd}$	37.6	37.6	37.6	33.7	28.9	24.1	19.3	14.5	9.63	4.82	0			
10.0	27.4	1240	n/a 1.00	$M_{c,Rd}$	41.2	41.2	41.2	41.2	41.2	41.2	41.2	41.2	41.2	41.2	41.2			
				$M_{N,Rd}$	41.2	41.2	41.2	36.6	31.4	26.2	20.9	15.7	10.5	5.24	0			
12.5 #	33.0	1490	n/a 1.00	$M_{c,Rd}$	47.9	47.9	47.9	47.9	47.9	47.9	47.9	47.9	47.9	47.9	47.9			
				$M_{N,Rd}$	47.9	47.9	47.9	42.1	36.1	30.1	24.1	18.0	12.0	6.01	0			

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Square Hollow Sections (HFSHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

$N_{Ed}$  = Design value of the axial force.

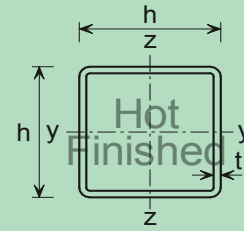
$n = N_{Ed} / N_{pl,Rd}$

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED SQUARE HOLLOW SECTIONS

Celsius® SHS



Member buckling check

Section Designation & Resistance (kNm)		n Limit	Compression Resistance $N_{b,Rd}$ (kN)												
h x h mm	t mm		for Varying buckling lengths (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$												
			1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
90x90	3.6 # $f_y W_{el} = 12.0$	1.00	419	395	361	312	256	205	165	111	79.4	59.3	46.0	36.6	29.9
	4.0 $f_y W_{el} = 13.1$	1.00	463	437	398	343	281	225	181	122	86.9	64.9	50.3	40.1	32.7
	5.0 $f_y W_{el} = 15.8$	1.00	568	534	485	416	338	270	216	146	104	77.5	60.0	47.8	39.0
	6.3 $f_y W_{el} = 18.8$	1.00	703	660	597	508	411	327	262	176	125	93.5	72.4	57.6	47.0
	7.1 # $f_y W_{el} = 20.5$	1.00	780	731	659	558	449	356	285	191	136	102	78.6	62.6	51.0
	8.0 $f_y W_{el} = 22.2$	1.00	867	812	729	614	492	389	311	208	148	110	85.5	68.1	55.5
	8.8 # $f_y W_{el} = 23.6$	1.00	941	879	786	659	525	414	330	221	157	117	90.7	72.2	58.8
	10.0 # $f_y W_{el} = 25.4$	1.00	1040	973	866	720	571	449	357	239	170	126	97.8	77.9	63.5
	12.5 # $f_y W_{el} = 28.3$	1.00	1250	1160	1020	829	648	506	401	267	190	141	109	86.9	70.8
100x100	3.6 $f_y W_{el} = 15.0$	1.00	471	449	419	377	323	268	219	150	108	81.0	62.9	50.2	41.0
	4.0 $f_y W_{el} = 16.5$	1.00	523	498	465	418	358	296	242	166	119	89.5	69.5	55.4	45.2
	5.0 $f_y W_{el} = 19.8$	1.00	643	612	569	509	434	357	292	200	143	107	83.4	66.5	54.3
	6.3 $f_y W_{el} = 23.8$	1.00	796	757	702	625	529	434	353	241	173	129	100	80.1	65.3
	7.1 # $f_y W_{el} = 26.1$	1.00	885	841	779	691	583	477	388	264	189	142	110	87.7	71.6
	8.0 $f_y W_{el} = 28.4$	1.00	987	936	866	765	643	524	425	289	207	155	120	95.9	78.2
	8.8 # $f_y W_{el} = 30.2$	1.00	1070	1020	937	825	690	560	454	308	221	165	128	102	83.3
	10.0 $f_y W_{el} = 32.8$	1.00	1190	1130	1040	910	757	612	495	335	240	179	139	111	90.4
	12.5 # $f_y W_{el} = 36.9$	1.00	1430	1350	1230	1070	875	702	565	381	272	203	157	125	102

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Square Hollow Sections (HFSHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

$$n = N_{Ed} / N_{pl,Rd}$$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

$M_{b,Rd}$  should be taken as equal to  $M_{c,Rd}$ .

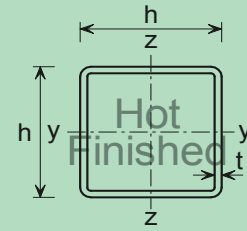
Axial force resistance  $N_{pl,Rd}$  which is equal to  $Af_y$  is given in the cross-section resistance check table opposite.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED SQUARE HOLLOW SECTIONS

Celsius® SHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n limit Class 3 Class 2	Moment Resistance $M_{c,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$													
h x h mm	t mm				n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0		
120x120	4.0 #	14.4	653	n/a	$M_{c,Rd}$	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	28.3	
				1.00	$M_{N,Rd}$	28.3	28.3	28.3	26.0	22.3	18.6	14.9	11.2	7.44	3.72	0		
	5.0	17.8	806	n/a	$M_{c,Rd}$	34.6	34.6	34.6	34.6	34.6	34.6	34.6	34.6	34.6	34.6	34.6	34.6	
				1.00	$M_{N,Rd}$	34.6	34.6	34.6	31.7	27.2	22.7	18.1	13.6	9.07	4.53	0		
	6.3	22.2	1000	n/a	$M_{c,Rd}$	42.6	42.6	42.6	42.6	42.6	42.6	42.6	42.6	42.6	42.6	42.6	42.6	
				1.00	$M_{N,Rd}$	42.6	42.6	42.6	38.8	33.3	27.7	22.2	16.6	11.1	5.55	0		
	7.1 #	24.7	1120	n/a	$M_{c,Rd}$	47.2	47.2	47.2	47.2	47.2	47.2	47.2	47.2	47.2	47.2	47.2	47.2	
				1.00	$M_{N,Rd}$	47.2	47.2	47.2	42.9	36.8	30.6	24.5	18.4	12.3	6.13	0		
8.0	27.6	1250	n/a	$M_{c,Rd}$	51.8	51.8	51.8	51.8	51.8	51.8	51.8	51.8	51.8	51.8	51.8	51.8		
			1.00	$M_{N,Rd}$	51.8	51.8	51.8	47.0	40.2	33.5	26.8	20.1	13.4	6.71	0			
8.8 #	30.1	1360	n/a	$M_{c,Rd}$	56.1	56.1	56.1	56.1	56.1	56.1	56.1	56.1	56.1	56.1	56.1	56.1		
			1.00	$M_{N,Rd}$	56.1	56.1	56.1	50.6	43.4	36.2	28.9	21.7	14.5	7.23	0			
10.0	33.7	1520	n/a	$M_{c,Rd}$	62.1	62.1	62.1	62.1	62.1	62.1	62.1	62.1	62.1	62.1	62.1	62.1		
			1.00	$M_{N,Rd}$	62.1	62.1	62.1	55.8	47.8	39.8	31.9	23.9	15.9	7.97	0			
12.5	40.9	1850	n/a	$M_{c,Rd}$	73.5	73.5	73.5	73.5	73.5	73.5	73.5	73.5	73.5	73.5	73.5	73.5		
			1.00	$M_{N,Rd}$	73.5	73.5	73.5	65.3	56.0	46.6	37.3	28.0	18.7	9.33	0			
140x140	5.0	21.0	948	n/a	$M_{c,Rd}$	47.9	47.9	47.9	47.9	47.9	47.9	47.9	47.9	47.9	47.9	47.9		
				1.00	$M_{N,Rd}$	47.9	47.9	47.9	44.0	37.7	31.4	25.2	18.9	12.6	6.29	0		
	6.3	26.1	1180	n/a	$M_{c,Rd}$	58.9	58.9	58.9	58.9	58.9	58.9	58.9	58.9	58.9	58.9	58.9		
				1.00	$M_{N,Rd}$	58.9	58.9	58.9	53.9	46.2	38.5	30.8	23.1	15.4	7.70	0		
	7.1 #	29.2	1320	n/a	$M_{c,Rd}$	65.3	65.3	65.3	65.3	65.3	65.3	65.3	65.3	65.3	65.3	65.3		
				1.00	$M_{N,Rd}$	65.3	65.3	65.3	59.6	51.1	42.6	34.1	25.5	17.0	8.51	0		
	8.0	32.6	1480	n/a	$M_{c,Rd}$	72.4	72.4	72.4	72.4	72.4	72.4	72.4	72.4	72.4	72.4	72.4		
				1.00	$M_{N,Rd}$	72.4	72.4	72.4	65.9	56.5	47.1	37.7	28.2	18.8	9.41	0		
8.8 #	35.6	1610	n/a	$M_{c,Rd}$	78.5	78.5	78.5	78.5	78.5	78.5	78.5	78.5	78.5	78.5	78.5			
			1.00	$M_{N,Rd}$	78.5	78.5	78.5	71.2	61.0	50.9	40.7	30.5	20.3	10.2	0			
10.0	40.0	1810	n/a	$M_{c,Rd}$	87.3	87.3	87.3	87.3	87.3	87.3	87.3	87.3	87.3	87.3	87.3			
			1.00	$M_{N,Rd}$	87.3	87.3	87.3	78.9	67.6	56.3	45.1	33.8	22.5	11.3	0			
12.5	48.7	2200	n/a	$M_{c,Rd}$	104	104	104	104	104	104	104	104	104	104	104			
			1.00	$M_{N,Rd}$	104	104	104	93.1	79.8	66.5	53.2	39.9	26.6	13.3	0			

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Square Hollow Sections (HFSHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

$N_{Ed}$  = Design value of the axial force.

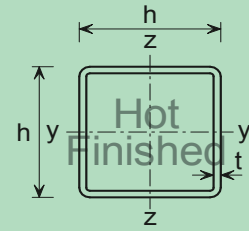
$n = N_{Ed} / N_{pl,Rd}$

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED SQUARE HOLLOW SECTIONS

Celsius® SHS



Member buckling check

Section Designation & Resistance (kNm)		n Limit	Compression Resistance $N_{b,Rd}$ (kN)												
h x h mm	t mm		for Varying buckling lengths (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$												
			1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
120x120	4.0 # $f_y W_{el} = 24.3$	1.00	642	620	592	556	508	448	385	277	203	154	120	96.1	78.7
	5.0 $f_y W_{el} = 29.5$	1.00	792	764	729	683	623	548	470	337	247	187	146	117	95.5
	6.3 $f_y W_{el} = 35.5$	1.00	982	947	903	845	767	672	574	410	300	227	177	141	116
	7.1 # $f_y W_{el} = 39.1$	1.00	1100	1060	1010	941	853	746	636	453	331	250	195	156	128
	8.0 $f_y W_{el} = 43.0$	1.00	1230	1180	1120	1050	947	826	702	499	364	275	214	172	140
	8.8 # $f_y W_{el} = 46.2$	1.00	1330	1280	1220	1140	1020	890	755	535	390	294	229	184	150
	10.0 $f_y W_{el} = 50.4$	1.00	1490	1430	1360	1270	1140	985	833	589	428	323	252	201	165
	12.5 $f_y W_{el} = 58.2$	1.00	1810	1740	1640	1520	1350	1160	973	683	495	373	290	232	190
140x140	5.0 $f_y W_{el} = 40.8$	1.00	940	914	883	845	797	736	662	508	383	294	231	186	153
	6.3 $f_y W_{el} = 50.1$	1.00	1170	1140	1100	1050	990	911	818	624	470	360	283	227	186
	7.1 # $f_y W_{el} = 55.0$	1.00	1310	1270	1230	1170	1100	1010	907	690	518	397	312	250	205
	8.0 $f_y W_{el} = 60.7$	1.00	1460	1420	1370	1310	1230	1130	1010	763	572	438	344	276	227
	8.8 # $f_y W_{el} = 65.3$	1.00	1600	1550	1490	1430	1340	1220	1090	826	619	473	371	298	245
	10.0 $f_y W_{el} = 71.7$	1.00	1790	1730	1670	1590	1490	1360	1210	911	680	520	408	327	268
	12.5 $f_y W_{el} = 83.8$	1.00	2180	2110	2030	1930	1800	1640	1440	1080	801	611	478	384	315

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$$n = N_{Ed} / N_{pl,Rd}$$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

$M_{b,Rd}$  should be taken as equal to  $M_{c,Rd}$ .

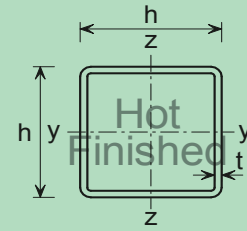
Axial force resistance  $N_{pl,Rd}$  which is equal to  $Af_y$  is given in the cross-section resistance check table opposite.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED SQUARE HOLLOW SECTIONS

Celsius® SHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n limit Class 3 Class 2	Moment Resistance $M_{c,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$													
h x h mm	t mm				n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0		
150x150	5.0	22.6	1020	n/a	$M_{c,Rd}$	55.4	55.4	55.4	55.4	55.4	55.4	55.4	55.4	55.4	55.4	55.4	55.4	
				1.00	$M_{N,Rd}$	55.4	55.4	55.4	50.9	43.6	36.4	29.1	21.8	14.5	7.27	0		
	6.3	28.1	1270	n/a	$M_{c,Rd}$	68.2	68.2	68.2	68.2	68.2	68.2	68.2	68.2	68.2	68.2	68.2	68.2	
				1.00	$M_{N,Rd}$	68.2	68.2	68.2	62.5	53.5	44.6	35.7	26.8	17.8	8.92	0		
	7.1 #	31.4	1420	n/a	$M_{c,Rd}$	75.6	75.6	75.6	75.6	75.6	75.6	75.6	75.6	75.6	75.6	75.6	75.6	
				1.00	$M_{N,Rd}$	75.6	75.6	75.6	69.1	59.2	49.3	39.5	29.6	19.7	9.87	0		
	8.0	35.1	1590	n/a	$M_{c,Rd}$	84.1	84.1	84.1	84.1	84.1	84.1	84.1	84.1	84.1	84.1	84.1	84.1	
				1.00	$M_{N,Rd}$	84.1	84.1	84.1	76.7	65.7	54.8	43.8	32.9	21.9	11.0	0		
	8.8 #	38.4	1740	n/a	$M_{c,Rd}$	91.2	91.2	91.2	91.2	91.2	91.2	91.2	91.2	91.2	91.2	91.2	91.2	
				1.00	$M_{N,Rd}$	91.2	91.2	91.2	82.9	71.1	59.2	47.4	35.5	23.7	11.8	0		
10.0	43.1	1950	n/a	$M_{c,Rd}$	102	102	102	102	102	102	102	102	102	102	102	102		
			1.00	$M_{N,Rd}$	102	102	102	91.9	78.8	65.7	52.5	39.4	26.3	13.1	0			
12.5	52.7	2380	n/a	$M_{c,Rd}$	121	121	121	121	121	121	121	121	121	121	121	121		
			1.00	$M_{N,Rd}$	121	121	121	109	93.5	77.9	62.3	46.7	31.2	15.6	0			
14.2 #	58.9	2660	n/a	$M_{c,Rd}$	134	134	134	134	134	134	134	134	134	134	134	134		
			1.00	$M_{N,Rd}$	134	134	134	119	102	85.4	68.3	51.2	34.1	17.1	0			
16.0 # r	65.2	2950	n/a	$M_{c,Rd}$	146	146	146	146	146	146	146	146	146	146	146	146		
			1.00	$M_{N,Rd}$	146	146	146	129	111	92.4	74.0	55.5	37.0	18.5	0			
160x160	5.0 #	24.1	1090	n/a	$M_{c,Rd}$	63.2	63.2	63.2	63.2	63.2	63.2	63.2	63.2	63.2	63.2	63.2		
				1.00	$M_{N,Rd}$	63.2	63.2	63.2	58.2	49.8	41.5	33.2	24.9	16.6	8.31	0		
	6.3	30.1	1360	n/a	$M_{c,Rd}$	78.1	78.1	78.1	78.1	78.1	78.1	78.1	78.1	78.1	78.1	78.1		
				1.00	$M_{N,Rd}$	78.1	78.1	78.1	71.6	61.4	51.2	40.9	30.7	20.5	10.2	0		
	7.1 #	33.7	1520	n/a	$M_{c,Rd}$	87.0	87.0	87.0	87.0	87.0	87.0	87.0	87.0	87.0	87.0	87.0		
				1.00	$M_{N,Rd}$	87.0	87.0	87.0	79.6	68.2	56.9	45.5	34.1	22.7	11.4	0		
	8.0	37.6	1700	n/a	$M_{c,Rd}$	96.6	96.6	96.6	96.6	96.6	96.6	96.6	96.6	96.6	96.6	96.6		
				1.00	$M_{N,Rd}$	96.6	96.6	96.6	88.2	75.6	63.0	50.4	37.8	25.2	12.6	0		
	8.8 #	41.1	1860	n/a	$M_{c,Rd}$	105	105	105	105	105	105	105	105	105	105	105		
				1.00	$M_{N,Rd}$	105	105	105	95.4	81.7	68.1	54.5	40.9	27.2	13.6	0		
10.0	46.3	2090	n/a	$M_{c,Rd}$	117	117	117	117	117	117	117	117	117	117	117			
			1.00	$M_{N,Rd}$	117	117	117	106	90.8	75.7	60.5	45.4	30.3	15.1	0			
12.5	56.6	2560	n/a	$M_{c,Rd}$	140	140	140	140	140	140	140	140	140	140	140			
			1.00	$M_{N,Rd}$	140	140	140	126	108	90.2	72.2	54.1	36.1	18.0	0			
14.2 #	63.3	2860	n/a	$M_{c,Rd}$	155	155	155	155	155	155	155	155	155	155	155			
			1.00	$M_{N,Rd}$	155	155	155	139	119	99.0	79.2	59.4	39.6	19.8	0			
16.0 #	70.2	3170	n/a	$M_{c,Rd}$	169	169	169	169	169	169	169	169	169	169	169			
			1.00	$M_{N,Rd}$	169	169	169	150	129	107	86.0	64.5	43.0	21.5	0			

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Square Hollow Sections (HFSHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

$N_{Ed}$  = Design value of the axial force.

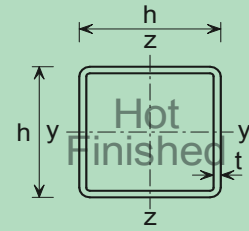
$n = N_{Ed} / N_{pl,Rd}$

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED SQUARE HOLLOW SECTIONS

Celsius® SHS



Member buckling check

Section Designation & Resistance (kNm)		n Limit	Compression Resistance $N_{b,Rd}$ (kN)												
h x h mm	t mm		for Varying buckling lengths (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$												
			2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
150x150	5.0 $f_y W_{el} = 47.6$	1.00	959	880	756	601	462	358	282	228	187	156	133	114	98.7
	6.3 $f_y W_{el} = 57.9$	1.00	1190	1090	937	741	568	440	347	280	230	192	163	140	121
	7.1 # $f_y W_{el} = 63.9$	1.00	1330	1220	1040	821	628	485	383	309	254	212	180	154	134
	8.0 $f_y W_{el} = 70.6$	1.00	1490	1360	1160	911	696	537	423	341	280	234	198	170	148
	8.8 # $f_y W_{el} = 76.0$	1.00	1630	1480	1260	987	753	581	458	369	303	253	214	184	159
	10.0 $f_y W_{el} = 83.8$	1.00	1820	1660	1400	1090	831	640	504	406	334	279	236	202	175
	12.5 $f_y W_{el} = 98.3$	1.00	2220	2010	1680	1300	984	756	595	479	393	328	278	238	207
	14.2 # $f_y W_{el} = 107$	1.00	2480	2240	1860	1420	1070	824	648	521	427	357	302	259	224
	16.0 # r $f_y W_{el} = 115$	1.00	2740	2460	2030	1540	1160	888	698	561	460	384	325	279	241
160x160	5.0 # $f_y W_{el} = 54.3$	1.00	1030	961	848	697	548	429	341	276	227	190	161	138	120
	6.3 $f_y W_{el} = 66.4$	1.00	1290	1200	1050	862	675	528	419	339	279	234	198	170	148
	7.1 # $f_y W_{el} = 73.5$	1.00	1440	1340	1170	958	749	585	464	375	309	258	219	188	163
	8.0 $f_y W_{el} = 81.3$	1.00	1610	1490	1310	1060	830	647	513	415	342	286	242	208	180
	8.8 # $f_y W_{el} = 87.7$	1.00	1760	1630	1420	1150	897	699	554	448	368	308	261	224	195
	10.0 $f_y W_{el} = 96.9$	1.00	1980	1820	1590	1280	996	775	614	496	408	341	289	248	215
	12.5 $f_y W_{el} = 114$	1.00	2410	2220	1920	1540	1180	919	727	587	482	403	342	293	254
	14.2 # $f_y W_{el} = 125$	1.00	2700	2470	2130	1690	1300	1010	794	641	527	440	373	320	278
	16.0 # $f_y W_{el} = 135$	1.00	2980	2730	2330	1840	1410	1090	858	692	569	475	403	345	299

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Square Hollow Sections (HFSHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

$$n = N_{Ed} / N_{pl,Rd}$$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

$M_{b,Rd}$  should be taken as equal to  $M_{c,Rd}$ .

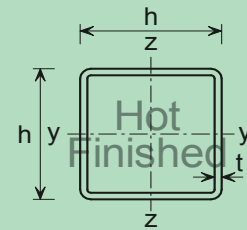
Axial force resistance  $N_{pl,Rd}$  which is equal to  $Af_y$  is given in the cross-section resistance check table opposite.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED SQUARE HOLLOW SECTIONS

Celsius® SHS



Cross-section resistance check

Section Designation		Mass per Metre	Axial Resistance	n limit	Moment Resistance $M_{c,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$													
h x h mm	t mm	kg/m	$N_{pl,Rd}$ kN	Class 3	n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0		
180x180	5.0 #	27.3	1230	1.00	$M_{c,Rd}$	69.6	69.6	69.6	69.6	69.6	69.6	69.6	69.6	69.6	69.6	69.6	69.6	
				<b>0.00</b>	$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	
	6.3	34.0	1540	n/a	$M_{c,Rd}$	99.8	99.8	99.8	99.8	99.8	99.8	99.8	99.8	99.8	99.8	99.8	99.8	
				<b>1.00</b>	$M_{N,Rd}$	99.8	99.8	99.8	91.7	78.6	65.5	52.4	39.3	26.2	13.1	0		
	7.1 #	38.1	1730	n/a	$M_{c,Rd}$	111	111	111	111	111	111	111	111	111	111	111	111	
				<b>1.00</b>	$M_{N,Rd}$	111	111	111	102	87.7	73.1	58.4	43.8	29.2	14.6	0		
	8.0	42.7	1930	n/a	$M_{c,Rd}$	124	124	124	124	124	124	124	124	124	124	124	124	
				<b>1.00</b>	$M_{N,Rd}$	124	124	124	113	97.2	81.0	64.8	48.6	32.4	16.2	0		
	8.8 #	46.7	2110	n/a	$M_{c,Rd}$	135	135	135	135	135	135	135	135	135	135	135	135	
				<b>1.00</b>	$M_{N,Rd}$	135	135	135	123	105	87.7	70.2	52.6	35.1	17.5	0		
10.0	52.5	2370	n/a	$M_{c,Rd}$	151	151	151	151	151	151	151	151	151	151	151	151		
			<b>1.00</b>	$M_{N,Rd}$	151	151	151	137	117	97.9	78.3	58.7	39.1	19.6	0			
12.5	64.4	2910	n/a	$M_{c,Rd}$	181	181	181	181	181	181	181	181	181	181	181	181		
			<b>1.00</b>	$M_{N,Rd}$	181	181	181	164	141	117	93.7	70.3	46.9	23.4	0			
14.2 #	72.2	3270	n/a	$M_{c,Rd}$	201	201	201	201	201	201	201	201	201	201	201	201		
			<b>1.00</b>	$M_{N,Rd}$	201	201	201	181	155	129	103	77.5	51.7	25.8	0			
16.0	80.2	3620	n/a	$M_{c,Rd}$	220	220	220	220	220	220	220	220	220	220	220	220		
			<b>1.00</b>	$M_{N,Rd}$	220	220	220	197	169	141	113	84.5	56.4	28.2	0			
200x200	5.0	30.4	1370	*	$M_{c,Rd}$	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘		
					$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-		
	6.3	38.0	1720	n/a	$M_{c,Rd}$	124	124	124	124	124	124	124	124	124	124	124		
				<b>1.00</b>	$M_{N,Rd}$	124	124	124	114	98.0	81.7	65.4	49.0	32.7	16.3	0		
	7.1 #	42.6	1920	n/a	$M_{c,Rd}$	139	139	139	139	139	139	139	139	139	139	139		
				<b>1.00</b>	$M_{N,Rd}$	139	139	139	128	109	91.1	72.9	54.6	36.4	18.2	0		
	8.0	47.7	2160	n/a	$M_{c,Rd}$	155	155	155	155	155	155	155	155	155	155	155		
				<b>1.00</b>	$M_{N,Rd}$	155	155	155	142	122	101	81.1	60.8	40.6	20.3	0		
	8.8 #	52.2	2360	n/a	$M_{c,Rd}$	168	168	168	168	168	168	168	168	168	168	168		
				<b>1.00</b>	$M_{N,Rd}$	168	168	168	154	132	110	88.0	66.0	44.0	22.0	0		
10.0	58.8	2660	n/a	$M_{c,Rd}$	189	189	189	189	189	189	189	189	189	189	189			
			<b>1.00</b>	$M_{N,Rd}$	189	189	189	172	147	123	98.3	73.7	49.2	24.6	0			
12.5	72.3	3270	n/a	$M_{c,Rd}$	228	228	228	228	228	228	228	228	228	228	228			
			<b>1.00</b>	$M_{N,Rd}$	228	228	228	207	178	148	118	88.8	59.2	29.6	0			
14.2 #	81.1	3660	n/a	$M_{c,Rd}$	253	253	253	253	253	253	253	253	253	253	253			
			<b>1.00</b>	$M_{N,Rd}$	253	253	253	229	196	163	131	98.0	65.4	32.7	0			
16.0	90.3	4080	n/a	$M_{c,Rd}$	279	279	279	279	279	279	279	279	279	279	279			
			<b>1.00</b>	$M_{N,Rd}$	279	279	279	251	215	179	143	107	71.6	35.8	0			

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Square Hollow Sections (HFSHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

\* The section is a Class 4 section and is independent of the design axial force  $N_{Ed}$ . Values of  $M_{c,Rd}$  are calculated based on Class 4 section properties and are displayed in italics.

$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

✘ Section becomes Class 4, see note 10.

\$ For these values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

- Not applicable for Class 3 and Class 4 sections.

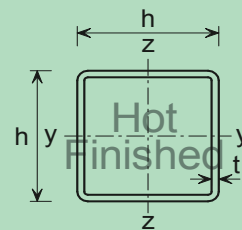
# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.



HOT-FINISHED SQUARE HOLLOW SECTIONS

Celsius® SHS



Member buckling check

Section Designation & Resistance (kNm)		n Limit	Compression Resistance $N_{b,Rd}$ (kN)												
h x h mm	t mm		for Varying buckling lengths (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$												
			2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
180x180	5.0 # $f_y W_{el} = 69.6$	1.00	1180	1120	1020	889	733	590	475	388	321	270	229	197	171
	6.3 $f_y W_{el} = 85.6$	1.00	1480	1390	1270	1100	905	726	585	477	395	331	282	242	211
	7.1 # $f_y W_{el} = 94.8$	1.00	1660	1560	1430	1230	1010	810	652	531	440	369	314	270	234
	8.0 $f_y W_{el} = 105$	1.00	1850	1750	1590	1370	1120	899	723	589	487	409	347	299	260
	8.8 # $f_y W_{el} = 114$	1.00	2020	1900	1730	1490	1220	973	781	636	526	442	375	323	280
	10.0 $f_y W_{el} = 126$	1.00	2280	2140	1950	1670	1360	1080	869	708	585	491	417	359	311
	12.5 $f_y W_{el} = 149$	1.00	2790	2620	2370	2020	1630	1300	1040	844	697	584	497	427	371
	14.2 # $f_y W_{el} = 164$	1.00	3120	2930	2640	2230	1800	1420	1140	926	764	641	544	468	406
	16.0 $f_y W_{el} = 178$	1.00	3460	3230	2900	2450	1960	1550	1240	1000	829	695	590	507	440
200x200	5.0 $f_y W_{el} = 87.0$	*	1220	1170	1100	1010	882	746	619	514	430	364	311	268	234
	6.3 $f_y W_{el} = 107$	1.00	1670	1590	1480	1340	1150	953	782	645	537	453	386	333	290
	7.1 # $f_y W_{el} = 119$	1.00	1870	1780	1660	1490	1280	1060	869	716	596	503	429	369	321
	8.0 $f_y W_{el} = 132$	1.00	2090	1990	1860	1670	1430	1180	967	796	663	559	476	410	357
	8.8 # $f_y W_{el} = 143$	1.00	2290	2180	2030	1820	1560	1280	1050	865	720	607	517	446	388
	10.0 $f_y W_{el} = 159$	1.00	2570	2450	2280	2040	1740	1430	1170	962	800	674	574	495	430
	12.5 $f_y W_{el} = 190$	1.00	3160	3010	2790	2480	2100	1720	1410	1150	959	807	687	592	515
	14.2 # $f_y W_{el} = 208$	1.00	3530	3360	3110	2760	2330	1900	1550	1270	1050	887	756	651	566
	16.0 $f_y W_{el} = 227$	1.00	3940	3740	3460	3060	2570	2090	1700	1390	1160	972	827	712	619

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Square Hollow Sections (HFSHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

$$n = N_{Ed} / N_{pl,Rd}$$

\* The section is a Class 4 section.

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

$M_{b,Rd}$  should be taken as equal to  $M_{c,Rd}$ .

Axial force resistance  $N_{pl,Rd}$  which is equal to  $A f_y$  is given in the cross-section resistance check table opposite.

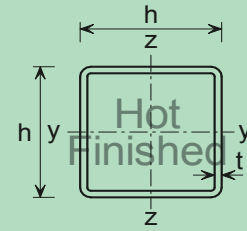
$N_{b,Rd}$  values in *italic type* indicate that the section is Class 4 and allowance has been made in calculating  $N_{b,Rd}$ .

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED SQUARE HOLLOW SECTIONS

Celsius® SHS



Cross-section resistance check

Section Designation		Mass per Metre	Axial Resistance	n limit	Moment Resistance $M_{c,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$											
h x h mm	t mm	kg/m	$N_{pl,Rd}$ kN	Class 3 Class 2	n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
250x250	5.0 #	38.3	1730	*	$M_{c,Rd}$	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
					$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-
	6.3	47.9	2170	*	$M_{c,Rd}$	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
					$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-
	7.1 #	53.7	2430	1.00 0.00	$M_{c,Rd}$	190	190	190	190	190	190	190	190	190	190	190
					$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-
	8.0	60.3	2730	n/a 1.00	$M_{c,Rd}$	246	246	246	246	246	246	246	246	246	246	246
					$M_{N,Rd}$	246	246	246	227	194	162	130	97.2	64.8	32.4	0
	8.8 #	66.0	2990	n/a 1.00	$M_{c,Rd}$	269	269	269	269	269	269	269	269	269	269	269
					$M_{N,Rd}$	269	269	269	247	212	177	141	106	70.7	35.3	0
10.0	74.5	3370	n/a 1.00	$M_{c,Rd}$	302	302	302	302	302	302	302	302	302	302	302	
				$M_{N,Rd}$	302	302	302	277	237	198	158	119	79.1	39.6	0	
12.5	91.9	4150	n/a 1.00	$M_{c,Rd}$	368	368	368	368	368	368	368	368	368	368	368	
				$M_{N,Rd}$	368	368	368	336	288	240	192	144	96.0	48.0	0	
14.2 #	103	4690	n/a 1.00	$M_{c,Rd}$	411	411	411	411	411	411	411	411	411	411	411	
				$M_{N,Rd}$	411	411	411	374	321	267	214	160	107	53.5	0	
16.0	115	5220	n/a 1.00	$M_{c,Rd}$	454	454	454	454	454	454	454	454	454	454	454	
				$M_{N,Rd}$	454	454	454	412	353	294	235	177	118	58.9	0	
260x260	6.3 #	49.9	2250	*	$M_{c,Rd}$	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
					$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-
	7.1 #	56.0	2530	1.00 0.00	$M_{c,Rd}$	207	207	207	207	207	207	207	207	207	207	207
					$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-
	8.0 #	62.8	2840	n/a 1.00	$M_{c,Rd}$	267	267	267	267	267	267	267	267	267	267	267
					$M_{N,Rd}$	267	267	267	246	211	176	141	106	70.3	35.2	0
	8.8 #	68.8	3110	n/a 1.00	$M_{c,Rd}$	292	292	292	292	292	292	292	292	292	292	292
					$M_{N,Rd}$	292	292	292	268	230	192	153	115	76.7	38.3	0
10.0 #	77.7	3510	n/a 1.00	$M_{c,Rd}$	328	328	328	328	328	328	328	328	328	328	328	
				$M_{N,Rd}$	328	328	328	301	258	215	172	129	86.0	43.0	0	
12.5 #	95.8	4330	n/a 1.00	$M_{c,Rd}$	400	400	400	400	400	400	400	400	400	400	400	
				$M_{N,Rd}$	400	400	400	365	313	261	209	157	104	52.2	0	
14.2 #	108	4860	n/a 1.00	$M_{c,Rd}$	447	447	447	447	447	447	447	447	447	447	447	
				$M_{N,Rd}$	447	447	447	407	349	290	232	174	116	58.1	0	
16.0 #	120	5430	n/a 1.00	$M_{c,Rd}$	495	495	495	495	495	495	495	495	495	495	495	
				$M_{N,Rd}$	495	495	495	449	385	321	256	192	128	64.1	0	

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Square Hollow Sections (HFSHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

\* The section is a Class 4 section and is independent of the design axial force  $N_{Ed}$ . Values of  $M_{c,Rd}$  are calculated based on Class 4 section properties and are displayed in italics.

$N_{Ed}$  = Design value of the axial force.

$$n = N_{Ed} / N_{pl,Rd}$$

✗ Section becomes Class 4, see note 10.

✗ For these values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

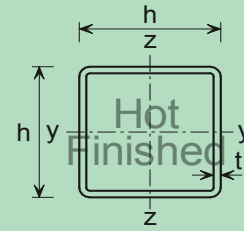
- Not applicable for Class 3 and Class 4 sections.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED SQUARE HOLLOW SECTIONS

Celsius® SHS



Member buckling check

Section Designation & Resistance (kNm)		n Limit	Compression Resistance $N_{b,Rd}$ (kN) for Varying buckling lengths (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$												
h x h mm	t mm		2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
250x250	5.0 # $f_y W_{el} = 138$	*	1340	1300	1260	1210	1150	1060	966	858	751	655	571	500	440
	6.3 $f_y W_{el} = 171$	*	1960	1900	1830	1740	1620	1480	1310	1130	976	841	727	633	555
	7.1 # $f_y W_{el} = 190$	1.00	2390	2320	2220	2100	1940	1740	1520	1300	1110	953	821	713	624
	8.0 $f_y W_{el} = 212$	1.00	2690	2600	2490	2360	2170	1950	1700	1450	1240	1060	915	795	695
	8.8 # $f_y W_{el} = 230$	1.00	2940	2840	2730	2580	2380	2130	1850	1580	1350	1160	995	864	756
	10.0 $f_y W_{el} = 257$	1.00	3320	3210	3070	2900	2670	2390	2070	1770	1510	1290	1110	966	845
	12.5 $f_y W_{el} = 310$	1.00	4090	3950	3780	3560	3270	2910	2520	2150	1830	1560	1350	1170	1020
	14.2 # $f_y W_{el} = 343$	1.00	4610	4450	4260	4010	3670	3260	2820	2400	2040	1740	1500	1300	1130
	16.0 $f_y W_{el} = 377$	1.00	5130	4950	4740	4450	4070	3600	3100	2640	2240	1910	1640	1420	1240
260x260	6.3 # $f_y W_{el} = 185$	*	1990	1940	1870	1790	1680	1550	1390	1230	1070	923	802	700	615
	7.1 # $f_y W_{el} = 207$	1.00	2500	2420	2330	2220	2070	1880	1660	1430	1230	1060	917	797	699
	8.0 # $f_y W_{el} = 230$	1.00	2810	2720	2620	2490	2320	2100	1860	1610	1380	1190	1030	895	784
	8.8 # $f_y W_{el} = 250$	1.00	3070	2980	2860	2720	2530	2290	2010	1740	1490	1280	1110	963	843
	10.0 # $f_y W_{el} = 280$	1.00	3470	3360	3230	3070	2850	2580	2270	1960	1680	1450	1250	1090	952
	12.5 # $f_y W_{el} = 338$	1.00	4270	4140	3980	3770	3500	3160	2770	2390	2050	1760	1520	1320	1150
	14.2 # $f_y W_{el} = 375$	1.00	4800	4640	4460	4220	3910	3510	3070	2640	2260	1940	1670	1450	1270
	16.0 # $f_y W_{el} = 411$	1.00	5350	5180	4970	4700	4350	3900	3400	2920	2490	2130	1840	1600	1400

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Square Hollow Sections (HFSHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

$$n = N_{Ed} / N_{pl,Rd}$$

\* The section is a Class 4 section.

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

$M_{b,Rd}$  should be taken as equal to  $M_{c,Rd}$ .

Axial force resistance  $N_{pl,Rd}$  which is equal to  $Af_y$  is given in the cross-section resistance check table opposite.

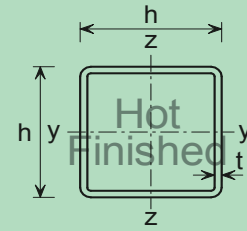
$N_{b,Rd}$  values in *italic type* indicate that the section is Class 4 and allowance has been made in calculating  $N_{b,Rd}$ .

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED SQUARE HOLLOW SECTIONS

Celsius® SHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n limit Class 3 Class 2	Moment Resistance $M_{c,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$													
h x h mm	t mm				n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0		
300x300	6.3 #	57.8	2610	*	$M_{c,Rd}$	x	x	x	x	x	x	x	x	x	x	\$	\$	
					$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-
	7.1 #	64.9	2930	*	$M_{c,Rd}$	x	x	x	x	x	x	x	x	x	x	\$	\$	
					$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-
	8.0	72.8	3290	*	$M_{c,Rd}$	x	x	x	x	x	x	x	x	x	x	x	\$	
					$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-
	8.8 #	79.8	3620	1.00	$M_{c,Rd}$	339	339	339	339	339	339	339	339	339	339	339	339	
					$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-
10.0	90.2	4080	n/a	$M_{c,Rd}$	442	442	442	442	442	442	442	442	442	442	442	442		
			1.00	$M_{N,Rd}$	442	442	442	407	349	291	233	174	116	58.1	0			
12.5	112	5040	n/a	$M_{c,Rd}$	541	541	541	541	541	541	541	541	541	541	541			
			1.00	$M_{N,Rd}$	541	541	541	496	425	354	283	213	142	70.9	0			
14.2 #	126	5680	n/a	$M_{c,Rd}$	606	606	606	606	606	606	606	606	606	606	606			
			1.00	$M_{N,Rd}$	606	606	606	554	475	396	317	237	158	79.1	0			
16.0	141	6350	n/a	$M_{c,Rd}$	673	673	673	673	673	673	673	673	673	673	673			
			1.00	$M_{N,Rd}$	673	673	673	613	525	438	350	263	175	87.6	0			
350x350	8.0	85.4	3870	*	$M_{c,Rd}$	x	x	x	x	x	x	x	x	x	\$	\$		
					$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	
	8.8 #	93.6	4220	*	$M_{c,Rd}$	x	x	x	x	x	x	x	x	x	\$	\$		
					$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	
	10.0	106	4790	1.00	$M_{c,Rd}$	525	525	525	525	525	525	525	525	525	525	525		
				0.00	$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	
12.5	131	5930	n/a	$M_{c,Rd}$	748	748	748	748	748	748	748	748	748	748	748			
			1.00	$M_{N,Rd}$	748	748	748	687	589	491	393	294	196	98.2	0			
14.2 #	148	6710	n/a	$M_{c,Rd}$	839	839	839	839	839	839	839	839	839	839	839			
			1.00	$M_{N,Rd}$	839	839	839	770	660	550	440	330	220	110	0			
16.0	166	7490	n/a	$M_{c,Rd}$	934	934	934	934	934	934	934	934	934	934	934			
			1.00	$M_{N,Rd}$	934	934	934	854	732	610	488	366	244	122	0			
400x400	8.0 #	97.9	4440	*	$M_{c,Rd}$	x	x	x	x	x	x	x	x	\$	\$	\$		
					$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	
	8.8 #	107	4860	*	$M_{c,Rd}$	x	x	x	x	x	x	x	x	x	\$	\$		
					$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	
	10.0	122	5500	*	$M_{c,Rd}$	x	x	x	x	x	x	x	x	x	x	\$		
					$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	
	12.5	151	6820	n/a	$M_{c,Rd}$	988	988	988	988	988	988	988	988	988	988	988		
				1.00	$M_{N,Rd}$	988	988	988	909	779	649	520	390	260	130	0		
14.2 #	170	7700	n/a	$M_{c,Rd}$	1110	1110	1110	1110	1110	1110	1110	1110	1110	1110	1110			
			1.00	$M_{N,Rd}$	1110	1110	1110	1020	874	729	583	437	291	146	0			
16.0	191	8630	n/a	$M_{c,Rd}$	1240	1240	1240	1240	1240	1240	1240	1240	1240	1240	1240			
			1.00	$M_{N,Rd}$	1240	1240	1240	1130	972	810	648	486	324	162	0			
20.0 ^	235	10400	n/a	$M_{c,Rd}$	1470	1470	1470	1470	1470	1470	1470	1470	1470	1470	1470			
			1.00	$M_{N,Rd}$	1470	1470	1470	1340	1150	956	764	573	382	191	0			

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\* The section is a Class 4 section and is independent of the design axial force  $N_{Ed}$ . Values of  $M_{c,Rd}$  are calculated based on Class 4 section properties and are displayed in italics.

$N_{Ed}$  = Design value of the axial force.

$$n = N_{Ed} / N_{pl,Rd}$$

x Section becomes Class 4, see note 10.

\$ For these values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

- Not applicable for Class 3 and Class 4 sections.

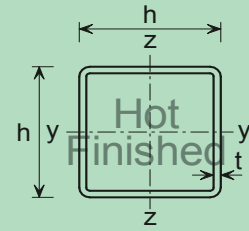
^ SAW process (single longitudinal seam weld, slightly proud).

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED SQUARE HOLLOW SECTIONS

Celsius® SHS



Member buckling check

Section Designation & Resistance (kNm)		n Limit	Compression Resistance $N_{b,Rd}$ (kN)												
h x h mm	t mm		for Varying buckling lengths (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$												
			2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
300x300	6.3 # $f_y W_{el} = 250$	*	2110	2060	2010	1960	1890	1800	1700	1570	1430	1290	1150	1020	911
	7.1 # $f_y W_{el} = 279$	*	2570	2510	2440	2370	2270	2160	2010	1840	1660	1480	1310	1150	1020
	8.0 $f_y W_{el} = 311$	*	3110	3040	2950	2850	2730	2570	2380	2160	1920	1700	1490	1320	1160
	8.8 # $f_y W_{el} = 339$	1.00	3610	3510	3410	3290	3130	2940	2700	2440	2160	1900	1660	1460	1290
	10.0 $f_y W_{el} = 379$	1.00	4060	3960	3840	3700	3520	3300	3030	2720	2410	2110	1850	1620	1430
	12.5 $f_y W_{el} = 460$	1.00	5010	4880	4740	4560	4340	4060	3720	3330	2940	2580	2250	1980	1740
	14.2 # $f_y W_{el} = 512$	1.00	5650	5500	5330	5130	4870	4550	4160	3720	3280	2870	2510	2200	1940
	16.0 $f_y W_{el} = 564$	1.00	6320	6150	5960	5730	5440	5070	4620	4120	3620	3170	2760	2420	2130
350x350	8.0 $f_y W_{el} = 428$	*	3320	3270	3200	3130	3040	2940	2820	2670	2500	2300	2100	1900	1720
	8.8 # $f_y W_{el} = 468$	*	3860	3800	3720	3620	3520	3390	3230	3050	2830	2600	2350	2120	1900
	10.0 $f_y W_{el} = 525$	1.00	4790	4700	4600	4470	4330	4150	3940	3680	3380	3070	2760	2470	2210
	12.5 $f_y W_{el} = 640$	1.00	5930	5810	5680	5520	5330	5110	4830	4500	4130	3730	3350	2990	2670
	14.2 # $f_y W_{el} = 714$	1.00	6710	6580	6420	6250	6040	5780	5470	5100	4670	4230	3790	3380	3020
	16.0 $f_y W_{el} = 790$	1.00	7490	7340	7170	6970	6730	6440	6090	5660	5180	4680	4190	3730	3330
400x400	8.0 # $f_y W_{el} = 566$	*	3460	3440	3390	3330	3260	3190	3110	3010	2890	2760	2610	2450	2270
	8.8 # $f_y W_{el} = 618$	*	4060	4040	3970	3890	3810	3720	3610	3480	3340	3170	2970	2770	2550
	10.0 $f_y W_{el} = 694$	*	5010	4970	4880	4780	4670	4550	4400	4230	4030	3790	3530	3260	2990
	12.5 $f_y W_{el} = 849$	1.00	6820	6740	6610	6470	6310	6120	5890	5630	5310	4950	4560	4170	3790
	14.2 # $f_y W_{el} = 950$	1.00	7700	7620	7470	7310	7120	6900	6650	6340	5980	5570	5130	4680	4240
	16.0 $f_y W_{el} = 1050$	1.00	8630	8530	8360	8170	7960	7720	7430	7080	6670	6200	5700	5200	4710
	20.0 ^ $f_y W_{el} = 1230$	1.00	10400	10200	10000	9810	9560	9260	8910	8500	8000	7450	6850	6240	5660

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$$n = N_{Ed} / N_{pl,Rd}$$

\* The section is a Class 4 section.

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

$M_{b,Rd}$  should be taken as equal to  $M_{c,Rd}$ .

Axial force resistance  $N_{pl,Rd}$  which is equal to  $Af_y$  is given in the cross-section resistance check table opposite.

$N_{b,Rd}$  values in *italic type* indicate that the section is Class 4 and allowance has been made in calculating  $N_{b,Rd}$ .

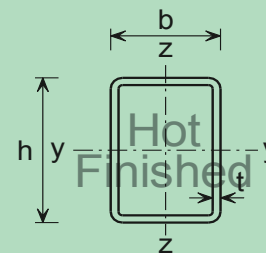
^ SAW process (single longitudinal seam weld, slightly proud).

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n Limit Class 3 <b>Class 2</b>		Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$															
h x b mm	t mm			Axis		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0				
				y-y	z-z																
50x30	3.0 #	3.41	154	n/a <b>1.00</b>	n/a <b>1.00</b>	$M_{c,y,Rd}$	2.44	2.44	2.44	2.44	2.44	2.44	2.44	2.44	2.44	2.44	2.44	2.44			
						$M_{c,z,Rd}$	1.69	1.69	1.69	1.69	1.69	1.69	1.69	1.69	1.69	1.69	1.69	1.69	1.69	1.69	
						$M_{N,y,Rd}$	2.44	2.44	2.44	2.28	1.95	1.63	1.30	0.977	0.651	0.326	0				
						$M_{N,z,Rd}$	1.69	1.69	1.60	1.40	1.20	0.999	0.799	0.599	0.400	0.200	0				
	3.2	3.61	163	n/a <b>1.00</b>	n/a <b>1.00</b>	$M_{c,y,Rd}$	2.57	2.57	2.57	2.57	2.57	2.57	2.57	2.57	2.57	2.57	2.57	2.57			
						$M_{c,z,Rd}$	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78	1.78		
						$M_{N,y,Rd}$	2.57	2.57	2.57	2.40	2.06	1.72	1.37	1.03	0.686	0.343	0				
						$M_{N,z,Rd}$	1.78	1.78	1.67	1.47	1.26	1.05	0.837	0.628	0.419	0.209	0				
	3.6 #	4.01	181	n/a <b>1.00</b>	n/a <b>1.00</b>	$M_{c,y,Rd}$	2.82	2.82	2.82	2.82	2.82	2.82	2.82	2.82	2.82	2.82	2.82	2.82			
						$M_{c,z,Rd}$	1.94	1.94	1.94	1.94	1.94	1.94	1.94	1.94	1.94	1.94	1.94	1.94	1.94		
						$M_{N,y,Rd}$	2.82	2.82	2.82	2.63	2.25	1.88	1.50	1.13	0.752	0.376	0				
						$M_{N,z,Rd}$	1.94	1.94	1.82	1.59	1.36	1.14	0.909	0.682	0.454	0.227	0				
	4.0	4.39	198	n/a <b>1.00</b>	n/a <b>1.00</b>	$M_{c,y,Rd}$	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05	3.05			
						$M_{c,z,Rd}$	2.09	2.09	2.09	2.09	2.09	2.09	2.09	2.09	2.09	2.09	2.09	2.09	2.09		
						$M_{N,y,Rd}$	3.05	3.05	3.05	2.85	2.44	2.03	1.63	1.22	0.813	0.407	0				
						$M_{N,z,Rd}$	2.09	2.09	1.95	1.70	1.46	1.22	0.973	0.730	0.487	0.243	0				
	5.0	5.28	239	n/a <b>1.00</b>	n/a <b>1.00</b>	$M_{c,y,Rd}$	3.55	3.55	3.55	3.55	3.55	3.55	3.55	3.55	3.55	3.55	3.55	3.55			
						$M_{c,z,Rd}$	2.41	2.41	2.41	2.41	2.41	2.41	2.41	2.41	2.41	2.41	2.41	2.41	2.41		
						$M_{N,y,Rd}$	3.55	3.55	3.55	3.31	2.84	2.37	1.89	1.42	0.947	0.473	0				
						$M_{N,z,Rd}$	2.41	2.41	2.22	1.94	1.66	1.39	1.11	0.831	0.554	0.277	0				

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

$N_{Ed}$  = Design value of the axial force.

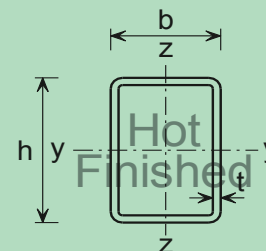
$n = N_{Ed} / N_{pl,Rd}$

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Member buckling check

Section Designation & Resistances (kNm)		n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$														
h x b mm	t mm		L (m)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0	
50x30	3.0 # $f_y W_{el,y} = 1.93$ $f_y W_{el,z} = 1.41$	1.00	$N_{b,y,Rd}$	128	90.9	58.8	39.7	28.3	21.2	16.4	10.7	7.47	5.53	4.25	3.37	2.74	
			$N_{b,z,Rd}$	89.9	47.2	27.9	18.3	12.9	9.53	7.35	4.75	3.32	2.45	1.88	1.49	1.21	
			1.00	$M_{b,Rd}$	2.44	2.44	2.44	2.43	2.40	2.36	2.33	2.26	2.20	2.14	2.09	2.03	1.97
	3.2 $f_y W_{el,y} = 2.02$ $f_y W_{el,z} = 1.47$	1.00	$N_{b,y,Rd}$	135	95.6	61.7	41.6	29.7	22.2	17.2	11.2	7.83	5.79	4.46	3.54	2.87	
			$N_{b,z,Rd}$	94.2	49.3	29.1	19.0	13.4	9.94	7.66	4.95	3.46	2.55	1.96	1.55	1.26	
			1.00	$M_{b,Rd}$	2.57	2.57	2.57	2.56	2.52	2.49	2.45	2.38	2.32	2.26	2.20	2.14	2.08
	3.6 # $f_y W_{el,y} = 2.19$ $f_y W_{el,z} = 1.58$	1.00	$N_{b,y,Rd}$	149	104	67.1	45.2	32.2	24.1	18.6	12.1	8.49	6.28	4.83	3.83	3.11	
			$N_{b,z,Rd}$	102	53.0	31.2	20.4	14.4	10.6	8.21	5.30	3.70	2.73	2.10	1.66	1.35	
			1.00	$M_{b,Rd}$	2.82	2.82	2.82	2.81	2.76	2.72	2.68	2.61	2.53	2.47	2.40	2.33	2.26
	4.0 $f_y W_{el,y} = 2.34$ $f_y W_{el,z} = 1.68$	1.00	$N_{b,y,Rd}$	162	113	72.1	48.5	34.6	25.8	20.0	13.0	9.10	6.73	5.18	4.11	3.34	
			$N_{b,z,Rd}$	111	57.1	33.6	22.0	15.5	11.5	8.84	5.71	3.99	2.94	2.26	1.79	1.45	
			1.00	$M_{b,Rd}$	3.05	3.05	3.05	3.03	2.98	2.94	2.90	2.82	2.74	2.66	2.59	2.51	2.44
5.0 $f_y W_{el,y} = 2.66$ $f_y W_{el,z} = 1.87$	1.00	$N_{b,y,Rd}$	192	130	82.5	55.3	39.4	29.4	22.7	14.8	10.3	7.65	5.88	4.66	3.79		
		$N_{b,z,Rd}$	125	63.4	37.2	24.3	17.1	12.6	9.74	6.29	4.39	3.24	2.49	1.97	1.60		
		1.00	$M_{b,Rd}$	3.55	3.55	3.55	3.52	3.46	3.41	3.36	3.26	3.17	3.08	2.99	2.90	2.82	

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

$$n = N_{Ed} / N_{pl,Rd}$$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

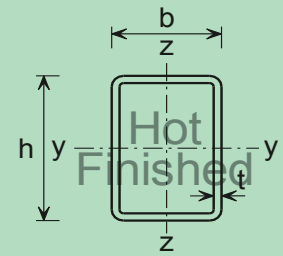
Axial force resistance  $N_{pl,Rd}$  which is equal to  $Af_y$  is given in the cross-section resistance check table opposite.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n Limit Class 3 <b>Class 2</b>		Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$															
h x b mm	t mm			Axis		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0				
				y-y	z-z																
60x40	3.0 #	4.35	197	n/a <b>1.00</b>	n/a <b>1.00</b>	$M_{c,y,Rd}$	3.87	3.87	3.87	3.87	3.87	3.87	3.87	3.87	3.87	3.87	3.87	3.87			
						$M_{c,z,Rd}$	2.91	2.91	2.91	2.91	2.91	2.91	2.91	2.91	2.91	2.91	2.91	2.91	2.91	2.91	
						$M_{N,y,Rd}$	3.87	3.87	3.87	3.61	3.10	2.58	2.06	1.55	1.03	0.516	0				
						$M_{N,z,Rd}$	2.91	2.91	2.82	2.47	2.11	1.76	1.41	1.06	0.705	0.352	0				
	3.2	4.62	209	n/a <b>1.00</b>	n/a <b>1.00</b>	$M_{c,y,Rd}$	4.08	4.08	4.08	4.08	4.08	4.08	4.08	4.08	4.08	4.08	4.08	4.08			
						$M_{c,z,Rd}$	3.07	3.07	3.07	3.07	3.07	3.07	3.07	3.07	3.07	3.07	3.07	3.07	3.07	3.07	
						$M_{N,y,Rd}$	4.08	4.08	4.08	3.81	3.27	2.72	2.18	1.63	1.09	0.544	0				
						$M_{N,z,Rd}$	3.07	3.07	2.97	2.60	2.23	1.86	1.48	1.11	0.742	0.371	0				
	3.6 #	5.14	232	n/a <b>1.00</b>	n/a <b>1.00</b>	$M_{c,y,Rd}$	4.51	4.51	4.51	4.51	4.51	4.51	4.51	4.51	4.51	4.51	4.51	4.51			
						$M_{c,z,Rd}$	3.37	3.37	3.37	3.37	3.37	3.37	3.37	3.37	3.37	3.37	3.37	3.37	3.37	3.37	
						$M_{N,y,Rd}$	4.51	4.51	4.51	4.21	3.61	3.01	2.40	1.80	1.20	0.601	0				
						$M_{N,z,Rd}$	3.37	3.37	3.25	2.84	2.44	2.03	1.62	1.22	0.812	0.406	0				
	4.0	5.64	255	n/a <b>1.00</b>	n/a <b>1.00</b>	$M_{c,y,Rd}$	4.90	4.90	4.90	4.90	4.90	4.90	4.90	4.90	4.90	4.90	4.90	4.90			
						$M_{c,z,Rd}$	3.66	3.66	3.66	3.66	3.66	3.66	3.66	3.66	3.66	3.66	3.66	3.66	3.66	3.66	
						$M_{N,y,Rd}$	4.90	4.90	4.90	4.57	3.92	3.27	2.61	1.96	1.31	0.653	0				
						$M_{N,z,Rd}$	3.66	3.66	3.51	3.07	2.63	2.19	1.75	1.32	0.877	0.439	0				
	5.0	6.85	310	n/a <b>1.00</b>	n/a <b>1.00</b>	$M_{c,y,Rd}$	5.82	5.82	5.82	5.82	5.82	5.82	5.82	5.82	5.82	5.82	5.82	5.82			
						$M_{c,z,Rd}$	4.33	4.33	4.33	4.33	4.33	4.33	4.33	4.33	4.33	4.33	4.33	4.33	4.33	4.33	
						$M_{N,y,Rd}$	5.82	5.82	5.82	5.43	4.66	3.88	3.11	2.33	1.55	0.776	0				
						$M_{N,z,Rd}$	4.33	4.33	4.11	3.59	3.08	2.57	2.05	1.54	1.03	0.513	0				
	6.3	8.31	376	n/a <b>1.00</b>	n/a <b>1.00</b>	$M_{c,y,Rd}$	6.82	6.82	6.82	6.82	6.82	6.82	6.82	6.82	6.82	6.82	6.82	6.82			
						$M_{c,z,Rd}$	5.04	5.04	5.04	5.04	5.04	5.04	5.04	5.04	5.04	5.04	5.04	5.04	5.04	5.04	
						$M_{N,y,Rd}$	6.82	6.82	6.82	6.36	5.45	4.54	3.64	2.73	1.82	0.909	0				
						$M_{N,z,Rd}$	5.04	5.04	4.71	4.12	3.53	2.94	2.35	1.77	1.18	0.588	0				

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$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

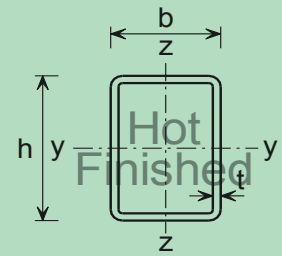
# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.



HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Member buckling check

Section Designation & Resistances (kNm)		n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$														
h x b mm	t mm		L (m)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0	
60x40	3.0 # $f_y W_{el,y} = 3.13$ $f_y W_{el,z} = 2.47$	1.00	$N_{b,y,Rd}$	175	144	104	73.2	53.1	40.0	31.1	20.3	14.3	10.6	8.17	6.48	5.27	
			$N_{b,z,Rd}$	153	99.1	61.6	41.1	29.2	21.7	16.8	10.9	7.64	5.65	4.34	3.44	2.80	
			1.00	$M_{b,Rd}$	3.87	3.87	3.87	3.87	3.87	3.86	3.82	3.74	3.67	3.59	3.53	3.46	3.39
	3.2 $f_y W_{el,y} = 3.29$ $f_y W_{el,z} = 2.59$	1.00	$N_{b,y,Rd}$	186	153	111	77.6	56.3	42.4	33.0	21.6	15.2	11.3	8.67	6.88	5.60	
			$N_{b,z,Rd}$	162	104	64.7	43.1	30.6	22.8	17.6	11.4	8.01	5.92	4.55	3.61	2.93	
			1.00	$M_{b,Rd}$	4.08	4.08	4.08	4.08	4.08	4.07	4.03	3.94	3.87	3.79	3.72	3.65	3.58
	3.6 # $f_y W_{el,y} = 3.59$ $f_y W_{el,z} = 2.82$	1.00	$N_{b,y,Rd}$	206	169	121	85.0	61.6	46.4	36.1	23.6	16.6	12.3	9.47	7.52	6.11	
			$N_{b,z,Rd}$	179	115	71.1	47.4	33.6	25.0	19.4	12.6	8.79	6.50	5.00	3.96	3.22	
			1.00	$M_{b,Rd}$	4.51	4.51	4.51	4.51	4.51	4.49	4.45	4.35	4.26	4.18	4.10	4.02	3.94
	4.0 $f_y W_{el,y} = 3.87$ $f_y W_{el,z} = 3.02$	1.00	$N_{b,y,Rd}$	226	184	132	92.0	66.6	50.1	39.0	25.5	17.9	13.3	10.2	8.11	6.60	
			$N_{b,z,Rd}$	196	124	76.4	50.8	36.1	26.9	20.8	13.5	9.43	6.97	5.36	4.25	3.45	
			1.00	$M_{b,Rd}$	4.90	4.90	4.90	4.90	4.90	4.88	4.83	4.72	4.63	4.54	4.45	4.36	4.28
5.0 $f_y W_{el,y} = 4.51$ $f_y W_{el,z} = 3.47$	1.00	$N_{b,y,Rd}$	273	219	154	107	77.5	58.3	45.3	29.6	20.8	15.4	11.9	9.41	7.65		
		$N_{b,z,Rd}$	233	144	88.5	58.8	41.7	31.0	24.0	15.5	10.9	8.03	6.18	4.90	3.98		
		1.00	$M_{b,Rd}$	5.82	5.82	5.82	5.82	5.82	5.79	5.72	5.60	5.49	5.37	5.27	5.16	5.06	
6.3 $f_y W_{el,y} = 5.15$ $f_y W_{el,z} = 3.91$	1.00	$N_{b,y,Rd}$	328	258	178	123	88.4	66.4	51.5	33.6	23.6	17.5	13.5	10.7	8.68		
		$N_{b,z,Rd}$	274	164	99.9	66.1	46.8	34.8	26.9	17.4	12.2	9.00	6.92	5.48	4.45		
		1.00	$M_{b,Rd}$	6.82	6.82	6.82	6.82	6.82	6.76	6.68	6.54	6.40	6.27	6.14	6.01	5.89	

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

$$n = N_{Ed} / N_{pl,Rd}$$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

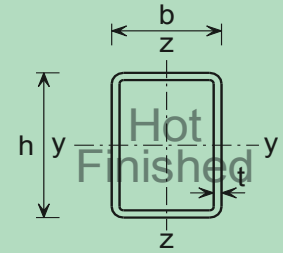
Axial force resistance  $N_{pl,Rd}$  which is equal to  $Af_y$  is given in the cross-section resistance check table opposite.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n Limit Class 3		Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$																						
h x b mm	t mm			Class 2		n	Axis																					
				y-y	z-z		0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0											
80x40	3.0 #	5.29	239	n/a	n/a	$M_{c,y,Rd}$	6.07	6.07	6.07	6.07	6.07	6.07	6.07	6.07	6.07	6.07	6.07	6.07	6.07	6.07	6.07	6.07	6.07	6.07				
						$M_{c,z,Rd}$	3.69	3.69	3.69	3.69	3.69	3.69	3.69	3.69	3.69	3.69	3.69	3.69	3.69	3.69	3.69	3.69	3.69	3.69	3.69	3.69	3.69	
						$M_{N,y,Rd}$	6.07	6.07	6.07	5.67	4.86	4.05	3.24	2.43	1.62	0.809	0											
						$M_{N,z,Rd}$	3.69	3.69	3.45	3.02	2.59	2.16	1.73	1.29	0.863	0.431	0											
	3.2	5.62	254	n/a	n/a	$M_{c,y,Rd}$	6.39	6.39	6.39	6.39	6.39	6.39	6.39	6.39	6.39	6.39	6.39	6.39	6.39	6.39	6.39	6.39	6.39	6.39	6.39			
						$M_{c,z,Rd}$	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	3.91	
						$M_{N,y,Rd}$	6.39	6.39	6.39	5.96	5.11	4.26	3.41	2.56	1.70	0.852	0											
						$M_{N,z,Rd}$	3.91	3.91	3.64	3.19	2.73	2.28	1.82	1.37	0.911	0.455	0											
	3.6 #	6.27	283	n/a	n/a	$M_{c,y,Rd}$	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10	7.10			
						$M_{c,z,Rd}$	4.30	4.30	4.30	4.30	4.30	4.30	4.30	4.30	4.30	4.30	4.30	4.30	4.30	4.30	4.30	4.30	4.30	4.30	4.30	4.30	4.30	
						$M_{N,y,Rd}$	7.10	7.10	7.10	6.63	5.68	4.73	3.79	2.84	1.89	0.947	0											
						$M_{N,z,Rd}$	4.30	4.30	3.99	3.49	2.99	2.49	2.00	1.50	0.998	0.499	0											
4.0	6.90	312	n/a	n/a	$M_{c,y,Rd}$	7.74	7.74	7.74	7.74	7.74	7.74	7.74	7.74	7.74	7.74	7.74	7.74	7.74	7.74	7.74	7.74	7.74	7.74	7.74				
					$M_{c,z,Rd}$	4.69	4.69	4.69	4.69	4.69	4.69	4.69	4.69	4.69	4.69	4.69	4.69	4.69	4.69	4.69	4.69	4.69	4.69	4.69	4.69	4.69		
					$M_{N,y,Rd}$	7.74	7.74	7.74	7.22	6.19	5.16	4.13	3.10	2.06	1.03	0												
					$M_{N,z,Rd}$	4.69	4.69	4.34	3.80	3.25	2.71	2.17	1.63	1.08	0.542	0												
5.0	8.42	380	n/a	n/a	$M_{c,y,Rd}$	9.27	9.27	9.27	9.27	9.27	9.27	9.27	9.27	9.27	9.27	9.27	9.27	9.27	9.27	9.27	9.27	9.27	9.27	9.27				
					$M_{c,z,Rd}$	5.57	5.57	5.57	5.57	5.57	5.57	5.57	5.57	5.57	5.57	5.57	5.57	5.57	5.57	5.57	5.57	5.57	5.57	5.57	5.57	5.57		
					$M_{N,y,Rd}$	9.27	9.27	9.27	8.65	7.41	6.18	4.94	3.71	2.47	1.24	0												
					$M_{N,z,Rd}$	5.57	5.57	5.10	4.46	3.83	3.19	2.55	1.91	1.28	0.638	0												
6.3	10.3	465	n/a	n/a	$M_{c,y,Rd}$	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0				
					$M_{c,z,Rd}$	6.53	6.53	6.53	6.53	6.53	6.53	6.53	6.53	6.53	6.53	6.53	6.53	6.53	6.53	6.53	6.53	6.53	6.53	6.53	6.53	6.53		
					$M_{N,y,Rd}$	11.0	11.0	11.0	10.3	8.83	7.36	5.89	4.42	2.94	1.47	0												
					$M_{N,z,Rd}$	6.53	6.53	5.91	5.17	4.43	3.69	2.95	2.21	1.48	0.738	0												
7.1 #	11.4	515	n/a	n/a	$M_{c,y,Rd}$	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0				
					$M_{c,z,Rd}$	7.03	7.03	7.03	7.03	7.03	7.03	7.03	7.03	7.03	7.03	7.03	7.03	7.03	7.03	7.03	7.03	7.03	7.03	7.03	7.03	7.03		
					$M_{N,y,Rd}$	12.0	12.0	12.0	11.2	9.60	8.00	6.40	4.80	3.20	1.60	0												
					$M_{N,z,Rd}$	7.03	7.03	6.31	5.52	4.73	3.94	3.15	2.36	1.58	0.788	0												
8.0	12.5	568	n/a	n/a	$M_{c,y,Rd}$	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0				
					$M_{c,z,Rd}$	7.53	7.53	7.53	7.53	7.53	7.53	7.53	7.53	7.53	7.53	7.53	7.53	7.53	7.53	7.53	7.53	7.53	7.53	7.53	7.53	7.53		
					$M_{N,y,Rd}$	13.0	13.0	13.0	12.1	10.4	8.64	6.91	5.18	3.46	1.73	0												
					$M_{N,z,Rd}$	7.53	7.53	6.69	5.85	5.02	4.18	3.34	2.51	1.67	0.836	0												

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$N_{Ed}$  = Design value of the axial force.

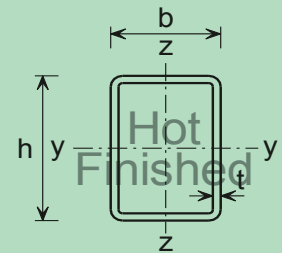
$n = N_{Ed} / N_{pl,Rd}$

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Member buckling check

Section Designation & Resistances (kNm)		n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm)													
h x b mm	t mm		for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
			L (m)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
80x40	3.0 # $f_y W_{el,y} = 4.83$ $f_y W_{el,z} = 3.20$	1.00	$N_{b,y,Rd}$	224	204	172	134	102	78.6	61.9	40.9	29.0	21.5	16.6	13.2	10.8
			$N_{b,z,Rd}$	190	126	79.2	53.0	37.7	28.1	21.7	14.1	9.88	7.30	5.62	4.45	3.62
		1.00	$M_{b,Rd}$	6.07	6.07	6.07	6.07	6.07	6.00	5.93	5.79	5.67	5.54	5.43	5.31	5.20
	3.2 $f_y W_{el,y} = 5.08$ $f_y W_{el,z} = 3.36$	1.00	$N_{b,y,Rd}$	238	216	182	142	108	83.0	65.4	43.2	30.6	22.7	17.6	14.0	11.4
			$N_{b,z,Rd}$	202	134	84.1	56.3	40.0	29.8	23.1	15.0	10.5	7.76	5.97	4.73	3.84
		1.00	$M_{b,Rd}$	6.39	6.39	6.39	6.39	6.39	6.32	6.24	6.10	5.96	5.84	5.71	5.59	5.47
	3.6 # $f_y W_{el,y} = 5.57$ $f_y W_{el,z} = 3.66$	1.00	$N_{b,y,Rd}$	265	240	202	157	119	91.3	71.9	47.5	33.6	25.0	19.3	15.3	12.5
			$N_{b,z,Rd}$	223	147	91.8	61.3	43.6	32.5	25.1	16.3	11.4	8.44	6.49	5.15	4.18
		1.00	$M_{b,Rd}$	7.10	7.10	7.10	7.10	7.10	7.01	6.92	6.76	6.61	6.47	6.33	6.19	6.06
	4.0 $f_y W_{el,y} = 6.07$ $f_y W_{el,z} = 3.94$	1.00	$N_{b,y,Rd}$	291	264	221	171	129	99.4	78.2	51.6	36.5	27.1	21.0	16.7	13.6
			$N_{b,z,Rd}$	244	159	98.9	66.0	46.9	34.9	27.0	17.5	12.3	9.07	6.97	5.53	4.49
		1.00	$M_{b,Rd}$	7.74	7.74	7.74	7.74	7.73	7.63	7.54	7.37	7.20	7.04	6.89	6.74	6.59
5.0 $f_y W_{el,y} = 7.14$ $f_y W_{el,z} = 4.58$	1.00	$N_{b,y,Rd}$	354	319	265	203	153	117	92.1	60.8	42.9	31.9	24.6	19.6	15.9	
		$N_{b,z,Rd}$	292	186	115	76.6	54.3	40.5	31.3	20.3	14.2	10.5	8.07	6.40	5.20	
	1.00	$M_{b,Rd}$	9.27	9.27	9.27	9.27	9.24	9.12	9.01	8.80	8.60	8.40	8.21	8.03	7.85	
6.3 $f_y W_{el,y} = 8.27$ $f_y W_{el,z} = 5.18$	1.00	$N_{b,y,Rd}$	431	386	316	239	179	137	107	70.8	50.0	37.2	28.7	22.8	18.6	
		$N_{b,z,Rd}$	348	214	131	87.1	61.7	45.9	35.5	23.0	16.1	11.9	9.15	7.25	5.89	
	1.00	$M_{b,Rd}$	11.0	11.0	11.0	11.0	11.0	10.8	10.7	10.4	10.2	9.95	9.72	9.50	9.27	
7.1 # $f_y W_{el,y} = 8.88$ $f_y W_{el,z} = 5.47$	1.00	$N_{b,y,Rd}$	476	425	344	259	193	148	116	76.2	53.8	40.0	30.8	24.5	19.9	
		$N_{b,z,Rd}$	379	230	140	92.8	65.7	48.9	37.8	24.5	17.1	12.6	9.72	7.71	6.26	
	1.00	$M_{b,Rd}$	12.0	12.0	12.0	12.0	11.9	11.7	11.6	11.3	11.0	10.8	10.5	10.3	10.0	
8.0 $f_y W_{el,y} = 9.41$ $f_y W_{el,z} = 5.72$	1.00	$N_{b,y,Rd}$	524	464	372	277	206	157	123	81.1	57.2	42.5	32.8	26.0	21.2	
		$N_{b,z,Rd}$	409	242	147	97.2	68.8	51.1	39.5	25.6	17.9	13.2	10.2	8.05	6.54	
	1.00	$M_{b,Rd}$	13.0	13.0	13.0	13.0	12.8	12.7	12.5	12.2	11.9	11.6	11.3	11.0	10.8	

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$$n = N_{Ed} / N_{pl,Rd}$$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

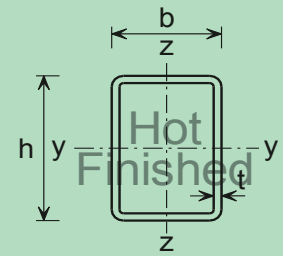
Axial force resistance  $N_{pl,Rd}$  which is equal to  $A_f f_y$  is given in the cross-section resistance check table opposite.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n Limit Class 3 <b>Class 2</b>		Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$															
h x b mm	t mm			Axis		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0				
				y-y	z-z																
90x50	3.0 #	6.24	282	n/a <b>1.00</b>	n/a <b>1.00</b>	$M_{c,y,Rd}$	8.24	8.24	8.24	8.24	8.24	8.24	8.24	8.24	8.24	8.24	8.24	8.24			
						$M_{c,z,Rd}$	5.43	5.43	5.43	5.43	5.43	5.43	5.43	5.43	5.43	5.43	5.43	5.43	5.43	5.43	
						$M_{N,y,Rd}$	8.24	8.24	8.24	7.69	6.59	5.49	4.39	3.29	2.20	1.10	0				
						$M_{N,z,Rd}$	5.43	5.43	5.17	4.53	3.88	3.23	2.59	1.94	1.29	0.647	0				
	3.2	6.63	300	n/a <b>1.00</b>	n/a <b>1.00</b>	$M_{c,y,Rd}$	8.73	8.73	8.73	8.73	8.73	8.73	8.73	8.73	8.73	8.73	8.73	8.73			
						$M_{c,z,Rd}$	5.75	5.75	5.75	5.75	5.75	5.75	5.75	5.75	5.75	5.75	5.75	5.75	5.75	5.75	
						$M_{N,y,Rd}$	8.73	8.73	8.73	8.15	6.99	5.82	4.66	3.49	2.33	1.16	0				
						$M_{N,z,Rd}$	5.75	5.75	5.47	4.79	4.10	3.42	2.73	2.05	1.37	0.684	0				
	3.6 #	7.40	334	n/a <b>1.00</b>	n/a <b>1.00</b>	$M_{c,y,Rd}$	9.66	9.66	9.66	9.66	9.66	9.66	9.66	9.66	9.66	9.66	9.66	9.66			
						$M_{c,z,Rd}$	6.39	6.39	6.39	6.39	6.39	6.39	6.39	6.39	6.39	6.39	6.39	6.39	6.39	6.39	
						$M_{N,y,Rd}$	9.66	9.66	9.66	9.01	7.72	6.44	5.15	3.86	2.57	1.29	0				
						$M_{N,z,Rd}$	6.39	6.39	6.06	5.30	4.54	3.79	3.03	2.27	1.51	0.757	0				
	4.0	8.15	369	n/a <b>1.00</b>	n/a <b>1.00</b>	$M_{c,y,Rd}$	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.6			
						$M_{c,z,Rd}$	6.96	6.96	6.96	6.96	6.96	6.96	6.96	6.96	6.96	6.96	6.96	6.96	6.96	6.96	
						$M_{N,y,Rd}$	10.6	10.6	10.6	9.87	8.46	7.05	5.64	4.23	2.82	1.41	0				
						$M_{N,z,Rd}$	6.96	6.96	6.58	5.76	4.93	4.11	3.29	2.47	1.64	0.822	0				
	5.0	9.99	451	n/a <b>1.00</b>	n/a <b>1.00</b>	$M_{c,y,Rd}$	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8			
						$M_{c,z,Rd}$	8.34	8.34	8.34	8.34	8.34	8.34	8.34	8.34	8.34	8.34	8.34	8.34	8.34	8.34	
						$M_{N,y,Rd}$	12.8	12.8	12.8	11.9	10.2	8.52	6.82	5.11	3.41	1.70	0				
						$M_{N,z,Rd}$	8.34	8.34	7.81	6.84	5.86	4.88	3.91	2.93	1.95	0.976	0				
	6.3	12.3	554	n/a <b>1.00</b>	n/a <b>1.00</b>	$M_{c,y,Rd}$	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3			
						$M_{c,z,Rd}$	9.94	9.94	9.94	9.94	9.94	9.94	9.94	9.94	9.94	9.94	9.94	9.94	9.94	9.94	
						$M_{N,y,Rd}$	15.3	15.3	15.3	14.3	12.3	10.2	8.18	6.13	4.09	2.04	0				
						$M_{N,z,Rd}$	9.94	9.94	9.21	8.06	6.91	5.76	4.60	3.45	2.30	1.15	0				
	7.1 #	13.6	614	n/a <b>1.00</b>	n/a <b>1.00</b>	$M_{c,y,Rd}$	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8			
						$M_{c,z,Rd}$	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	
						$M_{N,y,Rd}$	16.8	16.8	16.8	15.6	13.4	11.2	8.94	6.70	4.47	2.23	0				
						$M_{N,z,Rd}$	10.8	10.8	9.96	8.72	7.47	6.23	4.98	3.74	2.49	1.25	0				
8.0	15.0	682	n/a <b>1.00</b>	n/a <b>1.00</b>	$M_{c,y,Rd}$	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2				
					$M_{c,z,Rd}$	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7		
					$M_{N,y,Rd}$	18.2	18.2	18.2	17.0	14.6	12.2	9.73	7.30	4.87	2.43	0					
					$M_{N,z,Rd}$	11.7	11.7	10.7	9.34	8.01	6.67	5.34	4.00	2.67	1.33	0					

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$N_{Ed}$  = Design value of the axial force.

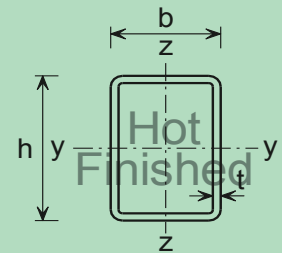
$n = N_{Ed} / N_{pl,Rd}$

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Member buckling check

Section Designation & Resistances (kNm)		n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm)														
h x b mm	t mm		for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$														
			L (m)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0	
90x50	3.0 # $f_y W_{el,y} = 6.67$ $f_y W_{el,z} = 4.76$	1.00	$N_{b,y,Rd}$	268	251	224	187	149	117	93.3	62.4	44.4	33.1	25.6	20.4	16.6	
			$N_{b,z,Rd}$	247	196	136	94.3	68.0	51.1	39.7	25.9	18.2	13.5	10.4	8.24	6.70	
		1.00	$M_{b,Rd}$	8.24	8.24	8.24	8.24	8.24	8.24	8.24	8.24	8.09	7.95	7.81	7.68	7.56	7.44
	3.2 $f_y W_{el,y} = 7.03$ $f_y W_{el,z} = 5.01$	1.00	$N_{b,y,Rd}$	285	266	237	198	157	124	98.7	65.9	46.9	35.0	27.0	21.5	17.5	
			$N_{b,z,Rd}$	262	207	144	99.4	71.7	53.8	41.8	27.3	19.2	14.2	10.9	8.67	7.05	
		1.00	$M_{b,Rd}$	8.73	8.73	8.73	8.73	8.73	8.73	8.73	8.73	8.57	8.42	8.28	8.14	8.01	7.88
	3.6 # $f_y W_{el,y} = 7.74$ $f_y W_{el,z} = 5.50$	1.00	$N_{b,y,Rd}$	318	297	264	220	174	137	109	72.8	51.7	38.6	29.8	23.7	19.4	
			$N_{b,z,Rd}$	292	230	159	110	79.3	59.5	46.2	30.1	21.2	15.7	12.1	9.59	7.79	
		1.00	$M_{b,Rd}$	9.66	9.66	9.66	9.66	9.66	9.66	9.65	9.47	9.31	9.15	9.00	8.85	8.71	
	4.0 $f_y W_{el,y} = 8.45$ $f_y W_{el,z} = 5.96$	1.00	$N_{b,y,Rd}$	351	327	290	241	190	149	119	79.4	56.4	42.1	32.5	25.9	21.1	
			$N_{b,z,Rd}$	321	252	173	119	85.9	64.5	50.1	32.7	22.9	17.0	13.1	10.4	8.44	
		1.00	$M_{b,Rd}$	10.6	10.6	10.6	10.6	10.6	10.6	10.6	10.4	10.2	10.0	9.85	9.69	9.53	
	5.0 $f_y W_{el,y} = 10.0$ $f_y W_{el,z} = 6.99$	1.00	$N_{b,y,Rd}$	428	398	351	289	227	178	141	94.2	66.9	49.8	38.5	30.7	25.0	
			$N_{b,z,Rd}$	389	301	205	141	101	75.8	58.9	38.4	26.9	19.9	15.4	12.2	9.90	
		1.00	$M_{b,Rd}$	12.8	12.8	12.8	12.8	12.8	12.8	12.7	12.5	12.3	12.1	11.9	11.7	11.5	
	6.3 $f_y W_{el,y} = 11.8$ $f_y W_{el,z} = 8.09$	1.00	$N_{b,y,Rd}$	524	486	426	347	271	212	168	112	79.2	59.0	45.6	36.3	29.6	
		$N_{b,z,Rd}$	473	358	240	164	117	87.9	68.2	44.4	31.2	23.1	17.7	14.1	11.4		
	1.00	$M_{b,Rd}$	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.0	14.7	14.4	14.2	13.9	13.7		
7.1 # $f_y W_{el,y} = 12.8$ $f_y W_{el,z} = 8.66$	1.00	$N_{b,y,Rd}$	581	536	468	379	295	229	182	121	85.7	63.8	49.3	39.3	32.0		
		$N_{b,z,Rd}$	522	390	259	176	126	94.6	73.4	47.7	33.5	24.8	19.1	15.1	12.3		
	1.00	$M_{b,Rd}$	16.8	16.8	16.8	16.8	16.8	16.8	16.7	16.3	16.0	15.7	15.5	15.2	14.9		
8.0 $f_y W_{el,y} = 13.7$ $f_y W_{el,z} = 9.16$	1.00	$N_{b,y,Rd}$	643	592	514	412	319	248	196	130	92.2	68.6	53.0	42.2	34.4		
		$N_{b,z,Rd}$	574	422	277	188	135	101	78.1	50.8	35.6	26.4	20.3	16.1	13.1		
	1.00	$M_{b,Rd}$	18.2	18.2	18.2	18.2	18.2	18.2	18.1	17.8	17.4	17.1	16.8	16.5	16.2		

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

$$n = N_{Ed} / N_{pl,Rd}$$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

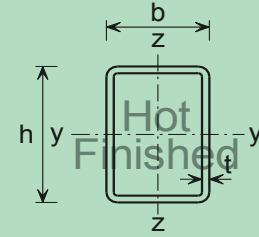
Axial force resistance  $N_{pl,Rd}$  which is equal to  $A_f f_y$  is given in the cross-section resistance check table opposite.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance N <sub>pl,Rd</sub> kN	n Limit Class 3		Moment Resistance M <sub>c,y,Rd</sub> , M <sub>c,z,Rd</sub> (kNm) and Reduced Moment Resistance M <sub>N,y,Rd</sub> , M <sub>N,z,Rd</sub> (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance n = N <sub>Ed</sub> / N <sub>pl,Rd</sub>																
h x b mm	t mm			Class 2		n	Axis															
				y-y	z-z		0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0					
100x50	3.0 #	6.71	303	n/a	n/a	M <sub>c,y,Rd</sub>	9.69	9.69	9.69	9.69	9.69	9.69	9.69	9.69	9.69	9.69	9.69	9.69	9.69	9.69		
						M <sub>c,z,Rd</sub>	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96	
						M <sub>N,y,Rd</sub>	9.69	9.69	9.69	9.05	7.75	6.46	5.17	3.88	2.58	1.29	0					
						M <sub>N,z,Rd</sub>	5.96	5.96	5.60	4.90	4.20	3.50	2.80	2.10	1.40	0.701	0					
	3.2	7.13	322	n/a	n/a	M <sub>c,y,Rd</sub>	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3		
						M <sub>c,z,Rd</sub>	6.28	6.28	6.28	6.28	6.28	6.28	6.28	6.28	6.28	6.28	6.28	6.28	6.28	6.28	6.28	
						M <sub>N,y,Rd</sub>	10.3	10.3	10.3	9.58	8.21	6.84	5.47	4.10	2.74	1.37	0					
						M <sub>N,z,Rd</sub>	6.28	6.28	5.90	5.16	4.42	3.69	2.95	2.21	1.47	0.737	0					
	3.6 #	7.96	359	n/a	n/a	M <sub>c,y,Rd</sub>	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4		
						M <sub>c,z,Rd</sub>	6.96	6.96	6.96	6.96	6.96	6.96	6.96	6.96	6.96	6.96	6.96	6.96	6.96	6.96	6.96	6.96
						M <sub>N,y,Rd</sub>	11.4	11.4	11.4	10.6	9.12	7.60	6.08	4.56	3.04	1.52	0					
						M <sub>N,z,Rd</sub>	6.96	6.96	6.50	5.69	4.87	4.06	3.25	2.44	1.62	0.812	0					
	4.0	8.78	398	n/a	n/a	M <sub>c,y,Rd</sub>	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5		
						M <sub>c,z,Rd</sub>	7.63	7.63	7.63	7.63	7.63	7.63	7.63	7.63	7.63	7.63	7.63	7.63	7.63	7.63	7.63	7.63
						M <sub>N,y,Rd</sub>	12.5	12.5	12.5	11.7	10.00	8.33	6.66	5.00	3.33	1.67	0					
						M <sub>N,z,Rd</sub>	7.63	7.63	7.12	6.23	5.34	4.45	3.56	2.67	1.78	0.890	0					
5.0	10.8	486	n/a	n/a	M <sub>c,y,Rd</sub>	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.1			
					M <sub>c,z,Rd</sub>	9.16	9.16	9.16	9.16	9.16	9.16	9.16	9.16	9.16	9.16	9.16	9.16	9.16	9.16	9.16	9.16	
					M <sub>N,y,Rd</sub>	15.1	15.1	15.1	14.1	12.1	10.1	8.07	6.05	4.03	2.02	0						
					M <sub>N,z,Rd</sub>	9.16	9.16	8.47	7.41	6.35	5.29	4.24	3.18	2.12	1.06	0						
6.3	13.3	600	n/a	n/a	M <sub>c,y,Rd</sub>	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2			
					M <sub>c,z,Rd</sub>	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	10.9	
					M <sub>N,y,Rd</sub>	18.2	18.2	18.2	17.0	14.6	12.1	9.71	7.28	4.86	2.43	0						
					M <sub>N,z,Rd</sub>	10.9	10.9	10.0	8.77	7.52	6.26	5.01	3.76	2.51	1.25	0						
7.1 #	14.7	664	n/a	n/a	M <sub>c,y,Rd</sub>	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0			
					M <sub>c,z,Rd</sub>	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	11.9	
					M <sub>N,y,Rd</sub>	20.0	20.0	20.0	18.7	16.0	13.3	10.7	7.99	5.33	2.66	0						
					M <sub>N,z,Rd</sub>	11.9	11.9	10.8	9.46	8.11	6.76	5.41	4.06	2.70	1.35	0						
8.0	16.3	738	n/a	n/a	M <sub>c,y,Rd</sub>	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8			
					M <sub>c,z,Rd</sub>	12.9	12.9	12.9	12.9	12.9	12.9	12.9	12.9	12.9	12.9	12.9	12.9	12.9	12.9	12.9	12.9	
					M <sub>N,y,Rd</sub>	21.8	21.8	21.8	20.3	17.4	14.5	11.6	8.72	5.81	2.91	0						
					M <sub>N,z,Rd</sub>	12.9	12.9	11.7	10.2	8.74	7.28	5.83	4.37	2.91	1.46	0						
8.8 #	17.6	799	n/a	n/a	M <sub>c,y,Rd</sub>	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3			
					M <sub>c,z,Rd</sub>	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	
					M <sub>N,y,Rd</sub>	23.3	23.3	23.3	21.7	18.6	15.5	12.4	9.32	6.21	3.11	0						
					M <sub>N,z,Rd</sub>	13.7	13.7	12.3	10.7	9.20	7.67	6.14	4.60	3.07	1.53	0						
10.0 #	19.6	884	n/a	n/a	M <sub>c,y,Rd</sub>	25.3	25.3	25.3	25.3	25.3	25.3	25.3	25.3	25.3	25.3	25.3	25.3	25.3	25.3			
					M <sub>c,z,Rd</sub>	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7	
					M <sub>N,y,Rd</sub>	25.3	25.3	25.3	23.6	20.2	16.9	13.5	10.1	6.74	3.37	0						
					M <sub>N,z,Rd</sub>	14.7	14.7	13.0	11.4	9.78	8.15	6.52	4.89	3.26	1.63	0						

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

N<sub>Ed</sub> = Design value of the axial force.

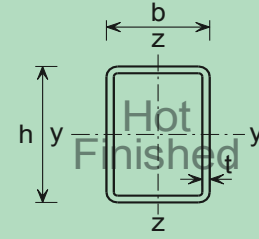
n = N<sub>Ed</sub> / N<sub>pl,Rd</sub>

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Member buckling check

Section Designation & Resistances (kNm)		n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
h x b mm	t mm		L (m)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
100x50	3.0 # $f_y W_{el,y} = 7.77$ $f_y W_{el,z} = 5.22$	1.00	$N_{b,y,Rd}$	292	275	252	220	181	146	118	79.7	56.9	42.5	33.0	26.3	21.4
		1.00	$N_{b,z,Rd}$	266	214	150	104	75.1	56.5	43.9	28.6	20.1	14.9	11.5	9.12	7.41
		1.00	$M_{b,Rd}$	9.69	9.69	9.69	9.69	9.69	9.69	9.66	9.48	9.31	9.15	8.99	8.84	8.69
	3.2 $f_y W_{el,y} = 8.24$ $f_y W_{el,z} = 5.50$	1.00	$N_{b,y,Rd}$	310	293	268	233	192	155	125	84.3	60.2	45.0	34.9	27.8	22.7
		1.00	$N_{b,z,Rd}$	283	226	158	110	79.2	59.5	46.3	30.2	21.2	15.7	12.1	9.60	7.80
		1.00	$M_{b,Rd}$	10.3	10.3	10.3	10.3	10.3	10.3	10.2	10.0	9.85	9.68	9.51	9.35	9.19
	3.6 # $f_y W_{el,y} = 9.09$ $f_y W_{el,z} = 6.04$	1.00	$N_{b,y,Rd}$	345	325	297	258	212	171	137	92.8	66.2	49.5	38.4	30.6	24.9
		1.00	$N_{b,z,Rd}$	314	249	173	120	86.5	65.0	50.5	32.9	23.1	17.1	13.2	10.5	8.52
		1.00	$M_{b,Rd}$	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.1	10.9	10.7	10.6	10.4	10.2
	4.0 $f_y W_{el,y} = 9.90$ $f_y W_{el,z} = 6.57$	1.00	$N_{b,y,Rd}$	382	360	329	285	234	187	151	102	72.7	54.3	42.1	33.5	27.3
		1.00	$N_{b,z,Rd}$	347	274	189	131	94.2	70.8	55.0	35.8	25.2	18.6	14.4	11.4	9.26
		1.00	$M_{b,Rd}$	12.5	12.5	12.5	12.5	12.5	12.5	12.4	12.2	12.0	11.8	11.6	11.4	11.2
	5.0 $f_y W_{el,y} = 11.8$ $f_y W_{el,z} = 7.70$	1.00	$N_{b,y,Rd}$	466	439	400	344	280	224	180	121	86.6	64.7	50.1	39.9	32.5
		1.00	$N_{b,z,Rd}$	422	328	225	154	111	83.4	64.8	42.2	29.6	21.9	16.9	13.4	10.9
		1.00	$M_{b,Rd}$	15.1	15.1	15.1	15.1	15.1	15.1	15.0	14.7	14.5	14.2	14.0	13.7	13.5
	6.3 $f_y W_{el,y} = 14.0$ $f_y W_{el,z} = 8.95$	1.00	$N_{b,y,Rd}$	574	540	489	417	338	269	216	145	103	77.2	59.7	47.6	38.8
		1.00	$N_{b,z,Rd}$	515	392	264	180	130	97.1	75.3	49.1	34.4	25.5	19.6	15.6	12.7
		1.00	$M_{b,Rd}$	18.2	18.2	18.2	18.2	18.2	18.2	18.1	17.7	17.4	17.0	16.7	16.4	16.1
	7.1 # $f_y W_{el,y} = 15.2$ $f_y W_{el,z} = 9.59$	1.00	$N_{b,y,Rd}$	635	596	538	457	368	292	234	157	112	83.5	64.6	51.5	42.0
		1.00	$N_{b,z,Rd}$	566	426	285	194	139	104	80.9	52.7	37.0	27.4	21.1	16.7	13.6
		1.00	$M_{b,Rd}$	20.0	20.0	20.0	20.0	20.0	20.0	19.8	19.4	19.0	18.7	18.3	18.0	17.7
	8.0 $f_y W_{el,y} = 16.3$ $f_y W_{el,z} = 10.2$	1.00	$N_{b,y,Rd}$	705	660	593	500	401	317	254	170	121	90.3	69.8	55.6	45.3
		1.00	$N_{b,z,Rd}$	625	463	306	208	149	111	86.4	56.2	39.4	29.2	22.5	17.8	14.5
		1.00	$M_{b,Rd}$	21.8	21.8	21.8	21.8	21.8	21.8	21.5	21.1	20.7	20.3	19.9	19.5	19.2
	8.8 # $f_y W_{el,y} = 17.2$ $f_y W_{el,z} = 10.6$	1.00	$N_{b,y,Rd}$	761	712	638	535	427	337	269	180	128	95.4	73.8	58.8	47.9
		1.00	$N_{b,z,Rd}$	670	488	319	216	155	116	89.7	58.3	40.9	30.3	23.3	18.5	15.0
		1.00	$M_{b,Rd}$	23.3	23.3	23.3	23.3	23.3	23.2	23.0	22.5	22.1	21.6	21.2	20.8	20.4
	10.0 # $f_y W_{el,y} = 18.4$ $f_y W_{el,z} = 11.1$	1.00	$N_{b,y,Rd}$	841	783	697	578	458	360	286	191	136	101	78.4	62.4	50.8
		1.00	$N_{b,z,Rd}$	732	521	337	228	162	121	94.1	61.1	42.9	31.7	24.4	19.3	15.7
		1.00	$M_{b,Rd}$	25.3	25.3	25.3	25.3	25.3	25.2	24.9	24.4	23.9	23.4	22.9	22.5	22.0

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

$$n = N_{Ed} / N_{pl,Rd}$$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

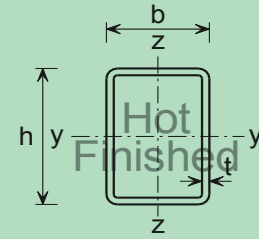
Axial force resistance  $N_{pl,Rd}$  which is equal to  $Af_y$  is given in the cross-section resistance check table opposite.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance N <sub>pl,Rd</sub> kN	n Limit Class 3		Moment Resistance M <sub>c,y,Rd</sub> , M <sub>c,z,Rd</sub> (kNm) and Reduced Moment Resistance M <sub>N,y,Rd</sub> , M <sub>N,z,Rd</sub> (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance n = N <sub>Ed</sub> / N <sub>pl,Rd</sub>																		
h x b mm	t mm			Class 2		n	Axis																	
				y-y	z-z		0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0							
100x60	3.0 #	7.18	324	n/a	n/a	M <sub>c,y,Rd</sub>	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7			
						M <sub>c,z,Rd</sub>	7.53	7.53	7.53	7.53	7.53	7.53	7.53	7.53	7.53	7.53	7.53	7.53	7.53	7.53	7.53	7.53	7.53	
						M <sub>N,y,Rd</sub>	10.7	10.7	10.7	10.0	8.58	7.15	5.72	4.29	2.86	1.43	0							
						M <sub>N,z,Rd</sub>	7.53	7.53	7.27	6.36	5.45	4.54	3.63	2.73	1.82	0.909	0							
	3.2	7.63	345	n/a	n/a	M <sub>c,y,Rd</sub>	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4			
						M <sub>c,z,Rd</sub>	7.95	7.95	7.95	7.95	7.95	7.95	7.95	7.95	7.95	7.95	7.95	7.95	7.95	7.95	7.95	7.95	7.95	
						M <sub>N,y,Rd</sub>	11.4	11.4	11.4	10.6	9.09	7.57	6.06	4.54	3.03	1.51	0							
						M <sub>N,z,Rd</sub>	7.95	7.95	7.67	6.71	5.75	4.79	3.84	2.88	1.92	0.959	0							
	3.6 #	8.53	387	n/a	n/a	M <sub>c,y,Rd</sub>	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6		
						M <sub>c,z,Rd</sub>	8.84	8.84	8.84	8.84	8.84	8.84	8.84	8.84	8.84	8.84	8.84	8.84	8.84	8.84	8.84	8.84	8.84	
						M <sub>N,y,Rd</sub>	12.6	12.6	12.6	11.8	10.1	8.43	6.74	5.06	3.37	1.69	0							
						M <sub>N,z,Rd</sub>	8.84	8.84	8.52	7.45	6.39	5.32	4.26	3.19	2.13	1.06	0							
4.0	9.41	426	n/a	n/a	M <sub>c,y,Rd</sub>	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.9			
					M <sub>c,z,Rd</sub>	9.69	9.69	9.69	9.69	9.69	9.69	9.69	9.69	9.69	9.69	9.69	9.69	9.69	9.69	9.69	9.69	9.69		
					M <sub>N,y,Rd</sub>	13.9	13.9	13.9	13.0	11.1	9.25	7.40	5.55	3.70	1.85	0								
					M <sub>N,z,Rd</sub>	9.69	9.69	9.30	8.14	6.98	5.81	4.65	3.49	2.33	1.16	0								
5.0	11.6	522	n/a	n/a	M <sub>c,y,Rd</sub>	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8			
					M <sub>c,z,Rd</sub>	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7		
					M <sub>N,y,Rd</sub>	16.8	16.8	16.8	15.7	13.5	11.2	8.97	6.73	4.49	2.24	0								
					M <sub>N,z,Rd</sub>	11.7	11.7	11.1	9.73	8.34	6.95	5.56	4.17	2.78	1.39	0								
6.3	14.2	643	n/a	n/a	M <sub>c,y,Rd</sub>	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3			
					M <sub>c,z,Rd</sub>	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0	14.0		
					M <sub>N,y,Rd</sub>	20.3	20.3	20.3	19.0	16.3	13.6	10.8	8.14	5.42	2.71	0								
					M <sub>N,z,Rd</sub>	14.0	14.0	13.2	11.6	9.92	8.27	6.61	4.96	3.31	1.65	0								
7.1 #	15.8	717	n/a	n/a	M <sub>c,y,Rd</sub>	22.3	22.3	22.3	22.3	22.3	22.3	22.3	22.3	22.3	22.3	22.3	22.3	22.3	22.3	22.3	22.3			
					M <sub>c,z,Rd</sub>	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3		
					M <sub>N,y,Rd</sub>	22.3	22.3	22.3	20.8	17.9	14.9	11.9	8.93	5.95	2.98	0								
					M <sub>N,z,Rd</sub>	15.3	15.3	14.4	12.6	10.8	9.01	7.20	5.40	3.60	1.80	0								
8.0	17.5	795	n/a	n/a	M <sub>c,y,Rd</sub>	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.4			
					M <sub>c,z,Rd</sub>	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7	16.7		
					M <sub>N,y,Rd</sub>	24.4	24.4	24.4	22.8	19.5	16.3	13.0	9.76	6.50	3.25	0								
					M <sub>N,z,Rd</sub>	16.7	16.7	15.6	13.7	11.7	9.75	7.80	5.85	3.90	1.95	0								
8.8 #	19.0	859	n/a	n/a	M <sub>c,y,Rd</sub>	26.1	26.1	26.1	26.1	26.1	26.1	26.1	26.1	26.1	26.1	26.1	26.1	26.1	26.1	26.1	26.1			
					M <sub>c,z,Rd</sub>	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8	17.8		
					M <sub>N,y,Rd</sub>	26.1	26.1	26.1	24.4	20.9	17.4	13.9	10.5	6.97	3.48	0								
					M <sub>N,z,Rd</sub>	17.8	17.8	16.5	14.4	12.4	10.3	8.25	6.19	4.13	2.06	0								
10.0 #	21.1	955	n/a	n/a	M <sub>c,y,Rd</sub>	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5			
					M <sub>c,z,Rd</sub>	19.3	19.3	19.3	19.3	19.3	19.3	19.3	19.3	19.3	19.3	19.3	19.3	19.3	19.3	19.3	19.3	19.3		
					M <sub>N,y,Rd</sub>	28.5	28.5	28.5	26.6	22.8	19.0	15.2	11.4	7.59	3.80	0								
					M <sub>N,z,Rd</sub>	19.3	19.3	17.7	15.5	13.3	11.1	8.86	6.65	4.43	2.22	0								

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

N<sub>Ed</sub> = Design value of the axial force.

n = N<sub>Ed</sub> / N<sub>pl,Rd</sub>

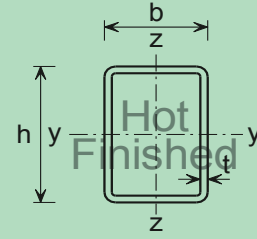
# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.



HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Member buckling check

Section Designation & Resistances (kNm)		n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
h x b mm	t mm		L (m)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
100x60	3.0 # $f_y W_{el,y} = 8.77$ $f_y W_{el,z} = 6.60$	1.00	$N_{b,y,Rd}$	313	296	273	240	201	163	132	89.6	64.1	48.0	37.2	29.7	24.2
			$N_{b,z,Rd}$	297	259	202	148	109	83.0	64.9	42.6	30.0	22.3	17.2	13.7	11.1
		1.00	$M_{b,Rd}$	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.6	10.4	10.3	10.1	10.00
	3.2 $f_y W_{el,y} = 9.30$ $f_y W_{el,z} = 6.96$	1.00	$N_{b,y,Rd}$	333	315	290	255	213	173	140	94.8	67.8	50.8	39.3	31.4	25.6
			$N_{b,z,Rd}$	315	275	214	157	115	87.7	68.5	45.0	31.7	23.5	18.1	14.4	11.7
		1.00	$M_{b,Rd}$	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.2	11.0	10.9	10.7	10.6
	3.6 # $f_y W_{el,y} = 10.3$ $f_y W_{el,z} = 7.67$	1.00	$N_{b,y,Rd}$	373	353	325	285	237	192	155	105	75.3	56.3	43.7	34.8	28.4
			$N_{b,z,Rd}$	353	307	238	173	128	96.9	75.7	49.7	35.0	26.0	20.0	15.9	12.9
		1.00	$M_{b,Rd}$	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.4	12.3	12.1	11.9	11.8
	4.0 $f_y W_{el,y} = 11.2$ $f_y W_{el,z} = 8.34$	1.00	$N_{b,y,Rd}$	410	388	357	312	259	210	169	115	82.1	61.4	47.6	37.9	30.9
			$N_{b,z,Rd}$	388	337	261	190	140	106	82.7	54.2	38.2	28.4	21.9	17.4	14.1
		1.00	$M_{b,Rd}$	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.7	13.5	13.3	13.1	12.9
	5.0 $f_y W_{el,y} = 13.4$ $f_y W_{el,z} = 9.90$	1.00	$N_{b,y,Rd}$	502	474	434	378	312	251	203	137	97.9	73.2	56.7	45.2	36.9
			$N_{b,z,Rd}$	474	408	311	225	165	125	97.4	63.9	45.0	33.4	25.7	20.4	16.6
		1.00	$M_{b,Rd}$	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.5	16.3	16.1	15.9	15.6
	6.3 $f_y W_{el,y} = 16.0$ $f_y W_{el,z} = 11.6$	1.00	$N_{b,y,Rd}$	617	582	531	459	376	302	243	164	117	87.3	67.6	53.9	43.9
			$N_{b,z,Rd}$	581	495	373	267	195	148	115	75.5	53.2	39.4	30.4	24.1	19.6
		1.00	$M_{b,Rd}$	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.3	20.0	19.7	19.4	19.1	18.8
	7.1 # $f_y W_{el,y} = 17.3$ $f_y W_{el,z} = 12.5$	1.00	$N_{b,y,Rd}$	688	648	589	507	414	331	266	179	128	95.3	73.8	58.8	48.0
			$N_{b,z,Rd}$	646	546	406	290	211	160	125	81.5	57.4	42.5	32.8	26.0	21.2
		1.00	$M_{b,Rd}$	22.3	22.3	22.3	22.3	22.3	22.3	22.3	22.2	21.9	21.6	21.3	21.0	20.7
	8.0 $f_y W_{el,y} = 18.7$ $f_y W_{el,z} = 13.4$	1.00	$N_{b,y,Rd}$	762	716	650	556	452	360	289	194	138	103	80.1	63.8	52.0
			$N_{b,z,Rd}$	713	598	440	312	227	171	134	87.4	61.5	45.6	35.1	27.9	22.7
		1.00	$M_{b,Rd}$	24.4	24.4	24.4	24.4	24.4	24.4	24.4	24.2	23.9	23.5	23.2	22.8	22.5
	8.8 # $f_y W_{el,y} = 19.8$ $f_y W_{el,z} = 14.1$	1.00	$N_{b,y,Rd}$	822	772	698	594	480	382	306	205	146	109	84.6	67.4	54.9
			$N_{b,z,Rd}$	768	639	467	330	240	181	141	92.0	64.7	48.0	37.0	29.4	23.9
		1.00	$M_{b,Rd}$	26.1	26.1	26.1	26.1	26.1	26.1	26.1	26.0	25.5	25.2	24.8	24.4	24.1
	10.0 # $f_y W_{el,y} = 21.3$ $f_y W_{el,z} = 14.9$	1.00	$N_{b,y,Rd}$	912	854	767	647	519	411	328	220	156	117	90.3	71.9	58.6
			$N_{b,z,Rd}$	848	695	499	350	253	191	149	97.0	68.2	50.6	38.9	30.9	25.1
		1.00	$M_{b,Rd}$	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.2	27.8	27.4	26.9	26.5	26.2

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

$$n = N_{Ed} / N_{pl,Rd}$$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

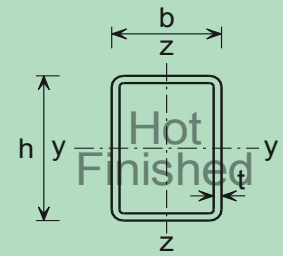
Axial force resistance  $N_{pl,Rd}$  which is equal to  $A_f$  is given in the cross-section resistance check table opposite.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n Limit Class 3 <b>Class 2</b>		Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$															
h x b mm	t mm			Axis		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0				
				y-y	z-z																
120x60	3.0 #	8.12	366	0.885	*	$M_{c,y,Rd}$	14.2	14.2	14.2	14.2	14.2	11.5	11.5	11.5	11.5	✘	\$				
						$M_{c,z,Rd}$	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	\$	
						$M_{N,y,Rd}$	14.2	14.2	14.2	13.3	11.4	-	-	-	-	-	-	-	-	-	-
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3.2 #	8.64	391	0.986	*	$M_{c,y,Rd}$	15.1	15.1	15.1	15.1	15.1	15.1	12.1	12.1	12.1	12.1	12.1	\$			
						$M_{c,z,Rd}$	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	\$	
						$M_{N,y,Rd}$	15.1	15.1	15.1	14.0	12.0	10.0	-	-	-	-	-	-	-	-	-
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	3.6 #	9.66	437	n/a <b>1.00</b>	n/a <b>1.00</b>	$M_{c,y,Rd}$	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8			
						$M_{c,z,Rd}$	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3		
						$M_{N,y,Rd}$	16.8	16.8	16.8	15.6	13.4	11.2	8.94	6.70	4.47	2.23	0				
						$M_{N,z,Rd}$	10.3	10.3	9.64	8.44	7.23	6.03	4.82	3.62	2.41	1.21	0				
	4.0	10.7	483	n/a <b>1.00</b>	n/a <b>1.00</b>	$M_{c,y,Rd}$	18.4	18.4	18.4	18.4	18.4	18.4	18.4	18.4	18.4	18.4	18.4	18.4			
						$M_{c,z,Rd}$	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3		
						$M_{N,y,Rd}$	18.4	18.4	18.4	17.2	14.7	12.3	9.83	7.37	4.91	2.46	0				
						$M_{N,z,Rd}$	11.3	11.3	10.6	9.24	7.92	6.60	5.28	3.96	2.64	1.32	0				
	5.0	13.1	593	n/a <b>1.00</b>	n/a <b>1.00</b>	$M_{c,y,Rd}$	22.4	22.4	22.4	22.4	22.4	22.4	22.4	22.4	22.4	22.4	22.4	22.4			
						$M_{c,z,Rd}$	13.6	13.6	13.6	13.6	13.6	13.6	13.6	13.6	13.6	13.6	13.6	13.6	13.6		
						$M_{N,y,Rd}$	22.4	22.4	22.4	20.9	17.9	14.9	11.9	8.96	5.97	2.99	0				
						$M_{N,z,Rd}$	13.6	13.6	12.7	11.1	9.52	7.93	6.35	4.76	3.17	1.59	0				

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

\* The section is a Class 4 section about the appropriate axis and is independent of the design axial force  $N_{Ed}$ . Values of  $M_{c,Rd}$  are calculated based on Class 4 section properties and are displayed in italics.

$N_{Ed}$  = Design value of the axial force.

$$n = N_{Ed} / N_{pl,Rd}$$

✘ Section becomes class 4, see note 10.

\$ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

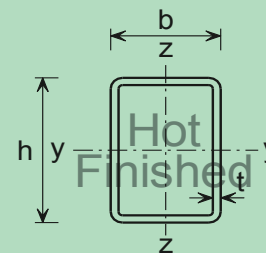
- Not applicable for Class 3 and Class 4 sections.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Member buckling check

Section Designation & Resistances (kNm)		n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$														
h x b mm	t mm		L (m)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0	
120x60	§ 3.0 # $f_y W_{el,y} = 11.5$ $f_y W_{el,z} = 7.74$	0.885	$N_{b,y,Rd}$	357	343	325	300	267	229	192	134	97.5	73.4	57.1	45.7	37.3	
			$N_{b,z,Rd}$	336	295	233	172	128	97.1	76.0	49.9	35.2	26.1	20.2	16.0	13.0	
		0.885	$M_{b,Rd}$	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.5	11.4	11.3	11.1	11.0	10.9
			<b>0.450</b> $M_{b,Rd}$	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.2	14.1	13.9	13.7	13.5	13.3	13.1
	§ 3.2 # $f_y W_{el,y} = 12.1$ $f_y W_{el,z} = 8.20$	0.986	$N_{b,y,Rd}$	381	366	347	320	284	243	204	143	104	78.1	60.7	48.6	39.7	
			$N_{b,z,Rd}$	358	315	248	183	135	103	80.5	52.9	37.3	27.7	21.4	17.0	13.8	
		0.986	$M_{b,Rd}$	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1	11.9	11.8	11.7	11.5	
			<b>0.519</b> $M_{b,Rd}$	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.0	14.7	14.5	14.3	14.1	13.9	
	3.6 # $f_y W_{el,y} = 13.5$ $f_y W_{el,z} = 9.02$	1.00	$N_{b,y,Rd}$	426	409	387	357	317	271	227	159	115	86.5	67.3	53.8	44.0	
			$N_{b,z,Rd}$	400	350	275	202	149	113	88.7	58.2	41.1	30.5	23.5	18.7	15.2	
		<b>1.00</b>	$M_{b,Rd}$	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.7	16.4	16.1	15.9	15.5	
4.0 $f_y W_{el,y} = 14.7$ $f_y W_{el,z} = 9.83$	1.00	$N_{b,y,Rd}$	471	452	428	394	349	298	249	174	126	94.9	73.8	59.0	48.2		
		$N_{b,z,Rd}$	442	386	301	220	163	124	96.6	63.4	44.7	33.2	25.6	20.3	16.5		
	<b>1.00</b>	$M_{b,Rd}$	18.4	18.4	18.4	18.4	18.4	18.4	18.4	18.4	18.3	18.0	17.7	17.5	17.2	17.0	
5.0 $f_y W_{el,y} = 17.7$ $f_y W_{el,z} = 11.7$	1.00	$N_{b,y,Rd}$	578	554	523	480	424	360	300	209	151	114	88.6	70.8	57.8		
		$N_{b,z,Rd}$	541	469	363	264	194	147	115	75.5	53.2	39.5	30.4	24.2	19.7		
	<b>1.00</b>	$M_{b,Rd}$	22.4	22.4	22.4	22.4	22.4	22.4	22.4	22.4	22.2	21.9	21.5	21.2	20.9	20.6	

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$$n = N_{Ed} / N_{pl,Rd}$$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

Axial force resistance  $N_{pl,Rd}$  which is equal to  $Af_y$  is given in the cross-section resistance check table opposite.

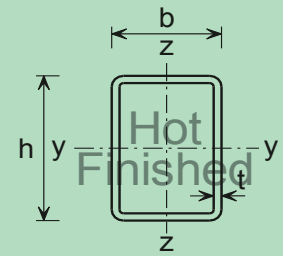
§ The section can be a Class 4 section but no allowance has been made in calculating  $N_{b,y,Rd}$  and  $N_{b,z,Rd}$ .

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n Limit Class 3 <b>Class 2</b>		Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$												
h x b mm	t mm			Axis		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	
				y-y	z-z													
120x60	6.3	16.2	735	n/a <b>1.00</b>	n/a <b>1.00</b>	$M_{c,y,Rd}$	27.2	27.2	27.2	27.2	27.2	27.2	27.2	27.2	27.2	27.2	27.2	
						$M_{c,z,Rd}$	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.4
						$M_{N,y,Rd}$	27.2	27.2	27.2	25.4	21.8	18.2	14.5	10.9	7.26	3.63	0	
						$M_{N,z,Rd}$	16.4	16.4	15.2	13.3	11.4	9.50	7.60	5.70	3.80	1.90	0	
	7.1 #	18.1	817	n/a <b>1.00</b>	n/a <b>1.00</b>	$M_{c,y,Rd}$	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	
						$M_{c,z,Rd}$	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	18.0	
						$M_{N,y,Rd}$	30.0	30.0	30.0	28.0	24.0	20.0	16.0	12.0	7.99	3.99	0	
						$M_{N,z,Rd}$	18.0	18.0	16.6	14.5	12.4	10.4	8.29	6.22	4.14	2.07	0	
	8.0	20.1	909	n/a <b>1.00</b>	n/a <b>1.00</b>	$M_{c,y,Rd}$	32.9	32.9	32.9	32.9	32.9	32.9	32.9	32.9	32.9	32.9	32.9	
						$M_{c,z,Rd}$	19.7	19.7	19.7	19.7	19.7	19.7	19.7	19.7	19.7	19.7	19.7	
						$M_{N,y,Rd}$	32.9	32.9	32.9	30.7	26.3	21.9	17.6	13.2	8.78	4.39	0	
						$M_{N,z,Rd}$	19.7	19.7	18.0	15.7	13.5	11.2	8.99	6.74	4.50	2.25	0	
	8.8 #	21.8	987	n/a <b>1.00</b>	n/a <b>1.00</b>	$M_{c,y,Rd}$	35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4	
						$M_{c,z,Rd}$	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	21.0	
						$M_{N,y,Rd}$	35.4	35.4	35.4	33.0	28.3	23.6	18.9	14.1	9.43	4.71	0	
						$M_{N,z,Rd}$	21.0	21.0	19.1	16.7	14.3	11.9	9.55	7.17	4.78	2.39	0	
	10.0 #	24.3	1100	n/a <b>1.00</b>	n/a <b>1.00</b>	$M_{c,y,Rd}$	38.7	38.7	38.7	38.7	38.7	38.7	38.7	38.7	38.7	38.7	38.7	
						$M_{c,z,Rd}$	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	
						$M_{N,y,Rd}$	38.7	38.7	38.7	36.1	31.0	25.8	20.6	15.5	10.3	5.16	0	
						$M_{N,z,Rd}$	22.9	22.9	20.6	18.0	15.4	12.9	10.3	7.72	5.15	2.57	0	
	12.5 #	29.1	1320	n/a <b>1.00</b>	n/a <b>1.00</b>	$M_{c,y,Rd}$	44.7	44.7	44.7	44.7	44.7	44.7	44.7	44.7	44.7	44.7	44.7	
						$M_{c,z,Rd}$	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	
						$M_{N,y,Rd}$	44.7	44.7	44.7	41.7	35.8	29.8	23.9	17.9	11.9	5.96	0	
						$M_{N,z,Rd}$	26.0	25.8	23.0	20.1	17.2	14.3	11.5	8.61	5.74	2.87	0	

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$N_{Ed}$  = Design value of the axial force.

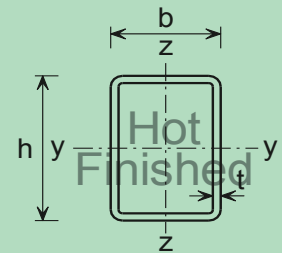
$n = N_{Ed} / N_{pl,Rd}$

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Member buckling check

Section Designation & Resistances (kNm)		n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm)													
h x b mm	t mm		for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
			L (m)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
120x60	6.3 $f_y W_{el,y} = 21.2$ $f_y W_{el,z} = 13.8$	1.00	$N_{b,y,Rd}$	716	685	646	590	518	437	363	252	182	137	106	85.0	69.4
			$N_{b,z,Rd}$	667	572	436	314	230	174	136	89.2	62.8	46.6	35.9	28.5	23.2
	1.00	$M_{b,Rd}$	27.2	27.2	27.2	27.2	27.2	27.2	27.2	27.2	27.0	26.5	26.1	25.7	25.3	24.9
		7.1 # $f_y W_{el,y} = 23.1$ $f_y W_{el,z} = 14.9$	1.00	$N_{b,y,Rd}$	795	760	715	652	570	480	398	276	199	149	116	92.7
	$N_{b,z,Rd}$			739	631	476	342	250	189	148	96.7	68.1	50.5	38.9	30.9	25.2
	1.00	$M_{b,Rd}$	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	29.6	29.1	28.7	28.2	27.8	27.4
		8.0 $f_y W_{el,y} = 25.1$ $f_y W_{el,z} = 16.0$	1.00	$N_{b,y,Rd}$	884	845	794	722	629	528	436	301	217	163	127	101
	$N_{b,z,Rd}$			819	694	518	370	270	204	159	104	73.3	54.4	41.9	33.3	27.1
	1.00	$M_{b,Rd}$	32.9	32.9	32.9	32.9	32.9	32.9	32.9	32.9	32.5	32.0	31.4	31.0	30.5	30.0
		8.8 # $f_y W_{el,y} = 26.7$ $f_y W_{el,z} = 16.9$	1.00	$N_{b,y,Rd}$	959	916	859	780	676	565	466	322	232	174	135	108
	$N_{b,z,Rd}$			887	747	553	393	286	216	169	110	77.6	57.6	44.4	35.2	28.6
	1.00	$M_{b,Rd}$	35.4	35.4	35.4	35.4	35.4	35.4	35.4	35.4	34.9	34.3	33.7	33.2	32.7	32.2
		10.0 # $f_y W_{el,y} = 28.9$ $f_y W_{el,z} = 17.9$	1.00	$N_{b,y,Rd}$	1060	1020	950	857	738	614	505	347	249	187	145	116
	$N_{b,z,Rd}$			979	813	592	418	303	229	178	116	81.9	60.7	46.8	37.1	30.2
	1.00	$M_{b,Rd}$	38.7	38.7	38.7	38.7	38.7	38.7	38.7	38.7	38.1	37.5	36.8	36.3	35.7	35.1
		12.5 # $f_y W_{el,y} = 32.3$ $f_y W_{el,z} = 19.5$	1.00	$N_{b,y,Rd}$	1270	1210	1130	1010	856	704	575	393	282	211	164	131
	$N_{b,z,Rd}$			1160	940	665	463	335	252	196	128	89.9	66.6	51.3	40.7	33.1
	1.00	$M_{b,Rd}$	44.7	44.7	44.7	44.7	44.7	44.7	44.7	44.7	43.9	43.1	42.3	41.6	40.9	40.3

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

$$n = N_{Ed} / N_{pl,Rd}$$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

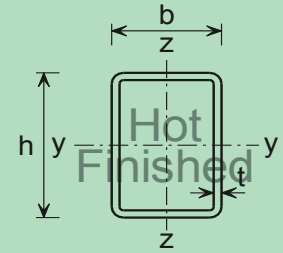
Axial force resistance  $N_{pl,Rd}$  which is equal to  $Af_y$  is given in the cross-section resistance check table opposite.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n Limit Class 3		Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$															
h x b mm	t mm			Class 2		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0				
				y-y	z-z																
120x80	3.6 #	10.8	486	n/a	n/a	$M_{c,y,Rd}$	19.7	19.7	19.7	19.7	19.7	19.7	19.7	19.7	19.7	19.7	19.7	19.7			
						$M_{c,z,Rd}$	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	14.9	
						$M_{N,y,Rd}$	19.7	19.7	19.7	18.4	15.8	13.2	10.5	7.90	5.26	2.63	0				
						$M_{N,z,Rd}$	14.9	14.9	14.6	12.8	11.0	9.14	7.31	5.49	3.66	1.83	0				
	4.0	11.9	540	n/a	n/a	$M_{c,y,Rd}$	21.7	21.7	21.7	21.7	21.7	21.7	21.7	21.7	21.7	21.7	21.7	21.7			
						$M_{c,z,Rd}$	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.4		
						$M_{N,y,Rd}$	21.7	21.7	21.7	20.3	17.4	14.5	11.6	8.69	5.79	2.90	0				
						$M_{N,z,Rd}$	16.4	16.4	16.0	14.0	12.0	10.0	8.02	6.02	4.01	2.01	0				
	5.0	14.7	664	n/a	n/a	$M_{c,y,Rd}$	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5			
						$M_{c,z,Rd}$	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9	19.9		
						$M_{N,y,Rd}$	26.5	26.5	26.5	24.7	21.2	17.7	14.1	10.6	7.06	3.53	0				
						$M_{N,z,Rd}$	19.9	19.9	19.4	17.0	14.6	12.1	9.70	7.28	4.85	2.43	0				
6.3	18.2	824	n/a	n/a	$M_{c,y,Rd}$	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3				
					$M_{c,z,Rd}$	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2			
					$M_{N,y,Rd}$	32.3	32.3	32.3	30.2	25.8	21.5	17.2	12.9	8.61	4.31	0					
					$M_{N,z,Rd}$	24.2	24.2	23.5	20.5	17.6	14.7	11.7	8.79	5.86	2.93	0					
7.1 #	20.3	916	n/a	n/a	$M_{c,y,Rd}$	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5				
					$M_{c,z,Rd}$	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7			
					$M_{N,y,Rd}$	35.5	35.5	35.5	33.1	28.4	23.7	18.9	14.2	9.47	4.73	0					
					$M_{N,z,Rd}$	26.7	26.7	25.7	22.5	19.3	16.1	12.9	9.65	6.43	3.22	0					
8.0	22.6	1020	n/a	n/a	$M_{c,y,Rd}$	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4				
					$M_{c,z,Rd}$	29.3	29.3	29.3	29.3	29.3	29.3	29.3	29.3	29.3	29.3	29.3	29.3	29.3			
					$M_{N,y,Rd}$	39.4	39.4	39.4	36.8	31.5	26.3	21.0	15.8	10.5	5.25	0					
					$M_{N,z,Rd}$	29.3	29.3	28.2	24.6	21.1	17.6	14.1	10.6	7.04	3.52	0					
8.8 #	24.5	1110	n/a	n/a	$M_{c,y,Rd}$	42.2	42.2	42.2	42.2	42.2	42.2	42.2	42.2	42.2	42.2	42.2	42.2				
					$M_{c,z,Rd}$	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5	31.5			
					$M_{N,y,Rd}$	42.2	42.2	42.2	39.4	33.8	28.2	22.5	16.9	11.3	5.63	0					
					$M_{N,z,Rd}$	31.5	31.5	30.1	26.3	22.6	18.8	15.0	11.3	7.52	3.76	0					
10.0	27.4	1240	n/a	n/a	$M_{c,y,Rd}$	46.5	46.5	46.5	46.5	46.5	46.5	46.5	46.5	46.5	46.5	46.5	46.5				
					$M_{c,z,Rd}$	34.5	34.5	34.5	34.5	34.5	34.5	34.5	34.5	34.5	34.5	34.5	34.5	34.5			
					$M_{N,y,Rd}$	46.5	46.5	46.5	43.4	37.2	31.0	24.8	18.6	12.4	6.20	0					
					$M_{N,z,Rd}$	34.5	34.5	32.7	28.7	24.6	20.5	16.4	12.3	8.19	4.09	0					
12.5 #	33.0	1490	n/a	n/a	$M_{c,y,Rd}$	54.3	54.3	54.3	54.3	54.3	54.3	54.3	54.3	54.3	54.3	54.3	54.3				
					$M_{c,z,Rd}$	40.1	40.1	40.1	40.1	40.1	40.1	40.1	40.1	40.1	40.1	40.1	40.1	40.1			
					$M_{N,y,Rd}$	54.3	54.3	54.3	50.7	43.5	36.2	29.0	21.7	14.5	7.24	0					
					$M_{N,z,Rd}$	40.1	40.1	37.5	32.8	28.1	23.4	18.7	14.1	9.37	4.68	0					

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$N_{Ed}$  = Design value of the axial force.

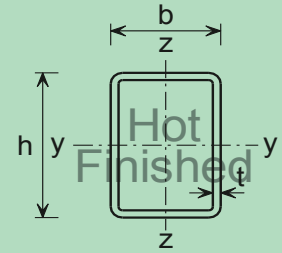
$n = N_{Ed} / N_{pl,Rd}$

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Member buckling check

Section Designation & Resistances (kNm)		n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm)														
h x b mm	t mm		for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$														
			L (m)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0	
120x80	3.6 # $f_y W_{el,y} = 16.3$ $f_y W_{el,z} = 13.0$	1.00	$N_{b,y,Rd}$	476	458	436	405	364	316	268	189	138	104	81.0	64.8	53.0	
			$N_{b,z,Rd}$	463	433	387	323	258	203	162	108	77.0	57.4	44.4	35.4	28.8	
		1.00	$M_{b,Rd}$	19.7	19.7	19.7	19.7	19.7	19.7	19.7	19.7	19.7	19.7	19.7	19.5	19.3	19.1
	4.0 $f_y W_{el,y} = 17.9$ $f_y W_{el,z} = 14.3$	1.00	$N_{b,y,Rd}$	528	508	483	449	403	349	295	209	152	114	89.2	71.3	58.3	
			$N_{b,z,Rd}$	514	479	428	357	283	223	178	119	84.4	63.0	48.7	38.8	31.6	
		1.00	$M_{b,Rd}$	21.7	21.7	21.7	21.7	21.7	21.7	21.7	21.7	21.7	21.7	21.7	21.5	21.3	21.0
	5.0 $f_y W_{el,y} = 21.6$ $f_y W_{el,z} = 17.1$	1.00	$N_{b,y,Rd}$	650	625	593	550	492	425	358	253	184	138	108	86.2	70.5	
			$N_{b,z,Rd}$	631	588	522	433	342	269	214	143	101	75.6	58.5	46.6	38.0	
		1.00	$M_{b,Rd}$	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.4	26.2	25.9	25.6
6.3 $f_y W_{el,y} = 26.0$ $f_y W_{el,z} = 20.4$	1.00	$N_{b,y,Rd}$	805	773	733	678	604	519	436	306	222	167	130	104	85.2		
		$N_{b,z,Rd}$	781	726	640	526	413	323	257	171	121	90.5	70.0	55.7	45.4		
	1.00	$M_{b,Rd}$	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.2	31.9	31.5	31.2	
7.1 # $f_y W_{el,y} = 28.5$ $f_y W_{el,z} = 22.3$	1.00	$N_{b,y,Rd}$	895	859	813	750	667	571	479	335	243	183	142	114	93.1		
		$N_{b,z,Rd}$	868	805	708	578	453	354	281	187	133	98.8	76.4	60.8	49.5		
	1.00	$M_{b,Rd}$	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.5	35.4	35.0	34.6	34.3	
8.0 $f_y W_{el,y} = 31.1$ $f_y W_{el,z} = 24.2$	1.00	$N_{b,y,Rd}$	998	957	905	833	737	628	525	367	266	200	156	124	102		
		$N_{b,z,Rd}$	967	895	783	636	495	386	306	204	144	108	83.2	66.2	53.9		
	1.00	$M_{b,Rd}$	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.2	38.8	38.4	38.0	
8.8 # $f_y W_{el,y} = 33.2$ $f_y W_{el,z} = 25.7$	1.00	$N_{b,y,Rd}$	1080	1040	981	902	796	677	565	394	285	215	167	133	109		
		$N_{b,z,Rd}$	1050	969	843	680	528	411	325	216	153	114	88.2	70.1	57.1		
	1.00	$M_{b,Rd}$	42.2	42.2	42.2	42.2	42.2	42.2	42.2	42.2	42.2	42.2	42.1	41.6	41.1	40.7	
10.0 $f_y W_{el,y} = 36.2$ $f_y W_{el,z} = 27.7$	1.00	$N_{b,y,Rd}$	1210	1160	1090	998	877	742	617	429	310	233	181	145	118		
		$N_{b,z,Rd}$	1170	1070	929	743	574	445	352	234	165	123	95.2	75.7	61.7		
	1.00	$M_{b,Rd}$	46.5	46.5	46.5	46.5	46.5	46.5	46.5	46.5	46.5	46.5	46.3	45.7	45.2	44.8	
12.5 # $f_y W_{el,y} = 40.8$ $f_y W_{el,z} = 31.0$	1.00	$N_{b,y,Rd}$	1450	1390	1300	1180	1030	859	709	489	353	265	206	164	134		
		$N_{b,z,Rd}$	1400	1280	1090	854	652	503	397	263	186	138	107	84.9	69.2		
	1.00	$M_{b,Rd}$	54.3	54.3	54.3	54.3	54.3	54.3	54.3	54.3	54.3	53.9	53.3	52.7	52.1		

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

$$n = N_{Ed} / N_{pl,Rd}$$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

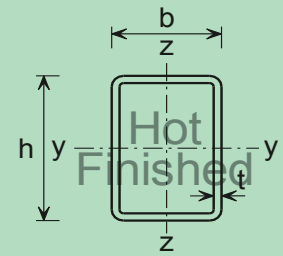
Axial force resistance  $N_{pl,Rd}$  which is equal to  $Af_y$  is given in the cross-section resistance check table opposite.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n Limit Class 3		Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$																
h x b mm	t mm			Class 2		n	Axis															
				y-y	z-z		0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0					
150x100	4.0 #	15.1	682	0.986	*	<i><math>M_{c,y,Rd}</math></i>	34.6	34.6	34.6	34.6	34.6	28.8	28.8	28.8	28.8	28.8	28.8	28.8	\$			
				<b>0.465</b>		<i><math>M_{c,z,Rd}</math></i>	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	\$			
						<i><math>M_{N,y,Rd}</math></i>	34.6	34.6	34.6	32.3	27.7	-	-	-	-	-	-	-	-			
						<i><math>M_{N,z,Rd}</math></i>	-	-	-	-	-	-	-	-	-	-	-	-	-			
	5.0	18.6	841	n/a	n/a	<i><math>M_{c,y,Rd}</math></i>	42.2	42.2	42.2	42.2	42.2	42.2	42.2	42.2	42.2	42.2	42.2	42.2	42.2			
				<b>1.00</b>	<b>1.00</b>	<i><math>M_{c,z,Rd}</math></i>	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0		
						<i><math>M_{N,y,Rd}</math></i>	42.2	42.2	42.2	39.4	33.8	28.2	22.5	16.9	11.3	5.63	0			0		
						<i><math>M_{N,z,Rd}</math></i>	32.0	32.0	31.3	27.4	23.5	19.6	15.7	11.8	7.84	3.92	0			0		
	6.3	23.1	1050	n/a	n/a	<i><math>M_{c,y,Rd}</math></i>	52.2	52.2	52.2	52.2	52.2	52.2	52.2	52.2	52.2	52.2	52.2	52.2	52.2	52.2		
				<b>1.00</b>	<b>1.00</b>	<i><math>M_{c,z,Rd}</math></i>	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1	39.1		
					<i><math>M_{N,y,Rd}</math></i>	52.2	52.2	52.2	48.7	41.7	34.8	27.8	20.9	13.9	6.96	0			0			
					<i><math>M_{N,z,Rd}</math></i>	39.1	39.1	38.1	33.3	28.6	23.8	19.0	14.3	9.52	4.76	0			0			
7.1 #	25.9	1170	n/a	n/a	<i><math>M_{c,y,Rd}</math></i>	57.9	57.9	57.9	57.9	57.9	57.9	57.9	57.9	57.9	57.9	57.9	57.9	57.9	57.9			
			<b>1.00</b>	<b>1.00</b>	<i><math>M_{c,z,Rd}</math></i>	43.3	43.3	43.3	43.3	43.3	43.3	43.3	43.3	43.3	43.3	43.3	43.3	43.3	43.3			
					<i><math>M_{N,y,Rd}</math></i>	57.9	57.9	57.9	54.0	46.3	38.6	30.9	23.1	15.4	7.72	0			0			
					<i><math>M_{N,z,Rd}</math></i>	43.3	43.3	42.1	36.8	31.5	26.3	21.0	15.8	10.5	5.26	0			0			
8.0	28.9	1310	n/a	n/a	<i><math>M_{c,y,Rd}</math></i>	63.9	63.9	63.9	63.9	63.9	63.9	63.9	63.9	63.9	63.9	63.9	63.9	63.9	63.9			
			<b>1.00</b>	<b>1.00</b>	<i><math>M_{c,z,Rd}</math></i>	47.9	47.9	47.9	47.9	47.9	47.9	47.9	47.9	47.9	47.9	47.9	47.9	47.9	47.9			
					<i><math>M_{N,y,Rd}</math></i>	63.9	63.9	63.9	59.6	51.1	42.6	34.1	25.6	17.0	8.52	0			0			
					<i><math>M_{N,z,Rd}</math></i>	47.9	47.9	46.4	40.6	34.8	29.0	23.2	17.4	11.6	5.80	0			0			
8.8 #	31.5	1420	n/a	n/a	<i><math>M_{c,y,Rd}</math></i>	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2			
			<b>1.00</b>	<b>1.00</b>	<i><math>M_{c,z,Rd}</math></i>	51.8	51.8	51.8	51.8	51.8	51.8	51.8	51.8	51.8	51.8	51.8	51.8	51.8	51.8			
					<i><math>M_{N,y,Rd}</math></i>	69.2	69.2	69.2	64.6	55.4	46.2	36.9	27.7	18.5	9.23	0			0			
					<i><math>M_{N,z,Rd}</math></i>	51.8	51.8	50.0	43.8	37.5	31.3	25.0	18.8	12.5	6.25	0			0			
10.0	35.3	1590	n/a	n/a	<i><math>M_{c,y,Rd}</math></i>	76.7	76.7	76.7	76.7	76.7	76.7	76.7	76.7	76.7	76.7	76.7	76.7	76.7	76.7			
			<b>1.00</b>	<b>1.00</b>	<i><math>M_{c,z,Rd}</math></i>	57.2	57.2	57.2	57.2	57.2	57.2	57.2	57.2	57.2	57.2	57.2	57.2	57.2	57.2			
					<i><math>M_{N,y,Rd}</math></i>	76.7	76.7	76.7	71.6	61.3	51.1	40.9	30.7	20.4	10.2	0			0			
					<i><math>M_{N,z,Rd}</math></i>	57.2	57.2	54.8	48.0	41.1	34.3	27.4	20.6	13.7	6.85	0			0			
12.5	42.8	1940	n/a	n/a	<i><math>M_{c,y,Rd}</math></i>	90.9	90.9	90.9	90.9	90.9	90.9	90.9	90.9	90.9	90.9	90.9	90.9	90.9	90.9			
			<b>1.00</b>	<b>1.00</b>	<i><math>M_{c,z,Rd}</math></i>	67.5	67.5	67.5	67.5	67.5	67.5	67.5	67.5	67.5	67.5	67.5	67.5	67.5	67.5			
					<i><math>M_{N,y,Rd}</math></i>	90.9	90.9	90.9	84.8	72.7	60.6	48.5	36.4	24.2	12.1	0			0			
					<i><math>M_{N,z,Rd}</math></i>	67.5	67.5	64.0	56.0	48.0	40.0	32.0	24.0	16.0	8.00	0			0			

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

\* The section is a Class 4 section about the appropriate axis and is independent of the design axial force  $N_{Ed}$ . Values of  $M_{c,Rd}$  are calculated based on Class 4 section properties and are displayed in italics.

$N_{Ed}$  = Design value of the axial force.

$$n = N_{Ed} / N_{pl,Rd}$$

✘ Section becomes class 4, see note 10.

\$ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

- Not applicable for Class 3 and Class 4 sections.

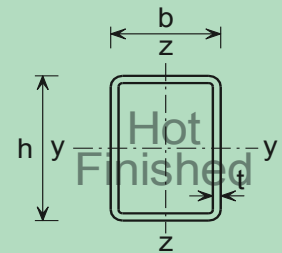
# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.



HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Member buckling check

Section Designation & Resistances (kNm)		n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm)														
h x b mm	t mm		for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$														
			L (m)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0	
150x100	§ 4.0 # $f_y W_{el,y} = 28.8$ $f_y W_{el,z} = 23.0$	0.986	$N_{b,y,Rd}$	677	658	637	611	579	537	487	378	287	220	174	140	115	
			$N_{b,z,Rd}$	663	635	597	544	475	399	331	229	165	124	96.5	77.0	62.9	
		0.986	$M_{b,Rd}$	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8	28.8
			<b>0.465</b> $M_{b,Rd}$	34.6	34.6	34.6	34.6	34.6	34.6	34.6	34.6	34.6	34.6	34.6	34.6	34.6	34.6
	5.0 $f_y W_{el,y} = 35.0$ $f_y W_{el,z} = 27.9$	1.00	$N_{b,y,Rd}$	835	812	785	753	712	659	596	461	349	268	211	170	139	
			$N_{b,z,Rd}$	818	782	734	668	581	487	402	278	200	150	117	93.3	76.2	
		1.00	$M_{b,Rd}$	42.2	42.2	42.2	42.2	42.2	42.2	42.2	42.2	42.2	42.2	42.2	42.2	42.1	41.8
	6.3 $f_y W_{el,y} = 42.6$ $f_y W_{el,z} = 33.7$	1.00	$N_{b,y,Rd}$	1040	1010	976	935	882	815	734	565	426	327	257	207	170	
			$N_{b,z,Rd}$	1020	971	910	824	712	594	489	337	243	182	141	113	92.2	
		1.00	$M_{b,Rd}$	52.2	52.2	52.2	52.2	52.2	52.2	52.2	52.2	52.2	52.2	52.2	52.0	51.5	
7.1 # $f_y W_{el,y} = 46.9$ $f_y W_{el,z} = 36.9$	1.00	$N_{b,y,Rd}$	1160	1130	1090	1040	981	905	814	623	470	360	283	228	187		
		$N_{b,z,Rd}$	1130	1080	1010	913	786	654	537	369	266	199	155	124	101		
	1.00	$M_{b,Rd}$	57.9	57.9	57.9	57.9	57.9	57.9	57.9	57.9	57.9	57.9	57.9	57.6	57.1		
8.0 $f_y W_{el,y} = 51.5$ $f_y W_{el,z} = 40.5$	1.00	$N_{b,y,Rd}$	1290	1260	1210	1160	1090	1010	904	690	519	398	312	251	206		
		$N_{b,z,Rd}$	1270	1210	1130	1020	873	724	594	408	293	220	171	136	111		
	1.00	$M_{b,Rd}$	63.9	63.9	63.9	63.9	63.9	63.9	63.9	63.9	63.9	63.9	63.9	63.6	63.0		
8.8 # $f_y W_{el,y} = 55.4$ $f_y W_{el,z} = 43.3$	1.00	$N_{b,y,Rd}$	1410	1370	1320	1260	1190	1090	978	744	559	428	336	270	221		
		$N_{b,z,Rd}$	1380	1310	1230	1100	941	778	637	436	313	235	182	146	119		
	1.00	$M_{b,Rd}$	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2	68.9	68.3		
10.0 $f_y W_{el,y} = 60.7$ $f_y W_{el,z} = 47.2$	1.00	$N_{b,y,Rd}$	1580	1530	1480	1410	1320	1210	1080	819	614	469	368	296	243		
		$N_{b,z,Rd}$	1540	1470	1370	1220	1040	855	698	477	343	257	199	159	130		
	1.00	$M_{b,Rd}$	76.7	76.7	76.7	76.7	76.7	76.7	76.7	76.7	76.7	76.7	76.7	76.2	75.5		
12.5 $f_y W_{el,y} = 70.3$ $f_y W_{el,z} = 54.3$	1.00	$N_{b,y,Rd}$	1920	1860	1790	1700	1590	1450	1290	963	718	548	430	345	283		
		$N_{b,z,Rd}$	1870	1780	1640	1450	1220	997	810	551	395	296	229	183	149		
	1.00	$M_{b,Rd}$	90.9	90.9	90.9	90.9	90.9	90.9	90.9	90.9	90.9	90.9	90.9	90.2	89.4		

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

$$n = N_{Ed} / N_{pl,Rd}$$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

Axial force resistance  $N_{pl,Rd}$  which is equal to  $Af_y$  is given in the cross-section resistance check table opposite.

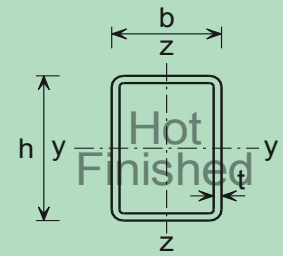
§ The section can be a Class 4 section but no allowance has been made in calculating  $N_{b,y,Rd}$  and  $N_{b,z,Rd}$ .

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n Limit Class 3		Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$															
h x b mm	t mm			Class 2		n	Axis														
				y-y	z-z		0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0				
160x80	4.0 #	14.4	653	0.885	*	$M_{c,y,Rd}$	33.6	33.6	33.6	33.6	33.6	27.2	27.2	27.2	27.2	✘	§				
						$M_{c,z,Rd}$	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	§	
						$M_{N,y,Rd}$	33.6	33.6	33.6	31.4	26.9	-	-	-	-	-	-	-	-	-	-
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	5.0	17.8	806	n/a	1.00	1.00	$M_{c,y,Rd}$	41.2	41.2	41.2	41.2	41.2	41.2	41.2	41.2	41.2	41.2	41.2			
							$M_{c,z,Rd}$	25.2	25.2	25.2	25.2	25.2	25.2	25.2	25.2	25.2	25.2	25.2	25.2		
							$M_{N,y,Rd}$	41.2	41.2	41.2	38.4	32.9	27.5	22.0	16.5	11.0	5.49	0			
							$M_{N,z,Rd}$	25.2	25.2	23.7	20.7	17.8	14.8	11.8	8.88	5.92	2.96	0			
	6.3	22.2	1000	n/a	1.00	1.00	$M_{c,y,Rd}$	50.4	50.4	50.4	50.4	50.4	50.4	50.4	50.4	50.4	50.4	50.4			
							$M_{c,z,Rd}$	30.8	30.8	30.8	30.8	30.8	30.8	30.8	30.8	30.8	30.8	30.8	30.8		
$M_{N,y,Rd}$							50.4	50.4	50.4	47.0	40.3	33.6	26.9	20.2	13.4	6.72	0				
$M_{N,z,Rd}$							30.8	30.8	28.7	25.2	21.6	18.0	14.4	10.8	7.19	3.59	0				
7.1 #	24.7	1120	n/a	1.00	1.00	$M_{c,y,Rd}$	56.1	56.1	56.1	56.1	56.1	56.1	56.1	56.1	56.1	56.1	56.1				
						$M_{c,z,Rd}$	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0			
						$M_{N,y,Rd}$	56.1	56.1	56.1	52.4	44.9	37.4	29.9	22.4	15.0	7.48	0				
						$M_{N,z,Rd}$	34.0	34.0	31.6	27.7	23.7	19.8	15.8	11.9	7.91	3.96	0				
8.0	27.6	1250	n/a	1.00	1.00	$M_{c,y,Rd}$	62.1	62.1	62.1	62.1	62.1	62.1	62.1	62.1	62.1	62.1	62.1				
						$M_{c,z,Rd}$	37.6	37.6	37.6	37.6	37.6	37.6	37.6	37.6	37.6	37.6	37.6	37.6			
						$M_{N,y,Rd}$	62.1	62.1	62.1	58.0	49.7	41.4	33.1	24.9	16.6	8.28	0				
						$M_{N,z,Rd}$	37.6	37.6	34.9	30.5	26.1	21.8	17.4	13.1	8.71	4.36	0				
8.8 #	30.1	1360	n/a	1.00	1.00	$M_{c,y,Rd}$	67.1	67.1	67.1	67.1	67.1	67.1	67.1	67.1	67.1	67.1	67.1				
						$M_{c,z,Rd}$	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5	40.5			
						$M_{N,y,Rd}$	67.1	67.1	67.1	62.6	53.7	44.7	35.8	26.8	17.9	8.95	0				
						$M_{N,z,Rd}$	40.5	40.5	37.3	32.7	28.0	23.3	18.7	14.0	9.33	4.66	0				
10.0	33.7	1520	n/a	1.00	1.00	$M_{c,y,Rd}$	74.2	74.2	74.2	74.2	74.2	74.2	74.2	74.2	74.2	74.2	74.2				
						$M_{c,z,Rd}$	44.4	44.4	44.4	44.4	44.4	44.4	44.4	44.4	44.4	44.4	44.4	44.4			
						$M_{N,y,Rd}$	74.2	74.2	74.2	69.2	59.4	49.5	39.6	29.7	19.8	9.89	0				
						$M_{N,z,Rd}$	44.4	44.4	40.7	35.6	30.5	25.4	20.3	15.2	10.2	5.08	0				
12.5	40.9	1850	n/a	1.00	1.00	$M_{c,y,Rd}$	87.7	87.7	87.7	87.7	87.7	87.7	87.7	87.7	87.7	87.7	87.7				
						$M_{c,z,Rd}$	51.8	51.8	51.8	51.8	51.8	51.8	51.8	51.8	51.8	51.8	51.8	51.8			
						$M_{N,y,Rd}$	87.7	87.7	87.7	81.8	70.1	58.5	46.8	35.1	23.4	11.7	0				
						$M_{N,z,Rd}$	51.8	51.8	46.9	41.0	35.2	29.3	23.5	17.6	11.7	5.86	0				

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

\* The section is a Class 4 section about the appropriate axis and is independent of the design axial force  $N_{Ed}$ . Values of  $M_{c,Rd}$  are calculated based on Class 4 section properties and are displayed in italics.

$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

✘ Section becomes class 4, see note 10.

§ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

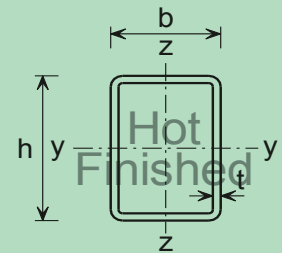
- Not applicable for Class 3 and Class 4 sections.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Member buckling check

Section Designation & Resistances (kNm)		n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm)														
h x b mm	t mm		for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$														
			L (m)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0	
160x80	§ 4.0 # $f_y W_{el,y} = 27.2$ $f_y W_{el,z} = 18.4$	0.885	$N_{b,y,Rd}$	649	632	613	589	560	522	476	374	286	221	174	140	115	
			$N_{b,z,Rd}$	624	585	527	445	358	284	227	152	108	80.8	62.5	49.8	40.6	
		0.885	$M_{b,Rd}$	27.2	27.2	27.2	27.2	27.2	27.2	27.2	27.2	27.2	27.2	27.2	27.1	26.8	26.6
			<b>0.448</b>	$M_{b,Rd}$	33.6	33.6	33.6	33.6	33.6	33.6	33.6	33.6	33.6	33.6	33.3	32.9	32.5
	5.0 $f_y W_{el,y} = 33.0$ $f_y W_{el,z} = 22.1$	1.00	$N_{b,y,Rd}$	801	779	755	725	688	641	583	456	348	268	211	170	140	
			$N_{b,z,Rd}$	769	719	645	543	434	343	274	183	131	97.4	75.4	60.0	48.9	
		<b>1.00</b>	$M_{b,Rd}$	41.2	41.2	41.2	41.2	41.2	41.2	41.2	41.2	41.2	41.2	40.7	40.3	39.8	39.4
			$N_{b,y,Rd}$	994	967	937	899	852	791	718	559	425	327	257	207	170	
	6.3 $f_y W_{el,y} = 40.1$ $f_y W_{el,z} = 26.6$	1.00	$N_{b,z,Rd}$	953	890	795	664	528	416	331	222	158	117	90.9	72.4	59.0	
			<b>1.00</b>	$M_{b,Rd}$	50.4	50.4	50.4	50.4	50.4	50.4	50.4	50.4	50.4	49.8	49.2	48.7	48.1
	7.1 # $f_y W_{el,y} = 44.0$ $f_y W_{el,z} = 29.0$	1.00	$N_{b,y,Rd}$	1110	1080	1050	1000	949	880	797	618	469	361	284	228	188	
			$N_{b,z,Rd}$	1060	991	881	732	579	455	362	242	172	128	99.1	78.9	64.3	
	<b>1.00</b>	$M_{b,Rd}$	56.1	56.1	56.1	56.1	56.1	56.1	56.1	56.1	56.1	56.1	55.4	54.7	54.1	53.5	
		$N_{b,y,Rd}$	1240	1210	1170	1120	1060	978	884	682	516	397	312	251	206		
8.0 $f_y W_{el,y} = 48.3$ $f_y W_{el,z} = 31.6$	1.00	$N_{b,z,Rd}$	1190	1100	977	806	635	498	396	264	188	140	108	86.1	70.1		
		<b>1.00</b>	$M_{b,Rd}$	62.1	62.1	62.1	62.1	62.1	62.1	62.1	62.1	62.1	61.3	60.5	59.8	59.1	
8.8 # $f_y W_{el,y} = 52.2$ $f_y W_{el,z} = 33.7$	1.00	$N_{b,y,Rd}$	1350	1310	1270	1210	1150	1060	955	735	555	426	335	270	221		
		$N_{b,z,Rd}$	1290	1200	1060	868	682	533	424	282	201	149	116	92.0	74.9		
	<b>1.00</b>	$M_{b,Rd}$	67.1	67.1	67.1	67.1	67.1	67.1	67.1	67.1	67.1	67.0	66.1	65.3	64.5	63.8	
		$N_{b,y,Rd}$	1510	1470	1420	1360	1280	1180	1060	811	611	468	368	296	243		
10.0 $f_y W_{el,y} = 57.2$ $f_y W_{el,z} = 36.6$	1.00	$N_{b,z,Rd}$	1440	1340	1170	954	745	582	461	307	218	162	125	99.9	81.4		
		<b>1.00</b>	$M_{b,Rd}$	74.2	74.2	74.2	74.2	74.2	74.2	74.2	74.2	74.0	73.0	72.1	71.3	70.4	
12.5 $f_y W_{el,y} = 66.0$ $f_y W_{el,z} = 41.2$	1.00	$N_{b,y,Rd}$	1830	1780	1720	1640	1540	1410	1260	951	712	545	428	344	282		
		$N_{b,z,Rd}$	1740	1600	1390	1110	856	664	525	349	247	184	142	113	92.1		
	<b>1.00</b>	$M_{b,Rd}$	87.7	87.7	87.7	87.7	87.7	87.7	87.7	87.7	87.2	86.0	85.0	83.9	82.9		

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

$$n = N_{Ed} / N_{pl,Rd}$$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

Axial force resistance  $N_{pl,Rd}$  which is equal to  $Af_y$  is given in the cross-section resistance check table opposite.

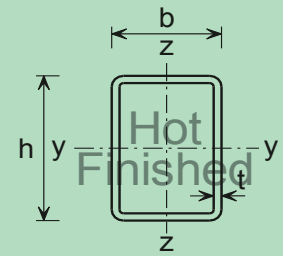
§ The section can be a Class 4 section but no allowance has been made in calculating  $N_{b,y,Rd}$  and  $N_{b,z,Rd}$ .

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n Limit Class 3		Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$															
h x b mm	t mm			Class 2		n	Axis														
				y-y	z-z		0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0				
180x60	4.0 #	14.4	653	0.720	*	$M_{c,y,Rd}$	35.4	35.4	35.4	35.4	27.5	27.5	27.5	27.5	✘	§	§				
						$M_{c,z,Rd}$	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	§	§		
						$M_{N,y,Rd}$	35.4	35.4	35.4	33.1	-	-	-	-	-	-	-	-	-	-	
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	5.0 #	17.8	806	1.00	1.00	0.642	0.00	$M_{c,y,Rd}$	43.3	43.3	43.3	43.3	43.3	43.3	43.3	33.4	33.4	33.4	33.4		
								$M_{c,z,Rd}$	17.1	17.1	17.1	17.1	17.1	17.1	17.1	17.1	17.1	17.1	17.1	17.1	17.1
								$M_{N,y,Rd}$	43.3	43.3	43.3	40.4	34.6	28.9	23.1	-	-	-	-	-	-
								$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-
	6.3 #	22.2	1000	n/a	n/a	1.00	1.00	$M_{c,y,Rd}$	53.3	53.3	53.3	53.3	53.3	53.3	53.3	53.3	53.3	53.3	53.3		
								$M_{c,z,Rd}$	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	
								$M_{N,y,Rd}$	53.3	53.3	53.3	49.7	42.6	35.5	28.4	21.3	14.2	7.10	0		
								$M_{N,z,Rd}$	23.6	23.6	21.0	18.3	15.7	13.1	10.5	7.86	5.24	2.62	0		
7.1 #	24.7	1120	n/a	n/a	1.00	1.00	$M_{c,y,Rd}$	58.9	58.9	58.9	58.9	58.9	58.9	58.9	58.9	58.9	58.9	58.9			
							$M_{c,z,Rd}$	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0			
							$M_{N,y,Rd}$	58.9	58.9	58.9	55.0	47.1	39.3	31.4	23.6	15.7	7.86	0			
							$M_{N,z,Rd}$	26.0	25.9	23.0	20.1	17.2	14.4	11.5	8.62	5.75	2.87	0			
8.0 #	27.6	1250	n/a	n/a	1.00	1.00	$M_{c,y,Rd}$	65.3	65.3	65.3	65.3	65.3	65.3	65.3	65.3	65.3	65.3	65.3			
							$M_{c,z,Rd}$	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5	28.5			
							$M_{N,y,Rd}$	65.3	65.3	65.3	61.0	52.3	43.5	34.8	26.1	17.4	8.71	0			
							$M_{N,z,Rd}$	28.5	28.3	25.1	22.0	18.8	15.7	12.6	9.42	6.28	3.14	0			
8.8 #	30.1	1360	n/a	n/a	1.00	1.00	$M_{c,y,Rd}$	70.6	70.6	70.6	70.6	70.6	70.6	70.6	70.6	70.6	70.6	70.6			
							$M_{c,z,Rd}$	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6	30.6			
							$M_{N,y,Rd}$	70.6	70.6	70.6	65.9	56.5	47.1	37.7	28.3	18.8	9.42	0			
							$M_{N,z,Rd}$	30.6	30.1	26.8	23.4	20.1	16.7	13.4	10.0	6.70	3.35	0			
10.0 #	33.7	1520	n/a	n/a	1.00	1.00	$M_{c,y,Rd}$	78.1	78.1	78.1	78.1	78.1	78.1	78.1	78.1	78.1	78.1	78.1			
							$M_{c,z,Rd}$	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5	33.5			
							$M_{N,y,Rd}$	78.1	78.1	78.1	72.9	62.5	52.1	41.7	31.2	20.8	10.4	0			
							$M_{N,z,Rd}$	33.5	32.8	29.2	25.5	21.9	18.2	14.6	10.9	7.29	3.64	0			
12.5 #	40.9	1850	n/a	n/a	1.00	1.00	$M_{c,y,Rd}$	92.3	92.3	92.3	92.3	92.3	92.3	92.3	92.3	92.3	92.3	92.3			
							$M_{c,z,Rd}$	38.7	38.7	38.7	38.7	38.7	38.7	38.7	38.7	38.7	38.7	38.7			
							$M_{N,y,Rd}$	92.3	92.3	92.3	86.1	73.8	61.5	49.2	36.9	24.6	12.3	0			
							$M_{N,z,Rd}$	38.7	37.4	33.2	29.1	24.9	20.8	16.6	12.5	8.30	4.15	0			

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

\* The section is a Class 4 section about the appropriate axis and is independent of the design axial force  $N_{Ed}$ . Values of  $M_{c,Rd}$  are calculated based on Class 4 section properties and are displayed in italics.

$N_{Ed}$  = Design value of the axial force.

$$n = N_{Ed} / N_{pl,Rd}$$

✘ Section becomes class 4, see note 10.

§ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

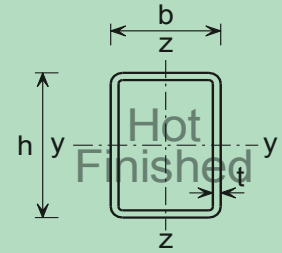
- Not applicable for Class 3 and Class 4 sections.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Member buckling check

Section Designation & Resistances (kNm)		n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm)														
h x b mm	t mm		for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$														
			L (m)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0	
180x60	§ 4.0 # $f_y W_{el,y} = 27.5$ $f_y W_{el,z} = 14.3$	0.720	$N_{b,y,Rd}$	651	636	618	597	572	540	500	406	317	247	196	158	130	
			$N_{b,z,Rd}$	601	532	424	315	234	178	140	91.9	64.8	48.1	37.1	29.5	24.0	
		0.720	$M_{b,Rd}$	27.5	27.5	27.5	27.5	27.5	27.5	27.5	27.5	27.4	26.8	26.2	25.7	25.2	24.7
			$M_{b,Rd}$	35.4	35.4	35.4	35.4	35.4	35.4	35.2	34.2	33.3	32.5	31.7	31.0	30.3	
	5.0 # $f_y W_{el,y} = 33.4$ $f_y W_{el,z} = 17.1$	1.00	$N_{b,y,Rd}$	803	784	761	735	703	663	613	495	385	299	237	192	158	
			$N_{b,z,Rd}$	740	651	514	380	281	214	167	110	77.6	57.6	44.4	35.3	28.7	
		1.00	$M_{b,Rd}$	33.4	33.4	33.4	33.4	33.4	33.4	33.4	33.4	33.2	32.5	31.8	31.2	30.6	30.0
			$M_{b,Rd}$	43.3	43.3	43.3	43.3	43.3	43.3	42.9	41.7	40.6	39.6	38.6	37.7	36.8	
	6.3 # $f_y W_{el,y} = 40.5$ $f_y W_{el,z} = 20.2$	1.00	$N_{b,y,Rd}$	997	973	945	911	870	819	755	607	470	365	289	233	192	
			$N_{b,z,Rd}$	915	798	621	454	335	254	199	130	92.0	68.3	52.6	41.8	34.0	
		1.00	$M_{b,Rd}$	53.3	53.3	53.3	53.3	53.3	53.3	52.6	51.1	49.7	48.4	47.2	46.1	45.0	
	7.1 # $f_y W_{el,y} = 44.7$ $f_y W_{el,z} = 22.0$	1.00	$N_{b,y,Rd}$	1110	1090	1050	1020	970	912	840	672	519	403	319	257	211	
			$N_{b,z,Rd}$	1020	885	684	498	366	278	217	142	100	74.4	57.4	45.6	37.1	
		1.00	$M_{b,Rd}$	58.9	58.9	58.9	58.9	58.9	58.9	58.1	56.4	54.9	53.5	52.1	50.8	49.6	
8.0 # $f_y W_{el,y} = 49.0$ $f_y W_{el,z} = 23.7$	1.00	$N_{b,y,Rd}$	1240	1210	1180	1130	1080	1010	932	743	572	444	351	283	233		
		$N_{b,z,Rd}$	1140	979	749	541	397	301	235	154	109	80.6	62.1	49.3	40.1		
	1.00	$M_{b,Rd}$	65.3	65.3	65.3	65.3	65.3	65.2	64.2	62.3	60.6	59.0	57.5	56.1	54.7		
8.8 # $f_y W_{el,y} = 52.5$ $f_y W_{el,z} = 25.1$	1.00	$N_{b,y,Rd}$	1350	1320	1280	1230	1170	1100	1010	800	615	476	376	303	249		
		$N_{b,z,Rd}$	1230	1050	797	573	420	318	248	162	114	84.8	65.4	51.9	42.2		
	1.00	$M_{b,Rd}$	70.6	70.6	70.6	70.6	70.6	70.4	69.3	67.2	65.4	63.6	62.0	60.4	58.9		
10.0 # $f_y W_{el,y} = 57.5$ $f_y W_{el,z} = 26.9$	1.00	$N_{b,y,Rd}$	1510	1480	1430	1380	1310	1220	1120	884	677	524	413	333	274		
		$N_{b,z,Rd}$	1370	1160	868	620	453	342	267	175	123	91.1	70.2	55.8	45.4		
	1.00	$M_{b,Rd}$	78.1	78.1	78.1	78.1	78.1	77.6	76.4	74.1	72.0	70.0	68.2	66.4	64.7		
12.5 # $f_y W_{el,y} = 66.4$ $f_y W_{el,z} = 29.7$	1.00	$N_{b,y,Rd}$	1840	1790	1730	1660	1580	1460	1330	1040	789	608	479	385	317		
		$N_{b,z,Rd}$	1650	1370	992	699	507	383	298	195	137	101	78.2	62.1	50.5		
	1.00	$M_{b,Rd}$	92.3	92.3	92.3	92.3	92.3	91.1	89.6	86.8	84.2	81.8	79.5	77.4	75.3		

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

$$n = N_{Ed} / N_{pl,Rd}$$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

Axial force resistance  $N_{pl,Rd}$  which is equal to  $Af_y$  is given in the cross-section resistance check table opposite.

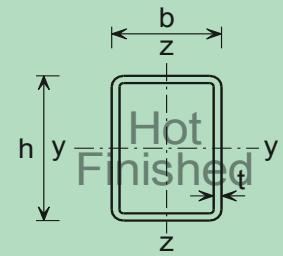
§ The section can be a Class 4 section but no allowance has been made in calculating  $N_{b,y,Rd}$  and  $N_{b,z,Rd}$ .

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n Limit Class 3		Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$															
h x b mm	t mm			Class 2		n	Axis														
				y-y	z-z		0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0				
180x100	4.0 #	16.9	767	0.720	*	$M_{c,y,Rd}$	45.4	45.4	45.4	45.4	37.3	37.3	37.3	37.3	✘	§	§				
						$M_{c,z,Rd}$	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	§	§			
						$M_{N,y,Rd}$	45.4	45.4	45.4	42.4	-	-	-	-	-	-	-	-	-		
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-		
	5.0 #	21.0	948	1.00	1.00	0.546	0.00	$M_{c,y,Rd}$	55.7	55.7	55.7	55.7	55.7	55.7	45.4	45.4	45.4	45.4			
								$M_{c,z,Rd}$	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7	32.7		
								$M_{N,y,Rd}$	55.7	55.7	55.7	52.0	44.6	37.2	-	-	-	-	-	-	
								$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	
	6.3 #	26.1	1180	n/a	n/a	1.00	1.00	$M_{c,y,Rd}$	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9			
								$M_{c,z,Rd}$	45.4	45.4	45.4	45.4	45.4	45.4	45.4	45.4	45.4	45.4			
								$M_{N,y,Rd}$	68.9	68.9	68.9	64.3	55.1	45.9	36.7	27.5	18.4	9.18	0		
								$M_{N,z,Rd}$	45.4	45.4	43.2	37.8	32.4	27.0	21.6	16.2	10.8	5.41	0		
7.1 #	29.2	1320	n/a	n/a	1.00	1.00	$M_{c,y,Rd}$	76.3	76.3	76.3	76.3	76.3	76.3	76.3	76.3	76.3	76.3				
							$M_{c,z,Rd}$	50.4	50.4	50.4	50.4	50.4	50.4	50.4	50.4	50.4	50.4				
							$M_{N,y,Rd}$	76.3	76.3	76.3	71.2	61.1	50.9	40.7	30.5	20.4	10.2	0			
							$M_{N,z,Rd}$	50.4	50.4	47.8	41.8	35.9	29.9	23.9	17.9	12.0	5.98	0			
8.0 #	32.6	1480	n/a	n/a	1.00	1.00	$M_{c,y,Rd}$	84.8	84.8	84.8	84.8	84.8	84.8	84.8	84.8	84.8	84.8				
							$M_{c,z,Rd}$	55.7	55.7	55.7	55.7	55.7	55.7	55.7	55.7	55.7	55.7				
							$M_{N,y,Rd}$	84.8	84.8	84.8	79.2	67.9	56.6	45.3	33.9	22.6	11.3	0			
							$M_{N,z,Rd}$	55.7	55.7	52.7	46.1	39.5	32.9	26.3	19.8	13.2	6.59	0			
8.8 #	35.6	1610	n/a	n/a	1.00	1.00	$M_{c,y,Rd}$	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9				
							$M_{c,z,Rd}$	60.4	60.4	60.4	60.4	60.4	60.4	60.4	60.4	60.4	60.4				
							$M_{N,y,Rd}$	91.9	91.9	91.9	85.8	73.6	61.3	49.0	36.8	24.5	12.3	0			
							$M_{N,z,Rd}$	60.4	60.4	56.9	49.8	42.7	35.5	28.4	21.3	14.2	7.11	0			
10.0 #	40.0	1810	n/a	n/a	1.00	1.00	$M_{c,y,Rd}$	102	102	102	102	102	102	102	102	102					
							$M_{c,z,Rd}$	66.7	66.7	66.7	66.7	66.7	66.7	66.7	66.7	66.7	66.7				
							$M_{N,y,Rd}$	102	102	102	95.4	81.8	68.2	54.5	40.9	27.3	13.6	0			
							$M_{N,z,Rd}$	66.7	66.7	62.5	54.7	46.9	39.1	31.3	23.5	15.6	7.82	0			
12.5 #	48.7	2200	n/a	n/a	1.00	1.00	$M_{c,y,Rd}$	122	122	122	122	122	122	122	122	122					
							$M_{c,z,Rd}$	79.2	79.2	79.2	79.2	79.2	79.2	79.2	79.2	79.2	79.2				
							$M_{N,y,Rd}$	122	122	122	114	97.7	81.4	65.1	48.8	32.6	16.3	0			
							$M_{N,z,Rd}$	79.2	79.2	73.4	64.3	55.1	45.9	36.7	27.5	18.4	9.18	0			

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

\* The section is a Class 4 section about the appropriate axis and is independent of the design axial force  $N_{Ed}$ . Values of  $M_{c,Rd}$  are calculated based on Class 4 section properties and are displayed in italics.

$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

✘ Section becomes class 4, see note 10.

§ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

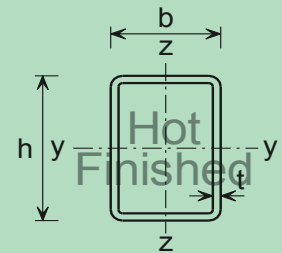
- Not applicable for Class 3 and Class 4 sections.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Member buckling check

Section Designation & Resistances (kNm)		n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm)														
h x b mm	t mm		for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$														
			L (m)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0	
180x100	§ 4.0 # $f_y W_{el,y} = 37.3$ $f_y W_{el,z} = 26.9$	0.720	$N_{b,y,Rd}$	767	750	731	710	684	653	614	516	412	326	260	211	174	
			$N_{b,z,Rd}$	747	716	675	618	544	461	383	266	193	145	113	89.9	73.5	
	5.0 # $f_y W_{el,y} = 45.4$ $f_y W_{el,z} = 32.7$	1.00	$M_{b,Rd}$	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3	37.3
			$M_{b,Rd}$	45.4	45.4	45.4	45.4	45.4	45.4	45.4	45.4	45.4	45.4	45.4	45.4	45.1	44.7
	6.3 # $f_y W_{el,y} = 55.4$ $f_y W_{el,z} = 39.4$	1.00	$N_{b,y,Rd}$	948	927	903	877	844	805	756	633	505	399	318	258	213	
			$N_{b,z,Rd}$	923	884	832	760	666	562	467	324	234	176	137	109	89.1	
	7.1 # $f_y W_{el,y} = 61.4$ $f_y W_{el,z} = 43.7$	1.00	$M_{b,Rd}$	45.4	45.4	45.4	45.4	45.4	45.4	45.4	45.4	45.4	45.4	45.4	45.4	45.4	45.4
			$M_{b,Rd}$	55.7	55.7	55.7	55.7	55.7	55.7	55.7	55.7	55.7	55.7	55.7	55.7	55.3	54.8
	8.0 # $f_y W_{el,y} = 67.5$ $f_y W_{el,z} = 47.6$	1.00	$N_{b,y,Rd}$	1180	1150	1130	1090	1050	999	937	781	620	489	389	316	260	
			$N_{b,z,Rd}$	1150	1100	1030	941	820	688	569	394	284	213	166	132	108	
	8.8 # $f_y W_{el,y} = 72.8$ $f_y W_{el,z} = 51.1$	1.00	$M_{b,Rd}$	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.2	67.6
			$N_{b,y,Rd}$	1320	1290	1260	1220	1170	1110	1040	868	688	542	431	350	288	
	10.0 # $f_y W_{el,y} = 80.2$ $f_y W_{el,z} = 55.7$	1.00	$N_{b,z,Rd}$	1280	1230	1150	1050	909	762	629	434	313	235	183	146	119	
			$M_{b,Rd}$	76.3	76.3	76.3	76.3	76.3	76.3	76.3	76.3	76.3	76.3	76.3	76.3	75.6	74.9
	12.5 # $f_y W_{el,y} = 94.1$ $f_y W_{el,z} = 64.6$	1.00	$N_{b,y,Rd}$	1480	1440	1400	1360	1310	1240	1160	963	761	598	476	385	318	
			$N_{b,z,Rd}$	1430	1370	1280	1160	1010	841	693	477	344	258	200	160	131	
	12.5 # $f_y W_{el,y} = 94.1$ $f_y W_{el,z} = 64.6$	1.00	$M_{b,Rd}$	84.8	84.8	84.8	84.8	84.8	84.8	84.8	84.8	84.8	84.8	84.8	84.0	83.2	
			$N_{b,y,Rd}$	1610	1570	1530	1480	1420	1350	1260	1040	823	646	514	416	343	
12.5 # $f_y W_{el,y} = 94.1$ $f_y W_{el,z} = 64.6$	1.00	$N_{b,z,Rd}$	1560	1490	1400	1260	1090	905	744	512	368	276	215	171	140		
		$M_{b,Rd}$	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.9	91.8	90.9	90.1	
12.5 # $f_y W_{el,y} = 94.1$ $f_y W_{el,z} = 64.6$	1.00	$N_{b,y,Rd}$	1800	1760	1710	1660	1590	1510	1410	1160	910	713	566	458	378		
		$N_{b,z,Rd}$	1750	1670	1560	1400	1200	997	818	561	403	303	235	187	153		
12.5 # $f_y W_{el,y} = 94.1$ $f_y W_{el,z} = 64.6$	1.00	$M_{b,Rd}$	102	102	102	102	102	102	102	102	102	102	102	101	100		
		$N_{b,y,Rd}$	2200	2150	2090	2020	1930	1830	1700	1380	1080	842	668	540	444		
12.5 # $f_y W_{el,y} = 94.1$ $f_y W_{el,z} = 64.6$	1.00	$N_{b,z,Rd}$	2130	2030	1880	1680	1420	1170	954	651	467	350	271	217	177		
		$M_{b,Rd}$	122	122	122	122	122	122	122	122	122	122	122	120	119		

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

$$n = N_{Ed} / N_{pl,Rd}$$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

Axial force resistance  $N_{pl,Rd}$  which is equal to  $Af_y$  is given in the cross-section resistance check table opposite.

§ The section can be a Class 4 section but no allowance has been made in calculating  $N_{b,y,Rd}$  and  $N_{b,z,Rd}$ .

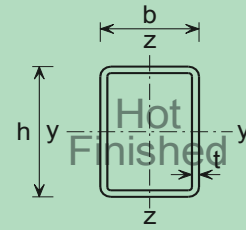
# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.



HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n Limit Class 3 Class 2		Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$																						
h x b mm	t mm			Axis		n	0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0																					
				y-y	z-z																							
200x100	4.0 #	18.2	824	0.591	*	$M_{c,y,Rd}$	53.3	53.3	53.3	43.3	43.3	43.3	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘				
						$M_{c,z,Rd}$	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	
						$M_{N,y,Rd}$	53.3	53.3	53.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5.0	22.6	22.6	1020	0.885	*	$M_{c,y,Rd}$	65.7	65.7	65.7	65.7	65.7	52.9	52.9	52.9	52.9	52.9	52.9	✘	✘	✘	✘	✘	✘	✘				
						$M_{c,z,Rd}$	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	
						$M_{N,y,Rd}$	65.7	65.7	65.7	61.3	52.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6.3	28.1	28.1	1270	n/a	n/a	$M_{c,y,Rd}$	80.9	80.9	80.9	80.9	80.9	80.9	80.9	80.9	80.9	80.9	80.9	80.9	80.9	80.9	80.9	80.9	80.9	80.9				
						$M_{c,z,Rd}$	49.7	49.7	49.7	49.7	49.7	49.7	49.7	49.7	49.7	49.7	49.7	49.7	49.7	49.7	49.7	49.7	49.7	49.7	49.7	49.7	49.7	
						$M_{N,y,Rd}$	80.9	80.9	80.9	75.5	64.8	54.0	43.2	32.4	21.6	10.8	0	-	-	-	-	-	-	-	-	-	-	-
						$M_{N,z,Rd}$	49.7	49.7	46.7	40.8	35.0	29.2	23.3	17.5	11.7	5.83	0	-	-	-	-	-	-	-	-	-	-	-
7.1 #	31.4	31.4	1420	n/a	n/a	$M_{c,y,Rd}$	90.2	90.2	90.2	90.2	90.2	90.2	90.2	90.2	90.2	90.2	90.2	90.2	90.2	90.2	90.2	90.2	90.2	90.2				
						$M_{c,z,Rd}$	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	
						$M_{N,y,Rd}$	90.2	90.2	90.2	84.2	72.1	60.1	48.1	36.1	24.0	12.0	0	-	-	-	-	-	-	-	-	-	-	-
						$M_{N,z,Rd}$	55.0	55.0	51.5	45.0	38.6	32.2	25.7	19.3	12.9	6.44	0	-	-	-	-	-	-	-	-	-	-	-
8.0	35.1	35.1	1590	n/a	n/a	$M_{c,y,Rd}$	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100			
						$M_{c,z,Rd}$	61.1	61.1	61.1	61.1	61.1	61.1	61.1	61.1	61.1	61.1	61.1	61.1	61.1	61.1	61.1	61.1	61.1	61.1	61.1	61.1	61.1	
						$M_{N,y,Rd}$	100	100	100	93.4	80.1	66.7	53.4	40.0	26.7	13.3	0	-	-	-	-	-	-	-	-	-	-	-
						$M_{N,z,Rd}$	61.1	61.1	57.0	49.9	42.7	35.6	28.5	21.4	14.2	7.12	0	-	-	-	-	-	-	-	-	-	-	-
8.8 #	38.4	38.4	1740	n/a	n/a	$M_{c,y,Rd}$	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109	109				
						$M_{c,z,Rd}$	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	66.0	
						$M_{N,y,Rd}$	109	109	109	101	86.9	72.4	57.9	43.5	29.0	14.5	0	-	-	-	-	-	-	-	-	-	-	-
						$M_{N,z,Rd}$	66.0	66.0	61.4	53.8	46.1	38.4	30.7	23.0	15.4	7.68	0	-	-	-	-	-	-	-	-	-	-	-
10.0	43.1	43.1	1950	n/a	n/a	$M_{c,y,Rd}$	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121	121				
						$M_{c,z,Rd}$	73.1	73.1	73.1	73.1	73.1	73.1	73.1	73.1	73.1	73.1	73.1	73.1	73.1	73.1	73.1	73.1	73.1	73.1	73.1	73.1	73.1	
						$M_{N,y,Rd}$	121	121	121	113	96.8	80.7	64.6	48.4	32.3	16.1	0	-	-	-	-	-	-	-	-	-	-	-
						$M_{N,z,Rd}$	73.1	73.1	67.7	59.2	50.8	42.3	33.8	25.4	16.9	8.46	0	-	-	-	-	-	-	-	-	-	-	-
12.5	52.7	52.7	2380	n/a	n/a	$M_{c,y,Rd}$	145	145	145	145	145	145	145	145	145	145	145	145	145	145	145	145	145	145				
						$M_{c,z,Rd}$	87.0	87.0	87.0	87.0	87.0	87.0	87.0	87.0	87.0	87.0	87.0	87.0	87.0	87.0	87.0	87.0	87.0	87.0	87.0	87.0	87.0	
						$M_{N,y,Rd}$	145	145	145	135	116	96.6	77.2	57.9	38.6	19.3	0	-	-	-	-	-	-	-	-	-	-	-
						$M_{N,z,Rd}$	87.0	87.0	79.7	69.8	59.8	49.8	39.9	29.9	19.9	9.97	0	-	-	-	-	-	-	-	-	-	-	-
14.2 #	58.9	58.9	2660	n/a	n/a	$M_{c,y,Rd}$	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160	160				
						$M_{c,z,Rd}$	95.1	95.1	95.1	95.1	95.1	95.1	95.1	95.1	95.1	95.1	95.1	95.1	95.1	95.1	95.1	95.1	95.1	95.1	95.1	95.1	95.1	
						$M_{N,y,Rd}$	160	160	160	149	128	107	85.2	63.9	42.6	21.3	0	-	-	-	-	-	-	-	-	-	-	-
						$M_{N,z,Rd}$	95.1	95.1	86.6	75.8	65.0	54.1	43.3	32.5	21.7	10.8	0	-	-	-	-	-	-	-	-	-	-	-
16.0 #	65.2	65.2	2950	n/a	n/a	$M_{c,y,Rd}$	174	174	174	174	174	174	174	174	174	174	174	174	174	174	174	174	174	174				
						$M_{c,z,Rd}$	103	103	103	103	103	103	103	103	103	103	103	103	103	103	103	103	103	103	103	103	103	
						$M_{N,y,Rd}$	174	174	174	163	139	116	93.0	69.7	46.5	23.2	0	-	-	-	-	-	-	-	-	-	-	-
						$M_{N,z,Rd}$	103	103	93.0	81.4	69.8	58.1	46.5	34.9	23.3	11.6	0	-	-	-	-	-	-	-	-	-	-	-

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

\* The section is a Class 4 section about the appropriate axis and is independent of the design axial force  $N_{Ed}$ . Values of  $M_{c,Rd}$  are calculated based on Class 4 section properties and are displayed in italics.

$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

✘ Section becomes class 4, see note 10.

\$ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

- Not applicable for Class 3 and Class 4 sections.

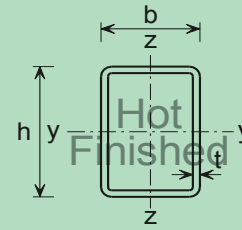
# Check availability r External corner radius > 2t but ≤ 3t

FOR EXPLANATION OF TABLES SEE NOTE 10.



HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Member buckling check

Section Designation & Resistances (kNm)		n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$														
h x b mm	t mm		L (m)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0	
200x100	§ 4.0 # $f_y W_{el,y} = 43.3$ $f_y W_{el,z} = 29.5$	0.591	$N_{b,y,Rd}$	824	811	793	773	750	723	690	604	501	405	328	268	222	
			$N_{b,z,Rd}$	803	770	727	668	590	502	419	292	211	159	124	98.8	80.7	
	§ 5.0 $f_y W_{el,y} = 52.9$ $f_y W_{el,z} = 35.9$	0.591	$M_{b,Rd}$	43.3	43.3	43.3	43.3	43.3	43.3	43.3	43.3	43.3	43.3	43.3	43.3	43.2	
			<b>0.239</b> $M_{b,Rd}$	53.3	53.3	53.3	53.3	53.3	53.3	53.3	53.3	53.3	53.3	53.3	53.2	52.7	52.2
	6.3 $f_y W_{el,y} = 65.0$ $f_y W_{el,z} = 43.7$	1.00	$N_{b,y,Rd}$	1270	1250	1220	1190	1150	1110	1060	920	759	611	493	402	333	
			$N_{b,z,Rd}$	1240	1180	1110	1020	891	752	624	432	312	235	182	146	119	
	7.1 # $f_y W_{el,y} = 71.7$ $f_y W_{el,z} = 47.9$	1.00	$N_{b,y,Rd}$	1420	1400	1360	1330	1290	1240	1180	1020	842	677	546	445	368	
			$N_{b,z,Rd}$	1380	1320	1240	1130	987	830	686	475	343	257	200	160	130	
	8.0 $f_y W_{el,y} = 79.2$ $f_y W_{el,z} = 52.5$	1.00	$M_{b,Rd}$	90.2	90.2	90.2	90.2	90.2	90.2	90.2	90.2	90.2	90.2	90.2	89.8	88.9	88.1
			$N_{b,y,Rd}$	1590	1560	1530	1490	1440	1380	1320	1140	934	750	604	492	407	
	8.8 # $f_y W_{el,y} = 85.6$ $f_y W_{el,z} = 56.4$	1.00	$N_{b,z,Rd}$	1550	1480	1390	1260	1090	917	757	523	377	283	220	176	143	
			$M_{b,Rd}$	100	100	100	100	100	100	100	100	100	100	100	99.7	98.7	97.7
	10.0 $f_y W_{el,y} = 94.4$ $f_y W_{el,z} = 61.8$	1.00	$N_{b,y,Rd}$	1740	1710	1670	1620	1570	1510	1430	1240	1010	811	653	532	440	
			$N_{b,z,Rd}$	1690	1610	1510	1370	1190	991	817	564	406	305	237	189	154	
	12.5 $f_y W_{el,y} = 111$ $f_y W_{el,z} = 71.4$	1.00	$M_{b,Rd}$	109	109	109	109	109	109	109	109	109	109	109	108	107	106
			$N_{b,y,Rd}$	1950	1910	1870	1820	1760	1690	1600	1380	1120	899	722	588	486	
	14.2 # $f_y W_{el,y} = 121$ $f_y W_{el,z} = 76.7$	1.00	$N_{b,z,Rd}$	1890	1810	1690	1530	1320	1090	900	619	445	334	259	207	169	
			$M_{b,Rd}$	121	121	121	121	121	121	121	121	121	121	121	120	119	118
	16.0 # r $f_y W_{el,y} = 131$ $f_y W_{el,z} = 81.3$	1.00	$N_{b,y,Rd}$	2380	2340	2280	2220	2140	2050	1940	1660	1340	1070	857	697	576	
			$N_{b,z,Rd}$	2310	2200	2050	1830	1560	1290	1050	720	517	387	301	240	196	
	16.0 # r $f_y W_{el,y} = 131$ $f_y W_{el,z} = 81.3$	1.00	$M_{b,Rd}$	145	145	145	145	145	145	145	145	145	145	144	142	141	
			$N_{b,y,Rd}$	2660	2610	2550	2470	2390	2280	2150	1830	1470	1170	936	761	628	
	16.0 # r $f_y W_{el,y} = 131$ $f_y W_{el,z} = 81.3$	1.00	$N_{b,z,Rd}$	2570	2450	2270	2020	1710	1400	1140	779	558	418	325	259	211	
			$M_{b,Rd}$	160	160	160	160	160	160	160	160	160	160	160	158	157	155
16.0 # r $f_y W_{el,y} = 131$ $f_y W_{el,z} = 81.3$	1.00	$N_{b,y,Rd}$	2950	2880	2810	2730	2630	2510	2370	2000	1600	1270	1010	822	678		
		$N_{b,z,Rd}$	2840	2700	2490	2200	1850	1500	1220	830	594	445	345	275	224		
16.0 # r $f_y W_{el,y} = 131$ $f_y W_{el,z} = 81.3$	1.00	$M_{b,Rd}$	174	174	174	174	174	174	174	174	174	174	172	171	169		

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

$$n = N_{Ed} / N_{pl,Rd}$$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

Axial force resistance  $N_{pl,Rd}$  which is equal to  $Af_y$  is given in the cross-section resistance check table opposite.

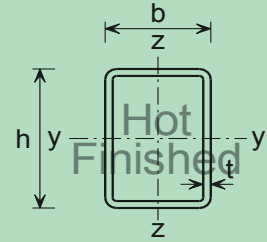
§ The section can be a Class 4 section but no allowance has been made in calculating  $N_{b,y,Rd}$  and  $N_{b,z,Rd}$ .

# Check availability r External corner radius > 2t but ≤ 3t

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n Limit Class 3 Class 2		Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$											
h x b mm	t mm			y-y	z-z	n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
200x120	5.0 #	24.1	1090				0.885	*	<i><math>M_{c,y,Rd}</math></i>	72.8	72.8	72.8	72.8	72.8	59.6	59.6	59.6
				0.420		<i><math>M_{c,z,Rd}</math></i>	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	\$
						<i><math>M_{N,y,Rd}</math></i>	72.8	72.8	72.8	67.9	58.2	-	-	-	-	-	-
						<i><math>M_{N,z,Rd}</math></i>	-	-	-	-	-	-	-	-	-	-	-
	6.3	30.1	1360	n/a	n/a	<i><math>M_{c,y,Rd}</math></i>	89.8	89.8	89.8	89.8	89.8	89.8	89.8	89.8	89.8	89.8	89.8
				1.00	1.00	<i><math>M_{c,z,Rd}</math></i>	62.8	62.8	62.8	62.8	62.8	62.8	62.8	62.8	62.8	62.8	62.8
						<i><math>M_{N,y,Rd}</math></i>	89.8	89.8	89.8	83.8	71.9	59.9	47.9	35.9	24.0	12.0	0
						<i><math>M_{N,z,Rd}</math></i>	62.8	62.8	60.6	53.1	45.5	37.9	30.3	22.7	15.2	7.58	0
	7.1 #	33.7	1520	n/a	n/a	<i><math>M_{c,y,Rd}</math></i>	99.8	99.8	99.8	99.8	99.8	99.8	99.8	99.8	99.8	99.8	99.8
				1.00	1.00	<i><math>M_{c,z,Rd}</math></i>	69.9	69.9	69.9	69.9	69.9	69.9	69.9	69.9	69.9	69.9	69.9
					<i><math>M_{N,y,Rd}</math></i>	99.8	99.8	99.8	93.1	79.8	66.5	53.2	39.9	26.6	13.3	0	
					<i><math>M_{N,z,Rd}</math></i>	69.9	69.9	67.3	58.9	50.5	42.1	33.7	25.2	16.8	8.42	0	
8.0	37.6	1700	n/a	n/a	<i><math>M_{c,y,Rd}</math></i>	111	111	111	111	111	111	111	111	111	111	111	
			1.00	1.00	<i><math>M_{c,z,Rd}</math></i>	77.4	77.4	77.4	77.4	77.4	77.4	77.4	77.4	77.4	77.4	77.4	
					<i><math>M_{N,y,Rd}</math></i>	111	111	111	104	88.9	74.1	59.3	44.4	29.6	14.8	0	
					<i><math>M_{N,z,Rd}</math></i>	77.4	77.4	74.3	65.0	55.7	46.4	37.1	27.9	18.6	9.29	0	
8.8 #	41.1	1860	n/a	n/a	<i><math>M_{c,y,Rd}</math></i>	121	121	121	121	121	121	121	121	121	121	121	
			1.00	1.00	<i><math>M_{c,z,Rd}</math></i>	84.1	84.1	84.1	84.1	84.1	84.1	84.1	84.1	84.1	84.1	84.1	
					<i><math>M_{N,y,Rd}</math></i>	121	121	121	113	96.6	80.5	64.4	48.3	32.2	16.1	0	
					<i><math>M_{N,z,Rd}</math></i>	84.1	84.1	80.5	70.5	60.4	50.3	40.3	30.2	20.1	10.1	0	
10.0	46.3	2090	n/a	n/a	<i><math>M_{c,y,Rd}</math></i>	135	135	135	135	135	135	135	135	135	135	135	
			1.00	1.00	<i><math>M_{c,z,Rd}</math></i>	93.4	93.4	93.4	93.4	93.4	93.4	93.4	93.4	93.4	93.4	93.4	
					<i><math>M_{N,y,Rd}</math></i>	135	135	135	126	108	89.7	71.8	53.8	35.9	17.9	0	
					<i><math>M_{N,z,Rd}</math></i>	93.4	93.4	89.0	77.8	66.7	55.6	44.5	33.4	22.2	11.1	0	
12.5 #	56.6	2560	n/a	n/a	<i><math>M_{c,y,Rd}</math></i>	162	162	162	162	162	162	162	162	162	162	162	
			1.00	1.00	<i><math>M_{c,z,Rd}</math></i>	111	111	111	111	111	111	111	111	111	111	111	
					<i><math>M_{N,y,Rd}</math></i>	162	162	162	151	129	108	86.1	64.6	43.1	21.5	0	
					<i><math>M_{N,z,Rd}</math></i>	111	111	105	92.2	79.0	65.8	52.7	39.5	26.3	13.2	0	
14.2 #	63.3	2860	n/a	n/a	<i><math>M_{c,y,Rd}</math></i>	179	179	179	179	179	179	179	179	179	179	179	
			1.00	1.00	<i><math>M_{c,z,Rd}</math></i>	123	123	123	123	123	123	123	123	123	123	123	
					<i><math>M_{N,y,Rd}</math></i>	179	179	179	167	143	119	95.2	71.4	47.6	23.8	0	
					<i><math>M_{N,z,Rd}</math></i>	123	123	115	101	86.5	72.1	57.7	43.3	28.8	14.4	0	
16.0 #	70.2	3170	n/a	n/a	<i><math>M_{c,y,Rd}</math></i>	195	195	195	195	195	195	195	195	195	195	195	
			1.00	1.00	<i><math>M_{c,z,Rd}</math></i>	134	134	134	134	134	134	134	134	134	134	134	
					<i><math>M_{N,y,Rd}</math></i>	195	195	195	182	156	130	104	78.1	52.1	26.0	0	
					<i><math>M_{N,z,Rd}</math></i>	134	134	125	109	93.6	78.0	62.4	46.8	31.2	15.6	0	

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\* The section is a Class 4 section about the appropriate axis and is independent of the design axial force  $N_{Ed}$ . Values of  $M_{c,Rd}$  are calculated based on Class 4 section properties and are displayed in italics.

$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

✘ Section becomes class 4, see note 10.

\$ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

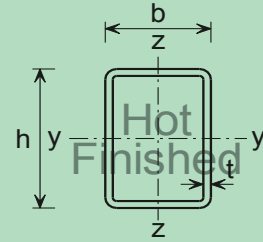
- Not applicable for Class 3 and Class 4 sections.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Member buckling check

Section Designation & Resistances (kNm)		n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$														
h x b mm	t mm		L (m)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0	
200x120	§ 5.0 # $f_y W_{el,y} = 59.6$ $f_y W_{el,z} = 45.1$	0.885	$N_{b,y,Rd}$	1090	1070	1050	1030	997	962	920	811	679	552	448	366	304	
			$N_{b,z,Rd}$	1070	1040	998	945	874	785	686	504	372	283	221	178	145	
		0.420	$M_{b,Rd}$	59.6	59.6	59.6	59.6	59.6	59.6	59.6	59.6	59.6	59.6	59.6	59.6	59.6	59.6
			$M_{b,Rd}$	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8	72.8
	6.3 $f_y W_{el,y} = 73.5$ $f_y W_{el,z} = 55.0$	1.00	$N_{b,y,Rd}$	1360	1340	1310	1280	1240	1200	1140	1010	839	680	551	451	374	
			$N_{b,z,Rd}$	1340	1300	1240	1170	1080	970	844	617	455	345	270	216	177	
		1.00	$M_{b,Rd}$	89.8	89.8	89.8	89.8	89.8	89.8	89.8	89.8	89.8	89.8	89.8	89.8	89.8	89.8
			$M_{b,Rd}$	89.8	89.8	89.8	89.8	89.8	89.8	89.8	89.8	89.8	89.8	89.8	89.8	89.8	89.8
	7.1 # $f_y W_{el,y} = 81.3$ $f_y W_{el,z} = 60.7$	1.00	$N_{b,y,Rd}$	1520	1500	1470	1430	1390	1340	1280	1120	933	756	611	500	414	
			$N_{b,z,Rd}$	1500	1450	1390	1310	1210	1080	938	684	504	383	299	240	196	
		1.00	$M_{b,Rd}$	99.8	99.8	99.8	99.8	99.8	99.8	99.8	99.8	99.8	99.8	99.8	99.8	99.8	99.7
			$M_{b,Rd}$	99.8	99.8	99.8	99.8	99.8	99.8	99.8	99.8	99.8	99.8	99.8	99.8	99.8	99.7
	8.0 $f_y W_{el,y} = 89.8$ $f_y W_{el,z} = 66.7$	1.00	$N_{b,y,Rd}$	1700	1680	1640	1600	1550	1500	1430	1250	1040	839	678	554	459	
			$N_{b,z,Rd}$	1680	1620	1550	1460	1350	1200	1040	756	556	422	329	264	216	
		1.00	$M_{b,Rd}$	111	111	111	111	111	111	111	111	111	111	111	111	111	111
			$M_{b,Rd}$	111	111	111	111	111	111	111	111	111	111	111	111	111	111
8.8 # $f_y W_{el,y} = 96.9$ $f_y W_{el,z} = 72.1$	1.00	$N_{b,y,Rd}$	1860	1830	1790	1750	1690	1630	1550	1360	1120	908	733	599	496		
		$N_{b,z,Rd}$	1830	1770	1690	1590	1460	1300	1130	817	600	455	356	285	233		
	1.00	$M_{b,Rd}$	121	121	121	121	121	121	121	121	121	121	121	121	121	121	
		$M_{b,Rd}$	121	121	121	121	121	121	121	121	121	121	121	121	121	121	
10.0 $f_y W_{el,y} = 108$ $f_y W_{el,z} = 79.2$	1.00	$N_{b,y,Rd}$	2090	2060	2010	1960	1900	1830	1740	1520	1250	1010	815	665	551		
		$N_{b,z,Rd}$	2060	1990	1900	1780	1630	1450	1250	900	660	500	390	313	256		
	1.00	$M_{b,Rd}$	135	135	135	135	135	135	135	135	135	135	135	135	135	134	
		$M_{b,Rd}$	135	135	135	135	135	135	135	135	135	135	135	135	135	134	
12.5 # $f_y W_{el,y} = 127$ $f_y W_{el,z} = 92.3$	1.00	$N_{b,y,Rd}$	2560	2510	2460	2390	2320	2230	2110	1830	1500	1200	967	788	652		
		$N_{b,z,Rd}$	2510	2420	2310	2170	1970	1730	1480	1060	778	589	459	368	301		
	1.00	$M_{b,Rd}$	162	162	162	162	162	162	162	162	162	162	162	162	162	161	
		$M_{b,Rd}$	162	162	162	162	162	162	162	162	162	162	162	162	162	161	
14.2 # $f_y W_{el,y} = 139$ $f_y W_{el,z} = 100$	1.00	$N_{b,y,Rd}$	2860	2810	2750	2670	2590	2480	2350	2030	1650	1320	1060	865	715		
		$N_{b,z,Rd}$	2810	2710	2580	2410	2180	1910	1620	1160	845	638	498	398	326		
	1.00	$M_{b,Rd}$	179	179	179	179	179	179	179	179	179	179	179	179	179	178	
		$M_{b,Rd}$	179	179	179	179	179	179	179	179	179	179	179	179	179	178	
16.0 # $f_y W_{el,y} = 150$ $f_y W_{el,z} = 107$	1.00	$N_{b,y,Rd}$	3170	3110	3040	2960	2860	2740	2590	2220	1800	1430	1150	936	773		
		$N_{b,z,Rd}$	3110	2990	2850	2650	2390	2070	1760	1250	907	684	533	427	349		
	1.00	$M_{b,Rd}$	195	195	195	195	195	195	195	195	195	195	195	195	195	194	
		$M_{b,Rd}$	195	195	195	195	195	195	195	195	195	195	195	195	195	194	

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

$n = N_{Ed} / N_{pl,Rd}$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

Axial force resistance  $N_{pl,Rd}$  which is equal to  $Af_y$  is given in the cross-section resistance check table opposite.

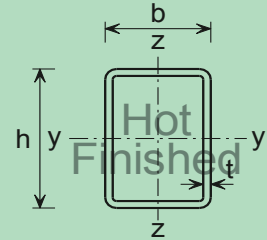
§ The section can be a Class 4 section but no allowance has been made in calculating  $N_{b,y,Rd}$  and  $N_{b,z,Rd}$ .

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n Limit Class 3 Class 2		Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$														
h x b mm	t mm			Axis		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0			
				y-y	z-z															
200x150	5.0 #	26.5	1200	0.885	*	$M_{c,y,Rd}$	83.1	83.1	83.1	83.1	69.9	69.9	69.9	69.9	69.9	✘	\$			
						$M_{c,z,Rd}$	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	\$	
						$M_{N,y,Rd}$	83.1	83.1	83.1	77.5	-	-	-	-	-	-	-	-	-	-
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	6.3 #	33.0	1490	n/a	1.00	n/a	$M_{c,y,Rd}$	103	103	103	103	103	103	103	103	103	103	103		
							$M_{c,z,Rd}$	84.1	84.1	84.1	84.1	84.1	84.1	84.1	84.1	84.1	84.1	84.1	84.1	
							$M_{N,y,Rd}$	103	103	103	95.8	82.1	68.4	54.7	41.0	27.4	13.7	0	0	
							$M_{N,z,Rd}$	84.1	84.1	84.1	73.7	63.2	52.6	42.1	31.6	21.1	10.5	0	0	
	7.1 #	37.0	1670	n/a	1.00	n/a	$M_{c,y,Rd}$	114	114	114	114	114	114	114	114	114	114	114		
							$M_{c,z,Rd}$	93.7	93.7	93.7	93.7	93.7	93.7	93.7	93.7	93.7	93.7	93.7	93.7	
							$M_{N,y,Rd}$	114	114	114	107	91.4	76.2	61.0	45.7	30.5	15.2	0	0	
							$M_{N,z,Rd}$	93.7	93.7	93.5	81.9	70.2	58.5	46.8	35.1	23.4	11.7	0	0	
8.0	41.4	1870	n/a	1.00	n/a	$M_{c,y,Rd}$	127	127	127	127	127	127	127	127	127	127	127			
						$M_{c,z,Rd}$	104	104	104	104	104	104	104	104	104	104	104	104		
						$M_{N,y,Rd}$	127	127	127	119	102	85.0	68.0	51.0	34.0	17.0	0	0		
						$M_{N,z,Rd}$	104	104	104	91.0	78.0	65.0	52.0	39.0	26.0	13.0	0	0		
8.8 #	45.3	2050	n/a	1.00	n/a	$M_{c,y,Rd}$	138	138	138	138	138	138	138	138	138	138	138			
						$M_{c,z,Rd}$	113	113	113	113	113	113	113	113	113	113	113	113		
						$M_{N,y,Rd}$	138	138	138	129	111	92.3	73.8	55.4	36.9	18.5	0	0		
						$M_{N,z,Rd}$	113	113	113	98.5	84.4	70.3	56.3	42.2	28.1	14.1	0	0		
10.0	51.0	2300	n/a	1.00	n/a	$M_{c,y,Rd}$	155	155	155	155	155	155	155	155	155	155	155			
						$M_{c,z,Rd}$	126	126	126	126	126	126	126	126	126	126	126	126		
						$M_{N,y,Rd}$	155	155	155	144	124	103	82.5	61.9	41.3	20.6	0	0		
						$M_{N,z,Rd}$	126	126	125	109	93.8	78.2	62.6	46.9	31.3	15.6	0	0		
12.5 #	62.5	2830	n/a	1.00	n/a	$M_{c,y,Rd}$	186	186	186	186	186	186	186	186	186	186	186			
						$M_{c,z,Rd}$	152	152	152	152	152	152	152	152	152	152	152			
						$M_{N,y,Rd}$	186	186	186	174	149	124	99.4	74.6	49.7	24.9	0	0		
						$M_{N,z,Rd}$	152	152	149	131	112	93.3	74.7	56.0	37.3	18.7	0	0		
14.2 #	70.0	3170	n/a	1.00	n/a	$M_{c,y,Rd}$	207	207	207	207	207	207	207	207	207	207				
						$M_{c,z,Rd}$	168	168	168	168	168	168	168	168	168	168	168			
						$M_{N,y,Rd}$	207	207	207	193	165	138	110	82.6	55.1	27.5	0	0		
						$M_{N,z,Rd}$	168	168	164	144	123	103	82.1	61.6	41.0	20.5	0	0		
16.0 #	77.7	3510	n/a	1.00	n/a	$M_{c,y,Rd}$	226	226	226	226	226	226	226	226	226	226				
						$M_{c,z,Rd}$	184	184	184	184	184	184	184	184	184	184	184			
						$M_{N,y,Rd}$	226	226	226	211	181	151	121	90.6	60.4	30.2	0	0		
						$M_{N,z,Rd}$	184	184	179	156	134	112	89.4	67.0	44.7	22.3	0	0		

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

\* The section is a Class 4 section about the appropriate axis and is independent of the design axial force  $N_{Ed}$ . Values of  $M_{c,Rd}$  are calculated based on Class 4 section properties and are displayed in italics.

$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

✘ Section becomes class 4, see note 10.

\$ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

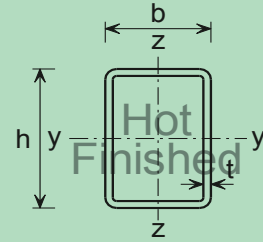
- Not applicable for Class 3 and Class 4 sections.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Member buckling check

Section Designation & Resistances (kNm)		n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$														
h x b mm	t mm		L (m)	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	
200x150	§ 5.0 # $f_y W_{el,y} = 69.9$ $f_y W_{el,z} = 60.0$	0.885	$N_{b,y,Rd}$	1160	1100	1020	911	773	635	518	425	353	297	253	218	190	
			$N_{b,z,Rd}$	1130	1050	912	738	574	447	354	286	235	197	167	143	124	
		0.885	$M_{b,Rd}$	69.9	69.9	69.9	69.9	69.9	69.9	69.9	69.9	69.9	69.9	69.9	69.9	69.9	69.9
			<b>0.382</b>	$M_{b,Rd}$	83.1	83.1	83.1	83.1	83.1	83.1	83.1	83.1	83.1	83.1	83.1	83.1	82.9
	6.3 # $f_y W_{el,y} = 85.9$ $f_y W_{el,z} = 73.5$	1.00	$N_{b,y,Rd}$	1440	1370	1270	1130	957	784	638	524	435	366	312	269	234	
			$N_{b,z,Rd}$	1410	1300	1130	913	708	551	436	352	290	242	205	176	153	
		<b>1.00</b>	$M_{b,Rd}$	103	103	103	103	103	103	103	103	103	103	103	103	103	102
	7.1 # $f_y W_{el,y} = 95.1$ $f_y W_{el,z} = 81.3$	1.00	$N_{b,y,Rd}$	1620	1530	1420	1260	1070	872	710	582	483	407	346	298	259	
			$N_{b,z,Rd}$	1580	1450	1260	1010	784	609	482	389	320	268	227	195	169	
		<b>1.00</b>	$M_{b,Rd}$	114	114	114	114	114	114	114	114	114	114	114	114	114	
	8.0 $f_y W_{el,y} = 105$ $f_y W_{el,z} = 89.8$	1.00	$N_{b,y,Rd}$	1810	1720	1590	1410	1190	968	787	645	536	450	384	330	287	
			$N_{b,z,Rd}$	1770	1630	1410	1130	870	675	534	431	354	296	251	216	187	
		<b>1.00</b>	$M_{b,Rd}$	127	127	127	127	127	127	127	127	127	127	127	127	127	
	8.8 # $f_y W_{el,y} = 114$ $f_y W_{el,z} = 96.9$	1.00	$N_{b,y,Rd}$	1980	1880	1740	1540	1290	1050	854	700	581	489	416	358	311	
			$N_{b,z,Rd}$	1930	1770	1530	1220	943	731	578	467	384	321	272	233	202	
		<b>1.00</b>	$M_{b,Rd}$	138	138	138	138	138	138	138	138	138	138	138	138	138	
10.0 $f_y W_{el,y} = 127$ $f_y W_{el,z} = 107$	1.00	$N_{b,y,Rd}$	2220	2110	1950	1720	1440	1170	948	776	644	542	461	397	345		
		$N_{b,z,Rd}$	2170	1990	1710	1360	1050	811	641	517	425	355	301	258	224		
	<b>1.00</b>	$M_{b,Rd}$	155	155	155	155	155	155	155	155	155	155	155	155	154		
12.5 # $f_y W_{el,y} = 151$ $f_y W_{el,z} = 126$	1.00	$N_{b,y,Rd}$	2720	2580	2370	2080	1730	1400	1130	928	769	646	550	473	411		
		$N_{b,z,Rd}$	2650	2430	2070	1630	1250	963	760	612	503	420	356	305	265		
	<b>1.00</b>	$M_{b,Rd}$	186	186	186	186	186	186	186	186	186	186	186	186	186		
14.2 # $f_y W_{el,y} = 165$ $f_y W_{el,z} = 138$	1.00	$N_{b,y,Rd}$	3050	2880	2650	2310	1910	1550	1250	1020	845	710	604	519	451		
		$N_{b,z,Rd}$	2970	2700	2290	1790	1370	1050	830	669	549	459	389	333	289		
	<b>1.00</b>	$M_{b,Rd}$	207	207	207	207	207	207	207	207	207	207	207	207	205		
16.0 # $f_y W_{el,y} = 179$ $f_y W_{el,z} = 149$	1.00	$N_{b,y,Rd}$	3380	3190	2920	2540	2090	1680	1360	1110	916	770	654	563	489		
		$N_{b,z,Rd}$	3290	2990	2510	1950	1480	1140	898	723	593	496	420	360	312		
	<b>1.00</b>	$M_{b,Rd}$	226	226	226	226	226	226	226	226	226	226	226	226	225		

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

$n = N_{Ed} / N_{pl,Rd}$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

Axial force resistance  $N_{pl,Rd}$  which is equal to  $Af_y$  is given in the cross-section resistance check table opposite.

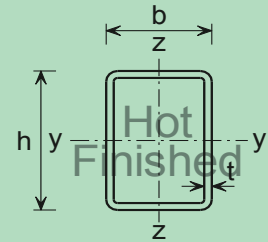
§ The section can be a Class 4 section but no allowance has been made in calculating  $N_{b,y,Rd}$  and  $N_{b,z,Rd}$ .

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n Limit		Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$														
h x b mm	t mm			Class 3	Class 2	n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0			
				Axis																
				y-y	z-z															
220x120	5.0 #	25.7	1160	0.750	*	$M_{c,y,Rd}$	83.8	83.8	83.8	83.8	68.5	68.5	68.5	68.5	✗	✗	\$			
						$M_{c,z,Rd}$	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	\$	
						$M_{N,y,Rd}$	83.8	83.8	83.8	78.2	-	-	-	-	-	-	-	-	-	-
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	6.3 #	32.0	1450	1.00	1.00	$M_{c,y,Rd}$	104	104	104	104	104	104	84.1	84.1	84.1	84.1	84.1			
						$M_{c,z,Rd}$	59.6	59.6	59.6	59.6	59.6	59.6	59.6	59.6	59.6	59.6	59.6			
						$M_{N,y,Rd}$	104	104	104	96.7	82.9	69.1	-	-	-	-	-	-		
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-		
	7.1 #	35.9	1620	n/a	n/a	$M_{c,y,Rd}$	116	116	116	116	116	116	116	116	116	116	116			
						$M_{c,z,Rd}$	75.6	75.6	75.6	75.6	75.6	75.6	75.6	75.6	75.6	75.6	75.6			
						$M_{N,y,Rd}$	116	116	116	108	92.6	77.2	61.7	46.3	30.9	15.4	0			
						$M_{N,z,Rd}$	75.6	75.6	71.9	62.9	53.9	44.9	35.9	26.9	18.0	8.98	0			
8.0 #	40.2	1820	n/a	n/a	$M_{c,y,Rd}$	129	129	129	129	129	129	129	129	129	129	129				
					$M_{c,z,Rd}$	83.8	83.8	83.8	83.8	83.8	83.8	83.8	83.8	83.8	83.8	83.8				
					$M_{N,y,Rd}$	129	129	129	120	103	85.7	68.5	51.4	34.3	17.1	0				
					$M_{N,z,Rd}$	83.8	83.8	79.4	69.5	59.6	49.6	39.7	29.8	19.9	9.93	0				
8.8 #	43.9	1980	n/a	n/a	$M_{c,y,Rd}$	140	140	140	140	140	140	140	140	140	140	140				
					$M_{c,z,Rd}$	90.9	90.9	90.9	90.9	90.9	90.9	90.9	90.9	90.9	90.9	90.9				
					$M_{N,y,Rd}$	140	140	140	131	112	93.2	74.6	55.9	37.3	18.6	0				
					$M_{N,z,Rd}$	90.9	90.9	85.9	75.2	64.4	53.7	43.0	32.2	21.5	10.7	0				
10.0 #	49.4	2230	n/a	n/a	$M_{c,y,Rd}$	156	156	156	156	156	156	156	156	156	156	156				
					$M_{c,z,Rd}$	101	101	101	101	101	101	101	101	101	101	101				
					$M_{N,y,Rd}$	156	156	156	146	125	104	83.3	62.5	41.7	20.8	0				
					$M_{N,z,Rd}$	101	101	95.3	83.3	71.4	59.5	47.6	35.7	23.8	11.9	0				
12.5 #	60.5	2740	n/a	n/a	$M_{c,y,Rd}$	188	188	188	188	188	188	188	188	188	188	188				
					$M_{c,z,Rd}$	121	121	121	121	121	121	121	121	121	121	121				
					$M_{N,y,Rd}$	188	188	188	176	151	125	100	75.3	50.2	25.1	0				
					$M_{N,z,Rd}$	121	121	113	98.9	84.8	70.7	56.5	42.4	28.3	14.1	0				
14.2 #	67.8	3060	n/a	n/a	$M_{c,y,Rd}$	208	208	208	208	208	208	208	208	208	208	208				
					$M_{c,z,Rd}$	133	133	133	133	133	133	133	133	133	133	133				
					$M_{N,y,Rd}$	208	208	208	194	166	139	111	83.2	55.5	27.7	0				
					$M_{N,z,Rd}$	133	133	124	108	92.9	77.4	61.9	46.5	31.0	15.5	0				
16.0 #	75.2	3400	n/a	n/a	$M_{c,y,Rd}$	228	228	228	228	228	228	228	228	228	228	228				
					$M_{c,z,Rd}$	146	146	146	146	146	146	146	146	146	146	146				
					$M_{N,y,Rd}$	228	228	228	213	183	152	122	91.3	60.9	30.4	0				
					$M_{N,z,Rd}$	146	146	134	117	101	83.9	67.1	50.3	33.6	16.8	0				

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\* The section is a Class 4 section about the appropriate axis and is independent of the design axial force  $N_{Ed}$ . Values of  $M_{c,Rd}$  are calculated based on Class 4 section properties and are displayed in italics.

$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

✗ Section becomes class 4, see note 10.

\$ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

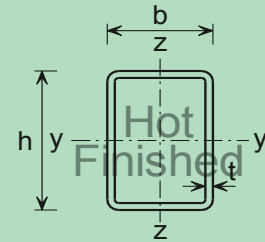
- Not applicable for Class 3 and Class 4 sections.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Member buckling check

Section Designation & Resistances (kNm)		n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
h x b mm	t mm		L (m)	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
220x120	§ 5.0 # $f_y W_{el,y} = 68.5$ $f_y W_{el,z} = 49.0$	0.750	$N_{b,y,Rd}$	1130	1080	1010	916	793	663	547	452	377	318	271	234	204
			$N_{b,z,Rd}$	1070	936	739	545	404	307	240	193	158	132	111	95.4	82.6
	0.342	$M_{b,Rd}$	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.0	67.6
		$M_{b,Rd}$	83.8	83.8	83.8	83.8	83.8	83.8	83.8	83.8	83.8	83.6	83.0	82.4	81.7	81.2
	6.3 # $f_y W_{el,y} = 84.1$ $f_y W_{el,z} = 59.6$	1.00	$N_{b,y,Rd}$	1410	1340	1260	1140	983	819	674	557	464	392	334	288	251
			$N_{b,z,Rd}$	1330	1160	912	670	495	376	294	236	193	161	136	117	101
	0.585	$M_{b,Rd}$	84.1	84.1	84.1	84.1	84.1	84.1	84.1	84.1	84.1	84.1	84.1	84.1	83.5	83.0
		$M_{b,Rd}$	104	104	104	104	104	104	104	104	104	103	103	102	101	100
	7.1 # $f_y W_{el,y} = 93.4$ $f_y W_{el,z} = 66.0$	1.00	$N_{b,y,Rd}$	1570	1500	1410	1270	1090	911	749	618	515	435	371	320	278
			$N_{b,z,Rd}$	1480	1300	1010	741	547	415	325	260	213	178	150	129	111
	1.00	$M_{b,Rd}$	116	116	116	116	116	116	116	116	116	115	114	114	113	112
	8.0 # $f_y W_{el,y} = 103$ $f_y W_{el,z} = 72.8$	1.00	$N_{b,y,Rd}$	1760	1680	1570	1420	1220	1010	831	685	571	481	411	354	308
			$N_{b,z,Rd}$	1660	1440	1120	819	604	458	358	287	235	196	166	142	123
	1.00	$M_{b,Rd}$	129	129	129	129	129	129	129	129	129	128	127	126	125	124
	8.8 # $f_y W_{el,y} = 112$ $f_y W_{el,z} = 78.5$	1.00	$N_{b,y,Rd}$	1920	1830	1710	1540	1320	1100	900	742	618	521	444	383	333
			$N_{b,z,Rd}$	1810	1570	1220	886	652	495	387	310	254	211	179	153	133
	1.00	$M_{b,Rd}$	140	140	140	140	140	140	140	140	140	139	138	137	136	135
	10.0 # $f_y W_{el,y} = 124$ $f_y W_{el,z} = 86.3$	1.00	$N_{b,y,Rd}$	2160	2060	1920	1730	1480	1220	1000	826	687	579	494	426	370
			$N_{b,z,Rd}$	2030	1760	1350	977	718	544	425	341	279	232	196	168	146
	1.00	$M_{b,Rd}$	156	156	156	156	156	156	156	156	156	155	154	153	152	151
12.5 # $f_y W_{el,y} = 147$ $f_y W_{el,z} = 101$	1.00	$N_{b,y,Rd}$	2650	2520	2340	2090	1780	1470	1200	983	818	689	587	505	440	
		$N_{b,z,Rd}$	2480	2120	1610	1160	848	642	501	401	328	273	231	198	171	
1.00	$M_{b,Rd}$	188	188	188	188	188	188	188	188	188	187	185	184	183	181	
14.2 # $f_y W_{el,y} = 161$ $f_y W_{el,z} = 110$	1.00	$N_{b,y,Rd}$	2960	2820	2610	2330	1970	1620	1320	1080	898	756	644	555	483	
		$N_{b,z,Rd}$	2770	2350	1760	1260	921	696	543	435	356	296	250	214	186	
1.00	$M_{b,Rd}$	208	208	208	208	208	208	208	208	208	206	205	203	202	200	
16.0 # $f_y W_{el,y} = 175$ $f_y W_{el,z} = 118$	1.00	$N_{b,y,Rd}$	3290	3120	2890	2560	2160	1760	1430	1180	976	821	699	602	524	
		$N_{b,z,Rd}$	3060	2580	1910	1360	991	749	583	467	382	318	269	230	199	
1.00	$M_{b,Rd}$	228	228	228	228	228	228	228	228	228	226	224	223	221	219	

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

$n = N_{Ed} / N_{pl,Rd}$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

Axial force resistance  $N_{pl,Rd}$  which is equal to  $Af_y$  is given in the cross-section resistance check table opposite.

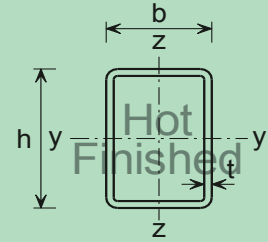
§ The section can be a Class 4 section but no allowance has been made in calculating  $N_{b,y,Rd}$  and  $N_{b,z,Rd}$ .

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n Limit Class 3 Class 2		Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$											
h x b mm	t mm			Axis		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
				y-y	z-z												
250x100	5.0 #	26.5	1200	0.591	*	$M_{c,y,Rd}$	93.4	93.4	93.4	74.2	74.2	74.2	✗	✗	✗	\$	\$
				<b>0.257</b>		$M_{c,z,Rd}$	✗	✗	✗	✗	✗	✗	✗	✗	✗	\$	\$
						$M_{N,y,Rd}$	93.4	93.4	93.4	-	-	-	-	-	-	-	-
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-
	6.3 #	33.0	1490	0.897	*	$M_{c,y,Rd}$	116	116	116	116	116	91.2	91.2	91.2	91.2	✗	\$
				<b>0.491</b>		$M_{c,z,Rd}$	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	\$
						$M_{N,y,Rd}$	116	116	116	108	92.6	-	-	-	-	-	-
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-
	7.1 #	37.0	1670	1.00	1.00	$M_{c,y,Rd}$	129	129	129	129	129	129	129	101	101	101	101
				<b>0.638</b>	<b>0.00</b>	$M_{c,z,Rd}$	58.6	58.6	58.6	58.6	58.6	58.6	58.6	58.6	58.6	58.6	58.6
					$M_{N,y,Rd}$	129	129	129	120	103	85.9	68.7	-	-	-	-	
					$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	
8.0 #	41.4	1870	n/a	n/a	$M_{c,y,Rd}$	143	143	143	143	143	143	143	143	143	143	143	
			<b>1.00</b>	<b>1.00</b>	$M_{c,z,Rd}$	74.2	74.2	74.2	74.2	74.2	74.2	74.2	74.2	74.2	74.2	74.2	
					$M_{N,y,Rd}$	143	143	143	134	115	95.6	76.5	57.4	38.2	19.1	0	
					$M_{N,z,Rd}$	74.2	74.2	67.5	59.1	50.7	42.2	33.8	25.3	16.9	8.44	0	
8.8 #	45.3	2050	n/a	n/a	$M_{c,y,Rd}$	156	156	156	156	156	156	156	156	156	156	156	
			<b>1.00</b>	<b>1.00</b>	$M_{c,z,Rd}$	80.2	80.2	80.2	80.2	80.2	80.2	80.2	80.2	80.2	80.2	80.2	
					$M_{N,y,Rd}$	156	156	156	145	125	104	83.1	62.3	41.6	20.8	0	
					$M_{N,z,Rd}$	80.2	80.2	72.8	63.7	54.6	45.5	36.4	27.3	18.2	9.10	0	
10.0 #	51.0	2300	n/a	n/a	$M_{c,y,Rd}$	174	174	174	174	174	174	174	174	174	174	174	
			<b>1.00</b>	<b>1.00</b>	$M_{c,z,Rd}$	89.1	89.1	89.1	89.1	89.1	89.1	89.1	89.1	89.1	89.1	89.1	
					$M_{N,y,Rd}$	174	174	174	163	139	116	93.0	69.7	46.5	23.2	0	
					$M_{N,z,Rd}$	89.1	89.1	80.5	70.5	60.4	50.3	40.3	30.2	20.1	10.1	0	
12.5 #	62.5	2830	n/a	n/a	$M_{c,y,Rd}$	210	210	210	210	210	210	210	210	210	210	210	
			<b>1.00</b>	<b>1.00</b>	$M_{c,z,Rd}$	106	106	106	106	106	106	106	106	106	106	106	
					$M_{N,y,Rd}$	210	210	210	196	168	140	112	84.1	56.0	28.0	0	
					$M_{N,z,Rd}$	106	106	95.1	83.2	71.4	59.5	47.6	35.7	23.8	11.9	0	
14.2 #	70.0	3170	n/a	n/a	$M_{c,y,Rd}$	233	233	233	233	233	233	233	233	233	233	233	
			<b>1.00</b>	<b>1.00</b>	$M_{c,z,Rd}$	117	117	117	117	117	117	117	117	117	117	117	
					$M_{N,y,Rd}$	233	233	233	217	186	155	124	93.0	62.0	31.0	0	
					$M_{N,z,Rd}$	117	117	104	91.0	78.0	65.0	52.0	39.0	26.0	13.0	0	
16.0 #	77.7	3510	n/a	n/a	$M_{c,y,Rd}$	255	255	255	255	255	255	255	255	255	255	255	
			<b>1.00</b>	<b>1.00</b>	$M_{c,z,Rd}$	127	127	127	127	127	127	127	127	127	127	127	
					$M_{N,y,Rd}$	255	255	255	238	204	170	136	102	68.1	34.0	0	
					$M_{N,z,Rd}$	127	127	112	98.4	84.3	70.3	56.2	42.2	28.1	14.1	0	

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

\* The section is a Class 4 section about the appropriate axis and is independent of the design axial force  $N_{Ed}$ . Values of  $M_{c,Rd}$  are calculated based on Class 4 section properties and are displayed in italics.

$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

✗ Section becomes class 4, see note 10.

\$ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

- Not applicable for Class 3 and Class 4 sections.

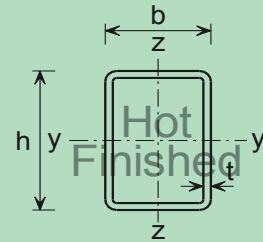
# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.



HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Member buckling check

Section Designation & Resistances (kNm)		n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for														
h x b mm	t mm		Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$														
			L (m)	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	
250x100	§ 5.0 # $f_y W_{el,y} = 74.2$ $f_y W_{el,z} = 44.0$	0.591	$N_{b,y,Rd}$	1170	1120	1070	988	884	762	642	537	452	383	328	284	247	
			$N_{b,z,Rd}$	1060	864	617	431	312	235	183	146	119	99.4	83.9	71.9	62.2	
	§ 6.3 # $f_y W_{el,y} = 91.2$ $f_y W_{el,z} = 53.3$	0.591	$M_{b,Rd}$	74.2	74.2	74.2	74.2	74.2	74.2	74.2	74.2	74.0	73.1	72.3	71.4	70.6	69.9
			$M_{b,Rd}$	93.4	93.4	93.4	93.4	93.4	93.4	91.9	90.6	89.3	88.1	86.9	85.7	84.6	
	7.1 # $f_y W_{el,y} = 101$ $f_y W_{el,z} = 58.6$	0.897	$N_{b,y,Rd}$	1460	1400	1330	1230	1100	943	793	663	557	472	404	349	305	
			$N_{b,z,Rd}$	1320	1070	755	526	380	286	222	178	145	121	102	87.3	75.6	
	8.0 # $f_y W_{el,y} = 112$ $f_y W_{el,z} = 64.6$	0.897	$M_{b,Rd}$	91.2	91.2	91.2	91.2	91.2	91.2	91.2	91.2	91.0	89.8	88.8	87.7	86.8	85.8
			$M_{b,Rd}$	116	116	116	116	116	116	114	112	110	109	107	106	105	
	8.8 # $f_y W_{el,y} = 121$ $f_y W_{el,z} = 69.2$	1.00	$N_{b,y,Rd}$	1630	1570	1490	1370	1220	1050	881	736	618	524	448	388	338	
			$N_{b,z,Rd}$	1470	1190	835	581	420	316	245	196	160	133	113	96.4	83.4	
	10.0 # $f_y W_{el,y} = 135$ $f_y W_{el,z} = 76.0$	1.00	$M_{b,Rd}$	101	101	101	101	101	101	101	101	101	99.6	98.4	97.3	96.2	95.1
			$M_{b,Rd}$	129	129	129	129	129	129	127	125	123	121	119	118	116	
	12.5 # $f_y W_{el,y} = 160$ $f_y W_{el,z} = 88.4$	1.00	$N_{b,y,Rd}$	1830	1760	1660	1540	1360	1170	979	818	686	581	498	430	375	
			$N_{b,z,Rd}$	1650	1320	923	641	462	348	270	216	176	147	124	106	91.8	
	14.2 # $f_y W_{el,y} = 175$ $f_y W_{el,z} = 95.5$	1.00	$M_{b,Rd}$	143	143	143	143	143	143	143	141	139	137	135	133	131	129
			$M_{b,Rd}$	156	156	156	156	156	155	153	150	148	146	144	142	140	
	16.0 # $f_y W_{el,y} = 190$ $f_y W_{el,z} = 102$	1.00	$N_{b,y,Rd}$	2000	1920	1820	1670	1490	1270	1060	887	744	630	539	466	406	
			$N_{b,z,Rd}$	1790	1430	998	691	499	375	291	233	190	158	133	114	98.9	
	16.0 # $f_y W_{el,y} = 190$ $f_y W_{el,z} = 102$	1.00	$M_{b,Rd}$	174	174	174	174	174	173	170	168	165	163	161	158	156	
			$M_{b,Rd}$	210	210	210	210	210	208	205	202	199	196	193	190	187	
	16.0 # $f_y W_{el,y} = 190$ $f_y W_{el,z} = 102$	1.00	$N_{b,y,Rd}$	2250	2160	2040	1880	1660	1420	1180	986	827	700	599	517	451	
			$N_{b,z,Rd}$	2010	1590	1100	758	546	410	319	254	208	173	146	125	108	
	16.0 # $f_y W_{el,y} = 190$ $f_y W_{el,z} = 102$	1.00	$M_{b,Rd}$	174	174	174	174	174	173	170	168	165	163	161	158	156	
			$M_{b,Rd}$	275	275	275	275	275	275	275	275	275	275	275	275	275	
16.0 # $f_y W_{el,y} = 190$ $f_y W_{el,z} = 102$	1.00	$N_{b,y,Rd}$	2750	2640	2490	2280	2010	1700	1420	1180	988	836	714	617	537		
		$N_{b,z,Rd}$	2450	1900	1290	890	640	480	373	297	243	202	170	146	126		
16.0 # $f_y W_{el,y} = 190$ $f_y W_{el,z} = 102$	1.00	$M_{b,Rd}$	210	210	210	210	210	208	205	202	199	196	193	190	187		
		$M_{b,Rd}$	233	233	233	233	233	233	230	226	222	219	216	213	210		
16.0 # $f_y W_{el,y} = 190$ $f_y W_{el,z} = 102$	1.00	$N_{b,y,Rd}$	3080	2950	2780	2540	2230	1880	1560	1300	1080	917	783	676	589		
		$N_{b,z,Rd}$	2720	2080	1400	961	690	517	402	320	262	217	184	157	136		
16.0 # $f_y W_{el,y} = 190$ $f_y W_{el,z} = 102$	1.00	$M_{b,Rd}$	233	233	233	233	233	230	226	222	219	216	213	210	207		
		$M_{b,Rd}$	255	255	255	255	255	255	252	247	243	240	236	232	229		
16.0 # $f_y W_{el,y} = 190$ $f_y W_{el,z} = 102$	1.00	$N_{b,y,Rd}$	3420	3270	3080	2800	2450	2060	1710	1410	1180	998	852	735	640		
		$N_{b,z,Rd}$	3000	2260	1510	1030	737	552	428	342	279	232	196	167	145		
16.0 # $f_y W_{el,y} = 190$ $f_y W_{el,z} = 102$	1.00	$M_{b,Rd}$	255	255	255	255	255	252	247	243	240	236	232	229	226		
		$M_{b,Rd}$	255	255	255	255	255	252	247	243	240	236	232	229	226		

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

$$n = N_{Ed} / N_{pl,Rd}$$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

Axial force resistance  $N_{pl,Rd}$  which is equal to  $A f_y$  is given in the cross-section resistance check table opposite.

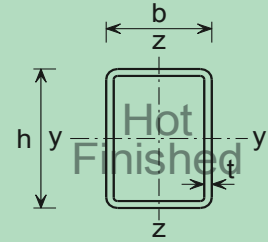
§ The section can be a Class 4 section but no allowance has been made in calculating  $N_{b,y,Rd}$  and  $N_{b,z,Rd}$ .

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n Limit Class 3 Class 2		Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$												
h x b mm	t mm			Axis		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	
				y-y	z-z													
250x150	5.0 #	30.4	1370	0.591	*	$M_{c,y,Rd}$	115	115	115	95.5	95.5	95.5	✗	✗	✗	\$	\$	
				<b>0.224</b>		$M_{c,z,Rd}$	✗	✗	✗	✗	✗	✗	✗	✗	✗	\$	\$	
						$M_{N,y,Rd}$	115	115	115	-	-	-	-	-	-	-	-	
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	
	6.3	38.0	1720	0.897	*	$M_{c,y,Rd}$	143	143	143	143	143	118	118	118	118	✗	\$	
				<b>0.427</b>		$M_{c,z,Rd}$	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	\$	\$
						$M_{N,y,Rd}$	143	143	143	133	114	-	-	-	-	-	-	
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	
	7.1 #	42.6	1920	1.00	1.00	$M_{c,y,Rd}$	159	159	159	159	159	159	131	131	131	131	131	
				<b>0.555</b>	<b>0.00</b>	$M_{c,z,Rd}$	98.3	98.3	98.3	98.3	98.3	98.3	98.3	98.3	98.3	98.3	98.3	
					$M_{N,y,Rd}$	159	159	159	149	128	106	-	-	-	-	-		
					$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-		
8.0	47.7	2160	n/a	n/a	$M_{c,y,Rd}$	178	178	178	178	178	178	178	178	178	178	178		
			<b>1.00</b>	<b>1.00</b>	$M_{c,z,Rd}$	124	124	124	124	124	124	124	124	124	124	124		
					$M_{N,y,Rd}$	178	178	178	166	142	119	94.9	71.1	47.4	23.7	0		
					$M_{N,z,Rd}$	124	124	120	105	89.9	74.9	60.0	45.0	30.0	15.0	0		
8.8 #	52.2	2360	n/a	n/a	$M_{c,y,Rd}$	193	193	193	193	193	193	193	193	193	193	193		
			<b>1.00</b>	<b>1.00</b>	$M_{c,z,Rd}$	135	135	135	135	135	135	135	135	135	135	135		
					$M_{N,y,Rd}$	193	193	193	181	155	129	103	77.4	51.6	25.8	0		
					$M_{N,z,Rd}$	135	135	130	114	97.7	81.4	65.1	48.8	32.6	16.3	0		
10.0	58.8	2660	n/a	n/a	$M_{c,y,Rd}$	217	217	217	217	217	217	217	217	217	217	217		
			<b>1.00</b>	<b>1.00</b>	$M_{c,z,Rd}$	151	151	151	151	151	151	151	151	151	151	151		
					$M_{N,y,Rd}$	217	217	217	202	174	145	116	86.8	57.8	28.9	0		
					$M_{N,z,Rd}$	151	151	145	127	109	90.7	72.6	54.4	36.3	18.1	0		
12.5	72.3	3270	n/a	n/a	$M_{c,y,Rd}$	263	263	263	263	263	263	263	263	263	263	263		
			<b>1.00</b>	<b>1.00</b>	$M_{c,z,Rd}$	182	182	182	182	182	182	182	182	182	182	182		
					$M_{N,y,Rd}$	263	263	263	245	210	175	140	105	70.1	35.0	0		
					$M_{N,z,Rd}$	182	182	174	152	130	109	87.0	65.2	43.5	21.7	0		
14.2 #	81.1	3660	n/a	n/a	$M_{c,y,Rd}$	292	292	292	292	292	292	292	292	292	292	292		
			<b>1.00</b>	<b>1.00</b>	$M_{c,z,Rd}$	202	202	202	202	202	202	202	202	202	202	202		
					$M_{N,y,Rd}$	292	292	292	273	234	195	156	117	77.9	39.0	0		
					$M_{N,z,Rd}$	202	202	192	168	144	120	95.8	71.9	47.9	24.0	0		
16.0	90.3	4080	n/a	n/a	$M_{c,y,Rd}$	322	322	322	322	322	322	322	322	322	322	322		
			<b>1.00</b>	<b>1.00</b>	$M_{c,z,Rd}$	222	222	222	222	222	222	222	222	222	222	222		
					$M_{N,y,Rd}$	322	322	322	300	257	214	172	129	85.8	42.9	0		
					$M_{N,z,Rd}$	222	222	209	183	157	131	105	78.5	52.3	26.2	0		

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\* The section is a Class 4 section about the appropriate axis and is independent of the design axial force  $N_{Ed}$ . Values of  $M_{c,Rd}$  are calculated based on Class 4 section properties and are displayed in italics.

$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

✗ Section becomes class 4, see note 10.

\$ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

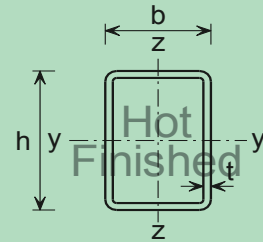
- Not applicable for Class 3 and Class 4 sections.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Member buckling check

Section Designation & Resistances (kNm)		n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$														
h x b mm	t mm		L (m)	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	
250x150	§ 5.0 # $f_y W_{el,y} = 95.5$ $f_y W_{el,z} = 72.4$	0.591	$N_{b,y,Rd}$	1350	1300	1240	1160	1060	930	796	673	570	486	417	361	315	
			$N_{b,z,Rd}$	1300	1210	1070	874	685	536	426	344	284	237	201	173	150	
		0.591	$M_{b,Rd}$	95.5	95.5	95.5	95.5	95.5	95.5	95.5	95.5	95.5	95.5	95.5	95.5	95.5	95.5
			<b>0.224</b> $M_{b,Rd}$	115	115	115	115	115	115	115	115	115	115	115	115	115	114
	§ 6.3 $f_y W_{el,y} = 118$ $f_y W_{el,z} = 88.8$	0.897	$N_{b,y,Rd}$	1690	1630	1550	1450	1320	1150	987	834	706	601	516	446	390	
			$N_{b,z,Rd}$	1630	1510	1320	1080	845	660	523	423	349	292	247	212	184	
		0.897	$M_{b,Rd}$	118	118	118	118	118	118	118	118	118	118	118	118	118	118
			<b>0.427</b> $M_{b,Rd}$	143	143	143	143	143	143	143	143	143	143	143	143	142	142
	7.1 # $f_y W_{el,y} = 131$ $f_y W_{el,z} = 98.3$	1.00	$N_{b,y,Rd}$	1890	1820	1740	1620	1470	1290	1100	929	786	669	574	497	434	
			$N_{b,z,Rd}$	1820	1690	1480	1200	939	733	581	470	387	324	274	236	204	
		1.00	$M_{b,Rd}$	131	131	131	131	131	131	131	131	131	131	131	131	131	
			<b>0.555</b> $M_{b,Rd}$	159	159	159	159	159	159	159	159	159	159	159	159	159	
	8.0 $f_y W_{el,y} = 145$ $f_y W_{el,z} = 109$	1.00	$N_{b,y,Rd}$	2120	2040	1940	1820	1640	1440	1230	1030	874	743	638	552	482	
			$N_{b,z,Rd}$	2040	1890	1650	1340	1040	813	644	521	429	359	304	261	226	
		1.00	$M_{b,Rd}$	178	178	178	178	178	178	178	178	178	178	178	178	177	176
	8.8 # $f_y W_{el,y} = 158$ $f_y W_{el,z} = 118$	1.00	$N_{b,y,Rd}$	2310	2230	2120	1980	1790	1570	1330	1120	949	807	692	599	523	
			$N_{b,z,Rd}$	2230	2060	1800	1460	1130	882	699	565	465	389	330	283	245	
		1.00	$M_{b,Rd}$	193	193	193	193	193	193	193	193	193	193	193	193	193	
10.0 $f_y W_{el,y} = 175$ $f_y W_{el,z} = 130$	1.00	$N_{b,y,Rd}$	2610	2510	2390	2230	2010	1750	1490	1250	1060	900	772	668	583		
		$N_{b,z,Rd}$	2510	2320	2010	1620	1260	977	773	625	514	430	364	313	271		
	1.00	$M_{b,Rd}$	217	217	217	217	217	217	217	217	217	217	217	216	215		
12.5 $f_y W_{el,y} = 210$ $f_y W_{el,z} = 154$	1.00	$N_{b,y,Rd}$	3200	3080	2930	2720	2450	2120	1800	1510	1270	1080	927	801	699		
		$N_{b,z,Rd}$	3080	2830	2450	1950	1510	1170	923	745	612	512	434	372	323		
	1.00	$M_{b,Rd}$	263	263	263	263	263	263	263	263	263	263	263	261	260		
14.2 # $f_y W_{el,y} = 231$ $f_y W_{el,z} = 169$	1.00	$N_{b,y,Rd}$	3580	3440	3270	3030	2720	2350	1980	1660	1400	1190	1020	880	768		
		$N_{b,z,Rd}$	3440	3150	2710	2150	1650	1280	1010	812	668	558	473	406	352		
	1.00	$M_{b,Rd}$	292	292	292	292	292	292	292	292	292	292	292	290	289		
16.0 $f_y W_{el,y} = 252$ $f_y W_{el,z} = 183$	1.00	$N_{b,y,Rd}$	3990	3840	3640	3370	3010	2600	2190	1830	1540	1310	1120	966	843		
		$N_{b,z,Rd}$	3830	3500	2990	2350	1800	1390	1100	884	727	607	514	441	383		
	1.00	$M_{b,Rd}$	322	322	322	322	322	322	322	322	322	322	321	319	317		

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$n = N_{Ed} / N_{pl,Rd}$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

Axial force resistance  $N_{pl,Rd}$  which is equal to  $Af_y$  is given in the cross-section resistance check table opposite.

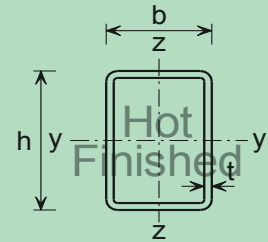
§ The section can be a Class 4 section but no allowance has been made in calculating  $N_{b,y,Rd}$  and  $N_{b,z,Rd}$ .

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n Limit Class 3 Class 2		Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$													
h x b mm	t mm			Axis		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0		
				y-y	z-z														
260x140	5.0 #	30.4	1370	0.546	*	$M_{c,y,Rd}$	118	118	118	96.6	96.6	96.6	✗	✗	✗	\$	\$		
						$M_{c,z,Rd}$	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	\$	\$	
						$M_{N,y,Rd}$	118	118	118	-	-	-	-	-	-	-	-	-	-
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-
	6.3 #	38.0	1720	0.839	*	$M_{c,y,Rd}$	146	146	146	146	146	119	119	119	119	✗	\$		
						$M_{c,z,Rd}$	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	\$	
						$M_{N,y,Rd}$	146	146	146	136	117	-	-	-	-	-	-	-	
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	
	7.1 #	42.6	1920	1.00	1.00	$M_{c,y,Rd}$	163	163	163	163	163	163	132	132	132	132	132		
						$M_{c,z,Rd}$	93.4	93.4	93.4	93.4	93.4	93.4	93.4	93.4	93.4	93.4	93.4		
						$M_{N,y,Rd}$	163	163	163	152	130	109	-	-	-	-	-		
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-		
8.0 #	47.7	2160	n/a	n/a	$M_{c,y,Rd}$	181	181	181	181	181	181	181	181	181	181	181			
					$M_{c,z,Rd}$	118	118	118	118	118	118	118	118	118	118	118			
					$M_{N,y,Rd}$	181	181	181	169	145	121	96.7	72.6	48.4	24.2	0			
					$M_{N,z,Rd}$	118	118	112	97.7	83.7	69.8	55.8	41.9	27.9	14.0	0			
8.8 #	52.2	2360	n/a	n/a	$M_{c,y,Rd}$	198	198	198	198	198	198	198	198	198	198	198			
					$M_{c,z,Rd}$	128	128	128	128	128	128	128	128	128	128	128			
					$M_{N,y,Rd}$	198	198	198	185	158	132	105	79.1	52.7	26.4	0			
					$M_{N,z,Rd}$	128	128	121	106	90.8	75.7	60.6	45.4	30.3	15.1	0			
10.0 #	58.8	2660	n/a	n/a	$M_{c,y,Rd}$	222	222	222	222	222	222	222	222	222	222				
					$M_{c,z,Rd}$	143	143	143	143	143	143	143	143	143	143	143			
					$M_{N,y,Rd}$	222	222	222	207	177	148	118	88.6	59.1	29.5	0			
					$M_{N,z,Rd}$	143	143	135	118	101	84.2	67.4	50.5	33.7	16.8	0			
12.5 #	72.3	3270	n/a	n/a	$M_{c,y,Rd}$	268	268	268	268	268	268	268	268	268	268				
					$M_{c,z,Rd}$	172	172	172	172	172	172	172	172	172	172				
					$M_{N,y,Rd}$	268	268	268	250	215	179	143	107	71.6	35.8	0			
					$M_{N,z,Rd}$	172	172	162	141	121	101	80.8	60.6	40.4	20.2	0			
14.2 #	81.1	3660	n/a	n/a	$M_{c,y,Rd}$	298	298	298	298	298	298	298	298	298	298				
					$M_{c,z,Rd}$	191	191	191	191	191	191	191	191	191	191				
					$M_{N,y,Rd}$	298	298	298	278	239	199	159	119	79.5	39.8	0			
					$M_{N,z,Rd}$	191	191	178	155	133	111	88.8	66.6	44.4	22.2	0			
16.0 #	90.3	4080	n/a	n/a	$M_{c,y,Rd}$	328	328	328	328	328	328	328	328	328	328				
					$M_{c,z,Rd}$	209	209	209	209	209	209	209	209	209	209				
					$M_{N,y,Rd}$	328	328	328	306	263	219	175	131	87.6	43.8	0			
					$M_{N,z,Rd}$	209	209	194	170	145	121	96.9	72.7	48.4	24.2	0			

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\* The section is a Class 4 section about the appropriate axis and is independent of the design axial force  $N_{Ed}$ . Values of  $M_{c,Rd}$  are calculated based on Class 4 section properties and are displayed in italics.

$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

✗ Section becomes class 4, see note 10.

\$ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

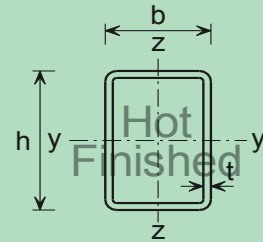
- Not applicable for Class 3 and Class 4 sections.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Member buckling check

Section Designation & Resistances (kNm)		n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$														
h x b mm	t mm		L (m)	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	
260x140	§ 5.0 # $f_y W_{el,y} = 96.6$ $f_y W_{el,z} = 68.5$	0.546	$N_{b,y,Rd}$	1350	1300	1250	1170	1080	953	822	700	594	507	436	378	330	
			$N_{b,z,Rd}$	1290	1190	1020	812	624	484	382	308	253	212	179	154	134	
	§ 6.3 # $f_y W_{el,y} = 119$ $f_y W_{el,z} = 84.1$	0.546	$M_{b,Rd}$	96.6	96.6	96.6	96.6	96.6	96.6	96.6	96.6	96.6	96.6	96.6	96.6	96.6	96.5
			$M_{b,Rd}$	118	118	118	118	118	118	118	118	118	118	118	118	117	116
	§ 6.3 # $f_y W_{el,y} = 119$ $f_y W_{el,z} = 84.1$	0.839	$N_{b,y,Rd}$	1690	1630	1560	1460	1340	1180	1020	867	736	628	539	468	409	
			$N_{b,z,Rd}$	1620	1480	1270	1000	770	596	470	379	312	261	221	189	164	
	§ 6.3 # $f_y W_{el,y} = 119$ $f_y W_{el,z} = 84.1$	0.839	$M_{b,Rd}$	119	119	119	119	119	119	119	119	119	119	119	119	119	119
			$M_{b,Rd}$	146	146	146	146	146	146	146	146	146	146	146	145	144	143
	7.1 # $f_y W_{el,y} = 132$ $f_y W_{el,z} = 93.4$	1.00	$N_{b,y,Rd}$	1890	1830	1740	1640	1500	1320	1140	965	818	698	600	520	454	
			$N_{b,z,Rd}$	1810	1650	1410	1110	853	659	520	419	345	288	244	209	182	
	7.1 # $f_y W_{el,y} = 132$ $f_y W_{el,z} = 93.4$	1.00	$M_{b,Rd}$	132	132	132	132	132	132	132	132	132	132	132	132	132	132
			$M_{b,Rd}$	163	163	163	163	163	163	163	163	163	163	163	162	161	160
	8.0 # $f_y W_{el,y} = 147$ $f_y W_{el,z} = 103$	1.00	$N_{b,y,Rd}$	2120	2050	1950	1830	1670	1470	1270	1070	910	776	666	577	504	
			$N_{b,z,Rd}$	2030	1850	1580	1240	947	731	577	465	382	319	270	232	201	
	8.0 # $f_y W_{el,y} = 147$ $f_y W_{el,z} = 103$	1.00	$M_{b,Rd}$	181	181	181	181	181	181	181	181	181	181	180	179	178	
	8.8 # $f_y W_{el,y} = 159$ $f_y W_{el,z} = 111$	1.00	$N_{b,y,Rd}$	2320	2240	2140	2000	1830	1610	1380	1170	990	844	725	628	548	
			$N_{b,z,Rd}$	2210	2020	1720	1350	1030	792	625	503	413	345	293	251	218	
	8.8 # $f_y W_{el,y} = 159$ $f_y W_{el,z} = 111$	1.00	$M_{b,Rd}$	198	198	198	198	198	198	198	198	198	198	197	195	194	
	10.0 # $f_y W_{el,y} = 177$ $f_y W_{el,z} = 123$	1.00	$N_{b,y,Rd}$	2610	2520	2400	2250	2050	1800	1540	1300	1100	940	807	699	610	
			$N_{b,z,Rd}$	2490	2270	1920	1500	1140	879	692	558	458	383	324	278	241	
	10.0 # $f_y W_{el,y} = 177$ $f_y W_{el,z} = 123$	1.00	$M_{b,Rd}$	222	222	222	222	222	222	222	222	222	222	220	219	217	
12.5 # $f_y W_{el,y} = 212$ $f_y W_{el,z} = 146$	1.00	$N_{b,y,Rd}$	3210	3090	2950	2750	2490	2180	1860	1570	1330	1130	968	838	731		
		$N_{b,z,Rd}$	3050	2770	2320	1790	1360	1040	822	661	543	453	384	329	285		
12.5 # $f_y W_{el,y} = 212$ $f_y W_{el,z} = 146$	1.00	$M_{b,Rd}$	268	268	268	268	268	268	268	268	268	268	266	264	263		
14.2 # $f_y W_{el,y} = 234$ $f_y W_{el,z} = 159$	1.00	$N_{b,y,Rd}$	3580	3450	3290	3070	2770	2420	2050	1730	1460	1240	1070	922	805		
		$N_{b,z,Rd}$	3410	3080	2560	1970	1490	1140	898	723	593	495	419	359	312		
14.2 # $f_y W_{el,y} = 234$ $f_y W_{el,z} = 159$	1.00	$M_{b,Rd}$	298	298	298	298	298	298	298	298	298	298	295	293	291		
16.0 # $f_y W_{el,y} = 255$ $f_y W_{el,z} = 173$	1.00	$N_{b,y,Rd}$	4000	3850	3660	3410	3070	2670	2260	1900	1600	1360	1170	1010	882		
		$N_{b,z,Rd}$	3800	3420	2820	2160	1620	1240	976	785	644	537	455	390	338		
16.0 # $f_y W_{el,y} = 255$ $f_y W_{el,z} = 173$	1.00	$M_{b,Rd}$	328	328	328	328	328	328	328	328	328	327	325	323	321		

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

$n = N_{Ed} / N_{pl,Rd}$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

Axial force resistance  $N_{pl,Rd}$  which is equal to  $Af_y$  is given in the cross-section resistance check table opposite.

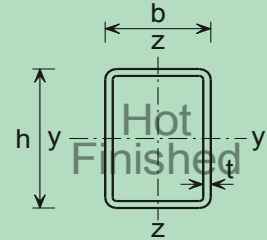
§ The section can be a Class 4 section but no allowance has been made in calculating  $N_{b,y,Rd}$  and  $N_{b,z,Rd}$ .

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n Limit Class 3 Class 2		Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$												
h x b mm	t mm			Axis		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	
				y-y	z-z													
300x100	5.0 #	30.4	1370	0.399	*	$M_{c,y,Rd}$	126	126	98.0	98.0	*	*	*	*	\$	\$	\$	
				<b>0.114</b>		$M_{c,z,Rd}$	*	*	*	*	*	*	*	*	\$	\$	\$	
						$M_{N,y,Rd}$	126	126	-	-	-	-	-	-	-	-	-	
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	
	6.3 #	38.0	1720	0.649	*	$M_{c,y,Rd}$	156	156	156	156	121	121	121	*	*	\$	\$	
				<b>0.317</b>		$M_{c,z,Rd}$	*	*	*	*	*	*	*	*	*	\$	\$	
						$M_{N,y,Rd}$	156	156	156	145	-	-	-	-	-	-	-	
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	
	7.1 #	42.6	1920	0.806	*	$M_{c,y,Rd}$	174	174	174	174	174	135	135	135	135	*	\$	
				<b>0.444</b>		$M_{c,z,Rd}$	*	*	*	*	*	*	*	*	*	*	\$	
					$M_{N,y,Rd}$	174	174	174	162	139	-	-	-	-	-	-		
					$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-		
8.0	47.7	2160	0.986	*	$M_{c,y,Rd}$	194	194	194	194	194	194	149	149	149	149	\$		
			<b>0.587</b>		$M_{c,z,Rd}$	*	*	*	*	*	*	*	*	*	*	\$		
					$M_{N,y,Rd}$	194	194	194	181	155	129	-	-	-	-	-		
					$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-		
8.8 #	52.2	2360	1.00	1.00	$M_{c,y,Rd}$	211	211	211	211	211	211	211	211	162	162	162		
			<b>0.717</b>	<b>0.00</b>	$M_{c,z,Rd}$	82.4	82.4	82.4	82.4	82.4	82.4	82.4	82.4	82.4	82.4	82.4		
					$M_{N,y,Rd}$	211	211	211	197	169	141	112	84.3	-	-	-		
					$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-		
10.0	58.8	2660	n/a	n/a	$M_{c,y,Rd}$	236	236	236	236	236	236	236	236	236	236	236		
			<b>1.00</b>	<b>1.00</b>	$M_{c,z,Rd}$	105	105	105	105	105	105	105	105	105	105	105		
					$M_{N,y,Rd}$	236	236	236	221	189	158	126	94.6	63.0	31.5	0		
					$M_{N,z,Rd}$	105	105	93.3	81.7	70.0	58.3	46.7	35.0	23.3	11.7	0		
12.5 #	72.3	3270	n/a	n/a	$M_{c,y,Rd}$	286	286	286	286	286	286	286	286	286	286	286		
			<b>1.00</b>	<b>1.00</b>	$M_{c,z,Rd}$	126	126	126	126	126	126	126	126	126	126	126		
					$M_{N,y,Rd}$	286	286	286	267	229	191	153	114	76.3	38.2	0		
					$M_{N,z,Rd}$	126	125	111	97.0	83.1	69.3	55.4	41.6	27.7	13.9	0		
14.2 #	81.1	3660	n/a	n/a	$M_{c,y,Rd}$	318	318	318	318	318	318	318	318	318	318	318		
			<b>1.00</b>	<b>1.00</b>	$M_{c,z,Rd}$	138	138	138	138	138	138	138	138	138	138	138		
					$M_{N,y,Rd}$	318	318	318	297	254	212	170	127	84.8	42.4	0		
					$M_{N,z,Rd}$	138	136	121	106	90.9	75.8	60.6	45.5	30.3	15.2	0		
16.0 #	90.3	4080	n/a	n/a	$M_{c,y,Rd}$	350	350	350	350	350	350	350	350	350	350	350		
			<b>1.00</b>	<b>1.00</b>	$M_{c,z,Rd}$	151	151	151	151	151	151	151	151	151	151	151		
					$M_{N,y,Rd}$	350	350	350	327	280	233	187	140	93.3	46.7	0		
					$M_{N,z,Rd}$	151	148	132	115	98.7	82.2	65.8	49.3	32.9	16.4	0		

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

\* The section is a Class 4 section about the appropriate axis and is independent of the design axial force  $N_{Ed}$ . Values of  $M_{c,Rd}$  are calculated based on Class 4 section properties and are displayed in italics.

$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

\* Section becomes class 4, see note 10.

\$ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

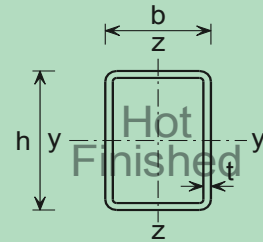
- Not applicable for Class 3 and Class 4 sections.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Member buckling check

Section Designation & Resistances (kNm)		n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
h x b mm	t mm		L (m)	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
300x100	§ 5.0 # $f_y W_{el,y} = 98.0$ $f_y W_{el,z} = 51.8$	0.399	$N_{b,y,Rd}$	1360	1320	1270	1200	1120	1020	898	778	669	576	497	433	379
			$N_{b,z,Rd}$	1220	1000	723	507	368	277	216	172	141	117	99.0	84.8	73.4
	§ 6.3 # $f_y W_{el,y} = 121$ $f_y W_{el,z} = 63.2$	0.399	$M_{b,Rd}$	98.0	98.0	98.0	98.0	98.0	98.0	98.0	96.9	95.6	94.4	93.3	92.2	91.1
			$M_{b,Rd}$	126	126	126	126	126	124	122	120	118	117	115	113	112
	§ 7.1 # $f_y W_{el,y} = 135$ $f_y W_{el,z} = 69.6$	0.649	$N_{b,y,Rd}$	1700	1650	1580	1510	1400	1270	1120	973	837	720	622	541	474
			$N_{b,z,Rd}$	1520	1240	889	622	450	339	264	211	172	143	121	104	89.7
	§ 8.0 $f_y W_{el,y} = 149$ $f_y W_{el,z} = 76.7$	0.649	$M_{b,Rd}$	121	121	121	121	121	121	121	120	118	117	115	114	112
			$M_{b,Rd}$	156	156	156	156	156	154	151	149	147	144	142	140	138
	§ 7.1 # $f_y W_{el,y} = 135$ $f_y W_{el,z} = 69.6$	0.806	$N_{b,y,Rd}$	1900	1840	1770	1680	1560	1410	1240	1080	923	793	685	596	522
			$N_{b,z,Rd}$	1700	1380	982	685	496	373	290	232	189	158	133	114	98.7
	§ 8.0 $f_y W_{el,y} = 149$ $f_y W_{el,z} = 76.7$	0.806	$M_{b,Rd}$	135	135	135	135	135	135	135	133	131	129	128	126	125
			$M_{b,Rd}$	174	174	174	174	174	172	169	166	163	161	159	156	154
	8.8 # $f_y W_{el,y} = 162$ $f_y W_{el,z} = 82.4$	0.986	$N_{b,y,Rd}$	2130	2060	1990	1890	1750	1590	1400	1210	1040	890	769	668	585
			$N_{b,z,Rd}$	1900	1540	1090	756	547	411	320	255	209	174	147	126	109
	8.8 # $f_y W_{el,y} = 162$ $f_y W_{el,z} = 82.4$	0.986	$M_{b,Rd}$	149	149	149	149	149	149	149	147	145	143	142	140	138
			$M_{b,Rd}$	194	194	194	194	194	191	188	185	182	179	176	174	171
	8.8 # $f_y W_{el,y} = 162$ $f_y W_{el,z} = 82.4$	1.00	$N_{b,y,Rd}$	2330	2260	2170	2060	1910	1720	1510	1300	1120	958	826	718	629
			$N_{b,z,Rd}$	2080	1670	1180	817	590	444	345	276	225	187	158	135	117
	8.8 # $f_y W_{el,y} = 162$ $f_y W_{el,z} = 82.4$	1.00	$M_{b,Rd}$	162	162	162	162	162	162	162	160	157	155	154	152	150
			$M_{b,Rd}$	211	211	211	211	211	207	204	201	198	194	192	189	186
	10.0 $f_y W_{el,y} = 180$ $f_y W_{el,z} = 90.5$	1.00	$N_{b,y,Rd}$	2620	2540	2440	2320	2150	1940	1700	1470	1260	1080	931	809	708
			$N_{b,z,Rd}$	2330	1860	1300	901	650	489	380	303	248	206	174	149	129
	10.0 $f_y W_{el,y} = 180$ $f_y W_{el,z} = 90.5$	1.00	$M_{b,Rd}$	236	236	236	236	236	232	228	224	221	217	214	211	208
			$M_{b,Rd}$	286	286	286	286	285	280	275	270	266	262	258	254	250
12.5 # $f_y W_{el,y} = 215$ $f_y W_{el,z} = 105$	1.00	$N_{b,y,Rd}$	3220	3120	2990	2830	2620	2350	2050	1760	1510	1290	1110	967	846	
		$N_{b,z,Rd}$	2840	2230	1530	1060	761	571	444	354	289	241	203	174	150	
12.5 # $f_y W_{el,y} = 215$ $f_y W_{el,z} = 105$	1.00	$M_{b,Rd}$	286	286	286	286	285	280	275	270	266	262	258	254	250	
		$M_{b,Rd}$	318	318	318	318	316	310	305	300	295	290	285	281	277	
14.2 # $f_y W_{el,y} = 237$ $f_y W_{el,z} = 114$	1.00	$N_{b,y,Rd}$	3600	3490	3340	3160	2920	2610	2270	1950	1660	1420	1230	1060	931	
		$N_{b,z,Rd}$	3160	2440	1660	1140	820	615	478	381	311	259	218	187	162	
14.2 # $f_y W_{el,y} = 237$ $f_y W_{el,z} = 114$	1.00	$M_{b,Rd}$	318	318	318	318	316	310	305	300	295	290	285	281	277	
		$M_{b,Rd}$	350	350	350	350	347	340	334	329	323	318	313	308	303	
16.0 # $f_y W_{el,y} = 259$ $f_y W_{el,z} = 122$	1.00	$N_{b,y,Rd}$	4020	3890	3720	3510	3240	2890	2510	2140	1830	1560	1340	1170	1020	
		$N_{b,z,Rd}$	3500	2680	1800	1230	886	664	515	411	336	279	236	202	174	
16.0 # $f_y W_{el,y} = 259$ $f_y W_{el,z} = 122$	1.00	$M_{b,Rd}$	350	350	350	350	347	340	334	329	323	318	313	308	303	

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

$$n = N_{Ed} / N_{pl,Rd}$$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

Axial force resistance  $N_{pl,Rd}$  which is equal to  $Af_y$  is given in the cross-section resistance check table opposite.

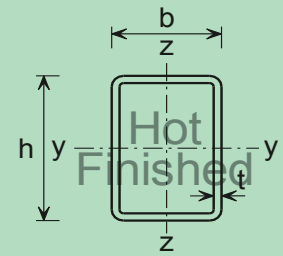
§ The section can be a Class 4 section but no allowance has been made in calculating  $N_{b,y,Rd}$  and  $N_{b,z,Rd}$ .

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n Limit Class 3		Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$														
h x b mm	t mm			Class 2		n	Axis													
				y-y	z-z		0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0			
300x150	8.0 # rr	54.0	2440	0.986	*	$M_{c,y,Rd}$	235	235	235	235	235	235	190	190	190	190	\$			
						$M_{c,z,Rd}$	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	\$	
						$M_{N,y,Rd}$	235	235	235	220	188	157	-	-	-	-	-	-	-	
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-	
	8.8 # rr	59.1	2670	1.00	1.00	$M_{c,y,Rd}$	257	257	257	257	257	257	257	206	206	206	206			
						$M_{c,z,Rd}$	138	138	138	138	138	138	138	138	138	138	138			
						$M_{N,y,Rd}$	257	257	257	240	205	171	137	-	-	-	-			
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-		
	10.0 #	66.7	3010	n/a	n/a	$M_{c,y,Rd}$	288	288	288	288	288	288	288	288	288	288	288			
						$M_{c,z,Rd}$	176	176	176	176	176	176	176	176	176	176	176			
						$M_{N,y,Rd}$	288	288	288	269	230	192	154	115	76.8	38.4	0			
						$M_{N,z,Rd}$	176	176	165	144	124	103	82.5	61.9	41.3	20.6	0			
	12.5 #	82.1	3730	n/a	n/a	$M_{c,y,Rd}$	350	350	350	350	350	350	350	350	350	350	350			
						$M_{c,z,Rd}$	213	213	213	213	213	213	213	213	213	213	213			
						$M_{N,y,Rd}$	350	350	350	327	280	233	187	140	93.3	46.7	0			
						$M_{N,z,Rd}$	213	213	199	174	149	124	99.4	74.6	49.7	24.9	0			
	14.2 #	92.3	4190	n/a	n/a	$M_{c,y,Rd}$	390	390	390	390	390	390	390	390	390	390	390			
						$M_{c,z,Rd}$	236	236	236	236	236	236	236	236	236	236	236			
						$M_{N,y,Rd}$	390	390	390	364	312	260	208	156	104	52.0	0			
						$M_{N,z,Rd}$	236	236	220	192	165	137	110	82.4	54.9	27.5	0			
	16.0 #	103	4650	n/a	n/a	$M_{c,y,Rd}$	431	431	431	431	431	431	431	431	431	431	431			
						$M_{c,z,Rd}$	260	260	260	260	260	260	260	260	260	260	260			
						$M_{N,y,Rd}$	431	431	431	402	344	287	230	172	115	57.4	0			
						$M_{N,z,Rd}$	260	260	240	210	180	150	120	90.0	60.0	30.0	0			

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\* The section is a Class 4 section about the appropriate axis and is independent of the design axial force  $N_{Ed}$ . Values of  $M_{c,Rd}$  are calculated based on Class 4 section properties and are displayed in italics.

$N_{Ed}$  = Design value of the axial force.

$$n = N_{Ed} / N_{pl,Rd}$$

✘ Section becomes class 4, see note 10.

\$ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

- Not applicable for Class 3 and Class 4 sections.

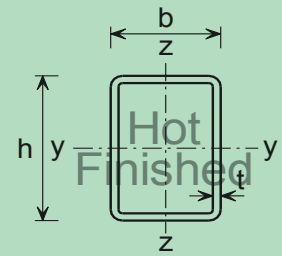
# Check availability rr External corner radius > 3t (Not compliant with BS EN 10210-2)

FOR EXPLANATION OF TABLES SEE NOTE 10.



HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Member buckling check

Section Designation & Resistances (kNm)		n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$														
h x b mm	t mm		L (m)	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	
300x150	§ 8.0 # rr $f_y W_{el,y} = 190$ $f_y W_{el,z} = 128$	0.986	$N_{b,y,Rd}$	2420	2350	2270	2170	2040	1870	1680	1470	1280	1100	958	836	734	
			$N_{b,z,Rd}$	2320	2150	1890	1550	1220	951	755	611	503	421	357	306	266	
	8.8 # rr $f_y W_{el,y} = 206$ $f_y W_{el,z} = 138$	0.986	$M_{b,Rd}$	190	190	190	190	190	190	190	190	190	190	190	190	190	190
			$M_{b,Rd}$	235	235	235	235	235	235	235	235	235	235	235	235	233	232
	10.0 # rr $f_y W_{el,y} = 230$ $f_y W_{el,z} = 154$	1.00	$N_{b,y,Rd}$	2650	2570	2480	2370	2230	2050	1840	1610	1400	1210	1050	915	803	
			$N_{b,z,Rd}$	2530	2350	2060	1680	1320	1030	817	661	544	455	386	331	288	
	12.5 # rr $f_y W_{el,y} = 277$ $f_y W_{el,z} = 182$	1.00	$M_{b,Rd}$	206	206	206	206	206	206	206	206	206	206	206	206	206	206
			$M_{b,Rd}$	257	257	257	257	257	257	257	257	257	257	257	256	254	253
	14.2 # rr $f_y W_{el,y} = 306$ $f_y W_{el,z} = 200$	1.00	$N_{b,y,Rd}$	2980	2900	2800	2670	2510	2300	2050	1790	1550	1340	1160	1020	891	
			$N_{b,z,Rd}$	2850	2640	2310	1880	1470	1140	908	734	604	505	429	368	319	
	16.0 # rr $f_y W_{el,y} = 335$ $f_y W_{el,z} = 218$	1.00	$M_{b,Rd}$	288	288	288	288	288	288	288	288	288	288	288	287	285	283
			$N_{b,y,Rd}$	3690	3580	3450	3290	3090	2820	2510	2190	1900	1640	1420	1230	1080	
	14.2 # rr $f_y W_{el,y} = 306$ $f_y W_{el,z} = 200$	1.00	$N_{b,z,Rd}$	3520	3250	2830	2280	1770	1370	1090	878	722	604	512	440	381	
			$M_{b,Rd}$	350	350	350	350	350	350	350	350	350	350	350	348	346	344
16.0 # rr $f_y W_{el,y} = 335$ $f_y W_{el,z} = 218$	1.00	$N_{b,y,Rd}$	4140	4020	3870	3690	3450	3150	2800	2430	2100	1810	1570	1370	1200		
		$N_{b,z,Rd}$	3950	3640	3150	2520	1950	1510	1200	966	794	664	563	483	419		
16.0 # rr $f_y W_{el,y} = 335$ $f_y W_{el,z} = 218$	1.00	$M_{b,Rd}$	390	390	390	390	390	390	390	390	390	390	390	388	385	383	
		$N_{b,y,Rd}$	4600	4460	4290	4090	3810	3470	3070	2670	2300	1980	1710	1490	1310		
16.0 # rr $f_y W_{el,y} = 335$ $f_y W_{el,z} = 218$	1.00	$N_{b,z,Rd}$	4380	4020	3460	2750	2120	1640	1300	1050	860	719	609	523	453		
		$M_{b,Rd}$	431	431	431	431	431	431	431	431	431	431	431	428	425	422	

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

$$n = N_{Ed} / N_{pl,Rd}$$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

Axial force resistance  $N_{pl,Rd}$  which is equal to  $Af_y$  is given in the cross-section resistance check table opposite.

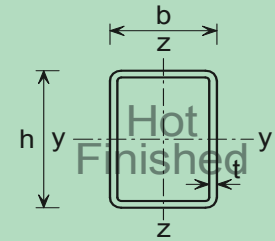
§ The section can be a Class 4 section but no allowance has been made in calculating  $N_{b,y,Rd}$  and  $N_{b,z,Rd}$ .

# Check availability  $r$  External corner radius > 3t (Not compliant with BS EN 10210-2)

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n Limit Class 3 <b>Class 2</b>		Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$											
h x b mm	t mm			Axis		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
				y-y	z-z		<i><math>M_{c,y,Rd}</math></i>	<i><math>M_{c,z,Rd}</math></i>	<i><math>M_{N,y,Rd}</math></i>	<i><math>M_{N,z,Rd}</math></i>							
300x200	5.0 #	38.3	1730	*	*	<i><math>M_{c,y,Rd}</math></i>	✗	✗	✗	✗	✗	✗	✗	✗	\$	\$	\$
						<i><math>M_{c,z,Rd}</math></i>	✗	✗	✗	✗	✗	✗	✗	✗	\$	\$	\$
						<i><math>M_{N,y,Rd}</math></i>	-	-	-	-	-	-	-	-	-	-	-
						<i><math>M_{N,z,Rd}</math></i>	-	-	-	-	-	-	-	-	-	-	-
	6.3	47.9	2170	0.649	*	<i><math>M_{c,y,Rd}</math></i>	222	222	222	185	185	185	185	✗	✗	\$	\$
						<i><math>M_{c,z,Rd}</math></i>	✗	✗	✗	✗	✗	✗	✗	✗	✗	\$	\$
						<i><math>M_{N,y,Rd}</math></i>	222	222	222	-	-	-	-	-	-	-	-
						<i><math>M_{N,z,Rd}</math></i>	-	-	-	-	-	-	-	-	-	-	-
7.1 #		53.7	2430	0.806	*	<i><math>M_{c,y,Rd}</math></i>	248	248	248	248	207	207	207	207	✗	\$	
						<i><math>M_{c,z,Rd}</math></i>	✗	✗	✗	✗	✗	✗	✗	✗	✗	\$	
						<i><math>M_{N,y,Rd}</math></i>	248	248	248	231	-	-	-	-	-	-	
						<i><math>M_{N,z,Rd}</math></i>	-	-	-	-	-	-	-	-	-	-	
8.0		60.3	2730	0.986	*	<i><math>M_{c,y,Rd}</math></i>	277	277	277	277	277	230	230	230	230	230	\$
						<i><math>M_{c,z,Rd}</math></i>	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	\$
						<i><math>M_{N,y,Rd}</math></i>	277	277	277	258	221	-	-	-	-	-	
						<i><math>M_{N,z,Rd}</math></i>	-	-	-	-	-	-	-	-	-	-	
8.8 #		66.0	2990	1.00	1.00	<i><math>M_{c,y,Rd}</math></i>	302	302	302	302	302	302	250	250	250	250	250
						<i><math>M_{c,z,Rd}</math></i>	200	200	200	200	200	200	200	200	200	200	200
						<i><math>M_{N,y,Rd}</math></i>	302	302	302	282	242	201	-	-	-	-	
						<i><math>M_{N,z,Rd}</math></i>	-	-	-	-	-	-	-	-	-	-	
10.0		74.5	3370	n/a	n/a	<i><math>M_{c,y,Rd}</math></i>	339	339	339	339	339	339	339	339	339	339	339
						<i><math>M_{c,z,Rd}</math></i>	256	256	256	256	256	256	256	256	256	256	256
						<i><math>M_{N,y,Rd}</math></i>	339	339	339	317	272	226	181	136	90.5	45.3	0
						<i><math>M_{N,z,Rd}</math></i>	256	256	251	220	188	157	125	94.1	62.7	31.4	0
12.5		91.9	4150	n/a	n/a	<i><math>M_{c,y,Rd}</math></i>	414	414	414	414	414	414	414	414	414	414	414
						<i><math>M_{c,z,Rd}</math></i>	311	311	311	311	311	311	311	311	311	311	311
						<i><math>M_{N,y,Rd}</math></i>	414	414	414	386	331	276	221	165	110	55.1	0
						<i><math>M_{N,z,Rd}</math></i>	311	311	304	266	228	190	152	114	75.9	37.9	0
14.2 #		103	4690	n/a	n/a	<i><math>M_{c,y,Rd}</math></i>	462	462	462	462	462	462	462	462	462	462	462
						<i><math>M_{c,z,Rd}</math></i>	347	347	347	347	347	347	347	347	347	347	347
						<i><math>M_{N,y,Rd}</math></i>	462	462	462	431	370	308	247	185	123	61.6	0
						<i><math>M_{N,z,Rd}</math></i>	347	347	338	295	253	211	169	127	84.4	42.2	0

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

\* The section is a Class 4 section about the appropriate axis and is independent of the design axial force  $N_{Ed}$ . Values of  $M_{c,Rd}$  are calculated based on Class 4 section properties and are displayed in italics.

$N_{Ed}$  = Design value of the axial force.

$$n = N_{Ed} / N_{pl,Rd}$$

✗ Section becomes class 4, see note 10.

\$ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

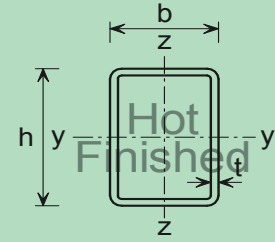
- Not applicable for Class 3 and Class 4 sections.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Member buckling check

Section Designation & Resistances (kNm)		n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$														
h x b	t		L (m)	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	
mm	mm																
300x200	♦ 5.0 # $f_y W_{el,y} = 149$ $f_y W_{el,z} = 121$	*	$N_{b,y,Rd}$	1330	1300	1270	1230	1180	1120	1050	970	878	785	698	619	549	
			$N_{b,z,Rd}$	1310	1260	1210	1130	1040	920	793	674	572	488	420	364	318	
		*	$M_{b,Rd}$	142	142	142	142	142	142	142	142	142	142	142	142	142	142
	§ 6.3 $f_y W_{el,y} = 185$ $f_y W_{el,z} = 149$	0.649	$N_{b,y,Rd}$	2150	2090	2030	1940	1840	1710	1550	1380	1210	1050	916	801	705	
			$N_{b,z,Rd}$	2110	2020	1900	1740	1520	1280	1060	883	738	624	533	460	401	
		0.649	$M_{b,Rd}$	185	185	185	185	185	185	185	185	185	185	185	185	185	185
			<b>0.251</b>	$M_{b,Rd}$	222	222	222	222	222	222	222	222	222	222	222	222	222
	§ 7.1 # $f_y W_{el,y} = 207$ $f_y W_{el,z} = 166$	0.806	$N_{b,y,Rd}$	2410	2350	2270	2180	2060	1920	1740	1540	1350	1180	1030	898	790	
			$N_{b,z,Rd}$	2360	2260	2130	1940	1700	1430	1190	984	823	695	594	512	446	
		0.806	$M_{b,Rd}$	207	207	207	207	207	207	207	207	207	207	207	207	207	
			<b>0.352</b>	$M_{b,Rd}$	248	248	248	248	248	248	248	248	248	248	248	248	
	§ 8.0 $f_y W_{el,y} = 230$ $f_y W_{el,z} = 184$	0.986	$N_{b,y,Rd}$	2710	2630	2550	2450	2320	2150	1950	1730	1520	1320	1150	1010	887	
			$N_{b,z,Rd}$	2650	2540	2390	2180	1900	1600	1320	1100	916	774	661	570	497	
		0.986	$M_{b,Rd}$	230	230	230	230	230	230	230	230	230	230	230	230	230	
			<b>0.465</b>	$M_{b,Rd}$	277	277	277	277	277	277	277	277	277	277	277	277	
	8.8 # $f_y W_{el,y} = 250$ $f_y W_{el,z} = 200$	1.00	$N_{b,y,Rd}$	2960	2880	2790	2670	2530	2340	2120	1880	1640	1430	1240	1090	957	
			$N_{b,z,Rd}$	2900	2780	2610	2380	2070	1740	1440	1190	995	840	717	619	539	
		1.00	$M_{b,Rd}$	250	250	250	250	250	250	250	250	250	250	250	250	250	
		<b>0.567</b>	$M_{b,Rd}$	302	302	302	302	302	302	302	302	302	302	302	302		
10.0 $f_y W_{el,y} = 280$ $f_y W_{el,z} = 223$	1.00	$N_{b,y,Rd}$	3340	3250	3150	3020	2850	2650	2390	2120	1850	1610	1400	1230	1080		
		$N_{b,z,Rd}$	3280	3130	2940	2670	2320	1950	1610	1330	1110	938	800	690	601		
	1.00	$M_{b,Rd}$	339	339	339	339	339	339	339	339	339	339	339	339	339		
12.5 $f_y W_{el,y} = 338$ $f_y W_{el,z} = 268$	1.00	$N_{b,y,Rd}$	4120	4000	3870	3700	3490	3220	2900	2560	2230	1930	1680	1470	1290		
		$N_{b,z,Rd}$	4030	3850	3610	3270	2820	2360	1940	1600	1340	1130	962	830	722		
	1.00	$M_{b,Rd}$	414	414	414	414	414	414	414	414	414	414	414	414	414		
14.2 # $f_y W_{el,y} = 375$ $f_y W_{el,z} = 296$	1.00	$N_{b,y,Rd}$	4650	4520	4370	4180	3940	3640	3280	2890	2510	2180	1900	1660	1450		
		$N_{b,z,Rd}$	4550	4340	4060	3670	3160	2630	2160	1780	1490	1250	1070	921	802		
	1.00	$M_{b,Rd}$	462	462	462	462	462	462	462	462	462	462	462	462	462		

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$$n = N_{Ed} / N_{pl,Rd}$$

\* The section is a Class 4 section about the y-y axis and is independent of the design axial force  $N_{Ed}$ .

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

Axial force resistance  $N_{pl,Rd}$  which is equal to  $Af_y$  is given in the cross-section resistance check table opposite.

§ The section can be a Class 4 section but no allowance has been made in calculating  $N_{b,y,Rd}$  and  $N_{b,z,Rd}$ .

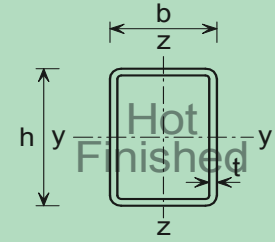
♦ For this section, resistances  $N_{b,Rd}$  and  $M_{b,Rd}$  are calculated based on Class 4 section properties and are displayed in italics.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n Limit Class 3		Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$																	
h x b mm	t mm			Axis		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0						
				y-y	z-z																		
300x250	5.0 #	42.2	1910	*	*	$M_{c,y,Rd}$	x	x	x	x	x	x	x	x	x	x	x						
						$M_{c,z,Rd}$	x	x	x	x	x	x	x	x	x	x	x	x	x				
						$M_{N,y,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
	6.3 #	52.8	2390	2390	*	*	$M_{c,y,Rd}$	x	x	x	x	x	x	x	x	x	x	x					
							$M_{c,z,Rd}$	x	x	x	x	x	x	x	x	x	x	x	x	x			
							$M_{N,y,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
							$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	7.1 #	59.3	2680	2680	0.806	*	$M_{c,y,Rd}$	242	242	242	242	242	242	242	242	242	242	x	\$				
							$M_{c,z,Rd}$	x	x	x	x	x	x	x	x	x	x	x	x	x	x		
							$M_{N,y,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
							$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8.0	66.5	3010	3010	0.986	*	$M_{c,y,Rd}$	318	318	318	318	318	270	270	270	270	270	270	\$					
						$M_{c,z,Rd}$	x	x	x	x	x	x	x	x	x	x	x	x	x	x			
						$M_{N,y,Rd}$	318	318	318	297	254	-	-	-	-	-	-	-	-	-	-	-	
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
8.8 #	72.9	3300	3300	1.00	1.00	$M_{c,y,Rd}$	348	348	348	348	348	348	294	294	294	294	294	294					
						$M_{c,z,Rd}$	267	267	267	267	267	267	267	267	267	267	267	267	267	267			
						$M_{N,y,Rd}$	348	348	348	324	278	232	-	-	-	-	-	-	-	-	-	-	
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
10.0 #	82.4	3730	3730	n/a	n/a	$M_{c,y,Rd}$	391	391	391	391	391	391	391	391	391	391	391	391					
						$M_{c,z,Rd}$	345	345	345	345	345	345	345	345	345	345	345	345	345	345			
						$M_{N,y,Rd}$	391	391	391	365	313	261	208	156	104	52.1	0	0	0	0			
						$M_{N,z,Rd}$	345	345	345	307	263	219	175	132	87.7	43.9	0	0	0				
12.5 #	102	4620	4620	n/a	n/a	$M_{c,y,Rd}$	477	477	477	477	477	477	477	477	477	477	477	477					
						$M_{c,z,Rd}$	421	421	421	421	421	421	421	421	421	421	421	421	421				
						$M_{N,y,Rd}$	477	477	477	446	382	318	255	191	127	63.7	0	0					
						$M_{N,z,Rd}$	421	421	421	373	320	267	213	160	107	53.4	0	0					
14.2 #	115	5180	5180	n/a	n/a	$M_{c,y,Rd}$	534	534	534	534	534	534	534	534	534	534	534	534					
						$M_{c,z,Rd}$	470	470	470	470	470	470	470	470	470	470	470	470					
						$M_{N,y,Rd}$	534	534	534	499	427	356	285	214	142	71.2	0	0					
						$M_{N,z,Rd}$	470	470	470	416	356	297	238	178	119	59.4	0	0					
16.0 #	128	5790	5790	n/a	n/a	$M_{c,y,Rd}$	592	592	592	592	592	592	592	592	592	592	592	592					
						$M_{c,z,Rd}$	521	521	521	521	521	521	521	521	521	521	521	521					
						$M_{N,y,Rd}$	592	592	592	553	474	395	316	237	158	79.0	0	0					
						$M_{N,z,Rd}$	521	521	521	459	393	328	262	197	131	65.6	0	0					

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\* The section is a Class 4 section about the appropriate axis and is independent of the design axial force  $N_{Ed}$ . Values of  $M_{c,Rd}$  are calculated based on Class 4 section properties and are displayed in italics.

$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

✘ Section becomes class 4, see note 10.

\$ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

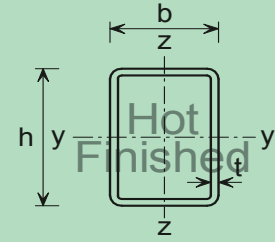
- Not applicable for Class 3 and Class 4 sections.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Member buckling check

Section Designation & Resistances (kNm)		n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
h x b	t		L (m)	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
mm	mm															
300x250	♦ 5.0 # $f_y W_{el,y} = 175$ $f_y W_{el,z} = 159$	*	$N_{b,y,Rd}$	1380	1350	1320	1280	1240	1190	1130	1050	964	872	783	699	624
			$N_{b,z,Rd}$	1370	1340	1300	1250	1200	1120	1040	934	830	730	641	564	498
		*	$M_{b,Rd}$	153	153	153	153	153	153	153	153	153	153	153	153	153
	♦ 6.3 # $f_y W_{el,y} = 218$ $f_y W_{el,z} = 197$	*	$N_{b,y,Rd}$	2040	1990	1940	1880	1800	1710	1590	1460	1310	1170	1030	911	807
			$N_{b,z,Rd}$	2030	1970	1910	1820	1720	1590	1430	1260	1100	955	830	725	637
		*	$M_{b,Rd}$	207	207	207	207	207	207	207	207	207	207	207	207	207
	§ 7.1 # $f_y W_{el,y} = 242$ $f_y W_{el,z} = 220$	0.806	$N_{b,y,Rd}$	2670	2600	2520	2420	2300	2150	1960	1750	1550	1350	1180	1040	913
			$N_{b,z,Rd}$	2650	2560	2460	2330	2170	1950	1710	1480	1270	1090	938	816	714
		0.806	$M_{b,Rd}$	242	242	242	242	242	242	242	242	242	242	242	242	242
			0.00	$M_{b,Rd}$	285	285	285	285	285	285	285	285	285	285	285	285
	§ 8.0 $f_y W_{el,y} = 270$ $f_y W_{el,z} = 245$	0.986	$N_{b,y,Rd}$	2990	2920	2830	2720	2580	2410	2200	1970	1740	1520	1330	1160	1030
			$N_{b,z,Rd}$	2970	2880	2760	2620	2430	2200	1930	1660	1420	1220	1050	916	802
0.986		$M_{b,Rd}$	270	270	270	270	270	270	270	270	270	270	270	270	270	
		0.421	$M_{b,Rd}$	318	318	318	318	318	318	318	318	318	318	318	318	
8.8 # $f_y W_{el,y} = 294$ $f_y W_{el,z} = 267$	1.00	$N_{b,y,Rd}$	3280	3190	3100	2980	2830	2640	2410	2160	1900	1660	1450	1280	1120	
		$N_{b,z,Rd}$	3250	3150	3030	2870	2670	2400	2110	1820	1560	1340	1150	1000	879	
	1.00	$M_{b,Rd}$	294	294	294	294	294	294	294	294	294	294	294	294	294	
		0.513	$M_{b,Rd}$	348	348	348	348	348	348	348	348	348	348	348	348	
10.0 # $f_y W_{el,y} = 329$ $f_y W_{el,z} = 298$	1.00	$N_{b,y,Rd}$	3700	3610	3490	3360	3190	2970	2710	2420	2130	1860	1620	1420	1250	
		$N_{b,z,Rd}$	3680	3560	3420	3240	3000	2700	2360	2030	1730	1490	1280	1110	975	
	1.00	$M_{b,Rd}$	391	391	391	391	391	391	391	391	391	391	391	391	391	
12.5 # $f_y W_{el,y} = 399$ $f_y W_{el,z} = 360$	1.00	$N_{b,y,Rd}$	4580	4460	4320	4150	3940	3660	3330	2960	2600	2270	1980	1730	1530	
		$N_{b,z,Rd}$	4550	4400	4220	3990	3690	3310	2880	2470	2110	1810	1560	1350	1180	
	1.00	$M_{b,Rd}$	477	477	477	477	477	477	477	477	477	477	477	477	477	
14.2 # $f_y W_{el,y} = 443$ $f_y W_{el,z} = 400$	1.00	$N_{b,y,Rd}$	5150	5010	4850	4650	4410	4090	3710	3300	2890	2510	2190	1920	1690	
		$N_{b,z,Rd}$	5110	4940	4740	4470	4120	3690	3210	2750	2340	2010	1730	1500	1310	
	1.00	$M_{b,Rd}$	534	534	534	534	534	534	534	534	534	534	534	534	534	
16.0 # $f_y W_{el,y} = 488$ $f_y W_{el,z} = 439$	1.00	$N_{b,y,Rd}$	5740	5590	5410	5180	4900	4540	4110	3640	3180	2770	2410	2110	1850	
		$N_{b,z,Rd}$	5700	5510	5280	4980	4580	4090	3550	3030	2580	2210	1900	1650	1440	
	1.00	$M_{b,Rd}$	592	592	592	592	592	592	592	592	592	592	592	592	592	

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

$$n = N_{Ed} / N_{pl,Rd}$$

\* The section is a Class 4 section about the y-y axis and is independent of the design axial force  $N_{Ed}$ .

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

Axial force resistance  $N_{pl,Rd}$  which is equal to  $Af_y$  is given in the cross-section resistance check table opposite.

§ The section can be a Class 4 section but no allowance has been made in calculating  $N_{b,y,Rd}$  and  $N_{b,z,Rd}$ .

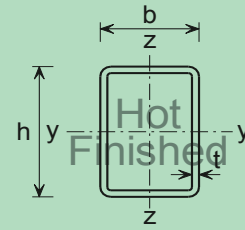
♦ For this section, resistances  $N_{b,Rd}$  and  $M_{b,Rd}$  are calculated based on Class 4 section properties and are displayed in italics.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n Limit Class 3		Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$															
h x b mm	t mm			Axis		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0				
				y-y	z-z		$M_{c,y,Rd}$	$M_{c,z,Rd}$	$M_{N,y,Rd}$	$M_{N,z,Rd}$											
340x100	10.0	65.1	2940	1.00	1.00	$M_{c,y,Rd}$	292	292	292	292	292	292	292	292	221	221	221				
						$M_{c,z,Rd}$	102	102	102	102	102	102	102	102	102	102	102	102	102		
						$M_{N,y,Rd}$	292	292	292	273	234	195	156	117	-	-	-	-	-	-	
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
350x150	5.0 #	38.3	1730	0.265	*	$M_{c,y,Rd}$	193	155	155	*	*	*	*	*	\$	\$	\$				
						$M_{c,z,Rd}$	*	*	*	*	*	*	*	*	\$	\$	\$				
						$M_{N,y,Rd}$	193	-	-	-	-	-	-	-	-	-	-	-	-	-	
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	6.3 #	47.9	2170	0.475	*	$M_{c,y,Rd}$	240	240	192	192	192	*	*	*	*	\$	\$				
						$M_{c,z,Rd}$	*	*	*	*	*	*	*	*	*	\$	\$				
						$M_{N,y,Rd}$	240	240	-	-	-	-	-	-	-	-	-	-	-	-	
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	7.1 #	53.7	2430	0.607	*	$M_{c,y,Rd}$	268	268	268	214	214	214	214	*	*	\$	\$				
						$M_{c,z,Rd}$	*	*	*	*	*	*	*	*	*	\$	\$				
						$M_{N,y,Rd}$	268	268	268	-	-	-	-	-	-	-	-	-	-	-	
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
8.0 #	60.3	2730	0.758	*	$M_{c,y,Rd}$	300	300	300	300	239	239	239	239	*	\$	\$					
					$M_{c,z,Rd}$	*	*	*	*	*	*	*	*	*	\$	\$					
					$M_{N,y,Rd}$	300	300	300	280	-	-	-	-	-	-	-	-	-	-		
					$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
8.8 #	66.0	2990	0.894	*	$M_{c,y,Rd}$	327	327	327	327	327	260	260	260	260	*	\$					
					$M_{c,z,Rd}$	*	*	*	*	*	*	*	*	*	*	\$					
					$M_{N,y,Rd}$	327	327	327	305	262	-	-	-	-	-	-	-	-	-		
					$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
10.0 #	74.5	3370	1.00	1.00	$M_{c,y,Rd}$	367	367	367	367	367	367	367	290	290	290	290					
					$M_{c,z,Rd}$	177	177	177	177	177	177	177	177	177	177	177	177				
					$M_{N,y,Rd}$	367	367	367	343	294	245	196	-	-	-	-	-	-			
					$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-			
12.5 #	91.9	4150	n/a	n/a	$M_{c,y,Rd}$	448	448	448	448	448	448	448	448	448	448	448					
					$M_{c,z,Rd}$	244	244	244	244	244	244	244	244	244	244	244	244				
					$M_{N,y,Rd}$	448	448	448	418	359	299	239	179	120	59.8	0	0				
					$M_{N,z,Rd}$	244	244	223	195	167	139	111	83.6	55.7	27.9	0	0				
14.2 #	103	4690	n/a	n/a	$M_{c,y,Rd}$	501	501	501	501	501	501	501	501	501	501	501					
					$M_{c,z,Rd}$	271	271	271	271	271	271	271	271	271	271	271	271				
					$M_{N,y,Rd}$	501	501	501	468	401	334	267	200	134	66.8	0	0				
					$M_{N,z,Rd}$	271	271	247	216	185	155	124	92.7	61.8	30.9	0	0				
16.0 #	115	5220	n/a	n/a	$M_{c,y,Rd}$	554	554	554	554	554	554	554	554	554	554	554					
					$M_{c,z,Rd}$	298	298	298	298	298	298	298	298	298	298	298	298				
					$M_{N,y,Rd}$	554	554	554	517	443	369	296	222	148	73.9	0	0				
					$M_{N,z,Rd}$	298	298	271	237	203	169	135	102	67.7	33.8	0	0				

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

\* The section is a Class 4 section about the appropriate axis and is independent of the design axial force  $N_{Ed}$ . Values of  $M_{c,Rd}$  are calculated based on Class 4 section properties and are displayed in italics.

$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

\* Section becomes class 4, see note 10.

\$ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

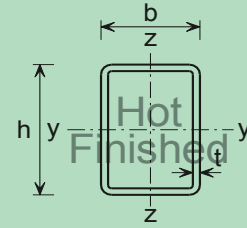
- Not applicable for Class 3 and Class 4 sections.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Member buckling check

Section Designation & Resistances (kNm)		n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
h x b mm	t mm		L (m)	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
340x100	10.0	1.00	$N_{b,y,Rd}$	2920	2840	2750	2640	2500	2320	2110	1870	1640	1430	1240	1090	958
	$f_y W_{el,y} = 221$		$N_{b,z,Rd}$	2590	2070	1450	1010	729	548	426	340	278	231	195	167	145
	$f_y W_{el,z} = 102$	1.00	$M_{b,Rd}$	221	221	221	221	221	221	218	213	209	205	201	197	193
	<b>0.744</b>		$M_{b,Rd}$	292	292	292	292	288	280	273	266	259	253	247	242	237
350x150	§ 5.0 # $f_y W_{el,y} = 155$ $f_y W_{el,z} = 97.3$	0.265	$N_{b,y,Rd}$	1730	1680	1640	1580	1520	1440	1340	1220	1090	970	856	756	669
			$N_{b,z,Rd}$	1650	1540	1370	1140	905	713	568	460	379	318	270	232	201
	0.265	$M_{b,Rd}$	155	155	155	155	155	155	155	155	155	155	155	155	155	155
		<b>0.004</b>	$M_{b,Rd}$	193	193	193	193	193	193	193	193	193	193	193	191	189
	§ 6.3 # $f_y W_{el,y} = 192$ $f_y W_{el,z} = 120$	0.475	$N_{b,y,Rd}$	2160	2110	2050	1990	1900	1800	1670	1530	1370	1220	1070	947	838
			$N_{b,z,Rd}$	2060	1920	1710	1410	1120	879	700	567	467	391	332	285	247
	0.475	$M_{b,Rd}$	192	192	192	192	192	192	192	192	192	192	192	192	192	192
		<b>0.164</b>	$M_{b,Rd}$	240	240	240	240	240	240	240	240	240	240	240	237	235
	§ 7.1 # $f_y W_{el,y} = 214$ $f_y W_{el,z} = 133$	0.607	$N_{b,y,Rd}$	2420	2360	2300	2220	2130	2010	1870	1700	1520	1350	1190	1050	927
			$N_{b,z,Rd}$	2310	2150	1910	1580	1250	978	778	630	519	435	369	317	275
	0.607	$M_{b,Rd}$	214	214	214	214	214	214	214	214	214	214	214	214	214	214
		<b>0.264</b>	$M_{b,Rd}$	268	268	268	268	268	268	268	268	268	268	268	265	263
	§ 8.0 # $f_y W_{el,y} = 239$ $f_y W_{el,z} = 147$	0.758	$N_{b,y,Rd}$	2720	2650	2580	2500	2390	2260	2100	1910	1710	1510	1330	1180	1040
			$N_{b,z,Rd}$	2590	2410	2130	1760	1390	1090	864	700	576	482	409	352	305
	0.758	$M_{b,Rd}$	239	239	239	239	239	239	239	239	239	239	239	239	239	238
		<b>0.377</b>	$M_{b,Rd}$	300	300	300	300	300	300	300	300	300	299	296	293	290
	§ 8.8 # $f_y W_{el,y} = 260$ $f_y W_{el,z} = 159$	0.894	$N_{b,y,Rd}$	2980	2900	2820	2730	2610	2460	2280	2070	1850	1640	1440	1270	1120
			$N_{b,z,Rd}$	2830	2630	2330	1920	1510	1180	938	759	626	524	444	382	331
	0.894	$M_{b,Rd}$	260	260	260	260	260	260	260	260	260	260	260	260	260	259
		<b>0.478</b>	$M_{b,Rd}$	327	327	327	327	327	327	327	327	327	327	327	323	320
	10.0 # $f_y W_{el,y} = 290$ $f_y W_{el,z} = 177$	1.00	$N_{b,y,Rd}$	3360	3280	3190	3080	2950	2780	2580	2340	2090	1850	1630	1440	1270
			$N_{b,z,Rd}$	3190	2960	2610	2140	1680	1310	1040	842	694	580	492	423	367
	1.00	$M_{b,Rd}$	290	290	290	290	290	290	290	290	290	290	290	290	289	
		<b>0.632</b>	$M_{b,Rd}$	367	367	367	367	367	367	367	367	367	366	363	359	356
12.5 # $f_y W_{el,y} = 351$ $f_y W_{el,z} = 211$	1.00	$N_{b,y,Rd}$	4140	4040	3920	3790	3620	3420	3160	2860	2550	2250	1980	1750	1540	
		$N_{b,z,Rd}$	3930	3640	3180	2590	2020	1570	1250	1010	830	694	589	505	439	
1.00	$M_{b,Rd}$	448	448	448	448	448	448	448	448	448	448	446	441	437	433	
14.2 # $f_y W_{el,y} = 389$ $f_y W_{el,z} = 231$	1.00	$N_{b,y,Rd}$	4670	4550	4420	4270	4080	3840	3540	3210	2850	2510	2210	1940	1720	
		$N_{b,z,Rd}$	4430	4090	3560	2870	2230	1740	1370	1110	914	764	648	556	483	
1.00	$M_{b,Rd}$	501	501	501	501	501	501	501	501	501	501	498	492	488	483	
16.0 # $f_y W_{el,y} = 428$ $f_y W_{el,z} = 252$	1.00	$N_{b,y,Rd}$	5200	5070	4920	4750	4530	4260	3920	3540	3140	2770	2430	2140	1890	
		$N_{b,z,Rd}$	4920	4530	3930	3150	2430	1890	1500	1210	993	830	704	604	524	
1.00	$M_{b,Rd}$	554	554	554	554	554	554	554	554	554	554	550	544	538	533	

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

$$n = N_{Ed} / N_{pl,Rd}$$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

Axial force resistance  $N_{pl,Rd}$  which is equal to  $Af_y$  is given in the cross-section resistance check table opposite.

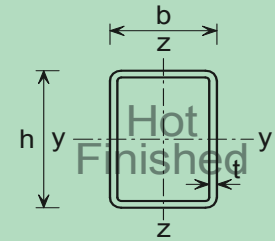
§ The section can be a Class 4 section but no allowance has been made in calculating  $N_{b,y,Rd}$  and  $N_{b,z,Rd}$ .

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n Limit Class 3 <b>Class 2</b>		Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$												
h x b mm	t mm			Axis		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	
				y-y	z-z													
350x250	6.3 #	57.8	2610	*	*	$M_{c,y,Rd}$	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	
						$M_{c,z,Rd}$	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	
						$M_{N,y,Rd}$	-	-	-	-	-	-	-	-	-	-	-	
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	
		7.1 #	64.9	2930	0.607	*	$M_{c,y,Rd}$	299	299	299	299	299	299	299	✗	✗	✗	✗
					<b>0.00</b>		$M_{c,z,Rd}$	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
							$M_{N,y,Rd}$	-	-	-	-	-	-	-	-	-	-	-
							$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-
350x250	8.0 #	72.8	3290	0.758	*	$M_{c,y,Rd}$	397	397	397	397	334	334	334	334	✗	✗	✗	
				<b>0.312</b>		$M_{c,z,Rd}$	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	
						$M_{N,y,Rd}$	397	397	397	370	-	-	-	-	-	-	-	
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	
350x250	8.8 #	79.8	3620	0.894	*	$M_{c,y,Rd}$	434	434	434	434	364	364	364	364	364	✗	✗	
				<b>0.394</b>		$M_{c,z,Rd}$	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	
						$M_{N,y,Rd}$	434	434	434	405	-	-	-	-	-	-	-	
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	
350x250	10.0 #	90.2	4080	1.00	1.00	$M_{c,y,Rd}$	488	488	488	488	488	488	408	408	408	408	408	
				<b>0.522</b>	<b>0.00</b>	$M_{c,z,Rd}$	339	339	339	339	339	339	339	339	339	339	339	
						$M_{N,y,Rd}$	488	488	488	456	391	325	-	-	-	-	-	
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	
350x250	12.5 #	112	5040	n/a	n/a	$M_{c,y,Rd}$	598	598	598	598	598	598	598	598	598	598	598	
				<b>1.00</b>	<b>1.00</b>	$M_{c,z,Rd}$	474	474	474	474	474	474	474	474	474	474	474	
						$M_{N,y,Rd}$	598	598	598	558	479	399	319	239	160	79.8	0	
						$M_{N,z,Rd}$	474	474	469	410	352	293	234	176	117	58.6	0	
350x250	14.2 #	126	5680	n/a	n/a	$M_{c,y,Rd}$	670	670	670	670	670	670	670	670	670	670	670	
				<b>1.00</b>	<b>1.00</b>	$M_{c,z,Rd}$	530	530	530	530	530	530	530	530	530	530	530	
						$M_{N,y,Rd}$	670	670	670	625	536	447	357	268	179	89.3	0	
						$M_{N,z,Rd}$	530	530	523	457	392	327	261	196	131	65.3	0	
350x250	16.0 #	141	6350	n/a	n/a	$M_{c,y,Rd}$	744	744	744	744	744	744	744	744	744	744	744	
				<b>1.00</b>	<b>1.00</b>	$M_{c,z,Rd}$	588	588	588	588	588	588	588	588	588	588	588	
						$M_{N,y,Rd}$	744	744	744	694	595	496	397	297	198	99.2	0	
						$M_{N,z,Rd}$	588	588	578	506	434	361	289	217	145	72.3	0	

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

\* The section is a Class 4 section about the appropriate axis and is independent of the design axial force  $N_{Ed}$ . Values of  $M_{c,Rd}$  are calculated based on Class 4 section properties and are displayed in italics.

$N_{Ed}$  = Design value of the axial force.

$$n = N_{Ed} / N_{pl,Rd}$$

✗ Section becomes class 4, see note 10.

✗ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

- Not applicable for Class 3 and Class 4 sections.

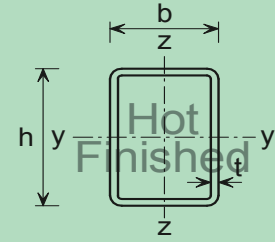
# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.



HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Member buckling check

Section Designation & Resistances (kNm)		n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
h x b	t		L (m)	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
mm	mm															
350x250	♦ 6.3 #	*	$N_{b,y,Rd}$	2090	2060	2020	1970	1920	1850	1770	1680	1570	1450	1320	1200	1080
	$f_y W_{el,y} = 268$		$N_{b,z,Rd}$	2080	2020	1960	1890	1800	1680	1530	1370	1210	1060	925	812	715
	$f_y W_{el,z} = 224$	*	$M_{b,Rd}$	255	255	255	255	255	255	255	255	255	255	255	255	255
§ 7.1 #	0.607		$N_{b,y,Rd}$	2930	2870	2800	2720	2620	2510	2360	2190	2000	1800	1610	1430	1270
	$f_y W_{el,y} = 299$		$N_{b,z,Rd}$	2900	2810	2700	2570	2390	2170	1920	1660	1430	1230	1060	924	809
	$f_y W_{el,z} = 250$	0.607	$M_{b,Rd}$	299	299	299	299	299	299	299	299	299	299	299	299	299
		<b>0.00</b>	$M_{b,Rd}$	355	355	355	355	355	355	355	355	355	355	355	355	355
§ 8.0 #	0.758		$N_{b,y,Rd}$	3290	3220	3140	3050	2940	2810	2640	2450	2230	2000	1790	1590	1410
	$f_y W_{el,y} = 334$		$N_{b,z,Rd}$	3250	3150	3040	2890	2690	2440	2150	1870	1600	1380	1190	1040	909
	$f_y W_{el,z} = 278$	0.758	$M_{b,Rd}$	334	334	334	334	334	334	334	334	334	334	334	334	334
		<b>0.312</b>	$M_{b,Rd}$	397	397	397	397	397	397	397	397	397	397	397	397	397
§ 8.8 #	0.894		$N_{b,y,Rd}$	3620	3540	3460	3360	3240	3090	2910	2690	2450	2200	1960	1750	1550
	$f_y W_{el,y} = 364$		$N_{b,z,Rd}$	3580	3460	3330	3160	2940	2660	2340	2020	1740	1490	1290	1120	982
	$f_y W_{el,z} = 303$	0.894	$M_{b,Rd}$	364	364	364	364	364	364	364	364	364	364	364	364	364
		<b>0.394</b>	$M_{b,Rd}$	434	434	434	434	434	434	434	434	434	434	434	434	434
10.0 #	1.00		$N_{b,y,Rd}$	4080	3990	3890	3780	3640	3470	3260	3020	2740	2460	2190	1950	1730
	$f_y W_{el,y} = 408$		$N_{b,z,Rd}$	4030	3910	3760	3570	3320	3000	2640	2280	1960	1680	1450	1260	1110
	$f_y W_{el,z} = 339$	1.00	$M_{b,Rd}$	408	408	408	408	408	408	408	408	408	408	408	408	408
		<b>0.522</b>	$M_{b,Rd}$	488	488	488	488	488	488	488	488	488	488	488	488	488
12.5 #	1.00		$N_{b,y,Rd}$	5040	4930	4800	4660	4490	4270	4010	3700	3360	3010	2670	2370	2110
	$f_y W_{el,y} = 495$		$N_{b,z,Rd}$	4970	4820	4630	4390	4070	3680	3230	2780	2380	2040	1760	1530	1340
	$f_y W_{el,z} = 410$	<b>1.00</b>	$M_{b,Rd}$	598	598	598	598	598	598	598	598	598	598	598	598	598
14.2 #	1.00		$N_{b,y,Rd}$	5680	5550	5410	5240	5050	4800	4500	4150	3750	3360	2980	2640	2350
	$f_y W_{el,y} = 552$		$N_{b,z,Rd}$	5600	5420	5210	4930	4570	4110	3590	3090	2640	2270	1950	1700	1490
	$f_y W_{el,z} = 456$	<b>1.00</b>	$M_{b,Rd}$	670	670	670	670	670	670	670	670	670	670	670	670	670
16.0 #	1.00		$N_{b,y,Rd}$	6350	6200	6040	5860	5630	5360	5010	4610	4160	3720	3300	2920	2590
	$f_y W_{el,y} = 609$		$N_{b,z,Rd}$	6260	6060	5820	5500	5090	4570	3990	3420	2920	2510	2160	1880	1640
	$f_y W_{el,z} = 501$	<b>1.00</b>	$M_{b,Rd}$	744	744	744	744	744	744	744	744	744	744	744	744	744

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

$$n = N_{Ed} / N_{pl,Rd}$$

\* The section is a Class 4 section about the y-y axis and is independent of the design axial force  $N_{Ed}$ .

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

Axial force resistance  $N_{pl,Rd}$  which is equal to  $Af_y$  is given in the cross-section resistance check table opposite.

§ The section can be a Class 4 section but no allowance has been made in calculating  $N_{b,y,Rd}$  and  $N_{b,z,Rd}$ .

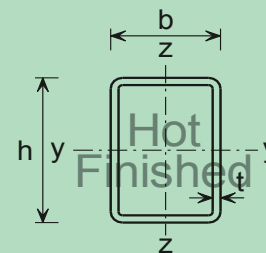
♦ For this section, resistances  $N_{b,Rd}$  and  $M_{b,Rd}$  are calculated based on Class 4 section properties and are displayed in italics.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n Limit Class 3		Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$																	
h x b mm	t mm			Class 2		n	Axis																
				y-y	z-z		0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0						
400x150	6.3 #	52.8	2390	0.347	*	<i><math>M_{c,y,Rd}</math></i>	297	235	235	235	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗			
						<i><math>M_{c,z,Rd}</math></i>	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	
						<i><math>M_{N,y,Rd}</math></i>	297	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						<i><math>M_{N,z,Rd}</math></i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	7.1 #	59.3	2680	0.461	*	<i><math>M_{c,y,Rd}</math></i>	332	332	263	263	263	✗	✗	✗	✗	✗	✗	✗	✗	✗			
						<i><math>M_{c,z,Rd}</math></i>	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	
						<i><math>M_{N,y,Rd}</math></i>	332	332	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						<i><math>M_{N,z,Rd}</math></i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	8.0 #	66.5	3010	0.591	*	<i><math>M_{c,y,Rd}</math></i>	371	371	371	293	293	293	✗	✗	✗	✗	✗	✗	✗	✗			
						<i><math>M_{c,z,Rd}</math></i>	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	
						<i><math>M_{N,y,Rd}</math></i>	371	371	371	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						<i><math>M_{N,z,Rd}</math></i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	8.8 #	72.9	3300	0.707	*	<i><math>M_{c,y,Rd}</math></i>	406	406	406	406	319	319	319	319	✗	✗	✗	✗	✗	✗			
						<i><math>M_{c,z,Rd}</math></i>	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	
						<i><math>M_{N,y,Rd}</math></i>	406	406	406	379	-	-	-	-	-	-	-	-	-	-	-	-	-
						<i><math>M_{N,z,Rd}</math></i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	10.0 #	82.4	3730	0.885	*	<i><math>M_{c,y,Rd}</math></i>	456	456	456	456	456	357	357	357	357	✗	✗	✗	✗	✗			
						<i><math>M_{c,z,Rd}</math></i>	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	
						<i><math>M_{N,y,Rd}</math></i>	456	456	456	426	365	-	-	-	-	-	-	-	-	-	-	-	-
						<i><math>M_{N,z,Rd}</math></i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	12.5 #	102	4620	n/a	n/a	<i><math>M_{c,y,Rd}</math></i>	558	558	558	558	558	558	558	558	558	558	558	558	558				
						<i><math>M_{c,z,Rd}</math></i>	274	274	274	274	274	274	274	274	274	274	274	274	274	274	274		
						<i><math>M_{N,y,Rd}</math></i>	558	558	558	521	446	372	297	223	149	74.4	0	0	0	0	0	0	
						<i><math>M_{N,z,Rd}</math></i>	274	274	248	217	186	155	124	92.9	62.0	31.0	0	0	0	0	0	0	
	14.2 #	115	5180	n/a	n/a	<i><math>M_{c,y,Rd}</math></i>	624	624	624	624	624	624	624	624	624	624	624	624	624				
						<i><math>M_{c,z,Rd}</math></i>	305	305	305	305	305	305	305	305	305	305	305	305	305	305	305		
						<i><math>M_{N,y,Rd}</math></i>	624	624	624	582	499	416	333	250	166	83.2	0	0	0	0	0	0	
						<i><math>M_{N,z,Rd}</math></i>	305	305	274	240	206	172	137	103	68.6	34.3	0	0	0	0	0	0	
16.0	128	5790	n/a	n/a	<i><math>M_{c,y,Rd}</math></i>	692	692	692	692	692	692	692	692	692	692	692	692	692					
					<i><math>M_{c,z,Rd}</math></i>	336	336	336	336	336	336	336	336	336	336	336	336	336	336	336			
					<i><math>M_{N,y,Rd}</math></i>	692	692	692	645	553	461	369	277	184	92.2	0	0	0	0	0	0		
					<i><math>M_{N,z,Rd}</math></i>	336	336	301	264	226	188	151	113	75.3	37.7	0	0	0	0	0	0		

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\* The section is a Class 4 section about the appropriate axis and is independent of the design axial force  $N_{Ed}$ . Values of  $M_{c,Rd}$  are calculated based on Class 4 section properties and are displayed in italics.

$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

✗ Section becomes class 4, see note 10.

✗ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

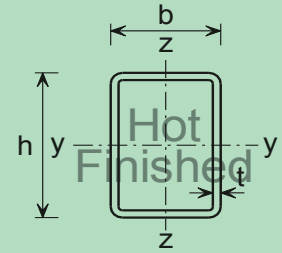
- Not applicable for Class 3 and Class 4 sections.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Member buckling check

Section Designation & Resistances (kNm)		n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$														
h x b mm	t mm		L (m)	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	
400x150	§ 6.3 # $f_y W_{el,y} = 235$ $f_y W_{el,z} = 135$	0.347	$N_{b,y,Rd}$	2390	2350	2290	2230	2160	2070	1970	1840	1700	1540	1390	1240	1110	
			$N_{b,z,Rd}$	2280	2120	1900	1580	1260	990	789	639	527	442	375	322	280	
		0.347	$M_{b,Rd}$	235	235	235	235	235	235	235	235	235	235	235	235	235	233
			0.070	$M_{b,Rd}$	297	297	297	297	297	297	297	297	297	297	294	291	288
	§ 7.1 # $f_y W_{el,y} = 263$ $f_y W_{el,z} = 150$	0.461	$N_{b,y,Rd}$	2680	2630	2570	2500	2420	2330	2210	2070	1900	1730	1560	1390	1250	
			$N_{b,z,Rd}$	2550	2380	2120	1760	1400	1100	875	709	585	490	416	357	310	
		0.461	$M_{b,Rd}$	263	263	263	263	263	263	263	263	263	263	263	263	262	260
			0.160	$M_{b,Rd}$	332	332	332	332	332	332	332	332	332	329	326	323	320
	§ 8.0 # $f_y W_{el,y} = 293$ $f_y W_{el,z} = 166$	0.591	$N_{b,y,Rd}$	3010	2950	2890	2810	2720	2610	2470	2310	2130	1930	1730	1550	1390	
			$N_{b,z,Rd}$	2860	2670	2370	1970	1560	1220	973	788	649	544	461	396	344	
		0.591	$M_{b,Rd}$	293	293	293	293	293	293	293	293	293	293	293	293	292	290
			0.261	$M_{b,Rd}$	371	371	371	371	371	371	371	371	371	368	364	360	357
	§ 8.8 # $f_y W_{el,y} = 319$ $f_y W_{el,z} = 180$	0.707	$N_{b,y,Rd}$	3300	3240	3160	3080	2980	2860	2710	2530	2330	2110	1900	1700	1520	
			$N_{b,z,Rd}$	3130	2920	2590	2140	1690	1330	1060	856	705	590	501	430	374	
		0.707	$M_{b,Rd}$	319	319	319	319	319	319	319	319	319	319	319	318	316	
			0.353	$M_{b,Rd}$	406	406	406	406	406	406	406	406	406	402	397	393	390
	§ 10.0 # $f_y W_{el,y} = 357$ $f_y W_{el,z} = 200$	0.885	$N_{b,y,Rd}$	3730	3660	3570	3470	3360	3220	3050	2850	2610	2370	2130	1900	1700	
			$N_{b,z,Rd}$	3540	3290	2910	2400	1890	1480	1180	954	786	658	558	479	416	
	0.885	$M_{b,Rd}$	357	357	357	357	357	357	357	357	357	357	357	356	353		
		0.491	$M_{b,Rd}$	456	456	456	456	456	456	456	456	456	451	446	442	437	
12.5 # $f_y W_{el,y} = 432$ $f_y W_{el,z} = 239$	1.00	$N_{b,y,Rd}$	4620	4530	4420	4300	4150	3980	3760	3510	3210	2910	2610	2330	2080		
		$N_{b,z,Rd}$	4370	4050	3570	2910	2280	1780	1410	1140	942	788	668	574	498		
	1.00	$M_{b,Rd}$	558	558	558	558	558	558	558	558	556	550	544	539	533		
14.2 # $f_y W_{el,y} = 481$ $f_y W_{el,z} = 263$	1.00	$N_{b,y,Rd}$	5180	5080	4960	4820	4660	4460	4210	3920	3590	3240	2900	2580	2300		
		$N_{b,z,Rd}$	4900	4540	3970	3220	2510	1960	1550	1250	1030	864	732	629	546		
	1.00	$M_{b,Rd}$	624	624	624	624	624	624	624	624	622	615	608	602	596		
16.0 $f_y W_{el,y} = 530$ $f_y W_{el,z} = 286$	1.00	$N_{b,y,Rd}$	5790	5670	5530	5380	5190	4960	4680	4350	3970	3580	3200	2850	2540		
		$N_{b,z,Rd}$	5470	5050	4400	3550	2760	2140	1700	1370	1130	944	800	687	596		
	1.00	$M_{b,Rd}$	692	692	692	692	692	692	692	692	688	680	673	666	659		

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

$$n = N_{Ed} / N_{pl,Rd}$$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

Axial force resistance  $N_{pl,Rd}$  which is equal to  $Af_y$  is given in the cross-section resistance check table opposite.

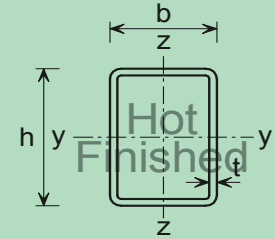
§ The section can be a Class 4 section but no allowance has been made in calculating  $N_{b,y,Rd}$  and  $N_{b,z,Rd}$ .

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n Limit Class 3 <b>Class 2</b>		Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$														
h x b mm	t mm			Axis		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0			
				y-y	z-z		<i><math>M_{c,y,Rd}</math></i>	<i><math>M_{c,z,Rd}</math></i>	<i><math>M_{N,y,Rd}</math></i>	<i><math>M_{N,z,Rd}</math></i>										
400x200	6.3 #	57.8	2610	0.347 <b>0.064</b>	*	<i><math>M_{c,y,Rd}</math></i>	341	279	279	279	✗	✗	✗	✗	\$	\$	\$			
						<i><math>M_{c,z,Rd}</math></i>	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	\$	\$	\$	
						<i><math>M_{N,y,Rd}</math></i>	341	-	-	-	-	-	-	-	-	-	-	-	-	-
						<i><math>M_{N,z,Rd}</math></i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	7.1 #	64.9	2930	0.461 <b>0.146</b>	*	<i><math>M_{c,y,Rd}</math></i>	382	382	311	311	311	✗	✗	✗	✗	\$	\$			
						<i><math>M_{c,z,Rd}</math></i>	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	\$	\$		
						<i><math>M_{N,y,Rd}</math></i>	382	382	-	-	-	-	-	-	-	-	-	-	-	
						<i><math>M_{N,z,Rd}</math></i>	-	-	-	-	-	-	-	-	-	-	-	-	-	
8.0	72.8	3290	0.591 <b>0.239</b>	*	<i><math>M_{c,y,Rd}</math></i>	427	427	427	347	347	347	✗	✗	✗	\$	\$				
					<i><math>M_{c,z,Rd}</math></i>	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	\$	\$			
					<i><math>M_{N,y,Rd}</math></i>	427	427	427	-	-	-	-	-	-	-	-	-			
					<i><math>M_{N,z,Rd}</math></i>	-	-	-	-	-	-	-	-	-	-	-	-			
8.8 #	79.8	3620	0.707 <b>0.321</b>	*	<i><math>M_{c,y,Rd}</math></i>	467	467	467	467	378	378	378	378	✗	\$	\$				
					<i><math>M_{c,z,Rd}</math></i>	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	\$	\$			
					<i><math>M_{N,y,Rd}</math></i>	467	467	467	436	-	-	-	-	-	-	-	-			
					<i><math>M_{N,z,Rd}</math></i>	-	-	-	-	-	-	-	-	-	-	-	-			
10.0	90.2	4080	0.885 <b>0.448</b>	*	<i><math>M_{c,y,Rd}</math></i>	525	525	525	525	525	425	425	425	425	✗	\$				
					<i><math>M_{c,z,Rd}</math></i>	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	\$			
					<i><math>M_{N,y,Rd}</math></i>	525	525	525	490	420	-	-	-	-	-	-	-			
					<i><math>M_{N,z,Rd}</math></i>	-	-	-	-	-	-	-	-	-	-	-	-			
12.5	112	5040	n/a <b>1.00</b>	n/a <b>1.00</b>	<i><math>M_{c,y,Rd}</math></i>	644	644	644	644	644	644	644	644	644	644	644				
					<i><math>M_{c,z,Rd}</math></i>	394	394	394	394	394	394	394	394	394	394	394	394			
					<i><math>M_{N,y,Rd}</math></i>	644	644	644	601	515	429	343	257	172	85.8	0				
					<i><math>M_{N,z,Rd}</math></i>	394	394	370	324	278	231	185	139	92.6	46.3	0				
14.2 #	126	5680	n/a <b>1.00</b>	n/a <b>1.00</b>	<i><math>M_{c,y,Rd}</math></i>	721	721	721	721	721	721	721	721	721	721	721				
					<i><math>M_{c,z,Rd}</math></i>	441	441	441	441	441	441	441	441	441	441	441				
					<i><math>M_{N,y,Rd}</math></i>	721	721	721	673	577	481	385	289	192	96.2	0				
					<i><math>M_{N,z,Rd}</math></i>	441	441	413	361	309	258	206	155	103	51.6	0				
16.0	141	6350	n/a <b>1.00</b>	n/a <b>1.00</b>	<i><math>M_{c,y,Rd}</math></i>	801	801	801	801	801	801	801	801	801	801	801				
					<i><math>M_{c,z,Rd}</math></i>	488	488	488	488	488	488	488	488	488	488	488				
					<i><math>M_{N,y,Rd}</math></i>	801	801	801	747	641	534	427	320	214	107	0				
					<i><math>M_{N,z,Rd}</math></i>	488	488	455	398	341	284	228	171	114	56.9	0				

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

\* The section is a Class 4 section about the appropriate axis and is independent of the design axial force  $N_{Ed}$ . Values of  $M_{c,Rd}$  are calculated based on Class 4 section properties and are displayed in italics.

$N_{Ed}$  = Design value of the axial force.

$$n = N_{Ed} / N_{pl,Rd}$$

✗ Section becomes class 4, see note 10.

\$ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

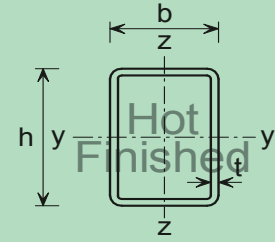
- Not applicable for Class 3 and Class 4 sections.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Member buckling check

Section Designation & Resistances (kNm)		n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for														
h x b mm	t mm		Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$														
			L (m)	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	
400x200	§ 6.3 # $f_y W_{el,y} = 279$ $f_y W_{el,z} = 191$	0.347	$N_{b,y,Rd}$	2610	2570	2520	2460	2380	2300	2190	2070	1920	1760	1600	1440	1300	
			$N_{b,z,Rd}$	2550	2450	2310	2130	1890	1610	1340	1120	940	796	680	588	512	
		0.347	$M_{b,Rd}$	279	279	279	279	279	279	279	279	279	279	279	279	279	279
			<b>0.064</b>	$M_{b,Rd}$	341	341	341	341	341	341	341	341	341	341	341	341	341
	§ 7.1 # $f_y W_{el,y} = 311$ $f_y W_{el,z} = 213$	0.461	$N_{b,y,Rd}$	2930	2890	2820	2760	2670	2580	2460	2320	2160	1980	1800	1620	1460	
			$N_{b,z,Rd}$	2860	2740	2590	2380	2110	1790	1500	1250	1050	886	757	654	570	
		0.461	$M_{b,Rd}$	311	311	311	311	311	311	311	311	311	311	311	311	311	
			<b>0.146</b>	$M_{b,Rd}$	382	382	382	382	382	382	382	382	382	382	382	382	
	§ 8.0 $f_y W_{el,y} = 347$ $f_y W_{el,z} = 236$	0.591	$N_{b,y,Rd}$	3290	3240	3170	3090	3000	2890	2760	2600	2410	2210	2000	1800	1620	
			$N_{b,z,Rd}$	3210	3080	2910	2670	2360	2000	1670	1390	1170	987	843	728	635	
		0.591	$M_{b,Rd}$	347	347	347	347	347	347	347	347	347	347	347	347	347	
			<b>0.239</b>	$M_{b,Rd}$	427	427	427	427	427	427	427	427	427	427	427	427	
	§ 8.8 # $f_y W_{el,y} = 378$ $f_y W_{el,z} = 257$	0.707	$N_{b,y,Rd}$	3620	3560	3490	3400	3300	3180	3030	2860	2650	2430	2200	1980	1780	
			$N_{b,z,Rd}$	3530	3380	3190	2930	2580	2190	1830	1520	1270	1080	921	795	693	
		0.707	$M_{b,Rd}$	378	378	378	378	378	378	378	378	378	378	378	378	378	
			<b>0.321</b>	$M_{b,Rd}$	467	467	467	467	467	467	467	467	467	467	467	467	
	§ 10.0 $f_y W_{el,y} = 425$ $f_y W_{el,z} = 287$	0.885	$N_{b,y,Rd}$	4080	4020	3930	3830	3710	3580	3410	3210	2970	2720	2460	2210	1980	
			$N_{b,z,Rd}$	3980	3810	3600	3290	2900	2460	2040	1700	1420	1200	1030	887	773	
		0.885	$M_{b,Rd}$	425	425	425	425	425	425	425	425	425	425	425	425	425	
			<b>0.448</b>	$M_{b,Rd}$	525	525	525	525	525	525	525	525	525	525	525	525	
	12.5 $f_y W_{el,y} = 516$ $f_y W_{el,z} = 346$	1.00	$N_{b,y,Rd}$	5040	4960	4850	4720	4580	4410	4190	3940	3650	3330	3010	2700	2420	
			$N_{b,z,Rd}$	4910	4700	4420	4040	3540	2980	2470	2050	1720	1450	1240	1070	931	
		1.00	$M_{b,Rd}$	644	644	644	644	644	644	644	644	644	644	644	644	644	
14.2 # $f_y W_{el,y} = 575$ $f_y W_{el,z} = 383$	1.00	$N_{b,y,Rd}$	5680	5580	5460	5320	5150	4950	4710	4420	4090	3730	3360	3020	2700		
		$N_{b,z,Rd}$	5530	5290	4970	4530	3950	3320	2750	2280	1900	1610	1370	1190	1030		
	1.00	$M_{b,Rd}$	721	721	721	721	721	721	721	721	721	721	721	721	721		
16.0 $f_y W_{el,y} = 634$ $f_y W_{el,z} = 420$	1.00	$N_{b,y,Rd}$	6350	6240	6100	5940	5750	5530	5250	4920	4540	4140	3730	3340	2990		
		$N_{b,z,Rd}$	6180	5910	5540	5040	4380	3670	3030	2510	2090	1770	1510	1300	1130		
	1.00	$M_{b,Rd}$	801	801	801	801	801	801	801	801	801	801	801	801	801		

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

$$n = N_{Ed} / N_{pl,Rd}$$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of

$n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

Axial force resistance  $N_{pl,Rd}$  which is equal to  $Af_y$  is given in the cross-section resistance check table opposite.

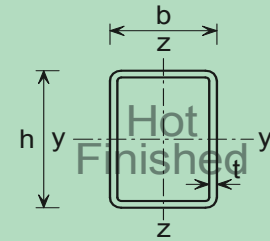
§ The section can be a Class 4 section but no allowance has been made in calculating  $N_{b,y,Rd}$  and  $N_{b,z,Rd}$ .

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n Limit Class 3 <b>Class 2</b>		Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$														
h x b mm	t mm			Axis		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0			
				y-y	z-z															
400x300	8.0 #	85.4	3870	*	*	<i><math>M_{c,y,Rd}</math></i>	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘			
						<i><math>M_{c,z,Rd}</math></i>	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	
						<i><math>M_{N,y,Rd}</math></i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						<i><math>M_{N,z,Rd}</math></i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	8.8 #	93.6	4220	0.707 <b>0.00</b>	*	<i><math>M_{c,y,Rd}</math></i>	498	498	498	498	498	498	498	498	✘	✘	✘			
						<i><math>M_{c,z,Rd}</math></i>	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘		
						<i><math>M_{N,y,Rd}</math></i>	-	-	-	-	-	-	-	-	-	-	-	-	-	
						<i><math>M_{N,z,Rd}</math></i>	-	-	-	-	-	-	-	-	-	-	-	-	-	
	10.0 #	106	4790	0.885 <b>0.382</b>	*	<i><math>M_{c,y,Rd}</math></i>	664	664	664	664	559	559	559	559	559	✘	✘			
						<i><math>M_{c,z,Rd}</math></i>	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘		
						<i><math>M_{N,y,Rd}</math></i>	664	664	664	620	-	-	-	-	-	-	-	-		
						<i><math>M_{N,z,Rd}</math></i>	-	-	-	-	-	-	-	-	-	-	-	-		
	12.5 #	131	5930	n/a <b>1.00</b>	n/a <b>1.00</b>	<i><math>M_{c,y,Rd}</math></i>	816	816	816	816	816	816	816	816	816	816	816			
						<i><math>M_{c,z,Rd}</math></i>	669	669	669	669	669	669	669	669	669	669	669			
						<i><math>M_{N,y,Rd}</math></i>	816	816	816	761	653	544	435	326	218	109	0			
						<i><math>M_{N,z,Rd}</math></i>	669	669	669	586	502	418	335	251	167	83.7	0			
	14.2 #	148	6710	n/a <b>1.00</b>	n/a <b>1.00</b>	<i><math>M_{c,y,Rd}</math></i>	916	916	916	916	916	916	916	916	916	916	916			
						<i><math>M_{c,z,Rd}</math></i>	750	750	750	750	750	750	750	750	750	750	750			
						<i><math>M_{N,y,Rd}</math></i>	916	916	916	855	732	610	488	366	244	122	0			
						<i><math>M_{N,z,Rd}</math></i>	750	750	750	656	562	469	375	281	187	93.7	0			
	16.0 #	166	7490	n/a <b>1.00</b>	n/a <b>1.00</b>	<i><math>M_{c,y,Rd}</math></i>	1020	1020	1020	1020	1020	1020	1020	1020	1020	1020	1020			
						<i><math>M_{c,z,Rd}</math></i>	834	834	834	834	834	834	834	834	834	834	834			
						<i><math>M_{N,y,Rd}</math></i>	1020	1020	1020	951	815	679	543	408	272	136	0			
						<i><math>M_{N,z,Rd}</math></i>	834	834	830	727	623	519	415	311	208	104	0			

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\* The section is a Class 4 section about the appropriate axis and is independent of the design axial force  $N_{Ed}$ . Values of  $M_{c,Rd}$  are calculated based on Class 4 section properties and are displayed in italics.

$N_{Ed}$  = Design value of the axial force.

$$n = N_{Ed} / N_{pl,Rd}$$

✘ Section becomes class 4, see note 10.

\$ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

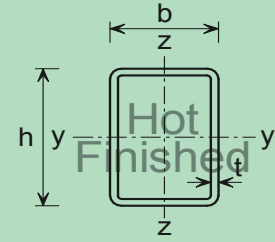
- Not applicable for Class 3 and Class 4 sections.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Member buckling check

Section Designation & Resistances (kNm)		n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$														
h x b	t		L (m)	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	
mm	mm																
400x300	♦ 8.0 # $f_y W_{el,y} = 456$ $f_y W_{el,z} = 392$	*	$N_{b,y,Rd}$	3290	3270	3210	3140	3070	2990	2900	2780	2650	2500	2330	2150	1970	
			$N_{b,z,Rd}$	3290	3220	3140	3050	2940	2810	2650	2450	2230	2010	1790	1590	1420	
		*	$M_{b,Rd}$	443	443	443	443	443	443	443	443	443	443	443	443	443	443
	§ 8.8 # $f_y W_{el,y} = 498$ $f_y W_{el,z} = 427$	0.707	$N_{b,y,Rd}$	4220	4170	4090	3990	3890	3760	3610	3430	3220	2980	2730	2480	2250	
			$N_{b,z,Rd}$	4210	4110	4000	3860	3700	3490	3230	2940	2620	2320	2040	1800	1590	
		0.707	$M_{b,Rd}$	498	498	498	498	498	498	498	498	498	498	498	498	498	498
		<b>0.00</b>	$M_{b,Rd}$	589	589	589	589	589	589	589	589	589	589	589	589	589	589
	§ 10.0 # $f_y W_{el,y} = 559$ $f_y W_{el,z} = 479$	0.885	$N_{b,y,Rd}$	4790	4730	4640	4530	4410	4270	4100	3890	3650	3390	3100	2820	2550	
			$N_{b,z,Rd}$	4780	4660	4530	4370	4180	3940	3650	3300	2950	2600	2290	2020	1780	
		0.885	$M_{b,Rd}$	559	559	559	559	559	559	559	559	559	559	559	559	559	
		<b>0.382</b>	$M_{b,Rd}$	664	664	664	664	664	664	664	664	664	664	664	664	664	
	12.5 # $f_y W_{el,y} = 683$ $f_y W_{el,z} = 583$	1.00	$N_{b,y,Rd}$	5930	5850	5730	5600	5450	5270	5060	4800	4500	4160	3810	3450	3120	
		$N_{b,z,Rd}$	5910	5760	5600	5400	5160	4860	4480	4060	3610	3180	2790	2460	2170		
<b>1.00</b>		$M_{b,Rd}$	816	816	816	816	816	816	816	816	816	816	816	816	816		
14.2 # $f_y W_{el,y} = 763$ $f_y W_{el,z} = 649$	1.00	$N_{b,y,Rd}$	6710	6620	6480	6330	6160	5950	5710	5410	5070	4680	4280	3880	3500		
		$N_{b,z,Rd}$	6690	6520	6330	6110	5840	5500	5070	4590	4080	3600	3160	2780	2460		
	<b>1.00</b>	$M_{b,Rd}$	916	916	916	916	916	916	916	916	916	916	916	916	916		
16.0 # $f_y W_{el,y} = 844$ $f_y W_{el,z} = 717$	1.00	$N_{b,y,Rd}$	7490	7390	7230	7060	6870	6640	6360	6020	5630	5190	4740	4290	3870		
		$N_{b,z,Rd}$	7460	7270	7060	6810	6500	6110	5630	5080	4510	3970	3490	3070	2710		
	<b>1.00</b>	$M_{b,Rd}$	1020	1020	1020	1020	1020	1020	1020	1020	1020	1020	1020	1020	1020		

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

$$n = N_{Ed} / N_{pl,Rd}$$

\* The section is a Class 4 section about the y-y axis and is independent of the design axial force  $N_{Ed}$ .

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

Axial force resistance  $N_{pl,Rd}$  which is equal to  $Af_y$  is given in the cross-section resistance check table opposite.

§ The section can be a Class 4 section but no allowance has been made in calculating  $N_{b,y,Rd}$  and  $N_{b,z,Rd}$ .

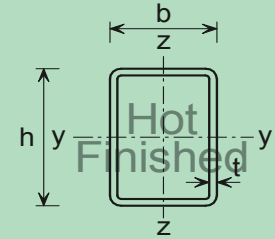
♦ For this section, resistances  $N_{b,Rd}$  and  $M_{b,Rd}$  are calculated based on Class 4 section properties and are displayed in italics.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n Limit Class 3		Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for													
h x b mm	t mm			Class 2		Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$													
				Axis		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0		
				y-y	z-z														
450x250	8.0	85.4	3870	0.463 <b>0.141</b>	*	$M_{c,y,Rd}$	576	576	475	475	475	✗	✗	✗	✗	\$	\$		
						$M_{c,z,Rd}$	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	\$	\$	
						$M_{N,y,Rd}$	576	576	-	-	-	-	-	-	-	-	-	-	-
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-
	8.8 #	93.6	4220	0.565 <b>0.213</b>	*	$M_{c,y,Rd}$	630	630	630	518	518	518	✗	✗	✗	\$	\$		
						$M_{c,z,Rd}$	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	\$	\$	
						$M_{N,y,Rd}$	630	630	630	-	-	-	-	-	-	-	-	-	-
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-
	10.0	106	4790	0.720 <b>0.319</b>	*	$M_{c,y,Rd}$	710	710	710	710	582	582	582	582	✗	\$	\$		
						$M_{c,z,Rd}$	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	\$	\$	
						$M_{N,y,Rd}$	710	710	710	663	-	-	-	-	-	-	-	-	
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-
12.5	131	5930	1.00 <b>0.546</b>	1.00 <b>0.00</b>	$M_{c,y,Rd}$	873	873	873	873	873	873	710	710	710	710	710			
					$M_{c,z,Rd}$	510	510	510	510	510	510	510	510	510	510	510	510		
					$M_{N,y,Rd}$	873	873	873	814	698	582	-	-	-	-	-	-		
					$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-	
14.2 #	148	6710	n/a <b>1.00</b>	n/a <b>1.00</b>	$M_{c,y,Rd}$	979	979	979	979	979	979	979	979	979	979	979			
					$M_{c,z,Rd}$	649	649	649	649	649	649	649	649	649	649	649	649		
					$M_{N,y,Rd}$	979	979	979	914	784	653	522	392	261	131	0	0		
					$M_{N,z,Rd}$	649	649	619	542	464	387	310	232	155	77.4	0	0		
16.0	166	7490	n/a <b>1.00</b>	n/a <b>1.00</b>	$M_{c,y,Rd}$	1090	1090	1090	1090	1090	1090	1090	1090	1090	1090	1090			
					$M_{c,z,Rd}$	720	720	720	720	720	720	720	720	720	720	720			
					$M_{N,y,Rd}$	1090	1090	1090	1020	872	727	581	436	291	145	0			
					$M_{N,z,Rd}$	720	720	685	599	514	428	342	257	171	85.6	0			

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\* The section is a Class 4 section about the appropriate axis and is independent of the design axial force  $N_{Ed}$ . Values of  $M_{c,Rd}$  are calculated based on Class 4 section properties and are displayed in italics.

$N_{Ed}$  = Design value of the axial force.

$$n = N_{Ed} / N_{pl,Rd}$$

✗ Section becomes class 4, see note 10.

\$ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

- Not applicable for Class 3 and Class 4 sections.

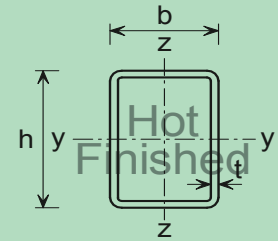
# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.



HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Member buckling check

Section Designation & Resistances (kNm)		n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
h x b	t		L (m)	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
mm	mm															
450x250	§ 8.0 $f_y W_{el,y} = 475$ $f_y W_{el,z} = 345$	0.463	$N_{b,y,Rd}$	3870	3840	3770	3690	3610	3510	3400	3260	3100	2920	2720	2510	2300
			$N_{b,z,Rd}$	3830	3720	3580	3420	3200	2930	2610	2280	1970	1700	1470	1280	1120
		0.463	$M_{b,Rd}$	475	475	475	475	475	475	475	475	475	475	475	475	475
			$M_{b,Rd}$	576	576	576	576	576	576	576	576	576	576	576	576	576
		0.141	$M_{b,Rd}$	576	576	576	576	576	576	576	576	576	576	576	576	576
			$M_{b,Rd}$	576	576	576	576	576	576	576	576	576	576	576	576	576
	§ 8.8 # $f_y W_{el,y} = 518$ $f_y W_{el,z} = 376$	0.565	$N_{b,y,Rd}$	4220	4190	4110	4030	3940	3830	3710	3560	3390	3190	2970	2740	2510
			$N_{b,z,Rd}$	4180	4050	3910	3720	3480	3180	2820	2450	2120	1830	1580	1380	1210
		0.565	$M_{b,Rd}$	518	518	518	518	518	518	518	518	518	518	518	518	518
			$M_{b,Rd}$	630	630	630	630	630	630	630	630	630	630	630	630	630
		0.213	$M_{b,Rd}$	630	630	630	630	630	630	630	630	630	630	630	630	630
			$M_{b,Rd}$	630	630	630	630	630	630	630	630	630	630	630	630	630
§ 10.0 $f_y W_{el,y} = 582$ $f_y W_{el,z} = 421$	0.720	$N_{b,y,Rd}$	4790	4750	4670	4570	4460	4340	4200	4030	3830	3600	3350	3080	2820	
		$N_{b,z,Rd}$	4740	4600	4430	4220	3950	3600	3200	2780	2400	2070	1790	1560	1370	
	0.720	$M_{b,Rd}$	582	582	582	582	582	582	582	582	582	582	582	582	582	
		$M_{b,Rd}$	710	710	710	710	710	710	710	710	710	710	710	710	710	
	0.319	$M_{b,Rd}$	710	710	710	710	710	710	710	710	710	710	710	710	710	
		$M_{b,Rd}$	710	710	710	710	710	710	710	710	710	710	710	710	710	
12.5 $f_y W_{el,y} = 710$ $f_y W_{el,z} = 510$	1.00	$N_{b,y,Rd}$	5930	5880	5770	5650	5520	5370	5190	4970	4720	4440	4120	3790	3460	
		$N_{b,z,Rd}$	5860	5680	5470	5210	4860	4420	3920	3400	2930	2520	2180	1900	1660	
	1.00	$M_{b,Rd}$	710	710	710	710	710	710	710	710	710	710	710	710	710	
		$M_{b,Rd}$	873	873	873	873	873	873	873	873	873	873	873	873	873	
	0.546	$M_{b,Rd}$	873	873	873	873	873	873	873	873	873	873	873	873	873	
		$M_{b,Rd}$	873	873	873	873	873	873	873	873	873	873	873	873	873	
14.2 # $f_y W_{el,y} = 794$ $f_y W_{el,z} = 568$	1.00	$N_{b,y,Rd}$	6710	6650	6520	6390	6240	6060	5860	5610	5330	5000	4640	4260	3890	
		$N_{b,z,Rd}$	6630	6430	6180	5880	5480	4970	4390	3800	3270	2810	2430	2110	1850	
	1.00	$M_{b,Rd}$	979	979	979	979	979	979	979	979	979	979	979	979	979	
		$M_{b,Rd}$	979	979	979	979	979	979	979	979	979	979	979	979	979	
16.0 $f_y W_{el,y} = 879$ $f_y W_{el,z} = 626$	1.00	$N_{b,y,Rd}$	7490	7420	7280	7130	6960	6760	6530	6250	5930	5550	5140	4720	4310	
		$N_{b,z,Rd}$	7400	7170	6890	6540	6090	5510	4850	4190	3590	3090	2670	2320	2030	
	1.00	$M_{b,Rd}$	1090	1090	1090	1090	1090	1090	1090	1090	1090	1090	1090	1090	1090	
		$M_{b,Rd}$	1090	1090	1090	1090	1090	1090	1090	1090	1090	1090	1090	1090	1090	

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$$n = N_{Ed} / N_{pl,Rd}$$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

Axial force resistance  $N_{pl,Rd}$  which is equal to  $A f_y$  is given in the cross-section resistance check table opposite.

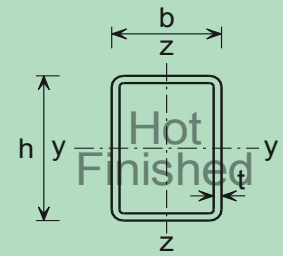
§ The section can be a Class 4 section but no allowance has been made in calculating  $N_{b,y,Rd}$  and  $N_{b,z,Rd}$ .

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n Limit Class 3		Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$													
h x b mm	t mm			Class 2		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0		
				y-y	z-z														
500x200	8.0 #	85.4	3870	0.361	*	$M_{c,y,Rd}$	606	484	484	484	✗	✗	✗	✗	\$	\$	\$		
						$M_{c,z,Rd}$	✗	✗	✗	✗	✗	✗	✗	✗	✗	\$	\$	\$	
						$M_{N,y,Rd}$	606	-	-	-	-	-	-	-	-	-	-	-	-
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-
	8.8 #	93.6	4220	0.452	*	$M_{c,y,Rd}$	663	663	528	528	528	✗	✗	✗	\$	\$	\$		
						$M_{c,z,Rd}$	✗	✗	✗	✗	✗	✗	✗	✗	✗	\$	\$	\$	
						$M_{N,y,Rd}$	663	663	-	-	-	-	-	-	-	-	-	-	-
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-
	10.0 #	106	4790	0.591	*	$M_{c,y,Rd}$	747	747	747	593	593	593	✗	✗	✗	\$	\$		
						$M_{c,z,Rd}$	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	\$	\$	
						$M_{N,y,Rd}$	747	747	747	-	-	-	-	-	-	-	-	-	-
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-
	12.5 #	131	5930	0.885	*	$M_{c,y,Rd}$	918	918	918	918	918	723	723	723	723	✗	\$		
						$M_{c,z,Rd}$	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	\$	
						$M_{N,y,Rd}$	918	918	918	857	734	-	-	-	-	-	-	-	
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	
	14.2 #	148	6710	1.00	1.00	$M_{c,y,Rd}$	1030	1030	1030	1030	1030	1030	1030	809	809	809	809		
						$M_{c,z,Rd}$	470	470	470	470	470	470	470	470	470	470	470		
						$M_{N,y,Rd}$	1030	1030	1030	962	825	687	550	-	-	-	-		
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-		
	16.0 #	166	7490	n/a	n/a	$M_{c,y,Rd}$	1150	1150	1150	1150	1150	1150	1150	1150	1150	1150	1150		
						$M_{c,z,Rd}$	592	592	592	592	592	592	592	592	592	592	592		
						$M_{N,y,Rd}$	1150	1150	1150	1070	918	765	612	459	306	153	0		
						$M_{N,z,Rd}$	592	592	539	472	404	337	270	202	135	67.4	0		

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\* The section is a Class 4 section about the appropriate axis and is independent of the design axial force  $N_{Ed}$ . Values of  $M_{c,Rd}$  are calculated based on Class 4 section properties and are displayed in italics.

$N_{Ed}$  = Design value of the axial force.

$$n = N_{Ed} / N_{pl,Rd}$$

✗ Section becomes class 4, see note 10.

\$ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

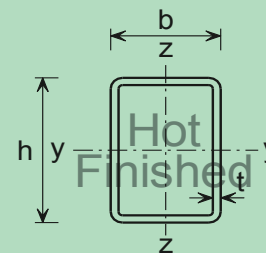
- Not applicable for Class 3 and Class 4 sections.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Member buckling check

Section Designation & Resistances (kNm)		n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$														
h x b mm	t mm		L (m)	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	
500x200	§ 8.0 # $f_y W_{el,y} = 484$ $f_y W_{el,z} = 289$	0.361	$N_{b,y,Rd}$	3870	3850	3790	3720	3640	3550	3460	3340	3210	3050	2870	2680	2480	
			$N_{b,z,Rd}$	3780	3630	3440	3170	2820	2420	2030	1690	1420	1200	1030	889	775	
		0.361	$M_{b,Rd}$	484	484	484	484	484	484	484	484	484	484	484	484	484	484
			<b>0.079</b>	$M_{b,Rd}$	606	606	606	606	606	606	606	606	606	606	606	606	606
	§ 8.8 # $f_y W_{el,y} = 528$ $f_y W_{el,z} = 314$	0.452	$N_{b,y,Rd}$	4220	4200	4130	4060	3970	3880	3770	3650	3500	3330	3140	2930	2710	
			$N_{b,z,Rd}$	4130	3960	3750	3450	3070	2620	2200	1830	1540	1300	1110	963	839	
		0.452	$M_{b,Rd}$	528	528	528	528	528	528	528	528	528	528	528	528	528	528
			<b>0.150</b>	$M_{b,Rd}$	663	663	663	663	663	663	663	663	663	663	663	663	663
	§ 10.0 # $f_y W_{el,y} = 593$ $f_y W_{el,z} = 351$	0.591	$N_{b,y,Rd}$	4790	4770	4690	4600	4510	4400	4270	4130	3960	3760	3540	3300	3050	
			$N_{b,z,Rd}$	4680	4490	4240	3910	3460	2950	2470	2060	1730	1460	1250	1080	942	
		0.591	$M_{b,Rd}$	593	593	593	593	593	593	593	593	593	593	593	593	593	593
			<b>0.256</b>	$M_{b,Rd}$	747	747	747	747	747	747	747	747	747	747	747	747	747
	§ 12.5 # $f_y W_{el,y} = 723$ $f_y W_{el,z} = 424$	0.885	$N_{b,y,Rd}$	5930	5900	5800	5690	5570	5440	5280	5100	4890	4640	4360	4060	3750	
			$N_{b,z,Rd}$	5780	5540	5230	4800	4230	3600	3000	2490	2090	1770	1510	1300	1140	
	0.885	$M_{b,Rd}$	723	723	723	723	723	723	723	723	723	723	723	723	723		
		<b>0.482</b>	$M_{b,Rd}$	918	918	918	918	918	918	918	918	918	918	918	918	918	917
14.2 # $f_y W_{el,y} = 809$ $f_y W_{el,z} = 470$	1.00	$N_{b,y,Rd}$	6710	6670	6560	6430	6300	6140	5970	5760	5510	5230	4910	4570	4220		
		$N_{b,z,Rd}$	6540	6260	5910	5410	4760	4030	3350	2790	2330	1970	1680	1450	1270		
	1.00	$M_{b,Rd}$	809	809	809	809	809	809	809	809	809	809	809	809	809		
		<b>0.636</b>	$M_{b,Rd}$	1030	1030	1030	1030	1030	1030	1030	1030	1030	1030	1030	1030	1030	
16.0 # $f_y W_{el,y} = 895$ $f_y W_{el,z} = 516$	1.00	$N_{b,y,Rd}$	7490	7450	7320	7180	7030	6850	6650	6420	6140	5820	5460	5070	4680		
		$N_{b,z,Rd}$	7290	6980	6580	6010	5260	4440	3690	3060	2560	2160	1850	1590	1390		
	1.00	$M_{b,Rd}$	1150	1150	1150	1150	1150	1150	1150	1150	1150	1150	1150	1150	1140		

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

$$n = N_{Ed} / N_{pl,Rd}$$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

Axial force resistance  $N_{pl,Rd}$  which is equal to  $Af_y$  is given in the cross-section resistance check table opposite.

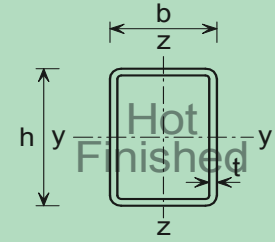
§ The section can be a Class 4 section but no allowance has been made in calculating  $N_{b,y,Rd}$  and  $N_{b,z,Rd}$ .

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n Limit Class 3 <b>Class 2</b>		Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$														
h x b mm	t mm			Axis		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0			
				y-y	z-z															
500x300	8.0 #	97.9	4440	*	*	$M_{c,y,Rd}$	*	*	*	*	*	*	*	*	\$	\$	\$			
						$M_{c,z,Rd}$	*	*	*	*	*	*	*	*	*	\$	\$	\$		
						$M_{N,y,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	8.8 #	107	4860	0.452 <b>0.00</b>	*	$M_{c,y,Rd}$	678	678	678	678	678	*	*	*	*	\$	\$			
						$M_{c,z,Rd}$	*	*	*	*	*	*	*	*	*	*	\$	\$		
						$M_{N,y,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-	
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-	
	10.0	122	5500	0.591 <b>0.223</b>	*	$M_{c,y,Rd}$	921	921	921	763	763	763	*	*	*	\$	\$			
						$M_{c,z,Rd}$	*	*	*	*	*	*	*	*	*	*	\$	\$		
						$M_{N,y,Rd}$	921	921	921	-	-	-	-	-	-	-	-	-	-	
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-	
	12.5 #	151	6820	0.885 <b>0.419</b>	*	$M_{c,y,Rd}$	1130	1130	1130	1130	1130	935	935	935	935	*	\$			
						$M_{c,z,Rd}$	*	*	*	*	*	*	*	*	*	*	*	\$		
						$M_{N,y,Rd}$	1130	1130	1130	1060	908	-	-	-	-	-	-	-		
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-		
	14.2 #	170	7700	1.00 <b>0.554</b>	1.00	$M_{c,y,Rd}$	1280	1280	1280	1280	1280	1280	1050	1050	1050	1050	1050			
						$M_{c,z,Rd}$	787	787	787	787	787	787	787	787	787	787	787			
						$M_{N,y,Rd}$	1280	1280	1280	1190	1020	850	-	-	-	-	-			
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-			
	16.0	191	8630	n/a <b>1.00</b>	n/a <b>1.00</b>	$M_{c,y,Rd}$	1420	1420	1420	1420	1420	1420	1420	1420	1420	1420	1420			
						$M_{c,z,Rd}$	995	995	995	995	995	995	995	995	995	995	995			
						$M_{N,y,Rd}$	1420	1420	1420	1330	1140	948	758	569	379	190	0			
						$M_{N,z,Rd}$	995	995	960	840	720	600	480	360	240	120	0			
	20.0 ^	235	10400	n/a <b>1.00</b>	n/a <b>1.00</b>	$M_{c,y,Rd}$	1690	1690	1690	1690	1690	1690	1690	1690	1690	1690	1690			
						$M_{c,z,Rd}$	1180	1180	1180	1180	1180	1180	1180	1180	1180	1180	1180			
						$M_{N,y,Rd}$	1690	1690	1690	1570	1350	1120	899	674	449	225	0			
						$M_{N,z,Rd}$	1180	1180	1130	988	847	705	564	423	282	141	0			

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

\* The section is a Class 4 section about the appropriate axis and is independent of the design axial force  $N_{Ed}$ . Values of  $M_{c,Rd}$  are calculated based on Class 4 section properties and are displayed in italics.

$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

\* Section becomes class 4, see note 10.

\$ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

- Not applicable for Class 3 and Class 4 sections.

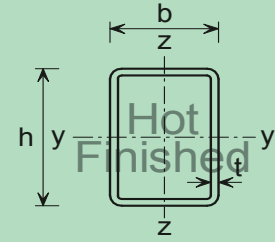
^ SAW process (single longitudinal seam weld, slightly proud).

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED RECTANGULAR HOLLOW SECTIONS

Celsius® RHS



Member buckling check

Section Designation & Resistances (kNm)		n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$														
h x b	t		L (m)	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	
mm	mm																
500x300	♦ 8.0 # $f_y W_{el,y} = 621$ $f_y W_{el,z} = 472$	*	$N_{b,y,Rd}$	3390	3390	3350	3310	3260	3200	3140	3080	3000	2910	2820	2710	2580	
			$N_{b,z,Rd}$	3390	3330	3260	3180	3080	2970	2830	2660	2470	2260	2040	1840	1650	
		*	$M_{b,Rd}$	604	604	604	604	604	604	604	604	604	604	604	604	604	604
	§ 8.8 # $f_y W_{el,y} = 678$ $f_y W_{el,z} = 515$	0.452	$N_{b,y,Rd}$	4860	4850	4780	4700	4610	4510	4400	4270	4120	3950	3760	3540	3310	
			$N_{b,z,Rd}$	4860	4740	4610	4470	4280	4060	3780	3460	3100	2760	2440	2150	1910	
		0.452	$M_{b,Rd}$	678	678	678	678	678	678	678	678	678	678	678	678	678	678
		<b>0.00</b>	$M_{b,Rd}$	817	817	817	817	817	817	817	817	817	817	817	817	817	817
	§ 10.0 $f_y W_{el,y} = 763$ $f_y W_{el,z} = 578$	0.591	$N_{b,y,Rd}$	5500	5490	5400	5310	5210	5100	4970	4830	4660	4460	4230	3980	3720	
			$N_{b,z,Rd}$	5490	5360	5220	5050	4850	4590	4280	3910	3510	3120	2760	2440	2160	
		0.591	$M_{b,Rd}$	763	763	763	763	763	763	763	763	763	763	763	763	763	
		<b>0.223</b>	$M_{b,Rd}$	921	921	921	921	921	921	921	921	921	921	921	921	921	
	§ 12.5 # $f_y W_{el,y} = 935$ $f_y W_{el,z} = 705$	0.885	$N_{b,y,Rd}$	6820	6800	6690	6570	6450	6310	6150	5970	5750	5510	5220	4910	4580	
		$N_{b,z,Rd}$	6800	6640	6460	6250	5990	5670	5270	4810	4310	3820	3380	2980	2640		
0.885		$M_{b,Rd}$	935	935	935	935	935	935	935	935	935	935	935	935	935		
	<b>0.419</b>	$M_{b,Rd}$	1130	1130	1130	1130	1130	1130	1130	1130	1130	1130	1130	1130	1130		
14.2 # $f_y W_{el,y} = 1050$ $f_y W_{el,z} = 787$	1.00	$N_{b,y,Rd}$	7700	7680	7560	7430	7280	7130	6940	6730	6490	6210	5880	5530	5150		
		$N_{b,z,Rd}$	7680	7500	7290	7050	6760	6380	5930	5390	4830	4280	3770	3330	2940		
	1.00	$M_{b,Rd}$	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050	1050		
	<b>0.554</b>	$M_{b,Rd}$	1280	1280	1280	1280	1280	1280	1280	1280	1280	1280	1280	1280	1280		
16.0 $f_y W_{el,y} = 1160$ $f_y W_{el,z} = 870$	1.00	$N_{b,y,Rd}$	8630	8600	8460	8310	8150	7970	7770	7530	7250	6930	6560	6160	5730		
		$N_{b,z,Rd}$	8600	8390	8160	7880	7550	7120	6600	6000	5350	4730	4170	3680	3250		
	1.00	$M_{b,Rd}$	1420	1420	1420	1420	1420	1420	1420	1420	1420	1420	1420	1420	1420		
20.0 ^ $f_y W_{el,y} = 1360$ $f_y W_{el,z} = 1010$	1.00	$N_{b,y,Rd}$	10400	10300	10200	9980	9790	9580	9340	9060	8730	8350	7920	7450	6940		
		$N_{b,z,Rd}$	10300	10100	9790	9460	9050	8540	7910	7180	6410	5660	4990	4400	3890		
	1.00	$M_{b,Rd}$	1690	1690	1690	1690	1690	1690	1690	1690	1690	1690	1690	1690	1690		

Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Rectangular Hollow Sections (HFRHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

$$n = N_{Ed} / N_{pl,Rd}$$

\* The section is a Class 4 section about the y-y axis and is independent of the design axial force  $N_{Ed}$ .

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

Axial force resistance  $N_{pl,Rd}$  which is equal to  $Af_y$  is given in the cross-section resistance check table opposite.

§ The section can be a Class 4 section but no allowance has been made in calculating  $N_{b,y,Rd}$  and  $N_{b,z,Rd}$ .

♦ For this section, resistances  $N_{b,Rd}$  and  $M_{b,Rd}$  are calculated based on Class 4 section properties and are displayed in italics.

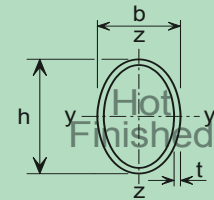
^ SAW process (single longitudinal seam weld, slightly proud).

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED ELLIPTICAL HOLLOW SECTIONS

Celsius® OHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	Section classification	Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm)	
h x b mm	t mm				$M_{c,y,Rd}$	$M_{c,z,Rd}$
150x75	4 *	10.7	384	4	$M_{c,y,Rd}$ 11.3	$M_{c,z,Rd}$ 7.59
	5 *	13.3	596	4	$M_{c,y,Rd}$ 17.2	$M_{c,z,Rd}$ 11.5
	6.3	16.5	746	3	$M_{c,y,Rd}$ 21.2	$M_{c,z,Rd}$ 13.9
200x100	5 *	17.9	603	4	$M_{c,y,Rd}$ 23.7	$M_{c,z,Rd}$ 16.0
	6.3 *	22.3	946	4	$M_{c,y,Rd}$ 36.6	$M_{c,z,Rd}$ 24.5
	8	28.0	1270	3	$M_{c,y,Rd}$ 48.3	$M_{c,z,Rd}$ 31.7
	10	34.5	1560	2	$M_{c,y,Rd}$ 83.4	$M_{c,z,Rd}$ 50.1
	12.5	42.4	1920	1	$M_{c,y,Rd}$ 101	$M_{c,z,Rd}$ 60.0
250x125	6.3 *	28.2	957	4	$M_{c,y,Rd}$ 46.9	$M_{c,z,Rd}$ 31.7
	8 *	35.4	1530	4	$M_{c,y,Rd}$ 74.1	$M_{c,z,Rd}$ 49.1
	10	43.8	1980	3	$M_{c,y,Rd}$ 94.1	$M_{c,z,Rd}$ 61.8
	12.5	53.9	2440	2	$M_{c,y,Rd}$ 163	$M_{c,z,Rd}$ 98.0

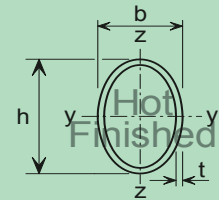
Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Oval Hollow Sections (HFOHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

\* The section is a Class 4 section.

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED ELLIPTICAL HOLLOW SECTIONS

Celsius® OHS



Member buckling check

Section Designation & Resistances (kNm)		Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for													
h x b mm	t mm	Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
		L (m)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
150x75	4 * $f_{y,red}W_{el,y} = 11.3$ $f_{y,red}W_{el,z} = 7.59$	$N_{b,y,Rd}$	379	368	355	338	317	289	257	194	145	110	86.6	69.6	57.0
		$N_{b,z,Rd}$	362	335	292	236	183	143	113	75.1	53.3	39.7	30.7	24.4	19.9
		$M_{b,Rd}$	11.3	11.3	11.3	11.3	11.2	11.0	10.9	10.6	10.4	10.2	9.98	9.80	9.64
	5 * $f_{y,red}W_{el,y} = 17.2$ $f_{y,red}W_{el,z} = 11.5$	$N_{b,y,Rd}$	585	564	539	505	460	405	347	249	182	138	108	86.2	70.5
		$N_{b,z,Rd}$	553	497	409	311	234	179	141	92.6	65.4	48.6	37.5	29.8	24.3
		$M_{b,Rd}$	17.2	17.2	17.2	16.9	16.6	16.4	16.1	15.7	15.3	15.0	14.7	14.4	14.1
	6.3 $f_yW_{el,y} = 21.2$ $f_yW_{el,z} = 13.9$	$N_{b,y,Rd}$	732	705	673	629	571	501	428	306	223	169	132	105	86.2
		$N_{b,z,Rd}$	690	616	501	377	282	215	169	111	78.5	58.3	45.0	35.8	29.1
		$M_{b,Rd}$	21.2	21.2	21.2	20.8	20.4	20.1	19.8	19.3	18.8	18.4	18.0	17.6	17.3
200x100	5 * $f_{y,red}W_{el,y} = 23.7$ $f_{y,red}W_{el,z} = 16$	$N_{b,y,Rd}$	603	593	580	566	549	529	505	442	367	297	240	196	163
		$N_{b,z,Rd}$	588	563	532	488	430	365	304	212	153	115	89.6	71.6	58.5
		$M_{b,Rd}$	23.7	23.7	23.7	23.7	23.7	23.7	23.5	23.1	22.6	22.3	21.9	21.6	21.3
	6.3 * $f_{y,red}W_{el,y} = 36.6$ $f_{y,red}W_{el,z} = 24.5$	$N_{b,y,Rd}$	945	924	900	872	838	796	745	618	489	384	306	248	204
		$N_{b,z,Rd}$	913	866	800	706	592	482	391	266	190	143	111	88.1	71.9
		$M_{b,Rd}$	36.6	36.6	36.6	36.6	36.5	36.0	35.6	34.8	34.1	33.5	32.9	32.3	31.8
	8 $f_yW_{el,y} = 48.3$ $f_yW_{el,z} = 31.7$	$N_{b,y,Rd}$	1260	1230	1200	1160	1110	1050	972	790	616	480	381	308	253
		$N_{b,z,Rd}$	1220	1150	1050	910	747	600	483	326	233	174	135	107	87.6
		$M_{b,Rd}$	48.3	48.3	48.3	48.3	47.8	47.1	46.5	45.5	44.5	43.6	42.8	42.1	41.4
	10 $f_yW_{el,y} = 58.2$ $f_yW_{el,z} = 37.6$	$N_{b,y,Rd}$	1560	1520	1480	1430	1360	1280	1190	960	746	580	460	371	306
		$N_{b,z,Rd}$	1500	1410	1280	1100	897	717	576	388	277	207	160	127	104
		$M_{b,Rd}$	83.4	83.4	82.7	81.1	79.7	78.4	77.2	75.0	73.1	71.3	69.7	68.2	66.8
	12.5 $f_yW_{el,y} = 69.2$ $f_yW_{el,z} = 44$	$N_{b,y,Rd}$	1910	1860	1810	1740	1670	1570	1440	1160	897	696	551	445	366
		$N_{b,z,Rd}$	1830	1720	1560	1320	1070	848	679	456	325	242	188	150	122
		$M_{b,Rd}$	101	101	99.7	97.8	96.0	94.4	93.0	90.3	87.9	85.8	83.8	81.9	80.2
250x125	6.3 * $f_{y,red}W_{el,y} = 46.9$ $f_{y,red}W_{el,z} = 31.7$	$N_{b,y,Rd}$	957	953	938	921	903	882	859	800	722	628	533	449	379
		$N_{b,z,Rd}$	946	918	885	843	788	719	639	480	358	273	214	172	141
		$M_{b,Rd}$	46.9	46.9	46.9	46.9	46.9	46.9	46.9	46.5	45.8	45.1	44.5	43.9	43.4
	8 * $f_{y,red}W_{el,y} = 74.1$ $f_{y,red}W_{el,z} = 49.1$	$N_{b,y,Rd}$	1530	1510	1480	1450	1410	1370	1320	1200	1030	858	706	583	486
		$N_{b,z,Rd}$	1500	1440	1380	1290	1170	1020	870	621	453	343	267	214	175
		$M_{b,Rd}$	74.1	74.1	74.1	74.1	74.1	74.1	73.3	71.8	70.5	69.3	68.3	67.3	66.3
	10 $f_yW_{el,y} = 94.1$ $f_yW_{el,z} = 61.8$	$N_{b,y,Rd}$	1980	1960	1920	1870	1830	1770	1700	1520	1290	1060	870	715	595
		$N_{b,z,Rd}$	1940	1860	1770	1640	1470	1270	1070	754	548	413	322	257	210
		$M_{b,Rd}$	94.1	94.1	94.1	94.1	94.1	93.6	92.6	90.7	89.0	87.5	86.1	84.7	83.5
	12.5 $f_yW_{el,y} = 114$ $f_yW_{el,z} = 73.5$	$N_{b,y,Rd}$	2440	2410	2360	2300	2240	2170	2080	1860	1570	1290	1050	865	719
		$N_{b,z,Rd}$	2380	2290	2170	2000	1780	1530	1280	900	653	492	383	306	250
		$M_{b,Rd}$	163	163	163	161	159	156	154	150	147	144	141	138	136

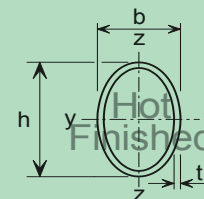
Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Oval Hollow Sections (HFOHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

Axial force resistance  $N_{pl,Rd}$  which is equal to  $Af_y$  is given in the cross-section resistance check table opposite.

FOR EXPLANATION OF TABLES SEE NOTE 10.

HOT-FINISHED ELLIPTICAL HOLLOW SECTIONS

Celsius® OHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	Section classification	Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm)	
h x b mm	t mm				$M_{c,y,Rd}$	$M_{c,z,Rd}$
300x150	8 *	42.8	1540	4	$M_{c,y,Rd}$ 90.5	$M_{c,z,Rd}$ 60.6
	10 *	53.0	2380	4	$M_{c,y,Rd}$ 138	$M_{c,z,Rd}$ 91.6
	12.5	65.5	2960	3	$M_{c,y,Rd}$ 169	$M_{c,z,Rd}$ 110
	16	82.5	3730	2	$M_{c,y,Rd}$ 297	$M_{c,z,Rd}$ 179
400x200	8 *	57.6	1550	4	$M_{c,y,Rd}$ 124	$M_{c,z,Rd}$ 84.0
	10 *	71.5	2410	4	$M_{c,y,Rd}$ 190	$M_{c,z,Rd}$ 128
	12.5 *	88.6	3730	4	$M_{c,y,Rd}$ 290	$M_{c,z,Rd}$ 193
	16	112	5080	3	$M_{c,y,Rd}$ 386	$M_{c,z,Rd}$ 253
500x250	10 *	90.0	2430	4	$M_{c,y,Rd}$ 242	$M_{c,z,Rd}$ 164
	12.5 *	112	3750	4	$M_{c,y,Rd}$ 370	$M_{c,z,Rd}$ 249
	16 *	142	6090	4	$M_{c,y,Rd}$ 592	$M_{c,z,Rd}$ 394

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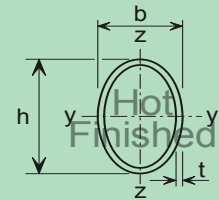
\* The section is a Class 4 section.

FOR EXPLANATION OF TABLES SEE NOTE 10.



HOT-FINISHED ELLIPTICAL HOLLOW SECTIONS

Celsius® OHS



Member buckling check

Section Designation & Resistances (kNm)		Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm)													
h x b mm	t mm	for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
		L (m)	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
300x150	8 * $f_{y,red}W_{el,y} = 90.5$ $f_{y,red}W_{el,z} = 60.6$	$N_{b,y,Rd}$	1520	1480	1420	1360	1270	1160	1030	897	774	668	578	504	442
		$N_{b,z,Rd}$	1450	1340	1170	945	734	572	453	366	301	252	213	183	159
		$M_{b,Rd}$	90.5	90.5	90.5	90.5	89.3	88.0	86.9	85.9	84.9	83.9	83.1	82.2	81.4
	10 * $f_{y,red}W_{el,y} = 138$ $f_{y,red}W_{el,z} = 91.6$	$N_{b,y,Rd}$	2340	2250	2150	2020	1840	1620	1390	1170	995	848	728	631	551
		$N_{b,z,Rd}$	2210	1980	1630	1240	930	712	559	450	369	308	260	223	194
		$M_{b,Rd}$	138	138	138	135	133	131	129	127	126	124	123	121	120
	12.5 $f_yW_{el,y} = 169$ $f_yW_{el,z} = 110$	$N_{b,y,Rd}$	2910	2800	2670	2500	2270	1990	1700	1430	1210	1030	887	768	670
		$N_{b,z,Rd}$	2740	2450	1990	1500	1120	857	673	540	443	369	313	268	232
		$M_{b,Rd}$	169	169	168	165	162	160	158	155	153	151	150	148	146
	16 $f_yW_{el,y} = 207$ $f_yW_{el,z} = 133$	$N_{b,y,Rd}$	3650	3520	3350	3130	2830	2470	2100	1770	1500	1270	1090	944	824
		$N_{b,z,Rd}$	3440	3050	2450	1830	1360	1040	812	652	534	445	377	323	280
		$M_{b,Rd}$	297	295	287	281	275	269	265	260	256	252	248	244	241
400x200	8 * $f_{y,red}W_{el,y} = 124$ $f_{y,red}W_{el,z} = 84$	$N_{b,y,Rd}$	1550	1540	1510	1480	1440	1400	1360	1300	1230	1160	1070	987	901
		$N_{b,z,Rd}$	1530	1470	1410	1330	1210	1070	926	787	668	570	490	425	371
		$M_{b,Rd}$	124	124	124	124	124	124	124	124	124	123	122	121	120
	10 * $f_{y,red}W_{el,y} = 190$ $f_{y,red}W_{el,z} = 128$	$N_{b,y,Rd}$	2410	2370	2320	2260	2190	2110	2020	1900	1760	1610	1460	1320	1180
		$N_{b,z,Rd}$	2350	2250	2120	1950	1720	1460	1220	1010	847	716	612	528	460
		$M_{b,Rd}$	190	190	190	190	190	190	188	186	184	183	181	180	178
	12.5 * $f_{y,red}W_{el,y} = 290$ $f_{y,red}W_{el,z} = 193$	$N_{b,y,Rd}$	3730	3650	3550	3450	3310	3150	2950	2720	2460	2200	1950	1730	1530
		$N_{b,z,Rd}$	3600	3420	3160	2790	2340	1910	1550	1270	1050	887	755	650	565
		$M_{b,Rd}$	290	290	290	290	289	285	282	278	275	273	270	267	265
	16 $f_yW_{el,y} = 386$ $f_yW_{el,z} = 253$	$N_{b,y,Rd}$	5060	4940	4800	4640	4440	4190	3880	3530	3150	2790	2450	2160	1910
		$N_{b,z,Rd}$	4880	4600	4200	3640	2990	2400	1930	1580	1300	1090	931	800	695
		$M_{b,Rd}$	386	386	386	386	382	377	372	367	363	359	356	352	349
500x250	10 * $f_{y,red}W_{el,y} = 242$ $f_{y,red}W_{el,z} = 164$	$N_{b,y,Rd}$	2430	2430	2400	2370	2330	2290	2240	2190	2130	2060	1980	1890	1790
		$N_{b,z,Rd}$	2420	2360	2290	2210	2110	1980	1820	1640	1450	1270	1120	982	867
		$M_{b,Rd}$	242	242	242	242	242	242	242	242	242	242	242	240	239
	12.5 * $f_{y,red}W_{el,y} = 370$ $f_{y,red}W_{el,z} = 249$	$N_{b,y,Rd}$	3750	3740	3680	3620	3540	3470	3380	3270	3150	3010	2840	2670	2480
		$N_{b,z,Rd}$	3710	3600	3470	3310	3100	2830	2520	2190	1890	1630	1410	1230	1080
		$M_{b,Rd}$	370	370	370	370	370	370	370	370	370	367	364	361	359
	16 * $f_{y,red}W_{el,y} = 592$ $f_{y,red}W_{el,z} = 394$	$N_{b,y,Rd}$	6090	6030	5910	5790	5650	5480	5290	5050	4780	4470	4130	3780	3440
		$N_{b,z,Rd}$	5980	5760	5490	5130	4650	4070	3470	2930	2480	2110	1810	1570	1370
		$M_{b,Rd}$	592	592	592	592	592	591	585	579	573	568	563	558	554

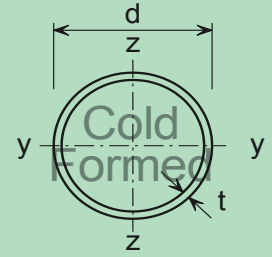
Celsius® is a trademark of Tata Steel. A fuller description of the relationship between Hot Finished Oval Hollow Sections (HFOHS) and the Celsius® range of sections manufactured by Tata Steel is given in note 12.

Axial force resistance  $N_{pl,Rd}$  which is equal to  $Af_y$  is given in the cross-section resistance check table opposite.

FOR EXPLANATION OF TABLES SEE NOTE 10.

COLD FORMED CIRCULAR HOLLOW SECTIONS

Hybox® CHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial resistance $N_{pl,Rd}$ kN	Moment Resistance $M_{c,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$												
D mm	t mm			n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	
33.7	3.0	2.27	103	$M_{c,Rd}$	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	1.01	
				$M_{N,Rd}$	1.01	0.988	0.943	0.878	0.796	0.698	0.585	0.458	0.318	0.165	0	
42.4	3.0	2.91	132	$M_{c,Rd}$	1.66	1.66	1.66	1.66	1.66	1.66	1.66	1.66	1.66	1.66	1.66	
				$M_{N,Rd}$	1.66	1.62	1.55	1.44	1.31	1.15	0.962	0.754	0.523	0.272	0	
48.3	3.0	3.35	152	$M_{c,Rd}$	2.19	2.19	2.19	2.19	2.19	2.19	2.19	2.19	2.19	2.19	2.19	
				$M_{N,Rd}$	2.19	2.15	2.05	1.91	1.73	1.52	1.27	0.996	0.691	0.359	0	
	4.0 #	4.37	198	$M_{c,Rd}$	2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79	2.79	
				$M_{N,Rd}$	2.79	2.74	2.61	2.43	2.21	1.93	1.62	1.27	0.882	0.458	0	
60.3	3.0 #	4.24	192	$M_{c,Rd}$	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	3.50	
				$M_{N,Rd}$	3.50	3.43	3.27	3.05	2.76	2.42	2.03	1.59	1.11	0.574	0	
	4.0	5.55	251	$M_{c,Rd}$	4.51	4.51	4.51	4.51	4.51	4.51	4.51	4.51	4.51	4.51	4.51	
				$M_{N,Rd}$	4.51	4.42	4.22	3.93	3.56	3.12	2.62	2.05	1.42	0.739	0	
76.1	3.0	5.41	245	$M_{c,Rd}$	5.68	5.68	5.68	5.68	5.68	5.68	5.68	5.68	5.68	5.68	5.68	
				$M_{N,Rd}$	5.68	5.57	5.31	4.95	4.48	3.93	3.30	2.58	1.79	0.931	0	
	4.0	7.11	322	$M_{c,Rd}$	7.38	7.38	7.38	7.38	7.38	7.38	7.38	7.38	7.38	7.38	7.38	
				$M_{N,Rd}$	7.38	7.24	6.91	6.43	5.83	5.11	4.29	3.36	2.33	1.21	0	
88.9	3.0	6.36	288	$M_{c,Rd}$	7.85	7.85	7.85	7.85	7.85	7.85	7.85	7.85	7.85	7.85	7.85	
				$M_{N,Rd}$	7.85	7.69	7.34	6.83	6.19	5.43	4.55	3.57	2.48	1.29	0	
	3.5 #	7.37	333	$M_{c,Rd}$	9.05	9.05	9.05	9.05	9.05	9.05	9.05	9.05	9.05	9.05	9.05	
				$M_{N,Rd}$	9.05	8.87	8.47	7.88	7.15	6.27	5.25	4.12	2.86	1.48	0	
	4.0	8.38	380	$M_{c,Rd}$	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	10.3	
				$M_{N,Rd}$	10.3	10.1	9.59	8.93	8.10	7.10	5.95	4.66	3.24	1.68	0	
	5.0	10.3	469	$M_{c,Rd}$	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	
				$M_{N,Rd}$	12.5	12.2	11.7	10.9	9.86	8.65	7.25	5.68	3.94	2.05	0	
6.3	12.8	579	$M_{c,Rd}$	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3		
			$M_{N,Rd}$	15.3	15.0	14.3	13.3	12.1	10.6	8.88	6.96	4.83	2.51	0		
114.3	3.0 #	8.23	373	$M_{c,Rd}$	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2	
				$M_{N,Rd}$	13.2	12.9	12.3	11.5	10.4	9.14	7.66	6.00	4.17	2.17	0	
	3.5	9.56	433	$M_{c,Rd}$	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3	
				$M_{N,Rd}$	15.3	15.0	14.3	13.3	12.0	10.6	8.86	6.94	4.82	2.50	0	
	4.0 #	10.9	493	$M_{c,Rd}$	17.3	17.3	17.3	17.3	17.3	17.3	17.3	17.3	17.3	17.3	17.3	
				$M_{N,Rd}$	17.3	16.9	16.2	15.1	13.6	12.0	10.0	7.86	5.46	2.84	0	
	5.0	13.5	611	$M_{c,Rd}$	21.2	21.2	21.2	21.2	21.2	21.2	21.2	21.2	21.2	21.2	21.2	
				$M_{N,Rd}$	21.2	20.8	19.9	18.5	16.8	14.7	12.3	9.65	6.70	3.48	0	
6.0	16.0	724	$M_{c,Rd}$	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0		
			$M_{N,Rd}$	25.0	24.5	23.4	21.8	19.7	17.3	14.5	11.4	7.89	4.10	0		
6.3	16.8	760	$M_{c,Rd}$	26.1	26.1	26.1	26.1	26.1	26.1	26.1	26.1	26.1	26.1	26.1		
			$M_{N,Rd}$	26.1	25.6	24.4	22.8	20.6	18.1	15.2	11.9	8.25	4.28	0		

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Circular Hollow Sections (CFCHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

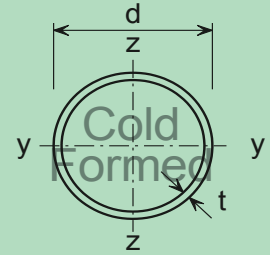
$N_{pl,Rd}$  is the axial force resistance

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

COLD FORMED CIRCULAR HOLLOW SECTIONS

Hybox® CHS



Member buckling check

Section Designation & Resistance (kNm)		Mass per Metre kg	Compression Resistance $N_{b,Rd}$ (kN)												
D mm	t mm		for Varying buckling lengths (m)												
			1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
33.7	3.0 $f_y W_{el} = 0.724$	2.27	44.5	24.0	14.6	9.74	6.95	5.20	4.04	2.63	1.85	1.37	1.06	0.841	0.684
42.4	3.0 $f_y W_{el} = 1.21$	2.91	76.2	45.9	29.0	19.7	14.2	10.7	8.32	5.46	3.85	2.86	2.21	1.76	1.43
48.3	3.0 $f_y W_{el} = 1.62$	3.35	99.1	64.4	42.0	28.9	21.0	15.9	12.4	8.18	5.79	4.31	3.33	2.66	2.16
	4.0 # $f_y W_{el} = 2.02$	4.37	127	81.1	52.6	36.1	26.2	19.8	15.5	10.2	7.20	5.36	4.14	3.30	2.69
60.3	3.0 # $f_y W_{el} = 2.62$	4.24	145	107	75.4	53.8	39.8	30.5	24.0	16.0	11.4	8.49	6.58	5.25	4.29
	4.0 $f_y W_{el} = 3.32$	5.55	189	138	96.6	68.8	50.8	38.9	30.6	20.3	14.5	10.8	8.38	6.68	5.46
76.1	3.0 $f_y W_{el} = 4.30$	5.41	205	168	131	99.0	75.7	59.1	47.1	31.8	22.8	17.1	13.3	10.7	8.73
	4.0 $f_y W_{el} = 5.50$	7.11	269	219	169	127	97.1	75.7	60.3	40.6	29.1	21.9	17.0	13.6	11.1
88.9	3.0 $f_y W_{el} = 5.96$	6.36	253	218	179	143	113	89.8	72.5	49.7	35.9	27.1	21.2	17.0	13.9
	3.5 # $f_y W_{el} = 6.85$	7.37	293	252	207	164	130	103	83.2	56.9	41.1	31.0	24.2	19.4	15.9
	4.0 $f_y W_{el} = 7.70$	8.38	333	286	234	186	146	116	93.8	64.1	46.3	35.0	27.3	21.9	17.9
	5.0 $f_y W_{el} = 9.30$	10.3	410	351	286	226	178	141	114	77.7	56.1	42.3	33.0	26.5	21.7
	6.3 $f_y W_{el} = 11.2$	12.8	505	430	349	275	215	171	137	93.7	67.6	51.0	39.8	31.9	26.1
114.3	3.0 # $f_y W_{el} = 10.1$	8.23	348	315	278	240	202	168	140	99.8	73.6	56.2	44.2	35.7	29.4
	3.5 $f_y W_{el} = 11.6$	9.56	404	365	322	277	233	194	162	115	84.7	64.7	50.9	41.1	33.8
	4.0 # $f_y W_{el} = 13.1$	10.9	459	415	366	315	264	220	183	130	95.7	73.0	57.5	46.3	38.1
	5.0 $f_y W_{el} = 16.0$	13.5	568	512	451	387	325	270	224	159	117	89.2	70.1	56.5	46.5
	6.0 $f_y W_{el} = 18.6$	16.0	672	605	532	455	381	315	262	185	136	104	81.6	65.8	54.1
	6.3 $f_y W_{el} = 19.4$	16.8	704	634	557	476	398	330	274	193	142	108	85.2	68.7	56.5

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Circular Hollow Sections (CFCHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

$M_{b,Rd}$  should be taken as equal to  $M_{c,Rd}$ .

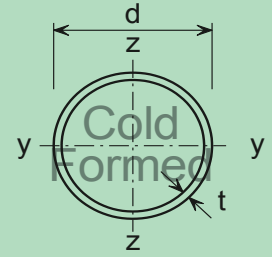
$n = N_{Ed} / N_{pl,Rd}$

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

COLD FORMED CIRCULAR HOLLOW SECTIONS

Hybox® CHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial resistance $N_{pl,Rd}$ kN	Moment Resistance $M_{c,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$											
D mm	t mm			n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0
139.7	3.0 #	10.1	458	$M_{c,Rd}$	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3
				$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-
	4.0 #	13.4	607	$M_{c,Rd}$	26.2	26.2	26.2	26.2	26.2	26.2	26.2	26.2	26.2	26.2	26.2
				$M_{N,Rd}$	26.2	25.6	24.5	22.8	20.7	18.1	15.2	11.9	8.26	4.29	0
	5.0	16.6	753	$M_{c,Rd}$	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2	32.2
				$M_{N,Rd}$	32.2	31.6	30.1	28.1	25.4	22.3	18.7	14.7	10.2	5.29	0
	6.0	19.8	895	$M_{c,Rd}$	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0
				$M_{N,Rd}$	38.0	37.2	35.5	33.1	30.0	26.3	22.0	17.3	12.0	6.23	0
	6.3	20.7	937	$M_{c,Rd}$	39.8	39.8	39.8	39.8	39.8	39.8	39.8	39.8	39.8	39.8	39.8
				$M_{N,Rd}$	39.8	39.0	37.2	34.6	31.4	27.5	23.1	18.1	12.6	6.52	0
	8.0	26.0	1180	$M_{c,Rd}$	49.3	49.3	49.3	49.3	49.3	49.3	49.3	49.3	49.3	49.3	49.3
				$M_{N,Rd}$	49.3	48.4	46.1	43.0	39.0	34.2	28.6	22.4	15.6	8.09	0
	10.0	32.0	1440	$M_{c,Rd}$	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0
				$M_{N,Rd}$	60.0	58.8	56.1	52.2	47.4	41.5	34.8	27.3	18.9	9.84	0
168.3	4.0	16.2	731	$M_{c,Rd}$	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	
				$M_{N,Rd}$	38.3	37.6	35.9	33.4	30.3	26.5	22.3	17.4	12.1	6.29	0
	4.5 #	18.2	824	$M_{c,Rd}$	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	43.0	
				$M_{N,Rd}$	43.0	42.1	40.2	37.4	33.9	29.7	24.9	19.5	13.6	7.04	0
	5.0	20.1	912	$M_{c,Rd}$	47.2	47.2	47.2	47.2	47.2	47.2	47.2	47.2	47.2	47.2	
				$M_{N,Rd}$	47.2	46.3	44.2	41.1	37.3	32.7	27.4	21.5	14.9	7.74	0
	6.0	24.0	1090	$M_{c,Rd}$	56.1	56.1	56.1	56.1	56.1	56.1	56.1	56.1	56.1	56.1	
				$M_{N,Rd}$	56.1	55.0	52.5	48.8	44.3	38.8	32.6	25.5	17.7	9.20	0
	6.3	25.2	1140	$M_{c,Rd}$	58.6	58.6	58.6	58.6	58.6	58.6	58.6	58.6	58.6	58.6	58.6
				$M_{N,Rd}$	58.6	57.4	54.8	51.0	46.2	40.5	34.0	26.6	18.5	9.61	0
	8.0	31.6	1430	$M_{c,Rd}$	73.1	73.1	73.1	73.1	73.1	73.1	73.1	73.1	73.1	73.1	73.1
				$M_{N,Rd}$	73.1	71.7	68.4	63.7	57.7	50.6	42.4	33.2	23.1	12.0	0
	10.0	39.0	1760	$M_{c,Rd}$	89.1	89.1	89.1	89.1	89.1	89.1	89.1	89.1	89.1	89.1	89.1
				$M_{N,Rd}$	89.1	87.3	83.3	77.6	70.3	61.7	51.7	40.5	28.1	14.6	0
	12.5	48.0	2170	$M_{c,Rd}$	108	108	108	108	108	108	108	108	108	108	108
				$M_{N,Rd}$	108	106	101	94.0	85.2	74.7	62.6	49.1	34.1	17.7	0

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Circular Hollow Sections (CFCHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

$N_{Ed}$  = Design value of the axial force.

$$n = N_{Ed} / N_{pl,Rd}$$

$N_{pl,Rd}$  is the axial force resistance

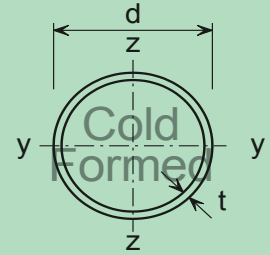
- Not applicable for Class 3 and Class 4 sections.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

COLD FORMED CIRCULAR HOLLOW SECTIONS

Hybox® CHS



Member buckling check

Section Designation & Resistance (kNm)		Mass per Metre kg	Compression Resistance $N_{b,Rd}$ (kN)													
D mm	t mm		for Varying buckling lengths (m)													
			1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0	
139.7	3.0 # $f_y W_{el} = 15.3$	10.1	441	409	375	338	299	261	226	168	127	98.3	78.1	63.4	52.4	
	4.0 # $f_y W_{el} = 20.0$	13.4	585	542	496	447	395	344	297	220	166	129	102	83.1	68.7	
	5.0 $f_y W_{el} = 24.4$	16.6	724	671	614	552	487	424	365	271	204	158	126	102	84.2	
	6.0 $f_y W_{el} = 28.7$	19.8	860	796	727	653	575	500	430	318	240	185	147	119	98.6	
	6.3 $f_y W_{el} = 29.9$	20.7	900	833	761	683	602	522	449	332	250	193	154	125	103	
	8.0 $f_y W_{el} = 36.6$	26.0	1130	1040	949	850	747	646	554	408	307	237	188	153	126	
	10.0 $f_y W_{el} = 43.7$	32.0	1380	1280	1160	1040	908	784	671	493	370	285	226	183	151	
168.3	4.0 $f_y W_{el} = 29.4$	16.2	722	680	636	590	541	490	438	344	269	213	171	140	117	
	4.5 # $f_y W_{el} = 32.8$	18.2	813	765	716	664	608	550	492	386	301	238	192	157	131	
	5.0 $f_y W_{el} = 36.2$	20.1	900	847	793	735	673	608	544	426	333	263	212	173	144	
	6.0 $f_y W_{el} = 42.6$	24.0	1070	1010	942	872	798	721	644	503	392	310	249	204	170	
	6.3 $f_y W_{el} = 44.4$	25.2	1120	1060	988	914	836	755	674	527	411	324	261	213	177	
	8.0 $f_y W_{el} = 54.7$	31.6	1410	1320	1240	1140	1040	940	838	653	508	400	321	263	218	
	10.0 $f_y W_{el} = 66.0$	39.0	1730	1630	1520	1400	1280	1150	1020	794	616	485	389	318	264	
	12.5 $f_y W_{el} = 78.8$	48.0	2130	2000	1860	1720	1560	1400	1240	960	743	584	468	382	317	

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$M_{b,Rd}$  should be taken as equal to  $M_{c,Rd}$ .

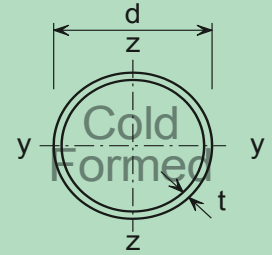
$$n = N_{Ed} / N_{pl,Rd}$$

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

COLD FORMED CIRCULAR HOLLOW SECTIONS

Hybox® CHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial resistance $N_{pl,Rd}$ kN	Moment Resistance $M_{c,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$												
D mm	t mm			n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	
193.7	4.0 #	18.7	845	$M_{c,Rd}$	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4	
				$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-
	4.5 #	21.0	948	$M_{c,Rd}$	57.2	57.2	57.2	57.2	57.2	57.2	57.2	57.2	57.2	57.2	57.2	
				$M_{N,Rd}$	57.2	56.0	53.4	49.8	45.1	39.6	33.2	26.0	18.0	9.37	0	
	5.0	23.3	1050	$M_{c,Rd}$	63.2	63.2	63.2	63.2	63.2	63.2	63.2	63.2	63.2	63.2	63.2	
				$M_{N,Rd}$	63.2	61.9	59.1	55.0	49.9	43.7	36.7	28.7	19.9	10.4	0	
	6.0	27.8	1260	$M_{c,Rd}$	74.9	74.9	74.9	74.9	74.9	74.9	74.9	74.9	74.9	74.9	74.9	
				$M_{N,Rd}$	74.9	73.4	70.0	65.2	59.1	51.9	43.5	34.1	23.6	12.3	0	
6.3	29.1	1320	$M_{c,Rd}$	78.5	78.5	78.5	78.5	78.5	78.5	78.5	78.5	78.5	78.5	78.5		
			$M_{N,Rd}$	78.5	76.9	73.4	68.3	61.9	54.3	45.5	35.7	24.8	12.9	0		
8.0	36.6	1660	$M_{c,Rd}$	98.0	98.0	98.0	98.0	98.0	98.0	98.0	98.0	98.0	98.0	98.0		
			$M_{N,Rd}$	98.0	96.0	91.6	85.3	77.3	67.8	56.9	44.5	30.9	16.1	0		
10.0	45.3	2050	$M_{c,Rd}$	120	120	120	120	120	120	120	120	120	120	120		
			$M_{N,Rd}$	120	118	112	104	94.7	83.1	69.6	54.6	37.9	19.7	0		
12.5	55.9	2530	$M_{c,Rd}$	146	146	146	146	146	146	146	146	146	146	146		
			$M_{N,Rd}$	146	143	136	127	115	101	84.7	66.3	46.1	23.9	0		
219.1	4.5 #	23.8	1080	$M_{c,Rd}$	56.4	56.4	56.4	56.4	56.4	56.4	56.4	56.4	56.4	56.4		
				$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-	
	5.0	26.4	1190	$M_{c,Rd}$	81.3	81.3	81.3	81.3	81.3	81.3	81.3	81.3	81.3	81.3		
				$M_{N,Rd}$	81.3	79.7	76.0	70.8	64.2	56.3	47.2	37.0	25.7	13.3	0	
	6.0	31.5	1430	$M_{c,Rd}$	96.9	96.9	96.9	96.9	96.9	96.9	96.9	96.9	96.9	96.9		
				$M_{N,Rd}$	96.9	95.0	90.6	84.4	76.5	67.1	56.2	44.1	30.6	15.9	0	
	6.3	33.1	1490	$M_{c,Rd}$	101	101	101	101	101	101	101	101	101	101		
				$M_{N,Rd}$	101	99.2	94.6	88.1	79.9	70.0	58.7	46.0	31.9	16.6	0	
	8.0	41.6	1890	$M_{c,Rd}$	127	127	127	127	127	127	127	127	127	127		
				$M_{N,Rd}$	127	124	119	110	100	87.7	73.6	57.6	40.0	20.8	0	
10.0	51.6	2330	$M_{c,Rd}$	155	155	155	155	155	155	155	155	155	155			
			$M_{N,Rd}$	155	152	145	135	123	108	90.2	70.7	49.1	25.5	0		
12.0 #	61.3	2770	$M_{c,Rd}$	183	183	183	183	183	183	183	183	183	183			
			$M_{N,Rd}$	183	179	171	159	144	127	106	83.1	57.7	30.0	0		
12.5	63.7	2880	$M_{c,Rd}$	190	190	190	190	190	190	190	190	190	190			
			$M_{N,Rd}$	190	186	177	165	150	131	110	86.2	59.8	31.1	0		
16.0	80.1	3620	$M_{c,Rd}$	235	235	235	235	235	235	235	235	235	235			
			$M_{N,Rd}$	235	230	219	204	185	162	136	107	74.1	38.5	0		

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$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

$N_{pl,Rd}$  is the axial force resistance

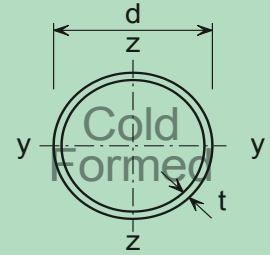
- Not applicable for Class 3 and Class 4 sections.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

COLD FORMED CIRCULAR HOLLOW SECTIONS

Hybox® CHS



Member buckling check

Section Designation & Resistance (kNm)		Mass per Metre kg	Compression Resistance $N_{b,Rd}$ (kN)												
D mm	t mm		for Varying buckling lengths (m)												
			2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
193.7	4.0 # $f_y W_{el} = 39.4$	18.7	763	671	570	468	379	306	250	207	173	147	126	109	95.4
	4.5 # $f_y W_{el} = 44.0$	21.0	855	752	638	524	423	342	279	231	193	164	140	122	106
	5.0 $f_y W_{el} = 48.3$	23.3	947	832	706	579	467	377	308	254	213	181	155	134	117
	6.0 $f_y W_{el} = 57.2$	27.8	1130	993	841	689	556	448	365	302	253	214	184	159	139
	6.3 $f_y W_{el} = 59.6$	29.1	1190	1040	881	721	581	469	382	316	264	224	192	166	146
	8.0 $f_y W_{el} = 73.8$	36.6	1490	1300	1100	899	723	582	474	391	327	277	238	206	180
	10.0 $f_y W_{el} = 89.5$	45.3	1840	1600	1350	1100	880	708	576	475	397	336	288	250	218
	12.5 $f_y W_{el} = 108$	55.9	2260	1970	1650	1340	1070	858	697	574	480	406	348	301	263
219.1	4.5 # $f_y W_{el} = 56.4$	23.8	996	896	786	670	559	463	384	321	271	231	199	173	152
	5.0 $f_y W_{el} = 62.5$	26.4	1100	993	871	742	618	512	424	354	299	255	220	191	167
	6.0 $f_y W_{el} = 73.8$	31.5	1320	1190	1040	884	737	609	504	421	355	303	261	227	199
	6.3 $f_y W_{el} = 77.4$	33.1	1380	1240	1090	925	770	636	527	440	371	317	273	237	208
	8.0 $f_y W_{el} = 95.9$	41.6	1740	1560	1370	1160	963	794	657	548	462	394	339	295	258
	10.0 $f_y W_{el} = 116$	51.6	2150	1930	1680	1420	1180	970	802	668	563	480	413	359	314
	12.0 # $f_y W_{el} = 136$	61.3	2550	2280	1980	1680	1390	1140	939	782	659	561	483	419	367
	12.5 $f_y W_{el} = 141$	63.7	2650	2370	2060	1740	1440	1180	974	811	683	581	500	434	380
	16.0 $f_y W_{el} = 171$	80.1	3320	2960	2560	2150	1770	1450	1190	993	835	711	611	530	464

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$M_{b,Rd}$  should be taken as equal to  $M_{c,Rd}$ .

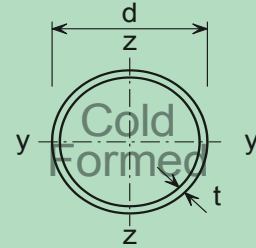
$$n = N_{Ed} / N_{pl,Rd}$$

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

COLD FORMED CIRCULAR HOLLOW SECTIONS

Hybox® CHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial resistance $N_{pl,Rd}$ kN	Moment Resistance $M_{c,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$												
D mm	t mm			n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	
244.5	5.0 #	29.5	1330	$M_{c,Rd}$	78.5	78.5	78.5	78.5	78.5	78.5	78.5	78.5	78.5	78.5	78.5	
				$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-
	6.0	35.3	1600	$M_{c,Rd}$	121	121	121	121	121	121	121	121	121	121	121	
				$M_{N,Rd}$	121	119	113	105	95.6	83.8	70.3	55.0	38.2	19.9	0	
	6.3	37.0	1670	$M_{c,Rd}$	127	127	127	127	127	127	127	127	127	127	127	
				$M_{N,Rd}$	127	125	119	111	100	88.0	73.8	57.8	40.1	20.8	0	
	8.0	46.7	2110	$M_{c,Rd}$	159	159	159	159	159	159	159	159	159	159	159	
				$M_{N,Rd}$	159	156	149	138	126	110	92.3	72.3	50.2	26.1	0	
	10.0	57.8	2620	$M_{c,Rd}$	195	195	195	195	195	195	195	195	195	195	195	
				$M_{N,Rd}$	195	191	183	170	154	135	113	88.8	61.6	32.0	0	
	12.0 #	68.8	3110	$M_{c,Rd}$	230	230	230	230	230	230	230	230	230	230	230	
				$M_{N,Rd}$	230	226	215	201	182	159	134	105	72.7	37.8	0	
	12.5	71.5	3230	$M_{c,Rd}$	239	239	239	239	239	239	239	239	239	239	239	
				$M_{N,Rd}$	239	234	223	208	189	165	139	109	75.4	39.2	0	
16.0	90.2	4080	$M_{c,Rd}$	297	297	297	297	297	297	297	297	297	297	297		
			$M_{N,Rd}$	297	291	278	259	235	206	172	135	93.8	48.7	0		
273	* 4.0 #	26.5	1200	$M_{c,Rd}$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$		
				$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-	
	* 4.5 #	29.8	1350	$M_{c,Rd}$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$		
				$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-	
	5.0 #	33.0	1490	$M_{c,Rd}$	98.3	98.3	98.3	98.3	98.3	98.3	98.3	98.3	98.3	98.3		
				$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-	
	6.0	39.5	1790	$M_{c,Rd}$	152	152	152	152	152	152	152	152	152	152		
				$M_{N,Rd}$	152	149	142	132	120	105	88.2	69.1	48.0	24.9	0	
	6.3	41.4	1870	$M_{c,Rd}$	159	159	159	159	159	159	159	159	159	159		
				$M_{N,Rd}$	159	156	149	138	126	110	92.3	72.3	50.2	26.1	0	
	8.0	52.3	2360	$M_{c,Rd}$	200	200	200	200	200	200	200	200	200	200		
				$M_{N,Rd}$	200	196	187	174	157	138	116	90.7	63.0	32.7	0	
	10.0	64.9	2930	$M_{c,Rd}$	246	246	246	246	246	246	246	246	246	246		
				$M_{N,Rd}$	246	241	230	214	194	170	143	112	77.6	40.3	0	
	12.0 #	77.2	3490	$M_{c,Rd}$	290	290	290	290	290	290	290	290	290	290		
				$M_{N,Rd}$	290	285	272	253	229	201	169	132	91.7	47.6	0	
	12.5	80.3	3620	$M_{c,Rd}$	301	301	301	301	301	301	301	301	301	301		
				$M_{N,Rd}$	301	295	282	262	238	209	175	137	95.1	49.4	0	
16.0	101	4580	$M_{c,Rd}$	376	376	376	376	376	376	376	376	376	376			
			$M_{N,Rd}$	376	368	351	327	296	260	218	171	119	61.6	0		

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Circular Hollow Sections (CFCHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

\* The section is a Class 4 section.

$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

$N_{pl,Rd}$  is the axial force resistance

- Not applicable for Class 3 and Class 4 sections.

\$  $M_{c,Rd}$  is not calculated for Class 4 sections.

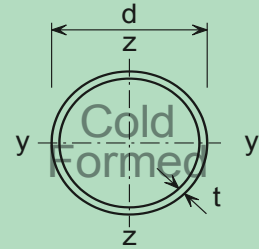
# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.



COLD FORMED CIRCULAR HOLLOW SECTIONS

Hybox® CHS



Member buckling check

Section Designation & Resistance (kNm)		Mass per Metre kg	Compression Resistance $N_{b,Rd}$ (kN)												
D mm	t mm		for Varying buckling lengths (m)												
			2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
244.5	5.0 # $f_y W_{el} = 78.5$	29.5	1260	1150	1030	907	778	659	556	471	401	344	298	260	228
	6.0 $f_y W_{el} = 93.0$	35.3	1510	1380	1230	1080	927	785	662	559	476	409	354	308	271
	6.3 $f_y W_{el} = 97.3$	37.0	1580	1440	1290	1130	970	820	691	584	497	427	369	322	283
	8.0 $f_y W_{el} = 121$	46.7	1990	1810	1620	1420	1220	1030	865	731	621	533	461	402	354
	10.0 $f_y W_{el} = 147$	57.8	2460	2240	2010	1750	1500	1260	1060	895	761	652	564	492	432
	12.0 # $f_y W_{el} = 173$	68.8	2930	2660	2380	2070	1760	1490	1250	1050	893	765	662	577	507
	12.5 $f_y W_{el} = 179$	71.5	3040	2770	2470	2150	1830	1540	1290	1090	924	792	684	597	524
	16.0 $f_y W_{el} = 219$	90.2	3830	3480	3090	2680	2280	1910	1600	1350	1140	978	844	736	646
273	* 4.0 # $f_y W_{el} = 79.5$	26.5	-	-	-	-	-	-	-	-	-	-	-	-	-
	* 4.5 # $f_y W_{el} = 89.1$	29.8	-	-	-	-	-	-	-	-	-	-	-	-	-
	5.0 # $f_y W_{el} = 98.3$	33.0	1440	1330	1220	1090	963	836	720	619	533	461	402	352	311
	6.0 $f_y W_{el} = 117$	39.5	1720	1590	1450	1300	1150	995	856	735	633	547	477	418	369
	6.3 $f_y W_{el} = 122$	41.4	1800	1670	1520	1370	1200	1040	897	770	663	574	499	438	386
	8.0 $f_y W_{el} = 152$	52.3	2270	2100	1910	1720	1510	1310	1120	963	828	716	623	546	482
	10.0 $f_y W_{el} = 186$	64.9	2810	2600	2370	2120	1860	1610	1380	1180	1020	879	765	670	591
	12.0 # $f_y W_{el} = 218$	77.2	3350	3090	2810	2510	2200	1900	1630	1400	1200	1040	900	788	695
	12.5 $f_y W_{el} = 226$	80.3	3470	3200	2910	2600	2280	1970	1690	1440	1240	1070	930	814	718
	16.0 $f_y W_{el} = 278$	101	4380	4030	3660	3260	2850	2450	2100	1790	1540	1320	1150	1010	888

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\* The section can become a Class 4 section.

$M_{b,Rd}$  should be taken as equal to  $M_{c,Rd}$ .

$$n = N_{Ed} / N_{pl,Rd}$$

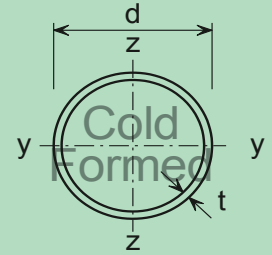
$N_{b,Rd}$  values for Class 4 sections are not calculated.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

COLD FORMED CIRCULAR HOLLOW SECTIONS

Hybox® CHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial resistance $N_{pl,Rd}$ kN	Moment Resistance $M_{c,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$																								
D mm	t mm			n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0													
323.9	* 5.0 #	39.3	1780	$M_{c,Rd}$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	$M_{N,Rd}$	-	-	-	-	-	-	-	-	-				
	6.0	47.0	2130	$M_{c,Rd}$	166	166	166	166	166	166	166	166	166	166	166	$M_{N,Rd}$	-	-	-	-	-	-	-	-	-			
	6.3 #	49.3	2230	$M_{c,Rd}$	174	174	174	174	174	174	174	174	174	174	174	$M_{N,Rd}$	-	-	-	-	-	-	-	-	-			
	8.0	62.3	2820	$M_{c,Rd}$	284	284	284	284	284	284	284	284	284	284	284	$M_{N,Rd}$	284	278	265	247	224	196	165	129	89.5	46.5	0	
	10.0	77.4	3500	$M_{c,Rd}$	350	350	350	350	350	350	350	350	350	350	350	$M_{N,Rd}$	350	343	327	305	276	242	203	159	111	57.4	0	
	12.0 #	92.3	4190	$M_{c,Rd}$	415	415	415	415	415	415	415	415	415	415	415	$M_{N,Rd}$	415	406	388	361	327	287	241	189	131	68.0	0	
	12.5	96.0	4330	$M_{c,Rd}$	431	431	431	431	431	431	431	431	431	431	431	$M_{N,Rd}$	431	422	403	375	340	298	250	196	136	70.6	0	
	16.0	121	5500	$M_{c,Rd}$	539	539	539	539	539	539	539	539	539	539	539	$M_{N,Rd}$	539	528	504	469	425	373	313	245	170	88.4	0	
	355.6	* 5.0 #	43.2	1960	$M_{c,Rd}$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$	$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-		
		6.0	51.7	2340	$M_{c,Rd}$	201	201	201	201	201	201	201	201	201	201	201	$M_{N,Rd}$	-	-	-	-	-	-	-	-	-		
		6.3 #	54.3	2450	$M_{c,Rd}$	211	211	211	211	211	211	211	211	211	211	211	$M_{N,Rd}$	-	-	-	-	-	-	-	-	-		
		8.0	68.6	3100	$M_{c,Rd}$	343	343	343	343	343	343	343	343	343	343	343	$M_{N,Rd}$	343	336	321	299	271	238	199	156	108	56.3	0
		10.0	85.2	3870	$M_{c,Rd}$	424	424	424	424	424	424	424	424	424	424	424	$M_{N,Rd}$	424	416	397	369	335	294	246	193	134	69.6	0
		12.0 #	102	4620	$M_{c,Rd}$	503	503	503	503	503	503	503	503	503	503	503	$M_{N,Rd}$	503	493	470	438	397	348	292	229	159	82.5	0
12.5		106	4790	$M_{c,Rd}$	523	523	523	523	523	523	523	523	523	523	523	$M_{N,Rd}$	523	512	489	455	412	362	303	238	165	85.7	0	
16.0		134	6070	$M_{c,Rd}$	656	656	656	656	656	656	656	656	656	656	656	$M_{N,Rd}$	656	643	613	571	518	454	381	298	207	108	0	

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\* The section is a Class 4 section.

$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

$N_{pl,Rd}$  is the axial force resistance

- Not applicable for Class 3 and Class 4 sections.

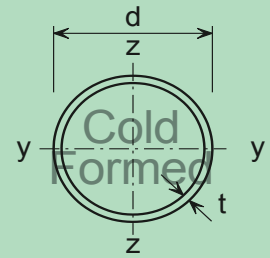
\$  $M_{c,Rd}$  is not calculated for Class 4 sections.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

COLD FORMED CIRCULAR HOLLOW SECTIONS

Hybox® CHS



Member buckling check

Section Designation & Resistance (kNm)		Mass per Metre kg	Compression Resistance $N_{b,Rd}$ (kN)												
D mm	t mm		for Varying buckling lengths (m)												
			2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
323.9	* 5.0 # $f_y W_{el} = 140$	39.3	-	-	-	-	-	-	-	-	-	-	-	-	-
	6.0 $f_y W_{el} = 166$	47.0	2090	1960	1830	1690	1540	1380	1230	1090	955	840	741	656	583
	6.3 # $f_y W_{el} = 174$	49.3	2190	2060	1920	1770	1620	1450	1290	1140	1000	882	778	689	612
	8.0 $f_y W_{el} = 217$	62.3	2770	2600	2430	2240	2040	1830	1630	1440	1270	1110	982	869	773
	10.0 $f_y W_{el} = 267$	77.4	3440	3230	3010	2770	2520	2260	2010	1770	1550	1370	1200	1060	946
	12.0 # $f_y W_{el} = 314$	92.3	4110	3850	3590	3300	3000	2690	2380	2090	1840	1610	1420	1260	1120
	12.5 $f_y W_{el} = 326$	96.0	4250	3980	3710	3410	3100	2780	2460	2170	1900	1670	1470	1300	1150
	16.0 $f_y W_{el} = 403$	121	5390	5050	4700	4320	3920	3500	3100	2720	2380	2090	1840	1630	1440
355.6	* 5.0 # $f_y W_{el} = 169$	43.2	-	-	-	-	-	-	-	-	-	-	-	-	-
	6.0 $f_y W_{el} = 201$	51.7	2330	2200	2070	1940	1790	1640	1480	1330	1190	1060	943	841	753
	6.3 # $f_y W_{el} = 211$	54.3	2440	2310	2170	2030	1880	1720	1560	1400	1250	1110	989	882	789
	8.0 $f_y W_{el} = 263$	68.6	3080	2910	2740	2560	2370	2160	1950	1750	1560	1390	1240	1100	986
	10.0 $f_y W_{el} = 324$	85.2	3840	3630	3410	3180	2940	2680	2420	2170	1930	1720	1530	1360	1210
	12.0 # $f_y W_{el} = 382$	102	4580	4330	4070	3800	3500	3200	2890	2590	2300	2050	1820	1620	1450
	12.5 $f_y W_{el} = 397$	106	4750	4490	4220	3930	3620	3300	2980	2660	2370	2100	1870	1660	1490
	16.0 $f_y W_{el} = 492$	134	6010	5680	5330	4960	4570	4160	3740	3340	2970	2630	2340	2080	1860

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\* The section can become a Class 4 section.

$M_{b,Rd}$  should be taken as equal to  $M_{c,Rd}$ .

$n = N_{Ed} / N_{pl,Rd}$

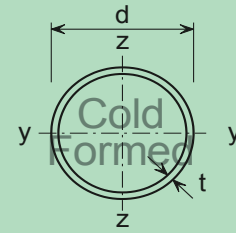
$N_{b,Rd}$  values for Class 4 sections are not calculated.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

COLD FORMED CIRCULAR HOLLOW SECTIONS

Hybox® CHS



Cross-section resistance check

Section Designation		Mass per metre kg/m	Axial resistance $N_{pl,Rd}$ kN	Moment Resistance $M_{c,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$												
D mm	t mm			n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	
406.4	* 6.0 #	59.2	2680	$M_{c,Rd}$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$		
				$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-	
	* 6.3 #	62.2	2810	$M_{c,Rd}$	\$	\$	\$	\$	\$	\$	\$	\$	\$	\$		
				$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-	
	8.0	78.6	3550	$M_{c,Rd}$	347	347	347	347	347	347	347	347	347	347		
				$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-	
	10.0	97.8	4440	$M_{c,Rd}$	558	558	558	558	558	558	558	558	558	558		
				$M_{N,Rd}$	558	547	522	486	441	386	324	254	176	91.5	0	
	12.0 #	117	5290	$M_{c,Rd}$	663	663	663	663	663	663	663	663	663	663		
				$M_{N,Rd}$	663	650	620	577	523	459	385	301	209	109	0	
	12.5	121	5500	$M_{c,Rd}$	689	689	689	689	689	689	689	689	689	689		
				$M_{N,Rd}$	689	675	644	600	544	477	400	313	217	113	0	
	16.0	154	6960	$M_{c,Rd}$	866	866	866	866	866	866	866	866	866	866		
				$M_{N,Rd}$	866	849	810	754	684	600	503	394	273	142	0	
457	* 6.0 #	66.7	3020	$M_{c,Rd}$	\$	\$	\$	\$	\$	\$	\$	\$	\$			
				$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-	
	* 6.3 #	70.0	3170	$M_{c,Rd}$	\$	\$	\$	\$	\$	\$	\$	\$	\$			
				$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-	
	8.0	88.6	4010	$M_{c,Rd}$	442	442	442	442	442	442	442	442	442			
				$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-	
	10.0	110	4970	$M_{c,Rd}$	709	709	709	709	709	709	709	709	709			
				$M_{N,Rd}$	709	695	663	618	560	491	412	322	224	116	0	
	12.0 #	132	5960	$M_{c,Rd}$	844	844	844	844	844	844	844	844	844	844		
				$M_{N,Rd}$	844	827	789	735	666	584	490	384	266	138	0	
	12.5	137	6210	$M_{c,Rd}$	877	877	877	877	877	877	877	877	877	877		
				$M_{N,Rd}$	877	859	820	764	692	607	509	399	277	144	0	
	16.0	174	7880	$M_{c,Rd}$	1110	1110	1110	1110	1110	1110	1110	1110	1110	1110		
				$M_{N,Rd}$	1110	1080	1030	962	872	765	641	502	349	181	0	
508	* 6.0 #	74.3	3360	$M_{c,Rd}$	\$	\$	\$	\$	\$	\$	\$	\$	\$			
				$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-	
	* 6.3 #	77.9	3530	$M_{c,Rd}$	\$	\$	\$	\$	\$	\$	\$	\$	\$			
				$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-	
	* 8.0 #	98.6	4470	$M_{c,Rd}$	\$	\$	\$	\$	\$	\$	\$	\$	\$			
				$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-	
	10.0	123	5540	$M_{c,Rd}$	678	678	678	678	678	678	678	678	678			
				$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-	
	12.0 #	147	6640	$M_{c,Rd}$	1050	1050	1050	1050	1050	1050	1050	1050	1050			
				$M_{N,Rd}$	1050	1030	980	913	828	726	608	477	331	172	0	
	12.5	153	6920	$M_{c,Rd}$	1090	1090	1090	1090	1090	1090	1090	1090	1090			
				$M_{N,Rd}$	1090	1070	1020	949	860	754	633	496	344	179	0	
	16.0 #	194	8770	$M_{c,Rd}$	1380	1380	1380	1380	1380	1380	1380	1380	1380			
				$M_{N,Rd}$	1380	1350	1290	1200	1090	952	798	625	434	226	0	

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\* The section is a Class 4 section.

$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

$N_{pl,Rd}$  is the axial force resistance

- Not applicable for Class 3 and Class 4 sections.

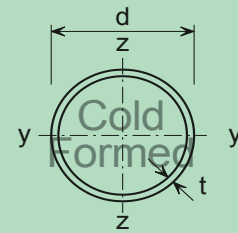
\$  $M_{c,Rd}$  is not calculated for Class 4 sections.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

COLD FORMED CIRCULAR HOLLOW SECTIONS

Hybox® CHS



Member buckling check

Section Designation & Resistance (kNm)		Mass per Metre kg	Compression Resistance $N_{b,Rd}$ (kN) for Varying buckling lengths (m)												
D mm	t mm		2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
406.4	* 6.0 # $f_y W_{el} = 264$	59.2	-	-	-	-	-	-	-	-	-	-	-	-	-
	* 6.3 # $f_y W_{el} = 277$	62.2	-	-	-	-	-	-	-	-	-	-	-	-	-
	8.0 $f_y W_{el} = 347$	78.6	3550	3410	3240	3060	2880	2680	2480	2270	2070	1870	1690	1530	1380
	10.0 $f_y W_{el} = 428$	97.8	4440	4260	4040	3820	3590	3340	3080	2820	2570	2320	2100	1890	1710
	12.0 # $f_y W_{el} = 506$	117	5290	5070	4820	4550	4280	3980	3680	3360	3060	2770	2500	2260	2040
	12.5 $f_y W_{el} = 525$	121	5500	5270	5010	4730	4430	4130	3800	3480	3160	2860	2580	2320	2100
	16.0 $f_y W_{el} = 654$	154	6960	6660	6320	5960	5590	5200	4790	4370	3970	3580	3230	2910	2620
457	* 6.0 # $f_y W_{el} = 336$	66.7	-	-	-	-	-	-	-	-	-	-	-	-	-
	* 6.3 # $f_y W_{el} = 352$	70.0	-	-	-	-	-	-	-	-	-	-	-	-	-
	8.0 $f_y W_{el} = 442$	88.6	4010	3920	3750	3570	3400	3210	3010	2800	2600	2390	2190	2010	1830
	10.0 $f_y W_{el} = 545$	110	4970	4850	4640	4420	4200	3960	3720	3460	3200	2950	2700	2470	2250
	12.0 # $f_y W_{el} = 646$	132	5960	5810	5560	5300	5030	4740	4440	4130	3820	3520	3220	2940	2680
	12.5 $f_y W_{el} = 670$	137	6210	6050	5790	5520	5240	4940	4630	4310	3980	3660	3350	3060	2790
	16.0 $f_y W_{el} = 838$	174	7880	7670	7340	6990	6630	6250	5850	5440	5030	4620	4220	3860	3520
508	* 6.0 # $f_y W_{el} = 417$	74.3	-	-	-	-	-	-	-	-	-	-	-	-	-
	* 6.3 # $f_y W_{el} = 437$	77.9	-	-	-	-	-	-	-	-	-	-	-	-	-
	* 8.0 # $f_y W_{el} = 549$	98.6	-	-	-	-	-	-	-	-	-	-	-	-	-
	10.0 $f_y W_{el} = 678$	123	5540	5470	5260	5050	4830	4600	4370	4120	3860	3600	3350	3100	2860
	12.0 # $f_y W_{el} = 804$	147	6640	6560	6300	6050	5780	5510	5220	4920	4610	4300	3990	3690	3410
	12.5 $f_y W_{el} = 835$	153	6920	6840	6570	6310	6030	5740	5440	5130	4810	4480	4160	3850	3550
	16.0 # $f_y W_{el} = 1050$	194	8770	8650	8320	7980	7630	7260	6880	6480	6070	5650	5250	4850	4470

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Circular Hollow Sections (CFCHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

\* The section can become a Class 4 section.

$M_{b,Rd}$  should be taken as equal to  $M_{c,Rd}$ .

$n = N_{Ed} / N_{pl,Rd}$

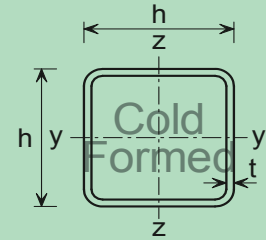
$N_{b,Rd}$  values for Class 4 sections are not calculated.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

COLD-FORMED SQUARE HOLLOW SECTIONS

Hybox® SHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n limit Class 3 Class 2	Moment Resistance $M_{c,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$															
h x h mm	t mm				n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0				
25x25	2.0 #	1.36	61.8	n/a 1.00	$M_{c,Rd}$ $M_{N,Rd}$	0.522 0.522	0.522 0.522	0.522 0.522	0.522 0.464	0.522 0.398	0.522 0.331	0.522 0.265	0.522 0.199	0.522 0.133	0.522 0.066	0.522 0				
	2.5	1.64	74.2	n/a 1.00	$M_{c,Rd}$ $M_{N,Rd}$	0.607 0.607	0.607 0.607	0.607 0.607	0.607 0.532	0.607 0.456	0.607 0.380	0.607 0.304	0.607 0.228	0.607 0.152	0.607 0.076	0.607 0				
30x30	2.0 #	1.68	76.0	n/a 1.00	$M_{c,Rd}$ $M_{N,Rd}$	0.785 0.785	0.785 0.785	0.785 0.785	0.785 0.704	0.785 0.603	0.785 0.503	0.785 0.402	0.785 0.302	0.785 0.201	0.785 0.101	0.785 0				
	2.5 #	2.03	91.9	n/a 1.00	$M_{c,Rd}$ $M_{N,Rd}$	0.927 0.927	0.927 0.927	0.927 0.927	0.927 0.821	0.927 0.704	0.927 0.587	0.927 0.469	0.927 0.352	0.927 0.235	0.927 0.117	0.927 0				
	3.0	2.36	107	n/a 1.00	$M_{c,Rd}$ $M_{N,Rd}$	1.05 1.05	1.05 1.05	1.05 1.05	1.05 0.921	1.05 0.789	1.05 0.658	1.05 0.526	1.05 0.395	1.05 0.263	1.05 0.132	1.05 0				
40x40	2.0 #	2.31	104	n/a 1.00	$M_{c,Rd}$ $M_{N,Rd}$	1.47 1.47	1.47 1.47	1.47 1.47	1.47 1.33	1.47 1.14	1.47 0.949	1.47 0.760	1.47 0.570	1.47 0.380	1.47 0.190	1.47 0				
	2.5	2.82	127	n/a 1.00	$M_{c,Rd}$ $M_{N,Rd}$	1.76 1.76	1.76 1.76	1.76 1.76	1.76 1.59	1.76 1.36	1.76 1.13	1.76 0.906	1.76 0.680	1.76 0.453	1.76 0.227	1.76 0				
	3.0	3.30	149	n/a 1.00	$M_{c,Rd}$ $M_{N,Rd}$	2.03 2.03	2.03 2.03	2.03 2.03	2.03 1.81	2.03 1.55	2.03 1.29	2.03 1.03	2.03 0.776	2.03 0.517	2.03 0.259	2.03 0				
	4.0	4.20	190	n/a 1.00	$M_{c,Rd}$ $M_{N,Rd}$	2.49 2.49	2.49 2.49	2.49 2.49	2.49 2.18	2.49 1.87	2.49 1.56	2.49 1.25	2.49 0.934	2.49 0.623	2.49 0.311	2.49 0				
50x50	2.5	3.60	163	n/a 1.00	$M_{c,Rd}$ $M_{N,Rd}$	2.86 2.86	2.86 2.86	2.86 2.86	2.86 2.60	2.86 2.23	2.86 1.85	2.86 1.48	2.86 1.11	2.86 0.742	2.86 0.371	2.86 0				
	3.0	4.25	192	n/a 1.00	$M_{c,Rd}$ $M_{N,Rd}$	3.33 3.33	3.33 3.33	3.33 3.33	3.33 3.00	3.33 2.57	3.33 2.14	3.33 1.72	3.33 1.29	3.33 0.858	3.33 0.429	3.33 0				
	4.0	5.45	247	n/a 1.00	$M_{c,Rd}$ $M_{N,Rd}$	4.15 4.15	4.15 4.15	4.15 4.15	4.15 3.69	4.15 3.16	4.15 2.64	4.15 2.11	4.15 1.58	4.15 1.05	4.15 0.527	4.15 0				
	5.0	6.56	297	n/a 1.00	$M_{c,Rd}$ $M_{N,Rd}$	4.86 4.86	4.86 4.86	4.86 4.86	4.86 4.26	4.86 3.65	4.86 3.04	4.86 2.43	4.86 1.83	4.86 1.22	4.86 0.609	4.86 0				
60x60	3.0	5.19	235	n/a 1.00	$M_{c,Rd}$ $M_{N,Rd}$	4.97 4.97	4.97 4.97	4.97 4.97	4.97 4.50	4.97 3.86	4.97 3.22	4.97 2.57	4.97 1.93	4.97 1.29	4.97 0.644	4.97 0				
	4.0	6.71	304	n/a 1.00	$M_{c,Rd}$ $M_{N,Rd}$	6.25 6.25	6.25 6.25	6.25 6.25	6.25 5.60	6.25 4.80	6.25 4.00	6.25 3.20	6.25 2.40	6.25 1.60	6.25 0.800	6.25 0				
	5.0	8.13	369	n/a 1.00	$M_{c,Rd}$ $M_{N,Rd}$	7.42 7.42	7.42 7.42	7.42 7.42	7.42 6.59	7.42 5.65	7.42 4.71	7.42 3.76	7.42 2.82	7.42 1.88	7.42 0.941	7.42 0				
	6.0 #	9.45	426	n/a 1.00	$M_{c,Rd}$ $M_{N,Rd}$	8.41 8.41	8.41 8.41	8.41 8.41	8.41 7.36	8.41 6.31	8.41 5.26	8.41 4.21	8.41 3.16	8.41 2.10	8.41 1.05	8.41 0				

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Square Hollow Sections (CFSHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

$N_{Ed}$  = Design value of the axial force.

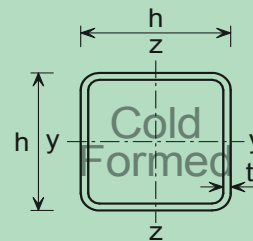
$n = N_{Ed} / N_{pl,Rd}$

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

COLD-FORMED SQUARE HOLLOW SECTIONS

Hybox® SHS



Member buckling check

Section Designation & Resistance (kNm)		n Limit	Compression Resistance $N_{b,Rd}$ (kN)												
h x h mm	t mm		for Varying buckling lengths (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$												
			1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
25x25	2.0 # $f_y W_{el} = 0.422$	1.00	21.2	10.9	6.52	4.32	3.07	2.29	1.77	1.15	0.809	0.599	0.461	0.366	0.298
	2.5 $f_y W_{el} = 0.479$	1.00	24.4	12.5	7.45	4.93	3.50	2.61	2.02	1.31	0.921	0.682	0.525	0.417	0.339
30x30	2.0 # $f_y W_{el} = 0.643$	1.00	34.5	18.9	11.5	7.71	5.50	4.12	3.20	2.09	1.47	1.09	0.841	0.668	0.543
	2.5 # $f_y W_{el} = 0.746$	1.00	40.3	21.9	13.3	8.88	6.33	4.74	3.68	2.40	1.69	1.25	0.965	0.767	0.624
	3.0 $f_y W_{el} = 0.831$	1.00	45.7	24.6	15.0	9.98	7.11	5.32	4.13	2.69	1.89	1.40	1.08	0.860	0.699
40x40	2.0 # $f_y W_{el} = 1.23$	1.00	65.8	41.7	26.9	18.4	13.3	10.1	7.87	5.18	3.66	2.73	2.11	1.68	1.37
	2.5 $f_y W_{el} = 1.46$	1.00	79.1	49.5	31.8	21.8	15.7	11.9	9.27	6.09	4.31	3.20	2.48	1.97	1.61
	3.0 $f_y W_{el} = 1.65$	1.00	91.6	57.0	36.5	24.9	18.0	13.6	10.6	6.97	4.92	3.66	2.83	2.25	1.84
	4.0 $f_y W_{el} = 1.97$	1.00	113	69.0	43.8	29.8	21.5	16.2	12.6	8.30	5.86	4.36	3.37	2.68	2.18
50x50	2.5 $f_y W_{el} = 2.41$	1.00	120	85.9	59.2	41.8	30.8	23.5	18.4	12.2	8.69	6.49	5.03	4.01	3.27
	3.0 $f_y W_{el} = 2.77$	1.00	140	100	68.7	48.5	35.6	27.1	21.3	14.1	10.0	7.50	5.81	4.63	3.78
	4.0 $f_y W_{el} = 3.37$	1.00	178	125	84.8	59.6	43.7	33.2	26.1	17.3	12.3	9.16	7.09	5.65	4.61
	5.0 $f_y W_{el} = 3.83$	1.00	210	145	97.9	68.5	50.1	38.1	29.9	19.8	14.0	10.5	8.09	6.45	5.26
60x60	3.0 $f_y W_{el} = 4.15$	1.00	189	148	110	80.5	60.5	46.7	37.0	24.8	17.7	13.3	10.3	8.23	6.73
	4.0 $f_y W_{el} = 5.15$	1.00	242	188	138	101	75.5	58.2	46.1	30.8	22.0	16.5	12.8	10.2	8.35
	5.0 $f_y W_{el} = 5.96$	1.00	292	224	163	118	88.5	68.1	53.8	36.0	25.6	19.2	14.9	11.9	9.73
	6.0 # $f_y W_{el} = 6.64$	1.00	333	253	182	132	98.3	75.5	59.6	39.8	28.4	21.2	16.5	13.1	10.7

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Square Hollow Sections (CFSHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

$$n = N_{Ed} / N_{pl,Rd}$$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

$M_{b,Rd}$  should be taken as equal to  $M_{c,Rd}$ .

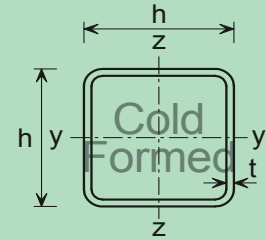
Axial load resistance  $N_{pl,Rd}$  which is equal to  $Af_y$  is given in the cross-section resistance check table opposite.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

COLD-FORMED SQUARE HOLLOW SECTIONS

Hybox® SHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n limit Class 3 Class 2	Moment Resistance $M_{c,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$												
h x h mm	t mm				n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	
70x70	3.0	6.13	277	n/a	$M_{c,Rd}$	6.89	6.89	6.89	6.89	6.89	6.89	6.89	6.89	6.89	6.89	6.89	6.89
				1.00	$M_{N,Rd}$	6.89	6.89	6.89	6.27	5.37	4.48	3.58	2.69	1.79	0.896	0	
	3.5	7.06	319	n/a	$M_{c,Rd}$	7.88	7.88	7.88	7.88	7.88	7.88	7.88	7.88	7.88	7.88	7.88	7.88
				1.00	$M_{N,Rd}$	7.88	7.88	7.88	7.14	6.12	5.10	4.08	3.06	2.04	1.02	0	
	4.0	7.97	359	n/a	$M_{c,Rd}$	8.80	8.80	8.80	8.80	8.80	8.80	8.80	8.80	8.80	8.80	8.80	8.80
				1.00	$M_{N,Rd}$	8.80	8.80	8.80	7.93	6.80	5.66	4.53	3.40	2.27	1.13	0	
	5.0	9.70	440	n/a	$M_{c,Rd}$	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5
				1.00	$M_{N,Rd}$	10.5	10.5	10.5	9.40	8.06	6.72	5.37	4.03	2.69	1.34	0	
	6.0 #	11.3	511	n/a	$M_{c,Rd}$	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0
				1.00	$M_{N,Rd}$	12.0	12.0	12.0	10.6	9.09	7.58	6.06	4.55	3.03	1.52	0	
80x80	3.0	7.07	320	n/a	$M_{c,Rd}$	9.16	9.16	9.16	9.16	9.16	9.16	9.16	9.16	9.16	9.16	9.16	
				1.00	$M_{N,Rd}$	9.16	9.16	9.16	8.37	7.17	5.98	4.78	3.59	2.39	1.20	0	
	3.5	8.16	369	n/a	$M_{c,Rd}$	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	
				1.00	$M_{N,Rd}$	10.5	10.5	10.5	9.53	8.17	6.81	5.45	4.08	2.72	1.36	0	
	4.0	9.22	415	n/a	$M_{c,Rd}$	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	11.8	
				1.00	$M_{N,Rd}$	11.8	11.8	11.8	10.6	9.11	7.60	6.08	4.56	3.04	1.52	0	
	5.0	11.3	511	n/a	$M_{c,Rd}$	14.1	14.1	14.1	14.1	14.1	14.1	14.1	14.1	14.1	14.1	14.1	
				1.00	$M_{N,Rd}$	14.1	14.1	14.1	12.7	10.9	9.06	7.25	5.44	3.62	1.81	0	
	6.0	13.2	596	n/a	$M_{c,Rd}$	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	16.3	
				1.00	$M_{N,Rd}$	16.3	16.3	16.3	14.5	12.4	10.3	8.28	6.21	4.14	2.07	0	
90x90	3.0	8.01	362	n/a	$M_{c,Rd}$	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7	11.7	
				1.00	$M_{N,Rd}$	11.7	11.7	11.7	10.7	9.19	7.66	6.13	4.60	3.06	1.53	0	
	3.5	9.26	419	n/a	$M_{c,Rd}$	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5		
				1.00	$M_{N,Rd}$	13.5	13.5	13.5	12.3	10.5	8.77	7.02	5.26	3.51	1.75	0	
	4.0	10.5	472	n/a	$M_{c,Rd}$	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.1	15.1		
				1.00	$M_{N,Rd}$	15.1	15.1	15.1	13.7	11.8	9.81	7.85	5.89	3.92	1.96	0	
	5.0	12.8	582	n/a	$M_{c,Rd}$	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2	18.2		
				1.00	$M_{N,Rd}$	18.2	18.2	18.2	16.5	14.1	11.8	9.43	7.07	4.71	2.36	0	
	6.0 #	15.1	682	n/a	$M_{c,Rd}$	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1	21.1		
				1.00	$M_{N,Rd}$	21.1	21.1	21.1	18.9	16.2	13.5	10.8	8.11	5.41	2.70	0	

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Square Hollow Sections (CFSHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

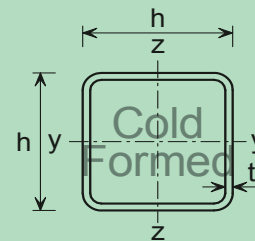
# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.



COLD-FORMED SQUARE HOLLOW SECTIONS

Hybox® SHS



Member buckling check

Section Designation & Resistance (kNm)		n Limit	Compression Resistance $N_{b,Rd}$ (kN)												
h x h mm	t mm		for Varying buckling lengths (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$												
			1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
70x70	3.0 $f_y W_{el} = 5.82$	1.00	236	197	155	119	92.0	72.1	57.7	39.1	28.1	21.1	16.5	13.2	10.8
	3.5 $f_y W_{el} = 6.60$	1.00	271	225	177	136	105	82.0	65.6	44.4	31.9	24.0	18.7	15.0	12.2
	4.0 $f_y W_{el} = 7.31$	1.00	304	252	198	151	116	91.0	72.8	49.2	35.4	26.6	20.7	16.6	13.6
	5.0 $f_y W_{el} = 8.59$	1.00	371	305	238	181	139	108	86.5	58.4	41.9	31.5	24.5	19.6	16.1
	6.0 # $f_y W_{el} = 9.66$	1.00	428	350	271	205	156	122	97.2	65.5	47.0	35.3	27.5	22.0	18.0
80x80	3.0 $f_y W_{el} = 7.81$	1.00	284	246	204	164	130	104	84.2	57.8	41.9	31.6	24.7	19.8	16.3
	3.5 $f_y W_{el} = 8.88$	1.00	327	283	234	188	149	119	96.2	66.0	47.8	36.1	28.2	22.6	18.5
	4.0 $f_y W_{el} = 9.87$	1.00	367	316	261	209	165	132	106	73.0	52.8	39.9	31.1	25.0	20.5
	5.0 $f_y W_{el} = 11.7$	1.00	450	387	318	253	200	159	128	87.8	63.5	47.9	37.4	30.0	24.6
	6.0 $f_y W_{el} = 13.2$	1.00	523	447	366	289	227	181	146	99.4	71.8	54.2	42.3	33.9	27.8
90x90	3.0 $f_y W_{el} = 10.0$	1.00	330	294	253	211	173	141	116	80.8	59.0	44.8	35.2	28.3	23.2
	3.5 $f_y W_{el} = 11.4$	1.00	382	339	292	243	199	162	133	92.6	67.6	51.3	40.2	32.4	26.6
	4.0 $f_y W_{el} = 12.8$	1.00	430	381	327	272	222	180	148	103	75.0	57.0	44.7	35.9	29.5
	5.0 $f_y W_{el} = 15.2$	1.00	528	467	399	330	268	218	178	124	90.2	68.4	53.6	43.1	35.4
	6.0 # $f_y W_{el} = 17.4$	1.00	617	544	463	382	310	251	205	142	103	78.4	61.4	49.4	40.5

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Square Hollow Sections (CFSHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

$$n = N_{Ed} / N_{pl,Rd}$$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

$M_{b,Rd}$  should be taken as equal to  $M_{c,Rd}$ .

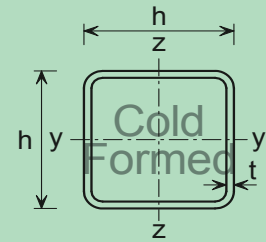
Axial load resistance  $N_{pl,Rd}$  which is equal to  $A_f y$  is given in the cross-section resistance check table opposite.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

COLD-FORMED SQUARE HOLLOW SECTIONS

Hybox® SHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n limit Class 3 Class 2	Moment Resistance $M_{c,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$												
h x h mm	t mm				n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	
100x100	3.0	8.96	405	n/a	$M_{c,Rd}$	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6
				1.00	$M_{N,Rd}$	14.6	14.6	14.6	13.4	11.5	9.58	7.67	5.75	3.83	1.92	0	
	4.0	11.7	529	n/a	$M_{c,Rd}$	18.9	18.9	18.9	18.9	18.9	18.9	18.9	18.9	18.9	18.9	18.9	18.9
				1.00	$M_{N,Rd}$	18.9	18.9	18.9	17.2	14.8	12.3	9.85	7.39	4.92	2.46	0	
	5.0	14.4	653	n/a	$M_{c,Rd}$	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9
				1.00	$M_{N,Rd}$	22.9	22.9	22.9	20.8	17.8	14.9	11.9	8.91	5.94	2.97	0	
	6.0	17.0	767	n/a	$M_{c,Rd}$	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7
				1.00	$M_{N,Rd}$	26.7	26.7	26.7	24.0	20.6	17.1	13.7	10.3	6.86	3.43	0	
	8.0	21.4	966	n/a	$M_{c,Rd}$	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3	32.3
				1.00	$M_{N,Rd}$	32.3	32.3	32.3	28.5	24.4	20.4	16.3	12.2	8.15	4.07	0	
120x120	3.0 #	10.8	490	*	$M_{c,Rd}$	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘
				1.00	$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-
	4.0	14.2	643	n/a	$M_{c,Rd}$	27.8	27.8	27.8	27.8	27.8	27.8	27.8	27.8	27.8	27.8	27.8	27.8
				1.00	$M_{N,Rd}$	27.8	27.8	27.8	25.4	21.8	18.2	14.5	10.9	7.27	3.63	0	
	5.0	17.5	795	n/a	$M_{c,Rd}$	33.9	33.9	33.9	33.9	33.9	33.9	33.9	33.9	33.9	33.9	33.9	33.9
				1.00	$M_{N,Rd}$	33.9	33.9	33.9	30.9	26.5	22.1	17.6	13.2	8.82	4.41	0	
	6.0	20.7	937	n/a	$M_{c,Rd}$	39.8	39.8	39.8	39.8	39.8	39.8	39.8	39.8	39.8	39.8	39.8	39.8
				1.00	$M_{N,Rd}$	39.8	39.8	39.8	36.0	30.9	25.7	20.6	15.4	10.3	5.15	0	
	8.0	26.4	1190	n/a	$M_{c,Rd}$	49.0	49.0	49.0	49.0	49.0	49.0	49.0	49.0	49.0	49.0	49.0	49.0
				1.00	$M_{N,Rd}$	49.0	49.0	49.0	43.6	37.4	31.2	24.9	18.7	12.5	6.24	0	
10.0	31.8	1440	n/a	$M_{c,Rd}$	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5	57.5	
			1.00	$M_{N,Rd}$	57.5	57.5	57.5	50.6	43.4	36.1	28.9	21.7	14.5	7.23	0		
140x140	4.0	16.8	756	1.00	$M_{c,Rd}$	33.1	33.1	33.1	33.1	33.1	33.1	33.1	33.1	33.1	33.1	33.1	
				0.00	$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-	
	5.0	20.7	937	n/a	$M_{c,Rd}$	46.9	46.9	46.9	46.9	46.9	46.9	46.9	46.9	46.9	46.9	46.9	
				1.00	$M_{N,Rd}$	46.9	46.9	46.9	42.9	36.7	30.6	24.5	18.4	12.2	6.12	0	
	6.0	24.5	1110	n/a	$M_{c,Rd}$	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	55.0	
				1.00	$M_{N,Rd}$	55.0	55.0	55.0	50.1	42.9	35.8	28.6	21.5	14.3	7.15	0	
	8.0	31.4	1420	n/a	$M_{c,Rd}$	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	68.9	
				1.00	$M_{N,Rd}$	68.9	68.9	68.9	61.8	53.0	44.1	35.3	26.5	17.7	8.83	0	
	10.0	38.1	1730	n/a	$M_{c,Rd}$	81.7	81.7	81.7	81.7	81.7	81.7	81.7	81.7	81.7	81.7	81.7	
				1.00	$M_{N,Rd}$	81.7	81.7	81.7	72.5	62.2	51.8	41.4	31.1	20.7	10.4	0	

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Square Hollow Sections (CFSHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

\* The section is a Class 4 section and is independent of the design axial force  $N_{Ed}$ . Values of  $M_{c,Rd}$  are calculated based on Class 4 section properties and are displayed in italics.

$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

✘ Section becomes Class 4, see note 10.

\$ For these values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

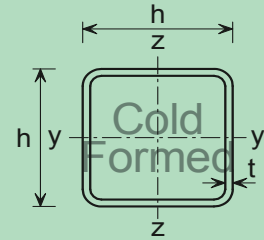
- Not applicable for Class 3 and Class 4 sections.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

COLD-FORMED SQUARE HOLLOW SECTIONS

Hybox® SHS



Member buckling check

Section Designation & Resistance (kNm)		n Limit	Compression Resistance $N_{b,Rd}$ (kN)												
h x h mm	t mm		for Varying buckling lengths (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$												
			1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
100x100	3.0 $f_y W_{el} = 12.6$	1.00	377	342	302	260	219	183	153	108	79.9	61.0	48.0	38.7	31.9
	4.0 $f_y W_{el} = 16.1$	1.00	492	445	392	337	283	235	196	139	102	77.9	61.3	49.4	40.7
	5.0 $f_y W_{el} = 19.2$	1.00	606	547	481	411	344	286	237	168	123	94.1	74.0	59.6	49.0
	6.0 $f_y W_{el} = 22.1$	1.00	710	639	560	477	398	329	273	193	142	108	84.8	68.3	56.2
	8.0 $f_y W_{el} = 26.0$	1.00	888	795	692	584	483	397	328	230	168	128	101	81.1	66.6
120x120	3.0 # $f_y W_{el} = 18.5$	*	431	401	369	335	299	262	228	171	130	101	80.5	65.4	54.1
	4.0 $f_y W_{el} = 23.8$	1.00	617	571	521	468	412	357	307	227	171	132	105	85.0	70.3
	5.0 $f_y W_{el} = 28.7$	1.00	763	705	642	575	505	437	375	276	208	161	127	103	85.3
	6.0 $f_y W_{el} = 33.3$	1.00	897	828	754	673	590	509	436	321	241	186	147	119	98.6
	8.0 $f_y W_{el} = 40.1$	1.00	1140	1050	949	843	734	630	537	392	293	226	179	145	120
	10.0 $f_y W_{el} = 45.8$	1.00	1370	1260	1130	1000	868	740	628	456	340	262	207	167	138
140x140	4.0 $f_y W_{el} = 33.1$	1.00	742	696	648	597	543	486	431	333	258	203	162	133	110
	5.0 $f_y W_{el} = 40.1$	1.00	919	861	802	738	670	599	531	409	316	248	199	162	135
	6.0 $f_y W_{el} = 46.5$	1.00	1080	1020	945	868	787	703	621	478	368	289	231	189	157
	8.0 $f_y W_{el} = 57.2$	1.00	1390	1300	1200	1100	993	883	777	593	455	356	284	232	192
	10.0 $f_y W_{el} = 66.4$	1.00	1680	1570	1450	1320	1190	1060	925	702	537	419	335	272	226

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Square Hollow Sections (CFSHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

$$n = N_{Ed} / N_{pl,Rd}$$

\* The section is a Class 4 section.

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

$M_{b,Rd}$  should be taken as equal to  $M_{c,Rd}$ .

Axial load resistance  $N_{pl,Rd}$  which is equal to  $Af_y$  is given in the cross-section resistance check table opposite.

$N_{b,Rd}$  values in *italic type* indicate that the section is class 4 and allowance has been made in calculating  $N_{b,Rd}$ .

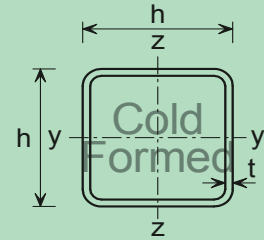
# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.



COLD-FORMED SQUARE HOLLOW SECTIONS

Hybox® SHS



Member buckling check

Section Designation & Resistance (kNm)		n Limit	Compression Resistance $N_{b,Rd}$ (kN)												
h x h mm	t mm		for Varying buckling lengths (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$												
			2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
150x150	4.0 # $f_y W_{el} = 38.3$	*	679	584	481	384	303	241	195	160	133	113	96.5	83.5	72.9
	5.0 $f_y W_{el} = 46.5$	1.00	881	751	612	482	378	300	241	198	165	139	119	103	89.7
	6.0 $f_y W_{el} = 54.3$	1.00	1040	885	718	565	442	350	282	231	192	162	138	120	104
	8.0 $f_y W_{el} = 66.7$	1.00	1330	1120	904	706	550	434	349	285	237	200	171	148	129
	10.0 $f_y W_{el} = 78.1$	1.00	1610	1350	1080	840	652	514	412	337	280	236	201	174	152
	160x160	4.0 # $f_y W_{el} = 43.7$	*	712	625	530	434	350	283	230	190	159	135	116	100
	5.0 $f_y W_{el} = 53.3$	1.00	959	832	693	558	444	355	288	237	198	167	143	124	108
	6.0 $f_y W_{el} = 62.5$	1.00	1130	982	816	656	521	416	337	277	232	196	168	145	127
	8.0 $f_y W_{el} = 77.4$	1.00	1450	1250	1030	825	652	520	420	345	288	243	208	180	157
	10.0 $f_y W_{el} = 90.9$	1.00	1770	1510	1240	987	777	618	499	409	341	288	246	213	186
180x180	5.0 $f_y W_{el} = 68.5$	1.00	1120	993	857	717	588	481	395	328	276	234	202	175	153
	6.0 $f_y W_{el} = 80.2$	1.00	1320	1170	1010	845	692	565	464	385	323	275	236	205	179
	6.3 # $f_y W_{el} = 82.7$	1.00	1370	1220	1050	874	715	583	479	397	334	283	244	211	185
	8.0 $f_y W_{el} = 100$	1.00	1700	1510	1290	1080	877	713	584	484	406	345	296	257	225
	10.0 $f_y W_{el} = 119$	1.00	2080	1840	1570	1300	1050	854	699	579	485	412	353	306	268
	12.0 # $f_y W_{el} = 131$	1.00	2380	2100	1780	1460	1180	952	777	642	537	456	391	339	296
	12.5 $f_y W_{el} = 134$	1.00	2460	2160	1830	1500	1210	977	797	658	551	467	401	347	304

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Square Hollow Sections (CFSHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

$$n = N_{Ed} / N_{pl,Rd}$$

\* The section is a Class 4 section.

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

$M_{b,Rd}$  should be taken as equal to  $M_{c,Rd}$ .

Axial load resistance  $N_{pl,Rd}$  which is equal to  $A_f y$  is given in the cross-section resistance check table opposite.

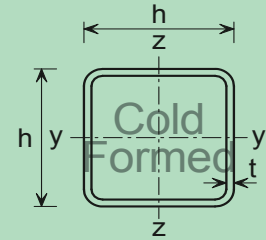
$N_{b,Rd}$  values in *italic type* indicate that the section is class 4 and allowance has been made in calculating  $N_{b,Rd}$ .

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

COLD-FORMED SQUARE HOLLOW SECTIONS

Hybox® SHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n limit Class 3 Class 2	Moment Resistance $M_{c,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$															
h x h mm	t mm				n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0				
200x200	5.0	30.1	1360	*	<i><math>M_{c,Rd}</math></i>	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘		
					$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-		
	6.0	35.8	1620	n/a 1.00	<i><math>M_{c,Rd}</math></i>	117	117	117	117	117	117	117	117	117	117	117	117	117		
					$M_{N,Rd}$	117	117	117	107	92.1	76.8	61.4	46.1	30.7	15.4	0				
	6.3 #	37.2	1680	n/a 1.00	<i><math>M_{c,Rd}</math></i>	121	121	121	121	121	121	121	121	121	121	121	121	121		
					$M_{N,Rd}$	121	121	121	111	94.8	79.0	63.2	47.4	31.6	15.8	0				
	8.0	46.5	2100	n/a 1.00	<i><math>M_{c,Rd}</math></i>	149	149	149	149	149	149	149	149	149	149	149	149	149		
$M_{N,Rd}$					149	149	149	136	116	97.0	77.6	58.2	38.8	19.4	0					
10.0	57.0	2580	n/a 1.00	<i><math>M_{c,Rd}</math></i>	180	180	180	180	180	180	180	180	180	180	180	180	180			
				$M_{N,Rd}$	180	180	180	163	140	116	93.0	69.8	46.5	23.3	0					
12.0 #	66.0	2990	n/a 1.00	<i><math>M_{c,Rd}</math></i>	204	204	204	204	204	204	204	204	204	204	204	204	204			
				$M_{N,Rd}$	204	204	204	182	156	130	104	78.1	52.1	26.0	0					
12.5	68.3	3090	n/a 1.00	<i><math>M_{c,Rd}</math></i>	211	211	211	211	211	211	211	211	211	211	211	211	211			
				$M_{N,Rd}$	211	211	211	187	161	134	107	80.3	53.6	26.8	0					
250x250	6.0	45.2	2040	*	<i><math>M_{c,Rd}</math></i>	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘			
					$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-			
	6.3 #	47.1	2130	*	<i><math>M_{c,Rd}</math></i>	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘			
					$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-			
	8.0	59.1	2670	n/a 1.00	<i><math>M_{c,Rd}</math></i>	240	240	240	240	240	240	240	240	240	240	240	240			
					$M_{N,Rd}$	240	240	240	219	188	157	125	94.0	62.7	31.3	0				
	10.0	72.7	3290	n/a 1.00	<i><math>M_{c,Rd}</math></i>	292	292	292	292	292	292	292	292	292	292	292	292			
$M_{N,Rd}$					292	292	292	265	227	189	152	114	75.8	37.9	0					
12.0 #	84.8	3830	n/a 1.00	<i><math>M_{c,Rd}</math></i>	335	335	335	335	335	335	335	335	335	335	335	335				
				$M_{N,Rd}$	335	335	335	302	259	215	172	129	86.2	43.1	0					
12.5	88.0	3980	n/a 1.00	<i><math>M_{c,Rd}</math></i>	346	346	346	346	346	346	346	346	346	346	346	346				
				$M_{N,Rd}$	346	346	346	311	267	222	178	133	88.9	44.4	0					

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\* The section is a Class 4 section and is independent of the design axial force  $N_{Ed}$ . Values of  $M_{c,Rd}$  are calculated based on Class 4 section properties and are displayed in italics.

$N_{Ed}$  = Design value of the axial force.

$$n = N_{Ed} / N_{pl,Rd}$$

✘ Section becomes Class 4, see note 10.

\$ For these values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

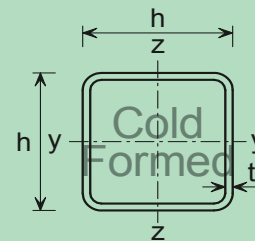
- Not applicable for Class 3 and Class 4 sections.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

COLD-FORMED SQUARE HOLLOW SECTIONS

Hybox® SHS



Member buckling check

Section Designation & Resistance (kNm)		n Limit	Compression Resistance $N_{b,Rd}$ (kN)												
h x h mm	t mm		for Varying buckling lengths (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$												
			2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
200x200	5.0 $f_y W_{el} = 85.6$	*	1170	1060	952	831	710	599	504	425	362	310	268	234	205
	6.0 $f_y W_{el} = 100$	1.00	1510	1370	1210	1040	877	732	610	512	433	370	319	278	244
	6.3 # $f_y W_{el} = 104$	1.00	1570	1420	1250	1080	908	757	631	529	448	382	330	287	252
	8.0 $f_y W_{el} = 127$	1.00	1950	1760	1560	1330	1120	931	775	649	549	468	404	351	308
	10.0 $f_y W_{el} = 151$	1.00	2390	2150	1890	1620	1350	1120	930	778	657	561	483	420	369
	12.0 # $f_y W_{el} = 168$	1.00	2760	2480	2170	1840	1530	1260	1050	874	737	628	541	470	412
	12.5 $f_y W_{el} = 173$	1.00	2850	2560	2240	1900	1580	1300	1080	898	757	645	556	483	423
250x250	6.0 $f_y W_{el} = 161$	*	1770	1650	1530	1400	1260	1120	984	860	750	656	575	507	450
	6.3 # $f_y W_{el} = 167$	*	1890	1770	1630	1490	1340	1180	1040	903	786	686	601	529	469
	8.0 $f_y W_{el} = 205$	1.00	2580	2390	2200	1990	1770	1540	1340	1160	999	867	757	665	587
	10.0 $f_y W_{el} = 247$	1.00	3170	2940	2700	2430	2160	1880	1630	1400	1210	1050	917	805	711
	12.0 # $f_y W_{el} = 280$	1.00	3690	3420	3130	2810	2480	2160	1860	1600	1380	1200	1040	914	807
	12.5 $f_y W_{el} = 289$	1.00	3820	3540	3240	2910	2570	2230	1930	1660	1430	1230	1080	943	833

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Square Hollow Sections (CFSHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

$$n = N_{Ed} / N_{pl,Rd}$$

\* The section is a Class 4 section.

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

$M_{b,Rd}$  should be taken as equal to  $M_{c,Rd}$ .

Axial load resistance  $N_{pl,Rd}$  which is equal to  $A f_y$  is given in the cross-section resistance check table opposite.

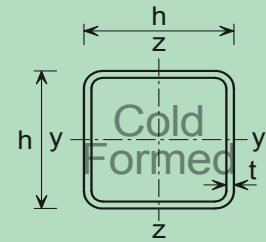
$N_{b,Rd}$  values in *italic type* indicate that the section is class 4 and allowance has been made in calculating  $N_{b,Rd}$ .

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

COLD-FORMED SQUARE HOLLOW SECTIONS

Hybox® SHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n limit Class 3 Class 2	Moment Resistance $M_{c,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$														
h x h mm	t mm				n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0			
300x300	6.0	54.7	2470	*	$M_{c,Rd}$	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
					$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	6.3 #	57.0	2580	*	$M_{c,Rd}$	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
					$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	8.0	71.6	3240	*	$M_{c,Rd}$	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗
					$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	10.0	88.4	4010	n/a 1.00	$M_{c,Rd}$	430	430	430	430	430	430	430	430	430	430	430	430	430	430
					$M_{N,Rd}$	430	430	430	393	337	281	225	168	112	56.2	0			
	12.0 #	104	4690	n/a 1.00	$M_{c,Rd}$	498	498	498	498	498	498	498	498	498	498	498	498	498	498
					$M_{N,Rd}$	498	498	498	451	386	322	258	193	129	64.4	0			
	12.5	108	4860	n/a 1.00	$M_{c,Rd}$	515	515	515	515	515	515	515	515	515	515	515	515	515	
					$M_{N,Rd}$	515	515	515	466	399	333	266	200	133	66.6	0			
350x350	6.0 #	64.1	2900	*	$M_{c,Rd}$	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	
					$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-	
	6.3 #	66.9	3020	*	$M_{c,Rd}$	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	
					$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-	
	8.0	84.2	3800	*	$M_{c,Rd}$	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	
					$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-	
	10.0	104	4720	1.00 0.00	$M_{c,Rd}$	511	511	511	511	511	511	511	511	511	511	511	511	511	
					$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-		
	12.0 #	123	5540	n/a 1.00	$M_{c,Rd}$	692	692	692	692	692	692	692	692	692	692	692	692	692	
					$M_{N,Rd}$	692	692	692	630	540	450	360	270	180	89.9	0			
	12.5	127	5750	n/a 1.00	$M_{c,Rd}$	717	717	717	717	717	717	717	717	717	717	717	717	717	
					$M_{N,Rd}$	717	717	717	652	559	466	372	279	186	93.1	0			
400x400	6.0 #	73.5	3320	*	$M_{c,Rd}$	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	
					$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-	
	6.3 #	76.8	3470	*	$M_{c,Rd}$	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	
					$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-	
	8.0	96.7	4370	*	$M_{c,Rd}$	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	
					$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-	
	10.0	120	5430	*	$M_{c,Rd}$	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗		
					$M_{N,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-		
	12.0 #	141	6390	n/a 1.00	$M_{c,Rd}$	918	918	918	918	918	918	918	918	918	918	918	918	918	
					$M_{N,Rd}$	918	918	918	839	719	599	479	359	240	120	0			
	12.5	147	6640	n/a 1.00	$M_{c,Rd}$	952	952	952	952	952	952	952	952	952	952	952	952	952	
					$M_{N,Rd}$	952	952	952	869	745	621	496	372	248	124	0			

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Square Hollow Sections (CFSHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

\* The section is a Class 4 section and is independent of the design axial force  $N_{Ed}$ . Values of  $M_{c,Rd}$  are calculated based on Class 4 section properties and are displayed in italics.

$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

✗ Section becomes Class 4, see note 10.

\$ For these values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

- Not applicable for Class 3 and Class 4 sections.

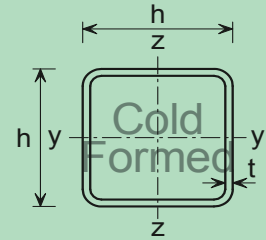
# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.



COLD-FORMED SQUARE HOLLOW SECTIONS

Hybox® SHS



Member buckling check

Section Designation & Resistance (kNm)		n Limit	Compression Resistance $N_{b,Rd}$ (kN)												
h x h mm	t mm		for Varying buckling lengths (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$												
			2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
300x300	6.0 $f_y W_{el} = 236$	*	1920	1830	1740	1640	1530	1420	1310	1190	1080	974	876	788	710
	6.3 # $f_y W_{el} = 245$	*	2070	1970	1870	1760	1640	1510	1390	1260	1140	1020	916	822	739
	8.0 $f_y W_{el} = 303$	*	3040	2870	2700	2510	2320	2110	1910	1710	1520	1350	1200	1070	953
	10.0 $f_y W_{el} = 367$	1.00	3960	3730	3500	3250	2980	2700	2420	2150	1900	1680	1490	1320	1180
	12.0 # $f_y W_{el} = 420$	1.00	4620	4360	4080	3780	3460	3130	2800	2490	2200	1940	1720	1530	1360
	12.5 $f_y W_{el} = 434$	1.00	4800	4520	4230	3920	3590	3250	2910	2580	2280	2020	1780	1580	1410
350x350	6.0 # $f_y W_{el} = 325$	*	2000	1960	1880	1800	1720	1630	1540	1450	1350	1250	1160	1070	981
	6.3 # $f_y W_{el} = 338$	*	2160	2120	2040	1950	1850	1760	1660	1550	1450	1340	1230	1130	1040
	8.0 $f_y W_{el} = 420$	*	3250	3150	3000	2850	2700	2530	2360	2180	2010	1830	1670	1520	1380
	10.0 $f_y W_{el} = 511$	1.00	4720	4520	4290	4050	3790	3530	3250	2970	2690	2430	2190	1980	1780
	12.0 # $f_y W_{el} = 589$	1.00	5540	5290	5010	4730	4420	4100	3770	3440	3110	2810	2520	2270	2050
	12.5 $f_y W_{el} = 610$	1.00	5750	5490	5210	4910	4590	4260	3920	3570	3230	2910	2620	2360	2120
400x400	6.0 # $f_y W_{el} = 428$	*	2050	2050	1990	1930	1860	1790	1710	1640	1560	1480	1400	1310	1230
	6.3 # $f_y W_{el} = 446$	*	2230	2230	2160	2080	2010	1930	1850	1760	1680	1590	1490	1400	1310
	8.0 $f_y W_{el} = 555$	*	3390	3360	3230	3110	2980	2840	2700	2550	2400	2250	2090	1940	1800
	10.0 $f_y W_{el} = 678$	*	4940	4840	4650	4440	4230	4010	3780	3540	3300	3060	2820	2590	2380
	12.0 # $f_y W_{el} = 787$	1.00	6390	6230	5960	5680	5390	5080	4760	4430	4100	3770	3450	3150	2870
	12.5 $f_y W_{el} = 814$	1.00	6640	6470	6190	5900	5600	5280	4950	4600	4260	3910	3580	3270	2990

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Square Hollow Sections (CFSHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

$$n = N_{Ed} / N_{pl,Rd}$$

\* The section is a Class 4 section.

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

$M_{b,Rd}$  should be taken as equal to  $M_{c,Rd}$ .

Axial load resistance  $N_{pl,Rd}$  which is equal to  $A_f y$  is given in the cross-section resistance check table opposite.

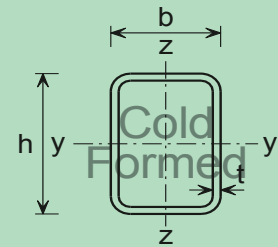
$N_{b,Rd}$  values in *italic type* indicate that the section is class 4 and allowance has been made in calculating  $N_{b,Rd}$ .

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

COLD-FORMED RECTANGULAR HOLLOW SECTIONS

Hybox® RHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n Limit Class 3 Class 2		Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$																		
h x b mm	t mm			Axis		n																		
				y-y	z-z		0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0							
50x25	2.0 #	2.15	97.3	n/a 1.00	n/a 1.00	$M_{c,y,Rd}$	1.51	1.51	1.51	1.51	1.51	1.51	1.51	1.51	1.51	1.51	1.51	1.51	1.51	1.51	1.51			
						$M_{c,z,Rd}$	0.930	0.930	0.930	0.930	0.930	0.930	0.930	0.930	0.930	0.930	0.930	0.930	0.930	0.930	0.930	0.930	0.930	
						$M_{N,y,Rd}$	1.51	1.51	1.51	1.41	1.21	1.01	0.807	0.605	0.403	0.202	0							
						$M_{N,z,Rd}$	0.930	0.930	0.860	0.753	0.645	0.538	0.430	0.323	0.215	0.108	0							
	2.5	2.62	119	n/a 1.00	n/a 1.00	$M_{c,y,Rd}$	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81	1.81			
						$M_{c,z,Rd}$	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11	1.11		
						$M_{N,y,Rd}$	1.81	1.81	1.81	1.69	1.45	1.21	0.967	0.726	0.484	0.242	0							
						$M_{N,z,Rd}$	1.11	1.11	1.01	0.887	0.760	0.633	0.507	0.380	0.253	0.127	0							
	3.0	3.07	139	n/a 1.00	n/a 1.00	$M_{c,y,Rd}$	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08	2.08			
						$M_{c,z,Rd}$	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.26	1.26		
						$M_{N,y,Rd}$	2.08	2.08	2.08	1.94	1.66	1.39	1.11	0.832	0.555	0.277	0							
						$M_{N,z,Rd}$	1.26	1.26	1.14	1.00	0.858	0.715	0.572	0.429	0.286	0.143	0							
50x30	2.0 #	2.31	104	n/a 1.00	n/a 1.00	$M_{c,y,Rd}$	1.68	1.68	1.68	1.68	1.68	1.68	1.68	1.68	1.68	1.68	1.68	1.68	1.68	1.68				
						$M_{c,z,Rd}$	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18	1.18			
						$M_{N,y,Rd}$	1.68	1.68	1.68	1.57	1.35	1.12	0.897	0.673	0.449	0.224	0							
						$M_{N,z,Rd}$	1.18	1.18	1.13	0.985	0.844	0.704	0.563	0.422	0.281	0.141	0							
	2.5	2.82	127	n/a 1.00	n/a 1.00	$M_{c,y,Rd}$	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02	2.02				
						$M_{c,z,Rd}$	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41	1.41				
						$M_{N,y,Rd}$	2.02	2.02	2.02	1.89	1.62	1.35	1.08	0.809	0.540	0.270	0							
						$M_{N,z,Rd}$	1.41	1.41	1.33	1.17	0.999	0.833	0.666	0.500	0.333	0.167	0							
	3.0	3.30	149	n/a 1.00	n/a 1.00	$M_{c,y,Rd}$	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33	2.33					
						$M_{c,z,Rd}$	1.63	1.63	1.63	1.63	1.63	1.63	1.63	1.63	1.63	1.63	1.63	1.63	1.63					
						$M_{N,y,Rd}$	2.33	2.33	2.33	2.18	1.87	1.55	1.24	0.933	0.622	0.311	0							
						$M_{N,z,Rd}$	1.63	1.63	1.52	1.33	1.14	0.949	0.760	0.570	0.380	0.190	0							
	4.0	4.20	190	n/a 1.00	n/a 1.00	$M_{c,y,Rd}$	2.86	2.86	2.86	2.86	2.86	2.86	2.86	2.86	2.86	2.86	2.86	2.86	2.86					
						$M_{c,z,Rd}$	1.98	1.98	1.98	1.98	1.98	1.98	1.98	1.98	1.98	1.98	1.98	1.98						
						$M_{N,y,Rd}$	2.86	2.86	2.86	2.67	2.29	1.91	1.52	1.14	0.762	0.381	0							
						$M_{N,z,Rd}$	1.98	1.98	1.81	1.59	1.36	1.13	0.907	0.680	0.453	0.227	0							

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Rectangular Hollow Sections (CFRHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

$N_{Ed}$  = Design value of the axial force.

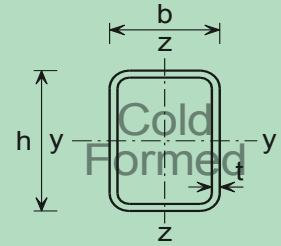
$n = N_{Ed} / N_{pl,Rd}$

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

COLD-FORMED RECTANGULAR HOLLOW SECTIONS

Hybox® RHS



Member buckling check

Section Designation & Resistances (kNm)		n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$														
h x b mm	t mm		L (m)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0	
50x25	2.0 # $f_y W_{el,y} = 1.19$ $f_y W_{el,z} = 0.799$	1.00	$N_{b,y,Rd}$	67.6	46.0	30.7	21.4	15.6	11.9	9.30	6.14	4.35	3.25	2.51	2.00	1.63	
			$N_{b,z,Rd}$	38.0	20.0	12.1	8.03	5.71	4.27	3.31	2.16	1.51	1.12	0.864	0.686	0.558	
		1.00	$M_{b,Rd}$	1.51	1.51	1.51	1.47	1.43	1.39	1.36	1.30	1.24	1.19	1.14	1.09	1.05	
	2.5 $f_y W_{el,y} = 1.40$ $f_y W_{el,z} = 0.930$	1.00	$N_{b,y,Rd}$	81.4	54.9	36.5	25.3	18.5	14.0	11.0	7.25	5.14	3.83	2.96	2.36	1.92	
			$N_{b,z,Rd}$	45.1	23.6	14.2	9.44	6.72	5.02	3.89	2.53	1.78	1.32	1.02	0.806	0.656	
		1.00	$M_{b,Rd}$	1.81	1.81	1.80	1.75	1.71	1.67	1.63	1.55	1.49	1.42	1.36	1.30	1.25	
	3.0 $f_y W_{el,y} = 1.59$ $f_y W_{el,z} = 1.04$	1.00	$N_{b,y,Rd}$	94.1	62.8	41.5	28.8	21.0	15.9	12.4	8.21	5.82	4.33	3.35	2.67	2.18	
			$N_{b,z,Rd}$	51.1	26.6	16.0	10.6	7.54	5.63	4.36	2.84	1.99	1.48	1.14	0.903	0.734	
		1.00	$M_{b,Rd}$	2.08	2.08	2.06	2.01	1.96	1.91	1.86	1.78	1.70	1.62	1.55	1.49	1.43	
	50x30	2.0 # $f_y W_{el,y} = 1.35$ $f_y W_{el,z} = 1.02$	1.00	$N_{b,y,Rd}$	73.9	51.1	34.4	24.1	17.6	13.4	10.5	6.95	4.93	3.68	2.85	2.27	1.85
				$N_{b,z,Rd}$	51.6	29.0	17.9	12.0	8.58	6.44	5.01	3.27	2.31	1.71	1.32	1.05	0.854
			1.00	$M_{b,Rd}$	1.68	1.68	1.68	1.68	1.65	1.62	1.58	1.53	1.47	1.42	1.38	1.33	1.29
2.5 $f_y W_{el,y} = 1.60$ $f_y W_{el,z} = 1.20$		1.00	$N_{b,y,Rd}$	89.2	61.1	41.0	28.6	20.9	15.9	12.4	8.22	5.83	4.35	3.36	2.68	2.19	
			$N_{b,z,Rd}$	61.7	34.5	21.2	14.2	10.2	7.62	5.92	3.87	2.73	2.02	1.56	1.24	1.01	
		1.00	$M_{b,Rd}$	2.02	2.02	2.02	2.02	1.98	1.94	1.90	1.83	1.77	1.71	1.65	1.59	1.54	
3.0 $f_y W_{el,y} = 1.82$ $f_y W_{el,z} = 1.35$		1.00	$N_{b,y,Rd}$	104	70.6	47.2	32.9	24.0	18.2	14.3	9.44	6.69	4.99	3.86	3.08	2.51	
			$N_{b,z,Rd}$	70.1	38.8	23.8	15.9	11.4	8.52	6.62	4.32	3.04	2.26	1.74	1.38	1.13	
		1.00	$M_{b,Rd}$	2.33	2.33	2.33	2.33	2.28	2.23	2.19	2.11	2.03	1.96	1.90	1.83	1.77	
4.0 $f_y W_{el,y} = 2.17$ $f_y W_{el,z} = 1.58$		1.00	$N_{b,y,Rd}$	129	85.9	56.8	39.4	28.7	21.7	17.0	11.2	7.96	5.93	4.59	3.65	2.98	
			$N_{b,z,Rd}$	85.3	46.5	28.4	19.0	13.5	10.1	7.87	5.13	3.61	2.68	2.07	1.64	1.34	
		1.00	$M_{b,Rd}$	2.86	2.86	2.86	2.85	2.78	2.73	2.67	2.57	2.48	2.39	2.31	2.23	2.15	

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Rectangular Hollow Sections (CFRHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

$$n = N_{Ed} / N_{pl,Rd}$$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

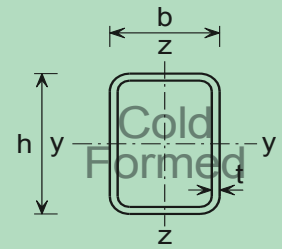
Axial force resistance  $N_{pl,Rd}$  which is equal to  $A_f y$  is given in the cross-section resistance check table opposite.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

COLD-FORMED RECTANGULAR HOLLOW SECTIONS

Hybox® RHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n Limit Class 3 Class 2		Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$																
h x b mm	t mm			Axis		n																
				y-y	z-z		0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0					
60x40	2.5 #	3.60	163	n/a	n/a	$M_{c,y,Rd}$	3.22	3.22	3.22	3.22	3.22	3.22	3.22	3.22	3.22	3.22	3.22	3.22	3.22			
						$M_{c,z,Rd}$	2.43	2.43	2.43	2.43	2.43	2.43	2.43	2.43	2.43	2.43	2.43	2.43	2.43	2.43		
						$M_{N,y,Rd}$	3.22	3.22	3.22	3.00	2.57	2.14	1.72	1.29	0.858	0.429	0					
						$M_{N,z,Rd}$	2.43	2.43	2.35	2.06	1.76	1.47	1.17	0.881	0.587	0.294	0					
	3.0	4.25	192	n/a	n/a	$M_{c,y,Rd}$	3.73	3.73	3.73	3.73	3.73	3.73	3.73	3.73	3.73	3.73	3.73	3.73	3.73			
						$M_{c,z,Rd}$	2.82	2.82	2.82	2.82	2.82	2.82	2.82	2.82	2.82	2.82	2.82	2.82	2.82			
						$M_{N,y,Rd}$	3.73	3.73	3.73	3.48	2.98	2.49	1.99	1.49	0.994	0.497	0					
						$M_{N,z,Rd}$	2.82	2.82	2.71	2.37	2.03	1.69	1.35	1.02	0.677	0.338	0					
	4.0	5.45	247	n/a	n/a	$M_{c,y,Rd}$	4.69	4.69	4.69	4.69	4.69	4.69	4.69	4.69	4.69	4.69	4.69	4.69	4.69			
						$M_{c,z,Rd}$	3.51	3.51	3.51	3.51	3.51	3.51	3.51	3.51	3.51	3.51	3.51	3.51				
						$M_{N,y,Rd}$	4.69	4.69	4.69	4.37	3.75	3.12	2.50	1.87	1.25	0.625	0					
						$M_{N,z,Rd}$	3.51	3.51	3.32	2.91	2.49	2.08	1.66	1.25	0.831	0.415	0					
	5.0	6.56	297	n/a	n/a	$M_{c,y,Rd}$	5.47	5.47	5.47	5.47	5.47	5.47	5.47	5.47	5.47	5.47	5.47	5.47	5.47			
						$M_{c,z,Rd}$	4.08	4.08	4.08	4.08	4.08	4.08	4.08	4.08	4.08	4.08	4.08	4.08				
						$M_{N,y,Rd}$	5.47	5.47	5.47	5.10	4.37	3.64	2.92	2.19	1.46	0.729	0					
						$M_{N,z,Rd}$	4.08	4.08	3.80	3.33	2.85	2.38	1.90	1.43	0.951	0.475	0					
70x40	3.0	4.72	213	n/a	n/a	$M_{c,y,Rd}$	4.76	4.76	4.76	4.76	4.76	4.76	4.76	4.76	4.76	4.76	4.76	4.76				
						$M_{c,z,Rd}$	3.21	3.21	3.21	3.21	3.21	3.21	3.21	3.21	3.21	3.21	3.21	3.21				
						$M_{N,y,Rd}$	4.76	4.76	4.76	4.44	3.81	3.17	2.54	1.90	1.27	0.634	0					
						$M_{N,z,Rd}$	3.21	3.21	3.03	2.65	2.27	1.89	1.51	1.13	0.756	0.378	0					
	4.0	6.08	275	n/a	n/a	$M_{c,y,Rd}$	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96	5.96				
						$M_{c,z,Rd}$	4.01	4.01	4.01	4.01	4.01	4.01	4.01	4.01	4.01	4.01	4.01					
						$M_{N,y,Rd}$	5.96	5.96	5.96	5.57	4.77	3.98	3.18	2.39	1.59	0.795	0					
						$M_{N,z,Rd}$	4.01	4.01	3.73	3.26	2.79	2.33	1.86	1.40	0.932	0.466	0					
	5.0	7.34	332	n/a	n/a	$M_{c,y,Rd}$	7.03	7.03	7.03	7.03	7.03	7.03	7.03	7.03	7.03	7.03	7.03	7.03				
						$M_{c,z,Rd}$	4.72	4.72	4.72	4.72	4.72	4.72	4.72	4.72	4.72	4.72	4.72					
						$M_{N,y,Rd}$	7.03	7.03	7.03	6.56	5.62	4.69	3.75	2.81	1.87	0.937	0					
						$M_{N,z,Rd}$	4.72	4.72	4.32	3.78	3.24	2.70	2.16	1.62	1.08	0.540	0					

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$N_{Ed}$  = Design value of the axial force.

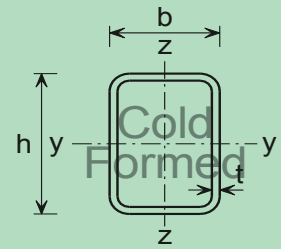
$n = N_{Ed} / N_{pl,Rd}$

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

COLD-FORMED RECTANGULAR HOLLOW SECTIONS

Hybox® RHS



Member buckling check

Section Designation & Resistances (kNm)		n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
h x b mm	t mm		L (m)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
60x40	2.5 # $f_y W_{el,y} = 2.61$ $f_y W_{el,z} = 2.08$	1.00	$N_{b,y,Rd}$	128	98.1	71.0	51.6	38.5	29.6	23.4	15.6	11.1	8.33	6.47	5.16	4.22
			$N_{b,z,Rd}$	106	68.6	44.7	30.8	22.3	16.9	13.2	8.69	6.15	4.58	3.54	2.82	2.30
		1.00	$M_{b,Rd}$	3.22	3.22	3.22	3.22	3.22	3.22	3.17	3.07	2.99	2.91	2.84	2.77	2.70
	3.0 $f_y W_{el,y} = 3.00$ $f_y W_{el,z} = 2.39$	1.00	$N_{b,y,Rd}$	150	115	82.7	59.9	44.6	34.3	27.1	18.1	12.9	9.65	7.49	5.98	4.88
			$N_{b,z,Rd}$	124	79.5	51.6	35.5	25.7	19.4	15.2	10.0	7.08	5.27	4.07	3.24	2.64
		1.00	$M_{b,Rd}$	3.73	3.73	3.73	3.73	3.73	3.73	3.67	3.56	3.46	3.37	3.29	3.21	3.13
	4.0 $f_y W_{el,y} = 3.66$ $f_y W_{el,z} = 2.89$	1.00	$N_{b,y,Rd}$	191	143	102	73.7	54.7	42.0	33.1	22.1	15.7	11.8	9.12	7.28	5.95
			$N_{b,z,Rd}$	155	97.7	62.9	43.1	31.2	23.5	18.4	12.1	8.55	6.36	4.92	3.92	3.19
		1.00	$M_{b,Rd}$	4.69	4.69	4.69	4.69	4.69	4.67	4.60	4.47	4.34	4.23	4.12	4.01	3.91
	5.0 $f_y W_{el,y} = 4.19$ $f_y W_{el,z} = 3.27$	1.00	$N_{b,y,Rd}$	227	168	119	85.3	63.2	48.4	38.2	25.4	18.1	13.5	10.5	8.36	6.83
			$N_{b,z,Rd}$	181	112	71.6	48.9	35.3	26.6	20.8	13.7	9.65	7.18	5.55	4.42	3.60
		1.00	$M_{b,Rd}$	5.47	5.47	5.47	5.47	5.47	5.44	5.36	5.20	5.05	4.92	4.79	4.67	4.55
70x40	3.0 $f_y W_{el,y} = 3.80$ $f_y W_{el,z} = 2.75$	1.00	$N_{b,y,Rd}$	177	143	109	81.7	62.1	48.2	38.4	25.8	18.5	13.9	10.8	8.64	7.07
			$N_{b,z,Rd}$	140	90.6	59.1	40.7	29.5	22.4	17.5	11.5	8.15	6.07	4.69	3.74	3.05
		1.00	$M_{b,Rd}$	4.76	4.76	4.76	4.76	4.76	4.72	4.64	4.50	4.38	4.26	4.14	4.03	3.93
	4.0 $f_y W_{el,y} = 4.65$ $f_y W_{el,z} = 3.35$	1.00	$N_{b,y,Rd}$	226	181	137	102	77.5	60.1	47.8	32.1	23.0	17.2	13.4	10.7	8.76
			$N_{b,z,Rd}$	175	112	72.4	49.7	36.0	27.2	21.3	14.0	9.90	7.37	5.69	4.53	3.69
		1.00	$M_{b,Rd}$	5.96	5.96	5.96	5.96	5.96	5.91	5.81	5.64	5.47	5.32	5.18	5.04	4.91
	5.0 $f_y W_{el,y} = 5.36$ $f_y W_{el,z} = 3.83$	1.00	$N_{b,y,Rd}$	271	215	161	119	89.9	69.6	55.2	37.1	26.5	19.9	15.4	12.3	10.1
			$N_{b,z,Rd}$	207	130	83.8	57.4	41.5	31.3	24.5	16.1	11.4	8.46	6.54	5.21	4.24
		1.00	$M_{b,Rd}$	7.03	7.03	7.03	7.03	7.03	6.95	6.83	6.62	6.43	6.25	6.08	5.91	5.76

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$$n = N_{Ed} / N_{pl,Rd}$$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

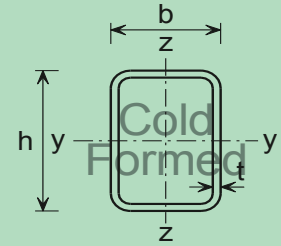
Axial force resistance  $N_{pl,Rd}$  which is equal to  $A_f f_y$  is given in the cross-section resistance check table opposite.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

COLD-FORMED RECTANGULAR HOLLOW SECTIONS

Hybox® RHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n Limit Class 3		Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$														
h x b mm	t mm			Class 2		n	Axis													
				y-y	z-z		0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0			
70x50	3.0 #	5.19	235	n/a	n/a	$M_{c,y,Rd}$	5.47	5.47	5.47	5.47	5.47	5.47	5.47	5.47	5.47	5.47	5.47	5.47	5.47	
						$M_{c,z,Rd}$	4.33	4.33	4.33	4.33	4.33	4.33	4.33	4.33	4.33	4.33	4.33	4.33	4.33	
						$M_{N,y,Rd}$	5.47	5.47	5.47	5.10	4.37	3.64	2.92	2.19	1.46	0.729	0			
						$M_{N,z,Rd}$	4.33	4.33	4.24	3.71	3.18	2.65	2.12	1.59	1.06	0.530	0			
	4.0	6.71	304	n/a	n/a	$M_{c,y,Rd}$	6.92	6.92	6.92	6.92	6.92	6.92	6.92	6.92	6.92	6.92	6.92	6.92	6.92	
						$M_{c,z,Rd}$	5.47	5.47	5.47	5.47	5.47	5.47	5.47	5.47	5.47	5.47	5.47	5.47		
						$M_{N,y,Rd}$	6.92	6.92	6.92	6.46	5.54	4.62	3.69	2.77	1.85	0.923	0			
						$M_{N,z,Rd}$	5.47	5.47	5.29	4.62	3.96	3.30	2.64	1.98	1.32	0.661	0			
	5.0	8.13	369	n/a	n/a	$M_{c,y,Rd}$	8.20	8.20	8.20	8.20	8.20	8.20	8.20	8.20	8.20	8.20	8.20	8.20	8.20	
						$M_{c,z,Rd}$	6.46	6.46	6.46	6.46	6.46	6.46	6.46	6.46	6.46	6.46	6.46	6.46		
						$M_{N,y,Rd}$	8.20	8.20	8.20	7.65	6.56	5.47	4.37	3.28	2.19	1.09	0			
						$M_{N,z,Rd}$	6.46	6.46	6.18	5.41	4.63	3.86	3.09	2.32	1.54	0.772	0			
80x40	3.0	5.19	235	n/a	n/a	$M_{c,y,Rd}$	5.86	5.86	5.86	5.86	5.86	5.86	5.86	5.86	5.86	5.86	5.86	5.86		
						$M_{c,z,Rd}$	3.62	3.62	3.62	3.62	3.62	3.62	3.62	3.62	3.62	3.62	3.62	3.62		
						$M_{N,y,Rd}$	5.86	5.86	5.86	5.47	4.69	3.91	3.12	2.34	1.56	0.781	0			
						$M_{N,z,Rd}$	3.62	3.62	3.36	2.94	2.52	2.10	1.68	1.26	0.839	0.420	0			
	4.0	6.71	304	n/a	n/a	$M_{c,y,Rd}$	7.42	7.42	7.42	7.42	7.42	7.42	7.42	7.42	7.42	7.42	7.42	7.42		
						$M_{c,z,Rd}$	4.54	4.54	4.54	4.54	4.54	4.54	4.54	4.54	4.54	4.54	4.54			
						$M_{N,y,Rd}$	7.42	7.42	7.42	6.92	5.94	4.95	3.96	2.97	1.98	0.989	0			
						$M_{N,z,Rd}$	4.54	4.54	4.16	3.64	3.12	2.60	2.08	1.56	1.04	0.520	0			
	5.0	8.13	369	n/a	n/a	$M_{c,y,Rd}$	8.77	8.77	8.77	8.77	8.77	8.77	8.77	8.77	8.77	8.77	8.77	8.77		
						$M_{c,z,Rd}$	5.33	5.33	5.33	5.33	5.33	5.33	5.33	5.33	5.33	5.33	5.33			
						$M_{N,y,Rd}$	8.77	8.77	8.77	8.18	7.01	5.85	4.68	3.51	2.34	1.17	0			
						$M_{N,z,Rd}$	5.33	5.33	4.82	4.21	3.61	3.01	2.41	1.81	1.20	0.602	0			
80x50	3.0	5.66	256	n/a	n/a	$M_{c,y,Rd}$	6.67	6.67	6.67	6.67	6.67	6.67	6.67	6.67	6.67	6.67	6.67			
						$M_{c,z,Rd}$	4.83	4.83	4.83	4.83	4.83	4.83	4.83	4.83	4.83	4.83	4.83			
						$M_{N,y,Rd}$	6.67	6.67	6.67	6.23	5.34	4.45	3.56	2.67	1.78	0.890	0			
						$M_{N,z,Rd}$	4.83	4.83	4.64	4.06	3.48	2.90	2.32	1.74	1.16	0.580	0			
	4.0	7.34	332	n/a	n/a	$M_{c,y,Rd}$	8.52	8.52	8.52	8.52	8.52	8.52	8.52	8.52	8.52	8.52	8.52			
						$M_{c,z,Rd}$	6.11	6.11	6.11	6.11	6.11	6.11	6.11	6.11	6.11	6.11	6.11			
						$M_{N,y,Rd}$	8.52	8.52	8.52	7.95	6.82	5.68	4.54	3.41	2.27	1.14	0			
						$M_{N,z,Rd}$	6.11	6.11	5.80	5.07	4.35	3.62	2.90	2.17	1.45	0.725	0			
	5.0	8.91	405	n/a	n/a	$M_{c,y,Rd}$	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1			
						$M_{c,z,Rd}$	7.28	7.28	7.28	7.28	7.28	7.28	7.28	7.28	7.28	7.28	7.28			
						$M_{N,y,Rd}$	10.1	10.1	10.1	9.44	8.09	6.75	5.40	4.05	2.70	1.35	0			
						$M_{N,z,Rd}$	7.28	7.28	6.84	5.99	5.13	4.28	3.42	2.57	1.71	0.855	0			

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Rectangular Hollow Sections (CFRHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

$N_{Ed}$  = Design value of the axial force.

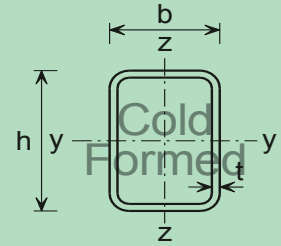
$n = N_{Ed} / N_{pl,Rd}$

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

COLD-FORMED RECTANGULAR HOLLOW SECTIONS

Hybox® RHS



Member buckling check

Section Designation & Resistances (kNm)		n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm)														
h x b mm	t mm		for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$														
			L (m)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0	
70x50	3.0 # $f_y W_{el,y} = 4.47$ $f_y W_{el,z} = 3.69$	1.00	$N_{b,y,Rd}$	197	161	125	94.4	72.2	56.3	44.9	30.3	21.7	16.3	12.7	10.2	8.32	
			$N_{b,z,Rd}$	176	129	89.7	63.8	47.1	36.0	28.4	18.8	13.4	10.0	7.76	6.19	5.05	
			1.00	$M_{b,Rd}$	5.47	5.47	5.47	5.47	5.47	5.47	5.47	5.40	5.27	5.16	5.05	4.95	4.85
	4.0 $f_y W_{el,y} = 5.54$ $f_y W_{el,z} = 4.58$	1.00	$N_{b,y,Rd}$	253	206	158	119	90.5	70.5	56.1	37.8	27.1	20.4	15.8	12.7	10.4	
			$N_{b,z,Rd}$	225	162	112	79.2	58.3	44.5	35.0	23.2	16.5	12.3	9.56	7.62	6.22	
			1.00	$M_{b,Rd}$	6.92	6.92	6.92	6.92	6.92	6.92	6.92	6.83	6.67	6.52	6.38	6.25	6.13
	5.0 $f_y W_{el,y} = 6.43$ $f_y W_{el,z} = 5.29$	1.00	$N_{b,y,Rd}$	305	246	188	141	107	82.9	66.0	44.4	31.8	23.8	18.5	14.8	12.1	
			$N_{b,z,Rd}$	270	192	132	93.1	68.4	52.2	41.0	27.2	19.3	14.4	11.2	8.91	7.27	
			1.00	$M_{b,Rd}$	8.20	8.20	8.20	8.20	8.20	8.20	8.20	8.07	7.89	7.71	7.55	7.39	7.24
	80x40	3.0 $f_y W_{el,y} = 4.65$ $f_y W_{el,z} = 3.12$	1.00	$N_{b,y,Rd}$	202	170	136	106	82.2	64.7	51.9	35.3	25.4	19.1	14.9	11.9	9.79
				$N_{b,z,Rd}$	155	101	66.3	45.7	33.2	25.1	19.7	13.0	9.18	6.83	5.29	4.21	3.43
				1.00	$M_{b,Rd}$	5.86	5.86	5.86	5.86	5.86	5.78	5.68	5.50	5.34	5.19	5.04	4.91
4.0 $f_y W_{el,y} = 5.75$ $f_y W_{el,z} = 3.80$		1.00	$N_{b,y,Rd}$	260	217	172	133	103	80.8	64.8	43.9	31.6	23.8	18.5	14.8	12.1	
			$N_{b,z,Rd}$	197	127	82.4	56.7	41.1	31.1	24.3	16.0	11.3	8.43	6.52	5.19	4.23	
			1.00	$M_{b,Rd}$	7.42	7.42	7.42	7.42	7.42	7.30	7.18	6.95	6.74	6.54	6.36	6.18	6.01
5.0 $f_y W_{el,y} = 6.67$ $f_y W_{el,z} = 4.37$		1.00	$N_{b,y,Rd}$	314	261	205	157	121	94.9	75.9	51.3	36.9	27.8	21.6	17.3	14.2	
			$N_{b,z,Rd}$	233	148	95.2	65.2	47.2	35.7	27.9	18.3	13.0	9.64	7.45	5.93	4.83	
			1.00	$M_{b,Rd}$	8.77	8.77	8.77	8.77	8.76	8.61	8.46	8.19	7.94	7.70	7.48	7.27	7.07
80x50	3.0 $f_y W_{el,y} = 5.43$ $f_y W_{el,z} = 4.19$	1.00	$N_{b,y,Rd}$	223	189	154	121	94.3	74.6	60.1	40.9	29.5	22.3	17.4	13.9	11.4	
			$N_{b,z,Rd}$	194	142	100.0	71.3	52.7	40.3	31.8	21.1	15.0	11.2	8.71	6.95	5.67	
			1.00	$M_{b,Rd}$	6.67	6.67	6.67	6.67	6.67	6.67	6.67	6.56	6.40	6.26	6.12	5.99	5.87
	4.0 $f_y W_{el,y} = 6.78$ $f_y W_{el,z} = 5.18$	1.00	$N_{b,y,Rd}$	288	243	196	153	119	94.2	75.7	51.5	37.1	28.0	21.8	17.5	14.3	
			$N_{b,z,Rd}$	248	181	126	89.6	66.1	50.5	39.7	26.4	18.8	14.0	10.9	8.67	7.08	
			1.00	$M_{b,Rd}$	8.52	8.52	8.52	8.52	8.52	8.52	8.52	8.35	8.15	7.97	7.79	7.63	7.47
	5.0 $f_y W_{el,y} = 7.92$ $f_y W_{el,z} = 6.00$	1.00	$N_{b,y,Rd}$	348	293	234	182	141	111	89.0	60.5	43.5	32.8	25.6	20.5	16.8	
			$N_{b,z,Rd}$	299	214	148	105	77.1	58.8	46.3	30.7	21.8	16.3	12.6	10.1	8.21	
			1.00	$M_{b,Rd}$	10.1	10.1	10.1	10.1	10.1	10.1	10.1	9.90	9.67	9.45	9.24	9.04	8.85

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Rectangular Hollow Sections (CFRHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

$$n = N_{Ed} / N_{pl,Rd}$$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

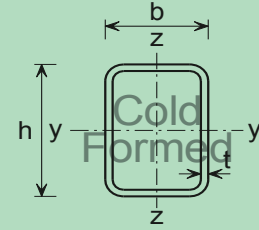
Axial force resistance  $N_{pl,Rd}$  which is equal to  $Af_y$  is given in the cross-section resistance check table opposite.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

COLD-FORMED RECTANGULAR HOLLOW SECTIONS

Hybox® RHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n Limit Class 3		Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for																
h x b mm	t mm			Class 2		Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$																
				Axis		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0					
				y-y	z-z																	
80x60	3.0	6.13	277	n/a	n/a	$M_{c,y,Rd}$	7.53	7.53	7.53	7.53	7.53	7.53	7.53	7.53	7.53	7.53	7.53	7.53	7.53	7.53		
						$M_{c,z,Rd}$	6.18	6.18	6.18	6.18	6.18	6.18	6.18	6.18	6.18	6.18	6.18	6.18	6.18	6.18	6.18	
						$M_{N,y,Rd}$	7.53	7.53	7.53	7.02	6.02	5.02	4.01	3.01	2.01	1.00	0	0	0	0	0	0
						$M_{N,z,Rd}$	6.18	6.18	6.12	5.36	4.59	3.83	3.06	2.30	1.53	0.765	0	0	0	0	0	0
	3.5	7.06	319	n/a	n/a	$M_{c,y,Rd}$	8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56		
						$M_{c,z,Rd}$	7.03	7.03	7.03	7.03	7.03	7.03	7.03	7.03	7.03	7.03	7.03	7.03	7.03	7.03		
						$M_{N,y,Rd}$	8.56	8.56	8.56	7.99	6.84	5.70	4.56	3.42	2.28	1.14	0	0	0	0	0	
						$M_{N,z,Rd}$	7.03	7.03	6.93	6.06	5.20	4.33	3.46	2.60	1.73	0.866	0	0	0	0	0	
	4.0	7.97	359	n/a	n/a	$M_{c,y,Rd}$	9.59	9.59	9.59	9.59	9.59	9.59	9.59	9.59	9.59	9.59	9.59	9.59	9.59	9.59		
						$M_{c,z,Rd}$	7.85	7.85	7.85	7.85	7.85	7.85	7.85	7.85	7.85	7.85	7.85	7.85	7.85	7.85		
						$M_{N,y,Rd}$	9.59	9.59	9.59	8.95	7.67	6.39	5.11	3.83	2.56	1.28	0	0	0	0	0	
						$M_{N,z,Rd}$	7.85	7.85	7.68	6.72	5.76	4.80	3.84	2.88	1.92	0.960	0	0	0	0	0	
	5.0	9.70	440	n/a	n/a	$M_{c,y,Rd}$	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4		
						$M_{c,z,Rd}$	9.37	9.37	9.37	9.37	9.37	9.37	9.37	9.37	9.37	9.37	9.37	9.37	9.37	9.37		
						$M_{N,y,Rd}$	11.4	11.4	11.4	10.7	9.14	7.62	6.10	4.57	3.05	1.52	0	0	0	0	0	
						$M_{N,z,Rd}$	9.37	9.37	9.11	7.98	6.84	5.70	4.56	3.42	2.28	1.14	0	0	0	0	0	
90x50	3.0 #	6.13	277	n/a	n/a	$M_{c,y,Rd}$	8.02	8.02	8.02	8.02	8.02	8.02	8.02	8.02	8.02	8.02	8.02	8.02	8.02			
						$M_{c,z,Rd}$	5.33	5.33	5.33	5.33	5.33	5.33	5.33	5.33	5.33	5.33	5.33	5.33	5.33			
						$M_{N,y,Rd}$	8.02	8.02	8.02	7.49	6.42	5.35	4.28	3.21	2.14	1.07	0	0	0	0		
						$M_{N,z,Rd}$	5.33	5.33	5.04	4.41	3.78	3.15	2.52	1.89	1.26	0.630	0	0	0	0		
	4.0 #	7.97	359	n/a	n/a	$M_{c,y,Rd}$	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2	10.2			
						$M_{c,z,Rd}$	6.78	6.78	6.78	6.78	6.78	6.78	6.78	6.78	6.78	6.78	6.78	6.78	6.78			
						$M_{N,y,Rd}$	10.2	10.2	10.2	9.54	8.18	6.82	5.45	4.09	2.73	1.36	0	0	0	0		
						$M_{N,z,Rd}$	6.78	6.78	6.33	5.54	4.75	3.96	3.17	2.38	1.58	0.792	0	0	0	0		
	5.0	9.70	440	n/a	n/a	$M_{c,y,Rd}$	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2			
						$M_{c,z,Rd}$	8.06	8.06	8.06	8.06	8.06	8.06	8.06	8.06	8.06	8.06	8.06	8.06	8.06			
						$M_{N,y,Rd}$	12.2	12.2	12.2	11.4	9.77	8.14	6.51	4.88	3.26	1.63	0	0	0			
						$M_{N,z,Rd}$	8.06	8.06	7.47	6.54	5.60	4.67	3.74	2.80	1.87	0.934	0	0	0			
100x40	3.0	6.13	277	n/a	n/a	$M_{c,y,Rd}$	8.41	8.41	8.41	8.41	8.41	8.41	8.41	8.41	8.41	8.41	8.41	8.41				
						$M_{c,z,Rd}$	4.40	4.40	4.40	4.40	4.40	4.40	4.40	4.40	4.40	4.40	4.40	4.40				
						$M_{N,y,Rd}$	8.41	8.41	8.41	7.85	6.73	5.61	4.49	3.37	2.24	1.12	0	0				
						$M_{N,z,Rd}$	4.40	4.40	3.98	3.49	2.99	2.49	1.99	1.49	0.996	0.498	0	0				
	4.0	7.97	359	n/a	n/a	$M_{c,y,Rd}$	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8				
						$M_{c,z,Rd}$	5.57	5.57	5.57	5.57	5.57	5.57	5.57	5.57	5.57	5.57	5.57	5.57				
						$M_{N,y,Rd}$	10.8	10.8	10.8	10.0	8.61	7.17	5.74	4.30	2.87	1.43	0	0				
						$M_{N,z,Rd}$	5.57	5.57	4.98	4.35	3.73	3.11	2.49	1.87	1.24	0.622	0	0				
	5.0 #	9.70	440	n/a	n/a	$M_{c,y,Rd}$	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8	12.8				
						$M_{c,z,Rd}$	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57				
						$M_{N,y,Rd}$	12.8	12.8	12.8	12.0	10.3	8.54	6.83	5.13	3.42	1.71	0	0				
						$M_{N,z,Rd}$	6.57	6.54	5.82	5.09	4.36	3.64	2.91	2.18	1.45	0.727	0	0				

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$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

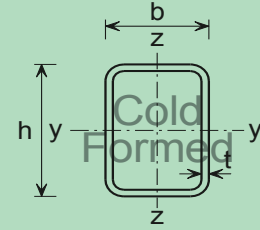
# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.



COLD-FORMED RECTANGULAR HOLLOW SECTIONS

Hybox® RHS



Member buckling check

Section Designation & Resistances (kNm)		n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
h x b	t		L (m)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
mm	mm															
80x60	3.0 $f_y W_{el,y} = 6.21$ $f_y W_{el,z} = 5.33$	1.00	$N_{b,y,Rd}$	243	209	171	136	107	84.8	68.4	46.8	33.8	25.5	19.9	16.0	13.1
			$N_{b,z,Rd}$	227	180	136	101	76.0	58.9	46.8	31.4	22.5	16.8	13.1	10.5	8.56
		1.00	$M_{b,Rd}$	7.53	7.53	7.53	7.53	7.53	7.53	7.53	7.53	7.45	7.31	7.17	7.05	6.93
	3.5 $f_y W_{el,y} = 7.03$ $f_y W_{el,z} = 6.00$	1.00	$N_{b,y,Rd}$	279	239	195	154	121	96.1	77.5	52.9	38.2	28.8	22.5	18.0	14.8
			$N_{b,z,Rd}$	260	206	154	114	85.8	66.4	52.7	35.3	25.3	18.9	14.7	11.8	9.62
		1.00	$M_{b,Rd}$	8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.56	8.47	8.31	8.15	8.01	7.88
	4.0 $f_y W_{el,y} = 7.81$ $f_y W_{el,z} = 6.64$	1.00	$N_{b,y,Rd}$	313	267	217	171	134	106	85.6	58.4	42.1	31.8	24.8	19.9	16.3
			$N_{b,z,Rd}$	291	229	171	126	95.0	73.5	58.3	39.1	27.9	20.9	16.3	13.0	10.6
		1.00	$M_{b,Rd}$	9.59	9.59	9.59	9.59	9.59	9.59	9.59	9.59	9.48	9.30	9.13	8.97	8.81
	5.0 $f_y W_{el,y} = 9.16$ $f_y W_{el,z} = 7.77$	1.00	$N_{b,y,Rd}$	383	325	262	206	161	127	102	69.5	50.2	37.8	29.5	23.6	19.4
			$N_{b,z,Rd}$	354	278	206	151	113	87.6	69.4	46.5	33.2	24.9	19.3	15.4	12.6
		1.00	$M_{b,Rd}$	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.4	11.3	11.1	10.9	10.7	10.5
90x50	3.0 # $f_y W_{el,y} = 6.46$ $f_y W_{el,z} = 4.65$	1.00	$N_{b,y,Rd}$	248	217	182	148	119	95.4	77.6	53.5	38.8	29.4	23.0	18.5	15.1
			$N_{b,z,Rd}$	211	157	111	79.1	58.6	44.8	35.3	23.5	16.7	12.5	9.70	7.74	6.32
		1.00	$M_{b,Rd}$	8.02	8.02	8.02	8.02	8.02	8.02	8.02	7.83	7.64	7.46	7.30	7.14	6.99
	4.0 # $f_y W_{el,y} = 8.09$ $f_y W_{el,z} = 5.79$	1.00	$N_{b,y,Rd}$	320	278	232	188	150	120	97.3	67.0	48.5	36.7	28.7	23.0	18.9
			$N_{b,z,Rd}$	270	197	138	98.3	72.6	55.5	43.7	29.0	20.7	15.4	12.0	9.55	7.79
		1.00	$M_{b,Rd}$	10.2	10.2	10.2	10.2	10.2	10.2	10.2	9.97	9.72	9.49	9.28	9.07	8.88
5.0 $f_y W_{el,y} = 9.51$ $f_y W_{el,z} = 6.71$	1.00	$N_{b,y,Rd}$	390	338	281	225	179	143	116	79.5	57.6	43.5	34.0	27.3	22.4	
		$N_{b,z,Rd}$	328	237	165	117	86.1	65.8	51.7	34.3	24.4	18.2	14.1	11.3	9.20	
	1.00	$M_{b,Rd}$	12.2	12.2	12.2	12.2	12.2	12.2	12.2	11.9	11.6	11.3	11.1	10.8	10.6	
100x40	3.0 $f_y W_{el,y} = 6.57$ $f_y W_{el,z} = 3.83$	1.00	$N_{b,y,Rd}$	252	223	190	158	128	104	85.3	59.2	43.2	32.8	25.7	20.6	16.9
			$N_{b,z,Rd}$	186	124	81.4	56.3	41.0	31.1	24.3	16.0	11.4	8.46	6.54	5.21	4.25
		1.00	$M_{b,Rd}$	8.41	8.41	8.41	8.41	8.30	8.07	7.85	7.46	7.12	6.81	6.53	6.27	6.04
	4.0 $f_y W_{el,y} = 8.20$ $f_y W_{el,z} = 4.72$	1.00	$N_{b,y,Rd}$	324	286	243	200	162	131	107	74.3	54.1	41.0	32.1	25.8	21.2
			$N_{b,z,Rd}$	236	153	100	69.2	50.2	38.0	29.7	19.6	13.9	10.3	7.98	6.36	5.18
		1.00	$M_{b,Rd}$	10.8	10.8	10.8	10.8	10.6	10.3	9.98	9.48	9.04	8.64	8.28	7.95	7.64
5.0 # $f_y W_{el,y} = 9.62$ $f_y W_{el,z} = 5.47$	1.00	$N_{b,y,Rd}$	396	348	294	241	194	156	127	88.1	64.0	48.5	38.0	30.5	25.0	
		$N_{b,z,Rd}$	284	182	118	81.3	58.9	44.6	34.8	22.9	16.2	12.1	9.34	7.43	6.06	
	1.00	$M_{b,Rd}$	12.8	12.8	12.8	12.8	12.5	12.2	11.8	11.2	10.7	10.2	9.79	9.40	9.03	

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Rectangular Hollow Sections (CFRHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

$$n = N_{Ed} / N_{pl,Rd}$$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

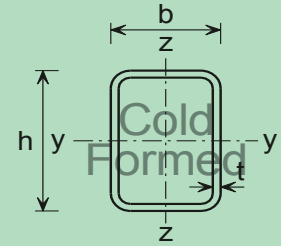
Axial force resistance  $N_{pl,Rd}$  which is equal to  $A_f y$  is given in the cross-section resistance check table opposite.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

COLD-FORMED RECTANGULAR HOLLOW SECTIONS

Hybox® RHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n Limit Class 3 Class 2		Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$																
h x b mm	t mm			Axis		n																
				y-y	z-z		0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0					
100x50	3.0	6.60	299	n/a 1.00	n/a 1.00	$M_{c,y,Rd}$	9.48	9.48	9.48	9.48	9.48	9.48	9.48	9.48	9.48	9.48	9.48	9.48	9.48	9.48		
						$M_{c,z,Rd}$	5.82	5.82	5.82	5.82	5.82	5.82	5.82	5.82	5.82	5.82	5.82	5.82	5.82	5.82	5.82	
						$M_{N,y,Rd}$	9.48	9.48	9.48	8.85	7.58	6.32	5.06	3.79	2.53	1.26	0					
						$M_{N,z,Rd}$	5.82	5.82	5.44	4.76	4.08	3.40	2.72	2.04	1.36	0.680	0					
	4.0	8.59	387	n/a 1.00	n/a 1.00	$M_{c,y,Rd}$	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1	12.1		
						$M_{c,z,Rd}$	7.42	7.42	7.42	7.42	7.42	7.42	7.42	7.42	7.42	7.42	7.42	7.42	7.42	7.42		
						$M_{N,y,Rd}$	12.1	12.1	12.1	11.3	9.68	8.07	6.46	4.84	3.23	1.61	0					
						$M_{N,z,Rd}$	7.42	7.42	6.85	5.99	5.13	4.28	3.42	2.57	1.71	0.856	0					
	5.0	10.5	476	n/a 1.00	n/a 1.00	$M_{c,y,Rd}$	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5	14.5		
						$M_{c,z,Rd}$	8.88	8.88	8.88	8.88	8.88	8.88	8.88	8.88	8.88	8.88	8.88	8.88	8.88	8.88		
						$M_{N,y,Rd}$	14.5	14.5	14.5	13.5	11.6	9.66	7.72	5.79	3.86	1.93	0					
						$M_{N,z,Rd}$	8.88	8.88	8.13	7.12	6.10	5.08	4.07	3.05	2.03	1.02	0					
	6.0	12.3	554	n/a 1.00	n/a 1.00	$M_{c,y,Rd}$	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6	16.6		
						$M_{c,z,Rd}$	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1		
						$M_{N,y,Rd}$	16.6	16.6	16.6	15.5	13.3	11.1	8.88	6.66	4.44	2.22	0					
						$M_{N,z,Rd}$	10.1	10.1	9.15	8.01	6.86	5.72	4.57	3.43	2.29	1.14	0					
100x60	3.0	7.07	320	n/a 1.00	n/a 1.00	$M_{c,y,Rd}$	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5			
						$M_{c,z,Rd}$	7.38	7.38	7.38	7.38	7.38	7.38	7.38	7.38	7.38	7.38	7.38	7.38	7.38			
						$M_{N,y,Rd}$	10.5	10.5	10.5	9.81	8.41	7.01	5.60	4.20	2.80	1.40	0					
						$M_{N,z,Rd}$	7.38	7.38	7.09	6.21	5.32	4.43	3.55	2.66	1.77	0.886	0					
	3.5	8.16	369	n/a 1.00	n/a 1.00	$M_{c,y,Rd}$	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0			
						$M_{c,z,Rd}$	8.45	8.45	8.45	8.45	8.45	8.45	8.45	8.45	8.45	8.45	8.45	8.45				
						$M_{N,y,Rd}$	12.0	12.0	12.0	11.2	9.60	8.00	6.40	4.80	3.20	1.60	0					
						$M_{N,z,Rd}$	8.45	8.45	8.08	7.07	6.06	5.05	4.04	3.03	2.02	1.01	0					
	4.0	9.22	415	n/a 1.00	n/a 1.00	$M_{c,y,Rd}$	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5			
						$M_{c,z,Rd}$	9.44	9.44	9.44	9.44	9.44	9.44	9.44	9.44	9.44	9.44	9.44	9.44				
						$M_{N,y,Rd}$	13.5	13.5	13.5	12.6	10.8	8.97	7.18	5.38	3.59	1.79	0					
						$M_{N,z,Rd}$	9.44	9.44	8.97	7.85	6.73	5.61	4.49	3.36	2.24	1.12	0					
	5.0	11.3	511	n/a 1.00	n/a 1.00	$M_{c,y,Rd}$	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2			
						$M_{c,z,Rd}$	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3				
						$M_{N,y,Rd}$	16.2	16.2	16.2	15.1	13.0	10.8	8.63	6.48	4.32	2.16	0					
						$M_{N,z,Rd}$	11.3	11.3	10.7	9.36	8.02	6.68	5.35	4.01	2.67	1.34	0					
	6.0	13.2	596	n/a 1.00	n/a 1.00	$M_{c,y,Rd}$	18.6	18.6	18.6	18.6	18.6	18.6	18.6	18.6	18.6	18.6	18.6	18.6	18.6			
						$M_{c,z,Rd}$	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0	13.0				
						$M_{N,y,Rd}$	18.6	18.6	18.6	17.4	14.9	12.4	9.94	7.46	4.97	2.49	0					
						$M_{N,z,Rd}$	13.0	13.0	12.1	10.6	9.10	7.58	6.06	4.55	3.03	1.52	0					

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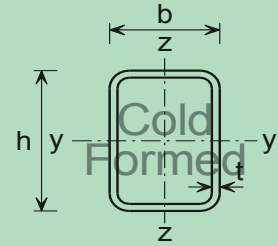
$N_{Ed}$  = Design value of the axial force.

$$n = N_{Ed} / N_{pl,Rd}$$

FOR EXPLANATION OF TABLES SEE NOTE 10.

COLD-FORMED RECTANGULAR HOLLOW SECTIONS

Hybox® RHS



Member buckling check

Section Designation & Resistances (kNm)		n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm)													
h x b mm	t mm		for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
			L (m)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
100x50	3.0 $f_y W_{el,y} = 7.56$ $f_y W_{el,z} = 5.11$	1.00	$N_{b,y,Rd}$	273	243	210	176	144	118	96.8	67.6	49.4	37.5	29.4	23.7	19.5
		$N_{b,z,Rd}$	229	170	121	86.5	64.1	49.1	38.7	25.8	18.3	13.7	10.6	8.49	6.93	
		1.00	$M_{b,Rd}$	9.48	9.48	9.48	9.48	9.48	9.48	9.45	9.20	8.97	8.75	8.55	8.36	8.17
		4.0 $f_y W_{el,y} = 9.51$ $f_y W_{el,z} = 6.39$	1.00	$N_{b,y,Rd}$	353	313	269	224	183	149	122	85.1	62.1	47.2	37.0	29.7
	$N_{b,z,Rd}$		294	216	152	109	80.4	61.5	48.5	32.2	22.9	17.1	13.3	10.6	8.66	
		1.00	$M_{b,Rd}$	12.1	12.1	12.1	12.1	12.1	12.1	12.1	11.7	11.4	11.2	10.9	10.6	10.4
		5.0 $f_y W_{el,y} = 11.2$ $f_y W_{el,z} = 7.46$	1.00	$N_{b,y,Rd}$	432	382	327	271	220	179	146	102	74.1	56.2	44.0	35.4
	$N_{b,z,Rd}$		356	259	181	128	94.7	72.3	57.0	37.8	26.9	20.1	15.6	12.4	10.1	
		1.00	$M_{b,Rd}$	14.5	14.5	14.5	14.5	14.5	14.5	14.4	14.0	13.7	13.3	13.0	12.7	12.4
		6.0 $f_y W_{el,y} = 12.7$ $f_y W_{el,z} = 8.34$	1.00	$N_{b,y,Rd}$	501	441	376	309	251	203	166	115	83.6	63.4	49.6	39.9
	$N_{b,z,Rd}$		410	295	204	145	106	81.2	63.9	42.4	30.1	22.5	17.4	13.9	11.3	
		1.00	$M_{b,Rd}$	16.6	16.6	16.6	16.6	16.6	16.6	16.5	16.1	15.6	15.3	14.9	14.5	14.2
100x60		3.0 $f_y W_{el,y} = 8.56$ $f_y W_{el,z} = 6.46$	1.00	$N_{b,y,Rd}$	294	263	229	193	160	131	108	75.8	55.5	42.3	33.2	26.7
	$N_{b,z,Rd}$		264	212	161	120	91.2	70.9	56.3	37.9	27.1	20.4	15.8	12.7	10.3	
		1.00	$M_{b,Rd}$	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.3	10.1	9.91	9.72	9.55
		3.5 $f_y W_{el,y} = 9.73$ $f_y W_{el,z} = 7.31$	1.00	$N_{b,y,Rd}$	339	303	263	221	182	150	123	86.3	63.2	48.1	37.7	30.4
	$N_{b,z,Rd}$		304	243	184	137	104	80.7	64.1	43.1	30.8	23.1	18.0	14.4	11.8	
		1.00	$M_{b,Rd}$	12.0	12.0	12.0	12.0	12.0	12.0	12.0	12.0	11.8	11.5	11.3	11.1	10.9
		4.0 $f_y W_{el,y} = 10.8$ $f_y W_{el,z} = 8.13$	1.00	$N_{b,y,Rd}$	381	339	294	247	203	166	137	95.8	70.1	53.3	41.8	33.6
	$N_{b,z,Rd}$		341	272	205	153	115	89.5	71.1	47.7	34.2	25.6	19.9	15.9	13.0	
		1.00	$M_{b,Rd}$	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.2	12.9	12.7	12.4	12.2
		5.0 $f_y W_{el,y} = 12.9$ $f_y W_{el,z} = 9.55$	1.00	$N_{b,y,Rd}$	467	416	359	300	246	201	165	115	84.2	63.9	50.1	40.3
	$N_{b,z,Rd}$		416	329	246	182	137	106	84.4	56.6	40.5	30.3	23.6	18.8	15.4	
		1.00	$M_{b,Rd}$	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	15.8	15.5	15.2	14.9	14.7
6.0 $f_y W_{el,y} = 14.6$ $f_y W_{el,z} = 10.8$		1.00	$N_{b,y,Rd}$	543	481	414	344	281	229	188	131	95.3	72.3	56.7	45.6	37.5
	$N_{b,z,Rd}$	482	379	281	207	156	120	95.5	64.0	45.7	34.3	26.6	21.3	17.4		
	1.00	$M_{b,Rd}$	18.6	18.6	18.6	18.6	18.6	18.6	18.6	18.6	18.2	17.8	17.5	17.2	16.8	

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$$n = N_{Ed} / N_{pl,Rd}$$

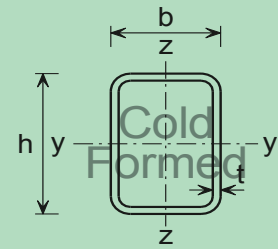
Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

Axial force resistance  $N_{pl,Rd}$  which is equal to  $Af_y$  is given in the cross-section resistance check table opposite.

FOR EXPLANATION OF TABLES SEE NOTE 10.

COLD-FORMED RECTANGULAR HOLLOW SECTIONS

Hybox® RHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n Limit Class 3		Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$																	
h x b mm	t mm			Class 2		n	Axis																
				y-y	z-z		0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0						
100x80	3.0 #	8.01	362	n/a	n/a	<i><math>M_{c,y,Rd}</math></i>	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6			
						<i><math>M_{c,z,Rd}</math></i>	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	10.8	
						<i><math>M_{N,y,Rd}</math></i>	12.6	12.6	12.6	11.7	10.1	8.38	6.70	5.03	3.35	1.68	0						
						<i><math>M_{N,z,Rd}</math></i>	10.8	10.8	10.8	9.51	8.15	6.79	5.44	4.08	2.72	1.36	0						
	4.0	10.5	472	n/a	n/a	<i><math>M_{c,y,Rd}</math></i>	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2			
						<i><math>M_{c,z,Rd}</math></i>	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.9		
						<i><math>M_{N,y,Rd}</math></i>	16.2	16.2	16.2	15.1	13.0	10.8	8.63	6.48	4.32	2.16	0						
						<i><math>M_{N,z,Rd}</math></i>	13.9	13.9	13.9	12.2	10.4	8.69	6.95	5.21	3.48	1.74	0						
	5.0	12.8	582	n/a	n/a	<i><math>M_{c,y,Rd}</math></i>	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6			
						<i><math>M_{c,z,Rd}</math></i>	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8	16.8		
						<i><math>M_{N,y,Rd}</math></i>	19.6	19.6	19.6	18.3	15.6	13.0	10.4	7.82	5.22	2.61	0						
						<i><math>M_{N,z,Rd}</math></i>	16.8	16.8	16.7	14.6	12.5	10.4	8.33	6.25	4.16	2.08	0						
6.0	15.1	682	n/a	n/a	<i><math>M_{c,y,Rd}</math></i>	22.6	22.6	22.6	22.6	22.6	22.6	22.6	22.6	22.6	22.6	22.6	22.6	22.6	22.6				
					<i><math>M_{c,z,Rd}</math></i>	19.4	19.4	19.4	19.4	19.4	19.4	19.4	19.4	19.4	19.4	19.4	19.4	19.4	19.4	19.4			
					<i><math>M_{N,y,Rd}</math></i>	22.6	22.6	22.6	21.1	18.1	15.1	12.1	9.06	6.04	3.02	0							
					<i><math>M_{N,z,Rd}</math></i>	19.4	19.4	19.1	16.7	14.3	11.9	9.56	7.17	4.78	2.39	0							
120x40	3.0 #	7.07	320	0.885	*	<i><math>M_{c,y,Rd}</math></i>	11.4	11.4	11.4	11.4	11.4	11.4	8.77	8.77	8.77	✘	\$						
						<i><math>M_{c,z,Rd}</math></i>	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	\$		
						<i><math>M_{N,y,Rd}</math></i>	11.4	11.4	11.4	10.7	9.14	7.62	-	-	-	-	-	-	-	-	-	-	
						<i><math>M_{N,z,Rd}</math></i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	4.0 #	9.22	415	n/a	n/a	<i><math>M_{c,y,Rd}</math></i>	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6	14.6				
						<i><math>M_{c,z,Rd}</math></i>	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57	6.57			
						<i><math>M_{N,y,Rd}</math></i>	14.6	14.6	14.6	13.7	11.7	9.75	7.80	5.85	3.90	1.95	0						
						<i><math>M_{N,z,Rd}</math></i>	6.57	6.49	5.77	5.05	4.33	3.61	2.89	2.16	1.44	0.722	0						
	5.0 #	11.3	511	n/a	n/a	<i><math>M_{c,y,Rd}</math></i>	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5				
						<i><math>M_{c,z,Rd}</math></i>	7.81	7.81	7.81	7.81	7.81	7.81	7.81	7.81	7.81	7.81	7.81	7.81	7.81	7.81			
						<i><math>M_{N,y,Rd}</math></i>	17.5	17.5	17.5	16.4	14.0	11.7	9.35	7.01	4.68	2.34	0						
						<i><math>M_{N,z,Rd}</math></i>	7.81	7.67	6.82	5.96	5.11	4.26	3.41	2.56	1.70	0.852	0						

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Rectangular Hollow Sections (CFRHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

\* The section is a Class 4 section about the appropriate axis and is independent of the design axial force  $N_{Ed}$ . Values of  $M_{c,Rd}$  are calculated based on class 4 section properties and are displayed in italics.

$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

✘ Section becomes Class 4, see note 10.

\$ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

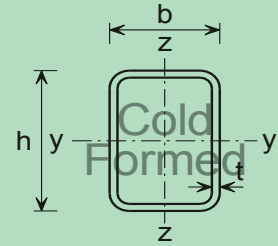
- Not applicable for Class 3 and Class 4 sections.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

COLD-FORMED RECTANGULAR HOLLOW SECTIONS

Hybox® RHS



Member buckling check

Section Designation & Resistances (kNm)		n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm)														
h x b mm	t mm		for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$														
			L (m)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0	
100x80	3.0 # $f_y W_{el,y} = 10.6$ $f_y W_{el,z} = 9.37$	1.00	$N_{b,y,Rd}$	336	302	266	227	190	157	130	92.1	67.7	51.7	40.6	32.7	26.9	
			$N_{b,z,Rd}$	324	282	237	192	154	123	100	69.1	50.1	37.9	29.7	23.8	19.5	
		1.00	$M_{b,Rd}$	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.5	12.3	12.1
	4.0 $f_y W_{el,y} = 13.5$ $f_y W_{el,z} = 11.9$	1.00	$N_{b,y,Rd}$	437	392	344	293	244	201	167	118	86.3	65.8	51.7	41.7	34.3	
			$N_{b,z,Rd}$	420	365	305	246	196	157	128	87.7	63.6	48.1	37.6	30.2	24.7	
		1.00	$M_{b,Rd}$	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.2	16.1	15.8	15.6
	5.0 $f_y W_{el,y} = 16.0$ $f_y W_{el,z} = 14.2$	1.00	$N_{b,y,Rd}$	537	482	421	357	296	244	202	142	104	79.2	62.2	50.1	41.2	
			$N_{b,z,Rd}$	516	447	371	298	237	189	153	105	76.2	57.6	45.0	36.1	29.6	
		1.00	$M_{b,Rd}$	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.4	19.1	18.9
	6.0 $f_y W_{el,y} = 18.4$ $f_y W_{el,z} = 16.2$	1.00	$N_{b,y,Rd}$	627	561	488	412	341	280	231	162	119	90.5	71.1	57.2	47.0	
			$N_{b,z,Rd}$	603	520	430	344	272	217	176	120	87.1	65.8	51.4	41.3	33.8	
		1.00	$M_{b,Rd}$	22.6	22.6	22.6	22.6	22.6	22.6	22.6	22.6	22.6	22.6	22.6	22.4	22.1	21.8
120x40	§ 3.0 # $f_y W_{el,y} = 8.77$ $f_y W_{el,z} = 4.58$	0.885	$N_{b,y,Rd}$	300	272	242	210	178	150	125	89.5	66.2	50.6	39.9	32.2	26.5	
			$N_{b,z,Rd}$	217	145	95.7	66.3	48.3	36.6	28.7	18.9	13.4	9.98	7.73	6.15	5.02	
		0.885	$M_{b,Rd}$	8.77	8.77	8.77	8.77	8.77	8.67	8.45	8.07	7.74	7.43	7.16	6.90	6.67	
		0.515	$M_{b,Rd}$	11.4	11.4	11.4	11.4	11.1	10.7	10.4	9.88	9.39	8.96	8.57	8.21	7.88	
	4.0 # $f_y W_{el,y} = 11.0$ $f_y W_{el,z} = 5.64$	1.00	$N_{b,y,Rd}$	388	352	312	270	228	191	159	113	83.7	64.0	50.4	40.7	33.5	
			$N_{b,z,Rd}$	277	182	120	82.7	60.1	45.5	35.6	23.5	16.6	12.4	9.58	7.63	6.22	
		1.00	$M_{b,Rd}$	14.6	14.6	14.6	14.6	14.1	13.7	13.3	12.6	11.9	11.4	10.9	10.4	9.98	
	5.0 # $f_y W_{el,y} = 13.1$ $f_y W_{el,z} = 6.57$	1.00	$N_{b,y,Rd}$	476	431	381	327	276	230	191	136	100.0	76.4	60.1	48.5	39.9	
			$N_{b,z,Rd}$	333	215	140	96.5	70.0	53.0	41.4	27.3	19.3	14.4	11.1	8.85	7.21	
		1.00	$M_{b,Rd}$	17.5	17.5	17.5	17.4	16.8	16.3	15.8	15.0	14.2	13.5	12.9	12.4	11.8	

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Rectangular Hollow Sections (CFRHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

$$n = N_{Ed} / N_{pl,Rd}$$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

Axial force resistance  $N_{pl,Rd}$  which is equal to  $Af_y$  is given in the cross-section resistance check table opposite.

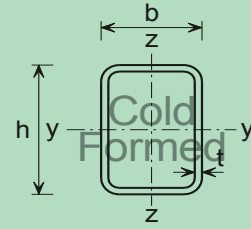
§ The section can be a Class 4 section but no allowance has been made in calculating  $N_{b,y,Rd}$  and  $N_{b,z,Rd}$ .

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

COLD-FORMED RECTANGULAR HOLLOW SECTIONS

Hybox® RHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n Limit		Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$															
h x b mm	t mm			Class 3	Class 2	n	Axis														
				y-y	z-z		0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0				
120x60	3.0	8.01	362	0.885	*	$M_{c,y,Rd}$	13.9	13.9	13.9	13.9	13.9	11.2	11.2	11.2	11.2	✘	\$				
						$M_{c,z,Rd}$	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	\$		
						$M_{N,y,Rd}$	13.9	13.9	13.9	13.0	11.1	-	-	-	-	-	-	-	-	-	
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
						$M_{c,y,Rd}$	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	12.7	12.7	12.7	12.7	
	3.5	9.26	419	1.00	1.00	0.635	0.00	$M_{c,y,Rd}$	8.66	8.66	8.66	8.66	8.66	8.66	8.66	8.66	8.66	8.66	8.66		
								$M_{c,z,Rd}$	15.9	15.9	15.9	14.9	12.8	10.6	8.50	-	-	-	-	-	
								$M_{N,y,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-
								$M_{N,z,Rd}$	17.9	17.9	17.9	17.9	17.9	17.9	17.9	17.9	17.9	17.9	17.9	17.9	17.9
								$M_{c,y,Rd}$	21.6	21.6	21.6	21.6	21.6	21.6	21.6	21.6	21.6	21.6	21.6	21.6	21.6
	4.0	10.5	472	n/a	n/a	1.00	1.00	$M_{c,y,Rd}$	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0	11.0			
								$M_{c,z,Rd}$	17.9	17.9	17.9	16.7	14.3	12.0	9.56	7.17	4.78	2.39	0		
								$M_{N,y,Rd}$	11.0	11.0	10.3	8.98	7.69	6.41	5.13	3.85	2.56	1.28	0		
								$M_{N,z,Rd}$	21.6	21.6	21.6	20.2	17.3	14.4	11.5	8.65	5.77	2.88	0		
								$M_{c,y,Rd}$	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1
5.0	12.8	582	n/a	n/a	1.00	1.00	$M_{c,y,Rd}$	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3				
							$M_{c,z,Rd}$	21.6	21.6	21.6	20.2	17.3	14.4	11.5	8.65	5.77	2.88	0			
							$M_{N,y,Rd}$	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3	13.3		
							$M_{N,z,Rd}$	25.1	25.1	25.1	23.4	20.1	16.7	13.4	10.0	6.68	3.34	0			
							$M_{c,y,Rd}$	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1	25.1		
6.0	15.1	682	n/a	n/a	1.00	1.00	$M_{c,y,Rd}$	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3	15.3				
							$M_{c,z,Rd}$	15.3	15.3	14.0	12.2	10.5	8.74	6.99	5.25	3.50	1.75	0			
							$M_{N,y,Rd}$	15.3	15.3	14.0	12.2	10.5	8.74	6.99	5.25	3.50	1.75	0			
							$M_{N,z,Rd}$	25.1	25.1	25.1	23.4	20.1	16.7	13.4	10.0	6.68	3.34	0			
							$M_{c,y,Rd}$	16.4	16.4	16.4	16.4	16.4	13.6	13.6	13.6	13.6	13.6	✘	\$		
120x80	3.0	8.96	405	0.885	*	0.407	$M_{c,y,Rd}$	16.4	16.4	16.4	16.4	16.4	13.6	13.6	13.6	13.6	✘	\$			
							$M_{c,z,Rd}$	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	\$		
							$M_{N,y,Rd}$	16.4	16.4	16.4	15.3	13.1	-	-	-	-	-	-	-		
							$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-		
							$M_{c,y,Rd}$	21.2	21.2	21.2	21.2	21.2	21.2	21.2	21.2	21.2	21.2	21.2	21.2	21.2	
	4.0	11.7	529	n/a	n/a	1.00	1.00	$M_{c,y,Rd}$	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0			
								$M_{c,z,Rd}$	21.2	21.2	21.2	19.8	17.0	14.2	11.3	8.49	5.66	2.83	0		
								$M_{N,y,Rd}$	16.0	16.0	15.6	13.7	11.7	9.76	7.81	5.86	3.90	1.95	0		
								$M_{N,z,Rd}$	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	
								$M_{c,y,Rd}$	19.4	19.4	19.4	19.4	19.4	19.4	19.4	19.4	19.4	19.4	19.4	19.4	
	5.0	14.4	653	n/a	n/a	1.00	1.00	$M_{c,y,Rd}$	25.7	25.7	25.7	24.0	20.6	17.1	13.7	10.3	6.85	3.43	0		
								$M_{c,z,Rd}$	19.4	19.4	18.8	16.5	14.1	11.8	9.40	7.05	4.70	2.35	0		
								$M_{N,y,Rd}$	19.4	19.4	18.8	16.5	14.1	11.8	9.40	7.05	4.70	2.35	0		
								$M_{N,z,Rd}$	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9		
								$M_{c,y,Rd}$	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5		
6.0	17.0	767	n/a	n/a	1.00	1.00	$M_{c,y,Rd}$	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5	22.5				
							$M_{c,z,Rd}$	29.9	29.9	29.9	27.9	23.9	20.0	16.0	12.0	7.98	3.99	0			
							$M_{N,y,Rd}$	22.5	22.5	21.6	18.9	16.2	13.5	10.8	8.12	5.41	2.71	0			
							$M_{N,z,Rd}$	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2			
							$M_{c,y,Rd}$	27.3	27.3	27.3	27.3	27.3	27.3	27.3	27.3	27.3	27.3	27.3			
8.0	21.4	966	n/a	n/a	1.00	1.00	$M_{c,y,Rd}$	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2				
							$M_{c,z,Rd}$	36.2	36.2	36.2	33.8	29.0	24.1	19.3	14.5	9.66	4.83	0			
							$M_{N,y,Rd}$	36.2	36.2	36.2	33.8	29.0	24.1	19.3	14.5	9.66	4.83	0			
							$M_{N,z,Rd}$	27.3	27.3	25.6	22.4	19.2	16.0	12.8	9.60	6.40	3.20	0			
							$M_{c,y,Rd}$	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2			

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\* The section is a Class 4 section about the appropriate axis and is independent of the design axial force  $N_{Ed}$ . Values of  $M_{c,Rd}$  are calculated based on class 4 section properties and are displayed in italics.

$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

✘ Section becomes Class 4, see note 10.

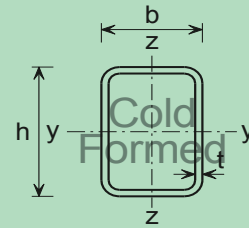
\$ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

- Not applicable for Class 3 and Class 4 sections.

FOR EXPLANATION OF TABLES SEE NOTE 10.

COLD-FORMED RECTANGULAR HOLLOW SECTIONS

Hybox® RHS



Member buckling check

Section Designation & Resistances (kNm)		n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$														
h x b mm	t mm		L (m)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0	
120x60	§ 3.0 $f_y W_{el,y} = 11.2$ $f_y W_{el,z} = 7.63$	0.885	$N_{b,y,Rd}$	343	314	282	249	214	182	154	111	82.9	63.7	50.3	40.7	33.5	
			$N_{b,z,Rd}$	301	244	187	140	107	83.0	66.1	44.5	31.9	23.9	18.6	14.9	12.2	
		0.885	$M_{b,Rd}$	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.2	11.0	10.8	10.6	10.4
			$M_{b,Rd}$	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.8	13.5	13.2	13.0	12.7	12.5	
		0.455	$M_{b,Rd}$	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.9	13.8	13.5	13.2	13.0	12.7	12.5
	3.5 $f_y W_{el,y} = 12.7$ $f_y W_{el,z} = 8.66$	1.00	$N_{b,y,Rd}$	396	363	326	287	247	210	177	128	95.1	73.0	57.7	46.6	38.4	
			$N_{b,z,Rd}$	347	280	214	160	122	94.7	75.4	50.7	36.3	27.3	21.2	17.0	13.9	
		1.00	$M_{b,Rd}$	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.7	12.5	12.3	12.1	11.9
			$M_{b,Rd}$	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.9	15.8	15.5	15.2	14.8	14.6	14.3
	4.0 $f_y W_{el,y} = 14.2$ $f_y W_{el,z} = 9.62$	1.00	$N_{b,y,Rd}$	446	408	366	322	276	234	198	143	106	81.3	64.2	51.9	42.8	
			$N_{b,z,Rd}$	390	314	239	179	136	105	83.8	56.3	40.3	30.3	23.5	18.8	15.4	
	1.00	$M_{b,Rd}$	17.9	17.9	17.9	17.9	17.9	17.9	17.9	17.8	17.4	17.0	16.7	16.3	16.0		
5.0 $f_y W_{el,y} = 17.0$ $f_y W_{el,z} = 11.4$	1.00	$N_{b,y,Rd}$	549	501	449	392	336	284	239	172	128	97.8	77.2	62.3	51.4		
		$N_{b,z,Rd}$	477	381	288	214	162	125	99.7	66.9	47.9	35.9	27.9	22.3	18.3		
	1.00	$M_{b,Rd}$	21.6	21.6	21.6	21.6	21.6	21.6	21.6	21.6	21.4	20.9	20.5	20.1	19.7	19.3	
6.0 $f_y W_{el,y} = 19.4$ $f_y W_{el,z} = 12.9$	1.00	$N_{b,y,Rd}$	641	584	522	455	388	327	274	197	146	112	88.0	71.1	58.6		
		$N_{b,z,Rd}$	555	441	330	244	184	143	113	76.0	54.4	40.8	31.7	25.3	20.7		
	1.00	$M_{b,Rd}$	25.1	25.1	25.1	25.1	25.1	25.1	25.1	24.8	24.2	23.7	23.2	22.8	22.3		
120x80	§ 3.0 $f_y W_{el,y} = 13.6$ $f_y W_{el,z} = 11.0$	0.885	$N_{b,y,Rd}$	386	355	322	286	249	214	182	133	99.5	76.7	60.7	49.1	40.6	
			$N_{b,z,Rd}$	364	319	269	220	177	142	116	80.1	58.2	44.1	34.5	27.7	22.7	
		0.885	$M_{b,Rd}$	13.6	13.6	13.6	13.6	13.6	13.6	13.6	13.6	13.6	13.6	13.6	13.5	13.4	
			$M_{b,Rd}$	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.4	16.2	15.9	15.7
	4.0 $f_y W_{el,y} = 17.4$ $f_y W_{el,z} = 14.0$	1.00	$N_{b,y,Rd}$	503	463	419	371	322	276	235	171	128	98.3	77.8	62.9	51.9	
			$N_{b,z,Rd}$	474	414	348	283	226	182	148	102	74.1	56.0	43.8	35.2	28.9	
		1.00	$M_{b,Rd}$	21.2	21.2	21.2	21.2	21.2	21.2	21.2	21.2	21.2	21.2	21.2	20.9	20.6	20.3
	5.0 $f_y W_{el,y} = 20.9$ $f_y W_{el,z} = 16.6$	1.00	$N_{b,y,Rd}$	621	570	514	455	394	336	286	207	155	119	94.1	76.1	62.8	
			$N_{b,z,Rd}$	583	508	425	344	275	221	179	123	89.4	67.7	52.9	42.5	34.8	
		1.00	$M_{b,Rd}$	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.3	24.9	24.6
6.0 $f_y W_{el,y} = 24.0$ $f_y W_{el,z} = 19.1$	1.00	$N_{b,y,Rd}$	727	666	600	529	457	389	329	238	178	136	108	87.2	71.9		
		$N_{b,z,Rd}$	682	592	493	397	316	253	205	141	102	77.2	60.3	48.4	39.7		
	1.00	$M_{b,Rd}$	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.9	29.4	29.0	28.6	
8.0 $f_y W_{el,y} = 28.2$ $f_y W_{el,z} = 22.3$	1.00	$N_{b,y,Rd}$	910	830	743	650	556	470	395	284	211	162	127	103	84.8		
		$N_{b,z,Rd}$	851	732	602	480	379	302	244	167	121	91.0	71.1	57.0	46.8		
	1.00	$M_{b,Rd}$	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	36.2	35.6	35.1	34.6	

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Rectangular Hollow Sections (CFRHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

$$n = N_{Ed} / N_{pl,Rd}$$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

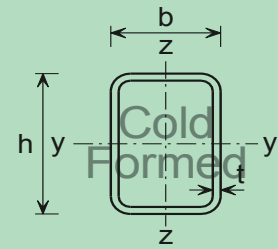
Axial force resistance  $N_{pl,Rd}$  which is equal to  $A_f f_y$  is given in the cross-section resistance check table opposite.

§ The section can be a Class 4 section but no allowance has been made in calculating  $N_{b,y,Rd}$  and  $N_{b,z,Rd}$ .

FOR EXPLANATION OF TABLES SEE NOTE 10.

COLD-FORMED RECTANGULAR HOLLOW SECTIONS

Hybox® RHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n Limit Class 3		Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$																
h x b mm	t mm			Class 2		n	Axis															
				y-y	z-z		0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0					
140x80	3.0 #	9.90	447	0.674	*	<i><math>M_{c,y,Rd}</math></i>	20.7	20.7	20.7	17.0	17.0	17.0	17.0	✗	✗	\$	\$					
						<i><math>M_{c,z,Rd}</math></i>	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	\$	\$				
						$M_{N,y,Rd}$	20.7	20.7	20.7	-	-	-	-	-	-	-	-	-	-			
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-			
	4.0	13.0	586	1.00	1.00	0.582	1.00	1.00	<i><math>M_{c,y,Rd}</math></i>	26.8	26.8	26.8	26.8	26.8	26.8	21.8	21.8	21.8	21.8			
									<i><math>M_{c,z,Rd}</math></i>	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	16.0	
									$M_{N,y,Rd}$	26.8	26.8	26.8	25.0	21.4	17.9	-	-	-	-	-	-	
									$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	
	5.0 #	16.0	724	n/a	n/a	1.00	1.00	1.00	<i><math>M_{c,y,Rd}</math></i>	32.6	32.6	32.6	32.6	32.6	32.6	32.6	32.6	32.6	32.6			
									<i><math>M_{c,z,Rd}</math></i>	22.1	22.1	22.1	22.1	22.1	22.1	22.1	22.1	22.1	22.1	22.1		
									$M_{N,y,Rd}$	32.6	32.6	32.6	30.4	26.1	21.7	17.4	13.0	8.69	4.35	0		
									$M_{N,z,Rd}$	22.1	22.1	21.0	18.3	15.7	13.1	10.5	7.86	5.24	2.62	0		
	6.0	18.9	852	n/a	n/a	1.00	1.00	1.00	<i><math>M_{c,y,Rd}</math></i>	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0			
									<i><math>M_{c,z,Rd}</math></i>	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7		
									$M_{N,y,Rd}$	38.0	38.0	38.0	35.5	30.4	25.3	20.3	15.2	10.1	5.06	0		
									$M_{N,z,Rd}$	25.7	25.7	24.2	21.2	18.1	15.1	12.1	9.07	6.05	3.02	0		
	8.0	23.9	1080	n/a	n/a	1.00	1.00	1.00	<i><math>M_{c,y,Rd}</math></i>	46.5	46.5	46.5	46.5	46.5	46.5	46.5	46.5	46.5	46.5			
									<i><math>M_{c,z,Rd}</math></i>	31.4	31.4	31.4	31.4	31.4	31.4	31.4	31.4	31.4	31.4	31.4		
									$M_{N,y,Rd}$	46.5	46.5	46.5	43.4	37.2	31.0	24.8	18.6	12.4	6.20	0		
									$M_{N,z,Rd}$	31.4	31.4	28.9	25.3	21.7	18.1	14.5	10.8	7.23	3.61	0		
	10.0	28.7	1300	n/a	n/a	1.00	1.00	1.00	<i><math>M_{c,y,Rd}</math></i>	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0			
									<i><math>M_{c,z,Rd}</math></i>	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6		
									$M_{N,y,Rd}$	54.0	54.0	54.0	50.4	43.2	36.0	28.8	21.6	14.4	7.19	0		
									$M_{N,z,Rd}$	36.6	36.6	33.1	29.0	24.9	20.7	16.6	12.4	8.29	4.14	0		

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Rectangular Hollow Sections (CFRHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

\* The section is a Class 4 section about the appropriate axis and is independent of the design axial force  $N_{Ed}$ . Values of  $M_{c,Rd}$  are calculated based on class 4 section properties and are displayed in italics.

$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

✗ Section becomes Class 4, see note 10.

\$ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

- Not applicable for Class 3 and Class 4 sections.

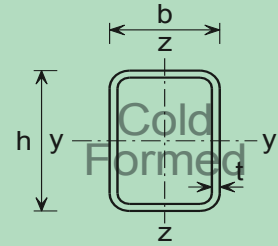
# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.



COLD-FORMED RECTANGULAR HOLLOW SECTIONS

Hybox® RHS



Member buckling check

Section Designation & Resistances (kNm)		n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
h x b mm	t mm		L (m)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
140x80	§ 3.0 # $f_y W_{el,y} = 17.0$ $f_y W_{el,z} = 12.5$	0.674	$N_{b,y,Rd}$	435	406	375	342	307	271	237	180	137	107	85.3	69.4	57.5
			$N_{b,z,Rd}$	404	355	301	248	200	162	132	91.4	66.5	50.4	39.4	31.7	26.0
		0.674	$M_{b,Rd}$	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	17.0	16.8	16.6
			<b>0.288</b>	$M_{b,Rd}$	20.7	20.7	20.7	20.7	20.7	20.7	20.7	20.7	20.7	20.6	20.2	19.9
	4.0 $f_y W_{el,y} = 21.8$ $f_y W_{el,z} = 16.0$	1.00	$N_{b,y,Rd}$	569	530	489	445	399	352	307	232	177	138	110	89.4	74.0
			$N_{b,z,Rd}$	527	462	390	319	257	207	169	117	84.7	64.2	50.2	40.3	33.1
		1.00	$M_{b,Rd}$	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.6	21.3
			<b>0.582</b>	$M_{b,Rd}$	26.8	26.8	26.8	26.8	26.8	26.8	26.8	26.8	26.8	26.6	26.2	25.8
	5.0 # $f_y W_{el,y} = 26.2$ $f_y W_{el,z} = 19.2$	1.00	$N_{b,y,Rd}$	702	654	603	547	489	430	375	282	215	167	133	108	89.6
			$N_{b,z,Rd}$	649	568	478	389	313	251	205	141	103	77.6	60.7	48.8	40.0
		<b>1.00</b>	$M_{b,Rd}$	32.6	32.6	32.6	32.6	32.6	32.6	32.6	32.6	32.6	32.6	32.4	31.9	30.9
			$N_{b,y,Rd}$	825	767	706	640	570	501	435	326	248	193	153	125	103
	6.0 $f_y W_{el,y} = 30.3$ $f_y W_{el,z} = 22.0$	1.00	$N_{b,z,Rd}$	761	663	556	451	360	289	235	162	117	88.8	69.4	55.7	45.7
			$M_{b,Rd}$	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	38.0	37.7	37.1	36.5	36.0
	8.0 $f_y W_{el,y} = 35.9$ $f_y W_{el,z} = 26.0$	1.00	$N_{b,y,Rd}$	1040	964	883	796	705	614	531	394	298	231	183	149	123
			$N_{b,z,Rd}$	956	826	685	549	435	347	281	193	140	105	82.4	66.1	54.2
		<b>1.00</b>	$M_{b,Rd}$	46.5	46.5	46.5	46.5	46.5	46.5	46.5	46.5	46.5	46.1	45.4	44.7	44.0
			$N_{b,y,Rd}$	1250	1150	1050	943	830	719	618	456	343	265	210	171	141
	10.0 $f_y W_{el,y} = 40.8$ $f_y W_{el,z} = 29.3$	1.00	$N_{b,z,Rd}$	1140	980	804	638	503	400	322	220	159	120	93.9	75.3	61.7
			$M_{b,Rd}$	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	54.0	53.4	52.6	51.7	51.0

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Rectangular Hollow Sections (CFRHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

$$n = N_{Ed} / N_{pl,Rd}$$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

Axial force resistance  $N_{pl,Rd}$  which is equal to  $Af_y$  is given in the cross-section resistance check table opposite.

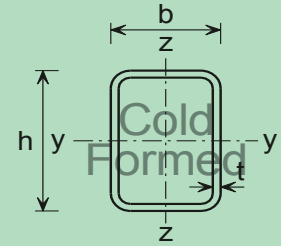
§ The section can be a Class 4 section but no allowance has been made in calculating  $N_{b,y,Rd}$  and  $N_{b,z,Rd}$ .

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

COLD-FORMED RECTANGULAR HOLLOW SECTIONS

Hybox® RHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n Limit Class 3		Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$														
h x b mm	t mm			Class 2		n	Axis													
				y-y	z-z		0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0			
150x100	3.0 #	11.3	511	0.591	*	$M_{c,y,Rd}$	26.1	26.1	26.1	21.8	21.8	21.8	✗	✗	✗	✗	✗	✗		
						$M_{c,z,Rd}$	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	
						$M_{N,y,Rd}$	26.1	26.1	26.1	-	-	-	-	-	-	-	-	-	-	-
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	4.0	14.9	671	0.986	*	$M_{c,y,Rd}$	34.0	34.0	34.0	34.0	34.0	28.2	28.2	28.2	28.2	28.2	28.2	✗		
						$M_{c,z,Rd}$	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	
						$M_{N,y,Rd}$	34.0	34.0	34.0	31.7	27.2	-	-	-	-	-	-	-	-	-
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	5.0	18.3	831	n/a	n/a	$M_{c,y,Rd}$	41.5	41.5	41.5	41.5	41.5	41.5	41.5	41.5	41.5	41.5	41.5	41.5		
						$M_{c,z,Rd}$	31.3	31.3	31.3	31.3	31.3	31.3	31.3	31.3	31.3	31.3	31.3	31.3		
						$M_{N,y,Rd}$	41.5	41.5	41.5	38.8	33.2	27.7	22.2	16.6	11.1	5.54	0	0		
						$M_{N,z,Rd}$	31.3	31.3	30.6	26.7	22.9	19.1	15.3	11.5	7.64	3.82	0	0		
	6.0	21.7	980	n/a	n/a	$M_{c,y,Rd}$	48.6	48.6	48.6	48.6	48.6	48.6	48.6	48.6	48.6	48.6	48.6	48.6		
						$M_{c,z,Rd}$	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6		
						$M_{N,y,Rd}$	48.6	48.6	48.6	45.4	38.9	32.4	25.9	19.5	13.0	6.48	0	0		
						$M_{N,z,Rd}$	36.6	36.6	35.4	31.0	26.6	22.1	17.7	13.3	8.85	4.43	0	0		
	8.0	27.7	1250	n/a	n/a	$M_{c,y,Rd}$	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0		
						$M_{c,z,Rd}$	45.4	45.4	45.4	45.4	45.4	45.4	45.4	45.4	45.4	45.4	45.4			
						$M_{N,y,Rd}$	60.0	60.0	60.0	56.0	48.0	40.0	32.0	24.0	16.0	8.00	0	0		
						$M_{N,z,Rd}$	45.4	45.4	43.2	37.8	32.4	27.0	21.6	16.2	10.8	5.40	0	0		
10.0	33.4	1510	n/a	n/a	$M_{c,y,Rd}$	70.6	70.6	70.6	70.6	70.6	70.6	70.6	70.6	70.6	70.6	70.6	70.6			
					$M_{c,z,Rd}$	53.3	53.3	53.3	53.3	53.3	53.3	53.3	53.3	53.3	53.3	53.3				
					$M_{N,y,Rd}$	70.6	70.6	70.6	65.9	56.5	47.1	37.7	28.3	18.8	9.42	0	0			
					$M_{N,z,Rd}$	53.3	53.3	50.0	43.7	37.5	31.2	25.0	18.7	12.5	6.25	0	0			

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\* The section is a Class 4 section about the appropriate axis and is independent of the design axial force  $N_{Ed}$ . Values of  $M_{c,Rd}$  are calculated based on class 4 section properties and are displayed in italics.

$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

✗ Section becomes Class 4, see note 10.

✗ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

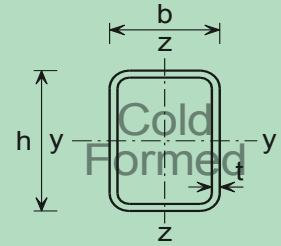
- Not applicable for Class 3 and Class 4 sections.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

COLD-FORMED RECTANGULAR HOLLOW SECTIONS

Hybox® RHS



Member buckling check

Section Designation & Resistances (kNm)		n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$														
h x b mm	t mm		L (m)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0	
150x100	§ 3.0 # $f_y W_{el,y} = 21.8$ $f_y W_{el,z} = 17.6$	0.591	$N_{b,y,Rd}$	503	473	441	408	372	335	298	232	180	142	114	93.3	77.6	
			$N_{b,z,Rd}$	481	439	392	342	292	246	207	149	110	84.5	66.6	53.8	44.3	
		0.591	$M_{b,Rd}$	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8	21.8
			<b>0.216</b>	$M_{b,Rd}$	26.1	26.1	26.1	26.1	26.1	26.1	26.1	26.1	26.1	26.1	26.1	26.1	26.1
	§ 4.0 $f_y W_{el,y} = 28.2$ $f_y W_{el,z} = 22.6$	0.986	$N_{b,y,Rd}$	659	619	578	533	486	437	388	301	234	184	148	121	100	
			$N_{b,z,Rd}$	630	573	511	445	379	319	267	191	142	109	85.5	69.1	56.9	
		0.986	$M_{b,Rd}$	28.2	28.2	28.2	28.2	28.2	28.2	28.2	28.2	28.2	28.2	28.2	28.2	28.2	
			<b>0.472</b>	$M_{b,Rd}$	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	34.0	33.9
	5.0 $f_y W_{el,y} = 34.0$ $f_y W_{el,z} = 27.3$	1.00	$N_{b,y,Rd}$	816	766	713	658	598	537	476	369	286	225	180	147	122	
			$N_{b,z,Rd}$	779	707	629	546	463	389	326	232	172	131	104	83.6	68.9	
		1.00	$M_{b,Rd}$	41.5	41.5	41.5	41.5	41.5	41.5	41.5	41.5	41.5	41.5	41.5	41.5	41.4	40.9
	6.0 $f_y W_{el,y} = 39.4$ $f_y W_{el,z} = 31.5$	1.00	$N_{b,y,Rd}$	961	901	839	772	702	629	557	430	332	261	209	171	142	
			$N_{b,z,Rd}$	917	832	738	639	541	453	379	270	199	152	120	96.8	79.7	
		1.00	$M_{b,Rd}$	48.6	48.6	48.6	48.6	48.6	48.6	48.6	48.6	48.6	48.6	48.6	48.6	48.5	47.9
	8.0 $f_y W_{el,y} = 47.6$ $f_y W_{el,z} = 38.0$	1.00	$N_{b,y,Rd}$	1220	1140	1060	973	879	783	690	528	406	318	254	207	172	
			$N_{b,z,Rd}$	1160	1050	928	797	670	557	464	329	242	185	146	117	96.6	
		1.00	$M_{b,Rd}$	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	59.8	59.1
	10.0 $f_y W_{el,y} = 55.0$ $f_y W_{el,z} = 43.7$	1.00	$N_{b,y,Rd}$	1470	1380	1270	1160	1050	928	814	618	473	370	295	240	199	
			$N_{b,z,Rd}$	1400	1260	1110	943	788	652	541	382	280	214	168	135	111	
		1.00	$M_{b,Rd}$	70.6	70.6	70.6	70.6	70.6	70.6	70.6	70.6	70.6	70.6	70.6	70.6	70.3	69.5

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Rectangular Hollow Sections (CFRHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

$$n = N_{Ed} / N_{pl,Rd}$$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

Axial force resistance  $N_{pl,Rd}$  which is equal to  $Af_y$  is given in the cross-section resistance check table opposite.

§ The section can be a Class 4 section but no allowance has been made in calculating  $N_{b,y,Rd}$  and  $N_{b,z,Rd}$ .

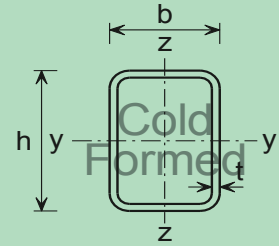
# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.



COLD-FORMED RECTANGULAR HOLLOW SECTIONS

Hybox® RHS



Member buckling check

Section Designation & Resistances (kNm)		n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$														
h x b mm	t mm		L (m)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0	
160x80	§ 3.0 # $f_y W_{el,y} = 20.6$ $f_y W_{el,z} = 14.1$	0.518	$N_{b,y,Rd}$	483	455	426	395	362	328	293	230	180	142	114	93.6	77.9	
			$N_{b,z,Rd}$	443	391	333	275	222	180	147	102	74.3	56.4	44.1	35.5	29.1	
		0.518	$M_{b,Rd}$	20.6	20.6	20.6	20.6	20.6	20.6	20.6	20.6	20.6	20.6	20.6	20.5	20.3	20.0
			<b>0.189</b>	$M_{b,Rd}$	25.3	25.3	25.3	25.3	25.3	25.3	25.3	25.3	25.3	25.3	25.1	24.7	24.3
		0.885	$N_{b,y,Rd}$	633	596	557	516	472	426	381	298	232	183	147	121	100	
			$N_{b,z,Rd}$	580	510	433	356	287	232	190	131	95.5	72.4	56.6	45.5	37.4	
		0.885	$M_{b,Rd}$	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.1	25.8	
			<b>0.456</b>	$M_{b,Rd}$	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	33.0	32.6	32.0	31.5
		1.00	$N_{b,y,Rd}$	783	736	688	636	581	523	466	364	283	223	179	147	122	
			$N_{b,z,Rd}$	715	627	530	433	349	281	229	158	115	87.1	68.2	54.8	45.0	
		<b>1.00</b>	$M_{b,Rd}$	40.1	40.1	40.1	40.1	40.1	40.1	40.1	40.1	40.1	40.1	39.6	38.9	38.3	37.7
		1.00	$N_{b,y,Rd}$	922	866	808	746	680	612	544	423	328	258	207	170	141	
			$N_{b,z,Rd}$	840	735	619	504	405	325	265	183	133	100	78.6	63.1	51.8	
		<b>1.00</b>	$M_{b,Rd}$	46.9	46.9	46.9	46.9	46.9	46.9	46.9	46.9	46.9	46.9	46.2	45.4	44.7	44.0
	1.00	$N_{b,y,Rd}$	1170	1100	1020	937	850	761	673	518	400	314	251	205	170		
		$N_{b,z,Rd}$	1060	922	769	620	494	395	321	220	160	121	94.4	75.8	62.1		
	<b>1.00</b>	$M_{b,Rd}$	57.9	57.9	57.9	57.9	57.9	57.9	57.9	57.9	57.9	57.0	56.0	55.1	54.3		
	1.00	$N_{b,y,Rd}$	1410	1320	1220	1120	1010	899	792	605	465	364	291	237	196		
		$N_{b,z,Rd}$	1270	1100	904	722	571	455	368	252	182	138	107	86.2	70.7		
	<b>1.00</b>	$M_{b,Rd}$	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8	67.8	66.7	65.5	64.5	63.4		

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$$n = N_{Ed} / N_{pl,Rd}$$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

Axial force resistance  $N_{pl,Rd}$  which is equal to  $Af_y$  is given in the cross-section resistance check table opposite.

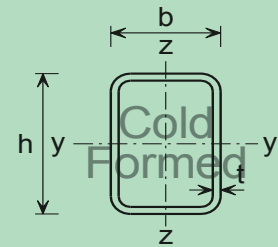
§ The section can be a Class 4 section but no allowance has been made in calculating  $N_{b,y,Rd}$  and  $N_{b,z,Rd}$ .

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

COLD-FORMED RECTANGULAR HOLLOW SECTIONS

Hybox® RHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n Limit Class 3		Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$																
h x b mm	t mm			Class 2		n	Axis															
				y-y	z-z		0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0					
180x80	3.0	11.8	533	0.399	*	<i><math>M_{c,y,Rd}</math></i>	30.5	30.5	24.5	24.5	✗	✗	✗	✗	\$	\$	\$					
						<i><math>M_{c,z,Rd}</math></i>	✗	✗	✗	✗	✗	✗	✗	✗	✗	\$	\$	\$				
						$M_{N,y,Rd}$	30.5	30.5	-	-	-	-	-	-	-	-	-	-	-			
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-			
	4.0	15.5	699	0.720	*	<i><math>M_{c,y,Rd}</math></i>	39.8	39.8	39.8	39.8	31.6	31.6	31.6	31.6	✗	\$	\$					
						<i><math>M_{c,z,Rd}</math></i>	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	\$	\$				
						$M_{N,y,Rd}$	39.8	39.8	39.8	37.1	-	-	-	-	-	-	-	-				
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-				
	5.0	19.1	866	1.00	1.00	<i><math>M_{c,y,Rd}</math></i>	48.6	48.6	48.6	48.6	48.6	48.6	38.3	38.3	38.3	38.3	38.3					
						<i><math>M_{c,z,Rd}</math></i>	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2	24.2					
						$M_{N,y,Rd}$	48.6	48.6	48.6	45.4	38.9	32.4	-	-	-	-	-					
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-					
	6.0 #	22.6	1020	n/a	n/a	<i><math>M_{c,y,Rd}</math></i>	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8					
						<i><math>M_{c,z,Rd}</math></i>	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0	32.0					
						$M_{N,y,Rd}$	56.8	56.8	56.8	53.0	45.4	37.9	30.3	22.7	15.1	7.57	0					
						$M_{N,z,Rd}$	32.0	32.0	29.3	25.6	22.0	18.3	14.6	11.0	7.32	3.66	0					
	8.0	28.9	1310	n/a	n/a	<i><math>M_{c,y,Rd}</math></i>	70.3	70.3	70.3	70.3	70.3	70.3	70.3	70.3	70.3	70.3	70.3					
						<i><math>M_{c,z,Rd}</math></i>	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4	39.4					
						$M_{N,y,Rd}$	70.3	70.3	70.3	65.6	56.2	46.9	37.5	28.1	18.7	9.37	0					
						$M_{N,z,Rd}$	39.4	39.4	35.4	30.9	26.5	22.1	17.7	13.3	8.84	4.42	0					
10.0 #	35.0	1580	n/a	n/a	<i><math>M_{c,y,Rd}</math></i>	83.1	83.1	83.1	83.1	83.1	83.1	83.1	83.1	83.1	83.1	83.1						
					<i><math>M_{c,z,Rd}</math></i>	46.5	46.5	46.5	46.5	46.5	46.5	46.5	46.5	46.5	46.5	46.5						
					$M_{N,y,Rd}$	83.1	83.1	83.1	77.5	66.5	55.4	44.3	33.2	22.2	11.1	0						
					$M_{N,z,Rd}$	46.5	46.3	41.2	36.0	30.9	25.7	20.6	15.4	10.3	5.15	0						

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Rectangular Hollow Sections (CFRHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

\* The section is a Class 4 section about the appropriate axis and is independent of the design axial force  $N_{Ed}$ . Values of  $M_{c,Rd}$  are calculated based on class 4 section properties and are displayed in italics.

$N_{Ed}$  = Design value of the axial force.

$n = N_{Ed} / N_{pl,Rd}$

✗ Section becomes Class 4, see note 10.

\$ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

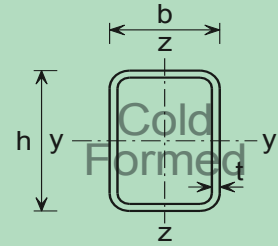
- Not applicable for Class 3 and Class 4 sections.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

COLD-FORMED RECTANGULAR HOLLOW SECTIONS

Hybox® RHS



Member buckling check

Section Designation & Resistances (kNm)		n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$														
h x b mm	t mm		L (m)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0	
180x80	§ 3.0 $f_y W_{el,y} = 24.5$ $f_y W_{el,z} = 15.7$	0.399	$N_{b,y,Rd}$	532	504	476	446	415	382	348	282	226	181	147	121	101	
			$N_{b,z,Rd}$	483	427	365	302	245	199	163	113	82.5	62.6	49.0	39.4	32.4	
		0.399	$M_{b,Rd}$	24.5	24.5	24.5	24.5	24.5	24.5	24.5	24.5	24.5	24.5	24.5	24.2	23.7	23.2
			<b>0.106</b>	$M_{b,Rd}$	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	30.5	29.7	28.9	28.2
	§ 4.0 $f_y W_{el,y} = 31.6$ $f_y W_{el,z} = 20.1$	0.720	$N_{b,y,Rd}$	697	661	623	584	542	498	453	367	293	235	190	157	131	
			$N_{b,z,Rd}$	633	558	475	392	318	257	210	146	106	80.5	63.0	50.7	41.6	
		0.720	$M_{b,Rd}$	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.6	31.3	30.6	30.0
			<b>0.350</b>	$M_{b,Rd}$	39.8	39.8	39.8	39.8	39.8	39.8	39.8	39.8	39.8	39.7	38.6	37.6	36.7
	5.0 $f_y W_{el,y} = 38.3$ $f_y W_{el,z} = 24.2$	1.00	$N_{b,y,Rd}$	863	817	770	721	669	614	557	449	358	286	232	191	160	
			$N_{b,z,Rd}$	781	687	582	478	386	312	254	176	128	97.0	75.9	61.0	50.1	
		1.00	$M_{b,Rd}$	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	38.3	37.9	37.1	36.3
			<b>0.597</b>	$M_{b,Rd}$	48.6	48.6	48.6	48.6	48.6	48.6	48.6	48.6	48.6	48.5	47.1	45.9	44.8
6.0 # $f_y W_{el,y} = 44.4$ $f_y W_{el,z} = 27.9$	1.00	$N_{b,y,Rd}$	1020	963	907	848	786	720	653	525	417	333	270	222	185		
		$N_{b,z,Rd}$	919	806	681	557	448	362	295	204	148	112	87.7	70.4	57.8		
	1.00	$M_{b,Rd}$	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.8	56.6	55.0	53.6	52.2	51.0	
8.0 $f_y W_{el,y} = 53.6$ $f_y W_{el,z} = 33.4$	1.00	$N_{b,y,Rd}$	1300	1220	1150	1070	990	903	815	649	513	408	330	271	226		
		$N_{b,z,Rd}$	1170	1020	850	688	550	441	358	247	179	135	106	85.0	69.7		
	1.00	$M_{b,Rd}$	70.3	70.3	70.3	70.3	70.3	70.3	70.3	70.3	70.3	69.9	68.0	66.2	64.5	63.0	
10.0 # $f_y W_{el,y} = 61.8$ $f_y W_{el,z} = 38.0$	1.00	$N_{b,y,Rd}$	1570	1480	1390	1290	1190	1080	968	765	601	477	384	315	262		
		$N_{b,z,Rd}$	1400	1210	1000	805	638	510	412	283	205	155	121	97.0	79.5		
	1.00	$M_{b,Rd}$	83.1	83.1	83.1	83.1	83.1	83.1	83.1	83.1	83.1	82.3	80.0	77.8	75.9	74.0	

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Rectangular Hollow Sections (CFRHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

$$n = N_{Ed} / N_{pl,Rd}$$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

Axial force resistance  $N_{pl,Rd}$  which is equal to  $A_f f_y$  is given in the cross-section resistance check table opposite.

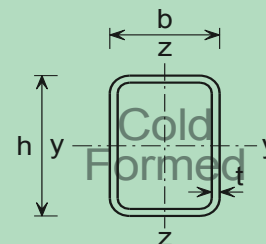
§ The section can be a Class 4 section but no allowance has been made in calculating  $N_{b,y,Rd}$  and  $N_{b,z,Rd}$ .

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

COLD-FORMED RECTANGULAR HOLLOW SECTIONS

Hybox® RHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n Limit Class 3		Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$															
h x b mm	t mm			Class 2		n	Axis														
				y-y	z-z		0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0				
180x100	4.0 #	16.8	756	0.720	*	<i><math>M_{c,y,Rd}</math></i>	44.7	44.7	44.7	44.7	36.6	36.6	36.6	36.6	✗	\$	\$				
						<i><math>M_{c,z,Rd}</math></i>	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	\$	\$		
						$M_{N,y,Rd}$	44.7	44.7	44.7	41.7	-	-	-	-	-	-	-	-	-	-	
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	5.0	20.7	937	1.00	1.00	<i><math>M_{c,y,Rd}</math></i>	54.7	54.7	54.7	54.7	54.7	54.7	44.4	44.4	44.4	44.4	44.4				
						<i><math>M_{c,z,Rd}</math></i>	32.1	32.1	32.1	32.1	32.1	32.1	32.1	32.1	32.1	32.1	32.1	32.1			
						$M_{N,y,Rd}$	54.7	54.7	54.7	51.0	43.7	36.4	-	-	-	-	-	-			
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-			
	6.0	24.5	1110	n/a	n/a	<i><math>M_{c,y,Rd}</math></i>	64.3	64.3	64.3	64.3	64.3	64.3	64.3	64.3	64.3	64.3	64.3				
						<i><math>M_{c,z,Rd}</math></i>	42.6	42.6	42.6	42.6	42.6	42.6	42.6	42.6	42.6	42.6	42.6				
						$M_{N,y,Rd}$	64.3	64.3	64.3	60.0	51.4	42.8	34.3	25.7	17.1	8.57	0				
						$M_{N,z,Rd}$	42.6	42.6	40.3	35.2	30.2	25.2	20.1	15.1	10.1	5.03	0				
	8.0	31.4	1420	n/a	n/a	<i><math>M_{c,y,Rd}</math></i>	80.2	80.2	80.2	80.2	80.2	80.2	80.2	80.2	80.2	80.2	80.2				
						<i><math>M_{c,z,Rd}</math></i>	53.3	53.3	53.3	53.3	53.3	53.3	53.3	53.3	53.3	53.3	53.3				
						$M_{N,y,Rd}$	80.2	80.2	80.2	74.9	64.2	53.5	42.8	32.1	21.4	10.7	0				
						$M_{N,z,Rd}$	53.3	53.3	49.5	43.3	37.2	31.0	24.8	18.6	12.4	6.19	0				
	10.0	38.1	1730	n/a	n/a	<i><math>M_{c,y,Rd}</math></i>	95.1	95.1	95.1	95.1	95.1	95.1	95.1	95.1	95.1	95.1	95.1				
						<i><math>M_{c,z,Rd}</math></i>	62.8	62.8	62.8	62.8	62.8	62.8	62.8	62.8	62.8	62.8	62.8				
						$M_{N,y,Rd}$	95.1	95.1	95.1	88.8	76.1	63.4	50.7	38.1	25.4	12.7	0				
						$M_{N,z,Rd}$	62.8	62.8	57.8	50.5	43.3	36.1	28.9	21.7	14.4	7.22	0				

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Rectangular Hollow Sections (CFRHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

\* The section is a Class 4 section about the appropriate axis and is independent of the design axial force  $N_{Ed}$ . Values of  $M_{c,Rd}$  are calculated based on class 4 section properties and are displayed in italics.

$N_{Ed}$  = Design value of the axial force.

$$n = N_{Ed} / N_{pl,Rd}$$

✗ Section becomes Class 4, see note 10.

\$ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

- Not applicable for Class 3 and Class 4 sections.

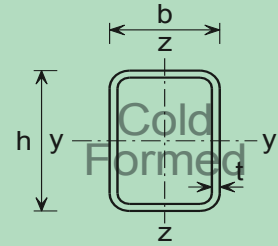
# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.



COLD-FORMED RECTANGULAR HOLLOW SECTIONS

Hybox® RHS



Member buckling check

Section Designation & Resistances (kNm)		n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$														
h x b mm	t mm		L (m)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0	
180x100	§ 4.0 # $f_y W_{el,y} = 36.6$ $f_y W_{el,z} = 26.6$	0.720	$N_{b,y,Rd}$	756	718	680	639	596	550	503	411	331	267	217	179	150	
			$N_{b,z,Rd}$	713	650	582	509	435	368	310	222	165	127	99.8	80.6	66.4	
		0.720	$M_{b,Rd}$	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6	36.6
			<b>0.324</b> $M_{b,Rd}$	44.7	44.7	44.7	44.7	44.7	44.7	44.7	44.7	44.7	44.7	44.7	44.7	44.3	43.7
	5.0 $f_y W_{el,y} = 44.4$ $f_y W_{el,z} = 32.1$	1.00	$N_{b,y,Rd}$	937	889	841	789	735	678	620	505	405	326	265	219	183	
			$N_{b,z,Rd}$	882	803	718	626	535	451	379	272	201	154	122	98.2	80.9	
		1.00	$M_{b,Rd}$	44.4	44.4	44.4	44.4	44.4	44.4	44.4	44.4	44.4	44.4	44.4	44.4	44.4	
			<b>0.552</b> $M_{b,Rd}$	54.7	54.7	54.7	54.7	54.7	54.7	54.7	54.7	54.7	54.7	54.7	54.7	54.1	53.4
	6.0 $f_y W_{el,y} = 51.8$ $f_y W_{el,z} = 37.3$	1.00	$N_{b,y,Rd}$	1110	1050	992	931	866	798	728	592	474	381	310	255	214	
			$N_{b,z,Rd}$	1040	947	844	735	626	526	442	316	234	179	141	114	93.9	
		1.00	$M_{b,Rd}$	64.3	64.3	64.3	64.3	64.3	64.3	64.3	64.3	64.3	64.3	64.3	64.3	63.5	62.7
			$M_{b,Rd}$	64.3	64.3	64.3	64.3	64.3	64.3	64.3	64.3	64.3	64.3	64.3	64.3	63.5	62.7
	8.0 $f_y W_{el,y} = 63.2$ $f_y W_{el,z} = 45.1$	1.00	$N_{b,y,Rd}$	1410	1340	1260	1180	1100	1010	915	738	588	471	382	314	262	
			$N_{b,z,Rd}$	1330	1200	1070	922	780	652	545	388	286	219	172	139	114	
		1.00	$M_{b,Rd}$	80.2	80.2	80.2	80.2	80.2	80.2	80.2	80.2	80.2	80.2	80.2	79.3	78.3	
			$M_{b,Rd}$	80.2	80.2	80.2	80.2	80.2	80.2	80.2	80.2	80.2	80.2	80.2	79.3	78.3	
	10.0 $f_y W_{el,y} = 73.5$ $f_y W_{el,z} = 52.2$	1.00	$N_{b,y,Rd}$	1720	1620	1530	1430	1320	1210	1090	875	694	554	448	368	307	
			$N_{b,z,Rd}$	1610	1450	1280	1100	922	767	638	452	333	254	200	161	133	
	1.00	$M_{b,Rd}$	95.1	95.1	95.1	95.1	95.1	95.1	95.1	95.1	95.1	95.1	95.1	93.9	92.7		
		$M_{b,Rd}$	95.1	95.1	95.1	95.1	95.1	95.1	95.1	95.1	95.1	95.1	95.1	93.9	92.7		

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Rectangular Hollow Sections (CFRHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

$$n = N_{Ed} / N_{pl,Rd}$$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

Axial force resistance  $N_{pl,Rd}$  which is equal to  $Af_y$  is given in the cross-section resistance check table opposite.

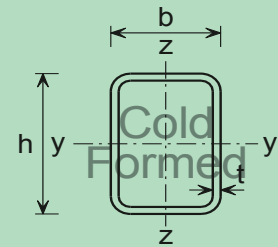
§ The section can be a Class 4 section but no allowance has been made in calculating  $N_{b,y,Rd}$  and  $N_{b,z,Rd}$ .

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

COLD-FORMED RECTANGULAR HOLLOW SECTIONS

Hybox® RHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n Limit Class 3		Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$															
h x b mm	t mm			Class 2		n	Axis														
				y-y	z-z		0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0				
200x100	4.0	18.0	813	0.591	*	<i><math>M_{c,y,Rd}</math></i>	52.5	52.5	52.5	42.6	42.6	42.6	✗	✗	✗	§	§				
						<i><math>M_{c,z,Rd}</math></i>	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	§	§		
						<i><math>M_{N,y,Rd}</math></i>	52.5	52.5	52.5	-	-	-	-	-	-	-	-	-	-	-	
						<i><math>M_{N,z,Rd}</math></i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	5.0	22.3	1010	0.885	*	<i><math>M_{c,y,Rd}</math></i>	64.3	64.3	64.3	64.3	64.3	51.8	51.8	51.8	51.8	✗	§				
						<i><math>M_{c,z,Rd}</math></i>	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	§			
						<i><math>M_{N,y,Rd}</math></i>	64.3	64.3	64.3	60.0	51.4	-	-	-	-	-	-	-	-		
						<i><math>M_{N,z,Rd}</math></i>	-	-	-	-	-	-	-	-	-	-	-	-	-		
	6.0	26.4	1190	n/a	n/a	<i><math>M_{c,y,Rd}</math></i>	75.6	75.6	75.6	75.6	75.6	75.6	75.6	75.6	75.6	75.6	75.6				
						<i><math>M_{c,z,Rd}</math></i>	46.9	46.9	46.9	46.9	46.9	46.9	46.9	46.9	46.9	46.9	46.9	46.9			
						<i><math>M_{N,y,Rd}</math></i>	75.6	75.6	75.6	70.6	60.5	50.4	40.3	30.2	20.2	10.1	0				
						<i><math>M_{N,z,Rd}</math></i>	46.9	46.9	43.7	38.3	32.8	27.3	21.9	16.4	10.9	5.47	0				
	8.0	33.9	1530	n/a	n/a	<i><math>M_{c,y,Rd}</math></i>	94.8	94.8	94.8	94.8	94.8	94.8	94.8	94.8	94.8	94.8	94.8				
						<i><math>M_{c,z,Rd}</math></i>	58.6	58.6	58.6	58.6	58.6	58.6	58.6	58.6	58.6	58.6	58.6				
						<i><math>M_{N,y,Rd}</math></i>	94.8	94.8	94.8	88.5	75.8	63.2	50.6	37.9	25.3	12.6	0				
						<i><math>M_{N,z,Rd}</math></i>	58.6	58.6	53.8	47.1	40.4	33.6	26.9	20.2	13.5	6.73	0				
	10.0	41.3	1870	n/a	n/a	<i><math>M_{c,y,Rd}</math></i>	113	113	113	113	113	113	113	113	113	113	113				
						<i><math>M_{c,z,Rd}</math></i>	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2	69.2				
						<i><math>M_{N,y,Rd}</math></i>	113	113	113	105	90.3	75.3	60.2	45.2	30.1	15.1	0				
						<i><math>M_{N,z,Rd}</math></i>	69.2	69.2	62.9	55.1	47.2	39.3	31.5	23.6	15.7	7.86	0				

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Rectangular Hollow Sections (CFRHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

\* The section is a Class 4 section about the appropriate axis and is independent of the design axial force  $N_{Ed}$ . Values of  $M_{c,Rd}$  are calculated based on class 4 section properties and are displayed in italics.

$N_{Ed}$  = Design value of the axial force.

$$n = N_{Ed} / N_{pl,Rd}$$

✗ Section becomes Class 4, see note 10.

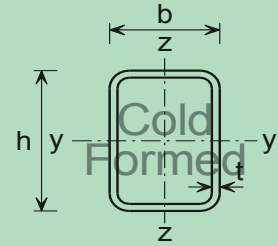
§ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

- Not applicable for Class 3 and Class 4 sections.

FOR EXPLANATION OF TABLES SEE NOTE 10.

COLD-FORMED RECTANGULAR HOLLOW SECTIONS

Hybox® RHS



Member buckling check

Section Designation & Resistances (kNm)		n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
h x b mm	t mm		L (m)	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
200x100	§ 4.0 $f_y W_{el,y} = 42.6$ $f_y W_{el,z} = 29.2$	0.591	$N_{b,y,Rd}$	746	665	577	485	400	328	270	224	189	161	138	120	105
			$N_{b,z,Rd}$	629	474	338	244	181	139	110	88.6	73.0	61.2	52.0	44.8	38.9
		0.591	$M_{b,Rd}$	42.6	42.6	42.6	42.6	42.6	42.6	42.6	42.6	42.5	42.0	41.6	41.1	40.7
			<b>0.242</b>	$M_{b,Rd}$	52.5	52.5	52.5	52.5	52.5	52.5	52.5	51.8	51.1	50.4	49.8	49.2
	§ 5.0 $f_y W_{el,y} = 51.8$ $f_y W_{el,z} = 35.3$	0.885	$N_{b,y,Rd}$	923	823	712	597	491	402	330	275	231	196	169	147	128
			$N_{b,z,Rd}$	777	582	414	298	221	169	134	108	89.0	74.6	63.4	54.5	47.4
		0.885	$M_{b,Rd}$	51.8	51.8	51.8	51.8	51.8	51.8	51.8	51.8	51.7	51.1	50.6	50.1	49.5
			<b>0.454</b>	$M_{b,Rd}$	64.3	64.3	64.3	64.3	64.3	64.3	64.2	63.3	62.4	61.7	60.9	60.1
	6.0 $f_y W_{el,y} = 60.4$ $f_y W_{el,z} = 40.8$	1.00	$N_{b,y,Rd}$	1090	971	838	701	576	470	387	321	270	230	197	171	150
			$N_{b,z,Rd}$	914	680	482	346	256	196	155	125	103	86.3	73.3	63.1	54.8
		1.00	$M_{b,Rd}$	75.6	75.6	75.6	75.6	75.6	75.6	75.4	74.4	73.4	72.5	71.6	70.7	69.9
			$N_{b,y,Rd}$	1390	1240	1060	881	719	585	479	397	333	283	243	211	185
	8.0 $f_y W_{el,y} = 74.2$ $f_y W_{el,z} = 50.1$	1.00	$N_{b,z,Rd}$	1160	853	599	427	316	242	190	154	127	106	90.0	77.4	67.3
			$M_{b,Rd}$	94.8	94.8	94.8	94.8	94.8	94.8	94.8	94.5	93.2	92.0	90.8	89.7	88.6
10.0 $f_y W_{el,y} = 86.6$ $f_y W_{el,z} = 58.2$	1.00	$N_{b,y,Rd}$	1690	1490	1270	1050	854	693	566	469	393	334	286	248	217	
		$N_{b,z,Rd}$	1390	1010	704	500	368	281	222	179	147	123	105	89.9	78.1	
	1.00	$M_{b,Rd}$	113	113	113	113	113	113	112	111	109	108	107	105	104	

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Rectangular Hollow Sections (CFRHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

$$n = N_{Ed} / N_{pl,Rd}$$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

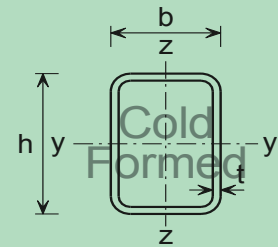
Axial force resistance  $N_{pl,Rd}$  which is equal to  $Af_y$  is given in the cross-section resistance check table opposite.

§ The section can be a Class 4 section but no allowance has been made in calculating  $N_{b,y,Rd}$  and  $N_{b,z,Rd}$ .

FOR EXPLANATION OF TABLES SEE NOTE 10.

COLD-FORMED RECTANGULAR HOLLOW SECTIONS

Hybox® RHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n Limit Class 3		Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$																
h x b mm	t mm			Class 2		n	Axis															
				y-y	z-z		0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0					
200x120	4.0	19.3	870	0.591	*	<i><math>M_{c,y,Rd}</math></i>	58.2	58.2	58.2	47.9	47.9	47.9	✗	✗	✗	§	§					
						<i><math>M_{c,z,Rd}</math></i>	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	§	§			
						<i><math>M_{N,y,Rd}</math></i>	58.2	58.2	58.2	-	-	-	-	-	-	-	-	-	-	-		
						<i><math>M_{N,z,Rd}</math></i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
	5.0	23.8	1080	0.885	*	<i><math>M_{c,y,Rd}</math></i>	71.4	71.4	71.4	71.4	71.4	58.6	58.6	58.6	58.6	✗	§					
						<i><math>M_{c,z,Rd}</math></i>	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	§				
						<i><math>M_{N,y,Rd}</math></i>	71.4	71.4	71.4	66.6	57.1	-	-	-	-	-	-	-	-			
						<i><math>M_{N,z,Rd}</math></i>	-	-	-	-	-	-	-	-	-	-	-	-	-			
	6.0	28.3	1280	n/a	n/a	<i><math>M_{c,y,Rd}</math></i>	84.1	84.1	84.1	84.1	84.1	84.1	84.1	84.1	84.1	84.1	84.1					
						<i><math>M_{c,z,Rd}</math></i>	58.9	58.9	58.9	58.9	58.9	58.9	58.9	58.9	58.9	58.9	58.9	58.9				
						<i><math>M_{N,y,Rd}</math></i>	84.1	84.1	84.1	78.5	67.3	56.1	44.9	33.7	22.4	11.2	0					
						<i><math>M_{N,z,Rd}</math></i>	58.9	58.9	56.6	49.5	42.4	35.4	28.3	21.2	14.1	7.07	0					
	8.0	36.5	1650	n/a	n/a	<i><math>M_{c,y,Rd}</math></i>	106	106	106	106	106	106	106	106	106	106	106					
						<i><math>M_{c,z,Rd}</math></i>	74.2	74.2	74.2	74.2	74.2	74.2	74.2	74.2	74.2	74.2	74.2					
						<i><math>M_{N,y,Rd}</math></i>	106	106	106	98.7	84.6	70.5	56.4	42.3	28.2	14.1	0					
						<i><math>M_{N,z,Rd}</math></i>	74.2	74.2	70.3	61.5	52.7	43.9	35.1	26.3	17.6	8.78	0					
	10.0	44.4	2010	n/a	n/a	<i><math>M_{c,y,Rd}</math></i>	126	126	126	126	126	126	126	126	126	126	126					
						<i><math>M_{c,z,Rd}</math></i>	88.8	88.8	88.8	88.8	88.8	88.8	88.8	88.8	88.8	88.8	88.8					
						<i><math>M_{N,y,Rd}</math></i>	126	126	126	118	101	84.3	67.4	50.6	33.7	16.9	0					
						<i><math>M_{N,z,Rd}</math></i>	88.8	88.8	83.2	72.8	62.4	52.0	41.6	31.2	20.8	10.4	0					

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Rectangular Hollow Sections (CFRHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

\* The section is a Class 4 section about the appropriate axis and is independent of the design axial force  $N_{Ed}$ . Values of  $M_{c,Rd}$  are calculated based on class 4 section properties and are displayed in italics.

$N_{Ed}$  = Design value of the axial force.

$$n = N_{Ed} / N_{pl,Rd}$$

✗ Section becomes Class 4, see note 10.

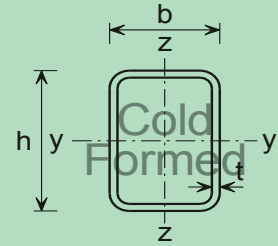
§ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

- Not applicable for Class 3 and Class 4 sections.

FOR EXPLANATION OF TABLES SEE NOTE 10.

COLD-FORMED RECTANGULAR HOLLOW SECTIONS

Hybox® RHS



Member buckling check

Section Designation & Resistances (kNm)		n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$														
h x b mm	t mm		L (m)	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	
200x120	§ 4.0 $f_y W_{el,y} = 47.9$ $f_y W_{el,z} = 36.6$	0.591	$N_{b,y,Rd}$	802	719	628	532	441	364	301	251	211	180	155	135	118	
			$N_{b,z,Rd}$	723	586	448	337	256	199	159	129	107	89.8	76.5	66.0	57.5	
		0.591	$M_{b,Rd}$	47.9	47.9	47.9	47.9	47.9	47.9	47.9	47.9	47.9	47.9	47.9	47.9	47.7	47.3
			<b>0.226</b>	$M_{b,Rd}$	58.2	58.2	58.2	58.2	58.2	58.2	58.2	58.2	58.2	58.2	57.8	57.2	56.6
	§ 5.0 $f_y W_{el,y} = 58.6$ $f_y W_{el,z} = 44.4$	0.885	$N_{b,y,Rd}$	994	890	775	655	543	446	369	307	259	220	190	165	144	
			$N_{b,z,Rd}$	893	721	550	412	313	243	193	157	130	109	93.2	80.4	70.0	
		0.885	$M_{b,Rd}$	58.6	58.6	58.6	58.6	58.6	58.6	58.6	58.6	58.6	58.6	58.6	58.6	58.3	57.8
			<b>0.424</b>	$M_{b,Rd}$	71.4	71.4	71.4	71.4	71.4	71.4	71.4	71.4	71.4	71.4	70.8	70.0	69.3
	6.0 $f_y W_{el,y} = 68.5$ $f_y W_{el,z} = 51.8$	1.00	$N_{b,y,Rd}$	1180	1050	914	771	638	524	432	360	303	258	222	193	169	
			$N_{b,z,Rd}$	1050	849	645	482	366	284	226	184	152	128	109	93.7	81.6	
		<b>1.00</b>	$M_{b,Rd}$	84.1	84.1	84.1	84.1	84.1	84.1	84.1	84.1	84.1	84.1	83.4	82.5	81.7	80.8
	8.0 $f_y W_{el,y} = 84.8$ $f_y W_{el,z} = 63.9$	1.00	$N_{b,y,Rd}$	1510	1340	1160	975	802	656	540	449	377	321	276	239	210	
			$N_{b,z,Rd}$	1350	1080	810	602	455	352	280	227	188	158	134	116	101	
		<b>1.00</b>	$M_{b,Rd}$	106	106	106	106	106	106	106	106	106	105	104	103	102	
10.0 $f_y W_{el,y} = 99.8$ $f_y W_{el,z} = 74.6$	1.00	$N_{b,y,Rd}$	1830	1630	1400	1170	956	780	640	531	446	379	326	283	248		
		$N_{b,z,Rd}$	1630	1290	963	712	536	415	329	267	221	185	158	136	118		
	<b>1.00</b>	$M_{b,Rd}$	126	126	126	126	126	126	126	126	126	125	124	123	121		

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Rectangular Hollow Sections (CFRHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

$$n = N_{Ed} / N_{pl,Rd}$$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

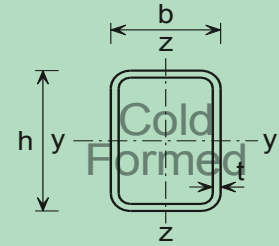
Axial force resistance  $N_{pl,Rd}$  which is equal to  $Af_y$  is given in the cross-section resistance check table opposite.

§ The section can be a Class 4 section but no allowance has been made in calculating  $N_{b,y,Rd}$  and  $N_{b,z,Rd}$ .

FOR EXPLANATION OF TABLES SEE NOTE 10.

COLD-FORMED RECTANGULAR HOLLOW SECTIONS

Hybox® RHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n Limit Class 3 <b>Class 2</b>		Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$															
h x b mm	t mm			Axis		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0				
				y-y	z-z																
200x150	4.0 #	21.2	955	*	*	$M_{c,y,Rd}$	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘				
						$M_{c,z,Rd}$	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘		
						$M_{N,y,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
	5.0 #	26.2	1190	1190	0.885	* <b>0.386</b>	$M_{c,y,Rd}$	81.7	81.7	81.7	81.7	68.5	68.5	68.5	68.5	68.5	✘	\$			
							$M_{c,z,Rd}$	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	\$
							$M_{N,y,Rd}$	81.7	81.7	81.7	76.2	-	-	-	-	-	-	-	-	-	-
							$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	6.0	31.1	1410	1410	n/a	n/a <b>1.00</b>	$M_{c,y,Rd}$	96.2	96.2	96.2	96.2	96.2	96.2	96.2	96.2	96.2	96.2	96.2			
							$M_{c,z,Rd}$	79.2	79.2	79.2	79.2	79.2	79.2	79.2	79.2	79.2	79.2	79.2	79.2		
							$M_{N,y,Rd}$	96.2	96.2	96.2	89.8	77.0	64.1	51.3	38.5	25.7	12.8	0			
							$M_{N,z,Rd}$	79.2	79.2	78.9	69.0	59.1	49.3	39.4	29.6	19.7	9.86	0			
	8.0	40.2	1820	1820	n/a	n/a <b>1.00</b>	$M_{c,y,Rd}$	122	122	122	122	122	122	122	122	122	122	122			
							$M_{c,z,Rd}$	100	100	100	100	100	100	100	100	100	100	100	100		
							$M_{N,y,Rd}$	122	122	122	114	97.7	81.4	65.1	48.8	32.6	16.3	0			
							$M_{N,z,Rd}$	100	100	98.9	86.6	74.2	61.8	49.5	37.1	24.7	12.4	0			
	10.0	49.1	2220	2220	n/a	n/a <b>1.00</b>	$M_{c,y,Rd}$	147	147	147	147	147	147	147	147	147	147	147			
							$M_{c,z,Rd}$	120	120	120	120	120	120	120	120	120	120	120	120		
							$M_{N,y,Rd}$	147	147	147	137	117	97.7	78.2	58.6	39.1	19.5	0			
							$M_{N,z,Rd}$	120	120	117	103	88.1	73.4	58.7	44.1	29.4	14.7	0			

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\* The section is a Class 4 section about the appropriate axis and is independent of the design axial force  $N_{Ed}$ . Values of  $M_{c,Rd}$  are calculated based on class 4 section properties and are displayed in italics.

$N_{Ed}$  = Design value of the axial force.

$$n = N_{Ed} / N_{pl,Rd}$$

✘ Section becomes Class 4, see note 10.

\$ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

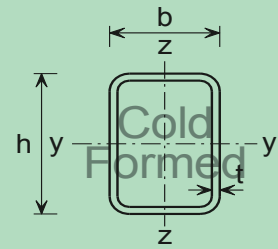
- Not applicable for Class 3 and Class 4 sections.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

COLD-FORMED RECTANGULAR HOLLOW SECTIONS

Hybox® RHS



Member buckling check

Section Designation & Resistances (kNm)		n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
h x b mm	t mm		L (m)	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
200x150	◆ 4.0 # $f_y W_{el,y} = 56.1$ $f_y W_{el,z} = 48.3$	*	$N_{b,y,Rd}$	764	696	623	544	465	392	330	279	237	203	176	153	135
			$N_{b,z,Rd}$	731	643	545	448	362	292	238	197	165	140	120	104	90.9
	§ 5.0 # $f_y W_{el,y} = 68.5$ $f_y W_{el,z} = 58.9$	0.885	$N_{b,y,Rd}$	1100	989	869	741	619	513	426	356	300	256	221	192	168
			$N_{b,z,Rd}$	1050	901	743	593	468	373	302	248	207	175	149	129	113
	6.0 $f_y W_{el,y} = 80.6$ $f_y W_{el,z} = 68.9$	0.885	$M_{b,Rd}$	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5
			<b>0.386</b> $M_{b,Rd}$	81.7	81.7	81.7	81.7	81.7	81.7	81.7	81.7	81.7	81.7	81.7	81.7	81.7
	8.0 $f_y W_{el,y} = 100$ $f_y W_{el,z} = 85.9$	1.00	$N_{b,y,Rd}$	1300	1170	1030	873	728	602	499	417	352	300	258	224	197
			$N_{b,z,Rd}$	1240	1060	875	696	549	437	353	290	241	204	174	151	132
	10.0 $f_y W_{el,y} = 119$ $f_y W_{el,z} = 102$	1.00	$M_{b,Rd}$	96.2	96.2	96.2	96.2	96.2	96.2	96.2	96.2	96.2	96.2	96.2	96.2	96.2
			$N_{b,y,Rd}$	1680	1500	1310	1110	923	760	628	524	442	376	324	282	247
		1.00	$N_{b,z,Rd}$	1590	1360	1110	880	692	549	443	363	302	255	218	189	165
			$M_{b,Rd}$	122	122	122	122	122	122	122	122	122	122	122	122	122
	1.00	$N_{b,y,Rd}$	2040	1830	1590	1340	1110	909	750	624	526	448	385	334	293	
		$N_{b,z,Rd}$	1940	1650	1340	1050	825	653	526	431	359	303	259	224	195	
		1.00	$M_{b,Rd}$	147	147	147	147	147	147	147	147	147	147	147	147	

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$$n = N_{Ed} / N_{pl,Rd}$$

\* The section is a class 4 section about the y-y axis and is independent of the design axial force  $N_{Ed}$ .

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

Axial force resistance  $N_{pl,Rd}$  which is equal to  $Af_y$  is given in the cross-section resistance check table opposite.

§ The section can be a Class 4 section but no allowance has been made in calculating  $N_{b,y,Rd}$  and  $N_{b,z,Rd}$ .

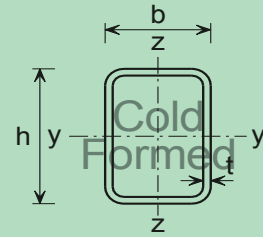
◆ For this section, resistances  $N_{b,Rd}$  and  $M_{b,Rd}$  are calculated based on class 4 section properties and are displayed in italics.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

COLD-FORMED RECTANGULAR HOLLOW SECTIONS

Hybox® RHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n Limit Class 3		Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$													
h x b mm	t mm			Class 2		n	Axis												
				y-y	z-z		0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0		
250x150	5.0	30.1	1360	0.591 <b>0.225</b>	*	<i><math>M_{c,y,Rd}</math></i>	114	114	114	93.7	93.7	93.7	✗	✗	✗	✗	✗		
						<i><math>M_{c,z,Rd}</math></i>	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	
						<i><math>M_{N,y,Rd}</math></i>	114	114	114	-	-	-	-	-	-	-	-	-	-
						<i><math>M_{N,z,Rd}</math></i>	-	-	-	-	-	-	-	-	-	-	-	-	-
	6.0	35.8	1620	0.826 <b>0.385</b>	*	<i><math>M_{c,y,Rd}</math></i>	134	134	134	134	110	110	110	110	110	✗	✗		
						<i><math>M_{c,z,Rd}</math></i>	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	
						<i><math>M_{N,y,Rd}</math></i>	134	134	134	125	-	-	-	-	-	-	-	-	
						<i><math>M_{N,z,Rd}</math></i>	-	-	-	-	-	-	-	-	-	-	-	-	
	6.3 #	37.2	1680	0.897 <b>0.436</b>	*	<i><math>M_{c,y,Rd}</math></i>	139	139	139	139	139	114	114	114	114	✗	✗		
						<i><math>M_{c,z,Rd}</math></i>	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗		
						<i><math>M_{N,y,Rd}</math></i>	139	139	139	130	111	-	-	-	-	-	-		
						<i><math>M_{N,z,Rd}</math></i>	-	-	-	-	-	-	-	-	-	-	-		
	8.0	46.5	2100	n/a <b>1.00</b>	n/a <b>1.00</b>	<i><math>M_{c,y,Rd}</math></i>	171	171	171	171	171	171	171	171	171	171	171		
						<i><math>M_{c,z,Rd}</math></i>	121	121	121	121	121	121	121	121	121	121	121		
						<i><math>M_{N,y,Rd}</math></i>	171	171	171	160	137	114	91.3	68.4	45.6	22.8	0		
						<i><math>M_{N,z,Rd}</math></i>	121	121	115	101	86.4	72.0	57.6	43.2	28.8	14.4	0		
	10.0	57.0	2580	n/a <b>1.00</b>	n/a <b>1.00</b>	<i><math>M_{c,y,Rd}</math></i>	207	207	207	207	207	207	207	207	207	207	207		
						<i><math>M_{c,z,Rd}</math></i>	145	145	145	145	145	145	145	145	145	145	145		
						<i><math>M_{N,y,Rd}</math></i>	207	207	207	193	165	138	110	82.6	55.1	27.5	0		
						<i><math>M_{N,z,Rd}</math></i>	145	145	138	120	103	86.0	68.8	51.6	34.4	17.2	0		
	12.0	66.0	2990	n/a <b>1.00</b>	n/a <b>1.00</b>	<i><math>M_{c,y,Rd}</math></i>	234	234	234	234	234	234	234	234	234	234	234		
						<i><math>M_{c,z,Rd}</math></i>	164	164	164	164	164	164	164	164	164	164	164		
						<i><math>M_{N,y,Rd}</math></i>	234	234	234	218	187	156	125	93.4	62.3	31.1	0		
						<i><math>M_{N,z,Rd}</math></i>	164	164	153	134	115	95.9	76.7	57.6	38.4	19.2	0		
12.5	68.3	3090	n/a <b>1.00</b>	n/a <b>1.00</b>	<i><math>M_{c,y,Rd}</math></i>	241	241	241	241	241	241	241	241	241	241	241			
					<i><math>M_{c,z,Rd}</math></i>	169	169	169	169	169	169	169	169	169	169	169			
					<i><math>M_{N,y,Rd}</math></i>	241	241	241	225	193	160	128	96.3	64.2	32.1	0			
					<i><math>M_{N,z,Rd}</math></i>	169	169	158	138	118	98.5	78.8	59.1	39.4	19.7	0			
300x100	8.0	46.5	2100	0.986 <b>0.603</b>	*	<i><math>M_{c,y,Rd}</math></i>	186	186	186	186	186	186	186	186	142	142	142		
						<i><math>M_{c,z,Rd}</math></i>	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗	✗		
						<i><math>M_{N,y,Rd}</math></i>	186	186	186	173	149	124	99.0	-	-	-	-		
						<i><math>M_{N,z,Rd}</math></i>	-	-	-	-	-	-	-	-	-	-			
10.0	57.0	2580	n/a <b>1.00</b>	n/a <b>1.00</b>	<i><math>M_{c,y,Rd}</math></i>	224	224	224	224	224	224	224	224	224	224	224			
					<i><math>M_{c,z,Rd}</math></i>	101	101	101	101	101	101	101	101	101	101	101			
					<i><math>M_{N,y,Rd}</math></i>	224	224	224	209	179	149	119	89.6	59.7	29.9	0			
					<i><math>M_{N,z,Rd}</math></i>	101	99.7	88.6	77.6	66.5	55.4	44.3	33.2	22.2	11.1	0			

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\* The section is a Class 4 section about the appropriate axis and is independent of the design axial force  $N_{Ed}$ . Values of  $M_{c,Rd}$  are calculated based on class 4 section properties and are displayed in italics.

$N_{Ed}$  = Design value of the axial force.

$$n = N_{Ed} / N_{pl,Rd}$$

✗ Section becomes Class 4, see note 10.

✗ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

- Not applicable for Class 3 and Class 4 sections.

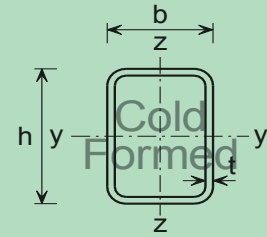
# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.



COLD-FORMED RECTANGULAR HOLLOW SECTIONS

Hybox® RHS



Member buckling check

Section Designation & Resistances (kNm)		n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$														
h x b mm	t mm		L (m)	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	
250x150	§ 5.0 $f_y W_{el,y} = 93.7$ $f_y W_{el,z} = 71.4$		0.591	$N_{b,y,Rd}$	1310	1210	1100	983	863	746	640	548	471	407	354	310	273
			$N_{b,z,Rd}$	1210	1050	873	702	558	446	362	297	248	210	180	156	136	
		0.591	$M_{b,Rd}$	93.7	93.7	93.7	93.7	93.7	93.7	93.7	93.7	93.7	93.7	93.7	93.7	93.7	93.7
		<b>0.225</b>	$M_{b,Rd}$	114	114	114	114	114	114	114	114	114	114	114	114	113	112
	§ 6.0 $f_y W_{el,y} = 110$ $f_y W_{el,z} = 83.8$	0.826	$N_{b,y,Rd}$	1550	1430	1300	1160	1020	881	755	646	555	479	416	365	322	
			$N_{b,z,Rd}$	1440	1240	1030	828	657	525	425	349	292	247	211	183	160	
		0.826	$M_{b,Rd}$	110	110	110	110	110	110	110	110	110	110	110	110	110	110
		<b>0.385</b>	$M_{b,Rd}$	134	134	134	134	134	134	134	134	134	134	134	134	134	133
	§ 6.3 # $f_y W_{el,y} = 114$ $f_y W_{el,z} = 86.3$	0.897	$N_{b,y,Rd}$	1610	1490	1350	1210	1060	910	779	666	572	494	429	376	331	
			$N_{b,z,Rd}$	1490	1290	1070	855	678	542	438	360	301	254	218	188	164	
		0.897	$M_{b,Rd}$	114	114	114	114	114	114	114	114	114	114	114	114	114	114
		<b>0.436</b>	$M_{b,Rd}$	139	139	139	139	139	139	139	139	139	139	139	139	139	137
	8.0 $f_y W_{el,y} = 139$ $f_y W_{el,z} = 105$	1.00	$N_{b,y,Rd}$	2010	1850	1680	1500	1310	1120	960	819	702	606	526	461	406	
			$N_{b,z,Rd}$	1850	1600	1320	1050	832	663	536	440	367	310	266	230	201	
		<b>1.00</b>	$M_{b,Rd}$	171	171	171	171	171	171	171	171	171	171	171	171	171	169
		10.0 $f_y W_{el,y} = 165$ $f_y W_{el,z} = 125$	1.00	$N_{b,y,Rd}$	2460	2260	2050	1820	1580	1360	1160	986	844	727	632	552	487
	$N_{b,z,Rd}$		2260	1940	1590	1270	997	793	640	525	437	370	316	273	239		
	<b>1.00</b>	$M_{b,Rd}$	207	207	207	207	207	207	207	207	207	207	207	206	204		
	12.0 $f_y W_{el,y} = 184$ $f_y W_{el,z} = 138$	1.00	$N_{b,y,Rd}$	2840	2600	2350	2080	1800	1540	1300	1110	946	814	706	617	543	
		$N_{b,z,Rd}$	2610	2230	1810	1430	1120	890	717	587	489	413	353	305	266		
	<b>1.00</b>	$M_{b,Rd}$	234	234	234	234	234	234	234	234	234	234	234	233	231		
	12.5 $f_y W_{el,y} = 189$ $f_y W_{el,z} = 142$	1.00	$N_{b,y,Rd}$	2930	2690	2430	2140	1850	1580	1340	1140	972	836	725	633	557	
		$N_{b,z,Rd}$	2700	2300	1870	1470	1150	913	735	602	501	423	362	313	273		
	<b>1.00</b>	$M_{b,Rd}$	241	241	241	241	241	241	241	241	241	241	241	240	238		
	300x100	§ 8.0 $f_y W_{el,y} = 142$ $f_y W_{el,z} = 74.2$	0.986	$N_{b,y,Rd}$	2040	1890	1740	1580	1410	1240	1080	934	809	704	615	541	478
			$N_{b,z,Rd}$	1620	1220	866	623	462	355	280	226	186	156	133	114	99.2	
	0.986	$M_{b,Rd}$	142	142	142	142	142	142	142	142	140	137	134	132	130	127	
	<b>0.603</b>	$M_{b,Rd}$	186	186	186	186	186	186	182	178	174	170	166	162	159	156	
	10.0 $f_y W_{el,y} = 168$ $f_y W_{el,z} = 87.0$	1.00	$N_{b,y,Rd}$	2490	2320	2130	1930	1720	1510	1310	1130	978	850	742	652	577	
			$N_{b,z,Rd}$	1970	1460	1030	738	547	419	330	266	220	184	156	134	117	
	<b>1.00</b>	$M_{b,Rd}$	224	224	224	224	224	219	214	209	204	199	195	191	187		

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Rectangular Hollow Sections (CFRHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

$$n = N_{Ed} / N_{pl,Rd}$$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

Axial force resistance  $N_{pl,Rd}$  which is equal to  $A f_y$  is given in the cross-section resistance check table opposite.

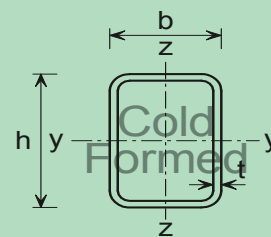
§ The section can be a Class 4 section but no allowance has been made in calculating  $N_{b,y,Rd}$  and  $N_{b,z,Rd}$ .

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

COLD-FORMED RECTANGULAR HOLLOW SECTIONS

Hybox® RHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n Limit Class 3		Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$													
h x b mm	t mm			Class 2		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0		
				Axis	Axis														
				y-y	z-z														
300x200	6.0	45.2	2040	0.591	*	<i><math>M_{c,y,Rd}</math></i>	209	209	209	174	174	174	✘	✘	✘	\$	\$		
						<i><math>M_{c,z,Rd}</math></i>	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	\$	\$	
						$M_{N,y,Rd}$	209	209	209	-	-	-	-	-	-	-	-	-	-
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	-
	6.3 #	47.1	2130	0.649	*	<i><math>M_{c,y,Rd}</math></i>	217	217	217	180	180	180	180	✘	✘	\$	\$		
						<i><math>M_{c,z,Rd}</math></i>	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	\$	\$	
						$M_{N,y,Rd}$	217	217	217	-	-	-	-	-	-	-	-	-	
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-	
	8.0	59.1	2670	0.986	*	<i><math>M_{c,y,Rd}</math></i>	269	269	269	269	269	222	222	222	222	222	\$		
						<i><math>M_{c,z,Rd}</math></i>	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	\$	
						$M_{N,y,Rd}$	269	269	269	251	215	-	-	-	-	-	-		
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-		
	10.0	72.7	3290	n/a	n/a	<i><math>M_{c,y,Rd}</math></i>	327	327	327	327	327	327	327	327	327	327	327		
						<i><math>M_{c,z,Rd}</math></i>	248	248	248	248	248	248	248	248	248	248	248		
						$M_{N,y,Rd}$	327	327	327	305	262	218	174	131	87.2	43.6	0		
						$M_{N,z,Rd}$	248	248	241	211	180	150	120	90.2	60.1	30.1	0		
	12.0 #	84.8	3830	n/a	n/a	<i><math>M_{c,y,Rd}</math></i>	375	375	375	375	375	375	375	375	375	375	375		
						<i><math>M_{c,z,Rd}</math></i>	284	284	284	284	284	284	284	284	284	284	284		
						$M_{N,y,Rd}$	375	375	375	350	300	250	200	150	100.0	50.0	0		
						$M_{N,z,Rd}$	284	284	273	239	205	171	136	102	68.2	34.1	0		
	12.5	88.0	3980	n/a	n/a	<i><math>M_{c,y,Rd}</math></i>	387	387	387	387	387	387	387	387	387	387	387		
						<i><math>M_{c,z,Rd}</math></i>	294	294	294	294	294	294	294	294	294	294	294		
						$M_{N,y,Rd}$	387	387	387	361	310	258	207	155	103	51.6	0		
						$M_{N,z,Rd}$	294	294	282	246	211	176	141	106	70.4	35.2	0		

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Rectangular Hollow Sections (CFRHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

\* The section is a Class 4 section about the appropriate axis and is independent of the design axial force  $N_{Ed}$ . Values of  $M_{c,Rd}$  are calculated based on class 4 section properties and are displayed in italics.

$N_{Ed}$  = Design value of the axial force.

$$n = N_{Ed} / N_{pl,Rd}$$

✘ Section becomes Class 4, see note 10.

\$ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

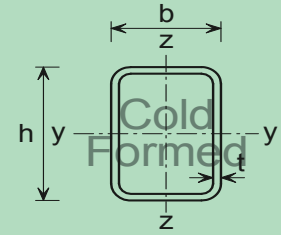
- Not applicable for Class 3 and Class 4 sections.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

COLD-FORMED RECTANGULAR HOLLOW SECTIONS

Hybox® RHS



Member buckling check

Section Designation & Resistances (kNm)		n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm)													
h x b mm	t mm		for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
			L (m)	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
300x200	§ 6.0 $f_y W_{el,y} = 174$ $f_y W_{el,z} = 141$	0.591	$N_{b,y,Rd}$	2010	1890	1770	1630	1490	1340	1190	1050	929	818	722	639	569
			$N_{b,z,Rd}$	1920	1750	1570	1370	1170	985	828	698	594	509	440	384	337
	§ 6.3 # $f_y W_{el,y} = 180$ $f_y W_{el,z} = 146$	0.591	$M_{b,Rd}$	174	174	174	174	174	174	174	174	174	174	174	174	174
			<b>0.216</b> $M_{b,Rd}$	209	209	209	209	209	209	209	209	209	209	209	209	209
	§ 8.0 $f_y W_{el,y} = 222$ $f_y W_{el,z} = 179$	0.649	$N_{b,y,Rd}$	2100	1970	1840	1700	1550	1400	1240	1100	967	852	752	666	593
			$N_{b,z,Rd}$	2000	1830	1630	1420	1210	1020	859	725	616	528	456	398	350
	§ 8.0 $f_y W_{el,y} = 222$ $f_y W_{el,z} = 179$	0.649	$M_{b,Rd}$	180	180	180	180	180	180	180	180	180	180	180	180	180
			<b>0.256</b> $M_{b,Rd}$	217	217	217	217	217	217	217	217	217	217	217	217	217
	10.0 $f_y W_{el,y} = 268$ $f_y W_{el,z} = 215$	0.986	$N_{b,y,Rd}$	2620	2460	2300	2120	1930	1740	1540	1360	1200	1050	930	823	732
			$N_{b,z,Rd}$	2510	2280	2030	1770	1510	1270	1060	895	760	651	563	490	431
	10.0 $f_y W_{el,y} = 268$ $f_y W_{el,z} = 215$	0.986	$M_{b,Rd}$	222	222	222	222	222	222	222	222	222	222	222	222	222
			<b>0.475</b> $M_{b,Rd}$	269	269	269	269	269	269	269	269	269	269	269	269	269
	12.0 # $f_y W_{el,y} = 303$ $f_y W_{el,z} = 243$	1.00	$N_{b,y,Rd}$	3230	3030	2820	2600	2370	2120	1890	1660	1460	1280	1130	1000	889
			$N_{b,z,Rd}$	3080	2800	2490	2160	1830	1540	1290	1080	918	786	679	591	519
12.0 # $f_y W_{el,y} = 303$ $f_y W_{el,z} = 243$	1.00	$M_{b,Rd}$	327	327	327	327	327	327	327	327	327	327	327	327	327	
		$N_{b,y,Rd}$	3760	3520	3270	3010	2730	2440	2160	1900	1660	1460	1280	1130	1010	
12.5 $f_y W_{el,y} = 312$ $f_y W_{el,z} = 251$	1.00	$N_{b,z,Rd}$	3580	3250	2880	2490	2100	1760	1470	1230	1040	892	770	670	588	
		$M_{b,Rd}$	375	375	375	375	375	375	375	375	375	375	375	375	375	
12.5 $f_y W_{el,y} = 312$ $f_y W_{el,z} = 251$	1.00	$N_{b,y,Rd}$	3890	3640	3390	3110	2810	2510	2220	1940	1700	1490	1310	1160	1030	
		$N_{b,z,Rd}$	3710	3360	2980	2570	2170	1810	1510	1270	1080	921	795	692	607	
12.5 $f_y W_{el,y} = 312$ $f_y W_{el,z} = 251$	1.00	$M_{b,Rd}$	387	387	387	387	387	387	387	387	387	387	387	387	387	

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$$n = N_{Ed} / N_{pl,Rd}$$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

Axial force resistance  $N_{pl,Rd}$  which is equal to  $Af_y$  is given in the cross-section resistance check table opposite.

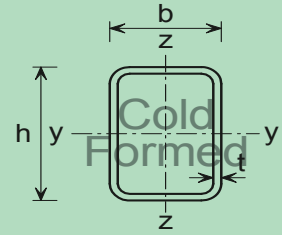
§ The section can be a Class 4 section but no allowance has been made in calculating  $N_{b,y,Rd}$  and  $N_{b,z,Rd}$ .

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

COLD-FORMED RECTANGULAR HOLLOW SECTIONS

Hybox® RHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n Limit Class 3		Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$																
h x b mm	t mm			Class 2		n	Axis															
				y-y	z-z		0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0					
400x200	6.0 #	54.7	2470	0.305	*	<i><math>M_{c,y,Rd}</math></i>	322	262	262	*	*	*	*	*	\$	\$	\$					
						<i><math>M_{c,z,Rd}</math></i>	*	*	*	*	*	*	*	*	\$	\$	\$					
						<i><math>M_{N,y,Rd}</math></i>	322	-	-	-	-	-	-	-	-	-	-	-	-	-		
						<i><math>M_{N,z,Rd}</math></i>	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
	6.3 #	57.0	2580	0.347	*	<i><math>M_{c,y,Rd}</math></i>	334	272	272	272	*	*	*	*	\$	\$	\$					
						<i><math>M_{c,z,Rd}</math></i>	*	*	*	*	*	*	*	*	\$	\$	\$					
						<i><math>M_{N,y,Rd}</math></i>	334	-	-	-	-	-	-	-	-	-	-	-	-			
						<i><math>M_{N,z,Rd}</math></i>	-	-	-	-	-	-	-	-	-	-	-	-	-			
	8.0	71.6	3240	0.591	*	<i><math>M_{c,y,Rd}</math></i>	416	416	416	337	337	337	*	*	*	\$	\$					
						<i><math>M_{c,z,Rd}</math></i>	*	*	*	*	*	*	*	*	\$	\$						
						<i><math>M_{N,y,Rd}</math></i>	416	416	416	-	-	-	-	-	-	-	-	-	-			
						<i><math>M_{N,z,Rd}</math></i>	-	-	-	-	-	-	-	-	-	-	-	-	-			
	10.0	88.4	4010	0.885	*	<i><math>M_{c,y,Rd}</math></i>	509	509	509	509	509	408	408	408	408	*	\$					
						<i><math>M_{c,z,Rd}</math></i>	*	*	*	*	*	*	*	*	*	*	\$					
						<i><math>M_{N,y,Rd}</math></i>	509	509	509	475	407	-	-	-	-	-	-	-				
						<i><math>M_{N,z,Rd}</math></i>	-	-	-	-	-	-	-	-	-	-	-	-				
	12.0 #	104	4690	n/a	n/a	<i><math>M_{c,y,Rd}</math></i>	588	588	588	588	588	588	588	588	588	588	588					
						<i><math>M_{c,z,Rd}</math></i>	365	365	365	365	365	365	365	365	365	365	365					
						<i><math>M_{N,y,Rd}</math></i>	588	588	588	549	470	392	314	235	157	78.4	0					
						<i><math>M_{N,z,Rd}</math></i>	365	365	338	296	253	211	169	127	84.4	42.2	0					
	12.5	108	4860	n/a	n/a	<i><math>M_{c,y,Rd}</math></i>	608	608	608	608	608	608	608	608	608	608	608					
						<i><math>M_{c,z,Rd}</math></i>	377	377	377	377	377	377	377	377	377	377	377					
						<i><math>M_{N,y,Rd}</math></i>	608	608	608	568	487	406	325	243	162	81.1	0					
						<i><math>M_{N,z,Rd}</math></i>	377	377	349	305	262	218	174	131	87.2	43.6	0					

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\* The section is a Class 4 section about the appropriate axis and is independent of the design axial force  $N_{Ed}$ . Values of  $M_{c,Rd}$  are calculated based on class 4 section properties and are displayed in italics.

$N_{Ed}$  = Design value of the axial force.

$$n = N_{Ed} / N_{pl,Rd}$$

\* Section becomes Class 4, see note 10.

\$ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

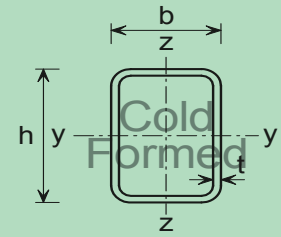
- Not applicable for Class 3 and Class 4 sections.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

COLD-FORMED RECTANGULAR HOLLOW SECTIONS

Hybox® RHS



Member buckling check

Section Designation & Resistances (kNm)		n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm)														
h x b mm	t mm		for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$														
			L (m)	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	
400x200	§ 6.0 # $f_y W_{el,y} = 262$ $f_y W_{el,z} = 181$	0.305	$N_{b,y,Rd}$	2470	2380	2270	2150	2030	1900	1760	1630	1490	1350	1230	1110	1010	
			$N_{b,z,Rd}$	2340	2140	1920	1690	1450	1230	1040	883	753	647	560	489	430	
		0.305	<b>0.033</b>	$M_{b,Rd}$	262	262	262	262	262	262	262	262	262	262	262	262	262
				$M_{b,Rd}$	322	322	322	322	322	322	322	322	322	322	322	322	322
	§ 6.3 # $f_y W_{el,y} = 272$ $f_y W_{el,z} = 188$	0.347		$N_{b,y,Rd}$	2580	2480	2370	2240	2110	1980	1830	1690	1540	1400	1270	1150	1040
				$N_{b,z,Rd}$	2440	2230	2000	1760	1510	1280	1080	918	783	672	582	508	447
		0.347	<b>0.064</b>	$M_{b,Rd}$	272	272	272	272	272	272	272	272	272	272	272	272	272
				$M_{b,Rd}$	334	334	334	334	334	334	334	334	334	334	334	334	334
	§ 8.0 $f_y W_{el,y} = 337$ $f_y W_{el,z} = 231$	0.591		$N_{b,y,Rd}$	3240	3120	2970	2810	2650	2470	2290	2110	1920	1750	1580	1430	1300
				$N_{b,z,Rd}$	3060	2790	2500	2200	1880	1600	1350	1140	969	831	719	628	552
		0.591	<b>0.243</b>	$M_{b,Rd}$	337	337	337	337	337	337	337	337	337	337	337	337	337
				$M_{b,Rd}$	416	416	416	416	416	416	416	416	416	416	416	416	416
	§ 10.0 $f_y W_{el,y} = 408$ $f_y W_{el,z} = 279$	0.885		$N_{b,y,Rd}$	4010	3860	3670	3480	3270	3050	2830	2600	2370	2150	1950	1760	1590
				$N_{b,z,Rd}$	3780	3450	3090	2700	2310	1950	1640	1390	1180	1010	875	764	671
		0.885	<b>0.456</b>	$M_{b,Rd}$	408	408	408	408	408	408	408	408	408	408	408	408	408
				$M_{b,Rd}$	509	509	509	509	509	509	509	509	509	509	509	509	509
12.0 # $f_y W_{el,y} = 466$ $f_y W_{el,z} = 319$	1.00		$N_{b,y,Rd}$	4690	4500	4280	4040	3800	3540	3270	3000	2730	2470	2230	2020	1820	
			$N_{b,z,Rd}$	4410	4010	3580	3120	2660	2240	1880	1590	1350	1150	998	870	764	
	<b>1.00</b>		$M_{b,Rd}$	588	588	588	588	588	588	588	588	588	588	588	588	588	
12.5 $f_y W_{el,y} = 481$ $f_y W_{el,z} = 329$	1.00		$N_{b,y,Rd}$	4860	4670	4440	4200	3940	3670	3400	3110	2830	2570	2320	2090	1890	
			$N_{b,z,Rd}$	4570	4160	3710	3230	2750	2320	1950	1640	1390	1190	1030	899	790	
	<b>1.00</b>		$M_{b,Rd}$	608	608	608	608	608	608	608	608	608	608	608	608	608	

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Rectangular Hollow Sections (CFRHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

$$n = N_{Ed} / N_{pl,Rd}$$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

Axial force resistance  $N_{pl,Rd}$  which is equal to  $Af_y$  is given in the cross-section resistance check table opposite.

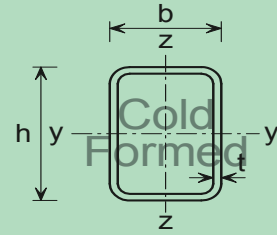
§ The section can be a Class 4 section but no allowance has been made in calculating  $N_{b,y,Rd}$  and  $N_{b,z,Rd}$ .

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

COLD-FORMED RECTANGULAR HOLLOW SECTIONS

Hybox® RHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n Limit Class 3		Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$												
h x b mm	t mm			Class 2		n	Axis											
				y-y	z-z		0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	
450x250	6.0 #	64.1	2900	*	*	$M_{c,y,Rd}$	*	*	*	*	*	*	*	*	\$	\$	\$	\$
						$M_{c,z,Rd}$	*	*	*	*	*	*	*	\$	\$	\$	\$	
						$M_{N,y,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-
	6.3 #	66.9	3020	*	*	$M_{c,y,Rd}$	*	*	*	*	*	*	*	*	\$	\$	\$	\$
						$M_{c,z,Rd}$	*	*	*	*	*	*	*	\$	\$	\$	\$	
						$M_{N,y,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-
	8.0 #	84.2	3800	0.463 <b>0.144</b>	*	$M_{c,y,Rd}$	564	564	463	463	463	*	*	*	*	\$	\$	
						$M_{c,z,Rd}$	*	*	*	*	*	*	*	*	*	\$	\$	
						$M_{N,y,Rd}$	564	564	-	-	-	-	-	-	-	-	-	-
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-
	10.0 #	104	4720	0.720 <b>0.324</b>	*	$M_{c,y,Rd}$	692	692	692	692	564	564	564	564	*	\$	\$	
						$M_{c,z,Rd}$	*	*	*	*	*	*	*	*	*	\$	\$	
						$M_{N,y,Rd}$	692	692	692	645	-	-	-	-	-	-	-	-
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	-
	12.0 #	123	5540	0.986 <b>0.515</b>	*	$M_{c,y,Rd}$	804	804	804	804	804	804	649	649	649	649	\$	
						$M_{c,z,Rd}$	*	*	*	*	*	*	*	*	*	*	\$	
						$M_{N,y,Rd}$	804	804	804	750	643	536	-	-	-	-	-	
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	
	12.5 #	127	5750	1.00 <b>0.562</b>	1.00 <b>0.00</b>	$M_{c,y,Rd}$	833	833	833	833	833	833	671	671	671	671	671	
						$M_{c,z,Rd}$	489	489	489	489	489	489	489	489	489	489	489	
						$M_{N,y,Rd}$	833	833	833	777	666	555	-	-	-	-	-	
						$M_{N,z,Rd}$	-	-	-	-	-	-	-	-	-	-	-	

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Rectangular Hollow Sections (CFRHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

\* The section is a Class 4 section about the appropriate axis and is independent of the design axial force  $N_{Ed}$ . Values of  $M_{c,Rd}$  are calculated based on class 4 section properties and are displayed in italics.

$N_{Ed}$  = Design value of the axial force.

$$n = N_{Ed} / N_{pl,Rd}$$

\* Section becomes Class 4, see note 10.

\$ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

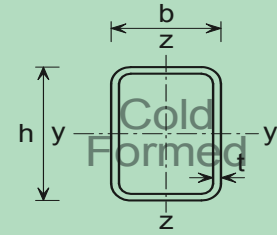
- Not applicable for Class 3 and Class 4 sections.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

COLD-FORMED RECTANGULAR HOLLOW SECTIONS

Hybox® RHS



Member buckling check

Section Designation & Resistances (kNm)		n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
h x b mm	t mm		L (m)	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
450x250	♦ 6.0 # $f_y W_{el,y} = 359$ $f_y W_{el,z} = 263$	*	$N_{b,y,Rd}$	1950	1950	1900	1830	1770	1700	1630	1560	1480	1410	1330	1250	1170
			$N_{b,z,Rd}$	1950	1850	1750	1640	1520	1400	1280	1160	1040	930	832	745	668
		*	$M_{b,Rd}$	338	338	338	338	338	338	338	338	338	338	338	338	338
	♦ 6.3 # $f_y W_{el,y} = 372$ $f_y W_{el,z} = 273$	*	$N_{b,y,Rd}$	2110	2110	2040	1970	1900	1830	1750	1670	1580	1500	1410	1320	1240
			$N_{b,z,Rd}$	2110	1990	1880	1760	1640	1500	1360	1230	1100	984	879	785	704
		*	$M_{b,Rd}$	357	357	357	357	357	357	357	357	357	357	357	357	357
	§ 8.0 # $f_y W_{el,y} = 463$ $f_y W_{el,z} = 338$	0.463	$N_{b,y,Rd}$	3800	3730	3570	3420	3250	3080	2900	2720	2530	2340	2160	1980	1820
			$N_{b,z,Rd}$	3700	3460	3200	2930	2640	2340	2060	1800	1570	1370	1200	1060	938
		0.463	$M_{b,Rd}$	463	463	463	463	463	463	463	463	463	463	463	463	463
		<b>0.144</b>	$M_{b,Rd}$	564	564	564	564	564	564	564	564	564	564	564	564	564
	§ 10.0 # $f_y W_{el,y} = 564$ $f_y W_{el,z} = 411$	0.720	$N_{b,y,Rd}$	4720	4630	4430	4240	4040	3820	3600	3370	3130	2900	2670	2450	2240
			$N_{b,z,Rd}$	4600	4290	3970	3630	3260	2890	2530	2210	1920	1680	1470	1290	1150
	0.720	$M_{b,Rd}$	564	564	564	564	564	564	564	564	564	564	564	564		
	<b>0.324</b>	$M_{b,Rd}$	692	692	692	692	692	692	692	692	692	692	692	692		
§ 12.0 # $f_y W_{el,y} = 649$ $f_y W_{el,z} = 473$	0.986	$N_{b,y,Rd}$	5540	5420	5190	4960	4720	4460	4200	3920	3640	3360	3090	2830	2590	
		$N_{b,z,Rd}$	5390	5020	4640	4230	3800	3360	2940	2560	2220	1940	1700	1500	1320	
	0.986	$M_{b,Rd}$	649	649	649	649	649	649	649	649	649	649	649	649		
	<b>0.515</b>	$M_{b,Rd}$	804	804	804	804	804	804	804	804	804	804	804	804		
12.5 # $f_y W_{el,y} = 671$ $f_y W_{el,z} = 489$	1.00	$N_{b,y,Rd}$	5750	5630	5390	5150	4900	4630	4360	4070	3780	3490	3210	2940	2690	
		$N_{b,z,Rd}$	5590	5220	4820	4390	3940	3490	3050	2650	2310	2010	1760	1550	1380	
	1.00	$M_{b,Rd}$	671	671	671	671	671	671	671	671	671	671	671	671		
	<b>0.562</b>	$M_{b,Rd}$	833	833	833	833	833	833	833	833	833	833	833	833		

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$$n = N_{Ed} / N_{pl,Rd}$$

\* The section is a class 4 section about the y-y axis and is independent of the design axial force  $N_{Ed}$ .

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

Axial force resistance  $N_{pl,Rd}$  which is equal to  $Af_y$  is given in the cross-section resistance check table opposite.

§ The section can be a Class 4 section but no allowance has been made in calculating  $N_{b,y,Rd}$  and  $N_{b,z,Rd}$ .

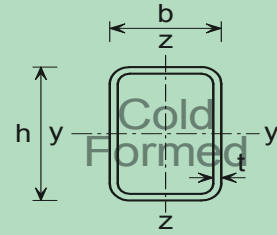
♦ For this section, resistances  $N_{b,Rd}$  and  $M_{b,Rd}$  are calculated based on class 4 section properties and are displayed in italics.

# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.

COLD-FORMED RECTANGULAR HOLLOW SECTIONS

Hybox® RHS



Cross-section resistance check

Section Designation		Mass per Metre kg/m	Axial Resistance $N_{pl,Rd}$ kN	n Limit Class 3		Moment Resistance $M_{c,y,Rd}$ , $M_{c,z,Rd}$ (kNm) and Reduced Moment Resistance $M_{N,y,Rd}$ , $M_{N,z,Rd}$ (kNm) for Ratios of Design Axial Force to Design Axial Plastic Resistance $n = N_{Ed} / N_{pl,Rd}$													
h x b mm	t mm			Class 2		n	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0		
				y-y	z-z														
500x300	6.0 #	73.5	3320	*	*	<i><math>M_{c,y,Rd}</math></i>	×	×	×	×	×	×	×	\$	\$	\$	\$		
						<i><math>M_{c,z,Rd}</math></i>	×	×	×	×	×	×	×	\$	\$	\$	\$		
						<i><math>M_{N,y,Rd}</math></i>	-	-	-	-	-	-	-	-	-	-	-	-	-
						<i><math>M_{N,z,Rd}</math></i>	-	-	-	-	-	-	-	-	-	-	-	-	-
	6.3 #	76.8	3470	*	*	<i><math>M_{c,y,Rd}</math></i>	×	×	×	×	×	×	×	\$	\$	\$	\$		
						<i><math>M_{c,z,Rd}</math></i>	×	×	×	×	×	×	×	\$	\$	\$	\$		
						<i><math>M_{N,y,Rd}</math></i>	-	-	-	-	-	-	-	-	-	-	-	-	
						<i><math>M_{N,z,Rd}</math></i>	-	-	-	-	-	-	-	-	-	-	-	-	
	8.0 #	96.7	4370	*	*	<i><math>M_{c,y,Rd}</math></i>	×	×	×	×	×	×	×	×	\$	\$	\$		
						<i><math>M_{c,z,Rd}</math></i>	×	×	×	×	×	×	×	\$	\$	\$			
						<i><math>M_{N,y,Rd}</math></i>	-	-	-	-	-	-	-	-	-	-	-		
						<i><math>M_{N,z,Rd}</math></i>	-	-	-	-	-	-	-	-	-	-	-		
	10.0 #	120	5430	0.591 <b>0.226</b>	*	<i><math>M_{c,y,Rd}</math></i>	901	901	901	743	743	743	×	×	×	\$	\$		
						<i><math>M_{c,z,Rd}</math></i>	×	×	×	×	×	×	×	×	×	\$	\$		
						<i><math>M_{N,y,Rd}</math></i>	901	901	901	-	-	-	-	-	-	-	-		
						<i><math>M_{N,z,Rd}</math></i>	-	-	-	-	-	-	-	-	-	-	-		
	12.0 #	141	6390	0.826 <b>0.390</b>	*	<i><math>M_{c,y,Rd}</math></i>	1050	1050	1050	1050	861	861	861	861	861	×	\$		
						<i><math>M_{c,z,Rd}</math></i>	×	×	×	×	×	×	×	×	×	×	\$		
						<i><math>M_{N,y,Rd}</math></i>	1050	1050	1050	981	-	-	-	-	-	-	-		
						<i><math>M_{N,z,Rd}</math></i>	-	-	-	-	-	-	-	-	-	-	-		
	12.5 #	147	6640	0.885 <b>0.431</b>	*	<i><math>M_{c,y,Rd}</math></i>	1090	1090	1090	1090	1090	891	891	891	891	×	\$		
						<i><math>M_{c,z,Rd}</math></i>	×	×	×	×	×	×	×	×	×	×	\$		
						<i><math>M_{N,y,Rd}</math></i>	1090	1090	1090	1020	872	-	-	-	-	-	-		
						<i><math>M_{N,z,Rd}</math></i>	-	-	-	-	-	-	-	-	-	-	-		

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\* The section is a Class 4 section about the appropriate axis and is independent of the design axial force  $N_{Ed}$ . Values of  $M_{c,Rd}$  are calculated based on class 4 section properties and are displayed in italics.

$N_{Ed}$  = Design value of the axial force.

$$n = N_{Ed} / N_{pl,Rd}$$

× Section becomes Class 4, see note 10.

\$ For these values of  $N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

- Not applicable for Class 3 and Class 4 sections.

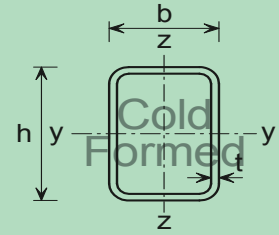
# Check availability

FOR EXPLANATION OF TABLES SEE NOTE 10.



COLD-FORMED RECTANGULAR HOLLOW SECTIONS

Hybox® RHS



Member buckling check

Section Designation & Resistances (kNm)		n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm) for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
h x b mm	t mm		L (m)	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
500x300	◆ 6.0 # $f_y W_{el,y} = 469$ $f_y W_{el,z} = 359$	*	<i><math>N_{b,y,Rd}</math></i>	2030	2030	2010	1950	1900	1840	1780	1720	1660	1590	1530	1460	1390
			<i><math>N_{b,z,Rd}</math></i>	2030	1980	1900	1820	1730	1630	1540	1440	1340	1230	1130	1040	953
		*	<i><math>M_{b,Rd}</math></i>	416	416	416	416	416	416	416	416	416	416	416	416	416
	◆ 6.3 # $f_y W_{el,y} = 488$ $f_y W_{el,z} = 373$	*	<i><math>N_{b,y,Rd}</math></i>	2200	2200	2170	2110	2050	1980	1920	1850	1780	1710	1640	1560	1480
			<i><math>N_{b,z,Rd}</math></i>	2200	2150	2050	1960	1860	1760	1650	1540	1430	1320	1210	1100	1010
		*	<i><math>M_{b,Rd}</math></i>	440	440	440	440	440	440	440	440	440	440	440	440	440
	◆ 8.0 # $f_y W_{el,y} = 608$ $f_y W_{el,z} = 464$	*	<i><math>N_{b,y,Rd}</math></i>	3320	3320	3240	3140	3030	2920	2810	2700	2580	2460	2330	2200	2070
			<i><math>N_{b,z,Rd}</math></i>	3320	3200	3040	2880	2720	2540	2350	2170	1980	1800	1630	1480	1340
		*	<i><math>M_{b,Rd}</math></i>	591	591	591	591	591	591	591	591	591	591	591	591	591
	§ 10.0 # $f_y W_{el,y} = 743$ $f_y W_{el,z} = 567$	0.591	<i><math>N_{b,y,Rd}</math></i>	5430	5400	5200	5010	4800	4590	4370	4150	3910	3670	3430	3190	2960
			<i><math>N_{b,z,Rd}</math></i>	5410	5120	4820	4510	4170	3820	3470	3120	2790	2480	2210	1980	1770
		0.226	<i><math>M_{b,Rd}</math></i>	743	743	743	743	743	743	743	743	743	743	743	743	743
	§ 12.0 # $f_y W_{el,y} = 861$ $f_y W_{el,z} = 656$	0.826	<i><math>N_{b,y,Rd}</math></i>	6390	6340	6110	5880	5630	5380	5120	4850	4570	4280	4000	3720	3450
			<i><math>N_{b,z,Rd}</math></i>	6350	6010	5660	5290	4890	4480	4050	3640	3250	2890	2580	2300	2060
		0.390	<i><math>M_{b,Rd}</math></i>	861	861	861	861	861	861	861	861	861	861	861	861	861
	§ 12.5 # $f_y W_{el,y} = 891$ $f_y W_{el,z} = 679$	0.885	<i><math>N_{b,y,Rd}</math></i>	6640	6590	6350	6100	5850	5590	5320	5040	4750	4450	4150	3860	3580
			<i><math>N_{b,z,Rd}</math></i>	6600	6240	5880	5490	5080	4650	4210	3780	3370	3010	2680	2390	2140
		0.431	<i><math>M_{b,Rd}</math></i>	891	891	891	891	891	891	891	891	891	891	891	891	891

Hybox® is a trademark of Tata Steel. A fuller description of the relationship between Cold Formed Rectangular Hollow Sections (CFRHS) and the Hybox® range of sections manufactured by Tata Steel is given in note 12.

$n = N_{Ed} / N_{pl,Rd}$

\* The section is a class 4 section about the y-y axis and is independent of the design axial force  $N_{Ed}$ .

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit. For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

Axial force resistance  $N_{pl,Rd}$  which is equal to  $Af_y$  is given in the cross-section resistance check table opposite.

§ The section can be a Class 4 section but no allowance has been made in calculating  $N_{b,y,Rd}$  and  $N_{b,z,Rd}$ .

◆ For this section, resistances  $N_{b,Rd}$  and  $M_{b,Rd}$  are calculated based on class 4 section properties and are displayed in italics.

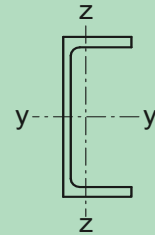
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FOR EXPLANATION OF TABLES SEE NOTE 10.



PARALLEL FLANGE CHANNEL

Advance® UKPFC



Member buckling check

Section Designation and Resistances (kN, kNm)	n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm)													
		for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
		L (m)	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0
430x100x64 $N_{pl,Rd} = 2830$ $f_y W_{el,y} = 352$ $f_y W_{el,z} = 33.8$	1.00	$N_{b,y,Rd}$	2830	2780	2660	2550	2430	2300	2170	2030	1890	1750	1610	1480	1360
		$N_{b,z,Rd}$	1750	1100	704	481	348	263	205	164	135	113	95.3	81.7	70.9
	1.00 <b>0.443</b>	$M_{b,Rd}$	275	213	171	143	122	108	96.0	86.8	79.4	73.1	67.9	63.3	59.4
		$M_{b,Rd}$	310	233	183	151	129	113	100	90.2	82.2	75.6	70.1	65.3	61.2
380x100x54 $N_{pl,Rd} = 2370$ $f_y W_{el,y} = 273$ $f_y W_{el,z} = 30.8$	1.00	$N_{b,y,Rd}$	2370	2300	2190	2080	1970	1850	1720	1590	1460	1340	1220	1110	1010
		$N_{b,z,Rd}$	1500	957	619	424	307	232	181	146	119	99.6	84.4	72.4	62.8
	1.00 <b>0.392</b>	$M_{b,Rd}$	215	167	135	113	97.0	85.3	76.3	69.1	63.2	58.3	54.1	50.5	47.4
		$M_{b,Rd}$	239	181	144	119	102	89.0	79.3	71.6	65.3	60.1	55.7	52.0	48.7
300x100x46 $N_{pl,Rd} = 2000$ $f_y W_{el,y} = 189$ $f_y W_{el,z} = 28.2$	1.00	$N_{b,y,Rd}$	1980	1870	1760	1640	1510	1380	1240	1110	986	875	777	692	618
		$N_{b,z,Rd}$	1290	834	542	373	270	204	160	128	105	87.8	74.4	63.9	55.4
	1.00	$M_{b,Rd}$	169	132	108	91.1	79.0	69.9	62.8	57.0	52.3	48.3	45.0	42.0	39.5
300x90x41 $N_{pl,Rd} = 1870$ $f_y W_{el,y} = 171$ $f_y W_{el,z} = 22.4$	1.00	$N_{b,y,Rd}$	1850	1740	1630	1510	1390	1260	1130	1000	887	785	695	617	550
		$N_{b,z,Rd}$	1070	641	404	274	197	149	116	92.7	75.9	63.3	53.6	45.9	39.8
	1.00	$M_{b,Rd}$	142	108	86.4	72.2	62.2	54.7	49.0	44.4	40.6	37.4	34.7	32.4	30.4
260x90x35 $N_{pl,Rd} = 1580$ $f_y W_{el,y} = 129$ $f_y W_{el,z} = 20.0$	1.00	$N_{b,y,Rd}$	1530	1430	1320	1200	1080	956	836	727	633	552	483	426	377
		$N_{b,z,Rd}$	918	555	351	238	172	129	101	80.8	66.2	55.2	46.7	40.1	34.7
	1.00	$M_{b,Rd}$	107	82.3	66.4	55.8	48.2	42.6	38.1	34.6	31.7	29.2	27.2	25.4	23.8
260x75x28 $N_{pl,Rd} = 1250$ $f_y W_{el,y} = 98.7$ $f_y W_{el,z} = 12.2$	1.00	$N_{b,y,Rd}$	1210	1130	1040	943	843	742	647	561	487	424	370	326	288
		$N_{b,z,Rd}$	579	319	195	131	93.3	69.9	54.3	43.4	35.4	29.5	24.9	21.4	18.5
	1.00	$M_{b,Rd}$	71.0	51.7	40.5	33.5	28.6	25.1	22.3	20.1	18.4	16.9	15.7	14.6	13.7
230x90x32 $N_{pl,Rd} = 1460$ $f_y W_{el,y} = 109$ $f_y W_{el,z} = 19.5$	1.00	$N_{b,y,Rd}$	1390	1290	1170	1050	921	796	682	584	502	434	377	330	291
		$N_{b,z,Rd}$	859	523	332	226	163	123	95.6	76.6	62.8	52.4	44.3	38.0	33.0
	1.00	$M_{b,Rd}$	91.7	71.7	58.8	49.9	43.5	38.6	34.7	31.6	29.0	26.8	25.0	23.3	21.9
230x75x26 $N_{pl,Rd} = 1160$ $f_y W_{el,y} = 84.8$ $f_y W_{el,z} = 12.4$	1.00	$N_{b,y,Rd}$	1110	1020	932	831	728	627	537	459	394	340	296	259	228
		$N_{b,z,Rd}$	554	308	189	126	90.4	67.8	52.7	42.1	34.4	28.7	24.2	20.8	18.0
	1.00	$M_{b,Rd}$	62.7	47.0	37.6	31.4	27.1	23.9	21.4	19.3	17.7	16.3	15.1	14.1	13.3

Advance® and UKPFC are trademarks of Tata Steel. A fuller description of the relationship between Parallel Flange Channels and the Advance® range of sections manufactured by Tata Steel is given in note 12.

$$n = N_{Ed} / N_{pl,Rd}$$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit.

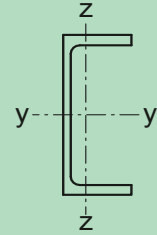
For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

FOR EXPLANATION OF TABLES SEE NOTE 10.



PARALLEL FLANGE CHANNEL

Advance® UKPFC



Member buckling check

Section Designation and Resistances (kN, kNm)	n Limit	Compression Resistance $N_{b,y,Rd}$ , $N_{b,z,Rd}$ (kN) and Buckling Resistance Moment $M_{b,Rd}$ (kNm)													
		for Varying buckling lengths L (m) within the limiting value of $n = N_{Ed} / N_{pl,Rd}$													
		L (m)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	5.0	6.0	7.0	8.0	9.0	10.0
200x90x30 $N_{pl,Rd} = 1350$ $f_y W_{el,y} = 89.5$ $f_y W_{el,z} = 19.0$	1.00	$N_{b,y,Rd}$	1350	1320	1260	1210	1150	1090	1020	889	756	635	533	449	381
		$N_{b,z,Rd}$	1170	990	800	626	489	386	310	211	152	115	89.6	71.8	58.8
	1.00	$M_{b,Rd}$	102	88.1	77.3	68.7	61.9	56.3	51.6	44.4	39.0	34.8	31.5	28.7	26.4
200x75x23 $N_{pl,Rd} = 1060$ $f_y W_{el,y} = 69.6$ $f_y W_{el,z} = 12.0$	1.00	$N_{b,y,Rd}$	1060	1040	995	950	904	856	805	698	593	497	417	351	298
		$N_{b,z,Rd}$	866	689	517	383	289	224	178	119	85.3	64.0	49.7	39.8	32.5
	1.00	$M_{b,Rd}$	74.3	62.1	53.0	46.1	40.8	36.6	33.2	28.1	24.4	21.6	19.4	17.6	16.1
180x90x26 $N_{pl,Rd} = 1180$ $f_y W_{el,y} = 71.7$ $f_y W_{el,z} = 16.8$	1.00	$N_{b,y,Rd}$	1180	1140	1090	1030	973	912	849	718	595	490	405	338	285
		$N_{b,z,Rd}$	1020	869	703	551	430	340	273	186	134	101	79.0	63.3	51.8
	1.00	$M_{b,Rd}$	81.3	70.2	61.6	54.8	49.4	44.9	41.2	35.5	31.2	27.8	25.1	23.0	21.1
180x75x20 $N_{pl,Rd} = 919$ $f_y W_{el,y} = 54.0$ $f_y W_{el,z} = 10.2$	1.00	$N_{b,y,Rd}$	919	887	844	800	754	706	655	551	455	373	308	256	216
		$N_{b,z,Rd}$	749	594	445	330	249	193	153	103	73.3	55.0	42.7	34.2	27.9
	1.00	$M_{b,Rd}$	57.5	48.0	40.8	35.4	31.2	28.0	25.3	21.4	18.5	16.4	14.7	13.4	12.2
150x90x24 $N_{pl,Rd} = 1080$ $f_y W_{el,y} = 55.0$ $f_y W_{el,z} = 15.8$	1.00	$N_{b,y,Rd}$	1070	1010	955	892	825	754	683	547	433	346	280	230	192
		$N_{b,z,Rd}$	938	796	643	504	394	311	250	170	123	92.7	72.3	58.0	47.5
	1.00	$M_{b,Rd}$	63.1	55.2	49.1	44.2	40.3	37.0	34.3	29.8	26.4	23.8	21.6	19.8	18.3
150x75x18 $N_{pl,Rd} = 809$ $f_y W_{el,y} = 40.8$ $f_y W_{el,z} = 9.44$	1.00	$N_{b,y,Rd}$	804	760	715	668	617	564	510	408	323	257	208	171	143
		$N_{b,z,Rd}$	661	527	396	294	222	172	137	91.6	65.6	49.2	38.2	30.6	25.0
	1.00	$M_{b,Rd}$	43.5	36.8	31.8	27.9	24.9	22.5	20.6	17.5	15.3	13.6	12.3	11.2	10.3
125x65x15 $N_{pl,Rd} = 667$ $f_y W_{el,y} = 27.4$ $f_y W_{el,z} = 6.67$	1.00	$N_{b,y,Rd}$	648	603	556	506	453	399	348	262	200	155	124	101	83.4
		$N_{b,z,Rd}$	510	379	268	192	142	109	85.8	57.1	40.6	30.4	23.6	18.8	15.4
	1.00	$M_{b,Rd}$	28.5	24.1	21.0	18.6	16.7	15.1	13.9	11.9	10.4	9.27	8.37	7.63	7.01
100x50x10 $N_{pl,Rd} = 462$ $f_y W_{el,y} = 14.7$ $f_y W_{el,z} = 3.51$	1.00	$N_{b,y,Rd}$	432	391	347	300	254	213	178	127	93.5	71.5	56.3	45.4	37.4
		$N_{b,z,Rd}$	297	191	124	85.2	61.8	46.7	36.5	24.0	17.0	12.7	9.79	7.79	6.35
	1.00	$M_{b,Rd}$	14.3	12.0	10.3	9.11	8.14	7.37	6.73	5.75	5.02	4.46	4.02	3.66	3.36

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$$n = N_{Ed} / N_{pl,Rd}$$

Under combined axial compression and bending the resistances are only valid up to the given  $N_{Ed} / N_{pl,Rd}$  limit.

For higher values of  $n = N_{Ed} / N_{pl,Rd}$  the section would be overloaded due to  $N_{Ed}$  alone even when  $M_{Ed}$  is zero, because  $N_{Ed}$  would exceed the local buckling resistance of the section.

FOR EXPLANATION OF TABLES SEE NOTE 10.

## Non Preloaded bolts

### Property Class 4.6 hexagon head bolts

Diameter of Bolt d mm	Tensile Stress Area $A_s$ mm <sup>2</sup>	Tension Resistance $F_{t,Rd}$ kN	Shear Resistance		Bolts in tension Min thickness for punching shear $t_{min}$ mm
			Single Shear $F_{v,Rd}$ kN	Double Shear $2 \times F_{v,Rd}$ kN	
12	84.3	24.3	16.2	32.4	1.8
16	157	45.2	30.1	60.3	2.7
20	245	70.6	47.0	94.1	3.4
24	353	102	67.8	136	4.1
30	561	162	108	215	5.1

Diameter of Bolt d mm	Minimum				Bearing Resistance (kN)										
	Edge distance $e_2$ mm	End distance $e_1$ mm	Pitch $p_1$ mm	Gauge $p_2$ mm	Thickness in mm of ply, t.										
	5	6	7	8	9	10	12	15	20	25	30				
12	20	25	35	40	30.3	36.3	42.4	48.4	54.5	60.5	72.6	90.8	121	151	182
16	25	35	50	50	42.7	51.2	59.7	68.3	76.8	85.4	102	128	171	213	256
20	30	40	60	60	48.3	57.9	67.6	77.2	86.9	96.5	116	145	193	241	290
24	35	50	70	70	<b>59.8</b>	71.8	83.8	95.8	108	120	144	180	239	299	359
30	45	60	85	90	<b>72.4</b>	<b>86.9</b>	<b>101</b>	116	130	145	174	217	290	362	434

See clause 3.7(1) of BS EN 1993-1-8: 2005 for calculation of the design resistance of a group of fasteners.

Values of bearing resistance in **bold** are less than the single shear resistance of the bolt.

Values of bearing resistance in *italic* are greater than the double shear resistance of the bolt.

Bearing values assume standard clearance holes.

If oversize or short slotted holes are used, bearing values should be multiplied by 0.8.

If long slotted or kidney shaped holes are used, bearing values should be multiplied by 0.6.

In single lap joints with only one bolt row, the design bearing resistance for each bolt should be limited to  $1.5f_u d t / \gamma_{M2}$

FOR EXPLANATION OF TABLES SEE NOTE 11.

## Non Preloaded bolts

### Property Class 8.8 hexagon head bolts

Diameter of Bolt d mm	Tensile Stress Area $A_s$ mm <sup>2</sup>	Tension Resistance $F_{t,Rd}$ kN	Shear Resistance		Bolts in tension Min thickness for punching shear $t_{min}$ mm
			Single Shear $F_{v,Rd}$ kN	Double Shear $2 \times F_{v,Rd}$ kN	
12	84.3	48.6	27.5	55.0	3.7
16	157	90.4	60.3	121	5.5
20	245	141	94.1	188	6.8
24	353	203	136	271	8.2
30	561	323	215	431	10.1

Diameter of Bolt d mm	Minimum				Bearing Resistance (kN)										
	Edge distance $e_2$ mm	End distance $e_1$ mm	Pitch $p_1$ mm	Gauge $p_2$ mm	Thickness in mm of ply, t.										
	5	6	7	8	9	10	12	15	20	25	30				
12	20	25	35	40	30.3	36.3	42.4	48.4	54.5	60.5	72.6	90.8	121	151	182
16	25	35	50	50	<b>42.7</b>	<b>51.2</b>	<b>59.7</b>	68.3	76.8	85.4	102	128	171	213	256
20	30	40	60	60	<b>48.3</b>	<b>57.9</b>	<b>67.6</b>	<b>77.2</b>	<b>86.9</b>	96.5	116	145	193	241	290
24	35	50	70	70	<b>59.8</b>	<b>71.8</b>	<b>83.8</b>	<b>95.8</b>	<b>108</b>	<b>120</b>	144	180	239	299	359
30	45	60	85	90	<b>72.4</b>	<b>86.9</b>	<b>101</b>	<b>116</b>	<b>130</b>	<b>145</b>	<b>174</b>	217	290	362	434

Diameter of Bolt d mm	Minimum				Bearing Resistance (kN)										
	Edge distance $e_2$ mm	End distance $e_1$ mm	Pitch $p_1$ mm	Gauge $p_2$ mm	Thickness in mm of ply, t.										
	5	6	7	8	9	10	12	15	20	25	30				
12	25	40	50	45	53.0	63.7	74.3	84.9	95.5	106	127	159	212	265	318
16	30	50	65	55	69.6	83.6	97.5	111	125	139	167	209	279	348	418
20	35	60	80	70	<b>85.5</b>	103	120	137	154	171	205	256	342	427	513
24	40	75	95	80	<b>108</b>	<b>130</b>	152	174	195	217	260	325	434	542	651
30	50	90	115	100	<b>128</b>	<b>154</b>	<b>179</b>	<b>205</b>	231	256	308	385	513	641	769

For M12 bolts the design shear resistance  $F_{v,Rd}$  has been calculated as 0.85 times the value given in BS EN 1993-1-8, Table 3.4 (§3.6.1(5))

See clause 3.7(1) of BS EN 1993-1-8: 2005 for calculation of the design resistance of a group of fasteners.

Values of bearing resistance in **bold** are less than the single shear resistance of the bolt.

Values of bearing resistance in *italic* are greater than the double shear resistance of the bolt.

Bearing values assume standard clearance holes.

If oversize or short slotted holes are used, bearing values should be multiplied by 0.8.

If long slotted or kidney shaped holes are used, bearing values should be multiplied by 0.6.

In single lap joints with only one bolt row, the design bearing resistance for each bolt should be limited to  $1.5f_u d t/\gamma_{M2}$

FOR EXPLANATION OF TABLES SEE NOTE 11.

## Non Preloaded bolts

### Property Class 10.9 hexagon head bolts

Diameter of Bolt d mm	Tensile Stress Area $A_s$ mm <sup>2</sup>	Tension Resistance $F_{t,Rd}$ kN	Shear Resistance		Bolts in tension Min thickness for punching shear $t_{min}$ mm
			Single Shear $F_{v,Rd}$ kN	Double Shear $2 \times F_{v,Rd}$ kN	
12	84.3	60.7	28.7	57.3	4.6
16	157	113	62.8	126	6.9
20	245	176	98.0	196	8.5
24	353	254	141	282	10.2
30	561	404	224	449	12.6

Diameter of Bolt d mm	Minimum				Bearing Resistance (kN)										
	Edge distance $e_2$ mm	End distance $e_1$ mm	Pitch $p_1$ mm	Gauge $p_2$ mm	Thickness in mm of ply, t.										
	5	6	7	8	9	10	12	15	20	25	30				
12	20	25	35	40	30.3	36.3	42.4	48.4	54.5	60.5	72.6	90.8	121	151	182
16	25	35	50	50	<b>42.7</b>	<b>51.2</b>	<b>59.7</b>	68.3	76.8	85.4	102	128	171	213	256
20	30	40	60	60	<b>48.3</b>	<b>57.9</b>	<b>67.6</b>	<b>77.2</b>	<b>86.9</b>	<b>96.5</b>	116	145	193	241	290
24	35	50	70	70	<b>59.8</b>	<b>71.8</b>	<b>83.8</b>	<b>95.8</b>	<b>108</b>	<b>120</b>	144	180	239	299	359
30	45	60	85	90	<b>72.4</b>	<b>86.9</b>	<b>101</b>	<b>116</b>	<b>130</b>	<b>145</b>	<b>174</b>	<b>217</b>	290	362	434

Diameter of Bolt d mm	Minimum				Bearing Resistance (kN)										
	Edge distance $e_2$ mm	End distance $e_1$ mm	Pitch $p_1$ mm	Gauge $p_2$ mm	Thickness in mm of ply, t.										
	5	6	7	8	9	10	12	15	20	25	30				
12	25	40	50	45	53	63.7	74.3	84.9	95.5	106	127	159	212	265	318
16	30	50	65	55	69.6	83.6	97.5	111	125	139	167	209	279	348	418
20	35	60	80	70	<b>85.5</b>	103	120	137	154	171	205	256	342	427	513
24	40	75	95	80	<b>108</b>	<b>130</b>	152	174	195	217	260	325	434	542	651
30	50	90	115	100	<b>128</b>	<b>154</b>	<b>179</b>	<b>205</b>	231	256	308	385	513	641	769

For M12 bolts the design shear resistance  $F_{v,Rd}$  has been calculated as 0.85 times the value given in BS EN 1993-1-8, Table 3.4 (§3.6.1(5))

See clause 3.7(1) of BS EN 1993-1-8: 2005 for calculation of the design resistance of a group of fasteners.

Values of bearing resistance in **bold** are less than the single shear resistance of the bolt.

Values of bearing resistance in *italic* are greater than the double shear resistance of the bolt.

Bearing values assume standard clearance holes.

If oversize or short slotted holes are used, bearing values should be multiplied by 0.8.

If long slotted or kidney shaped holes are used, bearing values should be multiplied by 0.6.

In single lap joints with only one bolt row, the design bearing resistance for each bolt should be limited to  $1.5f_u d t/\gamma_{M2}$

FOR EXPLANATION OF TABLES SEE NOTE 11.



## Non Preloaded bolts

### Property Class 4.6 countersunk bolts

Diameter of Bolt	Tensile Stress Area	Tension Resistance	Shear Resistance		Bolts in tension
			Single Shear	Double Shear	
d mm	A <sub>s</sub> mm <sup>2</sup>	F <sub>t,Rd</sub> kN	F <sub>v,Rd</sub> kN	2 x F <sub>v,Rd</sub> kN	Min thickness for punching shear t <sub>min</sub> mm
12	84.3	17.0	16.2	32.4	1.3
16	157	31.7	30.1	60.3	1.9
20	245	49.4	47.0	94.1	2.4
24	353	71.2	67.8	136	2.9
30	561	113	108	215	3.5

Diameter of Bolt	Minimum				Bearing Resistance (kN)										
	Edge distance	End distance	Pitch	Gauge	Thickness in mm of ply, t.										
d mm	e <sub>2</sub> mm	e <sub>1</sub> mm	p <sub>1</sub> mm	p <sub>2</sub> mm	5	6	7	8	9	10	12	15	20	25	30
12	20	25	35	40	<b>12.1</b>	18.2	24.2	30.3	36.3	42.4	54.5	72.6	103	133	163
16	25	35	50	50	<b>8.5</b>	<b>17.1</b>	<b>25.6</b>	34.1	42.7	51.2	68.3	93.9	137	179	222
20	30	40	60	60	<b>0</b>	<b>9.7</b>	<b>19.3</b>	<b>29.0</b>	<b>38.6</b>	48.3	67.6	96.5	145	193	241
24	35	50	70	70	<b>0</b>	<b>0</b>	<b>12.0</b>	<b>23.9</b>	<b>35.9</b>	<b>47.9</b>	71.8	108	168	227	287
30	45	60	85	90	<b>0</b>	<b>0</b>	<b>0</b>	<b>7.2</b>	<b>21.7</b>	<b>36.2</b>	<b>65.2</b>	109	181	253	326

See clause 3.7(1) of BS EN 1993-1-8: 2005 for calculation of the design resistance of a group of fasteners.

Values of bearing resistance in **bold** are less than the single shear resistance of the bolt.

Values of bearing resistance in *italic* are greater than the double shear resistance of the bolt.

Bearing values assume standard clearance holes.

If oversize or short slotted holes are used, bearing values should be multiplied by 0.8.

If long slotted or kidney shaped holes are used, bearing values should be multiplied by 0.6.

In single lap joints with only one bolt row, the design bearing resistance for each bolt should be limited to  $1.5f_u d t/\gamma_{M2}$

FOR EXPLANATION OF TABLES SEE NOTE 11

Non Preloaded bolts

Property Class 8.8 countersunk bolts

Diameter of Bolt d mm	Tensile Stress Area $A_s$ mm <sup>2</sup>	Tension Resistance $F_{t,Rd}$ kN	Shear Resistance		Bolts in tension Min thickness for punching shear $t_{min}$ mm
			Single Shear $F_{v,Rd}$ kN	Double Shear $2 \times F_{v,Rd}$ kN	
12	84.3	34.0	27.5	55.0	2.6
16	157	63.3	60.3	121	3.8
20	245	98.8	94.1	188	4.8
24	353	142	136	271	5.7
30	561	226	215	431	7.1

Diameter of Bolt d mm	Minimum				Bearing Resistance (kN)										
	Edge distance $e_2$ mm	End distance $e_1$ mm	Pitch $p_1$ mm	Gauge $p_2$ mm	Thickness in mm of ply, t.										
	5	6	7	8	9	10	12	15	20	25	30				
12	20	25	35	40	<b>12.1</b>	<b>18.2</b>	<b>24.2</b>	30.3	36.3	42.4	54.5	72.6	103	133	163
16	25	35	50	50	<b>8.5</b>	<b>17.1</b>	<b>25.6</b>	<b>34.1</b>	<b>42.7</b>	<b>51.2</b>	68.3	93.9	137	179	222
20	30	40	60	60	<b>0</b>	<b>9.7</b>	<b>19.3</b>	<b>29.0</b>	<b>38.6</b>	<b>48.3</b>	<b>67.6</b>	96.5	145	193	241
24	35	50	70	70	<b>0</b>	<b>0</b>	<b>12.0</b>	<b>23.9</b>	<b>35.9</b>	<b>47.9</b>	<b>71.8</b>	<b>108</b>	168	227	287
30	45	60	85	90	<b>0</b>	<b>0</b>	<b>0</b>	<b>7.2</b>	<b>21.7</b>	<b>36.2</b>	<b>65.2</b>	<b>109</b>	<b>181</b>	253	326

Diameter of Bolt d mm	Minimum				Bearing Resistance (kN)										
	Edge distance $e_2$ mm	End distance $e_1$ mm	Pitch $p_1$ mm	Gauge $p_2$ mm	Thickness in mm of ply, t.										
	5	6	7	8	9	10	12	15	20	25	30				
12	25	40	50	45	<b>21.2</b>	31.8	42.4	53.0	63.7	74.3	95.5	127	180	233	286
16	30	50	65	55	<b>13.9</b>	<b>27.9</b>	<b>41.8</b>	<b>55.7</b>	69.6	83.6	111	153	223	292	362
20	35	60	80	70	<b>0</b>	<b>17.1</b>	<b>34.2</b>	<b>51.3</b>	<b>68.4</b>	<b>85.5</b>	120	171	256	342	427
24	40	75	95	80	<b>0</b>	<b>0</b>	<b>21.7</b>	<b>43.4</b>	<b>65.1</b>	<b>86.8</b>	<b>130</b>	195	304	412	521
30	50	90	115	100	<b>0</b>	<b>0</b>	<b>0</b>	<b>12.8</b>	<b>38.5</b>	<b>64.1</b>	<b>115</b>	<b>192</b>	320	449	577

For M12 bolts the design shear resistance  $F_{v,Rd}$  has been calculated as 0.85 times the value given in BS EN 1993-1-8, Table 3.4 (§3.6.1(5))

See clause 3.7(1) of BS EN 1993-1-8: 2005 for calculation of the design resistance of a group of fasteners.

Values of bearing resistance in **bold** are less than the single shear resistance of the bolt.

Values of bearing resistance in *italic* are greater than the double shear resistance of the bolt.

Bearing values assume standard clearance holes.

If oversize or short slotted holes are used, bearing values should be multiplied by 0.8.

If long slotted or kidney shaped holes are used, bearing values should be multiplied by 0.6.

In single lap joints with only one bolt row, the design bearing resistance for each bolt should be limited to  $1.5f_u d t/\gamma_{M2}$

FOR EXPLANATION OF TABLES SEE NOTE 11

Non Preloaded bolts

Property Class 10.9 countersunk bolts

Diameter of Bolt d mm	Tensile Stress Area $A_s$ mm <sup>2</sup>	Tension Resistance $F_{t,Rd}$ kN	Shear Resistance		Bolts in tension Min thickness for punching shear $t_{min}$ mm
			Single Shear $F_{v,Rd}$ kN	Double Shear $2 \times F_{v,Rd}$ kN	
12	84.3	42.5	28.7	57.3	3.2
16	157	79.1	62.8	126	4.8
20	245	123	98.0	196	6.0
24	353	178	141	282	7.2
30	561	283	224	449	8.9

Diameter of Bolt d mm	Minimum				Bearing Resistance (kN)										
	Edge distance $e_2$ mm	End distance $e_1$ mm	Pitch $p_1$ mm	Gauge $p_2$ mm	Thickness in mm of ply, t.										
	5	6	7	8	9	10	12	15	20	25	30				
12	20	25	35	40	<b>12.1</b>	<b>18.2</b>	<b>24.2</b>	30.3	36.3	42.4	54.5	72.6	103	133	163
16	25	35	50	50	<b>8.5</b>	<b>17.1</b>	<b>25.6</b>	<b>34.1</b>	<b>42.7</b>	<b>51.2</b>	68.3	93.9	137	179	222
20	30	40	60	60	<b>0</b>	<b>9.7</b>	<b>19.3</b>	<b>29.0</b>	<b>38.6</b>	<b>48.3</b>	<b>67.6</b>	<b>96.5</b>	145	193	241
24	35	50	70	70	<b>0</b>	<b>0</b>	<b>12.0</b>	<b>23.9</b>	<b>35.9</b>	<b>47.9</b>	<b>71.8</b>	<b>108</b>	168	227	287
30	45	60	85	90	<b>0</b>	<b>0</b>	<b>0</b>	<b>7.2</b>	<b>21.7</b>	<b>36.2</b>	<b>65.2</b>	<b>109</b>	<b>181</b>	253	326

Diameter of Bolt d mm	Minimum				Bearing Resistance (kN)										
	Edge distance $e_2$ mm	End distance $e_1$ mm	Pitch $p_1$ mm	Gauge $p_2$ mm	Thickness in mm of ply, t.										
	5	6	7	8	9	10	12	15	20	25	30				
12	25	40	50	45	<b>21.2</b>	31.8	42.4	53.0	63.7	74.3	95.5	127	180	233	286
16	30	50	65	55	<b>13.9</b>	<b>27.9</b>	<b>41.8</b>	<b>55.7</b>	69.6	83.6	111	153	223	292	362
20	35	60	80	70	<b>0</b>	<b>17.1</b>	<b>34.2</b>	<b>51.3</b>	<b>68.4</b>	<b>85.5</b>	120	171	256	342	427
24	40	75	95	80	<b>0</b>	<b>0</b>	<b>21.7</b>	<b>43.4</b>	<b>65.1</b>	<b>86.8</b>	<b>130</b>	195	304	412	521
30	50	90	115	100	<b>0</b>	<b>0</b>	<b>0</b>	<b>12.8</b>	<b>38.5</b>	<b>64.1</b>	<b>115</b>	<b>192</b>	320	449	577

For M12 bolts the design shear resistance  $F_{v,Rd}$  has been calculated as 0.85 times the value given in BS EN 1993-1-8, Table 3.4 (§3.6.1(5))

See clause 3.7(1) of BS EN 1993-1-8: 2005 for calculation of the design resistance of a group of fasteners.

Values of bearing resistance in **bold** are less than the single shear resistance of the bolt.

Values of bearing resistance in *italic* are greater than the double shear resistance of the bolt.

Bearing values assume standard clearance holes.

If oversize or short slotted holes are used, bearing values should be multiplied by 0.8.

If long slotted or kidney shaped holes are used, bearing values should be multiplied by 0.6.

In single lap joints with only one bolt row, the design bearing resistance for each bolt should be limited to  $1.5f_u d t/\gamma_{M2}$

FOR EXPLANATION OF TABLES SEE NOTE 11

Preloaded bolts at serviceability limit state (Category B)

Property Class 8.8 hexagon head bolts

Diameter of Bolt $d$ mm	Tensile Stress Area $A_s$ mm <sup>2</sup>	Shear Resistance		Slip resistance, $F_{s,Rd,ser}$							
		Single Shear $F_{v,Rd}$ kN	Double Shear $2 \times F_{v,Rd}$ kN	$\mu = 0.2$		$\mu = 0.3$		$\mu = 0.4$		$\mu = 0.5$	
				Single Shear kN	Double Shear kN	Single Shear kN	Double Shear kN	Single Shear kN	Double Shear kN	Single Shear kN	Double Shear kN
12	84.3	27.5	55.0	8.6	17.2	12.9	25.7	17.2	34.3	21.5	42.9
16	157	60.3	121	16.0	32.0	24.0	48.0	32.0	63.9	40.0	79.9
20	245	94.1	188	24.9	49.9	37.4	74.8	49.9	100	62.4	125
24	353	136	271	35.9	71.9	53.9	108	71.9	144	89.9	180
30	561	215	431	57.1	114	85.7	171	114	228	143	286

Bearing resistances may be taken from the tables for non-preloaded bolts

For M12 bolts the design shear resistance  $F_{v,Rd}$  has been calculated as 0.85 times the value given in BS EN 1993-1-8, Table 3.4 (§3.6.1(5))

See clause 3.7(1) of BS EN 1993-1-8: 2005 for calculation of the design resistance of a group of fasteners.

The shear resistances are ULS values

The slip resistances are SLS values

Values have been calculated assuming  $k_s=1$ . See BS EN 1993-1-8, section 3.9 for other values of  $k_s$ .

Preloaded bolts in tension (Category E)

Property Class 8.8 hexagon head bolts

Diameter of bolt $d$ mm	Tensile Stress Area $A_s$ mm <sup>2</sup>	Tension Resistance $F_{t,Rd}$ kN	Min. thickness for punching shear $t_{min}$ mm
12	84.3	48.6	3.2
16	157	90.4	4.7
20	245	141	6.2
24	353	203	7.0
30	561	323	9.1

The minimum thickness is such that the design punching shear resistance  $B_{p,Rd}$  is equal to the design tension resistance  $F_{t,Rd}$ .

FOR EXPLANATION OF TABLES SEE NOTE 11

Preloaded bolts at serviceability limit state (Category B)

Property Class 10.9 hexagon head bolts

Diameter of Bolt  $d$ mm	Tensile Stress Area  $A_s$ mm <sup>2</sup>	Shear Resistance		Slip resistance, $F_{s,Rd,ser}$							
		Single Shear  $F_{v,Rd}$ kN	Double Shear  $2 \times F_{v,Rd}$ kN	$\mu = 0.2$		$\mu = 0.3$		$\mu = 0.4$		$\mu = 0.5$	
				Single	Double	Single	Double	Single	Double	Single	Double
				Shear	Shear	Shear	Shear	Shear	Shear	Shear	Shear
16	157	62.8	126	20.0	40.0	30.0	59.9	40.0	79.9	50.0	99.9
20	245	98.0	196	31.2	62.4	46.8	93.5	62.4	125	78.0	156
24	353	141	282	44.9	89.9	67.4	135	89.9	180	112	225
30	561	224	449	71.4	143	107	214	143	286	179	357

Bearing resistances may be taken from the tables for non-preloaded bolts

For M12 bolts the design shear resistance  $F_{v,Rd}$  has been calculated as 0.85 times the value given in BS EN 1993-1-8, Table 3.4 (§3.6.1(5))

See clause 3.7(1) of BS EN 1993-1-8: 2005 for calculation of the design resistance of a group of fasteners.

The shear resistances are ULS values

The slip resistances are SLS values

Values have been calculated assuming  $k_s=1$ . See BS EN 1993-1-8, section 3.9 for other values of  $k_s$ .

Preloaded bolts in tension (Category E)

Property Class 10.9 hexagon head bolts

Diameter of bolt  $d$ mm	Tensile Stress Area  $A_s$ mm <sup>2</sup>	Tension Resistance  $F_{t,Rd}$ kN	Min. thickness for punching shear  $t_{min}$ mm
16	157	113	5.9
20	245	176	7.8
24	353	254	8.7
30	561	404	11.4

The minimum thickness is such that the design punching shear resistance  $B_{p,Rd}$  is equal to the design tension resistance  $F_{t,Rd}$ .

FOR EXPLANATION OF TABLES SEE NOTE 11

Preloaded bolts at ultimate limit state (Category C)

Property Class 8.8 hexagon head bolts

Diameter of Bolt $d$ mm	Tensile Stress Area $A_s$ mm <sup>2</sup>	Slip Resistance							
		$\mu = 0.2$		$\mu = 0.3$		$\mu = 0.4$		$\mu = 0.5$	
		Single Shear kN	Double Shear kN	Single Shear kN	Double Shear kN	Single Shear kN	Double Shear kN	Single Shear kN	Double Shear kN
12	84.3	7.55	15.1	11.3	22.7	15.1	30.2	18.9	37.8
16	157	14.1	28.1	21.1	42.2	28.1	56.3	35.2	70.3
20	245	22.0	43.9	32.9	65.9	43.9	87.8	54.9	110
24	353	31.6	63.3	47.4	94.9	63.3	127	79.1	158
30	561	50.3	101	75.4	151	101	201	126	251

Bearing resistances may be taken from the tables for non-preloaded bolts

Shear resistances may be taken from the tables for Category B joints

FOR EXPLANATION OF TABLES SEE NOTE 11

Preloaded bolts at ultimate limit state (Category C)

Property Class 10.9 hexagon head bolts

Diameter of Bolt $d$ mm	Tensile Stress Area $A_s$ mm <sup>2</sup>	Slip Resistance							
		$\mu = 0.2$		$\mu = 0.3$		$\mu = 0.4$		$\mu = 0.5$	
		Single Shear kN	Double Shear kN	Single Shear kN	Double Shear kN	Single Shear kN	Double Shear kN	Single Shear kN	Double Shear kN
16	157	17.6	35.2	26.4	52.8	35.2	70.3	44.0	87.9
20	245	27.4	54.9	41.2	82.3	54.9	110	68.6	137
24	353	39.5	79.1	59.3	119	79.1	158	98.8	198
30	561	62.8	126	94.2	188	126	251	157	314

Bearing resistances may be taken from the tables for non-preloaded bolts

Shear resistances may be taken from the tables for Category B joints

FOR EXPLANATION OF TABLES SEE NOTE 11

Preloaded bolts at serviceability limit state (Category B)

Property Class 8.8 countersunk bolts

Diameter of Bolt  $d$ mm	Tensile Stress Area  $A_s$ mm <sup>2</sup>	Shear Resistance		Slip resistance, $F_{s,Rd,ser}$							
		Single Shear  $F_{v,Rd}$ kN	Double Shear  $2 \times F_{v,Rd}$ kN	$\mu = 0.2$		$\mu = 0.3$		$\mu = 0.4$		$\mu = 0.5$	
				Single Shear kN	Double Shear kN	Single Shear kN	Double Shear kN	Single Shear kN	Double Shear kN	Single Shear kN	Double Shear kN
12	84.3	27.5	55.0	8.6	17.2	12.9	25.7	17.2	34.3	21.5	42.9
16	157	60.3	121	16.0	32.0	24.0	48.0	32.0	63.9	40.0	79.9
20	245	94.1	188	24.9	49.9	37.4	74.8	49.9	100	62.4	125
24	353	136	271	35.9	71.9	53.9	108	71.9	144	89.9	180
30	561	215	431	57.1	114	85.7	171	114	228	143	286

Bearing resistances may be taken from the tables for non-preloaded countersunk bolts

For M12 bolts the design shear resistance  $F_{v,Rd}$  has been calculated as 0.85 times the value given in BS EN 1993-1-8, Table 3.4 (§3.6.1(5))

See clause 3.7(1) of BS EN 1993-1-8: 2005 for calculation of the design resistance of a group of fasteners.

The shear resistances are ULS values

The slip resistances are SLS values

Values have been calculated assuming  $k_s=1$ . See BS EN 1993-1-8, section 3.9 for other values of  $k_s$ .

Preloaded bolts in tension (Category E)

Property Class 8.8 countersunk bolts

Diameter of bolt  $d$ mm	Tensile Stress Area  $A_s$ mm <sup>2</sup>	Tension Resistance  $F_{t,Rd}$ kN	Min. thickness for punching shear  $t_{min}$ mm
12	84.3	34.0	2.3
16	157	63.3	3.3
20	245	98.8	4.4
24	353	142	4.9
30	561	226	6.4

The minimum thickness is such that the design punching shear resistance  $B_{p,Rd}$  is equal to the design tension resistance  $F_{t,Rd}$ .

FOR EXPLANATION OF TABLES SEE NOTE 11



Preloaded bolts at serviceability limit state (Category B)

Property Class 10.9 countersunk bolts

Diameter of Bolt  $d$ mm	Tensile Stress Area  $A_s$ mm <sup>2</sup>	Shear Resistance		Slip resistance, $F_{s,Rd,ser}$							
		Single Shear  $F_{v,Rd}$ kN	Double Shear  $2 \times F_{v,Rd}$ kN	$\mu = 0.2$		$\mu = 0.3$		$\mu = 0.4$		$\mu = 0.5$	
				Single Shear kN	Double Shear kN	Single Shear kN	Double Shear kN	Single Shear kN	Double Shear kN	Single Shear kN	Double Shear kN
16	157	62.8	126	20.0	40.0	30.0	59.9	40.0	79.9	50.0	99.9
20	245	98.0	196	31.2	62.4	46.8	93.5	62.4	125	78.0	156
24	353	141	282	44.9	89.9	67.4	135	89.9	180	112	225
30	561	224	449	71.4	143	107	214	143	286	179	357

Bearing resistances may be taken from the tables for non-preloaded countersunk bolts

See clause 3.7(1) of BS EN 1993-1-8: 2005 for calculation of the design resistance of a group of fasteners.

The shear resistances are ULS values

The slip resistances are SLS values

Values have been calculated assuming  $k_s=1$ . See BS EN 1993-1-8, section 3.9 for other values of  $k_s$ .

Preloaded bolts in tension (Category E)

Property Class 10.9 countersunk bolts

Diameter of bolt  $d$ mm	Tensile Stress Area  $A_s$ mm <sup>2</sup>	Tension Resistance  $F_{t,Rd}$ kN	Min. thickness for punching shear  $t_{min}$ mm
16	157	79.1	4.1
20	245	124	5.4
24	353	178	6.1
30	561	283	8

The minimum thickness is such that the design punching shear resistance  $B_{p,Rd}$  is equal to the design tension resistance  $F_{t,Rd}$ .

FOR EXPLANATION OF TABLES SEE NOTE 11

Preloaded bolts at ultimate limit state (Category C)

Property Class 8.8 countersunk bolts

Diameter of Bolt $d$ mm	Tensile Stress Area $A_s$ mm <sup>2</sup>	Slip Resistance							
		$\mu = 0.2$		$\mu = 0.3$		$\mu = 0.4$		$\mu = 0.5$	
		Single Shear kN	Double Shear kN	Single Shear kN	Double Shear kN	Single Shear kN	Double Shear kN	Single Shear kN	Double Shear kN
12	84.3	7.55	15.1	11.3	22.7	15.1	30.2	18.9	37.8
16	157	14.1	28.1	21.1	42.2	28.1	56.3	35.2	70.3
20	245	22.0	43.9	32.9	65.9	43.9	87.8	54.9	110
24	353	31.6	63.3	47.4	94.9	63.3	127	79.1	158
30	561	50.3	101	75.4	151	101	201	126	251

Bearing resistances may be taken from the tables for non-preloaded countersunk bolts

Shear resistances may be taken from the tables for Category B joints

FOR EXPLANATION OF TABLES SEE NOTE 11

Preloaded bolts at ultimate limit state (Category C)

Property Class 10.9 countersunk bolts

Diameter of Bolt $d$ mm	Tensile Stress Area $A_s$ mm <sup>2</sup>	Slip Resistance							
		$\mu = 0.2$		$\mu = 0.3$		$\mu = 0.4$		$\mu = 0.5$	
		Single Shear kN	Double Shear kN	Single Shear kN	Double Shear kN	Single Shear kN	Double Shear kN	Single Shear kN	Double Shear kN
16	157	17.6	35.2	26.4	52.8	35.2	70.3	44.0	87.9
20	245	27.4	54.9	41.2	82.3	54.9	110	68.6	137
24	353	39.5	79.1	59.3	119	79.1	158	98.8	198
30	561	62.8	126	94.2	188	126	251	157	314

Bearing resistances may be taken from the tables for non-preloaded countersunk bolts

Shear resistances may be taken from the tables for Category B joints

FOR EXPLANATION OF TABLES SEE NOTE 11

## Design weld resistances

Leg Length	Throat Thickness	Longitudinal resistance	Transverse resistance
s mm	a mm	$F_{w,L,Rd}$ kN/mm	$F_{w,T,Rd}$ kN/mm
3.0	2.1	0.51	0.62
4.0	2.8	0.68	0.83
5.0	3.5	0.84	1.03
6.0	4.2	1.01	1.24
8.0	5.6	1.35	1.65
10.0	7.0	1.69	2.07
12.0	8.4	2.03	2.48
15.0	10.5	2.53	3.10
18.0	12.6	3.04	3.72
20.0	14.0	3.38	4.14
22.0	15.4	3.71	4.55
25.0	17.5	4.22	5.17

FOR EXPLANATION OF TABLES SEE NOTE 11.2

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ISBN 978-1-85942-186-4

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