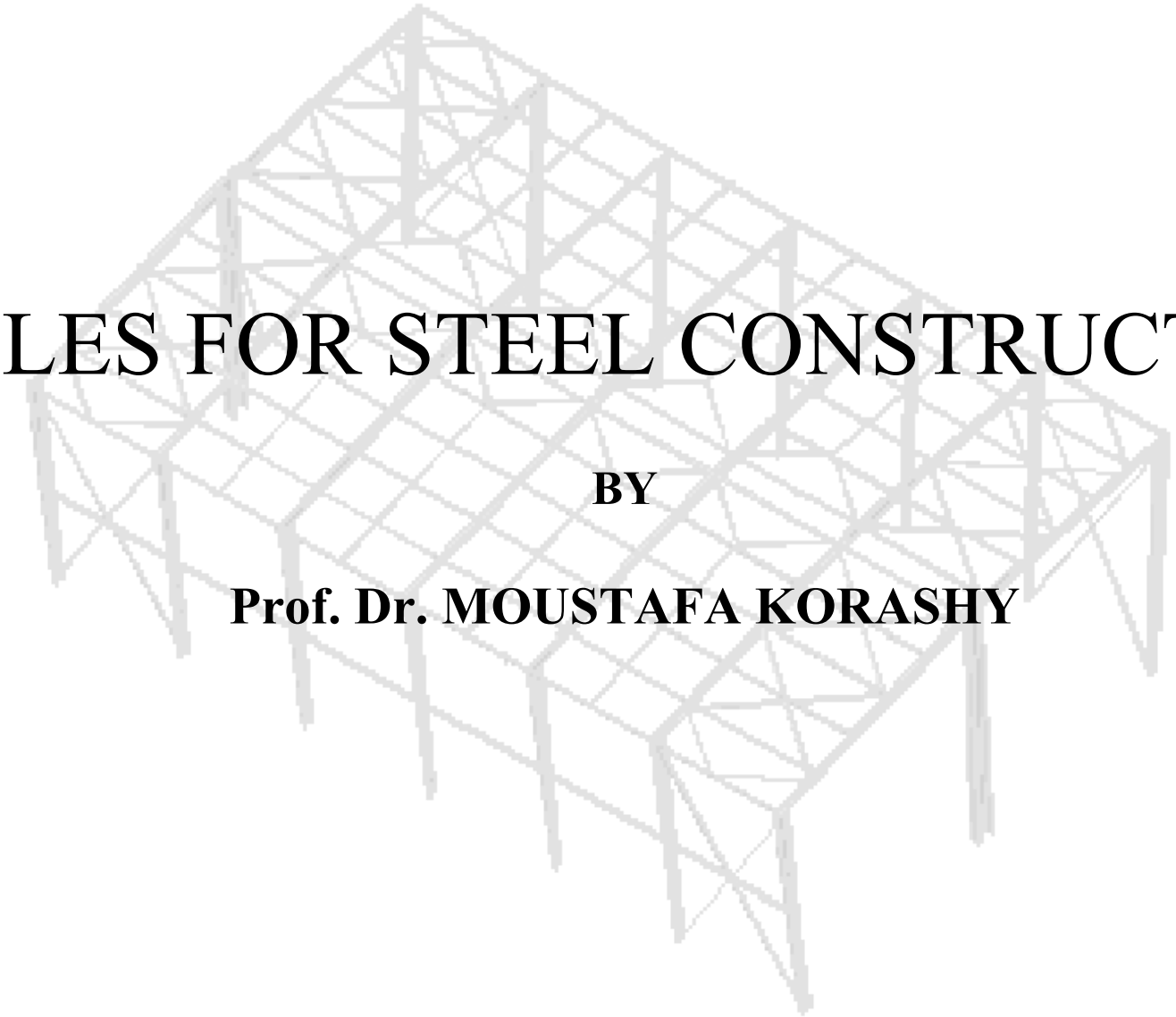

# TABLES FOR STEEL CONSTRUCTIONS

**BY**

**Prof. Dr. MOUSTAFA KORASHY**

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**CHECKED BY**

**Dr. SHERIF IBRAHIM**

**Eng. MOHAMED KORASHY**

**2001**

# CONTENTS

# LIST OF SYMBOLS

a (mm): Length of long leg for unequal angle.

b (mm): Length of short leg for unequal angle,
or flange width.

$b_1$ (mm): Width of upper flange for unsymmetrical welded I-sections.

$b_2$ (mm): Width of Lower flange for symmetrical welded I-sections.

c (mm): Height of curved part including flange thickness for channel and I-sections.

D (mm): Outer diameter of pipe.

d (mm): Height of web for built-up I-sections.

$d_{max.}$ (mm): Maximum diameter of bolt to be used.

e (mm): Distance measured from outer surface to neutral axis of section.

$e_x$ (mm): Distance from bottom surface to X-X axis.

$e_y$ (mm): Distance from outer surface to Y-Y Axis.

h (mm): Height of section.

I ($cm^4$): Moment of inertia for symmetrical section.

$I_u$ ($cm^4$): Moment of inertia about U-U axis.

$I_v$ ($cm^4$): Moment of inertia about V-V axis.

$I_x$ ($cm^4$): Moment of inertia about X-X axis.

$I_y$ ($cm^4$): Moment of inertia about Y-Y axis.

$I_{y\ upper\ flange}$ ($cm^4$): Moment of inertia for upper flange about Y-Y axis.

J ($cm^4$): Torsion constant.

r (mm, cm): Radius of inner fillet for cold formed section,
or Radius of gyration for symmetrical section.

$r_1$ (mm): Radius of fillet between web and flange.

$r_u$ (cm): Radius of gyration about U-U axis.

$r_v$ (cm): Radius of gyration about V-V axis.

$r_x$ (cm): Radius of gyration about X-X axis.

$r_y$ (cm): Radius of gyration about Y-Y axis.

s (mm): Thickness of web,
or Thickness of angle leg

S ($cm^3$): Elastic modulus of section.

$S_v$ ($cm^3$): Elastic modulus of section about V-V axis.

$S_x$ ($cm^3$): Elastic modulus of section about X-X axis.

$S_{xb}$ ($cm^3$): Elastic modulus of bottom extreme fibers about X-X axis.

$S_{xt}$ ($cm^3$): Elastic modulus of top extreme fibers about X-X axis.

$S_y$ ($cm^3$): Elastic modulus of section about Y-Y axis.

$S_{y\ upper\ flange}$ ($cm^3$): Elastic modulus of upper flange about Y-Y axis.

t (mm): Thickness of flange,
or Wall thickness.

$t_G$ (mm): Thickness of gusset plate.

$u_1$, $u_2$ (cm): Distance between outer fibers of an angle to V-V axis.

$U_m$ ($m^2/m$\): Surface area per unit length.

$U_t$ ($m^2/t$): Surface area per unit weight.

v, $v_1$,&$v_2$ (cm): Distance between outer fibers of an angle to U-U axis.

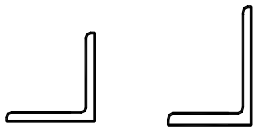
w, $w_1$ (mm): Distance determining bolt hole location relative to the section.

$X_m$ (cm): Distance between centroid of a channel and its shear center.

# Introduction

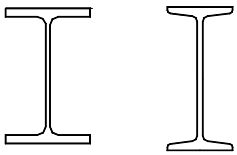
The aim of presenting these tables is to provide the structural engineers with wide range of information required in designing steel structures. Previously, a steel designer had to search in many tables, handbooks, manuals, …etc. to collect the necessary information needed to complete his/her design.

These tables are divided into nine chapters. Chapter one provides the geometrical properties of common hot rolled sections which includes the following:



- Equal and unequal angles: primarily used in trusses for resisting axial forces.

- Channels (UPN): used as truss members and purlins or side girts.

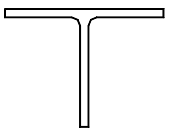


- I-sections (IPN, IPE, HEA, HEB, HEM):

  IPN section is suitable for beam subjected to bending moment about its major axis.

  IPE section used mainly for beams or beam column.

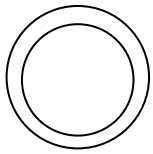
  HEA, HEB, and HEM sections are primarily used for members subjected to bi-moments or for heavy beam-columns.



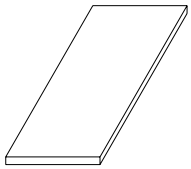
- T-sections are produced by cutting I-sections into two halves. They are used as brackets, truss members or light beams.

- Pipes and hollow sections: primarily used as truss members in welded trusses.

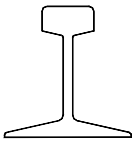
  Hollow square and rectangular sections, sometimes used as roof purlins or light beam-columns.



- Flat plates used in connections as head plates, gusset plates or it can be utilized in composing built-up section.



- Rails: used mainly in tracks of moving structures such as crane bridge.

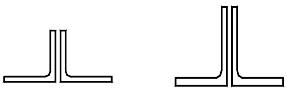


In unprecedented presentation of section properties in the Egyptian practice, Chapter two introduces the geometric properties for combined hot rolled sections and built–up welded sections.

This chapter provides the properties for the following combined sections:

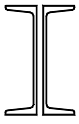
- Two equal or unequal angles back to back:

  Used mainly as lower or upper chord of trusses, or bracing members.



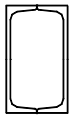
- Two channels back to back:

  Used mainly as lower or upper chord in heavy trusses.



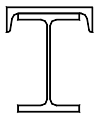
- Two channels toe to toe:

  Used as beam-column especially when the buckling lengths in-plane and out of plane are nearly equal.



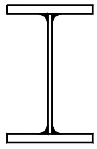
- IPE and UPN:

  This section is used primarily as section for crane girders. The "UPN" section is provided at the top flange where the lateral shock of the crane bridge is applied.



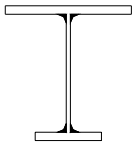
- Symmetrical welded I-Section:

  This section consists of three parts welded to form symmetrical I-sections. It is used mainly for beams or beam-columns.



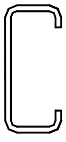
- Unsymmetrical welded I-sections:

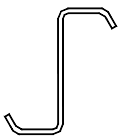
  This section is formed in away to make the upper flange approximately twice the lower flange. Thus it is suitable for crane girders where the lateral shock is applied at the upper flange. The section might also be used for composite construction when the upper and lower flanges are switched.



Chapter three introduces the geometrical properties of cold-formed steel sections, these sections includes:

- Channels (stiffened and unstiffened) and Z sections (with straight lips and with inclined lips): These sections are used mainly for roof purlins and side girts. Sometimes, they can be used in light trusses as web members.

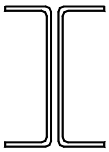




Chapter four provides the geometrical properties for combined cold-formed sections. These sections includes:

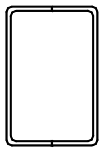
- Two channels back to back:

  Used as lower or upper chord in light trusses or in bracing members.



- Two channels toe to toe:

  Used in light beam columns or as eave struts I bracing system.



Chapter five provides complete information about the size, weight, and grip length of ordinary and high strength bolts. It also provides the dimension and weight of washers and nuts used for each type of bolts.
This chapter also includes the dimension and the weight of anchor bolts with various configurations.

Chapter six provides the geometrical properties of sample of corrugated sheets whether they are single layer, sandwich panels, or metal decking steel sheets. In this chapter the allowable spacing between purlins is also provided based on the strength and serviceability criteria.

Chapter seven includes samples of the wheel loads of crane bridges covering the following ranges of crane capacities:

- Light cranes with capacity range from 0.5 to 6.3 ton.
- Normal cranes with capacity range from 2.0 to 25 ton.
- Heavy cranes with capacity range from 25 to 63 ton.

Chapter eight provides the common symbols used in welding constructions.

Chapter nine includes various data covering the following areas:

- Conversion tables used to convert engineering units from imperial to SI or metric systems and vice versa.
- Dimensions of aircraft with various types to assist in choosing the configuration of aircraft hangar.
- Geometrical properties of common shapes in engineering practice.

# HOT ROLLED SECTIONS

EQUAL ANGLES

UNEQUAL ANGLE

CHANNELS (U.P.N)

I.P.N.

I.P.E.

H.E.A.

H.E.B.

H.E.M.

HALF I.P.E.

HALF H.E.A.

HALF H.E.B.

PIPES

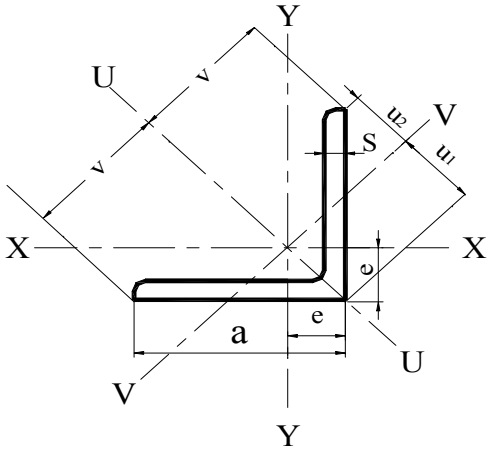
HOLLOW SQUARE SECTIONS

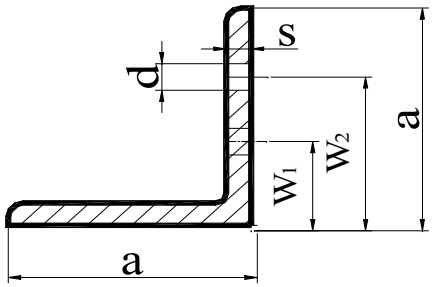
HOLLOW RECTANGULAR SECTIONS

PLATES

RAILS

# EQUAL ANGLES

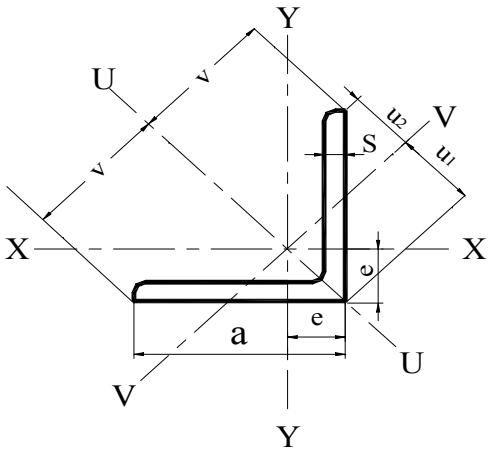


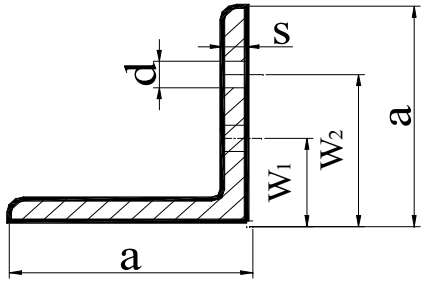




| Size | | Weight | Area | Dimensions | | | | Axis X-X and Y-Y | | | Axis u-u | | Axis v-v | | | Details | | | Surface Area | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| a | s | | | e | v | $u_1$ | $u_2$ | I | S | r | $I_u$ | $r_u$ | $I_v$ | $S_v$ | $r_v$ | $w_1$ | $w_2$ | $d_{max}$ | $U_m$ | $U_t$ |
| mm | mm | kg/m` | $cm^2$ | cm | cm | cm | cm | $cm^4$ | $cm^3$ | cm | $cm^4$ | cm | $cm^4$ | $cm^3$ | cm | mm | mm | mm | $x10^{-2}$ $m^2/m`$ | $m^2/t$ |
| 30 | 3 | 1.36 | 1.74 | 0.84 | 2.12 | 1.18 | 1.04 | 1.41 | 0.65 | 0.90 | 2.24 | 1.14 | 0.57 | 0.48 | 0.57 | N.A. | | | 11.60 | 85.30 |
| | 4 | 1.78 | 2.27 | 0.89 | | 1.24 | 1.05 | 1.81 | 0.86 | 0.89 | 2.85 | 1.12 | 0.76 | 0.61 | 0.58 | | | | 11.60 | 65.17 |
| | 5 | 2.18 | 2.78 | 0.92 | | 1.30 | 1.07 | 2.16 | 1.04 | 0.88 | 3.41 | 1.11 | 0.91 | 0.70 | 0.57 | | | | 11.60 | 53.21 |
| 35 | 3 | 1.60 | 2.04 | 0.96 | 2.47 | 1.36 | 1.23 | 2.29 | 0.90 | 1.06 | 3.63 | 1.34 | 0.95 | 0.70 | 0.68 | 20 | N.A. | M10 | 13.60 | 85.00 |
| | 4 | 2.10 | 2.67 | 1.00 | | 1.41 | 1.24 | 2.96 | 1.18 | 1.05 | 4.68 | 1.33 | 1.24 | 0.88 | 0.68 | 20 | | M10 | 13.60 | 64.76 |
| | 5 | 2.57 | 3.28 | 1.04 | | 1.47 | 1.25 | 3.56 | 1.45 | 1.04 | 5.63 | 1.31 | 1.49 | 1.10 | 0.67 | 20 | | M10 | 13.60 | 52.91 |
| 40 | 4 | 2.42 | 3.08 | 1.12 | 2.83 | 1.58 | 1.40 | 4.48 | 1.56 | 1.21 | 7.09 | 1.52 | 1.86 | 1.18 | 0.78 | 22 | N.A. | M10 | 15.50 | 64.00 |
| | 5 | 2.97 | 3.79 | 1.16 | | 1.64 | 1.42 | 5.43 | 1.91 | 1.20 | 8.64 | 1.51 | 2.22 | 1.35 | 0.77 | 22 | | M10 | 15.50 | 52.20 |
| | 6 | 3.52 | 4.48 | 1.20 | | 1.70 | 1.43 | 6.33 | 2.26 | 1.19 | 9.98 | 1.49 | 2.67 | 1.57 | 0.77 | 22 | | M10 | 15.50 | 44.03 |
| 45 | 5 | 3.38 | 4.30 | 1.28 | 3.18 | 1.81 | 1.58 | 7.83 | 2.43 | 1.35 | 12.40 | 1.70 | 3.25 | 1.80 | 0.87 | 25 | N.A. | M12 | 17.40 | 51.50 |
| | 6 | 4.00 | 5.09 | 1.32 | | 1.87 | 1.59 | 9.16 | 2.88 | 1.34 | 14.50 | 1.69 | 3.85 | 2.05 | 0.87 | 25 | | M12 | 17.40 | 43.50 |
| | 7 | 4.60 | 5.86 | 1.36 | | 1.92 | 1.61 | 10.40 | 3.31 | 1.33 | 16.40 | 1.67 | 4.39 | 2.29 | 0.87 | 25 | | M12 | 17.40 | 37.82 |
| 50 | 5 | 3.77 | 4.80 | 1.40 | 3.54 | 1.98 | 1.76 | 11.00 | 3.05 | 1.51 | 17.40 | 1.90 | 4.59 | 2.32 | 0.98 | 30 | N.A. | M12 | 19.40 | 51.50 |
| | 6 | 4.47 | 5.69 | 1.45 | | 2.04 | 1.77 | 12.80 | 3.51 | 1.50 | 20.40 | 1.89 | 5.24 | 2.57 | 0.96 | 30 | | M12 | 19.40 | 43.40 |
| | 7 | 5.15 | 6.56 | 1.49 | | 2.11 | 1.78 | 14.60 | 4.15 | 1.49 | 23.10 | 1.88 | 6.02 | 2.85 | 0.96 | 30 | | M12 | 19.40 | 37.67 |
| 55 | 5 | 4.18 | 5.32 | 1.52 | 3.89 | 2.15 | 1.93 | 14.70 | 3.70 | 1.66 | 23.30 | 2.09 | 6.11 | 2.84 | 1.07 | 30 | N.A. | M16 | 21.30 | 50.96 |
| | 6 | 4.95 | 6.31 | 1.56 | | 2.21 | 1.94 | 17.80 | 4.40 | 1.66 | 27.40 | 2.08 | 7.24 | 3.26 | 1.07 | 30 | | M16 | 21.30 | 33.30 |
| | 8 | 6.46 | 8.23 | 1.64 | | 2.32 | 1.97 | 22.10 | 5.72 | 1.64 | 34.80 | 2.06 | 9.35 | 4.03 | 1.07 | 30 | | M16 | 21.30 | 32.97 |
| 60 | 6 | 5.42 | 6.91 | 1.69 | 4.24 | 2.39 | 2.11 | 22.80 | 5.29 | 1.82 | 36.10 | 2.29 | 9.43 | 3.85 | 1.17 | 35 | N.A. | M16 | 23.30 | 43.00 |
| | 8 | 7.09 | 9.03 | 1.77 | | 2.50 | 2.14 | 29.10 | 6.88 | 1.80 | 46.10 | 2.26 | 12.10 | 4.84 | 1.16 | 35 | | M16 | 23.30 | 32.90 |
| | 10 | 8.69 | 11.10 | 1.85 | | 2.62 | 2.17 | 34.90 | 8.41 | 1.78 | 55.10 | 2.23 | 14.60 | 5.57 | 1.15 | 35 | | M16 | 23.30 | 26.80 |
| 65 | 7 | 6.83 | 8.70 | 1.85 | 4.60 | 2.62 | 2.29 | 33.40 | 7.13 | 1.96 | 53.00 | 2.47 | 13.80 | 5.27 | 1.26 | 35 | N.A. | M16 | 25.20 | 36.90 |
| | 8 | 7.73 | 9.85 | 1.89 | | 2.67 | 2.31 | 37.50 | 8.13 | 1.95 | 59.40 | 2.46 | 15.60 | 5.84 | 1.26 | 35 | | M16 | 25.20 | 32.60 |
| | 9 | 8.62 | 11.00 | 1.93 | | 2.73 | 2.32 | 41.30 | 9.04 | 1.94 | 65.40 | 2.44 | 17.20 | 6.30 | 1.25 | 35 | | M16 | 25.20 | 29.23 |

N.A.=not available for this angle size

# EQUAL ANGLES

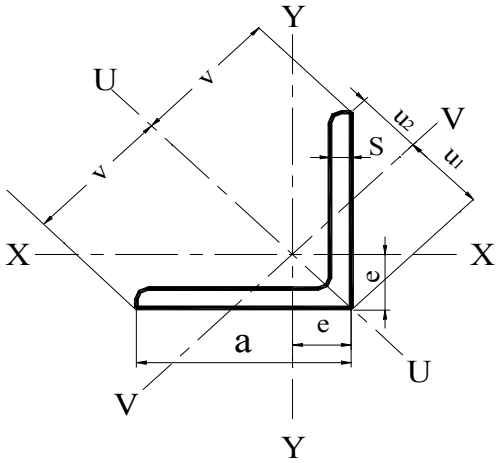


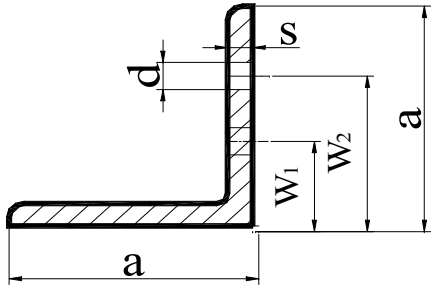




| Size | | Weight | Area | Dimensions | | | | Axis X-X and Y-Y | | | Axis u-u | | Axis v-v | | | Details | | | Surface Area | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| a | s | | | e | v | $u_1$ | $u_2$ | I | S | r | $I_u$ | $r_u$ | $I_v$ | $S_v$ | $r_v$ | $w_1$ | $w_2$ | $d_{max}$ | $U_m$ | $U_t$ |
| mm | mm | kg/m` | $cm^2$ | cm | cm | cm | cm | $cm^4$ | $cm^3$ | cm | $cm^4$ | cm | $cm^4$ | $cm^3$ | cm | mm | mm | mm | $x10^{-2}$ $m^2/m\backslash$ | $m^2/t$ |
| 70 | 7 | 7.38 | 9.40 | 1.97 | 4.95 | 2.79 | 2.47 | 42.4 | 8.43 | 2.12 | 67.1 | 2.67 | 17.6 | 6.37 | 1.37 | 40 | N.A. | M20 | 27.20 | 36.90 |
| | 9 | 9.34 | 11.90 | 2.05 | | 2.90 | 2.50 | 52.6 | 10.6 | 2.10 | 83.1 | 2.64 | 22.0 | 7.59 | 1.36 | 40 | | M20 | 27.20 | 29.10 |
| | 11 | 11.20 | 14.30 | 2.13 | | 3.01 | 2.53 | 61.8 | 12.7 | 2.09 | 97.6 | 2.61 | 26.0 | 8.61 | 1.35 | 40 | | M20 | 27.20 | 24.28 |
| 75 | 7 | 7.94 | 10.10 | 2.03 | 5.30 | 2.95 | 2.63 | 52.4 | 8.67 | 2.28 | 83.6 | 2.88 | 21.1 | 7.15 | 1.45 | 40 | N.A. | M20 | 29.10 | 36.65 |
| | 8 | 9.03 | 11.50 | 2.13 | | 3.01 | 2.65 | 58.9 | 11.0 | 2.26 | 93.3 | 2.85 | 24.4 | 8.11 | 1.46 | 40 | | M20 | 29.10 | 32.20 |
| | 10 | 11.10 | 14.10 | 2.21 | | 3.18 | 2.68 | 71.4 | 13.5 | 2.25 | 113 | 2.83 | 28.8 | 9.55 | 1.45 | 40 | | M20 | 29.10 | 26.21 |
| 80 | 8 | 9.66 | 12.30 | 2.26 | 5.66 | 3.20 | 2.82 | 72.3 | 12.6 | 2.42 | 115 | 3.06 | 29.6 | 9.25 | 1.55 | 45 | N.A. | M20 | 31.10 | 32.20 |
| | 10 | 11.90 | 15.10 | 2.34 | | 3.31 | 2.85 | 87.5 | 15.5 | 2.41 | 139 | 3.03 | 35.9 | 10.9 | 1.54 | 45 | | M20 | 31.10 | 26.10 |
| | 12 | 14.10 | 17.90 | 2.41 | | 3.41 | 2.89 | 102 | 18.2 | 2.39 | 161 | 3.00 | 43.0 | 12.6 | 1.53 | 45 | | M20 | 31.10 | 22.10 |
| 90 | 9 | 12.20 | 15.50 | 2.54 | 6.36 | 3.59 | 3.18 | 116 | 18.0 | 2.74 | 184 | 3.45 | 47.8 | 13.3 | 1.76 | 50 | N.A. | M20 | 35.10 | 28.80 |
| | 11 | 14.70 | 18.70 | 2.62 | | 3.70 | 3.21 | 138 | 21.6 | 2.72 | 218 | 3.41 | 57.1 | 15.4 | 1.75 | 50 | | M20 | 35.10 | 23.88 |
| | 13 | 17.10 | 21.80 | 2.70 | | 3.81 | 3.24 | 158 | 25.1 | 2.69 | 250 | 3.39 | 65.9 | 17.3 | 1.74 | 50 | | M20 | 35.10 | 20.53 |
| 100 | 10 | 15.10 | 19.20 | 2.82 | 7.07 | 3.99 | 3.54 | 177 | 24.7 | 3.04 | 280 | 3.82 | 73.3 | 18.4 | 1.95 | 55 | N.A. | M24 | 39.00 | 25.80 |
| | 12 | 17.80 | 22.70 | 2.90 | | 4.10 | 3.57 | 207 | 29.2 | 3.02 | 328 | 3.80 | 86.2 | 21.0 | 1.95 | 55 | | M24 | 39.00 | 21.90 |
| | 14 | 20.60 | 26.20 | 2.98 | | 4.21 | 3.60 | 235 | 33.5 | 3.00 | 372 | 3.77 | 98.3 | 23.4 | 1.94 | 55 | | M24 | 39.00 | 18.90 |
| 110 | 10 | 16.60 | 21.20 | 3.07 | 7.78 | 4.34 | 3.89 | 239 | 30.1 | 3.36 | 379 | 4.23 | 98.6 | 22.7 | 2.16 | 40 | 80 | M20 | 43.00 | 25.90 |
| | 12 | 19.70 | 25.10 | 3.15 | | 4.45 | 3.93 | 280 | 35.7 | 3.34 | 444 | 4.21 | 116 | 25.1 | 2.15 | 40 | 80 | M20 | 43.00 | 21.83 |
| | 14 | 22.80 | 29.00 | 3.21 | | 4.54 | 3.98 | 319 | 41.0 | 3.32 | 505 | 4.18 | 133 | 29.3 | 2.14 | 40 | 80 | M20 | 43.00 | 18.86 |
| 120 | 12 | 21.60 | 27.50 | 3.40 | 8.49 | 4.80 | 4.26 | 368 | 42.7 | 3.65 | 584 | 4.60 | 152 | 31.6 | 2.35 | 45 | 85 | M20 | 46.90 | 21.70 |
| | 13 | 23.30 | 29.90 | 3.44 | | 4.86 | 4.27 | 394 | 46.0 | 3.64 | 625 | 4.59 | 162 | 33.3 | 2.34 | 45 | 85 | M20 | 46.90 | 20.13 |
| | 15 | 26.60 | 33.90 | 3.51 | | 4.96 | 4.31 | 446 | 52.5 | 3.63 | 705 | 4.56 | 186 | 37.5 | 2.34 | 45 | 85 | M20 | 46.90 | 17.60 |

N.A.=not available for this angle size

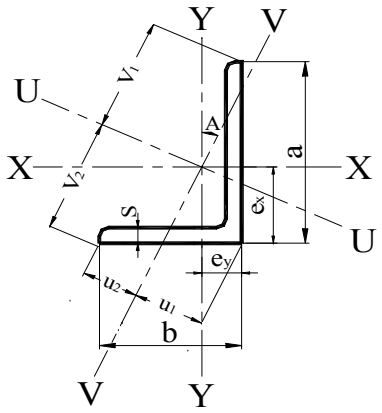
# EQUAL ANGLES

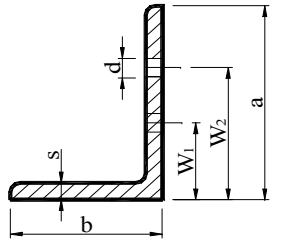



| Size | | Weight | Area | Dimensions | | | | Axis X-X and Y-Y | | | Axis u-u | | Axis v-v | | | Details | | | Surface Area | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| a | s | | | e | v | $u_1$ | $u_2$ | I | S | r | $I_u$ | $r_u$ | $I_v$ | $S_v$ | $r_v$ | $w_1$ | $w_2$ | $d_{max}$ | $U_m$ | $U_t$ |
| mm | mm | kg/m` | $cm^2$ | cm | cm | cm | cm | $cm^4$ | $cm^3$ | cm | $cm^4$ | cm | $cm^4$ | $cm^3$ | cm | mm | mm | mm | $x10^{-2}$ $m^2/m$\ | $m^2/t$ |
| 130 | 12 | 23.60 | 30.00 | 3.64 | 9.19 | 5.15 | 4.60 | 472 | 50.4 | 3.97 | 750 | 5.00 | 194 | 37.7 | 2.54 | 50 | 90 | M20 | 50.80 | 21.50 |
| | 14 | 27.20 | 34.70 | 3.72 | | 5.26 | 4.63 | 540 | 55.2 | 3.94 | 857 | 4.97 | 223 | 42.4 | 2.53 | 50 | 90 | M20 | 50.80 | 18.68 |
| | 16 | 30.90 | 39.30 | 3.80 | | 5.37 | 4.66 | 605 | 65.8 | 3.92 | 959 | 4.94 | 251 | 46.7 | 2.52 | 50 | 90 | M20 | 50.80 | 16.44 |
| 140 | 13 | 27.50 | 35.00 | 3.92 | 9.90 | 5.54 | 4.96 | 638 | 63.3 | 4.27 | 1010 | 5.38 | 262 | 47.3 | 2.74 | 55 | 105 | M24 | 54.70 | 19.90 |
| | 15 | 31.40 | 40.00 | 4.00 | | 5.66 | 4.99 | 723 | 72.3 | 4.25 | 1150 | 5.36 | 298 | 52.7 | 2.73 | 55 | 105 | M24 | 54.70 | 17.40 |
| 150 | 14 | 31.60 | 40.30 | 4.21 | 10.60 | 5.95 | 5.31 | 845 | 78.2 | 4.58 | 1340 | 5.77 | 347 | 58.3 | 2.94 | 60 | 110 | M24 | 58.60 | 18.50 |
| | 15 | 33.80 | 43.00 | 4.25 | | 6.01 | 5.33 | 898 | 82.5 | 4.57 | 1430 | 5.76 | 370 | 61.6 | 2.93 | 60 | 110 | M24 | 58.60 | 17.33 |
| | 16 | 35.90 | 45.70 | 4.29 | | 6.07 | 5.34 | 949 | 88.7 | 4.56 | 1510 | 5.74 | 391 | 64.4 | 2.93 | 60 | 110 | M24 | 58.60 | 16.30 |
| | 18 | 40.10 | 51.00 | 4.36 | | 6.17 | 5.38 | 1050 | 99.3 | 4.54 | 1670 | 5.70 | 438 | 71.0 | 2.93 | 60 | 110 | M24 | 58.60 | 14.61 |
| | 20 | 44.20 | 56.30 | 4.44 | | 6.28 | 5.41 | 1150 | 109 | 4.51 | 1820 | 5.68 | 477 | 76.0 | 2.91 | 60 | 110 | M24 | 58.60 | 13.25 |
| 160 | 15 | 36.20 | 46.10 | 4.49 | 11.30 | 6.35 | 5.67 | 1100 | 95.6 | 4.88 | 1750 | 6.15 | 453 | 71.3 | 3.14 | 60 | 120 | M27 | 62.50 | 17.30 |
| | 17 | 40.70 | 51.80 | 4.57 | | 6.46 | 5.70 | 1230 | 108 | 4.86 | 1950 | 6.13 | 506 | 78.3 | 3.13 | 60 | 120 | M27 | 62.50 | 15.40 |
| | 19 | 45.10 | 57.50 | 4.65 | | 6.58 | 5.73 | 1350 | 118 | 4.84 | 2140 | 6.10 | 558 | 84.8 | 3.12 | 60 | 120 | M27 | 62.50 | 13.85 |
| 180 | 16 | 43.50 | 55.40 | 5.02 | 12.70 | 7.11 | 6.39 | 1680 | 130 | 5.51 | 2690 | 6.96 | 679 | 95.5 | 3.50 | 65 | 135 | M27 | 70.50 | 16.20 |
| | 18 | 48.60 | 61.90 | 5.10 | | 7.22 | 6.41 | 1870 | 145 | 5.49 | 2970 | 6.93 | 757 | 105 | 3.49 | 65 | 135 | M27 | 70.50 | 14.50 |
| | 20 | 53.70 | 68.40 | 5.18 | | 7.33 | 6.44 | 2040 | 160 | 5.47 | 3260 | 6.90 | 830 | 113 | 3.49 | 65 | 135 | M27 | 70.50 | 13.12 |
| | 22 | 58.60 | 74.70 | 5.26 | | 7.44 | 6.47 | 2210 | 174 | 5.44 | 3510 | 6.86 | 918 | 123 | 3.50 | 65 | 135 | M27 | 70.50 | 12.03 |
| 200 | 16 | 48.50 | 61.80 | 5.52 | 14.10 | 7.80 | 7.09 | 2340 | 162 | 6.15 | 3740 | 7.78 | 943 | 121 | 3.91 | 65 | 150 | M27 | 78.50 | 16.20 |
| | 18 | 54.30 | 69.10 | 5.60 | | 7.92 | 7.12 | 2600 | 181 | 6.13 | 4150 | 7.75 | 1050 | 133 | 3.90 | 65 | 150 | M27 | 78.50 | 14.50 |
| | 20 | 59.90 | 76.40 | 5.68 | | 8.04 | 7.15 | 2850 | 199 | 6.11 | 4540 | 7.72 | 1160 | 144 | 3.89 | 65 | 150 | M27 | 78.50 | 13.10 |
| | 24 | 71.10 | 90.60 | 5.84 | | 8.26 | 7.21 | 3330 | 235 | 6.06 | 5280 | 7.64 | 1380 | 167 | 3.90 | 65 | 150 | M27 | 78.50 | 11.04 |
| | 28 | 82.00 | 105.00 | 5.99 | | 8.47 | 7.28 | 3780 | 270 | 6.02 | 5990 | 7.57 | 1580 | 186 | 3.89 | 65 | 150 | M27 | 78.50 | 9.57 |

# UNEQUAL ANGLES

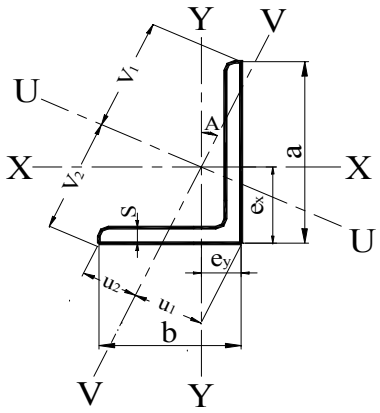


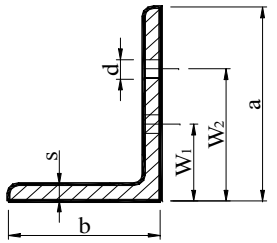




| Size | | | Weight | Area | Dimensions | | | | | | tan A | Axis X-X | | | Axis Y-Y | | | Axis u-u | | Axis v-v | | Details | | | Surface Area | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| a | b | s | | | $e_x$ | $e_y$ | $v_1$ | $v_2$ | $u_1$ | $u_2$ | | $I_x$ | $S_x$ | $r_x$ | $I_y$ | $S_y$ | $r_y$ | $I_u$ | $r_u$ | $I_v$ | $r_v$ | $w_1$ | $w_2$ | $d_{max}$ | $U_m$ | $U_t$ |
| mm | mm | mm | kg/m` | $cm^2$ | cm | cm | cm | cm | cm | cm | | $cm^4$ | $cm^3$ | cm | $cm^4$ | $cm^3$ | cm | $cm^4$ | cm | $cm^4$ | cm | mm | mm | mm | $x10^{-2}$ $m^2/m`$ | $m^2/t$ |
| 30 | 20 | 3 | 1.11 | 1.42 | 0.99 | 0.50 | 2.04 | 1.51 | 0.86 | 1.04 | 0.431 | 1.25 | 0.62 | 0.94 | 0.44 | 0.29 | 0.56 | 1.43 | 1.00 | 0.25 | 0.42 | N.A. | | | 9.68 | 87.20 |
| | | 4 | 1.45 | 1.85 | 1.03 | 0.54 | 2.02 | 1.52 | 0.91 | 1.03 | 0.423 | 1.59 | 0.81 | 0.93 | 0.55 | 0.38 | 0.55 | 1.81 | 0.99 | 0.33 | 0.42 | | | | 9.68 | 66.70 |
| 40 | 20 | 3 | 1.35 | 1.72 | 1.43 | 0.44 | 2.61 | 1.77 | 0.79 | 1.19 | 0.259 | 2.79 | 1.08 | 1.27 | 0.47 | 0.30 | 0.52 | 2.96 | 1.31 | 0.30 | 0.42 | 22 | N.A. | M10 | 11.68 | 86.50 |
| | | 4 | 1.77 | 2.25 | 1.47 | 0.48 | 2.57 | 1.80 | 0.83 | 1.18 | 0.252 | 3.59 | 1.42 | 1.26 | 0.60 | 0.39 | 0.52 | 3.79 | 1.30 | 0.39 | 0.42 | 22 | | M10 | 11.68 | 66.00 |
| 45 | 30 | 3 | 1.72 | 2.19 | 1.43 | 0.70 | 3.09 | 2.23 | 1.21 | 1.59 | 0.436 | 4.47 | 1.46 | 1.43 | 1.60 | 0.70 | 0.86 | 5.15 | 1.53 | 0.93 | 0.65 | 25 | N.A. | M12 | 14.64 | 85.00 |
| | | 4 | 2.25 | 2.87 | 1.48 | 0.74 | 3.07 | 2.26 | 1.27 | 1.58 | 0.433 | 5.78 | 1.91 | 1.42 | 2.05 | 0.91 | 0.85 | 6.65 | 1.52 | 1.18 | 0.64 | 25 | | M12 | 14.64 | 65.06 |
| | | 5 | 2.77 | 3.53 | 1.52 | 0.78 | 3.05 | 2.27 | 1.32 | 1.58 | 0.430 | 6.99 | 2.95 | 1.41 | 2.47 | 1.11 | 0.84 | 8.02 | 1.51 | 1.44 | 0.64 | 25 | | M12 | 14.64 | 52.80 |
| 60 | 30 | 5 | 3.37 | 4.29 | 2.15 | 0.68 | 3.90 | 2.67 | 1.20 | 1.77 | 0.256 | 15.6 | 4.04 | 1.90 | 2.60 | 1.12 | 0.78 | 16.5 | 1.96 | 1.69 | 0.63 | 35 | N.A. | M16 | 17.50 | 51.90 |
| | | 7 | 4.59 | 5.85 | 2.24 | 0.76 | 3.83 | 2.72 | 1.28 | 1.73 | 0.248 | 20.7 | 5.50 | 1.88 | 3.41 | 1.52 | 0.76 | 21.8 | 1.93 | 2.28 | 0.62 | 35 | | M16 | 17.50 | 38.10 |
| 60 | 40 | 5 | 3.76 | 4.79 | 1.96 | 0.97 | 4.08 | 3.01 | 1.68 | 2.09 | 0.437 | 17.2 | 4.25 | 1.89 | 6.11 | 2.02 | 1.13 | 19.8 | 2.03 | 3.50 | 0.86 | 35 | N.A. | M16 | 19.50 | 51.80 |
| | | 6 | 4.46 | 5.68 | 2.00 | 1.01 | 4.06 | 3.02 | 1.72 | 2.08 | 0.437 | 20.1 | 5.03 | 1.88 | 7.12 | 2.38 | 1.12 | 23.1 | 2.02 | 4.12 | 0.85 | 35 | | M16 | 19.50 | 37.90 |
| | | 7 | 5.14 | 6.55 | 2.04 | 1.05 | 4.04 | 3.03 | 1.77 | 2.07 | 0.422 | 23.0 | 5.79 | 1.87 | 8.07 | 2.74 | 1.11 | 26.3 | 2.00 | 4.73 | 0.85 | 35 | | M16 | 19.50 | 37.93 |
| 75 | 50 | 5 | 4.74 | 6.04 | 2.40 | 1.17 | 5.14 | 3.73 | 2.03 | 2.64 | 0.437 | 34.4 | 6.74 | 2.39 | 12.3 | 3.21 | 1.43 | 39.6 | 2.56 | 7.10 | 1.08 | 40 | N.A. | M20 | 24.44 | 51.50 |
| | | 7 | 6.51 | 8.30 | 2.48 | 1.25 | 5.10 | 3.77 | 2.13 | 2.63 | 0.433 | 46.4 | 9.24 | 2.36 | 16.5 | 4.39 | 1.41 | 53.3 | 2.53 | 9.56 | 1.07 | 40 | | M20 | 24.44 | 37.54 |
| | | 9 | 8.23 | 10.50 | 2.56 | 1.32 | 5.06 | 3.80 | 2.22 | 2.62 | 0.427 | 57.4 | 11.6 | 2.34 | 20.2 | 5.49 | 1.39 | 65.7 | 2.50 | 11.9 | 1.07 | 40 | | M20 | 24.44 | 29.70 |
| 80 | 40 | 6 | 5.41 | 6.89 | 2.85 | 0.88 | 5.21 | 3.53 | 1.55 | 2.42 | 0.259 | 44.9 | 8.7 | 2.55 | 7.6 | 2.44 | 1.05 | 47.6 | 2.63 | 4.90 | 0.84 | 45 | N.A. | M22 | 23.40 | 43.20 |
| | | 8 | 7.07 | 9.01 | 2.94 | 0.95 | 5.15 | 3.57 | 1.65 | 2.38 | 0.253 | 57.6 | 11.4 | 2.53 | 9.7 | 3.18 | 1.04 | 60.9 | 2.60 | 6.41 | 0.84 | 45 | | M22 | 23.40 | 33.10 |
| 90 | 60 | 6 | 6.82 | 8.69 | 2.89 | 1.41 | 6.14 | 4.50 | 2.46 | 3.16 | 0.442 | 71.7 | 11.7 | 2.87 | 25.8 | 5.61 | 1.72 | 82.8 | 3.09 | 14.6 | 1.30 | 50 | | M24 | 29.40 | 43.10 |
| | | 8 | 8.96 | 11.40 | 2.97 | 1.49 | 6.11 | 4.54 | 2.56 | 3.15 | 0.497 | 92.5 | 15.4 | 2.85 | 33.0 | 7.31 | 1.70 | 107 | 3.06 | 19.0 | 1.29 | 50 | | M24 | 29.40 | 32.80 |
| 100 | 50 | 6 | 6.85 | 8.73 | 3.49 | 1.04 | 6.50 | 4.39 | 1.91 | 2.98 | 0.263 | 89.7 | 13.8 | 3.20 | 15.3 | 3.86 | 1.32 | 95.2 | 3.30 | 9.78 | 1.06 | 55 | N.A. | M24 | 29.20 | 42.60 |
| | | 8 | 8.99 | 11.50 | 3.59 | 1.13 | 6.48 | 4.44 | 2.00 | 2.95 | 0.258 | 116 | 18.0 | 3.18 | 19.5 | 5.04 | 1.31 | 123 | 3.28 | 12.6 | 1.05 | 55 | | M24 | 29.20 | 32.80 |
| | | 10 | 11.10 | 14.10 | 3.67 | 1.20 | 6.43 | 4.49 | 2.08 | 2.91 | 0.252 | 141 | 22.2 | 3.16 | 23.4 | 6.17 | 1.29 | 149 | 3.25 | 15.5 | 1.04 | 55 | | M24 | 29.20 | 26.30 |
| 100 | 65 | 7 | 8.77 | 11.20 | 3.23 | 1.51 | 6.83 | 4.91 | 2.66 | 3.48 | 0.419 | 113 | 16.6 | 3.17 | 37.6 | 7.54 | 1.84 | 128 | 3.39 | 21.6 | 1.39 | 55 | N.A. | M24 | 32.10 | 36.60 |
| | | 9 | 11.10 | 14.20 | 3.32 | 1.59 | 6.78 | 4.94 | 2.76 | 3.46 | 0.415 | 141 | 21.0 | 3.15 | 46.7 | 9.52 | 1.82 | 160 | 3.36 | 27.2 | 1.39 | 55 | | M24 | 32.10 | 28.90 |
| | | 11 | 13.40 | 17.10 | 3.40 | 1.67 | 6.74 | 4.97 | 2.85 | 3.45 | 0.410 | 167 | 25.3 | 3.13 | 55.1 | 11.4 | 1.80 | 190 | 3.34 | 32.6 | 1.38 | 55 | | M24 | 32.10 | 24.00 |

N.A.=not available for this angle size

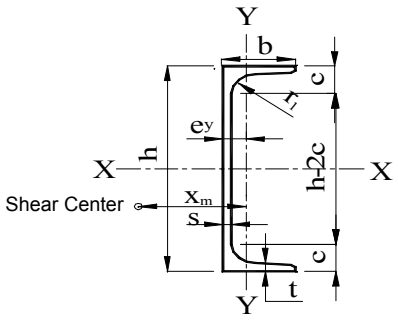
# UNEQUAL ANGLES

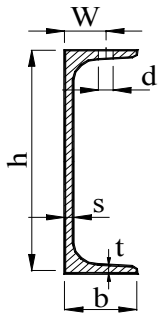



| Size | | | Weight | Area | Dimensions | | | | | | tan A | Axis X-X | | | Axis Y-Y | | | Axis u-u | | Axis v-v | | Details | | | Surface Area | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| a | b | s | | | $e_x$ | $e_y$ | $v_1$ | $v_2$ | $u_1$ | $u_2$ | | $I_x$ | $S_x$ | $r_x$ | $I_y$ | $S_y$ | $r_y$ | $I_u$ | $r_u$ | $I_v$ | $r_v$ | $w_1$ | $w_2$ | $d_{max}$ | $U_m$ | $U_t$ |
| mm | mm | mm | kg/m` | $cm^2$ | cm | cm | cm | cm | cm | cm | | $cm^4$ | $cm^3$ | cm | $cm^4$ | $cm^3$ | cm | $cm^4$ | cm | $cm^4$ | cm | mm | mm | mm | $x10^{-2}$ $m^2/m$\ | $m^2/t$ |
| 120 | 80 | 8 | 12.20 | 15.50 | 3.83 | 1.87 | 8.23 | 5.99 | 3.27 | 4.20 | 0.441 | 226 | 27.6 | 3.82 | 80.8 | 13.2 | 2.29 | 261 | 4.10 | 45.8 | 1.72 | 45 | 85 | M20 | 39.10 | 32.00 |
| | | 10 | 15.00 | 19.10 | 3.92 | 1.95 | 8.18 | 6.03 | 3.37 | 4.19 | 0.438 | 276 | 34.1 | 3.80 | 98.1 | 16.2 | 2.27 | 318 | 4.07 | 56.1 | 1.71 | 45 | 85 | M20 | 39.10 | 26.10 |
| | | 12 | 17.80 | 22.70 | 4.00 | 2.03 | 8.14 | 6.06 | 3.46 | 4.18 | 0.433 | 323 | 40.4 | 3.77 | 114 | 19.1 | 2.25 | 371 | 4.04 | 66.1 | 1.71 | 45 | 85 | M20 | 39.10 | 22.00 |
| | | 14 | 20.50 | 26.20 | 4.08 | 2.10 | 8.10 | 6.08 | 3.55 | 4.17 | 0.429 | 368 | 46.4 | 3.75 | 130 | 22.0 | 2.23 | 421 | 4.01 | 75.8 | 1.70 | 45 | 85 | M20 | 39.10 | 19.07 |
| 130 | 65 | 8 | 11.90 | 15.10 | 4.56 | 1.37 | 8.50 | 5.71 | 2.49 | 3.86 | 0.263 | 263 | 31.1 | 4.17 | 44.8 | 8.7 | 1.72 | 280 | 4.31 | 28.6 | 1.38 | 50 | 90 | M20 | 38.10 | 32.00 |
| | | 10 | 14.60 | 18.60 | 4.65 | 1.45 | 8.43 | 5.76 | 2.58 | 3.82 | 0.259 | 321 | 38.4 | 4.15 | 54.2 | 10.7 | 1.71 | 340 | 4.27 | 35.0 | 1.37 | 50 | 90 | M20 | 38.10 | 26.10 |
| | | 12 | 17.30 | 22.10 | 4.74 | 1.53 | 8.37 | 5.81 | 2.66 | 3.80 | 0.255 | 376 | 45.5 | 4.12 | 63.0 | 12.7 | 1.69 | 397 | 4.24 | 41.2 | 1.37 | 50 | 90 | M20 | 38.10 | 22.00 |
| 130 | 90 | 10 | 16.60 | 21.20 | 4.15 | 2.18 | 8.92 | 6.69 | 3.75 | 4.62 | 0.472 | 358 | 40.5 | 4.11 | 141 | 20.6 | 2.58 | 420 | 4.46 | 78.5 | 1.93 | 50 | 90 | M20 | 42.97 | 25.88 |
| | | 12 | 19.70 | 25.10 | 4.84 | 2.26 | 8.88 | 6.72 | 3.85 | 4.60 | 0.463 | 420 | 48.0 | 4.09 | 165.0 | 24.4 | 2.56 | 492 | 4.43 | 92.6 | 1.92 | 50 | 90 | M20 | 42.97 | 21.81 |
| 150 | 75 | 9 | 15.30 | 19.50 | 5.28 | 1.57 | 9.79 | 6.62 | 2.90 | 4.46 | 0.265 | 455 | 46.8 | 4.83 | 78.3 | 13.2 | 2.00 | 484 | 4.98 | 50.0 | 1.60 | 60 | 110 | M24 | 44.10 | 28.80 |
| | | 11 | 18.60 | 23.60 | 5.37 | 1.65 | 9.73 | 6.66 | 2.97 | 4.44 | 0.261 | 545 | 56.6 | 4.80 | 93.0 | 15.9 | 1.98 | 578 | 4.95 | 59.8 | 1.59 | 60 | 110 | M24 | 44.10 | 23.00 |
| 150 | 100 | 10 | 19.00 | 24.20 | 4.80 | 2.34 | 10.30 | 7.50 | 4.10 | 5.25 | 0.442 | 552 | 54.1 | 4.78 | 198 | 25.8 | 2.86 | 637 | 5.13 | 112 | 2.15 | 60 | 110 | M24 | 48.90 | 25.70 |
| | | 12 | 22.60 | 28.70 | 4.89 | 2.42 | 10.20 | 7.53 | 4.19 | 5.24 | 0.439 | 650 | 64.2 | 4.76 | 232 | 30.6 | 2.84 | 749 | 5.10 | 133 | 2.15 | 60 | 110 | M24 | 48.90 | 21.60 |
| | | 14 | 26.10 | 33.20 | 4.97 | 2.50 | 10.20 | 7.56 | 4.28 | 5.23 | 0.435 | 744 | 74.1 | 4.73 | 264 | 35.2 | 2.82 | 856 | 5.07 | 152 | 2.14 | 60 | 110 | M24 | 48.90 | 18.70 |
| 160 | 80 | 10 | 18.20 | 23.20 | 5.63 | 1.69 | 10.50 | 7.06 | 3.07 | 4.76 | 0.263 | 611 | 58.9 | 5.14 | 104 | 16.5 | 2.12 | 648 | 5.29 | 67.0 | 1.70 | 60 | 120 | M27 | 46.90 | 25.70 |
| | | 12 | 21.60 | 27.50 | 5.72 | 1.77 | 10.40 | 7.10 | 3.15 | 4.75 | 0.259 | 720 | 70.0 | 5.11 | 122 | 19.6 | 2.10 | 763 | 5.26 | 78.9 | 1.69 | 60 | 120 | M27 | 46.90 | 21.70 |
| | | 14 | 25.00 | 31.80 | 5.81 | 1.85 | 10.30 | 7.16 | 3.23 | 4.72 | 0.256 | 823 | 80.7 | 5.09 | 139 | 22.5 | 2.09 | 871 | 5.23 | 90.5 | 1.69 | 60 | 120 | M27 | 46.90 | 18.70 |
| 180 | 90 | 10 | 20.60 | 26.20 | 6.28 | 1.85 | 11.80 | 7.89 | 3.38 | 5.42 | 0.262 | 880 | 75.1 | 5.80 | 151 | 21.1 | 2.40 | 934 | 5.97 | 97.4 | 1.93 | 65 | 135 | M27 | 52.80 | 25.63 |
| | | 12 | 24.50 | 31.20 | 6.37 | 1.93 | 11.70 | 7.95 | 3.48 | 5.38 | 0.261 | 1040 | 89.3 | 5.77 | 177 | 25.1 | 2.38 | 1100 | 5.94 | 114 | 1.92 | 65 | 135 | M27 | 52.80 | 21.55 |
| | | 14 | 28.30 | 36.10 | 6.46 | 2.01 | 11.70 | 8.01 | 3.57 | 5.34 | 0.259 | 1190 | 103 | 5.75 | 202 | 28.9 | 2.37 | 1260 | 5.92 | 131 | 1.91 | 65 | 135 | M27 | 52.80 | 18.65 |
| 200 | 100 | 10 | 23.00 | 29.20 | 6.93 | 2.01 | 13.20 | 8.76 | 3.75 | 5.98 | 0.266 | 1220 | 93.2 | 6.46 | 210 | 26.3 | 2.68 | 1300 | 6.66 | 133 | 2.14 | 65 | 150 | M27 | 58.70 | 25.50 |
| | | 12 | 27.30 | 34.80 | 7.03 | 2.10 | 13.10 | 8.82 | 3.84 | 5.95 | 0.264 | 1440 | 111 | 6.43 | 247 | 31.3 | 2.67 | 1530 | 6.63 | 158 | 2.13 | 65 | 150 | M27 | 58.70 | 21.50 |
| | | 14 | 31.60 | 40.30 | 7.12 | 2.18 | 13.00 | 8.88 | 3.93 | 5.92 | 0.262 | 1650 | 128 | 6.41 | 282 | 36.1 | 2.65 | 1760 | 6.60 | 181 | 2.13 | 65 | 150 | M27 | 58.70 | 18.60 |
| | | 16 | 35.90 | 45.70 | 7.20 | 2.26 | 12.90 | 8.93 | 4.02 | 5.88 | 0.259 | 1860 | 145 | 6.38 | 316 | 40.8 | 2.63 | 1970 | 6.57 | 204 | 2.11 | 65 | 150 | M27 | 58.70 | 16.35 |

# CHANNEL
# (U.P.N.)

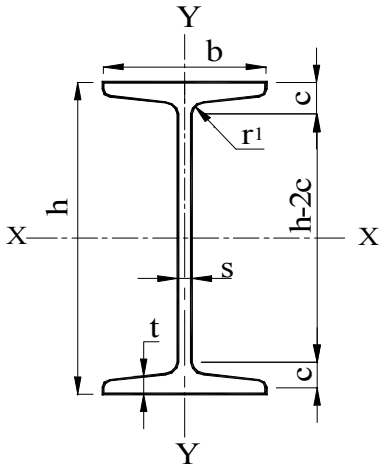


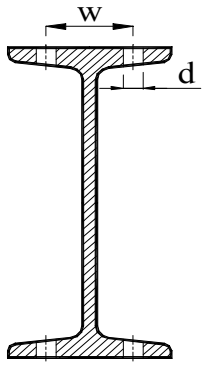




| Sec. No. | Weight | Area | $A_{web}$ | Dimensions | | | | | | | | Axis X-X | | | Axis Y-Y | | | Details | | Surface Area | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | h | b | s | $t=r_1$ | c | h-2c | $e_y$ | $X_m$ | $I_x$ | $S_x$ | $r_x$ | $I_y$ | $S_y$ | $r_y$ | W | $d_{max}$ | $U_m$ | $U_t$ |
| | kg/m` | $cm^2$ | $cm^2$ | mm | mm | mm | mm | mm | mm | cm | cm | $cm^4$ | $cm^3$ | cm | $cm^4$ | $cm^3$ | cm | mm | mm | $x10^{-2}\ m^2/m$\ | $m^2/t$ |
| **30x15** | 1.74 | 2.21 | 0.84 | 30 | 15 | 4.0 | 4.5 | 9.0 | 12 | 0.52 | 0.74 | 2.53 | 1.69 | 1.07 | 0.38 | 0.39 | 0.42 | N.A. | N.A. | 7.14 | 41.00 |
| **30** | 4.27 | 5.44 | 0.80 | 30 | 33 | 5.0 | 7.0 | 14.5 | 1 | 1.31 | 2.22 | 6.39 | 4.26 | 1.08 | 5.33 | 2.68 | 0.99 | N.A. | N.A. | 17.40 | 40.74 |
| **40x20** | 2.87 | 3.66 | 1.45 | 40 | 20 | 5.0 | 5.5 | 11.0 | 18 | 0.67 | 1.01 | 7.58 | 3.79 | 1.44 | 1.14 | 0.86 | 0.56 | N.A. | N.A. | 13.71 | 47.77 |
| **40** | 4.87 | 6.21 | 1.30 | 40 | 35 | 5.0 | 7.0 | 14.5 | 11 | 1.33 | 2.32 | 14.1 | 7.05 | 1.50 | 6.68 | 3.08 | 1.04 | N.A. | N.A. | 19.47 | 40.00 |
| **50x25** | 3.86 | 4.92 | 1.90 | 50 | 25 | 5.0 | 6.0 | 12.5 | 25 | 0.81 | 1.34 | 16.6 | 6.73 | 1.85 | 2.49 | 1.48 | 0.71 | N.A. | N.A. | 17.52 | 45.40 |
| **50** | 5.59 | 7.12 | 1.80 | 50 | 38 | 5.0 | 7.0 | 15.0 | 20 | 1.37 | 2.47 | 26.4 | 10.6 | 1.92 | 9.12 | 3.75 | 1.13 | N.A. | N.A. | 22.40 | 40.06 |
| **60** | 5.07 | 6.46 | 2.88 | 60 | 30 | 6.0 | 6.0 | 12.5 | 35 | 0.91 | 1.50 | 31.6 | 10.5 | 2.21 | 4.51 | 2.16 | 0.84 | N.A. | N.A. | 21.32 | 42.06 |
| **65** | 7.09 | 9.03 | 2.75 | 65 | 42 | 5.5 | 7.5 | 16.0 | 33 | 1.42 | 2.60 | 57.5 | 17.7 | 2.52 | 14.1 | 5.07 | 1.25 | 22 | M10 | 27.30 | 38.50 |
| **70** | 6.73 | 8.57 | 3.42 | 70 | 40 | 6.0 | 6.5 | 16.0 | 38 | 1.42 | 2.20 | 61.1 | 17.5 | 2.67 | 11.4 | 4.10 | 1.15 | 22 | M10 | 26.67 | 39.64 |
| **80** | 8.64 | 11.00 | 3.84 | 80 | 45 | 6.0 | 8.0 | 17.0 | 47 | 1.45 | 2.67 | 106 | 26.5 | 3.10 | 19.4 | 6.36 | 1.33 | 25 | M12 | 31.20 | 36.10 |
| **100** | 10.60 | 13.50 | 4.98 | 100 | 50 | 6.0 | 8.5 | 18.0 | 64 | 1.55 | 2.93 | 206 | 41.2 | 3.91 | 29.3 | 8.49 | 1.47 | 30 | M12 | 37.20 | 35.10 |
| **120** | 13.40 | 17.00 | 7.14 | 120 | 55 | 7.0 | 9.0 | 19.0 | 82 | 1.60 | 3.03 | 364 | 60.7 | 4.62 | 43.2 | 11.1 | 1.59 | 30 | M16 | 43.40 | 32.40 |
| **140** | 16.00 | 20.40 | 8.40 | 140 | 60 | 7.0 | 10.0 | 21.0 | 97 | 1.75 | 3.37 | 605 | 86.4 | 5.45 | 62.7 | 14.8 | 1.75 | 35 | M16 | 48.90 | 30.60 |
| **160** | 18.80 | 24.00 | 10.43 | 160 | 65 | 7.5 | 10.5 | 22.5 | 116 | 1.84 | 3.56 | 925 | 116 | 6.21 | 85.3 | 18.3 | 1.89 | 35 | M20 | 54.60 | 29.00 |
| **180** | 22.00 | 28.00 | 12.64 | 180 | 70 | 8.0 | 11.0 | 23.5 | 133 | 1.92 | 3.75 | 1350 | 150 | 6.95 | 114 | 22.4 | 2.02 | 40 | M20 | 61.10 | 37.80 |
| **200** | 25.30 | 32.20 | 15.05 | 200 | 75 | 8.5 | 11.5 | 24.5 | 151 | 2.01 | 3.94 | 1910 | 191 | 7.70 | 148 | 27.0 | 2.14 | 40 | M20 | 66.10 | 26.10 |
| **220** | 29.40 | 37.40 | 17.55 | 220 | 80 | 9.0 | 12.5 | 26.5 | 166 | 2.14 | 4.20 | 2690 | 245 | 8.48 | 197 | 33.6 | 2.30 | 45 | M20 | 71.80 | 24.40 |
| **240** | 33.20 | 42.30 | 20.33 | 240 | 85 | 9.5 | 13.0 | 28.0 | 185 | 2.23 | 4.39 | 3600 | 300 | 9.22 | 248 | 39.6 | 2.42 | 45 | M24 | 77.50 | 23.30 |
| **260** | 37.90 | 48.30 | 23.20 | 260 | 90 | 10.0 | 14.0 | 30.0 | 201 | 2.36 | 4.66 | 4820 | 371 | 9.99 | 317 | 47.7 | 2.56 | 50 | M24 | 83.40 | 22.00 |
| **280** | 41.80 | 53.30 | 25.00 | 280 | 95 | 10.0 | 15.0 | 32.0 | 213 | 2.53 | 5.02 | 6280 | 448 | 10.90 | 399 | 57.2 | 2.74 | 50 | M24 | 89.00 | 21.00 |
| **300** | 46.20 | 58.80 | 26.80 | 300 | 100 | 10.0 | 16.0 | 34.0 | 232 | 2.70 | 5.41 | 8030 | 535 | 11.70 | 495 | 67.8 | 2.90 | 55 | M27 | 95.00 | 20.60 |
| **320** | 59.50 | 75.80 | 39.90 | 320 | 100 | 14.0 | 17.5 | 37.0 | 247 | 2.60 | 4.82 | 10870 | 679 | 12.10 | 597 | 80.6 | 2.81 | 58 | M27 | 98.20 | 16.50 |
| **350** | 60.60 | 77.30 | 44.52 | 350 | 100 | 14.0 | 16.0 | 34.0 | 283 | 2.40 | 4.45 | 12840 | 734 | 12.90 | 570 | 75.0 | 2.72 | 58 | M27 | 105.00 | 17.30 |
| **380** | 63.10 | 80.40 | 46.98 | 380 | 102 | 13.5 | 16.0 | 33.5 | 313 | 2.38 | 4.58 | 15760 | 829 | 14.00 | 615 | 78.7 | 2.77 | 60 | M27 | 111.00 | 17.70 |
| **400** | 71.80 | 91.50 | 50.96 | 400 | 110 | 14.0 | 18.0 | 38.0 | 325 | 2.65 | 5.11 | 20350 | 1020 | 14.90 | 846 | 102 | 3.04 | 60 | M27 | 118.00 | 16.50 |

N.A.=not available for this channel size

# STANDARD I - BEAMS
# ( I.P.N. )

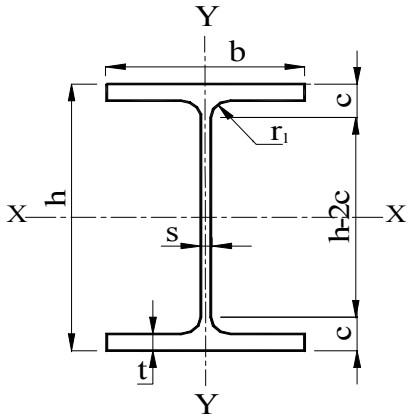


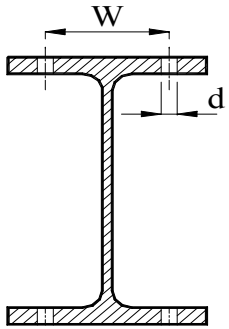




| Sec. No. | Weight | Area | $A_{web}$ | Dimensions | | | | | | Axis X-X | | | Axis Y-Y | | | Details | | Surface Area | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | h | b | s =$r_1$ | t | c | h-2c | $I_x$ | $S_x$ | $r_x$ | $I_y$ | $S_y$ | $r_y$ | w | $d_{max}$ | $U_m$ | $U_t$ |
| | kg/m` | $cm^2$ | $cm^2$ | mm | mm | mm | mm | mm | mm | $cm^4$ | $cm^3$ | cm | $cm^4$ | $cm^3$ | cm | mm | mm | $x10^{-2}$ $m^2/m$\ | $m^2/t$ |
| **80** | 5.94 | 7.57 | 2.66 | 80 | 42 | 3.9 | 5.9 | 10.5 | 59 | 77.8 | 19.5 | 3.20 | 6.29 | 3.00 | 0.91 | N.A. | | 30.40 | 51.20 |
| **100** | 8.34 | 10.60 | 3.89 | 100 | 50 | 4.5 | 6.8 | 12.5 | 75 | 171 | 34.2 | 4.01 | 12.2 | 4.88 | 1.07 | N.A. | | 37.00 | 44.40 |
| **120** | 11.10 | 14.20 | 5.33 | 120 | 58 | 5.1 | 7.7 | 14 | 92 | 328 | 54.7 | 4.81 | 21.5 | 7.41 | 1.23 | N.A. | | 43.90 | 39.50 |
| **140** | 14.30 | 18.20 | 7.00 | 140 | 66 | 5.7 | 8.6 | 15.5 | 109 | 573 | 81.9 | 5.61 | 35.2 | 10.7 | 1.40 | 34 | M10 | 50.20 | 35.10 |
| **160** | 17.90 | 22.80 | 8.88 | 160 | 74 | 6.3 | 9.5 | 17.5 | 125 | 935 | 117 | 6.40 | 54.7 | 14.8 | 1.55 | 40 | M10 | 57.50 | 32.10 |
| **180** | 21.90 | 27.90 | 10.98 | 180 | 82 | 6.9 | 10.4 | 19 | 142 | 1450 | 161 | 7.20 | 81.3 | 19.8 | 1.71 | 44 | M12 | 64.00 | 29.20 |
| **200** | 26.20 | 33.40 | 13.31 | 200 | 90 | 7.5 | 11.3 | 20.5 | 159 | 2140 | 214 | 8.00 | 117 | 26.0 | 1.87 | 48 | M12 | 70.90 | 27.00 |
| **220** | 31.10 | 39.50 | 15.84 | 220 | 98 | 8.1 | 12.2 | 22 | 176 | 3060 | 278 | 8.80 | 162 | 33.1 | 2.02 | 52 | M12 | 77.50 | 24.90 |
| **240** | 36.20 | 46.10 | 18.60 | 240 | 106 | 8.7 | 13.1 | 24 | 192 | 4250 | 354 | 9.59 | 221 | 41.7 | 2.20 | 56 | M16 | 84.40 | 23.30 |
| **260** | 41.90 | 53.30 | 21.79 | 260 | 113 | 9.4 | 14.1 | 26 | 208 | 5740 | 442 | 10.40 | 288 | 51.0 | 2.32 | 60 | M16 | 90.60 | 21.60 |
| **280** | 47.90 | 61.00 | 25.21 | 280 | 119 | 10.1 | 15.2 | 27.5 | 225 | 7590 | 542 | 11.10 | 364 | 61.2 | 2.45 | 60 | M16 | 96.60 | 20.10 |
| **300** | 54.20 | 69.00 | 28.90 | 300 | 125 | 10.8 | 16.2 | 29.5 | 241 | 9800 | 653 | 11.90 | 451 | 72.2 | 2.56 | 64 | M20 | 103.00 | 19.00 |
| **320** | 61.00 | 77.70 | 32.82 | 320 | 131 | 11.5 | 17.3 | 31 | 258 | 12510 | 782 | 12.70 | 555 | 84.7 | 2.67 | 70 | M20 | 109.00 | 17.90 |
| **340** | 68.00 | 86.70 | 37.01 | 340 | 137 | 12.2 | 18.3 | 33 | 274 | 15700 | 923 | 13.50 | 674 | 98.4 | 2.80 | 74 | M20 | 115.00 | 16.90 |
| **360** | 76.10 | 97.00 | 41.73 | 360 | 143 | 13 | 19.5 | 35 | 290 | 19610 | 1090 | 14.20 | 818 | 114 | 2.90 | 76 | M20 | 121.00 | 15.90 |
| **380** | 84.00 | 107.00 | 46.44 | 380 | 149 | 13.7 | 20.5 | 37 | 306 | 24010 | 1260 | 15.00 | 975 | 131 | 3.02 | 82 | M20 | 127.00 | 15.10 |
| **400** | 92.40 | 118.00 | 51.38 | 400 | s | 14.4 | 21.6 | 38.5 | 323 | 29210 | 1460 | 15.70 | 1160 | 149 | 3.13 | 86 | M20 | 133.00 | 14.40 |
| **425** | 104.00 | 132.00 | 57.99 | 425 | 163 | 15.3 | 23 | 41 | 343 | 36970 | 1740 | 16.70 | 1440 | 176 | 3.30 | 88 | M20 | 144.40 | 13.50 |
| **450** | 115.00 | 147.00 | 65.03 | 450 | 170 | 16.2 | 24.3 | 43.5 | 363 | 45850 | 2040 | 17.70 | 1730 | 203 | 3.43 | 94 | M24 | 148.00 | 12.90 |
| **475** | 128.00 | 163.00 | 72.47 | 475 | 178 | 17.1 | 25.6 | 45.5 | 384 | 56480 | 2380 | 18.60 | 2090 | 235 | 3.60 | 100 | M24 | 155.10 | 12.11 |
| **500** | 141.00 | 179.00 | 80.28 | 500 | 185 | 18 | 27 | 48 | 404 | 68740 | 2750 | 19.60 | 2480 | 268 | 3.72 | 100 | M27 | 163.00 | 11.50 |
| **550** | 166.00 | 212.00 | 93.10 | 550 | 200 | 19 | 30 | 52.5 | 445 | 99180 | 3610 | 21.60 | 3490 | 349 | 4.02 | 110 | M27 | 177.30 | 10.68 |
| **600** | 199.00 | 254.00 | 115.60 | 600 | 215 | 21.6 | 32.4 | 57.5 | 485 | 139000 | 4630 | 23.40 | 4670 | 434 | 4.30 | 120 | M27 | 191.90 | 9.64 |

N.A.=not available for this IPN size

# I.P.E.

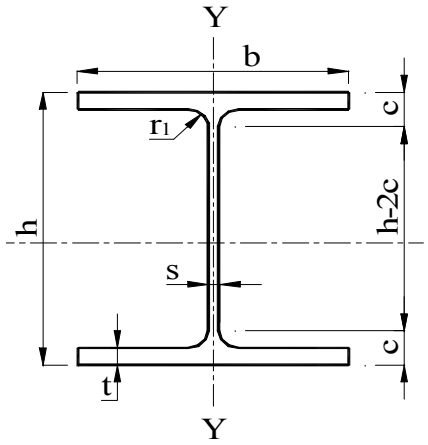


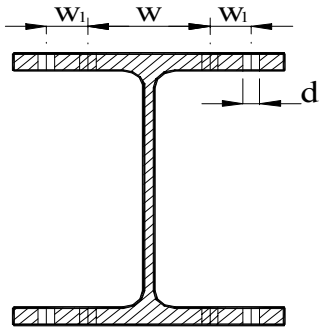




| Sec. No. | Weight | Area | $A_{web}$ | Dimensions | | | | | | | Axis X-X | | | Axis Y-Y | | | Details | | Surface Area | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | h | b | s | t | $r_1$ | c | h-2c | $I_x$ | $S_x$ | $r_x$ | $I_y$ | $S_y$ | $r_y$ | w | $d_{max}$ | $U_m$ | $U_t$ |
| | kg/m` | $cm^2$ | $cm^2$ | mm | mm | mm | mm | mm | mm | mm | $cm^4$ | $cm^3$ | cm | $cm^4$ | $cm^3$ | cm | mm | mm | $x10^{-2}$ $m^2/m$\ | $m^2/t$ |
| **80** | 6.00 | 7.64 | 2.64 | 80 | 46 | 3.8 | 5.2 | 5 | 10.2 | 59.6 | 80.1 | 20.0 | 3.24 | 8.49 | 3.69 | 1.05 | N.A. | N.A. | 32.80 | 54.80 |
| **100** | 8.10 | 10.30 | 3.63 | 100 | 55 | 4.1 | 5.7 | 7 | 12.7 | 74.6 | 171 | 34.2 | 4.07 | 15.9 | 5.79 | 1.24 | N.A. | N.A. | 40.00 | 49.50 |
| **120** | 10.40 | 13.20 | 4.73 | 120 | 64 | 4.4 | 6.3 | 7 | 13.3 | 93.4 | 318 | 53.0 | 4.90 | 27.7 | 8.65 | 1.45 | 36 | M10 | 47.50 | 45.60 |
| **140** | 12.90 | 16.40 | 5.93 | 140 | 73 | 4.7 | 6.9 | 7 | 13.9 | 112.2 | 541 | 77.3 | 5.74 | 44.9 | 12.3 | 1.65 | 38 | M10 | 55.10 | 42.60 |
| **160** | 15.80 | 20.10 | 7.26 | 160 | 82 | 5.0 | 7.4 | 9 | 16.4 | 127.2 | 869 | 109 | 6.58 | 68.3 | 16.7 | 1.84 | 44 | M12 | 62.30 | 39.40 |
| **180** | 18.80 | 23.90 | 8.69 | 180 | 91 | 5.3 | 8.0 | 9 | 17.0 | 146.0 | 1320 | 146 | 7.42 | 101 | 22.2 | 2.05 | 50 | M12 | 69.80 | 37.10 |
| **200** | 22.40 | 28.50 | 10.25 | 200 | 100 | 5.6 | 8.5 | 12 | 20.5 | 159.0 | 1940 | 194 | 8.26 | 142 | 28.5 | 2.24 | 56 | M12 | 76.80 | 34.30 |
| **220** | 26.20 | 33.40 | 11.89 | 220 | 110 | 5.9 | 9.2 | 12 | 21.2 | 177.6 | 2770 | 252 | 9.11 | 205 | 37.3 | 2.48 | 60 | M16 | 84.80 | 32.40 |
| **240** | 30.70 | 39.10 | 13.66 | 240 | 120 | 6.2 | 9.8 | 15 | 24.8 | 190.4 | 3890 | 324 | 9.97 | 284 | 47.3 | 2.69 | 68 | M16 | 92.20 | 30.00 |
| **270** | 36.10 | 45.90 | 16.47 | 270 | 135 | 6.6 | 10.2 | 15 | 25.2 | 219.6 | 5790 | 429 | 11.20 | 420 | 62.2 | 3.02 | 72 | M20 | 104.00 | 28.80 |
| **300** | 42.20 | 53.80 | 19.78 | 300 | 150 | 7.1 | 10.7 | 15 | 25.7 | 248.6 | 8360 | 557 | 12.50 | 604 | 80.5 | 3.35 | 80 | M20 | 116.00 | 27.50 |
| **330** | 49.10 | 62.60 | 23.03 | 330 | 160 | 7.5 | 11.5 | 18 | 29.5 | 271.0 | 11770 | 713 | 13.70 | 788 | 98.5 | 3.55 | 86 | M24 | 125.00 | 25.50 |
| **360** | 57.10 | 72.70 | 26.77 | 360 | 170 | 8.0 | 12.7 | 18 | 30.7 | 298.6 | 16270 | 904 | 15.00 | 1040 | 123 | 3.79 | 90 | M24 | 135.00 | 23.60 |
| **400** | 66.30 | 84.50 | 32.08 | 400 | 180 | 8.6 | 13.5 | 21 | 34.5 | 331.0 | 23130 | 1160 | 16.50 | 1320 | 146 | 3.95 | 96 | M27 | 147.00 | 22.20 |
| **450** | 77.60 | 98.80 | 39.56 | 450 | 190 | 9.4 | 14.6 | 21 | 35.6 | 378.8 | 33740 | 1500 | 18.50 | 1680 | 176 | 4.12 | 106 | M27 | 161.00 | 20.70 |
| **500** | 90.70 | 116.00 | 47.74 | 500 | 200 | 10.2 | 16.0 | 21 | 37.0 | 426.0 | 48200 | 1930 | 20.40 | 2140 | 214 | 4.31 | 110 | M27 | 174.00 | 19.20 |
| **550** | 106.00 | 134.00 | 57.23 | 550 | 210 | 11.1 | 17.2 | 24 | 41.2 | 467.6 | 67120 | 2440 | 22.30 | 2670 | 254 | 4.45 | 120 | M27 | 188.00 | 17.70 |
| **600** | 122.00 | 156.00 | 67.44 | 600 | 220 | 12.0 | 19.0 | 24 | 43.0 | 514.0 | 92080 | 3070 | 24.30 | 3390 | 308 | 4.66 | 120 | M27 | 202.00 | 16.60 |

N.A.=not available for this IPE size

# BROAD FLANGE I - BEAMS
# ( H.E.A. )

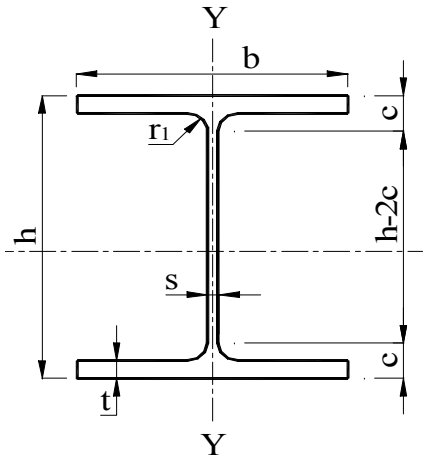


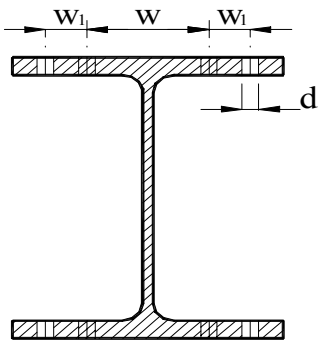




| Sec. No. | Weight | Area | $A_{web}$ | Dimensions | | | | | | | Axis X-X | | | Axis Y-Y | | | Details | | | Surface Area | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | h | b | s | t | $r_1$ | c | h-2c | $I_x$ | $S_x$ | $r_x$ | $I_y$ | $S_y$ | $r_y$ | w | $w_1$ | $d_{max}$ | $U_m$ | $U_t$ |
| | kg/m` | $cm^2$ | $cm^2$ | mm | mm | mm | mm | mm | mm | mm | $cm^4$ | $cm^3$ | cm | $cm^4$ | $cm^3$ | cm | mm | mm | mm | $x10^{-2}$ $m^2/m$\ | $m^2/t$ |
| **100** | 16.7 | 21.2 | 4.00 | 96 | 100 | 5.0 | 8.0 | 12 | 20 | 56 | 349 | 73 | 4.06 | 134 | 26.8 | 2.51 | 56 | N.A. | M12 | 56.10 | 33.60 |
| **120** | 19.9 | 25.3 | 4.90 | 114 | 120 | 5.0 | 8.0 | 12 | 20 | 74 | 606 | 106 | 4.89 | 231 | 38.5 | 3.02 | 66 | N.A. | M16 | 67.70 | 34.00 |
| **140** | 24.7 | 31.4 | 6.38 | 133 | 140 | 5.5 | 8.5 | 12 | 21 | 91 | 1030 | 155 | 5.73 | 389 | 55.6 | 3.52 | 76 | N.A. | M20 | 79.40 | 32.10 |
| **160** | 30.4 | 38.8 | 8.04 | 152 | 160 | 6.0 | 9.0 | 15 | 24 | 104 | 1670 | 220 | 6.57 | 616 | 76.9 | 3.98 | 86 | N.A. | M20 | 90.60 | 29.80 |
| **180** | 35.5 | 45.3 | 9.12 | 171 | 180 | 6.0 | 9.5 | 15 | 25 | 121 | 2510 | 294 | 7.45 | 925 | 103 | 4.52 | 100 | N.A. | M24 | 102.00 | 28.70 |
| **200** | 42.3 | 53.8 | 11.05 | 190 | 200 | 6.5 | 10.0 | 18 | 28 | 134 | 3690 | 389 | 8.28 | 1340 | 134 | 4.98 | 110 | N.A. | M24 | 114.00 | 26.90 |
| **220** | 50.5 | 64.3 | 13.16 | 210 | 220 | 7.0 | 11.0 | 18 | 29 | 152 | 5410 | 515 | 9.17 | 1950 | 178 | 5.51 | 120 | N.A. | M24 | 126.00 | 24.90 |
| **240** | 60.3 | 76.8 | 15.45 | 230 | 240 | 7.5 | 12.0 | 21 | 33 | 164 | 7760 | 675 | 10.10 | 2770 | 231 | 6.00 | 90 | 40 | M24 | 137.00 | 22.70 |
| **260** | 68.2 | 86.8 | 16.88 | 250 | 260 | 7.5 | 12.5 | 24 | 37 | 176 | 10450 | 836 | 11.00 | 3670 | 282 | 6.50 | 95 | 40 | M24 | 148.00 | 21.70 |
| **280** | 76.4 | 97.3 | 19.52 | 270 | 280 | 8.0 | 13.0 | 24 | 37 | 196 | 13670 | 1010 | 11.90 | 4760 | 340 | 7.00 | 110 | 40 | M24 | 160.00 | 21.00 |
| **300** | 88.3 | 113 | 22.27 | 290 | 300 | 8.5 | 14.0 | 27 | 41 | 208 | 18260 | 1260 | 12.70 | 6310 | 421 | 7.49 | 120 | 50 | M27 | 172.00 | 19.50 |
| **320** | 97.6 | 124 | 25.11 | 310 | 300 | 9.0 | 15.5 | 27 | 43 | 224 | 22930 | 1480 | 13.60 | 6990 | 466 | 7.49 | 120 | 50 | M27 | 176.00 | 18.00 |
| **340** | 105 | 133 | 28.22 | 330 | 300 | 9.5 | 16.5 | 27 | 44 | 242 | 27690 | 1680 | 14.40 | 7440 | 496 | 7.46 | 120 | 50 | M27 | 179.00 | 17.10 |
| **360** | 112 | 143 | 31.50 | 350 | 300 | 10.0 | 17.5 | 27 | 45 | 260 | 33090 | 1890 | 15.20 | 7890 | 526 | 7.43 | 120 | 50 | M27 | 183.00 | 16.40 |
| **400** | 125 | 159 | 38.72 | 390 | 300 | 11.0 | 19.0 | 27 | 46 | 298 | 45070 | 2310 | 16.80 | 8560 | 571 | 7.34 | 120 | 50 | M27 | 191.00 | 15.30 |
| **450** | 140 | 178 | 45.77 | 440 | 300 | 11.5 | 21.0 | 27 | 48 | 344 | 63720 | 2900 | 18.90 | 9470 | 631 | 7.29 | 120 | 50 | M27 | 201.00 | 14.40 |
| **500** | 155 | 198 | 53.28 | 490 | 300 | 12.0 | 23.0 | 27 | 50 | 390 | 86970 | 3550 | 21.00 | 10370 | 691 | 7.24 | 120 | 50 | M27 | 211.00 | 13.60 |
| **550** | 166 | 212 | 61.50 | 540 | 300 | 12.5 | 24.0 | 27 | 51 | 438 | 111900 | 4150 | 23.00 | 10820 | 721 | 7.15 | 120 | 50 | M27 | 221.00 | 13.30 |
| **600** | 178 | 226 | 70.20 | 590 | 300 | 13.0 | 25.0 | 27 | 52 | 486 | 141200 | 4790 | 25.00 | 11270 | 751 | 7.05 | 120 | 50 | M27 | 231.00 | 13.00 |
| **650** | 190 | 242 | 79.38 | 640 | 300 | 13.5 | 26.0 | 27 | 53 | 534 | 175200 | 5470 | 26.90 | 11720 | 782 | 6.97 | 120 | 50 | M27 | 241.00 | 12.70 |
| **700** | 204 | 260 | 92.22 | 690 | 300 | 14.5 | 27.0 | 27 | 54 | 582 | 215300 | 6240 | 28.80 | 12180 | 812 | 6.84 | 120 | 50 | M27 | 250.00 | 12.30 |
| **800** | 224 | 286 | 110.10 | 790 | 300 | 15.0 | 28.0 | 30 | 58 | 674 | 303400 | 7680 | 32.60 | 12640 | 843 | 6.65 | 120 | 50 | M27 | 270.00 | 12.00 |
| **900** | 252 | 321 | 132.80 | 890 | 300 | 16.0 | 30.0 | 30 | 60 | 770 | 422100 | 9480 | 36.30 | 13550 | 903 | 6.50 | 120 | 50 | M27 | 290.00 | 11.50 |
| **1000** | 272 | 347 | 153.12 | 990 | 300 | 16.5 | 31.0 | 30 | 61 | 868 | 553800 | 11190 | 40.00 | 14000 | 934 | 6.35 | 120 | 50 | M27 | 310.00 | 11.40 |

N.A. =not available for this HEA size

# BROAD FLANGE I - BEAMS
# ( H.E.B. )

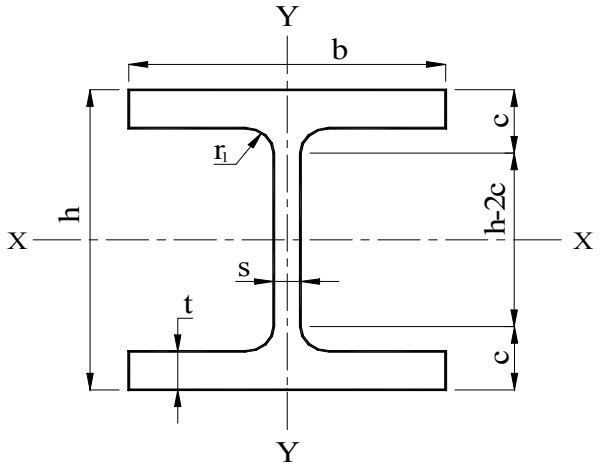


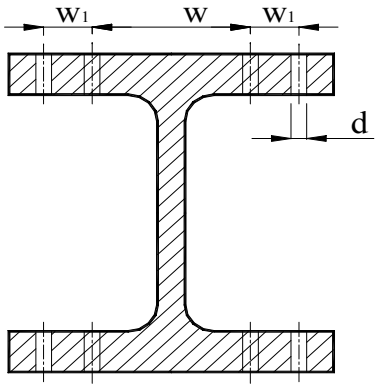




| Sec. No. | Weight | Area | $A_{web}$ | Dimensions | | | | | | | Axis X-X | | | Axis Y-Y | | | Details | | | Surface Area | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | h | b | s | t | $r_1$ | c | h-2c | $I_x$ | $S_x$ | $r_x$ | $I_y$ | $S_y$ | $r_y$ | w | $w_1$ | $d_{max}$ | $U_m$ | $U_t$ |
| | kg/m` | $cm^2$ | $cm^2$ | mm | mm | mm | mm | mm | mm | mm | $cm^4$ | $cm^3$ | cm | $cm^4$ | $cm^3$ | cm | mm | mm | mm | $x10^{-2}$ $m^2/m$\ | $m^2/t$ |
| **100** | 20.4 | 26.0 | 4.80 | 100 | 100 | 6.0 | 10.0 | 12 | 22.0 | 56 | 450 | 89.9 | 4.16 | 167 | 33.5 | 2.53 | 56 | N.A. | M12 | 56.70 | 27.80 |
| **120** | 26.7 | 34.0 | 6.37 | 120 | 120 | 6.5 | 11.0 | 12 | 23.0 | 74 | 864 | 144 | 5.04 | 318 | 52.9 | 3.06 | 66 | N.A. | M16 | 68.60 | 25.70 |
| **140** | 33.7 | 43.0 | 8.12 | 140 | 140 | 7.0 | 12.0 | 12 | 24.0 | 92 | 1510 | 216 | 5.93 | 550 | 78.5 | 3.58 | 76 | N.A. | M20 | 80.50 | 23.80 |
| **160** | 42.6 | 54.3 | 10.72 | 160 | 160 | 8.0 | 13.0 | 15 | 28.0 | 104 | 2490 | 311 | 6.78 | 889 | 111 | 4.05 | 86 | N.A. | M20 | 91.80 | 21.50 |
| **180** | 51.2 | 65.3 | 12.92 | 180 | 180 | 8.5 | 14.0 | 15 | 29.0 | 122 | 3830 | 426 | 7.66 | 1360 | 151 | 4.57 | 100 | N.A. | M24 | 104.00 | 20.30 |
| **200** | 61.3 | 78.1 | 15.30 | 200 | 200 | 9.0 | 15.0 | 18 | 33.0 | 134 | 5700 | 570 | 8.54 | 2000 | 200 | 5.07 | 110 | N.A. | M24 | 115.00 | 18.80 |
| **220** | 71.5 | 91.0 | 17.86 | 220 | 220 | 9.5 | 16.0 | 18 | 34.0 | 152 | 8090 | 736 | 9.43 | 2840 | 258 | 5.59 | 120 | N.A. | M24 | 127.00 | 17.80 |
| **240** | 83.2 | 106 | 20.60 | 240 | 240 | 10.0 | 17.0 | 21 | 38.0 | 164 | 11260 | 938 | 10.30 | 3920 | 327 | 6.08 | 90 | 40 | M20 | 138.00 | 16.60 |
| **260** | 93.0 | 118 | 22.50 | 260 | 260 | 10.0 | 17.5 | 24 | 41.5 | 177 | 14920 | 1150 | 11.20 | 5130 | 395 | 6.58 | 95 | 40 | M20 | 150.00 | 16.10 |
| **280** | 103 | 131 | 25.62 | 280 | 280 | 10.5 | 18.0 | 24 | 42.0 | 196 | 19270 | 1380 | 12.10 | 6590 | 471 | 7.09 | 110 | 40 | M20 | 162.00 | 15.70 |
| **300** | 117 | 149 | 28.82 | 300 | 300 | 11.0 | 19.0 | 27 | 46.0 | 208 | 25170 | 1680 | 13.00 | 8560 | 571 | 7.58 | 120 | 50 | M24 | 173.00 | 14.80 |
| **320** | 127 | 161 | 32.09 | 320 | 300 | 11.5 | 20.5 | 27 | 47.5 | 225 | 30820 | 1930 | 13.80 | 9240 | 616 | 7.57 | 120 | 50 | M24 | 177.00 | 13.90 |
| **340** | 134 | 171 | 35.64 | 340 | 300 | 12.0 | 21.5 | 27 | 48.5 | 243 | 36660 | 2160 | 14.60 | 9690 | 646 | 7.53 | 120 | 50 | M24 | 181.00 | 13.50 |
| **360** | 142 | 181 | 39.38 | 360 | 300 | 12.5 | 22.5 | 27 | 49.5 | 261 | 43190 | 2400 | 15.50 | 10140 | 676 | 7.49 | 120 | 50 | M24 | 185.00 | 13.00 |
| **400** | 155 | 198 | 47.52 | 400 | 300 | 13.5 | 24.0 | 27 | 51.0 | 298 | 57680 | 2880 | 17.10 | 10820 | 721 | 7.40 | 120 | 50 | M24 | 193.00 | 12.40 |
| **450** | 171 | 218 | 55.72 | 450 | 300 | 14.0 | 26.0 | 27 | 53.0 | 344 | 79890 | 3550 | 19.10 | 11720 | 781 | 7.33 | 120 | 50 | M24 | 203.00 | 11.90 |
| **500** | 187 | 239 | 64.38 | 500 | 300 | 14.5 | 28.0 | 27 | 55.0 | 390 | 107200 | 4290 | 21.20 | 12620 | 842 | 7.27 | 120 | 50 | M24 | 212.00 | 11.30 |
| **550** | 199 | 254 | 73.80 | 550 | 300 | 15.0 | 29.0 | 27 | 56.0 | 438 | 136700 | 4970 | 23.20 | 13080 | 872 | 7.17 | 120 | 50 | M24 | 222.00 | 12.20 |
| **600** | 212 | 270 | 83.70 | 600 | 300 | 15.5 | 30.0 | 27 | 57.0 | 486 | 171000 | 5700 | 25.20 | 13530 | 902 | 7.08 | 120 | 50 | M24 | 232.00 | 11.00 |
| **650** | 225 | 286 | 94.08 | 650 | 300 | 16.0 | 31.0 | 27 | 58.0 | 534 | 210600 | 6480 | 27.10 | 13980 | 932 | 6.99 | 120 | 50 | M24 | 242.00 | 10.80 |
| **700** | 241 | 306 | 108.1 | 700 | 300 | 17.0 | 32.0 | 27 | 59.0 | 582 | 256900 | 7340 | 29.00 | 14440 | 963 | 6.87 | 120 | 50 | M24 | 252.00 | 10.50 |
| **800** | 262 | 334 | 128.5 | 800 | 300 | 17.5 | 33.0 | 30 | 63.0 | 674 | 359100 | 9890 | 32.80 | 14900 | 994 | 6.68 | 120 | 50 | M24 | 271.00 | 10.40 |
| **900** | 291 | 371 | 153.6 | 900 | 300 | 18.5 | 35.0 | 30 | 65.0 | 770 | 494100 | 10980 | 36.50 | 15820 | 1050 | 6.53 | 120 | 50 | M24 | 291.00 | 10.00 |
| **1000** | 314 | 400 | 176.3 | 1000 | 300 | 19.0 | 36.0 | 30 | 66.0 | 868 | 644700 | 12890 | 40.10 | 16280 | 1090 | 6.38 | 120 | 50 | M24 | 311.00 | 9.90 |

N.A.=not available for this HEB size

# BROAD FLANGE I - BEAMS
# ( H.E.M. )

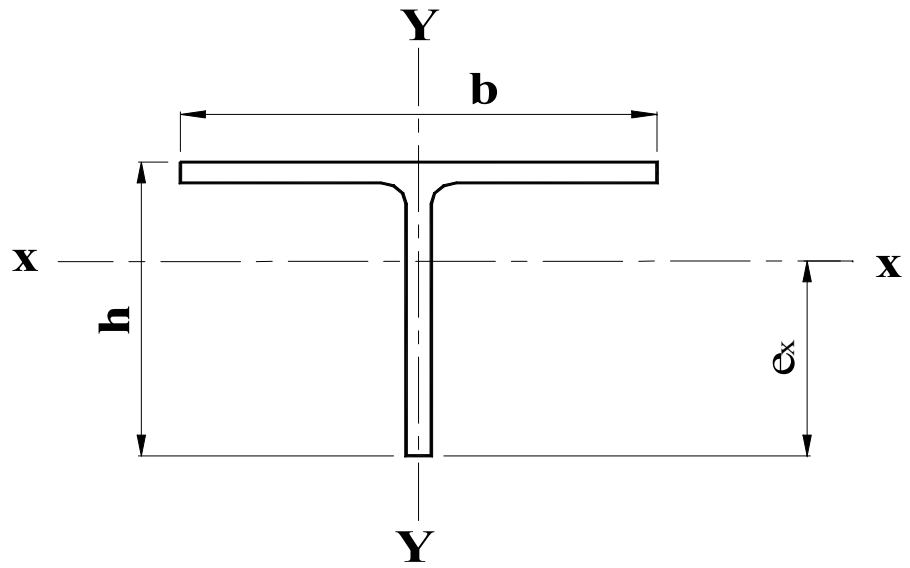



| Sec. No. | Weight | Area | $A_{web}$ | Dimensions | | | | | | | Axis X-X | | | Axis Y-Y | | | Details | | | Surface Area | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | h | b | s | t | $r_1$ | c | h-2c | $I_x$ | $S_x$ | $r_x$ | $I_y$ | $S_y$ | $r_y$ | w | $w_1$ | $d_{max}$ | $U_m$ | $U_t$ |
| | kg/m` | $cm^2$ | $cm^2$ | mm | mm | mm | mm | mm | mm | mm | $cm^4$ | $cm^3$ | cm | $cm^4$ | $cm^3$ | cm | mm | mm | mm | $x10^{-2}$ $m^2/m$\ | $m^2/t$ |
| **100** | 41.8 | 53.2 | 9.60 | 120 | 106 | 12 | 20 | 12 | 32 | 56 | 1140 | 190 | 4.63 | 400 | 75.3 | 2.74 | 60 | N.A. | M12 | 61.90 | 14.80 |
| **120** | 52.1 | 66.4 | 12.25 | 140 | 126 | 12.5 | 21 | 12 | 33 | 74 | 2020 | 288 | 5.51 | 700 | 112 | 3.25 | 68 | N.A. | M16 | 73.80 | 14.20 |
| **140** | 63.2 | 80.6 | 15.08 | 160 | 146 | 13 | 22 | 12 | 34 | 92 | 3290 | 411 | 6.39 | 1140 | 157 | 3.77 | 76 | N.A. | M20 | 85.70 | 13.60 |
| **160** | 76.2 | 97.1 | 18.76 | 180 | 166 | 14 | 23 | 15 | 38 | 104 | 5100 | 566 | 7.25 | 1760 | 212 | 4.26 | 86 | N.A. | M20 | 97.00 | 12.70 |
| **180** | 88.9 | 113 | 22.04 | 200 | 186 | 14.5 | 24 | 15 | 39 | 122 | 7480 | 748 | 8.13 | 2580 | 277 | 4.77 | 100 | N.A. | M24 | 109.00 | 12.30 |
| **200** | 103 | 131 | 25.50 | 220 | 206 | 15 | 25 | 18 | 43 | 134 | 10640 | 967 | 9.00 | 3650 | 354 | 5.27 | 110 | N.A. | M24 | 120.00 | 11.70 |
| **220** | 117 | 149 | 29.14 | 240 | 226 | 15.5 | 26 | 18 | 44 | 152 | 14600 | 1220 | 9.89 | 5010 | 444 | 5.79 | 120 | N.A. | M24 | 132.00 | 11.30 |
| **240** | 157 | 200 | 37.08 | 270 | 248 | 18 | 32 | 21 | 53 | 164 | 24290 | 1800 | 11.00 | 8150 | 657 | 6.39 | 100 | 40 | M20 | 146.00 | 9.30 |
| **260** | 172 | 220 | 40.50 | 290 | 268 | 18 | 32.5 | 24 | 57 | 176 | 31310 | 2160 | 11.90 | 10450 | 780 | 6.90 | 110 | 40 | M20 | 157.00 | 9.13 |
| **280** | 189 | 240 | 22.76 | 310 | 288 | 18.5 | 33 | 24 | 66 | 196 | 39550 | 2550 | 12.80 | 13160 | 914 | 7.40 | 116 | 40 | M20 | 169.00 | 8.94 |
| **300** | 238 | 303 | 55.02 | 340 | 310 | 21 | 39 | 27 | 67 | 208 | 59200 | 3480 | 14.00 | 19400 | 1250 | 8.00 | 120 | 50 | M24 | 183.00 | 7.70 |
| **320** | 245 | 312 | 58.59 | 359 | 309 | 21 | 40 | 27 | 67 | 225 | 68130 | 3800 | 14.80 | 19710 | 1280 | 7.95 | 126 | 50 | M24 | 187.00 | 7.63 |
| **340** | 248 | 316 | 62.37 | 377 | 309 | 21 | 40 | 27 | 67 | 243 | 76370 | 4050 | 15.60 | 19710 | 1280 | 7.90 | 126 | 50 | M24 | 190.00 | 7.67 |
| **360** | 250 | 319 | 66.15 | 395 | 308 | 21 | 40 | 27 | 67 | 261 | 84870 | 4300 | 16.30 | 19520 | 1270 | 7.83 | 126 | 50 | M24 | 193.00 | 7.77 |
| **400** | 256 | 326 | 73.92 | 432 | 307 | 21 | 40 | 27 | 67 | 298 | 104100 | 4820 | 17.90 | 19340 | 1260 | 7.70 | 126 | 50 | M24 | 200.00 | 7.81 |
| **450** | 263 | 335 | 83.58 | 478 | 307 | 21 | 40 | 27 | 67 | 344 | 131500 | 5500 | 19.80 | 19340 | 1260 | 7.59 | 126 | 50 | M24 | 210.00 | 7.97 |
| **500** | 270 | 344 | 93.24 | 524 | 306 | 21 | 40 | 27 | 67 | 390 | 161900 | 6180 | 21.70 | 19150 | 1250 | 7.46 | 130 | 50 | M24 | 218.00 | 8.07 |
| **550** | 278 | 354 | 103.32 | 572 | 306 | 21 | 40 | 27 | 67 | 438 | 198000 | 6920 | 23.60 | 19150 | 1250 | 7.35 | 130 | 50 | M24 | 228.00 | 8.20 |
| **600** | 285 | 364 | 113.40 | 620 | 305 | 21 | 40 | 27 | 67 | 486 | 237400 | 7660 | 25.60 | 18980 | 1240 | 7.22 | 130 | 50 | M24 | 237.00 | 8.32 |
| **650** | 293 | 374 | 123.48 | 668 | 305 | 21 | 40 | 27 | 67 | 534 | 281700 | 8430 | 27.50 | 18980 | 1240 | 7.13 | 130 | 50 | M24 | 247.00 | 8.42 |
| **700** | 301 | 383 | 133.56 | 716 | 304 | 21 | 40 | 27 | 67 | 582 | 329300 | 9200 | 29.30 | 18800 | 1240 | 7.01 | 130 | 50 | M24 | 256.00 | 8.50 |
| **800** | 317 | 404 | 154.14 | 814 | 303 | 21 | 40 | 30 | 70 | 674 | 442600 | 10870 | 33.10 | 18630 | 1230 | 6.79 | 132 | 50 | M24 | 275.00 | 8.66 |
| **900** | 333 | 424 | 174.30 | 910 | 302 | 21 | 40 | 30 | 70 | 770 | 570400 | 12540 | 36.70 | 18450 | 1220 | 6.60 | 132 | 50 | M24 | 293.00 | 8.80 |
| **1000** | 349 | 444 | 194.88 | 1008 | 302 | 21 | 40 | 30 | 70 | 868 | 722300 | 14330 | 40.30 | 18450 | 1220 | 6.45 | 132 | 50 | M24 | 313.00 | 8.97 |

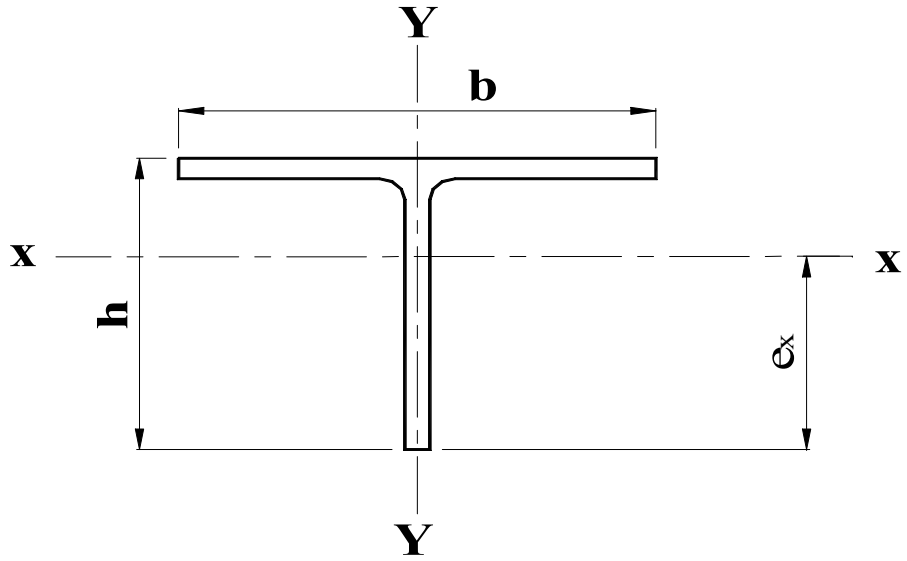
N.A.=not available for this HEM size

# T - SECTION
# Half I.P.E.



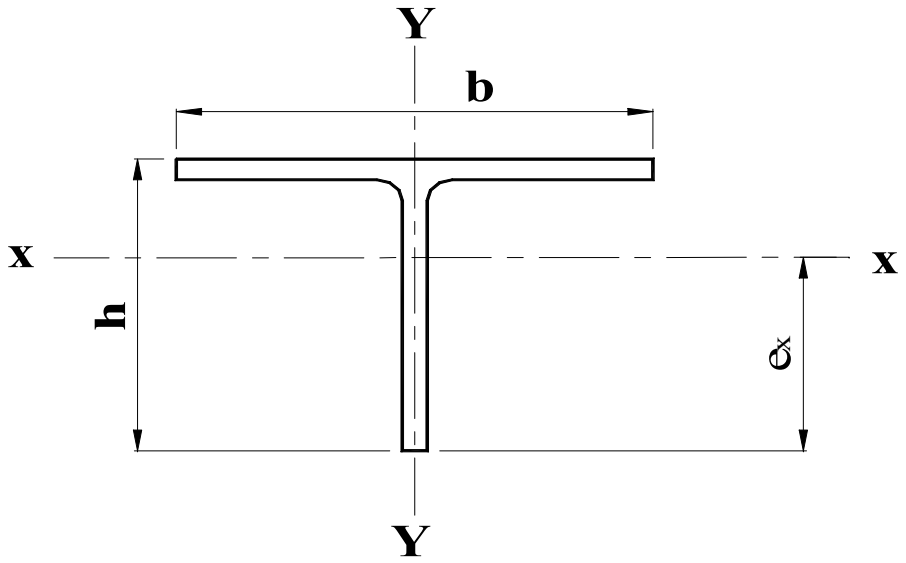

| 1/2 IPE No. | Weight | Area | $A_{web}$ | Dimensions | | Axis X-X | | | | | Axis Y-Y | | | Surface Area | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | h | b | $I_x$ | $S_{xb}$ | $S_{xt}$ | $r_x$ | $e_x$ | $I_y$ | $S_y$ | $r_y$ | $U_m$ | $U_t$ |
| | kg/m\ | $cm^2$ | $cm^2$ | mm | mm | $cm^4$ | $cm^3$ | $cm^3$ | cm | cm | $cm^4$ | $cm^3$ | cm | $x10^{-2}\ m^2/m$\ | $m^2/m$\ |
| **80** | 3.00 | 3.82 | 1.32 | 40 | 46 | 4.80 | 1.58 | 5.00 | 1.12 | 3.04 | 4.24 | 1.84 | 1.05 | 16.40 | 54.80 |
| **100** | 4.05 | 5.15 | 1.82 | 50 | 55 | 10.3 | 2.70 | 8.66 | 1.41 | 3.81 | 7.95 | 2.89 | 1.24 | 20.00 | 49.50 |
| **120** | 5.20 | 6.62 | 2.36 | 60 | 64 | 19.3 | 4.20 | 13.79 | 1.71 | 4.60 | 13.80 | 4.32 | 1.45 | 23.70 | 45.60 |
| **140** | 6.45 | 8.21 | 2.97 | 70 | 73 | 33.2 | 6.14 | 20.49 | 2.01 | 5.38 | 22.40 | 6.15 | 1.65 | 27.50 | 42.60 |
| **160** | 7.89 | 10.10 | 3.63 | 80 | 82 | 52.9 | 8.57 | 28.75 | 2.29 | 6.16 | 34.10 | 8.34 | 1.84 | 31.10 | 39.40 |
| **180** | 9.40 | 12.00 | 4.35 | 90 | 91 | 80.3 | 11.5 | 39.17 | 2.59 | 6.95 | 50.40 | 11.1 | 2.05 | 34.90 | 37.10 |
| **200** | 11.20 | 14.20 | 5.12 | 100 | 100 | 117 | 15.1 | 52.00 | 2.87 | 7.75 | 71.20 | 14.2 | 2.24 | 38.40 | 34.30 |
| **220** | 13.10 | 16.70 | 5.95 | 110 | 110 | 165 | 19.3 | 67.35 | 3.15 | 8.55 | 100.2 | 18.6 | 2.48 | 42.40 | 32.40 |
| **240** | 15.40 | 19.60 | 6.83 | 120 | 120 | 227 | 24.3 | 86.31 | 3.41 | 9.37 | 142.0 | 23.7 | 2.69 | 46.00 | 30.00 |
| **270** | 18.00 | 23.00 | 8.24 | 135 | 135 | 346 | 32.8 | 116.50 | 3.88 | 10.53 | 210.0 | 31.1 | 3.02 | 52.00 | 28.80 |
| **300** | 21.10 | 26.90 | 9.89 | 450 | 150 | 509 | 43.6 | 153.31 | 4.35 | 41.68 | 302.0 | 40.3 | 3.35 | 58.00 | 27.50 |
| **330** | 24.60 | 31.30 | 11.51 | 165 | 160 | 717 | 55.8 | 196.44 | 4.78 | 12.85 | 394.0 | 49.3 | 3.55 | 62.50 | 25.50 |
| **360** | 28.50 | 36.40 | 13.38 | 180 | 170 | 992 | 70.8 | 255.01 | 5.22 | 14.11 | 521.0 | 61.3 | 3.79 | 67.50 | 23.60 |
| **400** | 33.20 | 42.20 | 16.04 | 200 | 180 | 1450 | 93.7 | 320.80 | 5.86 | 15.48 | 659.0 | 73.4 | 3.95 | 73.50 | 22.20 |
| **450** | 38.80 | 49.40 | 19.78 | 225 | 190 | 2220 | 129 | 420.45 | 6.70 | 17.22 | 838.0 | 88.4 | 4.12 | 80.50 | 20.70 |
| **500** | 45.30 | 57.80 | 23.87 | 250 | 200 | 3260 | 172 | 542.43 | 7.52 | 18.99 | 1070 | 107.0 | 4.31 | 87.00 | 19.20 |
| **550** | 52.80 | 67.20 | 28.62 | 275 | 210 | 4670 | 225 | 689.81 | 8.33 | 20.73 | 1330 | 127.0 | 4.45 | 94.00 | 17.70 |
| **600** | 61.20 | 78.00 | 33.72 | 300 | 220 | 6500 | 288 | 868.98 | 9.13 | 22.52 | 1690 | 154.0 | 4.66 | 101.00 | 16.60 |

# T - SECTIONS
# Half H.E.A.



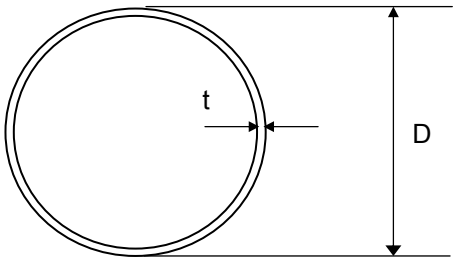

| 1/2 HEA No. | Weight | Area | $A_{web}$ | Dimensions | | Axis X-X | | | | | Axis Y-Y | | | Surface Area | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | h | b | $I_x$ | $S_{xb}$ | $S_{xt}$ | $r_x$ | $e_x$ | $I_y$ | $S_y$ | $r_y$ | $U_m$ | $U_t$ |
| | kg/m\ | $cm^2$ | $cm^2$ | mm | mm | $cm^4$ | $cm^3$ | $cm^3$ | cm | cm | $cm^4$ | $cm^3$ | cm | $x10^{-2}\ m^2/m$\ | $m^2/m$\ |
| **100** | 8.34 | 10.60 | 2.00 | 48 | 100 | 12.4 | 3.16 | 13.9 | 1.08 | 3.91 | 67 | 13.4 | 2.51 | 28.00 | 33.60 |
| **120** | 9.94 | 12.70 | 2.45 | 57 | 120 | 21.3 | 4.52 | 21.7 | 1.30 | 4.72 | 115 | 19.2 | 3.02 | 33.80 | 34.00 |
| **140** | 12.30 | 15.70 | 3.19 | 66 | 140 | 37.5 | 6.79 | 33.2 | 1.55 | 5.47 | 194 | 27.8 | 3.52 | 39.70 | 32.10 |
| **160** | 15.20 | 19.40 | 4.02 | 76 | 160 | 61.5 | 9.72 | 48.0 | 1.78 | 6.32 | 308 | 38.5 | 3.98 | 45.30 | 29.80 |
| **180** | 17.80 | 22.60 | 4.56 | 85 | 180 | 89.1 | 12.4 | 65.0 | 1.98 | 7.13 | 462 | 51.4 | 4.52 | 51.00 | 28.70 |
| **200** | 21.10 | 26.90 | 5.53 | 95 | 200 | 133 | 16.6 | 87.5 | 2.22 | 7.98 | 668 | 66.8 | 4.98 | 57.00 | 26.90 |
| **220** | 25.30 | 32.20 | 6.58 | 105 | 220 | 194 | 21.9 | 116.9 | 2.45 | 8.84 | 975 | 88.8 | 5.51 | 63.00 | 24.90 |
| **240** | 30.20 | 38.40 | 7.73 | 115 | 240 | 273 | 28.8 | 150.8 | 2.67 | 9.69 | 1380 | 115 | 6.00 | 68.50 | 22.70 |
| **260** | 34.10 | 43.40 | 8.44 | 125 | 260 | 355 | 33.5 | 185.9 | 2.86 | 10.59 | 1830 | 141 | 6.50 | 74.00 | 21.70 |
| **280** | 38.20 | 48.60 | 9.76 | 135 | 280 | 477 | 41.7 | 231.6 | 3.13 | 11.44 | 2380 | 170 | 7.00 | 80.00 | 21.00 |
| **300** | 44.20 | 56.30 | 11.14 | 145 | 300 | 630 | 51.2 | 285.1 | 3.35 | 12.29 | 3150 | 210 | 7.49 | 86.00 | 19.50 |
| **320** | 48.80 | 62.20 | 12.56 | 155 | 300 | 808 | 61.7 | 335.3 | 3.60 | 13.09 | 3490 | 233 | 7.49 | 88.00 | 18.00 |
| **340** | 52.40 | 66.70 | 14.11 | 165 | 300 | 1020 | 73.5 | 386.4 | 3.91 | 13.86 | 3720 | 248 | 7.46 | 89.50 | 17.10 |
| **360** | 56.00 | 71.40 | 15.75 | 175 | 300 | 1270 | 86.7 | 442.5 | 4.22 | 14.63 | 3940 | 263 | 7.43 | 91.50 | 16.40 |
| **400** | 62.40 | 79.50 | 19.36 | 195 | 300 | 1890 | 118 | 557.5 | 4.88 | 16.11 | 4280 | 285 | 7.34 | 99.50 | 15.30 |
| **450** | 69.90 | 89.00 | 22.89 | 220 | 300 | 2820 | 156 | 715.7 | 5.62 | 18.06 | 4730 | 315 | 7.29 | 100.00 | 14.40 |
| **500** | 77.50 | 98.80 | 26.64 | 245 | 300 | 4020 | 201 | 891.4 | 6.38 | 19.99 | 5180 | 345 | 7.24 | 105.00 | 13.60 |
| **550** | 83.10 | 106.00 | 30.75 | 270 | 300 | 5530 | 253 | 1070 | 7.23 | 21.83 | 5410 | 360 | 7.15 | 110.00 | 13.30 |
| **600** | 88.90 | 113.00 | 35.10 | 295 | 300 | 7400 | 313 | 1261 | 8.08 | 23.63 | 5630 | 375 | 7.05 | 115.00 | 13.00 |

# T - SECTIONS
# Half H.E.B.



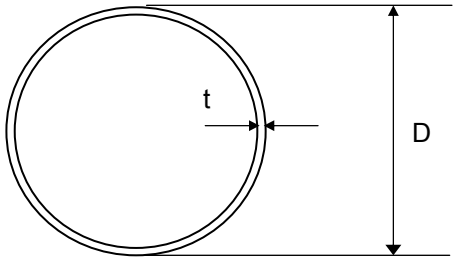

| 1/2 HEB No. | Weight | Area | $A_{web}$ | Dimensions | | Axis X-X | | | | | Axis Y-Y | | | Surface Area | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | h | b | $I_x$ | $S_{xb}$ | $S_{xt}$ | $r_x$ | $e_x$ | $I_y$ | $S_y$ | $r_y$ | $U_m$ | $U_t$ |
| | kg/m\ | $cm^2$ | $cm^2$ | mm | mm | $cm^4$ | $cm^3$ | $cm^3$ | cm | cm | $cm^4$ | $cm^3$ | cm | $x10^{-2}\ m^2/m$\ | $m^2/m$\ |
| **100** | 10.20 | 13.00 | 2.40 | 50 | 100 | 16.2 | 4.05 | 16.2 | 1.12 | 4.00 | 84 | 16.8 | 2.53 | 28.30 | 27.80 |
| **120** | 13.30 | 17.00 | 3.19 | 60 | 120 | 30.9 | 6.35 | 27.1 | 1.35 | 4.86 | 159 | 26.4 | 3.06 | 34.30 | 25.70 |
| **140** | 16.90 | 21.50 | 4.06 | 70 | 140 | 53.5 | 9.36 | 41.5 | 1.58 | 5.71 | 275 | 39.2 | 3.58 | 40.20 | 23.90 |
| **160** | 21.30 | 27.10 | 5.36 | 80 | 160 | 91.3 | 14.0 | 61.7 | 1.83 | 6.52 | 444 | 55.5 | 4.05 | 45.90 | 21.50 |
| **180** | 25.60 | 32.60 | 6.46 | 90 | 180 | 139 | 18.9 | 85.8 | 2.07 | 7.38 | 680 | 75.6 | 4.57 | 52.00 | 20.30 |
| **200** | 30.60 | 39.00 | 7.65 | 100 | 200 | 204 | 24.8 | 115.3 | 2.29 | 8.23 | 1002 | 100 | 5.07 | 57.00 | 18.80 |
| **220** | 35.70 | 45.50 | 8.93 | 110 | 220 | 289 | 31.8 | 150.5 | 2.52 | 9.08 | 1422 | 129 | 5.59 | 63.50 | 17.80 |
| **240** | 41.60 | 53.00 | 10.30 | 120 | 240 | 397 | 40.0 | 192.7 | 2.74 | 9.94 | 1961 | 163 | 6.08 | 69.00 | 16.60 |
| **260** | 46.50 | 59.20 | 11.25 | 130 | 260 | 512 | 47.3 | 235.9 | 2.94 | 10.83 | 2570 | 197 | 6.58 | 75.00 | 16.10 |
| **280** | 51.60 | 65.70 | 12.81 | 140 | 280 | 673 | 57.7 | 290.1 | 3.20 | 11.68 | 3300 | 235 | 7.09 | 81.00 | 15.70 |
| **300** | 58.50 | 74.60 | 14.41 | 150 | 300 | 871 | 69.5 | 352.6 | 3.42 | 12.53 | 4280 | 285 | 7.58 | 86.50 | 14.80 |
| **320** | 63.30 | 80.70 | 16.04 | 160 | 300 | 1097 | 82.3 | 409.3 | 3.69 | 13.32 | 4620 | 308 | 7.57 | 88.50 | 13.90 |
| **340** | 67.10 | 85.40 | 17.82 | 170 | 300 | 1362 | 96.7 | 468.0 | 3.99 | 14.09 | 4840 | 323 | 7.53 | 90.50 | 13.50 |
| **360** | 70.90 | 90.30 | 19.69 | 180 | 300 | 1671 | 113 | 530.5 | 4.30 | 14.85 | 5070 | 338 | 7.49 | 92.50 | 13.00 |
| **400** | 77.60 | 98.90 | 23.76 | 200 | 300 | 2437 | 149 | 665.8 | 4.96 | 16.34 | 5410 | 360 | 7.40 | 96.50 | 12.40 |
| **450** | 85.60 | 109.00 | 27.86 | 225 | 300 | 3566 | 195 | 843.0 | 5.72 | 18.27 | 5860 | 390 | 7.33 | 101.00 | 11.90 |
| **500** | 93.70 | 119.00 | 32.19 | 250 | 300 | 5020 | 249 | 1041.5 | 6.49 | 20.18 | 6310 | 421 | 7.27 | 106.00 | 11.30 |
| **550** | 99.70 | 127.00 | 36.90 | 275 | 300 | 6834 | 311 | 1244.8 | 7.33 | 22.01 | 6540 | 436 | 7.17 | 111.00 | 11.20 |
| **600** | 106.00 | 135.00 | 41.85 | 300 | 300 | 9060 | 381 | 1461.3 | 8.19 | 23.80 | 6760 | 451 | 7.08 | 116.00 | 11.00 |

# PIPES



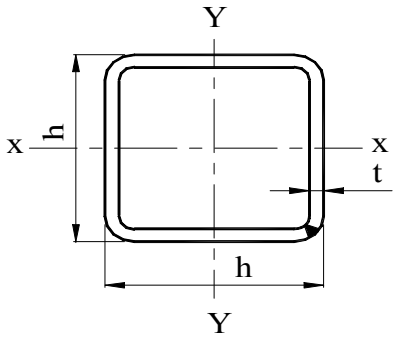

| Pipe No. | Weight | Area | Dimensions | | I | S | r | Surface Area | |
|---|---|---|---|---|---|---|---|---|---|
| | | | D | t | | | | $U_m$ | $U_t$ |
| | kg/m` | $cm^2$ | mm | mm | $cm^4$ | $cm^3$ | cm | $x10^{-2}$ $m^2/m^{\backslash}$ | $m^2/t$ |
| **38** | 2.59 | 3.30 | 38 | 3 | 5.00 | 2.68 | 1.24 | 11.94 | 46.09 |
| | 3.35 | 4.27 | 38 | 4 | 6.26 | 3.29 | 1.21 | 11.94 | 35.64 |
| **44.5** | 3.07 | 3.91 | 44.5 | 3 | 8.46 | 3.80 | 1.47 | 13.98 | 45.54 |
| | 4.00 | 5.09 | 44.5 | 4 | 10.5 | 4.74 | 1.44 | 13.98 | 34.95 |
| | 4.87 | 6.20 | 44.5 | 5 | 12.3 | 5.53 | 1.41 | 13.98 | 28.71 |
| **60** | 4.22 | 5.37 | 60 | 3 | 21.9 | 7.29 | 2.02 | 18.85 | 44.67 |
| | 5.52 | 7.04 | 60 | 4 | 27.7 | 9.24 | 1.99 | 18.85 | 34.15 |
| | 6.78 | 8.64 | 60 | 5 | 32.9 | 11.0 | 1.95 | 18.85 | 27.80 |
| **70** | 4.96 | 6.31 | 70 | 3 | 35.5 | 10.1 | 2.37 | 21.99 | 44.34 |
| | 6.51 | 8.29 | 70 | 4 | 45.3 | 13.0 | 2.34 | 21.99 | 33.78 |
| | 8.01 | 10.20 | 70 | 5 | 54.2 | 15.5 | 2.31 | 21.99 | 27.45 |
| | 9.47 | 12.10 | 70 | 6 | 62.3 | 17.8 | 2.27 | 21.99 | 23.22 |
| **76** | 5.40 | 6.88 | 76 | 3 | 45.9 | 12.1 | 2.58 | 23.88 | 44.21 |
| | 7.10 | 9.05 | 76 | 4 | 58.5 | 15.5 | 2.55 | 23.88 | 33.63 |
| | 8.75 | 11.20 | 76 | 5 | 70.6 | 18.6 | 2.52 | 23.88 | 27.29 |
| | 10.40 | 13.20 | 76 | 6 | 81.4 | 21.4 | 2.48 | 23.88 | 22.96 |
| **89** | 8.38 | 10.70 | 89 | 4 | 96.7 | 21.7 | 3.01 | 27.96 | 33.37 |
| | 10.40 | 13.20 | 89 | 5 | 117 | 26.2 | 2.98 | 27.96 | 26.88 |
| | 12.30 | 15.60 | 89 | 6 | 135 | 30.4 | 2.94 | 27.96 | 22.73 |
| | 14.20 | 18.00 | 89 | 7 | 153 | 34.3 | 2.91 | 27.96 | 19.69 |
| **108** | 12.70 | 16.20 | 108 | 5 | 215 | 39.8 | 3.65 | 33.93 | 26.72 |
| | 15.10 | 19.20 | 108 | 6 | 251 | 46.5 | 3.61 | 33.93 | 22.47 |
| | 17.40 | 22.20 | 108 | 7 | 285 | 52.7 | 3.58 | 33.93 | 19.50 |
| | 19.70 | 25.10 | 108 | 8 | 316 | 58.6 | 3.55 | 33.93 | 17.22 |
| **133** | 16.80 | 20.10 | 133 | 5 | 412 | 62.0 | 4.53 | 41.78 | 24.87 |
| | 18.80 | 23.90 | 133 | 6 | 484 | 72.7 | 4.5 | 41.78 | 22.23 |
| | 21.80 | 27.70 | 133 | 7 | 552 | 82.9 | 4.46 | 41.78 | 19.17 |
| | 24.70 | 31.40 | 133 | 8 | 616 | 92.6 | 4.43 | 41.78 | 16.92 |
| **159** | 19.00 | 24.20 | 159 | 5 | 718 | 90.3 | 5.45 | 49.95 | 26.29 |
| | 22.60 | 28.80 | 159 | 6 | 845 | 106 | 5.41 | 49.95 | 22.10 |
| | 26.20 | 33.40 | 159 | 7 | 967 | 122 | 5.38 | 49.95 | 19.07 |
| | 29.80 | 38.00 | 159 | 8 | 1080 | 136 | 5.35 | 49.95 | 16.76 |
| | 36.70 | 46.80 | 159 | 10 | 1300 | 164 | 5.28 | 49.95 | 13.61 |

# PIPES



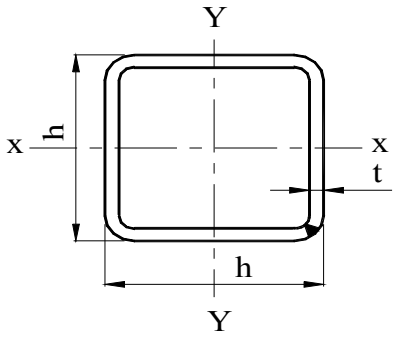

| Pipe No. | Weight | Area | Dimensions | | I | S | r | Surface Area | |
|---|---|---|---|---|---|---|---|---|---|
| | | | D | t | | | | $U_m$ | $U_t$ |
| | kg/m` | $cm^2$ | mm | mm | $cm^4$ | $cm^3$ | cm | $x10^{-2}$ $m^2/m^{\backslash}$ | $m^2/t$ |
| **194** | 27.8 | 35.4 | 194 | 6 | 1570 | 162 | 6.65 | 60.95 | 21.93 |
| | 32.3 | 41.1 | 194 | 7 | 1800 | 186 | 6.62 | 60.95 | 18.89 |
| | 36.7 | 46.7 | 194 | 8 | 2030 | 209 | 6.59 | 60.95 | 16.63 |
| | 45.4 | 57.8 | 194 | 10 | 2241 | 253 | 6.53 | 60.95 | 13.43 |
| **219** | 31.5 | 40.2 | 219 | 6 | 2280 | 208 | 7.53 | 68.80 | 21.84 |
| | 36.6 | 46.6 | 219 | 7 | 2620 | 240 | 7.50 | 68.80 | 18.81 |
| | 41.6 | 53.0 | 219 | 8 | 2960 | 270 | 7.46 | 68.80 | 16.54 |
| | 51.5 | 65.7 | 219 | 10 | 3590 | 328 | 7.40 | 68.80 | 13.36 |
| | 61.3 | 78.0 | 219 | 12 | 4190 | 383 | 7.32 | 68.80 | 11.22 |
| **245** | 41.1 | 52.3 | 245 | 7 | 3710 | 303 | 8.42 | 76.97 | 18.75 |
| | 46.8 | 59.6 | 245 | 8 | 4190 | 342 | 8.37 | 76.97 | 16.45 |
| | 57.9 | 73.8 | 245 | 10 | 5110 | 417 | 8.32 | 76.97 | 13.29 |
| | 68.9 | 87.8 | 245 | 12 | 5980 | 488 | 8.25 | 76.97 | 11.17 |
| | 79.8 | 102.0 | 245 | 14 | 6800 | 555 | 8.17 | 76.97 | 9.65 |
| **273** | 45.9 | 58.5 | 273 | 7 | 5180 | 379 | 9.40 | 85.77 | 18.68 |
| | 52.5 | 66.6 | 273 | 8 | 5850 | 429 | 9.37 | 85.77 | 16.34 |
| | 64.9 | 82.6 | 273 | 10 | 7150 | 524 | 9.30 | 85.77 | 13.22 |
| | 77.2 | 98.4 | 273 | 12 | 8400 | 615 | 9.24 | 85.77 | 11.10 |
| | 89.4 | 114.0 | 273 | 14 | 9580 | 702 | 9.17 | 85.77 | 9.59 |
| **325** | 62.5 | 79.7 | 325 | 8 | 10010 | 616 | 11.20 | 102.10 | 16.34 |
| | 77.7 | 99.0 | 325 | 10 | 12290 | 756 | 11.10 | 102.10 | 13.14 |
| | 92.7 | 118.0 | 325 | 12 | 14470 | 891 | 11.10 | 102.10 | 11.01 |
| | 107.0 | 137.0 | 325 | 14 | 16570 | 1020 | 11.00 | 102.10 | 9.54 |
| | 122.0 | 155.0 | 325 | 16 | 18590 | 1140 | 10.90 | 102.10 | 8.37 |
| **368** | 71.0 | 90.5 | 368 | 8 | 14660 | 797 | 12.70 | 115.61 | 16.27 |
| | 88.3 | 112.0 | 368 | 10 | 18030 | 980 | 12.70 | 115.61 | 13.09 |
| | 105.0 | 134.0 | 368 | 12 | 21290 | 1160 | 12.60 | 115.61 | 11.01 |
| | 122.0 | 156.0 | 368 | 14 | 24430 | 1330 | 12.50 | 115.61 | 9.48 |
| | 139.0 | 177.0 | 368 | 16 | 27460 | 1490 | 12.50 | 115.61 | 8.32 |
| | 172.0 | 219.0 | 368 | 20 | 33210 | 1800 | 12.30 | 115.61 | 6.72 |
| **419** | 100.5 | 128.0 | 419 | 10 | 26880 | 1283 | 14.50 | 131.63 | 13.10 |
| | 120.1 | 153.0 | 419 | 12 | 31800 | 1518 | 14.40 | 131.63 | 10.96 |
| | 159.4 | 203.0 | 419 | 16 | 41190 | 1970 | 14.30 | 131.63 | 8.26 |
| | 197.0 | 251.0 | 419 | 20 | 50020 | 2390 | 14.10 | 131.63 | 6.68 |
| **529** | 115.0 | 147.0 | 529 | 9 | 49710 | 1879 | 18.40 | 166.19 | 14.45 |
| | 128.0 | 163.0 | 529 | 10 | 54920 | 2077 | 18.40 | 166.19 | 12.99 |

# HOLLOW SQUARE SECTION



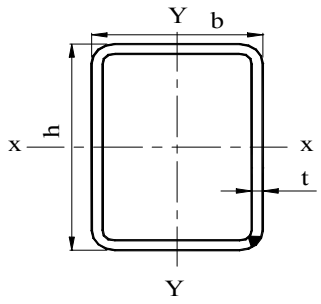

| Dimensions | | Weight | Area | Axis X-X & Y-Y | | | J | Surface Area | |
|---|---|---|---|---|---|---|---|---|---|
| h | t | | | I | S | r | | $U_m$ | $U_t$ |
| mm | mm | kg/m\ | $cm^2$ | $cm^4$ | $cm^3$ | cm | $cm^4$ | $x10^{-2}$ $m^2/m$\ | $m^2/t$ |
| **40** | **4.0** | 4.46 | 5.68 | 12.1 | 6.07 | 1.46 | 19.5 | 15.10 | 33.87 |
| **50** | **3.2** | 4.66 | 5.94 | 21.6 | 8.62 | 1.91 | 33.8 | 19.30 | 41.39 |
| | **4.0** | 5.71 | 7.28 | 25.5 | 10.2 | 1.87 | 40.4 | 19.10 | 33.42 |
| | **5.0** | 6.97 | 8.88 | 29.6 | 11.9 | 1.83 | 47.6 | 18.90 | 27.11 |
| **60** | **3.2** | 5.67 | 7.22 | 38.7 | 12.9 | 2.31 | 60.1 | 23.30 | 41.11 |
| | **4.0** | 6.97 | 8.88 | 46.1 | 15.4 | 2.28 | 72.4 | 23.10 | 33.14 |
| | **5.0** | 8.56 | 10.90 | 54.4 | 18.1 | 2.24 | 86.3 | 22.90 | 26.76 |
| **70** | **3.6** | 7.46 | 9.50 | 69.5 | 19.9 | 2.70 | 108 | 27.20 | 36.47 |
| | **5.0** | 10.13 | 12.90 | 90.1 | 25.7 | 2.64 | 142 | 26.90 | 26.56 |
| **80** | **3.6** | 8.56 | 10.90 | 106 | 26.5 | 3.11 | 164 | 31.20 | 36.46 |
| | **5.0** | 11.70 | 14.90 | 139 | 34.7 | 3.05 | 217 | 30.90 | 26.42 |
| | **6.3** | 14.44 | 18.40 | 165 | 41.3 | 3.00 | 261 | 30.60 | 21.19 |
| **90** | **3.6** | 9.73 | 12.40 | 154 | 34.1 | 3.52 | 237 | 35.20 | 36.16 |
| | **5.0** | 13.27 | 16.90 | 202 | 45.0 | 3.46 | 315 | 34.90 | 26.31 |
| | **6.3** | 16.41 | 20.90 | 242 | 53.9 | 3.41 | 381 | 34.60 | 21.09 |
| **100** | **4.0** | 12.01 | 15.30 | 234 | 46.8 | 3.91 | 361 | 39.10 | 32.55 |
| | **5.0** | 14.84 | 18.90 | 283 | 56.6 | 3.87 | 439 | 38.90 | 26.22 |
| | **6.3** | 18.37 | 23.40 | 341 | 68.2 | 3.81 | 533 | 38.60 | 21.01 |
| | **8.0** | 22.84 | 29.10 | 408 | 81.5 | 3.74 | 646 | 38.30 | 16.77 |
| | **10.0** | 27.87 | 35.50 | 474 | 94.9 | 3.65 | 761 | 37.90 | 13.60 |
| **120** | **5.0** | 17.98 | 22.90 | 503 | 83.8 | 4.69 | 775 | 46.90 | 26.09 |
| | **6.3** | 22.37 | 28.50 | 610 | 102 | 4.63 | 949 | 46.60 | 20.83 |
| | **8.0** | 27.87 | 35.50 | 738 | 123 | 4.56 | 1159 | 46.30 | 16.61 |
| | **10.0** | 34.15 | 43.50 | 870 | 145 | 4.47 | 1381 | 45.90 | 13.44 |
| **140** | **5.0** | 21.12 | 26.90 | 814 | 116 | 5.50 | 1251 | 54.90 | 26.00 |
| | **6.3** | 26.30 | 33.50 | 994 | 142 | 5.45 | 1538 | 54.60 | 20.76 |
| | **8.0** | 32.89 | 41.90 | 1212 | 173 | 5.38 | 1889 | 54.30 | 16.51 |
| | **10.0** | 40.43 | 51.50 | 1441 | 206 | 5.29 | 2269 | 53.90 | 13.33 |

# HOLLOW SQUARE SECTION



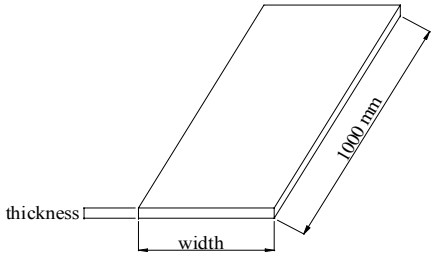

| Dimensions | | Weight | Area | Axis X-X & Y-Y | | | J | Surface Area | |
|---|---|---|---|---|---|---|---|---|---|
| h | t | | | I | S | r | | $U_m$ | $U_t$ |
| mm | mm | kg/m\ | $cm^2$ | $cm^4$ | $cm^3$ | cm | $cm^4$ | $x10^{-2}$ $m^2/m$\ | $m^2/t$ |
| 150 | **5.0** | 22.69 | 28.90 | 1009 | 135 | 5.91 | 1548 | 58.90 | 25.96 |
| | **6.3** | 28.26 | 36.00 | 1236 | 165 | 5.86 | 1907 | 58.60 | 20.74 |
| | **8.0** | 35.40 | 45.10 | 1510 | 201 | 5.78 | 2348 | 58.30 | 16.47 |
| | **10.0** | 43.57 | 55.50 | 1803 | 240 | 5.70 | 2829 | 57.90 | 13.29 |
| | **12.5** | 53.38 | 68.00 | 2125 | 283 | 5.59 | 3372 | 57.30 | 10.73 |
| | **16.0** | 66.33 | 84.50 | 2500 | 333 | 5.44 | 4029 | 56.60 | 8.53 |
| 180 | **6.3** | 34.23 | 43.60 | 2186 | 243 | 7.08 | 3357 | 70.60 | 20.63 |
| | **8.0** | 42.94 | 54.70 | 2689 | 299 | 7.01 | 4156 | 70.30 | 16.37 |
| | **10.0** | 52.99 | 67.50 | 3237 | 360 | 6.92 | 5041 | 69.90 | 13.19 |
| | **12.5** | 65.16 | 83.00 | 3856 | 428 | 6.82 | 6062 | 69.30 | 10.64 |
| | **16.0** | 81.64 | 104.00 | 4607 | 512 | 6.66 | 7339 | 68.60 | 8.40 |
| 200 | **6.3** | 38.15 | 48.60 | 3033 | 303 | 7.90 | 4647 | 78.60 | 20.60 |
| | **8.0** | 47.96 | 61.10 | 3744 | 374 | 7.83 | 5770 | 78.30 | 16.32 |
| | **10.0** | 59.27 | 75.50 | 4525 | 452 | 7.74 | 7020 | 77.90 | 13.14 |
| | **12.5** | 73.01 | 93.00 | 5419 | 542 | 7.63 | 8479 | 77.30 | 10.59 |
| | **16.0** | 91.85 | 117.00 | 6524 | 652 | 7.48 | 10330 | 76.60 | 8.34 |
| 250 | **6.3** | 48.04 | 61.20 | 6049 | 484 | 9.94 | 9228 | 98.60 | 20.52 |
| | **8.0** | 60.52 | 77.10 | 7510 | 601 | 9.87 | 11511 | 98.30 | 16.24 |
| | **10.0** | 74.97 | 95.50 | 9141 | 731 | 9.78 | 14086 | 97.90 | 13.06 |
| | **12.5** | 92.63 | 118.00 | 11050 | 884 | 9.68 | 17139 | 97.30 | 10.50 |
| | **16.0** | 116.97 | 149.00 | 13480 | 1078 | 9.53 | 21109 | 96.60 | 8.26 |
| 300 | **10.0** | 91.06 | 116.00 | 16150 | 1077 | 11.80 | 24776 | 118.00 | 12.96 |
| | **12.5** | 112.26 | 143.00 | 19630 | 1309 | 11.70 | 30290 | 117.00 | 10.42 |
| | **16.0** | 142.09 | 181.00 | 24160 | 1610 | 11.60 | 37566 | 117.00 | 8.23 |
| 350 | **10.0** | 106.76 | 136.00 | 26050 | 1489 | 13.90 | 39840 | 138.00 | 12.93 |
| | **12.5** | 131.88 | 168.00 | 31810 | 1817 | 13.80 | 48869 | 137.00 | 10.39 |
| | **16.0** | 167.21 | 213.00 | 39370 | 2250 | 13.60 | 60901 | 137.00 | 8.19 |
| 400 | **10.0** | 122.46 | 156.00 | 39350 | 1968 | 15.90 | 60028 | 158.00 | 12.90 |
| | **12.5** | 151.51 | 193.00 | 48190 | 2409 | 15.80 | 73815 | 157.00 | 10.36 |

# HOLLOW RECTANGULAR SECTION




| Dimensions | | | Weight | Area | Axis X-X | | | Axis Y-Y | | | J | Surface Area | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| h | b | t | | | $I_x$ | $S_x$ | $r_x$ | $I_y$ | $S_y$ | $r_y$ | | $U_m$ | $U_t$ |
| mm | mm | mm | kg/m\ | $cm^2$ | $cm^4$ | $cm^3$ | cm | $cm^4$ | $cm^3$ | cm | $cm^4$ | $x10^{-2}$ $m^2/m$\ | $m^2/t$ |
| 50 | 30 | 2.6 | 3.03 | 3.86 | 12.4 | 4.96 | 1.79 | 5.5 | 3.6 | 1.19 | 12.1 | 15.40 | 50.80 |
| | | 3.2 | 3.66 | 4.66 | 14.5 | 5.82 | 1.77 | 6.3 | 4.2 | 1.16 | 14.2 | 15.30 | 41.80 |
| 60 | 40 | 3.2 | 4.66 | 5.94 | 28.3 | 9.44 | 2.18 | 14.8 | 7.4 | 1.58 | 30.8 | 19.30 | 41.40 |
| | | 4.0 | 5.71 | 7.28 | 33.6 | 11.2 | 2.15 | 17.3 | 8.7 | 1.54 | 36.6 | 19.10 | 33.40 |
| 80 | 40 | 3.2 | 5.67 | 7.22 | 58.1 | 14.5 | 2.84 | 19.1 | 9.6 | 1.63 | 46.1 | 23.30 | 41.10 |
| | | 4.0 | 6.97 | 8.88 | 69.6 | 17.4 | 2.80 | 22.6 | 11.3 | 1.59 | 55.1 | 23.10 | 33.10 |
| 90 | 50 | 3.6 | 7.46 | 9.50 | 99.6 | 22.2 | 3.24 | 39.1 | 15.6 | 2.03 | 89.3 | 27.20 | 36.50 |
| | | 5.0 | 10.13 | 12.90 | 130 | 28.9 | 3.18 | 50.0 | 20.0 | 1.97 | 116 | 26.90 | 26.60 |
| 100 | 50 | 3.2 | 7.17 | 9.14 | 117 | 23.5 | 3.58 | 39.1 | 15.6 | 2.07 | 93 | 29.30 | 40.80 |
| | | 4.0 | 8.87 | 11.30 | 142 | 28.4 | 3.55 | 46.7 | 18.7 | 2.03 | 113 | 29.10 | 32.80 |
| | | 5.0 | 10.91 | 13.90 | 170 | 34.0 | 3.50 | 55.1 | 22.0 | 1.99 | 135 | 28.90 | 26.50 |
| | | 6.3 | 13.42 | 17.10 | 202 | 40.5 | 3.44 | 64.2 | 25.7 | 1.94 | 160 | 28.60 | 21.30 |
| | 60 | 3.6 | 8.56 | 10.90 | 147 | 29.3 | 3.66 | 65.4 | 21.8 | 2.45 | 142 | 31.20 | 36.30 |
| | | 5.0 | 11.70 | 14.90 | 192 | 38.5 | 3.60 | 84.7 | 28.2 | 2.39 | 187 | 30.90 | 26.40 |
| | | 6.3 | 14.44 | 18.40 | 230 | 46.0 | 3.54 | 99.9 | 33.3 | 2.33 | 224 | 30.60 | 21.30 |
| 120 | 60 | 3.6 | 9.73 | 12.40 | 230 | 38.3 | 4.31 | 76.9 | 25.6 | 2.49 | 183 | 35.20 | 36.20 |
| | | 5.0 | 13.27 | 16.90 | 304 | 50.7 | 4.24 | 99.9 | 33.3 | 2.43 | 242 | 34.90 | 26.20 |
| | | 6.0 | 16.41 | 20.90 | 366 | 61.0 | 4.18 | 118 | 39.4 | 2.38 | 290 | 34.60 | 21.10 |
| | 80 | 5.0 | 14.84 | 18.90 | 370 | 61.7 | 4.43 | 195 | 48.8 | 3.21 | 401 | 38.90 | 26.30 |
| | | 6.3 | 18.37 | 23.40 | 447 | 74.6 | 4.37 | 234 | 58.4 | 3.16 | 486 | 38.60 | 21.00 |
| | | 8.0 | 22.84 | 29.10 | 537 | 89.5 | 4.29 | 278 | 69.4 | 3.09 | 586 | 38.30 | 16.70 |
| | | 10.0 | 27.87 | 35.50 | 628 | 105 | 4.20 | 320 | 80.0 | 3.00 | 688 | 37.90 | 13.60 |
| 150 | 100 | 5.0 | 18.76 | 23.90 | 747 | 99.5 | 5.59 | 396 | 79.1 | 4.07 | 806 | 48.90 | 26.10 |
| | | 6.3 | 23.31 | 29.70 | 910 | 121 | 5.53 | 479 | 95.9 | 4.02 | 985 | 48.60 | 20.90 |
| | | 8.0 | 29.12 | 37.10 | 1106 | 147 | 5.46 | 577 | 115 | 3.94 | 1202 | 48.30 | 16.60 |
| | | 10.0 | 35.72 | 45.50 | 1312 | 175 | 5.37 | 678 | 136 | 3.86 | 1431 | 47.90 | 13.40 |
| 160 | 80 | 5.0 | 17.98 | 22.90 | 753 | 94.1 | 5.74 | 251 | 62.8 | 3.31 | 599 | 46.90 | 26.10 |
| | | 6.3 | 22.30 | 28.50 | 917 | 115 | 5.68 | 302 | 75.6 | 3.26 | 729 | 46.60 | 20.90 |
| | | 8.0 | 27.87 | 35.50 | 1113 | 139 | 5.60 | 361 | 90.2 | 3.19 | 882 | 46.30 | 16.60 |
| | | 10.0 | 34.15 | 43.50 | 1318 | 165 | 5.50 | 419 | 105 | 3.10 | 1041 | 45.90 | 13.40 |
| 200 | 100 | 5.0 | 22.69 | 28.90 | 1509 | 151 | 7.23 | 509 | 102 | 4.20 | 1202 | 58.90 | 25.90 |
| | | 6.3 | 28.26 | 36.00 | 1851 | 185 | 7.17 | 618 | 124 | 4.14 | 1473 | 58.60 | 20.70 |
| | | 8.0 | 35.40 | 45.10 | 2269 | 227 | 7.09 | 747 | 149 | 4.07 | 1802 | 58.30 | 16.50 |
| | | 10.0 | 43.57 | 55.50 | 2718 | 272 | 7.00 | 881 | 176 | 3.98 | 2154 | 57.90 | 13.30 |
| | | 12.5 | 53.38 | 68.00 | 3218 | 322 | 6.88 | 1022 | 204 | 3.88 | 2541 | 57.30 | 10.70 |
| | | 16.0 | 66.33 | 84.50 | 3808 | 381 | 6.71 | 1175 | 235 | 3.73 | 2988 | 56.60 | 8.52 |
| 250 | 150 | 6.3 | 38.15 | 48.60 | 4178 | 334 | 9.27 | 1886 | 252 | 6.23 | 4049 | 78.60 | 20.60 |
| | | 8.0 | 47.96 | 61.10 | 5167 | 416 | 9.19 | 2317 | 309 | 6.16 | 5014 | 78.30 | 16.30 |
| | | 10.0 | 59.27 | 75.50 | 6259 | 501 | 9.10 | 2784 | 371 | 6.07 | 6082 | 77.90 | 13.10 |
| | | 12.5 | 73.01 | 93.00 | 7518 | 601 | 8.99 | 3310 | 441 | 5.97 | 7317 | 77.30 | 10.60 |
| | | 16.0 | 91.85 | 117.00 | 9089 | 727 | 8.83 | 3943 | 526 | 5.82 | 8863 | 76.60 | 8.37 |
| 300 | 200 | 6.3 | 48.04 | 61.20 | 7880 | 525 | 11.30 | 4216 | 422 | 8.30 | 8468 | 98.60 | 20.50 |
| | | 8.0 | 60.52 | 77.10 | 9898 | 653 | 11.30 | 5219 | 522 | 8.23 | 10550 | 98.30 | 16.20 |
| | | 10.0 | 74.97 | 95.50 | 11940 | 796 | 11.20 | 6331 | 633 | 8.14 | 12890 | 97.90 | 13.10 |
| | | 12.5 | 92.63 | 118.00 | 14460 | 964 | 11.10 | 7619 | 762 | 8.04 | 15650 | 97.30 | 10.50 |
| | | 16.0 | 116.97 | 149.00 | 17700 | 1180 | 10.90 | 9239 | 924 | 7.89 | 19220 | 96.60 | 8.26 |
| 400 | 200 | 10.0 | 91.06 | 116.00 | 24140 | 1207 | 14.50 | 8138 | 814 | 8.39 | 19240 | 118.00 | 13.00 |
| | | 12.5 | 112.26 | 143.00 | 29410 | 1471 | 14.30 | 9820 | 982 | 8.29 | 23410 | 117.00 | 10.40 |
| | | 16.0 | 142.09 | 181.00 | 36300 | 1815 | 14.20 | 11950 | 1195 | 8.14 | 28840 | 117.00 | 8.24 |
| 450 | 250 | 10.0 | 106.76 | 136.00 | 37180 | 1653 | 16.60 | 14900 | 1192 | 10.50 | 33250 | 138.00 | 13.00 |
| | | 12.5 | 131.88 | 168.00 | 45470 | 2021 | 16.50 | 18100 | 1448 | 10.40 | 40670 | 137.00 | 10.40 |
| | | 16.0 | 167.21 | 213.00 | 56420 | 2508 | 16.30 | 22250 | 1780 | 10.20 | 50480 | 137.00 | 8.20 |

# MASS (kg/m$^{1}$) FOR RECTANGULAR STEEL PLATES*



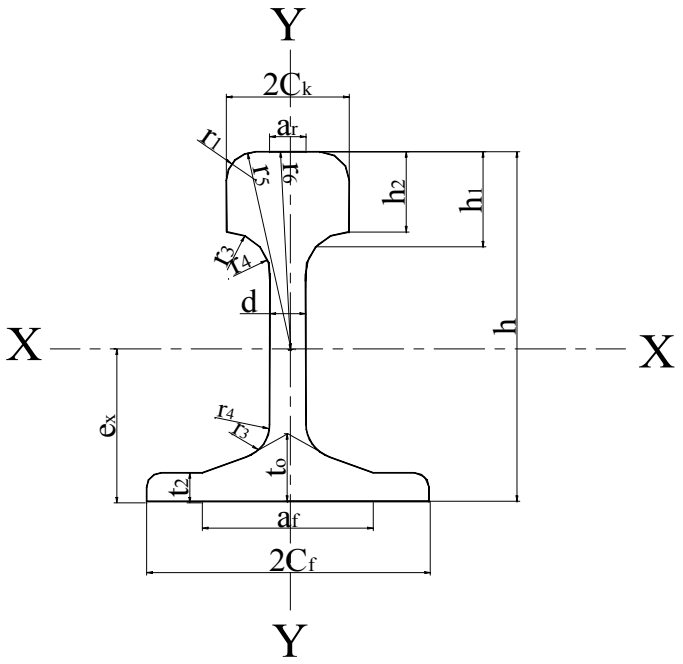

| Width (mm) | Thickness (mm) | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 5 | 6 | 7 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 25 | 28 | 30 | 35 | 40 |
| 25 | 0.98 | 1.18 | 1.53 | 1.57 | 1.96 | 2.36 | 2.75 | 3.14 | 3.53 | 3.93 | 4.32 | 4.91 | 5.50 | 5.89 | 6.87 | 7.85 |
| 28 | 1.10 | 1.32 | 1.72 | 1.76 | 2.20 | 2.64 | 3.08 | 3.52 | 3.96 | 4.40 | 4.84 | 5.50 | 6.15 | 6.59 | 7.69 | 8.79 |
| 30 | 1.18 | 1.41 | 1.84 | 1.88 | 2.36 | 2.83 | 3.30 | 3.77 | 4.24 | 4.71 | 5.18 | 5.89 | 6.59 | 7.07 | 8.24 | 9.42 |
| 35 | 1.37 | 1.65 | 2.14 | 2.20 | 2.75 | 3.30 | 3.85 | 4.40 | 4.95 | 5.50 | 6.04 | 6.87 | 7.69 | 8.24 | 9.62 | 10.99 |
| 40 | 1.57 | 1.88 | 2.45 | 2.51 | 3.14 | 3.77 | 4.40 | 5.02 | 5.65 | 6.28 | 6.91 | 7.85 | 8.79 | 9.42 | 10.99 | 12.56 |
| 45 | 1.77 | 2.12 | 2.76 | 2.83 | 3.53 | 4.24 | 4.95 | 5.65 | 6.36 | 7.07 | 7.77 | 8.83 | 9.89 | 10.60 | 12.36 | 14.13 |
| 50 | 1.96 | 2.36 | 3.06 | 3.14 | 3.93 | 4.71 | 5.50 | 6.28 | 7.07 | 7.85 | 8.64 | 9.81 | 10.99 | 11.78 | 13.74 | 15.70 |
| 55 | 2.16 | 2.59 | 3.37 | 3.45 | 4.32 | 5.18 | 6.04 | 6.91 | 7.77 | 8.64 | 9.50 | 10.79 | 12.09 | 12.95 | 15.11 | 17.27 |
| 60 | 2.36 | 2.83 | 3.68 | 3.77 | 4.71 | 5.65 | 6.59 | 7.54 | 8.48 | 9.42 | 10.36 | 11.78 | 13.19 | 14.13 | 16.49 | 18.84 |
| 70 | 2.75 | 3.30 | 4.29 | 4.40 | 5.50 | 6.59 | 7.69 | 8.79 | 9.89 | 10.99 | 12.09 | 13.74 | 15.39 | 16.49 | 19.23 | 21.98 |
| 80 | 3.14 | 3.77 | 4.90 | 5.02 | 6.28 | 7.54 | 8.79 | 10.05 | 11.30 | 12.56 | 13.82 | 15.70 | 17.58 | 18.84 | 21.98 | 25.12 |
| 90 | 3.53 | 4.24 | 5.51 | 5.65 | 7.07 | 8.48 | 9.89 | 11.30 | 12.72 | 14.13 | 15.54 | 17.66 | 19.78 | 21.20 | 24.73 | 28.26 |
| 100 | 3.93 | 4.71 | 6.13 | 6.28 | 7.85 | 9.42 | 10.99 | 12.56 | 14.13 | 15.70 | 17.27 | 19.63 | 21.98 | 23.55 | 27.48 | 31.40 |
| 110 | 4.32 | 5.18 | 6.74 | 6.91 | 8.64 | 10.36 | 12.09 | 13.82 | 15.54 | 17.27 | 19.00 | 21.59 | 24.18 | 25.91 | 30.22 | 34.54 |
| 120 | 4.71 | 5.65 | 7.35 | 7.54 | 9.42 | 11.30 | 13.19 | 15.07 | 16.96 | 18.84 | 20.72 | 23.55 | 26.38 | 28.26 | 32.97 | 37.68 |
| 140 | 5.50 | 6.59 | 8.58 | 8.79 | 10.99 | 13.19 | 15.39 | 17.58 | 19.78 | 21.98 | 24.18 | 27.48 | 30.77 | 32.97 | 38.47 | 43.96 |
| 160 | 6.28 | 7.54 | 9.80 | 10.05 | 12.56 | 15.07 | 17.58 | 20.10 | 22.61 | 25.12 | 27.63 | 31.40 | 35.17 | 37.68 | 43.96 | 50.24 |
| 180 | 7.07 | 8.48 | 11.03 | 11.30 | 14.13 | 16.96 | 19.78 | 22.61 | 25.43 | 28.26 | 31.09 | 35.33 | 39.56 | 42.39 | 49.46 | 56.52 |
| 200 | 7.85 | 9.42 | 12.25 | 12.56 | 15.70 | 18.84 | 21.98 | 25.12 | 28.26 | 31.40 | 34.54 | 39.25 | 43.96 | 47.10 | 54.95 | 62.80 |
| 220 | 8.64 | 10.36 | 13.48 | 13.82 | 17.27 | 20.72 | 24.18 | 27.63 | 31.09 | 34.54 | 37.99 | 43.18 | 48.36 | 51.81 | 60.45 | 69.08 |
| 250 | 9.81 | 11.78 | 15.31 | 15.70 | 19.63 | 23.55 | 27.48 | 31.40 | 35.33 | 39.25 | 43.18 | 49.06 | 54.95 | 58.88 | 68.69 | 78.50 |
| 300 | 11.78 | 14.13 | 18.38 | 18.84 | 23.55 | 28.26 | 32.97 | 37.68 | 42.39 | 47.10 | 51.81 | 58.88 | 65.94 | 70.65 | 82.43 | 94.20 |
| 350 | 13.74 | 16.49 | 21.44 | 21.98 | 27.48 | 32.97 | 38.47 | 43.96 | 49.46 | 54.95 | 60.45 | 68.69 | 76.93 | 82.43 | 96.16 | 109.90 |
| 400 | 15.70 | 18.84 | 24.50 | 25.12 | 31.40 | 37.68 | 43.96 | 50.24 | 56.52 | 62.80 | 69.08 | 78.50 | 87.92 | 94.20 | 109.90 | 125.60 |
| 450 | 17.66 | 21.20 | 27.56 | 28.26 | 35.33 | 42.39 | 49.46 | 56.52 | 63.59 | 70.65 | 77.72 | 88.31 | 98.91 | 105.98 | 123.64 | 141.30 |
| 500 | 19.63 | 23.55 | 30.63 | 31.40 | 39.25 | 47.10 | 54.95 | 62.80 | 70.65 | 78.50 | 86.35 | 98.13 | 109.90 | 117.75 | 137.38 | 157.00 |
| 600 | 23.55 | 28.26 | 36.75 | 37.68 | 47.10 | 56.52 | 65.94 | 75.36 | 84.78 | 94.20 | 103.62 | 117.75 | 131.88 | 141.30 | 164.85 | 188.40 |
| 700 | 27.48 | 32.97 | 42.88 | 43.96 | 54.95 | 65.94 | 76.93 | 87.92 | 98.91 | 109.90 | 120.89 | 137.38 | 153.86 | 164.85 | 192.33 | 219.80 |
| 800 | 31.40 | 37.68 | 49.00 | 50.24 | 62.80 | 75.36 | 87.92 | 100.48 | 113.04 | 125.60 | 138.16 | 157.00 | 175.84 | 188.40 | 219.80 | 251.20 |
| 900 | 35.33 | 42.39 | 55.13 | 56.52 | 70.65 | 84.78 | 98.91 | 113.04 | 127.17 | 141.30 | 155.43 | 176.63 | 197.82 | 211.95 | 247.28 | 282.60 |
| 1000 | 39.25 | 47.10 | 61.25 | 62.80 | 78.50 | 94.20 | 109.90 | 125.60 | 141.30 | 157.00 | 172.70 | 196.25 | 219.80 | 235.50 | 274.75 | 314.00 |

*Steel denisty 7850 kg/m3

# RAILS

## Dimensions

| Rail Type | h | $h_1$ | $h_2$ | $2c_k$ | $2c_f$ | d | $t_0$ | $t_2$ | $a_f$ | $r_1$ | $r_3$ | $r_4$ | $r_5$ | $r_6$ | $a_r$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | mm | mm | mm | mm | mm | mm | mm | mm | mm | mm | mm | mm | mm | mm | mm |
| vst | 130 | 43 | 33 | 60 | 100 | 12 | 23 | 12 | 67 | 13 | 10 | 80 | | 200 | 36 |
| I | 145 | 45 | 37 | 65 | 125 | 14 | 25 | | | 13 | 6 | 30 | 80 | 300 | 19 |
| III | 159 | 49 | 36 | 70 | 140 | 16 | 30 | 13 | 93 | 13 | 16 | 508 | 80 | 300 | 19 |
| IV | 161 | 51 | 39 | 67 | 125 | 16 | 30 | 14 | 91 | 13 | 16 | 508 | 80 | 300 | 19 |
| VI | 172 | 51 | 38 | 72 | 150 | 16.5 | 32 | 13 | 100 | 13 | 35 | 120 | 80 | 300 | 21 |




## Properties

| Rail Type | Weight | Area | $I_x$ | $S_{xt}$ | $S_{xb}$ | $e_x$ | $I_y$ | $S_y$ |
|---|---|---|---|---|---|---|---|---|
| | kg/m\ | $cm^2$ | $cm^4$ | $cm^3$ | $cm^3$ | cm | $cm^4$ | $cm^3$ |
| vst | 35.7 | 45.5 | 1000 | 156 | 153 | 6.6 | 157 | 31 |
| I | 46.2 | 58.8 | 1630 | 216 | 235 | 6.9 | 298 | 47.7 |
| III | 54.4 | 69.3 | 2350 | 279 | 313 | 7.5 | 418 | 59.6 |
| IV | 53.8 | 68.8 | 2310 | 276 | 298 | 7.8 | 341 | 54.6 |
| VI | 60.3 | 76.9 | 3060 | 336 | 377 | 8.1 | 513 | 68.4 |

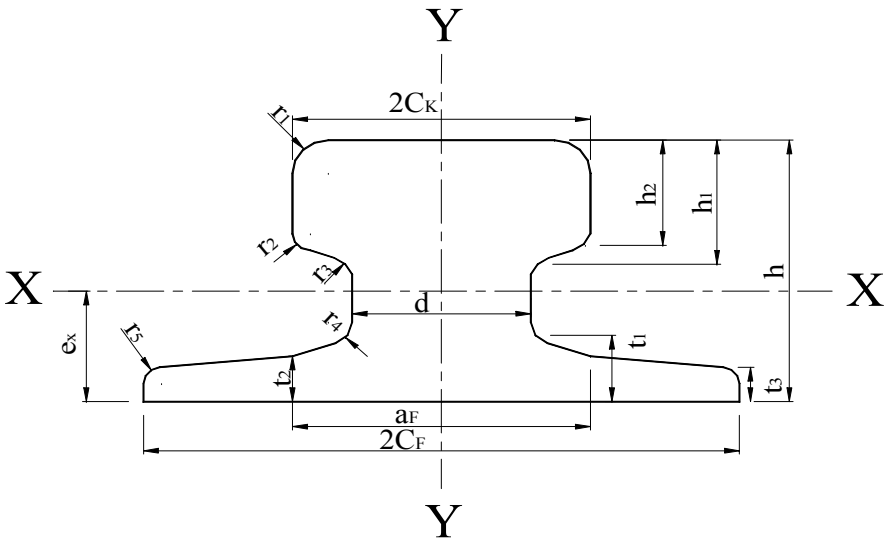
# RAILS

## Dimensions

| Rail Type | h | $2c_f$ | $a_f$ | $2c_k$ | d | $t_1$ | $t_2$ | $t_3$ | $h_1$ | $h_2$ | $r_1$ | $r_2$ | $r_3$ | $r_4$ | $r_5$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | mm | mm | mm | mm | mm | mm | mm | mm | mm | mm | mm | mm | mm | mm | mm |
| **A 45** | 55 | 125 | 54 | 45 | 24 | 14.5 | 11 | 8 | 24 | 20 | 4 | 3 | 4 | 5 | 4 |
| **A 55** | 65 | 150 | 66 | 55 | 31 | 17.5 | 12.5 | 9 | 28.5 | 25 | 5 | 5 | 5 | 6 | 5 |
| **A 65** | 75 | 175 | 78 | 65 | 38 | 20 | 14 | 10 | 34 | 30 | 6 | 5 | 5 | 6 | 5 |
| **A 75** | 85 | 200 | 90 | 75 | 45 | 22 | 15.4 | 11 | 39.5 | 35 | 8 | 6 | 6 | 8 | 6 |
| **A 100** | 95 | 200 | 100 | 100 | 60 | 23 | 16.5 | 12 | 45.5 | 40 | 10 | 6 | 6 | 8 | 6 |
| **A 120** | 105 | 220 | 120 | 120 | 72 | 30 | 20 | 14 | 55.5 | 47.5 | 10 | 6 | 10 | 10 | 6 |

## Properties

| Rail Type | Weight | Area | $I_x$ | $S_{xt}$ | $S_{xb}$ | $e_x$ | $I_y$ | $S_y$ |
|---|---|---|---|---|---|---|---|---|
| | kg/m\ | $cm^2$ | $cm^4$ | $cm^3$ | $cm^3$ | cm | $cm^4$ | $cm^3$ |
| **A 45** | 22.2 | 28.3 | 91 | 27.5 | 41.6 | 2.2 | 169 | 27.0 |
| **A 55** | 32.0 | 40.7 | 182 | 46.9 | 69.5 | 2.6 | 337 | 44.9 |
| **A 65** | 43.5 | 55.4 | 327 | 73.7 | 106.9 | 3.1 | 609 | 69.6 |
| **A 75** | 56.6 | 72.1 | 545 | 109.0 | 155.7 | 3.5 | 1010 | 101.0 |
| **A 100** | 75.2 | 95.6 | 888 | 170.0 | 207.0 | 4.3 | 1360 | 136.0 |
| **A 120** | 101.3 | 129.0 | 1420 | 249.0 | 295.8 | 4.8 | 2370 | 215.0 |



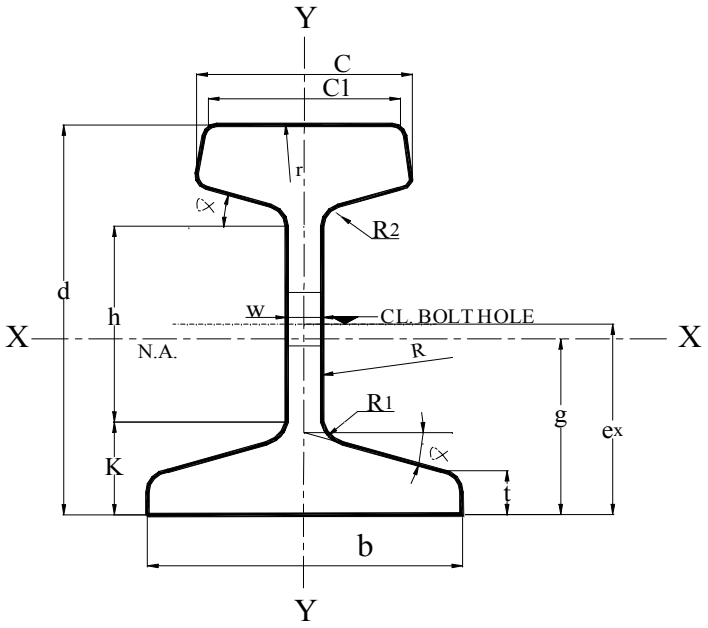
# RAILS

## Dimensions

| Rail Type | Depth | Head | | base | | Web | | k | h | r | R | $R_1$ | $R_2$ | Alpha |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | d | c | $c_1$ | b | t | w | g | | | | | | | |
| | mm | mm | mm | mm | mm | mm | mm | mm | mm | mm | mm | mm | mm | |
| **USS or BETH 135** | 146 | 87 | 76 | 132 | 12 | 32 | 63 | 27 | 71 | 356 | 305 | 19 | 19 | 13 |
| **BETH 171** | 152 | 109 | 102 | 152 | 16 | 32 | 67 | 32 | 70 | FLAT | VERT | 19 | 22 | 12 |
| **USS orBETH175** | 152 | 108 | 102 | 152 | 13 | 38 | 68 | 29 | 79 | 457 | VERT | 29 | 51 | 12 |

## Properties

| Rail Type | Weight | Area | $I_x$ | $S_{xt}$ | $S_{xb}$ | $e_x$ |
|---|---|---|---|---|---|---|
| | kg/m\ | $cm^2$ | $cm^4$ | $cm^3$ | $cm^3$ | cm |
| **USS & BETH 135** | 67 | 85.9 | 2110 | 282 | 295 | 7.11 |
| **BETH 171** | 84.9 | 108 | 3060 | 402 | 400 | 7.65 |
| **USS & BETH 175** | 86.8 | 110 | 2920 | 386 | 381 | 7.67 |



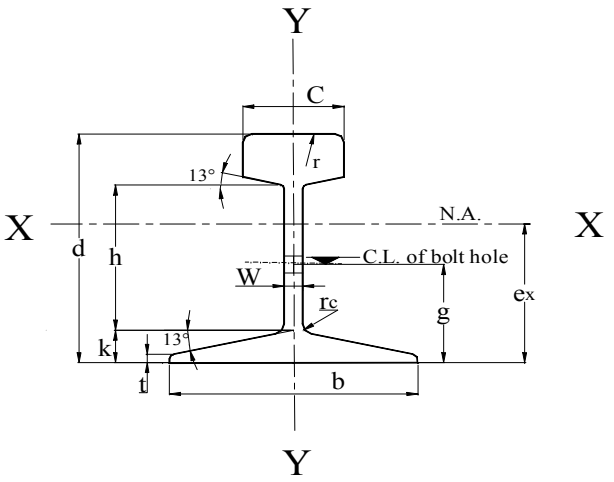
# RAILS

## Dimensions

| Rail Type | Depth | Head | Base | | Web | | k | h | r | $r_c$ | R |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | d | c | b | t | w | g | | | | | |
| | mm | mm | mm | mm | mm | mm | mm | mm | mm | mm | mm |
| **ASCE 40** | 89 | 48 | 89 | 6 | 10 | 40 | 16 | 47 | 305 | 6.4 | 305 |
| **ASCE 60** | 108 | 60 | 108 | 7 | 12 | 52 | 19 | 58 | 305 | 6.4 | 305 |
| **ASCE 85** | 132 | 65 | 132 | 8 | 14 | 63 | 23 | 70 | 305 | 6.4 | 305 |
| **BETH 104** | 127 | 64 | 127 | 13 | 25 | 62 | 27 | 62 | 305 | 12.7 | 89 |
| **USS 105** | 132 | 65 | 132 | 10 | 24 | 56 | 25 | 61 | 305 | 6.4 | 305 |

## Properties

| Rail Type | Weight | Area | $I_x$ | $S_{xt}$ | $S_{xb}$ | $e_x$ |
|---|---|---|---|---|---|---|
| | kg/m | $cm^2$ | $cm^4$ | $cm^3$ | $cm^3$ | cm |
| **ASCE 40** | 19.8 | 25.4 | 272 | 58.8 | 63.7 | 4.27 |
| **60** | 29.8 | 38.3 | 606 | 108 | 116 | 5.21 |
| **85** | 42.2 | 53.7 | 1250 | 182 | 199 | 6.27 |
| **BETH 104** | 51.6 | 66.4 | 1240 | 175 | 221 | 5.61 |
| **USS 105** | 52.1 | 66.5 | 1430 | 203 | 234 | 6.12 |



# COMBINED HOT ROLLED SECTIONS

TWO EQUAL ANGLES BACK TO BACK

TWO UNEQUAL ANGLES SHORT LEGS BACK TO BACK

TWO UNEQUAL ANGLES LONG LEGS BACK TO BACK

TWO CHANNELS (U.P.N.) BACK TO BACK

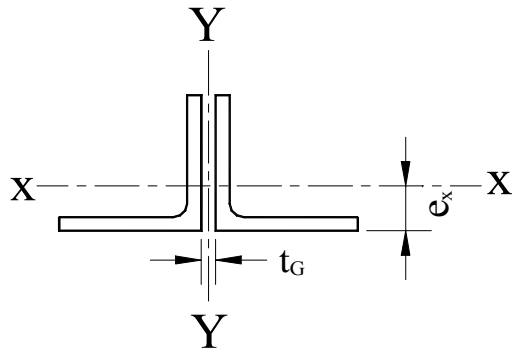
TWO CHANNELS (U.P.N.) TOE TO TOE

SYMMETRICAL WELDED I-BEAMS

UNSYMMETRICAL WELDED I-BEAMS

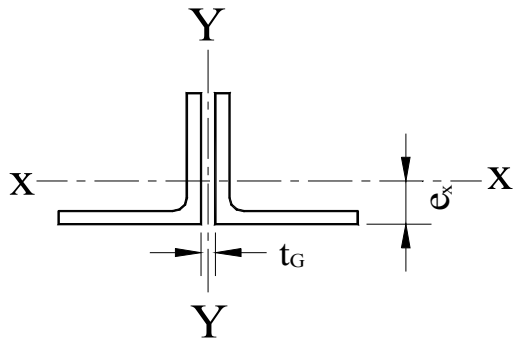
I.P.E +CHANNEL (U.P.N.)

# TWO EQUAL ANGLES
## Back to Back



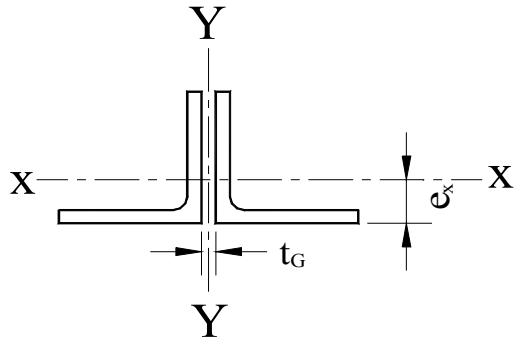

| size | | Weight | Area | Axis X-X | | | | $r_y$ (cm) About Axis Y-Y | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| a | s | | | $I_x$ | $S_x$ | $r_x$ | $e_x$ | $t_G$ (mm) | | | |
| mm | mm | kg/m\ | $cm^2$ | $cm^4$ | $cm^3$ | cm | cm | 8 | 10 | 12 | 14 |
| 30 | 3 | 2.72 | 3.48 | 2.82 | 1.30 | 0.90 | 0.84 | 1.53 | 1.61 | 1.70 | 1.78 |
| | 4 | 3.56 | 4.54 | 3.62 | 1.72 | 0.89 | 0.89 | 1.57 | 1.65 | 1.74 | 1.82 |
| | 5 | 4.36 | 5.56 | 4.32 | 2.08 | 0.88 | 0.92 | 1.59 | 1.67 | 1.76 | 1.84 |
| 35 | 3 | 3.20 | 4.08 | 4.58 | 1.80 | 1.06 | 0.96 | 1.72 | 1.80 | 1.89 | 1.97 |
| | 4 | 4.20 | 5.34 | 5.92 | 2.36 | 1.05 | 1.00 | 1.75 | 1.83 | 1.91 | 2.00 |
| | 5 | 5.14 | 6.56 | 7.12 | 2.90 | 1.04 | 1.04 | 1.78 | 1.86 | 1.94 | 2.03 |
| 40 | 4 | 4.84 | 6.16 | 8.96 | 3.12 | 1.21 | 1.12 | 1.94 | 2.02 | 2.10 | 2.19 |
| | 5 | 5.94 | 7.58 | 10.86 | 3.82 | 1.20 | 1.16 | 1.97 | 2.05 | 2.13 | 2.21 |
| | 6 | 7.04 | 8.96 | 12.66 | 4.52 | 1.19 | 1.20 | 1.99 | 2.08 | 2.16 | 2.24 |
| 45 | 5 | 6.76 | 8.60 | 15.66 | 4.86 | 1.35 | 1.28 | 2.16 | 2.23 | 2.31 | 2.40 |
| | 6 | 8.00 | 10.18 | 18.32 | 5.76 | 1.34 | 1.32 | 2.18 | 2.26 | 2.34 | 2.42 |
| | 7 | 9.20 | 11.72 | 20.80 | 6.62 | 1.33 | 1.36 | 2.21 | 2.29 | 2.37 | 2.45 |
| 50 | 5 | 7.54 | 9.60 | 22.00 | 6.10 | 1.51 | 1.40 | 2.35 | 2.43 | 2.51 | 2.59 |
| | 6 | 8.94 | 11.38 | 25.60 | 7.02 | 1.50 | 1.45 | 2.38 | 2.46 | 2.54 | 2.62 |
| | 7 | 10.30 | 13.12 | 29.20 | 8.30 | 1.49 | 1.49 | 2.41 | 2.49 | 2.57 | 2.65 |
| 55 | 5 | 8.36 | 10.64 | 29.40 | 7.40 | 1.66 | 1.52 | 2.54 | 2.61 | 2.69 | 2.77 |
| | 6 | 9.90 | 12.62 | 35.60 | 8.80 | 1.66 | 1.56 | 2.57 | 2.65 | 2.72 | 2.80 |
| | 8 | 12.92 | 16.46 | 44.20 | 11.44 | 1.64 | 1.64 | 2.62 | 2.70 | 2.78 | 2.86 |
| 60 | 6 | 10.84 | 13.82 | 45.60 | 10.58 | 1.82 | 1.69 | 2.77 | 2.85 | 2.93 | 3.00 |
| | 8 | 14.18 | 18.06 | 58.20 | 13.76 | 1.80 | 1.77 | 2.82 | 2.90 | 2.98 | 3.06 |
| | 10 | 17.38 | 22.20 | 69.80 | 16.82 | 1.78 | 1.85 | 2.87 | 2.95 | 3.03 | 3.11 |

# TWO EQUAL ANGLES
## Back to Back



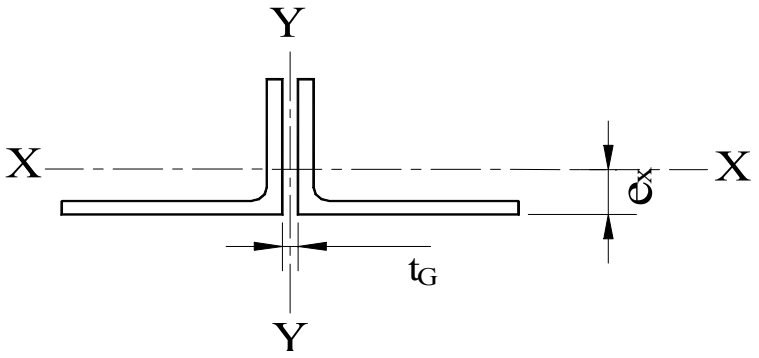

| size | | Weight | Area | Axis X-X | | | | $r_y$ (cm) About Axis Y-Y | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| a | s | | | $I_x$ | $S_x$ | $r_x$ | $e_x$ | $t_G$ (mm) | | | |
| mm | mm | kg\m\ | $cm^2$ | $cm^4$ | $cm^3$ | cm | cm | 8 | 10 | 12 | 14 |
| 65 | 7 | 13.64 | 17.40 | 66.8 | 14.3 | 1.96 | 1.85 | 2.98 | 3.06 | 3.14 | 3.22 |
| | 8 | 15.46 | 19.70 | 75.0 | 16.3 | 1.95 | 1.89 | 3.01 | 3.08 | 3.16 | 3.24 |
| | 9 | 17.24 | 22.00 | 82.6 | 18.1 | 1.94 | 1.93 | 3.03 | 3.11 | 3.19 | 3.27 |
| 70 | 7 | 14.76 | 18.80 | 84.8 | 16.9 | 2.12 | 1.97 | 3.18 | 3.26 | 3.33 | 3.41 |
| | 9 | 18.68 | 23.80 | 105.2 | 21.2 | 2.10 | 2.05 | 3.23 | 3.30 | 3.38 | 3.46 |
| | 11 | 22.40 | 28.60 | 123.6 | 25.4 | 2.09 | 2.13 | 3.28 | 3.36 | 3.44 | 3.52 |
| 75 | 7 | 15.88 | 20.20 | 104.8 | 17.3 | 2.28 | 2.03 | 3.33 | 3.41 | 3.48 | 3.56 |
| | 8 | 18.06 | 23.00 | 117.8 | 22.0 | 2.26 | 2.13 | 3.39 | 3.47 | 3.54 | 3.62 |
| | 10 | 22.20 | 28.20 | 142.8 | 27.0 | 2.25 | 2.21 | 3.45 | 3.52 | 3.60 | 3.68 |
| 80 | 8 | 19.32 | 24.60 | 144.6 | 25.2 | 2.42 | 2.26 | 3.60 | 3.67 | 3.75 | 3.82 |
| | 10 | 23.80 | 30.20 | 175.0 | 31.0 | 2.41 | 2.34 | 3.65 | 3.72 | 3.80 | 3.88 |
| | 12 | 28.20 | 35.80 | 204.0 | 36.4 | 2.39 | 2.41 | 3.69 | 3.77 | 3.84 | 3.92 |
| 90 | 9 | 24.40 | 31.00 | 232.0 | 36.0 | 2.74 | 2.54 | 4.02 | 4.09 | 4.17 | 4.24 |
| | 11 | 29.70 | 37.40 | 276.0 | 43.2 | 2.72 | 2.62 | 4.06 | 4.14 | 4.22 | 4.29 |
| | 13 | 34.20 | 43.60 | 316.0 | 50.2 | 2.69 | 2.70 | 4.10 | 4.18 | 4.26 | 4.34 |
| 100 | 10 | 30.20 | 38.40 | 354.0 | 49.4 | 3.04 | 2.82 | 4.43 | 4.50 | 4.58 | 4.65 |
| | 12 | 35.60 | 45.40 | 414.0 | 58.4 | 3.02 | 2.90 | 4.47 | 4.55 | 4.62 | 4.70 |
| | 14 | 41.20 | 52.40 | 470.0 | 67.0 | 3.00 | 2.98 | 4.52 | 4.59 | 4.67 | 4.75 |
| 110 | 10 | 33.20 | 42.40 | 478.0 | 60.2 | 3.36 | 3.07 | 4.83 | 4.90 | 4.98 | 5.05 |
| | 12 | 39.40 | 50.20 | 560.0 | 71.4 | 3.34 | 3.15 | 4.87 | 4.95 | 5.02 | 5.10 |
| | 14 | 45.60 | 58.00 | 638.0 | 82.0 | 3.32 | 3.21 | 4.90 | 4.98 | 5.05 | 5.13 |
| 120 | 12 | 43.20 | 55.00 | 736.0 | 85.4 | 3.65 | 3.40 | 5.27 | 5.34 | 5.42 | 5.49 |
| | 13 | 46.60 | 59.80 | 788.0 | 92.0 | 3.64 | 3.44 | 5.29 | 5.36 | 5.44 | 5.51 |
| | 15 | 53.20 | 67.80 | 892.0 | 105.0 | 3.63 | 3.51 | 5.34 | 5.41 | 5.48 | 5.56 |

# TWO ANGLES EQUAL
## Back to Back



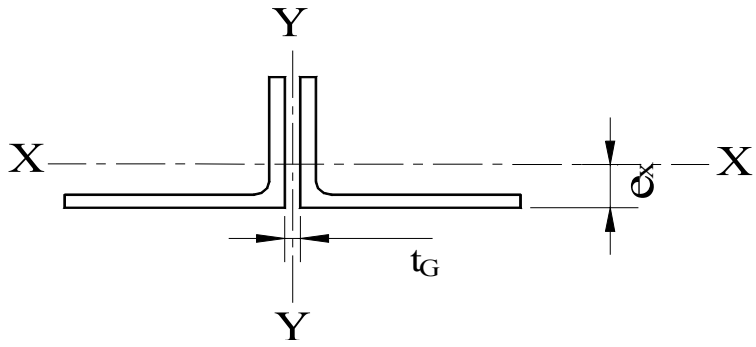

| size | | Weight | Area | Axis X-X | | | | $r_y$ (cm) About Axis Y-Y | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| a | s | | | $I_x$ | $S_x$ | $r_x$ | $e_x$ | $t_G$ (mm) | | | |
| mm | mm | kg\m\ | $cm^2$ | $cm^4$ | $cm^3$ | cm | cm | 8 | 10 | 12 | 14 |
| 130 | 12 | 47.20 | 60.00 | 944 | 100.8 | 3.97 | 3.64 | 5.66 | 5.74 | 5.81 | 5.88 |
| | 14 | 54.40 | 69.40 | 1080 | 110.4 | 3.94 | 3.72 | 5.70 | 5.77 | 5.85 | 5.92 |
| | 16 | 61.80 | 78.60 | 1210 | 131.6 | 3.92 | 3.80 | 5.75 | 5.82 | 5.89 | 5.97 |
| 140 | 13 | 55.00 | 70.00 | 1276 | 126.6 | 4.27 | 3.92 | 6.07 | 6.15 | 6.22 | 6.29 |
| | 15 | 62.80 | 80.00 | 1446 | 144.6 | 4.25 | 4.00 | 6.12 | 6.19 | 6.26 | 6.34 |
| 150 | 14 | 63.20 | 80.60 | 1690 | 156.4 | 4.58 | 4.21 | 6.50 | 6.57 | 6.64 | 6.71 |
| | 15 | 67.80 | 86.00 | 1796 | 165.0 | 4.57 | 4.25 | 6.52 | 6.59 | 6.66 | 6.74 |
| | 16 | 71.80 | 91.40 | 1898 | 177.4 | 4.56 | 4.29 | 6.54 | 6.61 | 6.69 | 6.76 |
| | 18 | 80.20 | 102.00 | 2100 | 198.6 | 4.54 | 4.36 | 6.58 | 6.65 | 6.72 | 6.80 |
| | 20 | 88.40 | 112.60 | 2300 | 218.0 | 4.51 | 4.44 | 6.62 | 6.69 | 6.76 | 6.84 |
| 160 | 15 | 72.40 | 92.20 | 2200 | 191.2 | 4.88 | 4.49 | 6.91 | 6.98 | 7.05 | 7.12 |
| | 17 | 81.40 | 103.60 | 2460 | 216.0 | 4.86 | 4.57 | 6.95 | 7.02 | 7.10 | 7.17 |
| | 19 | 90.20 | 115.00 | 2700 | 236.0 | 4.84 | 4.65 | 6.99 | 7.07 | 7.14 | 7.21 |
| 180 | 16 | 87.00 | 110.80 | 3360 | 260.0 | 5.51 | 5.02 | 7.73 | 7.80 | 7.87 | 7.94 |
| | 18 | 97.20 | 123.80 | 3740 | 290.0 | 5.49 | 5.10 | 7.77 | 7.84 | 7.91 | 7.99 |
| | 20 | 107.40 | 136.80 | 4080 | 320.0 | 5.47 | 5.18 | 7.81 | 7.89 | 7.96 | 8.03 |
| | 22 | 117.20 | 149.40 | 4220 | 348.0 | 5.44 | 5.26 | 7.85 | 7.92 | 8.00 | 8.07 |
| 200 | 16 | 97.00 | 123.60 | 4680 | 336.0 | 6.15 | 5.52 | 8.54 | 8.61 | 8.68 | 8.75 |
| | 18 | 108.60 | 138.20 | 5200 | 362.0 | 6.13 | 5.60 | 8.58 | 8.65 | 8.72 | 8.79 |
| | 20 | 119.80 | 152.80 | 5700 | 398.0 | 6.11 | 5.68 | 8.62 | 8.69 | 8.76 | 8.83 |
| | 24 | 142.20 | 181.20 | 6660 | 470.0 | 6.06 | 5.84 | 8.70 | 8.77 | 8.84 | 8.92 |
| | 28 | 164.00 | 210.00 | 7560 | 540.0 | 6.02 | 5.99 | 8.78 | 8.85 | 8.93 | 9.00 |

# TWO UNEQUAL ANGLES
## Short Legs Back to Back



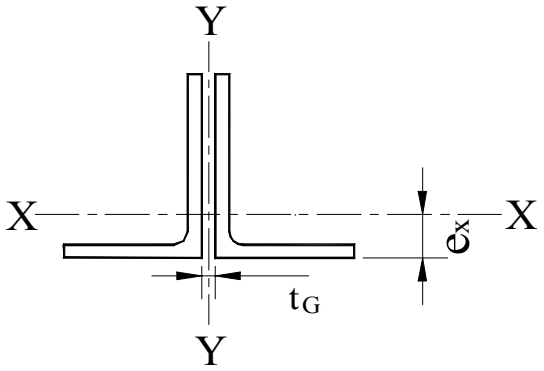

| Size | | | Weight | Area | Axis X-X | | | | $r_y$ (cm) About Axis Y-Y | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| a | b | s | | | $I_x$ | $S_x$ | $r_x$ | $e_x$ | $t_G$ (mm) | | | |
| mm | mm | mm | kg\m\ | $cm^2$ | $cm^4$ | $cm^3$ | cm | cm | 8 | 10 | 12 | 14 |
| 30 | 20 | 3 | 2.22 | 2.84 | 0.88 | 0.58 | 0.56 | 0.50 | 1.68 | 1.76 | 1.85 | 1.93 |
| | | 4 | 2.90 | 3.70 | 1.10 | 0.76 | 0.55 | 0.54 | 1.71 | 1.79 | 1.88 | 1.96 |
| 40 | 20 | 3 | 2.70 | 3.44 | 0.94 | 0.60 | 0.52 | 0.44 | 2.23 | 2.31 | 2.39 | 2.48 |
| | | 4 | 3.54 | 4.50 | 1.20 | 0.78 | 0.52 | 0.48 | 2.25 | 2.34 | 2.42 | 2.51 |
| 45 | 30 | 3 | 3.44 | 4.38 | 3.20 | 1.40 | 0.86 | 0.70 | 2.32 | 2.40 | 2.48 | 2.57 |
| | | 4 | 4.50 | 5.74 | 4.10 | 1.82 | 0.85 | 0.74 | 2.36 | 2.44 | 2.52 | 2.60 |
| | | 5 | 5.54 | 7.06 | 4.94 | 2.22 | 0.84 | 0.78 | 2.38 | 2.46 | 2.55 | 2.63 |
| 60 | 30 | 5 | 6.74 | 8.58 | 5.20 | 2.24 | 0.78 | 0.68 | 3.18 | 3.26 | 3.34 | 3.43 |
| | | 7 | 9.18 | 11.70 | 6.82 | 3.04 | 0.76 | 0.76 | 3.24 | 3.32 | 3.41 | 3.49 |
| 60 | 40 | 5 | 7.52 | 9.58 | 12.22 | 4.04 | 1.13 | 0.97 | 3.02 | 3.10 | 3.18 | 3.26 |
| | | 6 | 8.92 | 11.36 | 14.24 | 4.76 | 1.12 | 1.01 | 3.05 | 3.13 | 3.21 | 3.29 |
| | | 7 | 10.28 | 13.10 | 16.14 | 5.48 | 1.11 | 1.05 | 3.07 | 3.15 | 3.24 | 3.32 |
| 75 | 50 | 5 | 9.48 | 12.08 | 24.60 | 6.42 | 1.43 | 1.17 | 3.68 | 3.76 | 3.84 | 3.91 |
| | | 7 | 13.02 | 16.60 | 33.00 | 8.78 | 1.41 | 1.25 | 3.72 | 3.80 | 3.88 | 3.96 |
| | | 9 | 16.46 | 21.00 | 40.40 | 10.98 | 1.39 | 1.32 | 3.77 | 3.85 | 3.93 | 4.01 |
| 80 | 40 | 6 | 10.82 | 13.78 | 15.18 | 4.88 | 1.05 | 0.88 | 4.13 | 4.21 | 4.29 | 4.37 |
| | | 8 | 14.14 | 18.02 | 19.36 | 6.36 | 1.04 | 0.95 | 4.19 | 4.27 | 4.35 | 4.43 |
| 90 | 60 | 6 | 13.64 | 17.38 | 51.60 | 11.22 | 1.72 | 1.41 | 4.37 | 4.44 | 4.52 | 4.60 |
| | | 8 | 17.92 | 22.80 | 66.00 | 14.62 | 1.70 | 1.49 | 4.41 | 4.49 | 4.57 | 4.65 |
| 100 | 50 | 6 | 13.70 | 17.46 | 30.60 | 7.72 | 1.32 | 1.04 | 5.04 | 5.11 | 5.19 | 5.27 |
| | | 8 | 17.98 | 23.00 | 39.00 | 10.08 | 1.31 | 1.13 | 5.10 | 5.18 | 5.26 | 5.34 |
| | | 10 | 22.20 | 28.20 | 46.80 | 12.34 | 1.29 | 1.20 | 5.15 | 5.23 | 5.31 | 5.39 |
| 100 | 65 | 7 | 17.54 | 22.40 | 75.20 | 15.08 | 1.84 | 1.51 | 4.82 | 4.90 | 4.97 | 5.05 |
| | | 9 | 22.20 | 28.40 | 93.40 | 19.04 | 1.82 | 1.59 | 4.87 | 4.95 | 5.03 | 5.11 |
| | | 11 | 26.80 | 34.20 | 110.20 | 22.80 | 1.80 | 1.67 | 4.92 | 5.00 | 5.08 | 5.16 |

# TWO UNEQUAL ANGLES
## Short Legs Back to Back



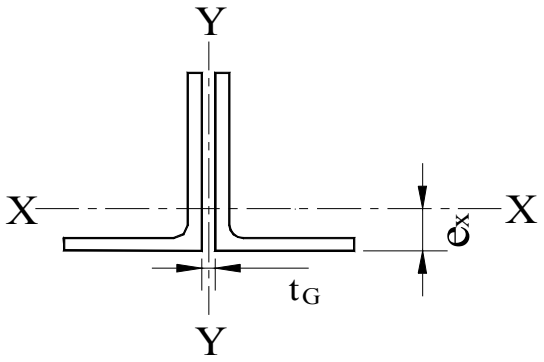

| Size | | | Weight | Area | Axis X-X | | | | $r_y$ (cm) About Axis Y-Y | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| a | b | s | | | $I_X$ | $S_X$ | $r_X$ | $e_X$ | $t_G$ (mm) | | | |
| mm | mm | mm | kg\m\ | $cm^2$ | $cm^4$ | $cm^3$ | cm | cm | 8 | 10 | 12 | 14 |
| 120 | 80 | 8 | 24.40 | 31.00 | 161.6 | 26.40 | 2.29 | 1.87 | 5.70 | 5.77 | 5.85 | 5.93 |
| | | 10 | 30.00 | 38.20 | 196.2 | 32.40 | 2.27 | 1.95 | 5.75 | 5.83 | 5.91 | 5.98 |
| | | 12 | 35.60 | 45.40 | 228.0 | 38.20 | 2.25 | 2.03 | 5.79 | 5.87 | 5.95 | 6.03 |
| | | 14 | 41.00 | 52.40 | 260.0 | 44.00 | 2.23 | 2.10 | 5.84 | 5.92 | 6.00 | 6.08 |
| 130 | 65 | 8 | 23.80 | 30.20 | 89.6 | 17.44 | 1.72 | 1.37 | 6.48 | 6.56 | 6.63 | 6.71 |
| | | 10 | 29.20 | 37.20 | 108.4 | 21.40 | 1.71 | 1.45 | 6.54 | 6.61 | 6.69 | 6.77 |
| | | 12 | 34.60 | 44.20 | 126.0 | 25.40 | 1.69 | 1.53 | 6.59 | 6.67 | 6.74 | 6.82 |
| 130 | 90 | 10 | 33.20 | 42.40 | 282.0 | 41.20 | 2.58 | 2.18 | 6.13 | 6.21 | 6.28 | 6.36 |
| | | 12 | 39.40 | 50.20 | 330.0 | 48.80 | 2.56 | 2.26 | 6.65 | 6.73 | 6.81 | 6.89 |
| 150 | 75 | 9 | 30.60 | 39.00 | 156.6 | 26.40 | 2.00 | 1.57 | 7.46 | 7.53 | 7.61 | 7.69 |
| | | 11 | 37.20 | 47.20 | 186.0 | 31.80 | 1.98 | 1.65 | 7.51 | 7.58 | 7.66 | 7.74 |
| 150 | 100 | 10 | 38.00 | 48.40 | 396.0 | 51.60 | 2.86 | 2.34 | 7.06 | 7.14 | 7.21 | 7.29 |
| | | 12 | 45.20 | 57.40 | 464.0 | 61.20 | 2.84 | 2.42 | 7.12 | 7.19 | 7.27 | 7.34 |
| | | 14 | 52.20 | 66.40 | 528.0 | 70.40 | 2.82 | 2.50 | 7.16 | 7.23 | 7.31 | 7.38 |
| 160 | 80 | 10 | 36.40 | 46.40 | 208.0 | 33.00 | 2.12 | 1.69 | 7.92 | 8.00 | 8.08 | 8.15 |
| | | 12 | 43.20 | 55.00 | 244.0 | 39.20 | 2.10 | 1.77 | 7.97 | 8.05 | 8.13 | 8.21 |
| | | 14 | 50.00 | 63.60 | 278.0 | 45.00 | 2.09 | 1.85 | 8.03 | 8.11 | 8.19 | 8.26 |
| 180 | 90 | 10 | 41.20 | 52.40 | 302.0 | 42.20 | 2.40 | 1.85 | 8.85 | 8.92 | 9.00 | 9.08 |
| | | 12 | 49.00 | 62.40 | 354.0 | 50.20 | 2.38 | 1.93 | 8.90 | 8.97 | 9.05 | 9.13 |
| | | 14 | 56.60 | 72.20 | 404.0 | 57.80 | 2.37 | 2.01 | 8.95 | 9.03 | 9.11 | 9.18 |
| 200 | 100 | 10 | 46.00 | 58.40 | 420.0 | 52.60 | 2.68 | 2.01 | 9.77 | 9.85 | 9.92 | 10.00 |
| | | 12 | 54.60 | 69.60 | 494.0 | 62.60 | 2.67 | 2.10 | 9.83 | 9.90 | 9.98 | 10.05 |
| | | 14 | 63.20 | 80.60 | 564.0 | 72.20 | 2.65 | 2.18 | 9.88 | 9.96 | 10.03 | 10.11 |
| | | 16 | 71.80 | 91.40 | 632.0 | 81.60 | 2.63 | 2.26 | 9.92 | 10.00 | 10.08 | 10.15 |

# TWO UNEQUAL ANGLES
## Long Legs Back to Back



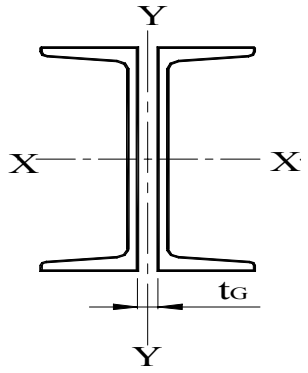

| Size | | | Weight | Area | Axis X-X | | | | $r_y$ (cm) About Axis Y-Y | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| a | b | s | | | $I_X$ | $S_X$ | $r_X$ | $e_x$ | $t_G$ (mm) | | | |
| mm | mm | mm | kg\m\ | $cm^2$ | $cm^4$ | $cm^3$ | cm | cm | 8 | 10 | 12 | 14 |
| 30 | 20 | 3 | 2.22 | 2.84 | 2.50 | 1.24 | 0.94 | 0.99 | 1.06 | 1.15 | 1.23 | 1.32 |
| | | 4 | 2.90 | 3.70 | 3.18 | 1.62 | 0.93 | 1.03 | 1.09 | 1.18 | 1.27 | 1.36 |
| 40 | 20 | 3 | 2.70 | 3.44 | 5.58 | 2.16 | 1.27 | 1.43 | 0.99 | 1.07 | 1.16 | 1.25 |
| | | 4 | 3.54 | 4.50 | 7.18 | 2.84 | 1.26 | 1.47 | 1.02 | 1.11 | 1.20 | 1.29 |
| 45 | 30 | 3 | 3.44 | 4.38 | 8.94 | 2.92 | 1.43 | 1.43 | 1.40 | 1.48 | 1.56 | 1.64 |
| | | 4 | 4.50 | 5.74 | 11.56 | 3.82 | 1.42 | 1.48 | 1.42 | 1.50 | 1.59 | 1.67 |
| | | 5 | 5.54 | 7.06 | 13.98 | 5.90 | 1.41 | 1.52 | 1.45 | 1.53 | 1.62 | 1.70 |
| 60 | 30 | 5 | 6.74 | 8.58 | 31.20 | 8.08 | 1.90 | 2.15 | 1.33 | 1.41 | 1.50 | 1.59 |
| | | 7 | 9.18 | 11.70 | 41.40 | 11.00 | 1.88 | 2.24 | 1.39 | 1.47 | 1.56 | 1.65 |
| 60 | 40 | 5 | 7.52 | 9.58 | 34.40 | 8.50 | 1.89 | 1.96 | 1.78 | 1.85 | 1.93 | 2.02 |
| | | 6 | 8.92 | 11.36 | 40.20 | 10.06 | 1.88 | 2.00 | 1.80 | 1.88 | 1.96 | 2.04 |
| | | 7 | 10.28 | 13.10 | 46.00 | 11.58 | 1.87 | 2.04 | 1.83 | 1.91 | 1.99 | 2.07 |
| 75 | 50 | 5 | 9.48 | 12.08 | 68.80 | 13.48 | 2.39 | 2.40 | 2.12 | 2.20 | 2.28 | 2.35 |
| | | 7 | 13.02 | 16.60 | 92.80 | 18.48 | 2.36 | 2.48 | 2.17 | 2.25 | 2.33 | 2.41 |
| | | 9 | 16.46 | 21.00 | 114.8 | 23.20 | 2.34 | 2.56 | 2.21 | 2.29 | 2.37 | 2.45 |
| 80 | 40 | 6 | 10.82 | 13.78 | 89.80 | 17.46 | 2.55 | 2.85 | 1.66 | 1.73 | 1.81 | 1.90 |
| | | 8 | 14.14 | 18.02 | 115.2 | 22.80 | 2.53 | 2.94 | 1.70 | 1.78 | 1.87 | 1.95 |
| 90 | 60 | 6 | 13.64 | 17.38 | 143.4 | 23.40 | 2.87 | 2.89 | 2.50 | 2.57 | 2.65 | 2.72 |
| | | 8 | 17.92 | 22.80 | 185.0 | 30.80 | 2.85 | 2.97 | 2.54 | 2.62 | 2.69 | 2.77 |
| 100 | 50 | 6 | 13.70 | 17.46 | 179.4 | 27.60 | 3.20 | 3.49 | 1.95 | 2.03 | 2.11 | 2.18 |
| | | 8 | 17.98 | 23.00 | 232.0 | 36.00 | 3.18 | 3.59 | 2.01 | 2.09 | 2.17 | 2.25 |
| | | 10 | 22.20 | 28.20 | 282.0 | 44.40 | 3.16 | 3.67 | 2.06 | 2.13 | 2.21 | 2.30 |
| 100 | 65 | 7 | 17.54 | 22.40 | 226.0 | 33.20 | 3.17 | 3.23 | 2.65 | 2.73 | 2.80 | 2.88 |
| | | 9 | 22.20 | 28.40 | 282.0 | 42.00 | 3.15 | 3.32 | 2.70 | 2.77 | 2.85 | 2.93 |
| | | 11 | 26.80 | 34.20 | 334.0 | 50.60 | 3.13 | 3.40 | 2.74 | 2.82 | 2.90 | 2.98 |

# TWO UNEQUAL ANGLES
## Long Legs Back to Back



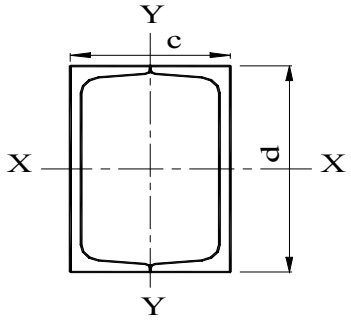

| Size | | | Weight | Area | Axis X-X | | | | $r_y$ (cm) About Axis Y-Y | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| a | b | s | | | $I_X$ | $S_X$ | $r_X$ | $e_x$ | $t_G$ (mm) | | | |
| mm | mm | mm | kg\m\ | $cm^2$ | $cm^4$ | $cm^3$ | cm | cm | 8 | 10 | 12 | 14 |
| 120 | 80 | 8 | 24.40 | 31.00 | 452 | 55.20 | 3.82 | 3.83 | 3.22 | 3.30 | 3.37 | 3.44 |
| | | 10 | 30.00 | 38.20 | 552 | 68.20 | 3.80 | 3.92 | 3.27 | 3.34 | 3.41 | 3.49 |
| | | 12 | 35.60 | 45.40 | 646 | 80.80 | 3.77 | 4.00 | 3.31 | 3.39 | 3.46 | 3.54 |
| | | 14 | 41.00 | 52.40 | 736 | 92.80 | 3.75 | 4.08 | 3.35 | 3.43 | 3.50 | 3.58 |
| 130 | 65 | 8 | 23.80 | 30.20 | 526 | 62.20 | 4.17 | 4.56 | 2.47 | 2.54 | 2.62 | 2.69 |
| | | 10 | 29.20 | 37.20 | 642 | 76.80 | 4.15 | 4.65 | 2.52 | 2.59 | 2.67 | 2.75 |
| | | 12 | 34.60 | 44.20 | 752 | 91.00 | 4.12 | 4.74 | 2.57 | 2.64 | 2.72 | 2.80 |
| 130 | 90 | 10 | 33.20 | 42.40 | 716 | 81.00 | 4.11 | 4.15 | 3.65 | 3.72 | 3.79 | 3.87 |
| | | 12 | 39.40 | 50.20 | 840 | 96.00 | 4.09 | 4.84 | 3.69 | 3.76 | 3.84 | 3.91 |
| 150 | 75 | 9 | 30.60 | 39.00 | 910 | 93.60 | 4.83 | 5.28 | 2.81 | 2.88 | 2.95 | 3.03 |
| | | 11 | 37.20 | 47.20 | 1090 | 113.2 | 4.80 | 5.37 | 2.85 | 2.92 | 3.00 | 3.07 |
| 150 | 100 | 10 | 38.00 | 48.40 | 1104 | 108.2 | 4.78 | 4.80 | 3.96 | 4.03 | 4.10 | 4.17 |
| | | 12 | 45.20 | 57.40 | 1300 | 128.4 | 4.76 | 4.89 | 4.00 | 4.07 | 4.15 | 4.22 |
| | | 14 | 52.20 | 66.40 | 1488 | 148.2 | 4.73 | 4.97 | 4.05 | 4.12 | 4.19 | 4.27 |
| 160 | 80 | 10 | 36.40 | 46.40 | 1222 | 117.8 | 5.14 | 5.63 | 2.98 | 3.05 | 3.12 | 3.19 |
| | | 12 | 43.20 | 55.00 | 1440 | 140.0 | 5.11 | 5.72 | 3.02 | 3.09 | 3.17 | 3.24 |
| | | 14 | 50.00 | 63.60 | 1646 | 161.4 | 5.09 | 5.81 | 3.07 | 3.14 | 3.22 | 3.30 |
| 180 | 90 | 10 | 41.20 | 52.40 | 1760 | 150.2 | 5.80 | 6.28 | 3.29 | 3.36 | 3.43 | 3.50 |
| | | 12 | 49.00 | 62.40 | 2080 | 178.6 | 5.77 | 6.37 | 3.33 | 3.40 | 3.47 | 3.55 |
| | | 14 | 56.60 | 72.20 | 2380 | 206.0 | 5.75 | 6.46 | 3.38 | 3.45 | 3.53 | 3.60 |
| 200 | 100 | 10 | 46.00 | 58.40 | 2440 | 184.4 | 6.46 | 6.93 | 3.60 | 3.67 | 3.74 | 3.81 |
| | | 12 | 54.60 | 69.60 | 2880 | 222.0 | 6.43 | 7.03 | 3.66 | 3.73 | 3.80 | 3.87 |
| | | 14 | 63.20 | 80.60 | 3300 | 256.0 | 6.41 | 7.12 | 3.70 | 3.77 | 3.84 | 3.91 |
| | | 16 | 71.80 | 91.40 | 3720 | 290.0 | 6.38 | 7.20 | 3.74 | 3.81 | 3.89 | 3.96 |

# TWO CHANNELS (U.P.N.)
# BACK to BACK




| Sec. No. | Weight | Area | $A_{web}$ | Axis X-X | | | Axis Y-Y | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | $I_x$ | $S_x$ | $r_x$ | $I_y$ | $S_y$ | $r_y$ | $I_y$ | $S_y$ | $r_y$ | $I_y$ | $S_y$ | $r_y$ |
| | kg/m` | $cm^2$ | $cm^2$ | $cm^4$ | $cm^3$ | cm | $t_G$ = 8 mm | | | $t_G$ = 10 mm | | | $t_G$ = 12 mm | | |
| **30x15** | 3.48 | 4.42 | 1.68 | 5.06 | 3.38 | 1.07 | 4.50 | 2.37 | 1.01 | 5.36 | 2.68 | 1.10 | 6.30 | 3.00 | 1.19 |
| **30** | 8.54 | 10.88 | 1.60 | 12.78 | 8.52 | 1.08 | 42.47 | 11.48 | 1.98 | 46.30 | 12.19 | 2.06 | 50.35 | 12.91 | 2.15 |
| **40x20** | 5.74 | 7.32 | 2.90 | 15.16 | 7.58 | 1.44 | 10.66 | 4.44 | 1.21 | 12.30 | 4.92 | 1.30 | 14.09 | 5.42 | 1.39 |
| **40** | 9.74 | 12.42 | 2.60 | 28.20 | 14.10 | 1.50 | 50.53 | 12.96 | 2.02 | 54.95 | 13.74 | 2.10 | 59.62 | 14.54 | 2.19 |
| **50x25** | 7.72 | 9.84 | 3.80 | 33.20 | 13.46 | 1.85 | 19.39 | 6.69 | 1.40 | 21.87 | 7.29 | 1.49 | 24.54 | 7.92 | 1.58 |
| **50** | 11.18 | 14.24 | 3.60 | 52.80 | 21.20 | 1.92 | 62.85 | 14.96 | 2.10 | 68.04 | 15.82 | 2.19 | 73.50 | 16.71 | 2.27 |
| **60** | 10.14 | 12.92 | 5.76 | 63.20 | 21.00 | 2.21 | 31.19 | 9.17 | 1.55 | 34.71 | 9.92 | 1.64 | 38.48 | 10.69 | 1.73 |
| **65** | 14.18 | 18.06 | 5.50 | 115.0 | 35.40 | 2.52 | 88.02 | 19.14 | 2.21 | 94.78 | 20.17 | 2.29 | 101.89 | 21.23 | 2.38 |
| **70** | 13.46 | 17.14 | 6.84 | 122.2 | 35.00 | 2.67 | 79.57 | 18.09 | 2.15 | 85.98 | 19.11 | 2.24 | 92.74 | 20.16 | 2.33 |
| **80** | 17.28 | 22.00 | 7.68 | 212.0 | 53.00 | 3.10 | 114.10 | 23.28 | 2.28 | 122.5 | 24.49 | 2.36 | 131.3 | 25.74 | 2.44 |
| **100** | 21.20 | 27.00 | 9.96 | 412.0 | 82.40 | 3.91 | 161.27 | 29.86 | 2.44 | 172.1 | 31.29 | 2.52 | 183.4 | 32.75 | 2.61 |
| **120** | 26.80 | 34.00 | 14.28 | 728.0 | 121.4 | 4.62 | 222.40 | 37.69 | 2.56 | 236.3 | 39.39 | 2.64 | 251.0 | 41.14 | 2.72 |
| **140** | 32.00 | 40.80 | 16.80 | 1210 | 172.8 | 5.45 | 314.00 | 49.06 | 2.77 | 332.0 | 51.07 | 2.85 | 350.7 | 53.14 | 2.93 |
| **160** | 37.60 | 48.00 | 20.85 | 1850 | 232.0 | 6.21 | 411.44 | 59.63 | 2.93 | 433.4 | 61.92 | 3.00 | 456.4 | 64.28 | 3.08 |
| **180** | 44.00 | 56.00 | 25.28 | 2700 | 300.0 | 6.95 | 529.41 | 71.54 | 3.07 | 556.0 | 74.13 | 3.15 | 583.6 | 76.79 | 3.23 |
| **200** | 50.60 | 64.40 | 30.09 | 3820 | 382.0 | 7.70 | 670.04 | 84.82 | 3.23 | 701.7 | 87.72 | 3.30 | 734.7 | 90.70 | 3.38 |
| **220** | 58.80 | 74.80 | 35.10 | 5380 | 490.0 | 8.48 | 876.58 | 104.4 | 3.42 | 915.3 | 107.7 | 3.50 | 955.6 | 111.1 | 3.57 |
| **240** | 66.40 | 84.60 | 40.66 | 7200 | 600.0 | 9.22 | 1081.2 | 121.5 | 3.57 | 1126.5 | 125.2 | 3.65 | 1173.6 | 129.0 | 3.72 |
| **260** | 75.80 | 96.60 | 46.40 | 9640 | 742.0 | 9.99 | 1369.9 | 145.7 | 3.77 | 1424.1 | 149.9 | 3.84 | 1480.4 | 154.2 | 3.91 |
| **280** | 83.60 | 106.60 | 50.00 | 12560 | 896.0 | 10.90 | 1713.2 | 173.0 | 4.01 | 1776.7 | 177.7 | 4.08 | 1842.3 | 182.4 | 4.16 |
| **300** | 92.40 | 117.60 | 53.60 | 16060 | 1070 | 11.70 | 2120.1 | 203.9 | 4.25 | 2194.2 | 209.0 | 4.32 | 2270.7 | 214.2 | 4.39 |
| **320** | 119.00 | 151.60 | 79.80 | 21740 | 1358 | 12.10 | 2558.4 | 246.0 | 4.11 | 2650.9 | 252.5 | 4.18 | 2746.4 | 259.1 | 4.26 |
| **350** | 121.20 | 154.60 | 89.04 | 25680 | 1468 | 12.90 | 2352.1 | 226.2 | 3.90 | 2440.2 | 232.4 | 3.97 | 2531.4 | 238.8 | 4.05 |
| **380** | 126.20 | 160.80 | 93.96 | 31520 | 1658 | 14.00 | 2472.7 | 233.3 | 3.92 | 2563.7 | 239.6 | 3.99 | 2658.0 | 246.1 | 4.07 |
| **400** | 143.60 | 183.00 | 101.92 | 40700 | 2040 | 14.90 | 3394.4 | 297.8 | 4.31 | 3507.8 | 305.0 | 4.38 | 3624.9 | 312.5 | 4.45 |

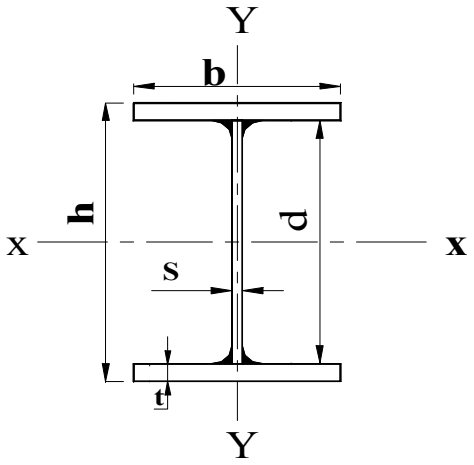
# TWO CHANNELS (U.P.N.)
# TOE to TOE




| Sec. No. | Weight | Area | $A_{web}$ | Axis X-X | | | Axis Y-Y (toe to toe) | | | Axis Y-Y (c=d) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | $I_x$ | $S_x$ | $r_x$ | $I_y$ | $S_y$ | $r_y$ | $I_y$ | $S_y$ | $r_y$ |
| | kg/m` | $cm^2$ | $cm^2$ | $cm^4$ | $cm^3$ | cm | $cm^4$ | $cm^3$ | cm | $cm^4$ | $cm^3$ | cm |
| **30x15** | 3.48 | 4.42 | 1.68 | 5.06 | 3.38 | 1.07 | 5.00 | 3.34 | 1.06 | 5.00 | 3.34 | 1.06 |
| **30** | 8.54 | 10.88 | 1.60 | 12.78 | 8.52 | 1.08 | 53.75 | 16.29 | 2.22 | | N.A. | |
| **40x20** | 5.74 | 7.32 | 2.90 | 15.16 | 7.58 | 1.44 | 15.23 | 7.61 | 1.44 | 15.23 | 7.61 | 1.44 |
| **40** | 9.74 | 12.42 | 2.60 | 28.20 | 14.10 | 1.50 | 71.84 | 20.53 | 2.41 | | N.A. | |
| **50x25** | 7.72 | 9.84 | 3.80 | 33.20 | 13.46 | 1.85 | 33.08 | 13.23 | 1.83 | 33.08 | 13.23 | 1.83 |
| **50** | 11.18 | 14.24 | 3.60 | 52.80 | 21.20 | 1.92 | 102.3 | 26.93 | 2.68 | | N.A. | |
| **60** | 10.14 | 12.92 | 5.76 | 63.20 | 21.00 | 2.21 | 65.46 | 21.82 | 2.25 | 65.46 | 21.82 | 2.25 |
| **65** | 14.18 | 18.06 | 5.50 | 115.0 | 35.40 | 2.52 | 167.8 | 39.95 | 3.05 | | N.A. | |
| **70** | 13.46 | 17.14 | 6.84 | 122.2 | 35.00 | 2.67 | 136.9 | 34.22 | 2.83 | | N.A. | |
| **80** | 17.28 | 22.00 | 7.68 | 212.0 | 53.00 | 3.10 | 243.5 | 54.10 | 3.33 | | N.A. | |
| **100** | 21.20 | 27.00 | 9.96 | 412.0 | 82.40 | 3.91 | 380.0 | 75.99 | 3.75 | 380.0 | 75.99 | 3.75 |
| **120** | 26.80 | 34.00 | 14.28 | 728.0 | 121.4 | 4.62 | 603.5 | 109.7 | 4.21 | 744.6 | 124.1 | 4.68 |
| **140** | 32.00 | 40.80 | 16.80 | 1210 | 172.8 | 5.45 | 862.4 | 143.7 | 4.60 | 1250 | 178.6 | 5.53 |
| **160** | 37.60 | 48.00 | 20.85 | 1850 | 232.0 | 6.21 | 1213 | 186.6 | 5.03 | 1992 | 249.0 | 6.44 |
| **180** | 44.00 | 56.00 | 25.28 | 2700 | 300.0 | 6.95 | 1673 | 239.0 | 5.47 | 3035 | 337.2 | 7.36 |
| **200** | 50.60 | 64.40 | 30.09 | 3820 | 382.0 | 7.70 | 2237 | 298.3 | 5.89 | 4407 | 440.7 | 8.27 |
| **220** | 58.80 | 74.80 | 35.10 | 5380 | 490.0 | 8.48 | 2963 | 370.3 | 6.29 | 6266 | 569.6 | 9.15 |
| **240** | 66.40 | 84.60 | 40.66 | 7200 | 600.0 | 9.22 | 3822 | 449.6 | 6.72 | 8571 | 714.3 | 10.07 |
| **260** | 75.80 | 96.60 | 46.40 | 9640 | 742.0 | 9.99 | 4893 | 543.7 | 7.12 | 11570 | 890.0 | 10.94 |
| **280** | 83.60 | 106.60 | 50.00 | 12560 | 896.0 | 10.90 | 5977 | 629.1 | 7.49 | 14822 | 1059 | 11.79 |
| **300** | 92.40 | 117.60 | 53.60 | 16060 | 1070 | 11.70 | 7257 | 725.7 | 7.86 | 18782 | 1252 | 12.64 |
| **320** | 119.00 | 151.60 | 79.80 | 21740 | 1358 | 12.10 | 9496 | 949.6 | 7.91 | 28415 | 1776 | 13.69 |
| **350** | 121.20 | 154.60 | 89.04 | 25680 | 1468 | 12.90 | 10070 | 1007 | 8.07 | 36390 | 2079 | 15.34 |
| **380** | 126.20 | 160.80 | 93.96 | 31520 | 1658 | 14.00 | 11063 | 1085 | 8.29 | 45647 | 2402 | 16.85 |
| **400** | 143.60 | 183.00 | 101.92 | 40700 | 2040 | 14.90 | 14451 | 1314 | 8.89 | 56779 | 2839 | 17.61 |

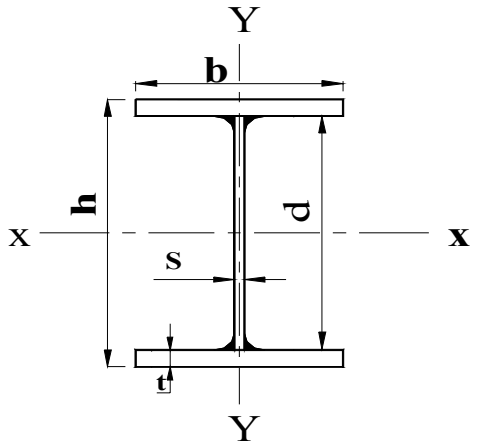
N.A.= Section is not avilable with the specified configuration.

# SYMMETRICAL WELDED I- SECTIONS



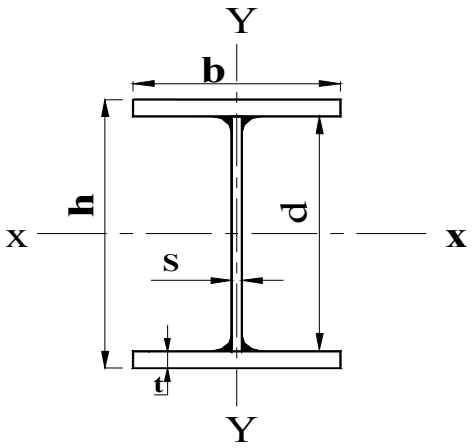

| depth | Web | | Flange | | Weight | Area | $A_{web}$ | Axis x-x | | | Axis y-y | | | Surface Area | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| h | d | s | b | t | | | | $I_x$ | $S_x$ | $r_x$ | $I_y$ | $S_y$ | $r_y$ | $U_m$ | $U_t$ |
| mm | mm | mm | mm | mm | kg/m` | $cm^2$ | $cm^2$ | $cm^4$ | $cm^3$ | cm | $cm^4$ | $cm^3$ | cm | $x10^{-2}m^2/m$\ | $m^2/t$ |
| **210** | **200** | **5** | **140** | **5** | 18.84 | 24.0 | 10.0 | 1805 | 172 | 8.67 | 228.9 | 32.7 | 3.09 | 97.00 | 51.49 |
| **212** | **200** | **5** | **140** | **6** | 21.04 | 26.8 | 10.0 | 2116 | 200 | 8.89 | 274.6 | 39.2 | 3.20 | 97.40 | 46.30 |
| **214** | **200** | **5** | **140** | **7** | 23.24 | 29.6 | 10.0 | 2434 | 227 | 9.07 | 320.3 | 45.8 | 3.29 | 97.80 | 42.09 |
| **260** | **250** | **5** | **140** | **5** | 20.80 | 26.5 | 12.5 | 2927 | 225 | 10.51 | 228.9 | 32.7 | 2.94 | 107.00 | 51.44 |
| **262** | **250** | **5** | **140** | **6** | 23.00 | 29.3 | 12.5 | 3404 | 260 | 10.78 | 274.7 | 39.2 | 3.06 | 107.40 | 46.69 |
| **264** | **250** | **5** | **140** | **7** | 25.20 | 32.1 | 12.5 | 3888 | 295 | 11.01 | 320.4 | 45.8 | 3.16 | 107.80 | 42.78 |
| **262** | **250** | **5** | **165** | **6** | 25.36 | 32.3 | 12.5 | 3896 | 297 | 10.98 | 449.5 | 54.5 | 3.73 | 117.40 | 46.30 |
| **264** | **250** | **5** | **165** | **7** | 27.95 | 35.6 | 12.5 | 4466 | 338 | 11.20 | 524.3 | 63.6 | 3.84 | 117.80 | 42.15 |
| **340** | **330** | **5** | **140** | **5** | 23.94 | 30.5 | 16.5 | 5426 | 319 | 13.34 | 229.0 | 32.7 | 2.74 | 123.00 | 51.37 |
| **342** | **330** | **5** | **140** | **6** | 26.14 | 33.3 | 16.5 | 6240 | 365 | 13.69 | 274.7 | 39.2 | 2.87 | 123.40 | 47.21 |
| **344** | **330** | **5** | **140** | **7** | 28.34 | 36.1 | 16.5 | 7063 | 411 | 13.99 | 320.5 | 45.8 | 2.98 | 123.80 | 43.69 |
| **342** | **330** | **5** | **165** | **6** | 28.50 | 36.3 | 16.5 | 7086 | 414 | 13.97 | 449.6 | 54.5 | 3.52 | 133.40 | 46.81 |
| **344** | **330** | **5** | **165** | **7** | 31.09 | 39.6 | 16.5 | 8057 | 468 | 14.26 | 524.4 | 63.6 | 3.64 | 133.80 | 43.04 |
| **346** | **330** | **5** | **165** | **8** | 33.68 | 42.9 | 16.5 | 9039 | 522 | 14.52 | 599.3 | 72.6 | 3.74 | 134.20 | 39.85 |
| **344** | **330** | **5** | **200** | **7** | 34.93 | 44.5 | 16.5 | 9448 | 549 | 14.57 | 933.7 | 93.4 | 4.58 | 147.80 | 42.31 |
| **346** | **330** | **5** | **200** | **8** | 38.07 | 48.5 | 16.5 | 10639 | 615 | 14.81 | 1067.0 | 106.7 | 4.69 | 148.20 | 38.93 |

# SYMMETRICAL WELDED I- SECTIONS



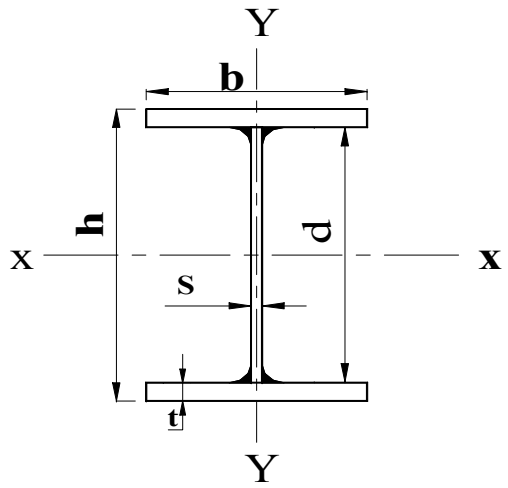

| depth | Web | | Flange | | Weight | Area | $A_{web}$ | Axis x-x | | | Axis y-y | | | Surface Area | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| h | d | s | b | t | | | | $I_x$ | $S_x$ | $r_x$ | $I_y$ | $S_y$ | $r_y$ | $U_m$ | $U_t$ |
| mm | mm | mm | mm | mm | kg/m\ | $cm^2$ | $cm^2$ | $cm^4$ | $cm^3$ | cm | $cm^4$ | $cm^3$ | cm | $x10^{-2}m^2/m$\ | $m^2/t$ |
| **414** | **400** | **5** | **140** | **7** | 31.09 | 39.6 | 20.0 | 10784 | 521 | 16.50 | 320.6 | 45.8 | 2.85 | 137.80 | 44.33 |
| **412** | **400** | **5** | **165** | **6** | 31.24 | 39.8 | 20.0 | 10827 | 526 | 16.49 | 449.7 | 54.5 | 3.36 | 147.40 | 47.18 |
| **414** | **400** | **5** | **165** | **7** | 33.83 | 43.1 | 20.0 | 12234 | 591 | 16.85 | 524.6 | 63.6 | 3.49 | 147.80 | 43.68 |
| **416** | **400** | **5** | **165** | **8** | 36.42 | 46.4 | 20.0 | 13655 | 656 | 17.15 | 599.4 | 72.7 | 3.59 | 148.20 | 40.69 |
| **414** | **400** | **5** | **200** | **7** | 37.68 | 48.0 | 20.0 | 14263 | 689 | 17.24 | 933.8 | 93.4 | 4.41 | 161.80 | 42.94 |
| **416** | **400** | **5** | **200** | **8** | 40.82 | 52.0 | 20.0 | 15985 | 769 | 17.53 | 1067.1 | 106.7 | 4.53 | 162.20 | 39.74 |
| **420** | **400** | **5** | **200** | **10** | 47.10 | 60.0 | 20.0 | 19480 | 928 | 18.02 | 1333.8 | 133.4 | 4.71 | 163.00 | 34.61 |
| **514** | **500** | **6** | **140** | **7** | 38.94 | 49.6 | 30.0 | 18846 | 733 | 19.49 | 321.0 | 45.9 | 2.54 | 157.60 | 40.48 |
| **514** | **500** | **6** | **165** | **7** | 41.68 | 53.1 | 30.0 | 21096 | 821 | 19.93 | 525.0 | 63.6 | 3.14 | 167.60 | 40.21 |
| **516** | **500** | **6** | **165** | **8** | 44.27 | 56.4 | 30.0 | 23284 | 902 | 20.32 | 599.9 | 72.7 | 3.26 | 168.00 | 37.95 |
| **514** | **500** | **6** | **200** | **7** | 45.53 | 58.0 | 30.0 | 24245 | 943 | 20.45 | 934.2 | 93.4 | 4.01 | 181.60 | 39.89 |
| **516** | **500** | **6** | **200** | **8** | 48.67 | 62.0 | 30.0 | 26897 | 1043 | 20.83 | 1067.6 | 106.8 | 4.15 | 182.00 | 37.39 |
| **420** | **500** | **6** | **200** | **10** | 54.95 | 70.0 | 30.0 | 32263 | 1241 | 21.47 | 1334.2 | 133.4 | 4.37 | 182.80 | 33.27 |
| **520** | **500** | **6** | **250** | **10** | 62.80 | 80.0 | 30.0 | 38767 | 1491 | 22.01 | 2605.1 | 208.4 | 5.71 | 202.80 | 32.29 |
| **524** | **500** | **6** | **250** | **12** | 70.65 | 90.0 | 30.0 | 45579 | 1740 | 22.50 | 3125.9 | 250.1 | 5.89 | 203.60 | 28.82 |

# SYMMETRICAL WELDED I- SECTIONS



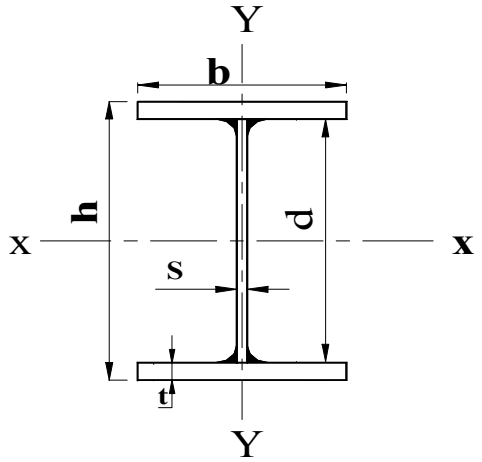

| depth | Web | | Flange | | Weight | Area | $A_{web}$ | Axis x-x | | | Axis y-y | | | Surface Area | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| h | d | s | b | t | | | | $I_x$ | $S_x$ | $r_x$ | $I_y$ | $S_y$ | $r_y$ | $U_m$ | $U_t$ |
| mm | mm | mm | mm | mm | kg/m` | $cm^2$ | $cm^2$ | $cm^4$ | $cm^3$ | cm | $cm^4$ | $cm^3$ | cm | $x10^{-2}m^2/m`$ | $m^2/t$ |
| **614** | **600** | **7** | **165** | **7** | 51.10 | 65.1 | 42.0 | 33879 | 1104 | 22.81 | 526 | 64 | 2.84 | 187.40 | 36.67 |
| **614** | **600** | **7** | **200** | **7** | 54.95 | 70.0 | 42.0 | 38393 | 1251 | 23.42 | 935 | 94 | 3.65 | 201.40 | 36.65 |
| **616** | **600** | **7** | **200** | **8** | 58.09 | 74.0 | 42.0 | 42175 | 1369 | 23.87 | 1068 | 107 | 3.80 | 201.80 | 34.74 |
| **620** | **600** | **7** | **200** | **10** | 64.37 | 82.0 | 42.0 | 49813 | 1607 | 24.65 | 1335 | 134 | 4.03 | 202.60 | 31.47 |
| **620** | **600** | **7** | **250** | **10** | 72.22 | 92.0 | 42.0 | 59117 | 1907 | 25.35 | 2606 | 208 | 5.32 | 222.60 | 30.82 |
| **624** | **600** | **7** | **250** | **12** | 80.07 | 102.0 | 42.0 | 68789 | 2205 | 25.97 | 3127 | 250 | 5.54 | 223.40 | 27.90 |
| **624** | **600** | **7** | **330** | **12** | 95.14 | 121.2 | 42.0 | 86769 | 2781 | 26.76 | 7189 | 436 | 7.70 | 255.40 | 26.84 |
| **674** | **660** | **7** | **165** | **7** | 54.40 | 69.3 | 46.2 | 42464 | 1260 | 24.75 | 526 | 64 | 2.75 | 199.40 | 36.65 |
| **676** | **660** | **7** | **165** | **8** | 56.99 | 72.6 | 46.2 | 46223 | 1368 | 25.23 | 601 | 73 | 2.88 | 199.80 | 35.06 |
| **674** | **660** | **7** | **200** | **7** | 58.25 | 74.2 | 46.2 | 47914 | 1422 | 25.41 | 935 | 94 | 3.55 | 213.40 | 36.64 |
| **676** | **660** | **7** | **200** | **8** | 61.39 | 78.2 | 46.2 | 52470 | 1552 | 25.90 | 1069 | 107 | 3.70 | 213.80 | 34.83 |
| **680** | **660** | **7** | **200** | **10** | 67.67 | 86.2 | 46.2 | 61664 | 1814 | 26.75 | 1335 | 134 | 3.94 | 214.60 | 31.71 |
| **680** | **660** | **7** | **250** | **10** | 75.52 | 96.2 | 46.2 | 72887 | 2144 | 27.53 | 2606 | 208 | 5.20 | 234.60 | 31.07 |
| **684** | **660** | **7** | **250** | **12** | 83.37 | 106.2 | 46.2 | 84515 | 2471 | 28.21 | 3127 | 250 | 5.43 | 235.40 | 28.24 |
| **680** | **660** | **7** | **330** | **10** | 88.08 | 112.2 | 46.2 | 90845 | 2672 | 28.45 | 5991 | 363 | 7.31 | 266.60 | 30.27 |

# SYMMETRICAL WELDED I- SECTIONS



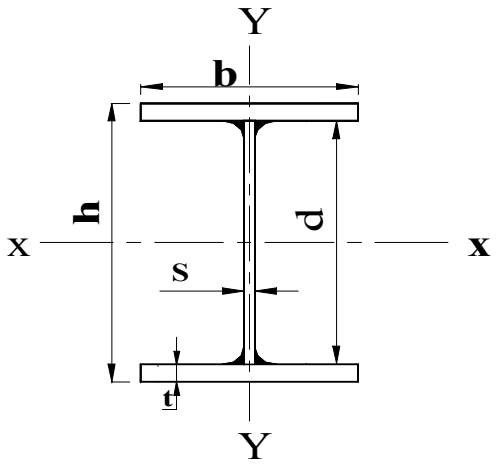

| depth | Web | | Flange | | Weight | Area | $A_{web}$ | Axis x-x | | | Axis y-y | | | Surface Area | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| h | d | s | b | t | | | | $I_x$ | $S_x$ | $r_x$ | $I_y$ | $S_y$ | $r_y$ | $U_m$ | $U_t$ |
| mm | mm | mm | mm | mm | kg/m` | $cm^2$ | $cm^2$ | $cm^4$ | $cm^3$ | cm | $cm^4$ | $cm^3$ | cm | $x10^{-2}m^2/m$\` | $m^2/t$ |
| **764** | **750** | **7** | **200** | **7** | 63.19 | 80.5 | 52.5 | 64724 | 1694 | 28.36 | 935.5 | 93.5 | 3.41 | 231.40 | 36.62 |
| **766** | **750** | **7** | **200** | **8** | 66.33 | 84.5 | 52.5 | 70576 | 1843 | 28.90 | 1068.8 | 106.9 | 3.56 | 231.80 | 34.95 |
| **770** | **750** | **7** | **200** | **10** | 72.61 | 92.5 | 52.5 | 82373 | 2140 | 29.84 | 1335.5 | 133.5 | 3.80 | 232.60 | 32.03 |
| **770** | **750** | **7** | **250** | **10** | 80.46 | 102.5 | 52.5 | 96814 | 2515 | 30.73 | 2606.3 | 208.5 | 5.04 | 252.60 | 31.39 |
| **774** | **750** | **7** | **250** | **12** | 88.31 | 112.5 | 52.5 | 111713 | 2887 | 31.51 | 3127.1 | 250.2 | 5.27 | 253.40 | 28.69 |
| **770** | **750** | **7** | **330** | **10** | 93.02 | 118.5 | 52.5 | 119919 | 3115 | 31.81 | 5991.6 | 363.1 | 7.11 | 284.60 | 30.59 |
| **774** | **750** | **7** | **330** | **12** | 103.38 | 131.7 | 52.5 | 139586 | 3607 | 32.56 | 7189.5 | 435.7 | 7.39 | 285.40 | 27.61 |
| **764** | **750** | **8** | **200** | **7** | 69.08 | 88.0 | 60.0 | 68240 | 1786 | 27.85 | 936.5 | 93.7 | 3.26 | 231.20 | 33.47 |
| **766** | **750** | **8** | **200** | **8** | 72.22 | 92.0 | 60.0 | 74092 | 1935 | 28.38 | 1069.9 | 107.0 | 3.41 | 231.60 | 32.07 |
| **770** | **750** | **8** | **200** | **10** | 78.50 | 100.0 | 60.0 | 85888 | 2231 | 29.31 | 1336.5 | 133.7 | 3.66 | 232.40 | 29.61 |
| **770** | **750** | **8** | **250** | **10** | 86.35 | 110.0 | 60.0 | 100329 | 2606 | 30.20 | 2607.4 | 208.6 | 4.87 | 252.40 | 29.23 |
| **774** | **750** | **8** | **250** | **12** | 94.20 | 120.0 | 60.0 | 115229 | 2977 | 30.99 | 3128.2 | 250.3 | 5.11 | 253.20 | 26.88 |
| **770** | **750** | **8** | **330** | **10** | 98.91 | 126.0 | 60.0 | 123435 | 3206 | 31.30 | 5992.7 | 363.2 | 6.90 | 284.40 | 28.75 |
| **774** | **750** | **8** | **330** | **12** | 109.27 | 139.2 | 60.0 | 143102 | 3698 | 32.06 | 7190.6 | 435.8 | 7.19 | 285.20 | 26.10 |

# SYMMETRICAL WELDED I- SECTIONS



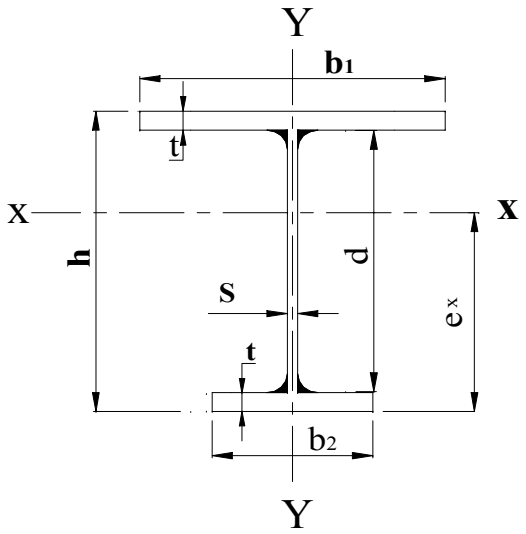

| depth | Web | | Flange | | Weight | Area | $A_{web}$ | Axis x-x | | | Axis y-y | | | Surface Area | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| h | d | s | b | t | | | | $I_x$ | $S_x$ | $r_x$ | $I_y$ | $S_y$ | $r_y$ | $U_m$ | $U_t$ |
| mm | mm | mm | mm | mm | kg/m` | $cm^2$ | $cm^2$ | $cm^4$ | $cm^3$ | cm | $cm^4$ | $cm^3$ | cm | $x10^{-2}m^2/m$\ | $m^2/t$ |
| **814** | **800** | **7** | **200** | **7** | 65.94 | 84.0 | 56.0 | 75455 | 1854 | 29.97 | 935.6 | 93.6 | 3.34 | 241.40 | 36.61 |
| **816** | **800** | **7** | **200** | **8** | 69.08 | 88.0 | 56.0 | 82097 | 2012 | 30.54 | 1069.0 | 106.9 | 3.49 | 241.80 | 35.00 |
| **820** | **800** | **7** | **200** | **10** | 75.36 | 96.0 | 56.0 | 95480 | 2329 | 31.54 | 1335.6 | 133.6 | 3.73 | 242.60 | 32.19 |
| **820** | **800** | **7** | **250** | **10** | 83.21 | 106.0 | 56.0 | 111883 | 2729 | 32.49 | 2606.5 | 208.5 | 4.96 | 262.60 | 31.56 |
| **824** | **800** | **7** | **250** | **12** | 91.06 | 116.0 | 56.0 | 128775 | 3126 | 33.32 | 3127.3 | 250.2 | 5.19 | 263.40 | 28.93 |
| **824** | **800** | **7** | **330** | **12** | 106.13 | 135.2 | 56.0 | 160426 | 3894 | 34.45 | 7189.7 | 435.7 | 7.29 | 295.40 | 27.83 |
| **828** | **800** | **7** | **330** | **14** | 116.49 | 148.4 | 56.0 | 182941 | 4419 | 35.11 | 8387.6 | 508.3 | 7.52 | 296.20 | 25.43 |
| **814** | **800** | **8** | **200** | **7** | 72.22 | 92.0 | 64.0 | 79722 | 1959 | 29.44 | 936.7 | 93.7 | 3.19 | 241.20 | 33.40 |
| **816** | **800** | **8** | **200** | **8** | 75.36 | 96.0 | 64.0 | 86364 | 2117 | 29.99 | 1070.1 | 107.0 | 3.34 | 241.60 | 32.06 |
| **820** | **800** | **8** | **200** | **10** | 81.64 | 104.0 | 64.0 | 99747 | 2433 | 30.97 | 1336.7 | 133.7 | 3.59 | 242.40 | 29.69 |
| **820** | **800** | **8** | **250** | **10** | 89.49 | 114.0 | 64.0 | 116150 | 2833 | 31.92 | 2607.6 | 208.6 | 4.78 | 262.40 | 29.32 |
| **824** | **800** | **8** | **250** | **12** | 97.34 | 124.0 | 64.0 | 133042 | 3229 | 32.76 | 3128.4 | 250.3 | 5.02 | 263.20 | 27.04 |
| **824** | **800** | **8** | **330** | **12** | 112.41 | 143.2 | 64.0 | 164693 | 3997 | 33.91 | 7190.8 | 435.8 | 7.09 | 295.20 | 26.26 |
| **828** | **800** | **8** | **330** | **14** | 122.77 | 156.4 | 64.0 | 187208 | 4522 | 34.60 | 8388.7 | 508.4 | 7.32 | 296.00 | 24.11 |

# SYMMETRICAL WELDED I- SECTIONS



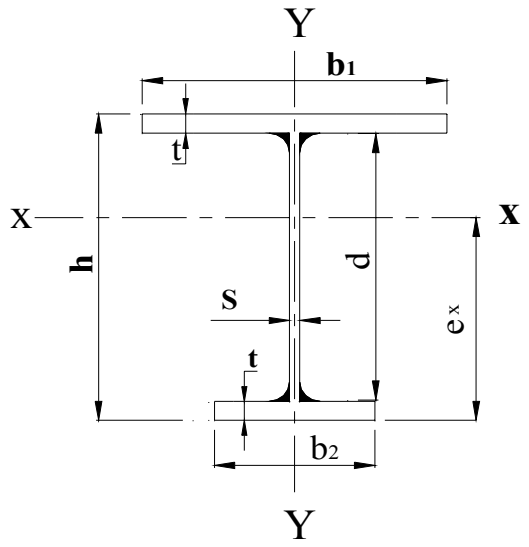

| depth | Web | | Flange | | Weight | Area | $A_{web}$ | Axis x-x | | | Axis y-y | | | Surface Area | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| h | d | s | b | t | | | | $I_x$ | $S_x$ | $r_x$ | $I_y$ | $S_y$ | $r_y$ | $U_m$ | $U_t$ |
| mm | mm | mm | mm | mm | kg/m` | $cm^2$ | $cm^2$ | $cm^4$ | $cm^3$ | cm | $cm^4$ | $cm^3$ | cm | $x10^{-2}m^2/m$\ | $m^2/t$ |
| **1014** | **1000** | **10** | **200** | **7** | 100.48 | 128.0 | 100.0 | 154318 | 3044 | 34.72 | 941.7 | 94.2 | 2.71 | 280.80 | 27.95 |
| **1016** | **1000** | **10** | **200** | **8** | 103.62 | 132.0 | 100.0 | 164620 | 3241 | 35.31 | 1075.0 | 107.5 | 2.85 | 281.20 | 27.14 |
| **1020** | **1000** | **10** | **200** | **10** | 109.90 | 140.0 | 100.0 | 185347 | 3634 | 36.39 | 1341.7 | 134.2 | 3.10 | 282.00 | 25.66 |
| **1020** | **1000** | **10** | **250** | **10** | 117.75 | 150.0 | 100.0 | 210850 | 4134 | 37.49 | 2612.5 | 209.0 | 4.17 | 302.00 | 25.65 |
| **1024** | **1000** | **10** | **250** | **12** | 125.60 | 160.0 | 100.0 | 236962 | 4628 | 38.48 | 3133.3 | 250.7 | 4.43 | 302.80 | 24.11 |
| **1020** | **1000** | **10** | **330** | **10** | 130.31 | 166.0 | 100.0 | 251655 | 4934 | 38.94 | 5997.8 | 363.5 | 6.01 | 334.00 | 25.63 |
| **1024** | **1000** | **10** | **330** | **12** | 140.67 | 179.2 | 100.0 | 286123 | 5588 | 39.96 | 7195.7 | 436.1 | 6.34 | 334.80 | 23.80 |
| **1028** | **1000** | **10** | **330** | **14** | 151.03 | 192.4 | 100.0 | 320862 | 6242 | 40.84 | 8393.6 | 508.7 | 6.60 | 335.60 | 22.22 |

# UNSYMMETRICAL WELDED I-SECTIONS



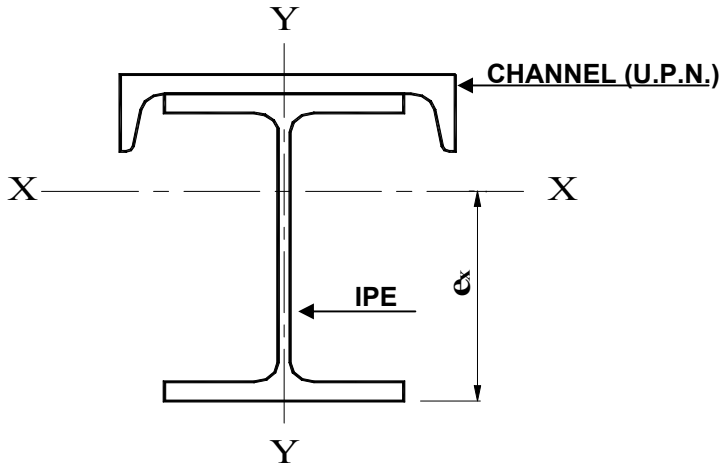

| depth | Web | | Flange | | | Weight | Area | $A_{web}$ | Axis x-x | | | | | Axis y-y | | | | Surface Area | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| h | d | s | $b_1$ | $b_2$ | t | | | | $I_x$ | $S_{xt}$ | $S_{xb}$ | $r_x$ | $e_x$ | $I_y$ | $S_y$ | $r_y$ | $S_{yupper\ flange}$ | $U_m$ | $U_t$ |
| mm | mm | mm | mm | mm | mm | kg/m` | $cm^2$ | $cm^2$ | $cm^4$ | $cm^3$ | $cm^3$ | cm | cm | $cm^4$ | $cm^3$ | cm | $cm^3$ | $x10^{-2}m^2/m^{\backslash}$ | $m^2/t$ |
| **224** | **200** | **5** | **140** | **70** | **12** | 27.63 | 35.2 | 10.0 | 2943 | 339 | 214 | 9.14 | 13.73 | 309 | 44 | 2.96 | 39.20 | 85.80 | 31.05 |
| **224** | **200** | **5** | **200** | **100** | **12** | 36.11 | 46.0 | 10.0 | 4031 | 478 | 289 | 9.36 | 13.97 | 900 | 90 | 4.42 | 80.00 | 103.80 | 28.75 |
| **274** | **250** | **5** | **140** | **70** | **12** | 29.59 | 37.7 | 12.5 | 4657 | 432 | 280 | 11.11 | 16.62 | 309 | 44 | 2.86 | 39.20 | 95.80 | 32.37 |
| **274** | **250** | **5** | **250** | **140** | **12** | 46.55 | 59.3 | 12.5 | 8184 | 759 | 493 | 11.75 | 16.62 | 1837 | 147 | 5.57 | 125.00 | 131.80 | 28.31 |
| **324** | **300** | **5** | **200** | **100** | **12** | 40.04 | 51.0 | 15.0 | 9203 | 735 | 463 | 13.43 | 19.87 | 900 | 90 | 4.20 | 80.00 | 123.80 | 30.92 |
| **324** | **300** | **5** | **250** | **140** | **12** | 48.51 | 61.8 | 15.0 | 11834 | 920 | 606 | 13.84 | 19.53 | 1837 | 147 | 5.45 | 125.00 | 141.80 | 29.23 |
| **354** | **330** | **5** | **200** | **100** | **12** | 41.21 | 52.5 | 16.5 | 11226 | 814 | 520 | 14.62 | 21.61 | 900 | 90 | 4.14 | 80.00 | 129.80 | 31.50 |
| **354** | **330** | **5** | **250** | **140** | **12** | 49.69 | 63.3 | 16.5 | 14383 | 1018 | 676 | 15.07 | 21.27 | 1837 | 147 | 5.39 | 125.00 | 147.80 | 29.74 |
| **358** | **330** | **5** | **300** | **140** | **14** | 61.31 | 78.1 | 16.5 | 17831 | 1375 | 781 | 15.11 | 22.83 | 3470 | 231 | 6.67 | 210.00 | 158.60 | 25.87 |
| **358** | **330** | **5** | **330** | **165** | **14** | 67.35 | 85.8 | 16.5 | 20171 | 1520 | 895 | 15.33 | 22.53 | 4717 | 286 | 7.41 | 254.10 | 169.60 | 25.18 |
| **428** | **400** | **5** | **250** | **140** | **14** | 58.56 | 74.6 | 20.0 | 24709 | 1443 | 962 | 18.20 | 25.67 | 2143 | 171 | 5.36 | 145.83 | 162.60 | 27.77 |
| **428** | **400** | **5** | **300** | **165** | **14** | 66.80 | 85.1 | 20.0 | 28773 | 1712 | 1107 | 18.39 | 26.00 | 3674 | 245 | 6.57 | 210.00 | 177.60 | 26.59 |
| **432** | **400** | **5** | **330** | **165** | **16** | 77.87 | 99.2 | 20.0 | 33909 | 2111 | 1250 | 18.49 | 27.14 | 5391 | 327 | 7.37 | 290.40 | 184.40 | 23.68 |
| **432** | **400** | **5** | **400** | **200** | **16** | 91.06 | 116.0 | 20.0 | 40401 | 2547 | 1478 | 18.66 | 27.34 | 9600 | 480 | 9.10 | 426.67 | 205.40 | 22.56 |
| **532** | **500** | **5** | **250** | **140** | **16** | 68.61 | 87.4 | 25.0 | 44398 | 2074 | 1396 | 22.54 | 31.80 | 2450 | 196 | 5.29 | 166.67 | 183.40 | 26.73 |
| **532** | **500** | **5** | **300** | **165** | **16** | 78.03 | 99.4 | 25.0 | 51623 | 2459 | 1603 | 22.79 | 32.21 | 4199 | 280 | 6.50 | 240.00 | 198.40 | 25.43 |
| **536** | **500** | **5** | **330** | **165** | **18** | 89.57 | 114.1 | 25.0 | 59816 | 2982 | 1783 | 22.90 | 33.54 | 6065 | 368 | 7.29 | 326.70 | 205.20 | 22.91 |
| **536** | **500** | **5** | **400** | **200** | **18** | 104.41 | 133.0 | 25.0 | 71148 | 3595 | 2104 | 23.13 | 33.81 | 10801 | 540 | 9.01 | 480.00 | 226.20 | 21.67 |
| **540** | **500** | **5** | **500** | **250** | **20** | 137.38 | 175.0 | 25.0 | 97001 | 4956 | 2817 | 23.54 | 34.43 | 23438 | 938 | 11.57 | 833.33 | 257.00 | 18.71 |

# UNSYMMETRICAL WELDED I-SECTIONS



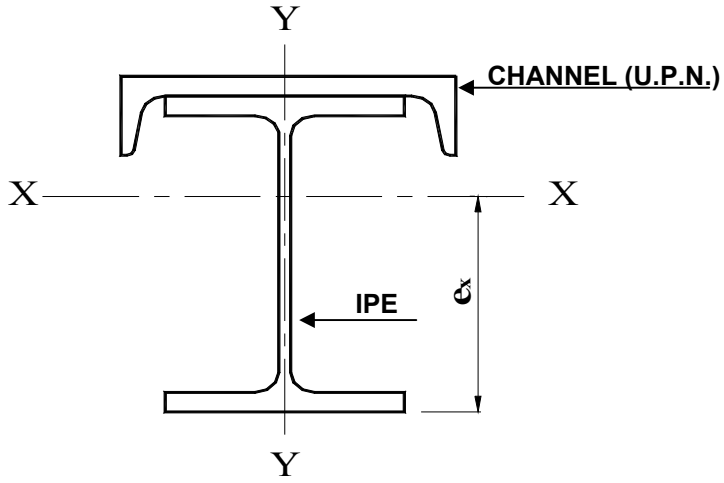

| depth | Web | | Flange | | | Weight | Area | $A_{web}$ | Axis x-x | | | | | Axis y-y | | | | Surface Area | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| h | d | s | $b_1$ | $b_2$ | t | | | | $I_x$ | $S_{xt}$ | $S_{xb}$ | $r_x$ | $e_x$ | $I_y$ | $S_y$ | $r_y$ | $S_{y\ upper\ flange}$ | $U_m$ | $U_t$ |
| mm | mm | mm | mm | mm | mm | kg/m` | $cm^2$ | $cm^2$ | $cm^4$ | $cm^3$ | $cm^3$ | cm | cm | $cm^4$ | $cm^3$ | cm | $cm^3$ | $x10^{-2}m^2/m$\ | $m^2/t$ |
| **632** | **600** | **6** | **300** | **165** | **16** | 86.66 | 110.4 | 36.0 | 77386 | 3026 | 2057 | 26.48 | 37.63 | 4200 | 280 | 6.17 | 240 | 218.20 | 25.18 |
| **636** | **600** | **6** | **330** | **165** | **18** | 98.20 | 125.1 | 36.0 | 89165 | 3645 | 2278 | 26.70 | 39.14 | 6065 | 368 | 6.96 | 327 | 225.00 | 22.91 |
| **636** | **600** | **6** | **400** | **200** | **18** | 113.04 | 144.0 | 36.0 | 105355 | 4376 | 2666 | 27.05 | 39.53 | 10801 | 540 | 8.66 | 480 | 246.00 | 21.76 |
| **640** | **600** | **6** | **400** | **250** | **20** | 130.31 | 166.0 | 36.0 | 130563 | 4946 | 3472 | 28.05 | 37.60 | 13272 | 664 | 8.94 | 533 | 256.80 | 19.71 |
| **640** | **600** | **6** | **500** | **250** | **20** | 146.01 | 186.0 | 36.0 | 142083 | 6004 | 3523 | 27.64 | 40.33 | 23439 | 938 | 11.23 | 833 | 276.80 | 18.96 |
| **696** | **660** | **7** | **300** | **165** | **18** | 101.97 | 129.9 | 46.2 | 107758 | 3787 | 2619 | 28.80 | 41.14 | 4726 | 315 | 6.03 | 270 | 230.80 | 22.63 |
| **700** | **660** | **7** | **330** | **165** | **20** | 113.98 | 145.2 | 46.2 | 122578 | 4495 | 2869 | 29.06 | 42.73 | 6740 | 408 | 6.81 | 363 | 237.60 | 20.85 |
| **700** | **660** | **7** | **400** | **200** | **20** | 130.47 | 166.2 | 46.2 | 144402 | 5385 | 3344 | 29.48 | 43.18 | 12002 | 600 | 8.50 | 533 | 258.60 | 19.82 |
| **704** | **660** | **7** | **400** | **250** | **22** | 148.52 | 189.2 | 46.2 | 176417 | 6031 | 4287 | 30.54 | 41.15 | 14600 | 730 | 8.78 | 587 | 269.40 | 18.14 |
| **704** | **660** | **7** | **500** | **250** | **22** | 165.79 | 211.2 | 46.2 | 192046 | 7297 | 4357 | 30.15 | 44.08 | 25783 | 1031 | 11.05 | 917 | 289.40 | 17.46 |
| **786** | **750** | **7** | **330** | **165** | **18** | 111.16 | 141.6 | 52.5 | 146831 | 4699 | 3101 | 32.20 | 47.35 | 6067 | 368 | 6.55 | 327 | 254.80 | 22.92 |
| **786** | **750** | **7** | **400** | **200** | **18** | 125.99 | 160.5 | 52.5 | 171984 | 5604 | 3590 | 32.73 | 47.91 | 10802 | 540 | 8.20 | 480 | 275.80 | 21.89 |
| **790** | **750** | **7** | **400** | **250** | **20** | 143.26 | 182.5 | 52.5 | 210035 | 6332 | 4583 | 33.92 | 45.83 | 13273 | 664 | 8.53 | 533 | 286.60 | 20.01 |
| **794** | **750** | **7** | **500** | **250** | **22** | 170.74 | 217.5 | 52.5 | 249797 | 8344 | 5050 | 33.89 | 49.46 | 25783 | 1031 | 10.89 | 917 | 307.40 | 18.00 |
| **1036** | **1000** | **10** | **330** | **165** | **18** | 148.44 | 189.1 | 100.0 | 302113 | 6897 | 5053 | 39.97 | 59.79 | 6073 | 368 | 5.67 | 327 | 304.20 | 20.49 |
| **1040** | **1000** | **10** | **400** | **200** | **20** | 172.70 | 220.0 | 100.0 | 376577 | 8814 | 6146 | 41.37 | 61.27 | 12008 | 600 | 7.39 | 533 | 326.00 | 18.88 |
| **1044** | **1000** | **10** | **400** | **250** | **22** | 190.76 | 243.0 | 100.0 | 445092 | 9834 | 7526 | 42.80 | 59.14 | 14606 | 730 | 7.75 | 587 | 336.80 | 17.66 |
| **1044** | **1000** | **10** | **500** | **250** | **22** | 208.03 | 265.0 | 100.0 | 484442 | 11647 | 7713 | 42.76 | 62.81 | 25790 | 1032 | 9.87 | 917 | 356.80 | 17.15 |

# BUILT-UP SECTION
# IPE +Channel (U.P.N.)




| IPE NO. | CHANNEL NO. | Weight | Area | $A_{web}$ | AXIS X-X | | | | | AXIS Y-Y | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | $I_x$ | $S_{xb}$ | $S_{xt}$ | $r_x$ | $e_x$ | $I_y$ | $S_y$ | $r_y$ | $I_{y\ upper\ flange}$ | $S_{y\ upper\ fLange}$ |
| | | kg/m\ | $cm^2$ | $cm^2$ | $cm^4$ | $cm^3$ | $cm^3$ | cm | cm | $cm^4$ | $cm^3$ | cm | $cm^4$ | $cm^3$ |
| **200** | **160** | 41.20 | 52.50 | 10.25 | 3060 | 217 | 458 | 7.63 | 14.07 | 1067 | 133.38 | 4.51 | 996 | 124.50 |
| | **180** | 44.40 | 56.50 | | 3168 | 220 | 495 | 7.49 | 14.40 | 1492 | 165.78 | 5.14 | 1421 | 157.89 |
| | **200** | 47.70 | 60.70 | | 3269 | 223 | 531 | 7.34 | 14.69 | 2052 | 205.20 | 5.81 | 1981 | 198.10 |
| **220** | **160** | 45.00 | 57.40 | 11.89 | 4227 | 279 | 556 | 8.58 | 15.14 | 1130 | 141.25 | 4.44 | 1028 | 128.44 |
| | **180** | 48.20 | 61.40 | | 4371 | 282 | 599 | 8.44 | 15.51 | 1555 | 172.78 | 5.03 | 1453 | 161.39 |
| | **220** | 55.60 | 70.80 | | 4648 | 288 | 689 | 8.10 | 16.16 | 2895 | 263.18 | 6.39 | 2793 | 253.86 |
| **240** | **180** | 52.70 | 67.10 | 13.66 | 5935 | 359 | 719 | 9.41 | 16.54 | 1634 | 181.56 | 4.93 | 1492 | 165.78 |
| | **200** | 56.00 | 71.30 | | 6113 | 362 | 768 | 9.26 | 16.90 | 2194 | 219.40 | 5.55 | 2052 | 205.20 |
| | **240** | 63.90 | 81.40 | | 6473 | 368 | 877 | 8.92 | 17.57 | 3884 | 323.67 | 6.91 | 3742 | 311.83 |
| **270** | **200** | 61.40 | 78.10 | 16.47 | 8820 | 474 | 952 | 10.63 | 18.59 | 2330 | 233.00 | 5.46 | 2120 | 212.00 |
| | **240** | 69.30 | 88.20 | | 9325 | 482 | 1086 | 10.28 | 19.36 | 4020 | 335.00 | 6.75 | 3810 | 317.50 |
| | **280** | 77.90 | 99.20 | | 9600 | 484 | 1173 | 9.84 | 19.82 | 6700 | 478.57 | 8.22 | 6490 | 463.57 |
| **300** | **200** | 67.50 | 86.00 | 19.78 | 12366 | 613 | 1159 | 11.99 | 20.18 | 2514 | 251.40 | 5.41 | 2212 | 221.20 |
| | **240** | 75.40 | 96.10 | | 13066 | 621 | 1318 | 11.66 | 21.04 | 4204 | 350.33 | 6.61 | 3902 | 325.17 |
| | **300** | 88.40 | 112.60 | | 13825 | 630 | 1527 | 11.08 | 21.95 | 8634 | 575.60 | 8.76 | 8332 | 555.47 |
| **330** | **220** | 78.50 | 100.00 | 23.03 | 17419 | 784 | 1490 | 13.20 | 22.21 | 3478 | 316.18 | 5.90 | 3084 | 280.36 |
| | **260** | 87.00 | 110.90 | | 18336 | 794 | 1681 | 12.86 | 23.09 | 5608 | 431.38 | 7.11 | 5214 | 401.08 |
| | **320** | 108.60 | 138.40 | | 20393 | 820 | 2142 | 12.14 | 24.88 | 11658 | 728.63 | 9.18 | 11264 | 704.00 |

# BUILT-UP SECTION
# IPE +Channel (U.P.N.)




| IPE NO. | CHANNEL NO. | Weight | Area | $A_{web}$ | AXIS X-X | | | | | AXIS Y-Y | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | $I_x$ | $S_{xb}$ | $S_{xt}$ | $r_x$ | $e_X$ | $I_y$ | $S_y$ | $r_y$ | $I_{y\ upper\ flange}$ | $S_{y\ upper\ fLange}$ |
| | | kg/m\ | $cm^2$ | $cm^2$ | $cm^4$ | $cm^3$ | $cm^3$ | cm | cm | $cm^4$ | $cm^3$ | cm | $cm^4$ | $cm^3$ |
| **360** | **240** | 90.30 | 115.00 | 26.77 | 23994 | 994 | 1875 | 14.44 | 24.15 | 4640 | 386.67 | 6.35 | 4120 | 343.33 |
| | **280** | 98.90 | 126.00 | | 24800 | 997 | 2046 | 14.03 | 24.88 | 7320 | 522.86 | 7.62 | 6800 | 485.71 |
| | **350** | 117.70 | 150.00 | | 27667 | 1034 | 2600 | 13.58 | 26.76 | 13880 | 793.14 | 9.62 | 13360 | 763.43 |
| **400** | **240** | 99.50 | 126.80 | 32.08 | 33256 | 1267 | 2262 | 16.19 | 26.24 | 4920 | 410.00 | 6.23 | 4260 | 355.00 |
| | **320** | 125.80 | 160.30 | | 37849 | 1310 | 3025 | 15.37 | 28.89 | 12190 | 761.88 | 8.72 | 11530 | 720.63 |
| | **400** | 138.10 | 176.00 | | 39420 | 1325 | 3383 | 14.97 | 29.75 | 21670 | 1083.50 | 11.10 | 21010 | 1050.50 |
| **450** | **260** | 115.50 | 147.10 | 39.56 | 48555 | 1649 | 2932 | 18.17 | 29.44 | 6500 | 500.00 | 6.65 | 5660 | 435.38 |
| | **320** | 137.10 | 174.60 | | 53797 | 1695 | 3671 | 17.55 | 31.75 | 12550 | 784.38 | 8.48 | 11710 | 731.88 |
| | **400** | 149.40 | 190.30 | | 56037 | 1713 | 4096 | 17.16 | 32.72 | 22030 | 1101.50 | 10.76 | 21190 | 1059.50 |
| **500** | **260** | 128.60 | 164.30 | 47.74 | 67574 | 2115 | 3547 | 20.28 | 31.95 | 6960 | 535.38 | 6.51 | 5890 | 453.08 |
| | **320** | 150.20 | 191.80 | | 74765 | 2173 | 4399 | 19.74 | 34.41 | 13010 | 813.13 | 8.24 | 11940 | 746.25 |
| | **400** | 162.50 | 207.50 | | 77899 | 2196 | 4891 | 19.38 | 35.47 | 22490 | 1124.50 | 10.41 | 21420 | 1071.00 |
| **550** | **280** | 147.80 | 187.30 | 57.23 | 92823 | 2665 | 4385 | 22.26 | 34.83 | 8950 | 639.29 | 6.91 | 7615 | 543.93 |
| | **320** | 165.50 | 209.80 | | 101204 | 2735 | 5217 | 21.96 | 37.00 | 13540 | 846.25 | 8.03 | 12205 | 762.81 |
| | **400** | 177.80 | 225.50 | | 105432 | 2764 | 5778 | 21.62 | 38.15 | 23020 | 1151.00 | 10.10 | 21685 | 1084.25 |
| **600** | **300** | 168.20 | 214.80 | 67.44 | 126776 | 3359 | 5452 | 24.29 | 37.75 | 11420 | 761.33 | 7.29 | 9725 | 648.33 |
| | **350** | 182.60 | 233.30 | | 136120 | 3437 | 6246 | 24.15 | 39.61 | 16230 | 927.43 | 8.34 | 14535 | 830.57 |
| | **400** | 193.80 | 247.50 | | 140596 | 3461 | 6769 | 23.83 | 40.63 | 23740 | 1187.00 | 9.79 | 22045 | 1102.25 |

# COLD FORMED SECTIONS

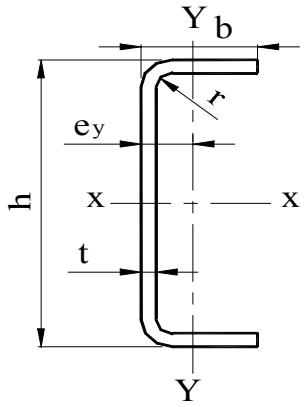
UNSTIFFENED CHANNEL

LIPPED CHANNEL

STRAIGHT LIPPED Z-CHANNEL

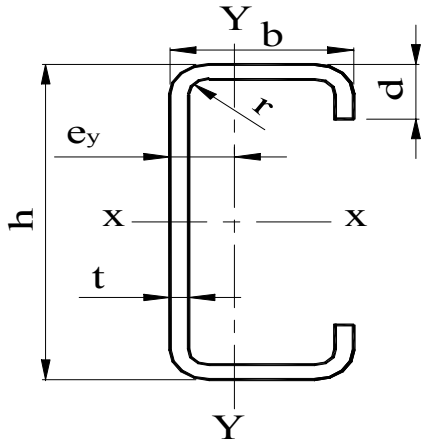
INCLINED LIPPED Z-CHANNEL

# UNSTIFFENED CHANNEL
## (COLD FORMED SECTION)



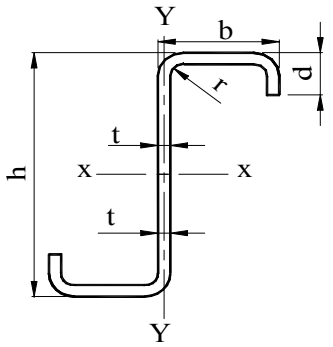

| Dimensions | | | | Weight | Area | $A_{web}$ | Axis X-X | | | Axis Y-Y | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| h | b | t | r | | | | $I_x$ | $S_x$ | $r_x$ | $I_y$ | $S_y$ | $r_y$ | $e_y$ |
| mm | mm | mm | mm | kg/m` | $cm^2$ | $cm^2$ | $cm^4$ | $cm^3$ | cm | $cm^4$ | $cm^3$ | cm | cm |
| **30** | **25** | **4** | **8** | 1.99 | 2.54 | 0.88 | 2.87 | 1.91 | 1.06 | 1.28 | 0.89 | 0.71 | 1.06 |
| **40** | **20** | **4** | **8** | 1.99 | 2.54 | 1.28 | 4.80 | 2.40 | 1.38 | 0.73 | 0.58 | 0.54 | 0.73 |
| **40** | **24** | **4** | **8** | 2.24 | 2.86 | 1.28 | 5.84 | 2.92 | 1.43 | 1.35 | 0.90 | 0.69 | 0.90 |
| **50** | **25** | **4** | **8** | 2.62 | 3.34 | 1.68 | 10.80 | 4.32 | 1.80 | 1.73 | 1.05 | 0.72 | 0.85 |
| **50** | **35** | **4** | **8** | 3.25 | 4.20 | 1.68 | 15.03 | 6.01 | 1.91 | 4.78 | 2.14 | 1.07 | 1.27 |
| **60** | **30** | **4** | **8** | 3.24 | 4.14 | 2.08 | 20.30 | 6.77 | 2.22 | 3.29 | 1.62 | 0.89 | 0.97 |
| **65** | **38** | **4** | **8** | 3.90 | 4.98 | 2.28 | 30.71 | 9.45 | 2.48 | 6.82 | 2.68 | 1.17 | 1.25 |
| **70** | **25** | **4** | **8** | 3.25 | 4.14 | 2.48 | 25.40 | 7.26 | 2.48 | 2.00 | 1.13 | 0.70 | 0.73 |
| **80** | **45** | **4** | **8** | 4.81 | 6.14 | 2.88 | 58.81 | 14.70 | 3.10 | 12.05 | 3.91 | 1.40 | 1.41 |
| **100** | **50** | **4** | **8** | 5.76 | 7.34 | 3.68 | 109.40 | 21.88 | 3.86 | 17.67 | 5.00 | 1.56 | 1.46 |
| **120** | **60** | **4** | **8** | 7.01 | 8.94 | 4.48 | 195.80 | 32.63 | 4.68 | 31.50 | 7.34 | 1.88 | 1.71 |
| **140** | **65** | **4** | **8** | 7.96 | 10.14 | 5.28 | 300.13 | 42.88 | 5.44 | 41.54 | 8.78 | 2.02 | 1.77 |
| **160** | **65** | **4** | **8** | 8.58 | 10.94 | 6.08 | 411.28 | 51.41 | 6.13 | 43.37 | 8.95 | 1.99 | 1.65 |
| **180** | **80** | **4** | **8** | 10.06 | 12.94 | 6.88 | 637.23 | 70.80 | 7.02 | 80.45 | 13.60 | 2.49 | 2.09 |
| **200** | **80** | **4** | **8** | 10.78 | 13.74 | 7.68 | 816.04 | 81.60 | 7.71 | 83.13 | 13.80 | 2.46 | 1.98 |
| **200** | **100** | **4** | **8** | 12.04 | 15.34 | 7.68 | 969.70 | 96.97 | 7.95 | 154.37 | 21.17 | 3.17 | 2.71 |
| **60** | **40** | **3.6** | **8** | 3.51 | 4.48 | 1.90 | 24.48 | 8.16 | 2.34 | 7.02 | 2.66 | 1.25 | 1.36 |
| **60** | **40** | **4** | **8** | 3.87 | 4.94 | 2.08 | 26.58 | 8.86 | 2.32 | 7.64 | 2.92 | 1.24 | 1.38 |
| **80** | **40** | **2.25** | **8** | 2.61 | 3.32 | 1.70 | 32.33 | 8.08 | 3.12 | 5.24 | 1.83 | 1.26 | 1.14 |
| **80** | **40** | **2.5** | **8** | 2.89 | 3.68 | 1.88 | 35.52 | 8.88 | 3.11 | 5.75 | 2.02 | 1.25 | 1.15 |
| **80** | **40** | **3** | **8** | 3.43 | 4.37 | 2.22 | 41.66 | 10.42 | 3.09 | 6.75 | 2.39 | 1.24 | 1.18 |
| **80** | **40** | **4** | **8** | 4.50 | 5.74 | 2.88 | 53.04 | 13.26 | 3.04 | 8.60 | 3.09 | 1.22 | 1.22 |
| **80** | **50** | **5** | **7.5** | 6.32 | 8.05 | 3.50 | 77.30 | 19.33 | 3.10 | 19.55 | 5.85 | 1.56 | 1.66 |
| **100** | **40** | **3** | **8** | 3.91 | 4.97 | 2.82 | 70.96 | 14.19 | 3.78 | 7.31 | 2.48 | 1.21 | 1.05 |
| **100** | **40** | **4** | **8** | 5.13 | 6.54 | 3.68 | 90.97 | 18.19 | 3.73 | 9.33 | 3.21 | 1.19 | 1.09 |
| **100** | **50** | **5** | **8** | 7.10 | 9.05 | 4.50 | 131.83 | 26.37 | 3.82 | 21.32 | 6.10 | 1.53 | 1.51 |
| **120** | **60** | **4** | **8** | 7.01 | 8.94 | 4.48 | 195.80 | 32.63 | 4.68 | 31.50 | 7.35 | 1.88 | 1.71 |
| **140** | **63** | **4** | **8** | 7.83 | 9.98 | 5.28 | 292.73 | 41.82 | 5.42 | 38.05 | 8.27 | 1.95 | 1.70 |
| **160** | **63** | **4** | **8** | 8.46 | 10.78 | 6.08 | 401.54 | 50.19 | 6.10 | 39.70 | 8.43 | 1.92 | 1.59 |
| **180** | **75** | **4** | **8** | 9.84 | 12.54 | 6.88 | 606.25 | 67.36 | 6.95 | 67.20 | 12.01 | 2.32 | 1.90 |

# LIPPED CHANNEL
## (COLD FORMED SECTION)



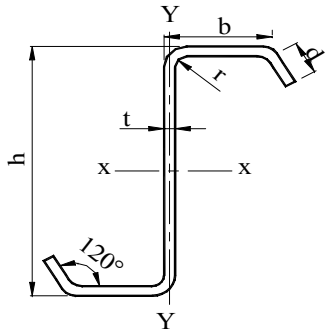

| Dimensions | | | | | Weight | Area | $A_{web}$ | Axis X-X | | | Axis Y-Y | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| h | b | d | t | r | | | | $I_x$ | $S_x$ | $r_x$ | $I_y$ | $S_y$ | $r_y$ | $e_y$ |
| mm | mm | mm | mm | mm | kg/m` | $cm^2$ | $cm^2$ | $cm^4$ | $cm^3$ | cm | $cm^4$ | $cm^3$ | cm | cm |
| **100** | **40** | **15** | **3** | **8** | 4.28 | 5.45 | 2.82 | 76.88 | 15.38 | 3.76 | 10.41 | 3.84 | 1.38 | 1.29 |
| **140** | **70** | **30** | **3** | **8** | 7.34 | 9.35 | 4.02 | 280.23 | 40.03 | 5.47 | 67.30 | 15.44 | 2.68 | 2.64 |
| **160** | **70** | **30** | **3** | **8** | 7.81 | 9.95 | 4.62 | 384.69 | 48.09 | 6.22 | 70.80 | 15.70 | 2.67 | 2.49 |
| **160** | **80** | **34** | **3** | **8** | 8.47 | 10.79 | 4.62 | 427.20 | 53.40 | 6.29 | 103.10 | 20.68 | 3.09 | 3.01 |
| **160** | **80** | **34** | **3.65** | **8** | 10.21 | 13.01 | 5.57 | 510.03 | 63.75 | 6.26 | 121.93 | 24.46 | 3.06 | 3.01 |
| **160** | **80** | **30** | **4** | **8** | 10.89 | 13.87 | 6.08 | 545.86 | 68.23 | 6.27 | 124.07 | 24.35 | 2.99 | 2.90 |
| **160** | **80** | **35** | **4** | **8** | 11.20 | 14.27 | 6.08 | 554.90 | 69.36 | 6.24 | 133.39 | 26.90 | 3.06 | 3.04 |
| **180** | **80** | **25** | **3.6** | **8** | 10.14 | 12.91 | 6.22 | 642.27 | 71.36 | 7.05 | 109.29 | 20.30 | 2.91 | 2.62 |
| **180** | **80** | **25** | **4** | **8** | 11.20 | 14.27 | 6.88 | 705.60 | 78.40 | 7.03 | 119.15 | 22.13 | 2.89 | 2.62 |
| **100** | **50** | **20** | **2** | **8** | 3.40 | 4.33 | 1.92 | 65.92 | 13.18 | 3.90 | 15.36 | 4.85 | 1.88 | 1.84 |
| **200** | **60** | **20** | **2** | **8** | 5.28 | 6.73 | 3.92 | 386.55 | 38.66 | 7.58 | 30.47 | 6.96 | 2.13 | 1.62 |
| **250** | **70** | **20** | **2** | **8** | 6.38 | 8.13 | 4.92 | 723.51 | 57.88 | 9.43 | 47.56 | 9.05 | 2.42 | 1.74 |
| **185** | **60** | **25** | **1.5** | **8** | 3.93 | 5.00 | 2.73 | 251.81 | 27.22 | 7.09 | 25.60 | 6.12 | 2.26 | 1.82 |
| **185** | **60** | **26.4** | **2** | **8** | 5.25 | 6.69 | 3.62 | 333.19 | 36.02 | 7.06 | 34.09 | 8.22 | 2.26 | 1.85 |
| **185** | **60** | **27.7** | **2.5** | **8** | 6.56 | 8.36 | 4.50 | 412.99 | 44.65 | 7.03 | 42.46 | 10.32 | 2.25 | 1.89 |
| **185** | **60** | **29.1** | **3** | **8** | 7.89 | 10.05 | 5.37 | 491.57 | 53.14 | 7.00 | 50.82 | 12.46 | 2.25 | 1.92 |
| **215** | **60** | **25** | **1.5** | **8** | 4.29 | 5.46 | 3.18 | 360.67 | 33.55 | 8.13 | 26.86 | 6.21 | 2.22 | 1.67 |
| **215** | **60** | **26.4** | **2** | **8** | 5.72 | 7.29 | 4.22 | 477.98 | 44.46 | 8.10 | 35.79 | 8.34 | 2.21 | 1.70 |
| **215** | **60** | **27.7** | **2.5** | **8** | 7.15 | 9.11 | 5.25 | 593.41 | 55.20 | 8.07 | 44.59 | 10.47 | 2.21 | 1.74 |
| **215** | **60** | **29.1** | **3** | **8** | 8.59 | 10.95 | 6.27 | 707.49 | 65.81 | 8.04 | 53.41 | 12.64 | 2.21 | 1.78 |

# STRAIGHT LIPPED Z-SECTION
## (COLD FORMED SECTION)




| Dimensions | | | | | Weight | Area | $A_{web}$ | Axis X-X | | | Axis Y-Y | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| h | b | d | t | r | | | | $I_x$ | $S_x$ | $r_x$ | $I_y$ | $S_y$ | $r_y$ |
| mm | mm | mm | mm | mm | kg/m` | $cm^2$ | $cm^2$ | $cm^4$ | $cm^3$ | cm | $cm^4$ | $cm^3$ | cm |
| **100** | **50** | **20** | **2** | **8** | 3.40 | 4.33 | 1.92 | 65.92 | 13.18 | 3.90 | 28.40 | 5.80 | 2.56 |
| **150** | **60** | **20** | **2** | **8** | 4.50 | 5.73 | 2.92 | 195.22 | 26.03 | 5.84 | 46.04 | 7.80 | 2.83 |
| **150** | **60** | **20** | **2.5** | **8** | 5.58 | 7.10 | 3.63 | 239.74 | 31.97 | 5.81 | 55.66 | 9.47 | 2.80 |
| **200** | **60** | **20** | **2** | **8** | 5.28 | 6.73 | 3.92 | 386.55 | 38.65 | 7.58 | 46.04 | 7.80 | 2.62 |
| **200** | **60** | **20** | **2.5** | **8** | 6.56 | 8.35 | 4.88 | 475.94 | 47.59 | 7.55 | 55.66 | 9.47 | 2.58 |
| **250** | **70** | **20** | **2** | **8** | 6.38 | 8.13 | 4.92 | 723.51 | 57.88 | 9.43 | 69.53 | 10.08 | 2.92 |
| **250** | **70** | **20** | **2.5** | **8** | 7.93 | 10.10 | 6.13 | 893.12 | 71.45 | 9.40 | 84.41 | 12.28 | 2.89 |

# INCLINED LIPPED Z-SECTION
## (COLD FORMED SECTION)



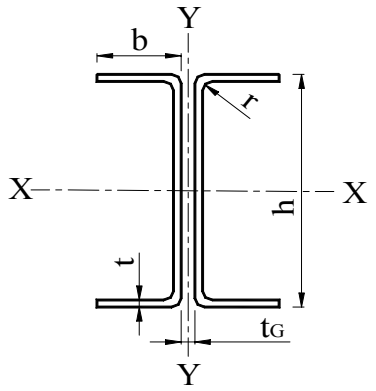

| Dimensions | | | | | Weight | Area | $A_{web}$ | Axis X-X | | | Axis Y-Y | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| h | b | d | t | r | | | | $I_x$ | $S_x$ | $r_x$ | $I_y$ | $S_y$ | $r_y$ |
| mm | mm | mm | mm | mm | kg/m` | $cm^2$ | $cm^2$ | $cm^4$ | $cm^3$ | cm | $cm^4$ | $cm^3$ | cm |
| **185** | **60** | **20.8** | **1.5** | **8** | 3.83 | 4.88 | 2.73 | 246.10 | 26.60 | 7.10 | 37.66 | 6.36 | 2.78 |
| **185** | **60** | **21.8** | **2** | **8** | 5.10 | 6.50 | 3.62 | 325.13 | 35.15 | 7.07 | 50.12 | 8.50 | 2.78 |
| **185** | **60** | **22.8** | **2.5** | **8** | 6.37 | 8.12 | 4.50 | 402.66 | 43.53 | 7.04 | 62.53 | 10.64 | 2.78 |
| **185** | **60** | **23.8** | **3** | **8** | 7.64 | 9.73 | 5.37 | 478.65 | 51.75 | 7.01 | 74.88 | 12.80 | 2.77 |
| **215** | **60** | **20.8** | **1.5** | **8** | 4.19 | 5.33 | 3.18 | 352.12 | 32.76 | 8.13 | 37.66 | 6.36 | 2.66 |
| **215** | **60** | **21.8** | **2** | **8** | 5.58 | 7.10 | 4.22 | 465.85 | 43.33 | 8.10 | 50.12 | 8.50 | 2.66 |
| **215** | **60** | **22.8** | **2.5** | **8** | 6.96 | 8.87 | 5.25 | 577.73 | 53.74 | 8.07 | 62.53 | 10.64 | 2.66 |
| **215** | **60** | **23.8** | **3** | **8** | 8.34 | 10.63 | 6.27 | 687.74 | 63.98 | 8.04 | 74.88 | 12.80 | 2.65 |

# COMBINED COLD FORMED SECTIONS

TWO CHANNELS BACK TO BACK

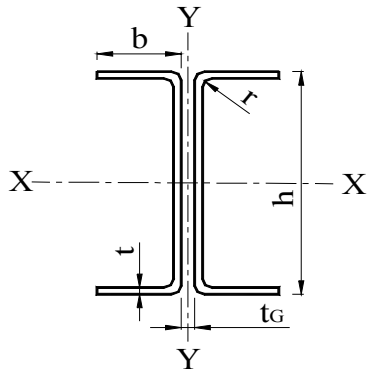
TWO  CHANNELS TOE TO TOE

# TWO CHANNELS (Cold Formed)
# BACK to BACK



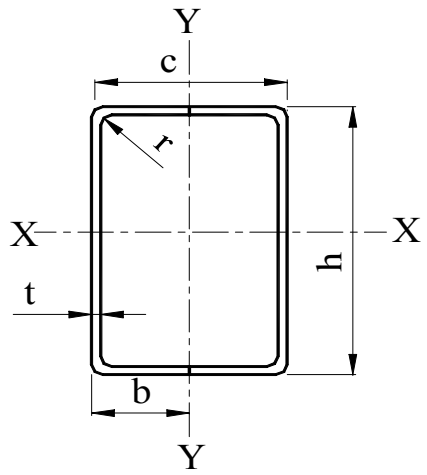

| Dimensions | | | | Weight | Area | $A_{web}$ | Axis X-X | | | Axis Y-Y | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Ix | $S_x$ | $r_x$ | Iy | $S_y$ | $r_y$ | Iy | $S_y$ | $r_y$ | Iy | $S_y$ | $r_y$ |
| h | b | t | r | kg/m` | $cm^2$ | $cm^2$ | $cm^4$ | $cm^3$ | cm | $t_G$ = 8 mm | | | $t_G$ = 10 mm | | | $t_G$ = 12 mm | | |
| 30 | 25 | 4 | 8 | 3.98 | 5.08 | 1.76 | 5.74 | 3.82 | 1.06 | 13.39 | 4.62 | 1.62 | 14.92 | 4.97 | 1.71 | 16.56 | 5.34 | 1.81 |
| 40 | 20 | 4 | 8 | 3.98 | 5.08 | 2.56 | 9.60 | 4.80 | 1.38 | 7.95 | 3.31 | 1.25 | 9.15 | 3.66 | 1.34 | 10.45 | 4.02 | 1.43 |
| 40 | 24 | 4 | 8 | 4.48 | 5.72 | 2.56 | 11.68 | 5.84 | 1.43 | 12.37 | 4.42 | 1.47 | 13.91 | 4.80 | 1.56 | 15.57 | 5.19 | 1.65 |
| 50 | 25 | 4 | 8 | 5.24 | 6.68 | 3.36 | 21.60 | 8.64 | 1.80 | 13.90 | 4.79 | 1.44 | 15.63 | 5.21 | 1.53 | 17.50 | 5.65 | 1.62 |
| 50 | 35 | 4 | 8 | 6.50 | 8.40 | 3.36 | 30.06 | 12.02 | 1.91 | 32.99 | 8.46 | 1.98 | 35.88 | 8.97 | 2.07 | 38.93 | 9.50 | 2.15 |
| 60 | 30 | 4 | 8 | 6.48 | 8.28 | 4.16 | 40.60 | 13.54 | 2.22 | 22.12 | 6.51 | 1.63 | 24.47 | 6.99 | 1.72 | 26.99 | 7.50 | 1.81 |
| 65 | 38 | 4 | 8 | 7.80 | 9.96 | 4.56 | 61.42 | 18.90 | 2.48 | 40.76 | 9.70 | 2.02 | 44.14 | 10.27 | 2.11 | 47.73 | 10.85 | 2.19 |
| 70 | 25 | 4 | 8 | 6.50 | 8.28 | 4.96 | 50.80 | 14.52 | 2.48 | 14.57 | 5.03 | 1.33 | 16.53 | 5.51 | 1.41 | 18.65 | 6.01 | 1.50 |
| 80 | 45 | 4 | 8 | 9.62 | 12.28 | 5.76 | 117.62 | 29.40 | 3.10 | 64.33 | 13.13 | 2.29 | 68.90 | 13.78 | 2.37 | 73.71 | 14.45 | 2.45 |
| 100 | 50 | 4 | 8 | 11.52 | 14.68 | 7.36 | 218.80 | 43.76 | 3.86 | 86.13 | 15.95 | 2.42 | 91.73 | 16.68 | 2.50 | 97.64 | 17.44 | 2.58 |
| 120 | 60 | 4 | 8 | 14.02 | 17.88 | 8.96 | 391.60 | 65.26 | 4.68 | 142.60 | 22.28 | 2.82 | 150.33 | 23.13 | 2.90 | 158.41 | 24.00 | 2.98 |
| 140 | 65 | 4 | 8 | 15.92 | 20.28 | 10.56 | 600.26 | 85.76 | 5.44 | 178.58 | 25.88 | 2.97 | 187.58 | 26.80 | 3.04 | 196.99 | 27.75 | 3.12 |
| 160 | 65 | 4 | 8 | 17.16 | 21.88 | 12.16 | 822.56 | 102.82 | 6.13 | 178.69 | 25.90 | 2.86 | 187.88 | 26.84 | 2.93 | 197.51 | 27.82 | 3.00 |
| 180 | 80 | 4 | 8 | 20.12 | 25.88 | 13.76 | 1274.5 | 141.60 | 7.02 | 321.36 | 38.26 | 3.52 | 334.51 | 39.35 | 3.60 | 348.17 | 40.48 | 3.67 |
| 200 | 80 | 4 | 8 | 21.56 | 27.48 | 15.36 | 1632.1 | 163.20 | 7.71 | 321.92 | 38.32 | 3.42 | 335.27 | 39.44 | 3.49 | 349.18 | 40.60 | 3.56 |
| 200 | 100 | 4 | 8 | 24.08 | 30.68 | 15.36 | 1939.4 | 193.94 | 7.95 | 605.48 | 58.22 | 4.44 | 624.87 | 59.51 | 4.51 | 644.87 | 60.84 | 4.58 |

# TWO CHANNELS BACK to BACK
# (Cold Formed SECTION)




| Dimensions | | | | Weight | Area | $A_{web}$ | Axis X-X | | | Axis Y-Y | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Ix | $S_x$ | $r_x$ | Iy | $S_y$ | $r_y$ | Iy | $S_y$ | $r_y$ | Iy | $S_y$ | $r_y$ |
| h | b | t | r | kg/m` | $cm^2$ | $cm^2$ | $cm^4$ | $cm^3$ | cm | $t_G$ = 8 mm | | | $t_G$ = 10 mm | | | $t_G$ = 12 mm | | |
| **60** | **40** | **3.6** | **8** | 7.02 | 8.96 | 4.22 | 48.96 | 16.32 | 2.34 | 41.79 | 9.50 | 2.16 | 45.04 | 10.01 | 2.24 | 48.46 | 10.53 | 2.33 |
| **60** | **40** | **4** | **8** | 7.74 | 9.88 | 4.16 | 53.16 | 17.72 | 2.32 | 46.58 | 10.59 | 2.17 | 50.20 | 11.16 | 2.25 | 54.01 | 11.74 | 2.34 |
| **80** | **40** | **2.25** | **8** | 5.22 | 6.64 | 6.04 | 64.66 | 16.16 | 3.12 | 26.23 | 5.96 | 1.99 | 28.34 | 6.30 | 2.07 | 30.58 | 6.65 | 2.15 |
| **80** | **40** | **2.5** | **8** | 5.78 | 7.36 | 6.00 | 71.04 | 17.76 | 3.11 | 29.18 | 6.63 | 1.99 | 31.54 | 7.01 | 2.07 | 34.04 | 7.40 | 2.15 |
| **80** | **40** | **3** | **8** | 6.86 | 8.74 | 5.92 | 83.32 | 20.84 | 3.09 | 35.32 | 8.03 | 2.01 | 38.17 | 8.48 | 2.09 | 41.19 | 8.95 | 2.17 |
| **80** | **40** | **4** | **8** | 9.00 | 11.48 | 5.76 | 106.08 | 26.52 | 3.04 | 47.33 | 10.76 | 2.03 | 51.16 | 11.37 | 2.11 | 55.23 | 12.01 | 2.19 |
| **80** | **50** | **5** | **8** | 12.64 | 16.10 | 5.60 | 154.60 | 38.66 | 3.10 | 107.42 | 19.89 | 2.58 | 114.22 | 20.77 | 2.66 | 121.33 | 21.67 | 2.75 |
| **100** | **40** | **3** | **8** | 7.82 | 9.94 | 7.52 | 141.92 | 28.38 | 3.78 | 35.52 | 8.07 | 1.89 | 38.50 | 8.56 | 1.97 | 41.68 | 9.06 | 2.05 |
| **100** | **40** | **4** | **8** | 10.26 | 13.08 | 7.36 | 181.94 | 36.38 | 3.73 | 47.70 | 10.84 | 1.91 | 51.73 | 11.50 | 1.99 | 56.02 | 12.18 | 2.07 |
| **100** | **50** | **5** | **8** | 14.20 | 18.10 | 7.20 | 263.66 | 52.74 | 3.82 | 108.67 | 20.12 | 2.45 | 115.77 | 21.05 | 2.53 | 123.22 | 22.00 | 2.61 |
| **120** | **60** | **4** | **8** | 14.02 | 17.88 | 8.96 | 391.60 | 65.26 | 4.68 | 142.60 | 22.28 | 2.82 | 150.33 | 23.13 | 2.90 | 158.41 | 24.00 | 2.98 |
| **140** | **63** | **4** | **8** | 15.66 | 19.96 | 10.56 | 585.46 | 83.64 | 5.42 | 164.12 | 24.50 | 2.87 | 172.71 | 25.40 | 2.94 | 181.69 | 26.33 | 3.02 |
| **160** | **63** | **4** | **8** | 16.92 | 21.56 | 12.16 | 803.08 | 100.38 | 6.10 | 164.78 | 24.59 | 2.76 | 173.58 | 25.53 | 2.84 | 182.80 | 26.49 | 2.91 |
| **180** | **75** | **4** | **8** | 19.68 | 25.08 | 13.76 | 1212.5 | 134.72 | 6.95 | 267.07 | 33.81 | 3.26 | 278.86 | 34.86 | 3.33 | 291.15 | 35.94 | 3.41 |

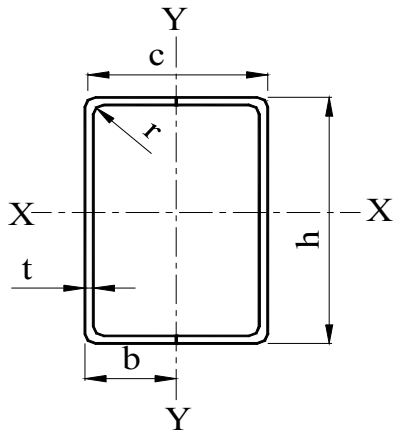
# TWO CHANNELS TOE to TOE
# (COLD FORMED SECTION)




| Dimensions (mm) | | | | Weight | Area | $A_{web}$ | Axis x-x | | | Axis y-y (toe to toe) | | | Axis y-y (c=h) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Ix | $S_x$ | $r_x$ | Iy | $S_y$ | $r_y$ | Iy | $S_y$ | $r_y$ |
| h | b | t | r | kg/m` | $cm^2$ | $cm^2$ | $cm^4$ | $cm^3$ | cm | $cm^4$ | $cm^3$ | cm | $cm^4$ | $cm^3$ | cm |
| 30 | 25 | 4 | 8 | 3.99 | 5.08 | 1.76 | 5.74 | 3.82 | 1.06 | 13.09 | 5.24 | 1.61 | N.A. | | |
| 40 | 20 | 4 | 8 | 3.99 | 5.08 | 2.56 | 9.60 | 4.80 | 1.38 | 9.65 | 4.83 | 1.38 | 9.65 | 4.83 | 1.38 |
| 40 | 24 | 4 | 8 | 4.49 | 5.72 | 2.56 | 11.68 | 5.84 | 1.43 | 15.57 | 6.49 | 1.65 | N.A. | | |
| 50 | 25 | 4 | 8 | 5.24 | 6.68 | 3.36 | 21.60 | 8.64 | 1.80 | 21.65 | 8.66 | 1.80 | 21.65 | 8.66 | 1.80 |
| 50 | 35 | 4 | 8 | 6.59 | 8.40 | 3.36 | 30.06 | 12.02 | 1.91 | 51.33 | 14.67 | 2.47 | N.A. | | |
| 60 | 30 | 4 | 8 | 6.50 | 8.28 | 4.16 | 40.60 | 13.54 | 2.22 | 40.70 | 13.57 | 2.22 | 40.70 | 13.57 | 2.22 |
| 65 | 38 | 4 | 8 | 7.82 | 9.96 | 4.56 | 61.42 | 18.90 | 2.48 | 78.40 | 20.63 | 2.81 | N.A. | | |
| 70 | 25 | 4 | 8 | 6.50 | 8.28 | 4.96 | 50.80 | 14.52 | 2.48 | 29.94 | 11.98 | 1.90 | 67.53 | 19.29 | 2.86 |
| 80 | 45 | 4 | 8 | 9.64 | 12.28 | 5.76 | 117.62 | 29.40 | 3.10 | 141.35 | 31.41 | 3.39 | 106.48 | 26.62 | 2.94 |
| 100 | 50 | 4 | 8 | 11.52 | 14.68 | 7.36 | 218.80 | 43.76 | 3.86 | 219.30 | 43.86 | 3.87 | 219.30 | 43.86 | 3.87 |
| 120 | 60 | 4 | 8 | 14.04 | 17.88 | 8.96 | 391.60 | 65.26 | 4.68 | 392.07 | 65.34 | 4.68 | 392.07 | 65.34 | 4.68 |
| 140 | 65 | 4 | 8 | 15.92 | 20.28 | 10.56 | 600.26 | 85.76 | 5.44 | 536.80 | 82.58 | 5.14 | 637.80 | 91.11 | 5.61 |
| 160 | 65 | 4 | 8 | 17.18 | 21.88 | 12.16 | 822.56 | 102.82 | 6.13 | 601.41 | 92.52 | 5.24 | 969.00 | 121.12 | 6.65 |
| 180 | 80 | 4 | 8 | 20.32 | 25.88 | 13.76 | 1274.46 | 141.60 | 7.02 | 1064.84 | 133.10 | 6.41 | 1396.62 | 155.18 | 7.35 |
| 200 | 80 | 4 | 8 | 21.57 | 27.48 | 15.36 | 1632.08 | 163.20 | 7.71 | 1162.15 | 145.27 | 6.50 | 1933.78 | 193.38 | 8.39 |
| 200 | 100 | 4 | 8 | 24.08 | 30.68 | 15.36 | 1939.40 | 193.94 | 7.95 | 1939.20 | 193.92 | 7.95 | 1939.20 | 193.92 | 7.95 |

N.A.= Section is not available with the specified configuration.

# TWO CHANNELS (Cold Formed)
# TOE to TOE




| Dimensions (mm) | | | | Weight | Area | $A_{web}$ | Axis x-x | | | Axis y-y (toe to toe) | | | Axis y-y (c=h) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Ix | $S_x$ | $r_x$ | Iy | $S_y$ | $r_y$ | Iy | $S_y$ | $r_y$ |
| h | b | t | r | kg/m` | $cm^2$ | $cm^2$ | $cm^4$ | $cm^3$ | cm | $cm^4$ | $cm^3$ | cm | $cm^4$ | $cm^3$ | cm |
| **60** | **40** | **3.6** | **8** | 7.03 | 8.96 | 4.22 | 48.96 | 16.32 | 2.34 | 76.49 | 19.12 | 2.92 | N.A. | | |
| **60** | **40** | **4** | **8** | 7.76 | 9.88 | 4.16 | 53.16 | 17.72 | 2.32 | 83.10 | 20.78 | 2.90 | | | |
| **80** | **40** | **2.25** | **8** | 5.21 | 6.64 | 6.04 | 64.66 | 16.16 | 3.12 | 64.79 | 16.20 | 3.12 | 64.79 | 16.20 | 3.12 |
| **80** | **40** | **2.5** | **8** | 5.78 | 7.36 | 6.00 | 71.04 | 17.76 | 3.11 | 71.28 | 17.82 | 3.11 | 71.28 | 17.82 | 3.11 |
| **80** | **40** | **3** | **8** | 6.86 | 8.74 | 5.92 | 83.32 | 20.84 | 3.09 | 83.00 | 20.75 | 3.08 | 83.00 | 20.75 | 3.08 |
| **80** | **40** | **4** | **8** | 9.01 | 11.48 | 5.76 | 106.08 | 26.52 | 3.04 | 105.92 | 26.48 | 3.04 | 105.92 | 26.48 | 3.04 |
| **80** | **50** | **5** | **8** | 12.64 | 16.10 | 5.60 | 154.60 | 38.66 | 3.10 | 218.71 | 43.74 | 3.69 | N.A. | | |
| **100** | **40** | **3** | **8** | 7.80 | 9.94 | 7.52 | 141.92 | 28.38 | 3.78 | 101.12 | 25.28 | 3.19 | 169.71 | 33.94 | 4.13 |
| **100** | **40** | **4** | **8** | 10.27 | 13.08 | 7.36 | 181.94 | 36.38 | 3.73 | 129.42 | 32.36 | 3.15 | 218.63 | 43.73 | 4.09 |
| **100** | **50** | **5** | **8** | 14.21 | 18.10 | 7.20 | 263.66 | 52.74 | 3.82 | 263.10 | 52.62 | 3.81 | 263.10 | 52.62 | 3.81 |
| **120** | **60** | **4** | **8** | 14.04 | 17.88 | 8.96 | 391.60 | 65.26 | 4.68 | 392.07 | 65.34 | 4.68 | 392.07 | 65.34 | 4.68 |
| **140** | **63** | **4** | **8** | 15.67 | 19.96 | 10.56 | 585.46 | 83.64 | 5.42 | 498.45 | 79.12 | 5.00 | 636.78 | 90.97 | 5.65 |
| **160** | **63** | **4** | **8** | 16.92 | 21.56 | 12.16 | 803.08 | 100.38 | 6.10 | 557.69 | 88.52 | 5.09 | 965.26 | 120.66 | 6.69 |
| **180** | **75** | **4** | **8** | 19.69 | 25.08 | 13.76 | 1212.50 | 134.72 | 6.95 | 920.91 | 122.79 | 6.06 | 1398.68 | 155.41 | 7.47 |

N.A.= Section is not available with the specified configuration.

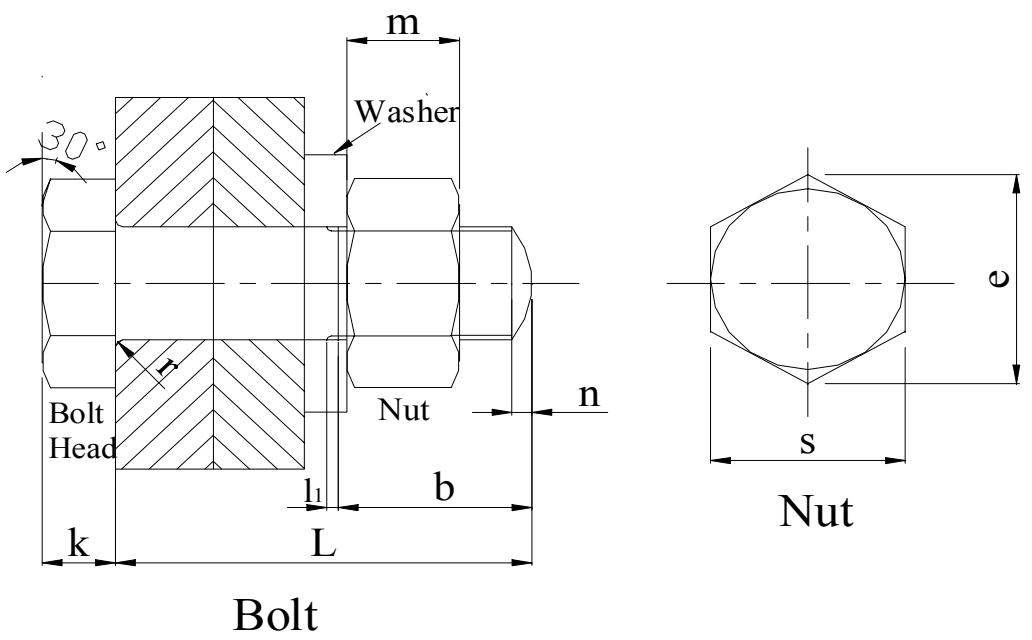
# BOLTS

ORDINARY BOLTS

HIGH STRENGTH BOLTS

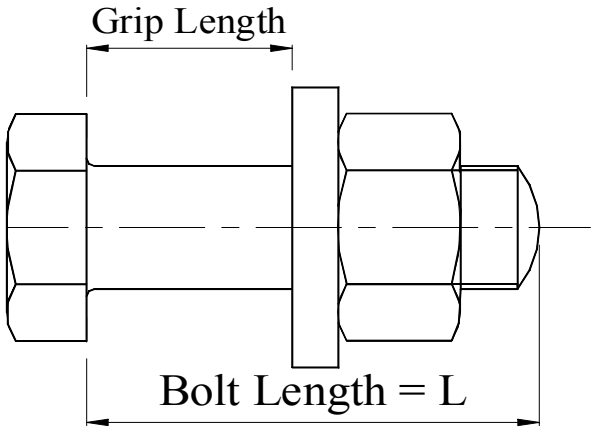
ANCHOR BOLTS

# ORDINARY BOLTS




| Nominal Bolt Size | | | M10 | M12 | M16 | M20 | M24 | M27 | M30 |
|---|---|---|---|---|---|---|---|---|---|
| Bolt Dimensions | k | mm | 7.0 | 8.0 | 10.0 | 13.0 | 15.0 | 17.0 | 19.0 |
| | $l_1$ | mm | 1.9 | 2.5 | 3.0 | 4.0 | 4.5 | 4.5 | 5.0 |
| | b | mm | 26.0 | 19.5 | 23.0 | 26.0 | 29.5 | 32.5 | 35.0 |
| | n | mm | 2.2 | 2.5 | 3.0 | 3.5 | 4.5 | 4.5 | 5.0 |
| | r | mm | 0.5 | 0.6 | 0.6 | 0.8 | 0.8 | 1.0 | 1.0 |
| | s | mm | 17.0 | 19.0 | 24.0 | 30.0 | 36.0 | 41.0 | 46.0 |
| | $e_{min.}$ | mm | 18.7 | 20.9 | 26.2 | 32.9 | 39.6 | 45.2 | 50.8 |
| Nut Dimensions | m | mm | 8.0 | 10.0 | 13.0 | 16.0 | 19.0 | 22.0 | 24.0 |
| | s | mm | 17.0 | 19.0 | 24.0 | 30.0 | 36.0 | 41.0 | 46.0 |
| | $e_{min.}$ | mm | 18.7 | 20.9 | 26.2 | 39.5 | 39.6 | 45.2 | 50.8 |
| Hole Diameter | $d_1$ | mm | 12.0 | 14.0 | 18.0 | 22.0 | 26.0 | 30.0 | 33.0 |

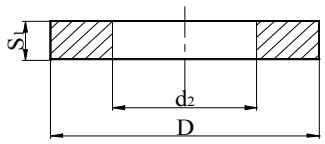
# MINIMUM AND MAXIMUM GRIPS FOR ORDINARY BOLTS, IN MILLIMETERS



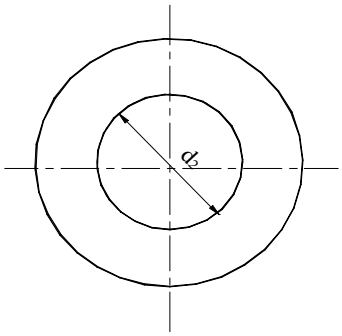

| Nominal Bolt Size | M10 | | M12 | | M16 | | M20 | | M24 | | M27 | | M30 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L | Min.Grip | Max. Grip | Min.Grip | Max. Grip | Min.Grip | Max. Grip | Min.Grip | Max. Grip | Min.Grip | Max. Grip | Min.Grip | Max. Grip | Min.Grip | Max. Grip |
| **30** | 0 | 9 | 2 | 9 | | | | | | | | | | |
| **35** | | | 10 | 11 | 6 | 7 | | | | | | | | |
| **40** | 10 | 19 | 12 | 19 | 8 | 15 | 5 | 12 | 2 | 9 | | | | |
| **45** | | | 20 | 21 | 16 | 17 | 13 | 14 | 10 | 11 | 7 | 8 | | |
| **50** | 20 | 29 | 22 | 29 | 18 | 25 | 15 | 22 | 12 | 19 | 9 | 16 | 6 | 13 |
| **55** | | | 30 | 31 | 26 | 27 | 23 | 24 | 20 | 21 | 17 | 18 | 14 | 15 |
| **60** | 30 | 39 | 32 | 39 | 28 | 35 | 25 | 32 | 22 | 29 | 19 | 26 | 16 | 23 |
| **65** | | | 40 | 41 | 36 | 37 | 33 | 34 | 30 | 31 | 27 | 28 | 24 | 25 |
| **70** | 40 | 49 | 42 | 49 | 38 | 45 | 35 | 42 | 32 | 39 | 29 | 36 | 26 | 33 |
| **75** | | | 50 | 51 | 46 | 47 | 43 | 44 | 40 | 41 | 37 | 38 | 34 | 35 |
| **80** | 50 | 59 | 52 | 59 | 48 | 55 | 45 | 52 | 42 | 49 | 39 | 46 | 36 | 43 |
| **85** | | | 60 | 61 | 56 | 57 | 53 | 54 | 50 | 51 | 47 | 48 | 44 | 45 |
| **90** | | | 62 | 69 | 58 | 65 | 55 | 62 | 52 | 59 | 49 | 56 | 46 | 53 |

# WASHERS FOR ORDINARY BOLTS

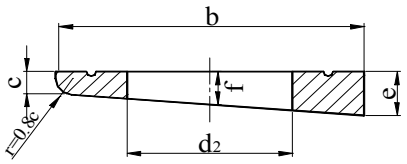
## Plain Circular Washer



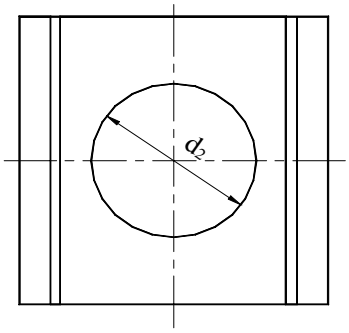

| Nominal Bolt Size | | M10 | M12 | M16 | M20 | M24 | M27 | M30 |
|---|---|---|---|---|---|---|---|---|
| $d_2$ | mm | 11 | 14 | 18 | 22 | 26 | 30 | 33 |
| D | mm | 21 | 24 | 30 | 37 | 44 | 50 | 56 |
| $S_1$ | mm | 8 | 8 | 8 | 8 | 8 | 8 | 8 |



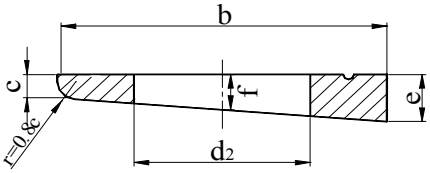

## Bevelled Square Washers For Channel Sections



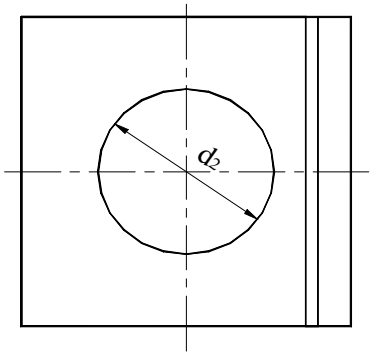

| Nominal Bolt Size | | M10 | M12 | M16 | M20 | M24 | M27 |
|---|---|---|---|---|---|---|---|
| **$d_2$** | **mm** | 11 | 14 | 18 | 22 | 26 | 30 |
| **b** | **mm** | 22 | 30 | 36 | 44 | 56 | 56 |
| **c** | **mm** | 2 | 2.5 | 3 | 3.5 | 4 | 4 |
| **e** | **mm** | 3.8 | 4.9 | 5.9 | 7 | 8.5 | 8.5 |
| **f** | **mm** | 2.9 | 3.7 | 4.45 | 5.25 | 6.25 | 6.25 |



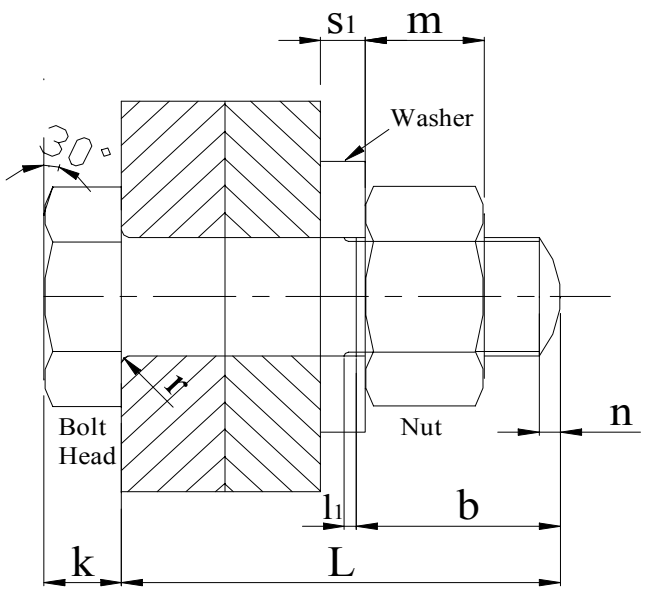

## Bevelled Square Washers For IPN Sections



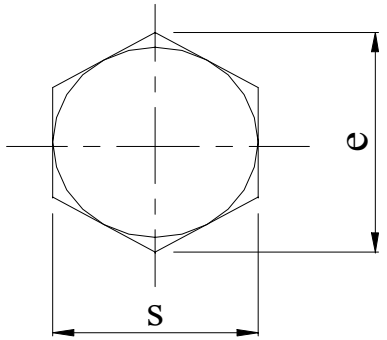

| Nominal Bolt Size | | M10 | M12 | M16 | M20 | M24 | M27 |
|---|---|---|---|---|---|---|---|
| **$d_2$** | **mm** | 11 | 14 | 18 | 22 | 26 | 30 |
| **b** | **mm** | 22 | 30 | 36 | 44 | 56 | 56 |
| **c** | **mm** | 1.5 | 2 | 2.5 | 3 | 3 | 3 |
| **e** | **mm** | 4.6 | 6.2 | 7.5 | 9.2 | 10.8 | 10.8 |
| **f** | **mm** | 3 | 4.1 | 5 | 6.1 | 6.9 | 6.9 |



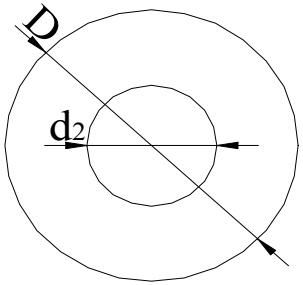
# LARGE DIAMETER ORDINARY BOLTS



Bolt



Nut

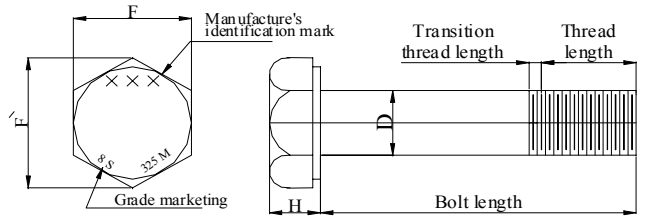


Washer

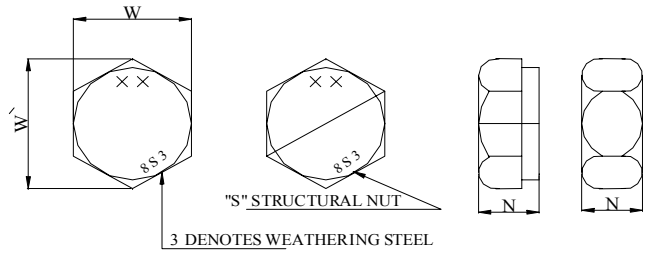
| Nominal Bolt Size | | | M30 | M33 | M36 | M39 | M42 | M45 | M48 | M52 |
|---|---|---|---|---|---|---|---|---|---|---|
| Bolt Dimensions | k | mm | 19 | 21 | 23 | 25 | 26 | 28 | 30 | 33 |
| | $l_1$ | mm | 30 | 33 | 36 | 39 | 42 | 45 | 48 | 52 |
| | b | mm | 4.5 | 4.5 | 5 | 5 | 5.5 | 5.5 | 6.3 | 6.3 |
| | n | mm | 66 | 72 | 78 | 84 | 90 | 96 | 102 | 116 |
| | r | mm | 5 | 5 | 6 | 6 | 6.5 | 6.5 | 7.5 | 7.5 |
| | s | mm | 46 | 50 | 55 | 60 | 65 | 70 | 75 | 80 |
| | $e_{min.}$ | mm | 50.8 | 55.4 | 60.8 | 66.4 | 72.1 | 77.7 | 83.4 | 89 |
| Nut Dimensions | m | mm | 24 | 26 | 29 | 31 | 34 | 36 | 38 | 42 |
| | s | mm | 46 | 50 | 55 | 60 | 65 | 70 | 75 | 80 |
| | $e_{min.}$ | mm | 50.8 | 55.4 | 60.8 | 66.4 | 72.1 | 77.7 | 83.4 | 89 |
| Washer Dimensions | D | mm | 56 | 60 | 66 | N.A. | | | | |
| | d2 | mm | 33 | 36 | 39 | | | | | |
| | s1 | mm | 8 | 8 | 8 | | | | | |
| Hole Diameter | $d_1$ | mm | 33 | 36 | 39 | 42 | 45 | 48 | 51 | 55 |

N.A. = Washer plates with appropriate thickness are used with these bolts size

# HIGH STRENGTH BOLTS




BOLT

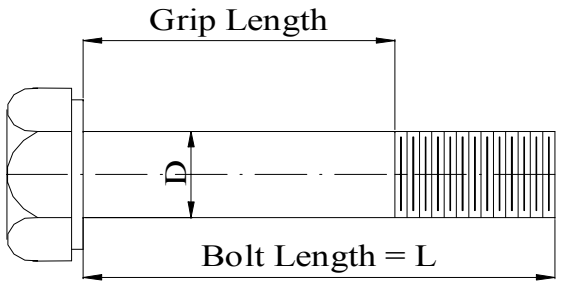



NUT

## DIMENSIONS

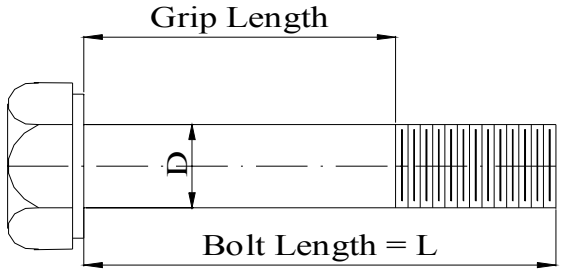
| Nominal Bolt Size | Heavy Hex Bolt or Nut Dimension | | | | Heavy Hex Nut Max. Height N | Heavy Hex Strucural Bolt | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Across Flats F or W | | Across Corners F/ or W/ | | | Max. Head Height H | Thread Length | | Max. Transition Thread Length |
| | | | | | | | Bolt Lengths ⩽100 | Bolt Lengths >100 | |
| | Max. | Min. | Max. | Min. | | | | | |
| mm | mm | mm | mm | mm | mm | mm | mm | mm | mm |
| **M16** | 27 | 26.2 | 31.18 | 29.56 | 17.1 | 10.75 | 31 | 38 | 6.0 |
| **M20** | 34 | 33.0 | 39.26 | 37.29 | 20.7 | 13.40 | 36 | 43 | 7.5 |
| **M22** | 36 | 35.0 | 41.57 | 39.55 | 23.6 | 14.90 | 38 | 45 | 7.5 |
| **M24** | 41 | 40.0 | 47.34 | 45.20 | 24.2 | 15.90 | 41 | 48 | 9.0 |
| **M27** | 46 | 45.0 | 53.12 | 50.58 | 27.6 | 17.90 | 44 | 51 | 9.0 |
| **M30** | 50 | 49.0 | 57.74 | 55.37 | 30.7 | 19.75 | 49 | 56 | 10.5 |
| **M36** | 60 | 58.8 | 69.28 | 66.44 | 36.6 | 23.55 | 56 | 63 | 12.0 |

# MINIMUM AND MAXIMUM GRIPS FOR HIGH STRENGTH BOLTS IN MILLIMETERS



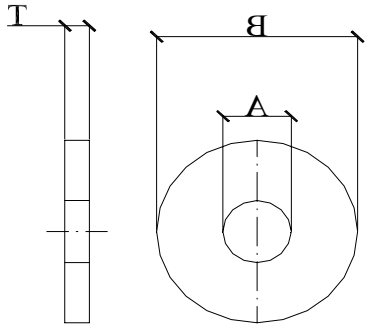

| Nominal Bolt Size | M16 | | M20 | | M22 | | M24 | | M27 | | M30 | | M36 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L Bolt Length (mm) | Min. Grip | Max. Grip | Min. Grip | Max. Grip | Min. Grip | Max. Grip | Min. Grip | Max. Grip | Min. Grip | Max. Grip | Min. Grip | Max. Grip | Min. Grip | Max. Grip |
| 45 | 14 | 26 | | 23 | | 20 | | | | | | | | |
| 50 | 19 | 31 | 14 | 28 | | 25 | | 24 | | | | | | |
| 55 | 24 | 36 | 19 | 32 | 17 | 29 | | 29 | | 25 | | | | |
| 60 | 29 | 41 | 24 | 37 | 22 | 34 | 19 | 34 | | 30 | | 27 | | |
| 65 | 34 | 46 | 29 | 42 | 27 | 39 | 24 | 39 | 21 | 35 | | 32 | | |
| 70 | 39 | 51 | 34 | 47 | 32 | 44 | 29 | 44 | 26 | 40 | 21 | 37 | | 31 |
| 75 | 44 | 56 | 39 | 52 | 37 | 49 | 34 | 49 | 31 | 45 | 26 | 42 | | 36 |
| 80 | 49 | 61 | 44 | 57 | 42 | 59 | 39 | 54 | 36 | 50 | 31 | 47 | 24 | 41 |
| 85 | 54 | 66 | 49 | 62 | 47 | 59 | 44 | 59 | 41 | 55 | 36 | 52 | 29 | 46 |
| 90 | 59 | 71 | 54 | 67 | 52 | 64 | 49 | 64 | 46 | 60 | 41 | 57 | 34 | 51 |
| 95 | 64 | 76 | 59 | 72 | 57 | 69 | 54 | 69 | 51 | 65 | 46 | 62 | 39 | 56 |
| 100 | 69 | 81 | 64 | 77 | 62 | 74 | 59 | 74 | 56 | 70 | 51 | 67 | 44 | 61 |
| 110 | 72 | 91 | 67 | 87 | 65 | 84 | 62 | 84 | 59 | 80 | 54 | 77 | 47 | 71 |
| 120 | 82 | 101 | 77 | 97 | 75 | 94 | 72 | 94 | 69 | 90 | 64 | 87 | 57 | 81 |
| 130 | 92 | 110 | 87 | 107 | 85 | 104 | 82 | 103 | 79 | 100 | 74 | 97 | 67 | 91 |
| 140 | 102 | 120 | 97 | 117 | 95 | 114 | 92 | 113 | 89 | 110 | 84 | 107 | 77 | 101 |
| 150 | 112 | 130 | 107 | 127 | 105 | 124 | 102 | 123 | 99 | 120 | 94 | 117 | 87 | 111 |

# MINIMUM AND MAXIMUM GRIPS FOR HIGH STRENGTH BOLTS IN MILLIMETERS

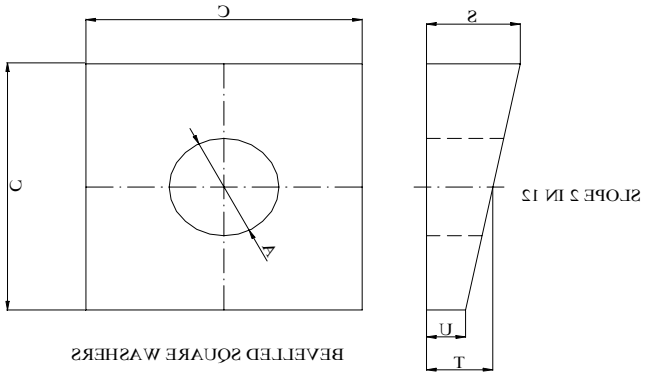



| Nominal Bolt Size | M16 | | M20 | | M22 | | M24 | | M27 | | M30 | | M36 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| L Bolt Length (mm) | Min. Grip | Max. Grip | Min. Grip | Max. Grip | Min. Grip | Max. Grip | Min. Grip | Max. Grip | Min. Grip | Max. Grip | Min. Grip | Max. Grip | Min. Grip | Max. Grip |
| 160 | 122 | 138 | 117 | 135 | 115 | 132 | 112 | 131 | 109 | 128 | 104 | 125 | 97 | 119 |
| 170 | 132 | 148 | 127 | 145 | 125 | 142 | 122 | 141 | 119 | 138 | 114 | 135 | 107 | 129 |
| 180 | 142 | 158 | 137 | 155 | 135 | 152 | 132 | 151 | 129 | 148 | 124 | 145 | 117 | 139 |
| 190 | 152 | 168 | 147 | 165 | 145 | 162 | 142 | 161 | 139 | 158 | 134 | 155 | 127 | 149 |
| 200 | 162 | 178 | 157 | 175 | 155 | 172 | 152 | 171 | 149 | 168 | 144 | 165 | 137 | 159 |
| 210 | 172 | 188 | 167 | 185 | 165 | 182 | 162 | 181 | 159 | 178 | 154 | 175 | 147 | 169 |
| 220 | 182 | 198 | 177 | 195 | 175 | 192 | 172 | 191 | 169 | 188 | 164 | 185 | 157 | 179 |
| 230 | 192 | 208 | 187 | 205 | 185 | 202 | 182 | 201 | 179 | 198 | 174 | 195 | 167 | 189 |
| 240 | 202 | 218 | 197 | 215 | 195 | 212 | 192 | 211 | 189 | 208 | 184 | 205 | 177 | 199 |
| 250 | 212 | 228 | 207 | 225 | 205 | 222 | 202 | 221 | 199 | 218 | 194 | 215 | 187 | 209 |
| 260 | 222 | 238 | 217 | 235 | 215 | 232 | 212 | 231 | 209 | 228 | 204 | 225 | 197 | 219 |
| 270 | 232 | 248 | 227 | 245 | 225 | 242 | 222 | 241 | 219 | 238 | 214 | 235 | 207 | 229 |
| 280 | 242 | 258 | 237 | 255 | 235 | 252 | 232 | 251 | 229 | 248 | 224 | 245 | 217 | 239 |
| 290 | 252 | 268 | 247 | 265 | 245 | 262 | 242 | 261 | 239 | 258 | 234 | 255 | 227 | 249 |
| 300 | 262 | 278 | 257 | 275 | 255 | 272 | 252 | 271 | 249 | 268 | 244 | 265 | 237 | 259 |

# WASHERS FOR HIGH STRENGTH BOLTS




PLAIN CIRCULAR WASHERS

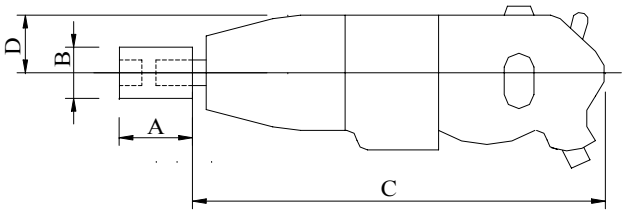


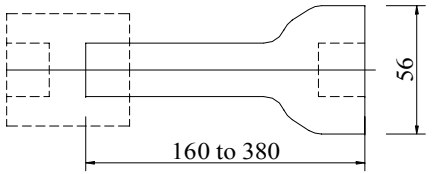

BEVELLED SQUARE WASHERS

| Metric Bolt Size | Outside Diameter B (mm) | | Hole Diameter A (mm) | | Thickness T (mm) | |
|---|---|---|---|---|---|---|
| | Max. | Min. | Max. | Min. | Max. | Min. |
| **M16** | 34 | 32.4 | 18.4 | 18 | 4.6 | 3.1 |
| **M20** | 41 | 39.4 | 22.5 | 22 | 4.6 | 3.1 |
| **M22** | 44 | 42.4 | 24.5 | 24 | 4.6 | 3.4 |
| **M24** | 50 | 48.4 | 26.5 | 26 | 4.6 | 3.4 |
| **M27** | 56 | 54.1 | 30.5 | 30 | 4.6 | 3.4 |
| **M30** | 60 | 58.1 | 33.5 | 33 | 4.6 | 3.4 |
| **M36** | 72 | 70.1 | 39.5 | 39 | 4.6 | 3.4 |

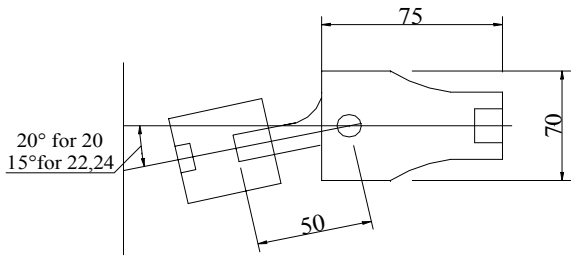
| Metric Bolt Size | Width C (mm) | | Hole Diameter A (mm) | | Thickness | | |
|---|---|---|---|---|---|---|---|
| | Max. | Min. | Max. | Min. | S (mm) ±0.5 | T (mm) | U (mm) ±0.5 |
| **M16** | 45 | 43 | 18.4 | 18 | 11.7 | 8 | 4.3 |
| **M20** | 45 | 43 | 22.5 | 22 | 11.7 | 8 | 4.3 |
| **M22** | 45 | 43 | 24.5 | 24 | 11.7 | 8 | 4.3 |
| **M24** | 45 | 43 | 26.5 | 26 | 11.7 | 8 | 4.3 |
| **M27** | 59 | 57 | 30.5 | 30 | 12.8 | 8 | 3.2 |
| **M30** | 59 | 57 | 33.5 | 33 | 12.8 | 8 | 3.2 |
| **M36** | 59 | 57 | 39.5 | 39 | 12.8 | 8 | 3.2 |

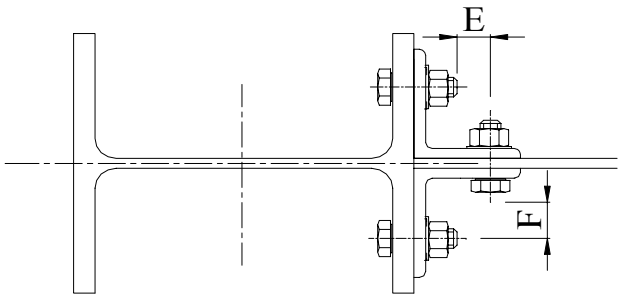
# ERECTION CLEARENCES
# FOR IMPACT WRENCHES




EXTENSION BAR



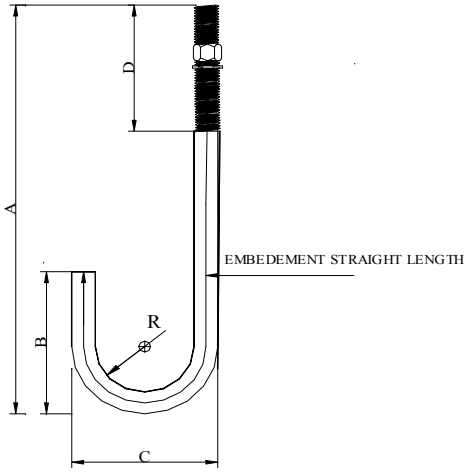




Minimum Clearences

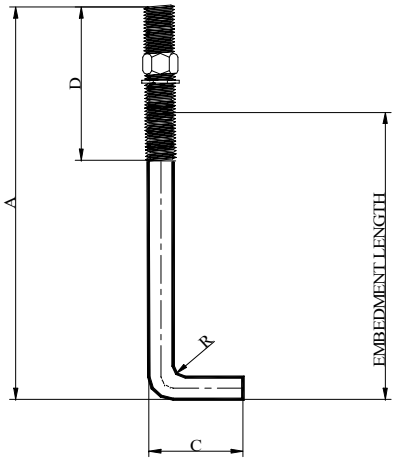
| | Size | C | D |
|---|---|---|---|
| **Light Wrenches** | 16-24 | 377-356 | 54 |
| **Heavy Wrenches** | 24-36 | 375-438 | 64 |

| Sockets | | | Min. Clearence | |
|---|---|---|---|---|
| **Bolt Size** | **A** | **B** | **E** | **F** |
| **16** | 80 | 45 | 25 | 28 |
| **20** | 85 | 54 | 30 | 34 |
| **22** | 90 | 57 | 32 | 36 |
| **24** | 95 | 60 | 34 | 38 |
| **27** | 100 | 70 | 38 | 42 |
| **30** | 110 | 75 | 41 | 45 |
| **36** | 130 | 90 | 48 | 52 |

# ANCHOR BOLTS




TYPICAL ANCHOR BOLT PROFILE




TYPICAL ANCHOR BOLT PROFILE

| Bolt | | Weight | A | B | C | D | R | Total Straight Length | Embedment Straight Length |
|---|---|---|---|---|---|---|---|---|---|
| Nominal Diameter | Thread Pitch | kg | mm | mm | mm | mm | mm | mm | mm |
| **M16** | 2.0 | 0.88 | 400 | 110 | 128 | 100 | 48 | 558 | 633 |
| **M20** | 2.5 | 1.72 | 500 | 140 | 160 | 125 | 60 | 700 | 775 |
| **M24** | 3.0 | 3.00 | 600 | 170 | 192 | 125 | 72 | 842 | 917 |
| **M30** | 3.5 | 7.00 | 900 | 240 | 300 | 150 | 120 | 1265 | 1340 |
| **M36** | 4.0 | 12.00 | 1000 | 400 | 360 | 200 | 144 | 1510 | 1635 |

| Bolt | | Weight | A | C | D | R | Total Straight Length | Embedment Straight Length |
|---|---|---|---|---|---|---|---|---|
| Nominal Bolt Size | Thread Pitch | kg | mm | mm | mm | mm | mm | mm |
| **M20** | 2.5 | 1.48 | 380 | 160 | 90 | 60 | 600 | 330 |
| **M25** | 3.0 | 2.90 | 500 | 180 | 125 | 75 | 755 | 400 |
| **M25** | 3.0 | 3.30 | 600 | 180 | 125 | 75 | 855 | 540 |
| **M32** | 3.5 | 8.00 | 900 | 240 | 125 | 128 | 1272 | 840-780 |
| **M32** | 3.5 | 8.53 | 980 | 240 | 125 | 128 | 1352 | 890-840 |

# SAMPLE OF CORRUGATED SHEETS

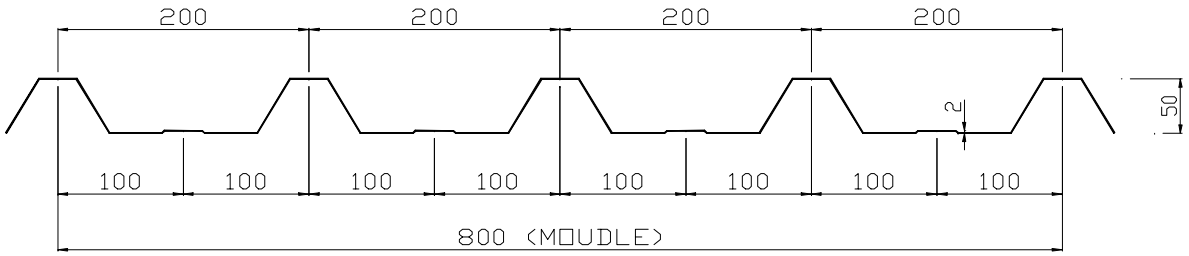
SINGLE LAYER CORRUGATED SHEETS

SANDWITCH PANELS

METAL DECK PANELS

# SINGLE LAYER CORRUGATED STEEL SHEETS (St.52)

## 800 mm MODULE

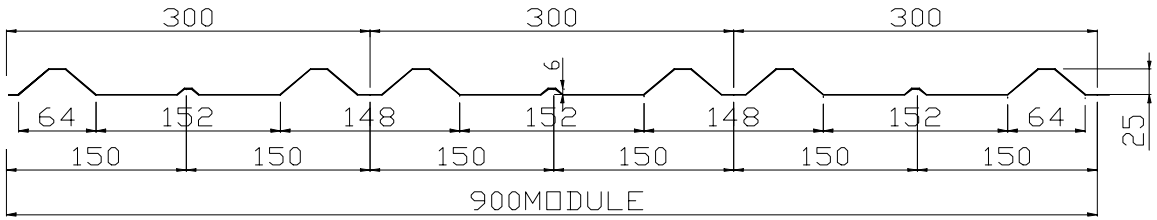



## Properties & Purlin Spacing

| Panel Nominal Thickness | Nominal Weight | Nominal Area | $I_x$ | $S_{xt}$ | $S_{xb}$ | Live Load (kg/m$^2$) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 50 | 100 | 150 | 200 |
| mm | kg/m$^2$ | cm$^2$ | cm$^4$ | cm$^3$ | cm$^3$ | Allowable Purlin Spacing (cm) | | | |
| **0.5** | 5.62 | 7.16 | 16.19 | 3.69 | 13.13 | 345 | 245 | 200 | 170 |
| **0.6** | 6.74 | 8.59 | 22.53 | 5.34 | 16.34 | 415 | 295 | 240 | 200 |
| **0.7** | 7.86 | 10.02 | 28.94 | 7.22 | 19.57 | 485 | 345 | 280 | 240 |

# SINGLE LAYER CORRUGATED STEEL SHEETS (St.52)

## 900 mm MODULE

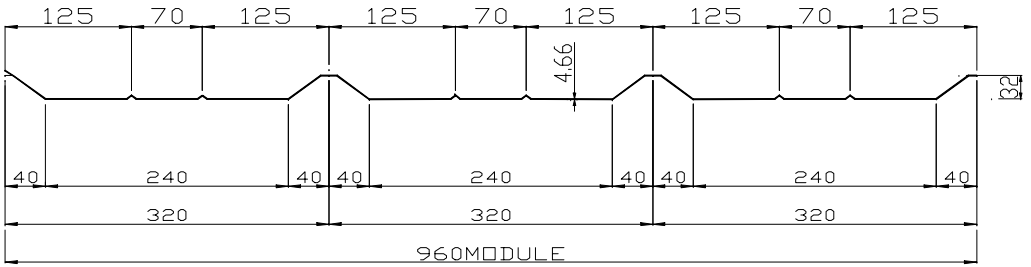



## Properties & Purlin Spacing

| Panel Nominal Thickness | Nominal Weight | Nominal Area | $I_x$ | $S_{xt}$ | $S_{xb}$ | Live Load (kg/m$^2$) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 50 | 100 | 150 | 200 |
| mm | kg/m$^2$ | cm$^2$ | cm$^4$ | cm$^3$ | cm$^3$ | Allowable Purlin Spacing (cm) | | | |
| **0.5** | 4.99 | 6.36 | 4.05 | 2.15 | 4.97 | 265 | 185 | 150 | 130 |
| **0.6** | 5.99 | 7.63 | 5.13 | 2.96 | 6.3 | 310 | 220 | 180 | 155 |
| **0.7** | 6.99 | 8.91 | 6.15 | 3.64 | 7.61 | 345 | 240 | 200 | 170 |

# SINGLE LAYER CORRUGATED STEEL SHEETS (St.52)

## 960 mm MODULE

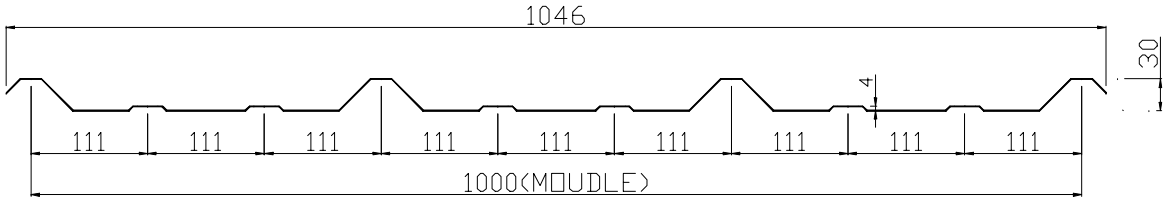



## Properties & Purlin Spacing

| Panel Nominal Thickness | Nominal Weight | Nominal Area | $I_x$ | $S_{xt}$ | $S_{xb}$ | Live Load (kg/m$^2$) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 50 | 100 | 150 | 200 |
| mm | kg/m$^2$ | cm$^2$ | cm$^4$ | cm$^3$ | cm$^3$ | Allowable Purlin Spacing (cm) | | | |
| **0.5** | 4.68 | 5.96 | 4.47 | 1.39 | 7.79 | 215 | 150 | 120 | 100 |
| **0.6** | 5.62 | 7.16 | 6.19 | 2.07 | 9.74 | 260 | 185 | 150 | 130 |
| **0.7** | 6.55 | 8.35 | 7.57 | 2.84 | 11.76 | 300 | 215 | 175 | 150 |

# SINGLE LAYER CORRUGATED STEEL SHEETS (St.52)

## 1000 mm MODULE

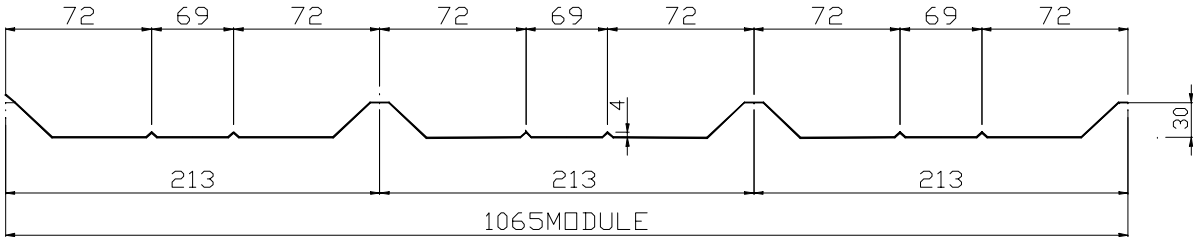



## Properties & Purlin Spacing

| Panel Nominal Thickness | Nominal Weight | Nominal Area | $I_x$ | $S_{xt}$ | $S_{xb}$ | Live Load (kg/m$^2$) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 50 | 100 | 150 | 200 |
| mm | kg/m$^2$ | cm$^2$ | cm$^4$ | cm$^3$ | cm$^3$ | Allowable Purlin Spacing (cm) | | | |
| **0.5** | 4.49 | 5.73 | 3.8 | 1.27 | 6.53 | 200 | 145 | 115 | 100 |
| **0.6** | 5.39 | 6.87 | 5.16 | 1.91 | 8.3 | 245 | 175 | 140 | 120 |
| **0.7** | 6.29 | 8.02 | 6.48 | 2.53 | 10.13 | 285 | 200 | 165 | 140 |

# SINGLE LAYER CORRUGATED STEEL SHEETS (St.52)

## 1065 mm MODULE

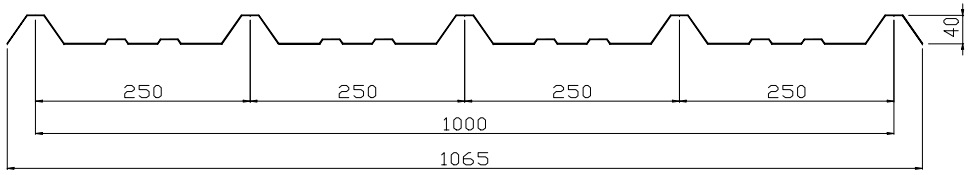



## Properties & Purlin Spacing

| Panel Nominal Thickness | Nominal Weight | Nominal Area | $I_x$ | $S_{xt}$ | $S_{xb}$ | Live Load (kg/m$^2$) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 50 | 100 | 150 | 200 |
| mm | kg/m$^2$ | cm$^2$ | cm$^4$ | cm$^3$ | cm$^3$ | Allowable Purlin Spacing (cm) | | | |
| **0.5** | 4.71 | 6 | 4.86 | 1.82 | 6.91 | 245 | 170 | 140 | 120 |
| **0.6** | 5.65 | 7.2 | 6.45 | 2.59 | 8.66 | 290 | 205 | 165 | 140 |
| **0.7** | 6.59 | 8.39 | 7.75 | 3.38 | 10.35 | 330 | 235 | 190 | 160 |

# SINGLE LAYER CORRUGATED STEEL SHEETS

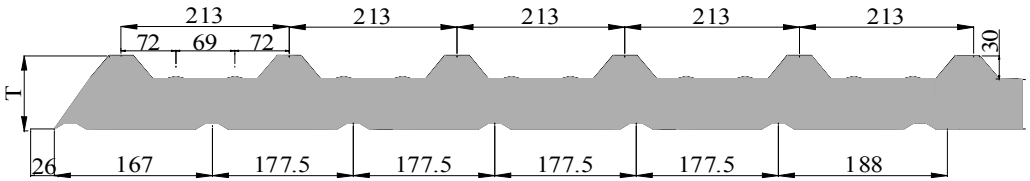
## 1065 mm MODULE




## Properties & Purlin Spacing

| Panel Nominal Thicknes | Nominal Weight | $I_x$ | Live Load (kg/m$^2$) | | | |
|---|---|---|---|---|---|---|
| | | | 50 | 100 | 150 | 200 |
| mm | kg/m$^2$ | cm$^4$ | Allowable Purlin Spacing (cm) | | | |
| **0.50** | 4.75 | 12.53 | 240 | 170 | 140 | 125 |
| **0.55** | 5.23 | 13.79 | 250 | 180 | 150 | 130 |
| **0.60** | 5.70 | 15.04 | 260 | 190 | 155 | 135 |
| **0.65** | 6.18 | 16.29 | 270 | 195 | 160 | 140 |
| **0.70** | 6.66 | 17.51 | 275 | 205 | 170 | 145 |

# SANDWITCH ROOF PANELS



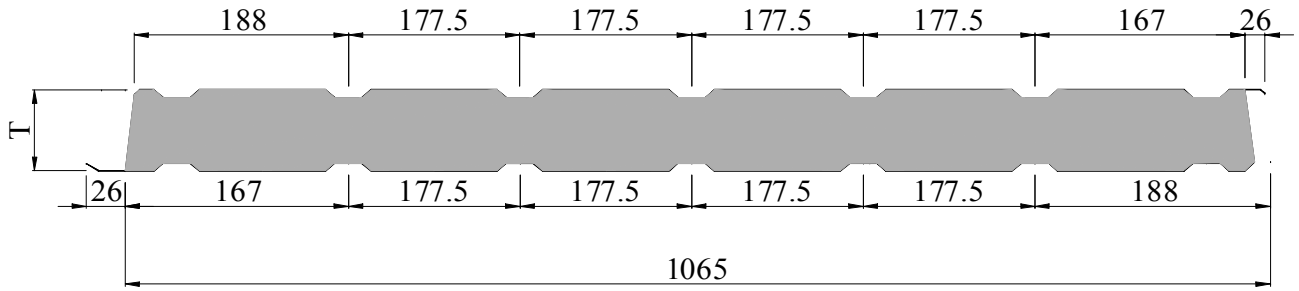

## Properties

| Panel Nominal Thickness T (mm) | Weight ($kg/m^2$) | $I_x$ ($cm^4$) | $S_x$ ($cm^3$) |
|---|---|---|---|
| 65 | 9.48 | 50.4 | 12 |
| 80 | 10.08 | 64.4 | 18.6 |
| 105 | 11.08 | 191.2 | 31 |
| 130 | 12.08 | 289.9 | 44.2 |

## Allowable Uniform Loads ($kg/m^2$)

| Panel Nominal Thickness T (mm) | Span in Meters | | | | | |
|---|---|---|---|---|---|---|
| | 2.5 | 3 | 3.5 | 4 | 4.5 | 5 |
| 65 | 164 | 137 | 117 | 103 | 91 | 75 |
| 80 | 224 | 187 | 160 | 140 | 125 | 112 |
| 105 | 324 | 271 | 232 | 203 | 180 | 162 |
| 130 | 425 | 354 | 303 | 266 | 236 | 212 |

# SANDWITCH SIDE WALL PANELS



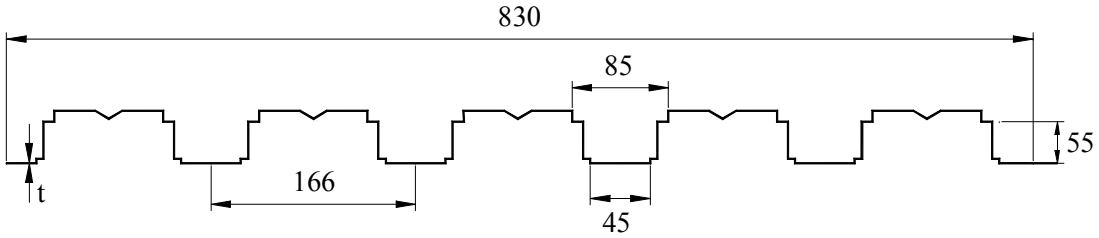

## Properties

| Panel Nominal Thickness (mm) | Weight ($kg/m^2$) | Ix ($cm^4$) | Sx ($cm^3$) |
|---|---|---|---|
| 35 | 8.74 | 30.5 | 17.3 |
| 50 | 9.34 | 64.4 | 25.3 |
| 75 | 10.34 | 144.9 | 37.9 |
| 100 | 11.34 | 257.9 | 50.6 |

## Allowable Uniform Loads ($kg/m^2$)

| Panel Nominal Thickness (mm) | Span in Meters | | | | | |
|---|---|---|---|---|---|---|
| | 2.5 | 3 | 3.5 | 4 | 4.5 | 5 |
| 35 | 140 | 117 | 100 | 88 | 76 | 62 |
| 50 | 200 | 167 | 143 | 125 | 110 | 90 |
| 75 | 301 | 251 | 215 | 188 | 166 | 135 |
| 100 | 401 | 334 | 286 | 251 | 222 | 180 |

# CORRUGATED STEEL DECKING SHEETS FOR CONCRETE FLOOR SLABS

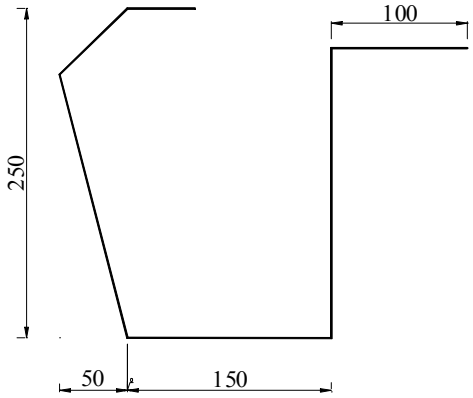



**PROFILE OF STEEL DECKING**

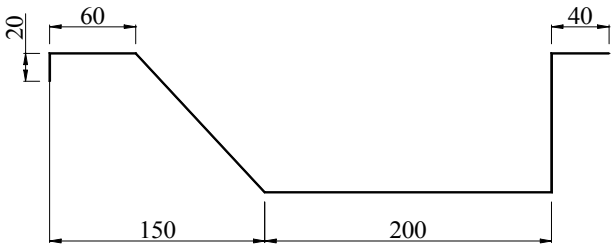
| EFFECTIVE CHARACTERISTICS OF THE STEEL DECKING SHEET | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Thickness t (mm)** | | | **0.70** | **0.75** | **0.80** | **0.88** | **1.00** |
| **Weight (kg/m$^2$)** | | | 8.57 | 9.18 | 9.79 | 10.77 | 12.24 |
| **Moment of inertia (cm$^4$)** | | | 47.12 | 50.49 | 53.85 | 59.24 | 67.32 |
| **$S_{xb}$ (cm$^3$)** | | | 14.71 | 15.65 | 16.81 | 18.44 | 21.01 |
| **$S_{xt}$ (cm$^3$)** | | | 20.52 | 22.70 | 23.46 | 26.14 | 29.32 |
| **Weight (kg/m$^2$)** | **Total thickness of the roof in (cm)** | **9.5** | 156.6 | 157 | 157.6 | 158.4 | 159.6 |
| | | **10** | 168.8 | 169.3 | 169.8 | 170.6 | 171.9 |
| | | **11** | 193.3 | 193.8 | 194.3 | 195.1 | 196.4 |
| | | **12** | 217.8 | 218.3 | 218.8 | 219.6 | 220.9 |
| | | **13** | 242.3 | 242.8 | 243.3 | 244.1 | 245.4 |
| | | **14** | 266.8 | 267.3 | 267.8 | 268.6 | 269.9 |
| | | **15** | 291.3 | 291.8 | 292.3 | 293.1 | 294.4 |
| | | **16** | 315.8 | 316.3 | 316.8 | 317.6 | 318.8 |

# ACCESSORIES

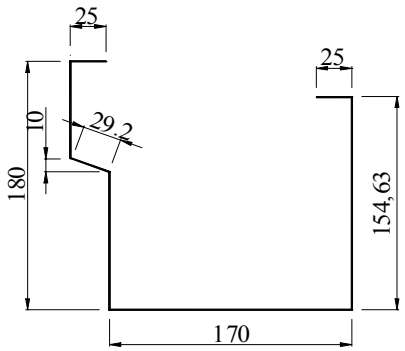
# ACCESSORIES*



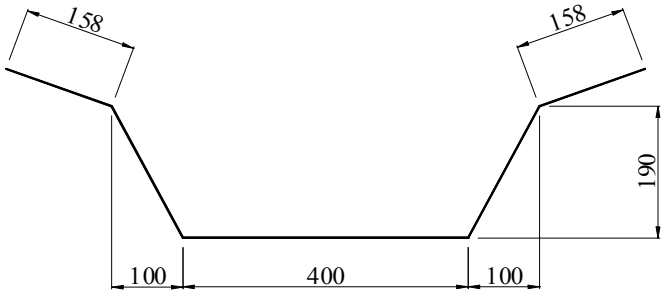

OUTSIDE GUTTER SECTION



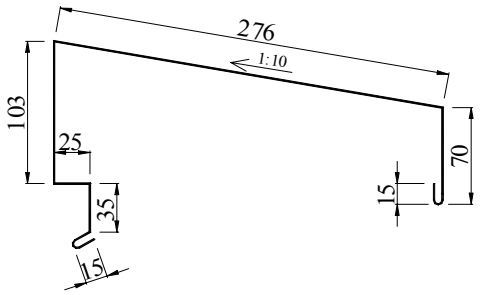

INSIDE GUTTER SECTION



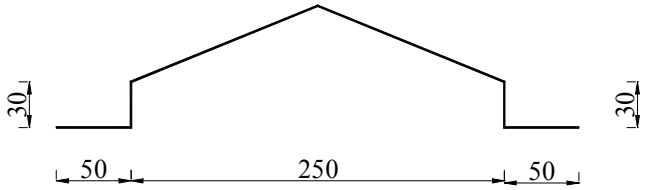

EAVE GUTTER



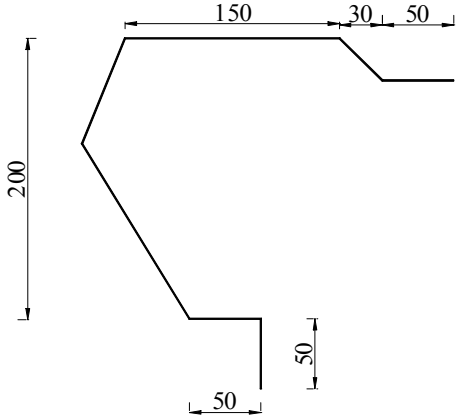

VALLEY GUTTER



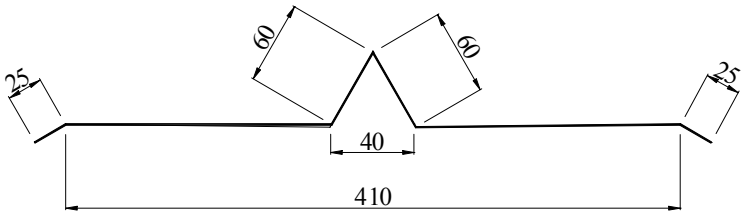

CAP FLASHING




PEAK CAP SHEET



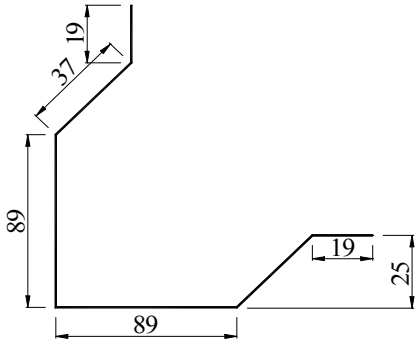

EAVE &PEAK FASCIA



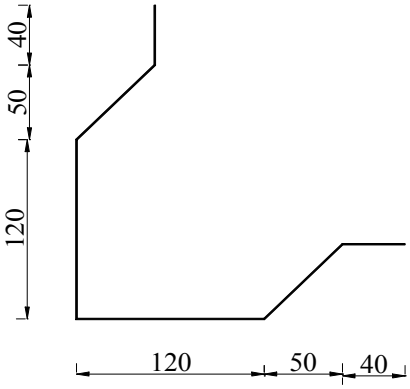

EXPANSION JOINT TRIM

*Indicated dimensions may be altered to fit project requirements

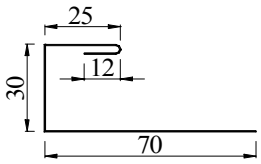
# ACCESSORIES*



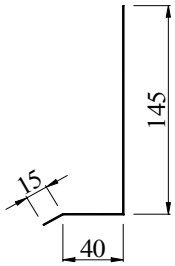

CORNER TRIM



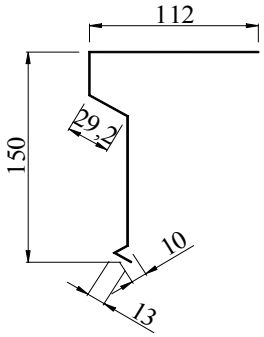

CORNER TRIM



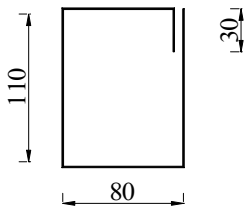

FRAMED OPENING TRIM




DRIP TRIM




OASIS EAVE TRIM

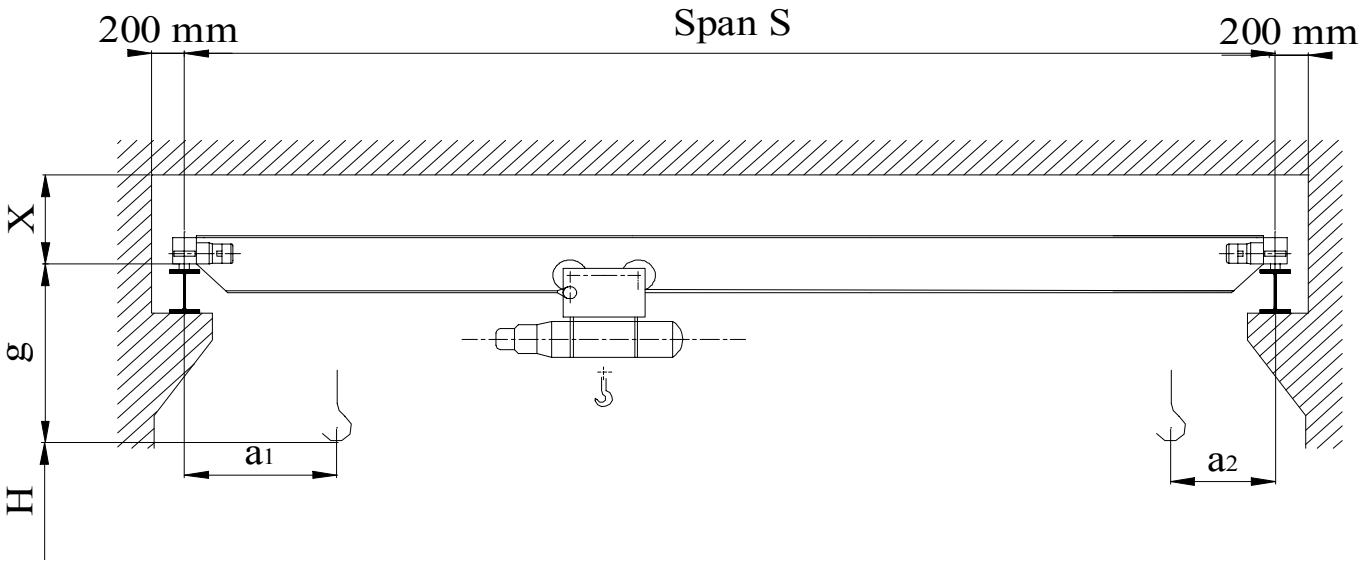


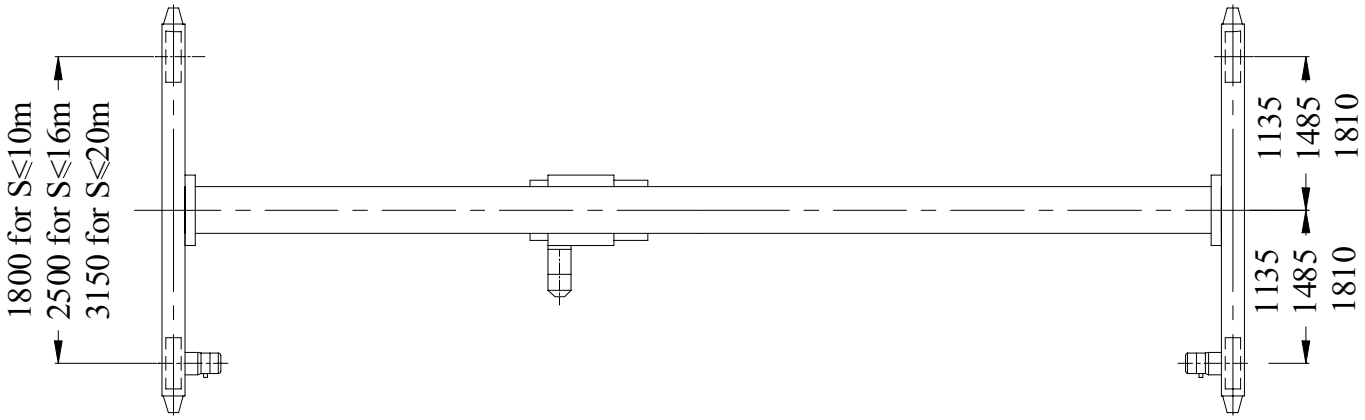

DOWN SPOUT

*Indicated dimensions may be altered to fit project requirements

# CRANES

# LIGHT CAPACITY
## SINGLE GIRDER




## Wheel loads in kg

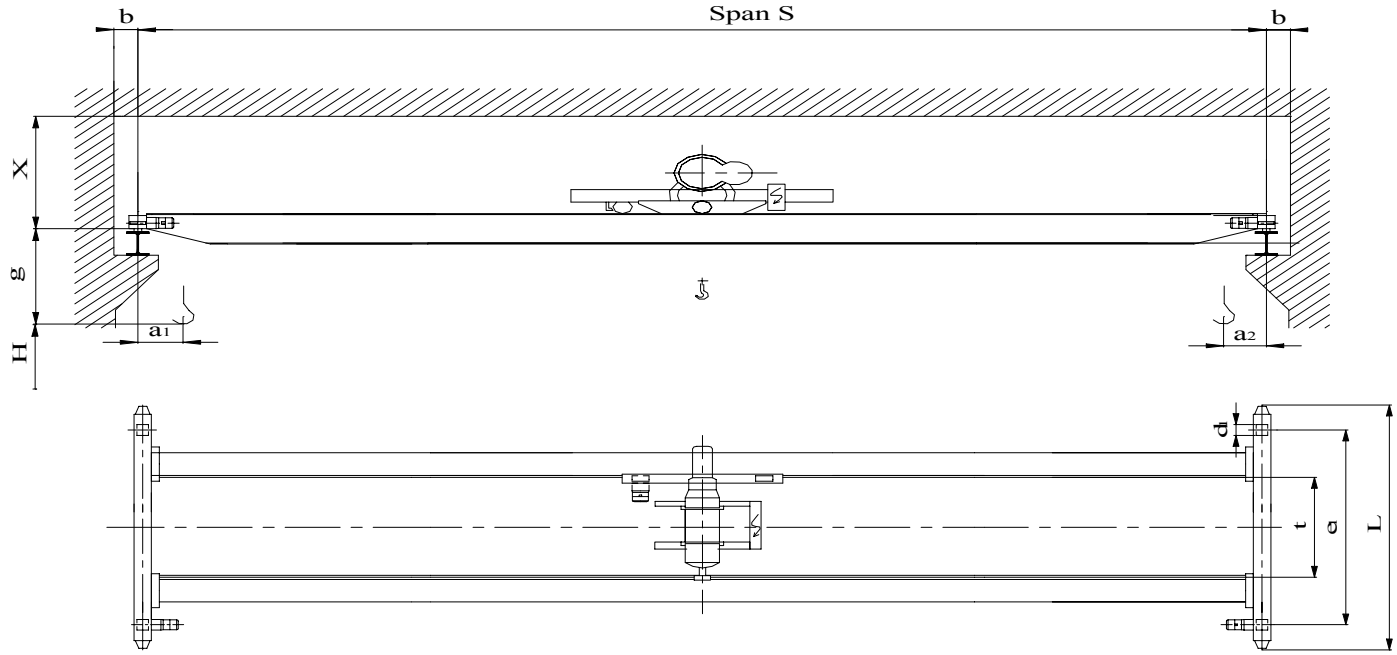
| Capacity | Wheel | Span in Meters | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| ton | Load | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 |
| 0.5 | max. | 650 | 750 | 800 | 850 | 900 | 950 | 1050 | 1150 |
| | min. | 350 | 350 | 400 | 450 | 500 | 550 | 700 | 750 |
| 0.8 | max. | 800 | 850 | 900 | 950 | 1000 | 1050 | 1200 | 1200 |
| | min. | 350 | 400 | 400 | 450 | 500 | 550 | 700 | 750 |
| 1.0 | max. | 950 | 1000 | 1050 | 1150 | 1200 | 1250 | 1400 | 1500 |
| | min. | 350 | 400 | 450 | 500 | 550 | 600 | 750 | 800 |
| 1.6 | max. | 1200 | 1250 | 1300 | 1400 | 1450 | 1500 | 1650 | 1700 |
| | min. | 400 | 400 | 450 | 500 | 550 | 600 | 800 | 850 |
| 2.0 | max. | 1500 | 1600 | 1650 | 1750 | 1850 | 1900 | 2050 | 2150 |
| | min. | 450 | 450 | 500 | 550 | 600 | 650 | 850 | 950 |
| 3.2 | max. | 2200 | 2300 | 2400 | 2500 | 2600 | 2700 | 2800 | 2900 |
| | min. | 600 | 600 | 650 | 700 | 800 | 900 | 1000 | 1100 |
| 4.0 | max. | 2450 | 2550 | 2650 | 2800 | 2850 | 2900 | 3100 | 3200 |
| | min. | 600 | 600 | 600 | 650 | 800 | 900 | 1000 | 1150 |
| 5.0 | max. | 3000 | 3150 | 3300 | 3400 | 3500 | 3550 | 3750 | 3900 |
| | min. | 750 | 750 | 750 | 750 | 850 | 950 | 1100 | 1300 |
| 6.3 | max. | 3600 | 3800 | 3900 | 4000 | 4100 | 4350 | 4400 | 4500 |
| | min. | 800 | 800 | 850 | 900 | 1000 | 1100 | 1300 | 1500 |

# LIGHT CAPACITY
## SINGLE GIRDER

### Dimensions

| Capacity | $H_{max.}$ | S (up to) | g | $a_1$ | $a_2$ |
|---|---|---|---|---|---|
| ton | m | m | mm | mm | mm |
| **0.5** | 7.0 | 15.2 | 850 | 600 | 525 |
| | | 17.0 | 950 | 600 | 600 |
| | | 18.5 | 950 | 600 | 600 |
| | | 20.0 | 1050 | 775 | 775 |
| **0.8** | 7.0 | 14.3 | 850 | 600 | 525 |
| | | 17.0 | 950 | 600 | 600 |
| | | 20.0 | 1050 | 775 | 775 |
| **1.0** | 7.0 | 13.0 | 850 | 600 | 525 |
| | | 16.0 | 950 | 600 | 600 |
| | | 19.0 | 1050 | 775 | 775 |
| | | 20.0 | 1150 | 1000 | 1000 |
| **1.6** | 3.5 | 11.8 | 825 | 600 | 525 |
| | | 15.0 | 925 | 600 | 600 |
| | | 17.0 | 1025 | 775 | 775 |
| | | 20.0 | 1125 | 1000 | 1000 |
| **1.6** | 7.0 | 11.8 | 1000 | 650 | 600 |
| | | 17.0 | 1100 | 650 | 600 |
| | | 20.0 | 1200 | 800 | 800 |
| **2.0** | 3.5 | 12.0 | 1300 | 1000 | 1000 |
| | | 13.8 | 825 | 600 | 525 |
| | | 18.0 | 925 | 600 | 600 |
| | | 20.0 | 1025 | 775 | 775 |
| **2.0** | 7.0 | 12.0 | 1125 | 1000 | 1000 |
| | | 13.8 | 1000 | 650 | 600 |
| | | 18.0 | 1100 | 650 | 600 |
| | | 20.0 | 1200 | 800 | 800 |
| **3.2** | 3.5 | 10.7 | 1300 | 1000 | 1000 |
| | | 13.6 | 1000 | 650 | 600 |
| | | 16.4 | 1100 | 650 | 600 |
| | | 20.0 | 1200 | 800 | 800 |
| **3.2** | 7.0 | 9.7 | 1300 | 1000 | 1000 |
| | | 12.5 | 1200 | 850 | 700 |
| | | 14.4 | 1300 | 850 | 700 |
| | | 20.0 | 1400 | 850 | 800 |
| **4.0** | 3.5 | 9.7 | 1500 | 1050 | 1050 |
| | | 12.5 | 1000 | 650 | 600 |
| | | 14.4 | 1100 | 650 | 600 |
| | | 20.0 | 1200 | 800 | 800 |
| **4.0** | 7.0 | 9.4 | 1300 | 1000 | 1000 |
| | | 12.0 | 1200 | 850 | 700 |
| | | 14.8 | 1300 | 850 | 700 |
| | | 18.0 | 1400 | 850 | 800 |
| | | 20.0 | 1500 | 1050 | 1050 |
| **5.0** | 8.0 | 8.3 | 1375 | 900 | 800 |
| | | 10.9 | 1475 | 900 | 800 |
| | | 13.8 | 1575 | 900 | 850 |
| | | 17.0 | 1675 | 1050 | 1050 |
| | | 20.0 | 1775 | 1250 | 1250 |
| **6.3** | 3.5 | 8.3 | 1150 | 850 | 700 |
| | | 10.9 | 1250 | 850 | 700 |
| | | 13.8 | 1350 | 850 | 800 |
| | | 17.0 | 1450 | 1000 | 1000 |
| | | 20.0 | 1550 | 1200 | 1200 |
| **6.3** | 8.0 | 8.3 | 1375 | 900 | 800 |
| | | 10.9 | 1475 | 900 | 800 |
| | | 13.8 | 1575 | 900 | 850 |
| | | 17.0 | 1675 | 1050 | 1050 |
| | | 20.0 | 1775 | 1250 | 1250 |

# NORMAL CAPACITY
## DOUBLE GIRDER




## Wheel loads in kg

| Capacity | Wheel | Span in Meters | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ton | Load | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 26 | 28 | 30 |
| 2.0 | max. | 1450 | 1550 | 1600 | 1750 | 1900 | 2000 | 2150 | 2250 | 2950 | 3050 | 3350 | 3600 | 3900 |
| | min. | 450 | 500 | 500 | 600 | 750 | 800 | 950 | 1050 | 1700 | 1850 | 2100 | 2400 | 2300 |
| 3.2 | max. | 2050 | 2200 | 2300 | 2400 | 2550 | 2650 | 2850 | 3100 | 3600 | 3900 | 4150 | 4300 | 4600 |
| | min. | 550 | 550 | 550 | 650 | 750 | 850 | 1000 | 1250 | 1750 | 2000 | 2250 | 2400 | 2700 |
| 4.0 | max. | 2450 | 2550 | 2700 | 2800 | 3000 | 3150 | 3350 | 3550 | 4050 | 4300 | 4600 | 4850 | 5150 |
| | min. | 600 | 600 | 650 | 650 | 800 | 900 | 1100 | 1300 | 1750 | 2000 | 2250 | 2550 | 2800 |
| 5.0 | max. | 2900 | 3100 | 3250 | 3400 | 3550 | 3750 | 3950 | 4150 | 4650 | 4850 | 5200 | 5400 | 5750 |
| | min. | 650 | 650 | 700 | 750 | 850 | 1000 | 1200 | 1350 | 1850 | 2000 | 2400 | 2550 | 2900 |
| 6.3 | max. | 3550 | 3750 | 3900 | 4100 | 4250 | 4450 | 4700 | 4900 | 5350 | 5600 | 5900 | 6150 | 6450 |
| | min. | 750 | 700 | 750 | 850 | 950 | 1100 | 1300 | 1500 | 1900 | 2150 | 2400 | 2650 | 2900 |
| 8.0 | max. | 4600 | 4850 | 5050 | 5250 | 5450 | 5700 | 6050 | 6300 | 6550 | 6800 | 7100 | 7500 | 7800 |
| | min. | 950 | 900 | 950 | 1000 | 1150 | 1300 | 1650 | 1800 | 2000 | 2250 | 2550 | 2900 | 3200 |
| 10.0 | max. | 5550 | 5850 | 6100 | 6300 | 6600 | 6850 | 7150 | 7450 | 7650 | 7950 | 8350 | 8650 | 8950 |
| | min. | 1100 | 1050 | 1050 | 1150 | 1350 | 1500 | 1750 | 2000 | 2150 | 2400 | 2750 | 3050 | 3350 |
| 12.5 | max. | 6500 | 6900 | 7200 | 7500 | 7800 | 8100 | 8400 | 8650 | 9000 | 9300 | 9700 | 10100 | 10550 |
| | min. | 1500 | 1400 | 1350 | 1450 | 1600 | 1750 | 1950 | 2150 | 2450 | 2700 | 3000 | 3400 | 3850 |
| 16.0 | max. | 8350 | 8800 | 9200 | 9700 | 9900 | 10350 | 10600 | 11000 | 11300 | 11700 | 12150 | 12600 | 13000 |
| | min. | 1850 | 1600 | 1600 | 1800 | 1900 | 2050 | 2250 | 2550 | 2750 | 3100 | 3500 | 3900 | 4250 |
| 20.0 | max. | 10300 | 10850 | 11300 | 11700 | 12000 | 12350 | 12750 | 13150 | 13550 | 14100 | 14400 | 15250 | 1550 |
| | min. | 2350 | 2100 | 2050 | 2050 | 2150 | 2300 | 2550 | 2850 | 3200 | 3650 | 3900 | 4650 | 4950 |
| 25.0 | max. | 11900 | 12900 | 13600 | 14150 | 14600 | 15150 | 15550 | 16000 | 16550 | 16950 | | | |
| | min. | 3950 | 3350 | 3050 | 2950 | 2950 | 3100 | 3250 | 3500 | 3900 | 4150 | | | |

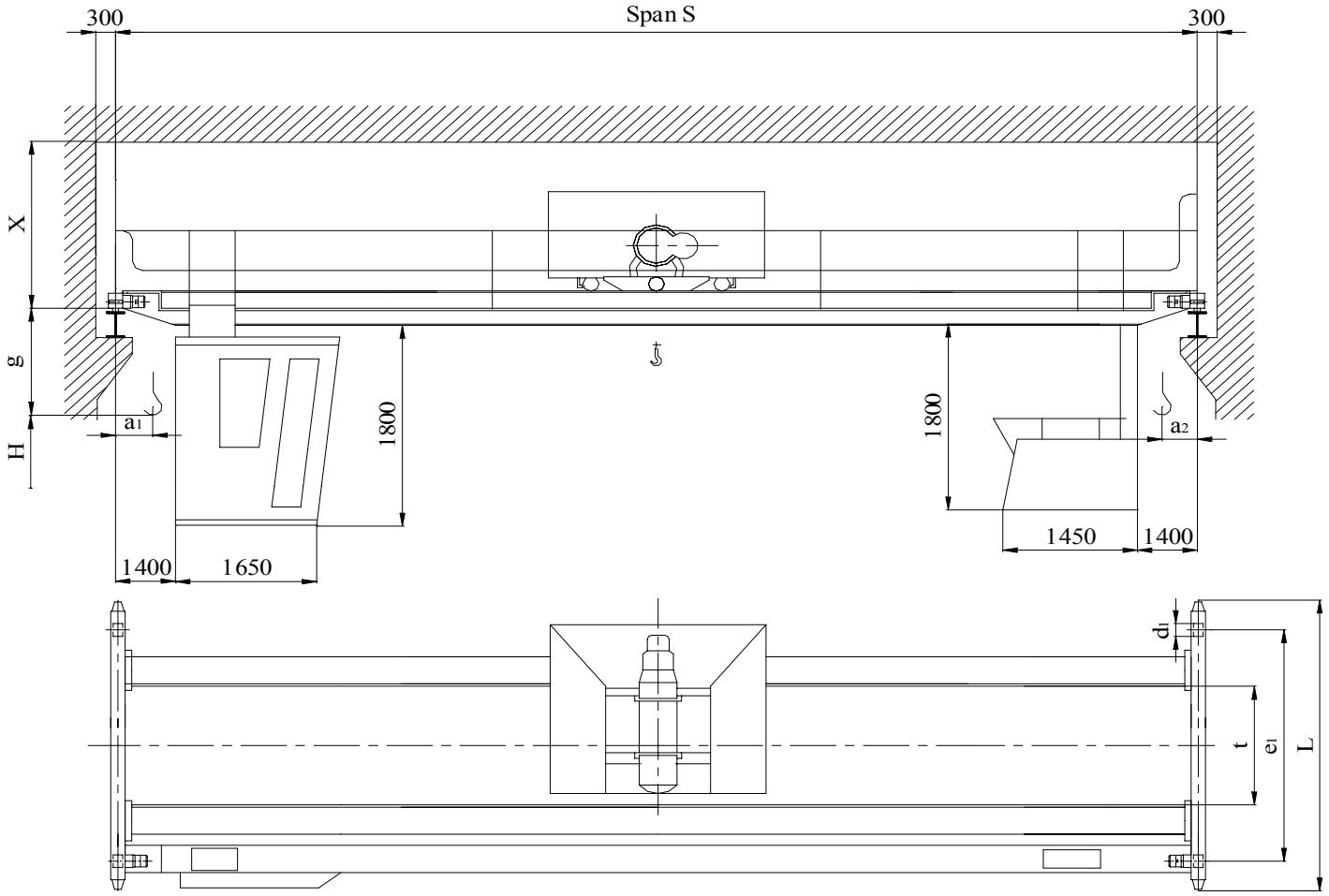
# NORMAL CAPACITY
## DOUBLE GIRDER

### Dimensions

| Capacity | $H_{max.}$ | S (up to) | g | $a_1$ | $a_2$ | $e_1$ | L | $d_1$ | t | x | b |
|---|---|---|---|---|---|---|---|---|---|---|---|
| ton | m | m | mm | mm | mm | mm | mm | mm | mm | mm | mm |
| 2.0 | 3.5 | 12 | 0 | 750 | 750 | 2000 | 2470 | 250 | 1000 | 920 | 200 |
| | | 20 | 50 | 900 | 750 | 3150 | 3620 | 250 | 1400 | 920 | 200 |
| | | 25 | -50 | 1100 | 750 | 4000 | 4560 | 400 | 2240 | 1040 | 200 |
| | | 30 | -50 | 1100 | 750 | 4560 | 5210 | 400 | 2800 | 1040 | 200 |
| | 7 | 12 | 150 | 750 | 750 | 2000 | 2470 | 250 | 1000 | 990 | 200 |
| | | 20 | 150 | 900 | 750 | 3150 | 3620 | 250 | 1400 | 990 | 200 |
| | | 25 | 50 | 1100 | 750 | 4000 | 4560 | 400 | 2240 | 1100 | 200 |
| | | 30 | 50 | 1100 | 750 | 4560 | 5210 | 400 | 2800 | 1100 | 200 |
| 3.2 | 3.5 | 12 | 150 | 750 | 750 | 2000 | 2470 | 250 | 1000 | 990 | 200 |
| | | 20 | 150 | 900 | 750 | 3150 | 3620 | 250 | 1400 | 990 | 200 |
| | | 25 | 50 | 1100 | 750 | 4000 | 4560 | 400 | 2240 | 1100 | 200 |
| | | 30 | 50 | 1100 | 750 | 4560 | 5210 | 400 | 2800 | 1100 | 200 |
| | 7 | 12 | 300 | 750 | 750 | 2000 | 2470 | 250 | 1000 | 1055 | 200 |
| | | 20 | 300 | 900 | 750 | 3150 | 3620 | 250 | 1400 | 1055 | 200 |
| | | 25 | 200 | 1100 | 750 | 4000 | 4560 | 400 | 2240 | 1065 | 200 |
| | | 30 | 200 | 1100 | 750 | 4560 | 5210 | 400 | 2800 | 1065 | 200 |
| 4.0 | 3.5 | 12 | 150 | 750 | 750 | 2000 | 2470 | 250 | 1000 | 990 | 200 |
| | | 20 | 150 | 900 | 750 | 3150 | 3620 | 250 | 1400 | 990 | 200 |
| | | 25 | 50 | 1100 | 750 | 4000 | 4560 | 400 | 2240 | 1100 | 200 |
| | | 30 | 50 | 1100 | 750 | 4560 | 5210 | 400 | 2800 | 1100 | 200 |
| | 7 | 12 | 300 | 750 | 750 | 2000 | 2470 | 250 | 1000 | 1055 | 200 |
| | | 20 | 300 | 900 | 750 | 3150 | 3620 | 250 | 1400 | 1055 | 200 |
| | | 25 | 200 | 1100 | 750 | 4000 | 4560 | 400 | 2240 | 1065 | 200 |
| | | 30 | 200 | 1100 | 750 | 4560 | 5210 | 400 | 2800 | 1065 | 200 |
| 5.0 | 8 | 12 | 350 | 750 | 750 | 2000 | 2470 | 250 | 1000 | 1115 | 200 |
| | | 16 | 350 | 750 | 750 | 2500 | 2970 | 250 | 1400 | 1115 | 200 |
| | | 20 | 350 | 900 | 750 | 3150 | 3620 | 250 | 1400 | 1115 | 200 |
| | | 25 | 300 | 1100 | 750 | 4000 | 4560 | 400 | 2240 | 1225 | 200 |
| | | 30 | 300 | 1100 | 750 | 4560 | 5210 | 400 | 2800 | 1225 | 200 |
| 6.3 | 3.5 | 12 | 200 | 750 | 750 | 2000 | 2470 | 250 | 1000 | 1050 | 200 |
| | | 16 | 200 | 750 | 750 | 2500 | 2970 | 250 | 1400 | 1050 | 200 |
| | | 20 | 200 | 900 | 750 | 3150 | 3620 | 250 | 1400 | 1050 | 200 |
| | | 25 | 100 | 1100 | 750 | 4000 | 4560 | 400 | 2240 | 1160 | 200 |
| | | 30 | 100 | 1100 | 750 | 4560 | 5210 | 400 | 2800 | 1160 | 200 |
| | 8 | 12 | 300 | 750 | 750 | 2000 | 2470 | 250 | 1000 | 1115 | 200 |
| | | 16 | 300 | 750 | 750 | 2500 | 2970 | 250 | 1400 | 1115 | 200 |
| | | 20 | 300 | 900 | 750 | 3150 | 3620 | 250 | 1400 | 1115 | 200 |
| | | 25 | 200 | 1100 | 750 | 4000 | 4560 | 400 | 2240 | 1225 | 200 |
| | | 30 | 200 | 1100 | 750 | 4560 | 5210 | 400 | 2800 | 1225 | 200 |
| 8.0 | 3.5 | 16 | 100 | 750 | 750 | 2500 | 3150 | 400 | 1400 | 1165 | 200 |
| | | 20 | 100 | 900 | 750 | 3150 | 3800 | 400 | 1400 | 1165 | 200 |
| | | 25 | 100 | 1100 | 750 | 4000 | 4650 | 400 | 2240 | 1165 | 200 |
| | | 30 | 100 | 1100 | 750 | 4560 | 5210 | 400 | 2800 | 1165 | 200 |
| | 12 | 16 | 450 | 750 | 750 | 2500 | 3150 | 400 | 1400 | 1355 | 200 |
| | | 20 | 450 | 900 | 750 | 3150 | 3800 | 400 | 1400 | 1355 | 200 |
| | | 25 | 450 | 1100 | 750 | 4000 | 4650 | 400 | 2240 | 1355 | 200 |
| | | 30 | 450 | 1100 | 750 | 4560 | 5210 | 400 | 2800 | 1355 | 200 |
| 10.0 | 4 | 16 | 200 | 750 | 750 | 2500 | 3150 | 400 | 1400 | 1225 | 200 |
| | | 20 | 200 | 900 | 750 | 3150 | 3800 | 400 | 1400 | 1225 | 200 |
| | | 25 | 200 | 1100 | 750 | 4000 | 4650 | 400 | 2240 | 1225 | 200 |
| | | 30 | 200 | 1100 | 750 | 4560 | 5210 | 400 | 2800 | 1225 | 200 |
| | 12 | 16 | 450 | 750 | 750 | 2500 | 3150 | 400 | 1400 | 1355 | 200 |
| | | 20 | 450 | 900 | 750 | 3150 | 3800 | 400 | 1400 | 1355 | 200 |
| | | 25 | 450 | 1100 | 750 | 4000 | 4650 | 400 | 2240 | 1355 | 200 |
| | | 30 | 450 | 1100 | 750 | 4560 | 5210 | 400 | 2800 | 1355 | 200 |
| 12.5 | 4 | 14 | -150 | 900 | 900 | 2500 | 3150 | 400 | 1400 | 1385 | 200 |
| | | 20 | -150 | 900 | 900 | 3150 | 3800 | 400 | 1400 | 1385 | 200 |
| | | 25 | -150 | 1000 | 900 | 4000 | 4650 | 400 | 2240 | 1385 | 200 |
| | | 30 | -250 | 1100 | 900 | 4560 | 5350 | 500 | 2800 | 1485 | 200 |
| | 6 | 14 | 50 | 900 | 900 | 2500 | 3150 | 400 | 1400 | 1500 | 200 |
| | | 20 | 50 | 900 | 900 | 3150 | 3800 | 400 | 1400 | 1500 | 200 |
| | | 25 | 50 | 1000 | 900 | 4000 | 4650 | 400 | 2240 | 1500 | 200 |
| | | 30 | -50 | 1100 | 900 | 4560 | 5350 | 500 | 2800 | 1600 | 250 |
| 16.0 | 6 | 11 | 50 | 900 | 900 | 2500 | 3150 | 400 | 1400 | 1470 | 200 |
| | | 25 | -50 | 900 | 900 | 4000 | 4790 | 500 | 2240 | 1600 | 250 |
| | | 30 | -50 | 900 | 900 | 4560 | 5350 | 500 | 2800 | 1600 | 250 |
| 20.0 | 6 | 25 | -50 | 900 | 900 | 4000 | 4790 | 500 | 2240 | 1600 | 250 |
| | | 30 | -50 | 900 | 900 | 4560 | 5350 | 500 | 2800 | 1600 | 250 |
| 25.0 | 6 | 20 | 100 | 1350 | 1350 | 4000 | 4790 | 500 | 2240 | 1850 | 250 |
| | | 25 | 100 | 1350 | 1350 | 4000 | 4790 | 500 | 2240 | 1850 | 250 |

negative (g) dimensions = hook above crane rail

# HEAVY CAPACITY
## DOUBLE GIRDER




## Wheel loads in kg

| Capacity | Wheel | Span in Meters | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ton | Load | 6 | 8 | 10 | 12 | 14 | 16 | 18 | 20 | 22 | 24 | 26 | 28 | 30 |
| 25 | max. | 13100 | 14300 | 15100 | 15800 | 16500 | 17100 | 17500 | 18200 | 1900 | 19900 | 21100 | 21800 | 22500 |
| | min. | 4900 | 4200 | 3800 | 3600 | 3600 | 3700 | 3500 | 4000 | 4300 | 4900 | 5800 | 6300 | 6800 |
| 32 | max. | 15700 | 17100 | 18100 | 19000 | 19700 | 20400 | 21000 | 21700 | 22600 | 23700 | 24600 | 25300 | 26300 |
| | min. | 5800 | 4800 | 4400 | 4200 | 4100 | 4100 | 4200 | 4500 | 5000 | 5700 | 6200 | 6600 | 7400 |
| 40 | max. | 18600 | 20300 | 21500 | 22600 | 23400 | 24400 | 25200 | 26100 | 27000 | 27900 | 28900 | 29700 | 30600 |
| | min. | 7200 | 5900 | 5200 | 4900 | 4800 | 4900 | 5100 | 5500 | 5900 | 6400 | 6900 | 7400 | 8100 |
| 50 | max. | 23300 | 25500 | 27000 | 28300 | 29400 | 30400 | 31700 | 32400 | 33400 | 34300 | 35100 | 35900 | 37200 |
| | min. | 9000 | 7200 | 6400 | 5900 | 5800 | 5800 | 6300 | 6600 | 6800 | 7200 | 7500 | 8000 | 9000 |
| 63 | max. | 28100 | 30900 | 32800 | 34300 | 35500 | 37000 | 38000 | 39000 | 40000 | 41000 | 42000 | 42900 | 44000 |
| | min. | 10700 | 8700 | 7700 | 7100 | 6900 | 7100 | 7200 | 7700 | 7800 | 8200 | 8600 | 9200 | 10000 |

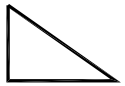
# HEAVY CAPACITY
## DOUBLE GIRDER

### Dimensions

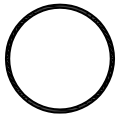
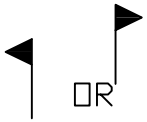
| Capacity | $H_{max.}$ | S (up to) | g | $e_1$ | L | $d_1$ | t | X |
|---|---|---|---|---|---|---|---|---|
| ton | m | m | mm | mm | mm | mm | mm | mm |
| 25 | 10 | 25 | 530 | 3950 | 5280 | 630 | 1800 | 2480 |
| | 15 | 25 | 530 | 4500 | 5830 | 630 | 2800 | 2480 |
| | 20 | 25 | 530 | 4850 | 6180 | 630 | 3150 | 2480 |
| | 10 | 30 | 530 | 4500 | 5830 | 630 | 1800 | 2480 |
| | 15 | 30 | 530 | 5500 | 6830 | 630 | 2800 | 2480 |
| | 20 | 30 | 530 | 5850 | 7180 | 630 | 3150 | 2480 |
| 32 | 10 | 22 | 530 | 3500 | 4830 | 630 | 1800 | 2480 |
| | 15 | 22 | 530 | 4500 | 5830 | 630 | 2800 | 2480 |
| | 20 | 22 | 530 | 4850 | 6180 | 630 | 3150 | 2480 |
| | 10 | 24 | 530 | 3950 | 5280 | 630 | 1800 | 2480 |
| | 15 | 24 | 530 | 4500 | 5830 | 630 | 2800 | 2480 |
| | 20 | 24 | 530 | 4850 | 6180 | 630 | 3150 | 2480 |
| | 10 | 30 | 530 | 4500 | 5830 | 630 | 1800 | 2480 |
| | 15 | 30 | 530 | 5500 | 6830 | 630 | 2800 | 2480 |
| | 20 | 30 | 530 | 5850 | 7180 | 630 | 3150 | 2480 |
| 40 | 10 | 23 | 530 | 3500 | 4830 | 630 | 1800 | 2480 |
| | 15 | 23 | 530 | 4500 | 5830 | 630 | 2800 | 2480 |
| | 20 | 23 | 530 | 4850 | 6180 | 630 | 3150 | 2480 |
| | 10 | 24 | 530 | 4500 | 5830 | 630 | 1800 | 2480 |
| | 15 | 24 | 530 | 5500 | 6830 | 630 | 2800 | 2480 |
| | 20 | 24 | 530 | 5850 | 7180 | 630 | 3150 | 2480 |
| | 10 | 30 | 530 | 4500 | 5830 | 630 | 1800 | 2560 |
| | 15 | 30 | 530 | 5500 | 6830 | 630 | 2800 | 2560 |
| | 20 | 30 | 530 | 5850 | 7180 | 630 | 3150 | 2560 |
| 50 | 10 | 13 | 770 | 3500 | 4830 | 630 | 1800 | 2480 |
| | 15 | 13 | 770 | 4500 | 5830 | 630 | 2800 | 2480 |
| | 20 | 13 | 770 | 4850 | 6180 | 630 | 3150 | 2480 |
| | 10 | 19 | 770 | 3500 | 4830 | 630 | 1800 | 2480 |
| | 15 | 19 | 770 | 4500 | 5830 | 630 | 2800 | 2480 |
| | 20 | 19 | 770 | 4850 | 6180 | 630 | 3150 | 2480 |
| | 10 | 30 | 770 | 4500 | 5830 | 630 | 1800 | 2480 |
| | 15 | 30 | 770 | 5500 | 6830 | 630 | 2800 | 2480 |
| | 20 | 30 | 770 | 5850 | 7180 | 630 | 3150 | 2480 |
| 63 | 10 | 8 | 770 | 3500 | 4830 | 630 | 1800 | 2480 |
| | 15 | 8 | 770 | 4500 | 5830 | 630 | 2800 | 2480 |
| | 20 | 8 | 770 | 4850 | 6180 | 630 | 3150 | 2480 |
| | 10 | 14 | 770 | 3500 | 4830 | 630 | 1800 | 2480 |
| | 15 | 14 | 770 | 4500 | 5830 | 630 | 2800 | 2480 |
| | 20 | 14 | 770 | 4850 | 6180 | 630 | 3150 | 2480 |
| | 10 | 19 | 770 | 4500 | 5830 | 630 | 1800 | 2480 |
| | 15 | 19 | 770 | 5500 | 6830 | 630 | 2800 | 2480 |
| | 20 | 19 | 770 | 5850 | 7180 | 630 | 3150 | 2480 |
| | 10 | 30 | 690 | 4700 | 6150 | 710 | 1800 | 2560 |
| | 15 | 30 | 690 | 5700 | 7150 | 710 | 2800 | 2560 |
| | 20 | 30 | 690 | 6050 | 7500 | 710 | 3150 | 2560 |

# WELDING SYMBOLS

# BASIC WELD SYMBOLS

| BACK | FILLET | PLUG OR SLOT | GROOVE OR BUTT | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | SQUARE | V | BEVEL | U | J | FLARE V | FLARE BEVEL |
|  |  |  |  |  |  |  |  |  |  |

## SUPPLEMENTARY WELD SUMBOLS

| WELD ALL AROUND | *FIELD WELD | CONTOUR | |
|---|---|---|---|
| | | FLUSH | CONVEX |
|  |  |  |  |

NOTE :

Size , weld symbol, lenghth of weld and spacing must be read in that order from left to right along the referance line.

Neither orientation of referance line nor location of the arrow alter this rule.

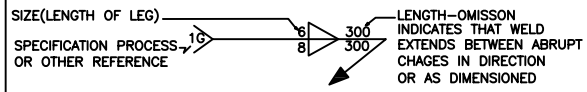
The perpendicular leg of  ,  , ,  weld symbols must be at left.

Size and spacing of fillet welds must be shown on both the Arrow Side and the other Side symbol.

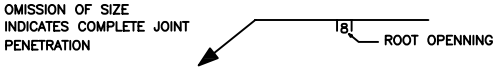
Symbol applied between abrupt changes direction of welding unless governed by the "all around" symbol or otherwise dimensioned.

# WELDING SYMBOLS

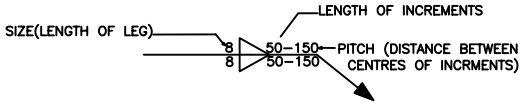
DOUBLE–FILLET SYMBOL



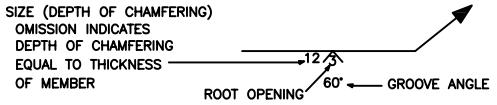

SQUARE–GROVE WELDING SYMBOL



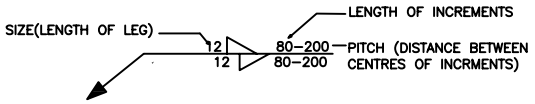

CHAIN–INTERMITTENT–FILLET WELDING SYMBOL



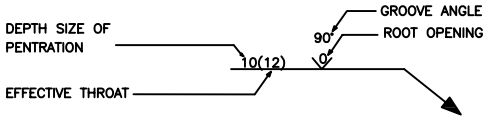

SINGLE–V GROOVE WELDING SYMBOL



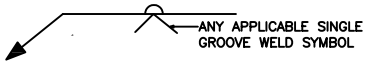

STAGGERED INTERMITTENT–FILLET WELDING SYMBOL



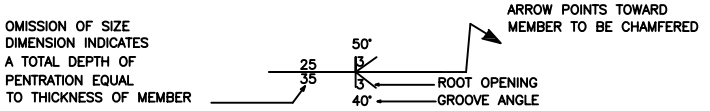

SINGLE–V GROOVE WELDING SYMBOL INDICATING ROOT PENETRATION




BEAD WELD SYMBOL INDICATING BEAD TYPE BACK WELD

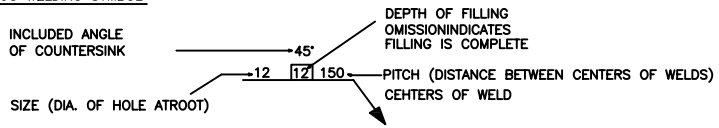



DOUBLE–BEVEL GROOVE WELDING SYMBOL

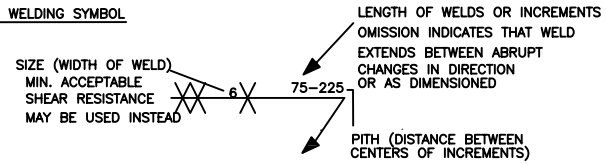



DUAL BEAD WELD SYMBOL INDICATING BUILT–UP SURFACE

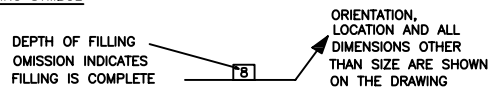

PLUG WELDING SYMBOL




SEAM WELDING SYMBOL




SLOT WELDING SYMBOL

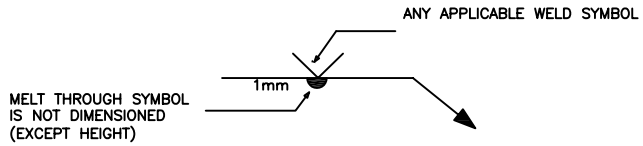




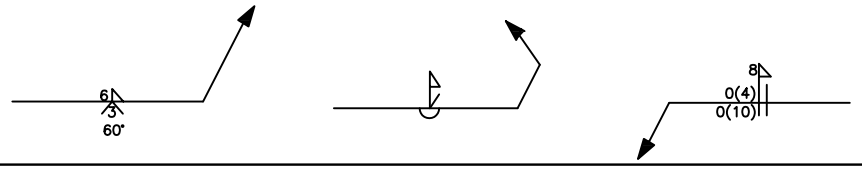

M.Korashy

# WELDING SYMBOLS

## MELT–THROUGH SYMBOL

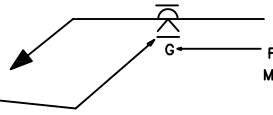



## WELDING SYMBOLS FOR COMBINED WELDS



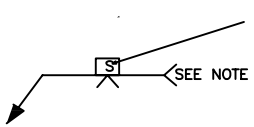

## FLUSH CONTOUR SYMBOL

FLUSH CONTOUR SYMBOL INDICATES FACE OF WELD TO BE MADE FLUSH.WHEN USED WITHOUT A FINISH SYMBOL.INDICATES WELD WITHOUT SUBSEQUENT FINISHING




FINISH SYMBOL(USER' S STANDARD) INDICATES METHOD OF OBTAINING SPECIFIED CONTOUR BUT NOT DEGREE OF FINISH

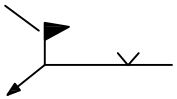
## JOINT WITH BACKING




NOTE : DIMENSIONS OF BAKING AS SPECIFED

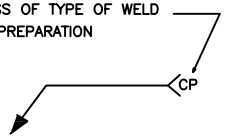
## FIELD WELD SYMBOL

FIELD WELD SYMBOL INDICATES THAT WELD IS TO BE MADE AT A PLACE OTHER THAN OF INTIAL CONSTRUCTION

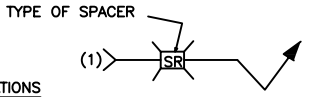


## COMPLETE PENETRATION

INDICATES COMPLETE PENETRATION REGARDLESS OF TYPE OF WELD OR JOINT PREPARATION



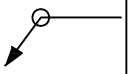
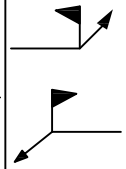
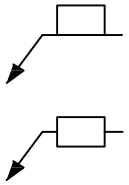
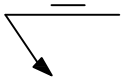
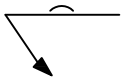
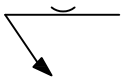

## JOINT WITH SPACER



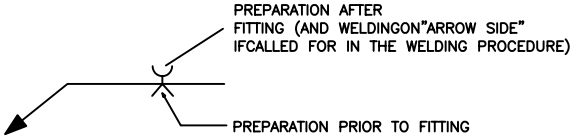

LETTER DESIGNATIONS

S– STEEL OR OTHER MATERIAL AS SPECIFIED
SR– SAME AS (S) BUT REMOVE AFTER WELDING
T–TAPE
F–FLUX

## SUPPLEMENTARY SYMBOLS

| WELD –ALL AROUND | FIELD WELD | MELT THROUGH | BACKING, SPACER | CONTOUR | | |
|---|---|---|---|---|---|---|
| | | | | FLUSH | CONVEX | CONCAVE |
|  |  |  |  |  |  |  |

## JOINT PREPARATION

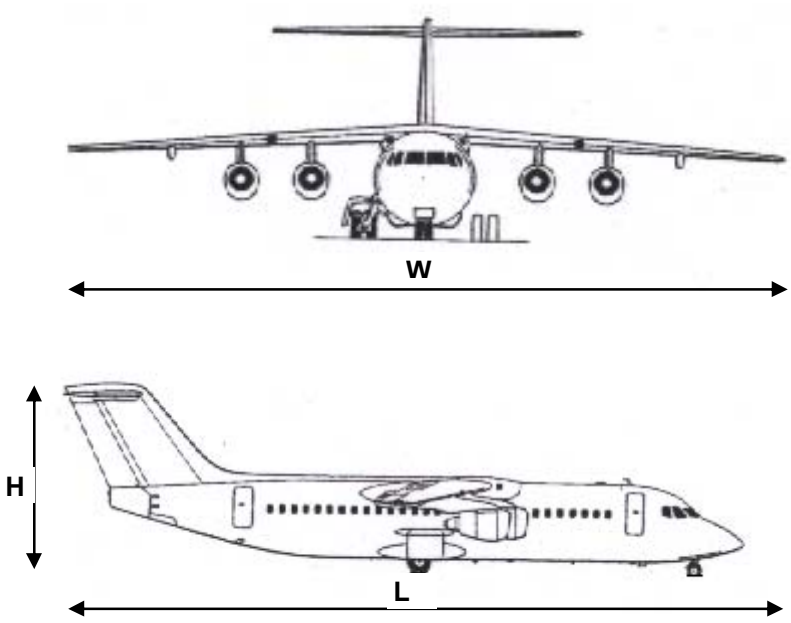





M.Korashy

# MISCELLANEOUS

# AIRCRAFT HANGERS




## Dimensions

| TYPE OF AIRCRAFT | L (m) | W (m) | H (m) |
|---|---|---|---|
| BOING 727-200 | 46.680 | 32.920 | 8.660 |
| BOING 737-500 | 29.790 | 28.890 | 8.660 |
| BOEING 747-400 COMBI | 68.600 | 64.940 | 19.580 |
| BOEING 757-200 | 47.320 | 38.049 | 13.564 |
| BOEING 767-300 | 54.940 | 47.574 | 15.849 |
| AIRBUS A340-200 | 59.422 | 58.640 | 16.918 |
| AIRBUS A340-300 | 63.658 | 60.304 | 16.828 |
| McDONNELL-DOUGLAS DC-8-70 | 57.125 | 45.237 | 12.929 |
| McDONNELL-DOUGLAS DC-9-80 | 45.020 | 32.850 | 9.200 |
| McDONNELL-DOUGLAS DC-10 | 55.499 | 50.934 | 17.704 |
| FASLCON 900 | 19.550 | 19.330 | 7.550 |
| LOCKHEAD C-5A GALAXY | 75.540 | 67.882 | 19.850 |
| LOCKHEAD C-130 HERCULES | 29.794 | 40.411 | 11.659 |
| LOCKHEAD -141 STRLIFTER | 51.178 | 48.743 | 11.976 |
| LOCKHEAD L-1011 | 54.178 | 47.346 | 16.866 |
| CONCORDE | 62.103 | 25.552 | 11.405 |

# Common Conversion Factors

| Item | Imperial or Metric to SI | SI to Imperial or Metric |
|---|---|---|
| **Length** | 1 ft. = 0.3048 m<br>1 in. = 25.4 mm<br>1 in. = 2.54 cm<br>1 yd. = 0.914 m<br>1 mile = 1.609344 km | 1 m = 3.28 ft.<br>1 mm = 0.0394 in.<br>1 in. = 0.3937 cm<br>1 m = 1.09 yd.<br>1 km = 0.622 mi. |
| **Area** | 1 acre = 0.404685 6 ha<br>1 $ft.^2$ = 0.09290304 $m^2$<br>1 $in.^2$ = 645.16 $mm^2$<br>1 $in^{-2}$ = 6.4516 $cm^2$<br>1 $mi.^2$ = 2.589 988 $km^2$<br>1 $yd.^2$ = 0.836127 $m^2$ | 1 ha = 2.471 acres<br>1 $m^2$ = 10.764 $ft.^2$<br>1 $mm^2$ = 1.55x $10^{-3}$ $in^2$<br>1 $cm^2$ = 0.155 $in^2$<br>1 $km^2$ = 0.3861 $mi.^2$<br>1 $m^2$ = 1.20 $yd.^2$ |
| **Volume** | 1 $in.^3$ = 16387.064$mm.^3$<br>1 $in.^3$ = 16.387064 $cm^3$<br>1 $ft.^3$ = 28.316 $85m.^3$<br>1 $yd.^3$ = 0.764 $555m.^3$ | 1 $mm^3$ = 0.061 x$10^{-3}$ $in.^3$<br>1 $cm^3$ = 0.061 $in.^3$<br>1 $dm^3$ = 0.0353 $ft.^3$<br>1 $m^3$ = 1.308 $yd.^3$ |
| **Mass** | 1 lb. = 0.45359237 kg<br>1 ton = 0.90718474 Mg | 1 kg = 2.20 lb.<br>1 Mg = 1.10 ton =2200 lb. |
| **Mass per unit Length** | 1 lb./in. = 17.858 kg/m<br>1 lb./ ft. = 1.48816 kg/m<br>1 lb./yd. = 0.496055 kg/m | 1 kg/m = 0.056 lb./in.<br>1 kg/m = 0.672 lb./ft.<br>1 kg/m = 2.016 lb./yd. |
| **Mass per unit Area** | 1 lb./ $ft.^2$ = 4.88243 $kg/m^2$<br>1 lb./ $ft.^2$ = 4.88243 x$10^{-4}$ $kg/cm^2$<br>1 oz./$ft.^2$ = 305.152 $g/m^2$<br>1 lb./$in.^2$ = 703.0696 $kg/m^2$ | 1 $kg/m^2$ = 0.2051 lb./$ft.^2$<br>1 $kg/cm^2$ = 2051 lb./$ft.^2$<br>1 $g/m^2$ = 3.277X$10^{-3}$ oz./$ft.^2$<br>1 $kg/m^2$ = 1.42X $10^{-3}$ lb./$in.^2$ |
| **Mass per unit volume** | 1 lb./$ft.^3$ = 16.01846 $kg/m^3$<br>1 lb./$in.^3$ = 27.67990 $Mg/m^3$ | 1 $kg/m^3$ = 62.4X$10^{-3}$ lb./$ft.^3$<br>1 $Mg/m^3$ = 0.0361 lb./$in.^3$ |
| **Force** | 1 kg force = 9.80665 N<br>1 Kip = 4.448222 kN<br>1 pound force = 4.448222 N | 1 N = 0.1019716 kg force<br>1 kN = 0.225 Kip<br>1 N = 0.225 pound force |
| **Torque or Moment of Force** | 1 pound-force foot = 1.355818 N.m<br>1 pound-force inch = 0.112985 N.m | 1 N.m = 0.737562 pound-force foot<br>1 N.m = 8.850732 pound-force inch |
| **Pressure or Stress** | 1 psf = 47.88026 pa<br>1 psi = 6.894757 kpa<br>1 ksi = 6.894757 Mpa<br>1 $kg/cm^2$ = 0.0980665 Mpa<br>1 $t/cm^2$ = 98.0665 Mpa | 1 pa = 0.0209 psf<br>1 kpa = 0.145 psi<br>1 Mpa = 0.145 ksi<br>1 Mpa = 10.19 $kg/cm^2$<br>1 Mpa = 0.01019 $t/cm^2$ |
| **Moment of inertia**<br>**a) second Moment of Area**<br>**b) section Modulus** | 1 $in.^4$ = 416231.4 $mm^4$<br>1 $in.^4$ = 41.62314 $cm^4$<br>1 $in.^3$ =16387.064 $mm^3$<br>1 $in.^3$ = 16.387064 $cm^3$ | 1 $mm^4$ = 2.4 x$10^{-6}$ $in.^4$<br>1 $cm^4$ = 0.024 $in.^4$<br>1 $cm^4$ = 0.024 $in.^4$<br>1 $mm^3$ = 0.061 x$10^{-3}$ $in.^3$<br>1 $cm^3$ = 0.061 $in.^3$ |

# PROPERTIES OF GEOMETRIC SECTIONS AND STRUCTURAL SHAPES

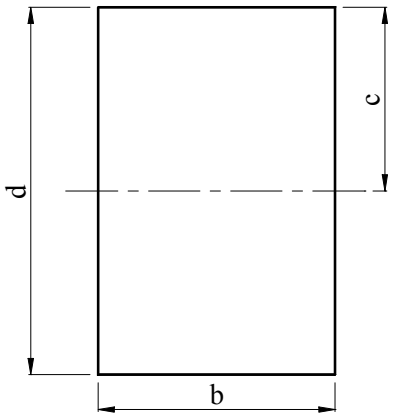
$$A = bd$$

$$c = \frac{d}{2}$$

$$I = \frac{bd^3}{12}$$

$$S = \frac{bd^2}{6}$$

$$r = \frac{d}{\sqrt{12}}$$



RECTANGLE

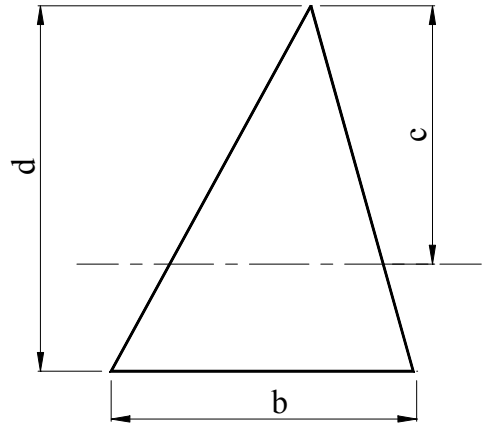
$$A = \frac{bd}{2}$$

$$c = 2d/3$$

$$I = \frac{bd^3}{36}$$

$$S = \frac{bd^2}{24}$$

$$r = \frac{d}{\sqrt{18}}$$



TRIANGLE

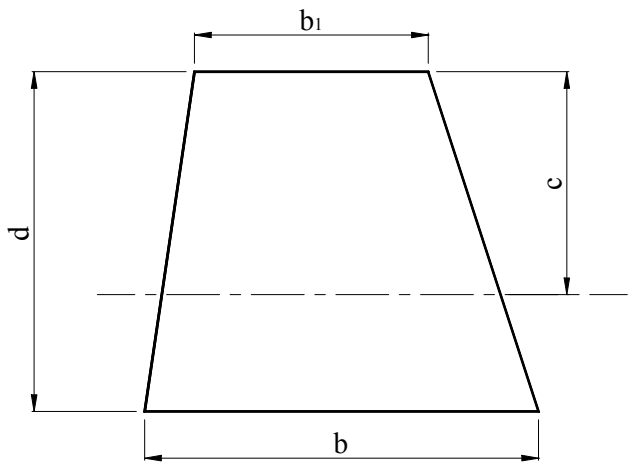
$$A = \frac{d(b+b_1)}{2}$$

$$c = \frac{d(2b+b_1)}{3(b+b_1)}$$

$$I = \frac{d^3(b\ +4bb_1+b_1{}^2)}{36(b+b_1)}$$

$$S = \frac{d^2(b^2+4bb_1+b_1^2)}{12(2b+b_1)}$$

$$r = \frac{d}{6(b+b_1)}\sqrt{2(b^2+4bb_1+b_1^2)}$$




TRAPEZOID

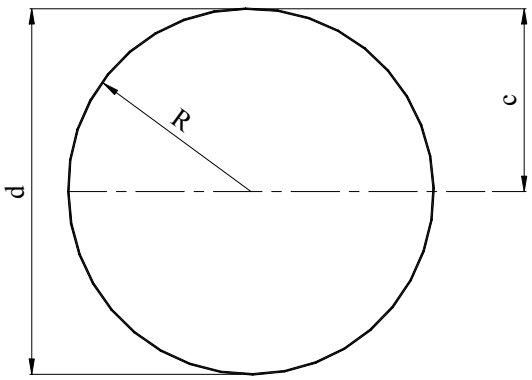
$$A = \frac{\pi d^2}{4} = \pi R^2$$

$$c = \frac{d}{2} = R$$

$$I = \frac{\pi d^4}{64} = \frac{\pi R^4}{4}$$

$$S = \frac{\pi d^3}{32} = \frac{\pi R^3}{4}$$

$$r = \frac{d}{4} = \frac{R}{2}$$




CIRCLE

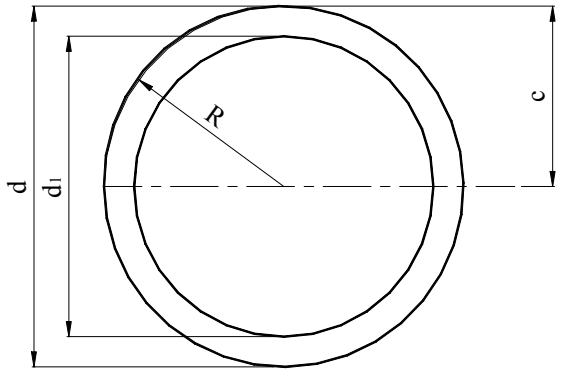
$$A = \frac{\pi (d^2 - d_1^2)}{4}$$

$$c = \frac{d}{2}$$

$$I = \frac{\pi (d^4 - d_1^4)}{64}$$

$$S = \frac{\pi (d^4 - d_1^4)}{32d}$$

$$r = \frac{\sqrt{d^2 + d_1^2}}{4}$$




HOLLOW CIRCLE

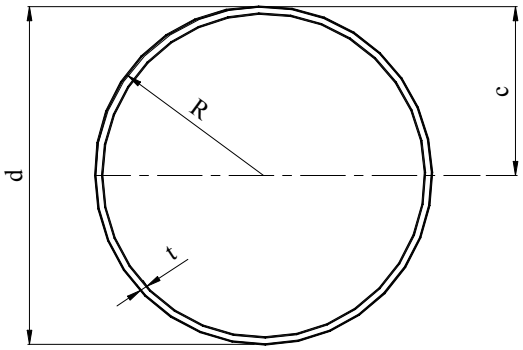
$$A = \pi Dt = 2\pi Rt$$

$$c = R$$

$$I = \pi D^3 t/8$$

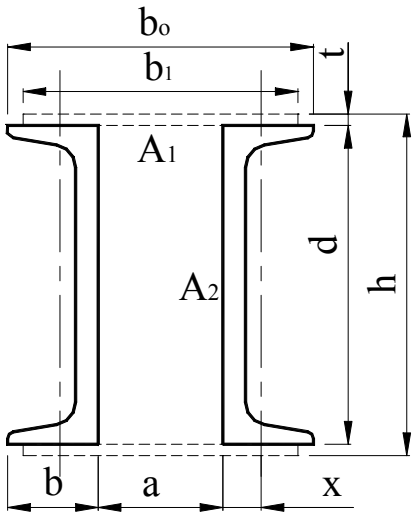
$$S = \pi D^2 t/8$$

$$r = D/\sqrt{8}$$

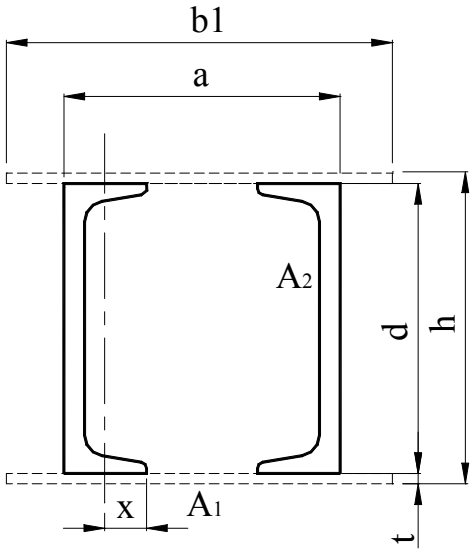



THIN WALLED SECTION

$$h = d + 2t$$
$$b_o = a + 2b$$
$$A_1 = b_1 t$$
$$A = 2\left(A_1 + A_2\right)$$
$$I_{xx} = 2I_{xc} + \frac{b_1}{12}\left[h^3 - d^3\right]$$
$$S_{xx} = 2I_{xx}/h$$
$$r_{xx} = \sqrt{I_{xx}/A}$$
$$I_{yy} = 2I_{yc} + \frac{A_1}{6}b_1^2 + 2A_2\left(x + a/2\right)^2$$
$$S_{yy} = 2I_{yy}/b_o \qquad if\ b_1 < b_o$$
$$S_{yy} = 2I_{yy}/b_1 \qquad if\ b_1 \geq b_o$$
$$r_{yy} = \sqrt{I_{yy}/A}$$

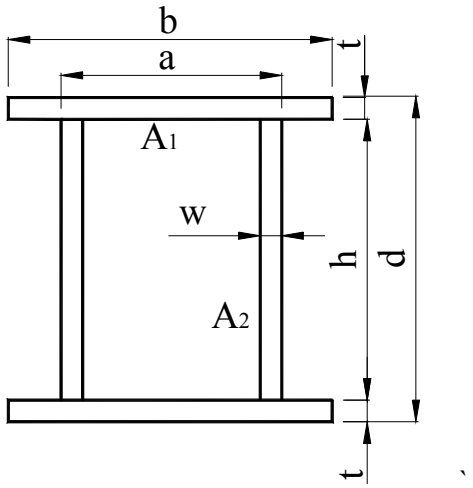



$$h = d + 2t$$
$$A_1 = b_1 t$$
$$A = 2\left(A_1 + A_2\right)$$
$$I_{xx} = 2I_{xc} + \frac{b_1}{12}\left(h^3 - d^3\right)$$
$$S_{xx} = 2\,I_{xx}/h$$
$$r_{xx} = \sqrt{I_{xx}/A}$$
$$I_{yy} = 2I_{yc} + \frac{A_1}{6}b_1^2 + 2A_2\left(a/2 - x\right)^2$$
$$S_{yy} = 2\,I_{yy}/b_1 \qquad if\ a < b_1$$
$$S_{yy} = 2\,I_{yy}/a \qquad if\ a \geq b_1$$
$$r_{yy} = \sqrt{I_{yy}/A}$$

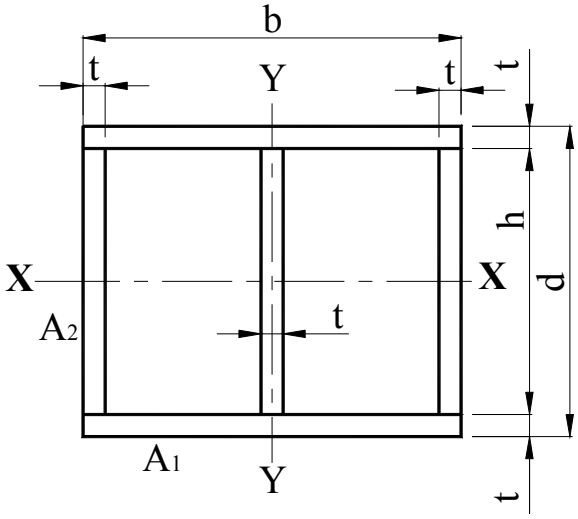



Note: Elements of the shape, which are shown in dotted outline, are continuous and if disconnected the variable defining their size should be set equal to zero.

$$h = d - 2t$$
$$A_1 = bt$$
$$A_2 = wh$$
$$A = 2(A_1 + A_2)$$
$$I_{xx} = \frac{1}{12}\left\{b(d^3 - h^3) + 2A_2h^2\right\}$$
$$S_{xx} = 2I_{xx}/d$$
$$r_{xx} = \sqrt{I_{xx}/A}$$
$$c = a - 2w$$
$$I_{yy} = \frac{1}{12}\left\{2A_1b^2 + h(a^3 - c^3)\right\}$$
$$S_{yy} = 2I_{yy}/b$$
$$r_{yy} = \sqrt{I_{yy}/A}$$

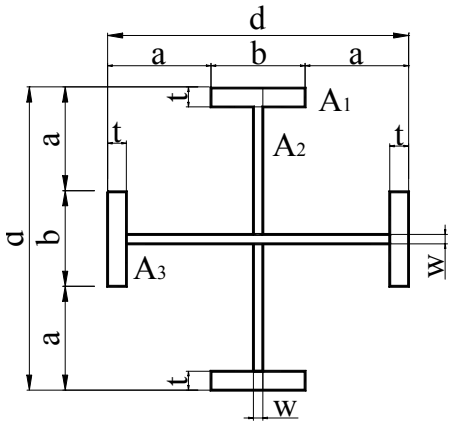



$$h = d - 2t$$
$$A_1 = bt$$
$$A_2 = ht$$
$$A = 2A_1 + 3A_2$$
$$I_{xx} = \frac{1}{12}\left[3A_2h^2 + b(d^3 - h^3)\right]$$
$$S_{xx} = 2I_{xx}/d$$
$$r_{xx} = \sqrt{I_{xx}/A}$$
$$I_{yy} = \frac{1}{12}\left\{2A_1b^2 + A_2t^2 + 2t[b^3 - (b-2t)^3]\right\}$$
$$S_{yy} = 2I_{yy}/b$$
$$r_{yy} = \sqrt{I_{yy}/A}$$

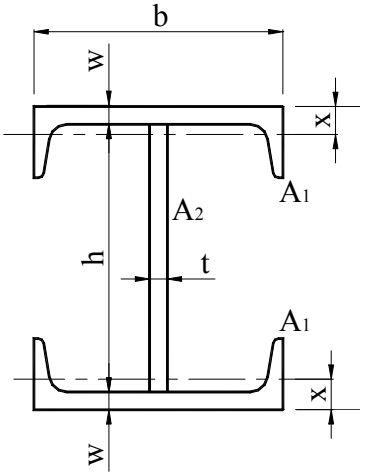



Note: Elements of the shape, which are shown in dotted outline, are continuous and if disconnected the variable defining their size should be set equal to zero.

$$A_1 = bt$$
$$A_2 = (d - w - 2t)\,w/2$$
$$A_3 = 2A_2 + w^2$$
$$A = 4A_1 + 2A_2 + A_3$$
$$E = d - 2t$$
$$I_x = I_y = \frac{1}{12}\left\{b(d^3 - E^3) + wE^3 + 2tb^3 + Ew^3 - w^4\right\}$$
$$S_x = S_y = 2I_x/d$$
$$r_x = r_y = \sqrt{I_x/A}$$




$$h = d - 2w$$
$$A_2 = ht$$
$$A = A_1 + A_2$$
$$I_{xx} = 2I_{yc} + \frac{1}{12}A_2h^2 + 2A_1(d/2 - x)^2$$
$$S_{xx} = 2I_{xx}/d$$
$$r_{xx} = \sqrt{I_{xx}/A}$$
$$I_{yy} = 2I_{xc} + \frac{1}{12}A_2t^2$$
$$S_{yy} = 2I_{yy}/b$$
$$r_{yy} = \sqrt{I_{yy}/A}$$




Note: Elements of the shape, which are shown in dotted outline, are continuous and if disconnected the variable defining their size should be set equal to zero.

$$A_2 = bt$$

$$A = 2(A_1 + A_2)$$

$$I_{xx} = 2I_{xI} + \frac{1}{12} b\left[(d + 2t)^3 - d^3\right]$$

$$S_{xx} = 2I_{xx} / (d + 2t)$$

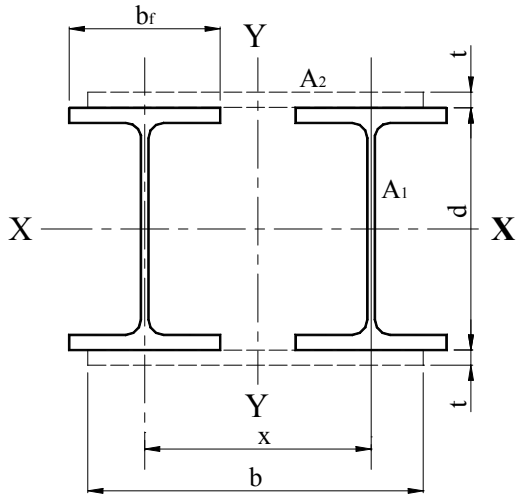
$$r_{xx} = \sqrt{I_{xx} / A}$$

$$I_{yy} = 2I_{yI} + \frac{1}{6} A_2 t^2 + \frac{1}{2} A_1 x^2$$

$$S_{yy} = 2I_{yy} / (x + b_f) \qquad if\ (x + b_f) > b$$

$$S_{yy} = 2I_{yy} / b \qquad if\ (x + b_f) \le b$$

$$r_{yy} = \sqrt{I_{yy} / A}$$




$$d_0 = d + 2t$$

$$A_3 = b_1 t$$

$$A = 2(A_1 + A_3) + A_2$$

$$I_{xx} = 2I_{x1} + I_{y2} + \frac{b_1}{12}(d_0{}^3 - d^3)$$

$$S_{xx} = 2I_{xx} / d_0$$

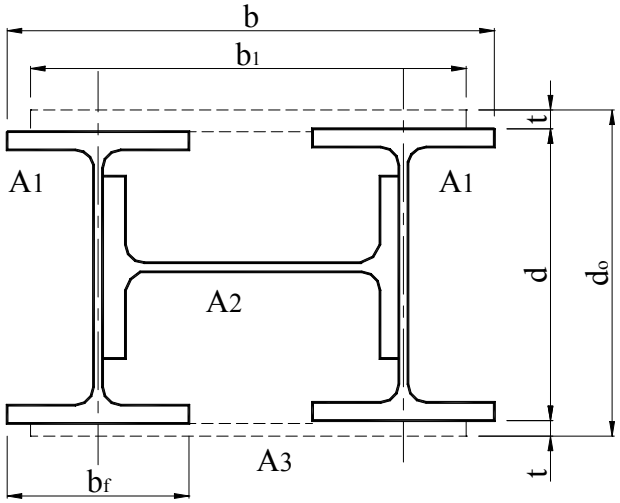
$$r_{xx} = \sqrt{I_{xx} / A}$$

$$I_{yy} = I_{x2} + 2I_{Y1} + \frac{A_3}{6} b_1^2 + A_1 b_1^2 / 2$$

$$S_{yy} = 2I_{xx} / b \qquad if\ b \ge b_1$$

$$S_{yy} = 2I_{xx} / b_1 \qquad if\ b < b_1$$

$$r_{yy} = I_{yy} / A$$




Note: Elements of the shape, which are shown in dotted outline, are continuous and if disconnected the variable defining their size should be set equal to zero.

$$h = d + \frac{1}{2}(b_1 + w_1)$$

$$y_1 = \frac{A_1(d + w_1/2) + A_2 d/2}{A_1 + A_2}$$

$$y_2 = h - y_1$$

$$A = A_1 + A_2$$

$$I_{xx} = I_{y1} + I_{x2} + A_1(y_2 - b_1/2)^2$$

$$S_{x1} = I_{xx}/y_1$$

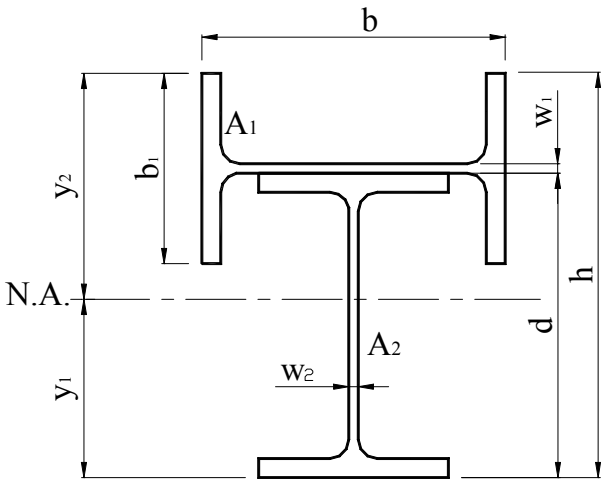
$$S_{x2} = I_{xx}/y_2$$

$$r_{xx} = \sqrt{I_{xx}/A}$$

$$I_{yy} = I_{x1} + I_{y2}$$

$$S_{yy} = 2I_{yy}/b$$

$$r_{yy} = \sqrt{I_{yy}/A}$$




$$A = A_c + A_I$$

$$d_o = d + w$$

$$y_1 = \frac{A_I d/2 + A_c(d_0 - x)}{A}$$

$$y_2 = d_0 - y_1$$

$$I_{xx} = I_{xI} + I_{yc} + A_I(y_1 - d/2)^2 + A_c(y_2 - x)^2$$

$$S_{x1} = I_{xx}/y_1$$

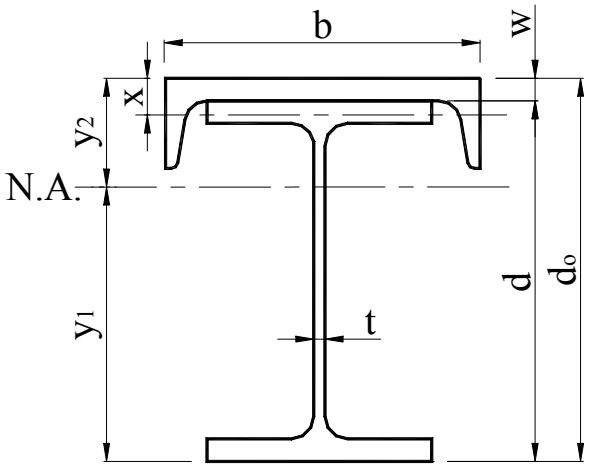
$$S_{x2} = I_{xx}/y_2$$

$$r_{xx} = \sqrt{I_{xx}/A}$$

$$I_{yy} = I_{yI} + I_{xc}$$

$$S_{yy} = 2I_{yy}/b$$

$$r_{yy} = \sqrt{I_{yy}/A}$$

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