*भारतीय मानक*

**IS 1252 : 2024**

(Amalgamating IS 1863 and IS 1864)

***Indian Standard***

**जहाज़ निर्माण के लिए तप्त बेल्लित इस्पात अनुभाग — आयाम और छूटें**

**Hot Rolled Steel Sections for Shipbuilding — Dimensions and Tolerances**

(ICS No. 77.140.70)

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भारतीय मानक ब्यूरो

BUREAU OF INDIAN STANDARDS

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*March* 2024

**Price Group XX**

Structural Engineering and Structural Sections Sectional Committee, CED 07

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Structural Engineering and Structural Sections Sectional Committee had been approved by the Civil Engineering Division Council.

Bulb angles, bulb flats and ‘L’ sections are generally used in shipbuilding industries. In the preparation of this standard the Sectional Committee specially kept in view the requirements of these industries.

**Bureau of Indian Standards** had published standards for dimensions and tolerances for bulb angles, bulb flats and ‘L’ sections as follows:

|  |  |
| --- | --- |
| IS 1252 : 1991 | Hot rolled steel bulb angles ― Dimensions (*first revision*) |
| IS 1863 : 1979 | Specification for rolled steel bulb flats (*first revision*) |
| IS 1864 : 1979 | Specification for hot rolled steel ‘L’ sections for shipbuilding (*first revision*) |

In this revision, in view of the recent developments that have taken place, the Committee viewed that these standards be revised and merged into one standard. The merger will facilitate better access of the sectional details under one resource document. The following additional modifications have been effected in this revision:

1. References clause has been updated;
2. Dimensions and sectional properties values of section has been updated; and
3. Provision relating to customization of sizes has been added.

In the formulation of this standard, assistance has been derived from EN 10067 : 1996 ‘Hot rolled bulb flats —Dimensions and tolerances on shape, dimensions and mass.

This standard also aims at satisfying some Sustainable Development Goals by United Nations, especially Goal 9 ‘Industry, innovation and infrastructure’, particularly its target **9.1**.

The composition of the Committee responsible for the formulation of this standard is given in Annex A.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the results of a test or analysis, shall be rounded off in accordance with IS 2 : 2022 ‘Rules for rounding off numerical values (*second revision*)’. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

*Indian Standard*

HOT ROLLED STEEL SECTIONS FOR SHIPBUILDING — DIMENSIONS AND TOLERANCES

**1 SCOPE**

This standard specifies the nominal dimensions, mass and sectional properties and dimensional tolerances of hot rolled steel bulb angles, bulb flats, ‘L’ sections for shipbuilding.

**2 REFERENCE**

The standards given below contain provisions which through reference in this text, constitute provision of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of these standards:

|  |  |
| --- | --- |
| *IS No.* | *Title* |
| IS 808 : 2021 | Hot rolled steel beam, column, channel and angle sections — Dimensions and properties (*fourth revision*) |
| IS 1852 : 1985 | Specification for rolling and cutting tolerances for hot-rolled steel products ­(*fourth revision*) |
| IS 2062 : 2011 | Hot rolled medium and high tensile structural steel — Specification (*seventh revision*) |
| IS 3039 : 2024 | Structural steel for ship construction — Specification (*third revision*) |

**3 TERMINOLOGY**

For the purpose of this standard, the definitions given in IS 2062 and the following shall apply.

**3.1 U-U and V-V Axis** — Lines passing through the centre of gravity of the profile of the section, representing the principal axes of the section where U-U is the major axis and V-V is the minor axis.

**3.2 Y-Y Axis** — A line passing through the centre of gravity of the profile of the sections and parallel to the axis of the web.

**3.3 Z-Z Axis** — A line passing through the centre of gravity of the profile along the length of the of the sections.

**4 MATERIAL**

The bulb flats may be manufactured from steel conforming to IS 2062 and IS 3039 as appropriate.

NOTE — As these sections are intended mainly to be used in shipbuilding, the steel shall, when so required, conform to the specification quoted by the purchaser.

**5 SYMBOLS**

Letter symbols used in this standard have been indicated in the figure in Table 1. More explicit definitions for certain symbols used in the table and figure are given below:

|  |  |  |
| --- | --- | --- |
| *a* | = | Sectional area in mm2 |
| *C*yy | = | Distance of centre of gravity of the section from the back line of the flange |
| *C*zz | = | Distance of centre of gravity of the section from the back line of the flange |
| *D* | = | Projection of the bulb from the inside face of the web |
| *e*yy | = | Distance of extreme fibre from the *Y*-*Y* axis |
| *e*zz | = | Distance of extreme fibre from the *Z*-*Z* axis |
| *I*uu | = | Moment of inertia (*Max*) about the *U*-*U* axis |
| *I*vv | = | Moment of inertia (*Max*) about the *V*-*V* axis |
| *I*yy | = | Moment of inertia about the *Y*-*Y* axis |
| *I*zz | = | Moment of inertia ab out the *Z*-*Z* axis |
| *m* | = | Nominal mass in kg per m = 0.785 a |
| *r*uu | = | $\sqrt{\frac{I\_{uu}}{a}}= $Radius of gyration about the *U*-*U* axis |
| *r*vv | = | $\sqrt{\frac{I\_{vv}}{a}}= $Radius of gyration about the *V*-*V* axis |
| *r*yy | = | $\sqrt{\frac{I\_{yy}}{a}}= $Radius of gyration about the *Y*-*Y* axis |
| *R*zz | = | $\sqrt{\frac{I\_{zz}}{a}}= $Radius of gyration about the *Z*-*Z* axis |
| *Z*yy | = | $\frac{I\_{yy}}{C\_{yy}}=$ Modulus of section about *Y*-*Y* axis |
| *Z*zz | = | $\frac{I\_{zz}}{C\_{zz}}= $Modulus of section about *Z*-*Z* axis |
| α | = | Angle between the *U*-*U* axis and *Z*-*Z* axis |

**6 DESIGNATION**

**6.1** Hot rolled steel bulb angles conforming to this standard shall be designated by letters BA followed by a figure denoting the depth of longer side of the angle in mm \* and \*\* to denote heavier sections.

**6.2** The bulb flats conforming to theis standard shall be designated by the width (*b*) and thickness (*t*).

*Example*: 200 × 10

**6.3** ‘L’ Angle sections with unequal width and thickness shall be designated by the alphabet ‘L’ followed by height of web (H), width of flange (B), thickness of web (t) and thickness of flange (T).

*Example*: L 250 × 90 × 9 × 13

**7 DIMENSIONS**

**7.1** The dimensions and mass of bulb angle sections shall be as given in Fig. 1 and Table 1. Sectional properties of the bulb angle sections have been given in Table 1 for information.

NOTE — A new range of sections suiting to the need of the design requirements can be produced based on the formulae to calculate the geometrical sectional properties as per Annex A and Annex B of IS 808 that fulfils the design criteria or as agreed between purchaser and user.

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Fig. 1 Hot Rolled Steel Bulb Angle

**7.2** The dimensions and mass of bulb flat sections shall be as given in Fig. 2 and Table 2. Sectional properties of the bulb flat sections have been given in Table 2 for information.

NOTE — Other sections of bulb flats may also be manufactured by mutual arrangement between the supplier and the manufacturer subject to the tolerances given in this standard.



Fig. 2 Typical Bulb Flat

**7.3** The dimensions and mass of ‘L’ sections shall be as given Fig. 3 and Table 3. Sectional properties of ‘L’ sections have been given in Table 3 for information.

NOTE — Other sections of bulb flats may also be manufactured by mutual arrangement between the supplier and the manufacturer subject to the tolerances given in this standard.



Fig. 3 Typical ‘L’ Section

**Table 1 Nominal Dimensions, Mass and Sectional Properties of Bulb Angles**

(*Clauses* 5 *and* 7.1)

| **Sl No.** | **Designation** | **Mass per****Meter** | **Sectional****Area** | **Size** | **Thickness of web** | **Thickness flange** | **(D)** | **Radius at Root** | **Radius at Toe** | **Radius at Bulb Corners** | **Centre of gravity** | **Distance of Extreme Fibres** | **Tan α** | **Moment of Inertia** | **Radii of Gyration** | **Moduli of Section** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  | a |  | *t*w | *t*f |  | *r*1 | *r*2 | *r*3 | *C*zz | *C*yy | *t*zz | *t*yy |  | *I*zz | *I*yy | *I*zz(*Max*) | *I*yy (*Min*) | *r*zz | *r*yy | *r*uu(*Max*) | *r*vv(*Min*) | *Z*zz | *Z*yy |
|  |  | kg | 100\*mm2 | mm × mm | mm | mm | mm | mm | mm | mm | cm | cm | cm | cm |  | cm4 | cm4 | cm4 | cm4 | cm | cm | cm | cm | cm3 | cm3 |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) | (13) | (14) | (15) | (16) | (17) | (18) | (19) | (20) | (21) | (22) | (23) | (24) | (25) | (26) |
| i) | BA 100 | 8.6 | 10.94 | 100 × 65 | 6.0 | 6.0 | 13 | 10.0 | 5.0 | 4.0 | 3.92 | 1.43 | 6.08 | 5.07 | 0.291 | 143 | 33.0 | 153 | 22.8 | 3.61 | 1.74 | 3.74 | 1.44 | 23.5 | 6.5 |
| ii) | BA 100\* | 9.6 | 12.17 | 100 × 65 | 7.0 | 6.5 | 13 | 10.0 | 5.0 | 4.0 | 3.95 | 1.43 | 6.05 | 5.07 | 0.288 | 155 | 35.7 | 165 | 24.9 | 3.56 | 1.71 | 3.69 | 1.43 | 25.6 | 7.0 |
| iii) | BA 125 | 12.2 | 15.60 | 125 × 75 | 7.0 | 7.0 | 16 | 11.0 | 5.5 | 5.0 | 5.06 | 1.60 | 7.44 | 5.90 | 0.248 | 322 | 60.4 | 339 | 43.3 | 4.54 | 1.97 | 4.66 | 1.67 | 43.2 | 10.2 |
| iv) | BA 125\* | 13.4 | 17.11 | 125 × 75 | 8.0 | 7.5 | 16 | 11.0 | 5.5 | 5.0 | 5.08 | 1.61 | 7.42 | 5.89 | 0.246 | 344 | 64.6 | 362 | 46.6 | 4.49 | 1.94 | 4.60 | 1.65 | 46.4 | 11.0 |
| v) | BA 150 | 16.1 | 20.45 | 150 × 75 | 8.0 | 8.0 | 20 | 11.0 | 5.5 | 6.0 | 6.52 | 1.55 | 8.48 | 5.95 | 0.167 | 613 | 71.4 | 628 | 55.9 | 5.47 | 1.87 | 5.54 | 1.65 | 72.2 | 12.0 |
| vi) | BA 150\* | 18.8 | 23.94 | 150 × 75 | 10.0 | 9.0 | 20 | 11.0 | 5.5 | 6.0 | 6.53 | 1.57 | 8.47 | 5.93 | 0.162 | 686 | 79.8 | 703 | 63.4 | 5.36 | 1.83 | 5.42 | 1.63 | 81.1 | 13.5 |
| vii) | BA 175 | 20.0 | 25.54 | 175 × 90 | 8.0 | 9.0 | 23 | 13.5 | 6.5 | 7.0 | 7.44 | 1.89 | 10.06 | 7.11 | 0.185 | 1 070 | 137 | 1 110 | 104 | 6.48 | 2.32 | 6.58 | 2.02 | 107 | 19.3 |
| viii) | BA 175\* | 23.3 | 29.66 | 175 × 90 | 10.0 | 10.0 | 23 | 13.5 | 6.5 | 7.0 | 7.46 | 1.90 | 10.04 | 7.10 | 0.181 | 1 190 | 152 | 1 230 | 117 | 6.34 | 2.27 | 6.43 | 1.99 | 119 | 21.4 |
| ix) | BA 175\*\* | 26.5 | 33.74 | 175 × 90 | 12.0 | 11.0 | 23 | 13.5 | 6.5 | 7.0 | 7.49 | 1.92 | 10.01 | 7.08 | 0.177 | 1 310 | 166 | 1 350 | 130 | 6.23 | 2.22 | 6.32 | 1.96 | 131 | 23.5 |
| x) | BA 200 | 28.2 | 35.95 | 200 × 90 | 11.0 | 11.0 | 26 | 13.5 | 6.5 | 8.0 | 8.87 | 1.86 | 11.13 | 7.14 | 0.136 | 1 880 | 172 | 1 910 | 140 | 7.23 | 2.19 | 7.29 | 1.97 | 169 | 24.1 |
| xi) | BA 200\* | 33.6 | 42.76 | 200 × 90 | 14.0 | 12.5 | 26 | 13.5 | 6.5 | 8.0 | 8.89 | 1.91 | 11.11 | 7.09 | 0.131 | 2 130 | 194 | 2 160 | 160 | 7.06 | 2.13 | 7.12 | 1.93 | 192 | 27.3 |
| xii) | BA 225 | 31.4 | 39.94 | 225 × 90 | 11.0 | 11.0 | 29 | 13.5 | 6.5 | 9.0 | 10.4 | 1.80 | 12.10 | 7.20 | 0.103 | 2 660 | 179 | 2 690 | 152 | 8.17 | 2.12 | 8.21 | 1.95 | 220 | 24.9 |
| xiii) | BA 225\* | 37.3 | 47.50 | 225 × 90 | 14.0 | 12.5 | 29 | 13.5 | 6.5 | 9.0 | 10.4 | 1.85 | 12.13 | 7.15 | 0.098 | 3 020 | 202 | 3 040 | 175 | 7.97 | 2.06 | 8.01 | 1.92 | 249 | 28.2 |
| xiv) | BA 250 | 34.9 | 44.41 | 250 × 90 | 11.0 | 11.0 | 33 | 13.5 | 6.5 | 10.0 | 12.1 | 1.78 | 12.93 | 7.22 | 0.075 | 3 680 | 188 | 3 700 | 168 | 9.11 | 2.06 | 9.13 | 1.95 | 285 | 26.0 |
| xv) | BA 250\* | 39.2 | 49.96 | 250 × 90 | 13.0 | 12.0 | 33 | 13.5 | 6.5 | 10.0 | 12.0 | 1.81 | 13.01 | 7.19 | 0.072 | 4 010 | 205 | 4 030 | 185 | 8.96 | 2.02 | 8.98 | 1.92 | 308 | 28.5 |
| xvi) | BA 275 | 40.9 | 52.13 | 275 × 90 | 12.0 | 12.0 | 36 | 13.5 | 6.5 | 11.0 | 13.5 | 1.80 | 13.93 | 7.21 | 0.057 | 5 160 | 213 | 5 180 | 197 | 9.95 | 2.02 | 9.97 | 1.94 | 370 | 29.6 |
| xvii) | BA 275\* | 45.6 | 58.15 | 300 × 90 | 14.0 | 13.0 | 36 | 13.5 | 6.5 | 11.0 | 13.4 | 1.83 | 14.05 | 7.17 | 0.054 | 5 580 | 231 | 5 600 | 215 | 9.80 | 1.99 | 9.81 | 1.92 | 397 | 32.2 |
| xviii) | BA 300 | 47.5 | 60.47 | 275 × 90 | 13.0 | 13.0 | 39 | 13.5 | 6.5 | 12.0 | 15.0 | 1.82 | 15.02 | 7.18 | 0.042 | 7 030 | 241 | 7 050 | 229 | 10.8 | 2.00 | 10.8 | 1.95 | 468 | 33.6 |
| xix) | BA 300\* | 52.6 | 66.96 | 300 × 90 | 15.0 | 14.0 | 39 | 13.5 | 6.5 | 12.0 | 14.9 | 1.86 | 15.08 | 7.14 | 0.040 | 7 570 | 260 | 7 580 | 248 | 10.6 | 1.97 | 10.6 | 1.92 | 502 | 36.4 |
| NOTE — Sections carrying with \* and \*\* in the designation are heavier sections in each size obtained from the same set of rolls as the lighter sections by spreading of the rolls. The width of flanges of these difference between of the webs. Therefore, while ordering these heavier sections, mass should be mentioned. |

| **Table 2 Bulb Flats — Dimensions and Sectional Properties about X-X Axis**(*Clauses* 7.2 *and* 8.2.5) |
| --- |
| **Sl No.** | **Dimension** | **Mass** | **SectionalArea** |  | **Dimensions** |  | **Surface Area** | **Centroid** | **Sectional Properties** |
| *b* | *t* | *c* | *r*1 |  | *C*x | *I*x | *Z*x |
| kg/m | cm2 | mm | mm | mm | mm | m2/m  | mm | cm2 | cm2 |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
|  | 60 x 4 | 2.81 | 3.58 | 60 | 4 | 13 | 3.5 | 0.146 | 3.82 | 12.2 | 3.20 |
|  | 60 x 5 | 3.28 | 4.18 | 60 | 5 | 13 | 3.5 | 0.148 | 3.70 | 14.4 | 3.89 |
|  | 60 x 6 | 3.75 | 4.78 | 60 | 6 | 13 | 3.5 | 0.150 | 3.62 | 16.4 | 4.55 |
|  | 80 x 5 | 4.25 | 5.41 | 80 | 5 | 14 | 4 | 0.189 | 4.90 | 33.87 | 6.91 |
|  | 80 x 6 | 4.87 | 6.20 | 80 | 6 | 14 | 4 | 0.192 | 4.78 | 39.0 | 8.15 |
|  | 80 x 7 | 5.10 | 7.00 | 80 | 7 | 14 | 4 | 0.194 | 4.69 | 43.1 | 9.24 |
|  | 80 x 8 | 6.12 | 7.80 | 80 | 8 | 14 | 4 | 0.196 | 4.62 | 48.0 | 10.39 |
|  | 100 x 6 | 6.08 | 7.74 | 100 | 6 | 15.5 | 4.5 | 0.234 | 5.98 | 76.1 | 12.7 |
|  | 100 x 7 | 6.86 | 8.74 | 100 | 7 | 15.5 | 4.5 | 0.236 | 5.87 | 85.3 | 14.5 |
|  | 100 x 8 | 7.65 | 9.74 | 100 | 8 | 15.5 | 4.5 | 0.238 | 5.78 | 94.3 | 16.3 |
|  | 120 x 6 | 7.32 | 9.32 | 120 | 6 | 17 | 5 | 0.276 | 7.21 | 133 | 18.5 |
|  | 120 x 7 | 8.25 | 10.1 | 120 | 7 | 17 | 5 | 0.278 | 7.07 | 148 | 21.0 |
|  | 120 x 8 | 9.19 | 11.7 | 120 | 8 | 17 | 5 | 0.280 | 6.96 | 164 | 23.6 |
|  | 140 x 7 | 9.74 | 12.4 | 140 | 7 | 19 | 5.5 | 0.320 | 8.31 | 241 | 29.0 |
|  | 140 x 8 | 10.8 | 13.8 | 140 | 8 | 19 | 5.5 | 0.322 | 8.18 | 268 | 32.5 |
|  | 140 x 9 | 11.9 | 15.2 | 140 | 9 | 19 | 5.5 | 0.324 | 8.07 | 291 | 36.0 |
|  | 140 x 10 | 13.1 | 16.6 | 140 | 10 | 19 | 5.5 | 0.326 | 7.92 | 316 | 39.8 |
|  | 160 x 7 | 11.4 | 14.6 | 160 | 7 | 22 | 6 | 0.365 | 9.66 | 373 | 38.6 |
|  | 160 x 8 | 12.7 | 16.2 | 160 | 8 | 22 | 6 | 0.367 | 9.49 | 411 | 43.3 |
|  | 160 x 9 | 14.0 | 17.8 | 160 | 9 | 22 | 6 | 0.169 | 9.16 | 448 | 47.9 |
|  | 160 x 10 | 15.3 | 18.4 | 160 | 10 | 22 | 6 | 0.371 | 9.93 | 485 | 52.5 |
|  | 180 x 8 | 14.8 | 18.9 | 180 | 8 | 25 | 7 | 0.411 | 10.9 | 609 | 55.0 |
|  | 180 x 9 | 16.2 | 20.7 | 180 | 9 | 25 | 7 | 0.413 | 10.7 | 663 | 61.8 |
|  | 180 x 10 | 17.6 | 22.5 | 180 | 10 | 25 | 7 | 0.415 | 10.6 | 717 | 67.8 |
|  | 180 x 11 | 19.04 | 24.26 | 180 | 11 | 25 | 7 | 0.417 | 10.47 | 770 | 73.5 |
|  | 200 x 9 | 18.5 | 23.6 | 200 | 9 | 28 | 8 | 0.457 | 12.1 | 841 | 77.7 |
|  | 200 x 10 | 20.1 | 25.6 | 200 | 10 | 28 | 8 | 0.459 | 11.9 | 1 021 | 85.0 |
|  | 200 x 11 | 21.74 | 27.66 | 200 | 11 | 28 | 8 | 0.461 | 11.82 | 1091 | 92.3 |
|  | 200 x 11.5 | 22.5 | 28.6 | 200 | 11.5 | 28 | 8 | 0.462 | 11.7 | 1 130 | 96.2 |
|  | 200 x 12 | 23.28 | 29.66 | 200 | 12 | 28 | 8 | 0.463 | 11.69 | 1164 | 99.5 |
|  | 220 x 9 | 21.0 | 26.8 | 220 | 9 | 31 | 9 | 0.50 | 13.6 | 1 300 | 95.3 |
|  | 220 x 10 | 22.8 | 29.0 | 220 | 10 | 31 | 9 | 0.503 | 13.4 | 1 400 | 105 |
|  | 220 x 11 | 24.5 | 31.2 | 220 | 11 | 31 | 9 | 0.506 | 13.19 | 1496 | 114 |
|  | 220 x 12 | 26.22 | 33.4 | 220 | 12 | 31 | 9 | 0.507 | 13.04 | 1595 | 122 |
|  | 240 x 10 | 25.4 | 32.4 | 240 | 10 | 34 | 10 | 0.547 | 14.7 | 1 860 | 126 |
|  | 240 x 11 | 27.4 | 34.9 | 240 | 11 | 34 | 10 | 0.549 | 14.6 | 2 000 | 137 |
|  | 240 x 12 | 29.3 | 37.3 | 240 | 12 | 34 | 10 | 0.551 | 14.4 | 2 130 | 148 |
|  | 260 x 10 | 28.3 | 36.1 | 260 | 10 | 37 | 11 | 0.593 | 16.2 | 2 470 | 153 |
|  | 260 x 11 | 30.3 | 38.7 | 260 | 11 | 37 | 11 | 0.593 | 16.0 | 2 610 | 162 |
|  | 260 x 12 | 32.4 | 41.3 | 260 | 12 | 37 | 11 | 0.595 | 15.8 | 2 770 | 175 |
|  | 280 x 10 | 30.3 | 39.8 | 280 | 10 | 40 | 12 | 0.635 | 17.8 | 3 130 | 178 |
|  | 280 x 11 | 33.5 | 42.6 | 280 | 11 | 40 | 12 | 0.637 | 17.4 | 3 330 | 191 |
|  | 280 x 12 | 35.7 | 45.5 | 280 | 12 | 40 | 12 | 0.639 | 17.2 | 3 550 | 206 |
|  | 280 x 13 | 37.9 | 48.28 | 280 | 13 | 40 | 12 | 0.641 | 17.04 | 3757 | 221 |
|  | 300 x 11 | 36.7 | 46.7 | 300 | 11 | 43 | 13 | 0.681 | 18.9 | 4 190 | 222 |
|  | 300 x 12 | 39.0 | 49.7 | 300 | 12 | 43 | 13 | 0.683 | 18.7 | 4 460 | 239 |
|  | 300 x 13 | 41.5 | 52.8 | 300 | 13 | 43 | 13 | 0.685 | 18.5 | 4 720 | 256 |
|  | 320 x 12 | 42.5 | 54.2 | 320 | 12 | 46 | 14 | 0.728 | 20.1 | 5 530 | 274 |
|  | 320 x 13 | 45.0 | 57.4 | 320 | 13 | 46 | 14 | 0.730 | 19.9 | 5 850 | 294 |
|  | 320 x 14 | 47.6 | 60.85 | 320 | 14 | 46 | 14 | 0.732 | 19.68 | 6 168 | 313 |
|  | 340 x 12 | 46.1 | 58.8 | 340 | 12 | 49 | 15 | 0.772 | 21.5 | 6 760 | 313 |
|  | 340 x 13 | 48.86 | 62.24 | 340 | 13 | 49 | 15 | 0.774 | 21.34 | 7 152 | 335 |
|  | 340 x 14 | 51.5 | 65.5 | 340 | 14 | 49 | 15 | 0.776 | 21.1 | 7 540 | 357 |
|  | 340 x 15 | 54.2 | 69.2 | 340 | 15 | 49 | 15 | 0.778 | 20.9 | 7 920 | 379 |
|  | 370 x 13 | 54.6 | 69.6 | 370 | 13 | 53.5 | 16.5 | 0.840 | 23.5 | 9 470 | 402 |
|  | 370 x 14 | 57.60 | 73.40 | 370 | 14 | 53.5 | 16.5 | 0.842 | 23.29 | 9 980 | 429 |
|  | 370 x 15 | 60.5 | 77.0 | 370 | 15 | 53.5 | 16.5 | 0.844 | 23.0 | 10 400 | 455 |
|  | 370 x 16 | 63.5 | 80.7 | 370 | 16 | 53.5 | 16.5 | 0.886 | 22.8 | 11 000 | 481 |
|  | 400 x 14 | 63.9 | 81.4 | 400 | 14 | 58 | 18 | 0.908 | 25.5 | 12 900 | 507 |
|  | 400 x 15 | 67.10 | 85.48 | 400 | 15 | 58 | 18 | 0.910 | 25.24 | 13 573 | 538 |
|  | 400 x 16 | 70.2 | 89.48 | 400 | 16 | 58 | 18 | 0.912 | 25.0 | 14 200 | 568 |
|  | 430 x 14 | 70.6 | 89.70 | 430 | 14 | 58 | 18 | 0.975 | 27.7 | 16 460 | 594 |
|  | 430 x 15 | 73.9 | 94.1 | 430 | 15 | 62.5 | 19.5 | 0.976 | 27.4 | 17 300 | 628 |
|  | 430 x 17 | 80.6 | 103 | 430 | 17 | 62.5 | 19.5 | 0.980 | 26.9 | 18 900 | 700 |
|  | 430 x 19 | 87.4 | 111.4 | 430 | 19 | 62.5 | 19.5 | 0.984 | 26.53 | 20 413 | 770 |
|  | 430 x 20 | 90.8 | 115.0 | 430 | 20 | 62.5 | 19.5 | 0.986 | 26.30 | 21 180 | 804 |

| **Table 3 ‘L’ Sections — Dimensions and Sectional Properties**(*Clauses* 7.3 *and* 8.3.8) |
| --- |
| **Sl No.** | **Designation** | **Mass** | **Dimensions** | **Sectional Area** | **Centroid** | **Moment of Inertia** 𝑰𝒙 |
| *H* | *B* | *t* | *T* | *R* | *r* |
| kg/m | mm | mm | mm | mm | mm | mm | cm2 | cm2 | cm4 |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
|  | L 75 × 50 × 6 × 8 | 6.25 | 75 | 50 | 6 | 8 | 6.5 | 4 | 8.0 | 2.20 | 48.0 |
|  | L 100 × 50 × 8 × 10 | 11.0 | 100 | 65 | 8 | 10 | 11 | 5.5 | 13.7 | 3.13 | 137 |
|  | L 100 × 75 × 12 × 15 | 16.8 | 100 | 75 | 12 | 15 | 11 | 5.5 | 21.4 | 3.13 | 197 |
|  | L 125 × 75 × 10 × 12 | 15.8 | 125 | 75 | 10 | 12 | 13.5 | 6.5 | 20.3 | 4.08 | 917 |
|  | L 150 × 90 × 14 × 18 | 27.0 | 150 | 90 | 14 | 18 | 13.5 | 6.5 | 34.6 | 5.02 | 742 |
|  | L 200 × 90 × 8 × 14 | 21.8 | 200 | 90 | 8 | 14 | 14 | 7 | 27.8 | 6.07 | 1 120 |
|  | L 200 × 90 × 9 × 12 | 22.0 | 200 | 90 | 9 | 12 | 15 | 7.5 | 28.1 | 6.63 | 1 160 |
|  | L 200 × 90 × 9 × 14 | 23.3 | 200 | 90 | 9 | 14 | 14 | 7 | 29.66 | 6.36 | 1 210 |
|  | L 200 × 90 × 10 × 14 | 24.7 | 200 | 90 | 10 | 14 | 14 | 7 | 31.52 | 6.61 | 1 300 |
|  | L 225 × 90 × 9 × 12 | 23.8 | 225 | 90 | 9 | 12 | 15 | 7.5 | 30.3 | 7.71 | 1 610 |
|  | L 225 × 90 × 10.5 × 14 | 27.6 | 225 | 90 | 10.5 | 14 | 15 | 7.5 | 35.1 | 7.80 | 1 850 |
|  | L 225 × 90 × 10 × 15 | 29.4 | 250 | 90 | 10 | 15 | 15 | 7.5 | 37.5 | 8.61 | 2 440 |
|  | L 250 × 90 × 9 × 13 | 26.2 | 250 | 90 | 9 | 13 | 15 | 7.5 | 33.4 | 8.64 | 2 190 |
|  | L 250 × 90 × 9 × 14 | 26.9 | 250 | 90 | 9 | 14 | 17 | 8.5 | 34.31 | 8.46 | 2 240 |
|  | L 250 × 90 × 9 × 15 | 27.6 | 250 | 90 | 9 | 15 | 17 | 8.5 | 35.12 | 8.30 | 2 280 |
|  | L 250 × 90 × 10 × 15 | 29.4 | 250 | 90 | 10 | 15 | 17 | 8.5 | 37.47 | 8.61 | 2 440 |
|  | L 250 × 90 × 10.5 × 15 | 30.3 | 250 | 90 | 10.5 | 15 | 15 | 7.5 | 38.5 | 8.76 | 2 510 |
|  | L 250 × 90 × 11 × 16 | 31.9 | 250 | 90 | 11 | 16 | 17 | 8.5 | 40.61 | 8.74 | 2 640 |
|  | L 250 × 90 × 11.5 × 16 | 32.7 | 250 | 90 | 11.5 | 16 | 15 | 7.5 | 41.7 | 8.90 | 2 710 |
|  | L 250 × 90 × 12 × 16 | 33.7 | 250 | 90 | 12 | 16 | 17 | 8.5 | 42.95 | 8.99 | 2 790 |
|  | L 275 × 100 × 10.5 × 14 | 32.8 | 275 | 100 | 10.5 | 14 | 15 | 7.5 | 41.8 | 9.72 | 3 330 |
|  | L 275 × 100 × 11.5 × 15 | 35.5 | 275 | 100 | 11.5 | 15 | 15 | 7.5 | 45.3 | 9.84 | 3 500 |
|  | L 300 × 90 × 10 × 16 | 34.1 | 300 | 90 | 10 | 16 | 19 | 9.5 | 43.38 | 10.6 | 4 100 |
|  | L 300 × 90 × 11 × 16 | 36.3 | 300 | 90 | 11 | 16 | 19 | 9.5 | 46.22 | 11.0 | 4 370 |
|  | L 300 × 90 × 12 × 17 | 39.1 | 300 | 90 | 12 | 17 | 19 | 9.5 | 49.84 | 11.1 | 4 690 |
|  | L 300 × 90 × 13 × 17 | 41.3 | 300 | 90 | 13 | 17 | 19 | 9.5 | 52.67 | 11.3 | 4 940 |
|  | L 300 × 100 × 10.5 × 15 | 35.6 | 300 | 100 | 10.5 | 15 | 15 | 7.5 | 45.3 | 10.6 | 4 290 |
|  | L 300 × 100 × 11.5 × 16 | 38.5 | 300 | 100 | 11.5 | 16 | 15 | 7.5 | 49.0 | 10.7 | 4 630 |
|  | L 325 × 120 × 10.5 × 14 | 39.3 | 325 | 120 | 10.5 | 14 | 20 | 10 | 50.1 | 11.3 | 5 600 |
|  | L 325 × 120 × 11.5 × 15 | 42.6 | 325 | 120 | 11.5 | 15 | 20 | 10 | 54.3 | 11.4 | 6 060 |
|  | L 330 × 120 × 10.5 × 16 | 43.1 | 330 | 120 | 10.5 | 16 | 20 | 10 | 54.9 | 12.0 | 7 110 |
|  | L 350 × 100 × 11 × 17 | 42.7 | 350 | 100 | 11 | 17 | 22 | 11 | 54.41 | 12.7 | 7 030 |
|  | L 350 × 100 × 12 × 17 | 45.3 | 350 | 100 | 12 | 17 | 22 | 11 | 57.74 | 13.0 | 7 440 |
|  | L 350 × 120 × 11.5 × 18 | 47.4 | 350 | 120 | 11.5 | 18 | 20 | 10 | 60.4 | 12.0 | 7 780 |
|  | L 375 × 120 × 10.5 × 18 | 46.9 | 375 | 120 | 10.5 | 18 | 20 | 10 | 59.7 | 12.7 | 8 850 |
|  | L 375 × 120 × 11.5 × 20 | 51.4 | 375 | 120 | 11.5 | 20 | 20 | 10 | 65.4 | 12.7 | 9 650 |
|  | L 400 × 100 × 11.5 × 16 | 47.9 | 400 | 100 | 11.5 | 16 | 24 | 12 | 61.09 | 15.3 | 10 300 |
|  | L 400 × 100 × 11.5 × 16 | 50.8 | 400 | 100 | 12 | 18 | 24 | 12 | 64.77 | 15.1 | 10 900 |
|  | L 400 × 100 × 11.5 × 16 | 53.8 | 400 | 100 | 13 | 18 | 24 | 12 | 68.59 | 15.4 | 11 500 |
|  | L 400 × 100 × 13 × 18 | 53.8 | 400 | 100 | 13 | 18 | 24 | 12 | 68.6 | 15.4 | 11500 |
|  | L 400 × 120 × 11.5 × 23 | 56.2 | 400 | 120 | 11.5 | 23 | 20 | 10 | 71.6 | 13.3 | 11 900 |
|  | L 400 × 120 × 12.5 × 25 | 60.8 | 400 | 120 | 12.5 | 25 | 20 | 10 | 77.5 | 13.4 | 12 900 |
|  | L 425 × 120 × 11.5 × 24 | 59.3 | 425 | 120 | 11.5 | 24 | 20 | 10 | 75.5 | 14.2 | 14 200 |
|  | L 425 × 120 × 12.5 × 26 | 64.1 | 425 | 120 | 12.5 | 26 | 20 | 10 | 81.7 | 14.3 | 15 400 |
|  | L 450 × 120 × 11.5 × 25 | 62.4 | 450 | 120 | 11.5 | 25 | 20 | 10 | 89.5 | 15.1 | 16 800 |
|  | L 450 × 125 × 11.5 × 25 | 57.4 | 450 | 125 | 11.5 | 18 | 24 | 12 | 73.11 | 16.2 | 15 700 |
|  | L 450 × 120 × 12.5 × 27 | 67.4 | 450 | 120 | 12.5 | 27 | 20 | 10 | 85.9 | 15.2 | 18 200 |
|  | L 475 × 120 × 11.5 × 28 | 67.2 | 475 | 120 | 11.5 | 28 | 20 | 10 | 85.6 | 15.7 | 20 100 |
|  | L 475 × 120 × 12.5 × 30 | 72.4 | 475 | 120 | 12.5 | 30 | 20 | 10 | 92.2 | 15.9 | 21 600 |
|  | L 500 × 120 × 11.5 × 30 | 71.2 | 450 | 120 | 11.5 | 30 | 20 | 10 | 90.7 | 16.4 | 23 600 |
|  | L 500 × 120 × 12.5 × 33 | 77.4 | 500 | 120 | 12.5 | 33 | 20 | 10 | 98.6 | 16.5 | 25 500 |
|  | L 500 × 120 × 13.5 × 35 | 82.8 | 500 | 120 | 13.5 | 35 | 20 | 10 | 105 | 16.6 | 27 100 |

**8**  **TOLERANCES**

**8.1** **For Bulb Angles**

The rolling and cutting tolerances for bulb angles shall be as stipulated in IS 1852.

**8.2** **For Bulb Flats**

**8.2.1** *Width and Thickness*

Tolerances on width and thickness shall be as given in Table 4.

**Table 4 Tolerances on Width and Thickness**

(*Clause* 8.2.1)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sl No.** | **Width**, *b* | **Thickness**, *t* | **Tolerance on Width** | **Tolerance on Thickness** |
| Over | Up to and Including | Including and Over | Up to and Including |   | Over | Under |
| mm | mm | mm | mm | mm | mm | mm |
| (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| i) | – | 120 | 4.0 | 8.0 | ± 1.5 | + 0.7 | - 0.3 |
| ii) | 120 | 180 | 7.0 | 11.0 | ± 2.0 | + 1.0 | - 0.3 |
| iii) | 180 | 300 | 9.0 | 13.0 | ± 3.0 | + 1.0 | - 0.4 |
| iv) | 300 | 430 | 12.0 | 20.0 | ± 4.0 | + 1.2 | - 0.4 |

**8.2.2** *Radius at Corner*

The radius of curvature *r*2 at corners shall be within the limits given in Table 5.

**Table 5 Radius at Corner**

(*Clause* 8.2.2)

|  |  |  |
| --- | --- | --- |
| **Sl No.** | **Thickness** | **Radius of Curvature** (*r*2), *Max* |
| Over | Up to and Including |
| mm | mm | mm |
| (1) | (2) | (3) | (4) |
| i) | – | 6 | 1.5 |
| ii) | 6 | 9 | 2.0 |
| iii) | 9 | 13 | 3.0 |
| iv) | 13 | 17 | 4.0 |

**8.2.3** *Straightness*

The maximum permissible variation in straightness when measured over the entire length shall be
 0.003 5 × length.

**8.2.4** *Length*

The cutting tolerance on length shall be ± $\frac{+ 100}{- 0}$ mm. The bulb flats may be supplied to tighter length tolerances subject to agreement between the purchaser and the supplier.

**8.2.5** *Weight*

The tolerance on weight shall be ± 2.5 percent of the mass per unit length of sections given in Table 2.

**8.2.6** *Flatness*

**8.2.6.1** The plate flatness tolerance, *h* is 0.3 percent of the bulb flat width b and is measured as shown below and in Fig. 4.

Plate flatness tolerance: *h* ≤ 0.003 × *b*



Fig. 4 Plate Flatness Tolerance of Bulb Flat

**8.2.6.2** The bulb flatness tolerance of the heel is n measured as shown below with a 2 mm maximum (*see* Fig. 5).

Bulb flatness tolerance: n ≤ 2.0 mm



Fig. 5 Bulb Flatness Tolerance of Bulb Flat

**8.3 For ‘L’ Section**

**8.3.1** *Height of Web* (*H*) *and Width of Flange* (*B*)

The tolerance on H and B shall be as given below:

|  |  |  |
| --- | --- | --- |
| *Sl No.* | *H* | *Tolerance on H and B* |
|  | mm | mm |
| (1) | (2) | (3) |
| i) | Up to and including 200 | ± 3 |
| ii) | Over 200 | ± 4 |

**8.3.2** *Web Thickness, t*

The tolerance on the thickness of web shall be $\frac{+ 1.6}{- 0.4}$ mm.

**8.3.3** *Flange Thickness*, *T*

The tolerance on the thickness of flange leg *T* shall be as given in Table 6.

**Table 6 Tolerance on Thickness of Flange**

(*Clause* 8.3.3)

|  |  |  |
| --- | --- | --- |
| **Sl No.** | **Thickness,** *T* | **Tolerance** |
|  |  | Over | Up to and Including | Over | Under |
| (1) | (2) | (3) | (4) | (5) |
| i) | – | 20 | + 2.0 | - 0.4 |
| ii) | 20 | 30 | + 2.0 | - 0.5 |
| iii) | 30 | 35 | + 2.5 | - 0.6 |

**8.3.4** *Straightness*

The maximum permissible variation in straightness when measured over the entire length shall be 0.003 × length (L), (*see* Fig. 6)



Fig. 6 Measurement of Straightness

**8.3.5** *Out of Square*

The legs shall be perpendicular to each other within a maximum deviation on 2.5 percent of B. The deviation shall be measured at the end of shorter leg (*see* Fig. 7).



Fig. 7 Measurement of out-of-Square

**8.3.6** *Flatness*

The tolerance on flatness of web shall be subject to agreement between the purchaser and the manufacturer. The deviation from flatness shall however be measured as shown in Fig. 8.



Fig. 8 Measurement of Deviation in Flatness of Web

**8.3.7** *Length*

The tolerance on length shall be $\frac{+100}{-0}$ mm. The angle sections may be supplied to tighter length tolerances subject to agreement between the purchaser and the supplier.

**8.3.8** *Mass*

The tolerance or mass shall be ± 2.5 percent of the mass per unit length given in Table 3.

**ANNEX A**

(*Foreword*)

**COMMITTEE COMPOSITION**

Structural Engineering Sectional Committee, CED 07

| *Organization* |  | *Representative(s)* |
| --- | --- | --- |
| In Personal Capacity, Chennai |  | Dr V. Kalyanaraman **(*Chairperson*)** |
| Ashwathnarayana & Eswara, Chennai |  | Shri H. E. Sriprakash Shastry |
| Bhilai Institute of Technology, Durg |  | Dr Mohan Kumar Gupta  |
| Central Electricity Authority, New Delhi |  | Shri A. K. Jain Director (Transmission) (*Alternate*)  |
| Central Public Works Department, New Delhi |  | Shri D. K. Garg Shri N. K. Bansal (*Alternate*)  |
| Construma Consultancy Pvt Ltd, Mumbai |  | Dr Harshavardhan Subbarao |
|  C.R. Narayana Rao, Architects & Engineers, Chennai |  | Dr C. N. Srinivasan Shri C. R. Arvind (*Alternate*)  |
| CSIR - Structural Engineering Research Centre, Chennai |  | Dr G. S. PalaniDr Napa Prasad Rao (*Alternate* I) Dr R. Balagopal (*Alternate* II)  |
|  |
| Engineers India Ltd, New Delhi |  | Shri Anurag SinhaDr Sudip Paul (*Alternate*)  |
| GAIL India Ltd, New Delhi |  | Shri S. Ashish Vaidya  |
| Indian Institute of Engineering Science and Technology, Shibpur |  | Dr Subrata ChackrabortyMs Chaitali Ray (*Alternate*)  |
| Indian Institute of Technology Delhi, New Delhi |  | Dr Dipti Ranjan SahooDr Alok Madan (*Alternate*)  |
| Institute for Steel Development & Growth, Kolkata |  | Shri Arijit GuhaShri Lakhamana Rao Pydi (*Alternate*)  |
| Jindal Steel & Power Ltd, Gurugram |  | Shri Sanjay Nandanwar |
| Larsen & Toubro Ltd, Chennai |  | Shri T. Venkatesh Rao  |
| MECON Ltd, Ranchi |  | Shri B. K. Pandey Shri J. K. Sarkar (*Alternate*)  |
| M. N. Dastur & Company Pvt Ltd, Kolkata |  | Shri Shuvendu ChattopadhyayShri Gargi Aditya Basu (*Alternate* I) Shrimati Mohua Chatterjee (*Alternate* II)  |
| NTPC Ltd, Noida |  | Shri Himanshu KunduShri Chander Shekhar (*Alternate*)  |
| Powergrid Corporation of India Limited, New Delhi |  | Shri AbhishekMs Sumana Mukherjee (*Alternate*)  |
| Ramboll India, Hyderabad |  | Shri D. Sankar Ganesh |
| Salasar Techno Engineering Ltd, Noida |  | Shri Dayanand K. |
| Steel Authority of India Limited, Ranchi |  | Shri Gautam Kumar MitraShri Deepak Rangarao (*Alternate*)  |
| STUP Consultants Pvt Ltd, Kolkata |  | Shri Anirban SenguptaShri Sumantra Sengupta (*Alternate* I) Shri Mandar Sardesai (*Alternate* II)  |
| Takalkar Power Engineering and Consultants Pvt Ltd, Vadodara |  | Shri S. M. TakalkarShri Shreedhar V. Rana (*Alternate*)  |
| Tata Consulting Engineers Ltd, Mumbai |  | Shri Pratip BhattacharyaShri T. Shriprasad (*Alternate*)  |
| The Institution of Engineers (India), Kolkata |  | Shri S. H. Jain  |
| In Personal Capacity, Chennai |  | Shri V. N. Heggade |
| In Personal Capacity, |  | Shri Gayana Ranjan Mohainty |
| BIS Directorate General |  | Shri Dwaipayan Bhadra, Scientist ‘E’/Director and Head (Civil Engineering) [Representing Director General (*Ex-officio*)] |
| *Member Secretary*Shri Abhishek PalScientist ‘D’/Joint Director(Civil Engineering), BISandShri Dheeraj DamachyaScientist ‘B’/Assistant Director(Civil Engineering), BIS |