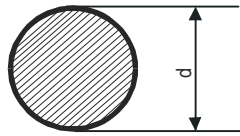




### 3. PERFILES COMERCIALES



#### 3.1. REDONDO LAMINADO EN CALIENTE. MEDIDAS Y TOLERANCIAS. UNE 36-541-76

Tabla 3-1 Redondo laminado en caliente – Pesos en Kg/m y Área de la sección transversal en cm<sup>2</sup> de barras de acero

| Diámetro nominal d mm | Sección transversal a cm <sup>2</sup> | Masa unitaria kg/m | Diámetro nominal d mm | Sección transversal a cm <sup>2</sup> | Masa unitaria kg/m | Diámetro nominal d mm | Sección transversal a cm <sup>2</sup> | Masa unitaria kg/m |
|-----------------------|---------------------------------------|--------------------|-----------------------|---------------------------------------|--------------------|-----------------------|---------------------------------------|--------------------|
| 3                     | 0,071                                 | 0,055              | 68                    | 36,317                                | 28,509             | 305                   | 730,618                               | 573,535            |
| 3,5                   | 0,096                                 | 0,076              | 70                    | 38,485                                | 30,210             | 310                   | 754,769                               | 592,494            |
| 4                     | 0,126                                 | 0,099              | 72                    | 40,715                                | 31,961             | 315                   | 779,313                               | 611,761            |
| 4,5                   | 0,159                                 | 0,125              | 74                    | 43,009                                | 33,762             | 320                   | 804,250                               | 631,336            |
| 5                     | 0,196                                 | 0,154              | 75                    | 44,179                                | 34,680             | 325                   | 829,579                               | 651,219            |
| 5,5                   | 0,238                                 | 0,187              | 76                    | 45,365                                | 35,611             | 330                   | 855,301                               | 671,411            |
| 6                     | 0,283                                 | 0,222              | 78                    | 47,784                                | 37,510             | 335                   | 881,415                               | 691,911            |
| 7                     | 0,385                                 | 0,302              | 80                    | 50,266                                | 39,458             | 340                   | 907,922                               | 712,719            |
| 8                     | 0,503                                 | 0,395              | 85                    | 56,745                                | 44,545             | 345                   | 934,822                               | 733,836            |
| 9                     | 0,636                                 | 0,499              | 90                    | 63,617                                | 49,940             | 350                   | 962,115                               | 755,260            |
| 10                    | 0,785                                 | 0,617              | 95                    | 70,882                                | 55,643             | 355                   | 989,800                               | 776,993            |
| 11                    | 0,950                                 | 0,746              | 100                   | 78,540                                | 61,654             | 360                   | 1017,878                              | 799,035            |
| 12                    | 1,131                                 | 0,888              | 105                   | 86,590                                | 67,973             | 365                   | 1046,349                              | 821,384            |
| 13                    | 1,327                                 | 1,042              | 110                   | 95,033                                | 74,601             | 370                   | 1075,213                              | 844,042            |
| 14                    | 1,539                                 | 1,208              | 115                   | 103,869                               | 81,537             | 375                   | 1104,469                              | 867,008            |
| 15                    | 1,767                                 | 1,387              | 120                   | 113,098                               | 88,782             | 380                   | 1134,118                              | 890,282            |
| 16                    | 2,011                                 | 1,578              | 125                   | 122,719                               | 96,334             | 385                   | 1164,159                              | 913,865            |
| 17                    | 2,270                                 | 1,782              | 130                   | 132,733                               | 104,195            | 390                   | 1194,593                              | 937,756            |
| 18                    | 2,545                                 | 1,998              | 135                   | 143,139                               | 112,364            | 395                   | 1225,420                              | 961,955            |
| 19                    | 2,835                                 | 2,226              | 140                   | 153,938                               | 120,842            | 400                   | 1256,640                              | 986,462            |
| 20                    | 3,142                                 | 2,466              | 145                   | 165,130                               | 129,627            | 405                   | 1288,252                              | 1011,278           |
| 21                    | 3,464                                 | 2,719              | 150                   | 176,715                               | 138,721            | 410                   | 1320,257                              | 1036,402           |
| 22                    | 3,801                                 | 2,984              | 155                   | 188,692                               | 148,123            | 415                   | 1352,655                              | 1061,834           |
| 23                    | 4,155                                 | 3,261              | 160                   | 201,062                               | 157,834            | 420                   | 1385,446                              | 1087,575           |
| 24                    | 4,524                                 | 3,551              | 165                   | 213,825                               | 167,853            | 425                   | 1418,629                              | 1113,624           |
| 25                    | 4,909                                 | 3,853              | 170                   | 226,981                               | 178,180            | 430                   | 1452,205                              | 1139,981           |
| 26                    | 5,309                                 | 4,168              | 175                   | 240,529                               | 188,815            | 435                   | 1486,173                              | 1166,646           |
| 27                    | 5,726                                 | 4,495              | 180                   | 254,470                               | 199,759            | 440                   | 1520,534                              | 1193,620           |
| 28                    | 6,158                                 | 4,834              | 185                   | 268,803                               | 211,010            | 445                   | 1555,288                              | 1220,901           |
| 29                    | 6,605                                 | 5,185              | 190                   | 283,529                               | 222,571            | 450                   | 1590,435                              | 1248,491           |
| 30                    | 7,069                                 | 5,549              | 195                   | 298,648                               | 234,439            | 455                   | 1625,974                              | 1276,390           |
| 32                    | 8,042                                 | 6,313              | 200                   | 314,160                               | 246,616            | 460                   | 1661,906                              | 1304,597           |
| 34                    | 9,079                                 | 7,127              | 205                   | 330,064                               | 259,101            | 465                   | 1698,231                              | 1333,111           |
| 36                    | 10,179                                | 7,990              | 210                   | 346,361                               | 271,894            | 470                   | 1734,949                              | 1361,935           |
| 38                    | 11,341                                | 8,903              | 215                   | 363,051                               | 284,995            | 475                   | 1772,059                              | 1391,066           |
| 40                    | 12,566                                | 9,865              | 220                   | 380,000                               | 298,000            | 480                   | 1809,562                              | 1420,506           |
| 41                    | 13,203                                | 10,364             | 225                   | 397,609                               | 312,123            | 485                   | 1847,457                              | 1450,254           |
| 42                    | 13,854                                | 10,876             | 230                   | 415,477                               | 326,149            | 490                   | 1885,745                              | 1480,310           |
| 44                    | 15,205                                | 11,936             | 235                   | 433,737                               | 340,484            | 495                   | 1924,426                              | 1510,675           |
| 46                    | 16,619                                | 13,046             | 240                   | 452,390                               | 355,126            | 500                   | 1963,500                              | 1541,348           |
| 48                    | 18,096                                | 14,205             | 245                   | 471,436                               | 370,078            | 510                   | 2042,825                              | 1603,618           |
| 50                    | 19,635                                | 15,413             | 250                   | 490,875                               | 385,337            | 520                   | 2123,722                              | 1667,121           |
| 52                    | 21,237                                | 16,671             | 255                   | 510,706                               | 400,904            | 530                   | 2206,189                              | 1731,858           |
| 54                    | 22,902                                | 17,978             | 260                   | 530,930                               | 416,780            | 550                   | 2375,835                              | 1865,030           |
| 55                    | 23,758                                | 18,650             | 265                   | 551,547                               | 432,965            | 575                   | 2596,729                              | 2038,432           |
| 56                    | 24,630                                | 19,335             | 270                   | 572,557                               | 449,457            | 600                   | 2827,440                              | 2219,540           |
| 58                    | 26,421                                | 20,740             | 275                   | 593,959                               | 466,258            | 650                   | 3318,315                              | 2604,877           |
| 60                    | 28,274                                | 22,195             | 280                   | 615,754                               | 483,367            | 700                   | 3848,460                              | 3021,041           |
| 62                    | 30,191                                | 23,700             | 285                   | 637,941                               | 500,784            | 750                   | 4417,875                              | 3468,032           |
| 64                    | 32,170                                | 25,253             | 290                   | 660,521                               | 518,509            | 800                   | 5026,560                              | 3945,850           |
| 65                    | 33,183                                | 26,049             | 295                   | 683,494                               | 536,543            |                       |                                       |                    |
| 66                    | 34,212                                | 26,856             | 300                   | 706,860                               | 554,885            |                       |                                       |                    |

Calidad: S275 JR



**TOLERANCIAS**

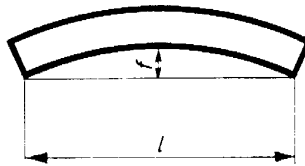
- Tolerancia en el diámetro:

**Tabla 3-2 Redondo laminado en caliente - Tolerancias en diámetro**

| Diámetro nominal d mm |                  | Tolerancias en mm |          |           |
|-----------------------|------------------|-------------------|----------|-----------|
| desde (excluido)      | hasta (incluido) | Nivel I           | Nivel II | Nivel III |
| 5 (1)                 | 7                | ± 0.4             | ± 0.3    | ----      |
| 7 (2)                 | 15               | ± 0.4             | ± 0.3    | ± 0.2     |
| 15                    | 20               | ± 0.5             | ± 0.3    | ± 0.2     |
| 20                    | 25               | ± 0.5             | ± 0.4    | ± 0.3     |
| 25                    | 30               | ± 0.6             | ± 0.4    | ± 0.3     |
| 30                    | 35               | ± 0.6             | ± 0.5    | ± 0.4     |
| 35                    | 50               | ± 0.8             | ± 0.5    | ± 0.4     |
| 50                    | 80               | ± 1.0             | ± 0.7    |           |
| 80                    | 100              | ± 1.3             |          |           |
| 100                   | 120              | ± 1.5             |          |           |
| 120                   | 160              | ± 2.0             |          |           |
| 160                   | 200              | ± 2.5             |          |           |
| 200                   | ----             | ± 3.0             |          |           |

(1) incluido  
(2) Incluido para el nivel III

- Ovalidad: Se define como ovalidad la diferencia entre el diámetro máximo y mínimo de una misma sección recta. La ovalidad no será mayor que el 80 % del intervalo total de la tolerancia definida en el diámetro.
- Tolerancia de enderezado.



**Tabla 3-3 Redondo laminado en caliente - Tolerancia en enderezado**

| Diámetro nominal d mm |               | Tolerancia: Flecha máxima f mm |            |
|-----------------------|---------------|--------------------------------|------------|
| desde                 | hasta         | Nivel I                        | Nivel II   |
| 20                    | 40 (excluido) | ----                           | 4 mm/m     |
| 40                    | 80 (incluido) | 0.4% de l                      | 0.25% de l |
| 80 (excluido)         |               | 0.25% de l                     |            |

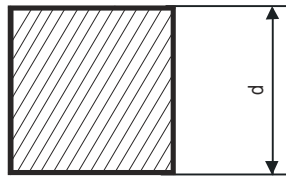
- Tolerancia en longitud: Para barras solicitadas a longitud fija, se admite una tolerancia de corte de ± 100 mm. Previa solicitud en el pedido las barras hasta 12 m (inclusive) se suministrarán con  $+^{75}_0$  (tolerancia restringida). Las tolerancias de corte en frío deberán convenirse en el pedido, si bien se recomienda la elección de los valores  $+^5_0$   $+^{10}_0$   $+^{25}_0$   $+^{50}_0$ .
- Tolerancia en masa: La desviación en masa es la diferencia entre la masa suministrada y la masa teórica. Ésta se determina multiplicando la masa teórica unitaria por el número de metros suministrados. Las tolerancias indicadas en la siguiente tabla sólo se aplican a lotes de redondos del mismo diámetro iguales o superiores a 5t. Para lotes inferiores estas tolerancias aumentarían un tercio.

**Tabla 3-4 Redondo laminado en caliente - Tolerancias en masa**

| Diámetro nominal d mm |                  | Tolerancias en masa |
|-----------------------|------------------|---------------------|
| desde                 | hasta (incluido) |                     |
| ----                  | 6                | ± 8                 |
| 6                     | 15               | ± 6                 |
| 15                    | ----             | ± 4                 |



### 3.2. CUADRADO LAMINADO EN CALIENTE. MEDIDAS Y TOLERANCIAS. UNE 36-542-76



**Tabla 3-5 Cuadrado laminado en caliente - Pesos en Kg/m y Área de la sección transversal en cm<sup>2</sup> de barras de acero.**

| Diámetro nominal d mm | Sección transversal a cm <sup>2</sup> | Masa unitaria kg/m | Diámetro nominal d mm | Sección transversal a cm <sup>2</sup> | Masa unitaria kg/m | Diámetro nominal d mm | Sección transversal a cm <sup>2</sup> | Masa unitaria kg/m |
|-----------------------|---------------------------------------|--------------------|-----------------------|---------------------------------------|--------------------|-----------------------|---------------------------------------|--------------------|
| 3                     | 0,090                                 | 0,071              | 68                    | 46,240                                | 36,298             | 305                   | 930,250                               | 730,246            |
| 3,5                   | 0,123                                 | 0,096              | 70                    | 49,000                                | 38,465             | 310                   | 961,000                               | 754,385            |
| 4                     | 0,160                                 | 0,126              | 72                    | 51,840                                | 40,694             | 315                   | 992,250                               | 778,916            |
| 4,5                   | 0,203                                 | 0,159              | 74                    | 54,760                                | 42,987             | 320                   | 1024,000                              | 803,840            |
| 5                     | 0,250                                 | 0,196              | 75                    | 56,250                                | 44,156             | 325                   | 1056,250                              | 829,156            |
| 5,5                   | 0,303                                 | 0,237              | 76                    | 57,760                                | 45,342             | 330                   | 1089,000                              | 854,865            |
| 6                     | 0,360                                 | 0,283              | 78                    | 60,840                                | 47,759             | 335                   | 1122,250                              | 880,966            |
| 7                     | 0,490                                 | 0,385              | 80                    | 64,000                                | 50,240             | 340                   | 1156,000                              | 907,460            |
| 8                     | 0,640                                 | 0,502              | 85                    | 72,250                                | 56,716             | 345                   | 1190,250                              | 934,346            |
| 9                     | 0,810                                 | 0,636              | 90                    | 81,000                                | 63,585             | 350                   | 1225,000                              | 961,625            |
| 10                    | 1,000                                 | 0,785              | 95                    | 90,250                                | 70,846             | 355                   | 1260,250                              | 989,296            |
| 11                    | 1,210                                 | 0,950              | 100                   | 100,000                               | 78,500             | 360                   | 1296,000                              | 1017,360           |
| 12                    | 1,440                                 | 1,130              | 105                   | 110,250                               | 86,546             | 365                   | 1332,250                              | 1045,816           |
| 13                    | 1,690                                 | 1,327              | 110                   | 121,000                               | 94,985             | 370                   | 1369,000                              | 1074,665           |
| 14                    | 1,960                                 | 1,539              | 115                   | 132,250                               | 103,816            | 375                   | 1406,250                              | 1103,906           |
| 15                    | 2,250                                 | 1,766              | 120                   | 144,000                               | 113,040            | 380                   | 1444,000                              | 1133,540           |
| 16                    | 2,560                                 | 2,010              | 125                   | 156,250                               | 122,656            | 385                   | 1482,250                              | 1163,566           |
| 17                    | 2,890                                 | 2,269              | 130                   | 169,000                               | 132,665            | 390                   | 1521,000                              | 1193,985           |
| 18                    | 3,240                                 | 2,543              | 135                   | 182,250                               | 143,066            | 395                   | 1560,250                              | 1224,796           |
| 19                    | 3,610                                 | 2,834              | 140                   | 196,000                               | 153,860            | 400                   | 1600,000                              | 1256,000           |
| 20                    | 4,000                                 | 3,140              | 145                   | 210,250                               | 165,046            | 405                   | 1640,250                              | 1287,596           |
| 21                    | 4,410                                 | 3,462              | 150                   | 225,000                               | 176,625            | 410                   | 1681,000                              | 1319,585           |
| 22                    | 4,840                                 | 3,799              | 155                   | 240,250                               | 188,596            | 415                   | 1722,250                              | 1351,966           |
| 23                    | 5,290                                 | 4,153              | 160                   | 256,000                               | 200,960            | 420                   | 1764,000                              | 1384,740           |
| 24                    | 5,760                                 | 4,522              | 165                   | 272,250                               | 213,716            | 425                   | 1806,250                              | 1417,906           |
| 25                    | 6,250                                 | 4,906              | 170                   | 289,000                               | 226,865            | 430                   | 1849,000                              | 1451,465           |
| 26                    | 6,760                                 | 5,307              | 175                   | 306,250                               | 240,406            | 435                   | 1892,250                              | 1485,416           |
| 27                    | 7,290                                 | 5,723              | 180                   | 324,000                               | 254,340            | 440                   | 1936,000                              | 1519,760           |
| 28                    | 7,840                                 | 6,154              | 185                   | 342,250                               | 268,666            | 445                   | 1980,250                              | 1554,496           |
| 29                    | 8,410                                 | 6,602              | 190                   | 361,000                               | 283,385            | 450                   | 2025,000                              | 1589,625           |
| 30                    | 9,000                                 | 7,065              | 195                   | 380,250                               | 298,496            | 455                   | 2070,250                              | 1625,146           |
| 32                    | 10,240                                | 8,038              | 200                   | 400,000                               | 314,000            | 460                   | 2116,000                              | 1661,060           |
| 34                    | 11,560                                | 9,075              | 205                   | 420,250                               | 329,896            | 465                   | 2162,250                              | 1697,366           |
| 36                    | 12,960                                | 10,174             | 210                   | 441,000                               | 346,185            | 470                   | 2209,000                              | 1734,065           |
| 38                    | 14,440                                | 11,335             | 215                   | 462,250                               | 362,866            | 475                   | 2256,250                              | 1771,156           |
| 40                    | 16,000                                | 12,560             | 220                   | 484,000                               | 379,940            | 480                   | 2304,000                              | 1808,640           |
| 41                    | 16,810                                | 13,196             | 225                   | 506,250                               | 397,406            | 485                   | 2352,250                              | 1846,516           |
| 42                    | 17,640                                | 13,847             | 230                   | 529,000                               | 415,265            | 490                   | 2401,000                              | 1884,785           |
| 44                    | 19,360                                | 15,198             | 235                   | 552,250                               | 433,516            | 495                   | 2450,250                              | 1923,446           |
| 46                    | 21,160                                | 16,611             | 240                   | 576,000                               | 452,160            | 500                   | 2500,000                              | 1962,500           |
| 48                    | 23,040                                | 18,086             | 245                   | 600,250                               | 471,196            | 510                   | 2601,000                              | 2041,785           |
| 50                    | 25,000                                | 19,625             | 250                   | 625,000                               | 490,625            | 520                   | 2704,000                              | 2122,640           |
| 52                    | 27,040                                | 21,226             | 255                   | 650,250                               | 510,446            | 530                   | 2809,000                              | 2205,065           |
| 54                    | 29,160                                | 22,891             | 260                   | 676,000                               | 530,660            | 550                   | 3025,000                              | 2374,625           |
| 55                    | 30,250                                | 23,746             | 265                   | 702,250                               | 551,266            | 575                   | 3306,250                              | 2595,406           |
| 56                    | 31,360                                | 24,618             | 270                   | 729,000                               | 572,265            | 600                   | 3600,000                              | 2826,000           |
| 58                    | 33,640                                | 26,407             | 275                   | 756,250                               | 593,656            | 650                   | 4225,000                              | 3316,625           |
| 60                    | 36,000                                | 28,260             | 280                   | 784,000                               | 615,440            | 700                   | 4900,000                              | 3846,500           |
| 62                    | 38,440                                | 30,175             | 285                   | 812,250                               | 637,616            | 750                   | 5625,000                              | 4415,625           |
| 64                    | 40,960                                | 32,154             | 290                   | 841,000                               | 660,185            | 800                   | 6400,000                              | 5024,000           |
| 65                    | 42,250                                | 33,166             | 295                   | 870,250                               | 683,146            |                       |                                       |                    |
| 66                    | 43,560                                | 34,195             | 300                   | 900,000                               | 706,500            |                       |                                       |                    |

Calidad: S275 JR



**TOLERANCIAS**

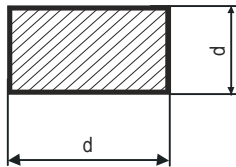
**Tabla 3-6 Cuadrado laminado en caliente - Tolerancias en sección.**

| Lado nominal a mm |                  | Tolerancia en mm |          |
|-------------------|------------------|------------------|----------|
| Desde (excluido)  | Hasta (incluido) | Nivel I          | Nivel II |
| 5 (1)             | 15               | ± 0.4            | ± 0.3    |
| 15                | 25               | ± 0.5            | ± 0.4    |
| 25                | 35               | ± 0.6            | ± 0.5    |
| 35                | 50               | ± 0.8            | ± 0.6    |
| 50                | 80               | ± 1.0            | ± 0.8    |
| 80                | 100              | ± 1.3            | ----     |
| 100               | 120              | ± 1.5            | ----     |
| 120               | ----             | ± 2.0            | ----     |

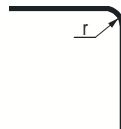
(1) incluido

· Defecto de forma.

Se define como defecto de forma la diferencia a-a' entre dos lados consecutivos, de una misma sección recta. Esta diferencia no será mayor que el 80% del intervalo total de la tolerancia en sección.



· Tolerancia en el redondeo de aristas.



**Tabla 3-7 Cuadrado laminado en caliente - Tolerancia en el redondeo de aristas.**

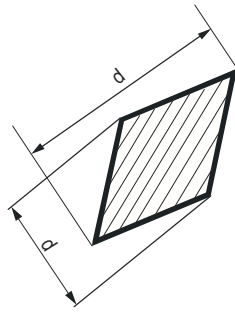
| Lado nominal a mm |                  | Tolerancia r máximo |
|-------------------|------------------|---------------------|
| Desde (excluido)  | Hasta (incluido) |                     |
| 5 (1)             | 12               | 1                   |
| 12                | 20               | 1.5                 |
| 20                | 30               | 2                   |
| 30                | 50               | 2.5                 |
| 50                | 100              | 3                   |
| 100               | ----             | 4                   |

1) incluido

· Falta de escuadrado

La falta de escuadrado se medirá por la diferencia de las diagonales de una misma sección recta y no será superior al 6% de la diagonal mayor (tolerancia normal) o al 4% de dicha diagonal (tolerancia restringida)

La tolerancia restringida solo es aplicable a cuadrados entre 20 y 80 mm.



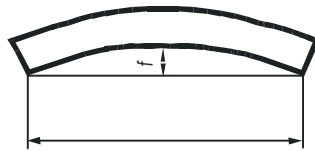
**Tolerancia de longitud**

Para barras solicitadas a longitud fija, se admite una tolerancia de corte de  $\pm 100$  mm. Previa solicitud en el pedido, las barras hasta 12m (inclusive) se suministrarán con  $^{+75}_0$  y las de longitud superior a 12 m con tolerancia de  $^{+100}_0$  (tolerancia restringida). La tolerancia de corte en frío deberá convenirse en el pedido, se recomienda la elección de los valores  $^{+5}_0$ ,  $^{+10}_0$ ,  $^{+25}_0$ ,  $^{+50}_0$ .

**Tolerancia de revirado**

Los cuadrados no deben superar un revirado superior a  $4^\circ$  por metro para tolerancias de Nivel I y de  $2^\circ$  por metro con un máximo de  $12^\circ$  para tolerancias del Nivel II.

**Tolerancia de enderezado**



**Tabla 3-8 Cuadrado laminado en caliente - Tolerancia de enderezado.**

| nivel I           |                          | nivel II               |                          |
|-------------------|--------------------------|------------------------|--------------------------|
| Lado nominal a mm | Tolerancia Flecha máxima | Lado nominal a mm      | Tolerancia Flecha máxima |
| Desde 40 hasta 80 | 0.004 L                  | Desde 20 hasta 40      | 4 mm por m               |
| Superior a 80     | 0.0025 L                 | Superior a 40 hasta 80 | 0.0025 L                 |

**Tolerancia en la masa**

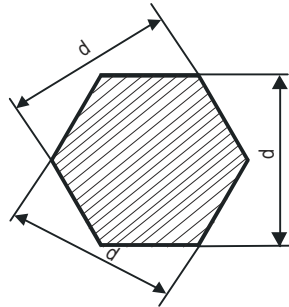
La desviación en masa es la diferencia entre la masa suministrada y la masa teórica. Ésta se determina multiplicando la masa teórica unitaria por el número de metros suministrados. Las tolerancias indicadas en la tabla sólo se aplican a lotes cuadrados del mismo lado iguales o superiores a 5t. Para lotes inferiores estas tolerancias aumentarán un tercio.

**Tabla 3-9 Cuadrado laminado en caliente - Tolerancia en masa**

| Lado nominal a mm |                  | Tolerancias en masa |
|-------------------|------------------|---------------------|
| Desde             | Hasta (incluido) |                     |
| ----              | 6                | $\pm 8$             |
| 6                 | 15               | $\pm 6$             |
| 15                | ----             | $\pm 4$             |



### 3.3 HEXAGONAL LAMINADO EN CALIENTE. MEDIDAS Y TOLERANCIAS. UNE 36-547-76; 79(ERRATUM)



**Tabla 3-10 Hexagonal laminado en caliente - Pesos en Kg/m y Área de la sección transversal en cm<sup>2</sup> de barras de acero.**

| Diámetro nominal d mm | Sección transversal a cm <sup>2</sup> | Masa unitaria kg/m | Diámetro nominal d mm | Sección transversal a cm <sup>2</sup> | Masa unitaria kg/m | Diámetro nominal d mm | Sección transversal a cm <sup>2</sup> | Masa unitaria kg/m |
|-----------------------|---------------------------------------|--------------------|-----------------------|---------------------------------------|--------------------|-----------------------|---------------------------------------|--------------------|
| 3                     | 0,078                                 | 0,061              | 62                    | 33,290                                | 26,133             | 265                   | 608,166                               | 477,411            |
| 3,5                   | 0,106                                 | 0,083              | 64                    | 35,472                                | 27,846             | 270                   | 631,333                               | 495,596            |
| 4                     | 0,139                                 | 0,109              | 65                    | 36,590                                | 28,723             | 275                   | 654,932                               | 514,121            |
| 4,5                   | 0,175                                 | 0,138              | 66                    | 37,724                                | 29,613             | 280                   | 678,964                               | 532,987            |
| 5                     | 0,217                                 | 0,170              | 68                    | 40,045                                | 31,435             | 285                   | 703,429                               | 552,192            |
| 5,5                   | 0,262                                 | 0,206              | 70                    | 42,435                                | 33,312             | 290                   | 728,327                               | 571,737            |
| 6                     | 0,312                                 | 0,245              | 72                    | 44,895                                | 35,242             | 295                   | 753,659                               | 591,622            |
| 7                     | 0,424                                 | 0,333              | 74                    | 47,424                                | 37,227             | 300                   | 779,423                               | 611,847            |
| 8                     | 0,554                                 | 0,435              | 75                    | 48,714                                | 38,240             | 305                   | 805,620                               | 632,412            |
| 9                     | 0,701                                 | 0,551              | 76                    | 50,022                                | 39,267             | 310                   | 832,250                               | 653,317            |
| 10                    | 0,866                                 | 0,680              | 78                    | 52,689                                | 41,361             | 315                   | 859,314                               | 674,561            |
| 11                    | 1,048                                 | 0,823              | 80                    | 55,426                                | 43,509             | 320                   | 886,810                               | 696,146            |
| 12                    | 1,247                                 | 0,979              | 85                    | 62,570                                | 49,118             | 325                   | 914,739                               | 718,070            |
| 13                    | 1,464                                 | 1,149              | 90                    | 70,148                                | 55,066             | 330                   | 943,102                               | 740,335            |
| 14                    | 1,697                                 | 1,332              | 95                    | 78,159                                | 61,355             | 335                   | 971,897                               | 762,939            |
| 15                    | 1,949                                 | 1,530              | 100                   | 86,603                                | 67,983             | 340                   | 1001,125                              | 785,883            |
| 16                    | 2,217                                 | 1,740              | 105                   | 95,479                                | 74,951             | 345                   | 1030,787                              | 809,168            |
| 17                    | 2,503                                 | 1,965              | 110                   | 104,789                               | 82,259             | 350                   | 1060,881                              | 832,792            |
| 18                    | 2,806                                 | 2,203              | 115                   | 114,532                               | 89,908             | 355                   | 1091,409                              | 856,756            |
| 19                    | 3,126                                 | 2,454              | 120                   | 124,708                               | 97,896             | 360                   | 1122,369                              | 881,060            |
| 20                    | 3,464                                 | 2,719              | 125                   | 135,316                               | 106,223            | 365                   | 1153,762                              | 905,703            |
| 21                    | 3,819                                 | 2,998              | 130                   | 146,358                               | 114,891            | 370                   | 1185,589                              | 930,687            |
| 22                    | 4,192                                 | 3,290              | 135                   | 157,833                               | 123,899            | 375                   | 1217,848                              | 956,011            |
| 23                    | 4,581                                 | 3,596              | 140                   | 169,741                               | 133,247            | 380                   | 1250,541                              | 981,674            |
| 24                    | 4,988                                 | 3,916              | 145                   | 182,082                               | 142,934            | 385                   | 1283,666                              | 1007,678           |
| 25                    | 5,413                                 | 4,249              | 150                   | 194,856                               | 152,962            | 390                   | 1317,225                              | 1034,021           |
| 26                    | 5,854                                 | 4,596              | 155                   | 208,063                               | 163,329            | 395                   | 1351,216                              | 1060,705           |
| 27                    | 6,313                                 | 4,956              | 160                   | 221,703                               | 174,036            | 400                   | 1385,641                              | 1087,728           |
| 28                    | 6,790                                 | 5,330              | 165                   | 235,775                               | 185,084            | 405                   | 1420,498                              | 1115,091           |
| 29                    | 7,283                                 | 5,717              | 170                   | 250,281                               | 196,471            | 410                   | 1455,789                              | 1142,794           |
| 30                    | 7,794                                 | 6,118              | 175                   | 265,220                               | 208,198            | 415                   | 1491,512                              | 1170,837           |
| 32                    | 8,868                                 | 6,961              | 180                   | 280,592                               | 220,265            | 420                   | 1527,669                              | 1199,220           |
| 34                    | 10,011                                | 7,859              | 185                   | 296,397                               | 232,672            | 425                   | 1564,258                              | 1227,943           |
| 36                    | 11,224                                | 8,811              | 190                   | 312,635                               | 245,419            | 430                   | 1601,281                              | 1257,006           |
| 38                    | 12,505                                | 9,817              | 195                   | 329,306                               | 258,505            | 435                   | 1638,737                              | 1286,408           |
| 40                    | 13,856                                | 10,877             | 200                   | 346,410                               | 271,932            | 440                   | 1676,625                              | 1316,151           |
| 41                    | 14,558                                | 11,428             | 205                   | 363,947                               | 285,699            | 445                   | 1714,947                              | 1346,233           |
| 42                    | 15,277                                | 11,992             | 210                   | 381,917                               | 299,805            | 450                   | 1753,701                              | 1376,656           |
| 44                    | 16,766                                | 13,162             | 215                   | 400,320                               | 314,251            | 455                   | 1792,889                              | 1407,418           |
| 46                    | 18,325                                | 14,385             | 220                   | 419,156                               | 329,038            | 460                   | 1832,510                              | 1438,520           |
| 48                    | 19,953                                | 15,663             | 225                   | 438,425                               | 344,164            | 465                   | 1872,563                              | 1469,962           |
| 50                    | 21,651                                | 16,996             | 230                   | 458,127                               | 359,630            | 470                   | 1913,050                              | 1501,744           |
| 52                    | 23,417                                | 18,383             | 235                   | 478,263                               | 375,436            | 475                   | 1953,970                              | 1533,866           |
| 54                    | 25,253                                | 19,824             | 240                   | 498,831                               | 391,582            | 480                   | 1995,323                              | 1566,328           |
| 55                    | 26,197                                | 20,565             | 245                   | 519,832                               | 408,068            | 485                   | 2037,108                              | 1599,130           |
| 56                    | 27,159                                | 21,319             | 250                   | 541,266                               | 424,894            | 490                   | 2079,327                              | 1632,272           |
| 58                    | 29,133                                | 22,869             | 255                   | 563,133                               | 442,059            | 495                   | 2121,979                              | 1665,753           |
| 60                    | 31,177                                | 24,474             | 260                   | 585,433                               | 459,565            | 500                   | 2165,064                              | 1699,575           |

Calidad: S275 JR



**TOLERANCIAS**

En los apartados siguientes se establecen para cada dimensión uno o varios niveles de tolerancias. En el pedido se indicará el nivel deseado para cada dimensión. Estas tolerancias no son aplicables a las barras calibradas cuyas tolerancias se establecen en la norma UNE 36-076.

- Tolerancias de la dimensión d.

**Tabla 3-11 Hexagonal laminado en caliente – Tolerancias de la dimensión d.**

| Dimensión nominal d mm |                  | Tolerancia en mm |
|------------------------|------------------|------------------|
| Desde (excluido)       | Hasta (incluido) | Nivel I          |
| ----                   | 15               | ± 0.4            |
| 15                     | 25               | ± 0.5            |
| 25                     | 35               | ± 0.6            |
| 35                     | 50               | ± 0.8            |
| 50                     | 100              | ± 1.0            |

- **Defecto de forma:** Se define como defecto de forma la existencia de una diferencia entre la distancia d y d' máxima y mínima de una misma sección recta. Esta diferencia no será mayor que el 80% del intervalo total de la tolerancia de la dimensión d.

**Tabla 3-12 Hexagonal laminado en caliente – Tolerancia en el redondeo de aristas.**

| Dimensión nominal d mm |                  | Tolerancia r máximo mm |
|------------------------|------------------|------------------------|
| Desde                  | Hasta (incluido) |                        |
| ----                   | 20               | 1.5                    |
| 21                     | 30               | 2.0                    |
| 31                     | 50               | 2.5                    |
| 50                     | ----             | 3.0                    |

- **Tolerancia de enderezado:** La flecha se medirá sobre la longitud l total de la barra.

**Tabla 3-13 Hexagonal laminado en caliente – Tolerancia de enderezado**

| Dimensión nominal d mm |                  | Tolerancia de enderezado flecha máxima mm |            |
|------------------------|------------------|---|------------|
| Desde                  | Hasta (incluido) | Nivel I                                   | Nivel II   |
| 20                     | 40               | ----                                      | 4 mm/m     |
| 40                     | ----             | 0.4% de l                                 | 0.25% de l |

- **Revirado:** La tolerancia en el revirado deberá convenirse en el pedido.
- **Tolerancia en longitud:** Para barras solicitadas a longitud fija, se admite una tolerancia de corte de ± 100 mm. Previa solicitud en el pedido, las barras de hasta 12 m (inclusive) se suministrarán con  $+75_0$  y las de longitud superior a 12 m con tolerancia de  $+100_0$  (tolerancia restringida). Las tolerancias de corte en frío deberán convenirse en el pedido si bien se recomienda la elección entre los valores  $+5_0$ ,  $+10_0$ ,  $+25_0$ ,  $+50_0$ .
- **Tolerancia en masa:**  
La desviación en masa es la diferencia entre la masa suministrada y la masa teórica. Esta se determina multiplicando la masa teórica unitaria por el número de metros.

**Tabla 3-14 Hexagonal laminado en caliente – Tolerancia en masa**

| Dimensión nominal d mm |                  | Tolerancia |
|------------------------|------------------|------------|
| Desde                  | Hasta (incluido) |            |
| ----                   | 15               | ± 6        |
| 15                     | ----             | ± 4        |

Las tolerancias indicadas en la tabla solo se aplican a lotes hexagonales de la misma dimensión, iguales o superiores a 5 t. Para lotes inferiores estas tolerancias se aumentarán un tercio.



### 3.4 BARRAS RECTANGULARES DE CANTO VIVO, LAMINADAS EN CALIENTE. UNE-36-543-80. FLEJES, PLETINAS Y LLANTAS DE ACERO (Hierros Planos).

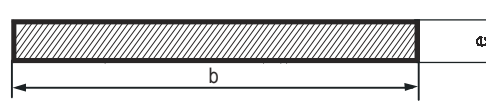
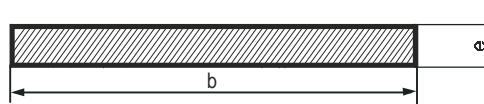


Tabla 3-15 Flejes, Pletinas y Llantas de acero - Dimensiones y masas en Kg/m

| Espesor mm | Anchos en mm |       |       |       |       |       |       |       |       |       |       |       |        |        |        |        |
|------------|--------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--------|--------|--------|--------|
|            | 10           | 12    | 14    | 15    | 16    | 18    | 20    | 22    | 24    | 25    | 26    | 28    | 30     | 32     | 34     | 35     |
| 1          | 0,079        | 0,094 | 0,110 | 0,118 | 0,126 | 0,141 | 0,157 | 0,173 | 0,188 | 0,196 | 0,204 | 0,220 | 0,236  | 0,251  | 0,267  | 0,275  |
| 2          | 0,157        | 0,188 | 0,220 | 0,236 | 0,251 | 0,283 | 0,314 | 0,345 | 0,377 | 0,393 | 0,408 | 0,440 | 0,471  | 0,502  | 0,534  | 0,550  |
| 3          | 0,236        | 0,283 | 0,330 | 0,353 | 0,377 | 0,424 | 0,471 | 0,518 | 0,565 | 0,589 | 0,612 | 0,659 | 0,707  | 0,754  | 0,801  | 0,824  |
| 4          | 0,314        | 0,377 | 0,440 | 0,471 | 0,502 | 0,565 | 0,628 | 0,691 | 0,754 | 0,785 | 0,816 | 0,879 | 0,942  | 1,005  | 1,068  | 1,099  |
| 5          | 0,393        | 0,471 | 0,550 | 0,589 | 0,628 | 0,707 | 0,785 | 0,864 | 0,942 | 0,981 | 1,021 | 1,099 | 1,178  | 1,256  | 1,335  | 1,374  |
| 6          | 0,471        | 0,565 | 0,659 | 0,707 | 0,754 | 0,848 | 0,942 | 1,036 | 1,130 | 1,178 | 1,225 | 1,319 | 1,413  | 1,507  | 1,601  | 1,649  |
| 7          | 0,550        | 0,659 | 0,769 | 0,824 | 0,879 | 0,989 | 1,099 | 1,209 | 1,319 | 1,374 | 1,429 | 1,539 | 1,649  | 1,758  | 1,868  | 1,923  |
| 8          | 0,628        | 0,754 | 0,879 | 0,942 | 1,005 | 1,130 | 1,256 | 1,382 | 1,507 | 1,570 | 1,633 | 1,758 | 1,884  | 2,010  | 2,135  | 2,198  |
| 9          | 0,707        | 0,848 | 0,989 | 1,060 | 1,130 | 1,272 | 1,413 | 1,554 | 1,696 | 1,766 | 1,837 | 1,978 | 2,120  | 2,261  | 2,402  | 2,473  |
| 10         | 0,785        | 0,942 | 1,099 | 1,178 | 1,256 | 1,413 | 1,570 | 1,727 | 1,884 | 1,963 | 2,041 | 2,198 | 2,355  | 2,512  | 2,669  | 2,748  |
| 11         | 0,864        | 1,036 | 1,209 | 1,295 | 1,382 | 1,554 | 1,727 | 1,900 | 2,072 | 2,159 | 2,245 | 2,418 | 2,591  | 2,763  | 2,936  | 3,022  |
| 12         | 0,942        | 1,130 | 1,319 | 1,413 | 1,507 | 1,696 | 1,884 | 2,072 | 2,261 | 2,355 | 2,449 | 2,638 | 2,826  | 3,014  | 3,203  | 3,297  |
| 13         | 1,021        | 1,225 | 1,429 | 1,531 | 1,633 | 1,837 | 2,041 | 2,245 | 2,449 | 2,551 | 2,653 | 2,857 | 3,062  | 3,266  | 3,470  | 3,572  |
| 14         | 1,099        | 1,319 | 1,539 | 1,649 | 1,758 | 1,978 | 2,198 | 2,418 | 2,638 | 2,748 | 2,857 | 3,077 | 3,297  | 3,517  | 3,737  | 3,847  |
| 15         | 1,178        | 1,413 | 1,649 | 1,766 | 1,884 | 2,120 | 2,355 | 2,591 | 2,826 | 2,944 | 3,062 | 3,297 | 3,533  | 3,768  | 4,004  | 4,121  |
| 16         | 1,256        | 1,507 | 1,758 | 1,884 | 2,010 | 2,261 | 2,512 | 2,763 | 3,014 | 3,140 | 3,266 | 3,517 | 3,768  | 4,019  | 4,270  | 4,396  |
| 17         | 1,335        | 1,601 | 1,868 | 2,002 | 2,135 | 2,402 | 2,669 | 2,936 | 3,203 | 3,336 | 3,470 | 3,737 | 4,004  | 4,270  | 4,537  | 4,671  |
| 18         | 1,413        | 1,696 | 1,978 | 2,120 | 2,261 | 2,543 | 2,826 | 3,109 | 3,391 | 3,533 | 3,674 | 3,956 | 4,239  | 4,522  | 4,804  | 4,946  |
| 19         | 1,492        | 1,790 | 2,088 | 2,237 | 2,386 | 2,685 | 2,983 | 3,281 | 3,580 | 3,729 | 3,878 | 4,176 | 4,475  | 4,773  | 5,071  | 5,220  |
| 20         | 1,570        | 1,884 | 2,198 | 2,355 | 2,512 | 2,826 | 3,140 | 3,454 | 3,768 | 3,925 | 4,082 | 4,396 | 4,710  | 5,024  | 5,338  | 5,495  |
| 21         | 1,649        | 1,978 | 2,308 | 2,473 | 2,638 | 2,967 | 3,297 | 3,627 | 3,956 | 4,121 | 4,286 | 4,616 | 4,946  | 5,275  | 5,605  | 5,770  |
| 22         | 1,727        | 2,072 | 2,418 | 2,591 | 2,763 | 3,109 | 3,454 | 3,799 | 4,145 | 4,318 | 4,490 | 4,836 | 5,181  | 5,526  | 5,872  | 6,045  |
| 23         | 1,806        | 2,167 | 2,528 | 2,708 | 2,889 | 3,250 | 3,611 | 3,972 | 4,333 | 4,514 | 4,694 | 5,055 | 5,417  | 5,778  | 6,139  | 6,319  |
| 24         | 1,884        | 2,261 | 2,638 | 2,826 | 3,014 | 3,391 | 3,768 | 4,145 | 4,522 | 4,710 | 4,898 | 5,275 | 5,652  | 6,029  | 6,406  | 6,594  |
| 25         | 1,963        | 2,355 | 2,748 | 2,944 | 3,140 | 3,533 | 3,925 | 4,318 | 4,710 | 4,906 | 5,103 | 5,495 | 5,888  | 6,280  | 6,673  | 6,869  |
| 26         | 2,041        | 2,449 | 2,857 | 3,062 | 3,266 | 3,674 | 4,082 | 4,490 | 4,898 | 5,103 | 5,307 | 5,715 | 6,123  | 6,531  | 6,939  | 7,144  |
| 27         | 2,120        | 2,543 | 2,967 | 3,179 | 3,391 | 3,815 | 4,239 | 4,663 | 5,087 | 5,299 | 5,511 | 5,935 | 6,359  | 6,782  | 7,206  | 7,418  |
| 28         | 2,198        | 2,638 | 3,077 | 3,297 | 3,517 | 3,956 | 4,396 | 4,836 | 5,275 | 5,495 | 5,715 | 6,154 | 6,594  | 7,034  | 7,473  | 7,693  |
| 29         | 2,277        | 2,732 | 3,187 | 3,415 | 3,642 | 4,098 | 4,553 | 5,008 | 5,464 | 5,691 | 5,919 | 6,374 | 6,830  | 7,285  | 7,740  | 7,968  |
| 30         | 2,355        | 2,826 | 3,297 | 3,533 | 3,768 | 4,239 | 4,710 | 5,181 | 5,652 | 5,888 | 6,123 | 6,594 | 7,065  | 7,536  | 8,007  | 8,243  |
| 31         | 2,434        | 2,920 | 3,407 | 3,650 | 3,894 | 4,380 | 4,867 | 5,354 | 5,840 | 6,084 | 6,327 | 6,814 | 7,301  | 7,787  | 8,274  | 8,517  |
| 32         | 2,512        | 3,014 | 3,517 | 3,768 | 4,019 | 4,522 | 5,024 | 5,526 | 6,029 | 6,280 | 6,531 | 7,034 | 7,536  | 8,038  | 8,541  | 8,792  |
| 33         | 2,591        | 3,109 | 3,627 | 3,886 | 4,145 | 4,663 | 5,181 | 5,699 | 6,217 | 6,476 | 6,735 | 7,253 | 7,772  | 8,290  | 8,808  | 9,067  |
| 34         | 2,669        | 3,203 | 3,737 | 4,004 | 4,270 | 4,804 | 5,338 | 5,872 | 6,406 | 6,673 | 6,939 | 7,473 | 8,007  | 8,541  | 9,075  | 9,342  |
| 35         | 2,748        | 3,297 | 3,847 | 4,121 | 4,396 | 4,946 | 5,495 | 6,045 | 6,594 | 6,869 | 7,144 | 7,693 | 8,243  | 8,792  | 9,342  | 9,616  |
| 36         | 2,826        | 3,391 | 3,956 | 4,239 | 4,522 | 5,087 | 5,652 | 6,217 | 6,782 | 7,065 | 7,348 | 7,913 | 8,478  | 9,043  | 9,608  | 9,891  |
| 37         | 2,905        | 3,485 | 4,066 | 4,357 | 4,647 | 5,228 | 5,809 | 6,390 | 6,971 | 7,261 | 7,552 | 8,133 | 8,714  | 9,294  | 9,875  | 10,166 |
| 38         | 2,983        | 3,580 | 4,176 | 4,475 | 4,773 | 5,369 | 5,966 | 6,563 | 7,159 | 7,458 | 7,756 | 8,352 | 8,949  | 9,546  | 10,142 | 10,441 |
| 39         | 3,062        | 3,674 | 4,286 | 4,592 | 4,898 | 5,511 | 6,123 | 6,735 | 7,348 | 7,654 | 7,960 | 8,572 | 9,185  | 9,797  | 10,409 | 10,715 |
| 40         | 3,140        | 3,768 | 4,396 | 4,710 | 5,024 | 5,652 | 6,280 | 6,908 | 7,536 | 7,850 | 8,164 | 8,792 | 9,420  | 10,048 | 10,676 | 10,990 |
| 41         | 3,219        | 3,862 | 4,506 | 4,828 | 5,150 | 5,793 | 6,437 | 7,081 | 7,724 | 8,046 | 8,368 | 9,012 | 9,656  | 10,299 | 10,943 | 11,265 |
| 42         | 3,297        | 3,956 | 4,616 | 4,946 | 5,275 | 5,935 | 6,594 | 7,253 | 7,913 | 8,243 | 8,572 | 9,232 | 9,891  | 10,550 | 11,210 | 11,540 |
| 43         | 3,376        | 4,051 | 4,726 | 5,063 | 5,401 | 6,076 | 6,751 | 7,426 | 8,101 | 8,439 | 8,776 | 9,451 | 10,127 | 10,802 | 11,477 | 11,814 |
| 44         | 3,454        | 4,145 | 4,836 | 5,181 | 5,526 | 6,217 | 6,908 | 7,599 | 8,290 | 8,635 | 8,980 | 9,671 | 10,362 | 11,053 | 11,744 | 12,089 |
| 45         | 3,533        | 4,239 | 4,946 | 5,299 | 5,652 | 6,359 | 7,065 | 7,772 | 8,478 | 8,831 | 9,185 | 9,891 | 10,598 | 11,304 | 12,011 | 12,364 |

Calidad: S275 JR

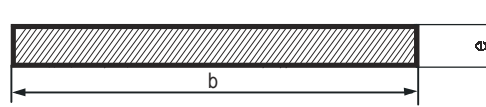




**Tabla 3.15. Flejes, Pletinas y Llantas de acero (Hierros Planos) Dimensiones y masas en Kg/m**

| Espesor mm | Anchos en mm |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
|------------|--------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|            | 36           | 38     | 40     | 42     | 44     | 45     | 46     | 48     | 50     | 52     | 54     | 55     | 56     | 58     | 60     |
| 1          | 0,283        | 0,298  | 0,314  | 0,330  | 0,345  | 0,353  | 0,361  | 0,377  | 0,393  | 0,408  | 0,424  | 0,432  | 0,440  | 0,455  | 0,471  |
| 2          | 0,565        | 0,597  | 0,628  | 0,659  | 0,691  | 0,707  | 0,722  | 0,754  | 0,785  | 0,816  | 0,848  | 0,864  | 0,879  | 0,911  | 0,942  |
| 3          | 0,848        | 0,895  | 0,942  | 0,989  | 1,036  | 1,060  | 1,083  | 1,130  | 1,178  | 1,225  | 1,272  | 1,295  | 1,319  | 1,366  | 1,413  |
| 4          | 1,130        | 1,193  | 1,256  | 1,319  | 1,382  | 1,413  | 1,444  | 1,507  | 1,570  | 1,633  | 1,696  | 1,727  | 1,758  | 1,821  | 1,884  |
| 5          | 1,413        | 1,492  | 1,570  | 1,649  | 1,727  | 1,766  | 1,806  | 1,884  | 1,963  | 2,041  | 2,120  | 2,159  | 2,198  | 2,277  | 2,355  |
| 6          | 1,696        | 1,790  | 1,884  | 1,978  | 2,072  | 2,120  | 2,167  | 2,261  | 2,355  | 2,449  | 2,543  | 2,591  | 2,638  | 2,732  | 2,826  |
| 7          | 1,978        | 2,088  | 2,198  | 2,308  | 2,418  | 2,473  | 2,528  | 2,638  | 2,748  | 2,857  | 2,967  | 3,022  | 3,077  | 3,187  | 3,297  |
| 8          | 2,261        | 2,386  | 2,512  | 2,638  | 2,763  | 2,826  | 2,889  | 3,014  | 3,140  | 3,266  | 3,391  | 3,454  | 3,517  | 3,642  | 3,768  |
| 9          | 2,543        | 2,685  | 2,826  | 2,967  | 3,109  | 3,179  | 3,250  | 3,391  | 3,533  | 3,674  | 3,815  | 3,886  | 3,956  | 4,098  | 4,239  |
| 10         | 2,826        | 2,983  | 3,140  | 3,297  | 3,454  | 3,533  | 3,611  | 3,768  | 3,925  | 4,082  | 4,239  | 4,318  | 4,396  | 4,553  | 4,710  |
| 11         | 3,109        | 3,281  | 3,454  | 3,627  | 3,799  | 3,886  | 3,972  | 4,145  | 4,318  | 4,490  | 4,663  | 4,749  | 4,836  | 5,008  | 5,181  |
| 12         | 3,391        | 3,580  | 3,768  | 3,956  | 4,145  | 4,239  | 4,333  | 4,522  | 4,710  | 4,898  | 5,087  | 5,181  | 5,275  | 5,464  | 5,652  |
| 13         | 3,674        | 3,878  | 4,082  | 4,286  | 4,490  | 4,592  | 4,694  | 4,898  | 5,103  | 5,307  | 5,511  | 5,613  | 5,715  | 5,919  | 6,123  |
| 14         | 3,956        | 4,176  | 4,396  | 4,616  | 4,836  | 4,946  | 5,055  | 5,275  | 5,495  | 5,715  | 5,935  | 6,045  | 6,154  | 6,374  | 6,594  |
| 15         | 4,239        | 4,475  | 4,710  | 4,946  | 5,181  | 5,299  | 5,417  | 5,652  | 5,888  | 6,123  | 6,359  | 6,476  | 6,594  | 6,830  | 7,065  |
| 16         | 4,522        | 4,773  | 5,024  | 5,275  | 5,526  | 5,652  | 5,778  | 6,029  | 6,280  | 6,531  | 6,782  | 6,908  | 7,034  | 7,285  | 7,536  |
| 17         | 4,804        | 5,071  | 5,338  | 5,605  | 5,872  | 6,005  | 6,139  | 6,406  | 6,673  | 6,939  | 7,206  | 7,340  | 7,473  | 7,740  | 8,007  |
| 18         | 5,087        | 5,369  | 5,652  | 5,935  | 6,217  | 6,359  | 6,500  | 6,782  | 7,065  | 7,348  | 7,630  | 7,772  | 7,913  | 8,195  | 8,478  |
| 19         | 5,369        | 5,668  | 5,966  | 6,264  | 6,563  | 6,712  | 6,861  | 7,159  | 7,458  | 7,756  | 8,054  | 8,203  | 8,352  | 8,651  | 8,949  |
| 20         | 5,652        | 5,966  | 6,280  | 6,594  | 6,908  | 7,065  | 7,222  | 7,536  | 7,850  | 8,164  | 8,478  | 8,635  | 8,792  | 9,106  | 9,420  |
| 21         | 5,935        | 6,264  | 6,594  | 6,924  | 7,253  | 7,418  | 7,583  | 7,913  | 8,243  | 8,572  | 8,902  | 9,067  | 9,232  | 9,561  | 9,891  |
| 22         | 6,217        | 6,563  | 6,908  | 7,253  | 7,599  | 7,772  | 7,944  | 8,290  | 8,635  | 8,980  | 9,326  | 9,499  | 9,671  | 10,017 | 10,362 |
| 23         | 6,500        | 6,861  | 7,222  | 7,583  | 7,944  | 8,125  | 8,305  | 8,666  | 9,028  | 9,389  | 9,750  | 9,930  | 10,111 | 10,472 | 10,833 |
| 24         | 6,782        | 7,159  | 7,536  | 7,913  | 8,290  | 8,478  | 8,666  | 9,043  | 9,420  | 9,797  | 10,174 | 10,362 | 10,550 | 10,927 | 11,304 |
| 25         | 7,065        | 7,458  | 7,850  | 8,243  | 8,635  | 8,831  | 9,028  | 9,420  | 9,813  | 10,205 | 10,598 | 10,794 | 10,990 | 11,383 | 11,775 |
| 26         | 7,348        | 7,756  | 8,164  | 8,572  | 8,980  | 9,185  | 9,389  | 9,797  | 10,205 | 10,613 | 11,021 | 11,226 | 11,430 | 11,838 | 12,246 |
| 27         | 7,630        | 8,054  | 8,478  | 8,902  | 9,326  | 9,538  | 9,750  | 10,174 | 10,598 | 11,021 | 11,445 | 11,657 | 11,869 | 12,293 | 12,717 |
| 28         | 7,913        | 8,352  | 8,792  | 9,232  | 9,671  | 9,891  | 10,111 | 10,550 | 10,990 | 11,430 | 11,869 | 12,089 | 12,309 | 12,748 | 13,188 |
| 29         | 8,195        | 8,651  | 9,106  | 9,561  | 10,017 | 10,244 | 10,472 | 10,927 | 11,383 | 11,838 | 12,293 | 12,521 | 12,748 | 13,204 | 13,659 |
| 30         | 8,478        | 8,949  | 9,420  | 9,891  | 10,362 | 10,598 | 10,833 | 11,304 | 11,775 | 12,246 | 12,717 | 12,953 | 13,188 | 13,659 | 14,130 |
| 31         | 8,761        | 9,247  | 9,734  | 10,221 | 10,707 | 10,951 | 11,194 | 11,681 | 12,168 | 12,654 | 13,141 | 13,384 | 13,628 | 14,114 | 14,601 |
| 32         | 9,043        | 9,546  | 10,048 | 10,550 | 11,053 | 11,304 | 11,555 | 12,058 | 12,560 | 13,062 | 13,565 | 13,816 | 14,067 | 14,570 | 15,072 |
| 33         | 9,326        | 9,844  | 10,362 | 10,880 | 11,398 | 11,657 | 11,916 | 12,434 | 12,953 | 13,471 | 13,989 | 14,248 | 14,507 | 15,025 | 15,543 |
| 34         | 9,608        | 10,142 | 10,676 | 11,210 | 11,744 | 12,011 | 12,277 | 12,811 | 13,345 | 13,879 | 14,413 | 14,680 | 14,946 | 15,480 | 16,014 |
| 35         | 9,891        | 10,441 | 10,990 | 11,540 | 12,089 | 12,364 | 12,639 | 13,188 | 13,738 | 14,287 | 14,837 | 15,111 | 15,386 | 15,936 | 16,485 |
| 36         | 10,174       | 10,739 | 11,304 | 11,869 | 12,434 | 12,717 | 13,000 | 13,565 | 14,130 | 14,695 | 15,260 | 15,543 | 15,826 | 16,391 | 16,956 |
| 37         | 10,456       | 11,037 | 11,618 | 12,199 | 12,780 | 13,070 | 13,361 | 13,942 | 14,523 | 15,103 | 15,684 | 15,975 | 16,265 | 16,846 | 17,427 |
| 38         | 10,739       | 11,335 | 11,932 | 12,529 | 13,125 | 13,424 | 13,722 | 14,318 | 14,915 | 15,512 | 16,108 | 16,407 | 16,705 | 17,301 | 17,898 |
| 39         | 11,021       | 11,634 | 12,246 | 12,858 | 13,471 | 13,777 | 14,083 | 14,695 | 15,308 | 15,920 | 16,532 | 16,838 | 17,144 | 17,757 | 18,369 |
| 40         | 11,304       | 11,932 | 12,560 | 13,188 | 13,816 | 14,130 | 14,444 | 15,072 | 15,700 | 16,328 | 16,956 | 17,270 | 17,584 | 18,212 | 18,840 |
| 41         | 11,587       | 12,230 | 12,874 | 13,518 | 14,161 | 14,483 | 14,805 | 15,449 | 16,093 | 16,736 | 17,380 | 17,702 | 18,024 | 18,667 | 19,311 |
| 42         | 11,869       | 12,529 | 13,188 | 13,847 | 14,507 | 14,837 | 15,166 | 15,826 | 16,485 | 17,144 | 17,804 | 18,134 | 18,463 | 19,123 | 19,782 |
| 43         | 12,152       | 12,827 | 13,502 | 14,177 | 14,852 | 15,190 | 15,527 | 16,202 | 16,878 | 17,553 | 18,228 | 18,565 | 18,903 | 19,578 | 20,253 |
| 44         | 12,434       | 13,125 | 13,816 | 14,507 | 15,198 | 15,543 | 15,888 | 16,579 | 17,270 | 17,961 | 18,652 | 18,997 | 19,342 | 20,033 | 20,724 |
| 45         | 12,717       | 13,424 | 14,130 | 14,837 | 15,543 | 15,896 | 16,250 | 16,956 | 17,663 | 18,369 | 19,076 | 19,429 | 19,782 | 20,489 | 21,195 |

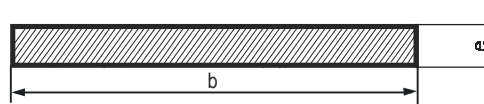
Calidad: S275 JR



**Tabla 3.15. Flejes, Pletinas y Llantas de acero (Hierros Planos) - Dimensiones y masas en Kg/m**

| Espesor mm | Anchos en mm |        |        |        |        |        |        |        |        |        |        |        |        |        |        |
|------------|--------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|            | 62           | 64     | 65     | 70     | 75     | 80     | 85     | 90     | 95     | 100    | 110    | 120    | 130    | 140    | 150    |
| 1          | 0,487        | 0,502  | 0,510  | 0,550  | 0,589  | 0,628  | 0,667  | 0,707  | 0,746  | 0,785  | 0,864  | 0,942  | 1,021  | 1,099  | 1,178  |
| 2          | 0,973        | 1,005  | 1,021  | 1,099  | 1,178  | 1,256  | 1,335  | 1,413  | 1,492  | 1,570  | 1,727  | 1,884  | 2,041  | 2,198  | 2,355  |
| 3          | 1,460        | 1,507  | 1,531  | 1,649  | 1,766  | 1,884  | 2,002  | 2,120  | 2,237  | 2,355  | 2,591  | 2,826  | 3,062  | 3,297  | 3,533  |
| 4          | 1,947        | 2,010  | 2,041  | 2,198  | 2,355  | 2,512  | 2,669  | 2,826  | 2,983  | 3,140  | 3,454  | 3,768  | 4,082  | 4,396  | 4,710  |
| 5          | 2,434        | 2,512  | 2,551  | 2,748  | 2,944  | 3,140  | 3,336  | 3,533  | 3,729  | 3,925  | 4,318  | 4,710  | 5,103  | 5,495  | 5,888  |
| 6          | 2,920        | 3,014  | 3,062  | 3,297  | 3,533  | 3,768  | 4,004  | 4,239  | 4,475  | 4,710  | 5,181  | 5,652  | 6,123  | 6,594  | 7,065  |
| 7          | 3,407        | 3,517  | 3,572  | 3,847  | 4,121  | 4,396  | 4,671  | 4,946  | 5,220  | 5,495  | 6,045  | 6,594  | 7,144  | 7,693  | 8,243  |
| 8          | 3,894        | 4,019  | 4,082  | 4,396  | 4,710  | 5,024  | 5,338  | 5,652  | 5,966  | 6,280  | 6,908  | 7,536  | 8,164  | 8,792  | 9,420  |
| 9          | 4,380        | 4,522  | 4,592  | 4,946  | 5,299  | 5,652  | 6,005  | 6,359  | 6,712  | 7,065  | 7,772  | 8,478  | 9,185  | 9,891  | 10,598 |
| 10         | 4,867        | 5,024  | 5,103  | 5,495  | 5,888  | 6,280  | 6,673  | 7,065  | 7,458  | 7,850  | 8,635  | 9,420  | 10,205 | 10,990 | 11,775 |
| 11         | 5,354        | 5,526  | 5,613  | 6,045  | 6,476  | 6,908  | 7,340  | 7,772  | 8,203  | 8,635  | 9,499  | 10,362 | 11,226 | 12,089 | 12,953 |
| 12         | 5,840        | 6,029  | 6,123  | 6,594  | 7,065  | 7,536  | 8,007  | 8,478  | 8,949  | 9,420  | 10,362 | 11,304 | 12,246 | 13,188 | 14,130 |
| 13         | 6,327        | 6,531  | 6,633  | 7,144  | 7,654  | 8,164  | 8,674  | 9,185  | 9,695  | 10,205 | 11,226 | 12,246 | 13,267 | 14,287 | 15,308 |
| 14         | 6,814        | 7,034  | 7,144  | 7,693  | 8,243  | 8,792  | 9,342  | 9,891  | 10,441 | 10,990 | 12,089 | 13,188 | 14,287 | 15,386 | 16,485 |
| 15         | 7,301        | 7,536  | 7,654  | 8,243  | 8,831  | 9,420  | 10,009 | 10,598 | 11,186 | 11,775 | 12,953 | 14,130 | 15,308 | 16,485 | 17,663 |
| 16         | 7,787        | 8,038  | 8,164  | 8,792  | 9,420  | 10,048 | 10,676 | 11,304 | 11,932 | 12,560 | 13,816 | 15,072 | 16,328 | 17,584 | 18,840 |
| 17         | 8,274        | 8,541  | 8,674  | 9,342  | 10,009 | 10,676 | 11,343 | 12,011 | 12,678 | 13,345 | 14,680 | 16,014 | 17,349 | 18,683 | 20,018 |
| 18         | 8,761        | 9,043  | 9,185  | 9,891  | 10,598 | 11,304 | 12,011 | 12,717 | 13,424 | 14,130 | 15,543 | 16,956 | 18,369 | 19,782 | 21,195 |
| 19         | 9,247        | 9,546  | 9,695  | 10,441 | 11,186 | 11,932 | 12,678 | 13,424 | 14,169 | 14,915 | 16,407 | 17,898 | 19,390 | 20,881 | 22,373 |
| 20         | 9,734        | 10,048 | 10,205 | 10,990 | 11,775 | 12,560 | 13,345 | 14,130 | 14,915 | 15,700 | 17,270 | 18,840 | 20,410 | 21,980 | 23,550 |
| 21         | 10,221       | 10,550 | 10,715 | 11,540 | 12,364 | 13,188 | 14,012 | 14,837 | 15,661 | 16,485 | 18,134 | 19,782 | 21,431 | 23,079 | 24,728 |
| 22         | 10,707       | 11,053 | 11,226 | 12,089 | 12,953 | 13,816 | 14,680 | 15,543 | 16,407 | 17,270 | 18,997 | 20,724 | 22,451 | 24,178 | 25,905 |
| 23         | 11,194       | 11,555 | 11,736 | 12,639 | 13,541 | 14,444 | 15,347 | 16,250 | 17,152 | 18,055 | 19,861 | 21,666 | 23,472 | 25,277 | 27,083 |
| 24         | 11,681       | 12,058 | 12,246 | 13,188 | 14,130 | 15,072 | 16,014 | 16,956 | 17,898 | 18,840 | 20,724 | 22,608 | 24,492 | 26,376 | 28,260 |
| 25         | 12,168       | 12,560 | 12,756 | 13,738 | 14,719 | 15,700 | 16,681 | 17,663 | 18,644 | 19,625 | 21,588 | 23,550 | 25,513 | 27,475 | 29,438 |
| 26         | 12,654       | 13,062 | 13,267 | 14,287 | 15,308 | 16,328 | 17,349 | 18,369 | 19,390 | 20,410 | 22,451 | 24,492 | 26,533 | 28,574 | 30,615 |
| 27         | 13,141       | 13,565 | 13,777 | 14,837 | 15,896 | 16,956 | 18,016 | 19,076 | 20,135 | 21,195 | 23,315 | 25,434 | 27,554 | 29,673 | 31,793 |
| 28         | 13,628       | 14,067 | 14,287 | 15,386 | 16,485 | 17,584 | 18,683 | 19,782 | 20,881 | 21,980 | 24,178 | 26,376 | 28,574 | 30,772 | 32,970 |
| 29         | 14,114       | 14,570 | 14,797 | 15,936 | 17,074 | 18,212 | 19,350 | 20,489 | 21,627 | 22,765 | 25,042 | 27,318 | 29,595 | 31,871 | 34,148 |
| 30         | 14,601       | 15,072 | 15,308 | 16,485 | 17,663 | 18,840 | 20,018 | 21,195 | 22,373 | 23,550 | 25,905 | 28,260 | 30,615 | 32,970 | 35,325 |
| 31         | 15,088       | 15,574 | 15,818 | 17,035 | 18,251 | 19,468 | 20,685 | 21,902 | 23,118 | 24,335 | 26,769 | 29,202 | 31,636 | 34,069 | 36,503 |
| 32         | 15,574       | 16,077 | 16,328 | 17,584 | 18,840 | 20,096 | 21,352 | 22,608 | 23,864 | 25,120 | 27,632 | 30,144 | 32,656 | 35,168 | 37,680 |
| 33         | 16,061       | 16,579 | 16,838 | 18,134 | 19,429 | 20,724 | 22,019 | 23,315 | 24,610 | 25,905 | 28,496 | 31,086 | 33,677 | 36,267 | 38,858 |
| 34         | 16,548       | 17,082 | 17,349 | 18,683 | 20,018 | 21,352 | 22,687 | 24,021 | 25,356 | 26,690 | 29,359 | 32,028 | 34,697 | 37,366 | 40,035 |
| 35         | 17,035       | 17,584 | 17,859 | 19,233 | 20,606 | 21,980 | 23,354 | 24,728 | 26,101 | 27,475 | 30,223 | 32,970 | 35,718 | 38,465 | 41,213 |
| 36         | 17,521       | 18,086 | 18,369 | 19,782 | 21,195 | 22,608 | 24,021 | 25,434 | 26,847 | 28,260 | 31,086 | 33,912 | 36,738 | 39,564 | 42,390 |
| 37         | 18,008       | 18,589 | 18,879 | 20,332 | 21,784 | 23,236 | 24,688 | 26,141 | 27,593 | 29,045 | 31,950 | 34,854 | 37,759 | 40,663 | 43,568 |
| 38         | 18,495       | 19,091 | 19,390 | 20,881 | 22,373 | 23,864 | 25,356 | 26,847 | 28,339 | 29,830 | 32,813 | 35,796 | 38,779 | 41,762 | 44,745 |
| 39         | 18,981       | 19,594 | 19,900 | 21,431 | 22,961 | 24,492 | 26,023 | 27,554 | 29,084 | 30,615 | 33,677 | 36,738 | 39,800 | 42,861 | 45,923 |
| 40         | 19,468       | 20,096 | 20,410 | 21,980 | 23,550 | 25,120 | 26,690 | 28,260 | 29,830 | 31,400 | 34,540 | 37,680 | 40,820 | 43,960 | 47,100 |
| 41         | 19,955       | 20,598 | 20,920 | 22,530 | 24,139 | 25,748 | 27,357 | 28,967 | 30,576 | 32,185 | 35,404 | 38,622 | 41,841 | 45,059 | 48,278 |
| 42         | 20,441       | 21,101 | 21,431 | 23,079 | 24,728 | 26,376 | 28,025 | 29,673 | 31,322 | 32,970 | 36,267 | 39,564 | 42,861 | 46,158 | 49,455 |
| 43         | 20,928       | 21,603 | 21,941 | 23,629 | 25,316 | 27,004 | 28,692 | 30,380 | 32,067 | 33,755 | 37,131 | 40,506 | 43,882 | 47,257 | 50,633 |
| 44         | 21,415       | 22,106 | 22,451 | 24,178 | 25,905 | 27,632 | 29,359 | 31,086 | 32,813 | 34,540 | 37,994 | 41,448 | 44,902 | 48,356 | 51,810 |
| 45         | 21,902       | 22,608 | 22,961 | 24,728 | 26,494 | 28,260 | 30,026 | 31,793 | 33,559 | 35,325 | 38,858 | 42,390 | 45,923 | 49,455 | 52,988 |

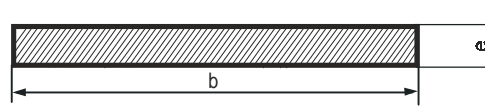
Calidad: S275 JR



**Tabla 3.15. Flejes, Pletinas y Llantas de acero (Hierros Planos) - Dimensiones y masas en Kg/m**

| espesor<br>mm | anchos en mm |        |        |        |        |        |        |        |        |        |        |        |        |         |         |
|---------------|--------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|---------|
|               | 160          | 170    | 180    | 190    | 200    | 210    | 220    | 230    | 240    | 250    | 260    | 270    | 280    | 290     | 300     |
| 1             | 1,256        | 1,335  | 1,413  | 1,492  | 1,570  | 1,649  | 1,727  | 1,806  | 1,884  | 1,963  | 2,041  | 2,120  | 2,198  | 2,277   | 2,355   |
| 2             | 2,512        | 2,669  | 2,826  | 2,983  | 3,140  | 3,297  | 3,454  | 3,611  | 3,768  | 3,925  | 4,082  | 4,239  | 4,396  | 4,553   | 4,710   |
| 3             | 3,768        | 4,004  | 4,239  | 4,475  | 4,710  | 4,946  | 5,181  | 5,417  | 5,652  | 5,888  | 6,123  | 6,359  | 6,594  | 6,830   | 7,065   |
| 4             | 5,024        | 5,338  | 5,652  | 5,966  | 6,280  | 6,594  | 6,908  | 7,222  | 7,536  | 7,850  | 8,164  | 8,478  | 8,792  | 9,106   | 9,420   |
| 5             | 6,280        | 6,673  | 7,065  | 7,458  | 7,850  | 8,243  | 8,635  | 9,028  | 9,420  | 9,813  | 10,205 | 10,598 | 10,990 | 11,383  | 11,775  |
| 6             | 7,536        | 8,007  | 8,478  | 8,949  | 9,420  | 9,891  | 10,362 | 10,833 | 11,304 | 11,775 | 12,246 | 12,717 | 13,188 | 13,659  | 14,130  |
| 7             | 8,792        | 9,342  | 9,891  | 10,441 | 10,990 | 11,540 | 12,089 | 12,639 | 13,188 | 13,738 | 14,287 | 14,837 | 15,386 | 15,936  | 16,485  |
| 8             | 10,048       | 10,676 | 11,304 | 11,932 | 12,560 | 13,188 | 13,816 | 14,444 | 15,072 | 15,700 | 16,328 | 16,956 | 17,584 | 18,212  | 18,840  |
| 9             | 11,304       | 12,011 | 12,717 | 13,424 | 14,130 | 14,837 | 15,543 | 16,250 | 16,956 | 17,663 | 18,369 | 19,076 | 19,782 | 20,489  | 21,195  |
| 10            | 12,560       | 13,345 | 14,130 | 14,915 | 15,700 | 16,485 | 17,270 | 18,055 | 18,840 | 19,625 | 20,410 | 21,195 | 21,980 | 22,765  | 23,550  |
| 11            | 13,816       | 14,680 | 15,543 | 16,407 | 17,270 | 18,134 | 18,997 | 19,861 | 20,724 | 21,588 | 22,451 | 23,315 | 24,178 | 25,042  | 25,905  |
| 12            | 15,072       | 16,014 | 16,956 | 17,898 | 18,840 | 19,782 | 20,724 | 21,666 | 22,608 | 23,550 | 24,492 | 25,434 | 26,376 | 27,318  | 28,260  |
| 13            | 16,328       | 17,349 | 18,369 | 19,390 | 20,410 | 21,431 | 22,451 | 23,472 | 24,492 | 25,513 | 26,533 | 27,554 | 28,574 | 29,595  | 30,615  |
| 14            | 17,584       | 18,683 | 19,782 | 20,881 | 21,980 | 23,079 | 24,178 | 25,277 | 26,376 | 27,475 | 28,574 | 29,673 | 30,772 | 31,871  | 32,970  |
| 15            | 18,840       | 20,018 | 21,195 | 22,373 | 23,550 | 24,728 | 25,905 | 27,083 | 28,260 | 29,438 | 30,615 | 31,793 | 32,970 | 34,148  | 35,325  |
| 16            | 20,096       | 21,352 | 22,608 | 23,864 | 25,120 | 26,376 | 27,632 | 28,888 | 30,144 | 31,400 | 32,656 | 33,912 | 35,168 | 36,424  | 37,680  |
| 17            | 21,352       | 22,687 | 24,021 | 25,356 | 26,690 | 28,025 | 29,359 | 30,694 | 32,028 | 33,363 | 34,697 | 36,032 | 37,366 | 38,701  | 40,035  |
| 18            | 22,608       | 24,021 | 25,434 | 26,847 | 28,260 | 29,673 | 31,086 | 32,499 | 33,912 | 35,325 | 36,738 | 38,151 | 39,564 | 40,977  | 42,390  |
| 19            | 23,864       | 25,356 | 26,847 | 28,339 | 29,830 | 31,322 | 32,813 | 34,305 | 35,796 | 37,288 | 38,779 | 40,271 | 41,762 | 43,254  | 44,745  |
| 20            | 25,120       | 26,690 | 28,260 | 29,830 | 31,400 | 32,970 | 34,540 | 36,110 | 37,680 | 39,250 | 40,820 | 42,390 | 43,960 | 45,530  | 47,100  |
| 21            | 26,376       | 28,025 | 29,673 | 31,322 | 32,970 | 34,619 | 36,267 | 37,916 | 39,564 | 41,213 | 42,861 | 44,510 | 46,158 | 47,807  | 49,455  |
| 22            | 27,632       | 29,359 | 31,086 | 32,813 | 34,540 | 36,267 | 37,994 | 39,721 | 41,448 | 43,175 | 44,902 | 46,629 | 48,356 | 50,083  | 51,810  |
| 23            | 28,888       | 30,694 | 32,499 | 34,305 | 36,110 | 37,916 | 39,721 | 41,527 | 43,332 | 45,138 | 46,943 | 48,749 | 50,554 | 52,360  | 54,165  |
| 24            | 30,144       | 32,028 | 33,912 | 35,796 | 37,680 | 39,564 | 41,448 | 43,332 | 45,216 | 47,100 | 48,984 | 50,868 | 52,752 | 54,636  | 56,520  |
| 25            | 31,400       | 33,363 | 35,325 | 37,288 | 39,250 | 41,213 | 43,175 | 45,138 | 47,100 | 49,063 | 51,025 | 52,988 | 54,950 | 56,913  | 58,875  |
| 26            | 32,656       | 34,697 | 36,738 | 38,779 | 40,820 | 42,861 | 44,902 | 46,943 | 48,984 | 51,025 | 53,066 | 55,107 | 57,148 | 59,189  | 61,230  |
| 27            | 33,912       | 36,032 | 38,151 | 40,271 | 42,390 | 44,510 | 46,629 | 48,749 | 50,868 | 52,988 | 55,107 | 57,227 | 59,346 | 61,466  | 63,585  |
| 28            | 35,168       | 37,366 | 39,564 | 41,762 | 43,960 | 46,158 | 48,356 | 50,554 | 52,752 | 54,950 | 57,148 | 59,346 | 61,544 | 63,742  | 65,940  |
| 29            | 36,424       | 38,701 | 40,977 | 43,254 | 45,530 | 47,807 | 50,083 | 52,360 | 54,636 | 56,913 | 59,189 | 61,466 | 63,742 | 66,019  | 68,295  |
| 30            | 37,680       | 40,035 | 42,390 | 44,745 | 47,100 | 49,455 | 51,810 | 54,165 | 56,520 | 58,875 | 61,230 | 63,585 | 65,940 | 68,295  | 70,650  |
| 31            | 38,936       | 41,370 | 43,803 | 46,237 | 48,670 | 51,104 | 53,537 | 55,971 | 58,404 | 60,838 | 63,271 | 65,705 | 68,138 | 70,572  | 73,005  |
| 32            | 40,192       | 42,704 | 45,216 | 47,728 | 50,240 | 52,752 | 55,264 | 57,776 | 60,288 | 62,800 | 65,312 | 67,824 | 70,336 | 72,848  | 75,360  |
| 33            | 41,448       | 44,039 | 46,629 | 49,220 | 51,810 | 54,401 | 56,991 | 59,582 | 62,172 | 64,763 | 67,353 | 69,944 | 72,534 | 75,125  | 77,715  |
| 34            | 42,704       | 45,373 | 48,042 | 50,711 | 53,380 | 56,049 | 58,718 | 61,387 | 64,056 | 66,725 | 69,394 | 72,063 | 74,732 | 77,401  | 80,070  |
| 35            | 43,960       | 46,708 | 49,455 | 52,203 | 54,950 | 57,698 | 60,445 | 63,193 | 65,940 | 68,688 | 71,435 | 74,183 | 76,930 | 79,678  | 82,425  |
| 36            | 45,216       | 48,042 | 50,868 | 53,694 | 56,520 | 59,346 | 62,172 | 64,998 | 67,824 | 70,650 | 73,476 | 76,302 | 79,128 | 81,954  | 84,780  |
| 37            | 46,472       | 49,377 | 52,281 | 55,186 | 58,090 | 60,995 | 63,899 | 66,804 | 69,708 | 72,613 | 75,517 | 78,422 | 81,326 | 84,231  | 87,135  |
| 38            | 47,728       | 50,711 | 53,694 | 56,677 | 59,660 | 62,643 | 65,626 | 68,609 | 71,592 | 74,575 | 77,558 | 80,541 | 83,524 | 86,507  | 89,490  |
| 39            | 48,984       | 52,046 | 55,107 | 58,169 | 61,230 | 64,292 | 67,353 | 70,415 | 73,476 | 76,538 | 79,599 | 82,661 | 85,722 | 88,784  | 91,845  |
| 40            | 50,240       | 53,380 | 56,520 | 59,660 | 62,800 | 65,940 | 69,080 | 72,220 | 75,360 | 78,500 | 81,640 | 84,780 | 87,920 | 91,060  | 94,200  |
| 41            | 51,496       | 54,715 | 57,933 | 61,152 | 64,370 | 67,589 | 70,807 | 74,026 | 77,244 | 80,463 | 83,681 | 86,900 | 90,118 | 93,337  | 96,555  |
| 42            | 52,752       | 56,049 | 59,346 | 62,643 | 65,940 | 69,237 | 72,534 | 75,831 | 79,128 | 82,425 | 85,722 | 89,019 | 92,316 | 95,613  | 98,910  |
| 43            | 54,008       | 57,384 | 60,759 | 64,135 | 67,510 | 70,886 | 74,261 | 77,637 | 81,012 | 84,388 | 87,763 | 91,139 | 94,514 | 97,890  | 101,265 |
| 44            | 55,264       | 58,718 | 62,172 | 65,626 | 69,080 | 72,534 | 75,988 | 79,442 | 82,896 | 86,350 | 89,804 | 93,258 | 96,712 | 100,166 | 103,620 |
| 45            | 56,520       | 60,053 | 63,585 | 67,118 | 70,650 | 74,183 | 77,715 | 81,248 | 84,780 | 88,313 | 91,845 | 95,378 | 98,910 | 102,443 | 105,975 |

Calidad: S275 JR



**Tabla 3.15. Flejes, Pletinas y Llantas de acero (Hierros Planos) - Dimensiones y masas en Kg/m**

| Espesor<br>mm | Anchos en mm |         |         |         |         |         |         |         |         |         |         |         |         |         |
|---------------|--------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
|               | 310          | 320     | 330     | 340     | 350     | 360     | 370     | 380     | 390     | 400     | 425     | 450     | 475     | 500     |
| 1             | 2.434        | 2.512   | 2.591   | 2.669   | 2.748   | 2.826   | 2.905   | 2.983   | 3.062   | 3.140   | 3.336   | 3.533   | 3.729   | 3.925   |
| 2             | 4.867        | 5.024   | 5.181   | 5.338   | 5.495   | 5.652   | 5.809   | 5.966   | 6.123   | 6.280   | 6.673   | 7.065   | 7.458   | 7.850   |
| 3             | 7.300        | 7.536   | 7.772   | 8.007   | 8.243   | 8.478   | 8.714   | 8.949   | 9.185   | 9.420   | 10.009  | 10.598  | 11.186  | 11.775  |
| 4             | 9.734        | 10.048  | 10.362  | 10.676  | 10.990  | 11.304  | 11.618  | 11.932  | 12.246  | 12.560  | 13.345  | 14.130  | 14.915  | 15.700  |
| 5             | 12.167       | 12.560  | 12.953  | 13.345  | 13.738  | 14.130  | 14.523  | 14.915  | 15.308  | 15.700  | 16.681  | 17.663  | 18.644  | 19.625  |
| 6             | 14.601       | 15.072  | 15.543  | 16.014  | 16.485  | 16.956  | 17.427  | 17.898  | 18.369  | 18.840  | 20.018  | 21.195  | 22.373  | 23.550  |
| 7             | 17.034       | 17.584  | 18.134  | 18.683  | 19.233  | 19.782  | 20.332  | 20.881  | 21.431  | 21.980  | 23.354  | 24.728  | 26.101  | 27.475  |
| 8             | 19.468       | 20.096  | 20.724  | 21.352  | 21.980  | 22.608  | 23.236  | 23.864  | 24.492  | 25.120  | 26.690  | 28.260  | 29.830  | 31.400  |
| 9             | 21.901       | 22.608  | 23.315  | 24.021  | 24.728  | 25.434  | 26.141  | 26.847  | 27.554  | 28.260  | 30.026  | 31.793  | 33.559  | 35.325  |
| 10            | 24.335       | 25.120  | 25.905  | 26.690  | 27.475  | 28.260  | 29.045  | 29.830  | 30.615  | 31.400  | 33.363  | 35.325  | 37.288  | 39.250  |
| 11            | 26.768       | 27.632  | 28.496  | 29.359  | 30.223  | 31.086  | 31.950  | 32.813  | 33.677  | 34.540  | 36.699  | 38.858  | 41.016  | 43.175  |
| 12            | 29.202       | 30.144  | 31.086  | 32.028  | 32.970  | 33.912  | 34.854  | 35.796  | 36.738  | 37.680  | 40.035  | 42.390  | 44.745  | 47.100  |
| 13            | 31.635       | 32.656  | 33.677  | 34.697  | 35.718  | 36.738  | 37.759  | 38.779  | 39.800  | 40.820  | 43.371  | 45.923  | 48.474  | 51.025  |
| 14            | 34.069       | 35.168  | 36.267  | 37.366  | 38.465  | 39.564  | 40.663  | 41.762  | 42.861  | 43.960  | 46.708  | 49.455  | 52.203  | 54.950  |
| 15            | 36.502       | 37.680  | 38.858  | 40.035  | 41.213  | 42.390  | 43.568  | 44.745  | 45.923  | 47.100  | 50.044  | 52.988  | 55.931  | 58.875  |
| 16            | 38.936       | 40.192  | 41.448  | 42.704  | 43.960  | 45.216  | 46.472  | 47.728  | 48.984  | 50.240  | 53.380  | 56.520  | 59.660  | 62.800  |
| 17            | 41.369       | 42.704  | 44.039  | 45.373  | 46.708  | 48.042  | 49.377  | 50.711  | 52.046  | 53.380  | 56.716  | 60.053  | 63.389  | 66.725  |
| 18            | 43.803       | 45.216  | 46.629  | 48.042  | 49.455  | 50.868  | 52.281  | 53.694  | 55.107  | 56.520  | 60.053  | 63.585  | 67.118  | 70.650  |
| 19            | 46.236       | 47.728  | 49.220  | 50.711  | 52.203  | 53.694  | 55.186  | 56.677  | 58.169  | 59.660  | 63.389  | 67.118  | 70.846  | 74.575  |
| 20            | 48.670       | 50.240  | 51.810  | 53.380  | 54.950  | 56.520  | 58.090  | 59.660  | 61.230  | 62.800  | 66.725  | 70.650  | 74.575  | 78.500  |
| 21            | 51.103       | 52.752  | 54.401  | 56.049  | 57.698  | 59.346  | 60.995  | 62.643  | 64.292  | 65.940  | 70.061  | 74.183  | 78.304  | 82.425  |
| 22            | 53.537       | 55.264  | 56.991  | 58.718  | 60.445  | 62.172  | 63.899  | 65.626  | 67.353  | 69.080  | 73.398  | 77.715  | 82.033  | 86.350  |
| 23            | 55.970       | 57.776  | 59.582  | 61.387  | 63.193  | 64.998  | 66.804  | 68.609  | 70.415  | 72.220  | 76.734  | 81.248  | 85.761  | 90.275  |
| 24            | 58.404       | 60.288  | 62.172  | 64.056  | 65.940  | 67.824  | 69.708  | 71.592  | 73.476  | 75.360  | 80.070  | 84.780  | 89.490  | 94.200  |
| 25            | 60.837       | 62.800  | 64.763  | 66.725  | 68.688  | 70.650  | 72.613  | 74.575  | 76.538  | 78.500  | 83.406  | 88.313  | 93.219  | 98.125  |
| 26            | 63.271       | 65.312  | 67.353  | 69.394  | 71.435  | 73.476  | 75.517  | 77.558  | 79.599  | 81.640  | 86.743  | 91.845  | 96.948  | 102.050 |
| 27            | 65.704       | 67.824  | 69.944  | 72.063  | 74.183  | 76.302  | 78.422  | 80.541  | 82.661  | 84.780  | 90.079  | 95.378  | 100.676 | 105.975 |
| 28            | 68.138       | 70.336  | 72.534  | 74.732  | 76.930  | 79.128  | 81.326  | 83.524  | 85.722  | 87.920  | 93.415  | 98.910  | 104.405 | 109.900 |
| 29            | 70.571       | 72.848  | 75.125  | 77.401  | 79.678  | 81.954  | 84.231  | 86.507  | 88.784  | 91.060  | 96.751  | 102.443 | 108.134 | 113.825 |
| 30            | 73.005       | 75.360  | 77.715  | 80.070  | 82.425  | 84.780  | 87.135  | 89.490  | 91.845  | 94.200  | 100.088 | 105.975 | 111.863 | 117.750 |
| 31            | 75.438       | 77.872  | 80.306  | 82.739  | 85.173  | 87.606  | 90.040  | 92.473  | 94.907  | 97.340  | 103.424 | 109.508 | 115.591 | 121.675 |
| 32            | 77.872       | 80.384  | 82.896  | 85.408  | 87.920  | 90.432  | 92.944  | 95.456  | 97.968  | 100.480 | 106.760 | 113.040 | 119.320 | 125.600 |
| 33            | 80.305       | 82.896  | 85.487  | 88.077  | 90.668  | 93.258  | 95.849  | 98.439  | 101.030 | 103.620 | 110.096 | 116.573 | 123.049 | 129.525 |
| 34            | 82.739       | 85.408  | 88.077  | 90.746  | 93.415  | 96.084  | 98.753  | 101.422 | 104.091 | 106.760 | 113.433 | 120.105 | 126.778 | 133.450 |
| 35            | 85.172       | 87.920  | 90.668  | 93.415  | 96.163  | 98.910  | 101.658 | 104.405 | 107.153 | 109.900 | 116.769 | 123.638 | 130.506 | 137.375 |
| 36            | 87.606       | 90.432  | 93.258  | 96.084  | 98.910  | 101.736 | 104.562 | 107.388 | 110.214 | 113.040 | 120.105 | 127.170 | 134.235 | 141.300 |
| 37            | 90.039       | 92.944  | 95.849  | 98.753  | 101.658 | 104.562 | 107.467 | 110.371 | 113.276 | 116.180 | 123.441 | 130.703 | 137.964 | 145.225 |
| 38            | 92.473       | 95.456  | 98.439  | 101.422 | 104.405 | 107.388 | 110.371 | 113.354 | 116.337 | 119.320 | 126.778 | 134.235 | 141.693 | 149.150 |
| 39            | 94.906       | 97.968  | 101.030 | 104.091 | 107.153 | 110.214 | 113.276 | 116.337 | 119.399 | 122.460 | 130.114 | 137.768 | 145.421 | 153.075 |
| 40            | 97.340       | 100.480 | 103.620 | 106.760 | 109.900 | 113.040 | 116.180 | 119.320 | 122.460 | 125.600 | 133.450 | 141.300 | 149.150 | 157.000 |
| 41            | 99.773       | 102.992 | 106.211 | 109.429 | 112.648 | 115.866 | 119.085 | 122.303 | 125.522 | 128.740 | 136.786 | 144.833 | 152.879 | 160.925 |
| 42            | 102.207      | 105.504 | 108.801 | 112.098 | 115.395 | 118.692 | 121.989 | 125.286 | 128.583 | 131.880 | 140.123 | 148.365 | 156.608 | 164.850 |
| 43            | 104.640      | 108.016 | 111.392 | 114.767 | 118.143 | 121.518 | 124.894 | 128.269 | 131.645 | 135.020 | 143.459 | 151.898 | 160.336 | 168.775 |
| 44            | 107.074      | 110.528 | 113.982 | 117.436 | 120.890 | 124.344 | 127.798 | 131.252 | 134.706 | 138.160 | 146.795 | 155.430 | 164.065 | 172.700 |
| 45            | 109.507      | 113.040 | 116.573 | 120.105 | 123.638 | 127.170 | 130.703 | 134.235 | 137.768 | 141.300 | 150.131 | 158.963 | 167.794 | 176.625 |

Calidad: S275 JR

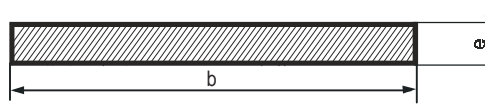
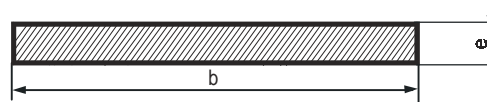


Tabla 3-16 Flejes, Pletinas y Llantas de acero - Dimensiones y secciones en cm<sup>2</sup>.

| Espesor mm | Anchos en mm |      |      |      |      |      |      |      |       |       |       |       |       |       |       |       |
|------------|--------------|------|------|------|------|------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|
|            | 10           | 12   | 14   | 15   | 16   | 18   | 20   | 22   | 24    | 25    | 26    | 28    | 30    | 32    | 34    | 35    |
| 1          | 0,10         | 0,12 | 0,14 | 0,15 | 0,16 | 0,18 | 0,20 | 0,22 | 0,24  | 0,25  | 0,26  | 0,28  | 0,30  | 0,32  | 0,34  | 0,35  |
| 2          | 0,20         | 0,24 | 0,28 | 0,30 | 0,32 | 0,36 | 0,40 | 0,44 | 0,48  | 0,50  | 0,52  | 0,56  | 0,60  | 0,64  | 0,68  | 0,70  |
| 3          | 0,30         | 0,36 | 0,42 | 0,45 | 0,48 | 0,54 | 0,60 | 0,66 | 0,72  | 0,75  | 0,78  | 0,84  | 0,90  | 0,96  | 1,02  | 1,05  |
| 4          | 0,40         | 0,48 | 0,56 | 0,60 | 0,64 | 0,72 | 0,80 | 0,88 | 0,96  | 1,00  | 1,04  | 1,12  | 1,20  | 1,28  | 1,36  | 1,40  |
| 5          | 0,50         | 0,60 | 0,70 | 0,75 | 0,80 | 0,90 | 1,00 | 1,10 | 1,20  | 1,25  | 1,30  | 1,40  | 1,50  | 1,60  | 1,70  | 1,75  |
| 6          | 0,60         | 0,72 | 0,84 | 0,90 | 0,96 | 1,08 | 1,20 | 1,32 | 1,44  | 1,50  | 1,56  | 1,68  | 1,80  | 1,92  | 2,04  | 2,10  |
| 7          | 0,70         | 0,84 | 0,98 | 1,05 | 1,12 | 1,26 | 1,40 | 1,54 | 1,68  | 1,75  | 1,82  | 1,96  | 2,10  | 2,24  | 2,38  | 2,45  |
| 8          | 0,80         | 0,96 | 1,12 | 1,20 | 1,28 | 1,44 | 1,60 | 1,76 | 1,92  | 2,00  | 2,08  | 2,24  | 2,40  | 2,56  | 2,72  | 2,80  |
| 9          | 0,90         | 1,08 | 1,26 | 1,35 | 1,44 | 1,62 | 1,80 | 1,98 | 2,16  | 2,25  | 2,34  | 2,52  | 2,70  | 2,88  | 3,06  | 3,15  |
| 10         | 1,00         | 1,20 | 1,40 | 1,50 | 1,60 | 1,80 | 2,00 | 2,20 | 2,40  | 2,50  | 2,60  | 2,80  | 3,00  | 3,20  | 3,40  | 3,50  |
| 11         | 1,10         | 1,32 | 1,54 | 1,65 | 1,76 | 1,98 | 2,20 | 2,42 | 2,64  | 2,75  | 2,86  | 3,08  | 3,30  | 3,52  | 3,74  | 3,85  |
| 12         | 1,20         | 1,44 | 1,68 | 1,80 | 1,92 | 2,16 | 2,40 | 2,64 | 2,88  | 3,00  | 3,12  | 3,36  | 3,60  | 3,84  | 4,08  | 4,20  |
| 13         | 1,30         | 1,56 | 1,82 | 1,95 | 2,08 | 2,34 | 2,60 | 2,86 | 3,12  | 3,25  | 3,38  | 3,64  | 3,90  | 4,16  | 4,42  | 4,55  |
| 14         | 1,40         | 1,68 | 1,96 | 2,10 | 2,24 | 2,52 | 2,80 | 3,08 | 3,36  | 3,50  | 3,64  | 3,92  | 4,20  | 4,48  | 4,76  | 4,90  |
| 15         | 1,50         | 1,80 | 2,10 | 2,25 | 2,40 | 2,70 | 3,00 | 3,30 | 3,60  | 3,75  | 3,90  | 4,20  | 4,50  | 4,80  | 5,10  | 5,25  |
| 16         | 1,60         | 1,92 | 2,24 | 2,40 | 2,56 | 2,88 | 3,20 | 3,52 | 3,84  | 4,00  | 4,16  | 4,48  | 4,80  | 5,12  | 5,44  | 5,60  |
| 17         | 1,70         | 2,04 | 2,38 | 2,55 | 2,72 | 3,06 | 3,40 | 3,74 | 4,08  | 4,25  | 4,42  | 4,76  | 5,10  | 5,44  | 5,78  | 5,95  |
| 18         | 1,80         | 2,16 | 2,52 | 2,70 | 2,88 | 3,24 | 3,60 | 3,96 | 4,32  | 4,50  | 4,68  | 5,04  | 5,40  | 5,76  | 6,12  | 6,30  |
| 19         | 1,90         | 2,28 | 2,66 | 2,85 | 3,04 | 3,42 | 3,80 | 4,18 | 4,56  | 4,75  | 4,94  | 5,32  | 5,70  | 6,08  | 6,46  | 6,65  |
| 20         | 2,00         | 2,40 | 2,80 | 3,00 | 3,20 | 3,60 | 4,00 | 4,40 | 4,80  | 5,00  | 5,20  | 5,60  | 6,00  | 6,40  | 6,80  | 7,00  |
| 21         | 2,10         | 2,52 | 2,94 | 3,15 | 3,36 | 3,78 | 4,20 | 4,62 | 5,04  | 5,25  | 5,46  | 5,88  | 6,30  | 6,72  | 7,14  | 7,35  |
| 22         | 2,20         | 2,64 | 3,08 | 3,30 | 3,52 | 3,96 | 4,40 | 4,84 | 5,28  | 5,50  | 5,72  | 6,16  | 6,60  | 7,04  | 7,48  | 7,70  |
| 23         | 2,30         | 2,76 | 3,22 | 3,45 | 3,68 | 4,14 | 4,60 | 5,06 | 5,52  | 5,75  | 5,98  | 6,44  | 6,90  | 7,36  | 7,82  | 8,05  |
| 24         | 2,40         | 2,88 | 3,36 | 3,60 | 3,84 | 4,32 | 4,80 | 5,28 | 5,76  | 6,00  | 6,24  | 6,72  | 7,20  | 7,68  | 8,16  | 8,40  |
| 25         | 2,50         | 3,00 | 3,50 | 3,75 | 4,00 | 4,50 | 5,00 | 5,50 | 6,00  | 6,25  | 6,50  | 7,00  | 7,50  | 8,00  | 8,50  | 8,75  |
| 26         | 2,60         | 3,12 | 3,64 | 3,90 | 4,16 | 4,68 | 5,20 | 5,72 | 6,24  | 6,50  | 6,76  | 7,28  | 7,80  | 8,32  | 8,84  | 9,10  |
| 27         | 2,70         | 3,24 | 3,78 | 4,05 | 4,32 | 4,86 | 5,40 | 5,94 | 6,48  | 6,75  | 7,02  | 7,56  | 8,10  | 8,64  | 9,18  | 9,45  |
| 28         | 2,80         | 3,36 | 3,92 | 4,20 | 4,48 | 5,04 | 5,60 | 6,16 | 6,72  | 7,00  | 7,28  | 7,84  | 8,40  | 8,96  | 9,52  | 9,80  |
| 29         | 2,90         | 3,48 | 4,06 | 4,35 | 4,64 | 5,22 | 5,80 | 6,38 | 6,96  | 7,25  | 7,54  | 8,12  | 8,70  | 9,28  | 9,86  | 10,15 |
| 30         | 3,00         | 3,60 | 4,20 | 4,50 | 4,80 | 5,40 | 6,00 | 6,60 | 7,20  | 7,50  | 7,80  | 8,40  | 9,00  | 9,60  | 10,20 | 10,50 |
| 31         | 3,10         | 3,72 | 4,34 | 4,65 | 4,96 | 5,58 | 6,20 | 6,82 | 7,44  | 7,75  | 8,06  | 8,68  | 9,30  | 9,92  | 10,54 | 10,85 |
| 32         | 3,20         | 3,84 | 4,48 | 4,80 | 5,12 | 5,76 | 6,40 | 7,04 | 7,68  | 8,00  | 8,32  | 8,96  | 9,60  | 10,24 | 10,88 | 11,20 |
| 33         | 3,30         | 3,96 | 4,62 | 4,95 | 5,28 | 5,94 | 6,60 | 7,26 | 7,92  | 8,25  | 8,58  | 9,24  | 9,90  | 10,56 | 11,22 | 11,55 |
| 34         | 3,40         | 4,08 | 4,76 | 5,10 | 5,44 | 6,12 | 6,80 | 7,48 | 8,16  | 8,50  | 8,84  | 9,52  | 10,20 | 10,88 | 11,56 | 11,90 |
| 35         | 3,50         | 4,20 | 4,90 | 5,25 | 5,60 | 6,30 | 7,00 | 7,70 | 8,40  | 8,75  | 9,10  | 9,80  | 10,50 | 11,20 | 11,90 | 12,25 |
| 36         | 3,60         | 4,32 | 5,04 | 5,40 | 5,76 | 6,48 | 7,20 | 7,92 | 8,64  | 9,00  | 9,36  | 10,08 | 10,80 | 11,52 | 12,24 | 12,60 |
| 37         | 3,70         | 4,44 | 5,18 | 5,55 | 5,92 | 6,66 | 7,40 | 8,14 | 8,88  | 9,25  | 9,62  | 10,36 | 11,10 | 11,84 | 12,58 | 12,95 |
| 38         | 3,80         | 4,56 | 5,32 | 5,70 | 6,08 | 6,84 | 7,60 | 8,36 | 9,12  | 9,50  | 9,88  | 10,64 | 11,40 | 12,16 | 12,92 | 13,30 |
| 39         | 3,90         | 4,68 | 5,46 | 5,85 | 6,24 | 7,02 | 7,80 | 8,58 | 9,36  | 9,75  | 10,14 | 10,92 | 11,70 | 12,48 | 13,26 | 13,65 |
| 40         | 4,00         | 4,80 | 5,60 | 6,00 | 6,40 | 7,20 | 8,00 | 8,80 | 9,60  | 10,00 | 10,40 | 11,20 | 12,00 | 12,80 | 13,60 | 14,00 |
| 41         | 4,10         | 4,92 | 5,74 | 6,15 | 6,56 | 7,38 | 8,20 | 9,02 | 9,84  | 10,25 | 10,66 | 11,48 | 12,30 | 13,12 | 13,94 | 14,35 |
| 42         | 4,20         | 5,04 | 5,88 | 6,30 | 6,72 | 7,56 | 8,40 | 9,24 | 10,08 | 10,50 | 10,92 | 11,76 | 12,60 | 13,44 | 14,28 | 14,70 |
| 43         | 4,30         | 5,16 | 6,02 | 6,45 | 6,88 | 7,74 | 8,60 | 9,46 | 10,32 | 10,75 | 11,18 | 12,04 | 12,90 | 13,76 | 14,62 | 15,05 |
| 44         | 4,40         | 5,28 | 6,16 | 6,60 | 7,04 | 7,92 | 8,80 | 9,68 | 10,56 | 11,00 | 11,44 | 12,32 | 13,20 | 14,08 | 14,96 | 15,40 |
| 45         | 4,50         | 5,40 | 6,30 | 6,75 | 7,20 | 8,10 | 9,00 | 9,90 | 10,80 | 11,25 | 11,70 | 12,60 | 13,50 | 14,40 | 15,30 | 15,75 |

Calidad: S275 JR

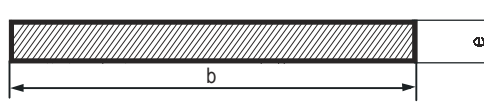


**Tabla 3.16. Flejes, Pletinas y Llantas de acero (Hierros Planos) - Dimensiones y secciones en cm<sup>2</sup>.**

| Espesor mm | Anchos en mm |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
|------------|--------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|            | 36           | 38    | 40    | 42    | 44    | 45    | 46    | 48    | 50    | 52    | 54    | 55    | 56    | 58    | 60    |
| 1          | 0,36         | 0,38  | 0,40  | 0,42  | 0,44  | 0,45  | 0,46  | 0,48  | 0,50  | 0,52  | 0,54  | 0,55  | 0,56  | 0,58  | 0,60  |
| 2          | 0,72         | 0,76  | 0,80  | 0,84  | 0,88  | 0,90  | 0,92  | 0,96  | 1,00  | 1,04  | 1,08  | 1,10  | 1,12  | 1,16  | 1,20  |
| 3          | 1,08         | 1,14  | 1,20  | 1,26  | 1,32  | 1,35  | 1,38  | 1,44  | 1,50  | 1,56  | 1,62  | 1,65  | 1,68  | 1,74  | 1,80  |
| 4          | 1,44         | 1,52  | 1,60  | 1,68  | 1,76  | 1,80  | 1,84  | 1,92  | 2,00  | 2,08  | 2,16  | 2,20  | 2,24  | 2,32  | 2,40  |
| 5          | 1,80         | 1,90  | 2,00  | 2,10  | 2,20  | 2,25  | 2,30  | 2,40  | 2,50  | 2,60  | 2,70  | 2,75  | 2,80  | 2,90  | 3,00  |
| 6          | 2,16         | 2,28  | 2,40  | 2,52  | 2,64  | 2,70  | 2,76  | 2,88  | 3,00  | 3,12  | 3,24  | 3,30  | 3,36  | 3,48  | 3,60  |
| 7          | 2,52         | 2,66  | 2,80  | 2,94  | 3,08  | 3,15  | 3,22  | 3,36  | 3,50  | 3,64  | 3,78  | 3,85  | 3,92  | 4,06  | 4,20  |
| 8          | 2,88         | 3,04  | 3,20  | 3,36  | 3,52  | 3,60  | 3,68  | 3,84  | 4,00  | 4,16  | 4,32  | 4,40  | 4,48  | 4,64  | 4,80  |
| 9          | 3,24         | 3,42  | 3,60  | 3,78  | 3,96  | 4,05  | 4,14  | 4,32  | 4,50  | 4,68  | 4,86  | 4,95  | 5,04  | 5,22  | 5,40  |
| 10         | 3,60         | 3,80  | 4,00  | 4,20  | 4,40  | 4,50  | 4,60  | 4,80  | 5,00  | 5,20  | 5,40  | 5,50  | 5,60  | 5,80  | 6,00  |
| 11         | 3,96         | 4,18  | 4,40  | 4,62  | 4,84  | 4,95  | 5,06  | 5,28  | 5,50  | 5,72  | 5,94  | 6,05  | 6,16  | 6,38  | 6,60  |
| 12         | 4,32         | 4,56  | 4,80  | 5,04  | 5,28  | 5,40  | 5,52  | 5,76  | 6,00  | 6,24  | 6,48  | 6,60  | 6,72  | 6,96  | 7,20  |
| 13         | 4,68         | 4,94  | 5,20  | 5,46  | 5,72  | 5,85  | 5,98  | 6,24  | 6,50  | 6,76  | 7,02  | 7,15  | 7,28  | 7,54  | 7,80  |
| 14         | 5,04         | 5,32  | 5,60  | 5,88  | 6,16  | 6,30  | 6,44  | 6,72  | 7,00  | 7,28  | 7,56  | 7,70  | 7,84  | 8,12  | 8,40  |
| 15         | 5,40         | 5,70  | 6,00  | 6,30  | 6,60  | 6,75  | 6,90  | 7,20  | 7,50  | 7,80  | 8,10  | 8,25  | 8,40  | 8,70  | 9,00  |
| 16         | 5,76         | 6,08  | 6,40  | 6,72  | 7,04  | 7,20  | 7,36  | 7,68  | 8,00  | 8,32  | 8,64  | 8,80  | 8,96  | 9,28  | 9,60  |
| 17         | 6,12         | 6,46  | 6,80  | 7,14  | 7,48  | 7,65  | 7,82  | 8,16  | 8,50  | 8,84  | 9,18  | 9,35  | 9,52  | 9,86  | 10,20 |
| 18         | 6,48         | 6,84  | 7,20  | 7,56  | 7,92  | 8,10  | 8,28  | 8,64  | 9,00  | 9,36  | 9,72  | 9,90  | 10,08 | 10,44 | 10,80 |
| 19         | 6,84         | 7,22  | 7,60  | 7,98  | 8,36  | 8,55  | 8,74  | 9,12  | 9,50  | 9,88  | 10,26 | 10,45 | 10,64 | 11,02 | 11,40 |
| 20         | 7,20         | 7,60  | 8,00  | 8,40  | 8,80  | 9,00  | 9,20  | 9,60  | 10,00 | 10,40 | 10,80 | 11,00 | 11,20 | 11,60 | 12,00 |
| 21         | 7,56         | 7,98  | 8,40  | 8,82  | 9,24  | 9,45  | 9,66  | 10,08 | 10,50 | 10,92 | 11,34 | 11,55 | 11,76 | 12,18 | 12,60 |
| 22         | 7,92         | 8,36  | 8,80  | 9,24  | 9,68  | 9,90  | 10,12 | 10,56 | 11,00 | 11,44 | 11,88 | 12,10 | 12,32 | 12,76 | 13,20 |
| 23         | 8,28         | 8,74  | 9,20  | 9,66  | 10,12 | 10,35 | 10,58 | 11,04 | 11,50 | 11,96 | 12,42 | 12,65 | 12,88 | 13,34 | 13,80 |
| 24         | 8,64         | 9,12  | 9,60  | 10,08 | 10,56 | 10,80 | 11,04 | 11,52 | 12,00 | 12,48 | 12,96 | 13,20 | 13,44 | 13,92 | 14,40 |
| 25         | 9,00         | 9,50  | 10,00 | 10,50 | 11,00 | 11,25 | 11,50 | 12,00 | 12,50 | 13,00 | 13,50 | 13,75 | 14,00 | 14,50 | 15,00 |
| 26         | 9,36         | 9,88  | 10,40 | 10,92 | 11,44 | 11,70 | 11,96 | 12,48 | 13,00 | 13,52 | 14,04 | 14,30 | 14,56 | 15,08 | 15,60 |
| 27         | 9,72         | 10,26 | 10,80 | 11,34 | 11,88 | 12,15 | 12,42 | 12,96 | 13,50 | 14,04 | 14,58 | 14,85 | 15,12 | 15,66 | 16,20 |
| 28         | 10,08        | 10,64 | 11,20 | 11,76 | 12,32 | 12,60 | 12,88 | 13,44 | 14,00 | 14,56 | 15,12 | 15,40 | 15,68 | 16,24 | 16,80 |
| 29         | 10,44        | 11,02 | 11,60 | 12,18 | 12,76 | 13,05 | 13,34 | 13,92 | 14,50 | 15,08 | 15,66 | 15,95 | 16,24 | 16,82 | 17,40 |
| 30         | 10,80        | 11,40 | 12,00 | 12,60 | 13,20 | 13,50 | 13,80 | 14,40 | 15,00 | 15,60 | 16,20 | 16,50 | 16,80 | 17,40 | 18,00 |
| 31         | 11,16        | 11,78 | 12,40 | 13,02 | 13,64 | 13,95 | 14,26 | 14,88 | 15,50 | 16,12 | 16,74 | 17,05 | 17,36 | 17,98 | 18,60 |
| 32         | 11,52        | 12,16 | 12,80 | 13,44 | 14,08 | 14,40 | 14,72 | 15,36 | 16,00 | 16,64 | 17,28 | 17,60 | 17,92 | 18,56 | 19,20 |
| 33         | 11,88        | 12,54 | 13,20 | 13,86 | 14,52 | 14,85 | 15,18 | 15,84 | 16,50 | 17,16 | 17,82 | 18,15 | 18,48 | 19,14 | 19,80 |
| 34         | 12,24        | 12,92 | 13,60 | 14,28 | 14,96 | 15,30 | 15,64 | 16,32 | 17,00 | 17,68 | 18,36 | 18,70 | 19,04 | 19,72 | 20,40 |
| 35         | 12,60        | 13,30 | 14,00 | 14,70 | 15,40 | 15,75 | 16,10 | 16,80 | 17,50 | 18,20 | 18,90 | 19,25 | 19,60 | 20,30 | 21,00 |
| 36         | 12,96        | 13,68 | 14,40 | 15,12 | 15,84 | 16,20 | 16,56 | 17,28 | 18,00 | 18,72 | 19,44 | 19,80 | 20,16 | 20,88 | 21,60 |
| 37         | 13,32        | 14,06 | 14,80 | 15,54 | 16,28 | 16,65 | 17,02 | 17,76 | 18,50 | 19,24 | 19,98 | 20,35 | 20,72 | 21,46 | 22,20 |
| 38         | 13,68        | 14,44 | 15,20 | 15,96 | 16,72 | 17,10 | 17,48 | 18,24 | 19,00 | 19,76 | 20,52 | 20,90 | 21,28 | 22,04 | 22,80 |
| 39         | 14,04        | 14,82 | 15,60 | 16,38 | 17,16 | 17,55 | 17,94 | 18,72 | 19,50 | 20,28 | 21,06 | 21,45 | 21,84 | 22,62 | 23,40 |
| 40         | 14,40        | 15,20 | 16,00 | 16,80 | 17,60 | 18,00 | 18,40 | 19,20 | 20,00 | 20,80 | 21,60 | 22,00 | 22,40 | 23,20 | 24,00 |
| 41         | 14,76        | 15,58 | 16,40 | 17,22 | 18,04 | 18,45 | 18,86 | 19,68 | 20,50 | 21,32 | 22,14 | 22,55 | 22,96 | 23,78 | 24,60 |
| 42         | 15,12        | 15,96 | 16,80 | 17,64 | 18,48 | 18,90 | 19,32 | 20,16 | 21,00 | 21,84 | 22,68 | 23,10 | 23,52 | 24,36 | 25,20 |
| 43         | 15,48        | 16,34 | 17,20 | 18,06 | 18,92 | 19,35 | 19,78 | 20,64 | 21,50 | 22,36 | 23,22 | 23,65 | 24,08 | 24,94 | 25,80 |
| 44         | 15,84        | 16,72 | 17,60 | 18,48 | 19,36 | 19,80 | 20,24 | 21,12 | 22,00 | 22,88 | 23,76 | 24,20 | 24,64 | 25,52 | 26,40 |
| 45         | 16,20        | 17,10 | 18,00 | 18,90 | 19,80 | 20,25 | 20,70 | 21,60 | 22,50 | 23,40 | 24,30 | 24,75 | 25,20 | 26,10 | 27,00 |

Calidad: S275 JR

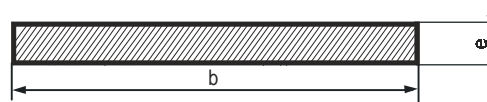




**Tabla 3.16. Flejes, Pletinas y Llantas de acero (Hierros Planos) - Dimensiones y secciones en cm<sup>2</sup>.**

| Espesor<br>mm | Anchos en mm |       |       |       |       |       |       |       |       |       |       |       |       |       |       |
|---------------|--------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
|               | 62           | 64    | 65    | 70    | 75    | 80    | 85    | 90    | 95    | 100   | 110   | 120   | 130   | 140   | 150   |
| 1             | 0,62         | 0,64  | 0,65  | 0,70  | 0,75  | 0,80  | 0,85  | 0,90  | 0,95  | 1,00  | 1,10  | 1,20  | 1,30  | 1,40  | 1,50  |
| 2             | 1,24         | 1,28  | 1,30  | 1,40  | 1,50  | 1,60  | 1,70  | 1,80  | 1,90  | 2,00  | 2,20  | 2,40  | 2,60  | 2,80  | 3,00  |
| 3             | 1,86         | 1,92  | 1,95  | 2,10  | 2,25  | 2,40  | 2,55  | 2,70  | 2,85  | 3,00  | 3,30  | 3,60  | 3,90  | 4,20  | 4,50  |
| 4             | 2,48         | 2,56  | 2,60  | 2,80  | 3,00  | 3,20  | 3,40  | 3,60  | 3,80  | 4,00  | 4,40  | 4,80  | 5,20  | 5,60  | 6,00  |
| 5             | 3,10         | 3,20  | 3,25  | 3,50  | 3,75  | 4,00  | 4,25  | 4,50  | 4,75  | 5,00  | 5,50  | 6,00  | 6,50  | 7,00  | 7,50  |
| 6             | 3,72         | 3,84  | 3,90  | 4,20  | 4,50  | 4,80  | 5,10  | 5,40  | 5,70  | 6,00  | 6,60  | 7,20  | 7,80  | 8,40  | 9,00  |
| 7             | 4,34         | 4,48  | 4,55  | 4,90  | 5,25  | 5,60  | 5,95  | 6,30  | 6,65  | 7,00  | 7,70  | 8,40  | 9,10  | 9,80  | 10,50 |
| 8             | 4,96         | 5,12  | 5,20  | 5,60  | 6,00  | 6,40  | 6,80  | 7,20  | 7,60  | 8,00  | 8,80  | 9,60  | 10,40 | 11,20 | 12,00 |
| 9             | 5,58         | 5,76  | 5,85  | 6,30  | 6,75  | 7,20  | 7,65  | 8,10  | 8,55  | 9,00  | 9,90  | 10,80 | 11,70 | 12,60 | 13,50 |
| 10            | 6,20         | 6,40  | 6,50  | 7,00  | 7,50  | 8,00  | 8,50  | 9,00  | 9,50  | 10,00 | 11,00 | 12,00 | 13,00 | 14,00 | 15,00 |
| 11            | 6,82         | 7,04  | 7,15  | 7,70  | 8,25  | 8,80  | 9,35  | 9,90  | 10,45 | 11,00 | 12,10 | 13,20 | 14,30 | 15,40 | 16,50 |
| 12            | 7,44         | 7,68  | 7,80  | 8,40  | 9,00  | 9,60  | 10,20 | 10,80 | 11,40 | 12,00 | 13,20 | 14,40 | 15,60 | 16,80 | 18,00 |
| 13            | 8,06         | 8,32  | 8,45  | 9,10  | 9,75  | 10,40 | 11,05 | 11,70 | 12,35 | 13,00 | 14,30 | 15,60 | 16,90 | 18,20 | 19,50 |
| 14            | 8,68         | 8,96  | 9,10  | 9,80  | 10,50 | 11,20 | 11,90 | 12,60 | 13,30 | 14,00 | 15,40 | 16,80 | 18,20 | 19,60 | 21,00 |
| 15            | 9,30         | 9,60  | 9,75  | 10,50 | 11,25 | 12,00 | 12,75 | 13,50 | 14,25 | 15,00 | 16,50 | 18,00 | 19,50 | 21,00 | 22,50 |
| 16            | 9,92         | 10,24 | 10,40 | 11,20 | 12,00 | 12,80 | 13,60 | 14,40 | 15,20 | 16,00 | 17,60 | 19,20 | 20,80 | 22,40 | 24,00 |
| 17            | 10,54        | 10,88 | 11,05 | 11,90 | 12,75 | 13,60 | 14,45 | 15,30 | 16,15 | 17,00 | 18,70 | 20,40 | 22,10 | 23,80 | 25,50 |
| 18            | 11,16        | 11,52 | 11,70 | 12,60 | 13,50 | 14,40 | 15,30 | 16,20 | 17,10 | 18,00 | 19,80 | 21,60 | 23,40 | 25,20 | 27,00 |
| 19            | 11,78        | 12,16 | 12,35 | 13,30 | 14,25 | 15,20 | 16,15 | 17,10 | 18,05 | 19,00 | 20,90 | 22,80 | 24,70 | 26,60 | 28,50 |
| 20            | 12,40        | 12,80 | 13,00 | 14,00 | 15,00 | 16,00 | 17,00 | 18,00 | 19,00 | 20,00 | 22,00 | 24,00 | 26,00 | 28,00 | 30,00 |
| 21            | 13,02        | 13,44 | 13,65 | 14,70 | 15,75 | 16,80 | 17,85 | 18,90 | 19,95 | 21,00 | 23,10 | 25,20 | 27,30 | 29,40 | 31,50 |
| 22            | 13,64        | 14,08 | 14,30 | 15,40 | 16,50 | 17,60 | 18,70 | 19,80 | 20,90 | 22,00 | 24,20 | 26,40 | 28,60 | 30,80 | 33,00 |
| 23            | 14,26        | 14,72 | 14,95 | 16,10 | 17,25 | 18,40 | 19,55 | 20,70 | 21,85 | 23,00 | 25,30 | 27,60 | 29,90 | 32,20 | 34,50 |
| 24            | 14,88        | 15,36 | 15,60 | 16,80 | 18,00 | 19,20 | 20,40 | 21,60 | 22,80 | 24,00 | 26,40 | 28,80 | 31,20 | 33,60 | 36,00 |
| 25            | 15,50        | 16,00 | 16,25 | 17,50 | 18,75 | 20,00 | 21,25 | 22,50 | 23,75 | 25,00 | 27,50 | 30,00 | 32,50 | 35,00 | 37,50 |
| 26            | 16,12        | 16,64 | 16,90 | 18,20 | 19,50 | 20,80 | 22,10 | 23,40 | 24,70 | 26,00 | 28,60 | 31,20 | 33,80 | 36,40 | 39,00 |
| 27            | 16,74        | 17,28 | 17,55 | 18,90 | 20,25 | 21,60 | 22,95 | 24,30 | 25,65 | 27,00 | 29,70 | 32,40 | 35,10 | 37,80 | 40,50 |
| 28            | 17,36        | 17,92 | 18,20 | 19,60 | 21,00 | 22,40 | 23,80 | 25,20 | 26,60 | 28,00 | 30,80 | 33,60 | 36,40 | 39,20 | 42,00 |
| 29            | 17,98        | 18,56 | 18,85 | 20,30 | 21,75 | 23,20 | 24,65 | 26,10 | 27,55 | 29,00 | 31,90 | 34,80 | 37,70 | 40,60 | 43,50 |
| 30            | 18,60        | 19,20 | 19,50 | 21,00 | 22,50 | 24,00 | 25,50 | 27,00 | 28,50 | 30,00 | 33,00 | 36,00 | 39,00 | 42,00 | 45,00 |
| 31            | 19,22        | 19,84 | 20,15 | 21,70 | 23,25 | 24,80 | 26,35 | 27,90 | 29,45 | 31,00 | 34,10 | 37,20 | 40,30 | 43,40 | 46,50 |
| 32            | 19,84        | 20,48 | 20,80 | 22,40 | 24,00 | 25,60 | 27,20 | 28,80 | 30,40 | 32,00 | 35,20 | 38,40 | 41,60 | 44,80 | 48,00 |
| 33            | 20,46        | 21,12 | 21,45 | 23,10 | 24,75 | 26,40 | 28,05 | 29,70 | 31,35 | 33,00 | 36,30 | 39,60 | 42,90 | 46,20 | 49,50 |
| 34            | 21,08        | 21,76 | 22,10 | 23,80 | 25,50 | 27,20 | 28,90 | 30,60 | 32,30 | 34,00 | 37,40 | 40,80 | 44,20 | 47,60 | 51,00 |
| 35            | 21,70        | 22,40 | 22,75 | 24,50 | 26,25 | 28,00 | 29,75 | 31,50 | 33,25 | 35,00 | 38,50 | 42,00 | 45,50 | 49,00 | 52,50 |
| 36            | 22,32        | 23,04 | 23,40 | 25,20 | 27,00 | 28,80 | 30,60 | 32,40 | 34,20 | 36,00 | 39,60 | 43,20 | 46,80 | 50,40 | 54,00 |
| 37            | 22,94        | 23,68 | 24,05 | 25,90 | 27,75 | 29,60 | 31,45 | 33,30 | 35,15 | 37,00 | 40,70 | 44,40 | 48,10 | 51,80 | 55,50 |
| 38            | 23,56        | 24,32 | 24,70 | 26,60 | 28,50 | 30,40 | 32,30 | 34,20 | 36,10 | 38,00 | 41,80 | 45,60 | 49,40 | 53,20 | 57,00 |
| 39            | 24,18        | 24,96 | 25,35 | 27,30 | 29,25 | 31,20 | 33,15 | 35,10 | 37,05 | 39,00 | 42,90 | 46,80 | 50,70 | 54,60 | 58,50 |
| 40            | 24,80        | 25,60 | 26,00 | 28,00 | 30,00 | 32,00 | 34,00 | 36,00 | 38,00 | 40,00 | 44,00 | 48,00 | 52,00 | 56,00 | 60,00 |
| 41            | 25,42        | 26,24 | 26,65 | 28,70 | 30,75 | 32,80 | 34,85 | 36,90 | 38,95 | 41,00 | 45,10 | 49,20 | 53,30 | 57,40 | 61,50 |
| 42            | 26,04        | 26,88 | 27,30 | 29,40 | 31,50 | 33,60 | 35,70 | 37,80 | 39,90 | 42,00 | 46,20 | 50,40 | 54,60 | 58,80 | 63,00 |
| 43            | 26,66        | 27,52 | 27,95 | 30,10 | 32,25 | 34,40 | 36,55 | 38,70 | 40,85 | 43,00 | 47,30 | 51,60 | 55,90 | 60,20 | 64,50 |
| 44            | 27,28        | 28,16 | 28,60 | 30,80 | 33,00 | 35,20 | 37,40 | 39,60 | 41,80 | 44,00 | 48,40 | 52,80 | 57,20 | 61,60 | 66,00 |
| 45            | 27,90        | 28,80 | 29,25 | 31,50 | 33,75 | 36,00 | 38,25 | 40,50 | 42,75 | 45,00 | 49,50 | 54,00 | 58,50 | 63,00 | 67,50 |

Calidad: S275 JR

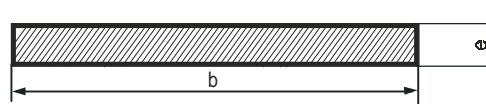


**Tabla 3.16. Flejes, Pletinas y Llantas de acero (Hierros Planos) -Dimensiones y secciones en cm<sup>2</sup>.**

| Espesor mm | Anchos en mm |       |       |       |       |       |       |        |        |        |        |        |        |        |        |
|------------|--------------|-------|-------|-------|-------|-------|-------|--------|--------|--------|--------|--------|--------|--------|--------|
|            | 160          | 170   | 180   | 190   | 200   | 210   | 220   | 230    | 240    | 250    | 260    | 270    | 280    | 290    | 300    |
| 1          | 1,60         | 1,70  | 1,80  | 1,90  | 2,00  | 2,10  | 2,20  | 2,30   | 2,40   | 2,50   | 2,60   | 2,70   | 2,80   | 2,90   | 3,00   |
| 2          | 3,20         | 3,40  | 3,60  | 3,80  | 4,00  | 4,20  | 4,40  | 4,60   | 4,80   | 5,00   | 5,20   | 5,40   | 5,60   | 5,80   | 6,00   |
| 3          | 4,80         | 5,10  | 5,40  | 5,70  | 6,00  | 6,30  | 6,60  | 6,90   | 7,20   | 7,50   | 7,80   | 8,10   | 8,40   | 8,70   | 9,00   |
| 4          | 6,40         | 6,80  | 7,20  | 7,60  | 8,00  | 8,40  | 8,80  | 9,20   | 9,60   | 10,00  | 10,40  | 10,80  | 11,20  | 11,60  | 12,00  |
| 5          | 8,00         | 8,50  | 9,00  | 9,50  | 10,00 | 10,50 | 11,00 | 11,50  | 12,00  | 12,50  | 13,00  | 13,50  | 14,00  | 14,50  | 15,00  |
| 6          | 9,60         | 10,20 | 10,80 | 11,40 | 12,00 | 12,60 | 13,20 | 13,80  | 14,40  | 15,00  | 15,60  | 16,20  | 16,80  | 17,40  | 18,00  |
| 7          | 11,20        | 11,90 | 12,60 | 13,30 | 14,00 | 14,70 | 15,40 | 16,10  | 16,80  | 17,50  | 18,20  | 18,90  | 19,60  | 20,30  | 21,00  |
| 8          | 12,80        | 13,60 | 14,40 | 15,20 | 16,00 | 16,80 | 17,60 | 18,40  | 19,20  | 20,00  | 20,80  | 21,60  | 22,40  | 23,20  | 24,00  |
| 9          | 14,40        | 15,30 | 16,20 | 17,10 | 18,00 | 18,90 | 19,80 | 20,70  | 21,60  | 22,50  | 23,40  | 24,30  | 25,20  | 26,10  | 27,00  |
| 10         | 16,00        | 17,00 | 18,00 | 19,00 | 20,00 | 21,00 | 22,00 | 23,00  | 24,00  | 25,00  | 26,00  | 27,00  | 28,00  | 29,00  | 30,00  |
| 11         | 17,60        | 18,70 | 19,80 | 20,90 | 22,00 | 23,10 | 24,20 | 25,30  | 26,40  | 27,50  | 28,60  | 29,70  | 30,80  | 31,90  | 33,00  |
| 12         | 19,20        | 20,40 | 21,60 | 22,80 | 24,00 | 25,20 | 26,40 | 27,60  | 28,80  | 30,00  | 31,20  | 32,40  | 33,60  | 34,80  | 36,00  |
| 13         | 20,80        | 22,10 | 23,40 | 24,70 | 26,00 | 27,30 | 28,60 | 29,90  | 31,20  | 32,50  | 33,80  | 35,10  | 36,40  | 37,70  | 39,00  |
| 14         | 22,40        | 23,80 | 25,20 | 26,60 | 28,00 | 29,40 | 30,80 | 32,20  | 33,60  | 35,00  | 36,40  | 37,80  | 39,20  | 40,60  | 42,00  |
| 15         | 24,00        | 25,50 | 27,00 | 28,50 | 30,00 | 31,50 | 33,00 | 34,50  | 36,00  | 37,50  | 39,00  | 40,50  | 42,00  | 43,50  | 45,00  |
| 16         | 25,60        | 27,20 | 28,80 | 30,40 | 32,00 | 33,60 | 35,20 | 36,80  | 38,40  | 40,00  | 41,60  | 43,20  | 44,80  | 46,40  | 48,00  |
| 17         | 27,20        | 28,90 | 30,60 | 32,30 | 34,00 | 35,70 | 37,40 | 39,10  | 40,80  | 42,50  | 44,20  | 45,90  | 47,60  | 49,30  | 51,00  |
| 18         | 28,80        | 30,60 | 32,40 | 34,20 | 36,00 | 37,80 | 39,60 | 41,40  | 43,20  | 45,00  | 46,80  | 48,60  | 50,40  | 52,20  | 54,00  |
| 19         | 30,40        | 32,30 | 34,20 | 36,10 | 38,00 | 39,90 | 41,80 | 43,70  | 45,60  | 47,50  | 49,40  | 51,30  | 53,20  | 55,10  | 57,00  |
| 20         | 32,00        | 34,00 | 36,00 | 38,00 | 40,00 | 42,00 | 44,00 | 46,00  | 48,00  | 50,00  | 52,00  | 54,00  | 56,00  | 58,00  | 60,00  |
| 21         | 33,60        | 35,70 | 37,80 | 39,90 | 42,00 | 44,10 | 46,20 | 48,30  | 50,40  | 52,50  | 54,60  | 56,70  | 58,80  | 60,90  | 63,00  |
| 22         | 35,20        | 37,40 | 39,60 | 41,80 | 44,00 | 46,20 | 48,40 | 50,60  | 52,80  | 55,00  | 57,20  | 59,40  | 61,60  | 63,80  | 66,00  |
| 23         | 36,80        | 39,10 | 41,40 | 43,70 | 46,00 | 48,30 | 50,60 | 52,90  | 55,20  | 57,50  | 59,80  | 62,10  | 64,40  | 66,70  | 69,00  |
| 24         | 38,40        | 40,80 | 43,20 | 45,60 | 48,00 | 50,40 | 52,80 | 55,20  | 57,60  | 60,00  | 62,40  | 64,80  | 67,20  | 69,60  | 72,00  |
| 25         | 40,00        | 42,50 | 45,00 | 47,50 | 50,00 | 52,50 | 55,00 | 57,50  | 60,00  | 62,50  | 65,00  | 67,50  | 70,00  | 72,50  | 75,00  |
| 26         | 41,60        | 44,20 | 46,80 | 49,40 | 52,00 | 54,60 | 57,20 | 59,80  | 62,40  | 65,00  | 67,60  | 70,20  | 72,80  | 75,40  | 78,00  |
| 27         | 43,20        | 45,90 | 48,60 | 51,30 | 54,00 | 56,70 | 59,40 | 62,10  | 64,80  | 67,50  | 70,20  | 72,90  | 75,60  | 78,30  | 81,00  |
| 28         | 44,80        | 47,60 | 50,40 | 53,20 | 56,00 | 58,80 | 61,60 | 64,40  | 67,20  | 70,00  | 72,80  | 75,60  | 78,40  | 81,20  | 84,00  |
| 29         | 46,40        | 49,30 | 52,20 | 55,10 | 58,00 | 60,90 | 63,80 | 66,70  | 69,60  | 72,50  | 75,40  | 78,30  | 81,20  | 84,10  | 87,00  |
| 30         | 48,00        | 51,00 | 54,00 | 57,00 | 60,00 | 63,00 | 66,00 | 69,00  | 72,00  | 75,00  | 78,00  | 81,00  | 84,00  | 87,00  | 90,00  |
| 31         | 49,60        | 52,70 | 55,80 | 58,90 | 62,00 | 65,10 | 68,20 | 71,30  | 74,40  | 77,50  | 80,60  | 83,70  | 86,80  | 89,90  | 93,00  |
| 32         | 51,20        | 54,40 | 57,60 | 60,80 | 64,00 | 67,20 | 70,40 | 73,60  | 76,80  | 80,00  | 83,20  | 86,40  | 89,60  | 92,80  | 96,00  |
| 33         | 52,80        | 56,10 | 59,40 | 62,70 | 66,00 | 69,30 | 72,60 | 75,90  | 79,20  | 82,50  | 85,80  | 89,10  | 92,40  | 95,70  | 99,00  |
| 34         | 54,40        | 57,80 | 61,20 | 64,60 | 68,00 | 71,40 | 74,80 | 78,20  | 81,60  | 85,00  | 88,40  | 91,80  | 95,20  | 98,60  | 102,00 |
| 35         | 56,00        | 59,50 | 63,00 | 66,50 | 70,00 | 73,50 | 77,00 | 80,50  | 84,00  | 87,50  | 91,00  | 94,50  | 98,00  | 101,50 | 105,00 |
| 36         | 57,60        | 61,20 | 64,80 | 68,40 | 72,00 | 75,60 | 79,20 | 82,80  | 86,40  | 90,00  | 93,60  | 97,20  | 100,80 | 104,40 | 108,00 |
| 37         | 59,20        | 62,90 | 66,60 | 70,30 | 74,00 | 77,70 | 81,40 | 85,10  | 88,80  | 92,50  | 96,20  | 99,90  | 103,60 | 107,30 | 111,00 |
| 38         | 60,80        | 64,60 | 68,40 | 72,20 | 76,00 | 79,80 | 83,60 | 87,40  | 91,20  | 95,00  | 98,80  | 102,60 | 106,40 | 110,20 | 114,00 |
| 39         | 62,40        | 66,30 | 70,20 | 74,10 | 78,00 | 81,90 | 85,80 | 89,70  | 93,60  | 97,50  | 101,40 | 105,30 | 109,20 | 113,10 | 117,00 |
| 40         | 64,00        | 68,00 | 72,00 | 76,00 | 80,00 | 84,00 | 88,00 | 92,00  | 96,00  | 100,00 | 104,00 | 108,00 | 112,00 | 116,00 | 120,00 |
| 41         | 65,60        | 69,70 | 73,80 | 77,90 | 82,00 | 86,10 | 90,20 | 94,30  | 98,40  | 102,50 | 106,60 | 110,70 | 114,80 | 118,90 | 123,00 |
| 42         | 67,20        | 71,40 | 75,60 | 79,80 | 84,00 | 88,20 | 92,40 | 96,60  | 100,80 | 105,00 | 109,20 | 113,40 | 117,60 | 121,80 | 126,00 |
| 43         | 68,80        | 73,10 | 77,40 | 81,70 | 86,00 | 90,30 | 94,60 | 98,90  | 103,20 | 107,50 | 111,80 | 116,10 | 120,40 | 124,70 | 129,00 |
| 44         | 70,40        | 74,80 | 79,20 | 83,60 | 88,00 | 92,40 | 96,80 | 101,20 | 105,60 | 110,00 | 114,40 | 118,80 | 123,20 | 127,60 | 132,00 |
| 45         | 72,00        | 76,50 | 81,00 | 85,50 | 90,00 | 94,50 | 99,00 | 103,50 | 108,00 | 112,50 | 117,00 | 121,50 | 126,00 | 130,50 | 135,00 |

Calidad: S275 JR





**Tabla 3.16. Flejes, Pletinas y Llantas de acero (Hierros Planos) - Dimensiones y secciones en cm<sup>2</sup>.**

| Espesor<br>mm | Anchos en mm |        |        |        |        |        |        |        |        |        |        |        |        |        |
|---------------|--------------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|
|               | 310          | 320    | 330    | 340    | 350    | 360    | 370    | 380    | 390    | 400    | 425    | 450    | 475    | 500    |
| 1             | 3,10         | 3,20   | 3,30   | 3,40   | 3,50   | 3,60   | 3,70   | 3,80   | 3,90   | 4,00   | 4,25   | 4,50   | 4,75   | 5,00   |
| 2             | 6,20         | 6,40   | 6,60   | 6,80   | 7,00   | 7,20   | 7,40   | 7,60   | 7,80   | 8,00   | 8,50   | 9,00   | 9,50   | 10,00  |
| 3             | 9,30         | 9,60   | 9,90   | 10,20  | 10,50  | 10,80  | 11,10  | 11,40  | 11,70  | 12,00  | 12,75  | 13,50  | 14,25  | 15,00  |
| 4             | 12,40        | 12,80  | 13,20  | 13,60  | 14,00  | 14,40  | 14,80  | 15,20  | 15,60  | 16,00  | 17,00  | 18,00  | 19,00  | 20,00  |
| 5             | 15,50        | 16,00  | 16,50  | 17,00  | 17,50  | 18,00  | 18,50  | 19,00  | 19,50  | 20,00  | 21,25  | 22,50  | 23,75  | 25,00  |
| 6             | 18,60        | 19,20  | 19,80  | 20,40  | 21,00  | 21,60  | 22,20  | 22,80  | 23,40  | 24,00  | 25,50  | 27,00  | 28,50  | 30,00  |
| 7             | 21,70        | 22,40  | 23,10  | 23,80  | 24,50  | 25,20  | 25,90  | 26,60  | 27,30  | 28,00  | 29,75  | 31,50  | 33,25  | 35,00  |
| 8             | 24,80        | 25,60  | 26,40  | 27,20  | 28,00  | 28,80  | 29,60  | 30,40  | 31,20  | 32,00  | 34,00  | 36,00  | 38,00  | 40,00  |
| 9             | 27,90        | 28,80  | 29,70  | 30,60  | 31,50  | 32,40  | 33,30  | 34,20  | 35,10  | 36,00  | 38,25  | 40,50  | 42,75  | 45,00  |
| 10            | 31,00        | 32,00  | 33,00  | 34,00  | 35,00  | 36,00  | 37,00  | 38,00  | 39,00  | 40,00  | 42,50  | 45,00  | 47,50  | 50,00  |
| 11            | 34,10        | 35,20  | 36,30  | 37,40  | 38,50  | 39,60  | 40,70  | 41,80  | 42,90  | 44,00  | 46,75  | 49,50  | 52,25  | 55,00  |
| 12            | 37,20        | 38,40  | 39,60  | 40,80  | 42,00  | 43,20  | 44,40  | 45,60  | 46,80  | 48,00  | 51,00  | 54,00  | 57,00  | 60,00  |
| 13            | 40,30        | 41,60  | 42,90  | 44,20  | 45,50  | 46,80  | 48,10  | 49,40  | 50,70  | 52,00  | 55,25  | 58,50  | 61,75  | 65,00  |
| 14            | 43,40        | 44,80  | 46,20  | 47,60  | 49,00  | 50,40  | 51,80  | 53,20  | 54,60  | 56,00  | 59,50  | 63,00  | 66,50  | 70,00  |
| 15            | 46,50        | 48,00  | 49,50  | 51,00  | 52,50  | 54,00  | 55,50  | 57,00  | 58,50  | 60,00  | 63,75  | 67,50  | 71,25  | 75,00  |
| 16            | 49,60        | 51,20  | 52,80  | 54,40  | 56,00  | 57,60  | 59,20  | 60,80  | 62,40  | 64,00  | 68,00  | 72,00  | 76,00  | 80,00  |
| 17            | 52,70        | 54,40  | 56,10  | 57,80  | 59,50  | 61,20  | 62,90  | 64,60  | 66,30  | 68,00  | 72,25  | 76,50  | 80,75  | 85,00  |
| 18            | 55,80        | 57,60  | 59,40  | 61,20  | 63,00  | 64,80  | 66,60  | 68,40  | 70,20  | 72,00  | 76,50  | 81,00  | 85,50  | 90,00  |
| 19            | 58,90        | 60,80  | 62,70  | 64,60  | 66,50  | 68,40  | 70,30  | 72,20  | 74,10  | 76,00  | 80,75  | 85,50  | 90,25  | 95,00  |
| 20            | 62,00        | 64,00  | 66,00  | 68,00  | 70,00  | 72,00  | 74,00  | 76,00  | 78,00  | 80,00  | 85,00  | 90,00  | 95,00  | 100,00 |
| 21            | 65,10        | 67,20  | 69,30  | 71,40  | 73,50  | 75,60  | 77,70  | 79,80  | 81,90  | 84,00  | 89,25  | 94,50  | 99,75  | 105,00 |
| 22            | 68,20        | 70,40  | 72,60  | 74,80  | 77,00  | 79,20  | 81,40  | 83,60  | 85,80  | 88,00  | 93,50  | 99,00  | 104,50 | 110,00 |
| 23            | 71,30        | 73,60  | 75,90  | 78,20  | 80,50  | 82,80  | 85,10  | 87,40  | 89,70  | 92,00  | 97,75  | 103,50 | 109,25 | 115,00 |
| 24            | 74,40        | 76,80  | 79,20  | 81,60  | 84,00  | 86,40  | 88,80  | 91,20  | 93,60  | 96,00  | 102,00 | 108,00 | 114,00 | 120,00 |
| 25            | 77,50        | 80,00  | 82,50  | 85,00  | 87,50  | 90,00  | 92,50  | 95,00  | 97,50  | 100,00 | 106,25 | 112,50 | 118,75 | 125,00 |
| 26            | 80,60        | 83,20  | 85,80  | 88,40  | 91,00  | 93,60  | 96,20  | 98,80  | 101,40 | 104,00 | 110,50 | 117,00 | 123,50 | 130,00 |
| 27            | 83,70        | 86,40  | 89,10  | 91,80  | 94,50  | 97,20  | 99,90  | 102,60 | 105,30 | 108,00 | 114,75 | 121,50 | 128,25 | 135,00 |
| 28            | 86,80        | 89,60  | 92,40  | 95,20  | 98,00  | 100,80 | 103,60 | 106,40 | 109,20 | 112,00 | 119,00 | 126,00 | 133,00 | 140,00 |
| 29            | 89,90        | 92,80  | 95,70  | 98,60  | 101,50 | 104,40 | 107,30 | 110,20 | 113,10 | 116,00 | 123,25 | 130,50 | 137,75 | 145,00 |
| 30            | 93,00        | 96,00  | 99,00  | 102,00 | 105,00 | 108,00 | 111,00 | 114,00 | 117,00 | 120,00 | 127,50 | 135,00 | 142,50 | 150,00 |
| 31            | 96,10        | 99,20  | 102,30 | 105,40 | 108,50 | 111,60 | 114,70 | 117,80 | 120,90 | 124,00 | 131,75 | 139,50 | 147,25 | 155,00 |
| 32            | 99,20        | 102,40 | 105,60 | 108,80 | 112,00 | 115,20 | 118,40 | 121,60 | 124,80 | 128,00 | 136,00 | 144,00 | 152,00 | 160,00 |
| 33            | 102,30       | 105,60 | 108,90 | 112,20 | 115,50 | 118,80 | 122,10 | 125,40 | 128,70 | 132,00 | 140,25 | 148,50 | 156,75 | 165,00 |
| 34            | 105,40       | 108,80 | 112,20 | 115,60 | 119,00 | 122,40 | 125,80 | 129,20 | 132,60 | 136,00 | 144,50 | 153,00 | 161,50 | 170,00 |
| 35            | 108,50       | 112,00 | 115,50 | 119,00 | 122,50 | 126,00 | 129,50 | 133,00 | 136,50 | 140,00 | 148,75 | 157,50 | 166,25 | 175,00 |
| 36            | 111,60       | 115,20 | 118,80 | 122,40 | 126,00 | 129,60 | 133,20 | 136,80 | 140,40 | 144,00 | 153,00 | 162,00 | 171,00 | 180,00 |
| 37            | 114,70       | 118,40 | 122,10 | 125,80 | 129,50 | 133,20 | 136,90 | 140,60 | 144,30 | 148,00 | 157,25 | 166,50 | 175,75 | 185,00 |
| 38            | 117,80       | 121,60 | 125,40 | 129,20 | 133,00 | 136,80 | 140,60 | 144,40 | 148,20 | 152,00 | 161,50 | 171,00 | 180,50 | 190,00 |
| 39            | 120,90       | 124,80 | 128,70 | 132,60 | 136,50 | 140,40 | 144,30 | 148,20 | 152,10 | 156,00 | 165,75 | 175,50 | 185,25 | 195,00 |
| 40            | 124,00       | 128,00 | 132,00 | 136,00 | 140,00 | 144,00 | 148,00 | 152,00 | 156,00 | 160,00 | 170,00 | 180,00 | 190,00 | 200,00 |
| 41            | 127,10       | 131,20 | 135,30 | 139,40 | 143,50 | 147,60 | 151,70 | 155,80 | 159,90 | 164,00 | 174,25 | 184,50 | 194,75 | 205,00 |
| 42            | 130,20       | 134,40 | 138,60 | 142,80 | 147,00 | 151,20 | 155,40 | 159,60 | 163,80 | 168,00 | 178,50 | 189,00 | 199,50 | 210,00 |
| 43            | 133,30       | 137,60 | 141,90 | 146,20 | 150,50 | 154,80 | 159,10 | 163,40 | 167,70 | 172,00 | 182,75 | 193,50 | 204,25 | 215,00 |
| 44            | 136,40       | 140,80 | 145,20 | 149,60 | 154,00 | 158,40 | 162,80 | 167,20 | 171,60 | 176,00 | 187,00 | 198,00 | 209,00 | 220,00 |
| 45            | 139,50       | 144,00 | 148,50 | 153,00 | 157,50 | 162,00 | 166,50 | 171,00 | 175,50 | 180,00 | 191,25 | 202,50 | 213,75 | 225,00 |

Calidad: S275 JR



**TOLERANCIAS**

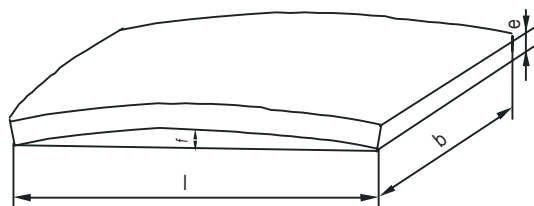
**Tabla 3-17 Flejes, Pletinas y Llantas de acero - Tolerancia en espesor**

| Dimensión nominal<br>e<br>mm |                   | Tolerancia<br>mm |
|------------------------------|-------------------|------------------|
| desde                        | hasta (inclusive) |                  |
| ----                         | 20                | ± 0.5            |
| 21                           | 40                | ± 1.0            |
| 41                           | 50                | ± 1.5            |

**Tabla 3-18 Flejes, Pletinas y Llantas de acero - Tolerancia en anchura**

| Dimensión nominal<br>e<br>mm |                   | Tolerancia<br>mm |
|------------------------------|-------------------|------------------|
| desde                        | hasta (inclusive) |                  |
| ----                         | 75                | ± 1.0            |
| 76                           | 100               | ± 1.5            |
| 101                          | 120               | ± 2.0            |
| 121                          | 180               | ± 2.5            |

- **Tolerancia en longitud:** Para barras solicitadas a longitud fija, se admite una tolerancia de corte de ±100 mm. Previa solicitud en el pedido, las barras hasta 12 m (inclusive) se suministrarán con  $+^{75}_0$  y las de longitud superior a 12m con tolerancias de  $+^{100}_0$  (tolerancia restringida). Las tolerancias de corte en frío deberán convenirse en el pedido si bien se recomienda la elección entre los valores  $+^5_0$ ,  $+^{10}_0$ ,  $+^{25}_0$ ,  $+^{50}_0$ .
- **Tolerancia en enderezado**



**Tabla 3-19 Flejes, Pletinas y Llantas de acero - Tolerancia en enderezado.**

| Sección nominal<br>b . e<br>mm <sup>2</sup> | Tolerancia en el plano a flecha máxima<br>mm |
|---|--|
| hasta 1000 (excluido)                       | 0.004 l                                      |
| igual o superior a 1000                     | 0.0025 l                                     |

- **Tolerancia en la masa:** La desviación en masa es la diferencia entre la masa suministrada y la masa teórica. Esta se determina multiplicando la masa teórica unitaria por el número de metros suministrados. Las tolerancias indicadas en la siguiente tabla sólo se aplican a lotes de productos de las mismas dimensiones iguales o superiores a 5t. Para lotes inferiores estas tolerancias se aumentarán un tercio.

**Tabla 3-20 Flejes, Pletinas y Llantas de acero – Tolerancia en la masa**

| Espesor nominal<br>e<br>mm |                   | Tolerancia en<br>% |
|----------------------------|-------------------|--------------------|
| desde                      | hasta (inclusive) |                    |
| ----                       | 6                 | ± 8                |
| 6                          | 15                | ± 6                |
| 15                         | ----              | ± 4                |



### 3.5 ANGULARES DE LADOS IGUALES (Perfiles L). UNE EN 10056-99.

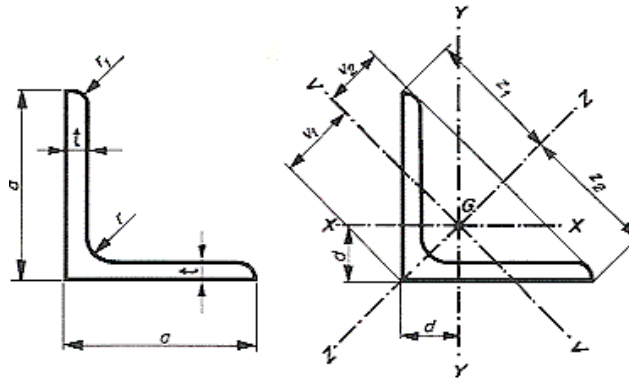


Tabla 3-21 Angulares de lados iguales (Perfiles L) - Dimensiones y características geométricas de los angulares laminados en caliente de lados iguales

| Designación      | Masa Kg/m | Área de la sección cm <sup>2</sup> | Dimensiones |     |                    | Distancias al centro de gravedad |                |                 | Características geométricas respecto de los ejes |                                 |                                 |                |                 |                 |                |                |
|------------------|-----------|------------------------------------|-------------|-----|--------------------|----------------------------------|----------------|-----------------|--|---------------------------------|---------------------------------|----------------|-----------------|-----------------|----------------|----------------|
|                  |           |                                    | a           | t   | r <sub>unión</sub> | C <sub>x</sub> =C <sub>y</sub>   | C <sub>u</sub> | C <sub>v</sub>  | X-X = Y-Y  |                                 |                                 | U-U            |                 | V-V             |                |                |
|                  |           |                                    |             |     |                    |                                  |                |                 | I <sub>x</sub> = I <sub>y</sub>                  | r <sub>x</sub> = r <sub>y</sub> | Z <sub>x</sub> = Z <sub>y</sub> | I <sub>u</sub> | r <sub>u</sub>  | I <sub>v</sub>  | r <sub>v</sub> | Z <sub>v</sub> |
| mm               | mm        | mm                                 | cm          | cm  | cm                 | cm <sup>4</sup>                  | cm             | cm <sup>3</sup> | cm <sup>4</sup>                                  | cm                              | cm <sup>4</sup>                 | cm             | cm <sup>4</sup> | cm <sup>3</sup> |                |                |
| L 20 x 20 x 3    | 0.882     | 1.12                               | 20          | 3   | 3.5                | 0.598                            | 1.41           | 0.846           | 0.392  | 0.590                           | 0.279                           | 0.618          | 0.742           | 0.165           | 0.383          | 0.195          |
| L 25 x 25 x 3    | 1.12      | 1.42                               | 25          | 3   | 3.5                | 0.723                            | 1.77           | 1.02            | 0.803  | 0.751                           | 0.452                           | 1.27           | 0.945           | 0.334           | 0.484          | 0.326          |
| L 25 x 25 x 4    | 1.45      | 1.85                               | 25          | 4   | 3.5                | 0.762                            | 1.77           | 1.08            | 1.02   | 0.741                           | 0.586                           | 1.61           | 0.931           | 0.430           | 0.482          | 0.399          |
| L 30 x 30 x 3    | 1.36      | 1.74                               | 30          | 3   | 5                  | 0.835                            | 2.12           | 1.18            | 1.40   | 0.899                           | 0.649                           | 2.22           | 1.13            | 0.585           | 0.581          | 0.496          |
| L 30 x 30 x 4    | 1.78      | 2.27                               | 30          | 4   | 5                  | 0.878                            | 2.12           | 1.24            | 1.80   | 0.892                           | 0.850                           | 2.85           | 1.12            | 0.754           | 0.577          | 0.607          |
| L 35 x 35 x 4    | 2.09      | 2.67                               | 35          | 4   | 5                  | 1.00                             | 2.47           | 1.42            | 2.95   | 1.05                            | 1.18                            | 4.68           | 1.32            | 1.23            | 0.678          | 0.865          |
| L 40 x 40 x 4    | 2.42      | 3.08                               | 40          | 4   | 6                  | 1.12                             | 2.83           | 1.58            | 4.47   | 1.21                            | 1.55                            | 7.09           | 1.52            | 1.86            | 0.777          | 1.17           |
| L 40 x 40 x 5    | 2.97      | 3.79                               | 40          | 5   | 6                  | 1.16                             | 2.83           | 1.64            | 5.43   | 1.20                            | 1.91                            | 8.60           | 1.51            | 2.26            | 0.773          | 1.38           |
| L 45 x 45 x 4    | 3.06      | 3.90                               | 45          | 4.5 | 7                  | 1.25                             | 3.18           | 1.78            | 7.14   | 1.35                            | 2.20                            | 11.4           | 1.71            | 2.94            | 0.870          | 1.65           |
| L 50 x 50 x 4    | 3.06      | 3.89                               | 50          | 4   | 7                  | 1.36                             | 3.54           | 1.92            | 8.97   | 1.52                            | 2.46                            | 14.2           | 1.91            | 3.73            | 0.979          | 1.94           |
| L 50 x 50 x 5    | 3.77      | 4.80                               | 50          | 5   | 7                  | 1.40                             | 3.54           | 1.99            | 11.0   | 1.51                            | 3.05                            | 17.4           | 1.90            | 4.55            | 0.973          | 2.29           |
| L 50 x 50 x 6    | 4.47      | 5.69                               | 50          | 6   | 7                  | 1.45                             | 3.54           | 2.04            | 12.8   | 1.50                            | 3.61                            | 20.3           | 1.89            | 5.34            | 0.968          | 2.61           |
| L 60 x 60 x 5    | 4.57      | 5.82                               | 60          | 5   | 8                  | 1.64                             | 4.24           | 2.32            | 19.4   | 1.82                            | 4.45                            | 30.7           | 2.30            | 8.03            | 1.17           | 3.46           |
| L 60 x 60 x 6    | 5.42      | 6.91                               | 60          | 6   | 8                  | 1.69                             | 4.24           | 2.39            | 22.8   | 1.82                            | 5.29                            | 36.1           | 2.29            | 9.44            | 1.17           | 3.96           |
| L 60 x 60 x 8    | 7.09      | 9.03                               | 60          | 8   | 8                  | 1.77                             | 4.24           | 2.50            | 29.2   | 1.80                            | 6.89                            | 46.1           | 2.26            | 12.2            | 1.16           | 4.86           |
| L 65 x 65 x 7    | 6.83      | 8.7                                | 65          | 7   | 9                  | 1.85                             | 4.60           | 2.62            | 33.4   | 1.96                            | 7.18                            | 53.0           | 2.47            | 13.8            | 1.26           | 5.27           |
| L 70 x 70 x 6    | 6.38      | 8.13                               | 70          | 6   | 9                  | 1.93                             | 4.95           | 2.73            | 36.9   | 2.13                            | 7.27                            | 58.5           | 2.68            | 15.3            | 1.37           | 5.60           |
| L 70 x 70 x 7    | 7.38      | 9.40                               | 70          | 7   | 9                  | 1.97                             | 4.95           | 2.79            | 42.3   | 2.12                            | 8.41                            | 67.1           | 2.67            | 17.5            | 1.36           | 6.28           |
| L 75 x 75 x 6    | 6.85      | 8.73                               | 75          | 6   | 9                  | 2.05                             | 5.30           | 2.90            | 45.8   | 2.29                            | 8.41                            | 72.7           | 2.89            | 18.9            | 1.47           | 6.53           |
| L 75 x 75 x 8    | 8.99      | 11.4                               | 75          | 8   | 9                  | 2.14                             | 5.30           | 3.02            | 59.1   | 2.27                            | 11.0                            | 93.8           | 2.86            | 24.5            | 1.46           | 8.09           |
| L 80 x 80 x 8    | 9.63      | 12.3                               | 80          | 8   | 10                 | 2.26                             | 5.66           | 3.19            | 72.2   | 2.43                            | 12.6                            | 115            | 3.06            | 29.9            | 1.56           | 9.37           |
| L 80 x 80 x 10   | 11.9      | 15.1                               | 80          | 10  | 10                 | 2.34                             | 5.66           | 3.30            | 87.5   | 2.41                            | 15.4                            | 139            | 3.03            | 36.4            | 1.55           | 11.0           |
| L 90 x 90 x 7    | 9.61      | 12.2                               | 90          | 7   | 11                 | 2.45                             | 6.36           | 3.47            | 92.6   | 2.75                            | 14.1                            | 147            | 3.46            | 38.3            | 1.77           | 11.0           |
| L 90 x 90 x 8    | 10.9      | 13.9                               | 90          | 8   | 11                 | 2.50                             | 6.36           | 3.53            | 104  | 2.74                            | 16.1                            | 166            | 3.45            | 43.1            | 1.76           | 12.2           |
| L 90 x 90 x 9    | 12.2      | 15.5                               | 90          | 9   | 11                 | 2.54                             | 6.36           | 3.59            | 116  | 2.73                            | 17.9                            | 184            | 3.44            | 47.9            | 1.76           | 13.3           |
| L 90 x 90 x 10   | 13.4      | 17.1                               | 90          | 10  | 11                 | 2.58                             | 6.36           | 3.65            | 127  | 2.72                            | 19.8                            | 201            | 3.42            | 52.6            | 1.75           | 14.4           |
| L 100 x 100 x 8  | 12.2      | 15.5                               | 100         | 8   | 12                 | 2.74                             | 7.07           | 3.87            | 145  | 3.06                            | 19.9                            | 230            | 3.85            | 59.9            | 1.96           | 15.5           |
| L 100 x 100 x 10 | 15.0      | 19.2                               | 100         | 10  | 12                 | 2.82                             | 7.07           | 3.99            | 177  | 3.04                            | 24.6                            | 280            | 3.83            | 73.0            | 1.95           | 18.3           |
| L 100 x 100 x 12 | 17.8      | 22.7                               | 100         | 12  | 12                 | 2.90                             | 7.07           | 4.11            | 207  | 3.02                            | 29.1                            | 328            | 3.80            | 85.7            | 1.94           | 20.9           |
| L 120 x 120 x 8  | 18.2      | 23.2                               | 120         | 10  | 13                 | 3.31                             | 8.49           | 4.69            | 313  | 3.67                            | 36.0                            | 497            | 4.63            | 129             | 2.36           | 27.5           |
| L 120 x 120 x 10 | 21.6      | 27.5                               | 120         | 12  | 13                 | 3.40                             | 8.49           | 4.80            | 368  | 3.65                            | 42.7                            | 584            | 4.60            | 152             | 2.35           | 31.6           |
| L 130 x 130 x 8  | 23.6      | 30.0                               | 130         | 12  | 14                 | 3.64                             | 9.19           | 5.15            | 472  | 3.97                            | 50.4                            | 750            | 5.00            | 194             | 2.54           | 37.7           |
| L 150 x 150 x 8  | 23.0      | 29.3                               | 150         | 10  | 16                 | 4.03                             | 10.6           | 5.71            | 624  | 4.62                            | 56.9                            | 990            | 5.82            | 258             | 2.97           | 45.1           |
| L 150 x 150 x 10 | 27.3      | 34.8                               | 150         | 12  | 16                 | 4.12                             | 10.6           | 5.83            | 737  | 4.60                            | 67.7                            | 1170           | 5.80            | 303             | 2.95           | 52.0           |
| L 150 x 150 x 12 | 33.8      | 43.0                               | 150         | 15  | 16                 | 4.25                             | 10.6           | 6.01            | 989  | 4.57                            | 83.5                            | 1430           | 5.76            | 370             | 2.93           | 61.6           |
| L 160 x 160 x 8  | 36.2      | 46.1                               | 160         | 15  | 17                 | 4.49                             | 11.3           | 6.35            | 1100   | 4.88                            | 95.6                            | 1750           | 6.15            | 453             | 3.14           | 71.3           |
| L 180 x 180 x 8  | 43.5      | 55.4                               | 180         | 16  | 18                 | 5.02                             | 12.7           | 7.11            | 1680   | 5.51                            | 130                             | 2690           | 6.96            | 679             | 3.50           | 95.5           |
| L 180 x 180 x 10 | 48.6      | 61.9                               | 180         | 18  | 18                 | 5.10                             | 12.7           | 7.22            | 1870   | 5.49                            | 145                             | 2960           | 6.92            | 768             | 3.52           | 106            |
| L 200 x 200 x 8  | 48.5      | 61.8                               | 200         | 16  | 18                 | 5.52                             | 14.1           | 7.81            | 2430   | 6.16                            | 162                             | 3740           | 7.76            | 960             | 3.94           | 123            |
| L 200 x 200 x 10 | 54.3      | 69.1                               | 200         | 18  | 18                 | 5.60                             | 14.1           | 7.92            | 2600   | 6.13                            | 181                             | 4150           | 7.75            | 1050            | 3.90           | 133            |
| L 200 x 200 x 12 | 59.9      | 76.3                               | 200         | 20  | 18                 | 5.68                             | 14.1           | 8.04            | 2850   | 6.11                            | 199                             | 4530           | 7.70            | 1170            | 3.92           | 146            |
| L 200 x 200 x 14 | 71.1      | 90.6                               | 200         | 24  | 18                 | 5.84                             | 14.1           | 8.26            | 3330   | 6.06                            | 235                             | 5280           | 7.64            | 1380            | 3.90           | 167            |

Calidad: S275 JR – S355J2G3



### 3.6. ANGULARES DE LADOS DESIGUALES (Perfiles LD). UNE EN 10056-1-99.

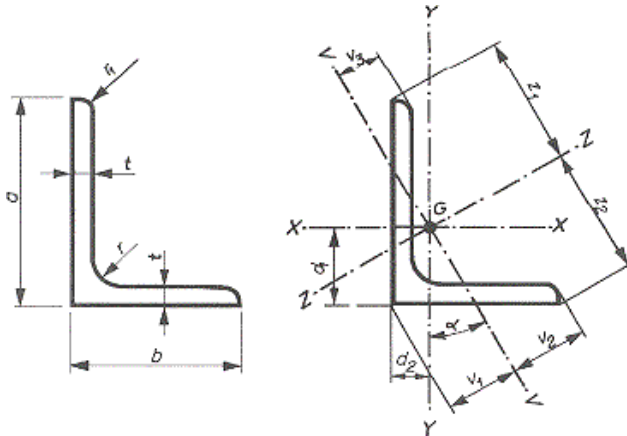


Tabla 3-22 Angulares de lados desiguales (Perfiles LD) – Dimensiones y características geométricas de los angulares laminados en caliente de lados desiguales

| Designación      | Masa Kg/m | Área de la sección cm <sup>2</sup> | Dimensiones |      |      |      | Distancias al centro de gravedad |                   |                    |                    | Características geométricas respecto de los ejes |                    |                                |                                |                                 |                                 |                                 |                                 | Inclinación del eje V - tan α |                     |                     |
|------------------|-----------|------------------------------------|-------------|------|------|------|----------------------------------|-------------------|--------------------|--------------------|--|--------------------|--------------------------------|--------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|-------------------------------|---------------------|---------------------|
|                  |           |                                    | a mm        | b mm | t mm | r mm | C <sub>x</sub> cm                | C <sub>y</sub> cm | C <sub>x1</sub> cm | C <sub>y1</sub> cm | C <sub>x2</sub> cm                               | C <sub>y2</sub> cm | I <sub>x</sub> cm <sup>4</sup> | I <sub>y</sub> cm <sup>4</sup> | I <sub>x1</sub> cm <sup>4</sup> | I <sub>y1</sub> cm <sup>4</sup> | I <sub>x2</sub> cm <sup>4</sup> | I <sub>y2</sub> cm <sup>4</sup> |                               | U-U cm <sup>4</sup> | V-V cm <sup>4</sup> |
| L 30 x 20 x 3    | 1.12      | 1.43                               | 30          | 20   | 3    | 4    | 0.990                            | 0.502             | 2.05               | 1.04               | 1.25   | 0.935              | 0.621                          | 0.437                          | 0.553                           | 0.292                           | 1.43                            | 1.00                            | 0.256                         | 0.424               | 0.427               |
| L 30 x 20 x 4    | 1.46      | 1.86                               | 30          | 20   | 4    | 4    | 1.03                             | 0.541             | 2.02               | 1.04               | 1.59   | 0.925              | 0.807                          | 0.433                          | 0.546                           | 0.379                           | 1.81                            | 0.988                           | 0.30                          | 0.421               | 0.421               |
| L 40 x 20 x 4    | 1.77      | 2.26                               | 40          | 20   | 4    | 4    | 1.47                             | 0.48              | 2.58               | 1.17               | 3.59   | 1.26               | 1.42                           | 0.600                          | 0.514                           | 0.393                           | 3.80                            | 1.30                            | 0.393                         | 0.417               | 0.252               |
| L 40 x 25 x 4    | 1.93      | 2.46                               | 40          | 25   | 4    | 4    | 1.36                             | 0.623             | 2.69               | 1.35               | 3.89   | 1.26               | 1.47                           | 1.16                           | 0.687                           | 0.619                           | 4.35                            | 1.33                            | 0.700                         | 0.534               | 0.380               |
| L 45 x 30 x 4    | 2.25      | 2.87                               | 45          | 30   | 4    | 4.5  | 1.48                             | 0.74              | 3.07               | 1.58               | 5.78   | 1.42               | 1.91                           | 2.05                           | 0.85                            | 0.91                            | 6.65                            | 1.52                            | 1.18                          | 0.64                | 0.436               |
| L 50 x 30 x 5    | 2.96      | 2.78                               | 50          | 30   | 5    | 5    | 1.73                             | 0.741             | 3.33               | 1.65               | 9.36   | 1.57               | 2.86                           | 2.51                           | 0.816                           | 1.11                            | 10.3                            | 1.65                            | 1.54                          | 0.639               | 0.352               |
| L 60 x 30 x 5    | 3.36      | 4.28                               | 60          | 30   | 5    | 5    | 2.17                             | 0.684             | 3.88               | 1.77               | 15.6   | 1.91               | 4.07                           | 2.63                           | 0.784                           | 1.14                            | 16.5                            | 1.97                            | 1.71                          | 0.633               | 0.257               |
| L 60 x 40 x 5    | 3.76      | 4.79                               | 60          | 40   | 5    | 6    | 1.96                             | 0.972             | 4.10               | 2.11               | 17.2   | 1.89               | 4.25                           | 6.11                           | 1.13                            | 2.02                            | 19.7                            | 2.03                            | 3.54                          | 0.86                | 0.434               |
| L 60 x 40 x 6    | 4.46      | 5.68                               | 60          | 40   | 6    | 6    | 2.00                             | 1.01              | 4.08               | 2.10               | 20.1   | 1.88               | 5.03                           | 7.12                           | 1.12                            | 2.38                            | 23.1                            | 2.02                            | 4.16                          | 0.855               | 0.431               |
| L 65 x 50 x 5    | 4.35      | 5.54                               | 60          | 50   | 5    | 6    | 1.99                             | 1.25              | 4.53               | 2.39               | 23.2   | 2.05               | 5.14                           | 11.9                           | 1.47                            | 3.19                            | 28.8                            | 2.28                            | 6.32                          | 1.07                | 0.577               |
| L 70 x 50 x 6    | 5.41      | 6.89                               | 65          | 50   | 6    | 7    | 2.23                             | 1.25              | 4.83               | 2.52               | 33.4   | 2.20               | 7.01                           | 14.2                           | 1.43                            | 3.78                            | 39.7                            | 2.40                            | 7.92                          | 1.07                | 0.500               |
| L 75 x 50 x 6    | 5.65      | 7.19                               | 70          | 50   | 6    | 7    | 2.44                             | 1.21              | 5.12               | 2.64               | 40.5   | 2.37               | 8.01                           | 14.4                           | 1.42                            | 3.81                            | 46.6                            | 2.55                            | 8.36                          | 1.08                | 0.435               |
| L 75 x 50 x 8    | 7.39      | 9.41                               | 75          | 50   | 8    | 7    | 2.52                             | 1.29              | 5.08               | 2.62               | 52.0   | 2.35               | 10.4                           | 18.4                           | 1.40                            | 4.95                            | 59.6                            | 2.52                            | 10.8                          | 1.07                | 0.430               |
| L 80 x 40 x 6    | 5.41      | 6.89                               | 75          | 40   | 6    | 7    | 2.85                             | 0.884             | 5.20               | 2.38               | 44.9   | 2.55               | 8.73                           | 7.59                           | 1.05                            | 2.44                            | 47.6                            | 2.63                            | 4.93                          | 0.845               | 0.258               |
| L 80 x 40 x 8    | 7.07      | 9.01                               | 80          | 40   | 8    | 7    | 2.94                             | 0.963             | 5.14               | 2.34               | 57.6   | 2.53               | 11.4                           | 9.61                           | 1.03                            | 3.16                            | 60.9                            | 2.60                            | 6.34                          | 0.838               | 0.253               |
| L 80 x 60 x 7    | 7.36      | 9.38                               | 80          | 60   | 7    | 8    | 2.51                             | 1.52              | 5.55               | 2.92               | 59.0   | 2.51               | 10.7                           | 28.4                           | 1.74                            | 6.34                            | 72.0                            | 2.77                            | 15.4                          | 1.28                | 0.546               |
| L 100 x 40 x 6   | 6.84      | 8.71                               | 80          | 50   | 6    | 8    | 3.51                             | 1.05              | 6.55               | 3.00               | 89.9   | 3.21               | 13.8                           | 15.4                           | 1.33                            | 3.89                            | 95.4                            | 3.31                            | 9.92                          | 1.07                | 0.262               |
| L 100 x 50 x 8   | 8.97      | 11.4                               | 100         | 50   | 8    | 8    | 3.60                             | 1.13              | 6.48               | 2.96               | 116  | 3.19               | 18.2                           | 19.7                           | 1.31                            | 5.08                            | 123                             | 3.28                            | 12.8                          | 1.06                | 0.258               |
| L 100 x 65 x 8   | 8.77      | 11.2                               | 100         | 65   | 7    | 10   | 3.23                             | 1.51              | 6.83               | 3.49               | 113  | 3.17               | 16.6                           | 37.6                           | 1.83                            | 7.53                            | 128                             | 3.39                            | 22.0                          | 1.40                | 0.415               |
| L 100 x 65 x 10  | 9.94      | 12.7                               | 100         | 65   | 8    | 10   | 3.27                             | 1.55              | 6.81               | 3.47               | 127  | 3.16               | 18.9                           | 42.2                           | 1.83                            | 8.54                            | 144                             | 3.37                            | 24.8                          | 1.40                | 0.413               |
| L 100 x 65 x 12  | 12.3      | 15.6                               | 100         | 65   | 10   | 10   | 3.36                             | 1.63              | 6.76               | 3.45               | 154  | 3.14               | 23.2                           | 51.0                           | 1.81                            | 10.5                            | 175                             | 3.35                            | 30.1                          | 1.39                | 0.410               |
| L 100 x 75 x 8   | 10.6      | 13.5                               | 100         | 75   | 8    | 10   | 3.10                             | 1.87              | 6.95               | 3.65               | 133  | 3.14               | 19.3                           | 64.1                           | 2.18                            | 11.4                            | 162                             | 3.47                            | 34.6                          | 1.60                | 0.547               |
| L 100 x 75 x 10  | 13.0      | 16.6                               | 100         | 75   | 10   | 10   | 3.19                             | 1.95              | 6.92               | 3.65               | 162  | 3.12               | 23.8                           | 77.6                           | 2.16                            | 14.0                            | 197                             | 3.45                            | 42.2                          | 1.59                | 0.544               |
| L 100 x 75 x 12  | 15.4      | 19.7                               | 100         | 75   | 12   | 10   | 3.27                             | 2.03              | 6.89               | 3.65               | 189  | 3.10               | 28.0                           | 90.2                           | 2.14                            | 16.5                            | 230                             | 3.42                            | 49.5                          | 1.59                | 0.540               |
| L 120 x 80 x 8   | 12.2      | 15.5                               | 120         | 80   | 8    | 11   | 3.83                             | 1.87              | 8.23               | 4.23               | 226  | 3.82               | 27.6                           | 80.8                           | 2.28                            | 13.2                            | 260                             | 4.10                            | 46.6                          | 1.74                | 0.437               |
| L 120 x 80 x 10  | 15.0      | 19.1                               | 120         | 80   | 10   | 11   | 3.92                             | 1.95              | 8.19               | 4.21               | 276  | 3.80               | 34.1                           | 98.1                           | 2.26                            | 16.2                            | 317                             | 4.07                            | 56.8                          | 1.72                | 0.435               |
| L 120 x 80 x 12  | 17.8      | 22.7                               | 120         | 80   | 12   | 11   | 4.00                             | 2.03              | 8.15               | 4.20               | 323  | 3.77               | 40.4                           | 114                            | 2.24                            | 19.1                            | 371                             | 4.04                            | 66.7                          | 1.71                | 0.431               |
| L 125 x 75 x 8   | 12.2      | 15.5                               | 125         | 75   | 8    | 11   | 4.14                             | 1.68              | 8.44               | 4.20               | 247  | 4.00               | 29.6                           | 67.6                           | 2.09                            | 11.6                            | 274                             | 4.21                            | 40.9                          | 1.63                | 0.360               |
| L 125 x 75 x 10  | 15.0      | 19.1                               | 125         | 75   | 10   | 11   | 4.23                             | 1.76              | 8.39               | 4.17               | 302  | 3.97               | 36.5                           | 82.1                           | 2.07                            | 14.3                            | 334                             | 4.18                            | 49.9                          | 1.61                | 0.357               |
| L 125 x 75 x 12  | 17.8      | 22.7                               | 125         | 75   | 12   | 11   | 4.31                             | 1.84              | 8.33               | 4.15               | 354  | 3.95               | 43.2                           | 95.5                           | 2.05                            | 16.9                            | 391                             | 4.15                            | 58.5                          | 1.61                | 0.354               |
| L 135 x 65 x 8   | 12.2      | 15.5                               | 135         | 65   | 8    | 11   | 4.78                             | 1.34              | 8.79               | 3.95               | 291  | 4.34               | 33.4                           | 45.2                           | 1.71                            | 8.75                            | 307                             | 4.45                            | 29.4                          | 1.38                | 0.245               |
| L 135 x 65 x 10  | 15.0      | 19.1                               | 135         | 65   | 10   | 11   | 4.88                             | 1.42              | 8.72               | 3.91               | 356  | 4.31               | 41.3                           | 54.7                           | 1.69                            | 10.8                            | 375                             | 4.43                            | 35.9                          | 1.37                | 0.243               |
| L 150 x 75 x 8   | 15.4      | 19.6                               | 150         | 75   | 9    | 12   | 5.26                             | 1.57              | 9.82               | 4.50               | 455  | 4.82               | 46.7                           | 77.9                           | 1.99                            | 13.1                            | 483                             | 4.96                            | 50.2                          | 1.60                | 0.261               |
| L 150 x 75 x 10  | 17.0      | 21.7                               | 150         | 75   | 10   | 12   | 5.31                             | 1.61              | 9.79               | 4.48               | 501  | 4.81               | 51.6                           | 85.6                           | 1.99                            | 14.5                            | 531                             | 4.95                            | 55.1                          | 1.60                | 0.261               |
| L 150 x 75 x 12  | 20.2      | 25.7                               | 150         | 75   | 12   | 12   | 5.40                             | 1.69              | 9.72               | 4.44               | 588  | 4.78               | 61.3                           | 99.6                           | 1.97                            | 17.1                            | 623                             | 4.92                            | 64.7                          | 1.59                | 0.258               |
| L 150 x 75 x 15  | 24.8      | 31.7                               | 150         | 75   | 15   | 12   | 5.52                             | 1.81              | 9.63               | 4.40               | 713  | 4.75               | 75.2                           | 119                            | 1.94                            | 21.0                            | 753                             | 4.88                            | 78.6                          | 1.58                | 0.253               |
| L 150 x 90 x 8   | 18.2      | 23.2                               | 150         | 90   | 10   | 12   | 5.00                             | 2.04              | 10.1               | 5.03               | 533  | 4.80               | 53.3                           | 146                            | 2.51                            | 21.0                            | 591                             | 5.05                            | 88.33                         | 1.95                | 0.360               |
| L 150 x 90 x 10  | 21.6      | 27.5                               | 150         | 90   | 12   | 12   | 5.08                             | 2.12              | 10.1               | 5.00               | 627  | 4.77               | 63.3                           | 171                            | 2.49                            | 24.8                            | 694                             | 5.02                            | 104                           | 1.94                | 0.358               |
| L 150 x 90 x 12  | 26.6      | 33.9                               | 150         | 90   | 15   | 12   | 5.21                             | 2.23              | 9.98               | 4.98               | 761  | 4.74               | 77.7                           | 205                            | 2.46                            | 30.4                            | 841                             | 4.98                            | 126                           | 1.93                | 0.354               |
| L 150 x 100 x 8  | 19.0      | 24.2                               | 150         | 100  | 10   | 12   | 4.81                             | 2.34              | 10.3               | 5.29               | 553  | 4.79               | 54.2                           | 199                            | 2.87                            | 25.9                            | 637                             | 5.13                            | 114                           | 2.17                | 0.438               |
| L 150 x 100 x 10 | 22.5      | 28.7                               | 150         | 100  | 12   | 12   | 4.89                             | 2.42              | 10.2               | 5.28               | 651  | 4.76               | 64.4                           | 233                            | 2.85                            | 30.7                            | 749                             | 5.11                            | 134                           | 2.16                | 0.436               |
| L 200 x 100 x 8  | 23.0      | 29.2                               | 200         | 100  | 10   | 15   | 6.93                             | 2.01              | 13.2               | 6.05               | 1220   | 6.46               | 93.2                           | 210                            | 2.68                            | 26.3                            | 1290                            | 6.65                            | 135                           | 2.15                | 0.263               |
| L 200 x 100 x 10 | 27.3      | 34.8                               | 200         | 100  | 12   | 15   | 7.03                             | 2.10              | 13.1               | 6.00               | 1440   | 6.43               | 111                            | 247                            | 2.67                            | 31.3                            | 1530                            | 6.63                            | 159                           | 2.14                | 0.262               |
| L 200 x 100 x 12 | 33.75     | 43.0                               | 200         | 100  | 15   | 15   | 7.16                             | 2.22              | 13.0               | 5.84               | 1758   | 6.4                | 137                            | 299                            | 2.64                            | 38.5                            | 1864                            | 6.59                            | 193                           | 2.12                | 0.260               |
| L 200 x 150 x 8  | 32.0      | 40.8                               | 200         | 150  | 12   | 15   | 6.08                             | 3.61              | 13.9               | 7.34               | 1650   | 6.36               | 119                            | 803                            | 4.44                            | 70.5                            | 2030                            | 7.04                            | 430                           | 3.25                | 0.552               |
| L 200 x 150 x 10 | 39.6      | 50.5                               | 200         | 150  | 15   | 15   | 6.21                             | 3.73              | 13.9               | 7.33               | 2022   | 6.33               | 147                            | 979                            | 4.40                            | 86.9                            | 2476                            | 7.00                            | 526                           | 3.23                | 0.551               |

Calidad: S275 JR – S355J2G3



**TOLERANCIAS DIMENSIONALES Y DE FORMA DE PERFILES ANGULARES DE LADOS IGUALES (PERFILES L) Y LADOS DESIGUALES (PERFILES LD). UNE EN 10056-2; 1993**

· Tolerancias de masa

La masa de una pieza no debe diferir de la masa teórica en más de:

- ± 6.0 % para espesores  $t \leq 4$  mm
- ± 4.0 % para espesores  $t > 4$  mm

La desviación de la masa nominal es la diferencia entre la masa real de la pieza y la masa calculada.

· Tolerancias de longitud

Los angulares deben suministrarse cortados a las longitudes solicitadas con las tolerancias indicadas a continuación.

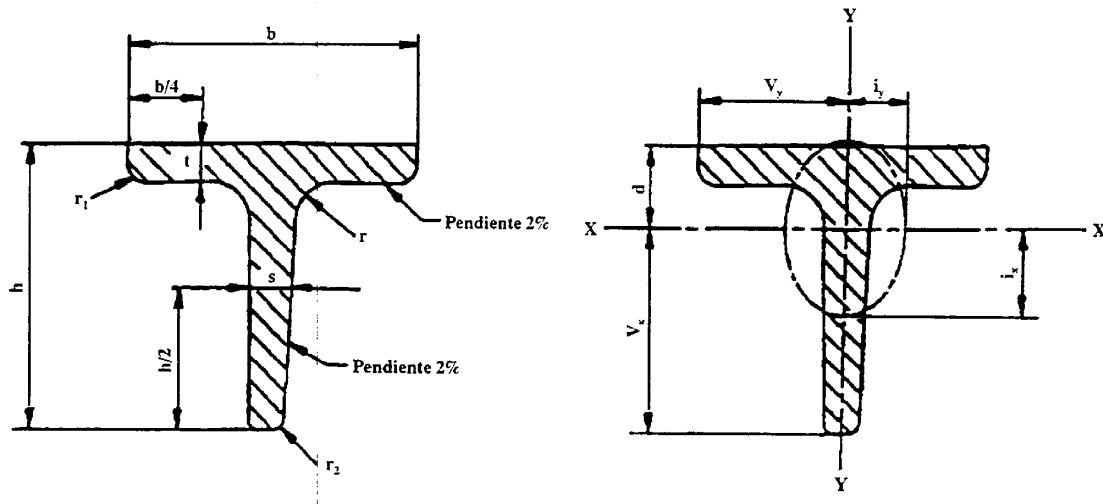
- ± 50 mm ó
- ${}_0^{+100}$  si en el pedido se solicitan longitudes mínimas

**Tabla 3-23 Tolerancias dimensionales y de forma de Perfiles Angulares de lados iguales(Perfiles L) y lados desiguales (Perfiles LD)**

| Dimensiones              | Longitud del lado        |  | Espesor del perfil     |   |
|--------------------------|--------------------------|--|------------------------|---|
|                          | longitud mm              | tolerancia mm  | espesor (t) mm         | tolerancia mm                                     |
|                          | $a \leq 50$              | ± 1.0  | $t \leq 5$             | ± 0.50  |
|                          | $50 < a \leq 100$        | ± 2.0  | $5 < t \leq 10$        | ± 0.75  |
|                          | $100 < a \leq 150$       | ± 3.0  | $10 < t \leq 15$       | ± 1.00  |
|                          | $150 < a \leq 200$       | ± 4.0  | $15 < t$               | ± 1.20  |
|                          | $200 < a$                | + 6.0<br>-4.0  |                        |   |
| Escuadrado<br>Desviación | Longitud del lado (a) mm |  | Tolerancia (k) mm      |   |
| Desviación               | $a \leq 100$             |  | 1.0                    |   |
|                          | $100 < a \leq 150$       |  | 1.5                    |   |
|                          | $150 < a \leq 200$       |  | 2.0                    |   |
|                          | $200 < a$                |  | 3.0                    |   |
| Rectitud                 | Longitud del lado a mm   | Tolerancia sobre toda la longitud de la barra (L) q mm | Longitud del lado a mm | Tolerancia sobre parte de la longitud de la barra |
|                          |                          |  |                        | longitud considerada mm                           |
|                          |                          |  |                        | q mm  |
|                          | $a \leq 150$             | 0.4 % L  | $a \leq 150$           | 1500  |
| $150 < a \leq 200$       | 0.2 % L                  | $150 < a \leq 200$                                     | 2000                   | 3   |
| $200 < a$                | 0.1 % L                  | $200 < a$  | 3000                   | 3   |



### 3.7. PERFIL T DE ACERO CON ALAS IGUALES Y ARISTAS REDONDEADAS LAMINADO EN CALIENTE. PERFILES SIMPLES T. UNE EN 10055-95.



**Tabla 3-24 Perfiles Simples T - Designación y medidas de los perfiles T de acero con alas iguales y aristas redondeadas laminados en caliente.**

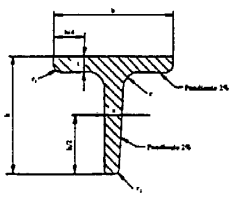
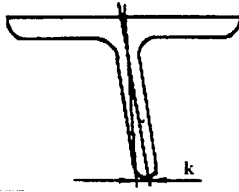
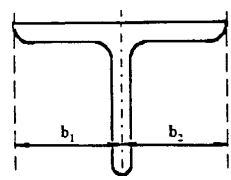
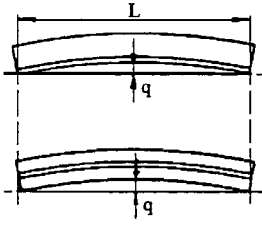
| Designación | Masa<br>Kg/m | Sección<br>cm <sup>2</sup> | Medidas     |              |                  |  |     |     | Posición del centro de gravedad<br>d<br>cm | Características respecto a los ejes |                 |      |                 |                 |      |
|-------------|--------------|----------------------------|-------------|--------------|------------------|--|-----|-----|--|-------------------------------------|-----------------|------|-----------------|-----------------|------|
|             |              |                            | Altura<br>h | Anchura<br>b | Espesor<br>s y t | Radios<br>r, r <sub>1</sub> , r <sub>2</sub> |     |     |  | X - X                               |                 |      | Y - Y           |                 |      |
|             |              |                            | mm          | mm           | mm               | mm   | mm  | mm  |  | cm <sup>4</sup>                     | cm <sup>3</sup> | cm   | cm <sup>4</sup> | cm <sup>3</sup> | cm   |
| T30         | 1.77         | 2.26                       | 30          | 30           | 4                | 4  | 2   | 1   | 0.85                                       | 1.72                                | 0.80            | 0.87 | 0.87            | 0.58            | 0.62 |
| T35         | 2.33         | 2.97                       | 35          | 35           | 4.5              | 4.5  | 2.5 | 1   | 0.99                                       | 3.10                                | 1.23            | 1.04 | 1.57            | 0.90            | 0.73 |
| T40         | 2.96         | 3.77                       | 40          | 40           | 5                | 5  | 2.5 | 1   | 1.12                                       | 5.28                                | 1.84            | 1.18 | 2.58            | 1.29            | 0.83 |
| T50         | 4.44         | 5.66                       | 50          | 50           | 6                | 6  | 3   | 1.5 | 1.39                                       | 12.1                                | 3.36            | 1.46 | 6.06            | 2.42            | 1.03 |
| T60         | 6.23         | 7.94                       | 60          | 60           | 7                | 7  | 3.5 | 2   | 1.66                                       | 23.8                                | 5.48            | 1.73 | 12.2            | 4.07            | 1.24 |
| T70         | 8.32         | 10.6                       | 70          | 70           | 8                | 8  | 4   | 2   | 1.94                                       | 44.5                                | 8.79            | 2.05 | 22.1            | 6.32            | 1.44 |
| T80         | 10.7         | 13.6                       | 80          | 80           | 9                | 9  | 4.5 | 2   | 2.22                                       | 73.7                                | 12.8            | 2.33 | 37.0            | 9.25            | 1.65 |
| T100        | 16.4         | 20.9                       | 100         | 100          | 11               | 11   | 5.5 | 3   | 2.74                                       | 179                                 | 24.6            | 2.92 | 88.3            | 17.7            | 2.05 |
| T120        | 23.2         | 29.6                       | 120         | 120          | 13               | 13   | 6.5 | 3   | 3.28                                       | 366                                 | 42.0            | 3.51 | 178             | 29.7            | 2.45 |
| T140        | 31.3         | 39.9                       | 140         | 140          | 15               | 15   | 7.5 | 4   | 3.80                                       | 660                                 | 64.7            | 4.07 | 330             | 47.2            | 2.88 |

Calidad: S275 JR



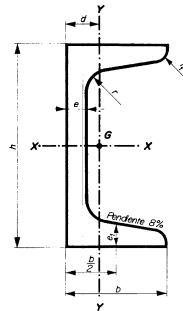
**TOLERANCIA**

**Tabla 3-25 Perfiles Simples T - Tolerancias dimensionales y de forma de los perfiles T de acero con alas iguales y aristas redondeadas laminados en caliente**

|   |   |   |                            |            |
|---|---|---|----------------------------|------------|
| 1   | <b>Sección</b><br>   | <b>Medidas nominales</b>  | <b>Tolerancias en (mm)</b> |            |
|   |   |   | b, h                       | s, t       |
|   |   | $b \leq 50$   | $\pm 1$                    | $\pm 0.5$  |
|   |   | $50 < b \leq 100$   | $\pm 1.5$                  | $\pm 0.75$ |
|   | $100 < b$   | $\pm 2.0$   | $\pm 1.0$                  |            |
| 2   | <b>Defecto de escuadra k</b><br>   | <b>Medidas nominales</b>  | <b>Tolerancias en (mm)</b> |            |
|   |   | $b, h \leq 100$   | $k \leq 1$                 |            |
|   |   | $100 < b, h$  | $k \leq 1.5$               |            |
| 3   | <b>Simetría e, <math>e = b_1 - b_2</math></b><br>   | <b>Medidas nominales</b>  | <b>Tolerancia s (mm)</b>   |            |
|   |   | $b \leq 60$   | $e \leq 1$                 |            |
|   |   | $60 < b$  | $e \leq 1.5$               |            |
| 4   | <b>Longitud L</b><br>L representa la máxima longitud útil de la sección teniendo en cuenta que los extremos de la sección se han cortado sin descuadre.<br>Las tolerancias requeridas deben indicarse en el pedido. Si se acuerda al hacer el pedido o la consulta, se pueden aceptar todas las tolerancias positivas como todas las tolerancias negativas. | <b>Tolerancias normales</b>   | <b>Tolerancias</b>         |            |
|   |   |   | $\pm 100$                  |            |
|   |   | <b>Tolerancias ajustadas</b>  | $\pm 50$                   |            |
|   |   |   | $\pm 25$                   |            |
| 5   | <b>Rectitud q</b><br>  | <b>Rectitud normal: la desviación q se mide sobre la longitud total L de la sección</b> |                            |            |
|   |   | <b>Medidas nominales</b>  | <b>Tolerancias</b>         |            |
|   |   | $50 \leq b, h \leq 100$   | $q \leq 0.4\%$ de L        |            |
| 6   | <b>Masa:</b> aplicable a secciones individuales   | <b>Espesores</b>  | <b>Tolerancias</b>         |            |
|   |   | $4 \leq s, t \leq 7$  | -8%                        |            |
|   |   | $7 < s, t$  | -6%                        |            |
| La desviación en masa de secciones individuales, es la diferencia entre la masa real y la masa teórica de cada sección. |   |   |                            |            |



### 3.8. PERFILES U PEQUEÑOS (COMERCIAL). UNE 36-525-72.



**Tabla 3-26 Perfiles U pequeños – Designación, medidas y datos de sección de los perfiles U comerciales laminados en caliente.**

| Designación por perfil | Medidas mm |    |     |                |     |                | A cm <sup>2</sup> | M Kg/m | Momento de inercia cm <sup>4</sup> |                | Módulo resistente cm <sup>3</sup> |                | Radio de giro cm |                | Posición del centro de gravedad d |
|------------------------|------------|----|-----|----------------|-----|----------------|-------------------|--------|------------------------------------|----------------|-----------------------------------|----------------|------------------|----------------|-----------------------------------|
|                        | h          | b  | e   | e <sub>1</sub> | r   | r <sub>1</sub> |                   |        | I <sub>x</sub>                     | I <sub>y</sub> | W <sub>x</sub>                    | W <sub>y</sub> | I <sub>x</sub>   | I <sub>y</sub> |                                   |
| U 30 x 15              | 30         | 15 | 4.0 | 4.5            | 4.5 | 2              | 2.21              | 1.74   | 2.53                               | 0.38           | 1.69                              | 0.39           | 1.07             | 0.42           | 0.52                              |
| U 40 x 20              | 40         | 20 | 5.0 | 5.5            | 5   | 2.5            | 3.66              | 2.85   | 7.58                               | 1.14           | 3.79                              | 0.86           | 1.44             | 0.56           | 0.67                              |
| U 50 x 25              | 50         | 25 | 5.0 | 6.0            | 6   | 3              | 4.92              | 3.86   | 16.8                               | 2.49           | 6.73                              | 1.48           | 1.85             | 0.71           | 0.81                              |
| U 60 x 30              | 60         | 30 | 6.0 | 6.0            | 6   | 3              | 6.46              | 5.07   | 31.6                               | 4.51           | 10.5                              | 2.16           | 2.21             | 0.84           | 0.91                              |
| U 30 x 33              | 30         | 33 | 5.0 | 7.0            | 7   | 3.5            | 5.44              | 4.27   | 6.39                               | 5.33           | 4.26                              | 2.68           | 1.08             | 0.99           | 1.31                              |
| U 40 x 35              | 40         | 35 | 5.0 | 7.0            | 7   | 3.5            | 6.21              | 4.87   | 14.7                               | 6.68           | 7.05                              | 3.08           | 2.50             | 1.04           | 1.33                              |
| U 50 x 38              | 50         | 38 | 5.0 | 7.0            | 7   | 3.5            | 7.12              | 5.59   | 26.4                               | 9.12           | 10.6                              | 3.75           | 1.92             | 1.13           | 1.37                              |
| U 65x 42               | 65         | 42 | 5.5 | 7.5            | 7.5 | 4              | 9.03              | 7.09   | 57.5                               | 14.1           | 17.7                              | 5.07           | 2.55             | 1.25           | 1.42                              |

Calidad: S275 JR

**TOLERANCIAS. UNE EN 10279: 2001**

- **Espesor del ala (t):** La desviación, respecto del espesor nominal del ala (t), medida en un punto situado a b/2 del extremo del ala, se debe situar dentro de las tolerancias indicadas en las tablas.
- **Radio de redondeo (r<sub>3</sub>):** El radio de redondeo (r<sub>3</sub>) no debe exceder de 0.3 t, siendo t el espesor del ala.
- **Longitud:** Los perfiles se deben suministrar cortados a las longitudes solicitadas con la tolerancias siguientes: a) <sup>+100</sup><sub>0</sub> m; o. por acuerdo entre el comprador y el fabricante b) ± 50 mm

**Tabla 3-27 Perfiles U pequeños - Tolerancias para los perfiles en U con alas inclinadas**

| Designación           | Característica                             | Intervalo             | Tolerancia |
|-----------------------|--|-----------------------|------------|
| h                     | Altura h                                   | h ≤ 65                | ± 1.5      |
|                       |  | 65 < h ≤ 200          | ± 2.0      |
|                       |  | 200 < h ≤ 400         | ± 3.0      |
|                       |  | 400 < h               | ± 4.0      |
| b                     | Anchura de ala b                           | b ≤ 50                | ± 1.5      |
|                       |  | 50 < b ≤ 100          | ± 2.0      |
|                       |  | 100 < b ≤ 125         | ± 2.5      |
| s                     | Espesor del alma s                         | 125 < b               | ± 3.0      |
|                       |  | s ≤ 10                | ± 0.5      |
|                       |  | 10 < s ≤ 15           | ± 0.7      |
| t                     | Espesor del ala t                          | 15 < s                | ± 1.0      |
|                       |  | t ≤ 10                | a -0.5     |
| r <sub>3</sub>        | Radio de redondeo r <sub>3</sub>           | 10 < t ≤ 15           | a -1.0     |
|                       |  | 15 < t                | a -1.5     |
|                       |  | Todas las dimensiones | ≤ 0.3t     |
| (K + K <sub>1</sub> ) | Falta de paralelismo (K + K <sub>1</sub> ) | b ≤ 100               | 2.0        |
|                       |  | 100 < b               | 2.5% de b  |
| f                     | Curvatura del alma f                       | h ≤ 100               | ± 0.5      |
|                       |  | 65 < h ≤ 200          | ± 1.0      |
|                       |  | 200 < h ≤ 400         | ± 1.5      |
|                       |  | 400 < h               | ± 1.5      |





**Tabla 3.27. Perfiles U pequeños - Tolerancias para los perfiles en U con alas inclinadas**

| Designación                  | Característica              | Intervalo     | Tolerancia   |
|------------------------------|-----------------------------|---------------|--------------|
| q <sub>xx</sub>              | Rectitud<br>q <sub>xx</sub> | h ≤ 150       | ± 0.3% de l  |
|                              |                             | 150 < h ≤ 300 | ± 0.2% de l  |
|                              |                             | 300 < h       | ± 0.15% de l |
| q <sub>yy</sub>              | Rectitud<br>q <sub>yy</sub> | h ≤ 150       | ± 0.5% de l  |
|                              |                             | 150 < h ≤ 300 | ± 0.3% de l  |
|                              |                             | 300 < h       | ± 0.2% de l  |
| Normal                       | Longitud<br>l               | Todas         | +100 0       |
| Alternativo<br>(por acuerdo) |                             | Todas         | ± 50         |
| Masa por unidad de longitud  | kg/m                        | h < 125       | ± 6%         |
|                              |                             | 125 < h       | ± 4%         |

a. Tolerancias en más limitadas por la masa.

**Tabla 3-28 Perfiles U pequeños - Tolerancias para los perfiles en U con alas paralelas**

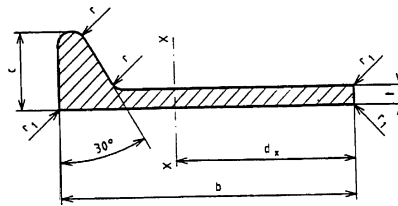
| Designación                  | Característica                                | Intervalo             | Tolerancia   |
|------------------------------|---|-----------------------|--------------|
| h                            | Altura<br>h                                   | h ≤ 65                | ± 1.5        |
|                              |   | 65 < h ≤ 200          | ± 2.0        |
|                              |   | 200 < h ≤ 400         | ± 3.0        |
|                              |   | 400 < h               | ± 4.0        |
| b                            | Anchura de ala<br>b                           | b ≤ 50                | ± 1.5        |
|                              |   | 50 < b ≤ 100          | ± 2.0        |
|                              |   | 100 < b ≤ 125         | ± 2.5        |
| s                            | Espesor del alma<br>s                         | 125 < b               | ± 3.0        |
| t                            |   | s ≤ 10                | ± 0.5        |
| r <sub>3</sub>               |   | Espesor del ala<br>t  | 10 < s ≤ 15  |
|                              | 15 < s  |                       | ± 1.0        |
|                              | t ≤ 10  |                       | a -0.5       |
|                              | Radio de redondeo<br>r <sub>3</sub>           | 10 < t ≤ 15           | a -1.0       |
|                              |   | 15 < t                | a -1.5       |
|                              |   | Todas las dimensiones | ≤ 0.3t       |
| (K + K <sub>1</sub> )        | Falta de paralelismo<br>(K + K <sub>1</sub> ) | b ≤ 100               | 2.0          |
|                              |   | 100 < b               | 2.5% de b    |
| f                            | Curvatura del alma<br>f                       | h ≤ 100               | ± 0.5        |
|                              |   | 65 < h ≤ 200          | ± 1.0        |
|                              |   | 200 < h ≤ 400         | ± 1.5        |
|                              |   | 400 < h               | ± 1.5        |
| q <sub>xx</sub>              | Rectitud<br>q <sub>xx</sub>                   | h ≤ 150               | ± 0.3% de l  |
|                              |   | 150 < h ≤ 300         | ± 0.2% de l  |
|                              |   | 300 < h               | ± 0.15% de l |
| q <sub>yy</sub>              | Rectitud<br>q <sub>yy</sub>                   | h ≤ 150               | ± 0.5% de l  |
|                              |   | 150 < h ≤ 300         | ± 0.3% de l  |
|                              |   | 300 < h               | ± 0.2% de l  |
| Normal                       | Longitud<br>l                                 | Todas                 | +100 0       |
| Alternativo<br>(por acuerdo) |   | Todas                 | ± 50         |
| Masa por unidad de longitud  | kg/m  | h < 125               | ± 6%         |
|                              |   | 125 < h               | ± 4%         |

a. Tolerancias en más limitadas por la masa.



### 3.9. OTROS PERFILES COMERCIALES

#### 3.9.1. LLANTAS BULBO LAMINADAS EN CALIENTE (CONSTRUCCIÓN NAVAL) UNE-EN 10067: 1997



**Tabla 3-29 Dimensiones, secciones transversales, masa por unidad de longitud, superficies laterales y características geométricas de las llantas con bulbo.**

| Dimensión nominal | Dimensiones para |         |         |         | Sección transversal<br>A<br>cm <sup>2</sup> | Masa/Ud de longitud<br>G<br>Kg/m | Superficie lateral<br>U<br>m <sup>2</sup> /m | Distancia al centro de gravedad<br>d<br>cm | Características geométricas respecto al eje xx          |  |
|-------------------|------------------|---------|---------|---------|---|----------------------------------|--|--|---|--|
|                   | b<br>mm          | t<br>mm | c<br>mm | r<br>mm |   |                                  |  |  | I <sub>x</sub><br>cm <sup>4</sup><br>momento de inercia | W <sub>x</sub><br>cm <sup>3</sup><br>módulo elástico |
| 80 x 5            | 80               | 5       | 14      | 4       | 5.41  | 4.25                             | 0.189  | 4.9  | 33.87   | 6.91   |
| 80 x 6            | 80               | 6       | 14      | 4       | 6.21  | 4.88                             | 0.191  | 4.78                                       | 38.7  | 8.1  |
| 100 x 7           | 100              | 7       | 15.5    | 4.5     | 8.74  | 6.68                             | 0.236  | 5.87                                       | 85.3  | 14.5   |
| 100 x 8           | 100              | 8       | 15.5    | 4.5     | 9.74  | 7.65                             | 0.238  | 5.78                                       | 94.3  | 16.3   |
| 120 x 6           | 120              | 6       | 17      | 5       | 9.32  | 7.32                             | 0.276  | 7.21                                       | 133   | 18.5   |
| 120 x 7           | 120              | 7       | 17      | 5       | 10.52                                       | 8.26                             | 0.278  | 7.07                                       | 149   | 21   |
| 120 x 8           | 120              | 8       | 17      | 5       | 11.72                                       | 9.2                              | 0.28   | 6.96                                       | 165   | 23.6   |
| 140 x 7           | 140              | 7       | 19      | 5.5     | 12.43                                       | 9.75                             | 0.32   | 8.32                                       | 241   | 29   |
| 140 x 8           | 140              | 8       | 19      | 5.5     | 13.83                                       | 10.85                            | 0.322  | 8.18                                       | 266   | 32.5   |
| 140 x 10          | 140              | 10      | 19      | 5.5     | 16.63                                       | 13.05                            | 0.326  | 7.99                                       | 315   | 39.5   |
| 160 x 7           | 160              | 7       | 22      | 6       | 14.6  | 11.46                            | 0.365  | 9.66                                       | 373   | 38.6   |
| 160 x 8           | 160              | 8       | 22      | 6       | 16.2  | 12.72                            | 0.367  | 9.5  | 411   | 43.3   |
| 160 x 9           | 160              | 9       | 22      | 6       | 17.8  | 13.97                            | 0.369  | 9.37                                       | 449   | 47.9   |
| 160 x 11          | 160              | 11      | 22      | 6       | 21  | 16.49                            | 0.373  | 9.16                                       | 522   | 57   |
| 180 x 8           | 180              | 8       | 25      | 7       | 18.86                                       | 14.8                             | 0.411  | 10.89                                      | 609   | 55.9   |
| 180 x 9           | 180              | 9       | 25      | 7       | 20.66                                       | 16.22                            | 0.413  | 10.73                                      | 664   | 61.8   |
| 180 x 10          | 180              | 10      | 25      | 7       | 22.46                                       | 17.63                            | 0.415  | 10.59                                      | 717   | 67.7   |
| 180 x 11          | 180              | 11      | 25      | 7       | 24.26                                       | 19.04                            | 0.417  | 10.47                                      | 770   | 73.5   |
| 200 x 9           | 200              | 9       | 28      | 8       | 23.66                                       | 18.57                            | 0.457  | 12.12                                      | 942   | 77.7   |
| 200 x 10          | 200              | 10      | 28      | 8       | 25.66                                       | 20.14                            | 0.459  | 11.96                                      | 1017  | 85.1   |
| 200 x 11          | 200              | 11      | 28      | 8       | 27.66                                       | 21.71                            | 0.461  | 11.82                                      | 1091  | 92.3   |
| 200 x 12          | 200              | 12      | 28      | 8       | 29.66                                       | 23.28                            | 0.463  | 11.69                                      | 1164  | 99.5   |
| 220 x 10          | 220              | 10      | 31      | 9       | 29  | 22.77                            | 0.503  | 13.35                                      | 1396  | 105  |
| 220 x 11          | 220              | 11      | 31      | 9       | 31.2  | 24.5                             | 0.506  | 13.19                                      | 1496  | 114  |
| 220 x 12          | 220              | 12      | 31      | 9       | 33.4  | 26.22                            | 0.507  | 13.04                                      | 1595  | 122  |
| 240 x 10          | 240              | 10      | 34      | 10      | 32.49                                       | 25.5                             | 0.547  | 14.77                                      | 1865  | 126  |
| 240 x 11          | 240              | 11      | 34      | 10      | 34.89                                       | 27.39                            | 0.549  | 14.58                                      | 1997  | 137  |
| 240 x 12          | 240              | 12      | 34      | 10      | 37.29                                       | 29.27                            | 0.551  | 14.42                                      | 2127  | 148  |
| 260 x 10          | 260              | 10      | 37      | 11      | 36.11                                       | 28.35                            | 0.591  | 16.22                                      | 2434  | 150  |
| 260 x 11          | 260              | 11      | 37      | 11      | 38.71                                       | 30.39                            | 0.593  | 16   | 2605  | 163  |
| 260 x 12          | 260              | 12      | 37      | 11      | 41.31                                       | 32.43                            | 0.596  | 15.81                                      | 2774  | 175  |
| 280 x 11          | 280              | 11      | 40      | 12      | 42.68                                       | 33.5                             | 0.637  | 17.44                                      | 3333  | 191  |
| 280 x 12          | 280              | 12      | 40      | 12      | 45.48                                       | 35.7                             | 0.639  | 17.23                                      | 3647  | 206  |
| 280 x 13          | 280              | 13      | 40      | 12      | 48.28                                       | 37.9                             | 0.641  | 17.04                                      | 3757  | 221  |
| 300 x 11          | 300              | 11      | 43      | 13      | 43.78                                       | 36.7                             | 0.681  | 18.9                                       | 4192  | 222  |
| 300 x 12          | 300              | 12      | 43      | 13      | 49.79                                       | 39.09                            | 0.683  | 18.7                                       | 4459  | 239  |
| 300 x 13          | 300              | 13      | 43      | 13      | 52.79                                       | 41.44                            | 0.685  | 18.45                                      | 4722  | 256  |
| 320 x 12          | 320              | 12      | 46      | 14      | 54.25                                       | 42.6                             | 0.728  | 20.12                                      | 5525  | 275  |
| 320 x 13          | 320              | 13      | 46      | 14      | 57.45                                       | 45.09                            | 0.73   | 19.89                                      | 5849  | 294  |
| 320 x 14          | 320              | 14      | 46      | 14      | 60.85                                       | 47.6                             | 0.732  | 19.68                                      | 6168  | 313  |
| 340 x 12          | 340              | 12      | 49      | 15      | 58.84                                       | 46.2                             | 0.772  | 21.69                                      | 6757  | 313  |
| 340 x 13          | 340              | 13      | 49      | 15      | 62.24                                       | 48.86                            | 0.774  | 21.34                                      | 7540  | 335  |
| 340 x 14          | 340              | 14      | 49      | 15      | 65.54                                       | 51.5                             | 0.776  | 21.1                                       | 7152  | 357  |
| 370 x 13          | 370              | 13      | 53.5    | 16.5    | 69.7  | 54.7                             | 0.84   | 23.54                                      | 9469  | 402  |
| 370 x 14          | 370              | 14      | 53.5    | 16.5    | 73.4  | 57.6                             | 0.842  | 23.29                                      | 9980  | 429  |
| 370 x 15          | 370              | 15      | 53.5    | 16.5    | 77.1  | 60.5                             | 0.844  | 23.06                                      | 10483   | 456  |
| 400 x 14          | 400              | 14      | 58      | 18      | 81.48                                       | 63.96                            | 0.908  | 25.49                                      | 12924   | 507  |
| 400 x 15          | 400              | 15      | 58      | 18      | 85.48                                       | 67.1                             | 0.91   | 25.24                                      | 13573   | 538  |
| 400 x 16          | 400              | 16      | 58      | 18      | 89.49                                       | 70.2                             | 0.912  | 25   | 14211   | 568  |
| 430 x 14          | 430              | 14      | 62.5    | 19.5    | 89.7  | 70.6                             | 0.975  | 27.7                                       | 16460   | 594  |
| 430 x 15          | 430              | 15      | 62.5    | 19.5    | 94.19                                       | 73.9                             | 0.976  | 27.46                                      | 17249   | 629  |
| 430 x 17          | 430              | 17      | 62.5    | 19.5    | 102.79                                      | 80.7                             | 0.98   | 26.95                                      | 18853   | 700  |
| 430 x 19          | 430              | 19      | 62.5    | 19.5    | 111.39                                      | 87.4                             | 0.984  | 26.53                                      | 20413   | 770  |
| 430 x 20          | 430              | 20      | 62.5    | 19.5    | 115   | 90.8                             | 0.986  | 26.3                                       | 21180   | 804  |



**TOLERANCIAS DIMENSIONALES Y DE FORMA**

- Anchura y espesor: La anchura se debe medir sobre la cota mayor de la llanta.

**Tabla 3-30 Llantas Bulbo - Tolerancias dimensionales**

| Dimensiones |     |    |    | Tolerancias |                |
|-------------|-----|----|----|-------------|----------------|
| b           |     | t  |    | para b      | para t         |
| >           | ≤   | ≥  | ≤  |             |                |
| ----        | 120 | 5  | 8  | ± 1.5       | + 0.7<br>- 0.3 |
| 120         | 180 | 7  | 11 | ± 2.0       | + 1.0<br>- 0.3 |
| 180         | 300 | 9  | 13 | ± 3.0       | + 1.0<br>- 0.4 |
| 300         | 430 | 12 | 20 | ± 4.0       | + 1.2<br>- 0.4 |

- Tolerancia para el defecto de escuadría del canto: El ángulo (q) formado por el canto y la vertical no debe exceder de 4º.
- Radio del chaflán:

**Tabla 3-31 Llantas Bulbo - Valor máximo del radio del chaflán**

| Espesor t |    | Radio del chaflán<br>r <sub>1</sub> max |
|-----------|----|---|
| >         | ≤  |   |
| ----      | 5  | 1.5                                     |
| 5         | 9  | 2                                       |
| 9         | 13 | 3                                       |
| 13        | 20 | 4                                       |

- Longitud: Las llantas con bulbo laminadas en caliente deben ser suministradas en longitudes de hasta 18m inclusive. Longitudes mayores de 18 m deben ser acordadas al hacer el pedido. Las tolerancias en longitud deben ser <sup>+100</sup><sub>-0</sub> mm.
- Rectitud: La tolerancia de rectitud q debe ser de 0.0035 L. La dimensión q se debe medir sobre toda la longitud L.
- Tolerancias de masa: Las tolerancias de masa deben ser.: <sup>+6</sup><sub>-2</sub> % de la masa total para suministros de 5t o más; <sup>+8</sup><sub>-2.7</sub> % de la masa total para suministros de menos de 5t. La desviación de la masa debe ser la diferencia entre la masa suministrada y la masa teórica.

**3.9.2. MEDIOS REDONDOS**

**Tabla 3-32 Acero semirredondo laminado en caliente: Kg/m**

| mm      | Kg/m  |
|---------|-------|
| 40 x 20 | 4.93  |
| 50 x 25 | 7.70  |
| 60 x 30 | 11.10 |
| 70 x 35 | 15.30 |

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**3.9.3. MEDIAS CAÑAS**

**Tabla 3-33 Media Caña laminado en caliente: Kg/m**

| mm      | Kg/m |
|---------|------|
| 20 x 5  | 0.56 |
| 25 x 6  | 0.85 |
| 30 x 6  | 1.10 |
| 35 x 6  | 1.36 |
| 40 x 8  | 1.76 |
| 40 x 10 | 2.24 |
| 45 x 10 | 2.50 |
| 50 x 10 | 2.72 |
| 50 x 12 | 3.30 |
| 60 x 10 | 3.21 |
| 60 x 12 | 3.91 |
| 60 x 14 | 4.95 |

