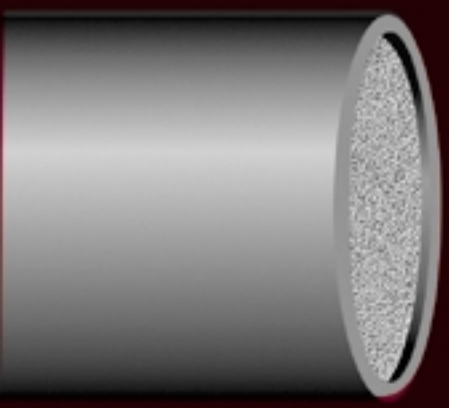
# HOLLOW STRUCTURAL SECTIONS

## Composite Load Tables



Steel Tube Institute
OF NORTH AMERICA

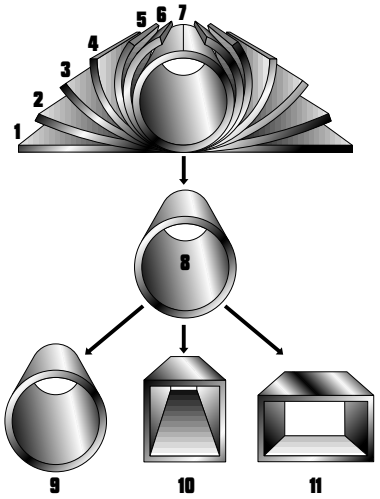
1999 REVISED EDITION

# HSS Manufacturing Methods

The transformation of steel strip into hollow structural sections (HSS) is the result of a series of operations including forming, welding and sizing. Currently three methods are being used in North America for the manufacture of HSS. These methods are described below. Each method can produce HSS to the tensile properties listed in ASTM A-500 or CSA G-42.21-92. Contact your HSS producer for available grades.

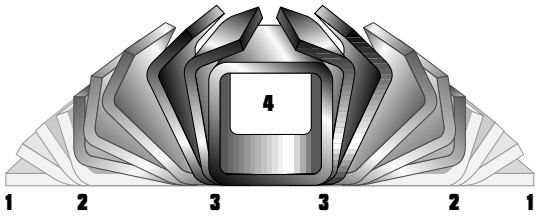
### *Electric Resistance Welding (ERW) Process*

In the tube mill, flat steel strip (1) is formed continuously around its longitudinal axis to produce a round tube. This is done by moving the strip through a progressive set of rolls (2-6). The strip edges (7) are heated by either high frequency induction or contact welding and then forged together by weld rolls to create a continuous longitudinal weld without the addition of filler metal. The weld seam (8) is then cooled and processed through a set of sizing/shaping rolls which cold-form it into a round (9), square (10) or rectangular (11) section.



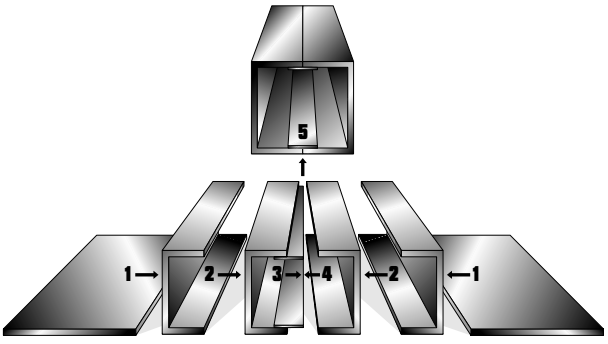

### *Form-Square Weld-Square (ERW) Process*

In the weld mill, driven forming dies progressively shape the flat strip (1) by forming the top two corners (2) of the square or rectangular tube in the initial forming station. Subsequent stations form the bottom two corners (3) of the shape. No cold working of the sides of the shape is performed, and the shape's seam is welded by high-frequency contacts when the tube is near its final shape and size. The welded tube (4) is cooled and then driven through a series of sizing stations which qualifies the tube's final dimensions.




### *Submerged Arc Weld (SAW) Process*

Two identical pieces of flat strip (1) are placed in a press brake and formed into two identical halves (2) of a finished tube size. A backup bar is tack welded to each leg of one of the half-sections (3). The two half-sections are fitted together toe-to-toe (4) and welded by the submerged arc process to complete the square or rectangular section (5).



# STI/HSS Member Companies

**Atlas Tube, Inc.**
200 Clark Street, P.O. Box 970
Harrow, Ontario N0R 1G0
Telephone: (519) 738-3541
(800) 265-6912
Fax: (519) 738-3537

**Bull Moose Tube Company**
1819 Clarkson Road, Suite 100
Chesterfield, MO 63017
Telephone: (636) 537-2600
(800) 325-4467
Fax: (636) 537-5848

**Eugene Welding Company**
P.O. Box 249
Marysville, MI 48040
Telephone: (810) 364-7421
(800) 336-3926
Fax: (810) 364-4347

**Hanna Steel Corporation**
P.O. Box 558, Fairfield, AL 35064
Telephone: (205) 780-1111
(800) 633-8252
Fax: (205) 783-8296

**Hannibal Industries, Inc.**
P.O. Box 58814, 3851 Santa Fe Ave.
Los Angeles, CA 90058
Telephone: (323) 588-4261
Fax: (323) 589-5640

**Independence Tube Corporation**
6226 W. 74th Street
Chicago, IL 60638-6196
Telephone: (708) 496-0380
(800) 376-6000
Fax: (708) 563-1950

**IPSCO Tubulars Inc.**
P.O. Box 18, 2011 7th Avenue
Camanche, IA 52730
Telephone: (563) 242-0000
(800) 950-4772
Fax: (563) 242-9137

**LTV Copperweld**
1855 East 122nd Street
Chicago, IL 60633
Telephone: (800) 733-5683
Fax: (773) 646-6128
*(In Canada)*
14 Holtby Avenue
Brampton, Ontario
Canada L6X 2M3
Telephone: (905) 451-2400
(800) 268-3005
Fax: (905) 840-4716

**Maverick Tube Corporation**
16401 Swingley Ridge Road,
Suite 700
Chesterfield, MO 63017
Telephone: (314) 733-1600
(800) 840-8823
Fax: (314) 733-1677

**Novamerican Steel Inc.**
2175 Hymus Boulevard
Dorval, Quebec, Canada H9P 1J8
Telephone: (514) 335-6682
(800) 361-1496
Fax: (514) 683-5285
*(In United States)*
600 Dean Sievres Place
Morrisville, PA 19067
Telephone: (215) 295-8813
Fax: (215) 295-8798

**Productos Laminados de Monterrey, SA de CV**
Headquarters & Monterrey Plant
Ave. Lazaro Cardenas 1525 Pte.
Col. Nino Artillero
Monterrey, N.L. Mexico C.P. 64280
Telephone: (8) 351-1625
(8) 351-1070
Fax: (8) 351-0322
*(U.S. Office)*

**Prolamsa, Inc.**
12603 SW Freeway, Suite 521
Stafford, TX 77477
Telephone: (281) 494-0900
Fax: (281) 494-0990

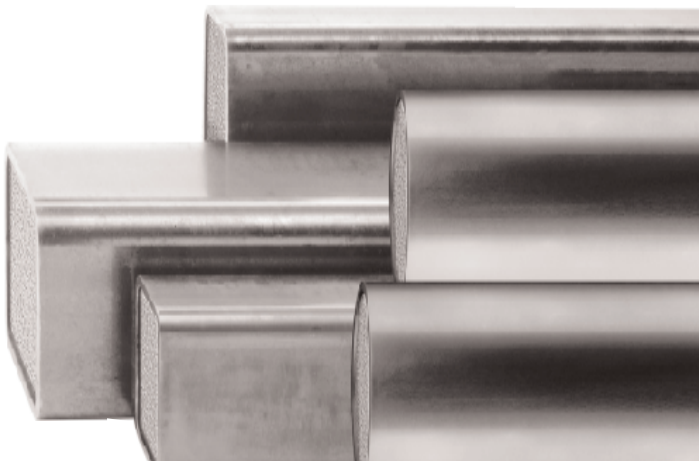
**Valmont Industries**
(Structural Tube Division)
P.O. Box 2620
Tulsa, OK 74101
Telephone: (918) 583-5881
(800) 331-3002
Fax: (918) 585-1927

**Vest, Incorporated**
6023 Alcoa Avenue
Los Angeles, CA 90058
Telephone: (323) 581-8823
(800) 421-6370
Fax: (323) 581-3465

**Welded Tube of Canada Limited**
111 Rayette Road
Concord, Ontario,
Canada L4K 2E9
Telephone: (905) 669-1111
(800) 565-8823
Fax: (905) 738-4070

# LRFD Composite Load Tables

***Please Note:*** *We've tried to make this brochure as comprehensive and factual as possible. However, some information may have been updated since the time of printing. Your HSS producer is your best source for up-to-date information.*



# "Designs for the 21st Century"

*The HSS composite photographs were supplied courtesy of Dean Lally L.P.*

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## Foreword

Tables of allowable axial compressive loads are presented for concrete-filled square, rectangular and round Hollow Structural Sections manufactured by the electric resistance welding (ERW) process and for concrete-filled square and rectangular HSS manufactured by the submerged arc welding (SAW) process.

The allowable axial compressive loads, in kips, have been calculated in accordance with the report of Task Group 20, Structural Stability Research Council, "*A Specification for the Design of Steel Concrete Composite Columns,*" American Institute of Steel Construction (AISC) Engineering Journal, 4th Quarter, 1979. The loads are based upon section property data for HSS that were recalculated in 1996 to account for today's more precise manufacturing methods. The recalculated section property data for HSS are published in "*Hollow Structural Sections - Dimensions and Section Properties*" available from the Steel Tube Institute of North America (STI).

Allowable axial loads are presented for one specified minimum yield stress steel, Fy=46 ksi, and for three specified compressive strengths of concrete, $f'_c$ = 3.5 ksi, $f'_c$ = 5.0 ksi, and $f'_c$ = 8.0 ksi. The tables apply to normal-weight concrete.

The allowable axial loads have been calculated for effective lengths, KL, with respect to the least radius of gyration (r or $r_y$) varying from 0 to 40 feet. The heavy horizontal lines within the tables indicate $K\ell/r = 200$. Loads are not tabulated beyond this point. Allowable loads for ERW and SAW sections are presented in separate tables. The properties at the bottom of the tables are useful for determining the strength with respect to the major axis and for the design of columns subject to combined axial and bending loads.

Refer to Part 3, Column Design in the AISC 9th Edition "*Manual of Steel Construction-Allowable Stress Design*" and the Task Group 20 report for a discussion of strength about the major axis and combined axial and bending loading (interaction). Symbols used in these tables follow those used in the Task Group 20 report.

Other recent design aid publications available from the STI include: *"Revised HSS Column Load Tables"* (1997); *"Revised HSS Beam Load Tables"* (1998).

The *"Hollow Structural Sections - Connections Manual"* published in 1998 by the AISC in conjunction with the STI is available through AISC Publications at 800-644-2400.

# Composite Load Tables

## Table of Contents

**Example 1**

Select the lightest 10-inch square Hollow Structural Section column filled with $f'_c$ = 3.5 ksi normal weight concrete to support a concentrated axial compressive load of 485 kips. The largest effective length, KL, is 14 feet.

Enter the $f'_c$ = 3.5 ksi table for the 10-inch square HSS.
Read across the row at KL = 14 and note the following:

10-in. x 10-in. x 5/8-in. can support
606 kips > 485 kips O.K.
10-in. x 10-in. x 1/2-in. can support
526 kips > 485 kips O.K.
10-in. x 10-in. x 3/8-in. can support
439 kips < 485 kips Not good

Select: **10-in. x 10-in. x 1/2-in.**
(weight = 62.46 lbs./ft.)

Note: Without concrete filling the application would require:

10-in. x 10-in. x 5/8 HSS* (weight = 76.33 lbs./ft.)
or
12-in. x 12-in. x 1/2 HSS* (weight = 76.07 lbs./ft.)
or
14-in. x 14-in. x 1/2 HSS* (weight = 89.68 lbs./ft.)
or
16-in. x 16-in. x 3/8 HSS* (weight = 78.52 lbs./ft.)

*See "Hollow Structural Sections Column Load Tables - Revised" available from the Steel Tube Institute of North America.

**Example 2**

Select the lightest 12-inch x 6-inch rectangular Hollow Structural Section column filled with $f'_c$ = 8.0 ksi normal weight concrete to support a concentrated axial compressive load of 380 kips. The effective length, KL, with respect to its minor axis is 16 feet. The effective length, KL, with respect to its major axis is 30 feet.

Enter the $f'_c$ = 8.0 ksi table for the 12-in. x 6 in. rectangular HSS.
Read across the row at KL = 16 and note the following:

12-in. x 6-in. x 5/8-in. can support
444 kips > 380 kips O.K.
12-in. x 6-in. x 1/2-in. can support
397 kips > 380 kips O.K.
12-in. x 6-in. x 3/8-in. can support
346 kips < 380 kips Not good

Tentatively select: 12-in. x 6-in. x 1/2-in.
$r_x/r_y$ = 1.73

Equivalent effective length for the major axis:
30/1.73 = 17.4 ft. > 16 ft. Major axis governs

Enter the same table, read across the row at KL = 17.4 and note the following:

12-in. x 6-in. x 1/2-in. can support
363 kips (interpolated) < 380 kips Not good

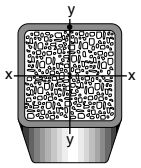
12-in. x 6-in. x 5/8-in. can support
406 kips (interpolated) > 380 kips
$r_x / r_y$ = 1.74 > 1.73 O.K.

Final selection:
**12-in. x 6-in. x 5/8-in.** HSS (weight = 67.82 lbs./ft.)

ERW

# HSS / Square Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips




**f'c = 3.5**

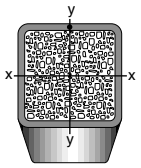


| Nominal Size | | 16 x 16 | | | 14 x 14 | | | 12 x 12 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 5/8 | 1/2 | 3/8 | 5/8 | 1/2 | 3/8 | 5/8 | 1/2 | 3/8 | 5/16 |
| Weight Per Foot | | 127.37 | 103.30 | 78.52 | 110.36 | 89.68 | 68.31 | 93.34 | 76.07 | 58.10 | 48.86 |
| Design Wall Thickness | | 0.581 | 0.465 | 0.349 | 0.581 | 0.465 | 0.349 | 0.581 | 0.465 | 0.349 | 0.291 |
| | | $F_y$ = 46 ksi | | | | | | | | | |
| Effective length KL in feet | 0 | 1360 | 1190 | 1010 | 1130 | 984 | 832 | 918 | 795 | 669 | 602 |
| | 4 | 1330 | 1160 | 993 | 1110 | 963 | 814 | 895 | 775 | 652 | 587 |
| | 5 | 1330 | 1160 | 987 | 1100 | 956 | 809 | 888 | 769 | 647 | 583 |
| | 6 | 1320 | 1150 | 982 | 1090 | 950 | 803 | 881 | 763 | 642 | 578 |
| | 7 | 1310 | 1140 | 976 | 1080 | 943 | 798 | 873 | 756 | 636 | 573 |
| | 8 | 1300 | 1140 | 970 | 1080 | 936 | 792 | 865 | 749 | 630 | 567 |
| | 9 | 1290 | 1130 | 963 | 1070 | 929 | 785 | 856 | 742 | 624 | 562 |
| | 10 | 1290 | 1120 | 957 | 1060 | 921 | 779 | 847 | 734 | 618 | 556 |
| | 11 | 1280 | 1110 | 950 | 1050 | 913 | 772 | 838 | 726 | 611 | 550 |
| | 12 | 1270 | 1110 | 943 | 1040 | 905 | 765 | 828 | 718 | 604 | 544 |
| | 13 | 1260 | 1100 | 936 | 1030 | 896 | 758 | 818 | 709 | 597 | 537 |
| | 14 | 1250 | 1090 | 928 | 1020 | 887 | 751 | 808 | 700 | 589 | 530 |
| | 15 | 1240 | 1080 | 920 | 1010 | 878 | 743 | 797 | 691 | 582 | 523 |
| | 16 | 1230 | 1070 | 912 | 998 | 869 | 735 | 786 | 681 | 574 | 516 |
| | 17 | 1210 | 1060 | 904 | 987 | 859 | 727 | 774 | 672 | 565 | 509 |
| | 18 | 1200 | 1050 | 896 | 976 | 849 | 718 | 763 | 662 | 557 | 501 |
| | 19 | 1190 | 1040 | 887 | 964 | 839 | 710 | 751 | 651 | 548 | 493 |
| | 20 | 1180 | 1030 | 878 | 952 | 829 | 701 | 739 | 641 | 540 | 485 |
| | 21 | 1170 | 1020 | 869 | 940 | 818 | 692 | 726 | 630 | 530 | 477 |
| | 22 | 1160 | 1010 | 860 | 927 | 807 | 683 | 713 | 619 | 521 | 469 |
| | 23 | 1140 | 998 | 851 | 914 | 796 | 673 | 700 | 608 | 512 | 460 |
| | 24 | 1130 | 987 | 841 | 901 | 785 | 664 | 686 | 596 | 502 | 452 |
| | 25 | 1120 | 976 | 831 | 888 | 773 | 654 | 673 | 584 | 492 | 443 |
| | 26 | 1100 | 964 | 821 | 874 | 762 | 644 | 658 | 572 | 482 | 433 |
| | 27 | 1090 | 952 | 811 | 860 | 749 | 634 | 644 | 560 | 471 | 424 |
| | 28 | 1080 | 940 | 801 | 846 | 737 | 624 | 629 | 547 | 461 | 415 |
| | 29 | 1060 | 928 | 790 | 832 | 725 | 613 | 614 | 534 | 450 | 405 |
| | 30 | 1050 | 915 | 780 | 817 | 712 | 602 | 599 | 521 | 439 | 395 |
| | 31 | 1030 | 902 | 769 | 802 | 699 | 591 | 584 | 508 | 428 | 385 |
| | 32 | 1020 | 889 | 758 | 787 | 686 | 580 | 568 | 494 | 416 | 374 |
| | 33 | 1000 | 876 | 746 | 771 | 672 | 569 | 552 | 480 | 405 | 364 |
| | 34 | 987 | 863 | 735 | 756 | 659 | 557 | 535 | 466 | 393 | 353 |
| | 35 | 972 | 849 | 723 | 740 | 645 | 545 | 518 | 452 | 381 | 342 |
| | 36 | 956 | 835 | 712 | 723 | 631 | 533 | 501 | 437 | 368 | 331 |
| | 37 | 940 | 821 | 700 | 707 | 616 | 521 | 484 | 422 | 356 | 320 |
| | 38 | 923 | 807 | 687 | 690 | 602 | 509 | 466 | 407 | 343 | 308 |
| | 39 | 907 | 793 | 675 | 673 | 587 | 496 | 448 | 391 | 330 | 297 |
| | 40 | 890 | 778 | 663 | 656 | 572 | 484 | 429 | 376 | 317 | 285 |
| **PROPERTIES** | | | | | | | | | | | |
| Area, In.$^2$ | | 35.0 | 28.3 | 21.5 | 30.3 | 24.6 | 18.7 | 25.7 | 20.9 | 16.0 | 13.4 |
| I, In.$^4$ | | 1370 | 1130 | 873 | 896 | 743 | 577 | 548 | 457 | 357 | 304 |
| r, In. | | 6.25 | 6.31 | 6.37 | 5.44 | 5.49 | 5.55 | 4.62 | 4.68 | 4.73 | 4.76 |
| B, Bending Factor | | 0.204 | 0.200 | 0.197 | 0.237 | 0.232 | 0.227 | 0.281 | 0.274 | 0.269 | 0.264 |
| a ÷ $10^6$ | | 264 | 232 | 197 | 168 | 147 | 124 | 99.5 | 87.2 | 73.5 | 66.1 |

# HSS / Square Structural Steel Tubing for Composite Columns

ERW

Allowable Concentric Loads in Kips



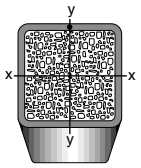

**f'c = 3.5**

$f'_c$=3.5 ksi

| Nominal Size | | 10 x 10 | | | | | 9 x 9 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 5/8 | 1/2 | 3/8 | 5/16 | 1/4 | 1/2 | 3/8 | 5/16 | 1/4 |
| Weight Per Foot | | 76.33 | 62.46 | 47.90 | 40.35 | 32.63 | 55.66 | 42.79 | 36.10 | 29.23 |
| Design Wall Thickness | | 0.581 | 0.465 | 0.349 | 0.291 | 0.233 | 0.465 | 0.349 | 0.291 | 0.233 |
| | | $F_y$ = 46 ksi | | | | | | | | |
| Effective length KL in feet | 0 | 719 | 621 | 519 | 465 | 405 | 538 | 449 | 400 | 352 |
| | 4 | 696 | 602 | 502 | 450 | 393 | 519 | 433 | 386 | 339 |
| | 5 | 689 | 596 | 497 | 446 | 389 | 513 | 428 | 382 | 335 |
| | 6 | 681 | 589 | 492 | 441 | 385 | 506 | 422 | 377 | 331 |
| | 7 | 673 | 583 | 487 | 436 | 380 | 500 | 417 | 372 | 327 |
| | 8 | 665 | 575 | 481 | 431 | 376 | 493 | 411 | 367 | 322 |
| | 9 | 656 | 568 | 474 | 425 | 371 | 485 | 405 | 361 | 317 |
| | 10 | 647 | 560 | 468 | 419 | 366 | 477 | 398 | 355 | 312 |
| | 11 | 637 | 552 | 461 | 413 | 360 | 469 | 391 | 349 | 307 |
| | 12 | 627 | 544 | 454 | 407 | 355 | 460 | 384 | 343 | 301 |
| | 13 | 617 | 535 | 447 | 400 | 349 | 451 | 377 | 336 | 295 |
| | 14 | 606 | 526 | 439 | 394 | 343 | 442 | 369 | 330 | 289 |
| | 15 | 595 | 516 | 432 | 387 | 337 | 432 | 361 | 323 | 283 |
| | 16 | 584 | 506 | 424 | 379 | 330 | 422 | 353 | 315 | 277 |
| | 17 | 572 | 496 | 415 | 372 | 324 | 412 | 345 | 308 | 270 |
| | 18 | 560 | 486 | 407 | 364 | 317 | 402 | 336 | 300 | 263 |
| | 19 | 548 | 475 | 398 | 356 | 310 | 391 | 327 | 292 | 256 |
| | 20 | 535 | 465 | 389 | 348 | 303 | 380 | 318 | 284 | 249 |
| | 21 | 522 | 453 | 380 | 340 | 296 | 368 | 309 | 276 | 242 |
| | 22 | 508 | 442 | 370 | 331 | 288 | 356 | 299 | 267 | 234 |
| | 23 | 494 | 430 | 360 | 323 | 280 | 344 | 289 | 258 | 226 |
| | 24 | 480 | 418 | 351 | 314 | 273 | 332 | 279 | 249 | 218 |
| | 25 | 466 | 406 | 340 | 305 | 264 | 319 | 268 | 240 | 210 |
| | 26 | 451 | 393 | 330 | 295 | 256 | 306 | 258 | 230 | 202 |
| | 27 | 436 | 380 | 319 | 286 | 248 | 293 | 247 | 221 | 193 |
| | 28 | 420 | 367 | 308 | 276 | 239 | 279 | 235 | 211 | 184 |
| | 29 | 404 | 353 | 297 | 266 | 230 | 265 | 224 | 200 | 175 |
| | 30 | 388 | 340 | 286 | 256 | 221 | 251 | 212 | 190 | 166 |
| | 31 | 371 | 325 | 274 | 245 | 212 | 236 | 200 | 179 | 157 |
| | 32 | 354 | 311 | 262 | 234 | 202 | 221 | 188 | 168 | 147 |
| | 33 | 337 | 296 | 250 | 223 | 193 | 208 | 176 | 158 | 138 |
| | 34 | 319 | 281 | 237 | 212 | 183 | 196 | 166 | 149 | 130 |
| | 35 | 301 | 266 | 225 | 201 | 175 | 185 | 157 | 141 | 123 |
| | 36 | 285 | 251 | 212 | 190 | 166 | 175 | 148 | 133 | 116 |
| | 37 | 270 | 238 | 201 | 180 | 157 | 165 | 140 | 126 | 110 |
| | 38 | 256 | 225 | 191 | 170 | 149 | 157 | 133 | 119 | 104 |
| | 39 | 243 | 214 | 181 | 162 | 141 | 149 | 126 | 113 | 99 |
| | 40 | 231 | 203 | 172 | 154 | 134 | 142 | 120 | 108 | 94 |
| **Properties** | | | | | | | | | | |
| Area, In.$^2$ | | 21.0 | 17.2 | 13.2 | 11.1 | 8.96 | 15.3 | 11.8 | 9.92 | 8.03 |
| I, In.$^4$ | | 304 | 256 | 202 | 172 | 141 | 182 | 145 | 124 | 102 |
| r, In. | | 3.80 | 3.86 | 3.92 | 3.94 | 3.97 | 3.45 | 3.51 | 3.54 | 3.56 |
| B, Bending Factor | | 0.345 | 0.336 | 0.327 | 0.323 | 0.318 | 0.378 | 0.366 | 0.360 | 0.354 |
| a ÷ $10^6$ | | 53.2 | 46.9 | 39.6 | 35.4 | 30.9 | 32.6 | 27.7 | 24.8 | 21.7 |

# HSS / Square Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips




**f'c = 3.5**



| Nominal Size | | 8 x 8 | | | | | | 7 x 7 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 5/8 | 1/2 | 3/8 | 5/16 | 1/4 | 3/16 | 5/8 | 1/2 | 3/8 | 5/16 | 1/4 | 3/16 |
| Weight Per Foot | | 59.32 | 48.85 | 37.69 | 31.84 | 25.82 | 19.63 | 50.81 | 42.05 | 32.58 | 27.59 | 22.42 | 17.08 |
| Design Wall Thickness | | 0.581 | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 | 0.581 | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 |
| | | $F_y$ = 46 ksi | | | | | | | | | | | |
| Effective length KL in feet | 0 | 536 | 461 | 382 | 340 | 297 | 253 | 447 | 386 | 318 | 283 | 246 | 208 |
| | 4 | 513 | 442 | 366 | 326 | 285 | 242 | 424 | 366 | 303 | 269 | 235 | 198 |
| | 5 | 506 | 436 | 361 | 322 | 281 | 239 | 417 | 360 | 298 | 265 | 231 | 195 |
| | 6 | 498 | 430 | 356 | 317 | 277 | 236 | 409 | 354 | 293 | 260 | 227 | 191 |
| | 7 | 490 | 423 | 351 | 312 | 273 | 232 | 401 | 347 | 287 | 255 | 222 | 187 |
| | 8 | 481 | 416 | 345 | 307 | 268 | 228 | 392 | 339 | 281 | 250 | 218 | 184 |
| | 9 | 472 | 408 | 338 | 301 | 263 | 224 | 383 | 331 | 274 | 244 | 213 | 179 |
| | 10 | 463 | 400 | 332 | 295 | 258 | 219 | 373 | 323 | 268 | 238 | 208 | 175 |
| | 11 | 453 | 391 | 325 | 289 | 253 | 215 | 363 | 314 | 261 | 232 | 202 | 171 |
| | 12 | 442 | 382 | 318 | 283 | 247 | 210 | 352 | 305 | 253 | 226 | 197 | 166 |
| | 13 | 432 | 373 | 310 | 276 | 241 | 205 | 341 | 296 | 246 | 219 | 191 | 161 |
| | 14 | 420 | 364 | 302 | 269 | 235 | 200 | 329 | 286 | 238 | 212 | 185 | 156 |
| | 15 | 409 | 354 | 294 | 262 | 229 | 195 | 317 | 276 | 229 | 205 | 179 | 150 |
| | 16 | 397 | 344 | 286 | 255 | 223 | 189 | 304 | 265 | 221 | 197 | 172 | 145 |
| | 17 | 384 | 333 | 277 | 247 | 216 | 184 | 291 | 254 | 212 | 189 | 165 | 139 |
| | 18 | 371 | 322 | 268 | 239 | 209 | 178 | 278 | 243 | 203 | 181 | 158 | 133 |
| | 19 | 358 | 311 | 259 | 231 | 202 | 172 | 264 | 231 | 193 | 173 | 151 | 127 |
| | 20 | 344 | 299 | 250 | 223 | 195 | 165 | 249 | 219 | 184 | 164 | 144 | 121 |
| | 21 | 330 | 287 | 240 | 214 | 187 | 159 | 234 | 206 | 173 | 155 | 136 | 114 |
| | 22 | 316 | 275 | 230 | 206 | 179 | 152 | 219 | 193 | 163 | 146 | 128 | 107 |
| | 23 | 301 | 262 | 220 | 196 | 172 | 146 | 203 | 180 | 152 | 137 | 120 | 100 |
| | 24 | 285 | 249 | 209 | 187 | 163 | 139 | 187 | 166 | 141 | 127 | 111 | 93 |
| | 25 | 269 | 236 | 198 | 177 | 155 | 131 | 172 | 153 | 130 | 117 | 103 | 86 |
| | 26 | 253 | 222 | 187 | 168 | 146 | 124 | 159 | 141 | 120 | 108 | 95 | 79 |
| | 27 | 236 | 208 | 176 | 157 | 137 | 116 | 148 | 131 | 112 | 100 | 88 | 74 |
| | 28 | 220 | 194 | 164 | 147 | 128 | 109 | 137 | 122 | 104 | 93 | 82 | 68 |
| | 29 | 205 | 181 | 153 | 137 | 119 | 101 | 128 | 114 | 97 | 87 | 76 | 64 |
| | 30 | 191 | 169 | 143 | 128 | 112 | 95 | 120 | 106 | 90 | 81 | 71 | 60 |
| | 31 | 179 | 158 | 134 | 120 | 105 | 89 | 112 | 99 | 85 | 76 | 67 | 56 |
| | 32 | 168 | 148 | 126 | 113 | 98 | 83 | 105 | 93 | 79 | 71 | 63 | 52 |
| | 33 | 158 | 139 | 118 | 106 | 92 | 78 | 99 | 88 | 75 | 67 | 59 | 49 |
| | 34 | 149 | 131 | 111 | 100 | 87 | 74 | 93 | 83 | 70 | 63 | 55 | 46 |
| | 35 | 141 | 124 | 105 | 94 | 82 | 70 | 88 | 78 | 66 | 60 | 52 | 44 |
| | 36 | 133 | 117 | 99 | 89 | 78 | 66 | 83 | 74 | 63 | 56 | 49 | 41 |
| | 37 | 126 | 111 | 94 | 84 | 73 | 62 | 79 | 70 | 59 | 53 | 47 | 39 |
| | 38 | 119 | 105 | 89 | 80 | 70 | 59 | 75 | 66 | 56 | 51 | 44 | 37 |
| | 39 | 113 | 100 | 85 | 76 | 66 | 56 | 71 | 63 | 53 | 48 | 42 | 35 |
| | 40 | 108 | 95 | 80 | 72 | 63 | 53 | 67 | 60 | 51 | 46 | 40 | 34 |
| **Properties** | | | | | | | | | | | | | |
| Area, In.$^2$ | | 16.4 | 13.5 | 10.4 | 8.76 | 7.10 | 5.37 | 14.0 | 11.6 | 8.97 | 7.59 | 6.17 | 4.67 |
| I, In.$^4$ | | 146 | 125 | 99.6 | 85.6 | 70.7 | 54.4 | 93.3 | 80.5 | 64.9 | 56.1 | 46.5 | 36.0 |
| r, In. | | 2.99 | 3.04 | 3.10 | 3.13 | 3.15 | 3.18 | 2.58 | 2.63 | 2.69 | 2.72 | 2.75 | 2.77 |
| B, Bending Factor | | 0.449 | 0.432 | 0.418 | 0.409 | 0.402 | 0.395 | 0.525 | 0.504 | 0.484 | 0.474 | 0.464 | 0.454 |
| a ÷ $10^6$ | | 24.8 | 21.9 | 18.5 | 16.6 | 14.5 | 12.3 | 15.5 | 13.8 | 11.7 | 10.5 | 9.23 | 7.73 |

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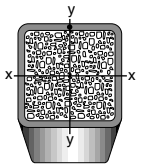
# HSS / Square Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips




**f'c = 3.5**

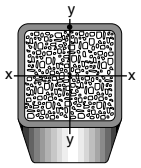
**$f'_c$=3.5 ksi**

| Nominal Size | | 6 x 6 | | | | | | 5 1/2 x 5 1/2 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 5/8 | 1/2 | 3/8 | 5/16 | 1/4 | 3/16 | 3/8 | 5/16 | 1/4 | 3/16 | 1/8 |
| Weight Per Foot | | 42.30 | 35.24 | 27.48 | 23.34 | 19.02 | 14.53 | 24.93 | 21.21 | 17.32 | 13.25 | 9.01 |
| Design Wall Thickness | | 0.581 | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 | 0.349 | 0.291 | 0.233 | 0.174 | 0.116 |
| | | **$F_y$ = 46 ksi** | | | | | | | | | | |
| Effective length KL in feet | 0 | 364 | 314 | 259 | 230 | 199 | 167 | 231 | 205 | 177 | 148 | 117 |
| | 4 | 342 | 295 | 244 | 216 | 188 | 157 | 216 | 191 | 165 | 138 | 110 |
| | 5 | 334 | 289 | 239 | 212 | 184 | 154 | 210 | 187 | 161 | 135 | 107 |
| | 6 | 326 | 282 | 233 | 207 | 180 | 151 | 205 | 182 | 157 | 131 | 105 |
| | 7 | 317 | 275 | 228 | 202 | 175 | 147 | 199 | 177 | 153 | 128 | 102 |
| | 8 | 308 | 268 | 221 | 197 | 171 | 143 | 193 | 171 | 148 | 124 | 98 |
| | 9 | 298 | 259 | 215 | 191 | 166 | 139 | 186 | 165 | 143 | 120 | 95 |
| | 10 | 288 | 251 | 208 | 185 | 161 | 135 | 179 | 159 | 138 | 115 | 92 |
| | 11 | 277 | 242 | 201 | 178 | 155 | 130 | 172 | 153 | 132 | 111 | 88 |
| | 12 | 266 | 232 | 193 | 172 | 149 | 125 | 164 | 146 | 126 | 106 | 84 |
| | 13 | 254 | 222 | 185 | 165 | 143 | 120 | 156 | 139 | 120 | 101 | 80 |
| | 14 | 242 | 212 | 177 | 157 | 137 | 115 | 147 | 131 | 114 | 95 | 76 |
| | 15 | 229 | 201 | 168 | 150 | 131 | 110 | 138 | 124 | 107 | 90 | 71 |
| | 16 | 215 | 190 | 159 | 142 | 124 | 104 | 129 | 116 | 100 | 84 | 67 |
| | 17 | 201 | 179 | 150 | 134 | 117 | 98 | 119 | 107 | 93 | 78 | 62 |
| | 18 | 187 | 166 | 140 | 125 | 110 | 92 | 109 | 98 | 86 | 72 | 57 |
| | 19 | 172 | 154 | 130 | 117 | 102 | 86 | 99 | 89 | 78 | 65 | 52 |
| | 20 | 156 | 141 | 119 | 107 | 94 | 79 | 89 | 81 | 70 | 59 | 47 |
| | 21 | 142 | 128 | 109 | 98 | 86 | 72 | 81 | 73 | 64 | 54 | 42 |
| | 22 | 129 | 117 | 99 | 89 | 78 | 66 | 74 | 67 | 58 | 49 | 39 |
| | 23 | 118 | 107 | 91 | 82 | 72 | 60 | 68 | 61 | 53 | 45 | 35 |
| | 24 | 108 | 98 | 83 | 75 | 66 | 55 | 62 | 56 | 49 | 41 | 33 |
| | 25 | 100 | 90 | 77 | 69 | 61 | 51 | 57 | 52 | 45 | 38 | 30 |
| | 26 | 92 | 83 | 71 | 64 | 56 | 47 | 53 | 48 | 41 | 35 | 28 |
| | 27 | 86 | 77 | 66 | 59 | 52 | 44 | 49 | 44 | 38 | 32 | 26 |
| | 28 | 80 | 72 | 61 | 55 | 48 | 41 | 46 | 41 | 36 | 30 | 24 |
| | 29 | 74 | 67 | 57 | 51 | 45 | 38 | 42 | 38 | 33 | 28 | 22 |
| | 30 | 69 | 63 | 53 | 48 | 42 | 35 | 40 | 36 | 31 | 26 | 21 |
| | 31 | 65 | 59 | 50 | 45 | 39 | 33 | 37 | 34 | 29 | 25 | 19 |
| | 32 | 61 | 55 | 47 | 42 | 37 | 31 | 35 | 31 | 27 | 23 | 18 |
| | 33 | 57 | 52 | 44 | 40 | 35 | 29 | 33 | 30 | 26 | 22 | 17 |
| | 34 | 54 | 49 | 41 | 37 | 33 | 28 | 31 | 28 | 24 | 20 | 16 |
| | 35 | 51 | 46 | 39 | 35 | 31 | 26 | | 26 | 23 | 19 | 15 |
| | 36 | 48 | 44 | 37 | 33 | 29 | 25 | | | | 18 | 14 |
| | 37 | | 41 | 35 | 32 | 28 | 23 | | | | | |
| | 38 | | | 33 | 30 | 26 | 22 | | | | | |
| | 39 | | | | | 25 | 21 | | | | | |
| | 40 | | | | | | | | | | | |
| **PROPERTIES** | | | | | | | | | | | | |
| Area, In.$^2$ | | 11.7 | 9.74 | 7.58 | 6.43 | 5.24 | 3.90 | 6.88 | 5.85 | 4.77 | 3.63 | 2.46 |
| I, In.$^4$ | | 55.1 | 48.2 | 39.4 | 34.3 | 28.6 | 22.3 | 29.7 | 25.9 | 21.7 | 17.0 | 11.8 |
| r, In. | | 2.17 | 2.23 | 2.28 | 2.31 | 2.34 | 2.37 | 2.08 | 2.11 | 2.13 | 2.16 | 2.19 |
| B, Bending Factor | | 0.637 | 0.606 | 0.577 | 0.562 | 0.550 | 0.535 | 0.637 | 0.621 | 0.604 | 0.587 | 0.573 |
| a ÷ $10^6$ | | 8.99 | 8.12 | 6.91 | 6.22 | 5.46 | 4.60 | 5.14 | 4.64 | 4.04 | 3.40 | 2.70 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

# HSS / Square Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips




**f'c = 3.5**

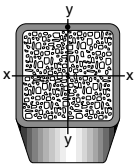


| Nominal Size | | 5 x 5 | | | | | | 4 1/2 x 4 1/2 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 1/2 | 3/8 | 5/16 | 1/4 | 3/16 | 1/8 | 1/2 | 3/8 | 5/16 | 1/4 | 3/16 | 1/8 |
| Weight Per Foot | | 28.43 | 22.37 | 19.08 | 15.62 | 11.97 | 8.16 | 25.03 | 19.82 | 16.96 | 13.91 | 10.70 | 7.31 |
| Design Wall Thickness | | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 | 0.116 | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 | 0.116 |
| | | $F_y$ = 46 ksi | | | | | | | | | | | |
| Effective length KL in feet | 0 | 247 | 203 | 180 | 155 | 129 | 102 | 214 | 177 | 156 | 135 | 112 | 88 |
| | 4 | 228 | 188 | 166 | 144 | 120 | 95 | 195 | 161 | 143 | 124 | 102 | 80 |
| | 5 | 221 | 183 | 162 | 140 | 117 | 92 | 188 | 156 | 138 | 120 | 99 | 78 |
| | 6 | 214 | 177 | 157 | 136 | 113 | 89 | 181 | 150 | 134 | 115 | 96 | 75 |
| | 7 | 207 | 171 | 152 | 131 | 109 | 87 | 173 | 144 | 128 | 111 | 92 | 72 |
| | 8 | 198 | 165 | 146 | 127 | 105 | 83 | 165 | 138 | 122 | 106 | 88 | 69 |
| | 9 | 190 | 158 | 140 | 122 | 101 | 80 | 156 | 131 | 116 | 101 | 84 | 66 |
| | 10 | 181 | 151 | 134 | 116 | 97 | 77 | 146 | 123 | 110 | 95 | 79 | 62 |
| | 11 | 171 | 143 | 127 | 110 | 92 | 73 | 136 | 115 | 103 | 90 | 74 | 58 |
| | 12 | 161 | 135 | 120 | 105 | 87 | 69 | 125 | 107 | 96 | 83 | 69 | 54 |
| | 13 | 150 | 126 | 113 | 98 | 82 | 65 | 114 | 98 | 88 | 77 | 64 | 50 |
| | 14 | 139 | 118 | 105 | 92 | 77 | 61 | 102 | 89 | 80 | 70 | 58 | 46 |
| | 15 | 128 | 108 | 97 | 85 | 71 | 56 | 90 | 79 | 72 | 63 | 52 | 41 |
| | 16 | 115 | 99 | 89 | 78 | 65 | 52 | 79 | 70 | 63 | 56 | 46 | 37 |
| | 17 | 103 | 88 | 80 | 70 | 59 | 47 | 70 | 62 | 56 | 49 | 41 | 32 |
| | 18 | 92 | 79 | 71 | 63 | 53 | 42 | 63 | 55 | 50 | 44 | 37 | 29 |
| | 19 | 82 | 71 | 64 | 56 | 47 | 38 | 56 | 49 | 45 | 40 | 33 | 26 |
| | 20 | 74 | 64 | 58 | 51 | 43 | 34 | 51 | 45 | 40 | 36 | 30 | 23 |
| | 21 | 67 | 58 | 52 | 46 | 39 | 31 | 46 | 40 | 37 | 32 | 27 | 21 |
| | 22 | 61 | 53 | 48 | 42 | 35 | 28 | 42 | 37 | 33 | 30 | 25 | 19 |
| | 23 | 56 | 48 | 44 | 38 | 32 | 26 | 38 | 34 | 31 | 27 | 22 | 18 |
| | 24 | 52 | 44 | 40 | 35 | 30 | 24 | 35 | 31 | 28 | 25 | 21 | 16 |
| | 25 | 48 | 41 | 37 | 33 | 27 | 22 | 32 | 28 | 26 | 23 | 19 | 15 |
| | 26 | 44 | 38 | 34 | 30 | 25 | 20 | 30 | 26 | 24 | 21 | 18 | 14 |
| | 27 | 41 | 35 | 32 | 28 | 23 | 19 | | 24 | 22 | 20 | 16 | 13 |
| | 28 | 38 | 33 | 29 | 26 | 22 | 17 | | | 21 | 18 | 15 | 12 |
| | 29 | 35 | 30 | 27 | 24 | 20 | 16 | | | | | 14 | 11 |
| | 30 | 33 | 28 | 26 | 23 | 19 | 15 | | | | | | |
| | 31 | | 27 | 24 | 21 | 18 | 14 | | | | | | |
| | 32 | | | | 20 | 17 | 13 | | | | | | |
| | 33 | | | | | | 12 | | | | | | |
| | 34 | | | | | | | | | | | | |
| | 35 | | | | | | | | | | | | |
| | 36 | | | | | | | | | | | | |
| | 37 | | | | | | | | | | | | |
| | 38 | | | | | | | | | | | | |
| | 39 | | | | | | | | | | | | |
| | 40 | | | | | | | | | | | | |
| **Properties** | | | | | | | | | | | | | |
| Area, In.$^2$ | | 7.88 | 6.18 | 5.26 | 4.30 | 3.28 | 2.23 | 6.95 | 5.48 | 4.68 | 3.84 | 2.93 | 2.00 |
| I, In.$^4$ | | 26.0 | 21.7 | 19.0 | 16.0 | 12.6 | 8.80 | 18.0 | 15.3 | 13.5 | 11.4 | 9.02 | 6.35 |
| r, In. | | 1.82 | 1.87 | 1.90 | 1.93 | 1.96 | 1.99 | 1.61 | 1.67 | 1.70 | 1.73 | 1.75 | 1.78 |
| B, Bending Factor | | 0.758 | 0.712 | 0.692 | 0.672 | 0.651 | 0.634 | 0.869 | 0.806 | 0.780 | 0.758 | 0.731 | 0.709 |
| a ÷ $10^6$ | | 4.28 | 3.68 | 3.33 | 2.93 | 2.46 | 1.95 | 2.92 | 2.56 | 2.33 | 2.06 | 1.71 | 1.35 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

# HSS / Square Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips




**f'c = 3.5**

**$f'_c$=3.5 ksi**

| Nominal Size | | 4 x 4 | | | | | |
|---|---|---|---|---|---|---|---|
| Wall Thickness | | 1/2 | 3/8 | 5/16 | 1/4 | 3/16 | 1/8 |
| Weight Per Foot | | 21.63 | 17.27 | 14.83 | 12.21 | 9.42 | 6.46 |
| Design Wall Thickness | | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 | 0.116 |
| | | $F_y$ = 46 ksi | | | | | |
| Effective length KL in feet | 0 | 183 | 151 | 134 | 115 | 95 | 74 |
| | 4 | 163 | 136 | 120 | 104 | 86 | 67 |
| | 5 | 156 | 130 | 116 | 100 | 82 | 64 |
| | 6 | 149 | 124 | 110 | 95 | 79 | 62 |
| | 7 | 141 | 118 | 105 | 91 | 75 | 59 |
| | 8 | 132 | 111 | 99 | 86 | 71 | 56 |
| | 9 | 122 | 103 | 93 | 80 | 67 | 52 |
| | 10 | 112 | 96 | 86 | 75 | 62 | 49 |
| | 11 | 102 | 87 | 79 | 69 | 57 | 45 |
| | 12 | 91 | 78 | 71 | 62 | 52 | 41 |
| | 13 | 79 | 69 | 63 | 55 | 47 | 37 |
| | 14 | 68 | 60 | 55 | 48 | 41 | 32 |
| | 15 | 59 | 52 | 48 | 42 | 35 | 28 |
| | 16 | 52 | 46 | 42 | 37 | 31 | 25 |
| | 17 | 46 | 40 | 37 | 33 | 28 | 22 |
| | 18 | 41 | 36 | 33 | 29 | 25 | 19 |
| | 19 | 37 | 32 | 30 | 26 | 22 | 17 |
| | 20 | 33 | 29 | 27 | 24 | 20 | 16 |
| | 21 | 30 | 27 | 24 | 21 | 18 | 14 |
| | 22 | 27 | 24 | 22 | 20 | 17 | 13 |
| | 23 | 25 | 22 | 20 | 18 | 15 | 12 |
| | 24 | | 20 | 19 | 16 | 14 | 11 |
| | 25 | | | | 15 | 13 | 10 |
| | 26 | | | | | | 9 |
| | 27 | | | | | | |
| | 28 | | | | | | |
| | 29 | | | | | | |
| | 30 | | | | | | |
| | 31 | | | | | | |
| | 32 | | | | | | |
| | 33 | | | | | | |
| | 34 | | | | | | |
| | 35 | | | | | | |
| | 36 | | | | | | |
| | 37 | | | | | | |
| | 38 | | | | | | |
| | 39 | | | | | | |
| | 40 | | | | | | |
| **Properties** | | | | | | | |
| Area, In.$^2$ | | 6.02 | 4.78 | 4.10 | 3.37 | 2.58 | 1.77 |
| I, In.$^4$ | | 11.9 | 10.3 | 9.14 | 7.80 | 6.21 | 4.40 |
| r, In. | | 1.41 | 1.46 | 1.49 | 1.52 | 1.55 | 1.58 |
| B, Bending Factor | | 1.01 | 0.928 | 0.897 | 0.864 | 0.831 | 0.805 |
| a ÷ $10^6$ | | 1.92 | 1.68 | 1.54 | 1.36 | 1.15 | 0.908 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

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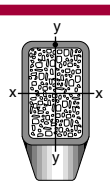
# HSS / Rectangular Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips




**f'c = 3.5**

**$f'_c$=3.5 ksi**

| Nominal Size | | 20 x 12 | 20 x 8 | | 20 x 4 | 18 x 6 | | 16 x 12 | |
|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 1/2 | 5/8 | 1/2 | 1/2 | 5/8 | 1/2 | 1/2 | 3/8 |
| Weight Per Foot | | 103.30 | 110.36 | 89.68 | 76.07 | 93.34 | 76.07 | 89.68 | 68.31 |
| Design Wall Thickness | | 0.465 | 0.581 | 0.465 | 0.465 | 0.581 | 0.465 | 0.465 | 0.349 |
| | | **$F_y$ = 46 ksi** | | | | | | | |
| Effective length KL in feet | 0 | 1160 | 1070 | 919 | 681 | 854 | 731 | 976 | 825 |
| | 4 | 1130 | 1030 | 885 | 622 | 809 | 693 | 952 | 804 |
| | 5 | 1120 | 1010 | 875 | 602 | 794 | 680 | 945 | 798 |
| | 6 | 1110 | 1000 | 863 | 580 | 778 | 667 | 938 | 792 |
| | 7 | 1100 | 986 | 851 | 556 | 761 | 653 | 930 | 785 |
| | 8 | 1090 | 971 | 839 | 531 | 743 | 638 | 922 | 778 |
| | 9 | 1080 | 956 | 825 | 504 | 724 | 622 | 913 | 771 |
| | 10 | 1070 | 939 | 812 | 475 | 704 | 605 | 904 | 764 |
| | 11 | 1060 | 922 | 797 | 445 | 683 | 587 | 895 | 756 |
| | 12 | 1050 | 904 | 782 | 413 | 661 | 569 | 885 | 747 |
| | 13 | 1040 | 886 | 766 | 380 | 638 | 550 | 875 | 739 |
| | 14 | 1030 | 867 | 749 | 344 | 614 | 530 | 865 | 730 |
| | 15 | 1020 | 847 | 732 | 307 | 589 | 509 | 854 | 721 |
| | 16 | 1000 | 826 | 715 | 270 | 564 | 487 | 843 | 712 |
| | 17 | 991 | 805 | 697 | 239 | 537 | 465 | 831 | 702 |
| | 18 | 977 | 783 | 678 | 214 | 509 | 442 | 820 | 692 |
| | 19 | 964 | 760 | 659 | 192 | 480 | 418 | 808 | 682 |
| | 20 | 950 | 737 | 639 | 173 | 451 | 393 | 795 | 672 |
| | 21 | 935 | 713 | 619 | 157 | 420 | 367 | 783 | 661 |
| | 22 | 920 | 688 | 598 | 143 | 388 | 341 | 770 | 650 |
| | 23 | 905 | 663 | 576 | 131 | 356 | 313 | 756 | 639 |
| | 24 | 890 | 637 | 554 | 120 | 327 | 288 | 743 | 627 |
| | 25 | 874 | 611 | 532 | 111 | 301 | 265 | 729 | 616 |
| | 26 | 858 | 584 | 508 | 102 | 278 | 245 | 715 | 604 |
| | 27 | 841 | 556 | 485 | 95 | 258 | 227 | 701 | 592 |
| | 28 | 824 | 527 | 460 | 88 | 240 | 211 | 686 | 579 |
| | 29 | 807 | 497 | 435 | | 224 | 197 | 671 | 567 |
| | 30 | 790 | 467 | 409 | | 209 | 184 | 656 | 554 |
| | 31 | 772 | 438 | 384 | | 196 | 172 | 640 | 541 |
| | 32 | 754 | 411 | 360 | | 184 | 162 | 624 | 527 |
| | 33 | 736 | 386 | 338 | | 173 | 152 | 608 | 514 |
| | 34 | 717 | 364 | 319 | | 163 | 143 | 592 | 500 |
| | 35 | 698 | 343 | 301 | | 154 | 135 | 575 | 486 |
| | 36 | 678 | 324 | 284 | | 145 | 128 | 558 | 471 |
| | 37 | 658 | 307 | 269 | | 138 | 121 | 541 | 456 |
| | 38 | 638 | 291 | 255 | | 130 | 115 | 523 | 442 |
| | 39 | 618 | 276 | 242 | | 124 | 109 | 505 | 426 |
| | 40 | 597 | 263 | 230 | | 118 | 104 | 487 | 411 |
| **Properties** | | | | | | | | | |
| Area, In.$^2$ | | 28.3 | 30.3 | 24.6 | 20.9 | 25.7 | 20.9 | 24.6 | 18.7 |
| $I_x$, In.$^4$ | | 1550 | 1440 | 1190 | 838 | 923 | 770 | 904 | 702 |
| $I_y$, In.$^4$ | | 705 | 338 | 283 | 58.7 | 158 | 134 | 581 | 452 |
| Ratio, $r_x/r_y$ | | 1.48 | 2.06 | 2.05 | 3.78 | 2.42 | 2.40 | 1.25 | 1.25 |
| $r_y$, In. | | 4.99 | 3.34 | 3.39 | 1.68 | 2.48 | 2.53 | 4.86 | 4.91 |
| $B_x$, Bending Factor | | 0.183 | 0.210 | 0.207 | 0.249 | 0.251 | 0.244 | 0.218 | 0.213 |
| $B_y$, Bending Factor | | 0.241 | 0.359 | 0.348 | 0.712 | 0.488 | 0.468 | 0.254 | 0.248 |
| $a_x \div 10^6$ | | 313 | 258 | 223 | 142 | 158 | 137 | 178 | 150 |
| $a_y \div 10^6$ | | 142 | 60.5 | 53.1 | 9.92 | 27.1 | 23.9 | 114 | 96.8 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

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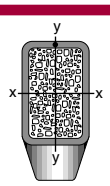
# HSS / Rectangular Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips




**f'c = 3.5**

$f'_c$ = 3.5 ksi

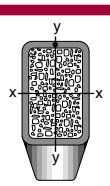
| Nominal Size | | 16 x 8 | | | 16 x 4 | | 14 x 10 | | |
|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 5/8 | 1/2 | 3/8 | 1/2 | 3/8 | 5/8 | 1/2 | 3/8 |
| Weight Per Foot | | 93.34 | 76.07 | 58.10 | 62.46 | 47.90 | 93.34 | 76.07 | 58.10 |
| Design Wall Thickness | | 0.581 | 0.465 | 0.349 | 0.465 | 0.349 | 0.581 | 0.465 | 0.349 |
| | | $F_y$ = 46 ksi | | | | | | | |
| Effective length KL in feet | 0 | 890 | 767 | 641 | 557 | 454 | 911 | 788 | 662 |
| | 4 | 856 | 738 | 617 | 508 | 415 | 884 | 764 | 642 |
| | 5 | 845 | 729 | 609 | 491 | 402 | 875 | 757 | 636 |
| | 6 | 834 | 719 | 601 | 472 | 388 | 866 | 750 | 630 |
| | 7 | 822 | 709 | 593 | 453 | 372 | 857 | 741 | 623 |
| | 8 | 809 | 698 | 584 | 431 | 356 | 847 | 733 | 616 |
| | 9 | 796 | 687 | 574 | 409 | 338 | 836 | 724 | 609 |
| | 10 | 782 | 675 | 564 | 385 | 319 | 825 | 715 | 601 |
| | 11 | 767 | 662 | 554 | 359 | 299 | 814 | 705 | 593 |
| | 12 | 752 | 649 | 543 | 332 | 279 | 802 | 695 | 584 |
| | 13 | 736 | 635 | 532 | 304 | 257 | 790 | 684 | 575 |
| | 14 | 719 | 621 | 520 | 274 | 233 | 777 | 673 | 566 |
| | 15 | 702 | 607 | 508 | 243 | 209 | 764 | 662 | 557 |
| | 16 | 684 | 592 | 496 | 214 | 184 | 750 | 650 | 547 |
| | 17 | 666 | 576 | 483 | 189 | 163 | 736 | 638 | 537 |
| | 18 | 647 | 560 | 469 | 169 | 146 | 722 | 626 | 527 |
| | 19 | 628 | 543 | 456 | 151 | 131 | 707 | 613 | 516 |
| | 20 | 608 | 526 | 442 | 137 | 118 | 692 | 600 | 505 |
| | 21 | 587 | 509 | 427 | 124 | 107 | 676 | 587 | 494 |
| | 22 | 566 | 491 | 412 | 113 | 98 | 660 | 573 | 483 |
| | 23 | 544 | 473 | 397 | 103 | 89 | 644 | 559 | 471 |
| | 24 | 522 | 454 | 381 | 95 | 82 | 627 | 545 | 459 |
| | 25 | 499 | 434 | 365 | 87 | 76 | 610 | 530 | 446 |
| | 26 | 475 | 414 | 349 | 81 | 70 | 592 | 515 | 434 |
| | 27 | 451 | 394 | 332 | 75 | 65 | 574 | 500 | 421 |
| | 28 | 427 | 373 | 314 | | 60 | 556 | 484 | 408 |
| | 29 | 401 | 351 | 296 | | | 537 | 468 | 394 |
| | 30 | 375 | 329 | 278 | | | 518 | 452 | 381 |
| | 31 | 351 | 308 | 260 | | | 498 | 435 | 367 |
| | 32 | 330 | 289 | 244 | | | 478 | 418 | 352 |
| | 33 | 310 | 272 | 230 | | | 458 | 400 | 338 |
| | 34 | 292 | 256 | 216 | | | 437 | 383 | 323 |
| | 35 | 276 | 242 | 204 | | | 415 | 364 | 308 |
| | 36 | 261 | 228 | 193 | | | 393 | 346 | 292 |
| | 37 | 247 | 216 | 183 | | | 372 | 327 | 276 |
| | 38 | 234 | 205 | 173 | | | 353 | 310 | 262 |
| | 39 | 222 | 195 | 165 | | | 335 | 295 | 249 |
| | 40 | 211 | 185 | 156 | | | 318 | 280 | 236 |
| **Properties** | | | | | | | | | |
| Area, In.$^2$ | | 25.7 | 20.9 | 16.0 | 17.2 | 13.2 | 25.7 | 20.9 | 16.0 |
| $I_x$, In.$^4$ | | 815 | 679 | 531 | 455 | 360 | 687 | 573 | 447 |
| $I_y$, In.$^4$ | | 274 | 230 | 181 | 47.0 | 38.3 | 407 | 341 | 267 |
| Ratio, $r_x/r_y$ | | 1.72 | 1.72 | 1.71 | 3.11 | 3.07 | 1.30 | 1.30 | 1.29 |
| $r_y$, In. | | 3.27 | 3.32 | 3.37 | 1.65 | 1.71 | 3.98 | 4.04 | 4.09 |
| $B_x$, Bending Factor | | 0.252 | 0.246 | 0.241 | 0.302 | 0.293 | 0.262 | 0.255 | 0.251 |
| $B_y$, Bending Factor | | 0.375 | 0.363 | 0.354 | 0.732 | 0.689 | 0.316 | 0.306 | 0.300 |
| $a_x \div 10^6$ | | 144 | 126 | 105 | 76.5 | 63.4 | 124 | 108 | 91.0 |
| $a_y \div 10^6$ | | 48.5 | 42.6 | 35.9 | 7.90 | 6.75 | 73.4 | 64.5 | 54.4 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

ERW

# HSS / Rectangular Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips




**f'c = 3.5**



| Nominal Size | | 14 x 6 | | | 14 x 4 | | | 12 x 10 | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 5/8 | 1/2 | 3/8 | 5/8 | 1/2 | 3/8 | 1/2 | 3/8 | 5/16 |
| Weight Per Foot | | 76.33 | 62.46 | 47.90 | 67.82 | 55.66 | 42.79 | 69.27 | 53.00 | 44.60 |
| Design Wall Thickness | | 0.581 | 0.465 | 0.349 | 0.581 | 0.465 | 0.349 | 0.465 | 0.349 | 0.291 |
| | | $F_y$ = 46 ksi | | | | | | | | |
| Effective length KL in feet | 0 | 690 | 593 | 490 | 581 | 494 | 404 | 703 | 590 | 529 |
| | 4 | 652 | 561 | 464 | 527 | 449 | 369 | 682 | 572 | 512 |
| | 5 | 640 | 551 | 456 | 509 | 434 | 357 | 675 | 567 | 507 |
| | 6 | 627 | 540 | 447 | 489 | 418 | 344 | 668 | 561 | 502 |
| | 7 | 613 | 528 | 437 | 467 | 400 | 330 | 661 | 555 | 497 |
| | 8 | 598 | 515 | 427 | 444 | 381 | 315 | 653 | 548 | 491 |
| | 9 | 582 | 502 | 416 | 419 | 361 | 299 | 645 | 541 | 485 |
| | 10 | 566 | 488 | 405 | 392 | 340 | 282 | 636 | 534 | 478 |
| | 11 | 548 | 473 | 393 | 365 | 317 | 264 | 627 | 527 | 472 |
| | 12 | 530 | 458 | 380 | 335 | 293 | 245 | 618 | 519 | 465 |
| | 13 | 511 | 442 | 367 | 304 | 268 | 225 | 608 | 511 | 458 |
| | 14 | 491 | 425 | 354 | 271 | 241 | 204 | 598 | 503 | 450 |
| | 15 | 470 | 408 | 340 | 238 | 213 | 182 | 588 | 494 | 442 |
| | 16 | 449 | 390 | 325 | 209 | 187 | 160 | 577 | 485 | 434 |
| | 17 | 426 | 371 | 310 | 185 | 166 | 142 | 566 | 476 | 426 |
| | 18 | 403 | 352 | 294 | 165 | 148 | 127 | 555 | 467 | 418 |
| | 19 | 379 | 332 | 278 | 148 | 133 | 114 | 543 | 457 | 409 |
| | 20 | 355 | 311 | 261 | 134 | 120 | 103 | 532 | 447 | 400 |
| | 21 | 329 | 290 | 244 | 121 | 109 | 93 | 519 | 437 | 391 |
| | 22 | 302 | 267 | 226 | 110 | 99 | 85 | 507 | 426 | 382 |
| | 23 | 277 | 245 | 207 | 101 | 91 | 78 | 494 | 415 | 372 |
| | 24 | 254 | 225 | 190 | 93 | 83 | 71 | 481 | 404 | 362 |
| | 25 | 234 | 207 | 175 | 86 | 77 | 66 | 467 | 393 | 352 |
| | 26 | 217 | 192 | 162 | 79 | 71 | 61 | 453 | 382 | 342 |
| | 27 | 201 | 178 | 150 | | 66 | 56 | 439 | 370 | 331 |
| | 28 | 187 | 165 | 140 | | | 52 | 425 | 358 | 321 |
| | 29 | 174 | 154 | 130 | | | | 410 | 346 | 309 |
| | 30 | 163 | 144 | 122 | | | | 395 | 333 | 298 |
| | 31 | 152 | 135 | 114 | | | | 380 | 320 | 287 |
| | 32 | 143 | 126 | 107 | | | | 364 | 307 | 275 |
| | 33 | 134 | 119 | 101 | | | | 348 | 293 | 263 |
| | 34 | 127 | 112 | 95 | | | | 331 | 280 | 251 |
| | 35 | 120 | 106 | 90 | | | | 315 | 266 | 238 |
| | 36 | 113 | 100 | 85 | | | | 298 | 251 | 225 |
| | 37 | 107 | 95 | 80 | | | | 282 | 238 | 213 |
| | 38 | 101 | 90 | 76 | | | | 267 | 226 | 202 |
| | 39 | 96 | 81 | 72 | | | | 254 | 214 | 192 |
| | 40 | 91 | 80 | 68 | | | | 241 | 204 | 183 |
| **Properties** | | | | | | | | | | |
| Area, In.$^2$ | | 21.0 | 17.2 | 13.2 | 18.7 | 15.3 | 11.8 | 19.0 | 14.6 | 12.2 |
| $I_x$, In.$^4$ | | 478 | 402 | 317 | 373 | 317 | 252 | 395 | 310 | 264 |
| $I_y$, In.$^4$ | | 124 | 105 | 84.1 | 47.1 | 41.1 | 33.6 | 298 | 234 | 200 |
| Ratio, $r_x/r_y$ | | 1.97 | 1.95 | 1.94 | 2.81 | 2.78 | 2.74 | 1.15 | 1.15 | 1.15 |
| $r_y$, In. | | 2.43 | 2.48 | 2.53 | 1.59 | 1.64 | 1.69 | 3.96 | 4.01 | 4.04 |
| $B_x$, Bending Factor | | 0.308 | 0.300 | 0.291 | 0.351 | 0.338 | 0.328 | 0.289 | 0.283 | 0.277 |
| $B_y$, Bending Factor | | 0.508 | 0.491 | 0.471 | 0.794 | 0.745 | 0.702 | 0.319 | 0.312 | 0.305 |
| $a_x \div 10^6$ | | 81.3 | 70.9 | 59.2 | 60.8 | 53.1 | 44.2 | 73.6 | 62.0 | 55.8 |
| $a_y \div 10^6$ | | 21.1 | 18.5 | 15.7 | 7.67 | 6.89 | 5.89 | 55.5 | 46.8 | 42.2 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

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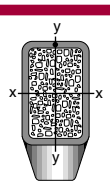
# HSS / Rectangular Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips




**f'c = 3.5**

$f'_c$ =3.5 ksi

| Nominal Size | | 12 x 8 | | | | 12 x 6 | | | |
|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 5/8 | 1/2 | 3/8 | 5/16 | 5/8 | 1/2 | 3/8 | 5/16 |
| Weight Per Foot | | 76.33 | 62.46 | 47.90 | 40.35 | 67.82 | 55.66 | 42.79 | 36.10 |
| Design Wall Thickness | | 0.581 | 0.465 | 0.349 | 0.291 | 0.581 | 0.465 | 0.349 | 0.291 |
| | | $F_y$ = 46 ksi | | | | | | | |
| Effective length KL in feet | 0 | 711 | 614 | 511 | 457 | 609 | 522 | 432 | 384 |
| | 4 | 683 | 590 | 492 | 440 | 575 | 494 | 409 | 364 |
| | 5 | 674 | 582 | 485 | 434 | 564 | 484 | 402 | 357 |
| | 6 | 665 | 574 | 479 | 428 | 553 | 475 | 394 | 350 |
| | 7 | 655 | 566 | 472 | 422 | 540 | 464 | 385 | 342 |
| | 8 | 644 | 557 | 464 | 415 | 526 | 453 | 376 | 334 |
| | 9 | 633 | 547 | 456 | 408 | 512 | 441 | 366 | 326 |
| | 10 | 621 | 537 | 448 | 401 | 497 | 428 | 356 | 317 |
| | 11 | 609 | 527 | 440 | 393 | 481 | 415 | 345 | 307 |
| | 12 | 596 | 516 | 431 | 385 | 465 | 401 | 334 | 297 |
| | 13 | 583 | 504 | 421 | 377 | 447 | 386 | 322 | 287 |
| | 14 | 569 | 493 | 412 | 368 | 429 | 371 | 310 | 276 |
| | 15 | 554 | 480 | 402 | 359 | 411 | 356 | 297 | 265 |
| | 16 | 539 | 468 | 391 | 350 | 391 | 339 | 284 | 253 |
| | 17 | 524 | 455 | 380 | 340 | 371 | 323 | 270 | 241 |
| | 18 | 508 | 441 | 369 | 330 | 350 | 305 | 256 | 229 |
| | 19 | 492 | 427 | 358 | 320 | 329 | 287 | 241 | 216 |
| | 20 | 475 | 413 | 346 | 310 | 306 | 268 | 226 | 202 |
| | 21 | 458 | 398 | 334 | 299 | 283 | 249 | 210 | 189 |
| | 22 | 440 | 383 | 322 | 288 | 259 | 229 | 194 | 174 |
| | 23 | 422 | 368 | 309 | 276 | 237 | 209 | 178 | 160 |
| | 24 | 403 | 352 | 296 | 265 | 218 | 192 | 163 | 147 |
| | 25 | 384 | 335 | 283 | 253 | 200 | 177 | 150 | 135 |
| | 26 | 364 | 319 | 269 | 240 | 185 | 164 | 139 | 125 |
| | 27 | 344 | 301 | 255 | 228 | 172 | 152 | 129 | 116 |
| | 28 | 323 | 283 | 240 | 215 | 160 | 141 | 120 | 108 |
| | 29 | 301 | 265 | 225 | 201 | 149 | 132 | 112 | 100 |
| | 30 | 282 | 248 | 210 | 188 | 139 | 123 | 104 | 94 |
| | 31 | 264 | 232 | 197 | 176 | 130 | 115 | 98 | 88 |
| | 32 | 247 | 218 | 185 | 165 | 122 | 108 | 92 | 82 |
| | 33 | 233 | 205 | 174 | 155 | 115 | 102 | 86 | 78 |
| | 34 | 219 | 193 | 164 | 146 | 108 | 96 | 81 | 73 |
| | 35 | 207 | 182 | 155 | 138 | 102 | 90 | 77 | 69 |
| | 36 | 196 | 172 | 146 | 131 | 97 | 85 | 72 | 65 |
| | 37 | 185 | 163 | 138 | 124 | 92 | 81 | 69 | 62 |
| | 38 | 175 | 154 | 131 | 117 | 87 | 77 | 65 | 58 |
| | 39 | 167 | 147 | 124 | 111 | 82 | 73 | 62 | 56 |
| | 40 | 158 | 139 | 118 | 106 | | 69 | 59 | 53 |
| **Properties** | | | | | | | | | |
| Area, In.$^2$ | | 21.0 | 17.2 | 13.2 | 11.1 | 18.7 | 15.3 | 11.8 | 9.92 |
| $I_x$, In.$^4$ | | 396 | 333 | 262 | 224 | 321 | 271 | 215 | 184 |
| $I_y$, In.$^4$ | | 210 | 177 | 140 | 120 | 106 | 91.1 | 72.9 | 62.8 |
| Ratio, $r_x/r_y$ | | 1.37 | 1.37 | 1.37 | 1.37 | 1.74 | 1.73 | 1.72 | 1.71 |
| $r_y$, In. | | 3.16 | 3.21 | 3.27 | 3.29 | 2.39 | 2.44 | 2.49 | 2.52 |
| $B_x$, Bending Factor | | 0.318 | 0.310 | 0.302 | 0.297 | 0.350 | 0.339 | 0.329 | 0.323 |
| $B_y$, Bending Factor | | 0.400 | 0.389 | 0.377 | 0.370 | 0.529 | 0.504 | 0.486 | 0.474 |
| $a_x \div 10^6$ | | 68.9 | 60.3 | 50.6 | 45.4 | 54.2 | 47.4 | 39.8 | 35.5 |
| $a_y \div 10^6$ | | 36.5 | 32.1 | 27.0 | 24.3 | 17.9 | 15.9 | 13.5 | 12.1 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

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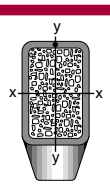
# HSS / Rectangular Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips




**f'c = 3.5**

**f'c=3.5 ksi**

| Nominal Size | | 12 x 4 | | | | 10 x 8 | | | |
|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 5/8 | 1/2 | 3/8 | 5/16 | 1/2 | 3/8 | 5/16 | 1/4 |
| Weight Per Foot | | 59.32 | 48.85 | 37.69 | 31.84 | 55.66 | 42.79 | 36.10 | 29.23 |
| Design Wall Thickness | | 0.581 | 0.465 | 0.349 | 0.291 | 0.465 | 0.349 | 0.291 | 0.233 |
| | | **$F_y$ = 46 ksi** | | | | | | | |
| Effective length KL in feet | 0 | 507 | 433 | 353 | 311 | 536 | 447 | 398 | 350 |
| | 4 | 459 | 394 | 322 | 284 | 515 | 429 | 383 | 336 |
| | 5 | 443 | 380 | 312 | 275 | 508 | 423 | 378 | 332 |
| | 6 | 425 | 366 | 300 | 265 | 501 | 417 | 372 | 327 |
| | 7 | 406 | 350 | 288 | 254 | 493 | 411 | 367 | 322 |
| | 8 | 385 | 333 | 274 | 243 | 485 | 404 | 361 | 317 |
| | 9 | 363 | 315 | 260 | 231 | 476 | 397 | 354 | 311 |
| | 10 | 340 | 296 | 245 | 218 | 467 | 390 | 348 | 305 |
| | 11 | 315 | 275 | 229 | 204 | 458 | 382 | 341 | 299 |
| | 12 | 289 | 254 | 212 | 189 | 448 | 374 | 334 | 293 |
| | 13 | 261 | 231 | 194 | 174 | 438 | 366 | 326 | 287 |
| | 14 | 232 | 207 | 176 | 158 | 427 | 357 | 318 | 280 |
| | 15 | 203 | 183 | 156 | 141 | 416 | 348 | 310 | 273 |
| | 16 | 178 | 160 | 137 | 124 | 405 | 338 | 302 | 265 |
| | 17 | 158 | 142 | 122 | 110 | 393 | 329 | 294 | 258 |
| | 18 | 141 | 127 | 108 | 98 | 381 | 319 | 285 | 250 |
| | 19 | 126 | 114 | 97 | 88 | 368 | 308 | 276 | 242 |
| | 20 | 114 | 103 | 88 | 79 | 356 | 298 | 266 | 234 |
| | 21 | 103 | 93 | 80 | 72 | 342 | 287 | 256 | 225 |
| | 22 | 94 | 85 | 73 | 66 | 329 | 276 | 247 | 217 |
| | 23 | 86 | 78 | 66 | 60 | 315 | 264 | 236 | 208 |
| | 24 | 79 | 71 | 61 | 55 | 300 | 252 | 226 | 198 |
| | 25 | 73 | 66 | 56 | 51 | 286 | 240 | 215 | 189 |
| | 26 | 67 | 61 | 52 | 47 | 270 | 228 | 204 | 179 |
| | 27 | | 56 | 48 | 44 | 255 | 215 | 192 | 169 |
| | 28 | | | | 40 | 239 | 201 | 181 | 159 |
| | 29 | | | | | 223 | 188 | 169 | 149 |
| | 30 | | | | | 208 | 176 | 158 | 139 |
| | 31 | | | | | 195 | 165 | 148 | 130 |
| | 32 | | | | | 183 | 154 | 139 | 122 |
| | 33 | | | | | 172 | 145 | 130 | 115 |
| | 34 | | | | | 162 | 137 | 123 | 108 |
| | 35 | | | | | 153 | 129 | 116 | 102 |
| | 36 | | | | | 144 | 122 | 110 | 96 |
| | 37 | | | | | 137 | 116 | 104 | 91 |
| | 38 | | | | | 130 | 110 | 98 | 87 |
| | 39 | | | | | 123 | 104 | 93 | 82 |
| | 40 | | | | | 117 | 99 | 89 | 78 |
| **Properties** | | | | | | | | | |
| Area, In.$^2$ | | 16.4 | 13.5 | 10.4 | 8.76 | 15.3 | 11.8 | 9.92 | 8.03 |
| $I_x$, In.$^4$ | | 245 | 209 | 168 | 144 | 214 | 169 | 145 | 119 |
| $I_y$, In.$^4$ | | 40.3 | 35.3 | 28.9 | 25.2 | 151 | 120 | 103 | 84.7 |
| Ratio, $r_x/r_y$ | | 2.47 | 2.44 | 2.41 | 2.39 | 1.19 | 1.19 | 1.19 | 1.19 |
| $r_y$, In. | | 1.57 | 1.62 | 1.67 | 1.70 | 3.14 | 3.19 | 3.22 | 3.25 |
| $B_x$, Bending Factor | | 0.402 | 0.388 | 0.371 | 0.365 | 0.357 | 0.349 | 0.342 | 0.337 |
| $B_y$, Bending Factor | | 0.814 | 0.765 | 0.720 | 0.695 | 0.405 | 0.393 | 0.385 | 0.379 |
| $a_x \div 10^6$ | | 39.8 | 34.9 | 29.3 | 26.0 | 38.2 | 32.1 | 28.8 | 25.2 |
| $a_y \div 10^6$ | | 6.54 | 5.89 | 5.04 | 4.55 | 27.0 | 22.8 | 20.5 | 18.0 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

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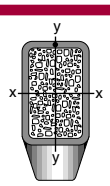
# HSS / Rectangular Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips




**f'c = 3.5**

$f'_c$=3.5 ksi

| Nominal Size | | 10 x 6 | | | | | 10 x 5 | | |
|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 5/8 | 1/2 | 3/8 | 5/16 | 1/4 | 3/8 | 5/16 | 1/4 |
| Weight Per Foot | | 59.32 | 48.85 | 37.69 | 31.84 | 25.82 | 35.13 | 29.72 | 24.12 |
| Design Wall Thickness | | 0.581 | 0.465 | 0.349 | 0.291 | 0.233 | 0.349 | 0.291 | 0.233 |
| | | $F_y$ = 46 ksi | | | | | | | |
| Effective length KL in feet | 0 | 528 | 454 | 375 | 333 | 290 | 338 | 300 | 260 |
| | 4 | 498 | 429 | 354 | 315 | 274 | 315 | 279 | 243 |
| | 5 | 489 | 421 | 348 | 309 | 269 | 308 | 273 | 237 |
| | 6 | 478 | 412 | 340 | 302 | 264 | 299 | 265 | 231 |
| | 7 | 467 | 402 | 333 | 296 | 258 | 290 | 258 | 224 |
| | 8 | 455 | 392 | 325 | 288 | 251 | 281 | 249 | 217 |
| | 9 | 442 | 382 | 316 | 281 | 245 | 271 | 240 | 209 |
| | 10 | 428 | 370 | 307 | 273 | 238 | 260 | 231 | 201 |
| | 11 | 414 | 358 | 297 | 264 | 230 | 249 | 221 | 193 |
| | 12 | 400 | 346 | 287 | 255 | 223 | 237 | 211 | 184 |
| | 13 | 384 | 333 | 277 | 246 | 215 | 225 | 200 | 174 |
| | 14 | 368 | 320 | 266 | 237 | 206 | 212 | 189 | 165 |
| | 15 | 351 | 305 | 254 | 227 | 198 | 199 | 177 | 155 |
| | 16 | 334 | 291 | 243 | 216 | 189 | 185 | 165 | 144 |
| | 17 | 316 | 276 | 230 | 206 | 179 | 170 | 152 | 133 |
| | 18 | 297 | 260 | 218 | 194 | 170 | 155 | 138 | 122 |
| | 19 | 278 | 244 | 204 | 183 | 160 | 139 | 125 | 110 |
| | 20 | 258 | 227 | 191 | 171 | 149 | 126 | 112 | 99 |
| | 21 | 237 | 210 | 177 | 159 | 138 | 114 | 102 | 90 |
| | 22 | 216 | 192 | 162 | 146 | 127 | 104 | 93 | 82 |
| | 23 | 197 | 175 | 148 | 133 | 116 | 95 | 85 | 75 |
| | 24 | 181 | 161 | 136 | 123 | 107 | 87 | 78 | 69 |
| | 25 | 167 | 148 | 126 | 113 | 99 | 81 | 72 | 63 |
| | 26 | 155 | 137 | 116 | 104 | 91 | 74 | 67 | 59 |
| | 27 | 143 | 127 | 108 | 97 | 84 | 69 | 62 | 54 |
| | 28 | 133 | 118 | 100 | 90 | 79 | 64 | 57 | 51 |
| | 29 | 124 | 110 | 93 | 84 | 73 | 60 | 53 | 47 |
| | 30 | 116 | 103 | 87 | 78 | 68 | 56 | 50 | 44 |
| | 31 | 109 | 96 | 82 | 73 | 64 | 52 | 47 | 41 |
| | 32 | 102 | 91 | 77 | 69 | 60 | 49 | 44 | 39 |
| | 33 | 96 | 85 | 72 | 65 | 57 | 46 | 41 | 36 |
| | 34 | 90 | 80 | 68 | 61 | 53 | 44 | 39 | 34 |
| | 35 | 85 | 76 | 64 | 58 | 50 | | | 32 |
| | 36 | 81 | 72 | 61 | 54 | 48 | | | |
| | 37 | 76 | 68 | 57 | 52 | 45 | | | |
| | 38 | 72 | 64 | 54 | 49 | 43 | | | |
| | 39 | 69 | 61 | 52 | 46 | 40 | | | |
| | 40 | | | 49 | 44 | 38 | | | |
| **Properties** | | | | | | | | | |
| Area, In.$^2$ | | 16.4 | 13.5 | 10.4 | 8.76 | 7.10 | 9.67 | 8.17 | 6.63 |
| $I_x$, In.$^4$ | | 201 | 171 | 137 | 118 | 96.9 | 120 | 104 | 85.8 |
| $I_y$, In.$^4$ | | 89.4 | 76.8 | 61.8 | 53.3 | 44.1 | 40.6 | 35.2 | 29.3 |
| Ratio, $r_x/r_y$ | | 1.50 | 1.49 | 1.49 | 1.48 | 1.48 | 1.72 | 1.72 | 1.71 |
| $r_y$, In. | | 2.34 | 2.39 | 2.44 | 2.47 | 2.49 | 2.05 | 2.07 | 2.10 |
| $B_x$, Bending Factor | | 0.408 | 0.395 | 0.380 | 0.371 | 0.366 | 0.403 | 0.393 | 0.386 |
| $B_y$, Bending Factor | | 0.550 | 0.527 | 0.505 | 0.493 | 0.483 | 0.595 | 0.580 | 0.566 |
| $a_x \div 10^6$ | | 33.7 | 29.6 | 25.0 | 22.4 | 19.5 | 21.4 | 19.2 | 16.7 |
| $a_y \div 10^6$ | | 15.0 | 13.3 | 11.3 | 10.1 | 8.88 | 7.24 | 6.51 | 5.72 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

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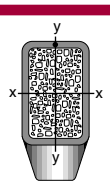
# HSS / Rectangular Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips




**f'c = 3.5**



| Nominal Size | | 10 x 4 | | | | | 9 x 7 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 5/8 | 1/2 | 3/8 | 5/16 | 1/4 | 5/8 | 1/2 | 3/8 | 5/16 | 1/4 |
| Weight Per Foot | | 50.81 | 42.05 | 32.58 | 27.59 | 22.42 | 59.32 | 48.85 | 37.69 | 31.84 | 25.82 |
| Design Wall Thickness | | 0.581 | 0.465 | 0.349 | 0.291 | 0.233 | 0.581 | 0.465 | 0.349 | 0.291 | 0.233 |
| | | $F_y$ = 46 ksi | | | | | | | | | |
| Effective length KL in feet | 0 | 431 | 370 | 302 | 267 | 230 | 534 | 460 | 380 | 338 | 295 |
| | 4 | 389 | 335 | 275 | 243 | 210 | 508 | 438 | 362 | 322 | 282 |
| | 5 | 375 | 323 | 266 | 235 | 203 | 500 | 431 | 357 | 317 | 277 |
| | 6 | 359 | 311 | 256 | 226 | 196 | 491 | 423 | 351 | 312 | 273 |
| | 7 | 343 | 297 | 245 | 217 | 188 | 482 | 415 | 344 | 306 | 268 |
| | 8 | 325 | 282 | 233 | 207 | 179 | 472 | 407 | 337 | 300 | 262 |
| | 9 | 305 | 266 | 220 | 196 | 170 | 461 | 398 | 330 | 294 | 257 |
| | 10 | 285 | 249 | 207 | 185 | 160 | 450 | 389 | 322 | 287 | 251 |
| | 11 | 263 | 231 | 193 | 172 | 150 | 438 | 379 | 314 | 280 | 245 |
| | 12 | 240 | 213 | 178 | 160 | 139 | 426 | 368 | 306 | 272 | 238 |
| | 13 | 216 | 193 | 163 | 146 | 128 | 413 | 358 | 297 | 265 | 231 |
| | 14 | 190 | 172 | 146 | 132 | 116 | 400 | 347 | 288 | 257 | 224 |
| | 15 | 166 | 150 | 129 | 117 | 103 | 386 | 335 | 278 | 248 | 217 |
| | 16 | 146 | 132 | 113 | 103 | 91 | 372 | 323 | 269 | 240 | 210 |
| | 17 | 129 | 117 | 100 | 91 | 80 | 357 | 310 | 259 | 231 | 202 |
| | 18 | 115 | 104 | 90 | 81 | 72 | 342 | 298 | 248 | 221 | 194 |
| | 19 | 103 | 94 | 80 | 73 | 64 | 326 | 284 | 237 | 212 | 186 |
| | 20 | 93 | 85 | 73 | 66 | 58 | 310 | 271 | 226 | 202 | 177 |
| | 21 | 85 | 77 | 66 | 60 | 53 | 293 | 257 | 215 | 192 | 168 |
| | 22 | 77 | 70 | 60 | 54 | 48 | 276 | 242 | 203 | 181 | 159 |
| | 23 | 71 | 64 | 55 | 50 | 44 | 258 | 227 | 191 | 171 | 150 |
| | 24 | 65 | 59 | 50 | 46 | 40 | 239 | 211 | 178 | 160 | 140 |
| | 25 | 60 | 54 | 46 | 42 | 37 | 221 | 195 | 165 | 148 | 130 |
| | 26 | | 50 | 43 | 39 | 34 | 204 | 181 | 152 | 137 | 120 |
| | 27 | | | 40 | 36 | 32 | 189 | 167 | 141 | 127 | 112 |
| | 28 | | | | | 30 | 176 | 156 | 131 | 118 | 104 |
| | 29 | | | | | | 164 | 145 | 123 | 110 | 97 |
| | 30 | | | | | | 153 | 136 | 114 | 103 | 90 |
| | 31 | | | | | | 144 | 127 | 107 | 96 | 85 |
| | 32 | | | | | | 135 | 119 | 101 | 90 | 79 |
| | 33 | | | | | | 127 | 112 | 95 | 85 | 75 |
| | 34 | | | | | | 119 | 106 | 89 | 80 | 70 |
| | 35 | | | | | | 113 | 100 | 84 | 76 | 66 |
| | 36 | | | | | | 107 | 94 | 79 | 71 | 63 |
| | 37 | | | | | | 101 | 89 | 75 | 68 | 59 |
| | 38 | | | | | | 96 | 85 | 71 | 64 | 56 |
| | 39 | | | | | | 91 | 80 | 68 | 61 | 53 |
| | 40 | | | | | | 86 | 76 | 64 | 58 | 51 |
| **Properties** | | | | | | | | | | | |
| Area, In.$^2$ | | 14.0 | 11.6 | 8.97 | 7.59 | 6.17 | 16.4 | 13.5 | 10.4 | 8.76 | 7.10 |
| $I_x$, In.$^4$ | | 149 | 129 | 104 | 90.1 | 74.7 | 174 | 149 | 119 | 102 | 84.1 |
| $I_y$, In.$^4$ | | 33.4 | 29.4 | 24.3 | 21.2 | 17.7 | 117 | 100 | 80.4 | 69.2 | 57.2 |
| Ratio, $r_x/r_y$ | | 2.11 | 2.09 | 2.07 | 2.06 | 2.05 | 1.22 | 1.22 | 1.21 | 1.21 | 1.21 |
| $r_y$, In. | | 1.54 | 1.59 | 1.64 | 1.67 | 1.70 | 2.68 | 2.73 | 2.78 | 2.81 | 2.84 |
| $B_x$, Bending Factor | | 0.470 | 0.450 | 0.431 | 0.421 | 0.413 | 0.424 | 0.408 | 0.393 | 0.386 | 0.380 |
| $B_y$, Bending Factor | | 0.838 | 0.789 | 0.738 | 0.716 | 0.697 | 0.491 | 0.473 | 0.453 | 0.443 | 0.434 |
| $a_x \div 10^6$ | | 24.1 | 21.4 | 18.0 | 16.1 | 14.0 | 29.4 | 26.0 | 22.0 | 19.6 | 17.2 |
| $a_y \div 10^6$ | | 5.40 | 4.88 | 4.21 | 3.80 | 3.32 | 19.7 | 17.5 | 14.8 | 13.3 | 11.7 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

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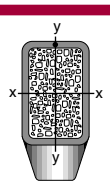
# HSS / Rectangular Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips




**f'c = 3.5**

$f'_c$=3.5 ksi

| Nominal Size | | 9 x 5 | | | | | 8 x 6 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 5/8 | 1/2 | 3/8 | 5/16 | 1/4 | 5/8 | 1/2 | 3/8 | 5/16 | 1/4 | 3/16 |
| Weight Per Foot | | 50.81 | 42.05 | 32.58 | 27.59 | 22.42 | 50.81 | 42.05 | 32.58 | 27.59 | 22.42 | 17.08 |
| Design Wall Thickness | | 0.581 | 0.465 | 0.349 | 0.291 | 0.233 | 0.581 | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 |
| | | $F_y$ = 46 ksi | | | | | | | | | | |
| Effective length KL in feet | 0 | 440 | 378 | 311 | 276 | 239 | 445 | 384 | 316 | 281 | 245 | 206 |
| | 4 | 408 | 352 | 290 | 257 | 223 | 419 | 362 | 299 | 265 | 231 | 195 |
| | 5 | 397 | 343 | 283 | 251 | 218 | 410 | 354 | 293 | 260 | 227 | 191 |
| | 6 | 385 | 333 | 275 | 244 | 212 | 401 | 347 | 287 | 255 | 222 | 187 |
| | 7 | 373 | 323 | 267 | 237 | 206 | 391 | 338 | 280 | 249 | 217 | 182 |
| | 8 | 360 | 312 | 258 | 229 | 199 | 380 | 329 | 273 | 242 | 211 | 178 |
| | 9 | 345 | 300 | 248 | 221 | 192 | 369 | 320 | 265 | 236 | 205 | 173 |
| | 10 | 330 | 287 | 239 | 212 | 184 | 357 | 310 | 257 | 229 | 199 | 168 |
| | 11 | 315 | 274 | 228 | 203 | 176 | 345 | 300 | 249 | 221 | 193 | 163 |
| | 12 | 298 | 260 | 217 | 193 | 168 | 332 | 289 | 240 | 213 | 186 | 157 |
| | 13 | 281 | 246 | 206 | 183 | 160 | 318 | 277 | 231 | 205 | 179 | 151 |
| | 14 | 263 | 231 | 194 | 172 | 151 | 304 | 265 | 221 | 197 | 172 | 145 |
| | 15 | 244 | 215 | 181 | 161 | 141 | 289 | 253 | 211 | 188 | 164 | 139 |
| | 16 | 224 | 198 | 168 | 150 | 131 | 274 | 240 | 201 | 179 | 156 | 132 |
| | 17 | 203 | 181 | 154 | 138 | 121 | 258 | 227 | 190 | 170 | 148 | 125 |
| | 18 | 182 | 163 | 140 | 125 | 110 | 242 | 213 | 179 | 160 | 140 | 118 |
| | 19 | 163 | 146 | 126 | 113 | 99 | 225 | 198 | 168 | 150 | 131 | 111 |
| | 20 | 147 | 132 | 114 | 102 | 90 | 207 | 184 | 156 | 139 | 122 | 103 |
| | 21 | 134 | 120 | 103 | 92 | 81 | 188 | 168 | 143 | 128 | 113 | 95 |
| | 22 | 122 | 109 | 94 | 84 | 74 | 172 | 153 | 131 | 117 | 103 | 87 |
| | 23 | 111 | 100 | 86 | 77 | 68 | 157 | 140 | 120 | 107 | 94 | 80 |
| | 24 | 102 | 92 | 79 | 71 | 62 | 144 | 129 | 110 | 98 | 86 | 73 |
| | 25 | 94 | 85 | 73 | 65 | 57 | 133 | 119 | 101 | 91 | 80 | 67 |
| | 26 | 87 | 78 | 67 | 60 | 53 | 123 | 110 | 94 | 84 | 74 | 62 |
| | 27 | 81 | 73 | 62 | 56 | 49 | 114 | 102 | 87 | 78 | 68 | 58 |
| | 28 | 75 | 67 | 58 | 52 | 46 | 106 | 95 | 81 | 72 | 63 | 54 |
| | 29 | 70 | 63 | 54 | 48 | 43 | 99 | 88 | 75 | 67 | 59 | 50 |
| | 30 | 65 | 59 | 51 | 45 | 40 | 92 | 82 | 70 | 63 | 55 | 47 |
| | 31 | 61 | 55 | 47 | 42 | 37 | 86 | 77 | 66 | 59 | 52 | 44 |
| | 32 | 57 | 52 | 44 | 40 | 35 | 81 | 72 | 62 | 55 | 49 | 41 |
| | 33 | | | 42 | 37 | 33 | 76 | 68 | 58 | 52 | 46 | 39 |
| | 34 | | | | 35 | 31 | 72 | 64 | 55 | 49 | 43 | 36 |
| | 35 | | | | | | 68 | 60 | 52 | 46 | 41 | 34 |
| | 36 | | | | | | 64 | 57 | 49 | 44 | 38 | 32 |
| | 37 | | | | | | 61 | 54 | 46 | 41 | 36 | 31 |
| | 38 | | | | | | | 51 | 44 | 39 | 34 | 29 |
| | 39 | | | | | | | | 42 | 37 | 33 | 28 |
| | 40 | | | | | | | | | 35 | 31 | 26 |
| **Properties** | | | | | | | | | | | | |
| Area, In.$^2$ | | 14.0 | 11.6 | 8.97 | 7.59 | 6.17 | 14.0 | 11.6 | 8.97 | 7.59 | 6.17 | 4.67 |
| $I_x$, In.$^4$ | | 133 | 115 | 92.5 | 79.8 | 66.1 | 114 | 98.2 | 79.1 | 68.3 | 56.6 | 43.7 |
| $I_y$, In.$^4$ | | 51.9 | 45.2 | 36.8 | 32.0 | 26.6 | 72.2 | 62.5 | 50.6 | 43.8 | 36.4 | 28.2 |
| Ratio, $r_x/r_y$ | | 1.60 | 1.59 | 1.58 | 1.58 | 1.58 | 1.26 | 1.25 | 1.25 | 1.25 | 1.25 | 1.25 |
| $r_y$, In. | | 1.92 | 1.97 | 2.03 | 2.05 | 2.08 | 2.27 | 2.32 | 2.38 | 2.40 | 2.43 | 2.46 |
| $B_x$, Bending Factor | | 0.474 | 0.454 | 0.436 | 0.428 | 0.420 | 0.491 | 0.473 | 0.454 | 0.445 | 0.436 | 0.427 |
| $B_y$, Bending Factor | | 0.674 | 0.642 | 0.609 | 0.593 | 0.580 | 0.582 | 0.557 | 0.532 | 0.520 | 0.509 | 0.497 |
| $a_x \div 10^6$ | | 21.8 | 19.4 | 16.4 | 14.7 | 12.8 | 18.9 | 16.8 | 14.2 | 12.7 | 11.1 | 9.37 |
| $a_y \div 10^6$ | | 8.53 | 7.64 | 6.52 | 5.88 | 5.14 | 12.0 | 10.7 | 9.09 | 8.17 | 7.16 | 6.04 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

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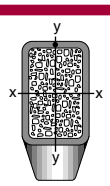
# HSS / Rectangular Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips




**f'c = 3.5**



| Nominal Size | | 8 x 4 | | | | | | 7 x 5 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 5/8 | 1/2 | 3/8 | 5/16 | 1/4 | 3/16 | 5/8 | 1/2 | 3/8 | 5/16 | 1/4 | 3/16 |
| Weight Per Foot | | 42.30 | 35.24 | 27.48 | 23.34 | 19.02 | 14.53 | 42.30 | 35.24 | 27.48 | 23.34 | 19.02 | 14.53 |
| Design Wall Thickness | | 0.581 | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 | 0.581 | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 |
| | | $F_y$ = 46 ksi | | | | | | | | | | | |
| Effective length KL in feet | 0 | 357 | 307 | 252 | 223 | 192 | 160 | 362 | 313 | 257 | 228 | 197 | 165 |
| | 4 | 322 | 278 | 229 | 202 | 175 | 146 | 335 | 290 | 239 | 212 | 184 | 154 |
| | 5 | 310 | 268 | 221 | 195 | 169 | 141 | 326 | 282 | 233 | 206 | 179 | 150 |
| | 6 | 296 | 257 | 212 | 188 | 163 | 135 | 316 | 274 | 226 | 201 | 174 | 146 |
| | 7 | 282 | 245 | 203 | 180 | 156 | 130 | 305 | 265 | 219 | 194 | 169 | 141 |
| | 8 | 267 | 233 | 193 | 171 | 148 | 124 | 294 | 255 | 211 | 188 | 163 | 136 |
| | 9 | 250 | 219 | 182 | 162 | 140 | 117 | 281 | 245 | 203 | 181 | 157 | 131 |
| | 10 | 233 | 205 | 171 | 152 | 132 | 110 | 269 | 234 | 195 | 173 | 150 | 126 |
| | 11 | 214 | 189 | 159 | 141 | 123 | 103 | 255 | 223 | 185 | 165 | 144 | 120 |
| | 12 | 195 | 173 | 146 | 130 | 114 | 95 | 241 | 211 | 176 | 157 | 137 | 114 |
| | 13 | 174 | 156 | 133 | 118 | 104 | 87 | 226 | 198 | 166 | 148 | 129 | 108 |
| | 14 | 152 | 138 | 119 | 106 | 93 | 79 | 210 | 185 | 155 | 139 | 121 | 102 |
| | 15 | 132 | 121 | 104 | 93 | 82 | 70 | 193 | 172 | 145 | 130 | 113 | 95 |
| | 16 | 116 | 106 | 91 | 82 | 72 | 61 | 176 | 157 | 133 | 120 | 105 | 88 |
| | 17 | 103 | 94 | 81 | 73 | 64 | 54 | 158 | 142 | 121 | 109 | 96 | 81 |
| | 18 | 92 | 84 | 72 | 65 | 57 | 48 | 141 | 127 | 109 | 98 | 87 | 73 |
| | 19 | 83 | 75 | 65 | 58 | 51 | 43 | 127 | 114 | 98 | 88 | 78 | 66 |
| | 20 | 74 | 68 | 59 | 52 | 46 | 39 | 114 | 103 | 88 | 80 | 70 | 59 |
| | 21 | 68 | 62 | 53 | 48 | 42 | 36 | 104 | 93 | 80 | 72 | 64 | 54 |
| | 22 | 62 | 56 | 48 | 43 | 38 | 32 | 94 | 85 | 73 | 66 | 58 | 49 |
| | 23 | 56 | 51 | 44 | 40 | 35 | 30 | 86 | 78 | 67 | 60 | 53 | 45 |
| | 24 | 52 | 47 | 41 | 36 | 32 | 27 | 79 | 72 | 61 | 55 | 49 | 41 |
| | 25 | 48 | 43 | 37 | 34 | 30 | 25 | 73 | 66 | 56 | 51 | 45 | 38 |
| | 26 | | 40 | 35 | 31 | 27 | 23 | 68 | 61 | 52 | 47 | 42 | 35 |
| | 27 | | | | 29 | 25 | 22 | 63 | 57 | 48 | 44 | 38 | 32 |
| | 28 | | | | | | 20 | 58 | 53 | 45 | 41 | 36 | 30 |
| | 29 | | | | | | | 54 | 49 | 42 | 38 | 33 | 28 |
| | 30 | | | | | | | 51 | 46 | 39 | 35 | 31 | 26 |
| | 31 | | | | | | | 48 | 43 | 37 | 33 | 29 | 25 |
| | 32 | | | | | | | | | 34 | 31 | 27 | 23 |
| | 33 | | | | | | | | | | 29 | 26 | 22 |
| | 34 | | | | | | | | | | | | 20 |
| | 35 | | | | | | | | | | | | |
| | 36 | | | | | | | | | | | | |
| | 37 | | | | | | | | | | | | |
| | 38 | | | | | | | | | | | | |
| | 39 | | | | | | | | | | | | |
| | 40 | | | | | | | | | | | | |
| **Properties** | | | | | | | | | | | | | |
| Area, In.$^2$ | | 11.7 | 9.74 | 7.58 | 6.43 | 5.24 | 3.98 | 11.7 | 9.74 | 7.58 | 6.43 | 5.24 | 3.98 |
| $I_x$, In.$^4$ | | 81.9 | 71.7 | 58.7 | 51.0 | 42.5 | 33.1 | 69.3 | 60.6 | 49.5 | 43.0 | 35.8 | 27.9 |
| $I_y$, In.$^4$ | | 26.6 | 23.6 | 19.6 | 17.2 | 14.4 | 11.3 | 40.5 | 35.6 | 29.2 | 25.5 | 21.3 | 16.6 |
| Ratio, $r_x/r_y$ | | 1.76 | 1.74 | 1.73 | 1.72 | 1.72 | 1.71 | 1.31 | 1.30 | 1.30 | 1.30 | 1.30 | 1.29 |
| $r_y$, In. | | 1.51 | 1.56 | 1.61 | 1.63 | 1.66 | 1.69 | 1.86 | 1.91 | 1.96 | 1.99 | 2.02 | 2.05 |
| $B_x$, Bending Factor | | 0.571 | 0.543 | 0.517 | 0.504 | 0.493 | 0.481 | 0.591 | 0.563 | 0.536 | 0.523 | 0.512 | 0.499 |
| $B_y$, Bending Factor | | 0.880 | 0.825 | 0.773 | 0.748 | 0.728 | 0.704 | 0.722 | 0.684 | 0.649 | 0.630 | 0.615 | 0.599 |
| $a_x \div 10^6$ | | 13.2 | 11.8 | 10.1 | 9.02 | 7.86 | 6.57 | 11.3 | 10.1 | 8.63 | 7.75 | 6.76 | 5.69 |
| $a_y \div 10^6$ | | 4.28 | 3.89 | 3.36 | 3.04 | 2.66 | 2.24 | 6.59 | 5.95 | 5.09 | 4.60 | 4.02 | 3.38 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

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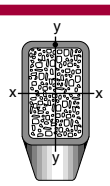
# HSS / Rectangular Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips




**f'c = 3.5**

$f'_c$=3.5 ksi

| Nominal Size | | 7 x 4 | | | | | 6 x 5 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 1/2 | 3/8 | 5/16 | 1/4 | 3/16 | 3/8 | 5/16 | 1/4 | 3/16 |
| Weight Per Foot | | 31.84 | 24.93 | 21.21 | 17.32 | 13.25 | 24.93 | 21.21 | 17.32 | 13.25 |
| Design Wall Thickness | | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 | 0.349 | 0.291 | 0.233 | 0.174 |
| | | $F_y$ = 46 ksi | | | | | | | | |
| Effective length KL in feet | 0 | 276 | 227 | 200 | 173 | 144 | 230 | 204 | 176 | 147 |
| | 4 | 249 | 205 | 182 | 157 | 130 | 213 | 189 | 164 | 137 |
| | 5 | 240 | 198 | 176 | 152 | 126 | 208 | 184 | 160 | 133 |
| | 6 | 230 | 190 | 169 | 146 | 121 | 202 | 179 | 155 | 129 |
| | 7 | 219 | 182 | 161 | 140 | 116 | 195 | 173 | 150 | 125 |
| | 8 | 207 | 172 | 153 | 133 | 110 | 188 | 167 | 145 | 121 |
| | 9 | 195 | 162 | 145 | 125 | 104 | 181 | 161 | 139 | 116 |
| | 10 | 181 | 152 | 136 | 118 | 98 | 173 | 154 | 133 | 111 |
| | 11 | 167 | 141 | 126 | 110 | 91 | 164 | 146 | 127 | 106 |
| | 12 | 152 | 129 | 116 | 101 | 84 | 155 | 139 | 121 | 101 |
| | 13 | 137 | 117 | 105 | 92 | 77 | 146 | 131 | 114 | 95 |
| | 14 | 120 | 103 | 94 | 83 | 69 | 137 | 122 | 107 | 89 |
| | 15 | 104 | 90 | 82 | 73 | 61 | 126 | 113 | 99 | 83 |
| | 16 | 92 | 79 | 72 | 64 | 53 | 116 | 104 | 91 | 77 |
| | 17 | 81 | 70 | 64 | 56 | 47 | 105 | 95 | 83 | 70 |
| | 18 | 73 | 63 | 57 | 50 | 42 | 94 | 85 | 75 | 63 |
| | 19 | 65 | 56 | 51 | 45 | 38 | 84 | 76 | 67 | 56 |
| | 20 | 59 | 51 | 46 | 41 | 34 | 76 | 69 | 60 | 51 |
| | 21 | 53 | 46 | 42 | 37 | 31 | 69 | 62 | 55 | 46 |
| | 22 | 49 | 42 | 38 | 34 | 28 | 63 | 57 | 50 | 42 |
| | 23 | 44 | 38 | 35 | 31 | 26 | 57 | 52 | 46 | 39 |
| | 24 | 41 | 35 | 32 | 28 | 24 | 53 | 48 | 42 | 35 |
| | 25 | 38 | 33 | 30 | 26 | 22 | 49 | 44 | 39 | 33 |
| | 26 | | 30 | 27 | 24 | 20 | 45 | 41 | 36 | 30 |
| | 27 | | | | 22 | 19 | 42 | 38 | 33 | 28 |
| | 28 | | | | | | 39 | 35 | 31 | 26 |
| | 29 | | | | | | 36 | 33 | 29 | 24 |
| | 30 | | | | | | 34 | 31 | 27 | 23 |
| | 31 | | | | | | 32 | 29 | 25 | 21 |
| | 32 | | | | | | 30 | 27 | 24 | 20 |
| | 33 | | | | | | | | 22 | 19 |
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| | 39 | | | | | | | | | |
| | 40 | | | | | | | | | |
| **Properties** | | | | | | | | | | |
| Area, In.$^2$ | | 8.81 | 6.88 | 5.85 | 4.77 | 3.63 | 6.88 | 5.85 | 4.77 | 3.63 |
| $I_x$, In.$^4$ | | 50.6 | 41.8 | 36.4 | 30.5 | 23.8 | 33.9 | 29.6 | 24.7 | 19.3 |
| $I_y$, In.$^4$ | | 20.7 | 17.3 | 15.2 | 12.8 | 10.0 | 25.5 | 22.3 | 18.7 | 14.6 |
| Ratio, $r_x/r_y$ | | 1.57 | 1.56 | 1.55 | 1.55 | 1.54 | 1.15 | 1.15 | 1.15 | 1.15 |
| $r_y$, In. | | 1.53 | 1.58 | 1.61 | 1.64 | 1.66 | 1.92 | 1.95 | 1.98 | 2.01 |
| $B_x$, Bending Factor | | 0.609 | 0.576 | 0.563 | 0.547 | 0.534 | 0.609 | 0.593 | 0.579 | 0.564 |
| $B_y$, Bending Factor | | 0.851 | 0.795 | 0.770 | 0.745 | 0.726 | 0.675 | 0.656 | 0.638 | 0.622 |
| $a_x \div 10^6$ | | 8.30 | 7.13 | 6.39 | 5.59 | 4.67 | 5.85 | 5.27 | 4.60 | 3.86 |
| $a_y \div 10^6$ | | 3.40 | 2.95 | 2.67 | 2.35 | 1.96 | 4.40 | 3.97 | 3.48 | 2.92 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

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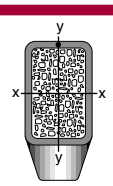
# HSS / Rectangular Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips




**f'c = 3.5**



| Nominal Size | | 6 x 4 | | | | | 5 x 4 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 1/2 | 3/8 | 5/16 | 1/4 | 3/16 | 1/2 | 3/8 | 5/16 | 1/4 | 3/16 |
| Weight Per Foot | | 28.43 | 22.37 | 19.08 | 15.62 | 11.97 | 25.03 | 19.82 | 16.96 | 13.91 | 10.70 |
| Design Wall Thickness | | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 |
| | | $F_y$ = 46 ksi | | | | | | | | | |
| Effective length KL in feet | 0 | 245 | 202 | 178 | 154 | 127 | 214 | 176 | 156 | 135 | 111 |
| | 4 | 220 | 182 | 161 | 139 | 116 | 192 | 159 | 141 | 122 | 101 |
| | 5 | 212 | 176 | 156 | 134 | 112 | 184 | 153 | 136 | 117 | 97 |
| | 6 | 203 | 168 | 149 | 129 | 107 | 176 | 146 | 130 | 112 | 93 |
| | 7 | 193 | 160 | 142 | 123 | 102 | 167 | 139 | 124 | 107 | 89 |
| | 8 | 182 | 152 | 135 | 117 | 97 | 157 | 132 | 117 | 102 | 84 |
| | 9 | 171 | 143 | 127 | 110 | 92 | 147 | 124 | 110 | 96 | 79 |
| | 10 | 159 | 133 | 119 | 103 | 86 | 136 | 115 | 102 | 89 | 74 |
| | 11 | 146 | 123 | 110 | 96 | 80 | 124 | 106 | 94 | 82 | 69 |
| | 12 | 132 | 112 | 101 | 88 | 73 | 111 | 96 | 86 | 75 | 63 |
| | 13 | 118 | 101 | 91 | 80 | 67 | 98 | 86 | 77 | 68 | 57 |
| | 14 | 102 | 89 | 81 | 71 | 59 | 85 | 75 | 68 | 60 | 50 |
| | 15 | 89 | 77 | 70 | 62 | 52 | 74 | 65 | 59 | 52 | 44 |
| | 16 | 78 | 68 | 62 | 55 | 46 | 65 | 57 | 52 | 46 | 39 |
| | 17 | 69 | 60 | 55 | 49 | 41 | 58 | 51 | 46 | 41 | 34 |
| | 18 | 62 | 54 | 49 | 43 | 36 | 51 | 45 | 41 | 36 | 31 |
| | 19 | 56 | 48 | 44 | 39 | 32 | 46 | 41 | 37 | 33 | 27 |
| | 20 | 50 | 44 | 40 | 35 | 29 | 42 | 37 | 33 | 29 | 25 |
| | 21 | 46 | 40 | 36 | 32 | 27 | 38 | 33 | 30 | 27 | 22 |
| | 22 | 41 | 36 | 33 | 29 | 24 | 34 | 30 | 27 | 24 | 20 |
| | 23 | 38 | 33 | 30 | 27 | 22 | 31 | 28 | 25 | 22 | 19 |
| | 24 | 35 | 30 | 28 | 24 | 20 | 29 | 26 | 23 | 20 | 17 |
| | 25 | 32 | 28 | 25 | 22 | 19 | | 24 | 21 | 19 | 16 |
| | 26 | | | 23 | 21 | 17 | | | | 17 | 15 |
| | 27 | | | | | 16 | | | | | |
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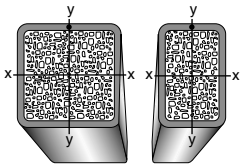
| | 38 | | | | | | | | | | |
| | 39 | | | | | | | | | | |
| | 40 | | | | | | | | | | |
| **Properties** | | | | | | | | | | | |
| Area, In.$^2$ | | 7.88 | 6.18 | 5.26 | 4.30 | 3.28 | 6.95 | 5.48 | 4.68 | 3.84 | 2.93 |
| $I_x$, In.$^4$ | | 33.9 | 28.3 | 24.8 | 20.9 | 16.4 | 21.2 | 17.9 | 15.8 | 13.4 | 10.6 |
| $I_y$, In.$^4$ | | 17.7 | 14.9 | 13.1 | 11.1 | 8.76 | 14.8 | 12.6 | 11.1 | 9.46 | 7.48 |
| Ratio, $r_x/r_y$ | | 1.38 | 1.38 | 1.37 | 1.37 | 1.37 | 1.20 | 1.19 | 1.19 | 1.19 | 1.19 |
| $r_y$, In. | | 1.50 | 1.55 | 1.58 | 1.61 | 1.63 | 1.46 | 1.52 | 1.54 | 1.57 | 1.60 |
| $B_x$, Bending Factor | | 0.697 | 0.655 | 0.636 | 0.617 | 0.600 | 0.820 | 0.765 | 0.741 | 0.716 | 0.691 |
| $B_y$, Bending Factor | | 0.890 | 0.830 | 0.803 | 0.775 | 0.749 | 0.939 | 0.870 | 0.843 | 0.812 | 0.783 |
| $a_x \div 10^6$ | | 5.53 | 4.79 | 4.31 | 3.79 | 3.17 | 3.43 | 3.00 | 2.72 | 2.39 | 2.01 |
| $a_y \div 10^6$ | | 2.89 | 2.52 | 2.28 | 2.01 | 1.69 | 2.39 | 2.11 | 1.91 | 1.69 | 1.42 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

# HSS/Structural Steel Tubing for Composite Columns
## Notes

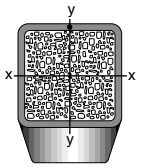



f'c = 3.5

ERW

# HSS / Square Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips




**f'c = 5.0**

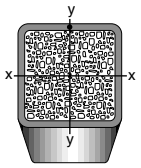


| Nominal Size | | 16 x 16 | | | 14 x 14 | | | 12 x 12 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 5/8 | 1/2 | 3/8 | 5/8 | 1/2 | 3/8 | 5/8 | 1/2 | 3/8 | 5/16 |
| Weight Per Foot | | 127.37 | 103.30 | 78.52 | 110.36 | 89.68 | 68.31 | 93.34 | 76.07 | 58.10 | 48.86 |
| Design Wall Thickness | | 0.581 | 0.465 | 0.349 | 0.581 | 0.465 | 0.349 | 0.581 | 0.465 | 0.349 | 0.291 |
| | | $F_y$ = 46 ksi | | | | | | | | | |
| Effective length KL in feet | 0 | 1530 | 1360 | 1190 | 1260 | 1110 | 967 | 1010 | 889 | 767 | 702 |
| | 4 | 1500 | 1330 | 1170 | 1230 | 1090 | 945 | 981 | 865 | 747 | 683 |
| | 5 | 1490 | 1330 | 1160 | 1220 | 1080 | 939 | 973 | 858 | 740 | 678 |
| | 6 | 1480 | 1320 | 1150 | 1210 | 1070 | 932 | 965 | 851 | 734 | 672 |
| | 7 | 1470 | 1310 | 1150 | 1200 | 1070 | 925 | 956 | 843 | 727 | 665 |
| | 8 | 1460 | 1300 | 1140 | 1190 | 1060 | 918 | 947 | 835 | 720 | 659 |
| | 9 | 1450 | 1290 | 1130 | 1180 | 1050 | 910 | 937 | 826 | 712 | 652 |
| | 10 | 1440 | 1280 | 1120 | 1170 | 1040 | 902 | 927 | 817 | 705 | 645 |
| | 11 | 1430 | 1270 | 1110 | 1160 | 1030 | 894 | 916 | 808 | 696 | 637 |
| | 12 | 1420 | 1260 | 1100 | 1150 | 1020 | 885 | 905 | 798 | 688 | 629 |
| | 13 | 1410 | 1250 | 1100 | 1140 | 1010 | 876 | 893 | 788 | 679 | 621 |
| | 14 | 1400 | 1240 | 1090 | 1130 | 1000 | 867 | 882 | 777 | 670 | 613 |
| | 15 | 1380 | 1230 | 1080 | 1120 | 989 | 857 | 869 | 767 | 661 | 604 |
| | 16 | 1370 | 1220 | 1070 | 1100 | 977 | 847 | 857 | 755 | 651 | 595 |
| | 17 | 1360 | 1210 | 1060 | 1090 | 966 | 837 | 844 | 744 | 641 | 586 |
| | 18 | 1340 | 1200 | 1050 | 1080 | 954 | 827 | 830 | 732 | 631 | 576 |
| | 19 | 1330 | 1180 | 1030 | 1060 | 942 | 816 | 816 | 720 | 620 | 567 |
| | 20 | 1320 | 1170 | 1020 | 1050 | 929 | 805 | 802 | 708 | 609 | 557 |
| | 21 | 1300 | 1160 | 1010 | 1030 | 917 | 794 | 788 | 695 | 598 | 546 |
| | 22 | 1290 | 1150 | 1000 | 1020 | 904 | 783 | 773 | 682 | 587 | 536 |
| | 23 | 1270 | 1130 | 988 | 1000 | 890 | 771 | 758 | 668 | 575 | 525 |
| | 24 | 1260 | 1120 | 976 | 990 | 877 | 759 | 742 | 655 | 563 | 514 |
| | 25 | 1240 | 1100 | 964 | 974 | 863 | 747 | 727 | 641 | 551 | 503 |
| | 26 | 1230 | 1090 | 951 | 958 | 849 | 734 | 710 | 627 | 539 | 491 |
| | 27 | 1210 | 1080 | 938 | 942 | 834 | 722 | 694 | 612 | 526 | 480 |
| | 28 | 1190 | 1060 | 925 | 925 | 819 | 709 | 677 | 597 | 513 | 468 |
| | 29 | 1180 | 1050 | 912 | 908 | 804 | 695 | 660 | 582 | 500 | 456 |
| | 30 | 1160 | 1030 | 898 | 891 | 789 | 682 | 642 | 567 | 486 | 443 |
| | 31 | 1140 | 1010 | 884 | 874 | 773 | 668 | 624 | 551 | 473 | 431 |
| | 32 | 1120 | 1000 | 870 | 856 | 757 | 654 | 606 | 535 | 459 | 418 |
| | 33 | 1110 | 983 | 856 | 838 | 741 | 640 | 587 | 518 | 444 | 404 |
| | 34 | 1090 | 966 | 841 | 819 | 725 | 626 | 568 | 502 | 430 | 391 |
| | 35 | 1070 | 950 | 827 | 801 | 708 | 611 | 549 | 485 | 415 | 377 |
| | 36 | 1050 | 933 | 812 | 782 | 691 | 596 | 529 | 467 | 400 | 363 |
| | 37 | 1030 | 915 | 796 | 762 | 674 | 581 | 509 | 449 | 384 | 349 |
| | 38 | 1010 | 898 | 781 | 742 | 656 | 565 | 489 | 431 | 368 | 334 |
| | 39 | 991 | 880 | 765 | 722 | 638 | 550 | 468 | 413 | 352 | 319 |
| | 40 | 971 | 862 | 749 | 702 | 620 | 534 | 446 | 394 | 336 | 304 |
| **Properties** | | | | | | | | | | | |
| Area, In.$^2$ | | 35.0 | 28.3 | 21.5 | 30.3 | 24.6 | 18.7 | 25.7 | 20.9 | 16.0 | 13.4 |
| I, In.$^4$ | | 1370 | 1130 | 873 | 896 | 743 | 577 | 548 | 457 | 357 | 304 |
| r, In. | | 6.25 | 6.31 | 6.37 | 5.44 | 5.49 | 5.55 | 4.62 | 4.68 | 4.73 | 4.76 |
| B, Bending Factor | | 0.204 | 0.200 | 0.197 | 0.237 | 0.232 | 0.227 | 0.281 | 0.274 | 0.269 | 0.264 |
| a ÷ $10^6$ | | 276 | 244 | 210 | 175 | 154 | 132 | 103 | 90.8 | 77.4 | 70.1 |

# HSS / Square Structural Steel Tubing for Composite Columns

ERW

Allowable Concentric Loads in Kips



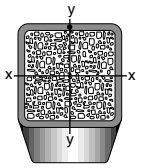

**f'c = 5.0**

$f'_c$=5.0 ksi

| Nominal Size | | 10 x 10 | | | | | 9 x 9 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 5/8 | 1/2 | 3/8 | 5/16 | 1/4 | 1/2 | 3/8 | 5/16 | 1/4 |
| Weight Per Foot | | 76.33 | 62.46 | 47.90 | 40.35 | 32.63 | 55.66 | 42.79 | 36.10 | 29.23 |
| Design Wall Thickness | | 0.581 | 0.465 | 0.349 | 0.291 | 0.233 | 0.465 | 0.349 | 0.291 | 0.233 |
| | | $F_y$ = 46 ksi | | | | | | | | |
| Effective length KL in feet | 0 | 778 | 684 | 585 | 532 | 473 | 588 | 501 | 454 | 407 |
| | 4 | 752 | 662 | 566 | 515 | 457 | 566 | 483 | 437 | 392 |
| | 5 | 745 | 655 | 560 | 509 | 453 | 559 | 477 | 432 | 387 |
| | 6 | 736 | 647 | 553 | 504 | 447 | 552 | 471 | 427 | 382 |
| | 7 | 727 | 640 | 547 | 498 | 442 | 544 | 464 | 421 | 377 |
| | 8 | 718 | 632 | 540 | 491 | 436 | 536 | 457 | 414 | 371 |
| | 9 | 708 | 623 | 532 | 484 | 430 | 528 | 450 | 408 | 365 |
| | 10 | 698 | 614 | 525 | 477 | 424 | 519 | 442 | 401 | 359 |
| | 11 | 687 | 605 | 517 | 470 | 417 | 509 | 434 | 393 | 352 |
| | 12 | 676 | 595 | 508 | 462 | 410 | 499 | 426 | 386 | 345 |
| | 13 | 664 | 585 | 500 | 454 | 403 | 489 | 417 | 378 | 338 |
| | 14 | 652 | 574 | 491 | 446 | 395 | 479 | 408 | 370 | 331 |
| | 15 | 640 | 563 | 481 | 438 | 388 | 468 | 399 | 361 | 323 |
| | 16 | 627 | 552 | 472 | 429 | 380 | 456 | 389 | 353 | 315 |
| | 17 | 614 | 541 | 462 | 420 | 371 | 445 | 379 | 344 | 307 |
| | 18 | 600 | 529 | 452 | 410 | 363 | 433 | 369 | 334 | 298 |
| | 19 | 586 | 516 | 441 | 401 | 354 | 420 | 359 | 325 | 290 |
| | 20 | 572 | 504 | 431 | 391 | 345 | 408 | 348 | 315 | 281 |
| | 21 | 557 | 491 | 420 | 381 | 336 | 395 | 337 | 305 | 272 |
| | 22 | 542 | 478 | 408 | 370 | 327 | 381 | 325 | 294 | 262 |
| | 23 | 526 | 464 | 397 | 360 | 317 | 367 | 314 | 284 | 252 |
| | 24 | 510 | 450 | 385 | 349 | 307 | 353 | 302 | 273 | 243 |
| | 25 | 494 | 436 | 372 | 337 | 297 | 339 | 289 | 261 | 232 |
| | 26 | 477 | 421 | 360 | 326 | 286 | 324 | 276 | 250 | 222 |
| | 27 | 460 | 406 | 347 | 314 | 276 | 308 | 263 | 238 | 211 |
| | 28 | 443 | 391 | 334 | 302 | 265 | 293 | 250 | 226 | 200 |
| | 29 | 425 | 375 | 321 | 290 | 254 | 276 | 236 | 213 | 189 |
| | 30 | 406 | 359 | 307 | 277 | 242 | 260 | 222 | 201 | 177 |
| | 31 | 388 | 343 | 293 | 264 | 230 | 243 | 208 | 188 | 166 |
| | 32 | 368 | 326 | 279 | 251 | 218 | 228 | 195 | 176 | 156 |
| | 33 | 349 | 309 | 264 | 238 | 206 | 215 | 184 | 166 | 146 |
| | 34 | 329 | 292 | 249 | 224 | 197 | 202 | 173 | 156 | 138 |
| | 35 | 310 | 275 | 235 | 211 | 186 | 191 | 163 | 147 | 130 |
| | 36 | 293 | 260 | 222 | 200 | 176 | 180 | 154 | 139 | 123 |
| | 37 | 278 | 246 | 210 | 189 | 166 | 171 | 146 | 132 | 116 |
| | 38 | 263 | 233 | 199 | 179 | 158 | 162 | 139 | 125 | 110 |
| | 39 | 250 | 222 | 189 | 170 | 150 | 154 | 132 | 119 | 105 |
| | 40 | 237 | 211 | 180 | 162 | 142 | 146 | 125 | 113 | 100 |
| **Properties** | | | | | | | | | | |
| Area, In.$^2$ | | 21.0 | 17.2 | 13.2 | 11.1 | 8.96 | 15.3 | 11.8 | 9.92 | 8.03 |
| I, In.$^4$ | | 304 | 256 | 202 | 172 | 141 | 182 | 145 | 124 | 102 |
| r, In. | | 3.80 | 3.86 | 3.92 | 3.94 | 3.97 | 3.45 | 3.51 | 3.54 | 3.56 |
| B, Bending Factor | | 0.345 | 0.336 | 0.327 | 0.323 | 0.318 | 0.378 | 0.366 | 0.360 | 0.354 |
| a ÷ $10^6$ | | 54.7 | 48.5 | 41.4 | 37.3 | 32.8 | 33.7 | 28.8 | 26.0 | 22.9 |

# HSS / Square Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips



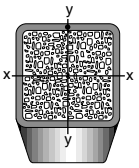

**f'c = 5.0**



| Nominal Size | | 8 x 8 | | | | | | 7 x 7 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 5/8 | 1/2 | 3/8 | 5/16 | 1/4 | 3/16 | 5/8 | 1/2 | 3/8 | 5/16 | 1/4 | 3/16 |
| Weight Per Foot | | 59.32 | 48.85 | 37.69 | 31.84 | 25.82 | 19.63 | 50.81 | 42.05 | 32.58 | 27.59 | 22.42 | 17.08 |
| Design Wall Thickness | | 0.581 | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 | 0.581 | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 |
| | | $F_y$ = 46 ksi | | | | | | | | | | | |
| Effective length KL in feet | 0 | 571 | 500 | 423 | 382 | 341 | 297 | 473 | 414 | 349 | 314 | 279 | 242 |
| | 4 | 546 | 478 | 405 | 366 | 326 | 284 | 448 | 393 | 331 | 299 | 265 | 229 |
| | 5 | 539 | 471 | 399 | 360 | 321 | 280 | 440 | 386 | 325 | 293 | 260 | 225 |
| | 6 | 530 | 464 | 393 | 355 | 316 | 276 | 432 | 379 | 319 | 288 | 256 | 221 |
| | 7 | 521 | 456 | 386 | 349 | 311 | 271 | 423 | 371 | 313 | 282 | 250 | 217 |
| | 8 | 512 | 448 | 379 | 343 | 305 | 266 | 413 | 362 | 306 | 276 | 245 | 212 |
| | 9 | 502 | 440 | 372 | 336 | 299 | 261 | 403 | 354 | 299 | 269 | 239 | 207 |
| | 10 | 491 | 430 | 365 | 329 | 293 | 256 | 393 | 345 | 291 | 263 | 233 | 201 |
| | 11 | 480 | 421 | 357 | 322 | 287 | 250 | 381 | 335 | 283 | 255 | 226 | 195 |
| | 12 | 469 | 411 | 348 | 315 | 280 | 244 | 370 | 325 | 275 | 248 | 220 | 190 |
| | 13 | 457 | 401 | 340 | 307 | 273 | 238 | 357 | 314 | 266 | 240 | 213 | 183 |
| | 14 | 445 | 390 | 331 | 299 | 265 | 231 | 345 | 303 | 257 | 232 | 205 | 177 |
| | 15 | 432 | 379 | 321 | 290 | 258 | 224 | 331 | 292 | 247 | 223 | 198 | 170 |
| | 16 | 418 | 367 | 311 | 281 | 250 | 217 | 318 | 280 | 237 | 214 | 190 | 163 |
| | 17 | 405 | 355 | 301 | 272 | 242 | 210 | 304 | 268 | 227 | 205 | 182 | 156 |
| | 18 | 390 | 343 | 291 | 263 | 233 | 203 | 289 | 255 | 217 | 196 | 173 | 149 |
| | 19 | 376 | 330 | 281 | 253 | 225 | 195 | 274 | 242 | 206 | 186 | 165 | 141 |
| | 20 | 361 | 317 | 270 | 243 | 216 | 187 | 258 | 229 | 195 | 176 | 156 | 133 |
| | 21 | 345 | 304 | 258 | 233 | 207 | 179 | 242 | 215 | 183 | 165 | 146 | 125 |
| | 22 | 329 | 290 | 247 | 223 | 197 | 170 | 225 | 200 | 171 | 154 | 137 | 116 |
| | 23 | 313 | 276 | 235 | 212 | 187 | 162 | 207 | 185 | 159 | 143 | 127 | 108 |
| | 24 | 296 | 261 | 222 | 201 | 177 | 153 | 191 | 170 | 146 | 132 | 117 | 99 |
| | 25 | 278 | 246 | 210 | 189 | 167 | 144 | 176 | 157 | 134 | 122 | 107 | 91 |
| | 26 | 260 | 230 | 197 | 177 | 156 | 134 | 162 | 145 | 124 | 112 | 99 | 84 |
| | 27 | 242 | 214 | 183 | 165 | 145 | 125 | 151 | 134 | 115 | 104 | 92 | 78 |
| | 28 | 225 | 199 | 170 | 154 | 135 | 116 | 140 | 125 | 107 | 97 | 86 | 73 |
| | 29 | 210 | 186 | 159 | 143 | 126 | 108 | 130 | 117 | 100 | 90 | 80 | 68 |
| | 30 | 196 | 174 | 148 | 134 | 118 | 101 | 122 | 109 | 93 | 84 | 75 | 63 |
| | 31 | 183 | 163 | 139 | 125 | 110 | 94 | 114 | 102 | 87 | 79 | 70 | 59 |
| | 32 | 172 | 153 | 130 | 118 | 103 | 89 | 107 | 96 | 82 | 74 | 66 | 56 |
| | 33 | 162 | 143 | 123 | 111 | 97 | 83 | 101 | 90 | 77 | 70 | 62 | 52 |
| | 34 | 152 | 135 | 115 | 104 | 92 | 79 | 95 | 85 | 73 | 66 | 58 | 49 |
| | 35 | 144 | 128 | 109 | 98 | 86 | 74 | 90 | 80 | 69 | 62 | 55 | 46 |
| | 36 | 136 | 121 | 103 | 93 | 82 | 70 | 85 | 76 | 65 | 59 | 52 | 44 |
| | 37 | 129 | 114 | 97 | 88 | 77 | 66 | 80 | 72 | 61 | 55 | 49 | 42 |
| | 38 | 122 | 108 | 92 | 83 | 73 | 63 | 76 | 68 | 58 | 53 | 47 | 39 |
| | 39 | 116 | 103 | 88 | 79 | 70 | 60 | 72 | 64 | 55 | 50 | 44 | 37 |
| | 40 | 110 | 98 | 83 | 75 | 66 | 57 | 69 | 61 | 53 | 47 | 42 | 36 |
| **Properties** | | | | | | | | | | | | | |
| Area, In.$^2$ | | 16.4 | 13.5 | 10.4 | 8.76 | 7.10 | 5.37 | 14.0 | 11.6 | 8.97 | 7.59 | 6.17 | 4.67 |
| I, In.$^4$ | | 146 | 125 | 99.6 | 85.6 | 70.7 | 54.4 | 93.3 | 80.5 | 64.9 | 56.1 | 46.5 | 36.0 |
| r, In. | | 2.99 | 3.04 | 3.10 | 3.13 | 3.15 | 3.18 | 2.58 | 2.63 | 2.69 | 2.72 | 2.75 | 2.77 |
| B, Bending Factor | | 0.449 | 0.432 | 0.418 | 0.409 | 0.402 | 0.395 | 0.525 | 0.504 | 0.484 | 0.474 | 0.464 | 0.454 |
| a ÷ $10^6$ | | 25.4 | 22.5 | 19.2 | 17.3 | 15.2 | 13.1 | 15.8 | 14.1 | 12.1 | 10.9 | 9.67 | 8.20 |

# HSS / Square Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips




**f'c = 5.0**

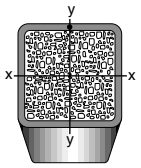


| Nominal Size | | 6 x 6 | | | | | | 5 1/2 x 5 1/2 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 5/8 | 1/2 | 3/8 | 5/16 | 1/4 | 3/16 | 3/8 | 5/16 | 1/4 | 3/16 | 1/8 |
| Weight Per Foot | | 42.30 | 35.24 | 27.48 | 23.34 | 19.02 | 14.53 | 24.93 | 21.21 | 17.32 | 13.25 | 9.01 |
| Design Wall Thickness | | 0.581 | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 | 0.349 | 0.291 | 0.233 | 0.174 | 0.116 |
| | | $F_y$ = 46 ksi | | | | | | | | | | |
| Effective length KL in feet | 0 | 382 | 334 | 281 | 252 | 223 | 191 | 248 | 223 | 196 | 168 | 139 |
| | 4 | 358 | 313 | 263 | 237 | 209 | 180 | 231 | 208 | 183 | 156 | 129 |
| | 5 | 350 | 306 | 258 | 232 | 205 | 176 | 226 | 203 | 178 | 153 | 126 |
| | 6 | 341 | 299 | 252 | 226 | 200 | 172 | 220 | 197 | 174 | 148 | 122 |
| | 7 | 332 | 291 | 245 | 220 | 195 | 167 | 213 | 192 | 168 | 144 | 119 |
| | 8 | 322 | 283 | 238 | 214 | 189 | 162 | 206 | 185 | 163 | 139 | 115 |
| | 9 | 311 | 274 | 231 | 208 | 183 | 157 | 199 | 179 | 157 | 134 | 110 |
| | 10 | 300 | 264 | 223 | 201 | 177 | 152 | 191 | 172 | 151 | 129 | 106 |
| | 11 | 289 | 255 | 215 | 193 | 171 | 146 | 183 | 164 | 144 | 123 | 101 |
| | 12 | 277 | 244 | 206 | 186 | 164 | 141 | 174 | 157 | 138 | 117 | 96 |
| | 13 | 264 | 233 | 197 | 178 | 157 | 134 | 165 | 148 | 130 | 111 | 91 |
| | 14 | 251 | 222 | 188 | 169 | 150 | 128 | 155 | 140 | 123 | 105 | 86 |
| | 15 | 237 | 210 | 178 | 161 | 142 | 121 | 145 | 131 | 115 | 98 | 80 |
| | 16 | 222 | 198 | 168 | 152 | 134 | 115 | 135 | 122 | 107 | 91 | 74 |
| | 17 | 207 | 185 | 158 | 142 | 126 | 107 | 124 | 112 | 99 | 84 | 68 |
| | 18 | 192 | 172 | 147 | 132 | 117 | 100 | 113 | 102 | 90 | 76 | 62 |
| | 19 | 175 | 158 | 135 | 122 | 108 | 92 | 102 | 92 | 81 | 69 | 55 |
| | 20 | 159 | 144 | 123 | 112 | 99 | 84 | 92 | 83 | 73 | 62 | 50 |
| | 21 | 144 | 131 | 112 | 101 | 90 | 76 | 83 | 75 | 66 | 56 | 45 |
| | 22 | 131 | 119 | 102 | 92 | 82 | 69 | 76 | 69 | 60 | 51 | 41 |
| | 23 | 120 | 109 | 93 | 84 | 75 | 64 | 69 | 63 | 55 | 47 | 38 |
| | 24 | 110 | 100 | 86 | 78 | 69 | 58 | 64 | 58 | 51 | 43 | 35 |
| | 25 | 102 | 92 | 79 | 71 | 63 | 54 | 59 | 53 | 47 | 40 | 32 |
| | 26 | 94 | 85 | 73 | 66 | 58 | 50 | 54 | 49 | 43 | 37 | 30 |
| | 27 | 87 | 79 | 68 | 61 | 54 | 46 | 50 | 46 | 40 | 34 | 27 |
| | 28 | 81 | 74 | 63 | 57 | 50 | 43 | 47 | 42 | 37 | 32 | 25 |
| | 29 | 75 | 69 | 59 | 53 | 47 | 40 | 44 | 40 | 35 | 29 | 24 |
| | 30 | 71 | 64 | 55 | 50 | 44 | 37 | 41 | 37 | 32 | 28 | 22 |
| | 31 | 66 | 60 | 51 | 47 | 41 | 35 | 38 | 35 | 30 | 26 | 21 |
| | 32 | 62 | 56 | 48 | 44 | 39 | 33 | 36 | 32 | 28 | 24 | 20 |
| | 33 | 58 | 53 | 45 | 41 | 36 | 31 | 34 | 31 | 27 | 23 | 18 |
| | 34 | 55 | 50 | 43 | 39 | 34 | 29 | 32 | 29 | 25 | 21 | 17 |
| | 35 | 52 | 47 | 40 | 36 | 32 | 27 | | 27 | 24 | 20 | 16 |
| | 36 | 49 | 44 | 38 | 34 | 30 | 26 | | | | 19 | 15 |
| | 37 | | 42 | 36 | 33 | 29 | 25 | | | | | |
| | 38 | | | 34 | 31 | 27 | 23 | | | | | |
| | 39 | | | | | 26 | 22 | | | | | |
| | 40 | | | | | | | | | | | |
| **Properties** | | | | | | | | | | | | |
| Area, In.$^2$ | | 11.7 | 9.74 | 7.58 | 6.43 | 5.24 | 3.90 | 6.88 | 5.85 | 4.77 | 3.63 | 2.46 |
| I, In.$^4$ | | 55.1 | 48.2 | 39.4 | 34.3 | 28.6 | 22.3 | 29.7 | 25.9 | 21.7 | 17.0 | 11.8 |
| r, In. | | 2.17 | 2.23 | 2.28 | 2.31 | 2.34 | 2.37 | 2.08 | 2.11 | 2.13 | 2.16 | 2.19 |
| B, Bending Factor | | 0.637 | 0.606 | 0.577 | 0.562 | 0.550 | 0.535 | 0.637 | 0.621 | 0.604 | 0.587 | 0.573 |
| a ÷ $10^6$ | | 9.14 | 8.30 | 7.11 | 6.43 | 5.69 | 4.84 | 5.28 | 4.79 | 4.19 | 3.57 | 2.88 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

# HSS / Square Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips




**f'c = 5.0**

**f'c=5.0 ksi**

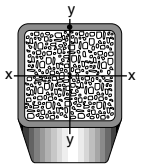
| Nominal Size | | 5 x 5 | | | | | | 4 1/2 x 4 1/2 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 1/2 | 3/8 | 5/16 | 1/4 | 3/16 | 1/8 | 1/2 | 3/8 | 5/16 | 1/4 | 3/16 | 1/8 |
| Weight Per Foot | | 28.43 | 22.37 | 19.08 | 15.62 | 11.97 | 8.16 | 25.03 | 19.82 | 16.96 | 13.91 | 10.70 | 7.31 |
| Design Wall Thickness | | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 | 0.116 | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 | 0.116 |
| | | $F_y$ = 46 ksi | | | | | | | | | | | |
| Effective length KL in feet | 0 | 259 | 217 | 195 | 171 | 146 | 119 | 224 | 188 | 168 | 147 | 125 | 102 |
| | 4 | 239 | 201 | 180 | 158 | 134 | 110 | 203 | 171 | 153 | 134 | 114 | 93 |
| | 5 | 232 | 195 | 175 | 153 | 131 | 107 | 196 | 165 | 148 | 130 | 110 | 90 |
| | 6 | 224 | 189 | 169 | 149 | 127 | 104 | 188 | 159 | 143 | 125 | 106 | 86 |
| | 7 | 216 | 182 | 163 | 144 | 122 | 100 | 180 | 152 | 137 | 120 | 102 | 83 |
| | 8 | 207 | 175 | 157 | 138 | 118 | 96 | 171 | 145 | 130 | 115 | 97 | 79 |
| | 9 | 198 | 167 | 150 | 132 | 113 | 92 | 161 | 137 | 124 | 109 | 92 | 74 |
| | 10 | 188 | 159 | 143 | 126 | 107 | 88 | 151 | 129 | 116 | 102 | 86 | 70 |
| | 11 | 178 | 151 | 136 | 119 | 102 | 83 | 140 | 120 | 109 | 96 | 81 | 65 |
| | 12 | 167 | 142 | 128 | 113 | 96 | 78 | 129 | 111 | 101 | 89 | 75 | 61 |
| | 13 | 156 | 133 | 119 | 105 | 90 | 73 | 117 | 102 | 92 | 81 | 69 | 55 |
| | 14 | 144 | 123 | 111 | 98 | 83 | 67 | 104 | 92 | 83 | 74 | 62 | 50 |
| | 15 | 131 | 112 | 102 | 90 | 76 | 62 | 91 | 81 | 74 | 66 | 55 | 44 |
| | 16 | 118 | 102 | 92 | 82 | 69 | 56 | 80 | 71 | 65 | 58 | 48 | 39 |
| | 17 | 105 | 91 | 82 | 73 | 62 | 50 | 71 | 63 | 57 | 51 | 43 | 34 |
| | 18 | 93 | 81 | 73 | 65 | 55 | 44 | 64 | 56 | 51 | 46 | 38 | 31 |
| | 19 | 84 | 72 | 66 | 58 | 50 | 40 | 57 | 50 | 46 | 41 | 34 | 28 |
| | 20 | 76 | 65 | 59 | 53 | 45 | 36 | 51 | 45 | 41 | 37 | 31 | 25 |
| | 21 | 69 | 59 | 54 | 48 | 41 | 33 | 47 | 41 | 38 | 33 | 28 | 23 |
| | 22 | 62 | 54 | 49 | 44 | 37 | 30 | 43 | 38 | 34 | 30 | 26 | 21 |
| | 23 | 57 | 49 | 45 | 40 | 34 | 27 | 39 | 34 | 31 | 28 | 23 | 19 |
| | 24 | 52 | 45 | 41 | 37 | 31 | 25 | 36 | 32 | 29 | 26 | 21 | 17 |
| | 25 | 48 | 42 | 38 | 34 | 29 | 23 | 33 | 29 | 27 | 24 | 20 | 16 |
| | 26 | 45 | 39 | 35 | 31 | 26 | 21 | 30 | 27 | 25 | 22 | 18 | 15 |
| | 27 | 41 | 36 | 33 | 29 | 25 | 20 | | 25 | 23 | 20 | 17 | 14 |
| | 28 | 39 | 33 | 30 | 27 | 23 | 18 | | | 21 | 19 | 16 | 13 |
| | 29 | 36 | 31 | 28 | 25 | 21 | 17 | | | | | 15 | 12 |
| | 30 | 34 | 29 | 26 | 23 | 20 | 16 | | | | | | |
| | 31 | | 27 | 25 | 22 | 19 | 15 | | | | | | |
| | 32 | | | | 21 | 17 | 14 | | | | | | |
| | 33 | | | | | | 13 | | | | | | |
| | 34 | | | | | | | | | | | | |
| | 35 | | | | | | | | | | | | |
| | 36 | | | | | | | | | | | | |
| | 37 | | | | | | | | | | | | |
| | 38 | | | | | | | | | | | | |
| | 39 | | | | | | | | | | | | |
| | 40 | | | | | | | | | | | | |
| **Properties** | | | | | | | | | | | | | |
| Area, In.$^2$ | | 7.88 | 6.18 | 5.26 | 4.30 | 3.28 | 2.23 | 6.95 | 5.48 | 4.68 | 3.84 | 2.93 | 2.00 |
| I, In.$^4$ | | 26.0 | 21.7 | 19.0 | 16.0 | 12.6 | 8.80 | 18.0 | 15.3 | 13.5 | 11.4 | 9.02 | 6.35 |
| r, In. | | 1.82 | 1.87 | 1.90 | 1.93 | 1.96 | 1.99 | 1.61 | 1.67 | 1.70 | 1.73 | 1.75 | 1.78 |
| B, Bending Factor | | 0.758 | 0.712 | 0.692 | 0.672 | 0.651 | 0.634 | 0.869 | 0.806 | 0.780 | 0.758 | 0.731 | 0.709 |
| a ÷ $10^6$ | | 4.35 | 3.77 | 3.42 | 3.03 | 2.58 | 2.07 | 2.96 | 2.62 | 2.39 | 2.12 | 1.78 | 1.43 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

ERW

# HSS / Square Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips




**f'c = 5.0**

$f'_c$=5.0 ksi

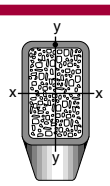
| Nominal Size | | 4 x 4 | | | | | |
|---|---|---|---|---|---|---|---|
| Wall Thickness | | 1/2 | 3/8 | 5/16 | 1/4 | 3/16 | 1/8 |
| Weight Per Foot | | 21.63 | 17.27 | 14.83 | 12.21 | 9.42 | 6.46 |
| Design Wall Thickness | | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 | 0.116 |
| | | $F_y$ = 46 ksi | | | | | |
| Effective length KL in feet | 0 | 190 | 159 | 143 | 125 | 105 | 85 |
| | 4 | 169 | 143 | 128 | 112 | 94 | 76 |
| | 5 | 162 | 137 | 123 | 107 | 91 | 73 |
| | 6 | 154 | 130 | 117 | 103 | 87 | 70 |
| | 7 | 145 | 123 | 111 | 97 | 82 | 66 |
| | 8 | 136 | 116 | 104 | 92 | 77 | 62 |
| | 9 | 126 | 108 | 97 | 86 | 72 | 58 |
| | 10 | 115 | 99 | 90 | 79 | 67 | 54 |
| | 11 | 104 | 90 | 82 | 72 | 61 | 49 |
| | 12 | 92 | 81 | 74 | 65 | 55 | 44 |
| | 13 | 80 | 70 | 65 | 57 | 49 | 39 |
| | 14 | 69 | 61 | 56 | 50 | 42 | 34 |
| | 15 | 60 | 53 | 49 | 43 | 37 | 30 |
| | 16 | 53 | 47 | 43 | 38 | 32 | 26 |
| | 17 | 47 | 41 | 38 | 34 | 29 | 23 |
| | 18 | 42 | 37 | 34 | 30 | 26 | 21 |
| | 19 | 37 | 33 | 30 | 27 | 23 | 18 |
| | 20 | 34 | 30 | 27 | 24 | 21 | 17 |
| | 21 | 31 | 27 | 25 | 22 | 19 | 15 |
| | 22 | 28 | 25 | 23 | 20 | 17 | 14 |
| | 23 | 25 | 23 | 21 | 18 | 16 | 13 |
| | 24 | | 21 | 19 | 17 | 14 | 12 |
| | 25 | | | | 16 | 13 | 11 |
| | 26 | | | | | | 10 |
| | 27 | | | | | | |
| | 28 | | | | | | |
| | 29 | | | | | | |
| | 30 | | | | | | |
| | 31 | | | | | | |
| | 32 | | | | | | |
| | 33 | | | | | | |
| | 34 | | | | | | |
| | 35 | | | | | | |
| | 36 | | | | | | |
| | 37 | | | | | | |
| | 38 | | | | | | |
| | 39 | | | | | | |
| | 40 | | | | | | |
| **Properties** | | | | | | | |
| Area, In.$^2$ | | 6.02 | 4.78 | 4.10 | 3.37 | 2.58 | 1.77 |
| I, In.$^4$ | | 11.9 | 10.3 | 9.14 | 7.80 | 6.21 | 4.40 |
| r, In. | | 1.41 | 1.46 | 1.49 | 1.52 | 1.55 | 1.58 |
| B, Bending Factor | | 1.01 | 0.928 | 0.897 | 0.864 | 0.831 | 0.805 |
| a ÷ $10^6$ | | 1.94 | 1.71 | 1.58 | 1.40 | 1.19 | 0.957 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

ERW

# HSS / Rectangular Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips




**f'c = 5.0**

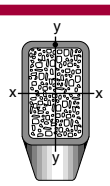
| Nominal Size | | 20 x 12 | 20 x 8 | | 20 x 4 | 18 x 6 | | 16 x 12 | |
|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 1/2 | 5/8 | 1/2 | 1/2 | 5/8 | 1/2 | 1/2 | 3/8 |
| Weight Per Foot | | 103.30 | 110.36 | 89.68 | 76.07 | 93.34 | 76.07 | 89.68 | 68.31 |
| Design Wall Thickness | | 0.465 | 0.581 | 0.465 | 0.465 | 0.581 | 0.465 | 0.465 | 0.349 |
| | | $F_y$ = 46 ksi | | | | | | | |
| Effective length KL in feet | 0 | 1320 | 1160 | 1020 | 726 | 916 | 797 | 1100 | 957 |
| | 4 | 1290 | 1120 | 983 | 661 | 866 | 754 | 1080 | 932 |
| | 5 | 1280 | 1110 | 971 | 639 | 850 | 740 | 1070 | 925 |
| | 6 | 1270 | 1090 | 958 | 615 | 832 | 725 | 1060 | 917 |
| | 7 | 1250 | 1070 | 944 | 589 | 814 | 709 | 1050 | 909 |
| | 8 | 1240 | 1060 | 929 | 561 | 794 | 692 | 1040 | 900 |
| | 9 | 1230 | 1040 | 913 | 531 | 773 | 674 | 1030 | 891 |
| | 10 | 1220 | 1020 | 897 | 500 | 750 | 654 | 1020 | 882 |
| | 11 | 1210 | 1000 | 880 | 467 | 727 | 634 | 1010 | 872 |
| | 12 | 1190 | 981 | 862 | 432 | 702 | 613 | 995 | 862 |
| | 13 | 1180 | 960 | 844 | 395 | 677 | 592 | 983 | 851 |
| | 14 | 1160 | 938 | 824 | 356 | 650 | 569 | 971 | 840 |
| | 15 | 1150 | 915 | 805 | 315 | 623 | 545 | 958 | 829 |
| | 16 | 1130 | 892 | 784 | 276 | 594 | 520 | 945 | 817 |
| | 17 | 1120 | 867 | 763 | 245 | 564 | 495 | 931 | 806 |
| | 18 | 1100 | 842 | 741 | 218 | 534 | 469 | 917 | 793 |
| | 19 | 1090 | 817 | 718 | 196 | 502 | 441 | 903 | 781 |
| | 20 | 1070 | 790 | 695 | 177 | 469 | 413 | 888 | 768 |
| | 21 | 1050 | 763 | 671 | 160 | 434 | 383 | 873 | 754 |
| | 22 | 1030 | 735 | 647 | 146 | 399 | 353 | 857 | 741 |
| | 23 | 1010 | 706 | 622 | 134 | 365 | 323 | 841 | 727 |
| | 24 | 996 | 676 | 596 | 123 | 335 | 297 | 825 | 713 |
| | 25 | 977 | 646 | 569 | 113 | 309 | 274 | 809 | 698 |
| | 26 | 957 | 615 | 542 | 105 | 286 | 253 | 792 | 683 |
| | 27 | 937 | 583 | 514 | 97 | 265 | 234 | 775 | 668 |
| | 28 | 917 | 550 | 485 | 90 | 246 | 218 | 757 | 653 |
| | 29 | 896 | 516 | 456 | | 230 | 203 | 739 | 637 |
| | 30 | 875 | 482 | 426 | | 214 | 190 | 721 | 621 |
| | 31 | 853 | 452 | 399 | | 201 | 178 | 702 | 605 |
| | 32 | 831 | 424 | 374 | | 188 | 167 | 683 | 588 |
| | 33 | 809 | 399 | 352 | | 177 | 157 | 664 | 571 |
| | 34 | 786 | 376 | 332 | | 167 | 148 | 644 | 554 |
| | 35 | 763 | 354 | 313 | | 158 | 140 | 624 | 536 |
| | 36 | 739 | 335 | 296 | | 149 | 132 | 603 | 518 |
| | 37 | 715 | 317 | 280 | | 141 | 125 | 582 | 500 |
| | 38 | 690 | 301 | 265 | | 134 | 118 | 561 | 481 |
| | 39 | 665 | 285 | 252 | | 127 | 112 | 539 | 462 |
| | 40 | 640 | 271 | 240 | | 121 | 107 | 517 | 442 |
| **Properties** | | | | | | | | | |
| Area, In.$^2$ | | 28.3 | 30.3 | 24.6 | 20.9 | 25.7 | 20.9 | 24.6 | 18.7 |
| $I_x$, In.$^4$ | | 1550 | 1440 | 1190 | 838 | 923 | 770 | 904 | 702 |
| $I_y$, In.$^4$ | | 705 | 338 | 283 | 58.7 | 158 | 134 | 581 | 452 |
| Ratio, $r_x/r_y$ | | 1.48 | 2.06 | 2.05 | 3.78 | 2.42 | 2.40 | 1.25 | 1.25 |
| $r_y$, In. | | 4.99 | 3.34 | 3.39 | 1.68 | 2.48 | 2.53 | 4.86 | 4.91 |
| $B_x$, Bending Factor | | 0.183 | 0.210 | 0.207 | 0.249 | 0.251 | 0.244 | 0.218 | 0.213 |
| $B_y$, Bending Factor | | 0.241 | 0.359 | 0.348 | 0.712 | 0.488 | 0.468 | 0.254 | 0.248 |
| $a_x \div 10^6$ | | 328 | 266 | 232 | 145 | 162 | 142 | 186 | 159 |
| $a_y \div 10^6$ | | 149 | 62.5 | 55.3 | 10.1 | 27.8 | 24.7 | 120 | 103 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

ERW

# HSS / Rectangular Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips




**f'c = 5.0**

$f'_c$=5.0 ksi

| Nominal Size | | 16 x 8 | | | 16 x 4 | | 14 x 10 | | |
|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 5/8 | 1/2 | 3/8 | 1/2 | 3/8 | 5/8 | 1/2 | 3/8 |
| Weight Per Foot | | 93.34 | 76.07 | 58.10 | 62.46 | 47.90 | 93.34 | 76.07 | 58.10 |
| Design Wall Thickness | | 0.581 | 0.465 | 0.349 | 0.465 | 0.349 | 0.581 | 0.465 | 0.349 |
| | | $F_y$ = 46 ksi | | | | | | | |
| Effective length KL in feet | 0 | 967 | 848 | 726 | 592 | 493 | 998 | 879 | 757 |
| | 4 | 929 | 815 | 698 | 538 | 449 | 966 | 851 | 733 |
| | 5 | 917 | 804 | 689 | 520 | 434 | 957 | 843 | 726 |
| | 6 | 904 | 793 | 679 | 500 | 418 | 947 | 834 | 718 |
| | 7 | 891 | 781 | 669 | 478 | 401 | 936 | 824 | 710 |
| | 8 | 876 | 769 | 658 | 455 | 382 | 925 | 814 | 701 |
| | 9 | 861 | 756 | 647 | 430 | 362 | 913 | 804 | 692 |
| | 10 | 845 | 742 | 635 | 404 | 341 | 900 | 793 | 683 |
| | 11 | 829 | 727 | 623 | 376 | 318 | 887 | 782 | 673 |
| | 12 | 811 | 712 | 610 | 346 | 295 | 874 | 770 | 662 |
| | 13 | 793 | 696 | 596 | 315 | 270 | 860 | 757 | 652 |
| | 14 | 775 | 680 | 582 | 283 | 244 | 845 | 745 | 641 |
| | 15 | 755 | 663 | 567 | 248 | 216 | 830 | 731 | 629 |
| | 16 | 735 | 646 | 552 | 218 | 190 | 814 | 718 | 617 |
| | 17 | 714 | 627 | 537 | 193 | 168 | 798 | 704 | 605 |
| | 18 | 693 | 609 | 521 | 172 | 150 | 782 | 689 | 593 |
| | 19 | 671 | 590 | 504 | 155 | 135 | 765 | 674 | 580 |
| | 20 | 648 | 570 | 488 | 140 | 122 | 748 | 659 | 567 |
| | 21 | 625 | 550 | 470 | 127 | 110 | 730 | 643 | 553 |
| | 22 | 601 | 529 | 452 | 115 | 100 | 711 | 627 | 539 |
| | 23 | 577 | 507 | 434 | 106 | 92 | 693 | 611 | 525 |
| | 24 | 551 | 485 | 415 | 97 | 84 | 673 | 594 | 510 |
| | 25 | 525 | 462 | 395 | 89 | 78 | 654 | 577 | 495 |
| | 26 | 498 | 439 | 375 | 83 | 72 | 633 | 559 | 480 |
| | 27 | 471 | 415 | 355 | 77 | 67 | 613 | 541 | 464 |
| | 28 | 443 | 391 | 334 | | 62 | 592 | 522 | 448 |
| | 29 | 414 | 365 | 312 | | | 570 | 504 | 432 |
| | 30 | 387 | 341 | 291 | | | 548 | 484 | 415 |
| | 31 | 362 | 320 | 273 | | | 525 | 464 | 398 |
| | 32 | 340 | 300 | 256 | | | 502 | 444 | 380 |
| | 33 | 320 | 282 | 241 | | | 479 | 423 | 362 |
| | 34 | 301 | 266 | 227 | | | 455 | 402 | 344 |
| | 35 | 284 | 251 | 214 | | | 430 | 381 | 325 |
| | 36 | 269 | 237 | 202 | | | 406 | 360 | 307 |
| | 37 | 254 | 224 | 192 | | | 385 | 341 | 291 |
| | 38 | 241 | 213 | 182 | | | 365 | 323 | 276 |
| | 39 | 229 | 202 | 172 | | | 346 | 307 | 262 |
| | 40 | 218 | 192 | 164 | | | 329 | 291 | 249 |
| **Properties** | | | | | | | | | |
| Area, In.$^2$ | | 25.7 | 20.9 | 16.0 | 17.2 | 13.2 | 25.7 | 20.9 | 16.0 |
| $I_x$, In.$^4$ | | 815 | 679 | 531 | 455 | 360 | 687 | 573 | 447 |
| $I_y$, In.$^4$ | | 274 | 230 | 181 | 47.0 | 38.3 | 407 | 341 | 267 |
| Ratio, $r_x/r_y$ | | 1.72 | 1.72 | 1.71 | 3.11 | 3.07 | 1.30 | 1.30 | 1.29 |
| $r_y$, In. | | 3.27 | 3.32 | 3.37 | 1.65 | 1.71 | 3.98 | 4.04 | 4.09 |
| $B_x$, Bending Factor | | 0.252 | 0.246 | 0.241 | 0.302 | 0.293 | 0.262 | 0.255 | 0.251 |
| $B_y$, Bending Factor | | 0.375 | 0.363 | 0.354 | 0.732 | 0.689 | 0.316 | 0.306 | 0.300 |
| $a_x \div 10^6$ | | 149 | 130 | 110 | 78.2 | 65.3 | 128 | 113 | 95.7 |
| $a_y \div 10^6$ | | 50.0 | 44.2 | 37.6 | 8.08 | 6.95 | 75.8 | 67.1 | 57.2 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

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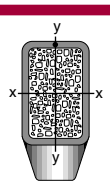
# HSS / Rectangular Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips




**f'c = 5.0**

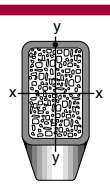
| Nominal Size | | 14 x 6 | | | 14 x 4 | | | 12 x 10 | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 5/8 | 1/2 | 3/8 | 5/8 | 1/2 | 3/8 | 1/2 | 3/8 | 5/16 |
| Weight Per Foot | | 76.33 | 62.46 | 47.90 | 67.82 | 55.66 | 42.79 | 69.27 | 53.00 | 44.60 |
| Design Wall Thickness | | 0.581 | 0.465 | 0.349 | 0.581 | 0.465 | 0.349 | 0.465 | 0.349 | 0.291 |
| | | $F_y$ = 46 ksi | | | | | | | | |
| Effective length KL in feet | 0 | 737 | 643 | 544 | 608 | 524 | 437 | 780 | 671 | 611 |
| | 4 | 696 | 608 | 514 | 551 | 476 | 398 | 755 | 649 | 591 |
| | 5 | 683 | 596 | 504 | 531 | 460 | 385 | 747 | 643 | 585 |
| | 6 | 668 | 584 | 494 | 510 | 442 | 370 | 739 | 636 | 579 |
| | 7 | 653 | 570 | 483 | 487 | 422 | 354 | 731 | 628 | 572 |
| | 8 | 636 | 556 | 471 | 462 | 402 | 338 | 722 | 620 | 565 |
| | 9 | 619 | 541 | 458 | 435 | 379 | 320 | 712 | 612 | 557 |
| | 10 | 600 | 525 | 445 | 407 | 356 | 300 | 702 | 604 | 549 |
| | 11 | 581 | 509 | 431 | 377 | 331 | 280 | 692 | 595 | 541 |
| | 12 | 561 | 491 | 416 | 345 | 305 | 259 | 681 | 585 | 532 |
| | 13 | 540 | 473 | 401 | 312 | 277 | 236 | 670 | 576 | 524 |
| | 14 | 518 | 454 | 385 | 277 | 248 | 213 | 658 | 566 | 514 |
| | 15 | 495 | 435 | 369 | 242 | 217 | 188 | 646 | 555 | 505 |
| | 16 | 471 | 415 | 352 | 212 | 191 | 165 | 634 | 544 | 495 |
| | 17 | 447 | 393 | 334 | 188 | 169 | 146 | 621 | 533 | 485 |
| | 18 | 421 | 371 | 316 | 168 | 151 | 130 | 608 | 522 | 475 |
| | 19 | 395 | 349 | 297 | 151 | 136 | 117 | 594 | 510 | 464 |
| | 20 | 367 | 325 | 277 | 136 | 122 | 106 | 580 | 498 | 453 |
| | 21 | 339 | 301 | 257 | 123 | 111 | 96 | 566 | 486 | 441 |
| | 22 | 310 | 276 | 235 | 112 | 101 | 87 | 552 | 473 | 430 |
| | 23 | 283 | 252 | 215 | 103 | 93 | 80 | 537 | 460 | 418 |
| | 24 | 260 | 232 | 198 | 94 | 85 | 73 | 521 | 447 | 406 |
| | 25 | 240 | 213 | 182 | 87 | 78 | 68 | 505 | 433 | 393 |
| | 26 | 222 | 197 | 168 | 80 | 72 | 62 | 489 | 419 | 381 |
| | 27 | 206 | 183 | 156 | | 67 | 58 | 473 | 405 | 367 |
| | 28 | 191 | 170 | 145 | | | 54 | 456 | 391 | 354 |
| | 29 | 178 | 159 | 135 | | | | 439 | 376 | 340 |
| | 30 | 167 | 148 | 127 | | | | 421 | 360 | 326 |
| | 31 | 156 | 139 | 119 | | | | 403 | 345 | 312 |
| | 32 | 146 | 130 | 111 | | | | 385 | 329 | 297 |
| | 33 | 138 | 122 | 105 | | | | 366 | 312 | 282 |
| | 34 | 130 | 115 | 99 | | | | 346 | 296 | 267 |
| | 35 | 122 | 109 | 93 | | | | 327 | 279 | 252 |
| | 36 | 116 | 103 | 88 | | | | 309 | 264 | 238 |
| | 37 | 109 | 97 | 83 | | | | 293 | 250 | 226 |
| | 38 | 104 | 92 | 79 | | | | 277 | 237 | 214 |
| | 39 | 99 | 88 | 75 | | | | 263 | 225 | 203 |
| | 40 | 94 | 83 | 71 | | | | 250 | 214 | 193 |
| **Properties** | | | | | | | | | | |
| Area, In.$^2$ | | 21.0 | 17.2 | 13.2 | 18.7 | 15.3 | 11.8 | 19.0 | 14.6 | 12.2 |
| $I_x$, In.$^4$ | | 478 | 402 | 317 | 373 | 317 | 252 | 395 | 310 | 264 |
| $I_y$, In.$^4$ | | 124 | 105 | 84.1 | 47.1 | 41.1 | 33.6 | 298 | 234 | 200 |
| Ratio, $r_x/r_y$ | | 1.97 | 1.95 | 1.94 | 2.81 | 2.78 | 2.74 | 1.15 | 1.15 | 1.15 |
| $r_y$, In. | | 2.43 | 2.48 | 2.53 | 1.59 | 1.64 | 1.69 | 3.96 | 4.01 | 4.04 |
| $B_x$, Bending Factor | | 0.308 | 0.300 | 0.291 | 0.351 | 0.338 | 0.328 | 0.289 | 0.283 | 0.277 |
| $B_y$, Bending Factor | | 0.508 | 0.491 | 0.471 | 0.794 | 0.745 | 0.702 | 0.319 | 0.312 | 0.305 |
| $a_x \div 10^6$ | | 83.2 | 73.0 | 61.5 | 61.8 | 54.3 | 45.5 | 76.5 | 65.0 | 58.9 |
| $a_y \div 10^6$ | | 21.6 | 19.1 | 16.3 | 7.80 | 7.04 | 6.06 | 57.7 | 49.1 | 44.7 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

ERW

# HSS / Rectangular Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips




**f'c = 5.0**

$f'_c$=5.0 ksi

| Nominal Size | | 12 x 8 | | | | 12 x 6 | | | |
|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 5/8 | 1/2 | 3/8 | 5/16 | 5/8 | 1/2 | 3/8 | 5/16 |
| Weight Per Foot | | 76.33 | 62.46 | 47.90 | 40.35 | 67.82 | 55.66 | 42.79 | 36.10 |
| Design Wall Thickness | | 0.581 | 0.465 | 0.349 | 0.291 | 0.581 | 0.465 | 0.349 | 0.291 |
| | | $F_y$ = 46 ksi | | | | | | | |
| Effective length KL in feet | 0 | 768 | 674 | 574 | 522 | 649 | 565 | 478 | 431 |
| | 4 | 736 | 646 | 551 | 501 | 612 | 533 | 452 | 407 |
| | 5 | 727 | 638 | 544 | 494 | 600 | 523 | 443 | 400 |
| | 6 | 716 | 629 | 536 | 487 | 587 | 512 | 434 | 391 |
| | 7 | 705 | 619 | 528 | 479 | 573 | 500 | 423 | 382 |
| | 8 | 693 | 608 | 519 | 471 | 558 | 487 | 413 | 372 |
| | 9 | 680 | 598 | 510 | 463 | 543 | 474 | 402 | 362 |
| | 10 | 667 | 586 | 500 | 454 | 526 | 459 | 390 | 352 |
| | 11 | 653 | 574 | 490 | 445 | 509 | 445 | 377 | 340 |
| | 12 | 639 | 561 | 479 | 435 | 491 | 429 | 364 | 329 |
| | 13 | 624 | 548 | 468 | 425 | 472 | 413 | 350 | 316 |
| | 14 | 608 | 535 | 456 | 414 | 452 | 396 | 336 | 304 |
| | 15 | 592 | 521 | 445 | 403 | 431 | 378 | 321 | 290 |
| | 16 | 576 | 506 | 432 | 392 | 410 | 360 | 306 | 276 |
| | 17 | 559 | 491 | 420 | 380 | 388 | 341 | 290 | 262 |
| | 18 | 541 | 476 | 406 | 368 | 365 | 321 | 274 | 247 |
| | 19 | 523 | 460 | 393 | 356 | 341 | 301 | 256 | 232 |
| | 20 | 504 | 444 | 379 | 343 | 316 | 280 | 239 | 216 |
| | 21 | 484 | 427 | 365 | 330 | 290 | 258 | 220 | 199 |
| | 22 | 464 | 409 | 350 | 317 | 265 | 235 | 201 | 182 |
| | 23 | 444 | 391 | 335 | 303 | 242 | 215 | 184 | 167 |
| | 24 | 423 | 373 | 319 | 288 | 222 | 198 | 169 | 153 |
| | 25 | 401 | 354 | 303 | 274 | 205 | 182 | 156 | 141 |
| | 26 | 379 | 335 | 287 | 259 | 190 | 168 | 144 | 130 |
| | 27 | 356 | 315 | 270 | 243 | 176 | 156 | 134 | 121 |
| | 28 | 332 | 294 | 252 | 227 | 163 | 145 | 124 | 112 |
| | 29 | 310 | 274 | 235 | 212 | 152 | 135 | 116 | 105 |
| | 30 | 289 | 256 | 220 | 198 | 142 | 127 | 108 | 98 |
| | 31 | 271 | 240 | 206 | 185 | 133 | 118 | 101 | 92 |
| | 32 | 254 | 225 | 193 | 174 | 125 | 111 | 95 | 86 |
| | 33 | 239 | 212 | 182 | 163 | 118 | 105 | 90 | 81 |
| | 34 | 225 | 200 | 171 | 154 | 111 | 99 | 84 | 76 |
| | 35 | 213 | 188 | 161 | 145 | 105 | 93 | 80 | 72 |
| | 36 | 201 | 178 | 153 | 137 | 99 | 88 | 75 | 68 |
| | 37 | 190 | 169 | 144 | 130 | 94 | 83 | 71 | 64 |
| | 38 | 180 | 160 | 137 | 123 | 89 | 79 | 68 | 61 |
| | 39 | 171 | 152 | 130 | 117 | 84 | 75 | 64 | 58 |
| | 40 | 163 | 144 | 124 | 111 | | 71 | 61 | 55 |
| **Properties** | | | | | | | | | |
| Area, In.$^2$ | | 21.0 | 17.2 | 13.2 | 11.1 | 18.7 | 15.3 | 11.8 | 9.92 |
| $I_x$, In.$^4$ | | 396 | 333 | 262 | 224 | 321 | 271 | 215 | 184 |
| $I_y$, In.$^4$ | | 210 | 177 | 140 | 120 | 106 | 91.1 | 72.9 | 62.8 |
| Ratio, $r_x/r_y$ | | 1.37 | 1.37 | 1.37 | 1.37 | 1.74 | 1.73 | 1.72 | 1.71 |
| $r_y$, In. | | 3.16 | 3.21 | 3.27 | 3.29 | 2.39 | 2.44 | 2.49 | 2.52 |
| $B_x$, Bending Factor | | 0.318 | 0.310 | 0.302 | 0.297 | 0.350 | 0.339 | 0.329 | 0.323 |
| $B_y$, Bending Factor | | 0.400 | 0.389 | 0.377 | 0.370 | 0.529 | 0.504 | 0.486 | 0.474 |
| $a_x \div 10^6$ | | 70.8 | 62.4 | 52.9 | 47.8 | 55.4 | 48.8 | 41.3 | 37.1 |
| $a_y \div 10^6$ | | 37.6 | 33.2 | 28.2 | 25.6 | 18.3 | 16.4 | 14.0 | 12.7 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

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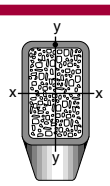
# HSS / Rectangular Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips




**f'c = 5.0**

| Nominal Size | | 12 x 4 | | | | 10 x 8 | | | |
|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 5/8 | 1/2 | 3/8 | 5/16 | 1/2 | 3/8 | 5/16 | 1/4 |
| Weight Per Foot | | 59.32 | 48.85 | 37.69 | 31.84 | 55.66 | 42.79 | 36.10 | 29.23 |
| Design Wall Thickness | | 0.581 | 0.465 | 0.349 | 0.291 | 0.465 | 0.349 | 0.291 | 0.233 |
| | | $F_y$ = 46 ksi | | | | | | | |
| Effective length KL in feet | 0 | 530 | 459 | 382 | 341 | 585 | 499 | 452 | 405 |
| | 4 | 480 | 416 | 347 | 310 | 561 | 478 | 433 | 388 |
| | 5 | 462 | 402 | 335 | 300 | 553 | 471 | 427 | 382 |
| | 6 | 443 | 386 | 322 | 289 | 545 | 464 | 421 | 377 |
| | 7 | 422 | 368 | 308 | 276 | 536 | 457 | 414 | 371 |
| | 8 | 400 | 350 | 293 | 263 | 527 | 449 | 407 | 364 |
| | 9 | 377 | 330 | 277 | 249 | 517 | 441 | 399 | 357 |
| | 10 | 352 | 309 | 261 | 234 | 507 | 432 | 391 | 350 |
| | 11 | 325 | 287 | 243 | 218 | 496 | 423 | 383 | 343 |
| | 12 | 297 | 264 | 224 | 201 | 485 | 413 | 374 | 335 |
| | 13 | 267 | 239 | 204 | 184 | 474 | 404 | 365 | 327 |
| | 14 | 236 | 213 | 183 | 165 | 462 | 393 | 356 | 318 |
| | 15 | 206 | 186 | 161 | 146 | 449 | 383 | 346 | 310 |
| | 16 | 181 | 164 | 141 | 128 | 436 | 372 | 336 | 301 |
| | 17 | 160 | 145 | 125 | 114 | 423 | 360 | 326 | 291 |
| | 18 | 143 | 129 | 112 | 101 | 409 | 348 | 315 | 282 |
| | 19 | 128 | 116 | 100 | 91 | 395 | 336 | 304 | 272 |
| | 20 | 116 | 105 | 90 | 82 | 380 | 324 | 293 | 262 |
| | 21 | 105 | 95 | 82 | 74 | 365 | 311 | 281 | 251 |
| | 22 | 96 | 87 | 75 | 68 | 349 | 298 | 269 | 240 |
| | 23 | 88 | 79 | 68 | 62 | 333 | 284 | 257 | 229 |
| | 24 | 80 | 73 | 63 | 57 | 317 | 270 | 244 | 218 |
| | 25 | 74 | 67 | 58 | 53 | 300 | 256 | 231 | 206 |
| | 26 | 68 | 62 | 53 | 49 | 283 | 241 | 218 | 194 |
| | 27 | | 57 | 50 | 45 | 265 | 226 | 204 | 181 |
| | 28 | | | | 42 | 246 | 210 | 190 | 169 |
| | 29 | | | | | 230 | 196 | 177 | 157 |
| | 30 | | | | | 215 | 183 | 165 | 147 |
| | 31 | | | | | 201 | 171 | 155 | 138 |
| | 32 | | | | | 189 | 161 | 145 | 129 |
| | 33 | | | | | 177 | 151 | 137 | 121 |
| | 34 | | | | | 167 | 143 | 129 | 114 |
| | 35 | | | | | 158 | 134 | 121 | 108 |
| | 36 | | | | | 149 | 127 | 115 | 102 |
| | 37 | | | | | 141 | 120 | 109 | 97 |
| | 38 | | | | | 134 | 114 | 103 | 92 |
| | 39 | | | | | 127 | 108 | 98 | 87 |
| | 40 | | | | | 121 | 103 | 93 | 83 |
| **Properties** | | | | | | | | | |
| Area, In.$^2$ | | 16.4 | 13.5 | 10.4 | 8.76 | 15.3 | 11.8 | 9.92 | 8.03 |
| $I_x$, In.$^4$ | | 245 | 209 | 168 | 144 | 214 | 169 | 145 | 119 |
| $I_y$, In.$^4$ | | 40.3 | 35.3 | 28.9 | 25.2 | 151 | 120 | 103 | 84.7 |
| Ratio, $r_x/r_y$ | | 2.47 | 2.44 | 2.41 | 2.39 | 1.19 | 1.19 | 1.19 | 1.19 |
| $r_y$, In. | | 1.57 | 1.62 | 1.67 | 1.70 | 3.14 | 3.19 | 3.22 | 3.25 |
| $B_x$, Bending Factor | | 0.402 | 0.388 | 0.371 | 0.365 | 0.357 | 0.349 | 0.342 | 0.337 |
| $B_y$, Bending Factor | | 0.814 | 0.765 | 0.720 | 0.695 | 0.405 | 0.393 | 0.385 | 0.379 |
| $a_x \div 10^6$ | | 40.4 | 35.6 | 30.1 | 26.9 | 39.5 | 33.4 | 30.2 | 26.7 |
| $a_y \div 10^6$ | | 6.65 | 6.01 | 5.18 | 4.70 | 27.8 | 23.7 | 21.5 | 19.0 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

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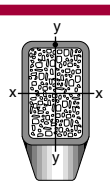
# HSS / Rectangular Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips




**f'c = 5.0**

$f'_c$=5.0 ksi

| Nominal Size | | 10 x 6 | | | | | 10 x 5 | | |
|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 5/8 | 1/2 | 3/8 | 5/16 | 1/4 | 3/8 | 5/16 | 1/4 |
| Weight Per Foot | | 59.32 | 48.85 | 37.69 | 31.84 | 25.82 | 35.13 | 29.72 | 24.12 |
| Design Wall Thickness | | 0.581 | 0.465 | 0.349 | 0.291 | 0.233 | 0.349 | 0.291 | 0.233 |
| | | $F_y$ = 46 ksi | | | | | | | |
| Effective length KL in feet | 0 | 561 | 489 | 413 | 372 | 330 | 369 | 331 | 293 |
| | 4 | 528 | 461 | 389 | 351 | 311 | 343 | 308 | 273 |
| | 5 | 518 | 452 | 381 | 344 | 305 | 334 | 300 | 266 |
| | 6 | 506 | 442 | 373 | 336 | 299 | 325 | 292 | 258 |
| | 7 | 494 | 432 | 364 | 328 | 292 | 315 | 283 | 250 |
| | 8 | 481 | 420 | 355 | 320 | 284 | 304 | 273 | 242 |
| | 9 | 467 | 408 | 345 | 311 | 276 | 292 | 263 | 233 |
| | 10 | 452 | 396 | 334 | 301 | 267 | 280 | 252 | 223 |
| | 11 | 436 | 383 | 323 | 291 | 259 | 268 | 241 | 213 |
| | 12 | 420 | 369 | 312 | 281 | 249 | 254 | 229 | 202 |
| | 13 | 403 | 354 | 300 | 270 | 240 | 240 | 216 | 191 |
| | 14 | 386 | 339 | 287 | 259 | 229 | 226 | 203 | 180 |
| | 15 | 368 | 323 | 274 | 247 | 219 | 210 | 189 | 168 |
| | 16 | 349 | 307 | 260 | 235 | 208 | 194 | 175 | 155 |
| | 17 | 329 | 290 | 246 | 222 | 197 | 178 | 160 | 142 |
| | 18 | 308 | 273 | 232 | 209 | 185 | 160 | 144 | 128 |
| | 19 | 287 | 254 | 216 | 195 | 173 | 144 | 129 | 115 |
| | 20 | 265 | 235 | 201 | 181 | 160 | 130 | 117 | 104 |
| | 21 | 242 | 216 | 184 | 167 | 147 | 118 | 106 | 94 |
| | 22 | 220 | 197 | 168 | 152 | 134 | 107 | 96 | 86 |
| | 23 | 202 | 180 | 154 | 139 | 122 | 98 | 88 | 78 |
| | 24 | 185 | 165 | 141 | 128 | 112 | 90 | 81 | 72 |
| | 25 | 171 | 152 | 130 | 118 | 104 | 83 | 75 | 66 |
| | 26 | 158 | 141 | 120 | 109 | 96 | 77 | 69 | 61 |
| | 27 | 146 | 131 | 112 | 101 | 89 | 71 | 64 | 57 |
| | 28 | 136 | 121 | 104 | 94 | 83 | 66 | 60 | 53 |
| | 29 | 127 | 113 | 97 | 87 | 77 | 62 | 56 | 49 |
| | 30 | 119 | 106 | 90 | 82 | 72 | 58 | 52 | 46 |
| | 31 | 111 | 99 | 85 | 77 | 67 | 54 | 49 | 43 |
| | 32 | 104 | 93 | 79 | 72 | 63 | 51 | 46 | 40 |
| | 33 | 98 | 87 | 75 | 68 | 59 | 48 | 43 | 38 |
| | 34 | 92 | 82 | 70 | 64 | 56 | 45 | 40 | 36 |
| | 35 | 87 | 78 | 66 | 60 | 53 | | | 34 |
| | 36 | 82 | 73 | 63 | 57 | 50 | | | |
| | 37 | 78 | 70 | 59 | 54 | 47 | | | |
| | 38 | 74 | 66 | 56 | 51 | 45 | | | |
| | 39 | 70 | 63 | 53 | 48 | 43 | | | |
| | 40 | | | 51 | 46 | 40 | | | |
| **Properties** | | | | | | | | | |
| Area, In.$^2$ | | 16.4 | 13.5 | 10.4 | 8.76 | 7.10 | 9.67 | 8.17 | 6.63 |
| $I_x$, In.$^4$ | | 201 | 171 | 137 | 118 | 96.9 | 120 | 104 | 85.8 |
| $I_y$, In.$^4$ | | 89.4 | 76.8 | 61.8 | 53.3 | 44.1 | 40.6 | 35.2 | 29.3 |
| Ratio, $r_x/r_y$ | | 1.50 | 1.49 | 1.49 | 1.48 | 1.48 | 1.72 | 1.72 | 1.71 |
| $r_y$, In. | | 2.34 | 2.39 | 2.44 | 2.47 | 2.49 | 2.05 | 2.07 | 2.10 |
| $B_x$, Bending Factor | | 0.408 | 0.395 | 0.380 | 0.371 | 0.366 | 0.403 | 0.393 | 0.386 |
| $B_y$, Bending Factor | | 0.550 | 0.527 | 0.505 | 0.493 | 0.483 | 0.595 | 0.580 | 0.566 |
| $a_x \div 10^6$ | | 34.4 | 30.4 | 25.9 | 23.4 | 20.5 | 22.1 | 20.0 | 17.5 |
| $a_y \div 10^6$ | | 15.3 | 13.7 | 11.7 | 10.6 | 9.33 | 7.47 | 6.76 | 5.98 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

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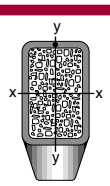
# HSS / Rectangular Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips




**f'c = 5.0**

| Nominal Size | | 10 x 4 | | | | | 9 x 7 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 5/8 | 1/2 | 3/8 | 5/16 | 1/4 | 5/8 | 1/2 | 3/8 | 5/16 | 1/4 |
| Weight Per Foot | | 50.81 | 42.05 | 32.58 | 27.59 | 22.42 | 59.32 | 48.85 | 37.69 | 31.84 | 25.82 |
| Design Wall Thickness | | 0.581 | 0.465 | 0.349 | 0.291 | 0.233 | 0.581 | 0.465 | 0.349 | 0.291 | 0.233 |
| | | $F_y$ = 46 ksi | | | | | | | | | |
| Effective length KL in feet | 0 | 450 | 391 | 326 | 291 | 256 | 569 | 497 | 420 | 379 | 338 |
| | 4 | 406 | 354 | 295 | 265 | 233 | 540 | 473 | 400 | 361 | 322 |
| | 5 | 390 | 341 | 285 | 256 | 225 | 531 | 465 | 393 | 355 | 316 |
| | 6 | 374 | 327 | 274 | 246 | 216 | 522 | 457 | 386 | 349 | 311 |
| | 7 | 356 | 312 | 262 | 235 | 207 | 511 | 448 | 379 | 342 | 304 |
| | 8 | 337 | 296 | 248 | 223 | 197 | 500 | 438 | 371 | 335 | 298 |
| | 9 | 316 | 278 | 234 | 211 | 186 | 489 | 428 | 362 | 327 | 291 |
| | 10 | 294 | 260 | 220 | 198 | 175 | 477 | 418 | 353 | 319 | 284 |
| | 11 | 271 | 241 | 204 | 184 | 162 | 464 | 406 | 344 | 311 | 277 |
| | 12 | 246 | 220 | 187 | 169 | 150 | 450 | 395 | 334 | 302 | 269 |
| | 13 | 221 | 199 | 170 | 154 | 136 | 436 | 383 | 324 | 293 | 260 |
| | 14 | 193 | 176 | 151 | 138 | 122 | 422 | 370 | 314 | 283 | 252 |
| | 15 | 168 | 153 | 133 | 121 | 107 | 407 | 357 | 303 | 273 | 243 |
| | 16 | 148 | 135 | 116 | 106 | 94 | 391 | 344 | 291 | 263 | 234 |
| | 17 | 131 | 119 | 103 | 94 | 84 | 375 | 330 | 279 | 252 | 224 |
| | 18 | 117 | 106 | 92 | 84 | 75 | 358 | 315 | 267 | 241 | 215 |
| | 19 | 105 | 96 | 83 | 75 | 67 | 341 | 300 | 255 | 230 | 204 |
| | 20 | 95 | 86 | 75 | 68 | 60 | 323 | 285 | 242 | 218 | 194 |
| | 21 | 86 | 78 | 68 | 62 | 55 | 304 | 269 | 228 | 206 | 183 |
| | 22 | 78 | 71 | 62 | 56 | 50 | 285 | 253 | 215 | 194 | 172 |
| | 23 | 72 | 65 | 56 | 51 | 46 | 266 | 236 | 200 | 181 | 160 |
| | 24 | 66 | 60 | 52 | 47 | 42 | 245 | 218 | 185 | 168 | 149 |
| | 25 | 61 | 55 | 48 | 43 | 39 | 226 | 201 | 171 | 154 | 137 |
| | 26 | | 51 | 44 | 40 | 36 | 209 | 186 | 158 | 143 | 127 |
| | 27 | | | 41 | 37 | 33 | 194 | 172 | 147 | 132 | 117 |
| | 28 | | | | | 31 | 180 | 160 | 136 | 123 | 109 |
| | 29 | | | | | | 168 | 149 | 127 | 115 | 102 |
| | 30 | | | | | | 157 | 139 | 119 | 107 | 95 |
| | 31 | | | | | | 147 | 131 | 111 | 100 | 89 |
| | 32 | | | | | | 138 | 123 | 104 | 94 | 84 |
| | 33 | | | | | | 130 | 115 | 98 | 89 | 79 |
| | 34 | | | | | | 122 | 109 | 92 | 84 | 74 |
| | 35 | | | | | | 115 | 102 | 87 | 79 | 70 |
| | 36 | | | | | | 109 | 97 | 82 | 75 | 66 |
| | 37 | | | | | | 103 | 92 | 78 | 71 | 63 |
| | 38 | | | | | | 98 | 87 | 74 | 67 | 59 |
| | 39 | | | | | | 93 | 83 | 70 | 63 | 56 |
| | 40 | | | | | | 88 | 78 | 67 | 60 | 53 |
| **Properties** | | | | | | | | | | | |
| Area, In.$^2$ | | 14.0 | 11.6 | 8.97 | 7.59 | 6.17 | 16.4 | 13.5 | 10.4 | 8.76 | 7.10 |
| $I_x$, In.$^4$ | | 149 | 129 | 104 | 90.1 | 74.7 | 174 | 149 | 119 | 102 | 84.1 |
| $I_y$, In.$^4$ | | 33.4 | 29.4 | 24.3 | 21.2 | 17.7 | 117 | 100 | 80.4 | 69.2 | 57.2 |
| Ratio, $r_x/r_y$ | | 2.11 | 2.09 | 2.07 | 2.06 | 2.05 | 1.22 | 1.22 | 1.21 | 1.21 | 1.21 |
| $r_y$, In. | | 1.54 | 1.59 | 1.64 | 1.67 | 1.70 | 2.68 | 2.73 | 2.78 | 2.81 | 2.84 |
| $B_x$, Bending Factor | | 0.470 | 0.450 | 0.431 | 0.421 | 0.413 | 0.424 | 0.408 | 0.393 | 0.386 | 0.380 |
| $B_y$, Bending Factor | | 0.838 | 0.789 | 0.738 | 0.716 | 0.697 | 0.491 | 0.473 | 0.453 | 0.443 | 0.434 |
| $a_x \div 10^6$ | | 24.5 | 21.8 | 18.5 | 16.7 | 14.6 | 30.0 | 26.8 | 22.8 | 20.5 | 18.1 |
| $a_y \div 10^6$ | | 5.48 | 4.98 | 4.32 | 3.92 | 3.45 | 20.2 | 18.0 | 15.4 | 13.9 | 12.3 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

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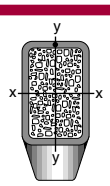
# HSS / Rectangular Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips




**f'c = 5.0**

$f'_c$=5.0 ksi

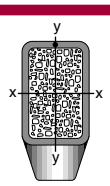
| Nominal Size | | 9 x 5 | | | | | 8 x 6 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 5/8 | 1/2 | 3/8 | 5/16 | 1/4 | 5/8 | 1/2 | 3/8 | 5/16 | 1/4 | 3/16 |
| Weight Per Foot | | 50.81 | 42.05 | 32.58 | 27.59 | 22.42 | 50.81 | 42.05 | 32.58 | 27.59 | 22.42 | 17.08 |
| Design Wall Thickness | | 0.581 | 0.465 | 0.349 | 0.291 | 0.233 | 0.581 | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 |
| | | $F_y$ = 46 ksi | | | | | | | | | | |
| Effective length KL in feet | 0 | 462 | 403 | 338 | 304 | 269 | 470 | 411 | 346 | 312 | 276 | 239 |
| | 4 | 428 | 374 | 314 | 283 | 250 | 442 | 387 | 326 | 294 | 260 | 225 |
| | 5 | 417 | 364 | 306 | 275 | 243 | 432 | 379 | 319 | 288 | 255 | 220 |
| | 6 | 404 | 354 | 298 | 268 | 237 | 422 | 370 | 312 | 281 | 249 | 215 |
| | 7 | 391 | 342 | 288 | 259 | 229 | 412 | 361 | 304 | 274 | 243 | 210 |
| | 8 | 376 | 330 | 278 | 250 | 221 | 400 | 351 | 296 | 267 | 237 | 204 |
| | 9 | 361 | 317 | 268 | 241 | 213 | 388 | 341 | 288 | 259 | 230 | 198 |
| | 10 | 345 | 303 | 256 | 230 | 204 | 375 | 330 | 279 | 251 | 222 | 192 |
| | 11 | 328 | 289 | 245 | 220 | 195 | 362 | 318 | 269 | 242 | 215 | 185 |
| | 12 | 310 | 274 | 232 | 209 | 185 | 348 | 306 | 259 | 233 | 207 | 178 |
| | 13 | 291 | 258 | 219 | 197 | 174 | 333 | 293 | 248 | 224 | 198 | 171 |
| | 14 | 272 | 241 | 205 | 185 | 164 | 317 | 280 | 238 | 214 | 190 | 163 |
| | 15 | 251 | 224 | 191 | 172 | 152 | 301 | 266 | 226 | 204 | 181 | 155 |
| | 16 | 230 | 205 | 176 | 159 | 141 | 285 | 252 | 214 | 193 | 171 | 147 |
| | 17 | 207 | 186 | 161 | 145 | 128 | 267 | 237 | 202 | 182 | 161 | 139 |
| | 18 | 185 | 167 | 145 | 130 | 116 | 250 | 222 | 189 | 170 | 151 | 130 |
| | 19 | 166 | 150 | 130 | 117 | 104 | 231 | 206 | 176 | 159 | 141 | 120 |
| | 20 | 150 | 135 | 117 | 105 | 94 | 211 | 189 | 163 | 146 | 130 | 111 |
| | 21 | 136 | 123 | 106 | 96 | 85 | 192 | 172 | 148 | 133 | 118 | 101 |
| | 22 | 124 | 112 | 97 | 87 | 77 | 175 | 157 | 135 | 121 | 108 | 92 |
| | 23 | 113 | 102 | 89 | 80 | 71 | 160 | 144 | 124 | 111 | 99 | 84 |
| | 24 | 104 | 94 | 81 | 73 | 65 | 147 | 132 | 114 | 102 | 90 | 77 |
| | 25 | 96 | 87 | 75 | 67 | 60 | 135 | 121 | 105 | 94 | 83 | 71 |
| | 26 | 89 | 80 | 69 | 62 | 55 | 125 | 112 | 97 | 87 | 77 | 66 |
| | 27 | 82 | 74 | 64 | 58 | 51 | 116 | 104 | 90 | 81 | 71 | 61 |
| | 28 | 76 | 69 | 60 | 54 | 48 | 108 | 97 | 83 | 75 | 66 | 57 |
| | 29 | 71 | 64 | 56 | 50 | 45 | 101 | 90 | 78 | 70 | 62 | 53 |
| | 30 | 67 | 60 | 52 | 47 | 42 | 94 | 84 | 73 | 65 | 58 | 50 |
| | 31 | 62 | 56 | 49 | 44 | 39 | 88 | 79 | 68 | 61 | 54 | 46 |
| | 32 | 59 | 53 | 46 | 41 | 37 | 83 | 74 | 64 | 57 | 51 | 44 |
| | 33 | | | 43 | 39 | 34 | 78 | 70 | 60 | 54 | 48 | 41 |
| | 34 | | | | 36 | 32 | 73 | 66 | 57 | 51 | 45 | 39 |
| | 35 | | | | | | 69 | 62 | 53 | 48 | 43 | 36 |
| | 36 | | | | | | 65 | 59 | 50 | 45 | 40 | 34 |
| | 37 | | | | | | 62 | 55 | 48 | 43 | 38 | 33 |
| | 38 | | | | | | | 53 | 45 | 41 | 36 | 31 |
| | 39 | | | | | | | | 43 | 39 | 34 | 29 |
| | 40 | | | | | | | | | 37 | 33 | 28 |
| **Properties** | | | | | | | | | | | | |
| Area, In.$^2$ | | 14.0 | 11.6 | 8.97 | 7.59 | 6.17 | 14.0 | 11.6 | 8.97 | 7.59 | 6.17 | 4.67 |
| $I_x$, In.$^4$ | | 133 | 115 | 92.5 | 79.8 | 66.1 | 114 | 98.2 | 79.1 | 68.3 | 56.6 | 43.7 |
| $I_y$, In.$^4$ | | 51.9 | 45.2 | 36.8 | 32.0 | 26.6 | 72.2 | 62.5 | 50.6 | 43.8 | 36.4 | 28.2 |
| Ratio, $r_x/r_y$ | | 1.60 | 1.59 | 1.58 | 1.58 | 1.58 | 1.26 | 1.25 | 1.25 | 1.25 | 1.25 | 1.25 |
| $r_y$, In. | | 1.92 | 1.97 | 2.03 | 2.05 | 2.08 | 2.27 | 2.32 | 2.38 | 2.40 | 2.43 | 2.46 |
| $B_x$, Bending Factor | | 0.474 | 0.454 | 0.436 | 0.428 | 0.420 | 0.491 | 0.473 | 0.454 | 0.445 | 0.436 | 0.427 |
| $B_y$, Bending Factor | | 0.674 | 0.642 | 0.609 | 0.593 | 0.580 | 0.582 | 0.557 | 0.532 | 0.520 | 0.509 | 0.497 |
| $a_x \div 10^6$ | | 22.2 | 19.9 | 16.9 | 15.2 | 13.3 | 19.3 | 17.2 | 14.7 | 13.2 | 11.7 | 9.92 |
| $a_y \div 10^6$ | | 8.68 | 7.82 | 6.72 | 6.09 | 5.37 | 12.2 | 10.9 | 9.38 | 8.48 | 7.50 | 6.40 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

ERW

# HSS / Rectangular Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips




**f'c = 5.0**



| Nominal Size | | 8 x 4 | | | | | | 7 x 5 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 5/8 | 1/2 | 3/8 | 5/16 | 1/4 | 3/16 | 5/8 | 1/2 | 3/8 | 5/16 | 1/4 | 3/16 |
| Weight Per Foot | | 42.30 | 35.24 | 27.48 | 23.34 | 19.02 | 14.53 | 42.30 | 35.24 | 27.48 | 23.34 | 19.02 | 14.53 |
| Design Wall Thickness | | 0.581 | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 | 0.581 | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 |
| | | $F_y$ = 46 ksi | | | | | | | | | | | |
| Effective length KL in feet | 0 | 372 | 324 | 270 | 242 | 212 | 181 | 379 | 331 | 278 | 250 | 220 | 189 |
| | 4 | 334 | 292 | 245 | 219 | 193 | 164 | 350 | 306 | 258 | 231 | 204 | 175 |
| | 5 | 322 | 281 | 236 | 211 | 186 | 158 | 340 | 298 | 251 | 225 | 199 | 170 |
| | 6 | 307 | 270 | 226 | 203 | 178 | 152 | 330 | 289 | 243 | 219 | 193 | 165 |
| | 7 | 292 | 257 | 216 | 194 | 170 | 145 | 318 | 279 | 235 | 211 | 186 | 160 |
| | 8 | 276 | 243 | 205 | 184 | 162 | 138 | 306 | 269 | 227 | 204 | 180 | 154 |
| | 9 | 258 | 228 | 193 | 173 | 152 | 130 | 293 | 258 | 217 | 196 | 173 | 148 |
| | 10 | 240 | 213 | 180 | 162 | 143 | 122 | 279 | 246 | 208 | 187 | 165 | 141 |
| | 11 | 220 | 196 | 167 | 150 | 132 | 113 | 264 | 234 | 198 | 178 | 157 | 135 |
| | 12 | 199 | 179 | 153 | 137 | 122 | 104 | 249 | 221 | 187 | 168 | 149 | 127 |
| | 13 | 177 | 160 | 138 | 124 | 110 | 94 | 233 | 207 | 176 | 158 | 140 | 120 |
| | 14 | 154 | 141 | 122 | 110 | 98 | 84 | 216 | 193 | 164 | 148 | 131 | 112 |
| | 15 | 134 | 123 | 107 | 96 | 86 | 73 | 198 | 178 | 152 | 137 | 121 | 104 |
| | 16 | 118 | 108 | 94 | 84 | 75 | 64 | 180 | 162 | 139 | 126 | 111 | 95 |
| | 17 | 105 | 96 | 83 | 75 | 67 | 57 | 161 | 146 | 125 | 114 | 101 | 86 |
| | 18 | 93 | 85 | 74 | 67 | 59 | 51 | 143 | 130 | 112 | 102 | 90 | 77 |
| | 19 | 84 | 77 | 66 | 60 | 53 | 46 | 129 | 117 | 100 | 91 | 81 | 69 |
| | 20 | 76 | 69 | 60 | 54 | 48 | 41 | 116 | 105 | 91 | 82 | 73 | 62 |
| | 21 | 68 | 63 | 54 | 49 | 44 | 37 | 105 | 95 | 82 | 75 | 66 | 57 |
| | 22 | 62 | 57 | 50 | 45 | 40 | 34 | 96 | 87 | 75 | 68 | 60 | 51 |
| | 23 | 57 | 52 | 45 | 41 | 36 | 31 | 88 | 80 | 69 | 62 | 55 | 47 |
| | 24 | 52 | 48 | 42 | 38 | 33 | 29 | 81 | 73 | 63 | 57 | 51 | 43 |
| | 25 | 48 | 44 | 38 | 35 | 31 | 26 | 74 | 67 | 58 | 53 | 47 | 40 |
| | 26 | | 41 | 36 | 32 | 28 | 24 | 69 | 62 | 54 | 49 | 43 | 37 |
| | 27 | | | | 30 | 26 | 23 | 64 | 58 | 50 | 45 | 40 | 34 |
| | 28 | | | | | | 21 | 59 | 54 | 46 | 42 | 37 | 32 |
| | 29 | | | | | | | 55 | 50 | 43 | 39 | 35 | 30 |
| | 30 | | | | | | | 52 | 47 | 40 | 37 | 32 | 28 |
| | 31 | | | | | | | 48 | 44 | 38 | 34 | 30 | 26 |
| | 32 | | | | | | | | | 35 | 32 | 29 | 24 |
| | 33 | | | | | | | | | | 30 | 27 | 23 |
| | 34 | | | | | | | | | | | | 22 |
| | 35 | | | | | | | | | | | | |
| | 36 | | | | | | | | | | | | |
| | 37 | | | | | | | | | | | | |
| | 38 | | | | | | | | | | | | |
| | 39 | | | | | | | | | | | | |
| | 40 | | | | | | | | | | | | |
| **Properties** | | | | | | | | | | | | | |
| Area, In.$^2$ | | 11.7 | 9.74 | 7.58 | 6.43 | 5.24 | 3.98 | 11.7 | 9.74 | 7.58 | 6.43 | 5.24 | 3.98 |
| $I_x$, In.$^4$ | | 81.9 | 71.7 | 58.7 | 51.0 | 42.5 | 33.1 | 69.3 | 60.6 | 49.5 | 43.0 | 35.8 | 27.9 |
| $I_y$, In.$^4$ | | 26.6 | 23.6 | 19.6 | 17.2 | 14.4 | 11.3 | 40.5 | 35.6 | 29.2 | 25.5 | 21.3 | 16.6 |
| Ratio, $r_x/r_y$ | | 1.76 | 1.74 | 1.73 | 1.72 | 1.72 | 1.71 | 1.31 | 1.30 | 1.30 | 1.30 | 1.30 | 1.29 |
| $r_y$, In. | | 1.51 | 1.56 | 1.61 | 1.63 | 1.66 | 1.69 | 1.86 | 1.91 | 1.96 | 1.99 | 2.02 | 2.05 |
| $B_x$, Bending Factor | | 0.571 | 0.543 | 0.517 | 0.504 | 0.493 | 0.481 | 0.591 | 0.563 | 0.536 | 0.523 | 0.512 | 0.499 |
| $B_y$, Bending Factor | | 0.880 | 0.825 | 0.773 | 0.748 | 0.728 | 0.704 | 0.722 | 0.684 | 0.649 | 0.630 | 0.615 | 0.599 |
| $a_x \div 10^6$ | | 13.4 | 12.0 | 10.3 | 9.30 | 8.16 | 6.89 | 11.4 | 10.3 | 8.87 | 8.01 | 7.04 | 5.99 |
| $a_y \div 10^6$ | | 4.34 | 3.96 | 3.45 | 3.14 | 2.76 | 2.35 | 6.69 | 6.07 | 5.23 | 4.75 | 4.19 | 3.56 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

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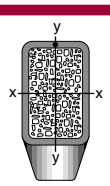
# HSS / Rectangular Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips




**f'c = 5.0**

f'c=5.0 ksi

| Nominal Size | | 7 x 4 | | | | | 6 x 5 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 1/2 | 3/8 | 5/16 | 1/4 | 3/16 | 3/8 | 5/16 | 1/4 | 3/16 |
| Weight Per Foot | | 31.84 | 24.93 | 21.21 | 17.32 | 13.25 | 24.93 | 21.21 | 17.32 | 13.25 |
| Design Wall Thickness | | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 | 0.349 | 0.291 | 0.233 | 0.174 |
| | | $F_y$ = 46 ksi | | | | | | | | |
| Effective length KL in feet | 0 | 290 | 243 | 217 | 190 | 162 | 248 | 222 | 196 | 167 |
| | 4 | 261 | 219 | 196 | 172 | 147 | 229 | 206 | 181 | 155 |
| | 5 | 251 | 211 | 189 | 166 | 141 | 223 | 200 | 176 | 150 |
| | 6 | 241 | 202 | 182 | 159 | 136 | 216 | 194 | 171 | 146 |
| | 7 | 229 | 193 | 173 | 152 | 129 | 209 | 187 | 165 | 141 |
| | 8 | 216 | 182 | 164 | 144 | 123 | 201 | 180 | 159 | 136 |
| | 9 | 203 | 172 | 154 | 136 | 115 | 192 | 173 | 152 | 130 |
| | 10 | 188 | 160 | 144 | 127 | 108 | 184 | 165 | 146 | 124 |
| | 11 | 173 | 148 | 133 | 118 | 100 | 174 | 157 | 138 | 118 |
| | 12 | 157 | 135 | 122 | 108 | 91 | 164 | 148 | 131 | 112 |
| | 13 | 140 | 121 | 110 | 97 | 82 | 154 | 139 | 123 | 105 |
| | 14 | 122 | 106 | 97 | 86 | 73 | 143 | 130 | 114 | 98 |
| | 15 | 106 | 93 | 85 | 75 | 63 | 132 | 120 | 106 | 90 |
| | 16 | 93 | 81 | 74 | 66 | 56 | 120 | 109 | 96 | 82 |
| | 17 | 83 | 72 | 66 | 59 | 49 | 108 | 98 | 87 | 74 |
| | 18 | 74 | 64 | 59 | 52 | 44 | 96 | 88 | 78 | 66 |
| | 19 | 66 | 58 | 53 | 47 | 40 | 86 | 79 | 70 | 59 |
| | 20 | 60 | 52 | 48 | 42 | 36 | 78 | 71 | 63 | 53 |
| | 21 | 54 | 47 | 43 | 38 | 32 | 71 | 64 | 57 | 49 |
| | 22 | 49 | 43 | 39 | 35 | 29 | 64 | 59 | 52 | 44 |
| | 23 | 45 | 39 | 36 | 32 | 27 | 59 | 54 | 47 | 40 |
| | 24 | 41 | 36 | 33 | 29 | 25 | 54 | 49 | 44 | 37 |
| | 25 | 38 | 33 | 30 | 27 | 23 | 50 | 45 | 40 | 34 |
| | 26 | | 31 | 28 | 25 | 21 | 46 | 42 | 37 | 32 |
| | 27 | | | | 23 | 20 | 43 | 39 | 34 | 29 |
| | 28 | | | | | | 40 | 36 | 32 | 27 |
| | 29 | | | | | | 37 | 34 | 30 | 25 |
| | 30 | | | | | | 35 | 32 | 28 | 24 |
| | 31 | | | | | | 32 | 30 | 26 | 22 |
| | 32 | | | | | | 30 | 28 | 25 | 21 |
| | 33 | | | | | | | | 23 | 20 |
| | 34 | | | | | | | | | |
| | 35 | | | | | | | | | |
| | 36 | | | | | | | | | |
| | 37 | | | | | | | | | |
| | 38 | | | | | | | | | |
| | 39 | | | | | | | | | |
| | 40 | | | | | | | | | |
| **Properties** | | | | | | | | | | |
| Area, In.$^2$ | | 8.81 | 6.88 | 5.85 | 4.77 | 3.63 | 6.88 | 5.85 | 4.77 | 3.63 |
| $I_x$, In.$^4$ | | 50.6 | 41.8 | 36.4 | 30.5 | 23.8 | 33.9 | 29.6 | 24.7 | 19.3 |
| $I_y$, In.$^4$ | | 20.7 | 17.3 | 15.2 | 12.8 | 10.0 | 25.5 | 22.3 | 18.7 | 14.6 |
| Ratio, $r_x/r_y$ | | 1.57 | 1.56 | 1.55 | 1.55 | 1.54 | 1.15 | 1.15 | 1.15 | 1.15 |
| $r_y$, In. | | 1.53 | 1.58 | 1.61 | 1.64 | 1.66 | 1.92 | 1.95 | 1.98 | 2.01 |
| $B_x$, Bending Factor | | 0.609 | 0.576 | 0.563 | 0.547 | 0.534 | 0.609 | 0.593 | 0.579 | 0.564 |
| $B_y$, Bending Factor | | 0.851 | 0.795 | 0.770 | 0.745 | 0.726 | 0.675 | 0.656 | 0.638 | 0.622 |
| $a_x \div 10^6$ | | 8.45 | 7.30 | 6.58 | 5.79 | 4.89 | 6.00 | 5.43 | 4.78 | 4.05 |
| $a_y \div 10^6$ | | 3.45 | 3.02 | 2.75 | 2.43 | 2.05 | 4.51 | 4.09 | 3.62 | 3.07 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

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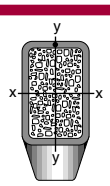
# HSS / Rectangular Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips

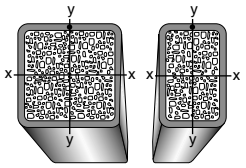



**f'c = 5.0**

| Nominal Size | | 6 x 4 | | | | | 5 x 4 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 1/2 | 3/8 | 5/16 | 1/4 | 3/16 | 1/2 | 3/8 | 5/16 | 1/4 | 3/16 |
| Weight Per Foot | | 28.43 | 22.37 | 19.08 | 15.62 | 11.97 | 25.03 | 19.82 | 16.96 | 13.91 | 10.70 |
| Design Wall Thickness | | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 |
| | | $F_y$ = 46 ksi | | | | | | | | | |
| Effective length KL in feet | 0 | 257 | 215 | 192 | 168 | 143 | 223 | 187 | 167 | 147 | 124 |
| | 4 | 231 | 194 | 173 | 152 | 129 | 200 | 168 | 151 | 132 | 112 |
| | 5 | 222 | 186 | 167 | 147 | 124 | 192 | 162 | 145 | 127 | 108 |
| | 6 | 212 | 178 | 160 | 140 | 119 | 183 | 155 | 139 | 122 | 103 |
| | 7 | 201 | 170 | 152 | 134 | 114 | 173 | 147 | 132 | 116 | 98 |
| | 8 | 189 | 160 | 144 | 127 | 107 | 163 | 139 | 124 | 109 | 93 |
| | 9 | 177 | 150 | 135 | 119 | 101 | 152 | 130 | 116 | 103 | 87 |
| | 10 | 164 | 140 | 126 | 111 | 94 | 140 | 120 | 108 | 95 | 81 |
| | 11 | 150 | 129 | 116 | 103 | 87 | 127 | 110 | 99 | 88 | 74 |
| | 12 | 136 | 117 | 106 | 94 | 79 | 114 | 100 | 90 | 79 | 67 |
| | 13 | 120 | 104 | 95 | 84 | 71 | 100 | 88 | 80 | 71 | 60 |
| | 14 | 104 | 91 | 83 | 74 | 62 | 86 | 77 | 69 | 62 | 53 |
| | 15 | 91 | 79 | 72 | 64 | 54 | 75 | 67 | 60 | 54 | 46 |
| | 16 | 80 | 70 | 64 | 57 | 48 | 66 | 59 | 53 | 47 | 40 |
| | 17 | 71 | 62 | 56 | 50 | 42 | 58 | 52 | 47 | 42 | 36 |
| | 18 | 63 | 55 | 50 | 45 | 38 | 52 | 46 | 42 | 37 | 32 |
| | 19 | 57 | 49 | 45 | 40 | 34 | 47 | 42 | 38 | 34 | 29 |
| | 20 | 51 | 45 | 41 | 36 | 31 | 42 | 38 | 34 | 30 | 26 |
| | 21 | 46 | 40 | 37 | 33 | 28 | 38 | 34 | 31 | 27 | 23 |
| | 22 | 42 | 37 | 34 | 30 | 25 | 35 | 31 | 28 | 25 | 21 |
| | 23 | 39 | 34 | 31 | 27 | 23 | 32 | 28 | 26 | 23 | 19 |
| | 24 | 35 | 31 | 28 | 25 | 21 | 29 | 26 | 24 | 21 | 18 |
| | 25 | 33 | 29 | 26 | 23 | 20 | | 24 | 22 | 19 | 16 |
| | 26 | | | 24 | 21 | 18 | | | | 18 | 15 |
| | 27 | | | | | 17 | | | | | |
| | 28 | | | | | | | | | | |
| | 29 | | | | | | | | | | |
| | 30 | | | | | | | | | | |
| | 31 | | | | | | | | | | |
| | 32 | | | | | | | | | | |
| | 33 | | | | | | | | | | |
| | 34 | | | | | | | | | | |
| | 35 | | | | | | | | | | |
| | 36 | | | | | | | | | | |
| | 37 | | | | | | | | | | |
| | 38 | | | | | | | | | | |
| | 39 | | | | | | | | | | |
| | 40 | | | | | | | | | | |
| **Properties** | | | | | | | | | | | |
| Area, In.$^2$ | | 7.88 | 6.18 | 5.26 | 4.30 | 3.28 | 6.95 | 5.48 | 4.68 | 3.84 | 2.93 |
| $I_x$, In.$^4$ | | 33.9 | 28.3 | 24.8 | 20.9 | 16.4 | 21.2 | 17.9 | 15.8 | 13.4 | 10.6 |
| $I_y$, In.$^4$ | | 17.7 | 14.9 | 13.1 | 11.1 | 8.76 | 14.8 | 12.6 | 11.1 | 9.46 | 7.48 |
| Ratio, $r_x/r_y$ | | 1.38 | 1.38 | 1.37 | 1.37 | 1.37 | 1.20 | 1.19 | 1.19 | 1.19 | 1.19 |
| $r_y$, In. | | 1.50 | 1.55 | 1.58 | 1.61 | 1.63 | 1.46 | 1.52 | 1.54 | 1.57 | 1.60 |
| $B_x$, Bending Factor | | 0.697 | 0.655 | 0.636 | 0.617 | 0.600 | 0.820 | 0.765 | 0.741 | 0.716 | 0.691 |
| $B_y$, Bending Factor | | 0.890 | 0.830 | 0.803 | 0.775 | 0.749 | 0.939 | 0.870 | 0.843 | 0.812 | 0.783 |
| $a_x \div 10^6$ | | 5.62 | 4.89 | 4.43 | 3.92 | 3.31 | 3.48 | 3.06 | 2.79 | 2.47 | 2.10 |
| $a_y \div 10^6$ | | 2.93 | 2.58 | 2.34 | 2.08 | 1.77 | 2.43 | 2.15 | 1.96 | 1.74 | 1.48 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

# HSS/Structural Steel Tubing for Composite Columns
## Notes

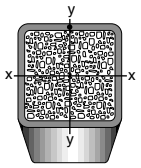



f'c = 5.0

ERW

# HSS / Square Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips

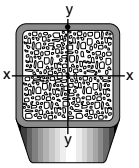



**f'c = 8.0**

| Nominal Size | | 16 x 16 | | | 14 x 14 | | | 12 x 12 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 5/8 | 1/2 | 3/8 | 5/8 | 1/2 | 3/8 | 5/8 | 1/2 | 3/8 | 5/16 |
| Weight Per Foot | | 127.37 | 103.30 | 78.52 | 110.36 | 89.68 | 68.31 | 93.34 | 76.07 | 58.10 | 48.86 |
| Design Wall Thickness | | 0.581 | 0.465 | 0.349 | 0.581 | 0.465 | 0.349 | 0.581 | 0.465 | 0.349 | 0.291 |
| | | $F_y$ = 46 ksi | | | | | | | | | |
| Effective length KL in feet | 0 | 1860 | 1710 | 1550 | 1510 | 1380 | 1240 | 1190 | 1080 | 962 | 901 |
| | 4 | 1820 | 1670 | 1520 | 1470 | 1340 | 1210 | 1150 | 1050 | 934 | 875 |
| | 5 | 1810 | 1660 | 1510 | 1460 | 1330 | 1200 | 1140 | 1040 | 926 | 867 |
| | 6 | 1800 | 1650 | 1500 | 1450 | 1320 | 1190 | 1130 | 1030 | 917 | 858 |
| | 7 | 1790 | 1640 | 1480 | 1440 | 1310 | 1180 | 1120 | 1020 | 907 | 849 |
| | 8 | 1780 | 1630 | 1470 | 1430 | 1300 | 1170 | 1110 | 1010 | 898 | 840 |
| | 9 | 1760 | 1610 | 1460 | 1410 | 1290 | 1160 | 1100 | 994 | 887 | 830 |
| | 10 | 1750 | 1600 | 1450 | 1400 | 1280 | 1150 | 1080 | 982 | 876 | 819 |
| | 11 | 1730 | 1590 | 1440 | 1390 | 1260 | 1130 | 1070 | 969 | 865 | 809 |
| | 12 | 1720 | 1570 | 1420 | 1370 | 1250 | 1120 | 1060 | 956 | 853 | 797 |
| | 13 | 1700 | 1560 | 1410 | 1360 | 1230 | 1110 | 1040 | 943 | 841 | 786 |
| | 14 | 1690 | 1540 | 1400 | 1340 | 1220 | 1100 | 1030 | 929 | 828 | 774 |
| | 15 | 1670 | 1530 | 1380 | 1320 | 1210 | 1080 | 1010 | 915 | 815 | 761 |
| | 16 | 1650 | 1510 | 1370 | 1310 | 1190 | 1070 | 995 | 900 | 801 | 748 |
| | 17 | 1640 | 1500 | 1350 | 1290 | 1170 | 1050 | 978 | 885 | 787 | 735 |
| | 18 | 1620 | 1480 | 1340 | 1270 | 1160 | 1040 | 961 | 869 | 773 | 721 |
| | 19 | 1600 | 1460 | 1320 | 1260 | 1140 | 1020 | 944 | 853 | 758 | 707 |
| | 20 | 1580 | 1450 | 1300 | 1240 | 1120 | 1010 | 926 | 836 | 743 | 693 |
| | 21 | 1560 | 1430 | 1290 | 1220 | 1110 | 991 | 907 | 819 | 727 | 678 |
| | 22 | 1540 | 1410 | 1270 | 1200 | 1090 | 974 | 888 | 802 | 711 | 662 |
| | 23 | 1520 | 1390 | 1250 | 1180 | 1070 | 957 | 869 | 784 | 695 | 647 |
| | 24 | 1500 | 1370 | 1240 | 1160 | 1050 | 940 | 849 | 766 | 678 | 631 |
| | 25 | 1480 | 1350 | 1220 | 1140 | 1030 | 922 | 828 | 747 | 661 | 615 |
| | 26 | 1460 | 1330 | 1200 | 1120 | 1010 | 904 | 808 | 728 | 644 | 598 |
| | 27 | 1440 | 1310 | 1180 | 1100 | 994 | 886 | 786 | 709 | 626 | 581 |
| | 28 | 1420 | 1290 | 1160 | 1070 | 974 | 867 | 765 | 689 | 608 | 564 |
| | 29 | 1390 | 1270 | 1140 | 1050 | 953 | 848 | 743 | 669 | 589 | 546 |
| | 30 | 1370 | 1250 | 1120 | 1030 | 932 | 829 | 720 | 648 | 570 | 528 |
| | 31 | 1350 | 1230 | 1100 | 1010 | 910 | 809 | 697 | 627 | 550 | 509 |
| | 32 | 1320 | 1200 | 1080 | 983 | 888 | 789 | 673 | 605 | 531 | 490 |
| | 33 | 1300 | 1180 | 1060 | 959 | 866 | 768 | 649 | 583 | 510 | 471 |
| | 34 | 1270 | 1160 | 1040 | 935 | 843 | 747 | 625 | 560 | 490 | 451 |
| | 35 | 1250 | 1130 | 1010 | 910 | 820 | 726 | 600 | 537 | 468 | 431 |
| | 36 | 1220 | 1110 | 993 | 885 | 797 | 704 | 574 | 514 | 447 | 410 |
| | 37 | 1200 | 1090 | 970 | 859 | 773 | 682 | 548 | 490 | 425 | 389 |
| | 38 | 1170 | 1060 | 947 | 833 | 749 | 659 | 522 | 466 | 403 | 369 |
| | 39 | 1140 | 1040 | 924 | 806 | 724 | 636 | 495 | 442 | 382 | 350 |
| | 40 | 1120 | 1010 | 900 | 779 | 699 | 613 | 471 | 420 | 364 | 333 |
| **Properties** | | | | | | | | | | | |
| Area, In.$^2$ | | 35.0 | 28.3 | 21.5 | 30.3 | 24.6 | 18.7 | 25.7 | 20.9 | 16.0 | 13.4 |
| I, In.$^4$ | | 1370 | 1130 | 873 | 896 | 743 | 577 | 548 | 457 | 357 | 304 |
| r, In. | | 6.25 | 6.31 | 6.37 | 5.44 | 5.49 | 5.55 | 4.62 | 4.68 | 4.73 | 4.76 |
| B, Bending Factor | | 0.204 | 0.200 | 0.197 | 0.237 | 0.232 | 0.227 | 0.281 | 0.274 | 0.269 | 0.264 |
| a ÷ $10^6$ | | 295 | 264 | 231 | 186 | 165 | 144 | 108 | 96.8 | 83.8 | 76.7 |

# HSS / Square Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips



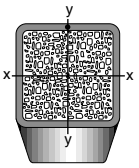

**f'c = 8.0**



| Nominal Size | | 10 x 10 | | | | | 9 x 9 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 5/8 | 1/2 | 3/8 | 5/16 | 1/4 | 1/2 | 3/8 | 5/16 | 1/4 |
| Weight Per Foot | | 76.33 | 62.46 | 47.90 | 40.35 | 32.63 | 55.66 | 42.79 | 36.10 | 29.23 |
| Design Wall Thickness | | 0.581 | 0.465 | 0.349 | 0.291 | 0.233 | 0.465 | 0.349 | 0.291 | 0.233 |
| | | $F_y$ = 46 ksi | | | | | | | | |
| Effective length KL in feet | 0 | 897 | 810 | 717 | 668 | 609 | 687 | 606 | 563 | 519 |
| | 4 | 866 | 781 | 691 | 644 | 586 | 660 | 582 | 540 | 497 |
| | 5 | 856 | 772 | 684 | 636 | 579 | 651 | 575 | 533 | 490 |
| | 6 | 846 | 763 | 675 | 629 | 572 | 642 | 566 | 525 | 483 |
| | 7 | 835 | 753 | 666 | 620 | 564 | 633 | 558 | 517 | 476 |
| | 8 | 823 | 743 | 657 | 611 | 556 | 622 | 549 | 508 | 468 |
| | 9 | 811 | 732 | 647 | 602 | 547 | 612 | 539 | 499 | 459 |
| | 10 | 799 | 720 | 637 | 592 | 538 | 600 | 529 | 490 | 450 |
| | 11 | 785 | 708 | 626 | 582 | 528 | 588 | 518 | 480 | 441 |
| | 12 | 772 | 696 | 615 | 571 | 518 | 576 | 507 | 469 | 431 |
| | 13 | 757 | 683 | 603 | 560 | 508 | 563 | 496 | 459 | 421 |
| | 14 | 742 | 669 | 591 | 548 | 497 | 550 | 484 | 447 | 410 |
| | 15 | 727 | 655 | 578 | 536 | 485 | 536 | 471 | 436 | 399 |
| | 16 | 711 | 641 | 565 | 524 | 474 | 522 | 459 | 424 | 388 |
| | 17 | 694 | 626 | 552 | 511 | 462 | 507 | 445 | 411 | 376 |
| | 18 | 678 | 610 | 538 | 498 | 450 | 492 | 432 | 398 | 364 |
| | 19 | 660 | 595 | 524 | 485 | 437 | 476 | 418 | 385 | 351 |
| | 20 | 642 | 578 | 509 | 471 | 424 | 460 | 403 | 372 | 338 |
| | 21 | 624 | 562 | 494 | 456 | 410 | 443 | 388 | 358 | 325 |
| | 22 | 605 | 545 | 478 | 442 | 396 | 426 | 373 | 343 | 312 |
| | 23 | 586 | 527 | 463 | 427 | 382 | 408 | 357 | 328 | 298 |
| | 24 | 566 | 509 | 446 | 411 | 368 | 390 | 341 | 313 | 283 |
| | 25 | 545 | 490 | 430 | 395 | 353 | 372 | 324 | 297 | 268 |
| | 26 | 525 | 472 | 413 | 379 | 338 | 353 | 307 | 281 | 253 |
| | 27 | 503 | 452 | 395 | 362 | 322 | 333 | 290 | 265 | 237 |
| | 28 | 481 | 432 | 377 | 345 | 306 | 313 | 272 | 248 | 221 |
| | 29 | 459 | 412 | 359 | 328 | 289 | 292 | 254 | 231 | 206 |
| | 30 | 436 | 391 | 340 | 310 | 272 | 273 | 237 | 216 | 193 |
| | 31 | 412 | 369 | 321 | 291 | 260 | 256 | 222 | 202 | 181 |
| | 32 | 388 | 348 | 301 | 274 | 244 | 240 | 208 | 190 | 169 |
| | 33 | 365 | 327 | 283 | 257 | 229 | 226 | 196 | 178 | 159 |
| | 34 | 344 | 308 | 267 | 242 | 216 | 213 | 184 | 168 | 150 |
| | 35 | 324 | 291 | 252 | 229 | 204 | 201 | 174 | 159 | 142 |
| | 36 | 307 | 275 | 238 | 216 | 192 | 190 | 165 | 150 | 134 |
| | 37 | 290 | 260 | 225 | 205 | 182 | 180 | 156 | 142 | 127 |
| | 38 | 275 | 246 | 213 | 194 | 173 | 170 | 148 | 135 | 120 |
| | 39 | 261 | 234 | 203 | 184 | 164 | 162 | 140 | 128 | 114 |
| | 40 | 248 | 222 | 193 | 175 | 156 | 154 | 133 | 121 | 108 |
| **Properties** | | | | | | | | | | |
| Area, In.$^2$ | | 21.0 | 17.2 | 13.2 | 11.1 | 8.96 | 15.3 | 11.8 | 9.92 | 8.03 |
| I, In.$^4$ | | 304 | 256 | 202 | 172 | 141 | 182 | 145 | 124 | 102 |
| r, In. | | 3.80 | 3.86 | 3.92 | 3.94 | 3.97 | 3.45 | 3.51 | 3.54 | 3.56 |
| B, Bending Factor | | 0.345 | 0.336 | 0.327 | 0.323 | 0.318 | 0.378 | 0.366 | 0.360 | 0.354 |
| a ÷ $10^6$ | | 57.2 | 51.3 | 44.4 | 40.3 | 35.9 | 35.4 | 30.7 | 28.0 | 25.0 |

# HSS / Square Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips



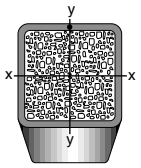

**f'c = 8.0**

| Nominal Size | | 8 x 8 | | | | | | 7 x 7 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 5/8 | 1/2 | 3/8 | 5/16 | 1/4 | 3/16 | 5/8 | 1/2 | 3/8 | 5/16 | 1/4 | 3/16 |
| Weight Per Foot | | 59.32 | 48.85 | 37.69 | 31.84 | 25.82 | 19.63 | 50.81 | 42.05 | 32.58 | 27.59 | 22.42 | 17.08 |
| Design Wall Thickness | | 0.581 | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 | 0.581 | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 |
| | | $F_y$ = 46 ksi | | | | | | | | | | | |
| Effective length KL in feet | 0 | 642 | 576 | 504 | 466 | 427 | 387 | 524 | 470 | 409 | 377 | 344 | 309 |
| | 4 | 613 | 550 | 481 | 444 | 407 | 368 | 496 | 444 | 387 | 357 | 325 | 292 |
| | 5 | 604 | 541 | 474 | 438 | 401 | 362 | 487 | 436 | 380 | 350 | 319 | 286 |
| | 6 | 594 | 532 | 466 | 430 | 394 | 356 | 477 | 428 | 372 | 343 | 313 | 280 |
| | 7 | 583 | 523 | 457 | 422 | 387 | 349 | 467 | 418 | 364 | 335 | 306 | 274 |
| | 8 | 572 | 513 | 448 | 414 | 379 | 342 | 455 | 408 | 355 | 327 | 298 | 267 |
| | 9 | 560 | 502 | 439 | 405 | 370 | 334 | 443 | 398 | 346 | 319 | 290 | 259 |
| | 10 | 547 | 491 | 429 | 396 | 362 | 326 | 431 | 386 | 336 | 310 | 282 | 251 |
| | 11 | 534 | 479 | 419 | 386 | 353 | 318 | 418 | 375 | 326 | 300 | 273 | 243 |
| | 12 | 521 | 467 | 408 | 376 | 343 | 309 | 404 | 362 | 315 | 290 | 264 | 235 |
| | 13 | 506 | 454 | 396 | 365 | 333 | 299 | 390 | 350 | 304 | 280 | 254 | 226 |
| | 14 | 492 | 440 | 385 | 354 | 323 | 290 | 375 | 336 | 293 | 269 | 244 | 217 |
| | 15 | 476 | 427 | 372 | 343 | 312 | 280 | 359 | 322 | 281 | 258 | 234 | 207 |
| | 16 | 460 | 412 | 360 | 331 | 301 | 270 | 343 | 308 | 268 | 246 | 223 | 197 |
| | 17 | 444 | 398 | 347 | 319 | 290 | 259 | 327 | 293 | 255 | 234 | 212 | 186 |
| | 18 | 427 | 382 | 333 | 306 | 278 | 248 | 309 | 278 | 242 | 221 | 200 | 176 |
| | 19 | 409 | 366 | 319 | 293 | 265 | 236 | 291 | 262 | 228 | 208 | 188 | 164 |
| | 20 | 391 | 350 | 305 | 280 | 253 | 225 | 273 | 245 | 213 | 195 | 175 | 153 |
| | 21 | 372 | 333 | 290 | 266 | 240 | 212 | 254 | 228 | 198 | 181 | 163 | 141 |
| | 22 | 353 | 316 | 275 | 252 | 226 | 200 | 234 | 210 | 183 | 167 | 149 | 128 |
| | 23 | 333 | 298 | 259 | 237 | 212 | 187 | 214 | 193 | 167 | 152 | 136 | 118 |
| | 24 | 313 | 280 | 243 | 222 | 198 | 173 | 197 | 177 | 154 | 140 | 125 | 108 |
| | 25 | 292 | 261 | 226 | 206 | 183 | 160 | 181 | 163 | 142 | 129 | 115 | 99 |
| | 26 | 270 | 242 | 209 | 190 | 169 | 148 | 167 | 151 | 131 | 119 | 107 | 92 |
| | 27 | 251 | 224 | 194 | 177 | 157 | 137 | 155 | 140 | 121 | 111 | 99 | 85 |
| | 28 | 233 | 208 | 180 | 164 | 146 | 127 | 144 | 130 | 113 | 103 | 92 | 79 |
| | 29 | 217 | 194 | 168 | 153 | 136 | 119 | 135 | 121 | 105 | 96 | 86 | 74 |
| | 30 | 203 | 181 | 157 | 143 | 127 | 111 | 126 | 113 | 98 | 90 | 80 | 69 |
| | 31 | 190 | 170 | 147 | 134 | 119 | 104 | 118 | 106 | 92 | 84 | 75 | 65 |
| | 32 | 178 | 159 | 138 | 126 | 112 | 98 | 111 | 100 | 86 | 79 | 70 | 61 |
| | 33 | 168 | 150 | 130 | 118 | 105 | 92 | 104 | 94 | 81 | 74 | 66 | 57 |
| | 34 | 158 | 141 | 122 | 111 | 99 | 86 | 98 | 88 | 77 | 70 | 62 | 54 |
| | 35 | 149 | 133 | 115 | 105 | 94 | 82 | 92 | 83 | 72 | 66 | 59 | 51 |
| | 36 | 141 | 126 | 109 | 99 | 88 | 77 | 87 | 79 | 68 | 62 | 56 | 48 |
| | 37 | 133 | 119 | 103 | 94 | 84 | 73 | 83 | 74 | 65 | 59 | 53 | 45 |
| | 38 | 127 | 113 | 98 | 89 | 79 | 69 | 78 | 71 | 61 | 56 | 50 | 43 |
| | 39 | 120 | 107 | 93 | 85 | 75 | 66 | 74 | 67 | 58 | 53 | 47 | 41 |
| | 40 | 114 | 102 | 88 | 80 | 72 | 62 | 71 | 64 | 55 | 50 | 45 | 39 |
| **Properties** | | | | | | | | | | | | | |
| Area, In.$^2$ | | 16.4 | 13.5 | 10.4 | 8.76 | 7.10 | 5.37 | 14.0 | 11.6 | 8.97 | 7.59 | 6.17 | 4.67 |
| I, In.$^4$ | | 146 | 125 | 99.6 | 85.6 | 70.7 | 54.4 | 93.3 | 80.5 | 64.9 | 56.1 | 46.5 | 36.0 |
| r, In. | | 2.99 | 3.04 | 3.10 | 3.13 | 3.15 | 3.18 | 2.58 | 2.63 | 2.69 | 2.72 | 2.75 | 2.77 |
| B, Bending Factor | | 0.449 | 0.432 | 0.418 | 0.409 | 0.402 | 0.395 | 0.525 | 0.504 | 0.484 | 0.474 | 0.464 | 0.454 |
| a ÷ $10^6$ | | 26.3 | 23.5 | 20.4 | 18.5 | 16.5 | 14.4 | 16.3 | 14.7 | 12.7 | 11.6 | 10.4 | 8.95 |

# HSS / Square Structural Steel Tubing for Composite Columns

ERW

Allowable Concentric Loads in Kips




**f'c = 8.0**

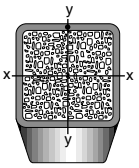
**f'c=8.0 ksi**

| Nominal Size | | 6 x 6 | | | | | | 5 1/2 x 5 1/2 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 5/8 | 1/2 | 3/8 | 5/16 | 1/4 | 3/16 | 3/8 | 5/16 | 1/4 | 3/16 | 1/8 |
| Weight Per Foot | | 42.30 | 35.24 | 27.48 | 23.34 | 19.02 | 14.53 | 24.93 | 21.21 | 17.32 | 13.25 | 9.01 |
| Design Wall Thickness | | 0.581 | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 | 0.349 | 0.291 | 0.233 | 0.174 | 0.116 |
| | | $F_y$ = 46 ksi | | | | | | | | | | |
| Effective length KL in feet | 0 | 417 | 373 | 323 | 297 | 269 | 240 | 284 | 260 | 235 | 208 | 181 |
| | 4 | 390 | 349 | 302 | 278 | 252 | 224 | 263 | 241 | 218 | 193 | 167 |
| | 5 | 381 | 341 | 295 | 271 | 246 | 219 | 256 | 235 | 212 | 188 | 162 |
| | 6 | 371 | 332 | 288 | 264 | 239 | 213 | 249 | 228 | 206 | 182 | 157 |
| | 7 | 360 | 323 | 280 | 257 | 233 | 207 | 241 | 221 | 199 | 176 | 152 |
| | 8 | 349 | 313 | 271 | 249 | 225 | 200 | 232 | 213 | 192 | 169 | 146 |
| | 9 | 337 | 302 | 262 | 240 | 218 | 193 | 223 | 204 | 184 | 162 | 140 |
| | 10 | 324 | 291 | 252 | 231 | 209 | 185 | 213 | 195 | 176 | 155 | 133 |
| | 11 | 311 | 279 | 242 | 222 | 201 | 178 | 203 | 186 | 167 | 147 | 126 |
| | 12 | 297 | 267 | 232 | 212 | 192 | 169 | 193 | 176 | 158 | 139 | 119 |
| | 13 | 282 | 254 | 220 | 202 | 182 | 161 | 182 | 166 | 149 | 131 | 111 |
| | 14 | 267 | 241 | 209 | 191 | 172 | 152 | 170 | 155 | 139 | 122 | 103 |
| | 15 | 251 | 227 | 197 | 180 | 162 | 142 | 158 | 144 | 129 | 112 | 94 |
| | 16 | 235 | 212 | 184 | 168 | 152 | 133 | 145 | 133 | 118 | 103 | 86 |
| | 17 | 217 | 197 | 171 | 156 | 140 | 122 | 132 | 120 | 107 | 92 | 76 |
| | 18 | 199 | 181 | 157 | 144 | 129 | 112 | 118 | 108 | 95 | 82 | 68 |
| | 19 | 180 | 165 | 143 | 130 | 117 | 101 | 106 | 97 | 86 | 74 | 61 |
| | 20 | 163 | 149 | 129 | 118 | 105 | 91 | 95 | 87 | 77 | 67 | 55 |
| | 21 | 148 | 135 | 117 | 107 | 95 | 83 | 87 | 79 | 70 | 61 | 50 |
| | 22 | 135 | 123 | 107 | 97 | 87 | 75 | 79 | 72 | 64 | 55 | 46 |
| | 23 | 123 | 113 | 98 | 89 | 80 | 69 | 72 | 66 | 58 | 50 | 42 |
| | 24 | 113 | 103 | 90 | 82 | 73 | 63 | 66 | 61 | 54 | 46 | 38 |
| | 25 | 104 | 95 | 83 | 75 | 67 | 58 | 61 | 56 | 49 | 43 | 35 |
| | 26 | 96 | 88 | 76 | 70 | 62 | 54 | 56 | 52 | 46 | 39 | 33 |
| | 27 | 89 | 82 | 71 | 65 | 58 | 50 | 52 | 48 | 42 | 37 | 30 |
| | 28 | 83 | 76 | 66 | 60 | 54 | 46 | 49 | 45 | 39 | 34 | 28 |
| | 29 | 77 | 71 | 61 | 56 | 50 | 43 | 45 | 42 | 37 | 32 | 26 |
| | 30 | 72 | 66 | 57 | 52 | 47 | 40 | 42 | 39 | 34 | 30 | 24 |
| | 31 | 68 | 62 | 54 | 49 | 44 | 38 | 40 | 36 | 32 | 28 | 23 |
| | 32 | 64 | 58 | 50 | 46 | 41 | 36 | 37 | 34 | 30 | 26 | 22 |
| | 33 | 60 | 55 | 47 | 43 | 39 | 33 | 35 | 32 | 28 | 25 | 20 |
| | 34 | 56 | 52 | 45 | 41 | 36 | 31 | 33 | 30 | 27 | 23 | 19 |
| | 35 | 53 | 49 | 42 | 38 | 34 | 30 | | 29 | 25 | 22 | 18 |
| | 36 | 50 | 46 | 40 | 36 | 32 | 28 | | | | 21 | 17 |
| | 37 | | 44 | 38 | 34 | 31 | 27 | | | | | |
| | 38 | | | 36 | 33 | 29 | 25 | | | | | |
| | 39 | | | | | 28 | 24 | | | | | |
| | 40 | | | | | | | | | | | |
| **Properties** | | | | | | | | | | | | |
| Area, In.$^2$ | | 11.7 | 9.74 | 7.58 | 6.43 | 5.24 | 3.90 | 6.88 | 5.85 | 4.77 | 3.63 | 2.46 |
| I, In.$^4$ | | 55.1 | 48.2 | 39.4 | 34.3 | 28.6 | 22.3 | 29.7 | 25.9 | 21.7 | 17.0 | 11.8 |
| r, In. | | 2.17 | 2.23 | 2.28 | 2.31 | 2.34 | 2.37 | 2.08 | 2.11 | 2.13 | 2.16 | 2.19 |
| B, Bending Factor | | 0.637 | 0.606 | 0.577 | 0.562 | 0.550 | 0.535 | 0.637 | 0.621 | 0.604 | 0.587 | 0.573 |
| a ÷ $10^6$ | | 9.38 | 8.58 | 7.43 | 6.78 | 6.06 | 5.24 | 5.50 | 5.03 | 4.45 | 3.84 | 3.17 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

# HSS / Square Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips




**f'c = 8.0**

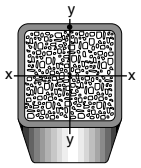
| Nominal Size | | 5 x 5 | | | | | | 4 1/2 x 4 1/2 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 1/2 | 3/8 | 5/16 | 1/4 | 3/16 | 1/8 | 1/2 | 3/8 | 5/16 | 1/4 | 3/16 | 1/8 |
| Weight Per Foot | | 28.43 | 22.37 | 19.08 | 15.62 | 11.97 | 8.16 | 25.03 | 19.82 | 16.96 | 13.91 | 10.70 | 7.31 |
| Design Wall Thickness | | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 | 0.116 | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 | 0.116 |
| | | $F_y$ = 46 ksi | | | | | | | | | | | |
| Effective length KL in feet | 0 | 284 | 246 | 225 | 202 | 179 | 154 | 243 | 210 | 192 | 172 | 151 | 129 |
| | 4 | 261 | 225 | 206 | 186 | 164 | 141 | 220 | 190 | 174 | 156 | 137 | 117 |
| | 5 | 253 | 219 | 200 | 180 | 159 | 136 | 212 | 183 | 167 | 150 | 132 | 112 |
| | 6 | 244 | 211 | 193 | 174 | 153 | 131 | 203 | 176 | 161 | 144 | 126 | 108 |
| | 7 | 235 | 203 | 186 | 167 | 147 | 126 | 193 | 168 | 153 | 138 | 120 | 102 |
| | 8 | 225 | 195 | 178 | 160 | 141 | 120 | 183 | 159 | 146 | 131 | 114 | 97 |
| | 9 | 214 | 185 | 170 | 153 | 134 | 114 | 172 | 150 | 137 | 123 | 107 | 91 |
| | 10 | 203 | 176 | 161 | 145 | 127 | 108 | 161 | 140 | 129 | 115 | 100 | 84 |
| | 11 | 191 | 166 | 151 | 136 | 119 | 101 | 149 | 130 | 119 | 107 | 93 | 78 |
| | 12 | 178 | 155 | 142 | 127 | 111 | 94 | 136 | 119 | 109 | 98 | 85 | 71 |
| | 13 | 165 | 144 | 131 | 118 | 103 | 86 | 122 | 108 | 99 | 89 | 76 | 63 |
| | 14 | 151 | 132 | 120 | 108 | 94 | 78 | 108 | 96 | 88 | 79 | 67 | 55 |
| | 15 | 137 | 119 | 109 | 98 | 85 | 70 | 94 | 84 | 77 | 69 | 59 | 48 |
| | 16 | 121 | 106 | 97 | 87 | 75 | 62 | 82 | 73 | 68 | 61 | 52 | 42 |
| | 17 | 108 | 94 | 86 | 77 | 66 | 55 | 73 | 65 | 60 | 54 | 46 | 37 |
| | 18 | 96 | 84 | 77 | 69 | 59 | 49 | 65 | 58 | 53 | 48 | 41 | 33 |
| | 19 | 86 | 75 | 69 | 62 | 53 | 44 | 58 | 52 | 48 | 43 | 37 | 30 |
| | 20 | 78 | 68 | 62 | 56 | 48 | 39 | 53 | 47 | 43 | 39 | 33 | 27 |
| | 21 | 70 | 62 | 56 | 50 | 44 | 36 | 48 | 43 | 39 | 35 | 30 | 25 |
| | 22 | 64 | 56 | 51 | 46 | 40 | 33 | 44 | 39 | 36 | 32 | 27 | 22 |
| | 23 | 59 | 51 | 47 | 42 | 36 | 30 | 40 | 36 | 33 | 29 | 25 | 20 |
| | 24 | 54 | 47 | 43 | 39 | 33 | 27 | 37 | 33 | 30 | 27 | 23 | 19 |
| | 25 | 50 | 43 | 40 | 36 | 31 | 25 | 34 | 30 | 28 | 25 | 21 | 17 |
| | 26 | 46 | 40 | 37 | 33 | 28 | 23 | 31 | 28 | 26 | 23 | 20 | 16 |
| | 27 | 43 | 37 | 34 | 31 | 26 | 22 | | 26 | 24 | 21 | 18 | 15 |
| | 28 | 40 | 35 | 32 | 28 | 24 | 20 | | | 22 | 20 | 17 | 14 |
| | 29 | 37 | 32 | 30 | 26 | 23 | 19 | | | | | 16 | 13 |
| | 30 | 35 | 30 | 28 | 25 | 21 | 18 | | | | | | |
| | 31 | | 28 | 26 | 23 | 20 | 16 | | | | | | |
| | 32 | | | | 22 | 19 | 15 | | | | | | |
| | 33 | | | | | | 15 | | | | | | |
| | 34 | | | | | | | | | | | | |
| | 35 | | | | | | | | | | | | |
| | 36 | | | | | | | | | | | | |
| | 37 | | | | | | | | | | | | |
| | 38 | | | | | | | | | | | | |
| | 39 | | | | | | | | | | | | |
| | 40 | | | | | | | | | | | | |
| **Properties** | | | | | | | | | | | | | |
| Area, In.$^2$ | | 7.88 | 6.18 | 5.26 | 4.30 | 3.28 | 2.23 | 6.95 | 5.48 | 4.68 | 3.84 | 2.93 | 2.00 |
| I, In.$^4$ | | 26.0 | 21.7 | 19.0 | 16.0 | 12.6 | 8.80 | 18.0 | 15.3 | 13.5 | 11.4 | 9.02 | 6.35 |
| r, In. | | 1.82 | 1.87 | 1.90 | 1.93 | 1.96 | 1.99 | 1.61 | 1.67 | 1.70 | 1.73 | 1.75 | 1.78 |
| B, Bending Factor | | 0.758 | 0.712 | 0.692 | 0.672 | 0.651 | 0.634 | 0.869 | 0.806 | 0.780 | 0.758 | 0.731 | 0.709 |
| a ÷ $10^6$ | | 4.47 | 3.91 | 3.58 | 3.20 | 2.76 | 2.27 | 3.04 | 2.71 | 2.49 | 2.23 | 1.90 | 1.56 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

ERW

# HSS / Square Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips




**f'c = 8.0**

$f'_c$=8.0 ksi

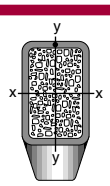
| Nominal Size | | 4 x 4 | | | | | |
|---|---|---|---|---|---|---|---|
| Wall Thickness | | 1/2 | 3/8 | 5/16 | 1/4 | 3/16 | 1/8 |
| Weight Per Foot | | 21.63 | 17.27 | 14.83 | 12.21 | 9.42 | 6.46 |
| Design Wall Thickness | | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 | 0.116 |
| | | $F_y$ = 46 ksi | | | | | |
| Effective length KL in feet | 0 | 204 | 176 | 161 | 144 | 126 | 107 |
| | 4 | 181 | 156 | 143 | 128 | 112 | 95 |
| | 5 | 173 | 150 | 137 | 123 | 107 | 90 |
| | 6 | 164 | 142 | 130 | 116 | 101 | 86 |
| | 7 | 154 | 134 | 123 | 110 | 96 | 81 |
| | 8 | 144 | 125 | 115 | 103 | 90 | 75 |
| | 9 | 133 | 116 | 106 | 95 | 83 | 70 |
| | 10 | 121 | 106 | 97 | 87 | 76 | 63 |
| | 11 | 108 | 96 | 88 | 79 | 68 | 57 |
| | 12 | 95 | 84 | 78 | 70 | 60 | 50 |
| | 13 | 81 | 73 | 67 | 60 | 52 | 43 |
| | 14 | 70 | 63 | 58 | 52 | 45 | 37 |
| | 15 | 61 | 55 | 50 | 45 | 39 | 32 |
| | 16 | 54 | 48 | 44 | 40 | 34 | 28 |
| | 17 | 48 | 42 | 39 | 35 | 30 | 25 |
| | 18 | 42 | 38 | 35 | 31 | 27 | 22 |
| | 19 | 38 | 34 | 31 | 28 | 24 | 20 |
| | 20 | 34 | 31 | 28 | 25 | 22 | 18 |
| | 21 | 31 | 28 | 26 | 23 | 20 | 16 |
| | 22 | 28 | 25 | 23 | 21 | 18 | 15 |
| | 23 | 26 | 23 | 21 | 19 | 17 | 14 |
| | 24 | | 21 | 20 | 18 | 15 | 12 |
| | 25 | | | | 16 | 14 | 12 |
| | 26 | | | | | | 11 |
| | 27 | | | | | | |
| | 28 | | | | | | |
| | 29 | | | | | | |
| | 30 | | | | | | |
| | 31 | | | | | | |
| | 32 | | | | | | |
| | 33 | | | | | | |
| | 34 | | | | | | |
| | 35 | | | | | | |
| | 36 | | | | | | |
| | 37 | | | | | | |
| | 38 | | | | | | |
| | 39 | | | | | | |
| | 40 | | | | | | |
| **Properties** | | | | | | | |
| Area, In.$^2$ | | 6.02 | 4.78 | 4.10 | 3.37 | 2.58 | 1.77 |
| I, In.$^4$ | | 11.9 | 10.3 | 9.14 | 7.80 | 6.21 | 4.40 |
| r, In. | | 1.41 | 1.46 | 1.49 | 1.52 | 1.55 | 1.58 |
| B, Bending Factor | | 1.01 | 0.928 | 0.897 | 0.864 | 0.831 | 0.805 |
| a ÷ $10^6$ | | 1.98 | 1.77 | 1.63 | 1.47 | 1.27 | 1.04 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

ERW

# HSS / Rectangular Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips




**f'c = 8.0**

| Nominal Size | | 20 x 12 | 20 x 8 | | 20 x 4 | 18 x 6 | | 16 x 12 | |
|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 1/2 | 5/8 | 1/2 | 1/2 | 5/8 | 1/2 | 1/2 | 3/8 |
| Weight Per Foot | | 103.30 | 110.36 | 89.68 | 76.07 | 93.34 | 76.07 | 89.68 | 68.31 |
| Design Wall Thickness | | 0.465 | 0.581 | 0.465 | 0.465 | 0.581 | 0.465 | 0.465 | 0.349 |
| | | $F_y$ = 46 ksi | | | | | | | |
| Effective length KL in feet | 0 | 1640 | 1360 | 1230 | 815 | 1040 | 929 | 1360 | 1220 |
| | 4 | 1600 | 1300 | 1180 | 738 | 980 | 876 | 1320 | 1190 |
| | 5 | 1580 | 1290 | 1160 | 712 | 961 | 858 | 1310 | 1180 |
| | 6 | 1570 | 1270 | 1140 | 684 | 940 | 839 | 1300 | 1170 |
| | 7 | 1550 | 1250 | 1130 | 653 | 917 | 819 | 1290 | 1150 |
| | 8 | 1540 | 1230 | 1110 | 619 | 893 | 797 | 1270 | 1140 |
| | 9 | 1520 | 1200 | 1090 | 584 | 867 | 775 | 1260 | 1130 |
| | 10 | 1510 | 1180 | 1060 | 546 | 840 | 751 | 1240 | 1120 |
| | 11 | 1490 | 1160 | 1040 | 506 | 812 | 725 | 1230 | 1100 |
| | 12 | 1470 | 1130 | 1020 | 464 | 782 | 699 | 1210 | 1090 |
| | 13 | 1450 | 1100 | 995 | 420 | 751 | 671 | 1200 | 1070 |
| | 14 | 1430 | 1080 | 969 | 373 | 719 | 642 | 1180 | 1060 |
| | 15 | 1410 | 1050 | 943 | 326 | 685 | 612 | 1160 | 1040 |
| | 16 | 1390 | 1020 | 916 | 286 | 651 | 581 | 1140 | 1020 |
| | 17 | 1370 | 987 | 888 | 254 | 614 | 549 | 1130 | 1010 |
| | 18 | 1340 | 955 | 859 | 226 | 577 | 515 | 1110 | 989 |
| | 19 | 1320 | 922 | 829 | 203 | 538 | 481 | 1090 | 971 |
| | 20 | 1300 | 889 | 799 | 183 | 497 | 444 | 1070 | 952 |
| | 21 | 1270 | 854 | 767 | 166 | 455 | 407 | 1050 | 933 |
| | 22 | 1250 | 818 | 735 | 151 | 415 | 371 | 1020 | 913 |
| | 23 | 1220 | 782 | 701 | 139 | 379 | 339 | 1000 | 893 |
| | 24 | 1200 | 744 | 667 | 127 | 348 | 312 | 981 | 873 |
| | 25 | 1170 | 705 | 631 | 117 | 321 | 287 | 958 | 852 |
| | 26 | 1140 | 665 | 595 | 108 | 297 | 266 | 935 | 831 |
| | 27 | 1110 | 624 | 558 | 101 | 275 | 246 | 912 | 809 |
| | 28 | 1090 | 582 | 519 | 94 | 256 | 229 | 887 | 787 |
| | 29 | 1060 | 542 | 484 | | 239 | 213 | 863 | 764 |
| | 30 | 1030 | 507 | 452 | | 223 | 199 | 838 | 741 |
| | 31 | 998 | 475 | 424 | | 209 | 187 | 812 | 717 |
| | 32 | 967 | 446 | 398 | | 196 | 175 | 786 | 693 |
| | 33 | 936 | 419 | 374 | | 184 | 165 | 759 | 668 |
| | 34 | 904 | 395 | 352 | | 174 | 155 | 732 | 643 |
| | 35 | 871 | 372 | 332 | | 164 | 147 | 704 | 617 |
| | 36 | 838 | 352 | 314 | | 155 | 138 | 676 | 591 |
| | 37 | 804 | 333 | 297 | | 147 | 131 | 647 | 564 |
| | 38 | 770 | 316 | 282 | | 139 | 124 | 617 | 536 |
| | 39 | 734 | 300 | 268 | | 132 | 118 | 587 | 509 |
| | 40 | 699 | 285 | 255 | | 125 | 112 | 558 | 484 |
| **Properties** | | | | | | | | | |
| Area, In.$^2$ | | 28.3 | 30.3 | 24.6 | 20.9 | 25.7 | 20.9 | 24.6 | 18.7 |
| $I_x$, In.$^4$ | | 1550 | 1440 | 1190 | 838 | 923 | 770 | 904 | 702 |
| $I_y$, In.$^4$ | | 705 | 338 | 283 | 58.7 | 158 | 134 | 581 | 452 |
| Ratio, $r_x/r_y$ | | 1.48 | 2.06 | 2.05 | 3.78 | 2.42 | 2.40 | 1.25 | 1.25 |
| $r_y$, In. | | 4.99 | 3.34 | 3.39 | 1.68 | 2.48 | 2.53 | 4.86 | 4.91 |
| $B_x$, Bending Factor | | 0.183 | 0.210 | 0.207 | 0.249 | 0.251 | 0.244 | 0.218 | 0.213 |
| $B_y$, Bending Factor | | 0.241 | 0.359 | 0.348 | 0.712 | 0.488 | 0.468 | 0.254 | 0.248 |
| $a_x \div 10^6$ | | 354 | 280 | 247 | 150 | 169 | 149 | 200 | 174 |
| $a_y \div 10^6$ | | 161 | 65.7 | 58.7 | 10.5 | 28.9 | 25.9 | 129 | 112 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

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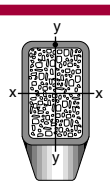
# HSS / Rectangular Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips




**f'c = 8.0**

**f'c = 8.0 ksi**

| Nominal Size | | 16 x 8 | | | 16 x 4 | | 14 x 10 | | |
|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 5/8 | 1/2 | 3/8 | 1/2 | 3/8 | 5/8 | 1/2 | 3/8 |
| Weight Per Foot | | 93.34 | 76.07 | 58.10 | 62.46 | 47.90 | 93.34 | 76.07 | 58.10 |
| Design Wall Thickness | | 0.581 | 0.465 | 0.349 | 0.465 | 0.349 | 0.581 | 0.465 | 0.349 |
| | | $F_y$ = 46 ksi | | | | | | | |
| Effective length KL in feet | 0 | 1120 | 1010 | 897 | 663 | 570 | 1170 | 1060 | 946 |
| | 4 | 1070 | 968 | 859 | 599 | 516 | 1130 | 1020 | 913 |
| | 5 | 1060 | 955 | 847 | 577 | 498 | 1120 | 1010 | 904 |
| | 6 | 1040 | 940 | 834 | 554 | 478 | 1110 | 1000 | 893 |
| | 7 | 1030 | 925 | 820 | 528 | 456 | 1090 | 989 | 882 |
| | 8 | 1010 | 909 | 805 | 500 | 433 | 1080 | 976 | 870 |
| | 9 | 991 | 892 | 790 | 471 | 408 | 1060 | 962 | 857 |
| | 10 | 971 | 874 | 773 | 439 | 381 | 1050 | 948 | 844 |
| | 11 | 950 | 855 | 756 | 406 | 353 | 1030 | 933 | 830 |
| | 12 | 928 | 835 | 738 | 371 | 323 | 1010 | 917 | 816 |
| | 13 | 906 | 815 | 720 | 334 | 292 | 996 | 901 | 801 |
| | 14 | 882 | 793 | 701 | 295 | 259 | 978 | 884 | 786 |
| | 15 | 858 | 771 | 681 | 257 | 226 | 959 | 866 | 770 |
| | 16 | 833 | 748 | 660 | 226 | 199 | 939 | 848 | 753 |
| | 17 | 807 | 725 | 639 | 200 | 176 | 919 | 829 | 736 |
| | 18 | 780 | 701 | 617 | 178 | 157 | 898 | 810 | 719 |
| | 19 | 752 | 675 | 594 | 160 | 141 | 876 | 791 | 701 |
| | 20 | 724 | 650 | 571 | 145 | 127 | 854 | 770 | 682 |
| | 21 | 695 | 623 | 547 | 131 | 115 | 831 | 750 | 663 |
| | 22 | 665 | 596 | 522 | 119 | 105 | 808 | 728 | 644 |
| | 23 | 633 | 567 | 497 | 109 | 96 | 784 | 706 | 624 |
| | 24 | 602 | 538 | 470 | 100 | 88 | 759 | 684 | 603 |
| | 25 | 569 | 509 | 443 | 92 | 81 | 734 | 661 | 582 |
| | 26 | 535 | 478 | 415 | 86 | 75 | 708 | 637 | 561 |
| | 27 | 500 | 446 | 387 | 79 | 70 | 682 | 613 | 539 |
| | 28 | 465 | 415 | 360 | | 65 | 654 | 588 | 516 |
| | 29 | 434 | 387 | 335 | | | 627 | 563 | 493 |
| | 30 | 405 | 361 | 313 | | | 598 | 537 | 469 |
| | 31 | 380 | 339 | 293 | | | 569 | 511 | 445 |
| | 32 | 356 | 318 | 275 | | | 540 | 483 | 420 |
| | 33 | 335 | 299 | 259 | | | 509 | 456 | 395 |
| | 34 | 316 | 281 | 244 | | | 480 | 429 | 372 |
| | 35 | 298 | 266 | 230 | | | 453 | 405 | 351 |
| | 36 | 281 | 251 | 218 | | | 428 | 383 | 332 |
| | 37 | 266 | 238 | 206 | | | 405 | 362 | 314 |
| | 38 | 253 | 225 | 195 | | | 384 | 344 | 298 |
| | 39 | 240 | 214 | 185 | | | 364 | 326 | 283 |
| | 40 | 228 | 203 | 176 | | | 346 | 310 | 269 |
| **Properties** | | | | | | | | | |
| Area, In.$^2$ | | 25.7 | 20.9 | 16.0 | 17.2 | 13.2 | 25.7 | 20.9 | 16.0 |
| $I_x$, In.$^4$ | | 815 | 679 | 531 | 455 | 360 | 687 | 573 | 447 |
| $I_y$, In.$^4$ | | 274 | 230 | 181 | 47.0 | 38.3 | 407 | 341 | 267 |
| Ratio, $r_x/r_y$ | | 1.72 | 1.72 | 1.71 | 3.11 | 3.07 | 1.30 | 1.30 | 1.29 |
| $r_y$, In. | | 3.27 | 3.32 | 3.37 | 1.65 | 1.71 | 3.98 | 4.04 | 4.09 |
| $B_x$, Bending Factor | | 0.252 | 0.246 | 0.241 | 0.302 | 0.293 | 0.262 | 0.255 | 0.251 |
| $B_y$, Bending Factor | | 0.375 | 0.363 | 0.354 | 0.732 | 0.689 | 0.316 | 0.306 | 0.300 |
| $a_x \div 10^6$ | | 156 | 138 | 119 | 80.9 | 68.4 | 135 | 120 | 103 |
| $a_y \div 10^6$ | | 52.4 | 46.8 | 40.4 | 8.36 | 7.27 | 79.8 | 71.4 | 61.8 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

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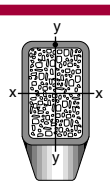
# HSS / Rectangular Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips




**f'c = 8.0**

| Nominal Size | | 14 x 6 | | | 14 x 4 | | | 12 x 10 | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 5/8 | 1/2 | 3/8 | 5/8 | 1/2 | 3/8 | 1/2 | 3/8 | 5/16 |
| Weight Per Foot | | 76.33 | 62.46 | 47.90 | 67.82 | 55.66 | 42.79 | 69.27 | 53.00 | 44.60 |
| Design Wall Thickness | | 0.581 | 0.465 | 0.349 | 0.581 | 0.465 | 0.349 | 0.465 | 0.349 | 0.291 |
| | | $F_y$ = 46 ksi | | | | | | | | |
| Effective length KL in feet | 0 | 832 | 744 | 652 | 664 | 585 | 504 | 933 | 831 | 775 |
| | 4 | 783 | 699 | 611 | 598 | 529 | 456 | 901 | 802 | 748 |
| | 5 | 767 | 685 | 598 | 576 | 509 | 440 | 891 | 794 | 739 |
| | 6 | 750 | 669 | 583 | 552 | 488 | 422 | 881 | 784 | 730 |
| | 7 | 731 | 652 | 568 | 525 | 465 | 402 | 870 | 774 | 721 |
| | 8 | 711 | 634 | 551 | 497 | 441 | 381 | 858 | 763 | 711 |
| | 9 | 690 | 614 | 534 | 466 | 415 | 359 | 846 | 752 | 700 |
| | 10 | 668 | 594 | 515 | 434 | 387 | 335 | 833 | 740 | 689 |
| | 11 | 645 | 573 | 496 | 400 | 357 | 310 | 819 | 728 | 677 |
| | 12 | 621 | 550 | 476 | 363 | 326 | 283 | 805 | 715 | 665 |
| | 13 | 595 | 527 | 454 | 325 | 293 | 255 | 790 | 702 | 652 |
| | 14 | 569 | 503 | 432 | 284 | 258 | 225 | 775 | 688 | 639 |
| | 15 | 541 | 477 | 409 | 248 | 225 | 196 | 759 | 674 | 626 |
| | 16 | 513 | 451 | 385 | 218 | 198 | 173 | 743 | 659 | 612 |
| | 17 | 483 | 424 | 360 | 193 | 175 | 153 | 727 | 644 | 597 |
| | 18 | 452 | 395 | 334 | 172 | 156 | 136 | 709 | 628 | 582 |
| | 19 | 420 | 366 | 307 | 154 | 140 | 122 | 692 | 612 | 567 |
| | 20 | 387 | 335 | 279 | 139 | 126 | 110 | 673 | 595 | 551 |
| | 21 | 353 | 304 | 253 | 126 | 115 | 100 | 655 | 578 | 535 |
| | 22 | 321 | 277 | 230 | 115 | 105 | 91 | 635 | 561 | 519 |
| | 23 | 294 | 253 | 211 | 105 | 96 | 84 | 616 | 543 | 502 |
| | 24 | 270 | 233 | 194 | 97 | 88 | 77 | 595 | 524 | 484 |
| | 25 | 249 | 215 | 178 | 89 | 81 | 71 | 575 | 505 | 466 |
| | 26 | 230 | 198 | 165 | 82 | 75 | 65 | 553 | 486 | 448 |
| | 27 | 213 | 184 | 153 | | 69 | 61 | 532 | 466 | 429 |
| | 28 | 198 | 171 | 142 | | | 56 | 509 | 446 | 410 |
| | 29 | 185 | 159 | 133 | | | | 487 | 425 | 390 |
| | 30 | 173 | 149 | 124 | | | | 463 | 404 | 370 |
| | 31 | 162 | 140 | 116 | | | | 439 | 382 | 349 |
| | 32 | 152 | 131 | 109 | | | | 415 | 359 | 328 |
| | 33 | 143 | 123 | 102 | | | | 390 | 338 | 308 |
| | 34 | 135 | 116 | 96 | | | | 368 | 318 | 290 |
| | 35 | 127 | 109 | 91 | | | | 347 | 300 | 274 |
| | 36 | 120 | 103 | 86 | | | | 328 | 284 | 259 |
| | 37 | 114 | 98 | 81 | | | | 310 | 269 | 245 |
| | 38 | 108 | 93 | 77 | | | | 294 | 255 | 233 |
| | 39 | 102 | 88 | 73 | | | | 279 | 242 | 221 |
| | 40 | 97 | 84 | 70 | | | | 266 | 230 | 210 |
| **Properties** | | | | | | | | | | |
| Area, In.$^2$ | | 21.0 | 17.2 | 13.2 | 18.7 | 15.3 | 11.8 | 19.0 | 14.6 | 12.2 |
| $I_x$, In.$^4$ | | 478 | 402 | 317 | 373 | 317 | 252 | 395 | 310 | 264 |
| $I_y$, In.$^4$ | | 124 | 105 | 84.1 | 47.1 | 41.1 | 33.6 | 298 | 234 | 200 |
| Ratio, $r_x/r_y$ | | 1.97 | 1.95 | 1.94 | 2.81 | 2.78 | 2.74 | 1.15 | 1.15 | 1.15 |
| $r_y$, In. | | 2.43 | 2.43 | 2.43 | 1.59 | 1.64 | 1.69 | 3.96 | 4.01 | 4.04 |
| $B_x$, Bending Factor | | 0.308 | 0.300 | 0.291 | 0.351 | 0.338 | 0.328 | 0.289 | 0.283 | 0.277 |
| $B_y$, Bending Factor | | 0.508 | 0.491 | 0.471 | 0.794 | 0.745 | 0.702 | 0.319 | 0.312 | 0.305 |
| $a_x \div 10^6$ | | 86.3 | 76.4 | 65.3 | 63.4 | 56.1 | 47.6 | 81.1 | 70.0 | 64.1 |
| $a_y \div 10^6$ | | 22.4 | 20.0 | 17.3 | 8.00 | 7.28 | 6.34 | 61.2 | 52.8 | 48.6 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

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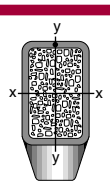
# HSS / Rectangular Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips




**f'c = 8.0**

**f'c = 8.0 ksi**

| Nominal Size | | 12 x 8 | | | | 12 x 6 | | | |
|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 5/8 | 1/2 | 3/8 | 5/16 | 5/8 | 1/2 | 3/8 | 5/16 |
| Weight Per Foot | | 76.33 | 62.46 | 47.90 | 40.35 | 67.82 | 55.66 | 42.79 | 36.10 |
| Design Wall Thickness | | 0.581 | 0.465 | 0.349 | 0.291 | 0.581 | 0.465 | 0.349 | 0.291 |
| | | $F_y$ = 46 ksi | | | | | | | |
| Effective length KL in feet | 0 | 881 | 793 | 701 | 652 | 729 | 651 | 570 | 526 |
| | 4 | 843 | 759 | 670 | 623 | 685 | 612 | 535 | 494 |
| | 5 | 831 | 748 | 660 | 613 | 671 | 599 | 524 | 484 |
| | 6 | 818 | 736 | 650 | 604 | 656 | 585 | 512 | 472 |
| | 7 | 804 | 724 | 639 | 593 | 639 | 571 | 499 | 460 |
| | 8 | 789 | 711 | 627 | 582 | 621 | 555 | 485 | 447 |
| | 9 | 774 | 697 | 614 | 570 | 603 | 538 | 471 | 434 |
| | 10 | 758 | 682 | 601 | 558 | 583 | 521 | 455 | 419 |
| | 11 | 741 | 667 | 588 | 545 | 562 | 502 | 439 | 404 |
| | 12 | 723 | 651 | 573 | 531 | 540 | 483 | 422 | 388 |
| | 13 | 705 | 634 | 558 | 517 | 518 | 463 | 404 | 372 |
| | 14 | 686 | 617 | 543 | 503 | 494 | 442 | 386 | 355 |
| | 15 | 666 | 599 | 527 | 487 | 470 | 420 | 366 | 337 |
| | 16 | 645 | 580 | 510 | 472 | 444 | 397 | 346 | 318 |
| | 17 | 624 | 561 | 493 | 455 | 417 | 373 | 325 | 298 |
| | 18 | 602 | 541 | 475 | 439 | 390 | 349 | 304 | 278 |
| | 19 | 580 | 521 | 457 | 421 | 361 | 323 | 281 | 257 |
| | 20 | 556 | 500 | 438 | 403 | 331 | 297 | 258 | 235 |
| | 21 | 532 | 478 | 419 | 385 | 301 | 270 | 234 | 214 |
| | 22 | 508 | 455 | 399 | 366 | 274 | 246 | 213 | 195 |
| | 23 | 482 | 432 | 378 | 347 | 251 | 225 | 195 | 178 |
| | 24 | 456 | 409 | 357 | 326 | 230 | 207 | 179 | 164 |
| | 25 | 429 | 384 | 335 | 306 | 212 | 190 | 165 | 151 |
| | 26 | 401 | 359 | 312 | 284 | 196 | 176 | 153 | 139 |
| | 27 | 373 | 333 | 290 | 264 | 182 | 163 | 142 | 129 |
| | 28 | 347 | 310 | 270 | 245 | 169 | 152 | 132 | 120 |
| | 29 | 323 | 289 | 251 | 228 | 158 | 142 | 123 | 112 |
| | 30 | 302 | 270 | 235 | 213 | 147 | 132 | 115 | 105 |
| | 31 | 283 | 253 | 220 | 200 | 138 | 124 | 107 | 98 |
| | 32 | 265 | 237 | 206 | 188 | 130 | 116 | 101 | 92 |
| | 33 | 250 | 223 | 194 | 176 | 122 | 109 | 95 | 87 |
| | 34 | 235 | 210 | 183 | 166 | 115 | 103 | 89 | 82 |
| | 35 | 222 | 198 | 173 | 157 | 108 | 97 | 84 | 77 |
| | 36 | 210 | 188 | 163 | 148 | 102 | 92 | 80 | 73 |
| | 37 | 199 | 178 | 154 | 140 | 97 | 87 | 75 | 69 |
| | 38 | 188 | 168 | 146 | 133 | 92 | 82 | 71 | 65 |
| | 39 | 179 | 160 | 139 | 126 | 87 | 78 | 68 | 62 |
| | 40 | 170 | 152 | 132 | 120 | | 74 | 65 | 59 |
| **Properties** | | | | | | | | | |
| Area, In.$^2$ | | 21.0 | 17.2 | 13.2 | 11.1 | 18.7 | 15.3 | 11.8 | 9.92 |
| $I_x$, In.$^4$ | | 396 | 333 | 262 | 224 | 321 | 271 | 215 | 184 |
| $I_y$, In.$^4$ | | 210 | 177 | 140 | 120 | 106 | 91.1 | 72.9 | 62.8 |
| Ratio, $r_x/r_y$ | | 1.37 | 1.37 | 1.37 | 1.37 | 1.74 | 1.73 | 1.72 | 1.71 |
| $r_y$, In. | | 3.16 | 3.21 | 3.27 | 3.29 | 2.39 | 2.44 | 2.49 | 2.52 |
| $B_x$, Bending Factor | | 0.318 | 0.310 | 0.302 | 0.297 | 0.350 | 0.339 | 0.329 | 0.323 |
| $B_y$, Bending Factor | | 0.400 | 0.389 | 0.377 | 0.370 | 0.529 | 0.504 | 0.486 | 0.474 |
| $a_x \div 10^6$ | | 73.9 | 65.8 | 56.5 | 51.6 | 57.4 | 51.0 | 43.7 | 39.6 |
| $a_y \div 10^6$ | | 39.2 | 35.0 | 30.2 | 27.6 | 19.0 | 17.1 | 14.8 | 13.5 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

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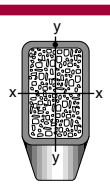
# HSS / Rectangular Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips




**f'c = 8.0**

| Nominal Size | | 12 x 4 | | | | 10 x 8 | | | |
|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 5/8 | 1/2 | 3/8 | 5/16 | 1/2 | 3/8 | 5/16 | 1/4 |
| Weight Per Foot | | 59.32 | 48.85 | 37.69 | 31.84 | 55.66 | 42.79 | 36.10 | 29.23 |
| Design Wall Thickness | | 0.581 | 0.465 | 0.349 | 0.291 | 0.465 | 0.349 | 0.291 | 0.233 |
| | | $F_y$ = 46 ksi | | | | | | | |
| Effective length KL in feet | 0 | 577 | 511 | 439 | 401 | 683 | 602 | 559 | 515 |
| | 4 | 520 | 461 | 396 | 362 | 653 | 575 | 533 | 491 |
| | 5 | 500 | 444 | 382 | 349 | 643 | 567 | 525 | 483 |
| | 6 | 478 | 425 | 366 | 334 | 633 | 558 | 517 | 475 |
| | 7 | 455 | 405 | 349 | 319 | 622 | 548 | 507 | 467 |
| | 8 | 429 | 383 | 330 | 302 | 610 | 537 | 498 | 458 |
| | 9 | 403 | 360 | 310 | 284 | 598 | 526 | 487 | 448 |
| | 10 | 374 | 335 | 289 | 265 | 585 | 515 | 476 | 438 |
| | 11 | 344 | 309 | 267 | 244 | 572 | 503 | 465 | 427 |
| | 12 | 312 | 281 | 244 | 223 | 558 | 490 | 453 | 416 |
| | 13 | 278 | 252 | 219 | 200 | 543 | 477 | 441 | 404 |
| | 14 | 242 | 221 | 192 | 176 | 528 | 463 | 428 | 392 |
| | 15 | 211 | 192 | 168 | 154 | 512 | 449 | 415 | 380 |
| | 16 | 185 | 169 | 147 | 135 | 495 | 435 | 401 | 367 |
| | 17 | 164 | 150 | 131 | 120 | 478 | 419 | 387 | 354 |
| | 18 | 146 | 134 | 116 | 107 | 461 | 404 | 372 | 340 |
| | 19 | 131 | 120 | 105 | 96 | 443 | 388 | 357 | 325 |
| | 20 | 119 | 108 | 94 | 86 | 424 | 371 | 341 | 311 |
| | 21 | 108 | 98 | 86 | 78 | 405 | 354 | 325 | 296 |
| | 22 | 98 | 89 | 78 | 71 | 385 | 336 | 308 | 280 |
| | 23 | 90 | 82 | 71 | 65 | 365 | 318 | 291 | 264 |
| | 24 | 82 | 75 | 66 | 60 | 344 | 299 | 274 | 247 |
| | 25 | 76 | 69 | 60 | 55 | 322 | 279 | 255 | 230 |
| | 26 | 70 | 64 | 56 | 51 | 300 | 259 | 237 | 213 |
| | 27 | | 59 | 52 | 47 | 278 | 241 | 219 | 197 |
| | 28 | | | | 44 | 259 | 224 | 204 | 183 |
| | 29 | | | | | 241 | 209 | 190 | 171 |
| | 30 | | | | | 225 | 195 | 178 | 160 |
| | 31 | | | | | 211 | 183 | 166 | 150 |
| | 32 | | | | | 198 | 171 | 156 | 140 |
| | 33 | | | | | 186 | 161 | 147 | 132 |
| | 34 | | | | | 176 | 152 | 138 | 124 |
| | 35 | | | | | 166 | 143 | 131 | 117 |
| | 36 | | | | | 157 | 135 | 123 | 111 |
| | 37 | | | | | 148 | 128 | 117 | 105 |
| | 38 | | | | | 141 | 121 | 111 | 100 |
| | 39 | | | | | 133 | 115 | 105 | 95 |
| | 40 | | | | | 127 | 110 | 100 | 90 |
| **Properties** | | | | | | | | | |
| Area, In.$^2$ | | 16.4 | 13.5 | 10.4 | 8.76 | 15.3 | 11.8 | 9.92 | 8.03 |
| $I_x$, In.$^4$ | | 245 | 209 | 168 | 144 | 214 | 169 | 145 | 119 |
| $I_y$, In.$^4$ | | 40.3 | 35.3 | 28.9 | 25.2 | 151 | 120 | 103 | 84.7 |
| Ratio, $r_x/r_y$ | | 2.47 | 2.44 | 2.41 | 2.39 | 1.19 | 1.19 | 1.19 | 1.19 |
| $r_y$, In. | | 1.57 | 1.62 | 1.67 | 1.70 | 3.14 | 3.19 | 3.22 | 3.25 |
| $B_x$, Bending Factor | | 0.402 | 0.388 | 0.371 | 0.365 | 0.357 | 0.349 | 0.342 | 0.337 |
| $B_y$, Bending Factor | | 0.814 | 0.765 | 0.720 | 0.695 | 0.405 | 0.393 | 0.385 | 0.379 |
| $a_x \div 10^6$ | | 41.4 | 36.8 | 31.5 | 28.3 | 41.5 | 35.5 | 32.5 | 29.1 |
| $a_y \div 10^6$ | | 6.81 | 6.21 | 5.41 | 4.95 | 29.2 | 25.2 | 23.1 | 20.7 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

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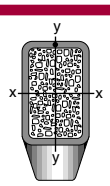
# HSS / Rectangular Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips




**f'c = 8.0**

**f'c = 8.0 ksi**

| Nominal Size | | 10 x 6 | | | | | 10 x 5 | | |
|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 5/8 | 1/2 | 3/8 | 5/16 | 1/4 | 3/8 | 5/16 | 1/4 |
| Weight Per Foot | | 59.32 | 48.85 | 37.69 | 31.84 | 25.82 | 35.13 | 29.72 | 24.12 |
| Design Wall Thickness | | 0.581 | 0.465 | 0.349 | 0.291 | 0.233 | 0.349 | 0.291 | 0.233 |
| | | $F_y$ = 46 ksi | | | | | | | |
| Effective length KL in feet | 0 | 626 | 559 | 488 | 450 | 411 | 430 | 395 | 359 |
| | 4 | 588 | 525 | 458 | 422 | 385 | 397 | 365 | 332 |
| | 5 | 575 | 514 | 448 | 413 | 377 | 387 | 355 | 322 |
| | 6 | 562 | 502 | 438 | 403 | 368 | 375 | 344 | 312 |
| | 7 | 547 | 489 | 426 | 393 | 358 | 362 | 332 | 302 |
| | 8 | 531 | 475 | 414 | 381 | 347 | 349 | 320 | 290 |
| | 9 | 515 | 461 | 401 | 369 | 336 | 334 | 306 | 278 |
| | 10 | 498 | 445 | 388 | 357 | 325 | 319 | 292 | 265 |
| | 11 | 479 | 429 | 374 | 344 | 312 | 303 | 277 | 251 |
| | 12 | 460 | 412 | 359 | 330 | 299 | 286 | 261 | 237 |
| | 13 | 440 | 394 | 343 | 315 | 286 | 268 | 245 | 222 |
| | 14 | 419 | 376 | 327 | 300 | 272 | 250 | 228 | 206 |
| | 15 | 398 | 357 | 310 | 284 | 257 | 230 | 210 | 189 |
| | 16 | 375 | 337 | 292 | 268 | 242 | 210 | 191 | 172 |
| | 17 | 352 | 316 | 274 | 251 | 226 | 189 | 171 | 153 |
| | 18 | 327 | 294 | 255 | 233 | 209 | 168 | 153 | 137 |
| | 19 | 302 | 271 | 235 | 215 | 192 | 151 | 137 | 123 |
| | 20 | 276 | 248 | 214 | 196 | 174 | 136 | 124 | 111 |
| | 21 | 250 | 225 | 195 | 178 | 158 | 124 | 112 | 101 |
| | 22 | 228 | 205 | 177 | 162 | 144 | 113 | 102 | 92 |
| | 23 | 208 | 188 | 162 | 148 | 132 | 103 | 93 | 84 |
| | 24 | 191 | 172 | 149 | 136 | 121 | 95 | 86 | 77 |
| | 25 | 176 | 159 | 137 | 125 | 112 | 87 | 79 | 71 |
| | 26 | 163 | 147 | 127 | 116 | 103 | 81 | 73 | 66 |
| | 27 | 151 | 136 | 118 | 107 | 96 | 75 | 68 | 61 |
| | 28 | 141 | 127 | 109 | 100 | 89 | 70 | 63 | 57 |
| | 29 | 131 | 118 | 102 | 93 | 83 | 65 | 59 | 53 |
| | 30 | 123 | 110 | 95 | 87 | 77 | 61 | 55 | 49 |
| | 31 | 115 | 103 | 89 | 82 | 73 | 57 | 51 | 46 |
| | 32 | 108 | 97 | 84 | 77 | 68 | 53 | 48 | 43 |
| | 33 | 101 | 91 | 79 | 72 | 64 | 50 | 45 | 41 |
| | 34 | 95 | 86 | 74 | 68 | 60 | 47 | 43 | 38 |
| | 35 | 90 | 81 | 70 | 64 | 57 | | | 36 |
| | 36 | 85 | 77 | 66 | 60 | 54 | | | |
| | 37 | 81 | 73 | 63 | 57 | 51 | | | |
| | 38 | 76 | 69 | 59 | 54 | 48 | | | |
| | 39 | 72 | 65 | 56 | 52 | 46 | | | |
| | 40 | | | 54 | 49 | 44 | | | |
| **Properties** | | | | | | | | | |
| Area, In.$^2$ | | 16.4 | 13.5 | 10.4 | 8.76 | 7.10 | 9.67 | 8.17 | 6.63 |
| $I_x$, In.$^4$ | | 201 | 171 | 137 | 118 | 96.9 | 120 | 104 | 85.8 |
| $I_y$, In.$^4$ | | 89.4 | 76.8 | 61.8 | 53.3 | 44.1 | 40.6 | 35.2 | 29.3 |
| Ratio, $r_x/r_y$ | | 1.50 | 1.49 | 1.49 | 1.48 | 1.48 | 1.72 | 1.72 | 1.71 |
| $r_y$, In. | | 2.34 | 2.39 | 2.44 | 2.47 | 2.49 | 2.05 | 2.07 | 2.10 |
| $B_x$, Bending Factor | | 0.408 | 0.395 | 0.380 | 0.371 | 0.366 | 0.403 | 0.393 | 0.386 |
| $B_y$, Bending Factor | | 0.550 | 0.527 | 0.505 | 0.493 | 0.483 | 0.595 | 0.580 | 0.566 |
| $a_x \div 10^6$ | | 35.5 | 31.7 | 27.3 | 24.9 | 22.1 | 23.2 | 21.1 | 18.7 |
| $a_y \div 10^6$ | | 15.8 | 14.3 | 12.3 | 11.3 | 10.1 | 7.84 | 7.16 | 6.40 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

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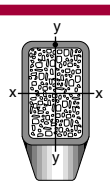
# HSS / Rectangular Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips




**f'c = 8.0**

| Nominal Size | | 10 x 4 | | | | | 9 x 7 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 5/8 | 1/2 | 3/8 | 5/16 | 1/4 | 5/8 | 1/2 | 3/8 | 5/16 | 1/4 |
| Weight Per Foot | | 50.81 | 42.05 | 32.58 | 27.59 | 22.42 | 59.32 | 48.85 | 37.69 | 31.84 | 25.82 |
| Design Wall Thickness | | 0.581 | 0.465 | 0.349 | 0.291 | 0.233 | 0.581 | 0.465 | 0.349 | 0.291 | 0.233 |
| | | $F_y$ = 46 ksi | | | | | | | | | |
| Effective length KL in feet | 0 | 488 | 433 | 372 | 341 | 308 | 638 | 572 | 500 | 462 | 423 |
| | 4 | 438 | 390 | 336 | 307 | 277 | 605 | 542 | 474 | 438 | 401 |
| | 5 | 421 | 375 | 323 | 296 | 267 | 594 | 532 | 465 | 430 | 393 |
| | 6 | 402 | 359 | 309 | 283 | 255 | 583 | 522 | 456 | 421 | 385 |
| | 7 | 382 | 341 | 294 | 269 | 243 | 571 | 511 | 447 | 412 | 377 |
| | 8 | 360 | 322 | 278 | 255 | 230 | 557 | 499 | 436 | 402 | 368 |
| | 9 | 337 | 302 | 261 | 239 | 216 | 544 | 487 | 425 | 392 | 359 |
| | 10 | 312 | 281 | 243 | 222 | 201 | 529 | 474 | 414 | 382 | 349 |
| | 11 | 286 | 258 | 224 | 205 | 185 | 514 | 460 | 402 | 370 | 338 |
| | 12 | 258 | 234 | 203 | 186 | 168 | 498 | 446 | 389 | 358 | 327 |
| | 13 | 228 | 208 | 181 | 167 | 150 | 481 | 431 | 376 | 346 | 316 |
| | 14 | 198 | 181 | 159 | 146 | 131 | 464 | 416 | 362 | 333 | 304 |
| | 15 | 172 | 158 | 138 | 127 | 114 | 446 | 399 | 348 | 320 | 291 |
| | 16 | 151 | 139 | 121 | 112 | 100 | 427 | 383 | 333 | 306 | 278 |
| | 17 | 134 | 123 | 108 | 99 | 89 | 408 | 365 | 318 | 292 | 265 |
| | 18 | 120 | 110 | 96 | 88 | 79 | 388 | 347 | 302 | 277 | 251 |
| | 19 | 107 | 99 | 86 | 79 | 71 | 367 | 329 | 285 | 262 | 237 |
| | 20 | 97 | 89 | 78 | 71 | 64 | 345 | 310 | 268 | 246 | 222 |
| | 21 | 88 | 81 | 70 | 65 | 58 | 323 | 290 | 251 | 229 | 207 |
| | 22 | 80 | 73 | 64 | 59 | 53 | 300 | 269 | 233 | 212 | 191 |
| | 23 | 73 | 67 | 59 | 54 | 49 | 276 | 248 | 214 | 195 | 175 |
| | 24 | 67 | 62 | 54 | 50 | 45 | 254 | 228 | 196 | 179 | 161 |
| | 25 | 62 | 57 | 50 | 46 | 41 | 234 | 210 | 181 | 165 | 148 |
| | 26 | | 53 | 46 | 42 | 38 | 216 | 194 | 167 | 153 | 137 |
| | 27 | | | 43 | 39 | 35 | 201 | 180 | 155 | 141 | 127 |
| | 28 | | | | | 33 | 187 | 167 | 144 | 132 | 118 |
| | 29 | | | | | | 174 | 156 | 134 | 123 | 110 |
| | 30 | | | | | | 162 | 146 | 126 | 115 | 103 |
| | 31 | | | | | | 152 | 136 | 118 | 107 | 96 |
| | 32 | | | | | | 143 | 128 | 110 | 101 | 90 |
| | 33 | | | | | | 134 | 120 | 104 | 95 | 85 |
| | 34 | | | | | | 126 | 113 | 98 | 89 | 80 |
| | 35 | | | | | | 119 | 107 | 92 | 84 | 76 |
| | 36 | | | | | | 113 | 101 | 87 | 80 | 71 |
| | 37 | | | | | | 107 | 96 | 83 | 75 | 68 |
| | 38 | | | | | | 101 | 91 | 78 | 71 | 64 |
| | 39 | | | | | | 96 | 86 | 74 | 68 | 61 |
| | 40 | | | | | | 91 | 82 | 71 | 64 | 58 |
| **Properties** | | | | | | | | | | | |
| Area, In.$^2$ | | 14.0 | 11.6 | 8.97 | 7.59 | 6.17 | 16.4 | 13.5 | 10.4 | 8.76 | 7.10 |
| $I_x$, In.$^4$ | | 149 | 129 | 104 | 90.1 | 74.7 | 174 | 149 | 119 | 102 | 84.1 |
| $I_y$, In.$^4$ | | 33.4 | 29.4 | 24.3 | 21.2 | 17.7 | 117 | 100 | 80.4 | 69.2 | 57.2 |
| Ratio, $r_x/r_y$ | | 2.11 | 2.09 | 2.07 | 2.06 | 2.05 | 1.22 | 1.22 | 1.21 | 1.21 | 1.21 |
| $r_y$, In. | | 1.54 | 1.59 | 1.64 | 1.67 | 1.70 | 2.68 | 2.73 | 2.78 | 2.81 | 2.84 |
| $B_x$, Bending Factor | | 0.470 | 0.450 | 0.431 | 0.421 | 0.413 | 0.424 | 0.408 | 0.393 | 0.386 | 0.380 |
| $B_y$, Bending Factor | | 0.838 | 0.789 | 0.738 | 0.716 | 0.697 | 0.491 | 0.473 | 0.453 | 0.443 | 0.434 |
| $a_x \div 10^6$ | | 25.1 | 22.5 | 19.3 | 17.5 | 15.5 | 31.1 | 28.0 | 24.1 | 21.9 | 19.6 |
| $a_y \div 10^6$ | | 5.62 | 5.13 | 4.51 | 4.12 | 3.67 | 20.9 | 18.8 | 16.3 | 14.9 | 13.3 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

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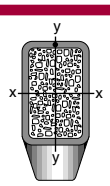
# HSS / Rectangular Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips




**f'c = 8.0**

**f'c = 8.0 ksi**

| Nominal Size | | 9 x 5 | | | | | 8 x 6 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 5/8 | 1/2 | 3/8 | 5/16 | 1/4 | 5/8 | 1/2 | 3/8 | 5/16 | 1/4 | 3/16 |
| Weight Per Foot | | 50.81 | 42.05 | 32.58 | 27.59 | 22.42 | 50.81 | 42.05 | 32.58 | 27.59 | 22.42 | 17.08 |
| Design Wall Thickness | | 0.581 | 0.465 | 0.349 | 0.291 | 0.233 | 0.581 | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 |
| | | $F_y$ = 46 ksi | | | | | | | | | | |
| Effective length KL in feet | 0 | 508 | 453 | 393 | 361 | 328 | 520 | 466 | 405 | 373 | 340 | 305 |
| | 4 | 469 | 419 | 363 | 333 | 303 | 487 | 436 | 380 | 350 | 318 | 285 |
| | 5 | 455 | 407 | 353 | 324 | 294 | 477 | 427 | 371 | 342 | 311 | 279 |
| | 6 | 441 | 394 | 342 | 314 | 285 | 465 | 417 | 362 | 333 | 304 | 272 |
| | 7 | 426 | 381 | 330 | 303 | 275 | 452 | 405 | 353 | 324 | 295 | 264 |
| | 8 | 409 | 366 | 318 | 291 | 264 | 439 | 393 | 342 | 315 | 286 | 256 |
| | 9 | 391 | 351 | 305 | 279 | 253 | 425 | 381 | 331 | 305 | 277 | 247 |
| | 10 | 373 | 334 | 291 | 266 | 241 | 410 | 368 | 320 | 294 | 267 | 238 |
| | 11 | 353 | 317 | 276 | 252 | 228 | 394 | 354 | 308 | 283 | 257 | 229 |
| | 12 | 332 | 299 | 260 | 238 | 215 | 378 | 339 | 295 | 271 | 246 | 218 |
| | 13 | 311 | 280 | 244 | 223 | 201 | 360 | 324 | 282 | 258 | 234 | 208 |
| | 14 | 288 | 260 | 227 | 207 | 187 | 342 | 308 | 268 | 245 | 222 | 197 |
| | 15 | 264 | 239 | 209 | 190 | 171 | 324 | 291 | 253 | 232 | 210 | 185 |
| | 16 | 239 | 217 | 190 | 173 | 155 | 304 | 274 | 238 | 218 | 197 | 173 |
| | 17 | 213 | 194 | 170 | 154 | 138 | 284 | 256 | 223 | 203 | 183 | 161 |
| | 18 | 190 | 173 | 152 | 138 | 123 | 263 | 237 | 207 | 188 | 169 | 148 |
| | 19 | 171 | 155 | 136 | 123 | 111 | 241 | 217 | 190 | 172 | 155 | 135 |
| | 20 | 154 | 140 | 123 | 111 | 100 | 218 | 197 | 172 | 156 | 140 | 121 |
| | 21 | 140 | 127 | 111 | 101 | 91 | 198 | 179 | 156 | 141 | 127 | 110 |
| | 22 | 127 | 116 | 102 | 92 | 83 | 180 | 163 | 142 | 129 | 116 | 100 |
| | 23 | 116 | 106 | 93 | 84 | 76 | 165 | 149 | 130 | 118 | 106 | 92 |
| | 24 | 107 | 97 | 85 | 77 | 69 | 152 | 137 | 119 | 108 | 97 | 84 |
| | 25 | 99 | 90 | 79 | 71 | 64 | 140 | 126 | 110 | 100 | 89 | 78 |
| | 26 | 91 | 83 | 73 | 66 | 59 | 129 | 117 | 102 | 92 | 83 | 72 |
| | 27 | 85 | 77 | 67 | 61 | 55 | 120 | 108 | 94 | 86 | 77 | 67 |
| | 28 | 79 | 71 | 63 | 57 | 51 | 111 | 101 | 88 | 80 | 71 | 62 |
| | 29 | 73 | 67 | 58 | 53 | 48 | 104 | 94 | 82 | 74 | 66 | 58 |
| | 30 | 68 | 62 | 55 | 50 | 44 | 97 | 88 | 76 | 69 | 62 | 54 |
| | 31 | 64 | 58 | 51 | 46 | 42 | 91 | 82 | 72 | 65 | 58 | 51 |
| | 32 | 60 | 55 | 48 | 44 | 39 | 85 | 77 | 67 | 61 | 55 | 47 |
| | 33 | | | 45 | 41 | 37 | 80 | 72 | 63 | 57 | 51 | 45 |
| | 34 | | | | 39 | 35 | 75 | 68 | 60 | 54 | 48 | 42 |
| | 35 | | | | | | 71 | 64 | 56 | 51 | 46 | 40 |
| | 36 | | | | | | 67 | 61 | 53 | 48 | 43 | 37 |
| | 37 | | | | | | 64 | 58 | 50 | 46 | 41 | 35 |
| | 38 | | | | | | | 55 | 48 | 43 | 39 | 34 |
| | 39 | | | | | | | | 45 | 41 | 37 | 32 |
| | 40 | | | | | | | | | 39 | 35 | 30 |
| **Properties** | | | | | | | | | | | | |
| Area, In.$^2$ | | 14.0 | 11.6 | 8.97 | 7.59 | 6.17 | 14.0 | 11.6 | 8.97 | 7.59 | 6.17 | 4.67 |
| $I_x$, In.$^4$ | | 133 | 115 | 92.5 | 79.8 | 66.1 | 114 | 98.2 | 79.1 | 68.3 | 56.6 | 43.7 |
| $I_y$, In.$^4$ | | 51.9 | 45.2 | 36.8 | 32.0 | 26.6 | 72.2 | 62.5 | 50.6 | 43.8 | 36.4 | 28.2 |
| Ratio, $r_x/r_y$ | | 1.60 | 1.59 | 1.58 | 1.58 | 1.58 | 1.26 | 1.25 | 1.25 | 1.25 | 1.25 | 1.25 |
| $r_y$, In. | | 1.92 | 1.97 | 2.03 | 2.05 | 2.08 | 2.27 | 2.32 | 2.38 | 2.40 | 2.43 | 2.46 |
| $B_x$, Bending Factor | | 0.474 | 0.454 | 0.436 | 0.428 | 0.420 | 0.491 | 0.473 | 0.454 | 0.445 | 0.436 | 0.427 |
| $B_y$, Bending Factor | | 0.674 | 0.642 | 0.609 | 0.593 | 0.580 | 0.582 | 0.557 | 0.532 | 0.520 | 0.509 | 0.497 |
| $a_x \div 10^6$ | | 22.9 | 20.6 | 17.7 | 16.1 | 14.3 | 19.9 | 17.9 | 15.4 | 14.0 | 12.5 | 10.8 |
| $a_y \div 10^6$ | | 8.92 | 8.10 | 7.05 | 6.44 | 5.74 | 12.6 | 11.4 | 9.87 | 9.00 | 8.04 | 6.98 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

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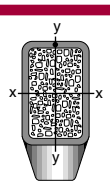
# HSS / Rectangular Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips




**f'c = 8.0**

| Nominal Size | | 8 x 4 | | | | | | 7 x 5 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 5/8 | 1/2 | 3/8 | 5/16 | 1/4 | 3/16 | 5/8 | 1/2 | 3/8 | 5/16 | 1/4 | 3/16 |
| Weight Per Foot | | 42.30 | 35.24 | 27.48 | 23.34 | 19.02 | 14.53 | 42.30 | 35.24 | 27.48 | 23.34 | 19.02 | 14.53 |
| Design Wall Thickness | | 0.581 | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 | 0.581 | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 |
| | | $F_y$ = 46 ksi | | | | | | | | | | | |
| Effective length KL in feet | 0 | 401 | 357 | 307 | 281 | 253 | 224 | 413 | 369 | 319 | 293 | 265 | 236 |
| | 4 | 359 | 320 | 276 | 252 | 228 | 201 | 380 | 340 | 294 | 270 | 244 | 217 |
| | 5 | 345 | 308 | 266 | 243 | 219 | 193 | 369 | 330 | 286 | 262 | 237 | 211 |
| | 6 | 329 | 294 | 254 | 232 | 209 | 184 | 357 | 319 | 277 | 254 | 230 | 204 |
| | 7 | 312 | 279 | 242 | 220 | 199 | 175 | 344 | 308 | 267 | 245 | 221 | 196 |
| | 8 | 294 | 263 | 228 | 208 | 187 | 165 | 330 | 296 | 256 | 235 | 212 | 188 |
| | 9 | 274 | 246 | 214 | 195 | 175 | 154 | 315 | 282 | 245 | 224 | 203 | 179 |
| | 10 | 253 | 228 | 198 | 181 | 163 | 143 | 299 | 269 | 233 | 214 | 193 | 170 |
| | 11 | 231 | 209 | 182 | 166 | 149 | 131 | 282 | 254 | 220 | 202 | 182 | 161 |
| | 12 | 207 | 189 | 165 | 150 | 135 | 118 | 265 | 239 | 207 | 190 | 171 | 151 |
| | 13 | 182 | 167 | 146 | 133 | 120 | 104 | 247 | 222 | 193 | 177 | 160 | 140 |
| | 14 | 158 | 145 | 127 | 116 | 104 | 90 | 227 | 206 | 179 | 164 | 147 | 129 |
| | 15 | 137 | 126 | 111 | 101 | 91 | 79 | 207 | 188 | 163 | 150 | 135 | 117 |
| | 16 | 121 | 111 | 98 | 89 | 80 | 69 | 186 | 169 | 147 | 135 | 121 | 105 |
| | 17 | 107 | 98 | 86 | 78 | 70 | 61 | 165 | 150 | 131 | 120 | 108 | 93 |
| | 18 | 95 | 88 | 77 | 70 | 63 | 55 | 147 | 134 | 117 | 107 | 96 | 83 |
| | 19 | 86 | 79 | 69 | 63 | 56 | 49 | 132 | 120 | 105 | 96 | 86 | 75 |
| | 20 | 77 | 71 | 62 | 57 | 51 | 44 | 119 | 109 | 95 | 87 | 78 | 67 |
| | 21 | 70 | 64 | 57 | 51 | 46 | 40 | 108 | 99 | 86 | 79 | 70 | 61 |
| | 22 | 64 | 59 | 52 | 47 | 42 | 37 | 98 | 90 | 78 | 72 | 64 | 56 |
| | 23 | 58 | 54 | 47 | 43 | 39 | 33 | 90 | 82 | 72 | 66 | 59 | 51 |
| | 24 | 54 | 49 | 43 | 39 | 35 | 31 | 83 | 75 | 66 | 60 | 54 | 47 |
| | 25 | 49 | 46 | 40 | 36 | 33 | 28 | 76 | 70 | 61 | 55 | 50 | 43 |
| | 26 | | 42 | 37 | 34 | 30 | 26 | 70 | 64 | 56 | 51 | 46 | 40 |
| | 27 | | | | 31 | 28 | 24 | 65 | 60 | 52 | 48 | 43 | 37 |
| | 28 | | | | | | 23 | 61 | 55 | 48 | 44 | 40 | 34 |
| | 29 | | | | | | | 57 | 52 | 45 | 41 | 37 | 32 |
| | 30 | | | | | | | 53 | 48 | 42 | 39 | 35 | 30 |
| | 31 | | | | | | | 50 | 45 | 39 | 36 | 32 | 28 |
| | 32 | | | | | | | | | 37 | 34 | 30 | 26 |
| | 33 | | | | | | | | | | 32 | 29 | 25 |
| | 34 | | | | | | | | | | | | 23 |
| | 35 | | | | | | | | | | | | |
| | 36 | | | | | | | | | | | | |
| | 37 | | | | | | | | | | | | |
| | 38 | | | | | | | | | | | | |
| | 39 | | | | | | | | | | | | |
| | 40 | | | | | | | | | | | | |
| **Properties** | | | | | | | | | | | | | |
| Area, In.$^2$ | | 11.7 | 9.74 | 7.58 | 6.43 | 5.24 | 3.98 | 11.7 | 9.74 | 7.58 | 6.43 | 5.24 | 3.98 |
| $I_x$, In.$^4$ | | 81.9 | 71.7 | 58.7 | 51.0 | 42.5 | 33.1 | 69.3 | 60.6 | 49.5 | 43.0 | 35.8 | 27.9 |
| $I_y$, In.$^4$ | | 26.6 | 23.6 | 19.6 | 17.2 | 14.4 | 11.3 | 40.5 | 35.6 | 29.2 | 25.5 | 21.3 | 16.6 |
| Ratio, $r_x/r_y$ | | 1.76 | 1.74 | 1.73 | 1.72 | 1.72 | 1.71 | 1.31 | 1.30 | 1.30 | 1.30 | 1.30 | 1.29 |
| $r_y$, In. | | 1.51 | 1.56 | 1.61 | 1.63 | 1.66 | 1.69 | 1.86 | 1.91 | 1.96 | 1.99 | 2.02 | 2.05 |
| $B_x$, Bending Factor | | 0.571 | 0.543 | 0.517 | 0.504 | 0.493 | 0.481 | 0.591 | 0.563 | 0.536 | 0.523 | 0.512 | 0.499 |
| $B_y$, Bending Factor | | 0.880 | 0.825 | 0.773 | 0.748 | 0.728 | 0.704 | 0.722 | 0.684 | 0.649 | 0.630 | 0.615 | 0.599 |
| $a_x \div 10^6$ | | 13.7 | 12.4 | 10.7 | 9.74 | 8.63 | 7.41 | 11.7 | 10.7 | 9.26 | 8.43 | 7.49 | 6.47 |
| $a_y \div 10^6$ | | 4.43 | 4.08 | 3.59 | 3.29 | 2.93 | 2.53 | 6.86 | 6.27 | 5.46 | 5.00 | 4.46 | 3.85 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

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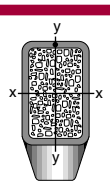
# HSS / Rectangular Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips




**f'c = 8.0**

**f'c = 8.0 ksi**

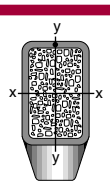
| Nominal Size | | 7 x 4 | | | | | 6 x 5 | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 1/2 | 3/8 | 5/16 | 1/4 | 3/16 | 3/8 | 5/16 | 1/4 | 3/16 |
| Weight Per Foot | | 31.84 | 24.93 | 21.21 | 17.32 | 13.25 | 24.93 | 21.21 | 17.32 | 13.25 |
| Design Wall Thickness | | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 | 0.349 | 0.291 | 0.233 | 0.174 |
| | | $F_y$ = 46 ksi | | | | | | | | |
| Effective length KL in feet | 0 | 318 | 274 | 251 | 226 | 199 | 283 | 259 | 234 | 207 |
| | 4 | 285 | 246 | 225 | 203 | 178 | 260 | 238 | 215 | 190 |
| | 5 | 274 | 237 | 216 | 195 | 171 | 252 | 231 | 209 | 185 |
| | 6 | 261 | 226 | 207 | 186 | 163 | 244 | 223 | 202 | 178 |
| | 7 | 248 | 214 | 196 | 177 | 155 | 235 | 215 | 194 | 172 |
| | 8 | 233 | 202 | 185 | 166 | 146 | 225 | 206 | 186 | 164 |
| | 9 | 218 | 189 | 173 | 156 | 136 | 215 | 197 | 178 | 157 |
| | 10 | 201 | 175 | 160 | 144 | 126 | 204 | 187 | 169 | 149 |
| | 11 | 184 | 160 | 147 | 132 | 115 | 193 | 177 | 159 | 140 |
| | 12 | 165 | 144 | 132 | 119 | 103 | 181 | 166 | 149 | 131 |
| | 13 | 145 | 127 | 117 | 105 | 90 | 168 | 154 | 139 | 121 |
| | 14 | 125 | 110 | 102 | 91 | 78 | 155 | 142 | 128 | 111 |
| | 15 | 109 | 96 | 88 | 79 | 68 | 141 | 129 | 116 | 101 |
| | 16 | 96 | 84 | 78 | 70 | 60 | 127 | 116 | 104 | 90 |
| | 17 | 85 | 75 | 69 | 62 | 53 | 112 | 103 | 92 | 80 |
| | 18 | 76 | 67 | 61 | 55 | 47 | 100 | 92 | 82 | 71 |
| | 19 | 68 | 60 | 55 | 50 | 42 | 90 | 82 | 74 | 64 |
| | 20 | 61 | 54 | 50 | 45 | 38 | 81 | 74 | 67 | 58 |
| | 21 | 56 | 49 | 45 | 41 | 35 | 74 | 67 | 60 | 52 |
| | 22 | 51 | 45 | 41 | 37 | 32 | 67 | 61 | 55 | 48 |
| | 23 | 46 | 41 | 38 | 34 | 29 | 61 | 56 | 50 | 44 |
| | 24 | 43 | 38 | 35 | 31 | 27 | 56 | 52 | 46 | 40 |
| | 25 | 39 | 35 | 32 | 29 | 24 | 52 | 48 | 43 | 37 |
| | 26 | | 32 | 29 | 26 | 23 | 48 | 44 | 39 | 34 |
| | 27 | | | | 25 | 21 | 45 | 41 | 37 | 32 |
| | 28 | | | | | | 41 | 38 | 34 | 29 |
| | 29 | | | | | | 39 | 35 | 32 | 27 |
| | 30 | | | | | | 36 | 33 | 30 | 26 |
| | 31 | | | | | | 34 | 31 | 28 | 24 |
| | 32 | | | | | | 32 | 29 | 26 | 22 |
| | 33 | | | | | | | | 24 | 21 |
| | 34 | | | | | | | | | |
| | 35 | | | | | | | | | |
| | 36 | | | | | | | | | |
| | 37 | | | | | | | | | |
| | 38 | | | | | | | | | |
| | 39 | | | | | | | | | |
| | 40 | | | | | | | | | |
| **Properties** | | | | | | | | | | |
| Area, In.$^2$ | | 8.81 | 6.88 | 5.85 | 4.77 | 3.63 | 6.88 | 5.85 | 4.77 | 3.63 |
| $I_x$, In.$^4$ | | 50.6 | 41.8 | 36.4 | 30.5 | 23.8 | 33.9 | 29.6 | 24.7 | 19.3 |
| $I_y$, In.$^4$ | | 20.7 | 17.3 | 15.2 | 12.8 | 10.0 | 25.5 | 22.3 | 18.7 | 14.6 |
| Ratio, $r_x/r_y$ | | 1.57 | 1.56 | 1.55 | 1.55 | 1.54 | 1.15 | 1.15 | 1.15 | 1.15 |
| $r_y$, In. | | 1.53 | 1.58 | 1.61 | 1.64 | 1.66 | 1.92 | 1.95 | 1.98 | 2.01 |
| $B_x$, Bending Factor | | 0.609 | 0.576 | 0.563 | 0.547 | 0.534 | 0.609 | 0.593 | 0.579 | 0.564 |
| $B_y$, Bending Factor | | 0.851 | 0.795 | 0.770 | 0.745 | 0.726 | 0.675 | 0.656 | 0.638 | 0.622 |
| $a_x \div 10^6$ | | 8.68 | 7.58 | 6.88 | 6.12 | 5.24 | 6.25 | 5.70 | 5.07 | 4.36 |
| $a_y \div 10^6$ | | 3.55 | 3.14 | 2.87 | 2.57 | 2.20 | 4.70 | 4.30 | 3.83 | 3.30 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

ERW

# HSS / Rectangular Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips

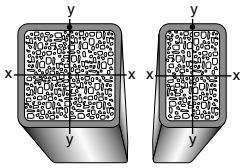



**f'c = 8.0**

| Nominal Size | | 6 x 4 | | | | | 5 x 4 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 1/2 | 3/8 | 5/16 | 1/4 | 3/16 | 1/2 | 3/8 | 5/16 | 1/4 | 3/16 |
| Weight Per Foot | | 28.43 | 22.37 | 19.08 | 15.62 | 11.97 | 25.03 | 19.82 | 16.96 | 13.91 | 10.70 |
| Design Wall Thickness | | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 |
| | | $F_y$ = 46 ksi | | | | | | | | | |
| Effective length KL in feet | 0 | 280 | 242 | 220 | 198 | 175 | 242 | 209 | 190 | 171 | 150 |
| | 4 | 251 | 216 | 198 | 178 | 156 | 216 | 187 | 170 | 153 | 134 |
| | 5 | 240 | 208 | 190 | 171 | 150 | 206 | 179 | 163 | 147 | 128 |
| | 6 | 229 | 198 | 181 | 163 | 143 | 196 | 170 | 155 | 140 | 122 |
| | 7 | 217 | 188 | 172 | 154 | 135 | 185 | 161 | 147 | 132 | 116 |
| | 8 | 204 | 177 | 161 | 145 | 127 | 174 | 151 | 138 | 124 | 108 |
| | 9 | 190 | 165 | 151 | 136 | 118 | 161 | 141 | 129 | 116 | 101 |
| | 10 | 175 | 152 | 139 | 125 | 109 | 148 | 130 | 118 | 106 | 93 |
| | 11 | 159 | 139 | 127 | 114 | 99 | 134 | 118 | 107 | 97 | 84 |
| | 12 | 142 | 124 | 114 | 103 | 88 | 118 | 105 | 96 | 86 | 75 |
| | 13 | 124 | 109 | 100 | 90 | 77 | 102 | 92 | 84 | 75 | 65 |
| | 14 | 107 | 94 | 87 | 78 | 67 | 88 | 79 | 72 | 65 | 56 |
| | 15 | 93 | 82 | 76 | 68 | 58 | 77 | 69 | 63 | 57 | 49 |
| | 16 | 82 | 72 | 66 | 60 | 51 | 68 | 61 | 55 | 50 | 43 |
| | 17 | 72 | 64 | 59 | 53 | 45 | 60 | 54 | 49 | 44 | 38 |
| | 18 | 65 | 57 | 53 | 47 | 40 | 53 | 48 | 44 | 39 | 34 |
| | 19 | 58 | 51 | 47 | 42 | 36 | 48 | 43 | 39 | 35 | 30 |
| | 20 | 52 | 46 | 43 | 38 | 33 | 43 | 39 | 35 | 32 | 27 |
| | 21 | 47 | 42 | 39 | 35 | 30 | 39 | 35 | 32 | 29 | 25 |
| | 22 | 43 | 38 | 35 | 32 | 27 | 36 | 32 | 29 | 26 | 23 |
| | 23 | 40 | 35 | 32 | 29 | 25 | 33 | 29 | 27 | 24 | 21 |
| | 24 | 36 | 32 | 30 | 27 | 23 | 30 | 27 | 25 | 22 | 19 |
| | 25 | 33 | 30 | 27 | 24 | 21 | | 25 | 23 | 20 | 18 |
| | 26 | | | 25 | 23 | 19 | | | | 19 | 16 |
| | 27 | | | | | 18 | | | | | |
| | 28 | | | | | | | | | | |
| | 29 | | | | | | | | | | |
| | 30 | | | | | | | | | | |
| | 31 | | | | | | | | | | |
| | 32 | | | | | | | | | | |
| | 33 | | | | | | | | | | |
| | 34 | | | | | | | | | | |
| | 35 | | | | | | | | | | |
| | 36 | | | | | | | | | | |
| | 37 | | | | | | | | | | |
| | 38 | | | | | | | | | | |
| | 39 | | | | | | | | | | |
| | 40 | | | | | | | | | | |
| **Properties** | | | | | | | | | | | |
| Area, In.$^2$ | | 7.88 | 6.18 | 5.26 | 4.30 | 3.28 | 6.95 | 5.48 | 4.68 | 3.84 | 2.93 |
| $I_x$, In.$^4$ | | 33.9 | 28.3 | 24.8 | 20.9 | 16.4 | 21.2 | 17.9 | 15.8 | 13.4 | 10.6 |
| $I_y$, In.$^4$ | | 17.7 | 14.9 | 13.1 | 11.1 | 8.76 | 14.8 | 12.6 | 11.1 | 9.46 | 7.48 |
| Ratio, $r_x/r_y$ | | 1.38 | 1.38 | 1.37 | 1.37 | 1.37 | 1.20 | 1.19 | 1.19 | 1.19 | 1.19 |
| $r_y$, In. | | 1.50 | 1.55 | 1.58 | 1.61 | 1.63 | 1.46 | 1.52 | 1.54 | 1.57 | 1.60 |
| $B_x$, Bending Factor | | 0.697 | 0.655 | 0.636 | 0.617 | 0.600 | 0.820 | 0.765 | 0.741 | 0.716 | 0.691 |
| $B_y$, Bending Factor | | 0.890 | 0.830 | 0.803 | 0.775 | 0.749 | 0.939 | 0.870 | 0.843 | 0.812 | 0.783 |
| $a_x \div 10^6$ | | 5.76 | 5.07 | 4.63 | 4.13 | 3.54 | 3.56 | 3.16 | 2.90 | 2.59 | 2.23 |
| $a_y \div 10^6$ | | 3.01 | 2.67 | 2.44 | 2.19 | 1.89 | 2.49 | 2.23 | 2.04 | 1.83 | 1.58 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

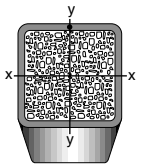
# HSS/Structural Steel Tubing for Composite Columns
## Notes




f'c = 8.0

# HSS / Square Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips




**f'c = 3.5**

| Nominal Size | | 28 x 28 | 26 x 26 | 24 x 24 | 22 x 22 | | 20 x 20 | | 18 x 18 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 5/8 | 5/8 | 5/8 | 5/8 | 1/2 | 5/8 | 1/2 | 5/8 | 1/2 | 3/8 |
| Weight Per Foot | | 225.80 | 208.79 | 191.78 | 174.76 | 142.67 | 157.75 | 129.06 | 140.73 | 115.45 | 87.91 |
| Design Wall Thickness | | 0.625 | 0.625 | 0.625 | 0.625 | 0.500 | 0.625 | 0.500 | 0.625 | 0.500 | 0.375 |
| | | $F_y$ = 46 ksi | | | | | | | | | |
| Effective length KL in feet | 0 | 3110 | 2780 | 2480 | 2180 | 1940 | 1900 | 1690 | 1640 | 1450 | 1240 |
| | 4 | 3070 | 2750 | 2450 | 2150 | 1920 | 1880 | 1660 | 1610 | 1430 | 1220 |
| | 5 | 3070 | 2750 | 2440 | 2150 | 1910 | 1870 | 1660 | 1610 | 1420 | 1220 |
| | 6 | 3060 | 2740 | 2430 | 2140 | 1900 | 1860 | 1650 | 1600 | 1410 | 1210 |
| | 7 | 3050 | 2730 | 2420 | 2130 | 1900 | 1850 | 1640 | 1590 | 1410 | 1200 |
| | 8 | 3040 | 2720 | 2410 | 2120 | 1890 | 1840 | 1640 | 1580 | 1400 | 1200 |
| | 9 | 3030 | 2710 | 2400 | 2110 | 1880 | 1830 | 1630 | 1570 | 1390 | 1190 |
| | 10 | 3020 | 2700 | 2390 | 2100 | 1870 | 1830 | 1620 | 1560 | 1380 | 1180 |
| | 11 | 3010 | 2690 | 2380 | 2090 | 1860 | 1820 | 1610 | 1550 | 1370 | 1180 |
| | 12 | 3000 | 2680 | 2370 | 2080 | 1850 | 1810 | 1600 | 1540 | 1370 | 1170 |
| | 13 | 2990 | 2670 | 2360 | 2070 | 1840 | 1800 | 1590 | 1530 | 1360 | 1160 |
| | 14 | 2980 | 2660 | 2350 | 2060 | 1830 | 1790 | 1580 | 1520 | 1350 | 1150 |
| | 15 | 2970 | 2650 | 2340 | 2050 | 1830 | 1770 | 1570 | 1510 | 1340 | 1150 |
| | 16 | 2960 | 2640 | 2330 | 2040 | 1820 | 1760 | 1560 | 1500 | 1330 | 1140 |
| | 17 | 2940 | 2630 | 2320 | 2030 | 1810 | 1750 | 1550 | 1490 | 1320 | 1130 |
| | 18 | 2930 | 2610 | 2310 | 2020 | 1790 | 1740 | 1540 | 1480 | 1310 | 1120 |
| | 19 | 2920 | 2600 | 2300 | 2010 | 1780 | 1730 | 1530 | 1470 | 1300 | 1110 |
| | 20 | 2910 | 2590 | 2280 | 1990 | 1770 | 1720 | 1520 | 1450 | 1290 | 1100 |
| | 21 | 2890 | 2580 | 2270 | 1980 | 1760 | 1700 | 1510 | 1440 | 1280 | 1090 |
| | 22 | 2880 | 2560 | 2260 | 1970 | 1750 | 1690 | 1500 | 1430 | 1260 | 1080 |
| | 23 | 2870 | 2550 | 2250 | 1950 | 1740 | 1680 | 1490 | 1420 | 1250 | 1070 |
| | 24 | 2860 | 2540 | 2230 | 1940 | 1730 | 1670 | 1480 | 1400 | 1240 | 1060 |
| | 25 | 2840 | 2520 | 2220 | 1930 | 1720 | 1650 | 1470 | 1390 | 1230 | 1050 |
| | 26 | 2830 | 2510 | 2210 | 1910 | 1700 | 1640 | 1450 | 1370 | 1220 | 1040 |
| | 27 | 2810 | 2500 | 2190 | 1900 | 1690 | 1620 | 1440 | 1360 | 1210 | 1030 |
| | 28 | 2800 | 2480 | 2180 | 1890 | 1680 | 1610 | 1430 | 1350 | 1190 | 1020 |
| | 29 | 2790 | 2470 | 2160 | 1870 | 1670 | 1600 | 1420 | 1330 | 1180 | 1010 |
| | 30 | 2770 | 2450 | 2150 | 1860 | 1650 | 1580 | 1400 | 1320 | 1170 | 999 |
| | 31 | 2760 | 2440 | 2130 | 1840 | 1640 | 1570 | 1390 | 1300 | 1150 | 988 |
| | 32 | 2740 | 2430 | 2120 | 1830 | 1630 | 1550 | 1380 | 1290 | 1140 | 977 |
| | 33 | 2730 | 2410 | 2100 | 1810 | 1610 | 1540 | 1360 | 1270 | 1130 | 965 |
| | 34 | 2710 | 2390 | 2090 | 1800 | 1600 | 1520 | 1350 | 1260 | 1110 | 953 |
| | 35 | 2700 | 2380 | 2070 | 1780 | 1590 | 1500 | 1340 | 1240 | 1100 | 941 |
| | 36 | 2680 | 2360 | 2060 | 1770 | 1570 | 1490 | 1320 | 1220 | 1080 | 929 |
| | 37 | 2660 | 2350 | 2040 | 1750 | 1560 | 1470 | 1310 | 1210 | 1070 | 917 |
| | 38 | 2650 | 2330 | 2020 | 1730 | 1540 | 1460 | 1290 | 1190 | 1060 | 904 |
| | 39 | 2630 | 2310 | 2010 | 1720 | 1530 | 1440 | 1280 | 1170 | 1040 | 891 |
| | 40 | 2610 | 2300 | 1990 | 1700 | 1510 | 1420 | 1260 | 1160 | 1030 | 878 |
| **Properties** | | | | | | | | | | | |
| Area, In.$^2$ | | 66.4 | 61.4 | 56.4 | 51.4 | 41.9 | 46.4 | 37.9 | 41.4 | 33.9 | 25.8 |
| I, In.$^4$ | | 8140 | 6460 | 5030 | 3820 | 3190 | 2830 | 2370 | 2020 | 1700 | 1320 |
| r, In. | | 11.1 | 10.3 | 9.44 | 8.62 | 8.72 | 7.81 | 7.90 | 6.99 | 7.08 | 7.15 |
| B, Bending Factor | | 0.114 | 0.124 | 0.135 | 0.148 | 0.144 | 0.164 | 0.160 | 0.184 | 0.179 | 0.176 |
| a ÷ $10^6$ | | 1840 | 1430 | 1070 | 794 | 711 | 572 | 511 | 398 | 355 | 304 |

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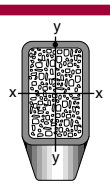
# HSS / Rectangular Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips




**f'c = 3.5**

| Nominal Size | | 28 x 24 | 26 x 24 | 24 x 22 | 22 x 20 | | 20 x 18 | | 20 x 16 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 5/8 | 5/8 | 5/8 | 5/8 | 1/2 | 5/8 | 1/2 | 5/8 | 1/2 |
| Weight Per Foot | | 208.79 | 200.28 | 183.27 | 166.25 | 135.86 | 149.24 | 122.25 | 140.73 | 115.45 |
| Design Wall Thickness | | 0.625 | 0.625 | 0.625 | 0.625 | 0.500 | 0.625 | 0.500 | 0.625 | 0.500 |
| | | $F_y$ = 46 ksi | | | | | | | | |
| Effective length KL in feet | 0 | 2780 | 2630 | 2330 | 2040 | 1810 | 1770 | 1570 | 1630 | 1440 |
| | 4 | 2740 | 2600 | 2300 | 2010 | 1790 | 1740 | 1540 | 1600 | 1420 |
| | 5 | 2740 | 2590 | 2290 | 2000 | 1780 | 1730 | 1530 | 1590 | 1410 |
| | 6 | 2730 | 2580 | 2280 | 1990 | 1770 | 1720 | 1530 | 1590 | 1400 |
| | 7 | 2720 | 2570 | 2270 | 1990 | 1760 | 1710 | 1520 | 1580 | 1390 |
| | 8 | 2710 | 2560 | 2260 | 1980 | 1760 | 1710 | 1510 | 1570 | 1390 |
| | 9 | 2700 | 2550 | 2250 | 1970 | 1750 | 1700 | 1500 | 1560 | 1380 |
| | 10 | 2690 | 2540 | 2240 | 1960 | 1740 | 1690 | 1490 | 1550 | 1370 |
| | 11 | 2680 | 2530 | 2230 | 1950 | 1730 | 1680 | 1480 | 1540 | 1360 |
| | 12 | 2660 | 2520 | 2220 | 1940 | 1720 | 1670 | 1480 | 1520 | 1350 |
| | 13 | 2650 | 2510 | 2210 | 1930 | 1710 | 1660 | 1470 | 1510 | 1340 |
| | 14 | 2640 | 2500 | 2200 | 1910 | 1700 | 1640 | 1460 | 1500 | 1330 |
| | 15 | 2630 | 2490 | 2190 | 1900 | 1690 | 1630 | 1450 | 1490 | 1320 |
| | 16 | 2620 | 2470 | 2180 | 1890 | 1680 | 1620 | 1440 | 1480 | 1310 |
| | 17 | 2610 | 2460 | 2160 | 1880 | 1670 | 1610 | 1430 | 1460 | 1290 |
| | 18 | 2590 | 2450 | 2150 | 1870 | 1660 | 1600 | 1410 | 1450 | 1280 |
| | 19 | 2580 | 2440 | 2140 | 1850 | 1650 | 1580 | 1400 | 1440 | 1270 |
| | 20 | 2570 | 2420 | 2130 | 1840 | 1640 | 1570 | 1390 | 1420 | 1260 |
| | 21 | 2550 | 2410 | 2110 | 1830 | 1630 | 1560 | 1380 | 1410 | 1250 |
| | 22 | 2540 | 2400 | 2100 | 1820 | 1610 | 1540 | 1370 | 1390 | 1230 |
| | 23 | 2520 | 2390 | 2090 | 1800 | 1600 | 1530 | 1360 | 1380 | 1220 |
| | 24 | 2510 | 2370 | 2070 | 1790 | 1590 | 1520 | 1340 | 1360 | 1210 |
| | 25 | 2500 | 2360 | 2060 | 1770 | 1580 | 1500 | 1330 | 1350 | 1190 |
| | 26 | 2480 | 2340 | 2040 | 1760 | 1560 | 1490 | 1320 | 1330 | 1180 |
| | 27 | 2470 | 2330 | 2030 | 1740 | 1550 | 1470 | 1310 | 1320 | 1170 |
| | 28 | 2450 | 2310 | 2020 | 1730 | 1540 | 1460 | 1290 | 1300 | 1150 |
| | 29 | 2430 | 2300 | 2000 | 1710 | 1520 | 1440 | 1280 | 1280 | 1140 |
| | 30 | 2420 | 2280 | 1980 | 1700 | 1510 | 1430 | 1270 | 1270 | 1120 |
| | 31 | 2400 | 2270 | 1970 | 1680 | 1500 | 1410 | 1250 | 1250 | 1110 |
| | 32 | 2390 | 2250 | 1950 | 1670 | 1480 | 1400 | 1240 | 1230 | 1090 |
| | 33 | 2370 | 2240 | 1940 | 1650 | 1470 | 1380 | 1220 | 1220 | 1080 |
| | 34 | 2350 | 2220 | 1920 | 1640 | 1450 | 1360 | 1210 | 1200 | 1060 |
| | 35 | 2340 | 2200 | 1900 | 1620 | 1440 | 1350 | 1190 | 1180 | 1050 |
| | 36 | 2320 | 2190 | 1890 | 1600 | 1420 | 1330 | 1180 | 1160 | 1030 |
| | 37 | 2300 | 2170 | 1870 | 1580 | 1410 | 1310 | 1160 | 1140 | 1010 |
| | 38 | 2280 | 2150 | 1850 | 1570 | 1390 | 1290 | 1150 | 1120 | 996 |
| | 39 | 2270 | 2140 | 1840 | 1550 | 1380 | 1280 | 1130 | 1100 | 979 |
| | 40 | 2250 | 2120 | 1820 | 1530 | 1360 | 1260 | 1120 | 1080 | 962 |
| **Properties** | | | | | | | | | | |
| Area, In.$^2$ | | 61.4 | 58.9 | 53.9 | 48.9 | 39.9 | 43.9 | 35.9 | 41.4 | 33.9 |
| $I_x$, In.$^4$ | | 7210 | 6060 | 4680 | 3530 | 2950 | 2590 | 2180 | 2360 | 1990 |
| $I_y$, In.$^4$ | | 5710 | 5370 | 4110 | 3060 | 2560 | 2210 | 1850 | 1680 | 1410 |
| Ratio, $r_x/r_y$ | | 1.12 | 1.06 | 1.07 | 1.07 | 1.07 | 1.08 | 1.08 | 1.18 | 1.18 |
| $r_y$, In. | | 9.65 | 9.55 | 8.73 | 7.91 | 8.00 | 7.10 | 7.19 | 6.37 | 6.46 |
| $B_x$, Bending Factor | | 0.119 | 0.126 | 0.138 | 0.152 | 0.149 | 0.169 | 0.165 | 0.175 | 0.170 |
| $B_y$, Bending Factor | | 0.129 | 0.132 | 0.144 | 0.160 | 0.156 | 0.179 | 0.175 | 0.197 | 0.192 |
| $a_x \div 10^6$ | | 1580 | 1310 | 985 | 723 | 647 | 516 | 463 | 462 | 414 |
| $a_y \div 10^6$ | | 1250 | 1160 | 865 | 627 | 562 | 440 | 393 | 329 | 294 |

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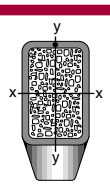
# HSS / Rectangular Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips

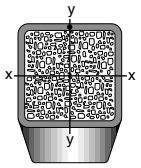



**f'c = 3.5**

| Nominal Size | | 20 x 12 | 18 x 12 | | | 16 x 12 | 14 x 12 | |
|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 5/8 | 5/8 | 1/2 | 3/8 | 5/8 | 1/2 | 3/8 |
| Weight Per Foot | | 123.72 | 115.21 | 95.03 | 72.59 | 106.71 | 81.42 | 62.39 |
| Design Wall Thickness | | 0.625 | 0.625 | 0.500 | 0.375 | 0.625 | 0.500 | 0.375 |
| | | $F_y$ = 46 ksi | | | | | | |
| Effective length KL in feet | 0 | 1360 | 1250 | 1100 | 933 | 1150 | 913 | 770 |
| | 4 | 1330 | 1220 | 1080 | 911 | 1120 | 890 | 751 |
| | 5 | 1320 | 1210 | 1070 | 904 | 1110 | 884 | 745 |
| | 6 | 1310 | 1200 | 1060 | 897 | 1100 | 876 | 739 |
| | 7 | 1300 | 1190 | 1050 | 890 | 1090 | 869 | 733 |
| | 8 | 1290 | 1180 | 1040 | 882 | 1080 | 861 | 726 |
| | 9 | 1270 | 1170 | 1030 | 874 | 1070 | 852 | 719 |
| | 10 | 1260 | 1160 | 1020 | 865 | 1060 | 844 | 712 |
| | 11 | 1250 | 1150 | 1010 | 856 | 1050 | 835 | 704 |
| | 12 | 1230 | 1140 | 1000 | 847 | 1040 | 825 | 696 |
| | 13 | 1220 | 1120 | 989 | 837 | 1020 | 816 | 688 |
| | 14 | 1210 | 1110 | 977 | 828 | 1010 | 805 | 680 |
| | 15 | 1190 | 1100 | 965 | 818 | 998 | 795 | 671 |
| | 16 | 1180 | 1080 | 953 | 807 | 985 | 784 | 662 |
| | 17 | 1160 | 1070 | 940 | 796 | 971 | 773 | 653 |
| | 18 | 1140 | 1050 | 927 | 785 | 957 | 762 | 643 |
| | 19 | 1130 | 1040 | 913 | 774 | 943 | 750 | 634 |
| | 20 | 1110 | 1020 | 900 | 762 | 928 | 738 | 624 |
| | 21 | 1090 | 1000 | 886 | 750 | 912 | 726 | 613 |
| | 22 | 1080 | 987 | 871 | 738 | 897 | 714 | 603 |
| | 23 | 1060 | 970 | 856 | 726 | 881 | 701 | 592 |
| | 24 | 1040 | 952 | 841 | 713 | 865 | 688 | 581 |
| | 25 | 1020 | 934 | 826 | 700 | 848 | 674 | 570 |
| | 26 | 1000 | 916 | 810 | 687 | 831 | 661 | 559 |
| | 27 | 981 | 898 | 794 | 673 | 814 | 647 | 547 |
| | 28 | 961 | 879 | 777 | 659 | 796 | 633 | 535 |
| | 29 | 940 | 859 | 761 | 645 | 778 | 618 | 523 |
| | 30 | 919 | 840 | 744 | 631 | 759 | 603 | 511 |
| | 31 | 898 | 820 | 726 | 616 | 741 | 588 | 498 |
| | 32 | 876 | 799 | 709 | 601 | 721 | 573 | 485 |
| | 33 | 854 | 779 | 691 | 586 | 702 | 557 | 472 |
| | 34 | 831 | 757 | 672 | 570 | 682 | 541 | 459 |
| | 35 | 808 | 736 | 654 | 554 | 662 | 525 | 445 |
| | 36 | 785 | 714 | 635 | 538 | 641 | 508 | 431 |
| | 37 | 761 | 691 | 615 | 522 | 620 | 491 | 417 |
| | 38 | 736 | 669 | 595 | 505 | 599 | 474 | 403 |
| | 39 | 712 | 645 | 575 | 488 | 577 | 457 | 388 |
| | 40 | 687 | 622 | 555 | 471 | 555 | 439 | 373 |
| **Properties** | | | | | | | | |
| Area, In.$^2$ | | 36.4 | 33.9 | 27.9 | 21.3 | 31.4 | 23.9 | 18.3 |
| $I_x$, In.$^4$ | | 1890 | 1450 | 1240 | 971 | 1090 | 678 | 534 |
| $I_y$, In.$^4$ | | 864 | 783 | 668 | 524 | 702 | 536 | 422 |
| Ratio, $r_x/r_y$ | | 1.48 | 1.36 | 1.36 | 1.36 | 1.24 | 1.12 | 1.12 |
| $r_y$, In. | | 4.87 | 4.81 | 4.89 | 4.95 | 4.73 | 4.73 | 4.80 |
| $B_x$, Bending Factor | | 0.193 | 0.210 | 0.203 | 0.197 | 0.230 | 0.247 | 0.240 |
| $B_y$, Bending Factor | | 0.253 | 0.260 | 0.251 | 0.244 | 0.268 | 0.268 | 0.260 |
| $a_x \div 10^6$ | | 355 | 270 | 243 | 207 | 201 | 130 | 110 |
| $a_y \div 10^6$ | | 162 | 146 | 131 | 112 | 129 | 102 | 87.1 |

# HSS / Square Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips




**f'c = 5.0**

| Nominal Size | | 28 x 28 | 26 x 26 | 24 x 24 | 22 x 22 | | 20 x 20 | | 18 x 18 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 5/8 | 5/8 | 5/8 | 5/8 | 1/2 | 5/8 | 1/2 | 5/8 | 1/2 | 3/8 |
| Weight Per Foot | | 225.80 | 208.79 | 191.78 | 174.76 | 142.67 | 157.75 | 129.06 | 140.73 | 115.45 | 87.91 |
| Design Wall Thickness | | 0.625 | 0.625 | 0.625 | 0.625 | 0.500 | 0.625 | 0.500 | 0.625 | 0.500 | 0.375 |
| | | **$F_y$ = 46 ksi** | | | | | | | | | |
| Effective length KL in feet | 0 | 3650 | 3250 | 2870 | 2510 | 2280 | 2170 | 1960 | 1850 | 1670 | 1470 |
| | 4 | 3610 | 3210 | 2830 | 2480 | 2250 | 2140 | 1930 | 1820 | 1640 | 1440 |
| | 5 | 3600 | 3200 | 2830 | 2470 | 2240 | 2130 | 1930 | 1810 | 1630 | 1440 |
| | 6 | 3590 | 3190 | 2810 | 2460 | 2230 | 2120 | 1920 | 1800 | 1630 | 1430 |
| | 7 | 3580 | 3180 | 2800 | 2450 | 2220 | 2110 | 1910 | 1790 | 1620 | 1420 |
| | 8 | 3570 | 3170 | 2790 | 2440 | 2210 | 2100 | 1900 | 1780 | 1610 | 1410 |
| | 9 | 3560 | 3160 | 2780 | 2420 | 2200 | 2090 | 1890 | 1770 | 1600 | 1410 |
| | 10 | 3540 | 3150 | 2770 | 2410 | 2190 | 2080 | 1880 | 1760 | 1590 | 1400 |
| | 11 | 3530 | 3140 | 2760 | 2400 | 2180 | 2070 | 1870 | 1750 | 1580 | 1390 |
| | 12 | 3520 | 3120 | 2750 | 2390 | 2170 | 2050 | 1860 | 1740 | 1570 | 1380 |
| | 13 | 3510 | 3110 | 2730 | 2380 | 2160 | 2040 | 1850 | 1730 | 1560 | 1370 |
| | 14 | 3490 | 3100 | 2720 | 2360 | 2150 | 2030 | 1830 | 1710 | 1540 | 1360 |
| | 15 | 3480 | 3080 | 2710 | 2350 | 2130 | 2020 | 1820 | 1700 | 1530 | 1350 |
| | 16 | 3460 | 3070 | 2690 | 2340 | 2120 | 2000 | 1810 | 1690 | 1520 | 1340 |
| | 17 | 3450 | 3050 | 2680 | 2320 | 2110 | 1990 | 1800 | 1670 | 1510 | 1330 |
| | 18 | 3430 | 3040 | 2660 | 2310 | 2100 | 1970 | 1790 | 1660 | 1500 | 1320 |
| | 19 | 3420 | 3020 | 2650 | 2290 | 2080 | 1960 | 1770 | 1650 | 1480 | 1300 |
| | 20 | 3400 | 3010 | 2630 | 2280 | 2070 | 1950 | 1760 | 1630 | 1470 | 1290 |
| | 21 | 3390 | 2990 | 2620 | 2260 | 2050 | 1930 | 1750 | 1620 | 1460 | 1280 |
| | 22 | 3370 | 2980 | 2600 | 2250 | 2040 | 1920 | 1730 | 1600 | 1440 | 1270 |
| | 23 | 3360 | 2960 | 2590 | 2230 | 2030 | 1900 | 1720 | 1590 | 1430 | 1260 |
| | 24 | 3340 | 2950 | 2570 | 2220 | 2010 | 1880 | 1700 | 1570 | 1420 | 1240 |
| | 25 | 3320 | 2930 | 2550 | 2200 | 2000 | 1870 | 1690 | 1550 | 1400 | 1230 |
| | 26 | 3300 | 2910 | 2540 | 2180 | 1980 | 1850 | 1670 | 1540 | 1390 | 1220 |
| | 27 | 3290 | 2890 | 2520 | 2170 | 1970 | 1830 | 1660 | 1520 | 1370 | 1200 |
| | 28 | 3270 | 2880 | 2500 | 2150 | 1950 | 1820 | 1640 | 1500 | 1360 | 1190 |
| | 29 | 3250 | 2860 | 2480 | 2130 | 1930 | 1800 | 1630 | 1490 | 1340 | 1180 |
| | 30 | 3230 | 2840 | 2470 | 2110 | 1920 | 1780 | 1610 | 1470 | 1320 | 1160 |
| | 31 | 3210 | 2820 | 2450 | 2100 | 1900 | 1760 | 1590 | 1450 | 1310 | 1150 |
| | 32 | 3190 | 2800 | 2430 | 2080 | 1880 | 1750 | 1580 | 1430 | 1290 | 1130 |
| | 33 | 3180 | 2790 | 2410 | 2060 | 1870 | 1730 | 1560 | 1410 | 1270 | 1120 |
| | 34 | 3160 | 2770 | 2390 | 2040 | 1850 | 1710 | 1540 | 1390 | 1260 | 1100 |
| | 35 | 3140 | 2750 | 2370 | 2020 | 1830 | 1690 | 1530 | 1380 | 1240 | 1090 |
| | 36 | 3120 | 2730 | 2350 | 2000 | 1810 | 1670 | 1510 | 1360 | 1220 | 1070 |
| | 37 | 3100 | 2710 | 2330 | 1980 | 1800 | 1650 | 1490 | 1340 | 1210 | 1060 |
| | 38 | 3080 | 2690 | 2310 | 1960 | 1780 | 1630 | 1470 | 1320 | 1190 | 1040 |
| | 39 | 3060 | 2670 | 2290 | 1940 | 1760 | 1610 | 1460 | 1300 | 1170 | 1020 |
| | 40 | 3030 | 2650 | 2270 | 1920 | 1740 | 1590 | 1440 | 1280 | 1150 | 1010 |
| **Properties** | | | | | | | | | | | |
| Area, In.$^2$ | | 66.4 | 61.4 | 56.4 | 51.4 | 41.9 | 46.4 | 37.9 | 41.4 | 33.9 | 25.8 |
| I, In.$^4$ | | 8140 | 6460 | 5030 | 3820 | 3190 | 2830 | 2370 | 2020 | 1700 | 1320 |
| r, In. | | 11.1 | 10.3 | 9.44 | 8.62 | 8.72 | 7.81 | 7.90 | 6.99 | 7.08 | 7.15 |
| B, Bending Factor | | 0.114 | 0.124 | 0.135 | 0.148 | 0.144 | 0.164 | 0.160 | 0.184 | 0.179 | 0.176 |
| a ÷ $10^6$ | | 1960 | 1520 | 1140 | 837 | 757 | 601 | 542 | 416 | 375 | 324 |

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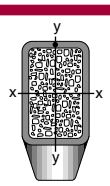
# HSS / Rectangular Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips




**f'c = 5.0**

| Nominal Size | | 28 x 24 | 26 x 24 | 24 x 22 | 22 x 20 | | 20 x 18 | | 20 x 16 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 5/8 | 5/8 | 5/8 | 5/8 | 1/2 | 5/8 | 1/2 | 5/8 | 1/2 |
| Weight Per Foot | | 208.79 | 200.28 | 183.27 | 166.25 | 135.86 | 149.24 | 122.25 | 140.73 | 115.45 |
| Design Wall Thickness | | 0.625 | 0.625 | 0.625 | 0.625 | 0.500 | 0.625 | 0.500 | 0.625 | 0.500 |
| | | $F_y$ = 46 ksi | | | | | | | | |
| Effective length KL in feet | 0 | 3240 | 3060 | 2690 | 2340 | 2120 | 2010 | 1810 | 1840 | 1660 |
| | 4 | 3200 | 3020 | 2650 | 2300 | 2080 | 1970 | 1780 | 1810 | 1630 |
| | 5 | 3190 | 3010 | 2640 | 2290 | 2080 | 1960 | 1770 | 1800 | 1620 |
| | 6 | 3180 | 3000 | 2630 | 2280 | 2070 | 1950 | 1760 | 1790 | 1610 |
| | 7 | 3170 | 2990 | 2620 | 2270 | 2060 | 1940 | 1750 | 1780 | 1600 |
| | 8 | 3150 | 2970 | 2610 | 2260 | 2050 | 1930 | 1740 | 1760 | 1590 |
| | 9 | 3140 | 2960 | 2590 | 2250 | 2040 | 1920 | 1730 | 1750 | 1580 |
| | 10 | 3130 | 2950 | 2580 | 2240 | 2030 | 1910 | 1720 | 1740 | 1570 |
| | 11 | 3120 | 2940 | 2570 | 2220 | 2010 | 1900 | 1710 | 1730 | 1560 |
| | 12 | 3100 | 2920 | 2560 | 2210 | 2000 | 1880 | 1700 | 1710 | 1550 |
| | 13 | 3090 | 2910 | 2540 | 2200 | 1990 | 1870 | 1690 | 1700 | 1530 |
| | 14 | 3070 | 2900 | 2530 | 2180 | 1980 | 1860 | 1680 | 1690 | 1520 |
| | 15 | 3060 | 2880 | 2520 | 2170 | 1970 | 1840 | 1670 | 1670 | 1510 |
| | 16 | 3040 | 2870 | 2500 | 2160 | 1950 | 1830 | 1650 | 1660 | 1490 |
| | 17 | 3030 | 2850 | 2490 | 2140 | 1940 | 1820 | 1640 | 1640 | 1480 |
| | 18 | 3010 | 2840 | 2470 | 2130 | 1930 | 1800 | 1630 | 1630 | 1470 |
| | 19 | 3000 | 2820 | 2460 | 2110 | 1910 | 1790 | 1610 | 1610 | 1450 |
| | 20 | 2980 | 2810 | 2440 | 2100 | 1900 | 1770 | 1600 | 1590 | 1440 |
| | 21 | 2960 | 2790 | 2430 | 2080 | 1880 | 1760 | 1580 | 1580 | 1420 |
| | 22 | 2950 | 2770 | 2410 | 2060 | 1870 | 1740 | 1570 | 1560 | 1410 |
| | 23 | 2930 | 2760 | 2390 | 2050 | 1850 | 1720 | 1560 | 1540 | 1390 |
| | 24 | 2910 | 2740 | 2380 | 2030 | 1840 | 1710 | 1540 | 1520 | 1370 |
| | 25 | 2890 | 2720 | 2360 | 2010 | 1820 | 1690 | 1520 | 1510 | 1360 |
| | 26 | 2870 | 2700 | 2340 | 2000 | 1810 | 1670 | 1510 | 1490 | 1340 |
| | 27 | 2850 | 2690 | 2320 | 1980 | 1790 | 1650 | 1490 | 1470 | 1320 |
| | 28 | 2830 | 2670 | 2300 | 1960 | 1770 | 1640 | 1480 | 1450 | 1310 |
| | 29 | 2820 | 2650 | 2290 | 1940 | 1760 | 1620 | 1460 | 1430 | 1290 |
| | 30 | 2800 | 2630 | 2270 | 1920 | 1740 | 1600 | 1440 | 1410 | 1270 |
| | 31 | 2780 | 2610 | 2250 | 1900 | 1720 | 1580 | 1430 | 1390 | 1250 |
| | 32 | 2750 | 2590 | 2230 | 1880 | 1710 | 1560 | 1410 | 1370 | 1230 |
| | 33 | 2730 | 2570 | 2210 | 1860 | 1690 | 1540 | 1390 | 1350 | 1210 |
| | 34 | 2710 | 2550 | 2190 | 1840 | 1670 | 1520 | 1370 | 1320 | 1190 |
| | 35 | 2690 | 2530 | 2170 | 1820 | 1650 | 1500 | 1350 | 1300 | 1170 |
| | 36 | 2670 | 2510 | 2150 | 1800 | 1630 | 1480 | 1340 | 1280 | 1150 |
| | 37 | 2650 | 2490 | 2130 | 1780 | 1610 | 1460 | 1320 | 1260 | 1130 |
| | 38 | 2630 | 2470 | 2110 | 1760 | 1590 | 1440 | 1300 | 1230 | 1110 |
| | 39 | 2600 | 2450 | 2080 | 1740 | 1580 | 1420 | 1280 | 1210 | 1090 |
| | 40 | 2580 | 2430 | 2060 | 1720 | 1560 | 1390 | 1260 | 1190 | 1070 |
| **Properties** | | | | | | | | | | |
| Area, In.$^2$ | | 61.4 | 58.9 | 53.9 | 48.9 | 39.9 | 43.9 | 35.9 | 41.4 | 33.9 |
| $I_x$, In.$^4$ | | 7210 | 6060 | 4680 | 3530 | 2950 | 2590 | 2180 | 2360 | 1990 |
| $I_y$, In.$^4$ | | 5710 | 5370 | 4110 | 3060 | 2560 | 2210 | 1850 | 1680 | 1410 |
| Ratio, $r_x/r_y$ | | 1.12 | 1.06 | 1.07 | 1.07 | 1.07 | 1.08 | 1.08 | 1.18 | 1.18 |
| $r_y$, In. | | 9.65 | 9.55 | 8.73 | 7.91 | 8.00 | 7.10 | 7.19 | 6.37 | 6.46 |
| $B_x$, Bending Factor | | 0.119 | 0.126 | 0.138 | 0.152 | 0.149 | 0.169 | 0.165 | 0.175 | 0.170 |
| $B_y$, Bending Factor | | 0.129 | 0.132 | 0.144 | 0.160 | 0.156 | 0.179 | 0.175 | 0.197 | 0.192 |
| $a_x \div 10^6$ | | 1670 | 1390 | 1040 | 761 | 688 | 541 | 490 | 484 | 437 |
| $a_y \div 10^6$ | | 1330 | 1230 | 914 | 660 | 597 | 462 | 416 | 344 | 310 |

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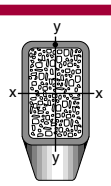
# HSS / Rectangular Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips

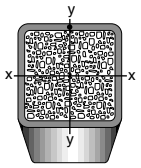



**f'c = 5.0**

| Nominal Size | | 20 x 12 | 18 x 12 | | | 16 x 12 | 14 x 12 | |
|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 5/8 | 5/8 | 1/2 | 3/8 | 5/8 | 1/2 | 3/8 |
| Weight Per Foot | | 123.72 | 115.21 | 95.03 | 72.59 | 106.71 | 81.42 | 62.39 |
| Design Wall Thickness | | 0.625 | 0.625 | 0.500 | 0.375 | 0.625 | 0.500 | 0.375 |
| | | $F_y$ = 46 ksi | | | | | | |
| Effective length KL in feet | 0 | 1510 | 1390 | 1240 | 1080 | 1270 | 1020 | 884 |
| | 4 | 1470 | 1350 | 1210 | 1050 | 1230 | 995 | 861 |
| | 5 | 1460 | 1340 | 1200 | 1050 | 1220 | 987 | 854 |
| | 6 | 1450 | 1330 | 1190 | 1040 | 1210 | 979 | 846 |
| | 7 | 1440 | 1320 | 1180 | 1030 | 1200 | 970 | 839 |
| | 8 | 1430 | 1310 | 1170 | 1020 | 1190 | 961 | 831 |
| | 9 | 1410 | 1290 | 1160 | 1010 | 1180 | 951 | 822 |
| | 10 | 1400 | 1280 | 1150 | 998 | 1170 | 941 | 813 |
| | 11 | 1380 | 1270 | 1140 | 987 | 1150 | 930 | 804 |
| | 12 | 1370 | 1250 | 1120 | 975 | 1140 | 919 | 794 |
| | 13 | 1350 | 1240 | 1110 | 964 | 1120 | 907 | 784 |
| | 14 | 1330 | 1220 | 1100 | 951 | 1110 | 896 | 774 |
| | 15 | 1320 | 1210 | 1080 | 939 | 1100 | 883 | 763 |
| | 16 | 1300 | 1190 | 1070 | 926 | 1080 | 871 | 753 |
| | 17 | 1280 | 1170 | 1050 | 913 | 1060 | 858 | 741 |
| | 18 | 1260 | 1150 | 1040 | 899 | 1050 | 844 | 730 |
| | 19 | 1240 | 1140 | 1020 | 885 | 1030 | 831 | 718 |
| | 20 | 1220 | 1120 | 1000 | 870 | 1010 | 816 | 706 |
| | 21 | 1200 | 1100 | 987 | 856 | 996 | 802 | 693 |
| | 22 | 1180 | 1080 | 969 | 840 | 978 | 787 | 680 |
| | 23 | 1160 | 1060 | 952 | 825 | 960 | 772 | 667 |
| | 24 | 1140 | 1040 | 934 | 809 | 941 | 757 | 654 |
| | 25 | 1120 | 1020 | 915 | 793 | 921 | 741 | 640 |
| | 26 | 1090 | 998 | 896 | 776 | 902 | 725 | 626 |
| | 27 | 1070 | 976 | 877 | 760 | 882 | 708 | 612 |
| | 28 | 1050 | 954 | 857 | 742 | 861 | 691 | 597 |
| | 29 | 1020 | 932 | 837 | 725 | 840 | 674 | 582 |
| | 30 | 998 | 909 | 817 | 707 | 819 | 657 | 567 |
| | 31 | 973 | 886 | 796 | 689 | 797 | 639 | 551 |
| | 32 | 947 | 862 | 775 | 670 | 775 | 621 | 536 |
| | 33 | 921 | 837 | 753 | 651 | 752 | 602 | 519 |
| | 34 | 894 | 813 | 731 | 632 | 729 | 583 | 503 |
| | 35 | 867 | 787 | 709 | 612 | 706 | 564 | 486 |
| | 36 | 840 | 762 | 686 | 592 | 682 | 544 | 469 |
| | 37 | 812 | 736 | 663 | 572 | 657 | 524 | 452 |
| | 38 | 783 | 709 | 639 | 551 | 632 | 504 | 434 |
| | 39 | 754 | 682 | 615 | 530 | 607 | 483 | 416 |
| | 40 | 725 | 654 | 590 | 508 | 581 | 462 | 398 |
| **PROPERTIES** | | | | | | | | |
| Area, In.$^2$ | | 36.4 | 33.9 | 27.9 | 21.3 | 31.4 | 23.9 | 18.3 |
| $I_x$, In.$^4$ | | 1890 | 1450 | 1240 | 971 | 1090 | 678 | 534 |
| $I_y$, In.$^4$ | | 864 | 783 | 668 | 524 | 702 | 536 | 422 |
| Ratio, $r_x/r_y$ | | 1.48 | 1.36 | 1.36 | 1.36 | 1.24 | 1.12 | 1.12 |
| $r_y$, In. | | 4.87 | 4.81 | 4.89 | 4.95 | 4.73 | 4.73 | 4.80 |
| $B_x$, Bending Factor | | 0.193 | 0.210 | 0.202 | 0.197 | 0.230 | 0.247 | 0.240 |
| $B_y$, Bending Factor | | 0.253 | 0.260 | 0.251 | 0.244 | 0.268 | 0.268 | 0.260 |
| $a_x \div 10^6$ | | 369 | 280 | 255 | 219 | 208 | 135 | 116 |
| $a_y \div 10^6$ | | 169 | 151 | 137 | 118 | 134 | 107 | 91.8 |

# HSS / Square Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips



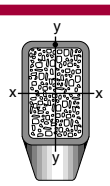

**f'c = 8.0**

| Nominal Size | | 28 x 28 | 26 x 26 | 24 x 24 | 22 x 22 | | 20 x 20 | | 18 x 18 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 5/8 | 5/8 | 5/8 | 5/8 | 1/2 | 5/8 | 1/2 | 5/8 | 1/2 | 3/8 |
| Weight Per Foot | | 225.80 | 208.79 | 191.78 | 174.76 | 142.67 | 157.75 | 129.06 | 140.73 | 115.45 | 87.91 |
| Design Wall Thickness | | 0.625 | 0.625 | 0.625 | 0.625 | 0.500 | 0.625 | 0.500 | 0.625 | 0.500 | 0.375 |
| | | $F_y$ = 46 ksi | | | | | | | | | |
| Effective length KL in feet | 0 | 4740 | 4180 | 3660 | 3170 | 2950 | 2710 | 2520 | 2280 | 2110 | 1920 |
| | 4 | 4690 | 4130 | 3610 | 3120 | 2910 | 2660 | 2470 | 2240 | 2070 | 1890 |
| | 5 | 4670 | 4120 | 3600 | 3110 | 2900 | 2650 | 2460 | 2220 | 2060 | 1880 |
| | 6 | 4660 | 4100 | 3580 | 3090 | 2880 | 2640 | 2450 | 2210 | 2050 | 1870 |
| | 7 | 4640 | 4090 | 3570 | 3080 | 2870 | 2620 | 2440 | 2200 | 2040 | 1860 |
| | 8 | 4620 | 4070 | 3550 | 3060 | 2850 | 2610 | 2420 | 2180 | 2020 | 1840 |
| | 9 | 4610 | 4060 | 3530 | 3050 | 2840 | 2590 | 2410 | 2170 | 2010 | 1830 |
| | 10 | 4590 | 4040 | 3520 | 3030 | 2830 | 2580 | 2390 | 2160 | 2000 | 1820 |
| | 11 | 4570 | 4020 | 3500 | 3020 | 2810 | 2560 | 2380 | 2140 | 1980 | 1800 |
| | 12 | 4550 | 4000 | 3480 | 3000 | 2790 | 2550 | 2360 | 2120 | 1970 | 1790 |
| | 13 | 4530 | 3980 | 3470 | 2980 | 2780 | 2530 | 2350 | 2110 | 1950 | 1780 |
| | 14 | 4510 | 3960 | 3450 | 2960 | 2760 | 2510 | 2330 | 2090 | 1940 | 1760 |
| | 15 | 4490 | 3950 | 3430 | 2940 | 2740 | 2490 | 2320 | 2070 | 1920 | 1750 |
| | 16 | 4470 | 3920 | 3410 | 2920 | 2720 | 2470 | 2300 | 2060 | 1900 | 1730 |
| | 17 | 4450 | 3900 | 3390 | 2910 | 2710 | 2460 | 2280 | 2040 | 1890 | 1710 |
| | 18 | 4430 | 3880 | 3370 | 2890 | 2690 | 2440 | 2260 | 2020 | 1870 | 1700 |
| | 19 | 4410 | 3860 | 3350 | 2870 | 2670 | 2420 | 2240 | 2000 | 1850 | 1680 |
| | 20 | 4380 | 3840 | 3330 | 2840 | 2650 | 2400 | 2220 | 1980 | 1830 | 1660 |
| | 21 | 4360 | 3820 | 3300 | 2820 | 2630 | 2380 | 2200 | 1960 | 1810 | 1650 |
| | 22 | 4340 | 3790 | 3280 | 2800 | 2610 | 2350 | 2180 | 1940 | 1790 | 1630 |
| | 23 | 4310 | 3770 | 3260 | 2780 | 2590 | 2330 | 2160 | 1920 | 1770 | 1610 |
| | 24 | 4290 | 3750 | 3230 | 2760 | 2570 | 2310 | 2140 | 1900 | 1750 | 1590 |
| | 25 | 4270 | 3720 | 3210 | 2730 | 2540 | 2290 | 2120 | 1870 | 1730 | 1570 |
| | 26 | 4240 | 3700 | 3190 | 2710 | 2520 | 2270 | 2100 | 1850 | 1710 | 1550 |
| | 27 | 4210 | 3670 | 3160 | 2690 | 2500 | 2240 | 2080 | 1830 | 1690 | 1530 |
| | 28 | 4190 | 3650 | 3140 | 2660 | 2480 | 2220 | 2060 | 1810 | 1670 | 1510 |
| | 29 | 4160 | 3620 | 3110 | 2640 | 2450 | 2190 | 2030 | 1780 | 1650 | 1490 |
| | 30 | 4130 | 3600 | 3090 | 2610 | 2430 | 2170 | 2010 | 1760 | 1620 | 1470 |
| | 31 | 4110 | 3570 | 3060 | 2590 | 2400 | 2140 | 1990 | 1730 | 1600 | 1450 |
| | 32 | 4080 | 3540 | 3030 | 2560 | 2380 | 2120 | 1960 | 1710 | 1580 | 1430 |
| | 33 | 4050 | 3520 | 3010 | 2530 | 2350 | 2090 | 1940 | 1680 | 1550 | 1400 |
| | 34 | 4020 | 3490 | 2980 | 2510 | 2330 | 2070 | 1910 | 1660 | 1530 | 1380 |
| | 35 | 3990 | 3460 | 2950 | 2480 | 2300 | 2040 | 1890 | 1630 | 1510 | 1360 |
| | 36 | 3960 | 3430 | 2920 | 2450 | 2280 | 2010 | 1860 | 1610 | 1480 | 1340 |
| | 37 | 3940 | 3400 | 2900 | 2420 | 2250 | 1990 | 1840 | 1580 | 1460 | 1310 |
| | 38 | 3900 | 3370 | 2870 | 2400 | 2220 | 1960 | 1810 | 1550 | 1430 | 1290 |
| | 39 | 3870 | 3340 | 2840 | 2370 | 2200 | 1930 | 1790 | 1520 | 1400 | 1260 |
| | 40 | 3840 | 3310 | 2810 | 2340 | 2170 | 1900 | 1760 | 1500 | 1380 | 1240 |
| **Properties** | | | | | | | | | | | |
| Area, In.$^2$ | | 66.4 | 61.4 | 56.4 | 51.4 | 41.9 | 46.4 | 37.9 | 41.4 | 33.9 | 25.8 |
| I, In.$^4$ | | 8140 | 6460 | 5030 | 3820 | 3190 | 2830 | 2370 | 2020 | 1700 | 1320 |
| r, In. | | 11.1 | 10.3 | 9.44 | 8.62 | 8.72 | 7.81 | 7.90 | 6.99 | 7.08 | 7.15 |
| B, Bending Factor | | 0.114 | 0.124 | 0.135 | 0.148 | 0.144 | 0.164 | 0.160 | 0.184 | 0.179 | 0.176 |
| a ÷ $10^6$ | | 2150 | 1660 | 1240 | 908 | 831 | 649 | 592 | 446 | 407 | 358 |

SAW

# HSS / Rectangular Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips



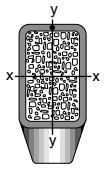

**f'c = 8.0**

| Nominal Size | | 28 x 24 | 26 x 24 | 24 x 22 | 22 x 20 | | 20 x 18 | | 20 x 16 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 5/8 | 5/8 | 5/8 | 5/8 | 1/2 | 5/8 | 1/2 | 5/8 | 1/2 |
| Weight Per Foot | | 208.79 | 200.28 | 183.27 | 166.25 | 135.86 | 149.24 | 122.25 | 140.73 | 115.45 |
| Design Wall Thickness | | 0.625 | 0.625 | 0.625 | 0.625 | 0.500 | 0.625 | 0.500 | 0.625 | 0.500 |
| | | $F_y$ = 46 ksi | | | | | | | | |
| Effective length KL in feet | 0 | 4170 | 3910 | 3400 | 2930 | 2730 | 2480 | 2310 | 2260 | 2090 |
| | 4 | 4110 | 3860 | 3350 | 2880 | 2680 | 2440 | 2260 | 2220 | 2050 |
| | 5 | 4100 | 3850 | 3340 | 2870 | 2670 | 2430 | 2250 | 2200 | 2040 |
| | 6 | 4080 | 3830 | 3330 | 2850 | 2660 | 2410 | 2240 | 2190 | 2030 |
| | 7 | 4060 | 3820 | 3310 | 2840 | 2640 | 2400 | 2230 | 2170 | 2010 |
| | 8 | 4050 | 3800 | 3290 | 2820 | 2630 | 2380 | 2210 | 2160 | 2000 |
| | 9 | 4030 | 3780 | 3280 | 2810 | 2610 | 2370 | 2200 | 2140 | 1980 |
| | 10 | 4010 | 3760 | 3260 | 2790 | 2600 | 2350 | 2180 | 2130 | 1970 |
| | 11 | 3990 | 3750 | 3240 | 2770 | 2580 | 2340 | 2170 | 2110 | 1950 |
| | 12 | 3970 | 3730 | 3230 | 2760 | 2560 | 2320 | 2150 | 2090 | 1940 |
| | 13 | 3950 | 3710 | 3210 | 2740 | 2550 | 2300 | 2130 | 2070 | 1920 |
| | 14 | 3930 | 3690 | 3190 | 2720 | 2530 | 2280 | 2120 | 2050 | 1900 |
| | 15 | 3910 | 3670 | 3170 | 2700 | 2510 | 2260 | 2100 | 2030 | 1880 |
| | 16 | 3890 | 3650 | 3150 | 2680 | 2490 | 2250 | 2080 | 2010 | 1860 |
| | 17 | 3870 | 3630 | 3130 | 2660 | 2470 | 2230 | 2060 | 1990 | 1840 |
| | 18 | 3840 | 3610 | 3110 | 2640 | 2450 | 2210 | 2040 | 1970 | 1820 |
| | 19 | 3820 | 3580 | 3080 | 2620 | 2430 | 2180 | 2020 | 1950 | 1800 |
| | 20 | 3800 | 3560 | 3060 | 2600 | 2410 | 2160 | 2000 | 1930 | 1780 |
| | 21 | 3770 | 3540 | 3040 | 2570 | 2390 | 2140 | 1980 | 1900 | 1760 |
| | 22 | 3750 | 3510 | 3020 | 2550 | 2370 | 2120 | 1960 | 1880 | 1740 |
| | 23 | 3720 | 3490 | 2990 | 2530 | 2350 | 2100 | 1940 | 1860 | 1720 |
| | 24 | 3690 | 3460 | 2970 | 2510 | 2330 | 2070 | 1920 | 1830 | 1690 |
| | 25 | 3670 | 3440 | 2940 | 2480 | 2300 | 2050 | 1900 | 1810 | 1670 |
| | 26 | 3640 | 3410 | 2920 | 2460 | 2280 | 2030 | 1880 | 1780 | 1650 |
| | 27 | 3610 | 3390 | 2890 | 2430 | 2260 | 2000 | 1850 | 1760 | 1620 |
| | 28 | 3590 | 3360 | 2870 | 2410 | 2230 | 1980 | 1830 | 1730 | 1600 |
| | 29 | 3560 | 3340 | 2840 | 2380 | 2210 | 1950 | 1810 | 1700 | 1570 |
| | 30 | 3530 | 3310 | 2820 | 2350 | 2180 | 1930 | 1780 | 1680 | 1550 |
| | 31 | 3500 | 3280 | 2790 | 2330 | 2160 | 1900 | 1760 | 1650 | 1520 |
| | 32 | 3470 | 3250 | 2760 | 2300 | 2130 | 1870 | 1730 | 1620 | 1490 |
| | 33 | 3440 | 3220 | 2730 | 2270 | 2110 | 1850 | 1710 | 1590 | 1470 |
| | 34 | 3410 | 3190 | 2700 | 2250 | 2080 | 1820 | 1680 | 1560 | 1440 |
| | 35 | 3380 | 3170 | 2680 | 2220 | 2050 | 1790 | 1650 | 1530 | 1410 |
| | 36 | 3350 | 3140 | 2650 | 2190 | 2030 | 1760 | 1630 | 1500 | 1380 |
| | 37 | 3320 | 3110 | 2620 | 2160 | 2000 | 1730 | 1600 | 1470 | 1350 |
| | 38 | 3280 | 3080 | 2590 | 2130 | 1970 | 1700 | 1570 | 1440 | 1320 |
| | 39 | 3250 | 3040 | 2560 | 2100 | 1940 | 1670 | 1550 | 1410 | 1300 |
| | 40 | 3220 | 3010 | 2530 | 2070 | 1910 | 1640 | 1520 | 1370 | 1260 |
| **Properties** | | | | | | | | | | |
| Area, In.$^2$ | | 61.4 | 58.9 | 53.9 | 48.9 | 39.9 | 43.9 | 35.9 | 41.4 | 33.9 |
| $I_x$, In.$^4$ | | 7210 | 6060 | 4680 | 3530 | 2950 | 2590 | 2180 | 2360 | 1990 |
| $I_y$, In.$^4$ | | 5710 | 5370 | 4110 | 3060 | 2560 | 2210 | 1850 | 1680 | 1410 |
| Ratio, $r_x/r_y$ | | 1.12 | 1.06 | 1.07 | 1.07 | 1.07 | 1.08 | 1.08 | 1.18 | 1.18 |
| $r_y$, In. | | 9.65 | 9.55 | 8.73 | 7.91 | 8.00 | 7.10 | 7.19 | 6.37 | 6.46 |
| $B_x$, Bending Factor | | 0.119 | 0.126 | 0.138 | 0.152 | 0.149 | 0.169 | 0.165 | 0.175 | 0.170 |
| $B_y$, Bending Factor | | 0.129 | 0.132 | 0.144 | 0.160 | 0.156 | 0.179 | 0.175 | 0.197 | 0.192 |
| $a_x \div 10^6$ | | 1830 | 1520 | 1130 | 824 | 753 | 582 | 533 | 518 | 474 |
| $a_y \div 10^6$ | | 1450 | 1340 | 994 | 714 | 653 | 497 | 452 | 369 | 336 |

SAW

# HSS / Rectangular Structural Steel Tubing for Composite Columns

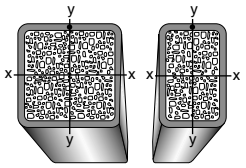
Allowable Concentric Loads in Kips




**f'c = 8.0**

| Nominal Size | | 20 x 12 | 18 x 12 | | | 16 x 12 | 14 x 12 | |
|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 5/8 | 5/8 | 1/2 | 3/8 | 5/8 | 1/2 | 3/8 |
| Weight Per Foot | | 123.72 | 115.21 | 95.03 | 72.59 | 106.71 | 81.42 | 62.39 |
| Design Wall Thickness | | 0.625 | 0.625 | 0.500 | 0.375 | 0.625 | 0.500 | 0.375 |
| | | $F_y$ = 46 ksi | | | | | | |
| Effective length KL in feet | 0 | 1820 | 1660 | 1530 | 1380 | 1500 | 1240 | 1110 |
| | 4 | 1770 | 1620 | 1490 | 1340 | 1460 | 1200 | 1080 |
| | 5 | 1750 | 1600 | 1470 | 1330 | 1450 | 1190 | 1070 |
| | 6 | 1740 | 1590 | 1460 | 1320 | 1440 | 1180 | 1060 |
| | 7 | 1720 | 1570 | 1450 | 1300 | 1420 | 1170 | 1050 |
| | 8 | 1700 | 1560 | 1430 | 1290 | 1410 | 1160 | 1040 |
| | 9 | 1690 | 1540 | 1420 | 1270 | 1390 | 1150 | 1030 |
| | 10 | 1670 | 1520 | 1400 | 1260 | 1380 | 1130 | 1010 |
| | 11 | 1650 | 1500 | 1380 | 1240 | 1360 | 1120 | 1000 |
| | 12 | 1630 | 1480 | 1370 | 1230 | 1340 | 1100 | 987 |
| | 13 | 1610 | 1470 | 1350 | 1210 | 1320 | 1090 | 973 |
| | 14 | 1580 | 1440 | 1330 | 1190 | 1310 | 1070 | 959 |
| | 15 | 1560 | 1420 | 1310 | 1180 | 1290 | 1060 | 944 |
| | 16 | 1540 | 1400 | 1290 | 1160 | 1270 | 1040 | 928 |
| | 17 | 1510 | 1380 | 1270 | 1140 | 1250 | 1020 | 913 |
| | 18 | 1490 | 1360 | 1250 | 1120 | 1220 | 1000 | 896 |
| | 19 | 1460 | 1330 | 1230 | 1100 | 1200 | 986 | 880 |
| | 20 | 1440 | 1310 | 1200 | 1080 | 1180 | 967 | 862 |
| | 21 | 1410 | 1280 | 1180 | 1060 | 1160 | 948 | 845 |
| | 22 | 1380 | 1260 | 1160 | 1040 | 1130 | 928 | 827 |
| | 23 | 1360 | 1230 | 1130 | 1010 | 1110 | 908 | 808 |
| | 24 | 1330 | 1210 | 1110 | 990 | 1090 | 887 | 789 |
| | 25 | 1300 | 1180 | 1080 | 967 | 1060 | 866 | 770 |
| | 26 | 1270 | 1150 | 1060 | 943 | 1030 | 844 | 750 |
| | 27 | 1240 | 1120 | 1030 | 919 | 1010 | 822 | 730 |
| | 28 | 1210 | 1090 | 1000 | 894 | 982 | 799 | 709 |
| | 29 | 1170 | 1060 | 977 | 869 | 954 | 776 | 688 |
| | 30 | 1140 | 1030 | 949 | 843 | 926 | 753 | 667 |
| | 31 | 1110 | 1000 | 921 | 817 | 898 | 729 | 645 |
| | 32 | 1070 | 972 | 892 | 790 | 869 | 704 | 622 |
| | 33 | 1040 | 940 | 862 | 762 | 839 | 679 | 599 |
| | 34 | 1000 | 908 | 831 | 734 | 809 | 654 | 576 |
| | 35 | 968 | 874 | 801 | 706 | 778 | 628 | 552 |
| | 36 | 931 | 840 | 769 | 677 | 747 | 601 | 528 |
| | 37 | 894 | 805 | 737 | 647 | 715 | 574 | 503 |
| | 38 | 856 | 770 | 704 | 616 | 682 | 546 | 478 |
| | 39 | 817 | 734 | 671 | 586 | 648 | 519 | 453 |
| | 40 | 777 | 698 | 637 | 557 | 616 | 493 | 431 |
| **Properties** | | | | | | | | |
| Area, In.$^2$ | | 36.4 | 33.9 | 27.9 | 21.3 | 31.4 | 23.9 | 18.3 |
| $I_x$, In.$^4$ | | 1890 | 1450 | 1240 | 971 | 1090 | 678 | 534 |
| $I_y$, In.$^4$ | | 864 | 783 | 668 | 524 | 702 | 536 | 422 |
| Ratio, $r_x/r_y$ | | 1.48 | 1.36 | 1.36 | 1.36 | 1.24 | 1.12 | 1.12 |
| $r_y$, In. | | 4.87 | 4.81 | 4.89 | 4.95 | 4.73 | 4.73 | 4.80 |
| $B_x$, Bending Factor | | 0.193 | 0.210 | 0.202 | 0.197 | 0.230 | 0.247 | 0.240 |
| $B_y$, Bending Factor | | 0.253 | 0.260 | 0.251 | 0.244 | 0.268 | 0.268 | 0.260 |
| $a_x \div 10^6$ | | 392 | 297 | 273 | 239 | 220 | 144 | 126 |
| $a_y \div 10^6$ | | 179 | 161 | 147 | 129 | 142 | 114 | 99.4 |

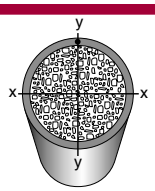
# HSS/Structural Steel Tubing for Composite Columns
## Notes



# HSS / Round Structural Steel Tubing for Composite Columns

ERW

Allowable Concentric Loads in Kips

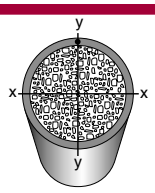



**f'c = 3.5**

| Nominal Outside Diameter | | 20.000 | | 18.000 | | 16.000 | | | | 14.000 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 0.500 | 0.375 | 0.500 | 0.375 | 0.500 | 0.438 | 0.375 | 0.312 | 0.500 | 0.375 | 0.312 |
| Weight Per Foot | | 104.13 | 78.60 | 93.45 | 70.59 | 82.77 | 72.80 | 62.58 | 52.28 | 72.09 | 54.57 | 45.61 |
| Design Wall Thickness | | 0.465 | 0.349 | 0.465 | 0.349 | 0.465 | 0.407 | 0.349 | 0.291 | 0.465 | 0.349 | 0.291 |
| | | $F_y$ = 46 ksi | | | | | | | | | | |
| Effective length KL in feet | 0 | 1300 | 1120 | 1120 | 955 | 945 | 873 | 803 | 731 | 786 | 662 | 597 |
| | 4 | 1270 | 1100 | 1090 | 937 | 925 | 854 | 786 | 715 | 766 | 646 | 582 |
| | 5 | 1270 | 1090 | 1090 | 932 | 919 | 848 | 781 | 710 | 761 | 641 | 578 |
| | 6 | 1260 | 1090 | 1080 | 926 | 913 | 843 | 775 | 705 | 754 | 635 | 573 |
| | 7 | 1260 | 1080 | 1080 | 921 | 906 | 837 | 770 | 700 | 748 | 630 | 568 |
| | 8 | 1250 | 1070 | 1070 | 915 | 899 | 830 | 764 | 695 | 741 | 624 | 563 |
| | 9 | 1240 | 1070 | 1060 | 909 | 892 | 824 | 758 | 689 | 734 | 618 | 558 |
| | 10 | 1230 | 1060 | 1050 | 902 | 885 | 817 | 751 | 684 | 727 | 612 | 552 |
| | 11 | 1230 | 1050 | 1050 | 895 | 877 | 810 | 745 | 678 | 719 | 605 | 546 |
| | 12 | 1220 | 1050 | 1040 | 889 | 869 | 802 | 738 | 671 | 711 | 599 | 540 |
| | 13 | 1210 | 1040 | 1030 | 881 | 861 | 795 | 731 | 665 | 703 | 592 | 534 |
| | 14 | 1200 | 1030 | 1020 | 874 | 852 | 787 | 724 | 658 | 694 | 584 | 527 |
| | 15 | 1190 | 1030 | 1010 | 866 | 843 | 779 | 716 | 651 | 685 | 577 | 520 |
| | 16 | 1180 | 1020 | 1000 | 859 | 834 | 770 | 708 | 644 | 676 | 569 | 513 |
| | 17 | 1170 | 1010 | 994 | 851 | 825 | 762 | 701 | 637 | 667 | 561 | 506 |
| | 18 | 1160 | 1000 | 984 | 842 | 815 | 753 | 692 | 630 | 657 | 553 | 499 |
| | 19 | 1150 | 992 | 975 | 834 | 806 | 744 | 684 | 622 | 647 | 545 | 491 |
| | 20 | 1140 | 984 | 965 | 825 | 796 | 734 | 675 | 614 | 637 | 536 | 483 |
| | 21 | 1130 | 975 | 954 | 817 | 785 | 725 | 667 | 606 | 627 | 528 | 476 |
| | 22 | 1120 | 966 | 944 | 808 | 775 | 715 | 658 | 598 | 616 | 519 | 467 |
| | 23 | 1110 | 957 | 933 | 798 | 764 | 705 | 648 | 589 | 605 | 509 | 459 |
| | 24 | 1100 | 947 | 922 | 789 | 753 | 695 | 639 | 581 | 594 | 500 | 450 |
| | 25 | 1090 | 938 | 911 | 779 | 742 | 685 | 630 | 572 | 583 | 490 | 442 |
| | 26 | 1080 | 928 | 900 | 770 | 730 | 674 | 620 | 563 | 571 | 481 | 433 |
| | 27 | 1070 | 918 | 888 | 760 | 719 | 663 | 610 | 554 | 559 | 471 | 424 |
| | 28 | 1060 | 908 | 877 | 750 | 707 | 652 | 600 | 545 | 547 | 460 | 415 |
| | 29 | 1040 | 897 | 865 | 739 | 695 | 641 | 589 | 535 | 535 | 450 | 405 |
| | 30 | 1030 | 887 | 853 | 729 | 682 | 630 | 579 | 526 | 522 | 439 | 395 |
| | 31 | 1020 | 876 | 840 | 718 | 670 | 618 | 568 | 516 | 510 | 428 | 386 |
| | 32 | 1010 | 865 | 828 | 707 | 657 | 606 | 557 | 506 | 496 | 417 | 376 |
| | 33 | 995 | 854 | 815 | 696 | 644 | 594 | 546 | 496 | 483 | 406 | 365 |
| | 34 | 982 | 843 | 802 | 685 | 631 | 582 | 535 | 485 | 470 | 395 | 355 |
| | 35 | 969 | 832 | 789 | 674 | 617 | 570 | 523 | 475 | 456 | 383 | 344 |
| | 36 | 956 | 820 | 775 | 662 | 604 | 557 | 512 | 464 | 442 | 371 | 334 |
| | 37 | 942 | 808 | 762 | 650 | 590 | 544 | 500 | 453 | 427 | 359 | 323 |
| | 38 | 929 | 797 | 748 | 638 | 576 | 531 | 488 | 442 | 413 | 347 | 312 |
| | 39 | 915 | 784 | 734 | 626 | 561 | 518 | 475 | 431 | 398 | 334 | 300 |
| | 40 | 901 | 772 | 719 | 614 | 547 | 504 | 463 | 420 | 383 | 321 | 289 |
| **PROPERTIES** | | | | | | | | | | | | |
| Area, In.$^2$ | | 28.5 | 21.5 | 25.6 | 19.4 | 22.7 | 19.9 | 17.2 | 14.4 | 19.8 | 15.0 | 12.5 |
| I, In.$^4$ | | 1360 | 1040 | 985 | 754 | 685 | 606 | 526 | 443 | 453 | 349 | 295 |
| r, In. | | 6.91 | 6.95 | 6.20 | 6.24 | 5.49 | 5.51 | 5.53 | 5.55 | 4.79 | 4.83 | 4.85 |
| B, Bending Factor | | 0.210 | 0.207 | 0.234 | 0.232 | 0.265 | 0.263 | 0.262 | 0.260 | 0.306 | 0.301 | 0.297 |
| a ÷ $10^6$ | | 299 | 254 | 209 | 177 | 140 | 129 | 118 | 107 | 89.5 | 75.0 | 67.3 |

# HSS / Round Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips



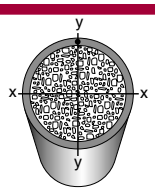

**f'c = 3.5**

| Nominal Outside Diameter | | 12.750 | | | 12.500 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 0.500 | 0.375 | 0.250 | 0.625 | 0.500 | 0.375 | 0.312 | 0.250 | 0.188 |
| Weight Per Foot | | 65.42 | 49.56 | 33.38 | 79.27 | 64.08 | 48.56 | 40.61 | 32.71 | 24.72 |
| Design Wall Thickness | | 0.465 | 0.349 | 0.233 | 0.581 | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 |
| | | $F_y$ = 46 ksi | | | | | | | | |
| Effective length KL in feet | 0 | 690 | 579 | 464 | 782 | 673 | 562 | 508 | 451 | 393 |
| | 4 | 671 | 563 | 451 | 760 | 654 | 546 | 494 | 438 | 382 |
| | 5 | 665 | 558 | 447 | 753 | 649 | 542 | 489 | 434 | 378 |
| | 6 | 659 | 553 | 443 | 746 | 642 | 536 | 485 | 430 | 375 |
| | 7 | 653 | 548 | 439 | 738 | 636 | 531 | 480 | 426 | 371 |
| | 8 | 646 | 542 | 434 | 730 | 629 | 525 | 475 | 421 | 367 |
| | 9 | 639 | 536 | 430 | 722 | 622 | 519 | 469 | 416 | 363 |
| | 10 | 631 | 530 | 424 | 713 | 615 | 513 | 464 | 411 | 358 |
| | 11 | 624 | 523 | 419 | 704 | 607 | 507 | 458 | 406 | 353 |
| | 12 | 616 | 517 | 414 | 695 | 599 | 500 | 452 | 400 | 349 |
| | 13 | 607 | 510 | 408 | 685 | 591 | 493 | 445 | 395 | 344 |
| | 14 | 599 | 502 | 402 | 675 | 582 | 486 | 439 | 389 | 339 |
| | 15 | 590 | 495 | 396 | 665 | 573 | 478 | 432 | 383 | 333 |
| | 16 | 581 | 487 | 390 | 654 | 564 | 471 | 425 | 377 | 328 |
| | 17 | 571 | 479 | 384 | 643 | 554 | 463 | 418 | 370 | 322 |
| | 18 | 561 | 471 | 377 | 632 | 545 | 455 | 411 | 364 | 316 |
| | 19 | 551 | 463 | 370 | 620 | 534 | 446 | 403 | 357 | 310 |
| | 20 | 541 | 454 | 363 | 608 | 524 | 438 | 395 | 350 | 304 |
| | 21 | 531 | 445 | 356 | 596 | 514 | 429 | 387 | 343 | 298 |
| | 22 | 520 | 436 | 349 | 583 | 503 | 420 | 379 | 335 | 291 |
| | 23 | 509 | 427 | 341 | 570 | 492 | 410 | 371 | 328 | 285 |
| | 24 | 498 | 418 | 334 | 557 | 480 | 401 | 362 | 320 | 278 |
| | 25 | 486 | 408 | 326 | 544 | 469 | 391 | 353 | 312 | 271 |
| | 26 | 475 | 398 | 318 | 530 | 457 | 381 | 344 | 304 | 264 |
| | 27 | 463 | 388 | 310 | 516 | 445 | 371 | 335 | 296 | 257 |
| | 28 | 450 | 378 | 301 | 501 | 433 | 361 | 326 | 288 | 249 |
| | 29 | 438 | 367 | 293 | 487 | 420 | 350 | 316 | 279 | 242 |
| | 30 | 425 | 356 | 284 | 472 | 407 | 340 | 306 | 271 | 234 |
| | 31 | 412 | 345 | 275 | 456 | 394 | 329 | 296 | 262 | 226 |
| | 32 | 399 | 334 | 266 | 441 | 380 | 317 | 286 | 253 | 218 |
| | 33 | 385 | 323 | 257 | 425 | 367 | 306 | 276 | 243 | 210 |
| | 34 | 371 | 311 | 247 | 408 | 353 | 294 | 265 | 234 | 202 |
| | 35 | 357 | 299 | 238 | 392 | 338 | 282 | 254 | 224 | 193 |
| | 36 | 343 | 287 | 228 | 375 | 324 | 270 | 243 | 214 | 184 |
| | 37 | 328 | 275 | 218 | 357 | 309 | 258 | 232 | 204 | 175 |
| | 38 | 313 | 262 | 207 | 340 | 294 | 245 | 220 | 194 | 166 |
| | 39 | 297 | 249 | 197 | 322 | 279 | 233 | 209 | 184 | 158 |
| | 40 | 283 | 237 | 187 | 306 | 265 | 221 | 199 | 175 | 150 |
| **Properties** | | | | | | | | | | |
| Area, In.$^2$ | | 17.9 | 13.6 | 9.16 | 21.8 | 17.6 | 13.3 | 11.2 | 8.98 | 6.74 |
| I, In.$^4$ | | 339 | 262 | 180 | 387 | 319 | 246 | 208 | 169 | 128 |
| r, In. | | 4.35 | 4.39 | 4.43 | 4.22 | 4.26 | 4.30 | 4.32 | 4.34 | 4.36 |
| B, Bending Factor | | 0.337 | 0.331 | 0.324 | 0.352 | 0.345 | 0.338 | 0.337 | 0.332 | 0.329 |
| a ÷ $10^6$ | | 65.2 | 54.6 | 43.2 | 70.6 | 61.1 | 50.9 | 45.8 | 40.3 | 34.6 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

# HSS / Round Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips

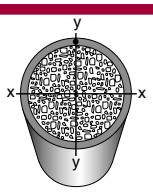



**f'c = 3.5**

| Nominal Outside Diameter | | 12.313 | | | | | | 12.250 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 0.625 | 0.500 | 0.375 | 0.312 | 0.250 | 0.188 | 0.625 | 0.500 | 0.375 | 0.312 | 0.250 | 0.188 |
| Weight Per Foot | | 78.02 | 63.08 | 47.81 | 39.99 | 32.21 | 24.35 | 77.60 | 62.75 | 47.56 | 39.78 | 32.04 | 24.22 |
| Design Wall Thickness | | 0.581 | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 | 0.581 | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 |
| | | $F_y$ = 46 ksi | | | | | | | | | | | |
| Effective length KL in feet | 0 | 765 | 659 | 551 | 497 | 441 | 384 | 760 | 654 | 546 | 492 | 438 | 381 |
| | 4 | 743 | 640 | 535 | 482 | 428 | 373 | 738 | 635 | 530 | 477 | 425 | 369 |
| | 5 | 736 | 634 | 530 | 478 | 424 | 369 | 731 | 630 | 525 | 473 | 421 | 366 |
| | 6 | 729 | 628 | 525 | 473 | 420 | 366 | 724 | 624 | 520 | 468 | 417 | 362 |
| | 7 | 721 | 622 | 519 | 468 | 416 | 362 | 717 | 617 | 515 | 464 | 412 | 359 |
| | 8 | 714 | 615 | 514 | 463 | 411 | 358 | 709 | 610 | 509 | 458 | 408 | 355 |
| | 9 | 705 | 608 | 508 | 458 | 406 | 354 | 701 | 603 | 503 | 453 | 403 | 350 |
| | 10 | 697 | 600 | 502 | 452 | 401 | 349 | 692 | 596 | 497 | 447 | 398 | 346 |
| | 11 | 688 | 593 | 495 | 446 | 396 | 345 | 683 | 588 | 490 | 442 | 393 | 341 |
| | 12 | 678 | 585 | 488 | 440 | 390 | 340 | 673 | 580 | 484 | 436 | 387 | 337 |
| | 13 | 668 | 576 | 481 | 434 | 385 | 335 | 664 | 572 | 477 | 429 | 382 | 332 |
| | 14 | 658 | 568 | 474 | 427 | 379 | 330 | 654 | 563 | 470 | 423 | 376 | 327 |
| | 15 | 648 | 559 | 467 | 421 | 373 | 324 | 643 | 554 | 462 | 416 | 370 | 321 |
| | 16 | 637 | 549 | 459 | 414 | 367 | 319 | 632 | 545 | 454 | 409 | 364 | 316 |
| | 17 | 626 | 540 | 451 | 406 | 360 | 313 | 621 | 535 | 446 | 402 | 357 | 310 |
| | 18 | 615 | 530 | 443 | 399 | 354 | 307 | 610 | 525 | 438 | 394 | 351 | 304 |
| | 19 | 603 | 520 | 434 | 391 | 347 | 301 | 598 | 515 | 430 | 387 | 344 | 298 |
| | 20 | 591 | 510 | 426 | 384 | 340 | 295 | 586 | 505 | 421 | 379 | 337 | 292 |
| | 21 | 579 | 499 | 417 | 376 | 333 | 289 | 574 | 495 | 412 | 371 | 330 | 286 |
| | 22 | 566 | 488 | 408 | 367 | 325 | 282 | 561 | 484 | 403 | 363 | 322 | 279 |
| | 23 | 553 | 477 | 399 | 359 | 318 | 276 | 548 | 473 | 394 | 355 | 315 | 273 |
| | 24 | 540 | 466 | 389 | 350 | 310 | 269 | 535 | 461 | 385 | 346 | 307 | 266 |
| | 25 | 526 | 454 | 379 | 342 | 302 | 262 | 521 | 450 | 375 | 337 | 299 | 259 |
| | 26 | 512 | 442 | 369 | 333 | 294 | 255 | 508 | 438 | 365 | 328 | 291 | 252 |
| | 27 | 498 | 430 | 359 | 323 | 286 | 248 | 493 | 426 | 355 | 319 | 283 | 245 |
| | 28 | 484 | 418 | 349 | 314 | 278 | 240 | 479 | 413 | 344 | 310 | 275 | 237 |
| | 29 | 469 | 405 | 338 | 304 | 269 | 233 | 464 | 400 | 334 | 300 | 266 | 230 |
| | 30 | 454 | 392 | 327 | 295 | 260 | 225 | 449 | 388 | 323 | 290 | 257 | 222 |
| | 31 | 439 | 379 | 316 | 285 | 251 | 217 | 434 | 374 | 312 | 280 | 248 | 214 |
| | 32 | 423 | 365 | 305 | 274 | 242 | 209 | 418 | 361 | 301 | 270 | 239 | 206 |
| | 33 | 407 | 352 | 294 | 264 | 233 | 201 | 402 | 347 | 289 | 260 | 230 | 198 |
| | 34 | 390 | 338 | 282 | 253 | 223 | 193 | 385 | 333 | 277 | 249 | 220 | 190 |
| | 35 | 374 | 323 | 270 | 242 | 214 | 184 | 369 | 319 | 265 | 238 | 211 | 181 |
| | 36 | 356 | 309 | 257 | 231 | 204 | 175 | 351 | 304 | 253 | 227 | 201 | 172 |
| | 37 | 339 | 294 | 245 | 220 | 194 | 166 | 334 | 289 | 241 | 216 | 191 | 163 |
| | 38 | 321 | 278 | 232 | 209 | 184 | 158 | 317 | 274 | 228 | 205 | 181 | 155 |
| | 39 | 305 | 264 | 221 | 198 | 174 | 150 | 301 | 260 | 217 | 194 | 172 | 147 |
| | 40 | 290 | 251 | 210 | 188 | 166 | 142 | 286 | 247 | 206 | 185 | 163 | 140 |
| **Properties** | | | | | | | | | | | | | |
| Area, In.$^2$ | | 21.4 | 17.3 | 13.1 | 11.0 | 8.84 | 6.64 | 21.3 | 17.2 | 13.0 | 10.9 | 8.80 | 6.60 |
| I, In.$^4$ | | 369 | 304 | 235 | 199 | 161 | 122 | 363 | 299 | 231 | 196 | 159 | 120 |
| r, In. | | 4.15 | 4.19 | 4.23 | 4.25 | 4.27 | 4.29 | 4.13 | 4.17 | 4.21 | 4.23 | 4.25 | 4.27 |
| B, Bending Factor | | 0.357 | 0.350 | 0.343 | 0.340 | 0.338 | 0.335 | 0.359 | 0.352 | 0.345 | 0.341 | 0.339 | 0.337 |
| a ÷ $10^6$ | | 66.8 | 57.9 | 48.3 | 43.4 | 38.2 | 32.8 | 65.8 | 57.0 | 47.5 | 42.6 | 37.6 | 32.2 |

# HSS / Round Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips

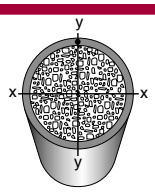



**f'c = 3.5**

| Nominal Outside Diameter | | 11.250 | | | | | | 10.750 | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 0.625 | 0.500 | 0.375 | 0.312 | 0.250 | 0.188 | 0.500 | 0.365 | 0.250 |
| Weight Per Foot | | 70.92 | 57.41 | 43.56 | 36.45 | 29.37 | 22.21 | 54.74 | 40.48 | 28.04 |
| Design Wall Thickness | | 0.581 | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 | 0.465 | 0.340 | 0.233 |
| | | $F_y$ = 46 ksi | | | | | | | | |
| Effective length KL in feet | 0 | 681 | 585 | 487 | 436 | 385 | 334 | 549 | 449 | 361 |
| | 4 | 659 | 567 | 472 | 422 | 373 | 323 | 531 | 433 | 348 |
| | 5 | 652 | 561 | 467 | 417 | 369 | 319 | 525 | 429 | 345 |
| | 6 | 645 | 555 | 462 | 413 | 365 | 316 | 519 | 424 | 341 |
| | 7 | 638 | 548 | 456 | 408 | 361 | 312 | 512 | 418 | 336 |
| | 8 | 630 | 541 | 451 | 403 | 356 | 308 | 505 | 413 | 332 |
| | 9 | 621 | 534 | 445 | 398 | 352 | 304 | 498 | 407 | 327 |
| | 10 | 612 | 527 | 439 | 392 | 347 | 300 | 491 | 401 | 322 |
| | 11 | 603 | 519 | 432 | 386 | 342 | 295 | 483 | 394 | 317 |
| | 12 | 594 | 511 | 425 | 380 | 336 | 290 | 475 | 388 | 312 |
| | 13 | 584 | 502 | 418 | 374 | 330 | 286 | 466 | 381 | 306 |
| | 14 | 574 | 494 | 411 | 367 | 325 | 280 | 457 | 374 | 300 |
| | 15 | 563 | 485 | 403 | 360 | 319 | 275 | 448 | 366 | 294 |
| | 16 | 552 | 475 | 396 | 353 | 312 | 270 | 439 | 358 | 288 |
| | 17 | 541 | 466 | 388 | 346 | 306 | 264 | 429 | 351 | 282 |
| | 18 | 529 | 456 | 379 | 339 | 300 | 258 | 419 | 342 | 275 |
| | 19 | 517 | 445 | 371 | 331 | 293 | 253 | 409 | 334 | 268 |
| | 20 | 505 | 435 | 362 | 323 | 286 | 246 | 398 | 325 | 261 |
| | 21 | 492 | 424 | 353 | 315 | 279 | 240 | 387 | 317 | 254 |
| | 22 | 479 | 413 | 344 | 307 | 271 | 234 | 376 | 307 | 247 |
| | 23 | 466 | 402 | 335 | 299 | 264 | 227 | 365 | 298 | 239 |
| | 24 | 453 | 390 | 325 | 290 | 256 | 221 | 353 | 289 | 231 |
| | 25 | 439 | 378 | 315 | 281 | 248 | 214 | 341 | 279 | 224 |
| | 26 | 424 | 366 | 305 | 272 | 240 | 207 | 329 | 269 | 215 |
| | 27 | 410 | 354 | 295 | 263 | 232 | 199 | 316 | 258 | 207 |
| | 28 | 395 | 341 | 284 | 253 | 224 | 192 | 303 | 248 | 199 |
| | 29 | 380 | 328 | 273 | 244 | 215 | 184 | 290 | 237 | 190 |
| | 30 | 364 | 315 | 262 | 234 | 206 | 177 | 277 | 226 | 181 |
| | 31 | 348 | 301 | 251 | 224 | 197 | 169 | 263 | 215 | 172 |
| | 32 | 332 | 287 | 239 | 213 | 188 | 161 | 249 | 203 | 162 |
| | 33 | 315 | 273 | 227 | 203 | 178 | 152 | 234 | 191 | 153 |
| | 34 | 298 | 258 | 215 | 192 | 169 | 144 | 221 | 180 | 144 |
| | 35 | 281 | 244 | 203 | 181 | 159 | 136 | 208 | 170 | 136 |
| | 36 | 266 | 230 | 192 | 171 | 150 | 128 | 197 | 161 | 129 |
| | 37 | 252 | 218 | 182 | 162 | 142 | 122 | 186 | 152 | 122 |
| | 38 | 239 | 207 | 172 | 154 | 135 | 115 | 177 | 144 | 115 |
| | 39 | 227 | 196 | 164 | 146 | 128 | 109 | 168 | 137 | 109 |
| | 40 | 215 | 187 | 156 | 139 | 122 | 104 | 159 | 130 | 104 |
| **Properties** | | | | | | | | | | |
| Area, In.$^2$ | | 19.5 | 15.8 | 12.0 | 10.0 | 8.06 | 6.05 | 15.0 | 11.1 | 7.70 |
| I, In.$^4$ | | 278 | 229 | 178 | 151 | 122 | 92.9 | 199 | 151 | 106 |
| r, In. | | 3.78 | 3.82 | 3.86 | 3.88 | 3.90 | 3.92 | 3.64 | 3.68 | 3.72 |
| B, Bending Factor | | 0.395 | 0.388 | 0.379 | 0.373 | 0.372 | 0.366 | 0.405 | 0.395 | 0.390 |
| a ÷ $10^6$ | | 49.6 | 43.0 | 35.8 | 31.9 | 28.1 | 24.0 | 36.7 | 30.0 | 24.0 |

# HSS / Round Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips



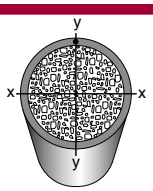

**f'c = 3.5**

| Nominal Outside Diameter | | 10.000 | | | | | | 9.625 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 0.625 | 0.500 | 0.375 | 0.312 | 0.250 | 0.188 | 0.500 | 0.375 | 0.312 | 0.250 | 0.188 |
| Weight Per Foot | | 62.58 | 50.73 | 38.55 | 32.28 | 26.03 | 19.70 | 48.73 | 37.05 | 31.03 | 25.03 | 18.95 |
| Design Wall Thickness | | 0.581 | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 |
| | | $F_y$ = 46 ksi | | | | | | | | | | |
| Effective length KL in feet | 0 | 584 | 499 | 414 | 369 | 325 | 279 | 476 | 393 | 350 | 307 | 263 |
| | 4 | 562 | 481 | 399 | 356 | 313 | 268 | 457 | 378 | 337 | 295 | 253 |
| | 5 | 556 | 475 | 394 | 352 | 309 | 265 | 452 | 373 | 332 | 292 | 250 |
| | 6 | 549 | 469 | 389 | 347 | 305 | 262 | 445 | 368 | 328 | 288 | 246 |
| | 7 | 541 | 462 | 383 | 342 | 301 | 258 | 439 | 363 | 323 | 283 | 243 |
| | 8 | 533 | 455 | 378 | 337 | 296 | 254 | 432 | 357 | 318 | 279 | 239 |
| | 9 | 524 | 448 | 372 | 332 | 292 | 250 | 425 | 351 | 313 | 274 | 235 |
| | 10 | 515 | 441 | 365 | 326 | 287 | 246 | 417 | 345 | 307 | 269 | 231 |
| | 11 | 506 | 433 | 359 | 320 | 281 | 241 | 409 | 338 | 301 | 264 | 226 |
| | 12 | 496 | 424 | 352 | 314 | 276 | 237 | 401 | 331 | 295 | 259 | 221 |
| | 13 | 486 | 416 | 345 | 308 | 270 | 232 | 392 | 324 | 289 | 253 | 217 |
| | 14 | 476 | 407 | 337 | 301 | 265 | 227 | 383 | 317 | 282 | 247 | 212 |
| | 15 | 465 | 398 | 330 | 294 | 259 | 221 | 374 | 309 | 275 | 241 | 206 |
| | 16 | 454 | 388 | 322 | 287 | 252 | 216 | 364 | 301 | 268 | 235 | 201 |
| | 17 | 442 | 378 | 314 | 280 | 246 | 211 | 354 | 293 | 261 | 229 | 195 |
| | 18 | 430 | 368 | 305 | 273 | 239 | 205 | 344 | 285 | 253 | 222 | 190 |
| | 19 | 418 | 358 | 297 | 265 | 232 | 199 | 333 | 276 | 246 | 215 | 184 |
| | 20 | 405 | 347 | 288 | 257 | 225 | 193 | 322 | 267 | 238 | 208 | 178 |
| | 21 | 392 | 336 | 279 | 249 | 218 | 187 | 311 | 258 | 229 | 201 | 171 |
| | 22 | 379 | 325 | 269 | 240 | 211 | 180 | 300 | 248 | 221 | 193 | 165 |
| | 23 | 365 | 313 | 260 | 232 | 203 | 174 | 288 | 238 | 212 | 186 | 158 |
| | 24 | 351 | 301 | 250 | 223 | 195 | 167 | 276 | 228 | 203 | 178 | 152 |
| | 25 | 336 | 289 | 240 | 214 | 187 | 160 | 263 | 218 | 194 | 170 | 145 |
| | 26 | 321 | 276 | 229 | 204 | 179 | 153 | 250 | 208 | 185 | 162 | 138 |
| | 27 | 306 | 264 | 219 | 195 | 171 | 145 | 237 | 197 | 175 | 153 | 130 |
| | 28 | 291 | 250 | 208 | 185 | 162 | 138 | 223 | 186 | 165 | 144 | 123 |
| | 29 | 275 | 237 | 196 | 175 | 153 | 130 | 210 | 174 | 155 | 135 | 115 |
| | 30 | 258 | 223 | 185 | 165 | 144 | 122 | 196 | 163 | 145 | 127 | 107 |
| | 31 | 242 | 209 | 173 | 154 | 135 | 114 | 183 | 153 | 136 | 119 | 100 |
| | 32 | 227 | 196 | 162 | 145 | 127 | 107 | 172 | 143 | 127 | 111 | 94 |
| | 33 | 213 | 184 | 153 | 136 | 119 | 101 | 162 | 135 | 120 | 105 | 89 |
| | 34 | 201 | 174 | 144 | 128 | 112 | 95 | 152 | 127 | 113 | 99 | 84 |
| | 35 | 190 | 164 | 136 | 121 | 106 | 90 | 144 | 120 | 106 | 93 | 79 |
| | 36 | 179 | 155 | 128 | 114 | 100 | 85 | 136 | 113 | 101 | 88 | 75 |
| | 37 | 170 | 147 | 122 | 108 | 95 | 80 | 129 | 107 | 95 | 83 | 71 |
| | 38 | 161 | 139 | 115 | 103 | 90 | 76 | 122 | 102 | 90 | 79 | 67 |
| | 39 | 153 | 132 | 109 | 98 | 85 | 72 | 116 | 96 | 86 | 75 | 63 |
| | 40 | 145 | 125 | 104 | 93 | 81 | 69 | 110 | 92 | 82 | 71 | 60 |
| **Properties** | | | | | | | | | | | | |
| Area, In.$^2$ | | 17.2 | 13.9 | 10.6 | 8.88 | 7.15 | 5.37 | 13.4 | 10.2 | 8.53 | 6.87 | 5.17 |
| I, In.$^4$ | | 191 | 159 | 123 | 105 | 85.3 | 64.8 | 141 | 110 | 93.0 | 75.9 | 57.7 |
| r, In. | | 3.34 | 3.38 | 3.41 | 3.43 | 3.45 | 3.47 | 3.24 | 3.28 | 3.30 | 3.32 | 3.34 |
| B, Bending Factor | | 0.450 | 0.437 | 0.431 | 0.423 | 0.419 | 0.414 | 0.457 | 0.446 | 0.441 | 0.436 | 0.431 |
| a ÷ $10^6$ | | 33.5 | 28.9 | 24.0 | 21.4 | 18.7 | 15.8 | 25.4 | 21.1 | 18.8 | 16.4 | 13.9 |

# HSS / Round Structural Steel Tubing for Composite Columns

ERW

Allowable Concentric Loads in Kips

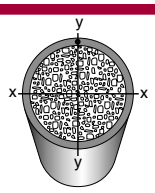



**f'c = 3.5**

| Nominal Outside Diameter | | 8.750 | | | | | 8.625 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 0.500 | 0.375 | 0.312 | 0.250 | 0.188 | 0.500 | 0.375 | 0.322 | 0.250 | 0.188 |
| Weight Per Foot | | 44.06 | 33.54 | 28.12 | 22.70 | 17.19 | 43.39 | 33.04 | 28.55 | 22.36 | 16.94 |
| Design Wall Thickness | | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 | 0.465 | 0.349 | 0.300 | 0.233 | 0.174 |
| | | $F_y$ = 46 ksi | | | | | | | | | |
| Effective length KL in feet | 0 | 420 | 345 | 307 | 268 | 228 | 411 | 338 | 307 | 263 | 224 |
| | 4 | 401 | 330 | 294 | 256 | 218 | 393 | 323 | 293 | 251 | 214 |
| | 5 | 396 | 325 | 289 | 253 | 215 | 387 | 319 | 289 | 248 | 211 |
| | 6 | 389 | 320 | 285 | 249 | 212 | 381 | 314 | 285 | 244 | 207 |
| | 7 | 383 | 315 | 280 | 245 | 208 | 375 | 308 | 280 | 239 | 204 |
| | 8 | 376 | 309 | 275 | 240 | 204 | 368 | 303 | 275 | 235 | 200 |
| | 9 | 368 | 303 | 270 | 236 | 200 | 360 | 297 | 269 | 230 | 196 |
| | 10 | 361 | 297 | 264 | 231 | 196 | 352 | 290 | 263 | 225 | 191 |
| | 11 | 352 | 290 | 258 | 225 | 192 | 344 | 284 | 257 | 220 | 187 |
| | 12 | 344 | 283 | 252 | 220 | 187 | 336 | 277 | 251 | 215 | 182 |
| | 13 | 335 | 276 | 245 | 214 | 182 | 327 | 269 | 244 | 209 | 178 |
| | 14 | 326 | 268 | 239 | 209 | 177 | 318 | 262 | 238 | 203 | 173 |
| | 15 | 316 | 261 | 232 | 202 | 172 | 308 | 254 | 231 | 197 | 167 |
| | 16 | 306 | 253 | 225 | 196 | 167 | 298 | 246 | 223 | 191 | 162 |
| | 17 | 296 | 244 | 217 | 190 | 161 | 288 | 238 | 216 | 184 | 157 |
| | 18 | 286 | 236 | 210 | 183 | 155 | 278 | 229 | 208 | 178 | 151 |
| | 19 | 275 | 227 | 202 | 176 | 149 | 267 | 220 | 200 | 171 | 145 |
| | 20 | 264 | 218 | 194 | 169 | 143 | 255 | 211 | 192 | 164 | 139 |
| | 21 | 252 | 208 | 185 | 162 | 137 | 244 | 202 | 183 | 156 | 132 |
| | 22 | 240 | 199 | 177 | 154 | 131 | 232 | 192 | 174 | 149 | 126 |
| | 23 | 228 | 189 | 168 | 146 | 124 | 220 | 182 | 165 | 141 | 119 |
| | 24 | 215 | 178 | 159 | 138 | 117 | 207 | 172 | 156 | 133 | 112 |
| | 25 | 202 | 168 | 149 | 130 | 110 | 194 | 161 | 146 | 125 | 105 |
| | 26 | 189 | 157 | 140 | 122 | 103 | 180 | 150 | 136 | 116 | 98 |
| | 27 | 175 | 146 | 130 | 113 | 95 | 167 | 139 | 127 | 108 | 91 |
| | 28 | 163 | 135 | 121 | 105 | 89 | 156 | 129 | 118 | 100 | 85 |
| | 29 | 152 | 126 | 112 | 98 | 83 | 145 | 121 | 110 | 94 | 79 |
| | 30 | 142 | 118 | 105 | 91 | 77 | 136 | 113 | 103 | 87 | 74 |
| | 31 | 133 | 110 | 98 | 86 | 72 | 127 | 106 | 96 | 82 | 69 |
| | 32 | 125 | 104 | 92 | 80 | 68 | 119 | 99 | 90 | 77 | 65 |
| | 33 | 117 | 97 | 87 | 76 | 64 | 112 | 93 | 85 | 72 | 61 |
| | 34 | 111 | 92 | 82 | 71 | 60 | 106 | 88 | 80 | 68 | 57 |
| | 35 | 104 | 87 | 77 | 67 | 57 | 100 | 83 | 75 | 64 | 54 |
| | 36 | 99 | 82 | 73 | 64 | 54 | 94 | 78 | 71 | 61 | 51 |
| | 37 | 93 | 78 | 69 | 60 | 51 | 89 | 74 | 67 | 57 | 48 |
| | 38 | 89 | 74 | 65 | 57 | 48 | 84 | 70 | 64 | 54 | 46 |
| | 39 | 84 | 70 | 62 | 54 | 46 | 80 | 67 | 61 | 52 | 44 |
| | 40 | 80 | 66 | 59 | 51 | 43 | 76 | 63 | 58 | 49 | 41 |
| **PROPERTIES** | | | | | | | | | | | |
| Area, In.$^2$ | | 12.1 | 9.21 | 7.73 | 6.23 | 4.69 | 11.9 | 9.07 | 7.85 | 6.14 | 4.62 |
| I, In.$^4$ | | 104 | 81.4 | 69.3 | 56.6 | 43.1 | 99.5 | 77.8 | 68.1 | 54.1 | 41.3 |
| r, In. | | 2.93 | 2.97 | 2.99 | 3.01 | 3.03 | 2.89 | 2.93 | 2.95 | 2.97 | 2.99 |
| B, Bending Factor | | 0.509 | 0.495 | 0.488 | 0.482 | 0.476 | 0.516 | 0.503 | 0.497 | 0.489 | 0.482 |
| a ÷ $10^6$ | | 18.4 | 15.3 | 13.6 | 11.9 | 10.0 | 17.6 | 14.6 | 13.3 | 11.3 | 9.55 |

# HSS / Round Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips



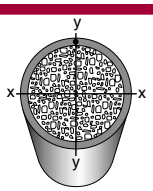

**f'c = 3.5**

| Nominal Outside Diameter | | 7.625 | | | 7.500 | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 0.375 | 0.328 | 0.125 | 0.500 | 0.375 | 0.312 | 0.250 | 0.188 |
| Weight Per Foot | | 29.04 | 25.56 | 10.01 | 37.38 | 28.54 | 23.95 | 19.36 | 14.68 |
| Design Wall Thickness | | 0.349 | 0.305 | 0.116 | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 |
| | | $F_y$ = 46 ksi | | | | | | | |
| Effective length KL in feet | 0 | 288 | 262 | 152 | 345 | 281 | 249 | 216 | 182 |
| | 4 | 273 | 249 | 144 | 327 | 266 | 236 | 205 | 173 |
| | 5 | 268 | 245 | 142 | 321 | 262 | 232 | 201 | 169 |
| | 6 | 263 | 240 | 139 | 314 | 257 | 227 | 197 | 166 |
| | 7 | 257 | 235 | 136 | 307 | 251 | 222 | 193 | 163 |
| | 8 | 252 | 230 | 133 | 300 | 245 | 217 | 189 | 159 |
| | 9 | 246 | 224 | 130 | 293 | 239 | 212 | 184 | 155 |
| | 10 | 239 | 218 | 126 | 285 | 233 | 206 | 179 | 151 |
| | 11 | 232 | 212 | 123 | 276 | 226 | 200 | 174 | 146 |
| | 12 | 225 | 206 | 119 | 267 | 219 | 194 | 168 | 142 |
| | 13 | 218 | 199 | 115 | 258 | 211 | 187 | 163 | 137 |
| | 14 | 210 | 192 | 111 | 248 | 203 | 180 | 157 | 132 |
| | 15 | 202 | 184 | 106 | 238 | 195 | 173 | 150 | 126 |
| | 16 | 194 | 177 | 102 | 228 | 187 | 166 | 144 | 121 |
| | 17 | 185 | 169 | 97 | 217 | 178 | 158 | 137 | 115 |
| | 18 | 176 | 161 | 93 | 206 | 169 | 150 | 131 | 110 |
| | 19 | 167 | 153 | 88 | 195 | 160 | 142 | 123 | 104 |
| | 20 | 158 | 144 | 82 | 183 | 151 | 134 | 116 | 97 |
| | 21 | 148 | 135 | 77 | 170 | 141 | 125 | 109 | 91 |
| | 22 | 138 | 126 | 72 | 158 | 130 | 116 | 101 | 84 |
| | 23 | 127 | 116 | 66 | 145 | 120 | 107 | 93 | 77 |
| | 24 | 117 | 107 | 61 | 133 | 110 | 98 | 85 | 71 |
| | 25 | 108 | 98 | 56 | 122 | 101 | 90 | 78 | 66 |
| | 26 | 100 | 91 | 52 | 113 | 94 | 83 | 72 | 61 |
| | 27 | 92 | 84 | 48 | 105 | 87 | 77 | 67 | 56 |
| | 28 | 86 | 78 | 45 | 98 | 81 | 72 | 62 | 52 |
| | 29 | 80 | 73 | 42 | 91 | 75 | 67 | 58 | 49 |
| | 30 | 75 | 68 | 39 | 85 | 70 | 63 | 54 | 46 |
| | 31 | 70 | 64 | 36 | 80 | 66 | 59 | 51 | 43 |
| | 32 | 66 | 60 | 34 | 75 | 62 | 55 | 48 | 40 |
| | 33 | 62 | 56 | 32 | 70 | 58 | 52 | 45 | 38 |
| | 34 | 58 | 53 | 30 | 66 | 55 | 49 | 42 | 35 |
| | 35 | 55 | 50 | 29 | 62 | 52 | 46 | 40 | 33 |
| | 36 | 52 | 47 | 27 | 59 | 49 | 43 | 38 | 32 |
| | 37 | 49 | 45 | 26 | 56 | 46 | 41 | 36 | 30 |
| | 38 | 47 | 43 | 24 | 53 | 44 | 39 | 34 | 28 |
| | 39 | 44 | 40 | 23 | 50 | 42 | 37 | 32 | 27 |
| | 40 | 42 | 38 | 22 | 48 | 40 | 35 | 31 | 26 |
| **Properties** | | | | | | | | | |
| Area, In.$^2$ | | 7.98 | 7.01 | 2.74 | 10.3 | 7.84 | 6.59 | 5.32 | 4.00 |
| I, In.$^4$ | | 52.9 | 47.1 | 19.3 | 63.9 | 50.2 | 42.9 | 35.2 | 26.9 |
| r, In. | | 2.58 | 2.59 | 2.66 | 2.49 | 2.53 | 2.55 | 2.57 | 2.59 |
| B, Bending Factor | | 0.575 | 0.567 | 0.541 | 0.604 | 0.586 | 0.576 | 0.567 | 0.558 |
| a ÷ $10^6$ | | 9.69 | 8.84 | 5.03 | 11.0 | 9.13 | 8.12 | 7.05 | 5.90 |

# HSS / Round Structural Steel Tubing for Composite Columns

ERW

Allowable Concentric Loads in Kips



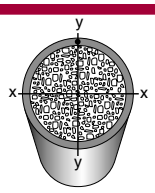

**f'c = 3.5**

| Nominal Outside Diameter | | 7.000 | | | | | | 6.875 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 0.500 | 0.375 | 0.312 | 0.250 | 0.188 | 0.125 | 0.500 | 0.375 | 0.312 | 0.250 | 0.188 |
| Weight Per Foot | | 34.71 | 26.53 | 22.29 | 18.02 | 13.68 | 9.18 | 34.04 | 26.03 | 21.87 | 17.69 | 13.43 |
| Design Wall Thickness | | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 | 0.116 | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 |
| | | $F_y$ = 46 ksi | | | | | | | | | | |
| Effective length KL in feet | 0 | 315 | 257 | 227 | 196 | 165 | 133 | 308 | 251 | 222 | 192 | 161 |
| | 4 | 297 | 242 | 214 | 185 | 156 | 126 | 290 | 236 | 209 | 181 | 151 |
| | 5 | 291 | 237 | 210 | 182 | 152 | 123 | 284 | 232 | 205 | 177 | 148 |
| | 6 | 285 | 232 | 205 | 178 | 149 | 121 | 277 | 226 | 200 | 173 | 145 |
| | 7 | 278 | 227 | 200 | 173 | 146 | 118 | 270 | 221 | 195 | 169 | 141 |
| | 8 | 271 | 221 | 195 | 169 | 142 | 115 | 263 | 215 | 190 | 164 | 138 |
| | 9 | 263 | 214 | 190 | 164 | 138 | 111 | 255 | 209 | 184 | 160 | 134 |
| | 10 | 255 | 208 | 184 | 159 | 134 | 108 | 247 | 202 | 179 | 154 | 129 |
| | 11 | 246 | 201 | 178 | 154 | 129 | 104 | 238 | 195 | 172 | 149 | 125 |
| | 12 | 237 | 194 | 171 | 148 | 124 | 100 | 229 | 188 | 166 | 144 | 120 |
| | 13 | 228 | 186 | 165 | 143 | 120 | 96 | 220 | 180 | 159 | 138 | 116 |
| | 14 | 218 | 178 | 158 | 137 | 115 | 92 | 210 | 172 | 152 | 132 | 110 |
| | 15 | 208 | 170 | 150 | 130 | 109 | 88 | 200 | 164 | 145 | 126 | 105 |
| | 16 | 197 | 161 | 143 | 124 | 104 | 83 | 189 | 156 | 138 | 119 | 100 |
| | 17 | 186 | 153 | 135 | 117 | 98 | 79 | 178 | 147 | 130 | 112 | 94 |
| | 18 | 175 | 143 | 127 | 110 | 92 | 74 | 166 | 137 | 122 | 105 | 88 |
| | 19 | 163 | 134 | 119 | 103 | 86 | 69 | 154 | 128 | 113 | 98 | 82 |
| | 20 | 151 | 124 | 110 | 95 | 80 | 64 | 142 | 118 | 105 | 91 | 76 |
| | 21 | 138 | 114 | 101 | 88 | 73 | 58 | 129 | 108 | 96 | 83 | 69 |
| | 22 | 126 | 104 | 92 | 80 | 67 | 53 | 118 | 98 | 87 | 75 | 63 |
| | 23 | 115 | 95 | 84 | 73 | 61 | 49 | 108 | 90 | 80 | 69 | 58 |
| | 24 | 106 | 87 | 77 | 67 | 56 | 45 | 99 | 82 | 73 | 63 | 53 |
| | 25 | 97 | 80 | 71 | 62 | 52 | 41 | 91 | 76 | 67 | 58 | 49 |
| | 26 | 90 | 74 | 66 | 57 | 48 | 38 | 84 | 70 | 62 | 54 | 45 |
| | 27 | 84 | 69 | 61 | 53 | 44 | 35 | 78 | 65 | 58 | 50 | 42 |
| | 28 | 78 | 64 | 57 | 49 | 41 | 33 | 73 | 60 | 54 | 47 | 39 |
| | 29 | 72 | 60 | 53 | 46 | 38 | 31 | 68 | 56 | 50 | 43 | 36 |
| | 30 | 68 | 56 | 50 | 43 | 36 | 29 | 63 | 53 | 47 | 41 | 34 |
| | 31 | 63 | 52 | 46 | 40 | 34 | 27 | 59 | 49 | 44 | 38 | 32 |
| | 32 | 59 | 49 | 44 | 38 | 32 | 25 | 56 | 46 | 41 | 36 | 30 |
| | 33 | 56 | 46 | 41 | 36 | 30 | 24 | 52 | 44 | 39 | 34 | 28 |
| | 34 | 53 | 43 | 39 | 33 | 28 | 22 | 49 | 41 | 36 | 32 | 26 |
| | 35 | 50 | 41 | 36 | 32 | 26 | 21 | 47 | 39 | 34 | 30 | 25 |
| | 36 | 47 | 39 | 34 | 30 | 25 | 20 | 44 | 37 | 33 | 28 | 24 |
| | 37 | 44 | 37 | 33 | 28 | 24 | 19 | 42 | 35 | 31 | 27 | 22 |
| | 38 | 42 | 35 | 31 | 27 | 22 | 18 | | 33 | 29 | 25 | 21 |
| | 39 | | 33 | 29 | 25 | 21 | 17 | | | | 24 | 20 |
| | 40 | | | | | 20 | 16 | | | | | |
| **Properties** | | | | | | | | | | | | |
| Area, In.$^2$ | | 9.55 | 7.29 | 6.13 | 4.95 | 3.73 | 2.51 | 9.36 | 7.16 | 6.02 | 4.86 | 3.66 |
| I, In.$^4$ | | 51.2 | 40.4 | 34.6 | 28.4 | 21.7 | 14.9 | 48.3 | 38.2 | 32.7 | 26.8 | 20.6 |
| r, In. | | 2.32 | 2.35 | 2.37 | 2.39 | 2.41 | 2.43 | 2.27 | 2.31 | 2.33 | 2.35 | 2.37 |
| B, Bending Factor | | 0.653 | 0.632 | 0.620 | 0.610 | 0.602 | 0.590 | 0.666 | 0.644 | 0.633 | 0.623 | 0.611 |
| a ÷ $10^6$ | | 8.77 | 7.22 | 6.42 | 5.57 | 4.65 | 3.70 | 8.21 | 6.83 | 6.07 | 5.26 | 4.39 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

# HSS / Round Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips



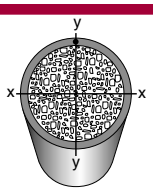

**f'c = 3.5**

| Nominal Outside Diameter | | 6.625 | | | | | | | | 6.125 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 0.500 | 0.432 | 0.375 | 0.312 | 0.280 | 0.250 | 0.188 | 0.125 | 0.500 | 0.375 | 0.312 | 0.250 | 0.188 |
| Weight Per Foot | | 32.71 | 28.57 | 25.03 | 21.04 | 18.97 | 17.02 | 12.92 | 8.68 | 30.04 | 23.03 | 19.37 | 15.69 | 11.92 |
| Design Wall Thickness | | 0.465 | 0.403 | 0.349 | 0.291 | 0.261 | 0.233 | 0.174 | 0.116 | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 |
| | | $F_y$ = 46 ksi | | | | | | | | | | | | |
| Effective length KL in feet | 0 | 294 | 265 | 239 | 211 | 196 | 182 | 153 | 123 | 266 | 216 | 190 | 164 | 136 |
| | 4 | 276 | 249 | 224 | 198 | 184 | 171 | 143 | 115 | 248 | 201 | 177 | 153 | 127 |
| | 5 | 270 | 243 | 220 | 194 | 180 | 168 | 140 | 113 | 242 | 197 | 173 | 149 | 124 |
| | 6 | 263 | 237 | 214 | 189 | 176 | 164 | 137 | 110 | 235 | 191 | 169 | 145 | 121 |
| | 7 | 256 | 231 | 209 | 184 | 172 | 159 | 133 | 107 | 228 | 186 | 164 | 141 | 117 |
| | 8 | 249 | 224 | 203 | 179 | 167 | 155 | 130 | 104 | 220 | 180 | 158 | 136 | 114 |
| | 9 | 241 | 217 | 197 | 174 | 162 | 150 | 126 | 101 | 212 | 173 | 153 | 131 | 109 |
| | 10 | 232 | 210 | 190 | 168 | 156 | 145 | 121 | 97 | 204 | 166 | 147 | 126 | 105 |
| | 11 | 224 | 202 | 183 | 162 | 150 | 140 | 117 | 94 | 195 | 159 | 141 | 121 | 101 |
| | 12 | 214 | 194 | 175 | 155 | 144 | 134 | 112 | 90 | 186 | 152 | 134 | 115 | 96 |
| | 13 | 205 | 185 | 168 | 148 | 138 | 128 | 107 | 86 | 176 | 144 | 127 | 109 | 91 |
| | 14 | 195 | 176 | 160 | 141 | 132 | 122 | 102 | 82 | 165 | 136 | 120 | 103 | 86 |
| | 15 | 184 | 167 | 151 | 134 | 125 | 116 | 97 | 77 | 155 | 127 | 113 | 97 | 81 |
| | 16 | 174 | 157 | 143 | 126 | 118 | 109 | 91 | 73 | 144 | 118 | 105 | 90 | 75 |
| | 17 | 162 | 147 | 134 | 119 | 110 | 103 | 86 | 68 | 132 | 109 | 97 | 83 | 69 |
| | 18 | 151 | 137 | 124 | 110 | 103 | 96 | 80 | 63 | 120 | 99 | 88 | 76 | 63 |
| | 19 | 138 | 126 | 115 | 102 | 95 | 88 | 74 | 58 | 108 | 90 | 80 | 68 | 57 |
| | 20 | 126 | 115 | 104 | 93 | 87 | 81 | 67 | 53 | 97 | 81 | 72 | 62 | 51 |
| | 21 | 114 | 104 | 95 | 84 | 79 | 73 | 61 | 48 | 88 | 73 | 65 | 56 | 46 |
| | 22 | 104 | 95 | 86 | 77 | 72 | 67 | 56 | 44 | 80 | 67 | 59 | 51 | 42 |
| | 23 | 95 | 87 | 79 | 70 | 65 | 61 | 51 | 40 | 73 | 61 | 54 | 47 | 39 |
| | 24 | 87 | 80 | 73 | 64 | 60 | 56 | 47 | 37 | 67 | 56 | 50 | 43 | 36 |
| | 25 | 80 | 73 | 67 | 59 | 55 | 52 | 43 | 34 | 62 | 52 | 46 | 39 | 33 |
| | 26 | 74 | 68 | 62 | 55 | 51 | 48 | 40 | 31 | 57 | 48 | 42 | 36 | 30 |
| | 27 | 69 | 63 | 57 | 51 | 47 | 44 | 37 | 29 | 53 | 44 | 39 | 34 | 28 |
| | 28 | 64 | 58 | 53 | 47 | 44 | 41 | 34 | 27 | 50 | 41 | 37 | 31 | 26 |
| | 29 | 60 | 54 | 50 | 44 | 41 | 38 | 32 | 25 | 46 | 38 | 34 | 29 | 24 |
| | 30 | 56 | 51 | 46 | 41 | 38 | 36 | 30 | 24 | 43 | 36 | 32 | 27 | 23 |
| | 31 | 52 | 48 | 43 | 39 | 36 | 34 | 28 | 22 | 40 | 34 | 30 | 26 | 21 |
| | 32 | 49 | 45 | 41 | 36 | 34 | 31 | 26 | 21 | 38 | 32 | 28 | 24 | 20 |
| | 33 | 46 | 42 | 38 | 34 | 32 | 30 | 25 | 20 | 36 | 30 | 26 | 23 | 19 |
| | 34 | 43 | 40 | 36 | 32 | 30 | 28 | 23 | 18 | | 28 | 25 | 21 | 18 |
| | 35 | 41 | 37 | 34 | 30 | 28 | 26 | 22 | 17 | | | | | 17 |
| | 36 | 39 | 35 | 32 | 29 | 27 | 25 | 21 | 16 | | | | | |
| | 37 | | | 31 | 27 | 25 | 24 | 20 | 16 | | | | | |
| | 38 | | | | | | | 19 | 15 | | | | | |
| | 39 | | | | | | | | | | | | | |
| | 40 | | | | | | | | | | | | | |
| **Properties** | | | | | | | | | | | | | | |
| Area, In.$^2$ | | 9.00 | 7.88 | 6.88 | 5.79 | 5.22 | 4.68 | 3.53 | 2.37 | 8.27 | 6.33 | 5.33 | 4.31 | 3.25 |
| I, In.$^4$ | | 42.9 | 38.3 | 34.0 | 29.1 | 26.5 | 23.9 | 18.4 | 12.6 | 33.3 | 26.5 | 22.7 | 18.7 | 14.4 |
| r, In. | | 2.18 | 2.20 | 2.22 | 2.24 | 2.25 | 2.26 | 2.28 | 2.30 | 2.01 | 2.05 | 2.07 | 2.08 | 2.10 |
| B, Bending Factor | | 0.695 | 0.682 | 0.670 | 0.659 | 0.653 | 0.649 | 0.635 | 0.623 | 0.761 | 0.732 | 0.719 | 0.706 | 0.691 |
| a ÷ $10^6$ | | 7.24 | 6.60 | 6.02 | 5.35 | 4.99 | 4.64 | 3.87 | 3.06 | 5.59 | 4.66 | 4.14 | 3.55 | 2.95 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

# HSS / Round Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips



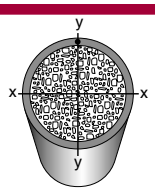

**f'c = 3.5**

| Nominal Outside Diameter | | 6.000 | | | | | | | 5.563 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 0.500 | 0.375 | 0.312 | 0.280 | 0.250 | 0.188 | 0.125 | 0.375 | 0.258 | 0.188 | 0.134 |
| Weight Per Foot | | 29.37 | 22.53 | 18.95 | 17.11 | 15.35 | 11.67 | 7.84 | 20.78 | 14.62 | 10.79 | 7.77 |
| Design Wall Thickness | | 0.465 | 0.349 | 0.291 | 0.261 | 0.233 | 0.174 | 0.116 | 0.349 | 0.241 | 0.174 | 0.125 |
| | | $F_y$ = 46 ksi | | | | | | | | | | |
| Effective length KL in feet | 0 | 259 | 211 | 185 | 172 | 159 | 133 | 106 | 191 | 147 | 120 | 99 |
| | 4 | 241 | 196 | 172 | 160 | 148 | 123 | 98 | 176 | 136 | 110 | 91 |
| | 5 | 235 | 191 | 168 | 156 | 145 | 120 | 96 | 171 | 132 | 107 | 89 |
| | 6 | 228 | 186 | 163 | 152 | 141 | 117 | 93 | 166 | 128 | 104 | 86 |
| | 7 | 221 | 180 | 158 | 147 | 136 | 113 | 90 | 160 | 124 | 101 | 83 |
| | 8 | 213 | 174 | 153 | 142 | 132 | 110 | 87 | 154 | 119 | 97 | 80 |
| | 9 | 205 | 167 | 148 | 137 | 127 | 106 | 84 | 148 | 114 | 93 | 76 |
| | 10 | 197 | 161 | 142 | 132 | 122 | 101 | 81 | 141 | 109 | 88 | 73 |
| | 11 | 188 | 153 | 135 | 126 | 117 | 97 | 77 | 133 | 103 | 84 | 69 |
| | 12 | 178 | 146 | 129 | 120 | 111 | 92 | 73 | 125 | 97 | 79 | 65 |
| | 13 | 168 | 138 | 122 | 113 | 105 | 87 | 69 | 117 | 91 | 74 | 61 |
| | 14 | 158 | 130 | 115 | 107 | 99 | 82 | 65 | 109 | 85 | 69 | 56 |
| | 15 | 147 | 121 | 107 | 100 | 92 | 77 | 61 | 100 | 78 | 63 | 52 |
| | 16 | 135 | 112 | 99 | 92 | 86 | 71 | 56 | 91 | 71 | 58 | 47 |
| | 17 | 124 | 102 | 91 | 85 | 79 | 65 | 52 | 81 | 63 | 52 | 42 |
| | 18 | 111 | 93 | 82 | 77 | 71 | 59 | 47 | 72 | 56 | 46 | 38 |
| | 19 | 100 | 83 | 74 | 69 | 64 | 53 | 42 | 65 | 51 | 41 | 34 |
| | 20 | 90 | 75 | 67 | 62 | 58 | 48 | 38 | 59 | 46 | 37 | 30 |
| | 21 | 82 | 68 | 60 | 56 | 52 | 44 | 34 | 53 | 41 | 34 | 28 |
| | 22 | 74 | 62 | 55 | 51 | 48 | 40 | 31 | 48 | 38 | 31 | 25 |
| | 23 | 68 | 57 | 50 | 47 | 44 | 36 | 29 | 44 | 35 | 28 | 23 |
| | 24 | 63 | 52 | 46 | 43 | 40 | 33 | 26 | 41 | 32 | 26 | 21 |
| | 25 | 58 | 48 | 43 | 40 | 37 | 31 | 24 | 37 | 29 | 24 | 19 |
| | 26 | 53 | 44 | 39 | 37 | 34 | 28 | 22 | 35 | 27 | 22 | 18 |
| | 27 | 49 | 41 | 37 | 34 | 32 | 26 | 21 | 32 | 25 | 21 | 17 |
| | 28 | 46 | 38 | 34 | 32 | 29 | 24 | 19 | 30 | 23 | 19 | 16 |
| | 29 | 43 | 36 | 32 | 30 | 27 | 23 | 18 | 28 | 22 | 18 | 14 |
| | 30 | 40 | 33 | 30 | 28 | 26 | 21 | 17 | 26 | 20 | 17 | 14 |
| | 31 | 37 | 31 | 28 | 26 | 24 | 20 | 16 | | 19 | 16 | 13 |
| | 32 | 35 | 29 | 26 | 24 | 23 | 19 | 15 | | | | 12 |
| | 33 | | 28 | 24 | 23 | 21 | 18 | 14 | | | | |
| | 34 | | | | | 20 | 17 | 13 | | | | |
| | 35 | | | | | | | | | | | |
| | 36 | | | | | | | | | | | |
| | 37 | | | | | | | | | | | |
| | 38 | | | | | | | | | | | |
| | 39 | | | | | | | | | | | |
| | 40 | | | | | | | | | | | |
| **Properties** | | | | | | | | | | | | |
| Area, In.$^2$ | | 8.09 | 6.20 | 5.22 | 4.71 | 4.22 | 3.18 | 2.14 | 5.72 | 4.03 | 2.95 | 2.14 |
| I, In.$^4$ | | 31.2 | 24.8 | 21.3 | 19.4 | 17.6 | 13.5 | 9.28 | 19.5 | 14.3 | 10.7 | 7.90 |
| r, In. | | 1.96 | 2.00 | 2.02 | 2.03 | 2.04 | 2.06 | 2.08 | 1.85 | 1.88 | 1.91 | 1.92 |
| B, Bending Factor | | 0.778 | 0.750 | 0.735 | 0.728 | 0.719 | 0.707 | 0.692 | 0.816 | 0.784 | 0.767 | 0.753 |
| a ÷ $10^6$ | | 5.19 | 4.32 | 3.84 | 3.58 | 3.33 | 2.76 | 2.18 | 3.37 | 2.63 | 2.15 | 1.75 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

# HSS / Round Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips



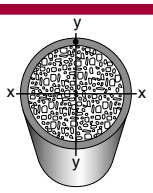

**f'c = 3.5**

| Nominal Outside Diameter | | 5.500 | | | 5.000 | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 0.500 | 0.375 | 0.258 | 0.500 | 0.375 | 0.312 | 0.258 | 0.250 | 0.188 | 0.125 |
| Weight Per Foot | | 26.70 | 20.53 | 14.44 | 24.03 | 18.52 | 15.62 | 13.07 | 12.68 | 9.66 | 6.51 |
| Design Wall Thickness | | 0.465 | 0.349 | 0.241 | 0.465 | 0.349 | 0.291 | 0.241 | 0.233 | 0.174 | 0.116 |
| | | $F_y$ = 46 ksi | | | | | | | | | |
| Effective length KL in feet | 0 | 232 | 188 | 145 | 206 | 167 | 146 | 128 | 125 | 103 | 81 |
| | 4 | 214 | 174 | 134 | 187 | 152 | 133 | 117 | 114 | 94 | 74 |
| | 5 | 208 | 169 | 130 | 181 | 147 | 129 | 113 | 111 | 91 | 72 |
| | 6 | 201 | 163 | 126 | 174 | 141 | 124 | 109 | 106 | 88 | 69 |
| | 7 | 194 | 157 | 122 | 166 | 135 | 119 | 104 | 102 | 84 | 66 |
| | 8 | 186 | 151 | 117 | 158 | 129 | 113 | 99 | 97 | 80 | 63 |
| | 9 | 177 | 145 | 112 | 150 | 122 | 107 | 94 | 92 | 76 | 60 |
| | 10 | 169 | 138 | 107 | 140 | 115 | 101 | 89 | 87 | 72 | 56 |
| | 11 | 159 | 130 | 101 | 131 | 107 | 95 | 83 | 81 | 67 | 53 |
| | 12 | 150 | 123 | 95 | 120 | 99 | 88 | 77 | 76 | 62 | 49 |
| | 13 | 139 | 115 | 89 | 110 | 91 | 80 | 70 | 69 | 57 | 45 |
| | 14 | 129 | 106 | 82 | 98 | 82 | 73 | 64 | 63 | 52 | 41 |
| | 15 | 117 | 97 | 75 | 86 | 73 | 65 | 57 | 56 | 46 | 36 |
| | 16 | 105 | 88 | 68 | 76 | 64 | 57 | 50 | 49 | 41 | 32 |
| | 17 | 93 | 78 | 61 | 67 | 56 | 50 | 44 | 44 | 36 | 28 |
| | 18 | 83 | 70 | 54 | 60 | 50 | 45 | 39 | 39 | 32 | 25 |
| | 19 | 75 | 63 | 49 | 54 | 45 | 40 | 35 | 35 | 29 | 23 |
| | 20 | 68 | 56 | 44 | 49 | 41 | 36 | 32 | 31 | 26 | 20 |
| | 21 | 61 | 51 | 40 | 44 | 37 | 33 | 29 | 29 | 24 | 18 |
| | 22 | 56 | 47 | 36 | 40 | 34 | 30 | 26 | 26 | 22 | 17 |
| | 23 | 51 | 43 | 33 | 37 | 31 | 27 | 24 | 24 | 20 | 15 |
| | 24 | 47 | 39 | 31 | 34 | 28 | 25 | 22 | 22 | 18 | 14 |
| | 25 | 43 | 36 | 28 | 31 | 26 | 23 | 20 | 20 | 17 | 13 |
| | 26 | 40 | 33 | 26 | 29 | 24 | 21 | 19 | 19 | 15 | 12 |
| | 27 | 37 | 31 | 24 | | 22 | 20 | 17 | 17 | 14 | 11 |
| | 28 | 34 | 29 | 22 | | | | 16 | 16 | 13 | 10 |
| | 29 | 32 | 27 | 21 | | | | | | | |
| | 30 | | 25 | 20 | | | | | | | |
| | 31 | | | 18 | | | | | | | |
| | 32 | | | | | | | | | | |
| | 33 | | | | | | | | | | |
| | 34 | | | | | | | | | | |
| | 35 | | | | | | | | | | |
| | 36 | | | | | | | | | | |
| | 37 | | | | | | | | | | |
| | 38 | | | | | | | | | | |
| | 39 | | | | | | | | | | |
| | 40 | | | | | | | | | | |
| **Properties** | | | | | | | | | | | |
| Area, In.$^2$ | | 7.36 | 5.65 | 3.98 | 6.62 | 5.10 | 4.30 | 3.60 | 3.49 | 2.64 | 1.78 |
| I, In.$^4$ | | 23.5 | 18.8 | 13.8 | 17.2 | 13.9 | 12.0 | 10.2 | 9.94 | 7.69 | 5.31 |
| r, In. | | 1.79 | 1.83 | 1.86 | 1.61 | 1.65 | 1.67 | 1.68 | 1.69 | 1.71 | 1.73 |
| B, Bending Factor | | 0.861 | 0.826 | 0.793 | 0.962 | 0.917 | 0.896 | 0.882 | 0.878 | 0.858 | 0.838 |
| a ÷ $10^6$ | | 3.89 | 3.25 | 2.54 | 2.80 | 2.35 | 2.09 | 1.84 | 1.81 | 1.50 | 1.17 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

# HSS / Round Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips




**f'c = 3.5**

| Nominal Outside Diameter | | 4.500 | | | | 4.000 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 0.337 | 0.237 | 0.188 | 0.125 | 0.337 | 0.313 | 0.250 | 0.237 | 0.226 | 0.220 | 0.188 | 0.125 |
| Weight Per Foot | | 14.98 | 10.79 | 8.66 | 5.84 | 13.18 | 12.33 | 10.01 | 9.52 | 9.11 | 8.88 | 7.65 | 5.17 |
| Design Wall Thickness | | 0.315 | 0.221 | 0.174 | 0.116 | 0.315 | 0.291 | 0.233 | 0.221 | 0.211 | 0.205 | 0.174 | 0.116 |
| | | $F_y$ = 46 ksi | | | | | | | | | | | |
| Effective length KL in feet | 0 | 135 | 105 | 89 | 70 | 117 | 110 | 94 | 90 | 87 | 85 | 76 | 59 |
| | 4 | 121 | 94 | 80 | 63 | 103 | 97 | 83 | 79 | 77 | 75 | 67 | 52 |
| | 5 | 117 | 91 | 77 | 60 | 98 | 92 | 79 | 76 | 73 | 72 | 64 | 50 |
| | 6 | 111 | 87 | 74 | 58 | 92 | 87 | 74 | 72 | 69 | 68 | 61 | 47 |
| | 7 | 106 | 82 | 70 | 55 | 87 | 82 | 70 | 67 | 65 | 64 | 57 | 44 |
| | 8 | 100 | 78 | 66 | 52 | 80 | 76 | 65 | 62 | 60 | 59 | 53 | 41 |
| | 9 | 93 | 73 | 62 | 48 | 73 | 70 | 59 | 57 | 56 | 54 | 49 | 38 |
| | 10 | 86 | 68 | 58 | 45 | 66 | 63 | 54 | 52 | 50 | 49 | 44 | 34 |
| | 11 | 79 | 62 | 53 | 41 | 59 | 56 | 48 | 46 | 45 | 44 | 39 | 30 |
| | 12 | 71 | 56 | 48 | 37 | 50 | 48 | 41 | 40 | 39 | 38 | 34 | 26 |
| | 13 | 63 | 50 | 43 | 33 | 43 | 41 | 35 | 34 | 33 | 32 | 29 | 22 |
| | 14 | 54 | 43 | 37 | 29 | 37 | 35 | 30 | 29 | 28 | 28 | 25 | 19 |
| | 15 | 47 | 38 | 32 | 25 | 32 | 31 | 26 | 26 | 25 | 24 | 22 | 17 |
| | 16 | 42 | 33 | 28 | 22 | 28 | 27 | 23 | 22 | 22 | 21 | 19 | 15 |
| | 17 | 37 | 29 | 25 | 20 | 25 | 24 | 20 | 20 | 19 | 19 | 17 | 13 |
| | 18 | 33 | 26 | 22 | 17 | 22 | 21 | 18 | 18 | 17 | 17 | 15 | 12 |
| | 19 | 30 | 23 | 20 | 16 | 20 | 19 | 16 | 16 | 15 | 15 | 14 | 10 |
| | 20 | 27 | 21 | 18 | 14 | 18 | 17 | 15 | 14 | 14 | 14 | 12 | 9 |
| | 21 | 24 | 19 | 16 | 13 | 16 | 16 | 13 | 13 | 13 | 12 | 11 | 9 |
| | 22 | 22 | 17 | 15 | 12 | | 14 | 12 | 12 | 11 | 11 | 10 | 8 |
| | 23 | 20 | 16 | 14 | 11 | | | | | | | | |
| | 24 | 19 | 15 | 13 | 10 | | | | | | | | |
| | 25 | | 14 | 12 | 9 | | | | | | | | |
| | 26 | | | | | | | | | | | | |
| | 27 | | | | | | | | | | | | |
| | 28 | | | | | | | | | | | | |
| | 29 | | | | | | | | | | | | |
| | 30 | | | | | | | | | | | | |
| | 31 | | | | | | | | | | | | |
| | 32 | | | | | | | | | | | | |
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| | 34 | | | | | | | | | | | | |
| | 35 | | | | | | | | | | | | |
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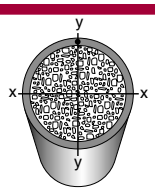
| | 37 | | | | | | | | | | | | |
| | 38 | | | | | | | | | | | | |
| | 39 | | | | | | | | | | | | |
| | 40 | | | | | | | | | | | | |
| **Properties** | | | | | | | | | | | | | |
| Area, In.$^2$ | | 4.14 | 2.97 | 2.36 | 1.60 | 3.65 | 3.39 | 2.76 | 2.62 | 2.51 | 2.44 | 2.09 | 1.42 |
| I, In.$^4$ | | 9.12 | 6.82 | 5.54 | 3.84 | 6.24 | 5.87 | 4.91 | 4.70 | 4.52 | 4.41 | 3.83 | 2.67 |
| r, In. | | 1.48 | 1.51 | 1.53 | 1.55 | 1.31 | 1.32 | 1.33 | 1.34 | 1.34 | 1.34 | 1.35 | 1.37 |
| B, Bending Factor | | 1.02 | 0.980 | 0.958 | 0.938 | 1.17 | 1.16 | 1.12 | 1.11 | 1.11 | 1.11 | 1.09 | 1.06 |
| a ÷ $10^6$ | | 1.54 | 1.22 | 1.05 | 0.815 | 1.04 | 0.994 | 0.851 | 0.828 | 0.800 | 0.782 | 0.703 | 0.545 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

# HSS / Round Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips

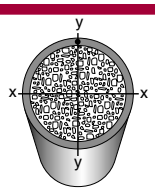



**f'c = 5.0**

| Nominal Outside Diameter | | 20.000 | | 18.000 | | 16.000 | | | | 14.000 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 0.500 | 0.375 | 0.500 | 0.375 | 0.500 | 0.438 | 0.375 | 0.312 | 0.500 | 0.375 | 0.312 |
| Weight Per Foot | | 104.13 | 78.60 | 93.45 | 70.59 | 82.77 | 72.80 | 62.58 | 52.28 | 72.09 | 54.57 | 45.61 |
| Design Wall Thickness | | 0.465 | 0.349 | 0.465 | 0.349 | 0.465 | 0.407 | 0.349 | 0.291 | 0.465 | 0.349 | 0.291 |
| | | $F_y$ = 46 ksi | | | | | | | | | | |
| Effective length KL in feet | 0 | 1510 | 1340 | 1290 | 1130 | 1080 | 1010 | 944 | 874 | 889 | 768 | 706 |
| | 4 | 1490 | 1320 | 1260 | 1110 | 1060 | 988 | 922 | 853 | 865 | 748 | 687 |
| | 5 | 1480 | 1310 | 1260 | 1110 | 1050 | 982 | 916 | 848 | 859 | 742 | 681 |
| | 6 | 1470 | 1300 | 1250 | 1100 | 1040 | 974 | 909 | 841 | 851 | 736 | 675 |
| | 7 | 1460 | 1290 | 1240 | 1090 | 1030 | 967 | 902 | 835 | 844 | 729 | 669 |
| | 8 | 1460 | 1290 | 1230 | 1080 | 1030 | 959 | 895 | 828 | 836 | 722 | 663 |
| | 9 | 1450 | 1280 | 1220 | 1080 | 1020 | 951 | 887 | 821 | 827 | 715 | 656 |
| | 10 | 1440 | 1270 | 1210 | 1070 | 1010 | 943 | 879 | 813 | 818 | 707 | 648 |
| | 11 | 1430 | 1260 | 1210 | 1060 | 999 | 934 | 871 | 806 | 809 | 699 | 641 |
| | 12 | 1420 | 1250 | 1200 | 1050 | 990 | 925 | 862 | 798 | 799 | 690 | 633 |
| | 13 | 1410 | 1240 | 1190 | 1040 | 980 | 915 | 854 | 789 | 790 | 682 | 625 |
| | 14 | 1400 | 1230 | 1170 | 1030 | 969 | 906 | 844 | 781 | 779 | 673 | 617 |
| | 15 | 1390 | 1220 | 1160 | 1020 | 958 | 895 | 835 | 772 | 769 | 663 | 608 |
| | 16 | 1370 | 1210 | 1150 | 1010 | 947 | 885 | 825 | 763 | 758 | 654 | 599 |
| | 17 | 1360 | 1200 | 1140 | 1000 | 936 | 874 | 815 | 753 | 747 | 644 | 590 |
| | 18 | 1350 | 1190 | 1130 | 991 | 925 | 863 | 805 | 744 | 735 | 634 | 581 |
| | 19 | 1340 | 1180 | 1120 | 981 | 913 | 852 | 794 | 734 | 723 | 624 | 571 |
| | 20 | 1330 | 1170 | 1110 | 970 | 900 | 841 | 783 | 723 | 711 | 613 | 561 |
| | 21 | 1310 | 1160 | 1090 | 958 | 888 | 829 | 772 | 713 | 699 | 602 | 551 |
| | 22 | 1300 | 1150 | 1080 | 947 | 875 | 817 | 761 | 702 | 686 | 591 | 541 |
| | 23 | 1290 | 1130 | 1070 | 935 | 862 | 805 | 749 | 692 | 673 | 579 | 530 |
| | 24 | 1270 | 1120 | 1050 | 923 | 849 | 792 | 737 | 680 | 660 | 568 | 519 |
| | 25 | 1260 | 1110 | 1040 | 911 | 835 | 779 | 725 | 669 | 646 | 556 | 508 |
| | 26 | 1240 | 1100 | 1030 | 898 | 821 | 766 | 713 | 657 | 632 | 544 | 497 |
| | 27 | 1230 | 1080 | 1010 | 885 | 807 | 753 | 700 | 646 | 618 | 531 | 485 |
| | 28 | 1220 | 1070 | 997 | 872 | 792 | 739 | 688 | 634 | 603 | 518 | 473 |
| | 29 | 1200 | 1060 | 982 | 859 | 778 | 725 | 674 | 621 | 589 | 505 | 461 |
| | 30 | 1190 | 1040 | 967 | 846 | 763 | 711 | 661 | 609 | 574 | 492 | 449 |
| | 31 | 1170 | 1030 | 951 | 832 | 747 | 696 | 647 | 596 | 558 | 479 | 436 |
| | 32 | 1150 | 1010 | 936 | 818 | 732 | 682 | 634 | 583 | 542 | 465 | 424 |
| | 33 | 1140 | 1000 | 920 | 804 | 716 | 667 | 620 | 570 | 527 | 451 | 411 |
| | 34 | 1120 | 990 | 904 | 789 | 700 | 652 | 605 | 556 | 510 | 437 | 397 |
| | 35 | 1110 | 970 | 887 | 774 | 683 | 636 | 591 | 543 | 494 | 422 | 384 |
| | 36 | 1090 | 960 | 871 | 760 | 666 | 620 | 576 | 529 | 477 | 407 | 370 |
| | 37 | 1070 | 940 | 854 | 744 | 650 | 604 | 561 | 515 | 459 | 392 | 356 |
| | 38 | 1050 | 930 | 837 | 729 | 632 | 588 | 545 | 500 | 442 | 376 | 341 |
| | 39 | 1040 | 910 | 819 | 713 | 615 | 572 | 530 | 486 | 424 | 361 | 327 |
| | 40 | 1020 | 890 | 801 | 698 | 597 | 555 | 514 | 471 | 406 | 345 | 312 |
| **Properties** | | | | | | | | | | | | |
| Area, In.$^2$ | | 28.5 | 21.5 | 25.6 | 19.4 | 22.7 | 19.9 | 17.2 | 14.4 | 19.8 | 15.0 | 12.5 |
| I, In.$^4$ | | 1360 | 1040 | 985 | 754 | 685 | 606 | 526 | 443 | 453 | 349 | 295 |
| r, In. | | 6.91 | 6.95 | 6.20 | 6.24 | 5.49 | 5.51 | 5.53 | 5.55 | 4.79 | 4.83 | 4.85 |
| B, Bending Factor | | 0.210 | 0.207 | 0.234 | 0.232 | 0.265 | 0.263 | 0.262 | 0.260 | 0.306 | 0.301 | 0.297 |
| a ÷ $10^6$ | | 318 | 274 | 221 | 190 | 147 | 136 | 126 | 114 | 93.7 | 79.5 | 71.8 |

# HSS / Round Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips

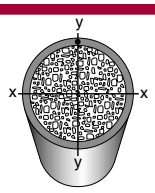



**f'c = 5.0**

| Nominal Outside Diameter | | 12.750 | | | 12.500 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 0.500 | 0.375 | 0.250 | 0.625 | 0.500 | 0.375 | 0.312 | 0.250 | 0.188 |
| Weight Per Foot | | 65.42 | 49.56 | 33.38 | 79.27 | 64.08 | 48.56 | 40.61 | 32.71 | 24.72 |
| Design Wall Thickness | | 0.465 | 0.349 | 0.233 | 0.581 | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 |
| | | $F_y$ = 46 ksi | | | | | | | | |
| Effective length KL in feet | 0 | 774 | 666 | 555 | 859 | 754 | 646 | 594 | 538 | 482 |
| | 4 | 751 | 647 | 538 | 834 | 732 | 627 | 576 | 521 | 467 |
| | 5 | 745 | 641 | 533 | 826 | 725 | 621 | 570 | 517 | 462 |
| | 6 | 738 | 635 | 528 | 818 | 718 | 615 | 565 | 511 | 458 |
| | 7 | 730 | 628 | 523 | 809 | 710 | 608 | 558 | 506 | 452 |
| | 8 | 722 | 621 | 517 | 800 | 702 | 601 | 552 | 500 | 447 |
| | 9 | 714 | 614 | 510 | 791 | 694 | 594 | 545 | 494 | 441 |
| | 10 | 705 | 606 | 504 | 781 | 685 | 586 | 538 | 487 | 435 |
| | 11 | 696 | 598 | 497 | 771 | 676 | 578 | 531 | 480 | 429 |
| | 12 | 686 | 590 | 490 | 760 | 666 | 570 | 523 | 473 | 423 |
| | 13 | 677 | 582 | 483 | 749 | 657 | 562 | 515 | 466 | 416 |
| | 14 | 666 | 573 | 475 | 737 | 646 | 553 | 507 | 459 | 409 |
| | 15 | 656 | 564 | 467 | 725 | 636 | 544 | 499 | 451 | 402 |
| | 16 | 645 | 554 | 459 | 713 | 625 | 534 | 490 | 443 | 395 |
| | 17 | 634 | 544 | 451 | 700 | 614 | 525 | 481 | 434 | 387 |
| | 18 | 622 | 534 | 443 | 687 | 602 | 515 | 472 | 426 | 379 |
| | 19 | 611 | 524 | 434 | 674 | 590 | 504 | 462 | 417 | 371 |
| | 20 | 599 | 514 | 425 | 660 | 578 | 494 | 452 | 408 | 363 |
| | 21 | 586 | 503 | 415 | 646 | 566 | 483 | 442 | 399 | 355 |
| | 22 | 573 | 492 | 406 | 631 | 553 | 472 | 432 | 389 | 346 |
| | 23 | 560 | 480 | 396 | 617 | 540 | 461 | 422 | 380 | 337 |
| | 24 | 547 | 469 | 386 | 601 | 527 | 449 | 411 | 370 | 328 |
| | 25 | 533 | 457 | 376 | 586 | 513 | 437 | 400 | 360 | 319 |
| | 26 | 519 | 445 | 366 | 570 | 499 | 425 | 388 | 349 | 309 |
| | 27 | 505 | 432 | 355 | 554 | 485 | 412 | 377 | 339 | 300 |
| | 28 | 491 | 419 | 344 | 537 | 470 | 400 | 365 | 328 | 290 |
| | 29 | 476 | 406 | 333 | 520 | 455 | 387 | 353 | 317 | 279 |
| | 30 | 461 | 393 | 322 | 503 | 440 | 374 | 341 | 305 | 269 |
| | 31 | 445 | 380 | 310 | 485 | 424 | 360 | 328 | 294 | 258 |
| | 32 | 429 | 366 | 298 | 467 | 408 | 346 | 315 | 282 | 247 |
| | 33 | 413 | 352 | 286 | 449 | 392 | 332 | 302 | 270 | 236 |
| | 34 | 396 | 337 | 274 | 430 | 375 | 317 | 289 | 257 | 225 |
| | 35 | 380 | 323 | 261 | 410 | 358 | 303 | 275 | 245 | 213 |
| | 36 | 362 | 307 | 248 | 391 | 341 | 288 | 261 | 232 | 202 |
| | 37 | 345 | 292 | 235 | 371 | 323 | 272 | 247 | 219 | 191 |
| | 38 | 327 | 277 | 223 | 351 | 306 | 258 | 234 | 208 | 181 |
| | 39 | 310 | 263 | 212 | 334 | 291 | 245 | 222 | 197 | 172 |
| | 40 | 295 | 250 | 201 | 317 | 277 | 233 | 211 | 188 | 163 |
| **Properties** | | | | | | | | | | |
| Area, In.$^2$ | | 17.9 | 13.6 | 9.16 | 21.8 | 17.6 | 13.3 | 11.2 | 8.98 | 6.74 |
| I, In.$^4$ | | 339 | 262 | 180 | 387 | 319 | 246 | 208 | 169 | 128 |
| r, In. | | 4.35 | 4.39 | 4.43 | 4.22 | 4.26 | 4.30 | 4.32 | 4.34 | 4.36 |
| B, Bending Factor | | 0.337 | 0.331 | 0.324 | 0.352 | 0.345 | 0.338 | 0.337 | 0.332 | 0.329 |
| a ÷ $10^6$ | | 68.0 | 57.6 | 46.4 | 73.1 | 63.7 | 53.7 | 48.7 | 43.2 | 37.6 |

# HSS / Round Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips



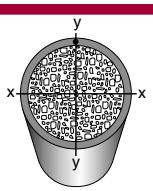

**f'c = 5.0**

| Nominal Outside Diameter | | 12.313 | | | | | | 12.250 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 0.625 | 0.500 | 0.375 | 0.312 | 0.250 | 0.188 | 0.625 | 0.500 | 0.375 | 0.312 | 0.250 | 0.188 |
| Weight Per Foot | | 78.02 | 63.08 | 47.81 | 39.99 | 32.21 | 24.35 | 77.60 | 62.75 | 47.56 | 39.78 | 32.04 | 24.22 |
| Design Wall Thickness | | 0.581 | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 | 0.581 | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 |
| | | $F_y$ = 46 ksi | | | | | | | | | | | |
| Effective length KL in feet | 0 | 840 | 737 | 632 | 579 | 525 | 470 | 834 | 731 | 626 | 574 | 521 | 466 |
| | 4 | 814 | 715 | 613 | 561 | 509 | 455 | 809 | 709 | 607 | 556 | 505 | 451 |
| | 5 | 807 | 708 | 607 | 556 | 504 | 451 | 801 | 702 | 601 | 550 | 500 | 447 |
| | 6 | 799 | 701 | 601 | 550 | 499 | 446 | 793 | 695 | 595 | 545 | 495 | 442 |
| | 7 | 790 | 693 | 594 | 544 | 493 | 441 | 785 | 688 | 588 | 539 | 489 | 437 |
| | 8 | 781 | 685 | 587 | 538 | 487 | 435 | 776 | 680 | 582 | 532 | 483 | 431 |
| | 9 | 772 | 677 | 580 | 531 | 481 | 430 | 766 | 672 | 574 | 526 | 477 | 426 |
| | 10 | 762 | 668 | 572 | 524 | 475 | 424 | 756 | 663 | 567 | 519 | 471 | 420 |
| | 11 | 751 | 659 | 564 | 517 | 468 | 418 | 746 | 654 | 559 | 511 | 464 | 414 |
| | 12 | 741 | 650 | 556 | 509 | 461 | 411 | 735 | 644 | 551 | 504 | 457 | 407 |
| | 13 | 729 | 640 | 548 | 501 | 454 | 405 | 724 | 634 | 542 | 496 | 450 | 401 |
| | 14 | 718 | 630 | 539 | 493 | 446 | 398 | 712 | 624 | 533 | 488 | 442 | 394 |
| | 15 | 706 | 619 | 530 | 485 | 438 | 391 | 700 | 614 | 524 | 479 | 434 | 387 |
| | 16 | 694 | 608 | 520 | 476 | 430 | 383 | 688 | 603 | 515 | 471 | 426 | 380 |
| | 17 | 681 | 597 | 510 | 467 | 422 | 376 | 675 | 592 | 505 | 462 | 418 | 372 |
| | 18 | 668 | 586 | 500 | 458 | 413 | 368 | 662 | 580 | 495 | 452 | 410 | 364 |
| | 19 | 654 | 574 | 490 | 448 | 405 | 360 | 649 | 568 | 485 | 443 | 401 | 356 |
| | 20 | 641 | 562 | 480 | 438 | 396 | 352 | 635 | 556 | 474 | 433 | 392 | 348 |
| | 21 | 626 | 549 | 469 | 428 | 386 | 343 | 621 | 544 | 464 | 423 | 383 | 340 |
| | 22 | 612 | 536 | 458 | 418 | 377 | 335 | 606 | 531 | 453 | 413 | 373 | 331 |
| | 23 | 597 | 523 | 446 | 408 | 367 | 326 | 592 | 518 | 441 | 402 | 363 | 322 |
| | 24 | 582 | 510 | 435 | 397 | 357 | 317 | 576 | 504 | 430 | 392 | 354 | 313 |
| | 25 | 566 | 496 | 423 | 386 | 347 | 307 | 561 | 491 | 418 | 381 | 343 | 304 |
| | 26 | 550 | 482 | 411 | 374 | 337 | 298 | 545 | 477 | 405 | 369 | 333 | 294 |
| | 27 | 534 | 468 | 398 | 363 | 326 | 288 | 529 | 462 | 393 | 358 | 322 | 285 |
| | 28 | 517 | 453 | 385 | 351 | 315 | 278 | 512 | 448 | 380 | 346 | 312 | 275 |
| | 29 | 500 | 438 | 372 | 339 | 304 | 268 | 495 | 433 | 367 | 334 | 300 | 264 |
| | 30 | 483 | 423 | 359 | 327 | 293 | 258 | 477 | 417 | 354 | 322 | 289 | 254 |
| | 31 | 465 | 407 | 345 | 314 | 281 | 247 | 460 | 402 | 340 | 309 | 277 | 243 |
| | 32 | 447 | 391 | 332 | 301 | 269 | 236 | 442 | 386 | 327 | 296 | 266 | 232 |
| | 33 | 429 | 375 | 317 | 288 | 257 | 225 | 423 | 369 | 312 | 283 | 253 | 221 |
| | 34 | 410 | 358 | 303 | 275 | 245 | 214 | 404 | 353 | 298 | 270 | 241 | 210 |
| | 35 | 390 | 341 | 288 | 261 | 232 | 202 | 385 | 335 | 283 | 256 | 228 | 198 |
| | 36 | 370 | 323 | 273 | 247 | 219 | 191 | 365 | 318 | 268 | 242 | 216 | 188 |
| | 37 | 351 | 306 | 258 | 234 | 208 | 181 | 345 | 301 | 254 | 229 | 204 | 178 |
| | 38 | 333 | 290 | 245 | 221 | 197 | 171 | 327 | 285 | 240 | 217 | 194 | 168 |
| | 39 | 316 | 276 | 232 | 210 | 187 | 163 | 311 | 271 | 228 | 206 | 184 | 160 |
| | 40 | 300 | 262 | 221 | 200 | 178 | 155 | 295 | 258 | 217 | 196 | 175 | 152 |
| **Properties** | | | | | | | | | | | | | |
| Area, In.$^2$ | | 21.4 | 17.3 | 13.1 | 11.0 | 8.84 | 6.64 | 21.3 | 17.2 | 13.0 | 10.9 | 8.80 | 6.60 |
| I, In.$^4$ | | 369 | 304 | 235 | 199 | 161 | 122 | 363 | 299 | 231 | 196 | 159 | 120 |
| r, In. | | 4.15 | 4.19 | 4.23 | 4.25 | 4.27 | 4.29 | 4.13 | 4.17 | 4.21 | 4.23 | 4.25 | 4.27 |
| B, Bending Factor | | 0.357 | 0.350 | 0.343 | 0.340 | 0.338 | 0.335 | 0.359 | 0.352 | 0.345 | 0.341 | 0.339 | 0.337 |
| a ÷ $10^6$ | | 69.2 | 60.3 | 50.9 | 46.1 | 40.9 | 35.6 | 68.1 | 59.3 | 50.0 | 45.2 | 40.3 | 35.0 |

# HSS / Round Structural Steel Tubing for Composite Columns

ERW

Allowable Concentric Loads in Kips

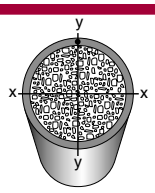



**f'c = 5.0**

| Nominal Outside Diameter | | 11.250 | | | | | | 10.750 | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 0.625 | 0.500 | 0.375 | 0.312 | 0.250 | 0.188 | 0.500 | 0.365 | 0.250 |
| Weight Per Foot | | 70.92 | 57.41 | 43.56 | 36.45 | 29.37 | 22.21 | 54.74 | 40.48 | 28.04 |
| Design Wall Thickness | | 0.581 | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 | 0.465 | 0.340 | 0.233 |
| | | $F_y$ = 46 ksi | | | | | | | | |
| Effective length KL in feet | 0 | 742 | 649 | 554 | 504 | 455 | 405 | 607 | 509 | 424 |
| | 4 | 717 | 628 | 536 | 487 | 440 | 391 | 586 | 491 | 409 |
| | 5 | 710 | 621 | 530 | 482 | 435 | 387 | 579 | 486 | 404 |
| | 6 | 702 | 614 | 524 | 476 | 430 | 382 | 572 | 480 | 399 |
| | 7 | 693 | 607 | 517 | 470 | 424 | 377 | 565 | 473 | 394 |
| | 8 | 684 | 599 | 510 | 464 | 419 | 372 | 557 | 467 | 388 |
| | 9 | 675 | 590 | 503 | 457 | 413 | 366 | 548 | 460 | 382 |
| | 10 | 665 | 582 | 496 | 450 | 406 | 361 | 540 | 452 | 376 |
| | 11 | 654 | 572 | 488 | 443 | 400 | 355 | 531 | 445 | 369 |
| | 12 | 643 | 563 | 480 | 436 | 393 | 348 | 521 | 437 | 363 |
| | 13 | 632 | 553 | 471 | 428 | 386 | 342 | 511 | 428 | 356 |
| | 14 | 621 | 543 | 463 | 420 | 378 | 335 | 501 | 420 | 348 |
| | 15 | 609 | 532 | 453 | 411 | 371 | 328 | 491 | 411 | 341 |
| | 16 | 596 | 521 | 444 | 403 | 363 | 321 | 480 | 401 | 333 |
| | 17 | 583 | 510 | 434 | 394 | 355 | 314 | 468 | 392 | 325 |
| | 18 | 570 | 499 | 424 | 385 | 346 | 306 | 457 | 382 | 316 |
| | 19 | 557 | 487 | 414 | 375 | 338 | 298 | 445 | 372 | 308 |
| | 20 | 543 | 475 | 404 | 366 | 329 | 290 | 433 | 361 | 299 |
| | 21 | 528 | 462 | 393 | 356 | 320 | 282 | 420 | 351 | 290 |
| | 22 | 514 | 449 | 382 | 346 | 310 | 273 | 407 | 340 | 280 |
| | 23 | 499 | 436 | 370 | 335 | 301 | 265 | 394 | 329 | 271 |
| | 24 | 483 | 422 | 359 | 324 | 291 | 256 | 380 | 317 | 261 |
| | 25 | 467 | 409 | 347 | 313 | 281 | 247 | 366 | 305 | 251 |
| | 26 | 451 | 394 | 334 | 302 | 271 | 237 | 352 | 293 | 241 |
| | 27 | 435 | 380 | 322 | 291 | 260 | 228 | 337 | 281 | 230 |
| | 28 | 418 | 365 | 309 | 279 | 249 | 218 | 322 | 268 | 219 |
| | 29 | 400 | 350 | 296 | 267 | 238 | 208 | 307 | 255 | 208 |
| | 30 | 382 | 334 | 282 | 254 | 227 | 197 | 291 | 241 | 196 |
| | 31 | 364 | 318 | 269 | 242 | 215 | 187 | 275 | 227 | 185 |
| | 32 | 346 | 302 | 254 | 229 | 203 | 176 | 258 | 214 | 173 |
| | 33 | 326 | 285 | 240 | 215 | 191 | 165 | 243 | 201 | 163 |
| | 34 | 308 | 268 | 226 | 203 | 180 | 156 | 229 | 189 | 154 |
| | 35 | 290 | 253 | 213 | 191 | 170 | 147 | 216 | 179 | 145 |
| | 36 | 274 | 239 | 202 | 181 | 161 | 139 | 204 | 169 | 137 |
| | 37 | 260 | 227 | 191 | 171 | 152 | 131 | 193 | 160 | 130 |
| | 38 | 246 | 215 | 181 | 162 | 144 | 125 | 183 | 151 | 123 |
| | 39 | 234 | 204 | 172 | 154 | 137 | 118 | 174 | 144 | 117 |
| | 40 | 222 | 194 | 163 | 147 | 130 | 113 | 165 | 137 | 111 |
| **Properties** | | | | | | | | | | |
| Area, In.$^2$ | | 19.5 | 15.8 | 12.0 | 10.0 | 8.06 | 6.05 | 15.0 | 11.1 | 7.70 |
| I, In.$^4$ | | 278 | 229 | 178 | 151 | 122 | 92.9 | 199 | 151 | 106 |
| r, In. | | 3.78 | 3.82 | 3.86 | 3.88 | 3.90 | 3.92 | 3.64 | 3.68 | 3.72 |
| B, Bending Factor | | 0.395 | 0.388 | 0.379 | 0.373 | 0.372 | 0.366 | 0.405 | 0.395 | 0.390 |
| a ÷ $10^6$ | | 51.2 | 44.7 | 37.6 | 33.8 | 30.0 | 25.9 | 38.1 | 31.5 | 25.6 |

# HSS / Round Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips



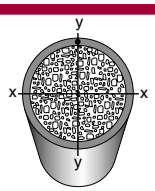

**f'c = 5.0**

| Nominal Outside Diameter | | 10.000 | | | | | | 9.625 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 0.625 | 0.500 | 0.375 | 0.312 | 0.250 | 0.188 | 0.500 | 0.375 | 0.312 | 0.250 | 0.188 |
| Weight Per Foot | | 62.58 | 50.73 | 38.55 | 32.28 | 26.03 | 19.70 | 48.73 | 37.05 | 31.03 | 25.03 | 18.95 |
| Design Wall Thickness | | 0.581 | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 |
| | | $F_y$ = 46 ksi | | | | | | | | | | |
| Effective length KL in feet | 0 | 631 | 548 | 466 | 423 | 379 | 335 | 521 | 441 | 399 | 358 | 315 |
| | 4 | 607 | 527 | 448 | 406 | 364 | 321 | 500 | 423 | 383 | 343 | 302 |
| | 5 | 599 | 521 | 442 | 401 | 360 | 317 | 494 | 418 | 378 | 338 | 298 |
| | 6 | 591 | 514 | 436 | 396 | 355 | 313 | 487 | 412 | 372 | 333 | 293 |
| | 7 | 583 | 506 | 430 | 390 | 350 | 308 | 479 | 405 | 367 | 328 | 289 |
| | 8 | 574 | 499 | 423 | 384 | 344 | 303 | 471 | 399 | 361 | 323 | 284 |
| | 9 | 564 | 490 | 416 | 377 | 338 | 298 | 463 | 392 | 354 | 317 | 278 |
| | 10 | 554 | 482 | 409 | 370 | 332 | 292 | 454 | 384 | 347 | 311 | 273 |
| | 11 | 544 | 473 | 401 | 363 | 325 | 286 | 445 | 376 | 340 | 304 | 267 |
| | 12 | 533 | 463 | 393 | 356 | 319 | 280 | 436 | 368 | 333 | 297 | 261 |
| | 13 | 522 | 453 | 384 | 348 | 312 | 274 | 426 | 360 | 325 | 290 | 255 |
| | 14 | 510 | 443 | 375 | 340 | 304 | 267 | 415 | 351 | 317 | 283 | 248 |
| | 15 | 498 | 432 | 366 | 332 | 297 | 261 | 405 | 342 | 309 | 276 | 242 |
| | 16 | 485 | 421 | 357 | 323 | 289 | 253 | 394 | 333 | 300 | 268 | 235 |
| | 17 | 472 | 410 | 347 | 314 | 281 | 246 | 382 | 323 | 291 | 260 | 227 |
| | 18 | 459 | 399 | 337 | 305 | 273 | 239 | 370 | 313 | 282 | 252 | 220 |
| | 19 | 445 | 387 | 327 | 296 | 264 | 231 | 358 | 302 | 273 | 243 | 212 |
| | 20 | 431 | 374 | 316 | 286 | 255 | 223 | 346 | 292 | 263 | 234 | 204 |
| | 21 | 416 | 361 | 305 | 276 | 246 | 215 | 333 | 281 | 253 | 225 | 196 |
| | 22 | 401 | 348 | 294 | 266 | 237 | 206 | 320 | 270 | 243 | 216 | 188 |
| | 23 | 385 | 335 | 283 | 255 | 227 | 198 | 306 | 258 | 232 | 206 | 179 |
| | 24 | 370 | 321 | 271 | 244 | 217 | 189 | 292 | 246 | 221 | 196 | 170 |
| | 25 | 353 | 307 | 259 | 233 | 207 | 180 | 278 | 234 | 210 | 186 | 161 |
| | 26 | 337 | 293 | 246 | 222 | 197 | 170 | 263 | 221 | 199 | 176 | 152 |
| | 27 | 319 | 278 | 233 | 210 | 186 | 161 | 248 | 208 | 187 | 165 | 142 |
| | 28 | 302 | 262 | 220 | 198 | 175 | 151 | 232 | 195 | 175 | 154 | 132 |
| | 29 | 284 | 247 | 207 | 186 | 164 | 141 | 217 | 182 | 163 | 144 | 123 |
| | 30 | 265 | 231 | 193 | 173 | 153 | 132 | 202 | 170 | 152 | 134 | 115 |
| | 31 | 249 | 216 | 181 | 162 | 143 | 123 | 190 | 159 | 143 | 126 | 108 |
| | 32 | 233 | 203 | 170 | 152 | 135 | 116 | 178 | 149 | 134 | 118 | 101 |
| | 33 | 219 | 191 | 160 | 143 | 127 | 109 | 167 | 141 | 126 | 111 | 95 |
| | 34 | 207 | 180 | 150 | 135 | 119 | 102 | 158 | 132 | 119 | 105 | 90 |
| | 35 | 195 | 170 | 142 | 127 | 112 | 97 | 149 | 125 | 112 | 99 | 85 |
| | 36 | 184 | 160 | 134 | 120 | 106 | 91 | 141 | 118 | 106 | 93 | 80 |
| | 37 | 174 | 152 | 127 | 114 | 101 | 86 | 133 | 112 | 100 | 88 | 76 |
| | 38 | 165 | 144 | 120 | 108 | 95 | 82 | 126 | 106 | 95 | 84 | 72 |
| | 39 | 157 | 137 | 114 | 103 | 91 | 78 | 120 | 101 | 90 | 79 | 68 |
| | 40 | 149 | 130 | 109 | 98 | 86 | 74 | 114 | 96 | 86 | 76 | 65 |
| **PROPERTIES** | | | | | | | | | | | | |
| Area, In.$^2$ | | 17.2 | 13.9 | 10.6 | 8.88 | 7.15 | 5.37 | 13.4 | 10.2 | 8.53 | 6.87 | 5.17 |
| I, In.$^4$ | | 191 | 159 | 123 | 105 | 85.3 | 64.8 | 141 | 110 | 93.0 | 75.9 | 57.7 |
| r, In. | | 3.34 | 3.38 | 3.41 | 3.43 | 3.45 | 3.47 | 3.24 | 3.28 | 3.30 | 3.32 | 3.34 |
| B, Bending Factor | | 0.450 | 0.437 | 0.431 | 0.423 | 0.419 | 0.414 | 0.457 | 0.446 | 0.441 | 0.436 | 0.431 |
| a ÷ $10^6$ | | 34.4 | 29.9 | 25.0 | 22.5 | 19.8 | 17.0 | 26.2 | 22.0 | 19.7 | 17.4 | 14.9 |

# HSS / Round Structural Steel Tubing for Composite Columns

ERW

Allowable Concentric Loads in Kips

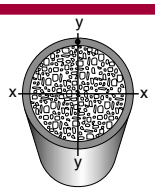



**f'c = 5.0**

| Nominal Outside Diameter | | 8.750 | | | | | 8.625 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 0.500 | 0.375 | 0.312 | 0.250 | 0.188 | 0.500 | 0.375 | 0.322 | 0.250 | 0.188 |
| Weight Per Foot | | 44.06 | 33.54 | 28.12 | 22.70 | 17.19 | 43.39 | 33.04 | 28.55 | 22.36 | 16.94 |
| Design Wall Thickness | | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 | 0.465 | 0.349 | 0.300 | 0.233 | 0.174 |
| | | $F_y$ = 46 ksi | | | | | | | | | |
| Effective length KL in feet | 0 | 456 | 384 | 347 | 309 | 271 | 447 | 376 | 346 | 303 | 265 |
| | 4 | 436 | 367 | 331 | 295 | 258 | 427 | 359 | 330 | 289 | 252 |
| | 5 | 429 | 361 | 326 | 291 | 254 | 420 | 353 | 325 | 284 | 248 |
| | 6 | 422 | 355 | 321 | 286 | 250 | 413 | 348 | 319 | 279 | 244 |
| | 7 | 415 | 349 | 315 | 281 | 245 | 406 | 341 | 313 | 274 | 239 |
| | 8 | 407 | 342 | 309 | 275 | 240 | 398 | 335 | 307 | 269 | 235 |
| | 9 | 399 | 335 | 303 | 269 | 235 | 389 | 328 | 301 | 263 | 229 |
| | 10 | 390 | 328 | 296 | 263 | 230 | 381 | 320 | 294 | 257 | 224 |
| | 11 | 381 | 320 | 289 | 257 | 224 | 371 | 312 | 287 | 251 | 218 |
| | 12 | 371 | 312 | 281 | 250 | 218 | 362 | 304 | 279 | 244 | 212 |
| | 13 | 361 | 303 | 274 | 243 | 212 | 352 | 296 | 272 | 237 | 206 |
| | 14 | 350 | 295 | 266 | 236 | 206 | 341 | 287 | 263 | 230 | 200 |
| | 15 | 340 | 285 | 257 | 229 | 199 | 330 | 278 | 255 | 222 | 193 |
| | 16 | 328 | 276 | 249 | 221 | 192 | 319 | 268 | 246 | 215 | 186 |
| | 17 | 317 | 266 | 240 | 213 | 185 | 308 | 259 | 237 | 207 | 179 |
| | 18 | 305 | 256 | 231 | 205 | 178 | 296 | 249 | 228 | 198 | 172 |
| | 19 | 293 | 246 | 221 | 196 | 170 | 283 | 238 | 219 | 190 | 164 |
| | 20 | 280 | 235 | 212 | 187 | 162 | 271 | 227 | 209 | 181 | 156 |
| | 21 | 267 | 224 | 202 | 178 | 154 | 258 | 216 | 198 | 172 | 148 |
| | 22 | 253 | 213 | 191 | 169 | 146 | 244 | 205 | 188 | 163 | 140 |
| | 23 | 239 | 201 | 180 | 159 | 137 | 230 | 193 | 177 | 153 | 131 |
| | 24 | 225 | 189 | 169 | 149 | 128 | 216 | 181 | 166 | 143 | 123 |
| | 25 | 210 | 176 | 158 | 139 | 119 | 201 | 169 | 154 | 133 | 113 |
| | 26 | 195 | 163 | 146 | 129 | 110 | 186 | 156 | 143 | 123 | 105 |
| | 27 | 181 | 151 | 136 | 119 | 102 | 172 | 145 | 132 | 114 | 97 |
| | 28 | 168 | 141 | 126 | 111 | 95 | 160 | 134 | 123 | 106 | 90 |
| | 29 | 157 | 131 | 118 | 103 | 88 | 149 | 125 | 115 | 99 | 84 |
| | 30 | 146 | 123 | 110 | 97 | 83 | 140 | 117 | 107 | 92 | 79 |
| | 31 | 137 | 115 | 103 | 91 | 77 | 131 | 110 | 100 | 86 | 74 |
| | 32 | 129 | 108 | 97 | 85 | 73 | 123 | 103 | 94 | 81 | 69 |
| | 33 | 121 | 101 | 91 | 80 | 68 | 115 | 97 | 89 | 76 | 65 |
| | 34 | 114 | 96 | 86 | 75 | 64 | 109 | 91 | 83 | 72 | 61 |
| | 35 | 108 | 90 | 81 | 71 | 61 | 103 | 86 | 79 | 68 | 58 |
| | 36 | 102 | 85 | 76 | 67 | 57 | 97 | 81 | 74 | 64 | 55 |
| | 37 | 96 | 81 | 72 | 64 | 54 | 92 | 77 | 70 | 61 | 52 |
| | 38 | 91 | 76 | 69 | 60 | 51 | 87 | 73 | 67 | 58 | 49 |
| | 39 | 87 | 73 | 65 | 57 | 49 | 83 | 69 | 63 | 55 | 47 |
| | 40 | 82 | 69 | 62 | 54 | 46 | 79 | 66 | 60 | 52 | 44 |
| **PROPERTIES** | | | | | | | | | | | |
| Area, In.$^2$ | | 12.1 | 9.21 | 7.73 | 6.23 | 4.69 | 11.9 | 9.07 | 7.85 | 6.14 | 4.62 |
| I, In.$^4$ | | 104 | 81.4 | 69.3 | 56.6 | 43.1 | 99.5 | 77.8 | 68.1 | 54.1 | 41.3 |
| r, In. | | 2.93 | 2.97 | 2.99 | 3.01 | 3.03 | 2.89 | 2.93 | 2.95 | 2.97 | 2.99 |
| B, Bending Factor | | 0.509 | 0.495 | 0.488 | 0.482 | 0.476 | 0.516 | 0.503 | 0.497 | 0.489 | 0.482 |
| a ÷ $10^6$ | | 19.0 | 15.9 | 14.3 | 12.5 | 10.7 | 18.1 | 15.2 | 13.9 | 12.0 | 10.2 |

# HSS / Round Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips



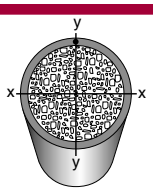

**f'c = 5.0**

| Nominal Outside Diameter | | 7.625 | | | 7.500 | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 0.375 | 0.328 | 0.125 | 0.500 | 0.375 | 0.312 | 0.250 | 0.188 |
| Weight Per Foot | | 29.04 | 25.56 | 10.01 | 37.38 | 28.54 | 23.95 | 19.36 | 14.68 |
| Design Wall Thickness | | 0.349 | 0.305 | 0.116 | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 |
| | | $F_y$ = 46 ksi | | | | | | | |
| Effective length KL in feet | 0 | 316 | 292 | 185 | 371 | 309 | 278 | 246 | 213 |
| | 4 | 300 | 276 | 175 | 350 | 292 | 263 | 232 | 201 |
| | 5 | 294 | 271 | 171 | 344 | 287 | 258 | 228 | 197 |
| | 6 | 288 | 266 | 168 | 337 | 281 | 252 | 223 | 193 |
| | 7 | 282 | 260 | 164 | 329 | 275 | 247 | 218 | 189 |
| | 8 | 275 | 254 | 160 | 321 | 268 | 241 | 213 | 184 |
| | 9 | 268 | 247 | 155 | 313 | 261 | 234 | 207 | 179 |
| | 10 | 261 | 240 | 151 | 304 | 253 | 228 | 201 | 173 |
| | 11 | 253 | 233 | 146 | 294 | 246 | 220 | 195 | 168 |
| | 12 | 245 | 226 | 141 | 285 | 237 | 213 | 188 | 162 |
| | 13 | 236 | 218 | 136 | 274 | 229 | 205 | 181 | 156 |
| | 14 | 227 | 210 | 130 | 264 | 220 | 197 | 174 | 150 |
| | 15 | 218 | 201 | 124 | 252 | 211 | 189 | 167 | 143 |
| | 16 | 209 | 192 | 119 | 241 | 201 | 180 | 159 | 136 |
| | 17 | 199 | 183 | 112 | 229 | 191 | 171 | 151 | 129 |
| | 18 | 189 | 173 | 106 | 216 | 181 | 162 | 143 | 122 |
| | 19 | 178 | 164 | 99 | 204 | 170 | 152 | 134 | 114 |
| | 20 | 167 | 153 | 93 | 190 | 159 | 142 | 125 | 107 |
| | 21 | 156 | 143 | 85 | 176 | 147 | 132 | 116 | 98 |
| | 22 | 144 | 132 | 78 | 162 | 136 | 121 | 106 | 90 |
| | 23 | 132 | 121 | 71 | 148 | 124 | 111 | 97 | 82 |
| | 24 | 121 | 111 | 66 | 136 | 114 | 102 | 89 | 76 |
| | 25 | 112 | 102 | 60 | 126 | 105 | 94 | 82 | 70 |
| | 26 | 103 | 94 | 56 | 116 | 97 | 87 | 76 | 64 |
| | 27 | 96 | 88 | 52 | 108 | 90 | 80 | 71 | 60 |
| | 28 | 89 | 81 | 48 | 100 | 84 | 75 | 66 | 56 |
| | 29 | 83 | 76 | 45 | 93 | 78 | 70 | 61 | 52 |
| | 30 | 77 | 71 | 42 | 87 | 73 | 65 | 57 | 48 |
| | 31 | 73 | 66 | 39 | 82 | 68 | 61 | 53 | 45 |
| | 32 | 68 | 62 | 37 | 77 | 64 | 57 | 50 | 43 |
| | 33 | 64 | 59 | 35 | 72 | 60 | 54 | 47 | 40 |
| | 34 | 60 | 55 | 33 | 68 | 57 | 51 | 44 | 38 |
| | 35 | 57 | 52 | 31 | 64 | 54 | 48 | 42 | 36 |
| | 36 | 54 | 49 | 29 | 61 | 51 | 45 | 40 | 34 |
| | 37 | 51 | 47 | 28 | 57 | 48 | 43 | 38 | 32 |
| | 38 | 48 | 44 | 26 | 54 | 45 | 41 | 36 | 30 |
| | 39 | 46 | 42 | 25 | 52 | 43 | 39 | 34 | 29 |
| | 40 | 44 | 40 | 24 | 49 | 41 | 37 | 32 | 27 |
| **PROPERTIES** | | | | | | | | | |
| Area, In.$^2$ | | 7.98 | 7.01 | 2.74 | 10.3 | 7.84 | 6.59 | 5.32 | 4.00 |
| I, In.$^4$ | | 52.9 | 47.1 | 19.3 | 63.9 | 50.2 | 42.9 | 35.2 | 26.9 |
| r, In. | | 2.58 | 2.59 | 2.66 | 2.49 | 2.53 | 2.55 | 2.57 | 2.59 |
| B, Bending Factor | | 0.575 | 0.567 | 0.541 | 0.604 | 0.586 | 0.576 | 0.567 | 0.558 |
| a ÷ $10^6$ | | 10.0 | 9.20 | 5.44 | 11.3 | 9.45 | 8.45 | 7.40 | 6.27 |

# HSS / Round Structural Steel Tubing for Composite Columns

ERW

Allowable Concentric Loads in Kips



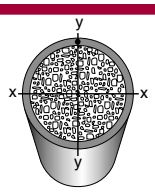

**f'c = 5.0**

| Nominal Outside Diameter | | 7.000 | | | | | | 6.875 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 0.500 | 0.375 | 0.312 | 0.250 | 0.188 | 0.125 | 0.500 | 0.375 | 0.312 | 0.250 | 0.188 |
| Weight Per Foot | | 34.71 | 26.53 | 22.29 | 18.02 | 13.68 | 9.18 | 34.04 | 26.03 | 21.87 | 17.69 | 13.43 |
| Design Wall Thickness | | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 | 0.116 | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 |
| | | $F_y$ = 46 ksi | | | | | | | | | | |
| Effective length KL in feet | 0 | 337 | 281 | 252 | 222 | 192 | 161 | 329 | 274 | 245 | 216 | 186 |
| | 4 | 317 | 264 | 237 | 209 | 180 | 151 | 309 | 257 | 231 | 203 | 175 |
| | 5 | 311 | 259 | 232 | 204 | 176 | 148 | 303 | 252 | 226 | 199 | 171 |
| | 6 | 304 | 253 | 227 | 200 | 172 | 144 | 295 | 246 | 220 | 194 | 167 |
| | 7 | 296 | 246 | 221 | 195 | 168 | 140 | 288 | 240 | 215 | 189 | 163 |
| | 8 | 288 | 240 | 215 | 189 | 163 | 136 | 280 | 233 | 209 | 184 | 158 |
| | 9 | 280 | 233 | 208 | 184 | 158 | 132 | 271 | 226 | 202 | 178 | 153 |
| | 10 | 271 | 225 | 202 | 178 | 153 | 128 | 262 | 218 | 196 | 172 | 148 |
| | 11 | 261 | 217 | 195 | 171 | 147 | 123 | 252 | 210 | 188 | 166 | 142 |
| | 12 | 251 | 209 | 187 | 165 | 141 | 118 | 242 | 202 | 181 | 159 | 136 |
| | 13 | 241 | 200 | 179 | 158 | 135 | 113 | 232 | 194 | 173 | 152 | 130 |
| | 14 | 230 | 191 | 171 | 151 | 129 | 107 | 221 | 185 | 165 | 145 | 124 |
| | 15 | 219 | 182 | 163 | 143 | 122 | 101 | 210 | 175 | 157 | 138 | 118 |
| | 16 | 207 | 172 | 154 | 135 | 116 | 95 | 198 | 165 | 148 | 130 | 111 |
| | 17 | 195 | 162 | 145 | 127 | 109 | 89 | 186 | 155 | 139 | 122 | 104 |
| | 18 | 182 | 151 | 135 | 119 | 101 | 83 | 173 | 145 | 129 | 113 | 96 |
| | 19 | 169 | 140 | 126 | 110 | 93 | 76 | 160 | 134 | 120 | 105 | 89 |
| | 20 | 155 | 129 | 115 | 101 | 86 | 69 | 146 | 122 | 109 | 96 | 81 |
| | 21 | 141 | 117 | 105 | 92 | 78 | 63 | 132 | 111 | 99 | 87 | 73 |
| | 22 | 129 | 107 | 96 | 84 | 71 | 57 | 121 | 101 | 90 | 79 | 67 |
| | 23 | 118 | 98 | 88 | 77 | 65 | 52 | 110 | 93 | 83 | 72 | 61 |
| | 24 | 108 | 90 | 80 | 70 | 59 | 48 | 101 | 85 | 76 | 66 | 56 |
| | 25 | 100 | 83 | 74 | 65 | 55 | 44 | 93 | 78 | 70 | 61 | 52 |
| | 26 | 92 | 77 | 68 | 60 | 51 | 41 | 86 | 72 | 65 | 57 | 48 |
| | 27 | 86 | 71 | 64 | 56 | 47 | 38 | 80 | 67 | 60 | 52 | 44 |
| | 28 | 80 | 66 | 59 | 52 | 44 | 35 | 74 | 62 | 56 | 49 | 41 |
| | 29 | 74 | 62 | 55 | 48 | 41 | 33 | 69 | 58 | 52 | 45 | 38 |
| | 30 | 69 | 58 | 51 | 45 | 38 | 31 | 65 | 54 | 49 | 42 | 36 |
| | 31 | 65 | 54 | 48 | 42 | 36 | 29 | 61 | 51 | 46 | 40 | 34 |
| | 32 | 61 | 51 | 45 | 40 | 33 | 27 | 57 | 48 | 43 | 37 | 32 |
| | 33 | 57 | 48 | 43 | 37 | 31 | 25 | 54 | 45 | 40 | 35 | 30 |
| | 34 | 54 | 45 | 40 | 35 | 30 | 24 | 50 | 42 | 38 | 33 | 28 |
| | 35 | 51 | 42 | 38 | 33 | 28 | 23 | 48 | 40 | 36 | 31 | 26 |
| | 36 | 48 | 40 | 36 | 31 | 26 | 21 | 45 | 38 | 34 | 29 | 25 |
| | 37 | 46 | 38 | 34 | 30 | 25 | 20 | 43 | 36 | 32 | 28 | 24 |
| | 38 | 43 | 36 | 32 | 28 | 24 | 19 | | 34 | 30 | 26 | 22 |
| | 39 | | 34 | 30 | 27 | 23 | 18 | | | | 25 | 21 |
| | 40 | | | | | 21 | 17 | | | | | |
| **Properties** | | | | | | | | | | | | |
| Area, In.$^2$ | | 9.55 | 7.29 | 6.13 | 4.95 | 3.73 | 2.51 | 9.36 | 7.16 | 6.02 | 4.86 | 3.66 |
| I, In.$^4$ | | 51.2 | 40.4 | 34.6 | 28.4 | 21.7 | 14.9 | 48.3 | 38.2 | 32.7 | 26.8 | 20.6 |
| r, In. | | 2.32 | 2.35 | 2.37 | 2.39 | 2.41 | 2.43 | 2.27 | 2.31 | 2.33 | 2.35 | 2.37 |
| B, Bending Factor | | 0.653 | 0.632 | 0.620 | 0.610 | 0.602 | 0.590 | 0.666 | 0.644 | 0.633 | 0.623 | 0.611 |
| a ÷ $10^6$ | | 8.98 | 7.46 | 6.67 | 5.83 | 4.93 | 4.00 | 8.40 | 7.05 | 6.30 | 5.50 | 4.65 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

# HSS / Round Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips




**f'c = 5.0**

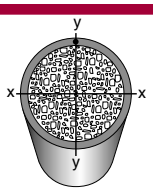
| Nominal Outside Diameter | | 6.625 | | | | | | | | 6.125 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 0.500 | 0.432 | 0.375 | 0.312 | 0.280 | 0.250 | 0.188 | 0.125 | 0.500 | 0.375 | 0.312 | 0.250 | 0.188 |
| Weight Per Foot | | 32.71 | 28.57 | 25.03 | 21.04 | 18.97 | 17.02 | 12.92 | 8.68 | 30.04 | 23.03 | 19.37 | 15.69 | 11.92 |
| Design Wall Thickness | | 0.465 | 0.403 | 0.349 | 0.291 | 0.261 | 0.233 | 0.174 | 0.116 | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 |
| | | $F_y$ = 46 ksi | | | | | | | | | | | | |
| Effective length KL in feet | 0 | 313 | 285 | 260 | 233 | 219 | 205 | 176 | 147 | 282 | 234 | 209 | 183 | 157 |
| | 4 | 293 | 267 | 244 | 218 | 205 | 192 | 165 | 138 | 262 | 217 | 194 | 170 | 145 |
| | 5 | 287 | 261 | 238 | 213 | 200 | 188 | 161 | 134 | 256 | 212 | 189 | 166 | 142 |
| | 6 | 280 | 255 | 232 | 208 | 195 | 183 | 157 | 131 | 249 | 206 | 184 | 161 | 138 |
| | 7 | 272 | 248 | 226 | 202 | 190 | 178 | 153 | 127 | 241 | 200 | 178 | 156 | 133 |
| | 8 | 264 | 240 | 219 | 196 | 184 | 173 | 148 | 123 | 233 | 193 | 172 | 151 | 129 |
| | 9 | 255 | 232 | 212 | 190 | 178 | 167 | 143 | 119 | 224 | 186 | 166 | 145 | 124 |
| | 10 | 246 | 224 | 205 | 183 | 172 | 161 | 138 | 114 | 215 | 178 | 159 | 139 | 118 |
| | 11 | 236 | 215 | 197 | 176 | 165 | 155 | 132 | 110 | 205 | 170 | 152 | 133 | 113 |
| | 12 | 226 | 206 | 188 | 168 | 158 | 148 | 127 | 105 | 194 | 162 | 144 | 126 | 107 |
| | 13 | 216 | 197 | 180 | 161 | 151 | 141 | 121 | 100 | 184 | 153 | 137 | 119 | 101 |
| | 14 | 205 | 187 | 170 | 153 | 143 | 134 | 114 | 94 | 173 | 144 | 128 | 112 | 95 |
| | 15 | 193 | 176 | 161 | 144 | 135 | 126 | 108 | 88 | 161 | 134 | 120 | 104 | 88 |
| | 16 | 181 | 165 | 151 | 135 | 127 | 119 | 101 | 83 | 149 | 124 | 111 | 96 | 81 |
| | 17 | 169 | 154 | 141 | 126 | 118 | 110 | 94 | 76 | 136 | 114 | 101 | 88 | 74 |
| | 18 | 156 | 142 | 130 | 116 | 109 | 102 | 86 | 70 | 122 | 103 | 92 | 79 | 67 |
| | 19 | 142 | 130 | 119 | 106 | 100 | 93 | 79 | 63 | 110 | 92 | 82 | 71 | 60 |
| | 20 | 129 | 118 | 108 | 96 | 90 | 84 | 71 | 57 | 99 | 83 | 74 | 64 | 54 |
| | 21 | 117 | 107 | 98 | 87 | 82 | 76 | 64 | 52 | 90 | 75 | 67 | 58 | 49 |
| | 22 | 106 | 97 | 89 | 80 | 74 | 70 | 59 | 47 | 82 | 69 | 61 | 53 | 45 |
| | 23 | 97 | 89 | 81 | 73 | 68 | 64 | 54 | 43 | 75 | 63 | 56 | 49 | 41 |
| | 24 | 89 | 82 | 75 | 67 | 63 | 58 | 49 | 40 | 69 | 58 | 52 | 45 | 37 |
| | 25 | 82 | 75 | 69 | 62 | 58 | 54 | 45 | 37 | 63 | 53 | 48 | 41 | 35 |
| | 26 | 76 | 70 | 64 | 57 | 53 | 50 | 42 | 34 | 59 | 49 | 44 | 38 | 32 |
| | 27 | 71 | 65 | 59 | 53 | 49 | 46 | 39 | 31 | 54 | 46 | 41 | 35 | 30 |
| | 28 | 66 | 60 | 55 | 49 | 46 | 43 | 36 | 29 | 51 | 42 | 38 | 33 | 28 |
| | 29 | 61 | 56 | 51 | 46 | 43 | 40 | 34 | 27 | 47 | 40 | 35 | 31 | 26 |
| | 30 | 57 | 52 | 48 | 43 | 40 | 37 | 32 | 25 | 44 | 37 | 33 | 29 | 24 |
| | 31 | 53 | 49 | 45 | 40 | 37 | 35 | 30 | 24 | 41 | 35 | 31 | 27 | 22 |
| | 32 | 50 | 46 | 42 | 38 | 35 | 33 | 28 | 22 | 39 | 32 | 29 | 25 | 21 |
| | 33 | 47 | 43 | 40 | 35 | 33 | 31 | 26 | 21 | 36 | 31 | 27 | 24 | 20 |
| | 34 | 44 | 41 | 37 | 33 | 31 | 29 | 25 | 20 | | 29 | 26 | 22 | 19 |
| | 35 | 42 | 38 | 35 | 31 | 29 | 27 | 23 | 19 | | | | | 18 |
| | 36 | 40 | 36 | 33 | 30 | 28 | 26 | 22 | 18 | | | | | |
| | 37 | | | 31 | 28 | 26 | 25 | 21 | 17 | | | | | |
| | 38 | | | | | | | 20 | 16 | | | | | |
| | 39 | | | | | | | | | | | | | |
| | 40 | | | | | | | | | | | | | |
| **Properties** | | | | | | | | | | | | | | |
| Area, In.$^2$ | | 9.00 | 7.88 | 6.88 | 5.79 | 5.22 | 4.68 | 3.53 | 2.37 | 8.27 | 6.33 | 5.33 | 4.31 | 3.25 |
| I, In.$^4$ | | 42.9 | 38.3 | 34.0 | 29.1 | 26.5 | 23.9 | 18.4 | 12.6 | 33.3 | 26.5 | 22.7 | 18.7 | 14.4 |
| r, In. | | 2.18 | 2.20 | 2.22 | 2.24 | 2.25 | 2.26 | 2.28 | 2.30 | 2.01 | 2.05 | 2.07 | 2.08 | 2.10 |
| B, Bending Factor | | 0.695 | 0.682 | 0.670 | 0.659 | 0.653 | 0.649 | 0.635 | 0.623 | 0.761 | 0.732 | 0.719 | 0.706 | 0.691 |
| a ÷ $10^6$ | | 7.40 | 6.78 | 6.20 | 5.55 | 5.19 | 4.85 | 4.09 | 3.30 | 5.71 | 4.79 | 4.28 | 3.70 | 3.11 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

# HSS / Round Structural Steel Tubing for Composite Columns

ERW

Allowable Concentric Loads in Kips



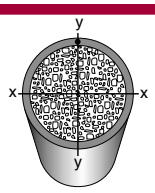

**f'c = 5.0**

| Nominal Outside Diameter | | 6.000 | | | | | | | 5.563 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 0.500 | 0.375 | 0.312 | 0.280 | 0.250 | 0.188 | 0.125 | 0.375 | 0.258 | 0.188 | 0.134 |
| Weight Per Foot | | 29.37 | 22.53 | 18.95 | 17.11 | 15.35 | 11.67 | 7.84 | 20.78 | 14.62 | 10.79 | 7.77 |
| Design Wall Thickness | | 0.465 | 0.349 | 0.291 | 0.261 | 0.233 | 0.174 | 0.116 | 0.349 | 0.241 | 0.174 | 0.125 |
| | | $F_y$ = 46 ksi | | | | | | | | | | |
| Effective length KL in feet | 0 | 275 | 227 | 203 | 190 | 178 | 152 | 126 | 205 | 163 | 136 | 116 |
| | 4 | 255 | 211 | 188 | 176 | 165 | 141 | 116 | 189 | 150 | 125 | 106 |
| | 5 | 248 | 206 | 183 | 172 | 161 | 137 | 113 | 184 | 146 | 121 | 103 |
| | 6 | 241 | 200 | 178 | 167 | 156 | 133 | 110 | 178 | 141 | 117 | 100 |
| | 7 | 233 | 193 | 172 | 162 | 151 | 129 | 106 | 171 | 136 | 113 | 96 |
| | 8 | 225 | 186 | 166 | 156 | 146 | 124 | 102 | 164 | 130 | 109 | 92 |
| | 9 | 216 | 179 | 160 | 150 | 140 | 119 | 98 | 157 | 124 | 104 | 88 |
| | 10 | 206 | 171 | 153 | 143 | 134 | 114 | 94 | 149 | 118 | 98 | 83 |
| | 11 | 197 | 163 | 146 | 137 | 128 | 108 | 89 | 141 | 112 | 93 | 78 |
| | 12 | 186 | 155 | 138 | 129 | 121 | 103 | 84 | 132 | 105 | 87 | 73 |
| | 13 | 175 | 146 | 130 | 122 | 114 | 97 | 79 | 123 | 98 | 81 | 68 |
| | 14 | 164 | 137 | 122 | 114 | 107 | 90 | 74 | 114 | 90 | 75 | 62 |
| | 15 | 152 | 127 | 113 | 106 | 99 | 84 | 68 | 104 | 82 | 68 | 57 |
| | 16 | 140 | 117 | 104 | 98 | 91 | 77 | 62 | 94 | 74 | 61 | 51 |
| | 17 | 127 | 106 | 95 | 89 | 83 | 70 | 56 | 83 | 66 | 54 | 45 |
| | 18 | 113 | 95 | 85 | 80 | 74 | 62 | 50 | 74 | 58 | 48 | 40 |
| | 19 | 102 | 85 | 76 | 71 | 67 | 56 | 45 | 67 | 52 | 43 | 36 |
| | 20 | 92 | 77 | 69 | 64 | 60 | 50 | 40 | 60 | 47 | 39 | 32 |
| | 21 | 83 | 70 | 63 | 58 | 55 | 46 | 37 | 54 | 43 | 36 | 29 |
| | 22 | 76 | 64 | 57 | 53 | 50 | 42 | 33 | 50 | 39 | 32 | 27 |
| | 23 | 69 | 58 | 52 | 49 | 45 | 38 | 31 | 45 | 36 | 30 | 24 |
| | 24 | 64 | 54 | 48 | 45 | 42 | 35 | 28 | 42 | 33 | 27 | 22 |
| | 25 | 59 | 49 | 44 | 41 | 38 | 32 | 26 | 38 | 30 | 25 | 21 |
| | 26 | 54 | 46 | 41 | 38 | 36 | 30 | 24 | 36 | 28 | 23 | 19 |
| | 27 | 50 | 42 | 38 | 35 | 33 | 28 | 22 | 33 | 26 | 22 | 18 |
| | 28 | 47 | 39 | 35 | 33 | 31 | 26 | 21 | 31 | 24 | 20 | 17 |
| | 29 | 44 | 37 | 33 | 31 | 29 | 24 | 19 | 29 | 23 | 19 | 15 |
| | 30 | 41 | 34 | 31 | 29 | 27 | 22 | 18 | 27 | 21 | 17 | 14 |
| | 31 | 38 | 32 | 29 | 27 | 25 | 21 | 17 | | 20 | 16 | 13 |
| | 32 | 36 | 30 | 27 | 25 | 23 | 20 | 16 | | | | 13 |
| | 33 | | 28 | 25 | 24 | 22 | 19 | 15 | | | | |
| | 34 | | | | | 21 | 17 | 14 | | | | |
| | 35 | | | | | | | | | | | |
| | 36 | | | | | | | | | | | |
| | 37 | | | | | | | | | | | |
| | 38 | | | | | | | | | | | |
| | 39 | | | | | | | | | | | |
| | 40 | | | | | | | | | | | |
| **Properties** | | | | | | | | | | | | |
| Area, In.$^2$ | | 8.09 | 6.20 | 5.22 | 4.71 | 4.22 | 3.18 | 2.14 | 5.72 | 4.03 | 2.95 | 2.14 |
| I, In.$^4$ | | 31.2 | 24.8 | 21.3 | 19.4 | 17.6 | 13.5 | 9.28 | 19.5 | 14.3 | 10.7 | 7.90 |
| r, In. | | 1.96 | 2.00 | 2.02 | 2.03 | 2.04 | 2.06 | 2.08 | 1.85 | 1.88 | 1.91 | 1.92 |
| B, Bending Factor | | 0.778 | 0.750 | 0.735 | 0.728 | 0.719 | 0.707 | 0.692 | 0.816 | 0.784 | 0.767 | 0.753 |
| a ÷ $10^6$ | | 5.29 | 4.44 | 3.97 | 3.71 | 3.46 | 2.91 | 2.33 | 3.46 | 2.73 | 2.26 | 1.86 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

# HSS / Round Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips




**f'c = 5.0**

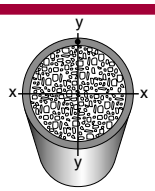
| Nominal Outside Diameter | | 5.500 | | | 5.000 | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 0.500 | 0.375 | 0.258 | 0.500 | 0.375 | 0.312 | 0.258 | 0.250 | 0.188 | 0.125 |
| Weight Per Foot | | 26.70 | 20.53 | 14.44 | 24.03 | 18.52 | 15.62 | 13.07 | 12.68 | 9.66 | 6.51 |
| Design Wall Thickness | | 0.465 | 0.349 | 0.241 | 0.465 | 0.349 | 0.291 | 0.241 | 0.233 | 0.174 | 0.116 |
| | | $F_y$ = 46 ksi | | | | | | | | | |
| Effective length KL in feet | 0 | 245 | 202 | 160 | 216 | 178 | 158 | 140 | 137 | 116 | 95 |
| | 4 | 225 | 186 | 147 | 196 | 162 | 143 | 127 | 125 | 106 | 86 |
| | 5 | 218 | 180 | 143 | 189 | 156 | 139 | 123 | 121 | 102 | 83 |
| | 6 | 211 | 174 | 138 | 182 | 150 | 133 | 118 | 116 | 98 | 80 |
| | 7 | 203 | 168 | 133 | 173 | 143 | 127 | 113 | 111 | 94 | 76 |
| | 8 | 195 | 161 | 128 | 165 | 136 | 121 | 108 | 106 | 89 | 72 |
| | 9 | 186 | 154 | 122 | 155 | 129 | 115 | 102 | 100 | 84 | 68 |
| | 10 | 176 | 146 | 116 | 146 | 121 | 108 | 95 | 94 | 79 | 64 |
| | 11 | 166 | 138 | 109 | 135 | 113 | 100 | 89 | 87 | 74 | 59 |
| | 12 | 155 | 129 | 102 | 124 | 104 | 92 | 82 | 81 | 68 | 54 |
| | 13 | 144 | 120 | 95 | 113 | 94 | 84 | 74 | 73 | 62 | 49 |
| | 14 | 133 | 111 | 88 | 100 | 85 | 75 | 67 | 66 | 55 | 44 |
| | 15 | 120 | 101 | 80 | 88 | 74 | 66 | 59 | 58 | 48 | 38 |
| | 16 | 107 | 90 | 71 | 77 | 65 | 58 | 51 | 51 | 43 | 34 |
| | 17 | 95 | 80 | 63 | 68 | 58 | 52 | 46 | 45 | 38 | 30 |
| | 18 | 85 | 71 | 56 | 61 | 52 | 46 | 41 | 40 | 34 | 27 |
| | 19 | 76 | 64 | 51 | 55 | 46 | 41 | 36 | 36 | 30 | 24 |
| | 20 | 69 | 58 | 46 | 49 | 42 | 37 | 33 | 33 | 27 | 22 |
| | 21 | 62 | 53 | 41 | 45 | 38 | 34 | 30 | 30 | 25 | 20 |
| | 22 | 57 | 48 | 38 | 41 | 35 | 31 | 27 | 27 | 23 | 18 |
| | 23 | 52 | 44 | 35 | 37 | 32 | 28 | 25 | 25 | 21 | 16 |
| | 24 | 48 | 40 | 32 | 34 | 29 | 26 | 23 | 23 | 19 | 15 |
| | 25 | 44 | 37 | 29 | 32 | 27 | 24 | 21 | 21 | 17 | 14 |
| | 26 | 41 | 34 | 27 | 29 | 25 | 22 | 19 | 19 | 16 | 13 |
| | 27 | 38 | 32 | 25 | | 23 | 20 | 18 | 18 | 15 | 12 |
| | 28 | 35 | 30 | 23 | | | | 17 | 17 | 14 | 11 |
| | 29 | 33 | 28 | 22 | | | | | | | |
| | 30 | | 26 | 20 | | | | | | | |
| | 31 | | | 19 | | | | | | | |
| | 32 | | | | | | | | | | |
| | 33 | | | | | | | | | | |
| | 34 | | | | | | | | | | |
| | 35 | | | | | | | | | | |
| | 36 | | | | | | | | | | |
| | 37 | | | | | | | | | | |
| | 38 | | | | | | | | | | |
| | 39 | | | | | | | | | | |
| | 40 | | | | | | | | | | |
| **Properties** | | | | | | | | | | | |
| Area, In.$^2$ | | 7.36 | 5.65 | 3.98 | 6.62 | 5.10 | 4.30 | 3.60 | 3.49 | 2.64 | 1.78 |
| I, In.$^4$ | | 23.5 | 18.8 | 13.8 | 17.2 | 13.9 | 12.0 | 10.2 | 9.94 | 7.69 | 5.31 |
| r, In. | | 1.79 | 1.83 | 1.86 | 1.61 | 1.65 | 1.67 | 1.68 | 1.69 | 1.71 | 1.73 |
| B, Bending Factor | | 0.861 | 0.826 | 0.793 | 0.962 | 0.917 | 0.896 | 0.882 | 0.878 | 0.858 | 0.838 |
| a ÷ $10^6$ | | 3.96 | 3.33 | 2.63 | 2.85 | 2.41 | 2.15 | 1.90 | 1.88 | 1.57 | 1.24 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

# HSS / Round Structural Steel Tubing for Composite Columns

ERW

Allowable Concentric Loads in Kips



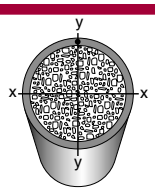

**f'c = 5.0**

| Nominal Outside Diameter | | 4.500 | | | | 4.000 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 0.337 | 0.237 | 0.188 | 0.125 | 0.337 | 0.313 | 0.250 | 0.237 | 0.226 | 0.220 | 0.188 | 0.125 |
| Weight Per Foot | | 14.98 | 10.79 | 8.66 | 5.84 | 13.18 | 12.33 | 10.01 | 9.52 | 9.11 | 8.88 | 7.65 | 5.17 |
| Design Wall Thickness | | 0.315 | 0.221 | 0.174 | 0.116 | 0.315 | 0.291 | 0.233 | 0.221 | 0.211 | 0.205 | 0.174 | 0.116 |
| | | $F_y$ = 46 ksi | | | | | | | | | | | |
| Effective length KL in feet | 0 | 144 | 115 | 100 | 81 | 123 | 117 | 101 | 98 | 95 | 93 | 84 | 68 |
| | 4 | 129 | 103 | 89 | 72 | 108 | 103 | 89 | 86 | 83 | 82 | 74 | 59 |
| | 5 | 124 | 99 | 86 | 69 | 103 | 98 | 84 | 82 | 79 | 78 | 70 | 56 |
| | 6 | 118 | 94 | 82 | 66 | 97 | 92 | 80 | 77 | 75 | 73 | 66 | 53 |
| | 7 | 112 | 89 | 77 | 62 | 91 | 86 | 74 | 72 | 70 | 69 | 62 | 50 |
| | 8 | 105 | 84 | 73 | 58 | 84 | 80 | 69 | 67 | 65 | 63 | 57 | 46 |
| | 9 | 98 | 78 | 68 | 54 | 77 | 73 | 63 | 61 | 59 | 58 | 52 | 42 |
| | 10 | 90 | 72 | 63 | 50 | 69 | 65 | 56 | 55 | 53 | 52 | 47 | 37 |
| | 11 | 82 | 66 | 57 | 45 | 60 | 57 | 49 | 48 | 47 | 46 | 41 | 33 |
| | 12 | 74 | 59 | 51 | 41 | 51 | 49 | 42 | 41 | 40 | 39 | 35 | 28 |
| | 13 | 64 | 52 | 45 | 35 | 44 | 42 | 36 | 35 | 34 | 33 | 30 | 24 |
| | 14 | 56 | 45 | 39 | 31 | 38 | 36 | 31 | 30 | 29 | 29 | 26 | 20 |
| | 15 | 48 | 39 | 34 | 27 | 33 | 31 | 27 | 26 | 25 | 25 | 23 | 18 |
| | 16 | 43 | 34 | 30 | 23 | 29 | 28 | 24 | 23 | 22 | 22 | 20 | 16 |
| | 17 | 38 | 30 | 26 | 21 | 26 | 24 | 21 | 20 | 20 | 19 | 18 | 14 |
| | 18 | 34 | 27 | 23 | 18 | 23 | 22 | 19 | 18 | 18 | 17 | 16 | 12 |
| | 19 | 30 | 24 | 21 | 17 | 20 | 20 | 17 | 16 | 16 | 16 | 14 | 11 |
| | 20 | 27 | 22 | 19 | 15 | 18 | 18 | 15 | 15 | 14 | 14 | 13 | 10 |
| | 21 | 25 | 20 | 17 | 14 | 17 | 16 | 14 | 13 | 13 | 13 | 11 | 9 |
| | 22 | 23 | 18 | 16 | 12 | | 15 | 13 | 12 | 12 | 12 | 10 | 8 |
| | 23 | 21 | 17 | 14 | 11 | | | | | | | | |
| | 24 | 19 | 15 | 13 | 10 | | | | | | | | |
| | 25 | | 14 | 12 | 10 | | | | | | | | |
| | 26 | | | | | | | | | | | | |
| | 27 | | | | | | | | | | | | |
| | 28 | | | | | | | | | | | | |
| | 29 | | | | | | | | | | | | |
| | 30 | | | | | | | | | | | | |
| | 31 | | | | | | | | | | | | |
| | 32 | | | | | | | | | | | | |
| | 33 | | | | | | | | | | | | |
| | 34 | | | | | | | | | | | | |
| | 35 | | | | | | | | | | | | |
| | 36 | | | | | | | | | | | | |
| | 37 | | | | | | | | | | | | |
| | 38 | | | | | | | | | | | | |
| | 39 | | | | | | | | | | | | |
| | 40 | | | | | | | | | | | | |
| **Properties** | | | | | | | | | | | | | |
| Area, In.$^2$ | | 4.14 | 2.97 | 2.36 | 1.60 | 3.65 | 3.39 | 2.76 | 2.62 | 2.51 | 2.44 | 2.09 | 1.42 |
| I, In.$^4$ | | 9.12 | 6.82 | 5.54 | 3.84 | 6.24 | 5.87 | 4.91 | 4.70 | 4.52 | 4.41 | 3.83 | 2.67 |
| r, In. | | 1.48 | 1.51 | 1.53 | 1.55 | 1.31 | 1.32 | 1.33 | 1.34 | 1.34 | 1.34 | 1.35 | 1.37 |
| B, Bending Factor | | 1.02 | 0.980 | 0.958 | 0.938 | 1.17 | 1.16 | 1.12 | 1.11 | 1.11 | 1.11 | 1.09 | 1.06 |
| a ÷ $10^6$ | | 1.57 | 1.26 | 1.09 | 0.862 | 1.06 | 1.02 | 0.875 | 0.852 | 0.825 | 0.807 | 0.729 | 0.574 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

# HSS / Round Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips



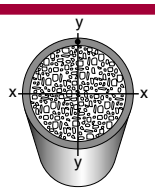

**f'c = 8.0**

| Nominal Outside Diameter | | 20.000 | | 18.000 | | 16.000 | | | | 14.000 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 0.500 | 0.375 | 0.500 | 0.375 | 0.500 | 0.438 | 0.375 | 0.312 | 0.500 | 0.375 | 0.312 |
| Weight Per Foot | | 104.13 | 78.60 | 93.45 | 70.59 | 82.77 | 72.80 | 62.58 | 52.28 | 72.09 | 54.57 | 45.61 |
| Design Wall Thickness | | 0.465 | 0.349 | 0.465 | 0.349 | 0.465 | 0.407 | 0.349 | 0.291 | 0.465 | 0.349 | 0.291 |
| | | $F_y$ = 46 ksi | | | | | | | | | | |
| Effective length KL in feet | 0 | 1950 | 1790 | 1640 | 1490 | 1350 | 1290 | 1230 | 1160 | 1090 | 981 | 922 |
| | 4 | 1910 | 1750 | 1600 | 1460 | 1320 | 1260 | 1190 | 1130 | 1060 | 953 | 895 |
| | 5 | 1900 | 1740 | 1590 | 1450 | 1310 | 1250 | 1190 | 1120 | 1050 | 944 | 887 |
| | 6 | 1890 | 1730 | 1580 | 1440 | 1300 | 1240 | 1180 | 1110 | 1040 | 935 | 878 |
| | 7 | 1880 | 1720 | 1570 | 1430 | 1290 | 1230 | 1170 | 1100 | 1030 | 926 | 869 |
| | 8 | 1870 | 1710 | 1560 | 1420 | 1280 | 1220 | 1150 | 1090 | 1020 | 916 | 859 |
| | 9 | 1850 | 1700 | 1550 | 1410 | 1270 | 1200 | 1140 | 1080 | 1010 | 905 | 849 |
| | 10 | 1840 | 1680 | 1530 | 1400 | 1250 | 1190 | 1130 | 1070 | 999 | 894 | 839 |
| | 11 | 1830 | 1670 | 1520 | 1380 | 1240 | 1180 | 1120 | 1060 | 987 | 882 | 828 |
| | 12 | 1810 | 1660 | 1510 | 1370 | 1230 | 1170 | 1110 | 1050 | 974 | 871 | 816 |
| | 13 | 1800 | 1640 | 1490 | 1360 | 1210 | 1150 | 1090 | 1030 | 960 | 858 | 804 |
| | 14 | 1780 | 1630 | 1480 | 1340 | 1200 | 1140 | 1080 | 1020 | 946 | 845 | 792 |
| | 15 | 1770 | 1610 | 1460 | 1330 | 1180 | 1120 | 1070 | 1010 | 932 | 832 | 779 |
| | 16 | 1750 | 1600 | 1450 | 1310 | 1170 | 1110 | 1050 | 993 | 917 | 818 | 766 |
| | 17 | 1730 | 1580 | 1430 | 1300 | 1150 | 1090 | 1040 | 979 | 902 | 804 | 753 |
| | 18 | 1720 | 1560 | 1410 | 1280 | 1140 | 1080 | 1020 | 965 | 886 | 790 | 739 |
| | 19 | 1700 | 1550 | 1400 | 1270 | 1120 | 1060 | 1010 | 950 | 870 | 775 | 724 |
| | 20 | 1680 | 1530 | 1380 | 1250 | 1100 | 1050 | 992 | 934 | 854 | 760 | 710 |
| | 21 | 1660 | 1510 | 1360 | 1230 | 1090 | 1030 | 975 | 918 | 837 | 744 | 695 |
| | 22 | 1640 | 1500 | 1340 | 1220 | 1070 | 1010 | 959 | 902 | 819 | 728 | 679 |
| | 23 | 1620 | 1480 | 1320 | 1200 | 1050 | 995 | 942 | 886 | 801 | 711 | 663 |
| | 24 | 1600 | 1460 | 1300 | 1180 | 1030 | 977 | 924 | 869 | 783 | 695 | 647 |
| | 25 | 1580 | 1440 | 1290 | 1160 | 1010 | 958 | 906 | 852 | 765 | 677 | 631 |
| | 26 | 1560 | 1420 | 1270 | 1140 | 993 | 940 | 888 | 834 | 746 | 660 | 614 |
| | 27 | 1540 | 1400 | 1240 | 1120 | 973 | 920 | 870 | 816 | 726 | 642 | 597 |
| | 28 | 1520 | 1380 | 1220 | 1100 | 952 | 901 | 851 | 798 | 706 | 623 | 579 |
| | 29 | 1500 | 1360 | 1200 | 1080 | 932 | 881 | 831 | 779 | 686 | 605 | 561 |
| | 30 | 1480 | 1340 | 1180 | 1060 | 911 | 860 | 812 | 760 | 665 | 585 | 542 |
| | 31 | 1450 | 1320 | 1160 | 1040 | 889 | 840 | 792 | 741 | 644 | 566 | 524 |
| | 32 | 1430 | 1300 | 1140 | 1020 | 867 | 818 | 771 | 721 | 622 | 546 | 504 |
| | 33 | 1410 | 1270 | 1110 | 1000 | 845 | 797 | 750 | 701 | 600 | 525 | 485 |
| | 34 | 1380 | 1250 | 1090 | 979 | 822 | 775 | 729 | 680 | 578 | 504 | 465 |
| | 35 | 1360 | 1230 | 1070 | 957 | 799 | 752 | 707 | 659 | 555 | 483 | 444 |
| | 36 | 1340 | 1210 | 1040 | 934 | 775 | 730 | 685 | 638 | 532 | 461 | 423 |
| | 37 | 1310 | 1180 | 1020 | 911 | 751 | 707 | 663 | 616 | 508 | 439 | 402 |
| | 38 | 1290 | 1160 | 995 | 888 | 727 | 683 | 640 | 594 | 483 | 417 | 381 |
| | 39 | 1260 | 1130 | 969 | 864 | 702 | 659 | 617 | 571 | 459 | 396 | 362 |
| | 40 | 1230 | 1110 | 944 | 840 | 677 | 634 | 593 | 548 | 436 | 376 | 344 |
| **PROPERTIES** | | | | | | | | | | | | |
| Area, In.$^2$ | | 28.5 | 21.5 | 25.6 | 19.4 | 22.7 | 19.9 | 17.2 | 14.4 | 19.8 | 15.0 | 12.5 |
| I, In.$^4$ | | 1360 | 1040 | 985 | 754 | 685 | 606 | 526 | 443 | 453 | 349 | 295 |
| r, In. | | 6.91 | 6.95 | 6.20 | 6.24 | 5.49 | 5.51 | 5.53 | 5.55 | 4.79 | 4.83 | 4.85 |
| B, Bending Factor | | 0.210 | 0.207 | 0.234 | 0.232 | 0.265 | 0.263 | 0.262 | 0.260 | 0.306 | 0.301 | 0.297 |
| a ÷ $10^6$ | | 348 | 305 | 240 | 210 | 159 | 149 | 138 | 127 | 101 | 86.7 | 79.2 |

# HSS / Round Structural Steel Tubing for Composite Columns

ERW

Allowable Concentric Loads in Kips

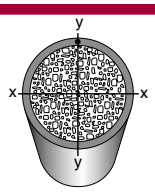



**f'c = 8.0**

| Nominal Outside Diameter | | 12.750 | | | 12.500 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 0.500 | 0.375 | 0.250 | 0.625 | 0.500 | 0.375 | 0.312 | 0.250 | 0.188 |
| Weight Per Foot | | 65.42 | 49.56 | 33.38 | 79.27 | 64.08 | 48.56 | 40.61 | 32.71 | 24.72 |
| Design Wall Thickness | | 0.465 | 0.349 | 0.233 | 0.581 | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 |
| | | $F_y$ = 46 ksi | | | | | | | | |
| Effective length KL in feet | 0 | 942 | 841 | 736 | 1010 | 915 | 813 | 764 | 712 | 659 |
| | 4 | 912 | 814 | 712 | 982 | 886 | 787 | 739 | 688 | 636 |
| | 5 | 903 | 806 | 705 | 972 | 877 | 779 | 731 | 680 | 629 |
| | 6 | 894 | 797 | 697 | 962 | 867 | 770 | 723 | 673 | 622 |
| | 7 | 884 | 788 | 688 | 951 | 857 | 761 | 714 | 664 | 614 |
| | 8 | 873 | 778 | 679 | 939 | 847 | 751 | 705 | 656 | 606 |
| | 9 | 862 | 768 | 670 | 927 | 835 | 741 | 695 | 646 | 597 |
| | 10 | 850 | 757 | 660 | 914 | 824 | 731 | 685 | 637 | 587 |
| | 11 | 838 | 746 | 650 | 901 | 812 | 720 | 675 | 626 | 578 |
| | 12 | 826 | 735 | 639 | 887 | 799 | 708 | 664 | 616 | 568 |
| | 13 | 813 | 723 | 628 | 873 | 786 | 696 | 652 | 605 | 557 |
| | 14 | 799 | 710 | 617 | 858 | 772 | 684 | 640 | 594 | 546 |
| | 15 | 785 | 697 | 605 | 843 | 758 | 671 | 628 | 582 | 535 |
| | 16 | 770 | 684 | 593 | 827 | 744 | 658 | 615 | 570 | 524 |
| | 17 | 755 | 670 | 580 | 811 | 729 | 644 | 602 | 557 | 512 |
| | 18 | 740 | 656 | 568 | 794 | 714 | 630 | 589 | 544 | 499 |
| | 19 | 724 | 641 | 554 | 777 | 698 | 615 | 575 | 531 | 487 |
| | 20 | 708 | 626 | 541 | 759 | 682 | 600 | 561 | 518 | 474 |
| | 21 | 691 | 611 | 526 | 741 | 665 | 585 | 546 | 504 | 460 |
| | 22 | 674 | 595 | 512 | 723 | 648 | 570 | 531 | 489 | 446 |
| | 23 | 657 | 579 | 497 | 704 | 630 | 553 | 516 | 474 | 432 |
| | 24 | 639 | 563 | 482 | 684 | 612 | 537 | 500 | 459 | 418 |
| | 25 | 620 | 546 | 467 | 664 | 594 | 520 | 484 | 444 | 403 |
| | 26 | 601 | 529 | 451 | 643 | 575 | 503 | 467 | 428 | 388 |
| | 27 | 582 | 511 | 434 | 623 | 556 | 485 | 450 | 412 | 372 |
| | 28 | 562 | 493 | 418 | 601 | 536 | 467 | 433 | 395 | 356 |
| | 29 | 542 | 474 | 401 | 579 | 516 | 449 | 415 | 378 | 340 |
| | 30 | 522 | 455 | 383 | 557 | 495 | 430 | 397 | 361 | 323 |
| | 31 | 501 | 436 | 365 | 534 | 474 | 410 | 378 | 343 | 306 |
| | 32 | 479 | 416 | 347 | 510 | 453 | 391 | 359 | 325 | 288 |
| | 33 | 457 | 396 | 328 | 486 | 431 | 370 | 340 | 306 | 271 |
| | 34 | 435 | 375 | 310 | 462 | 408 | 350 | 320 | 288 | 256 |
| | 35 | 412 | 354 | 292 | 437 | 385 | 330 | 302 | 272 | 241 |
| | 36 | 389 | 335 | 276 | 413 | 364 | 312 | 286 | 257 | 228 |
| | 37 | 368 | 317 | 261 | 391 | 345 | 295 | 270 | 243 | 216 |
| | 38 | 349 | 300 | 248 | 371 | 327 | 280 | 256 | 231 | 205 |
| | 39 | 332 | 285 | 235 | 352 | 310 | 266 | 243 | 219 | 194 |
| | 40 | 315 | 271 | 224 | 334 | 295 | 253 | 231 | 208 | 185 |
| **PROPERTIES** | | | | | | | | | | |
| Area, In.$^2$ | | 17.9 | 13.6 | 9.16 | 21.8 | 17.6 | 13.3 | 11.2 | 8.98 | 6.74 |
| I, In.$^4$ | | 339 | 262 | 180 | 387 | 319 | 246 | 208 | 169 | 128 |
| r, In. | | 4.35 | 4.39 | 4.43 | 4.22 | 4.26 | 4.30 | 4.32 | 4.34 | 4.36 |
| B, Bending Factor | | 0.337 | 0.331 | 0.324 | 0.352 | 0.345 | 0.338 | 0.337 | 0.332 | 0.329 |
| a ÷ $10^6$ | | 72.6 | 62.5 | 51.5 | 77.1 | 67.9 | 58.2 | 53.3 | 48.0 | 42.5 |

# HSS / Round Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips



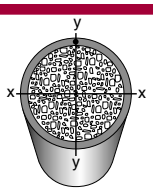

**f'c = 8.0**

| Nominal Outside Diameter | | 12.313 | | | | | | 12.250 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 0.625 | 0.500 | 0.375 | 0.312 | 0.250 | 0.188 | 0.625 | 0.500 | 0.375 | 0.312 | 0.250 | 0.188 |
| Weight Per Foot | | 78.02 | 63.08 | 47.81 | 39.99 | 32.21 | 24.35 | 77.60 | 62.75 | 47.56 | 39.78 | 32.04 | 24.22 |
| Design Wall Thickness | | 0.581 | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 | 0.581 | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 |
| | | $F_y$ = 46 ksi | | | | | | | | | | | |
| Effective length KL in feet | 0 | 989 | 893 | 794 | 745 | 694 | 642 | 982 | 885 | 786 | 737 | 688 | 636 |
| | 4 | 957 | 864 | 767 | 719 | 670 | 619 | 950 | 856 | 760 | 712 | 664 | 614 |
| | 5 | 948 | 855 | 759 | 712 | 663 | 612 | 941 | 848 | 752 | 704 | 657 | 607 |
| | 6 | 937 | 845 | 751 | 704 | 655 | 605 | 930 | 838 | 744 | 696 | 649 | 599 |
| | 7 | 927 | 835 | 742 | 695 | 646 | 597 | 919 | 828 | 735 | 688 | 641 | 591 |
| | 8 | 915 | 825 | 732 | 686 | 638 | 589 | 908 | 818 | 725 | 679 | 632 | 583 |
| | 9 | 903 | 814 | 722 | 676 | 629 | 580 | 896 | 807 | 715 | 669 | 623 | 574 |
| | 10 | 890 | 802 | 711 | 666 | 619 | 571 | 883 | 795 | 704 | 659 | 613 | 565 |
| | 11 | 877 | 790 | 700 | 655 | 609 | 561 | 870 | 783 | 693 | 648 | 603 | 555 |
| | 12 | 863 | 778 | 689 | 644 | 598 | 551 | 856 | 770 | 682 | 637 | 593 | 545 |
| | 13 | 849 | 764 | 677 | 633 | 587 | 541 | 842 | 757 | 670 | 626 | 582 | 535 |
| | 14 | 834 | 751 | 665 | 621 | 576 | 530 | 827 | 744 | 658 | 614 | 571 | 524 |
| | 15 | 819 | 737 | 652 | 609 | 564 | 519 | 812 | 730 | 645 | 602 | 559 | 513 |
| | 16 | 803 | 722 | 639 | 596 | 552 | 507 | 796 | 715 | 632 | 589 | 547 | 502 |
| | 17 | 787 | 708 | 625 | 583 | 540 | 495 | 780 | 701 | 618 | 576 | 534 | 490 |
| | 18 | 770 | 692 | 611 | 570 | 527 | 483 | 763 | 685 | 604 | 563 | 522 | 477 |
| | 19 | 753 | 676 | 596 | 556 | 514 | 470 | 746 | 669 | 590 | 549 | 508 | 465 |
| | 20 | 735 | 660 | 582 | 542 | 500 | 457 | 729 | 653 | 575 | 535 | 495 | 452 |
| | 21 | 717 | 643 | 566 | 527 | 486 | 444 | 710 | 637 | 560 | 521 | 481 | 439 |
| | 22 | 699 | 626 | 551 | 512 | 472 | 430 | 692 | 620 | 544 | 506 | 467 | 425 |
| | 23 | 680 | 609 | 535 | 497 | 457 | 416 | 673 | 602 | 528 | 490 | 452 | 411 |
| | 24 | 660 | 591 | 518 | 481 | 442 | 402 | 653 | 584 | 512 | 475 | 437 | 397 |
| | 25 | 640 | 573 | 501 | 465 | 427 | 387 | 633 | 566 | 495 | 459 | 422 | 382 |
| | 26 | 620 | 554 | 484 | 449 | 411 | 372 | 613 | 547 | 478 | 442 | 406 | 367 |
| | 27 | 599 | 534 | 467 | 432 | 395 | 356 | 592 | 528 | 460 | 425 | 390 | 351 |
| | 28 | 577 | 515 | 448 | 414 | 378 | 340 | 570 | 508 | 442 | 408 | 373 | 335 |
| | 29 | 555 | 495 | 430 | 397 | 361 | 324 | 548 | 488 | 424 | 390 | 356 | 319 |
| | 30 | 533 | 474 | 411 | 378 | 344 | 307 | 526 | 467 | 405 | 372 | 339 | 302 |
| | 31 | 510 | 453 | 392 | 360 | 326 | 290 | 503 | 446 | 385 | 354 | 321 | 285 |
| | 32 | 486 | 431 | 372 | 341 | 308 | 273 | 480 | 425 | 365 | 335 | 303 | 268 |
| | 33 | 462 | 409 | 351 | 321 | 290 | 256 | 456 | 402 | 345 | 315 | 285 | 252 |
| | 34 | 438 | 386 | 331 | 303 | 273 | 242 | 431 | 380 | 325 | 297 | 268 | 237 |
| | 35 | 413 | 365 | 313 | 286 | 257 | 228 | 407 | 359 | 307 | 280 | 253 | 224 |
| | 36 | 391 | 345 | 295 | 270 | 243 | 215 | 384 | 339 | 290 | 265 | 239 | 212 |
| | 37 | 370 | 326 | 280 | 256 | 230 | 204 | 364 | 321 | 275 | 251 | 226 | 200 |
| | 38 | 351 | 309 | 265 | 242 | 218 | 193 | 345 | 304 | 260 | 238 | 215 | 190 |
| | 39 | 333 | 294 | 252 | 230 | 207 | 184 | 328 | 289 | 247 | 226 | 204 | 180 |
| | 40 | 316 | 279 | 239 | 219 | 197 | 175 | 311 | 274 | 235 | 215 | 194 | 171 |
| **Properties** | | | | | | | | | | | | | |
| Area, In.$^2$ | | 21.4 | 17.3 | 13.1 | 11.0 | 8.84 | 6.64 | 21.3 | 17.2 | 13.0 | 10.9 | 8.80 | 6.60 |
| I, In.$^4$ | | 369 | 304 | 235 | 199 | 161 | 122 | 363 | 299 | 231 | 196 | 159 | 120 |
| r, In. | | 4.15 | 4.19 | 4.23 | 4.25 | 4.27 | 4.29 | 4.13 | 4.17 | 4.21 | 4.23 | 4.25 | 4.27 |
| B, Bending Factor | | 0.357 | 0.350 | 0.343 | 0.340 | 0.338 | 0.335 | 0.359 | 0.352 | 0.345 | 0.341 | 0.339 | 0.337 |
| a ÷ $10^6$ | | 72.9 | 64.3 | 55.1 | 50.4 | 45.4 | 40.2 | 71.7 | 63.2 | 54.1 | 49.4 | 44.6 | 39.5 |

# HSS / Round Structural Steel Tubing for Composite Columns

ERW

Allowable Concentric Loads in Kips



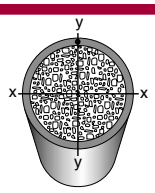

**f'c = 8.0**

| Nominal Outside Diameter | | 11.250 | | | | | | 10.750 | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 0.625 | 0.500 | 0.375 | 0.312 | 0.250 | 0.188 | 0.500 | 0.365 | 0.250 |
| Weight Per Foot | | 70.92 | 57.41 | 43.56 | 36.45 | 29.37 | 22.21 | 54.74 | 40.48 | 28.04 |
| Design Wall Thickness | | 0.581 | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 | 0.465 | 0.340 | 0.233 |
| | | $F_y$ = 46 ksi | | | | | | | | |
| Effective length KL in feet | 0 | 864 | 777 | 688 | 641 | 595 | 548 | 723 | 631 | 551 |
| | 4 | 834 | 749 | 663 | 617 | 573 | 527 | 696 | 607 | 529 |
| | 5 | 824 | 741 | 655 | 610 | 566 | 520 | 687 | 599 | 523 |
| | 6 | 814 | 732 | 647 | 602 | 558 | 513 | 678 | 591 | 515 |
| | 7 | 803 | 722 | 638 | 593 | 550 | 505 | 669 | 583 | 507 |
| | 8 | 792 | 712 | 629 | 584 | 542 | 497 | 658 | 573 | 499 |
| | 9 | 780 | 701 | 619 | 575 | 533 | 489 | 648 | 564 | 490 |
| | 10 | 768 | 689 | 608 | 565 | 524 | 480 | 636 | 554 | 481 |
| | 11 | 755 | 678 | 598 | 555 | 514 | 471 | 624 | 543 | 472 |
| | 12 | 741 | 665 | 586 | 544 | 504 | 461 | 612 | 532 | 462 |
| | 13 | 727 | 652 | 575 | 533 | 493 | 451 | 599 | 521 | 451 |
| | 14 | 712 | 639 | 563 | 522 | 482 | 441 | 586 | 509 | 440 |
| | 15 | 697 | 625 | 550 | 510 | 471 | 430 | 572 | 496 | 429 |
| | 16 | 682 | 611 | 537 | 498 | 459 | 419 | 558 | 484 | 418 |
| | 17 | 666 | 596 | 524 | 485 | 447 | 407 | 544 | 470 | 406 |
| | 18 | 649 | 581 | 510 | 472 | 435 | 395 | 529 | 457 | 393 |
| | 19 | 632 | 565 | 496 | 458 | 422 | 383 | 513 | 443 | 381 |
| | 20 | 614 | 549 | 481 | 444 | 409 | 370 | 497 | 428 | 368 |
| | 21 | 596 | 533 | 466 | 430 | 395 | 358 | 481 | 414 | 354 |
| | 22 | 578 | 516 | 451 | 416 | 381 | 344 | 464 | 398 | 340 |
| | 23 | 559 | 498 | 435 | 401 | 367 | 331 | 446 | 383 | 326 |
| | 24 | 539 | 481 | 419 | 385 | 352 | 317 | 428 | 367 | 311 |
| | 25 | 519 | 462 | 402 | 369 | 337 | 302 | 410 | 350 | 296 |
| | 26 | 499 | 444 | 385 | 353 | 321 | 287 | 391 | 333 | 281 |
| | 27 | 477 | 424 | 367 | 336 | 305 | 272 | 372 | 316 | 265 |
| | 28 | 456 | 405 | 350 | 319 | 289 | 256 | 352 | 298 | 249 |
| | 29 | 434 | 384 | 331 | 302 | 272 | 240 | 332 | 280 | 232 |
| | 30 | 411 | 364 | 312 | 284 | 255 | 225 | 311 | 262 | 217 |
| | 31 | 388 | 342 | 293 | 266 | 239 | 210 | 291 | 245 | 203 |
| | 32 | 364 | 321 | 275 | 249 | 224 | 197 | 274 | 230 | 191 |
| | 33 | 343 | 302 | 258 | 234 | 211 | 186 | 257 | 216 | 179 |
| | 34 | 323 | 285 | 243 | 221 | 199 | 175 | 242 | 204 | 169 |
| | 35 | 305 | 269 | 230 | 208 | 187 | 165 | 229 | 192 | 159 |
| | 36 | 288 | 254 | 217 | 197 | 177 | 156 | 216 | 182 | 151 |
| | 37 | 273 | 240 | 206 | 186 | 168 | 148 | 205 | 172 | 143 |
| | 38 | 258 | 228 | 195 | 177 | 159 | 140 | 194 | 163 | 135 |
| | 39 | 245 | 216 | 185 | 168 | 151 | 133 | 184 | 155 | 128 |
| | 40 | 233 | 206 | 176 | 160 | 143 | 126 | 175 | 147 | 122 |
| **Properties** | | | | | | | | | | |
| Area, In.$^2$ | | 19.5 | 15.8 | 12.0 | 10.0 | 8.06 | 6.05 | 15.0 | 11.1 | 7.70 |
| I, In.$^4$ | | 278 | 229 | 178 | 151 | 122 | 92.9 | 199 | 151 | 106 |
| r, In. | | 3.78 | 3.82 | 3.86 | 3.88 | 3.90 | 3.92 | 3.64 | 3.68 | 3.72 |
| B, Bending Factor | | 0.395 | 0.388 | 0.379 | 0.373 | 0.372 | 0.366 | 0.405 | 0.395 | 0.390 |
| a ÷ $10^6$ | | 53.7 | 47.4 | 40.5 | 36.8 | 33.1 | 29.1 | 40.3 | 33.9 | 28.1 |

# HSS / Round Structural Steel Tubing for Composite Columns

ERW

Allowable Concentric Loads in Kips



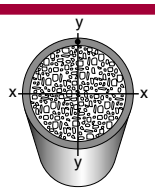

**f'c = 8.0**

| Nominal Outside Diameter | | 10.000 | | | | | | 9.625 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 0.625 | 0.500 | 0.375 | 0.312 | 0.250 | 0.188 | 0.500 | 0.375 | 0.312 | 0.250 | 0.188 |
| Weight Per Foot | | 62.58 | 50.73 | 38.55 | 32.28 | 26.03 | 19.70 | 48.73 | 37.05 | 31.03 | 25.03 | 18.95 |
| Design Wall Thickness | | 0.581 | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 |
| | | $F_y$ = 46 ksi | | | | | | | | | | |
| Effective length KL in feet | 0 | 725 | 647 | 570 | 529 | 489 | 447 | 612 | 537 | 497 | 458 | 418 |
| | 4 | 696 | 621 | 546 | 507 | 467 | 427 | 586 | 513 | 475 | 438 | 399 |
| | 5 | 686 | 612 | 538 | 500 | 461 | 421 | 578 | 506 | 468 | 431 | 393 |
| | 6 | 677 | 604 | 530 | 492 | 454 | 414 | 569 | 498 | 461 | 424 | 386 |
| | 7 | 666 | 594 | 522 | 484 | 446 | 407 | 559 | 490 | 453 | 417 | 379 |
| | 8 | 655 | 584 | 513 | 476 | 438 | 399 | 549 | 481 | 445 | 409 | 372 |
| | 9 | 643 | 573 | 503 | 466 | 429 | 391 | 539 | 471 | 436 | 400 | 364 |
| | 10 | 631 | 562 | 493 | 457 | 420 | 382 | 527 | 461 | 426 | 391 | 355 |
| | 11 | 618 | 551 | 483 | 447 | 411 | 374 | 516 | 451 | 416 | 382 | 347 |
| | 12 | 605 | 538 | 472 | 437 | 401 | 364 | 504 | 440 | 406 | 372 | 338 |
| | 13 | 591 | 526 | 460 | 426 | 391 | 355 | 491 | 429 | 395 | 362 | 328 |
| | 14 | 576 | 513 | 448 | 415 | 380 | 345 | 478 | 417 | 384 | 352 | 318 |
| | 15 | 561 | 499 | 436 | 403 | 369 | 334 | 464 | 405 | 373 | 341 | 308 |
| | 16 | 545 | 485 | 423 | 391 | 358 | 324 | 450 | 392 | 361 | 330 | 297 |
| | 17 | 529 | 471 | 410 | 379 | 346 | 312 | 436 | 379 | 349 | 318 | 286 |
| | 18 | 513 | 456 | 397 | 366 | 334 | 301 | 421 | 365 | 336 | 306 | 275 |
| | 19 | 496 | 440 | 383 | 353 | 322 | 289 | 405 | 351 | 323 | 294 | 263 |
| | 20 | 478 | 424 | 368 | 339 | 309 | 277 | 389 | 337 | 309 | 281 | 251 |
| | 21 | 460 | 408 | 354 | 325 | 295 | 264 | 373 | 322 | 295 | 268 | 239 |
| | 22 | 441 | 391 | 338 | 310 | 282 | 251 | 356 | 307 | 281 | 254 | 226 |
| | 23 | 422 | 374 | 323 | 295 | 268 | 238 | 338 | 291 | 266 | 240 | 212 |
| | 24 | 403 | 356 | 306 | 280 | 253 | 224 | 320 | 275 | 251 | 226 | 199 |
| | 25 | 382 | 338 | 290 | 264 | 238 | 210 | 302 | 259 | 235 | 211 | 185 |
| | 26 | 362 | 319 | 273 | 248 | 223 | 195 | 283 | 241 | 219 | 195 | 171 |
| | 27 | 340 | 299 | 255 | 231 | 207 | 181 | 263 | 224 | 203 | 181 | 158 |
| | 28 | 318 | 279 | 237 | 215 | 192 | 168 | 245 | 208 | 189 | 168 | 147 |
| | 29 | 297 | 261 | 221 | 201 | 179 | 157 | 228 | 194 | 176 | 157 | 137 |
| | 30 | 277 | 243 | 207 | 188 | 168 | 147 | 213 | 182 | 164 | 147 | 128 |
| | 31 | 260 | 228 | 194 | 176 | 157 | 137 | 200 | 170 | 154 | 137 | 120 |
| | 32 | 244 | 214 | 182 | 165 | 147 | 129 | 187 | 160 | 144 | 129 | 113 |
| | 33 | 229 | 201 | 171 | 155 | 139 | 121 | 176 | 150 | 136 | 121 | 106 |
| | 34 | 216 | 190 | 161 | 146 | 131 | 114 | 166 | 141 | 128 | 114 | 100 |
| | 35 | 204 | 179 | 152 | 138 | 123 | 108 | 157 | 133 | 121 | 108 | 94 |
| | 36 | 192 | 169 | 144 | 130 | 116 | 102 | 148 | 126 | 114 | 102 | 89 |
| | 37 | 182 | 160 | 136 | 123 | 110 | 96 | 140 | 119 | 108 | 96 | 84 |
| | 38 | 173 | 152 | 129 | 117 | 104 | 91 | 133 | 113 | 102 | 91 | 80 |
| | 39 | 164 | 144 | 122 | 111 | 99 | 87 | 126 | 107 | 97 | 87 | 76 |
| | 40 | 156 | 137 | 116 | 105 | 94 | 82 | 120 | 102 | 92 | 83 | 72 |
| **Properties** | | | | | | | | | | | | |
| Area, In.$^2$ | | 17.2 | 13.9 | 10.6 | 8.88 | 7.15 | 5.37 | 13.4 | 10.2 | 8.53 | 6.87 | 5.17 |
| I, In.$^4$ | | 191 | 159 | 123 | 105 | 85.3 | 64.8 | 141 | 110 | 93.0 | 75.9 | 57.7 |
| r, In. | | 3.34 | 3.38 | 3.41 | 3.43 | 3.45 | 3.47 | 3.24 | 3.28 | 3.30 | 3.32 | 3.34 |
| B, Bending Factor | | 0.450 | 0.437 | 0.431 | 0.423 | 0.419 | 0.414 | 0.457 | 0.446 | 0.441 | 0.436 | 0.431 |
| a ÷ $10^6$ | | 35.9 | 31.5 | 26.8 | 24.3 | 21.7 | 19.0 | 27.6 | 23.5 | 21.3 | 19.0 | 16.6 |

# HSS / Round Structural Steel Tubing for Composite Columns

ERW

Allowable Concentric Loads in Kips

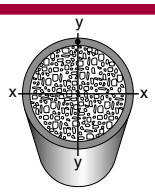



**f'c = 8.0**

| Nominal Outside Diameter | | 8.750 | | | | | 8.625 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 0.500 | 0.375 | 0.312 | 0.250 | 0.188 | 0.500 | 0.375 | 0.322 | 0.250 | 0.188 |
| Weight Per Foot | | 44.06 | 33.54 | 28.12 | 22.70 | 17.19 | 43.39 | 33.04 | 28.55 | 22.36 | 16.94 |
| Design Wall Thickness | | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 | 0.465 | 0.349 | 0.300 | 0.233 | 0.174 |
| | | $F_y$ = 46 ksi | | | | | | | | | |
| Effective length KL in feet | 0 | 530 | 462 | 427 | 392 | 356 | 518 | 452 | 423 | 383 | 347 |
| | 4 | 504 | 439 | 406 | 372 | 337 | 493 | 429 | 402 | 363 | 329 |
| | 5 | 496 | 432 | 399 | 366 | 331 | 485 | 422 | 395 | 357 | 323 |
| | 6 | 488 | 425 | 392 | 359 | 325 | 476 | 414 | 388 | 350 | 317 |
| | 7 | 478 | 416 | 384 | 352 | 318 | 467 | 406 | 380 | 343 | 310 |
| | 8 | 468 | 407 | 376 | 344 | 311 | 457 | 397 | 372 | 335 | 303 |
| | 9 | 458 | 398 | 367 | 336 | 303 | 447 | 388 | 363 | 327 | 295 |
| | 10 | 447 | 388 | 358 | 327 | 295 | 436 | 379 | 354 | 319 | 287 |
| | 11 | 435 | 378 | 348 | 318 | 287 | 424 | 368 | 344 | 310 | 279 |
| | 12 | 423 | 367 | 338 | 309 | 278 | 412 | 358 | 334 | 300 | 270 |
| | 13 | 411 | 356 | 328 | 299 | 269 | 400 | 347 | 323 | 290 | 261 |
| | 14 | 398 | 345 | 317 | 289 | 259 | 387 | 335 | 313 | 280 | 251 |
| | 15 | 384 | 333 | 306 | 278 | 249 | 373 | 323 | 301 | 270 | 241 |
| | 16 | 370 | 320 | 294 | 267 | 239 | 359 | 310 | 289 | 259 | 231 |
| | 17 | 356 | 307 | 282 | 256 | 228 | 345 | 298 | 277 | 247 | 220 |
| | 18 | 341 | 294 | 269 | 244 | 217 | 330 | 284 | 264 | 236 | 209 |
| | 19 | 325 | 280 | 256 | 231 | 205 | 314 | 270 | 251 | 223 | 198 |
| | 20 | 309 | 266 | 243 | 219 | 194 | 298 | 256 | 238 | 211 | 186 |
| | 21 | 292 | 251 | 229 | 206 | 181 | 282 | 242 | 224 | 198 | 174 |
| | 22 | 275 | 236 | 215 | 192 | 169 | 264 | 226 | 210 | 184 | 161 |
| | 23 | 258 | 220 | 200 | 178 | 155 | 247 | 211 | 195 | 170 | 148 |
| | 24 | 239 | 204 | 184 | 164 | 143 | 229 | 194 | 179 | 157 | 136 |
| | 25 | 221 | 188 | 170 | 151 | 131 | 211 | 179 | 165 | 144 | 125 |
| | 26 | 204 | 174 | 157 | 140 | 122 | 195 | 166 | 153 | 133 | 116 |
| | 27 | 189 | 161 | 146 | 130 | 113 | 181 | 154 | 142 | 124 | 107 |
| | 28 | 176 | 150 | 135 | 121 | 105 | 168 | 143 | 132 | 115 | 100 |
| | 29 | 164 | 140 | 126 | 112 | 98 | 157 | 133 | 123 | 107 | 93 |
| | 30 | 153 | 130 | 118 | 105 | 91 | 146 | 124 | 115 | 100 | 87 |
| | 31 | 144 | 122 | 111 | 98 | 86 | 137 | 117 | 107 | 94 | 81 |
| | 32 | 135 | 115 | 104 | 92 | 80 | 129 | 109 | 101 | 88 | 76 |
| | 33 | 127 | 108 | 98 | 87 | 75 | 121 | 103 | 95 | 83 | 72 |
| | 34 | 119 | 102 | 92 | 82 | 71 | 114 | 97 | 89 | 78 | 68 |
| | 35 | 113 | 96 | 87 | 77 | 67 | 108 | 91 | 84 | 74 | 64 |
| | 36 | 107 | 91 | 82 | 73 | 63 | 102 | 86 | 80 | 70 | 60 |
| | 37 | 101 | 86 | 78 | 69 | 60 | 96 | 82 | 75 | 66 | 57 |
| | 38 | 96 | 81 | 74 | 65 | 57 | 91 | 78 | 72 | 62 | 54 |
| | 39 | 91 | 77 | 70 | 62 | 54 | 87 | 74 | 68 | 59 | 51 |
| | 40 | 86 | 73 | 66 | 59 | 51 | 82 | 70 | 65 | 56 | 49 |
| **Properties** | | | | | | | | | | | |
| Area, In.$^2$ | | 12.1 | 9.21 | 7.73 | 6.23 | 4.69 | 11.9 | 9.07 | 7.85 | 6.14 | 4.62 |
| I, In.$^4$ | | 104 | 81.4 | 69.3 | 56.6 | 43.1 | 99.5 | 77.8 | 68.1 | 54.1 | 41.3 |
| r, In. | | 2.93 | 2.97 | 2.99 | 3.01 | 3.03 | 2.89 | 2.93 | 2.95 | 2.97 | 2.99 |
| B, Bending Factor | | 0.509 | 0.495 | 0.488 | 0.482 | 0.476 | 0.516 | 0.503 | 0.497 | 0.489 | 0.482 |
| a ÷ $10^6$ | | 19.9 | 16.9 | 15.3 | 13.6 | 11.8 | 19.0 | 16.1 | 14.9 | 13.0 | 11.3 |

# HSS / Round Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips

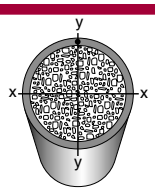



**f'c = 8.0**

| Nominal Outside Diameter | | 7.625 | | | 7.500 | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 0.375 | 0.328 | 0.125 | 0.500 | 0.375 | 0.312 | 0.250 | 0.188 |
| Weight Per Foot | | 29.04 | 25.56 | 10.01 | 37.38 | 28.54 | 23.95 | 19.36 | 14.68 |
| Design Wall Thickness | | 0.349 | 0.305 | 0.116 | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 |
| | | $F_y$ = 46 ksi | | | | | | | |
| Effective length KL in feet | 0 | 374 | 351 | 251 | 423 | 365 | 335 | 305 | 274 |
| | 4 | 353 | 331 | 235 | 398 | 343 | 315 | 287 | 257 |
| | 5 | 346 | 324 | 230 | 390 | 336 | 309 | 281 | 252 |
| | 6 | 338 | 317 | 224 | 382 | 329 | 302 | 275 | 246 |
| | 7 | 330 | 310 | 218 | 373 | 321 | 295 | 268 | 239 |
| | 8 | 322 | 301 | 212 | 363 | 312 | 287 | 260 | 233 |
| | 9 | 313 | 293 | 205 | 352 | 303 | 278 | 252 | 225 |
| | 10 | 303 | 284 | 198 | 341 | 294 | 269 | 244 | 218 |
| | 11 | 293 | 274 | 190 | 330 | 284 | 260 | 235 | 209 |
| | 12 | 282 | 264 | 183 | 318 | 273 | 250 | 226 | 201 |
| | 13 | 271 | 254 | 174 | 305 | 262 | 240 | 217 | 192 |
| | 14 | 260 | 243 | 166 | 292 | 251 | 229 | 207 | 183 |
| | 15 | 248 | 231 | 157 | 279 | 239 | 218 | 196 | 173 |
| | 16 | 236 | 220 | 147 | 264 | 226 | 206 | 186 | 163 |
| | 17 | 223 | 208 | 138 | 250 | 213 | 194 | 174 | 153 |
| | 18 | 210 | 195 | 128 | 235 | 200 | 182 | 163 | 142 |
| | 19 | 196 | 182 | 117 | 219 | 186 | 169 | 151 | 131 |
| | 20 | 182 | 168 | 106 | 202 | 172 | 155 | 138 | 119 |
| | 21 | 167 | 154 | 96 | 185 | 157 | 142 | 126 | 108 |
| | 22 | 152 | 140 | 88 | 169 | 143 | 129 | 114 | 99 |
| | 23 | 139 | 128 | 80 | 154 | 131 | 118 | 105 | 90 |
| | 24 | 128 | 118 | 74 | 142 | 120 | 108 | 96 | 83 |
| | 25 | 118 | 109 | 68 | 131 | 111 | 100 | 89 | 76 |
| | 26 | 109 | 100 | 63 | 121 | 102 | 92 | 82 | 71 |
| | 27 | 101 | 93 | 58 | 112 | 95 | 86 | 76 | 65 |
| | 28 | 94 | 87 | 54 | 104 | 88 | 80 | 71 | 61 |
| | 29 | 87 | 81 | 51 | 97 | 82 | 74 | 66 | 57 |
| | 30 | 82 | 75 | 47 | 91 | 77 | 69 | 62 | 53 |
| | 31 | 77 | 71 | 44 | 85 | 72 | 65 | 58 | 50 |
| | 32 | 72 | 66 | 41 | 80 | 68 | 61 | 54 | 47 |
| | 33 | 68 | 62 | 39 | 75 | 64 | 57 | 51 | 44 |
| | 34 | 64 | 59 | 37 | 71 | 60 | 54 | 48 | 41 |
| | 35 | 60 | 55 | 35 | 67 | 56 | 51 | 45 | 39 |
| | 36 | 57 | 52 | 33 | 63 | 53 | 48 | 43 | 37 |
| | 37 | 54 | 50 | 31 | 60 | 51 | 46 | 40 | 35 |
| | 38 | 51 | 47 | 29 | 57 | 48 | 43 | 38 | 33 |
| | 39 | 48 | 45 | 28 | 54 | 45 | 41 | 36 | 31 |
| | 40 | 46 | 42 | 27 | 51 | 43 | 39 | 35 | 30 |
| **Properties** | | | | | | | | | |
| Area, In.$^2$ | | 7.98 | 7.01 | 2.74 | 10.3 | 7.84 | 6.59 | 5.32 | 4.00 |
| I, In.$^4$ | | 52.9 | 47.1 | 19.3 | 63.9 | 50.2 | 42.9 | 35.2 | 26.9 |
| r, In. | | 2.58 | 2.59 | 2.66 | 2.49 | 2.53 | 2.55 | 2.57 | 2.59 |
| B, Bending Factor | | 0.575 | 0.567 | 0.541 | 0.604 | 0.586 | 0.576 | 0.567 | 0.558 |
| a ÷ $10^6$ | | 10.6 | 9.77 | 6.12 | 11.8 | 9.96 | 8.99 | 7.97 | 6.87 |

# HSS / Round Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips



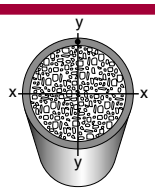

**f'c = 8.0**

| Nominal Outside Diameter | | 7.000 | | | | | | 6.875 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 0.500 | 0.375 | 0.312 | 0.250 | 0.188 | 0.125 | 0.500 | 0.375 | 0.312 | 0.250 | 0.188 |
| Weight Per Foot | | 34.71 | 26.53 | 22.29 | 18.02 | 13.68 | 9.18 | 34.04 | 26.03 | 21.87 | 17.69 | 13.43 |
| Design Wall Thickness | | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 | 0.116 | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 |
| | | $F_y$ = 46 ksi | | | | | | | | | | |
| Effective length KL in feet | 0 | 382 | 328 | 301 | 273 | 245 | 216 | 372 | 320 | 293 | 266 | 238 |
| | 4 | 358 | 308 | 282 | 256 | 228 | 201 | 348 | 299 | 274 | 248 | 221 |
| | 5 | 350 | 301 | 275 | 250 | 223 | 196 | 340 | 292 | 268 | 242 | 216 |
| | 6 | 341 | 293 | 269 | 243 | 217 | 191 | 331 | 285 | 261 | 236 | 210 |
| | 7 | 332 | 285 | 261 | 236 | 211 | 185 | 322 | 277 | 253 | 229 | 204 |
| | 8 | 323 | 277 | 253 | 229 | 204 | 179 | 312 | 269 | 245 | 222 | 197 |
| | 9 | 312 | 268 | 245 | 221 | 197 | 172 | 302 | 259 | 237 | 214 | 190 |
| | 10 | 301 | 258 | 236 | 213 | 189 | 165 | 291 | 250 | 228 | 206 | 183 |
| | 11 | 290 | 248 | 227 | 205 | 181 | 158 | 280 | 240 | 219 | 197 | 175 |
| | 12 | 278 | 238 | 217 | 196 | 173 | 150 | 268 | 230 | 209 | 188 | 166 |
| | 13 | 265 | 227 | 207 | 186 | 164 | 142 | 255 | 219 | 199 | 179 | 158 |
| | 14 | 252 | 215 | 196 | 176 | 155 | 133 | 242 | 207 | 189 | 169 | 149 |
| | 15 | 239 | 203 | 185 | 166 | 146 | 125 | 228 | 195 | 177 | 159 | 139 |
| | 16 | 225 | 191 | 173 | 155 | 136 | 115 | 214 | 183 | 166 | 148 | 129 |
| | 17 | 210 | 178 | 161 | 144 | 125 | 106 | 199 | 170 | 154 | 137 | 119 |
| | 18 | 194 | 164 | 149 | 132 | 115 | 96 | 184 | 156 | 141 | 126 | 108 |
| | 19 | 178 | 150 | 136 | 120 | 103 | 86 | 168 | 142 | 128 | 113 | 97 |
| | 20 | 162 | 136 | 123 | 109 | 93 | 78 | 151 | 129 | 116 | 102 | 88 |
| | 21 | 147 | 123 | 111 | 99 | 85 | 70 | 137 | 117 | 105 | 93 | 80 |
| | 22 | 134 | 112 | 101 | 90 | 77 | 64 | 125 | 106 | 96 | 85 | 73 |
| | 23 | 122 | 103 | 93 | 82 | 71 | 59 | 114 | 97 | 88 | 77 | 66 |
| | 24 | 112 | 95 | 85 | 75 | 65 | 54 | 105 | 89 | 80 | 71 | 61 |
| | 25 | 104 | 87 | 79 | 70 | 60 | 50 | 97 | 82 | 74 | 66 | 56 |
| | 26 | 96 | 81 | 73 | 64 | 55 | 46 | 90 | 76 | 69 | 61 | 52 |
| | 27 | 89 | 75 | 67 | 60 | 51 | 43 | 83 | 71 | 64 | 56 | 48 |
| | 28 | 83 | 69 | 63 | 55 | 48 | 40 | 77 | 66 | 59 | 52 | 45 |
| | 29 | 77 | 65 | 58 | 52 | 44 | 37 | 72 | 61 | 55 | 49 | 42 |
| | 30 | 72 | 60 | 55 | 48 | 41 | 34 | 67 | 57 | 51 | 46 | 39 |
| | 31 | 67 | 57 | 51 | 45 | 39 | 32 | 63 | 53 | 48 | 43 | 37 |
| | 32 | 63 | 53 | 48 | 42 | 36 | 30 | 59 | 50 | 45 | 40 | 34 |
| | 33 | 59 | 50 | 45 | 40 | 34 | 28 | 56 | 47 | 43 | 38 | 32 |
| | 34 | 56 | 47 | 42 | 38 | 32 | 27 | 52 | 44 | 40 | 35 | 30 |
| | 35 | 53 | 44 | 40 | 35 | 30 | 25 | 49 | 42 | 38 | 33 | 29 |
| | 36 | 50 | 42 | 38 | 34 | 29 | 24 | 47 | 40 | 36 | 32 | 27 |
| | 37 | 47 | 40 | 36 | 32 | 27 | 23 | 44 | 38 | 34 | 30 | 26 |
| | 38 | 45 | 38 | 34 | 30 | 26 | 21 | | 36 | 32 | 28 | 24 |
| | 39 | | 36 | 32 | 29 | 25 | 20 | | | | 27 | 23 |
| | 40 | | | | | 23 | 19 | | | | | |
| **Properties** | | | | | | | | | | | | |
| Area, In.$^2$ | | 9.55 | 7.29 | 6.13 | 4.95 | 3.73 | 2.51 | 9.36 | 7.16 | 6.02 | 4.86 | 3.66 |
| I, In.$^4$ | | 51.2 | 40.4 | 34.6 | 28.4 | 21.7 | 14.9 | 48.3 | 38.2 | 32.7 | 26.8 | 20.6 |
| r, In. | | 2.32 | 2.35 | 2.37 | 2.39 | 2.41 | 2.43 | 2.27 | 2.31 | 2.33 | 2.35 | 2.37 |
| B, Bending Factor | | 0.653 | 0.632 | 0.620 | 0.610 | 0.602 | 0.590 | 0.666 | 0.644 | 0.633 | 0.623 | 0.611 |
| a ÷ $10^6$ | | 9.33 | 7.84 | 7.07 | 6.26 | 5.38 | 4.47 | 8.72 | 7.40 | 6.67 | 5.90 | 5.06 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

# HSS / Round Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips




**f'c = 8.0**

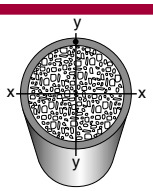
| Nominal Outside Diameter | | 6.625 | | | | | | | | 6.125 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 0.500 | 0.432 | 0.375 | 0.312 | 0.280 | 0.250 | 0.188 | 0.125 | 0.500 | 0.375 | 0.312 | 0.250 | 0.188 |
| Weight Per Foot | | 32.71 | 28.57 | 25.03 | 21.04 | 18.97 | 17.02 | 12.92 | 8.68 | 30.04 | 23.03 | 19.37 | 15.69 | 11.92 |
| Design Wall Thickness | | 0.465 | 0.403 | 0.349 | 0.291 | 0.261 | 0.233 | 0.174 | 0.116 | 0.465 | 0.349 | 0.291 | 0.233 | 0.174 |
| | | $F_y$ = 46 ksi | | | | | | | | | | | | |
| Effective length KL in feet | 0 | 352 | 326 | 302 | 277 | 263 | 251 | 224 | 196 | 315 | 269 | 246 | 222 | 197 |
| | 4 | 329 | 304 | 282 | 258 | 245 | 233 | 208 | 182 | 291 | 249 | 227 | 205 | 181 |
| | 5 | 321 | 297 | 275 | 252 | 239 | 228 | 202 | 177 | 284 | 242 | 221 | 199 | 176 |
| | 6 | 312 | 289 | 268 | 245 | 233 | 221 | 197 | 172 | 275 | 235 | 214 | 193 | 170 |
| | 7 | 303 | 280 | 260 | 237 | 226 | 214 | 190 | 166 | 266 | 227 | 207 | 186 | 164 |
| | 8 | 293 | 271 | 251 | 230 | 218 | 207 | 184 | 160 | 256 | 219 | 199 | 179 | 158 |
| | 9 | 283 | 262 | 242 | 221 | 210 | 200 | 177 | 153 | 246 | 210 | 191 | 171 | 151 |
| | 10 | 272 | 251 | 233 | 212 | 202 | 191 | 169 | 147 | 235 | 201 | 182 | 163 | 144 |
| | 11 | 260 | 241 | 223 | 203 | 193 | 183 | 161 | 139 | 223 | 191 | 173 | 155 | 136 |
| | 12 | 248 | 229 | 212 | 194 | 184 | 174 | 153 | 132 | 211 | 180 | 164 | 146 | 128 |
| | 13 | 236 | 218 | 201 | 183 | 174 | 165 | 145 | 124 | 199 | 169 | 154 | 137 | 119 |
| | 14 | 223 | 205 | 190 | 173 | 164 | 155 | 136 | 116 | 185 | 158 | 143 | 127 | 110 |
| | 15 | 209 | 193 | 178 | 162 | 153 | 145 | 126 | 107 | 171 | 146 | 132 | 117 | 101 |
| | 16 | 194 | 179 | 166 | 150 | 142 | 134 | 116 | 98 | 157 | 133 | 120 | 106 | 91 |
| | 17 | 179 | 165 | 153 | 138 | 130 | 123 | 106 | 88 | 142 | 120 | 108 | 95 | 81 |
| | 18 | 164 | 151 | 139 | 126 | 118 | 111 | 95 | 79 | 126 | 107 | 97 | 84 | 72 |
| | 19 | 148 | 136 | 125 | 113 | 106 | 100 | 86 | 71 | 113 | 96 | 87 | 76 | 65 |
| | 20 | 133 | 123 | 113 | 102 | 96 | 90 | 77 | 64 | 102 | 87 | 78 | 68 | 58 |
| | 21 | 121 | 111 | 102 | 92 | 87 | 82 | 70 | 58 | 93 | 79 | 71 | 62 | 53 |
| | 22 | 110 | 101 | 93 | 84 | 79 | 74 | 64 | 53 | 85 | 72 | 65 | 57 | 48 |
| | 23 | 101 | 93 | 85 | 77 | 72 | 68 | 58 | 48 | 77 | 66 | 59 | 52 | 44 |
| | 24 | 92 | 85 | 78 | 71 | 67 | 63 | 54 | 44 | 71 | 60 | 54 | 47 | 41 |
| | 25 | 85 | 78 | 72 | 65 | 61 | 58 | 49 | 41 | 66 | 56 | 50 | 44 | 37 |
| | 26 | 79 | 73 | 67 | 60 | 57 | 53 | 46 | 38 | 61 | 51 | 46 | 40 | 35 |
| | 27 | 73 | 67 | 62 | 56 | 53 | 49 | 42 | 35 | 56 | 48 | 43 | 38 | 32 |
| | 28 | 68 | 63 | 58 | 52 | 49 | 46 | 39 | 33 | 52 | 44 | 40 | 35 | 30 |
| | 29 | 63 | 58 | 54 | 48 | 46 | 43 | 37 | 30 | 49 | 41 | 37 | 33 | 28 |
| | 30 | 59 | 54 | 50 | 45 | 43 | 40 | 34 | 28 | 46 | 39 | 35 | 30 | 26 |
| | 31 | 55 | 51 | 47 | 42 | 40 | 37 | 32 | 27 | 43 | 36 | 33 | 28 | 24 |
| | 32 | 52 | 48 | 44 | 40 | 37 | 35 | 30 | 25 | 40 | 34 | 31 | 27 | 23 |
| | 33 | 49 | 45 | 41 | 37 | 35 | 33 | 28 | 23 | 38 | 32 | 29 | 25 | 21 |
| | 34 | 46 | 42 | 39 | 35 | 33 | 31 | 27 | 22 | | 30 | 27 | 24 | 20 |
| | 35 | 43 | 40 | 37 | 33 | 31 | 29 | 25 | 21 | | | | | 19 |
| | 36 | 41 | 38 | 35 | 31 | 30 | 28 | 24 | 20 | | | | | |
| | 37 | | | 33 | 30 | 28 | 26 | 23 | 19 | | | | | |
| | 38 | | | | | | | 21 | 18 | | | | | |
| | 39 | | | | | | | | | | | | | |
| | 40 | | | | | | | | | | | | | |
| **Properties** | | | | | | | | | | | | | | |
| Area, In.$^2$ | | 9.00 | 7.88 | 6.88 | 5.79 | 5.22 | 4.68 | 3.53 | 2.37 | 8.27 | 6.33 | 5.33 | 4.31 | 3.25 |
| I, In.$^4$ | | 42.9 | 38.3 | 34.0 | 29.1 | 26.5 | 23.9 | 18.4 | 12.6 | 33.3 | 26.5 | 22.7 | 18.7 | 14.4 |
| r, In. | | 2.18 | 2.20 | 2.22 | 2.24 | 2.25 | 2.26 | 2.28 | 2.30 | 2.01 | 2.05 | 2.07 | 2.08 | 2.10 |
| B, Bending Factor | | 0.695 | 0.682 | 0.670 | 0.659 | 0.653 | 0.649 | 0.635 | 0.623 | 0.761 | 0.732 | 0.719 | 0.706 | 0.691 |
| a ÷ $10^6$ | | 7.67 | 7.06 | 6.51 | 5.87 | 5.52 | 5.18 | 4.45 | 3.67 | 5.90 | 5.00 | 4.51 | 3.94 | 3.37 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

# HSS / Round Structural Steel Tubing for Composite Columns

ERW

Allowable Concentric Loads in Kips



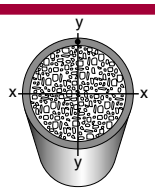

**f'c = 8.0**

| Nominal Outside Diameter | | 6.000 | | | | | | | 5.563 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 0.500 | 0.375 | 0.312 | 0.280 | 0.250 | 0.188 | 0.125 | 0.375 | 0.258 | 0.188 | 0.134 |
| Weight Per Foot | | 29.37 | 22.53 | 18.95 | 17.11 | 15.35 | 11.67 | 7.84 | 20.78 | 14.62 | 10.79 | 7.77 |
| Design Wall Thickness | | 0.465 | 0.349 | 0.291 | 0.261 | 0.233 | 0.174 | 0.116 | 0.349 | 0.241 | 0.174 | 0.125 |
| | | $F_y$ = 46 ksi | | | | | | | | | | |
| Effective length KL in feet | 0 | 306 | 261 | 238 | 226 | 215 | 190 | 166 | 234 | 194 | 169 | 150 |
| | 4 | 282 | 241 | 220 | 209 | 198 | 175 | 152 | 214 | 177 | 154 | 136 |
| | 5 | 275 | 234 | 214 | 203 | 192 | 170 | 147 | 207 | 172 | 149 | 131 |
| | 6 | 266 | 227 | 207 | 196 | 186 | 164 | 142 | 200 | 166 | 143 | 126 |
| | 7 | 257 | 219 | 200 | 189 | 179 | 158 | 137 | 192 | 159 | 137 | 121 |
| | 8 | 247 | 211 | 192 | 182 | 172 | 152 | 131 | 184 | 152 | 131 | 115 |
| | 9 | 237 | 202 | 184 | 174 | 165 | 145 | 124 | 175 | 144 | 124 | 109 |
| | 10 | 226 | 192 | 175 | 166 | 157 | 138 | 118 | 166 | 136 | 117 | 102 |
| | 11 | 214 | 183 | 166 | 157 | 148 | 130 | 111 | 156 | 128 | 110 | 95 |
| | 12 | 202 | 172 | 156 | 148 | 140 | 122 | 103 | 145 | 119 | 102 | 88 |
| | 13 | 189 | 161 | 146 | 138 | 130 | 113 | 96 | 134 | 109 | 93 | 80 |
| | 14 | 176 | 149 | 135 | 128 | 120 | 104 | 88 | 123 | 99 | 84 | 72 |
| | 15 | 161 | 137 | 124 | 117 | 110 | 95 | 79 | 110 | 89 | 75 | 63 |
| | 16 | 147 | 125 | 113 | 106 | 100 | 85 | 70 | 98 | 78 | 66 | 55 |
| | 17 | 131 | 112 | 100 | 94 | 89 | 76 | 62 | 86 | 69 | 58 | 49 |
| | 18 | 117 | 99 | 90 | 84 | 79 | 67 | 55 | 77 | 62 | 52 | 44 |
| | 19 | 105 | 89 | 80 | 76 | 71 | 61 | 50 | 69 | 56 | 47 | 39 |
| | 20 | 95 | 81 | 73 | 68 | 64 | 55 | 45 | 62 | 50 | 42 | 36 |
| | 21 | 86 | 73 | 66 | 62 | 58 | 50 | 41 | 57 | 45 | 38 | 32 |
| | 22 | 78 | 67 | 60 | 56 | 53 | 45 | 37 | 52 | 41 | 35 | 29 |
| | 23 | 72 | 61 | 55 | 52 | 48 | 41 | 34 | 47 | 38 | 32 | 27 |
| | 24 | 66 | 56 | 50 | 47 | 44 | 38 | 31 | 43 | 35 | 29 | 25 |
| | 25 | 61 | 52 | 46 | 44 | 41 | 35 | 29 | 40 | 32 | 27 | 23 |
| | 26 | 56 | 48 | 43 | 40 | 38 | 32 | 27 | 37 | 30 | 25 | 21 |
| | 27 | 52 | 44 | 40 | 37 | 35 | 30 | 25 | 34 | 28 | 23 | 19 |
| | 28 | 48 | 41 | 37 | 35 | 33 | 28 | 23 | 32 | 26 | 22 | 18 |
| | 29 | 45 | 38 | 35 | 32 | 30 | 26 | 21 | 30 | 24 | 20 | 17 |
| | 30 | 42 | 36 | 32 | 30 | 28 | 24 | 20 | 28 | 22 | 19 | 16 |
| | 31 | 39 | 34 | 30 | 28 | 27 | 23 | 19 | | 21 | 18 | 15 |
| | 32 | 37 | 31 | 28 | 27 | 25 | 21 | 18 | | | | 14 |
| | 33 | | 30 | 27 | 25 | 23 | 20 | 16 | | | | |
| | 34 | | | | | 22 | 19 | 16 | | | | |
| | 35 | | | | | | | | | | | |
| | 36 | | | | | | | | | | | |
| | 37 | | | | | | | | | | | |
| | 38 | | | | | | | | | | | |
| | 39 | | | | | | | | | | | |
| | 40 | | | | | | | | | | | |
| **Properties** | | | | | | | | | | | | |
| Area, In.$^2$ | | 8.09 | 6.20 | 5.22 | 4.71 | 4.22 | 3.18 | 2.14 | 5.72 | 4.03 | 2.95 | 2.14 |
| I, In.$^4$ | | 31.2 | 24.8 | 21.3 | 19.4 | 17.6 | 13.5 | 9.28 | 19.5 | 14.3 | 10.7 | 7.90 |
| r, In. | | 1.96 | 2.00 | 2.02 | 2.03 | 2.04 | 2.06 | 2.08 | 1.85 | 1.88 | 1.91 | 1.92 |
| B, Bending Factor | | 0.778 | 0.750 | 0.735 | 0.728 | 0.719 | 0.707 | 0.692 | 0.816 | 0.784 | 0.767 | 0.753 |
| a ÷ $10^6$ | | 5.46 | 4.64 | 4.18 | 3.93 | 3.69 | 3.15 | 2.58 | 3.60 | 2.89 | 2.43 | 2.05 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

# HSS / Round Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips




**f'c = 8.0**

| Nominal Outside Diameter | | 5.500 | | | 5.000 | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 0.500 | 0.375 | 0.258 | 0.500 | 0.375 | 0.312 | 0.258 | 0.250 | 0.188 | 0.125 |
| Weight Per Foot | | 26.70 | 20.53 | 14.44 | 24.03 | 18.52 | 15.62 | 13.07 | 12.68 | 9.66 | 6.51 |
| Design Wall Thickness | | 0.465 | 0.349 | 0.241 | 0.465 | 0.349 | 0.291 | 0.241 | 0.233 | 0.174 | 0.116 |
| | | $F_y$ = 46 ksi | | | | | | | | | |
| Effective length KL in feet | 0 | 270 | 230 | 191 | 236 | 200 | 181 | 165 | 162 | 142 | 122 |
| | 4 | 247 | 210 | 174 | 213 | 181 | 164 | 149 | 146 | 128 | 109 |
| | 5 | 239 | 204 | 168 | 205 | 174 | 158 | 143 | 141 | 123 | 105 |
| | 6 | 231 | 196 | 162 | 197 | 167 | 151 | 137 | 135 | 118 | 100 |
| | 7 | 222 | 189 | 156 | 187 | 159 | 144 | 130 | 129 | 112 | 95 |
| | 8 | 212 | 180 | 148 | 177 | 151 | 136 | 123 | 122 | 106 | 89 |
| | 9 | 201 | 171 | 141 | 167 | 142 | 128 | 116 | 114 | 99 | 84 |
| | 10 | 190 | 162 | 133 | 156 | 132 | 120 | 108 | 106 | 92 | 77 |
| | 11 | 179 | 152 | 124 | 144 | 122 | 110 | 99 | 98 | 85 | 71 |
| | 12 | 166 | 141 | 116 | 131 | 112 | 101 | 90 | 89 | 77 | 63 |
| | 13 | 153 | 130 | 106 | 118 | 100 | 90 | 81 | 80 | 68 | 56 |
| | 14 | 140 | 119 | 96 | 103 | 88 | 80 | 71 | 70 | 60 | 48 |
| | 15 | 125 | 107 | 86 | 90 | 77 | 69 | 62 | 61 | 52 | 42 |
| | 16 | 111 | 94 | 75 | 79 | 68 | 61 | 54 | 54 | 46 | 37 |
| | 17 | 98 | 83 | 67 | 70 | 60 | 54 | 48 | 48 | 40 | 33 |
| | 18 | 87 | 74 | 60 | 63 | 53 | 48 | 43 | 42 | 36 | 29 |
| | 19 | 78 | 67 | 54 | 56 | 48 | 43 | 38 | 38 | 32 | 26 |
| | 20 | 71 | 60 | 48 | 51 | 43 | 39 | 35 | 34 | 29 | 24 |
| | 21 | 64 | 55 | 44 | 46 | 39 | 35 | 31 | 31 | 26 | 21 |
| | 22 | 59 | 50 | 40 | 42 | 36 | 32 | 29 | 28 | 24 | 20 |
| | 23 | 54 | 46 | 37 | 38 | 33 | 29 | 26 | 26 | 22 | 18 |
| | 24 | 49 | 42 | 34 | 35 | 30 | 27 | 24 | 24 | 20 | 16 |
| | 25 | 45 | 39 | 31 | 32 | 28 | 25 | 22 | 22 | 19 | 15 |
| | 26 | 42 | 36 | 29 | 30 | 26 | 23 | 21 | 20 | 17 | 14 |
| | 27 | 39 | 33 | 27 | | 24 | 21 | 19 | 19 | 16 | 13 |
| | 28 | 36 | 31 | 25 | | | | 18 | 18 | 15 | 12 |
| | 29 | 34 | 29 | 23 | | | | | | | |
| | 30 | | 27 | 21 | | | | | | | |
| | 31 | | | 20 | | | | | | | |
| | 32 | | | | | | | | | | |
| | 33 | | | | | | | | | | |
| | 34 | | | | | | | | | | |
| | 35 | | | | | | | | | | |
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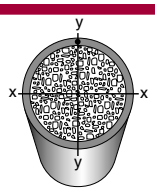
| | 37 | | | | | | | | | | |
| | 38 | | | | | | | | | | |
| | 39 | | | | | | | | | | |
| | 40 | | | | | | | | | | |
| **Properties** | | | | | | | | | | | |
| Area, In.$^2$ | | 7.36 | 5.65 | 3.98 | 6.62 | 5.10 | 4.30 | 3.60 | 3.49 | 2.64 | 1.78 |
| I, In.$^4$ | | 23.5 | 18.8 | 13.8 | 17.2 | 13.9 | 12.0 | 10.2 | 9.94 | 7.69 | 5.31 |
| r, In. | | 1.79 | 1.83 | 1.86 | 1.61 | 1.65 | 1.67 | 1.68 | 1.69 | 1.71 | 1.73 |
| B, Bending Factor | | 0.861 | 0.826 | 0.793 | 0.962 | 0.917 | 0.896 | 0.882 | 0.878 | 0.858 | 0.838 |
| a ÷ $10^6$ | | 4.08 | 3.47 | 2.78 | 2.92 | 2.49 | 2.24 | 2.00 | 1.98 | 1.68 | 1.36 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

# HSS / Round Structural Steel Tubing for Composite Columns

Allowable Concentric Loads in Kips




**f'c = 8.0**

| Nominal Outside Diameter | | 4.500 | | | | 4.000 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Wall Thickness | | 0.337 | 0.237 | 0.188 | 0.125 | 0.337 | 0.313 | 0.250 | 0.237 | 0.226 | 0.220 | 0.188 | 0.125 |
| Weight Per Foot | | 14.98 | 10.79 | 8.66 | 5.84 | 13.18 | 12.33 | 10.01 | 9.52 | 9.11 | 8.88 | 7.65 | 5.17 |
| Design Wall Thickness | | 0.315 | 0.221 | 0.174 | 0.116 | 0.315 | 0.291 | 0.233 | 0.221 | 0.211 | 0.205 | 0.174 | 0.116 |
| | | $F_y$ = 46 ksi | | | | | | | | | | | |
| Effective length KL in feet | 0 | 162 | 135 | 120 | 103 | 137 | 131 | 116 | 113 | 110 | 109 | 100 | 85 |
| | 4 | 144 | 120 | 107 | 90 | 119 | 114 | 101 | 98 | 96 | 94 | 87 | 73 |
| | 5 | 138 | 114 | 102 | 86 | 113 | 108 | 96 | 93 | 91 | 89 | 82 | 69 |
| | 6 | 131 | 108 | 97 | 82 | 106 | 102 | 90 | 87 | 85 | 84 | 77 | 64 |
| | 7 | 124 | 102 | 91 | 77 | 99 | 95 | 83 | 81 | 79 | 78 | 72 | 59 |
| | 8 | 116 | 95 | 85 | 71 | 91 | 87 | 76 | 74 | 72 | 71 | 65 | 54 |
| | 9 | 107 | 88 | 78 | 65 | 82 | 79 | 69 | 67 | 65 | 64 | 59 | 48 |
| | 10 | 98 | 80 | 71 | 59 | 73 | 70 | 61 | 59 | 58 | 57 | 52 | 42 |
| | 11 | 88 | 72 | 64 | 52 | 63 | 60 | 52 | 51 | 50 | 49 | 44 | 36 |
| | 12 | 78 | 63 | 56 | 45 | 53 | 51 | 44 | 43 | 42 | 41 | 37 | 30 |
| | 13 | 67 | 54 | 48 | 39 | 45 | 43 | 38 | 37 | 36 | 35 | 32 | 25 |
| | 14 | 58 | 47 | 41 | 33 | 39 | 37 | 32 | 32 | 31 | 30 | 27 | 22 |
| | 15 | 50 | 41 | 36 | 29 | 34 | 32 | 28 | 28 | 27 | 26 | 24 | 19 |
| | 16 | 44 | 36 | 32 | 25 | 30 | 29 | 25 | 24 | 23 | 23 | 21 | 17 |
| | 17 | 39 | 32 | 28 | 23 | 26 | 25 | 22 | 21 | 21 | 20 | 19 | 15 |
| | 18 | 35 | 28 | 25 | 20 | 24 | 23 | 20 | 19 | 19 | 18 | 17 | 13 |
| | 19 | 31 | 25 | 22 | 18 | 21 | 20 | 18 | 17 | 17 | 16 | 15 | 12 |
| | 20 | 28 | 23 | 20 | 16 | 19 | 18 | 16 | 15 | 15 | 15 | 13 | 11 |
| | 21 | 26 | 21 | 18 | 15 | 17 | 17 | 14 | 14 | 14 | 13 | 12 | 10 |
| | 22 | 23 | 19 | 17 | 13 | | 15 | 13 | 13 | 12 | 12 | 11 | 9 |
| | 23 | 21 | 17 | 15 | 12 | | | | | | | | |
| | 24 | 20 | 16 | 14 | 11 | | | | | | | | |
| | 25 | | 15 | 13 | 10 | | | | | | | | |
| | 26 | | | | | | | | | | | | |
| | 27 | | | | | | | | | | | | |
| | 28 | | | | | | | | | | | | |
| | 29 | | | | | | | | | | | | |
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| | 31 | | | | | | | | | | | | |
| | 32 | | | | | | | | | | | | |
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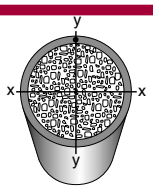
| | 38 | | | | | | | | | | | | |
| | 39 | | | | | | | | | | | | |
| | 40 | | | | | | | | | | | | |
| **Properties** | | | | | | | | | | | | | |
| Area, In.$^2$ | | 4.14 | 2.97 | 2.36 | 1.60 | 3.65 | 3.39 | 2.76 | 2.62 | 2.51 | 2.44 | 2.09 | 1.42 |
| I, In.$^4$ | | 9.12 | 6.82 | 5.54 | 3.84 | 6.24 | 5.87 | 4.91 | 4.70 | 4.52 | 4.41 | 3.83 | 2.67 |
| r, In. | | 1.48 | 1.51 | 1.53 | 1.55 | 1.31 | 1.32 | 1.33 | 1.34 | 1.34 | 1.34 | 1.35 | 1.37 |
| B, Bending Factor | | 1.02 | 0.980 | 0.958 | 0.938 | 1.17 | 1.16 | 1.12 | 1.11 | 1.11 | 1.11 | 1.09 | 1.06 |
| a ÷ $10^6$ | | 1.63 | 1.32 | 1.16 | 0.939 | 1.10 | 1.05 | 0.913 | 0.892 | 0.865 | 0.847 | 0.771 | 0.620 |

Note: Heavy horizontal line indicates kℓ/r limit of 200.

# HSS/Structural Steel Tubing for Composite Columns

## Notes



# HSS APPLICATIONS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