SIDE-BY-SIDE REFERENCE TABLE

# STEEL TUBE SPECIFICATIONS

STEEL TUBE INSTITUTE

## HSS STANDARDS:

| | ASTM A500 | ASTM A1085 | ASTM A1065 | ASTM A847 | CSA G40.21 |
|---|---|---|---|---|---|
| Description | Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes | Standard Specification for Cold-Formed Welded Carbon Steel Hollow Structural Sections (HSS) | Standard Specification for Cold-Formed Welded Carbon Steel Hollow Structural Sections (HSS) | Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Tubing with Improved Atmospheric Corrosion Resistance (Weathering Steel) | General Requirements for Rolled or Welded Structural Quality Steel (for HSS) - A Canadian Standard |

## NON-HSS STANDARDS:

| | ASTM A513 | ASTM A53 | ASTM A252 |
|---|---|---|---|
| Description | Standard Specification for Electric-Resistance-Welded Carbon and Alloy Steel Mechanical Tubing | Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless | Standard Specification for Welded and Seamless Steel Pipe Piles |

| TECHNICAL SPECIFICATIONS FOR TUBULAR MEMBERS[1,2,3,15] | | | | | | | |
|---|---|---|---|---|---|---|---|
| HOLLOW STRUCTURAL SECTION (HSS) SPECIFICATIONS | | | | | | | |
| ASTM/CSA Standard | ASTM A500 | | ASTM A1085 | ASTM A847 | CSA G40.21[4] | ASTM A1065 | |
| Grade | B | C[8,9] | | | 50W | 50 | 50W |
| Yield Strength | 46 ksi | 50 ksi | 50 ksi[14] | 50 ksi | 50 ksi | 50 ksi | |
| Tensile Strength | 58 ksi | 62 ksi | 65 ksi | 70 ksi | 65 ksi – 95 ksi | 60 ksi | 70 ksi |
| Minimum Elongation in 2 inches | 23% | 21% | 21% | 19% | 22% | 21% | |
| Material Availability[3,7] | Produced Regularly | | Produced On Demand | Produced On Demand | Produced Regularly (in Canada) | Produced On Demand | |
| Improved Atmospheric Corrosion Resistance | – | | – | Yes | Yes[13] | – | Yes |
| Maximum Periphery | 88 in | | 88 in | w/ seam, 88 in seamless,[6] 32 in | – | 200 in | |
| Specified Wall Thickness | $t_{nom} \leq 1.000$ in | | 0.148 in $\leq t_{nom} \leq$ 1.000 in | w/ seam, $t_{nom} \leq 1.000$ in seamless,[6] $t_{nom} \leq 0.500$ in | – | $t_{nom} \leq 1.000$ in | |
| Design Wall Thickness[5] | $0.93t_{nom}$ | | $1.0t_{nom}$ | $0.93t_{nom}$ | $1.0t_{nom}$ | $1.0t_{nom}$ | |
| Outside Corner Radii (Square, Rectangular) | $\leq 3t_{nom}$ | | t ≤ 0.400, r = 1.6t to 3.0t<br>t > 0.400, r = 1.8t to 3.0t | $\leq 3t_{nom}$ | t ≤ 0.500, r = varies[11]<br>t > 0.500, r = 3.0t | $\geq 3t_{nom}$ | |
| Charpy V–Notch Test (CVN) | – | | ≥ 25 ft–lb at 40°F Alternate CVN requirements can be requested using supplemental requirement S2 | Test required if included in purchase order using supplemental requirement S1 | To be specified by purchaser[12] | Test required if included in purchase order using supplemental requirement S1 | |
| TOLERANCES | | | | | | | |
| Wall Thickness | +10% / –10% | | +10% / –5% | +10% / –10% | +10% / –5% | +0.03 / –0.01 in | |
| Mass/Weight | – | | +10% / –3.5% | – | +10% / –3.5% | – | |
| Round Outer Diameter (OD) | OD ≤ 1.90 in = ± 0.5%<br>OD ≥ 2.00 in = ± 0.75% | | | | OD ≤ 2–1/2" = ±0.020 in<br>2–1/2" ≤ OD ≤ 3–1/2" = ±0.030 in<br>3–1/2" ≤ OD ≤ 5–1/2" = ±0.040 in<br>OD ≥ 5–1/2" = ±0.01*w | – | |
| Square/Rectangular Outside Large Flat Dimension | w ≤ 2–1/2" = ±0.020 in<br>2–1/2" ≤ w ≤ 3–1/2" = ±0.025 in<br>3–1/2" ≤ w ≤ 5–1/2" = ±0.030 in<br>w ≥ 5–1/2" = ±0.01*w | | | | w ≤ 2–1/2" = ±0.020 in<br>2–1/2" ≤ w ≤ 3–1/2" = ±0.030 in<br>3–1/2" ≤ w ≤ 5–1/2" = ±0.040 in<br>w ≥ 5–1/2" = ±0.01*w | $w_L/w_S < 3$ = ±0.015*flat dimension | |
| Rectangular Outside Small Flat Dimension | $w_L/w_S < 1.5$ = 1.0*Large Flat Tolerance<br>$1.5 \leq w_L/w_S \leq 3.0$ = 1.5*Large Flat Tolerance<br>$w_L/w_S > 3.0$ = 2.0*Large Flat Tolerance | | | | | $w_L/w_S \geq 3$ = ±0.02*flat dimension | |
| Straightness | (1/8 in) * (Length in ft) / 5 | | | | | | |
| Squareness of Sides | 90° ± 2° | | | | | | |

*SEE TABLE NOTES ON REVERSE SIDE

| TECHNICAL SPECIFICATIONS FOR TUBULAR MEMBERS[1,2,3,15] | | | | |
|---|---|---|---|---|
| NON–HSS SPECIFICATIONS | | | | |
| | PIPE PILES | | MECHANICAL TUBE | |
| ASTM | ASTM A252[4] | | ASTM A53 | ASTM A513[4] |
| Grade | 2 | 3[9] | B | 1006 – 8630 |
| Yield Strength | 35 ksi | 45 ksi | 35 ksi | varies by manufacturing process, grade, shape, and thickness |
| Tensile Strength | 60 ksi | 66 ksi | 60 ksi | |
| Minimum Elongation in 2 inches | 25% | 20% | varies based on cross–sectional area | |
| Material Availability[3,7] | Produced On Demand | | Produced Regularly | Produced Regularly |
| Improved Atmospheric Corrosion Resistance | – | | – | – |
| Maximum Periphery | – | | 81.7 in (26 in ∅) | – |
| Specified Wall Thickness | – | | 0.068 in ⩽ $t_{nom}$ ⩽ 2.5 in[10] | – |
| Design Wall Thickness[5] | See Note 4 | | 0.93 | See Note 4 |
| Outside Corner Radii (Square, Rectangular) | – | | – | See Table 17 in ASTM Specification |
| Charpy V–Notch Test (CVN) | – | | – | – |
| TOLERANCES: Wall Thickness | –12.5% | | –12.5% | varies by manufacturing process, grade, shape, and thickness |
| TOLERANCES: Mass/Weight | +15% / –5% | | ± 10% | – |
| TOLERANCES: Round Outer Diameter | +1% / –1% | | ⩽ NPS 1 1/2 = ± 1/64 in<br>⩾ NPS 2 = ± 1% | varies by manufacturing process, grade, shape, and thickness |
| TOLERANCES: Square/Rectangular Outside Dimensions | – | | – | |
| | – | | – | |
| TOLERANCES: Straightness | "reasonably straight" | | "reasonably straight" | varies based on shape and diameter |
| TOLERANCES: Squareness of Sides | – | | – | – |

## TABLE NOTES:

1. A dash ("–") indicates that the specification does not have a requirement for this item.
2. OD = Outer Diameter
   $t_{nom}$ = specified nominal thickness
   w = width of large flat
   $w_L/w_S$ = ratio of large flat width to small flat width
3. For availability of specific sizes of ASTM A500, ASTM A1085, ASTM A1065 and ASTM A513, see: STI HSS Capability Tool
4. Material not included in the scope of AISC 360-22 Specification Table A3.1. Refer to Sections A3.1a and A3.1b, or applicable design standard, for design guidance.
5. Per AISC 360-22, Section B4.2, a factor is required to be multiplied by the nominal HSS thickness to determine the design thickness for engineering calculations.
6. Seamless only applies to round sections
7. Produced Regularly: Indicates standard sizes are typically available
   Produced on Demand: Indicates tube is made to order based on customer needs
8. Preferred grade for structural applications
9. Most common grade
10. Thickness options vary based on Nominal Pipe Size (NPS) designation and ASTM A53 Table X2.2
11. Corner radius varies between 0.128 in and 1.5 in based on thickness
12. HSS with CVN tests can be ordered using the grade designation WT (weldable notch-tough steel) and indicating a Category (which indicates a test energy and temperature)
13. Improved atmospheric corrosion resistance for CSA G40.21 is available by using the below designations. For example, 50AT in lieu of 50W.
    A = Atmospheric corrosion-resistant weldable steel
    AT = Atmospheric corrosion-resistant weldable notch-tough steel
14. Test specimen yield strength cannot exceed 70 ksi
15. For additional information, see:
    Understanding HSS Material Specifications: Which ASTM Should I Specify for HSS? | Steel Tube Institute
    STI Tolerance Guide and Video

## ABOUT THE STEEL TUBE INSTITUTE

The Steel Tube Institute was formed in 1930 when a group of manufacturers joined forces to advance the steel tube industry. Today it is the leading technical resource in North America for steel tube products. STI is dedicated to advancing the growth and competitiveness of North America's steel tubular products. Our strength is bringing together resources to move the industry forward through active collaboration. We accomplish this by effective promotion, education, and problem solving; targeting all trades from engineers and architects to fabricators and field installers.

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