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FOREWORD

The American Institute of Steel Construction, founded 1921, is the non-profit technical specifying and trade organization for the fabricated structural steel industry in the United States. Executive and engineering headquarters of AISC are maintained in Chicago.

The Institute is supported by four classes of membership: Active Members engaged in the fabrication, production, and sale of structural steel; Associate Members, who include Erectors, Detailers, Industry-Related Consultants, Software Developers, and Steel Product Manufacturers; Professional Members, who are individuals or firms engaged in the practice of architecture or engineering, including architectural and engineering educators; and Affiliate Members, who include General Contractors, Building Inspectors, and Code Officials. The continuing financial support and active participation of Members in the engineering, research and development activities of the Institute make possible the publishing of this *Steel Construction Manual.*

The Institute's objective is to make structural steel the material of choice, by being the leader in structural-steel-related technical and market-building activities, including: specification and code development, research, education, technical assistance, quality certification, standardization, and market development. AISC has a long tradition of service to the steel construction industry providing timely and reliable information.

To accomplish these objectives, the Institute publishes manuals, design guides, and specifications. Best known and most widely used is the *Steel Construction Manual*, which holds a highly respected position in engineering literature. Outstanding among AISC standards are the *Specification for Structural Steel Buildings* and the *Code of Standard Practice for Steel Buildings and Bridges.*

The Institute also publishes technical information and timely articles in its *Engineering Journal*, Design Guide series, *Modern Steel Construction* magazine, and other design aids, research reports, and journal articles. Almost all of the information AISC publishes is available for download from the AISC web site at www.aisc.org.

PREFACE

This Manual is the thirteenth major update of the AISC *Steel Construction Manual,* which was first published in 1927. With this revision, the previously separate Allowable Stress Design and Load and Resistance Factor Design methods have been combined. Thus, this Manual replaces both the 9th Edition ASD Manual and the 3rd Edition LRFD Manual. Much of the HSS Connections Manual has also been incorporated and updated in this Manual.

The following specifications, codes and standards are printed in Part 16 of this Manual:

- 2005 AISC *Specification for Structural Steel Buildings*
- 2004 RCSC *Specification for Structural Joints Using ASTM A325 or A490 Bolts*
- 2005 AISC *Code of Standard Practice for Steel Buildings and Bridges*

The following resources are also included on the CD included with this Manual:

- *AISC Design Examples*, which illustrates the application of tables and specification provisions that are included in this Manual.
- *AISC Shapes Database V13.0 and V13.0H*
- Background and supporting literature for the *AISC Steel Construction Manual*

The following major improvements have been made in this revision:

- The number of design examples has been expanded and included in a companion CD.
- All tabular information has been updated to comply with the *2005 Specification for Structural Buildings* and the standards and other documents referenced therein.
- Shape information has been updated to ASTM A6-05, including the new W36 shape series.
- Design methods have been delineated by making use of a dual-color format, with numbers indicated in blue type representing LRFD design values, and numbers indicated in green shading representing ASD design values. Tabulated values presented in black type are independent of design method.
- Information on HSS connections has been integrated throughout this Manual.
- W8 members have been reintegrated into design tables with cautionary statements regarding accessibility and dimensional constraints for connections made to them.
- Shapes with special design considerations, such as slenderness in compression or noncompactness in flexure, have been indicated throughout the member selection tables with footnotes.
- Workable flat dimensions of HSS members have been tabulated.
- Design properties for Pipe are now tabulated using the same wall thickness reduction factor used for HSS.
- An overview of provisions and a simplified method have been included for second-order analysis and stability requirements.
- New information has been added on corrosion protection and compatibility of dissimilar metals.
- Charts have been added for shear strength of plate girders.
- Lower-bound strengths for eccentrically loaded single angles have been tabulated.
- Tables have been added for the critical buckling stress of compression members.

- Tables for members subjected to combined axial load and bending have been expanded and improved.
- A table has been provided for calculating the strength of concentrically loaded weld groups.
- A direct calculation method has been added for calculating the buckling strength of double-coped members.
- Prying action provisions have been modified so that the tensile strength is used in the calculation rather than the yield strength.
- Beam bearing constants have been expanded to include all crippling and yielding cases.
- Revised design procedures for single-plate shear connections have been adopted, including a new design procedure for extended single-plate shear connections.
- An updated design procedure for moment end-plate connections has been adopted based upon yield-line analysis.
- The uniform force method weld ductility factor has changed from 1.4 to 1.25.
- Guidance on washer selection for anchor rods has been expanded.
- The design of bracket plates has been modified so that the plastic section modulus is used rather than the elastic section modulus.
- The AISC Design Guide Series and other supporting references have been further integrated through indexing and references to this material, where appropriate.

In addition, many other improvements have been made throughout this Manual.

By the AISC Committee on Manuals and Textbooks,

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PART 1
DIMENSIONS AND PROPERTIES

SCOPE

The dimensions and properties for structural products commonly used in steel building design and construction are given in this Part. For availability and proper material specifications for these products, as well as general specification requirements and other design considerations, see Part 2. For the design of members, see Parts 3 through 6. For the design of connections, see Parts 7 through 15. For AISC Specifications and Codes, see Part 16. For other miscellaneous information, see Part 17. For torsional and flexural-torsional properties of rolled shapes see AISC Design Guide 9, *Torsional Analysis of Structural Steel Members*. For surface areas, box perimeters and areas, *W/D* ratios and *A/D* ratios, see AISC Design Guide 19, *Fire Resistance of Structural Steel Framing*.

STRUCTURAL PRODUCTS

W-, M-, S-, and HP-Shapes

Four types of H-shaped (or I-shaped) members are covered in this Manual:

- W-shapes, which have essentially parallel inner and outer flange surfaces.
- M-shapes, which are H-shaped members that are not classified in ASTM A6 as W-, S-, or HP-shapes. M-shapes may have a sloped inside flange face or other cross-section features that do not meet the criteria for W-, S-, or HP-shapes.
- S-shapes (also known as American standard beams), which have a slope of approximately 16⅔ percent (2 on 12) on the inner flange surfaces.
- HP-shapes (also known as bearing piles), which are similar to W-shapes, except their webs and flanges are of equal thickness and the depth and flange width are nominally equal for a given designation.

These shapes are designated by the mark W, M, S or HP, nominal depth (in.) and nominal weight (lb/ft). For example, a W24×55 is a W-shape that is nominally 24 in. deep and weighs 55 lb/ft.

The following dimensional and property information is given in this Manual for the W-, M-, S-, and HP-shapes covered in ASTM A6:

- Design dimensions, detailing dimensions, axial properties, and flexural properties are given in Tables 1–1, 1–2, 1–3, and 1–4 for W-, M-, S-, and HP-shapes, respectively.
- SI-equivalent designations are given in Table 17–1 for W-shapes and in Table 17–2 for M-, S-, and HP-shapes.

Tabulated decimal values are appropriate for use in design calculations, whereas fractional values are appropriate for use in detailing. All decimal and fractional values are similar with one exception: Because of the variation in fillet sizes used in shape production, the decimal value, k_{des}, is conservatively presented based on the smallest fillet used in production, and the fractional value, k_{det}, is conservatively presented based on the largest fillet used in production. For the definitions of the tabulated variables, refer to the Nomenclature section at the back of this Manual.

When appropriate, this Manual presents tabulated values for the Workable Gage of a section. The term Workable Gage refers to the gage for fasteners in the flange that provides for entering and tightening clearances and edge distance and spacing requirements. When the listed value is footnoted, the actual size, combination, and orientation of fastener components should be compared with the geometry of the cross-section to ensure compatibility. Other gages that provide for entering and tightening clearances and edge distance and spacing requirements can also be used.

Channels

Two types of channels are covered in this Manual:

- C-shapes (also known as American standard channels), which have a slope of approximately $16^2/_3$ percent (2 on 12) on the inner flange surfaces.
- MC-shapes (also known as miscellaneous channels), which have a slope other than $16^2/_3$ percent (2 on 12) on the inner flange surfaces.

These shapes are designated by the mark C or MC, nominal depth (in.) and nominal weight (lb/ft). For example, a C12×25 is a C-shape that is nominally 12 in. deep and weighs 25 lb/ft.

The following dimensional and property information is given in this Manual for the channels covered in ASTM A6:

- Design dimensions, detailing dimensions, and axial, flexural, and torsional properties are given in Tables 1–5 and 1–6 for C- and MC-shapes, respectively.
- SI-equivalent designations are given in Table 17–3.

For the definitions of the tabulated variables, refer to the Nomenclature section at the back of this Manual.

Angles

Angles (also known as L-shapes) have legs of equal thickness and either equal or unequal leg sizes. Angles are designated by the mark L, leg sizes (in.) and thickness (in.). For example, an L4×3×$^1/_2$ is an angle with one 4-in. leg, one 3-in. leg, and $^1/_2$-in. thickness.

The following dimensional and property information is given in this Manual for the angles covered in ASTM A6:

- Design dimensions, detailing dimensions, and axial, flexural, and flexural-torsional properties are given in Table 1–7. The effects of leg-to-leg and toe fillet radii have been considered in the determination of these section properties. Workable gages on angle legs are tabulated at the end of Table 1–7.
- SI-equivalent designations are given in Table 17–4.

For the definitions of the tabulated variables, refer to the Nomenclature section at the back of this Manual.

Structural Tees (WT-, MT-, and ST-Shapes)

Three types of structural tees are covered in this Manual:

- WT-shapes, which are made from W-shapes.
- MT-shapes, which are made from M-shapes.
- ST-shapes, which are made from S-shapes.

These shapes are designated by the mark WT, MT, or ST, nominal depth (in.) and nominal weight (lb/ft). WT-, MT-, and ST-shapes are split (sheared or thermal-cut) from W-, M-, and S-shapes, respectively, and have half the nominal depth and weight of that shape. For example, a WT12×27.5 is a structural tee split from a W-shape (W24×55), is nominally 12 in. deep and weighs 27.5 lb/ft. Although off-center splitting or splitting on two lines can be obtained by special order, the resulting nonstandard shape is not covered in this Manual.

The following dimensional and property information is given in this Manual for the structural tees cut from the W-, M-, and S-shapes covered in ASTM A6:

- Design dimensions, detailing dimensions, and axial, flexural, and torsional properties are given in Tables 1–8, 1–9, and 1–10 for WT-, MT-, and ST-shapes, respectively.
- SI-equivalent designations are given in Table 17–5 for WT-shapes and in Table 17–6 for MT- and ST-shapes.

For the definitions of the tabulated variables, refer to the Nomenclature section at the back of this Manual.

Hollow Structural Sections (HSS)

Three types of HSS are covered in this Manual:

- Rectangular HSS, which have an essentially rectangular cross-section, except for rounded corners, and uniform wall thickness, except at the weld seam(s).
- Square HSS, which have an essentially square cross-section, except for rounded corners, and uniform wall thickness, except at the weld seam(s).
- Round HSS, which have an essentially round cross-section and uniform wall thickness, except at the weld seam(s).

In each case, ASTM A500 covers only electric-resistance-welded (ERW) HSS with a maximum periphery of 64 in. The coverage of HSS in this Manual is similarly limited.

Rectangular HSS are designated by the mark "HSS," overall outside dimensions (in.), and wall thickness (in.), with all dimensions expressed as fractional numbers. For example, an HSS10×10×1/2 is nominally 10 in. by 10 in. with a 1/2-in. wall thickness. Round HSS are designated by the term "HSS," nominal outside diameter (in.) and wall thickness (in.) with both dimensions expressed to three decimal places. For example, an HSS10.000×0.500 is nominally 10 in. in diameter with a 1/2-in. nominal wall thickness.

Per AISC Specification Section B3.12, the wall thickness used in design, t_{des}, is taken as 0.93 times the nominal wall thickness, t_{nom}. The rationale for this requirement is explained in the corresponding Commentary Section B3.12.

In calculating the tabulated *b/t* and *h/t* ratios, the outside corner radii are taken as $1.5t_{des}$ for rectangular and square HSS, per AISC Specification Section B4.2. In other tabulated design dimensions, the corner radii are taken as $2t_{des}$. In the tabulated workable flat dimensions of rectangular (and square) HSS, the outside corner radii are taken as $2.25t_{nom}$. The term Workable Flat refers to a reasonable flat width or depth of material for use in making connections to HSS. The workable flat dimension is provided as a reflection of current industry practice, although the tolerances of ASTM A500 allow a greater maximum corner radius of $3t_{des}$.

The following dimensional and property information is given in this Manual for the HSS covered in ASTM A500, A501, A618 or A847:

- Design dimensions, detailing dimensions, and axial, strong-axis flexural, weak-axis flexural, torsional and flexural-torsional properties are given in Tables 1–11 and 1–12 for rectangular and square HSS, respectively.
- Design dimensions, detailing dimensions, and axial, flexural, and torsional properties are given in Table 1–13 for round HSS.
- SI-equivalent designations are given in Tables 17–7, 17–8, and 17–9 for rectangular, square, and round HSS, respectively.

For the definitions of the tabulated variables, refer to the Nomenclature section at the back of this Manual.

Pipe

Pipes have an essentially round cross-section and uniform thickness, except at the weld seam(s) for welded pipe.

Pipes up to and including NPS 12 are designated by the term "Pipe," nominal diameter (in.) and weight class (Std., x-strong, xx-strong). NPS stands for "nominal pipe size." For example, Pipe 5 Std. denotes a pipe with a 5-in. nominal diameter and a 0.258-in. wall thickness, which corresponds to the standard weight series. Pipes with wall thicknesses that do not correspond to the foregoing weight classes are designated by the term "Pipe," outside diameter (in.), and wall thickness (in.) with both expressed to three decimal places. For example, Pipe 14.000×0.375 and Pipe 5.563×0.500 are proper designations.

Per AISC Specification Section B3.12, the wall thickness used in design, t_{des}, is taken as 0.93 times the nominal wall thickness, t_{nom}. The rationale for this requirement is explained in the corresponding Commentary Section B3.12.

The following dimensional and property information is given in this Manual for the pipes covered in ASTM A53:

- Design dimensions, detailing dimensions, and axial, flexural, and torsional properties are given in Table 1–14.
- SI-equivalent designations are given in Table 17–10.

For the definitions of the tabulated variables, refer to the Nomenclature section at the back of this Manual.

Double Angles

Double angles (also known as 2L-shapes) are made with two angles that are interconnected through their back-to-back legs along the length of the member, either in contact for the full length or separated by spacers at the points of interconnection.

These shapes are designated by the mark 2L, the sizes and thickness of their legs (in.), and their orientation when the angle legs are not of equal size (LLBB or SLBB).[1] For example, a 2L4×3×½ LLBB has two angles with one 4-in. leg and one 3-in. leg and the 4-in. legs are back-to-back; a 2L4×3×½ SLBB is similar, except the 3-in. legs are back-to-back. In both cases, the legs are ½ in. thick.

[1] LLBB stands for long legs back-to-back. SLBB stands for short legs back-to-back. Alternatively, the orientations LLV and SLV, which stand for long legs vertical and short legs vertical, respectively, can be used.

The following dimensional and property information is given in this Manual for the double angles built-up from the angles covered in ASTM A6:

- Design dimensions, detailing dimensions, and axial, strong-axis flexural, weak-axis flexural, torsional, and flexural-torsional properties are given in Table 1–15 for equal-leg, LLBB and SLBB angles. In each case, angle separations of zero in., 3/8 in., and 3/4 in. are covered. The effects of leg-to-leg and toe fillet radii have been considered in the determination of these section properties. For workable gages on legs of angles, see Table 1–7.

For the definitions of the tabulated variables, refer to the Nomenclature section at the back of this Manual.

Double Channels

Double channels (also known as 2C- and 2MC-shapes) are made with two channels that are interconnected through their back-to-back webs along the length of the member, either in contact for the full length or separated by spacers at the points of interconnection.

These shapes are designated by the mark 2C or 2MC, nominal depth (in.), and nominal weight per channel (lb/ft). For example, a 2C12×25 is a double channel that consists of two channels that are each nominally 12 in. deep and each weigh 25 lb/ft.

The following dimensional and property information is given in this Manual for the double channels built-up from the channels covered in ASTM A6:

- Design dimensions, detailing dimensions, and axial, strong-axis flexural, and weak-axis flexural properties are given in Tables 1–16 and 1–17 for 2C- and 2MC-shapes, respectively. In each case, channel separations of zero, 3/8 in., and 3/4 in. are covered.

For the definitions of the tabulated variables, refer to the Nomenclature section at the back of this Manual.

W-Shapes and S-Shapes with Cap Channels

Common combined sections made with W- or S-shapes and channels (C- or MC-shapes) are tabulated in this Manual. In either case, the channel web is interconnected to the W-shape or S-shape top flange, respectively, with the flange toes down. The interconnection of the two elements must be designed for the horizontal shear, q, where

$$q = \frac{VQ}{I}$$

where

q = horizontal shear, kips/in.
V = vertical shear, kips.
Q = first moment of the channel area about the neutral axis of the combined cross section, in.^{3}
I = moment of inertia of the combined cross-section, in.^{4}

The effects of other forces, such as crane horizontal and lateral forces, may also require consideration, when applicable.

The following dimensional and property information is given in this Manual for combined sections, built-up from the W-shapes, S-shapes, and cap channels covered in ASTM A6:

- Design dimensions, detailing dimensions, and axial, strong-axis flexural and weak-axis flexural properties of W-shapes with cap channels are given in Table 1–19.
- Design dimensions, detailing dimensions, and axial, strong-axis flexural and weak-axis flexural properties of S-shapes with cap channels are given in Table 1–20.

For the definitions of the tabulated variables, refer to the Nomenclature section at the back of this Manual.

Plate Products

Plate products may be ordered as sheet, strip, or bar material. Sheet and strip are distinguished from structural bars and plates by their dimensional characteristics, as outlined in Table 2–2.

The historical classification system for structural bars and plates suggests that there is only a physical difference between them based upon size and production procedure. In raw form, flat stock has historically been classified as a bar if it is less than or equal to 8 in. wide and as a plate if it is greater than 8 in. wide. Bars are rolled between horizontal and vertical rolls and trimmed to length by shearing or thermal cutting on the ends only. Plates are generally produced using one of two methods:

1. Sheared plates are rolled between horizontal rolls and trimmed to width and length by shearing or thermal cutting on the edges and ends; or
2. Stripped plates are sheared or thermal cut from wider sheared plates.

There is very little, if any, structural difference between plates and bars. Consequently, the term "plate" is becoming a universally applied term today and a PL$^1/_2$×4$^1/_2$×1′-3″, for example, might be fabricated from plate or bar stock.

For structural plates, the preferred practice is to specify thickness in $^1/_{16}$-in. increments up to $^3/_8$-in. thickness, $^1/_8$-in. increments over $^3/_8$-in. to 1-in. thickness, and $^1/_4$-in. increments over 1-in. thickness. The current extreme widths for sheared plates is 200 in. Because mill practice regarding plate widths vary, individual mills should be consulted to determine preferences.

For bars, the preferred practice is to specify width in $^1/_4$-in. increments, and thickness and diameter in $^1/_8$-in. increments.

Raised-Pattern Floor Plates

Weights of raised-pattern floor plates are given in Table 1–18. Raised-pattern floor plates are commonly available in widths up to 120 in. For larger plate widths, see literature available from floor plate producers.

Crane Rails

Although crane rails are not listed as structural steel in Code of Standard Practice Section 2.1, this information is provided because some fabricators may choose to provide crane rails. Crane rails are designated by unit weight in lb/yard. Dimensions and properties for the crane rails shown are given in Table 1–21. Crane rails can be either heat treated or end hardened to reduce wear. For additional information or for profiles and properties of crane rails not listed, manufacturer's catalogs should be consulted. For crane-rail connections, see Part 15.

Other Structural Products

The following other structural products are covered in this Manual as indicated:

- High-strength bolts, common bolts, washers, nuts, and direct-tension-indicator washers are covered in Part 7.
- Welding filler metals and fluxes are covered in Part 8.
- Forged steel structural hardware items, such as clevises, turnbuckles, sleeve nuts, recessed-pin nuts, and cotter pins are covered in Part 15.
- Anchor rods and threaded rods are covered in Part 14.

STANDARD MILL PRACTICES

The production of structural products is subject to unavoidable variations relative to the theoretical dimensions and profiles, due to many factors, including roll wear, roll dressing practices, and temperature effects. Such variations are limited by the dimensional and profile tolerances as summarized below.

Hot-Rolled Structural Shapes

Acceptable dimensional tolerances for hot-rolled structural shapes (W-, M-, S-, and HP-shapes), channels (C- and MC-shapes), and angles are given in ASTM A6 Section 13 and summarized in Tables 1–22 through 1–26. Supplementary information, including permissible variations for sheet and strip and for other grades of steel, can also be found in literature from steel plate producers and the Association of Iron and Steel Technology.

Hollow Structural Sections

Acceptable dimensional tolerances for HSS are given in ASTM A500 Section 10, A501 Section 11, A618 Section 8, or A847 Section 10, as applicable, and summarized in Tables 1–27 and 1–28, for rectangular and round HSS, respectively. Supplementary information can also be found in literature from HSS producers and the Steel Tube Institute, such as *Recommended Methods to Check Dimensional Tolerances on Hollow Structural Sections (HSS) Made to ASTM A500.*

Pipe

Acceptable dimensional tolerances for pipes are given in ASTM A53 Section 12 and summarized in Table 1–28. Supplementary information can also be found in literature from pipe producers.

Plate Products

Acceptable dimensional tolerances for plate products are given in ASTM A6 Section 13 and summarized in Table 1–29. Note that plate thickness can be specified in inches or by weight per square foot, and separate tolerances apply to each method. No decimal edge thickness can be assured for plate specified by the latter method. Supplementary information, including permissible variations for sheet and strip and for other grades of steel, can also be found in literature from steel plate producers and the Association of Iron and Steel Technology.

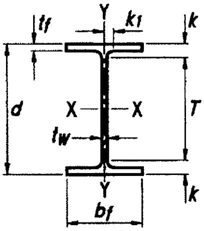


Table 1-1
W Shapes
Dimensions

Shape	Area, A	Depth, d		Web			Flange				Distance				
				Thickness, t_w		$\frac{t_w}{2}$	Width, b_f		Thickness, t_f		k		k_1	T	Workable Gage
											k_{des}	k_{det}			
	in.^{2}	in.		in.		in.	in.		in.		in.	in.	in.	in.	in.
W44×335[c]	98.5	44.0	44	1.03	1	1/2	15.9	16	1.77	1 3/4	2.56	2 5/8	1 5/16	38 3/4	5 1/2
×290[c]	85.4	43.6	43 5/8	0.865	7/8	7/16	15.8	15 7/8	1.58	1 9/16	2.36	2 7/16	1 1/4		
×262[c]	76.9	43.3	43 1/4	0.785	13/16	7/16	15.8	15 3/4	1.42	1 7/16	2.20	2 1/4	1 3/16		
×230[c,v]	67.7	42.9	42 7/8	0.710	11/16	3/8	15.8	15 3/4	1.22	1 1/4	2.01	2 1/16	1 3/16		
W40×593[h]	174	43.0	43	1.79	1 13/16	15/16	16.7	16 3/4	3.23	3 1/4	4.41	4 1/2	2 1/8	34	7 1/2
×503[h]	148	42.1	42	1.54	1 9/16	13/16	16.4	16 3/8	2.76	2 3/4	3.94	4	2		
×431[h]	127	41.3	41 1/4	1.34	1 5/16	11/16	16.2	16 1/4	2.36	2 3/8	3.54	3 5/8	1 7/8		
×397[h]	117	41.0	41	1.22	1 1/4	5/8	16.1	16 1/8	2.20	2 3/16	3.38	3 1/2	1 13/16		
×372[h]	109	40.6	40 5/8	1.16	1 3/16	5/8	16.1	16 1/8	2.05	2 1/16	3.23	3 5/16	1 13/16		
×362[h]	107	40.6	40 1/2	1.12	1 1/8	9/16	16.0	16	2.01	2	3.19	3 1/4	1 3/4		
×324	95.3	40.2	40 1/8	1.00	1	1/2	15.9	15 7/8	1.81	1 13/16	2.99	3 1/16	1 11/16		
×297[c]	87.4	39.8	39 7/8	0.930	15/16	1/2	15.8	15 7/8	1.65	1 5/8	2.83	2 15/16	1 11/16		
×277[c]	81.4	39.7	39 3/4	0.830	13/16	7/16	15.8	15 7/8	1.58	1 9/16	2.76	2 7/8	1 5/8		
×249[c]	73.3	39.4	39 3/8	0.750	3/4	3/8	15.8	15 3/4	1.42	1 7/16	2.60	2 11/16	1 9/16		
×215[c]	63.4	39.0	39	0.650	5/8	5/16	15.8	15 3/4	1.22	1 1/4	2.40	2 1/2	1 9/16		
×199[c]	58.5	38.7	38 5/8	0.650	5/8	5/16	15.8	15 3/4	1.07	1 1/16	2.25	2 5/16	1 9/16		
W40×392[h]	115	41.6	41 5/8	1.42	1 7/16	3/4	12.4	12 3/8	2.52	2 1/2	3.70	3 13/16	1 15/16	34	7 1/2
×331[h]	97.5	40.8	40 3/4	1.22	1 1/4	5/8	12.2	12 1/8	2.13	2 1/8	3.31	3 3/8	1 13/16		
×327[h]	96.0	40.8	40 3/4	1.18	1 3/16	5/8	12.1	12 1/8	2.13	2 1/8	3.31	3 3/8	1 13/16		
×294	86.3	40.4	40 3/8	1.06	1 1/16	9/16	12.0	12	1.93	1 15/16	3.11	3 3/16	1 3/4		
×278	82.0	40.2	40 1/8	1.03	1	1/2	12.0	12	1.81	1 13/16	2.99	3 1/16	1 3/4		
×264	77.6	40.0	40	0.960	15/16	1/2	11.9	11 7/8	1.73	1 3/4	2.91	3	1 11/16		
×235[c]	69.0	39.7	39 3/4	0.830	13/16	7/16	11.9	11 7/8	1.58	1 9/16	2.76	2 7/8	1 5/8		
×211[c]	62.0	39.4	39 3/8	0.750	3/4	3/8	11.8	11 3/4	1.42	1 7/16	2.60	2 11/16	1 9/16		
×183[c]	53.3	39.0	39	0.650	5/8	5/16	11.8	11 3/4	1.20	1 3/16	2.38	2 1/2	1 9/16		
×167[c]	49.2	38.6	38 5/8	0.650	5/8	5/16	11.8	11 3/4	1.03	1	2.21	2 5/16	1 9/16		
×149[c,v]	43.8	38.2	38 1/4	0.630	5/8	5/16	11.8	11 3/4	0.830	13/16	2.01	2 1/8	1 1/2		

[c] Shape is slender for compression with F_y = 50 ksi.
[h] Flange thickness greater than 2 in. Special requirements may apply per AISC Specification Section A3.1c.
[v] Shape does not meet the h/t_w limit for shear in Specification Section G2.1a with F_y = 50 ksi.

Table 1-1 (continued)
W Shapes
Properties

W44 – W40

Nom-inal Wt.	Compact Section Criteria		Axis X-X				Axis Y-Y				r_{ts}	h_o	Torsional Properties	
	$\frac{b_f}{2t_f}$	$\frac{h}{t_w}$	I	S	r	Z	I	S	r	Z			J	C_w
lb/ft			in.^{4}	in.^{3}	in.	in.^{3}	in.^{4}	in.^{3}	in.	in.^{3}	in.	in.	in.^{4}	in.^{6}
335	4.50	38.0	31100	1410	17.8	1620	1200	150	3.49	236	4.24	42.3	74.7	535000
290	5.02	45.0	27000	1240	17.8	1410	1040	132	3.49	205	4.21	42.0	50.9	461000
262	5.57	49.6	24100	1110	17.7	1270	923	117	3.47	182	4.17	41.9	37.3	405000
230	6.45	54.8	20800	971	17.5	1100	796	101	3.43	157	4.13	41.7	24.9	346000
593	2.58	19.1	50400	2340	17.0	2760	2520	302	3.80	481	4.63	39.8	445	997000
503	2.98	22.3	41600	1980	16.8	2310	2040	249	3.72	394	4.50	39.3	277	789000
431	3.44	25.5	34800	1690	16.6	1960	1690	208	3.65	328	4.41	38.9	177	638000
397	3.66	28.0	32000	1560	16.6	1800	1540	191	3.64	300	4.37	38.8	142	579000
372	3.93	29.5	29600	1460	16.5	1680	1420	177	3.60	277	4.34	38.6	116	528000
362	3.99	30.5	28900	1420	16.5	1640	1380	173	3.60	270	4.33	38.5	109	513000
324	4.40	34.2	25600	1280	16.4	1460	1220	153	3.58	239	4.28	38.4	79.4	448000
297	4.80	36.8	23200	1170	16.3	1330	1090	138	3.54	215	4.23	38.2	61.2	399000
277	5.03	41.2	21900	1100	16.4	1250	1040	132	3.58	204	4.25	38.1	51.5	379000
249	5.55	45.6	19600	993	16.3	1120	926	118	3.55	182	4.21	38.0	38.1	334000
215	6.45	52.6	16700	859	16.2	964	796	101	3.54	156	4.18	37.8	24.8	284000
199	7.39	52.6	14900	770	16.0	869	695	88.2	3.45	137	4.12	37.6	18.3	246000
392	2.45	24.1	29900	1440	16.1	1710	803	130	2.64	212	3.30	39.1	172	306000
331	2.86	28.0	24700	1210	15.9	1430	644	106	2.57	172	3.21	38.7	105	241000
327	2.85	29.0	24500	1200	16.0	1410	640	105	2.58	170	3.21	38.7	103	239000
294	3.11	32.2	21900	1080	15.9	1270	562	93.5	2.55	150	3.16	38.5	76.6	208000
278	3.31	33.3	20500	1020	15.8	1190	521	87.1	2.52	140	3.13	38.4	65.0	192000
264	3.45	35.6	19400	971	15.8	1130	493	82.6	2.52	132	3.12	38.3	56.1	181000
235	3.77	41.2	17400	875	15.9	1010	444	74.6	2.54	118	3.11	38.1	41.3	161000
211	4.17	45.6	15500	786	15.8	906	390	66.1	2.51	105	3.07	38.0	30.4	141000
183	4.92	52.6	13200	675	15.7	774	331	56.0	2.49	88.3	3.04	37.8	19.3	118000
167	5.76	52.6	11600	600	15.3	693	283	47.9	2.40	76.0	2.98	37.6	14.0	99700
149	7.11	54.3	9800	513	15.0	598	229	38.8	2.29	62.2	2.89	37.4	9.36	80000

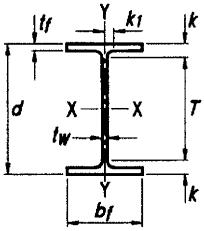


Table 1-1 (continued)
W Shapes
Dimensions

Shape	Area, A	Depth, d		Web: Thickness, t_w		Web: $\frac{t_w}{2}$	Flange: Width, b_f		Flange: Thickness, t_f		Distance: k, k_{des}	Distance: k, k_{det}	Distance: k_1	Distance: T	Workable Gage
	in.^{2}	in.		in.		in.	in.		in.		in.	in.	in.	in.	in.
W36×800[h]	236	42.6	42 1/2	2.38	2 3/8	1 3/16	18.0	18	4.29	4 5/16	5.24	5 9/16	2 3/8	31 3/8	7 1/2
×652[h]	192	41.1	41	1.97	2	1	17.6	17 5/8	3.54	3 9/16	4.49	4 13/16	2 3/16		
×529[h]	156	39.8	39 3/4	1.61	1 5/8	13/16	17.2	17 1/4	2.91	2 15/16	3.86	4 3/16	2		
×487[h]	143	39.3	39 3/8	1.50	1 1/2	3/4	17.1	17 1/8	2.68	2 11/16	3.63	4	1 15/16		
×441[h]	130	38.9	38 7/8	1.36	1 3/8	11/16	17.0	17	2.44	2 7/16	3.39	3 3/4	1 7/8		
×395[h]	116	38.4	38 3/8	1.22	1 1/4	5/8	16.8	16 7/8	2.20	2 3/16	3.15	3 7/16	1 13/16		
×361[h]	106	38.0	38	1.12	1 1/8	9/16	16.7	16 3/4	2.01	2	2.96	3 5/16	1 3/4		
×330	97.0	37.7	37 5/8	1.02	1	1/2	16.6	16 5/8	1.85	1 7/8	2.80	3 1/8	1 3/4		
×302	88.8	37.3	37 3/8	0.945	15/16	1/2	16.7	16 5/8	1.68	1 11/16	2.63	3	1 11/16		
×282[c]	82.9	37.1	37 1/8	0.885	7/8	7/16	16.6	16 5/8	1.57	1 9/16	2.52	2 7/8	1 5/8		
×262[c]	77.0	36.9	36 7/8	0.840	13/16	7/16	16.6	16 1/2	1.44	1 7/16	2.39	2 3/4	1 5/8		
×247[c]	72.5	36.7	36 5/8	0.800	13/16	7/16	16.5	16 1/2	1.35	1 3/8	2.30	2 5/8	1 5/8		
×231[c]	68.1	36.5	36 1/2	0.760	3/4	3/8	16.5	16 1/2	1.26	1 1/4	2.21	2 9/16	1 9/16		
W36×256	75.4	37.4	37 3/8	0.960	15/16	1/2	12.2	12 1/4	1.73	1 3/4	2.48	2 5/8	1 5/16	32 1/8	5 1/2
×232[c]	68.1	37.1	37 1/8	0.870	7/8	7/16	12.1	12 1/8	1.57	1 9/16	2.32	2 7/16	1 1/4		
×210[c]	61.8	36.7	36 3/4	0.830	13/16	7/16	12.2	12 1/8	1.36	1 3/8	2.11	2 5/16	1 1/4		
×194[c]	57.0	36.5	36 1/2	0.765	3/4	3/8	12.1	12 1/8	1.26	1 1/4	2.01	2 3/16	1 3/16		
×182[c]	53.6	36.3	36 3/8	0.725	3/4	3/8	12.1	12 1/8	1.18	1 3/16	1.93	2 1/8	1 3/16		
×170[c]	50.1	36.2	36 1/8	0.680	11/16	3/8	12.0	12	1.10	1 1/8	1.85	2	1 3/16		
×160[c]	47.0	36.0	36	0.650	5/8	5/16	12.0	12	1.02	1	1.77	1 15/16	1 1/8		
×150[c]	44.2	35.9	35 7/8	0.625	5/8	5/16	12.0	12	0.940	15/16	1.69	1 7/8	1 1/8		
×135[c,v]	39.7	35.6	35 1/2	0.600	5/8	5/16	12.0	12	0.790	13/16	1.54	1 11/16	1 1/8		
W33×387[h]	114	36.0	36	1.26	1 1/4	5/8	16.2	16 1/4	2.28	2 1/4	3.07	3 3/16	1 7/16	29 5/8	5 1/2
×354[h]	104	35.6	35 1/2	1.16	1 3/16	5/8	16.1	16 1/8	2.09	2 1/16	2.88	2 15/16	1 3/8		
×318	93.6	35.2	35 1/8	1.04	1 1/16	9/16	16.0	16	1.89	1 7/8	2.68	2 3/4	1 5/16		
×291	85.7	34.8	34 7/8	0.960	15/16	1/2	15.9	15 7/8	1.73	1 3/4	2.52	2 5/8	1 5/16		
×263	77.5	34.5	34 1/2	0.870	7/8	7/16	15.8	15 3/4	1.57	1 9/16	2.36	2 7/16	1 1/4		
×241[c]	71.0	34.2	34 1/8	0.830	13/16	7/16	15.9	15 7/8	1.40	1 3/8	2.19	2 1/4	1 1/4		
×221[c]	65.2	33.9	33 7/8	0.775	3/4	3/8	15.8	15 3/4	1.28	1 1/4	2.06	2 1/8	1 3/16		
×201[c]	59.2	33.7	33 5/8	0.715	11/16	3/8	15.7	15 3/4	1.15	1 1/8	1.94	2	1 3/16		
W33×169[c]	49.5	33.8	33 7/8	0.670	11/16	3/8	11.5	11 1/2	1.22	1 1/4	1.92	2 1/8	1 3/16	29 5/8	5 1/2
×152[c]	44.8	33.5	33 1/2	0.635	5/8	5/16	11.6	11 5/8	1.06	1 1/16	1.76	1 15/16	1 1/8		
×141[c]	41.6	33.3	33 1/4	0.605	5/8	5/16	11.5	11 1/2	0.960	15/16	1.66	1 13/16	1 1/8		
×130[c]	38.3	33.1	33 1/8	0.580	9/16	5/16	11.5	11 1/2	0.855	7/8	1.56	1 3/4	1 1/8		
×118[c,v]	34.7	32.9	32 7/8	0.550	9/16	5/16	11.5	11 1/2	0.740	3/4	1.44	1 5/8	1 1/8		

[c] Shape is slender for compression with F_y = 50 ksi.
[h] Flange thickness greater than 2 in. Special requirements may apply per AISC Specification Section A3.1c.
[v] Shape does not meet the h/t_w limit for shear in Specification Section G2.1a with F_y = 50 ksi.

Table 1-1 (continued)
W Shapes
Properties

W36 – W33

Nominal Wt.	Compact Section Criteria		Axis X-X				Axis Y-Y				r_{ts}	h_o	Torsional Properties	
	$\frac{b_f}{2t_f}$	$\frac{h}{t_w}$	I	S	r	Z	I	S	r	Z			J	C_w
lb/ft			in.^{4}	in.^{3}	in.	in.^{3}	in.^{4}	in.^{3}	in.	in.^{3}	in.	in.	in.^{4}	in.^{6}
800	2.10	13.5	64700	3040	16.6	3650	4200	467	4.22	743	5.14	38.3	1060	1540000
652	2.48	16.3	50600	2460	16.2	2910	3230	367	4.10	581	4.96	37.5	593	1130000
529	2.96	19.9	39600	1990	16.0	2330	2490	289	4.00	454	4.80	36.9	327	846000
487	3.19	21.4	36000	1830	15.8	2130	2250	263	3.96	412	4.74	36.7	258	754000
441	3.48	23.6	32100	1650	15.7	1910	1990	235	3.92	368	4.69	36.4	194	661000
395	3.83	26.3	28500	1490	15.7	1710	1750	208	3.88	325	4.61	36.2	142	575000
361	4.16	28.6	25700	1350	15.6	1550	1570	188	3.85	293	4.58	36.0	109	509000
330	4.49	31.4	23300	1240	15.5	1410	1420	171	3.83	265	4.53	35.8	84.3	456000
302	4.96	33.9	21100	1130	15.4	1280	1300	156	3.82	241	4.53	35.7	64.3	412000
282	5.29	36.2	19600	1050	15.4	1190	1200	144	3.80	223	4.50	35.5	52.7	378000
262	5.75	38.2	17900	972	15.3	1100	1090	132	3.76	204	4.46	35.4	41.6	342000
247	6.11	40.1	16700	913	15.2	1030	1010	123	3.74	190	4.42	35.3	34.7	316000
231	6.54	42.2	15600	854	15.1	963	940	114	3.71	176	4.40	35.2	28.7	292000
256	3.53	33.8	16800	895	14.9	1040	528	86.5	2.65	137	3.25	35.7	52.9	168000
232	3.86	37.3	15000	809	14.8	936	468	77.2	2.62	122	3.21	35.6	39.6	148000
210	4.48	39.1	13200	719	14.6	833	411	67.5	2.58	107	3.18	35.3	28.0	128000
194	4.81	42.4	12100	664	14.6	767	375	61.9	2.56	97.7	3.15	35.2	22.2	116000
182	5.12	44.8	11300	623	14.5	718	347	57.6	2.55	90.7	3.13	35.2	18.5	107000
170	5.47	47.7	10500	581	14.5	668	320	53.2	2.53	83.8	3.11	35.1	15.1	98500
160	5.88	49.9	9760	542	14.4	624	295	49.1	2.50	77.3	3.08	35.0	12.4	90200
150	6.37	51.9	9040	504	14.3	581	270	45.1	2.47	70.9	3.06	34.9	10.1	82200
135	7.56	54.1	7800	439	14.0	509	225	37.7	2.38	59.7	2.99	34.8	7.00	68100
387	3.55	23.7	24300	1350	14.6	1560	1620	200	3.77	312	4.49	33.7	148	459000
354	3.85	25.7	22000	1240	14.5	1420	1460	181	3.74	282	4.44	33.5	115	408000
318	4.23	28.7	19500	1110	14.5	1270	1290	161	3.71	250	4.39	33.3	84.4	357000
291	4.60	31.0	17700	1020	14.4	1160	1160	146	3.68	226	4.35	33.1	65.1	319000
263	5.03	34.3	15900	919	14.3	1040	1040	131	3.66	202	4.31	33.0	48.7	281000
241	5.66	35.9	14200	831	14.1	940	933	118	3.62	182	4.29	32.8	36.2	251000
221	6.20	38.5	12900	759	14.1	857	840	106	3.59	164	4.25	32.7	27.8	224000
201	6.85	41.7	11600	686	14.0	773	749	95.2	3.56	147	4.21	32.5	20.8	198000
169	4.71	44.7	9290	549	13.7	629	310	53.9	2.50	84.4	3.03	32.6	17.7	82400
152	5.48	47.2	8160	487	13.5	559	273	47.2	2.47	73.9	3.01	32.4	12.4	71700
141	6.01	49.6	7450	448	13.4	514	246	42.7	2.43	66.9	2.98	32.3	9.70	64400
130	6.73	51.7	6710	406	13.2	467	218	37.9	2.39	59.5	2.94	32.2	7.37	56600
118	7.76	54.5	5900	359	13.0	415	187	32.6	2.32	51.3	2.89	32.1	5.30	48300

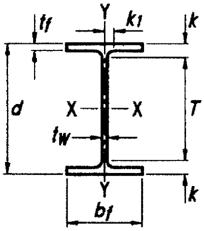


Table 1-1 (continued)
W Shapes
Dimensions

Shape	Area, A	Depth, d		Web Thickness, t_w		$\frac{t_w}{2}$	Flange Width, b_f		Flange Thickness, t_f		Distance k: k_{des}	Distance k: k_{det}	k_1	T	Workable Gage
	in.^{2}	in.		in.		in.	in.		in.		in.	in.	in.	in.	in.
W30×391[h]	115	33.2	33 1/4	1.36	1 3/8	11/16	15.6	15 5/8	2.44	2 7/16	3.23	3 3/8	1 1/2	26 1/2	5 1/2
×357[h]	105	32.8	32 3/4	1.24	1 1/4	5/8	15.5	15 1/2	2.24	2 1/4	3.03	3 1/8	1 7/16		
×326[h]	95.8	32.4	32 3/8	1.14	1 1/8	9/16	15.4	15 3/8	2.05	2 1/16	2.84	2 15/16	1 3/8		
×292	85.9	32.0	32	1.02	1	1/2	15.3	15 1/4	1.85	1 7/8	2.64	2 3/4	1 5/16		
×261	76.9	31.6	31 5/8	0.930	15/16	1/2	15.2	15 1/8	1.65	1 5/8	2.44	2 9/16	1 5/16		
×235	69.2	31.3	31 1/4	0.830	13/16	7/16	15.1	15	1.50	1 1/2	2.29	2 3/8	1 1/4		
×211	62.2	30.9	31	0.775	3/4	3/8	15.1	15 1/8	1.32	1 5/16	2.10	2 1/4	1 3/16		
×191[c]	56.3	30.7	30 5/8	0.710	11/16	3/8	15.0	15	1.19	1 3/16	1.97	2 1/16	1 3/16		
×173[c]	51.0	30.4	30 1/2	0.655	5/8	5/16	15.0	15	1.07	1 1/16	1.85	2	1 1/8		
W30×148[c]	43.5	30.7	30 5/8	0.650	5/8	5/16	10.5	10 1/2	1.18	1 3/16	1.83	2 1/16	1 1/8	26 1/2	5 1/2
×132[c]	38.9	30.3	30 1/4	0.615	5/8	5/16	10.5	10 1/2	1.00	1	1.65	1 7/8	1 1/8		
×124[c]	36.5	30.2	30 1/8	0.585	9/16	5/16	10.5	10 1/2	0.930	15/16	1.58	1 13/16	1 1/8		
×116[c]	34.2	30.0	30	0.565	9/16	5/16	10.5	10 1/2	0.850	7/8	1.50	1 3/4	1 1/8		
×108[c]	31.7	29.8	29 7/8	0.545	9/16	5/16	10.5	10 1/2	0.760	3/4	1.41	1 11/16	1 1/8		
×99[c]	29.1	29.7	29 5/8	0.520	1/2	1/4	10.5	10 1/2	0.670	11/16	1.32	1 9/16	1 1/16		
×90[c,v]	26.4	29.5	29 1/2	0.470	1/2	1/4	10.4	10 3/8	0.610	5/8	1.26	1 1/2	1 1/16		
W27×539[h]	159	32.5	32 1/2	1.97	2	1	15.3	15 1/4	3.54	3 9/16	4.33	4 7/16	1 13/16	23 5/8	5 1/2[g]
×368[h]	108	30.4	30 3/8	1.38	1 3/8	11/16	14.7	14 5/8	2.48	2 1/2	3.27	3 3/8	1 1/2		5 1/2
×336[h]	98.9	30.0	30	1.26	1 1/4	5/8	14.6	14 1/2	2.28	2 1/4	3.07	3 3/16	1 7/16		
×307[h]	90.4	29.6	29 5/8	1.16	1 3/16	5/8	14.4	14 1/2	2.09	2 1/16	2.88	3	1 7/16		
×281	82.9	29.3	29 1/4	1.06	1 1/16	9/16	14.4	14 3/8	1.93	1 15/16	2.72	2 13/16	1 3/8		
×258	76.0	29.0	29	0.980	1	1/2	14.3	14 1/4	1.77	1 3/4	2.56	2 11/16	1 5/16		
×235	69.4	28.7	28 5/8	0.910	15/16	1/2	14.2	14 1/4	1.61	1 5/8	2.40	2 1/2	1 5/16		
×217	64.0	28.4	28 3/8	0.830	13/16	7/16	14.1	14 1/8	1.50	1 1/2	2.29	2 3/8	1 1/4		
×194	57.2	28.1	28 1/8	0.750	3/4	3/8	14.0	14	1.34	1 5/16	2.13	2 1/4	1 3/16		
×178	52.5	27.8	27 3/4	0.725	3/4	3/8	14.1	14 1/8	1.19	1 3/16	1.98	2 1/16	1 3/16		
×161[c]	47.6	27.6	27 5/8	0.660	11/16	3/8	14.0	14	1.08	1 1/16	1.87	2	1 3/16		
×146[c]	43.1	27.4	27 3/8	0.605	5/8	5/16	14.0	14	0.975	1	1.76	1 7/8	1 1/8		
W27×129[c]	37.8	27.6	27 5/8	0.610	5/8	5/16	10.0	10	1.10	1 1/8	1.70	2	1 1/8	23 5/8	5 1/2
×114[c]	33.5	27.3	27 1/4	0.570	9/16	5/16	10.1	10 1/8	0.930	15/16	1.53	1 13/16	1 1/8		
×102[c]	30.0	27.1	27 1/8	0.515	1/2	1/4	10.0	10	0.830	13/16	1.43	1 3/4	1 1/16		
×94[c]	27.7	26.9	26 7/8	0.490	1/2	1/4	10.0	10	0.745	3/4	1.34	1 5/8	1 1/16		
×84[c]	24.8	26.7	26 3/4	0.460	7/16	1/4	10.0	10	0.640	5/8	1.24	1 9/16	1 1/16		

[c] Shape is slender for compression with F_y = 50 ksi.
[g] The actual size, combination, and orientation of fastener components should be compared with the geometry of the cross-section to ensure compatibility.
[h] Flange thickness greater than 2 in. Special requirements may apply per AISC Specification Section A3.1c.
[v] Shape does not meet the h/t_w limit for shear in Specification Section G2.1a with F_y = 50 ksi.

Table 1-1 (continued)
W Shapes
Properties

W30 – W27

Nom-inal Wt.	Compact Section Criteria		Axis X-X				Axis Y-Y				r_{ts}	h_o	Torsional Properties	
	$\frac{b_f}{2t_f}$	$\frac{h}{t_w}$	I	S	r	Z	I	S	r	Z			J	C_w
lb/ft			in.^{4}	in.^{3}	in.	in.^{3}	in.^{4}	in.^{3}	in.	in.^{3}	in.	in.	in.^{4}	in.^{6}
391	3.19	19.7	20700	1250	13.4	1450	1550	198	3.67	310	4.37	30.8	173	366000
357	3.45	21.6	18700	1140	13.3	1320	1390	179	3.64	279	4.32	30.6	134	324000
326	3.75	23.4	16800	1040	13.2	1190	1240	162	3.60	252	4.27	30.4	103	287000
292	4.12	26.2	14900	930	13.2	1060	1100	144	3.58	223	4.22	30.2	75.2	250000
261	4.59	28.7	13100	829	13.1	943	959	127	3.53	196	4.16	30.0	54.1	215000
235	5.02	32.2	11700	748	13.0	847	855	114	3.51	175	4.13	29.8	40.3	190000
211	5.74	34.5	10300	665	12.9	751	757	100	3.49	155	4.10	29.6	28.4	166000
191	6.35	37.7	9200	600	12.8	675	673	89.5	3.46	138	4.07	29.5	21.0	146000
173	7.04	40.8	8230	541	12.7	607	598	79.8	3.42	123	4.03	29.4	15.6	129000
148	4.44	41.6	6680	436	12.4	500	227	43.3	2.28	68.0	2.77	29.5	14.5	49400
132	5.27	43.9	5770	380	12.2	437	196	37.2	2.25	58.4	2.75	29.3	9.72	42100
124	5.65	46.2	5360	355	12.1	408	181	34.4	2.23	54.0	2.73	29.2	7.99	38600
116	6.17	47.8	4930	329	12.0	378	164	31.3	2.19	49.2	2.70	29.2	6.43	34900
108	6.89	49.6	4470	299	11.9	346	146	27.9	2.15	43.9	2.66	29.1	4.99	30900
99	7.80	51.9	3990	269	11.7	312	128	24.5	2.10	38.6	2.62	29.0	3.77	26800
90	8.52	57.5	3610	245	11.7	283	115	22.1	2.09	34.7	2.60	28.9	2.84	24000
539	2.15	12.1	25600	1570	12.7	1890	2110	277	3.65	437	4.41	29.0	496	443000
368	2.96	17.3	16200	1060	12.2	1240	1310	179	3.48	279	4.14	27.9	170	255000
336	3.19	18.9	14600	972	12.1	1130	1180	162	3.45	252	4.09	27.7	131	226000
307	3.46	20.6	13100	887	12.0	1030	1050	146	3.41	227	4.04	27.5	101	199000
281	3.72	22.5	11900	814	12.0	936	953	133	3.39	206	4.00	27.4	79.5	178000
258	4.03	24.4	10800	745	11.9	852	859	120	3.36	187	3.96	27.2	61.6	159000
235	4.41	26.2	9700	677	11.8	772	769	108	3.33	168	3.92	27.1	47.0	141000
217	4.71	28.7	8910	627	11.8	711	704	100	3.32	154	3.89	26.9	37.6	128000
194	5.24	31.8	7860	559	11.7	631	619	88.1	3.29	136	3.85	26.8	27.1	111000
178	5.92	32.9	7020	505	11.6	570	555	78.8	3.25	122	3.83	26.6	20.1	98400
161	6.49	36.1	6310	458	11.5	515	497	70.9	3.23	109	3.79	26.5	15.1	87300
146	7.16	39.4	5660	414	11.5	464	443	63.5	3.20	97.7	3.76	26.4	11.3	77200
129	4.55	39.7	4760	345	11.2	395	184	36.8	2.21	57.6	2.66	26.5	11.1	32500
114	5.41	42.5	4080	299	11.0	343	159	31.5	2.18	49.3	2.64	26.4	7.33	27600
102	6.03	47.1	3620	267	11.0	305	139	27.8	2.15	43.4	2.62	26.3	5.28	24000
94	6.70	49.5	3270	243	10.9	278	124	24.8	2.12	38.8	2.59	26.2	4.03	21300
84	7.78	52.7	2850	213	10.7	244	106	21.2	2.07	33.2	2.54	26.1	2.81	17900

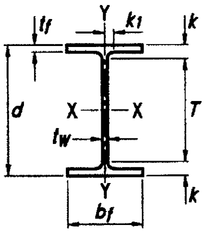


Table 1–1 (continued)
W Shapes
Dimensions

Shape	Area, A	Depth, d		Web: Thickness, t_w		Web: $\frac{t_w}{2}$	Flange: Width, b_f		Flange: Thickness, t_f		Distance: k, k_{des}	Distance: k, k_{det}	k_1	T	Workable Gage
	in.^{2}	in.		in.		in.	in.		in.		in.	in.	in.	in.	in.
W24×370[h]	109	28.0	28	1.52	1 1/2	3/4	13.7	13 5/8	2.72	2 3/4	3.22	3 5/8	1 9/16	20 3/4	5 1/2
×335[h]	98.4	27.5	27 1/2	1.38	1 3/8	11/16	13.5	13 1/2	2.48	2 1/2	2.98	3 3/8	1 1/2		
×306[h]	89.8	27.1	27 1/8	1.26	1 1/4	5/8	13.4	13 3/8	2.28	2 1/4	2.78	3 3/16	1 7/16		
x279[h]	82.0	26.7	26 3/4	1.16	1 3/16	5/8	13.3	13 1/4	2.09	2 1/16	2.59	3	1 7/16		
×250	73.5	26.3	26 3/8	1.04	1 1/16	9/16	13.2	13 1/8	1.89	1 7/8	2.39	2 13/16	1 3/8		
×229	67.2	26.0	26	0.960	15/16	1/2	13.1	13 1/8	1.73	1 3/4	2.23	2 5/8	1 5/16		
×207	60.7	25.7	25 3/4	0.870	7/8	7/16	13.0	13	1.57	1 9/16	2.07	2 1/2	1 1/4		
×192	56.3	25.5	25 1/2	0.810	13/16	7/16	13.0	13	1.46	1 7/16	1.96	2 3/8	1 1/4		
×176	51.7	25.2	25 1/4	0.750	3/4	3/8	12.9	12 7/8	1.34	1 5/16	1.84	2 1/4	1 3/16		
×162	47.7	25.0	25	0.705	11/16	3/8	13.0	13	1.22	1 1/4	1.72	2 1/8	1 3/16		
×146	43.0	24.7	24 3/4	0.650	5/8	5/16	12.9	12 7/8	1.09	1 1/16	1.59	2	1 1/8		
×131	38.5	24.5	24 1/2	0.605	5/8	5/16	12.9	12 7/8	0.960	15/16	1.46	1 7/8	1 1/8		
×117[c]	34.4	24.3	24 1/4	0.550	9/16	5/16	12.8	12 3/4	0.850	7/8	1.35	1 3/4	1 1/8		
×104[c]	30.6	24.1	24	0.500	1/2	1/4	12.8	12 3/4	0.750	3/4	1.25	1 5/8	1 1/16		
W24×103[c]	30.3	24.5	24 1/2	0.550	9/16	5/16	9.00	9	0.980	1	1.48	1 7/8	1 1/8	20 3/4	5 1/2
×94[c]	27.7	24.3	24 1/4	0.515	1/2	1/4	9.07	9 1/8	0.875	7/8	1.38	1 3/4	1 1/16		
×84[c]	24.7	24.1	24 1/8	0.470	1/2	1/4	9.02	9	0.770	3/4	1.27	1 11/16	1 1/16		
×76[c]	22.4	23.9	23 7/8	0.440	7/16	1/4	8.99	9	0.680	11/16	1.18	1 9/16	1 1/16		
×68[c]	20.1	23.7	23 3/4	0.415	7/16	1/4	8.97	9	0.585	9/16	1.09	1 1/2	1 1/16		
W24×62[c]	18.2	23.7	23 3/4	0.430	7/16	1/4	7.04	7	0.590	9/16	1.09	1 1/2	1 1/16	20 3/4	3 1/2[g]
×55[c,v]	16.2	23.6	23 5/8	0.395	3/8	3/16	7.01	7	0.505	1/2	1.01	1 7/16	1	20 3/4	3 1/2[g]
W21×201	59.2	23.0	23	0.910	15/16	1/2	12.6	12 5/8	1.63	1 5/8	2.13	2 1/2	1 5/16	18	5 1/2
×182	53.6	22.7	22 3/4	0.830	13/16	7/16	12.5	12 1/2	1.48	1 1/2	1.98	2 3/8	1 1/4		
×166	48.8	22.5	22 1/2	0.750	3/4	3/8	12.4	12 3/8	1.36	1 3/8	1.86	2 1/4	1 3/16		
×147	43.2	22.1	22	0.720	3/4	3/8	12.5	12 1/2	1.15	1 1/8	1.65	2	1 3/16		
×132	38.8	21.8	21 7/8	0.650	5/8	5/16	12.4	12 1/2	1.04	1 1/16	1.54	1 15/16	1 1/8		
×122	35.9	21.7	21 5/8	0.600	5/8	5/16	12.4	12 3/8	0.960	15/16	1.46	1 13/16	1 1/8		
×111	32.7	21.5	21 1/2	0.550	9/16	5/16	12.3	12 3/8	0.875	7/8	1.38	1 3/4	1 1/8		
×101[c]	29.8	21.4	21 3/8	0.500	1/2	1/4	12.3	12 1/4	0.800	13/16	1.30	1 11/16	1 1/16		

[c] Shape is slender for compression with F_y = 50 ksi.
[g] The actual size, combination, and orientation of fastener components should be compared with the geometry of the cross-section to ensure compatibility.
[h] Flange thickness greater than 2 in. Special requirements may apply per AISC Specification Section A3.1c.
[v] Shape does not meet the h/t_w limit for shear in Specification Section G2.1a with F_y = 50 ksi.

Table 1–1 (continued)
W Shapes
Properties

W24 – W21

Nom-inal Wt.	Compact Section Criteria		Axis X-X				Axis Y-Y				r_{ts}	h_o	Torsional Properties	
	$\frac{b_f}{2t_f}$	$\frac{h}{t_w}$	I	S	r	Z	I	S	r	Z			J	C_w
lb/ft			in.^{4}	in.^{3}	in.	in.^{3}	in.^{4}	in.^{3}	in.	in.^{3}	in.	in.	in.^{4}	in.^{6}
370	2.51	14.2	13400	957	11.1	1130	1160	170	3.27	267	3.92	25.3	201	186000
335	2.73	15.6	11900	864	11.0	1020	1030	152	3.23	238	3.86	25.0	152	161000
306	2.94	17.1	10700	789	10.9	922	919	137	3.20	214	3.81	24.9	117	142000
279	3.18	18.6	9600	718	10.8	835	823	124	3.17	193	3.76	24.6	90.5	125000
250	3.49	20.7	8490	644	10.7	744	724	110	3.14	171	3.71	24.5	66.6	108000
229	3.79	22.5	7650	588	10.7	675	651	99.4	3.11	154	3.67	24.3	51.3	96100
207	4.14	24.8	6820	531	10.6	606	578	88.8	3.08	137	3.62	24.1	38.3	84100
192	4.43	26.6	6260	491	10.5	559	530	81.8	3.07	126	3.60	24.0	30.8	76300
176	4.81	28.7	5680	450	10.5	511	479	74.3	3.04	115	3.57	23.9	23.9	68400
162	5.31	30.6	5170	414	10.4	468	443	68.4	3.05	105	3.57	23.8	18.5	62600
146	5.92	33.2	4580	371	10.3	418	391	60.5	3.01	93.2	3.53	23.7	13.4	54600
131	6.70	35.6	4020	329	10.2	370	340	53.0	2.97	81.5	3.49	23.5	9.50	47100
117	7.53	39.2	3540	291	10.1	327	297	46.5	2.94	71.4	3.46	23.4	6.72	40800
104	8.50	43.1	3100	258	10.1	289	259	40.7	2.91	62.4	3.42	23.3	4.72	35200
103	4.59	39.2	3000	245	10.0	280	119	26.5	1.99	41.5	2.40	23.6	7.07	16600
94	5.18	41.9	2700	222	9.87	254	109	24.0	1.98	37.5	2.40	23.4	5.26	15000
84	5.86	45.9	2370	196	9.79	224	94.4	20.9	1.95	32.6	2.37	23.3	3.70	12800
76	6.61	49.0	2100	176	9.69	200	82.5	18.4	1.92	28.6	2.34	23.2	2.68	11100
68	7.66	52.0	1830	154	9.55	177	70.4	15.7	1.87	24.5	2.30	23.1	1.87	9430
62	5.97	50.1	1550	131	9.23	153	34.5	9.80	1.38	15.7	1.75	23.2	1.71	4620
55	6.94	54.6	1350	114	9.11	134	29.1	8.30	1.34	13.3	1.71	23.1	1.18	3870
201	3.86	20.6	5310	461	9.47	530	542	86.1	3.02	133	3.55	21.4	40.9	62000
182	4.22	22.6	4730	417	9.40	476	483	77.2	3.00	119	3.51	21.2	30.7	54400
166	4.57	25.0	4280	380	9.36	432	435	70.0	2.99	108	3.48	21.1	23.6	48500
147	5.44	26.1	3630	329	9.17	373	376	60.1	2.95	92.6	3.45	20.9	15.4	41100
132	6.01	28.9	3220	295	9.12	333	333	53.5	2.93	82.3	3.42	20.8	11.3	36000
122	6.45	31.3	2960	273	9.09	307	305	49.2	2.92	75.6	3.40	20.7	8.98	32700
111	7.05	34.1	2670	249	9.05	279	274	44.5	2.90	68.2	3.37	20.6	6.83	29200
101	7.68	37.5	2420	227	9.02	253	248	40.3	2.89	61.7	3.35	20.6	5.21	26200

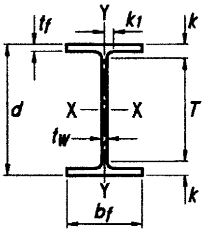


Table 1-1 (continued)
W Shapes
Dimensions

Shape	Area, A	Depth, d		Web Thickness, t_w		Web $\frac{t_w}{2}$	Flange Width, b_f		Flange Thickness, t_f		Distance k k_{des}	Distance k k_{det}	k_1	T	Workable Gage
	in.²	in.		in.		in.	in.		in.		in.	in.	in.	in.	in.
W21×93	27.3	21.6	21 5/8	0.580	9/16	5/16	8.42	8 3/8	0.930	15/16	1.43	1 5/8	15/16	18 3/8	5 1/2
×83[c]	24.3	21.4	21 3/8	0.515	1/2	1/4	8.36	8 3/8	0.835	13/16	1.34	1 1/2	7/8		
×73[c]	21.5	21.2	21 1/4	0.455	7/16	1/4	8.30	8 1/4	0.740	3/4	1.24	1 7/16	7/8		
×68[c]	20.0	21.1	21 1/8	0.430	7/16	1/4	8.27	8 1/4	0.685	11/16	1.19	1 3/8	7/8		
×62[c]	18.3	21.0	21	0.400	3/8	3/16	8.24	8 1/4	0.615	5/8	1.12	1 5/16	13/16		
×55[c]	16.2	20.8	20 3/4	0.375	3/8	3/16	8.22	8 1/4	0.522	1/2	1.02	1 3/16	13/16		
×48[c,f]	14.1	20.6	20 5/8	0.350	3/8	3/16	8.14	8 1/8	0.430	7/16	0.930	1 1/8	13/16		
W21×57[c]	16.7	21.1	21	0.405	3/8	3/16	6.56	6 1/2	0.650	5/8	1.15	1 5/16	13/16	18 3/8	3 1/2
×50[c]	14.7	20.8	20 7/8	0.380	3/8	3/16	6.53	6 1/2	0.535	9/16	1.04	1 1/4	13/16		
×44[c]	13.0	20.7	20 5/8	0.350	3/8	3/16	6.50	6 1/2	0.450	7/16	0.950	1 1/8	13/16		
W18×311[h]	91.6	22.3	22 3/8	1.52	1 1/2	3/4	12.0	12	2.74	2 3/4	3.24	3 7/16	1 3/8	15 1/2	5 1/2
×283[h]	83.3	21.9	21 7/8	1.40	1 3/8	11/16	11.9	11 7/8	2.50	2 1/2	3.00	3 3/16	1 5/16		
×258[h]	75.9	21.5	21 1/2	1.28	1 1/4	5/8	11.8	11 3/4	2.30	2 5/16	2.70	3	1 1/4		
×234[h]	68.8	21.1	21	1.16	1 3/16	5/8	11.7	11 5/8	2.11	2 1/8	2.51	2 3/4	1 3/16		
×211	62.1	20.7	20 5/8	1.06	1 1/16	9/16	11.6	11 1/2	1.91	1 15/16	2.31	2 9/16	1 3/16		
×192	56.4	20.4	20 3/8	0.960	15/16	1/2	11.5	11 1/2	1.75	1 3/4	2.15	2 7/16	1 1/8		
×175	51.3	20.0	20	0.890	7/8	7/16	11.4	11 3/8	1.59	1 9/16	1.99	2 7/16	1 1/4	15 1/8	
×158	46.3	19.7	19 3/4	0.810	13/16	7/16	11.3	11 1/4	1.44	1 7/16	1.84	2 3/8	1 1/4		
×143	42.1	19.5	19 1/2	0.730	3/4	3/8	11.2	11 1/4	1.32	1 5/16	1.72	2 3/16	1 3/16		
×130	38.2	19.3	19 1/4	0.670	11/16	3/8	11.2	11 1/8	1.20	1 3/16	1.60	2 1/16	1 3/16		
×119	35.1	19.0	19	0.655	5/8	5/16	11.3	11 1/4	1.06	1 1/16	1.46	1 15/16	1 3/16		
×106	31.1	18.7	18 3/4	0.590	9/16	5/16	11.2	11 1/4	0.940	15/16	1.34	1 13/16	1 1/8		
×97	28.5	18.6	18 5/8	0.535	9/16	5/16	11.1	11 1/8	0.870	7/8	1.27	1 3/4	1 1/8		
×86	25.3	18.4	18 3/8	0.480	1/2	1/4	11.1	11 1/8	0.770	3/4	1.17	1 5/8	1 1/16		
×76[c]	22.3	18.2	18 1/4	0.425	7/16	1/4	11.0	11	0.680	11/16	1.08	1 9/16	1 1/16		
W18×71	20.8	18.5	18 1/2	0.495	1/2	1/4	7.64	7 5/8	0.810	13/16	1.21	1 1/2	7/8	15 1/2	3 1/2[g]
×65	19.1	18.4	18 3/8	0.450	7/16	1/4	7.59	7 5/8	0.750	3/4	1.15	1 7/16	7/8		
×60[c]	17.6	18.2	18 1/4	0.415	7/16	1/4	7.56	7 1/2	0.695	11/16	1.10	1 3/8	13/16		
×55[c]	16.2	18.1	18 1/8	0.390	3/8	3/16	7.53	7 1/2	0.630	5/8	1.03	1 5/16	13/16		
×50[c]	14.7	18.0	18	0.355	3/8	3/16	7.50	7 1/2	0.570	9/16	0.972	1 1/4	13/16		
W18×46[c]	13.5	18.1	18	0.360	3/8	3/16	6.06	6	0.605	5/8	1.01	1 1/4	13/16	15 1/2	3 1/2[g]
×40[c]	11.8	17.9	17 7/8	0.315	5/16	3/16	6.02	6	0.525	1/2	0.927	1 3/16	13/16		
×35[c]	10.3	17.7	17 3/4	0.300	5/16	3/16	6.00	6	0.425	7/16	0.827	1 1/8	3/4		

[c] Shape is slender for compression with $F_y = 50$ ksi.
[f] Shape exceeds compact limit for flexure with $F_y = 50$ ksi.
[g] The actual size, combination, and orientation of fastener components should be compared with the geometry of the cross-section to ensure compatibility.
[h] Flange thickness greater than 2 in. Special requirements may apply per AISC Specification Section A3.1c.

Table 1–1 (continued)
W Shapes
Properties

W21 – W18

Nom-inal Wt.	Compact Section Criteria		Axis X-X				Axis Y-Y				r_{ts}	h_o	Torsional Properties	
	$\frac{b_f}{2t_f}$	$\frac{h}{t_w}$	I	S	r	Z	I	S	r	Z			J	C_w
lb/ft			in.^{4}	in.^{3}	in.	in.^{3}	in.^{4}	in.^{3}	in.	in.^{3}	in.	in.	in.^{4}	in.^{6}
93	4.53	32.3	2070	192	8.70	221	92.9	22.1	1.84	34.7	2.24	20.7	6.03	9940
83	5.00	36.4	1830	171	8.67	196	81.4	19.5	1.83	30.5	2.21	20.6	4.34	8630
73	5.60	41.2	1600	151	8.64	172	70.6	17.0	1.81	26.6	2.19	20.5	3.02	7410
68	6.04	43.6	1480	140	8.60	160	64.7	15.7	1.80	24.4	2.17	20.4	2.45	6760
62	6.70	46.9	1330	127	8.54	144	57.5	14.0	1.77	21.7	2.15	20.4	1.83	5960
55	7.87	50.0	1140	110	8.40	126	48.4	11.8	1.73	18.4	2.11	20.3	1.24	4980
48	9.47	53.6	959	93.0	8.24	107	38.7	9.52	1.66	14.9	2.05	20.2	0.803	3950
57	5.04	46.3	1170	111	8.36	129	30.6	9.35	1.35	14.8	1.68	20.4	1.77	3190
50	6.10	49.4	984	94.5	8.18	110	24.9	7.64	1.30	12.2	1.64	20.3	1.14	2570
44	7.22	53.6	843	81.6	8.06	95.4	20.7	6.37	1.26	10.2	1.60	20.2	0.770	2110
311	2.19	10.4	6970	624	8.72	754	795	132	2.95	207	3.53	19.6	176	76200
283	2.38	11.3	6170	565	8.61	676	704	118	2.91	185	3.47	19.4	134	65900
258	2.56	12.5	5510	514	8.53	611	628	107	2.88	166	3.42	19.2	103	57600
234	2.76	13.8	4900	466	8.44	549	558	95.8	2.85	149	3.37	19.0	78.7	50100
211	3.02	15.1	4330	419	8.35	490	493	85.3	2.82	132	3.32	18.8	58.6	43400
192	3.27	16.7	3870	380	8.28	442	440	76.8	2.79	119	3.28	18.6	44.7	38000
175	3.58	18.0	3450	344	8.20	398	391	68.8	2.76	106	3.24	18.5	33.8	33300
158	3.92	19.8	3060	310	8.12	356	347	61.4	2.74	94.8	3.20	18.3	25.2	29000
143	4.25	22.0	2750	282	8.09	322	311	55.5	2.72	85.4	3.17	18.2	19.2	25700
130	4.65	23.9	2460	256	8.03	290	278	49.9	2.70	76.7	3.13	18.1	14.5	22700
119	5.31	24.5	2190	231	7.90	262	253	44.9	2.69	69.1	3.13	17.9	10.6	20300
106	5.96	27.2	1910	204	7.84	230	220	39.4	2.66	60.5	3.10	17.8	7.48	17400
97	6.41	30.0	1750	188	7.82	211	201	36.1	2.65	55.3	3.08	17.7	5.86	15800
86	7.20	33.4	1530	166	7.77	186	175	31.6	2.63	48.4	3.05	17.6	4.10	13600
76	8.11	37.8	1330	146	7.73	163	152	27.6	2.61	42.2	3.02	17.5	2.83	11700
71	4.71	32.4	1170	127	7.50	146	60.3	15.8	1.70	24.7	2.05	17.7	3.49	4700
65	5.06	35.7	1070	117	7.49	133	54.8	14.4	1.69	22.5	2.03	17.6	2.73	4240
60	5.44	38.7	984	108	7.47	123	50.1	13.3	1.68	20.6	2.02	17.5	2.17	3850
55	5.98	41.1	890	98.3	7.41	112	44.9	11.9	1.67	18.5	2.00	17.5	1.66	3430
50	6.57	45.2	800	88.9	7.38	101	40.1	10.7	1.65	16.6	1.98	17.4	1.24	3040
46	5.01	44.6	712	78.8	7.25	90.7	22.5	7.43	1.29	11.7	1.58	17.5	1.22	1720
40	5.73	50.9	612	68.4	7.21	78.4	19.1	6.35	1.27	10.0	1.56	17.4	0.810	1440
35	7.06	53.5	510	57.6	7.04	66.5	15.3	5.12	1.22	8.06	1.52	17.3	0.506	1140

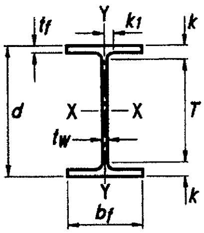


Table 1-1 (continued)
W Shapes
Dimensions

Shape	Area, A	Depth, d		Web Thickness, t_w		Web $\frac{t_w}{2}$	Flange Width, b_f		Flange Thickness, t_f		Distance k k_{des}	Distance k k_{det}	k_1	T	Workable Gage
	in.²	in.		in.		in.	in.		in.		in.	in.	in.	in.	in.
W16×100	29.5	17.0	17	0.585	9/16	5/16	10.4	10 3/8	0.985	1	1.39	1 7/8	1 1/8	13 1/4	5 1/2
×89	26.2	16.8	16 3/4	0.525	1/2	1/4	10.4	10 3/8	0.875	7/8	1.28	1 3/4	1 1/16		
×77	22.6	16.5	16 1/2	0.455	7/16	1/4	10.3	10 1/4	0.760	3/4	1.16	1 5/8	1 1/16		
×67[c]	19.7	16.3	16 3/8	0.395	3/8	3/16	10.2	10 1/4	0.665	11/16	1.07	1 9/16	1	↓	↓
W16×57	16.8	16.4	16 3/8	0.430	7/16	1/4	7.12	7 1/8	0.715	11/16	1.12	1 3/8	7/8	13 5/8	3 1/2[g]
×50[c]	14.7	16.3	16 1/4	0.380	3/8	3/16	7.07	7 1/8	0.630	5/8	1.03	1 5/16	13/16		
×45[c]	13.3	16.1	16 1/8	0.345	3/8	3/16	7.04	7	0.565	9/16	0.967	1 1/4	13/16		
×40[c]	11.8	16.0	16	0.305	5/16	3/16	7.00	7	0.505	1/2	0.907	1 3/16	13/16		
×36[c]	10.6	15.9	15 7/8	0.295	5/16	3/16	6.99	7	0.430	7/16	0.832	1 1/8	3/4	↓	↓
W16×31[c]	9.13	15.9	15 7/8	0.275	1/4	1/8	5.53	5 1/2	0.440	7/16	0.842	1 1/8	3/4	13 5/8	3 1/2
×26[c,v]	7.68	15.7	15 3/4	0.250	1/4	1/8	5.50	5 1/2	0.345	3/8	0.747	1 1/16	3/4	13 5/8	3 1/2
W14×730[h]	215	22.4	22 3/8	3.07	3 1/16	1 9/16	17.9	17 7/8	4.91	4 15/16	5.51	6 3/16	2 3/4	10	3-7 1/2-3[g]
×665[h]	196	21.6	21 5/8	2.83	2 13/16	1 7/16	17.7	17 5/8	4.52	4 1/2	5.12	5 13/16	2 5/8		3-7 1/2-3[g]
×605[h]	178	20.9	20 7/8	2.60	2 5/8	1 5/16	17.4	17 3/8	4.16	4 3/16	4.76	5 7/16	2 1/2		3-7 1/2-3
×550[h]	162	20.2	20 1/4	2.38	2 3/8	1 3/16	17.2	17 1/4	3.82	3 13/16	4.42	5 1/8	2 3/8		
×500[h]	147	19.6	19 5/8	2.19	2 3/16	1 1/8	17.0	17	3.50	3 1/2	4.10	4 13/16	2 5/16		
×455[h]	134	19.0	19	2.02	2	1	16.8	16 7/8	3.21	3 3/16	3.81	4 1/2	2 1/4		
×426[h]	125	18.7	18 5/8	1.88	1 7/8	15/16	16.7	16 3/4	3.04	3 1/16	3.63	4 5/16	2 1/8		
×398[h]	117	18.3	18 1/4	1.77	1 3/4	7/8	16.6	16 5/8	2.85	2 7/8	3.44	4 1/8	2 1/8		
×370[h]	109	17.9	17 7/8	1.66	1 5/8	13/16	16.5	16 1/2	2.66	2 11/16	3.26	3 15/16	2 1/16		
×342[h]	101	17.5	17 1/2	1.54	1 9/16	13/16	16.4	16 3/8	2.47	2 1/2	3.07	3 3/4	2		
×311[h]	91.4	17.1	17 1/8	1.41	1 7/16	3/4	16.2	16 1/4	2.26	2 1/4	2.86	3 9/16	1 15/16		
×283[h]	83.3	16.7	16 3/4	1.29	1 5/16	11/16	16.1	16 1/8	2.07	2 1/16	2.67	3 3/8	1 7/8		
×257	75.6	16.4	16 3/8	1.18	1 3/16	5/8	16.0	16	1.89	1 7/8	2.49	3 3/16	1 13/16		
×233	68.5	16.0	16	1.07	1 1/16	9/16	15.9	15 7/8	1.72	1 3/4	2.32	3	1 3/4		
×211	62.0	15.7	15 3/4	0.980	1	1/2	15.8	15 3/4	1.56	1 9/16	2.16	2 7/8	1 11/16		
×193	56.8	15.5	15 1/2	0.890	7/8	7/16	15.7	15 3/4	1.44	1 7/16	2.04	2 3/4	1 11/16		
×176	51.8	15.2	15 1/4	0.830	13/16	7/16	15.7	15 5/8	1.31	1 5/16	1.91	2 5/8	1 5/8		
×159	46.7	15.0	15	0.745	3/4	3/8	15.6	15 5/8	1.19	1 3/16	1.79	2 1/2	1 9/16		
×145	42.7	14.8	14 3/4	0.680	11/16	3/8	15.5	15 1/2	1.09	1 1/16	1.69	2 3/8	1 9/16	↓	↓

[c] Shape is slender for compression with F_y = 50 ksi.
[g] The actual size, combination, and orientation of fastener components should be compared with the geometry of the cross-section to ensure compatibility.
[h] Flange thickness greater than 2 in. Special requirements may apply per AISC Specification Section A3.1c.
[v] Shape does not meet the h/t_w limit for shear in Specification Section G2.1a with F_y = 50 ksi.

Table 1–1 (continued)
W Shapes
Properties

W16 – W14

Nom-inal Wt.	Compact Section Criteria		Axis X-X				Axis Y-Y				r_{ts}	h_o	Torsional Properties	
	$\frac{b_f}{2t_f}$	$\frac{h}{t_w}$	I	S	r	Z	I	S	r	Z			J	C_w
lb/ft			in.^{4}	in.^{3}	in.	in.^{3}	in.^{4}	in.^{3}	in.	in.^{3}	in.	in.	in.^{4}	in.^{6}
100	5.29	24.3	1490	175	7.10	198	186	35.7	2.51	54.9	2.92	16.0	7.73	11900
89	5.92	27.0	1300	155	7.05	175	163	31.4	2.49	48.1	2.88	15.9	5.45	10200
77	6.77	31.2	1110	134	7.00	150	138	26.9	2.47	41.1	2.85	15.8	3.57	8590
67	7.70	35.9	954	117	6.96	130	119	23.2	2.46	35.5	2.82	15.7	2.39	7300
57	4.98	33.0	758	92.2	6.72	105	43.1	12.1	1.60	18.9	1.92	15.7	2.22	2660
50	5.61	37.4	659	81.0	6.68	92.0	37.2	10.5	1.59	16.3	1.89	15.6	1.52	2270
45	6.23	41.1	586	72.7	6.65	82.3	32.8	9.34	1.57	14.5	1.88	15.6	1.11	1990
40	6.93	46.5	518	64.7	6.63	73.0	28.9	8.25	1.57	12.7	1.86	15.5	0.794	1730
36	8.12	48.1	448	56.5	6.51	64.0	24.5	7.00	1.52	10.8	1.83	15.4	0.545	1460
31	6.28	51.6	375	47.2	6.41	54.0	12.4	4.49	1.17	7.03	1.42	15.4	0.461	739
26	7.97	56.8	301	38.4	6.26	44.2	9.59	3.49	1.12	5.48	1.38	15.3	0.262	565
730	1.82	3.71	14300	1280	8.17	1660	4720	527	4.69	816	5.68	17.5	1450	362000
665	1.95	4.03	12400	1150	7.98	1480	4170	472	4.62	730	5.57	17.1	1120	305000
605	2.09	4.39	10800	1040	7.80	1320	3680	423	4.55	652	5.46	16.8	869	258000
550	2.25	4.79	9430	931	7.63	1180	3250	378	4.49	583	5.36	16.4	669	219000
500	2.43	5.21	8210	838	7.48	1050	2880	339	4.43	522	5.26	16.1	514	187000
455	2.62	5.66	7190	756	7.33	936	2560	304	4.38	468	5.17	15.8	395	160000
426	2.75	6.08	6600	706	7.26	869	2360	283	4.34	434	5.11	15.6	331	144000
398	2.92	6.44	6000	656	7.16	801	2170	262	4.31	402	5.06	15.4	273	129000
370	3.10	6.89	5440	607	7.07	736	1990	241	4.27	370	5.00	15.3	222	116000
342	3.31	7.41	4900	558	6.98	672	1810	221	4.24	338	4.94	15.1	178	103000
311	3.59	8.09	4330	506	6.88	603	1610	199	4.20	304	4.87	14.9	136	89100
283	3.89	8.84	3840	459	6.79	542	1440	179	4.17	274	4.81	14.7	104	77700
257	4.23	9.71	3400	415	6.71	487	1290	161	4.13	246	4.75	14.5	79.1	67800
233	4.62	10.7	3010	375	6.63	436	1150	145	4.10	221	4.69	14.3	59.5	59000
211	5.06	11.6	2660	338	6.55	390	1030	130	4.07	198	4.64	14.2	44.6	51500
193	5.45	12.8	2400	310	6.50	355	931	119	4.05	180	4.59	14.0	34.8	45900
176	5.97	13.7	2140	281	6.43	320	838	107	4.02	163	4.55	13.9	26.5	40500
159	6.54	15.3	1900	254	6.38	287	748	96.2	4.00	146	4.51	13.8	19.7	35600
145	7.11	16.8	1710	232	6.33	260	677	87.3	3.98	133	4.47	13.7	15.2	31700

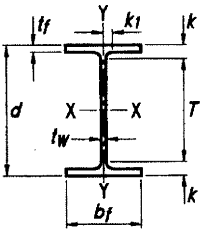


Table 1-1 (continued)
W Shapes
Dimensions

Shape	Area, A	Depth, d		Web: Thickness, t_w		Web: $\frac{t_w}{2}$	Flange: Width, b_f		Flange: Thickness, t_f		Distance: k, k_{des}	Distance: k, k_{det}	k_1	T	Workable Gage
	in.^{2}	in.		in.		in.	in.		in.		in.	in.	in.	in.	in.
W14×132	38.8	14.7	14 5/8	0.645	5/8	5/16	14.7	14 3/4	1.03	1	1.63	2 5/16	1 9/16	10	5 1/2
×120	35.3	14.5	14 1/2	0.590	9/16	5/16	14.7	14 5/8	0.940	15/16	1.54	2 1/4	1 1/2		
×109	32.0	14.3	14 3/8	0.525	1/2	1/4	14.6	14 5/8	0.860	7/8	1.46	2 3/16	1 1/2		
×99[f]	29.1	14.2	14 1/8	0.485	1/2	1/4	14.6	14 5/8	0.780	3/4	1.38	2 1/16	1 7/16		
×90[f]	26.5	14.0	14	0.440	7/16	1/4	14.5	14 1/2	0.710	11/16	1.31	2	1 7/16		
W14×82	24.0	14.3	14 1/4	0.510	1/2	1/4	10.1	10 1/8	0.855	7/8	1.45	1 11/16	1 1/16	10 7/8	5 1/2
×74	21.8	14.2	14 1/8	0.450	7/16	1/4	10.1	10 1/8	0.785	13/16	1.38	1 5/8	1 1/16		
×68	20.0	14.0	14	0.415	7/16	1/4	10.0	10	0.720	3/4	1.31	1 9/16	1 1/16		
×61	17.9	13.9	13 7/8	0.375	3/8	3/16	10.0	10	0.645	5/8	1.24	1 1/2	1		
W14×53	15.6	13.9	13 7/8	0.370	3/8	3/16	8.06	8	0.660	11/16	1.25	1 1/2	1	10 7/8	5 1/2
×48	14.1	13.8	13 3/4	0.340	5/16	3/16	8.03	8	0.595	5/8	1.19	1 7/16	1		
×43[c]	12.6	13.7	13 5/8	0.305	5/16	3/16	8.00	8	0.530	1/2	1.12	1 3/8	1		
W14×38[c]	11.2	14.1	14 1/8	0.310	5/16	3/16	6.77	6 3/4	0.515	1/2	0.915	1 1/4	13/16	11 5/8	3 1/2[g]
×34[c]	10.0	14.0	14	0.285	5/16	3/16	6.75	6 3/4	0.455	7/16	0.855	1 3/16	3/4		3 1/2
×30[c]	8.85	13.8	13 7/8	0.270	1/4	1/8	6.73	6 3/4	0.385	3/8	0.785	1 1/8	3/4		3 1/2
W14×26[c]	7.69	13.9	13 7/8	0.255	1/4	1/8	5.03	5	0.420	7/16	0.820	1 1/8	3/4	11 5/8	2 3/4[g]
×22[c]	6.49	13.7	13 3/4	0.230	1/4	1/8	5.00	5	0.335	5/16	0.735	1 1/16	3/4	11 5/8	2 3/4[g]
W12×336[h]	98.8	16.8	16 7/8	1.78	1 3/4	7/8	13.4	13 3/8	2.96	2 15/16	3.55	3 7/8	1 11/16	9 1/8	5 1/2
×305[h]	89.6	16.3	16 3/8	1.63	1 5/8	13/16	13.2	13 1/4	2.71	2 11/16	3.30	3 5/8	1 5/8		
×279[h]	81.9	15.9	15 7/8	1.53	1 1/2	3/4	13.1	13 1/8	2.47	2 1/2	3.07	3 3/8	1 5/8		
×252[h]	74.0	15.4	15 3/8	1.40	1 3/8	11/16	13.0	13	2.25	2 1/4	2.85	3 1/8	1 1/2		
×230[h]	67.7	15.1	15	1.29	1 5/16	11/16	12.9	12 7/8	2.07	2 1/16	2.67	2 15/16	1 1/2		
×210	61.8	14.7	14 3/4	1.18	1 3/16	5/8	12.8	12 3/4	1.90	1 7/8	2.50	2 13/16	1 7/16		
×190	55.8	14.4	14 3/8	1.06	1 1/16	9/16	12.7	12 5/8	1.74	1 3/4	2.33	2 5/8	1 3/8		
×170	50.0	14.0	14	0.960	15/16	1/2	12.6	12 5/8	1.56	1 9/16	2.16	2 7/16	1 5/16		
×152	44.7	13.7	13 3/4	0.870	7/8	7/16	12.5	12 1/2	1.40	1 3/8	2.00	2 5/16	1 1/4		
×136	39.9	13.4	13 3/8	0.790	13/16	7/16	12.4	12 3/8	1.25	1 1/4	1.85	2 1/8	1 1/4		
×120	35.3	13.1	13 1/8	0.710	11/16	3/8	12.3	12 3/8	1.11	1 1/8	1.70	2	1 3/16		
×106	31.2	12.9	12 7/8	0.610	5/8	5/16	12.2	12 1/4	0.990	1	1.59	1 7/8	1 1/8		
×96	28.2	12.7	12 3/4	0.550	9/16	5/16	12.2	12 1/8	0.900	7/8	1.50	1 13/16	1 1/8		
×87	25.6	12.5	12 1/2	0.515	1/2	1/4	12.1	12 1/8	0.810	13/16	1.41	1 11/16	1 1/16		
×79	23.2	12.4	12 3/8	0.470	1/2	1/4	12.1	12 1/8	0.735	3/4	1.33	1 5/8	1 1/16		
×72	21.1	12.3	12 1/4	0.430	7/16	1/4	12.0	12	0.670	11/16	1.27	1 9/16	1 1/16		
×65[f]	19.1	12.1	12 1/8	0.390	3/8	3/16	12.0	12	0.605	5/8	1.20	1 1/2	1		

[c] Shape is slender for compression with F_y = 50 ksi.
[f] Shape exceeds compact limit for flexure with F_y = 50 ksi.
[g] The actual size, combination, and orientation of fastener components should be compared with the geometry of the cross-section to ensure compatibility.
[h] Flange thickness greater than 2 in. Special requirements may apply per AISC Specification Section A3.1c.

Table 1-1 (continued)
W Shapes
Properties

W14 – W12

Nom-inal Wt.	Compact Section Criteria		Axis X-X				Axis Y-Y				r_{ts}	h_o	Torsional Properties	
	$\frac{b_f}{2t_f}$	$\frac{h}{t_w}$	I	S	r	Z	I	S	r	Z			J	C_w
lb/ft			in.^{4}	in.^{3}	in.	in.^{3}	in.^{4}	in.^{3}	in.	in.^{3}	in.	in.	in.^{4}	in.^{6}
132	7.15	17.7	1530	209	6.28	234	548	74.5	3.76	113	4.23	13.6	12.3	25500
120	7.80	19.3	1380	190	6.24	212	495	67.5	3.74	102	4.20	13.5	9.37	22700
109	8.49	21.7	1240	173	6.22	192	447	61.2	3.73	92.7	4.17	13.5	7.12	20200
99	9.34	23.5	1110	157	6.17	173	402	55.2	3.71	83.6	4.14	13.4	5.37	18000
90	10.2	25.9	999	143	6.14	157	362	49.9	3.70	75.6	4.11	13.3	4.06	16000
82	5.92	22.4	881	123	6.05	139	148	29.3	2.48	44.8	2.85	13.5	5.07	6710
74	6.41	25.4	795	112	6.04	126	134	26.6	2.48	40.5	2.82	13.4	3.87	5990
68	6.97	27.5	722	103	6.01	115	121	24.2	2.46	36.9	2.80	13.3	3.01	5380
61	7.75	30.4	640	92.1	5.98	102	107	21.5	2.45	32.8	2.78	13.2	2.19	4710
53	6.11	30.9	541	77.8	5.89	87.1	57.7	14.3	1.92	22.0	2.22	13.3	1.94	2540
48	6.75	33.6	484	70.2	5.85	78.4	51.4	12.8	1.91	19.6	2.20	13.2	1.45	2240
43	7.54	37.4	428	62.6	5.82	69.6	45.2	11.3	1.89	17.3	2.18	13.1	1.05	1950
38	6.57	39.6	385	54.6	5.87	61.5	26.7	7.88	1.55	12.1	1.82	13.6	0.798	1230
34	7.41	43.1	340	48.6	5.83	54.6	23.3	6.91	1.53	10.6	1.80	13.5	0.569	1070
30	8.74	45.4	291	42.0	5.73	47.3	19.6	5.82	1.49	8.99	1.77	13.5	0.380	887
26	5.98	48.1	245	35.3	5.65	40.2	8.91	3.55	1.08	5.54	1.31	13.5	0.358	405
22	7.46	53.3	199	29.0	5.54	33.2	7.00	2.80	1.04	4.39	1.27	13.4	0.208	314
336	2.26	5.47	4060	483	6.41	603	1190	177	3.47	274	4.13	13.9	243	57000
305	2.45	5.98	3550	435	6.29	537	1050	159	3.42	244	4.05	13.6	185	48600
279	2.66	6.35	3110	393	6.16	481	937	143	3.38	220	4.00	13.4	143	42000
252	2.89	6.96	2720	353	6.06	428	828	127	3.34	196	3.93	13.2	108	35800
230	3.11	7.56	2420	321	5.97	386	742	115	3.31	177	3.87	13.0	83.8	31200
210	3.37	8.23	2140	292	5.89	348	664	104	3.28	159	3.82	12.8	64.7	27200
190	3.65	9.16	1890	263	5.82	311	589	93.0	3.25	143	3.76	12.6	48.8	23600
170	4.03	10.1	1650	235	5.74	275	517	82.3	3.22	126	3.71	12.5	35.6	20100
152	4.46	11.2	1430	209	5.66	243	454	72.8	3.19	111	3.66	12.3	25.8	17200
136	4.96	12.3	1240	186	5.58	214	398	64.2	3.16	98.0	3.61	12.2	18.5	14700
120	5.57	13.7	1070	163	5.51	186	345	56.0	3.13	85.4	3.56	12.0	12.9	12400
106	6.17	15.9	933	145	5.47	164	301	49.3	3.11	75.1	3.52	11.9	9.13	10700
96	6.76	17.7	833	131	5.44	147	270	44.4	3.09	67.5	3.49	11.8	6.85	9410
87	7.48	18.9	740	118	5.38	132	241	39.7	3.07	60.4	3.46	11.7	5.10	8270
79	8.22	20.7	662	107	5.34	119	216	35.8	3.05	54.3	3.43	11.6	3.84	7330
72	8.99	22.6	597	97.4	5.31	108	195	32.4	3.04	49.2	3.40	11.6	2.93	6540
65	9.92	24.9	533	87.9	5.28	96.8	174	29.1	3.02	44.1	3.38	11.5	2.18	5780

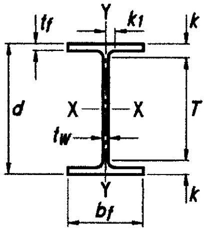


Table 1-1 (continued)
W Shapes
Dimensions

Shape	Area, A	Depth, d		Web			Flange				Distance				
				Thickness, t_w		$\frac{t_w}{2}$	Width, b_f		Thickness, t_f		k		k_1	T	Workable Gage
											k_{des}	k_{det}			
	in.^{2}	in.		in.		in.	in.		in.		in.	in.	in.	in.	in.
W12×58	17.0	12.2	12 1/4	0.360	3/8	3/16	10.0	10	0.640	5/8	1.24	1 1/2	15/16	9 1/4	5 1/2
×53	15.6	12.1	12	0.345	3/8	3/16	10.0	10	0.575	9/16	1.18	1 3/8	15/16	9 1/4	5 1/2
W12×50	14.6	12.2	12 1/4	0.370	3/8	3/16	8.08	8 1/8	0.640	5/8	1.14	1 1/2	15/16	9 1/4	5 1/2
×45	13.1	12.1	12	0.335	5/16	3/16	8.05	8	0.575	9/16	1.08	1 3/8	15/16		
×40	11.7	11.9	12	0.295	5/16	3/16	8.01	8	0.515	1/2	1.02	1 3/8	7/8		
W12×35[c]	10.3	12.5	12 1/2	0.300	5/16	3/16	6.56	6 1/2	0.520	1/2	0.820	1 3/16	3/4	10 1/8	3 1/2
×30[c]	8.79	12.3	12 3/8	0.260	1/4	1/8	6.52	6 1/2	0.440	7/16	0.740	1 1/8	3/4		
×26[c]	7.65	12.2	12 1/4	0.230	1/4	1/8	6.49	6 1/2	0.380	3/8	0.680	1 1/16	3/4		
W12×22[c]	6.48	12.3	12 1/4	0.260	1/4	1/8	4.03	4	0.425	7/16	0.725	15/16	5/8	10 3/8	2 1/4[g]
×19[c]	5.57	12.2	12 1/8	0.235	1/4	1/8	4.01	4	0.350	3/8	0.650	7/8	9/16		
×16[c]	4.71	12.0	12	0.220	1/4	1/8	3.99	4	0.265	1/4	0.565	13/16	9/16		
×14[c,v]	4.16	11.9	11 7/8	0.200	3/16	1/8	3.97	4	0.225	1/4	0.525	3/4	9/16		
W10×112	32.9	11.4	11 3/8	0.755	3/4	3/8	10.4	10 3/8	1.25	1 1/4	1.75	1 15/16	1	7 1/2	5 1/2
×100	29.4	11.1	11 1/8	0.680	11/16	3/8	10.3	10 3/8	1.12	1 1/8	1.62	1 13/16	1		
×88	25.9	10.8	10 7/8	0.605	5/8	5/16	10.3	10 1/4	0.990	1	1.49	1 11/16	15/16		
×77	22.6	10.6	10 5/8	0.530	1/2	1/4	10.2	10 1/4	0.870	7/8	1.37	1 9/16	7/8		
×68	20.0	10.4	10 3/8	0.470	1/2	1/4	10.1	10 1/8	0.770	3/4	1.27	1 7/16	7/8		
×60	17.6	10.2	10 1/4	0.420	7/16	1/4	10.1	10 1/8	0.680	11/16	1.18	1 3/8	13/16		
×54	15.8	10.1	10 1/8	0.370	3/8	3/16	10.0	10	0.615	5/8	1.12	1 5/16	13/16		
×49	14.4	10.0	10	0.340	5/16	3/16	10.0	10	0.560	9/16	1.06	1 1/4	13/16		
W10×45	13.3	10.1	10 1/8	0.350	3/8	3/16	8.02	8	0.620	5/8	1.12	1 5/16	13/16	7 1/2	5 1/2
×39	11.5	9.92	9 7/8	0.315	5/16	3/16	7.99	8	0.530	1/2	1.03	1 3/16	13/16		
×33	9.71	9.73	9 3/4	0.290	5/16	3/16	7.96	8	0.435	7/16	0.935	1 1/8	3/4		
W10×30	8.84	10.5	10 1/2	0.300	5/16	3/16	5.81	5 3/4	0.510	1/2	0.810	1 1/8	11/16	8 1/4	2 3/4[g]
×26	7.61	10.3	10 3/8	0.260	1/4	1/8	5.77	5 3/4	0.440	7/16	0.740	1 1/16	11/16		
×22[c]	6.49	10.2	10 1/8	0.240	1/4	1/8	5.75	5 3/4	0.360	3/8	0.660	15/16	5/8		
W10×19	5.62	10.2	10 1/4	0.250	1/4	1/8	4.02	4	0.395	3/8	0.695	15/16	5/8	8 3/8	2 1/4[g]
×17[c]	4.99	10.1	10 1/8	0.240	1/4	1/8	4.01	4	0.330	5/16	0.630	7/8	9/16		
×15[c]	4.41	10.0	10	0.230	1/4	1/8	4.00	4	0.270	1/4	0.570	13/16	9/16		
×12[c,f]	3.54	9.87	9 7/8	0.190	3/16	1/8	3.96	4	0.210	3/16	0.510	3/4	9/16		

[c] Shape is slender for compression with F_y = 50 ksi.
[f] Shape exceeds compact limit for flexure with F_y = 50 ksi.
[g] The actual size, combination, and orientation of fastener components should be compared with the geometry of the cross-section to ensure compatibility.
[v] Shape does not meet the h/t_w limit for shear in Specification Section G2.1a with F_y = 50 ksi.

Table 1-1 (continued)
W Shapes
Properties

W12 – W10

Nom-inal Wt.	Compact Section Criteria		Axis X-X				Axis Y-Y				r_{ts}	h_o	Torsional Properties	
	$\frac{b_f}{2t_f}$	$\frac{h}{t_w}$	I	S	r	Z	I	S	r	Z			J	C_w
lb/ft			in.^{4}	in.^{3}	in.	in.^{3}	in.^{4}	in.^{3}	in.	in.^{3}	in.	in.	in.^{4}	in.^{6}
58	7.82	27.0	475	78.0	5.28	86.4	107	21.4	2.51	32.5	2.82	11.6	2.10	3570
53	8.69	28.1	425	70.6	5.23	77.9	95.8	19.2	2.48	29.1	2.79	11.5	1.58	3160
50	6.31	26.8	391	64.2	5.18	71.9	56.3	13.9	1.96	21.3	2.25	11.6	1.71	1880
45	7.00	29.6	348	57.7	5.15	64.2	50.0	12.4	1.95	19.0	2.23	11.5	1.26	1650
40	7.77	33.6	307	51.5	5.13	57.0	44.1	11.0	1.94	16.8	2.21	11.4	0.906	1440
35	6.31	36.2	285	45.6	5.25	51.2	24.5	7.47	1.54	11.5	1.79	12.0	0.741	879
30	7.41	41.8	238	38.6	5.21	43.1	20.3	6.24	1.52	9.56	1.77	11.9	0.457	720
26	8.54	47.2	204	33.4	5.17	37.2	17.3	5.34	1.51	8.17	1.75	11.8	0.300	607
22	4.74	41.8	156	25.4	4.91	29.3	4.66	2.31	0.848	3.66	1.04	11.9	0.293	164
19	5.72	46.2	130	21.3	4.82	24.7	3.76	1.88	0.822	2.98	1.02	11.8	0.180	131
16	7.53	49.4	103	17.1	4.67	20.1	2.82	1.41	0.773	2.26	0.982	11.7	0.103	96.9
14	8.82	54.3	88.6	14.9	4.62	17.4	2.36	1.19	0.753	1.90	0.962	11.7	0.0704	80.4
112	4.17	10.4	716	126	4.66	147	236	45.3	2.68	69.2	3.07	10.1	15.1	6020
100	4.62	11.6	623	112	4.60	130	207	40.0	2.65	61.0	3.03	10.0	10.9	5150
88	5.18	13.0	534	98.5	4.54	113	179	34.8	2.63	53.1	2.99	9.85	7.53	4330
77	5.86	14.8	455	85.9	4.49	97.6	154	30.1	2.60	45.9	2.95	9.73	5.11	3630
68	6.58	16.7	394	75.7	4.44	85.3	134	26.4	2.59	40.1	2.91	9.63	3.56	3100
60	7.41	18.7	341	66.7	4.39	74.6	116	23.0	2.57	35.0	2.88	9.54	2.48	2640
54	8.15	21.2	303	60.0	4.37	66.6	103	20.6	2.56	31.3	2.86	9.48	1.82	2320
49	8.93	23.1	272	54.6	4.35	60.4	93.4	18.7	2.54	28.3	2.84	9.42	1.39	2070
45	6.47	22.5	248	49.1	4.32	54.9	53.4	13.3	2.01	20.3	2.27	9.48	1.51	1200
39	7.53	25.0	209	42.1	4.27	46.8	45.0	11.3	1.98	17.2	2.24	9.39	0.976	992
33	9.15	27.1	171	35.0	4.19	38.8	36.6	9.20	1.94	14.0	2.20	9.30	0.583	791
30	5.70	29.5	170	32.4	4.38	36.6	16.7	5.75	1.37	8.84	1.60	10.0	0.622	414
26	6.56	34.0	144	27.9	4.35	31.3	14.1	4.89	1.36	7.50	1.58	9.89	0.402	345
22	7.99	36.9	118	23.2	4.27	26.0	11.4	3.97	1.33	6.10	1.55	9.81	0.239	275
19	5.09	35.4	96.3	18.8	4.14	21.6	4.29	2.14	0.874	3.35	1.06	9.85	0.233	104
17	6.08	36.9	81.9	16.2	4.05	18.7	3.56	1.78	0.845	2.80	1.04	9.78	0.156	85.1
15	7.41	38.5	68.9	13.8	3.95	16.0	2.89	1.45	0.810	2.30	1.01	9.72	0.104	68.3
12	9.43	46.6	53.8	10.9	3.90	12.6	2.18	1.10	0.785	1.74	0.983	9.66	0.0547	50.9

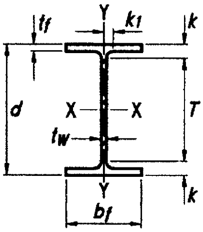


Table 1-1 (continued)
W Shapes
Dimensions

Shape	Area, A	Depth, d		Web Thickness, t_w		Web $\frac{t_w}{2}$	Flange Width, b_f		Flange Thickness, t_f		Distance k k_{des}	Distance k k_{det}	k_1	T	Workable Gage
	in.^{2}	in.		in.		in.	in.		in.		in.	in.	in.	in.	in.
W8×67	19.7	9.00	9	0.570	9/16	5/16	8.28	8 1/4	0.935	15/16	1.33	1 5/8	15/16	5 3/4	5 1/2
×58	17.1	8.75	8 3/4	0.510	1/2	1/4	8.22	8 1/4	0.810	13/16	1.20	1 1/2	7/8		
×48	14.1	8.50	8 1/2	0.400	3/8	3/16	8.11	8 1/8	0.685	11/16	1.08	1 3/8	13/16		
×40	11.7	8.25	8 1/4	0.360	3/8	3/16	8.07	8 1/8	0.560	9/16	0.954	1 1/4	13/16		
×35	10.3	8.12	8 1/8	0.310	5/16	3/16	8.02	8	0.495	1/2	0.889	1 3/16	13/16		
×31[f]	9.12	8.00	8	0.285	5/16	3/16	8.00	8	0.435	7/16	0.829	1 1/8	3/4		
W8×28	8.24	8.06	8	0.285	5/16	3/16	6.54	6 1/2	0.465	7/16	0.859	15/16	5/8	6 1/8	4
×24	7.08	7.93	7 7/8	0.245	1/4	1/8	6.50	6 1/2	0.400	3/8	0.794	7/8	9/16	6 1/8	4
W8×21	6.16	8.28	8 1/4	0.250	1/4	1/8	5.27	5 1/4	0.400	3/8	0.700	7/8	9/16	6 1/2	2 3/4[g]
×18	5.26	8.14	8 1/8	0.230	1/4	1/8	5.25	5 1/4	0.330	5/16	0.630	13/16	9/16	6 1/2	2 3/4[g]
W8×15	4.44	8.11	8 1/8	0.245	1/4	1/8	4.02	4	0.315	5/16	0.615	13/16	9/16	6 1/2	2 1/4[g]
×13	3.84	7.99	8	0.230	1/4	1/8	4.00	4	0.255	1/4	0.555	3/4	9/16		
×10[c,f]	2.96	7.89	7 7/8	0.170	3/16	1/8	3.94	4	0.205	3/16	0.505	11/16	1/2		
W6×25	7.34	6.38	6 3/8	0.320	5/16	3/16	6.08	6 1/8	0.455	7/16	0.705	15/16	9/16	4 1/2	3 1/2
×20	5.87	6.20	6 1/4	0.260	1/4	1/8	6.02	6	0.365	3/8	0.615	7/8	9/16		
×15[f]	4.43	5.99	6	0.230	1/4	1/8	5.99	6	0.260	1/4	0.510	3/4	9/16		
W6×16	4.74	6.28	6 1/4	0.260	1/4	1/8	4.03	4	0.405	3/8	0.655	7/8	9/16	4 1/2	2 1/4[g]
×12	3.55	6.03	6	0.230	1/4	1/8	4.00	4	0.280	1/4	0.530	3/4	9/16		
×9[f]	2.68	5.90	5 7/8	0.170	3/16	1/8	3.94	4	0.215	3/16	0.465	11/16	1/2		
×8.5[f]	2.52	5.83	5 7/8	0.170	3/16	1/8	3.94	4	0.195	3/16	0.445	11/16	1/2		
W5×19	5.56	5.15	5 1/8	0.270	1/4	1/8	5.03	5	0.430	7/16	0.730	13/16	7/16	3 1/2	2 3/4[g]
×16	4.71	5.01	5	0.240	1/4	1/8	5.00	5	0.360	3/8	0.660	3/4	7/16	3 1/2	2 3/4[g]
W4×13	3.83	4.16	4 1/8	0.280	1/4	1/8	4.06	4	0.345	3/8	0.595	3/4	1/2	2 5/8	2 1/4[g]

[c] Shape is slender for compression with F_y = 50 ksi.
[f] Shape exceeds compact limit for flexure with F_y = 50 ksi.
[g] The actual size, combination, and orientation of fastener components should be compared with the geometry of the cross-section to ensure compatibility.

Table 1-1 (continued)
W Shapes
Properties

W8 – W4

Nom-inal Wt.	Compact Section Criteria		Axis X-X				Axis Y-Y				r_{ts}	h_o	Torsional Properties	
	$\frac{b_f}{2t_f}$	$\frac{h}{t_w}$	I	S	r	Z	I	S	r	Z			J	C_w
lb/ft			in.^{4}	in.^{3}	in.	in.^{3}	in.^{4}	in.^{3}	in.	in.^{3}	in.	in.	in.^{4}	in.^{6}
67	4.43	11.1	272	60.4	3.72	70.1	88.6	21.4	2.12	32.7	2.43	8.07	5.05	1440
58	5.07	12.4	228	52.0	3.65	59.8	75.1	18.3	2.10	27.9	2.39	7.94	3.33	1180
48	5.92	15.9	184	43.2	3.61	49.0	60.9	15.0	2.08	22.9	2.35	7.82	1.96	931
40	7.21	17.6	146	35.5	3.53	39.8	49.1	12.2	2.04	18.5	2.31	7.69	1.12	726
35	8.10	20.5	127	31.2	3.51	34.7	42.6	10.6	2.03	16.1	2.28	7.63	0.769	619
31	9.19	22.3	110	27.5	3.47	30.4	37.1	9.27	2.02	14.1	2.26	7.57	0.536	530
28	7.03	22.3	98.0	24.3	3.45	27.2	21.7	6.63	1.62	10.1	1.84	7.60	0.537	312
24	8.12	25.9	82.7	20.9	3.42	23.1	18.3	5.63	1.61	8.57	1.82	7.53	0.346	259
21	6.59	27.5	75.3	18.2	3.49	20.4	9.77	3.71	1.26	5.69	1.46	7.88	0.282	152
18	7.95	29.9	61.9	15.2	3.43	17.0	7.97	3.04	1.23	4.66	1.43	7.81	0.172	122
15	6.37	28.1	48.0	11.8	3.29	13.6	3.41	1.70	0.876	2.67	1.06	7.80	0.137	51.8
13	7.84	29.9	39.6	9.91	3.21	11.4	2.73	1.37	0.843	2.15	1.03	7.74	0.0871	40.8
10	9.61	40.5	30.8	7.81	3.22	8.87	2.09	1.06	0.841	1.66	1.01	7.69	0.0426	30.9
25	6.68	15.5	53.4	16.7	2.70	18.9	17.1	5.61	1.52	8.56	1.74	5.93	0.461	150
20	8.25	19.1	41.4	13.4	2.66	14.9	13.3	4.41	1.50	6.72	1.70	5.84	0.240	113
15	11.5	21.6	29.1	9.72	2.56	10.8	9.32	3.11	1.45	4.75	1.66	5.73	0.101	76.5
16	4.98	19.1	32.1	10.2	2.60	11.7	4.43	2.20	0.967	3.39	1.13	5.88	0.223	38.2
12	7.14	21.6	22.1	7.31	2.49	8.30	2.99	1.50	0.918	2.32	1.08	5.75	0.0903	24.7
9	9.16	29.2	16.4	5.56	2.47	6.23	2.20	1.11	0.905	1.72	1.06	5.69	0.0405	17.7
8.5	10.1	29.1	14.9	5.10	2.43	5.73	1.99	1.01	0.890	1.56	1.05	5.64	0.0333	15.8
19	5.85	13.7	26.3	10.2	2.17	11.6	9.13	3.63	1.28	5.53	1.45	4.72	0.316	50.9
16	6.94	15.4	21.4	8.55	2.13	9.63	7.51	3.00	1.26	4.58	1.43	4.65	0.192	40.6
13	5.88	10.6	11.3	5.46	1.72	6.28	3.86	1.90	1.00	2.92	1.16	3.82	0.151	14.0

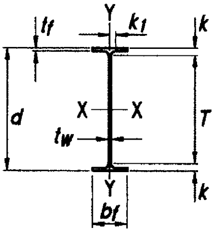


Table 1–2
M Shapes
Dimensions

Shape	Area, A	Depth, d		Web			Flange				Distance			
				Thickness, t_w		$\frac{t_w}{2}$	Width, b_f		Thickness, t_f		k	k_1	T	Workable Gage
	in.²	in.		in.		in.	in.		in.		in.	in.	in.	in.
M12.5×12.4[c,v]	3.63	12.5	12 1/2	0.155	1/8	1/16	3.75	3 3/4	0.228	1/4	9/16	3/8	11 3/8	—
×11.6[c,v]	3.40	12.5	12 1/2	0.155	1/8	1/16	3.50	3 1/2	0.211	3/16	9/16	3/8	11 3/8	—
M12×11.8[c]	3.47	12.0	12	0.177	3/16	1/8	3.07	3 1/8	0.225	1/4	9/16	3/8	10 7/8	—
×10.8[c]	3.18	12.0	12	0.160	3/16	1/8	3.07	3 1/8	0.210	3/16	9/16	3/8	10 7/8	—
M12×10[c,v]	2.95	12.0	12	0.149	1/8	1/16	3.25	3 1/4	0.180	3/16	1/2	3/8	11	—
M10×9[c]	2.65	10.0	10	0.157	3/16	1/8	2.69	2 3/4	0.206	3/16	9/16	3/8	8 7/8	—
×8[c]	2.37	9.95	10	0.141	1/8	1/16	2.69	2 3/4	0.182	3/16	9/16	3/8	8 7/8	—
M10×7.5[c,v]	2.22	9.99	10	0.130	1/8	1/16	2.69	2 3/4	0.173	3/16	7/16	5/16	9 1/8	—
M8×6.5[c]	1.92	8.00	8	0.135	1/8	1/16	2.28	2 1/4	0.189	3/16	9/16	3/8	6 7/8	—
×6.2[c]	1.82	8.00	8	0.129	1/8	1/16	2.28	2 1/4	0.177	3/16	7/16	1/4	7 1/8	—
M6×4.4[c]	1.29	6.00	6	0.114	1/8	1/16	1.84	1 7/8	0.171	3/16	3/8	1/4	5 1/4	—
×3.7[c]	1.09	5.92	5 7/8	0.0980	1/8	1/16	2.00	2	0.129	1/8	5/16	1/4	5 1/4	—
M5×18.9[t]	5.56	5.00	5	0.316	5/16	3/16	5.00	5	0.416	7/16	13/16	1/2	3 3/8	2 3/4[g]
M4×6[f]	1.75	3.80	3 3/4	0.130	1/8	1/16	3.80	3 3/4	0.160	3/16	1/2	3/8	2 3/4	—
×4.08	1.27	4.00	4	0.115	1/8	1/16	2.25	2 1/4	0.170	3/16	9/16	3/8	2 7/8	—
×3.45	1.01	4.00	4	0.0920	1/16	1/16	2.25	2 1/4	0.130	1/8	1/2	3/8	3	—
×3.2	1.01	4.00	4	0.0920	1/16	1/16	2.25	2 1/4	0.130	1/8	1/2	3/8	3	—
M3×2.9	0.914	3.00	3	0.0900	1/16	1/16	2.25	2 1/4	0.130	1/8	1/2	3/8	2	—

[c] Shape is slender for compression with F_y = 36 ksi.
[f] Shape exceeds compact limit for flexure with F_y = 36 ksi.
[g] The actual size, combination, and orientation of fastener components should be compared with the geometry of the cross-section to ensure compatibility.
[t] Shape has tapered flanges while other M-shapes have parallel flange surfaces.
[v] Shape does not meet the h/t_w limit for shear in Specification Section G2.1b(i) with F_y = 36 ksi.
— Flange is too narrow to establish a workable gage.

Table 1–2 (continued)
M Shapes
Properties

M SHAPES

Nom-inal Wt.	Compact Section Criteria		Axis X-X				Axis Y-Y				r_{ts}	h_o	$\frac{J}{S_x h_o}$	Torsional Properties	
	$\frac{b_f}{2t_f}$	$\frac{h}{t_w}$	I	S	r	Z	I	S	r	Z				J	C_w
lb/ft			in.^{4}	in.^{3}	in.	in.^{3}	in.^{4}	in.^{3}	in.	in.^{3}	in.	in.		in.^{4}	in.^{6}
12.4	8.22	74.8	89.3	14.2	4.96	16.5	2.01	1.07	0.744	1.68	0.100	12.3	0.000283	0.0493	76.0
11.6	8.29	74.8	80.3	12.8	4.86	15.0	1.51	0.864	0.667	1.37	0.099	12.3	0.000263	0.0414	57.1
11.8	6.81	62.5	72.2	12.0	4.56	14.3	1.09	0.709	0.559	1.15	0.108	11.8	0.000355	0.0500	37.7
10.8	7.30	69.2	66.7	11.1	4.58	13.2	1.01	0.661	0.564	1.07	0.104	11.8	0.000300	0.0393	35.0
10	9.03	74.7	61.7	10.3	4.57	12.2	1.03	0.636	0.592	1.02	0.098	11.8	0.000240	0.0292	35.9
9	6.53	58.4	39.0	7.79	3.83	9.22	0.672	0.500	0.503	0.809	0.117	9.81	0.000411	0.0314	16.1
8	7.39	65.0	34.6	6.95	3.82	8.20	0.593	0.441	0.500	0.711	0.111	9.81	0.000328	0.0224	14.2
7.5	7.77	71.0	33.0	6.60	3.85	7.77	0.562	0.418	0.503	0.670	0.107	9.81	0.000289	0.0187	13.5
6.5	6.03	53.8	18.5	4.63	3.11	5.43	0.376	0.329	0.443	0.529	0.131	7.81	0.000509	0.0184	5.73
6.2	6.44	56.5	17.6	4.39	3.10	5.15	0.352	0.308	0.439	0.495	0.127	7.81	0.000455	0.0156	5.38
4.4	5.39	47.0	7.23	2.41	2.36	2.80	0.180	0.195	0.372	0.311	0.152	5.81	0.000707	0.00990	1.53
3.7	7.75	54.7	5.96	2.01	2.34	2.33	0.173	0.173	0.398	0.273	0.137	5.75	0.000459	0.00530	1.45
18.9	6.01	11.2	24.2	9.67	2.08	11.1	8.70	3.48	1.25	5.33	0.28	4.56	0.00709	0.313	45.7
6	11.9	22.0	4.72	2.48	1.64	2.74	1.47	0.771	0.915	1.18	0.22	3.56	0.00208	0.0184	4.85
4.08	6.62	26.4	3.53	1.77	1.67	2.00	0.325	0.289	0.506	0.453	0.220	3.81	0.00218	0.0147	1.19
3.45	8.65	33.9	2.86	1.43	1.68	1.60	0.248	0.221	0.496	0.346	0.200	3.88	0.00148	0.00820	0.930
3.2	8.65	33.9	2.86	1.43	1.68	1.60	0.248	0.221	0.496	0.346	0.200	3.88	0.00148	0.00820	0.930
2.9	8.65	23.6	1.50	1.00	1.28	1.12	0.248	0.221	0.521	0.344	0.250	2.88	0.00275	0.00790	0.511

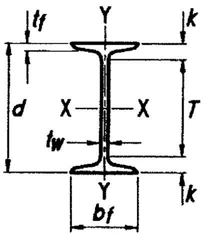


Table 1-3
S Shapes
Dimensions

Shape	Area, A	Depth, d		Web Thickness, t_w		Web $\frac{t_w}{2}$	Flange Width, b_f		Flange Thickness, t_f		Distance k	Distance T	Distance Workable Gage
	in.^{2}	in.		in.		in.	in.		in.		in.	in.	in.
S24×121	35.5	24.5	24 1/2	0.800	13/16	7/16	8.05	8	1.09	1 1/16	2	20 1/2	4
×106	31.1	24.5	24 1/2	0.620	5/8	5/16	7.87	7 7/8	1.09	1 1/16	2	20 1/2	4
S24×100	29.3	24.0	24	0.745	3/4	3/8	7.25	7 1/4	0.870	7/8	1 3/4	20 1/2	4
×90	26.5	24.0	24	0.625	5/8	5/16	7.13	7 1/8	0.870	7/8	1 3/4	20 1/2	4
×80	23.5	24.0	24	0.500	1/2	1/4	7.00	7	0.870	7/8	1 3/4	20 1/2	4
S20×96	28.2	20.3	20 1/4	0.800	13/16	7/16	7.20	7 1/4	0.920	15/16	1 3/4	16 3/4	4
×86	25.3	20.3	20 1/4	0.660	11/16	3/8	7.06	7	0.920	15/16	1 3/4	16 3/4	4
S20×75	22.0	20.0	20	0.635	5/8	5/16	6.39	6 3/8	0.795	13/16	1 5/8	16 3/4	3 1/2[g]
×66	19.4	20.0	20	0.505	1/2	1/4	6.26	6 1/4	0.795	13/16	1 5/8	16 3/4	3 1/2[g]
S18×70	20.5	18.0	18	0.711	11/16	3/8	6.25	6 1/4	0.691	11/16	1 1/2	15	3 1/2[g]
×54.7	16.0	18.0	18	0.461	7/16	1/4	6.00	6	0.691	11/16	1 1/2	15	3 1/2[g]
S15×50	14.7	15.0	15	0.550	9/16	5/16	5.64	5 5/8	0.622	5/8	1 3/8	12 1/4	3 1/2[g]
×42.9	12.6	15.0	15	0.411	7/16	1/4	5.50	5 1/2	0.622	5/8	1 3/8	12 1/4	3 1/2[g]
S12×50	14.6	12.0	12	0.687	11/16	3/8	5.48	5 1/2	0.659	11/16	1 7/16	9 1/8	3[g]
×40.8	11.9	12.0	12	0.462	7/16	1/4	5.25	5 1/4	0.659	11/16	1 7/16	9 1/8	3[g]
S12×35	10.2	12.0	12	0.428	7/16	1/4	5.08	5 1/8	0.544	9/16	1 3/16	9 5/8	3[g]
×31.8	9.31	12.0	12	0.350	3/8	3/16	5.00	5	0.544	9/16	1 3/16	9 5/8	3[g]
S10×35	10.3	10.0	10	0.594	5/8	5/16	4.94	5	0.491	1/2	1 1/8	7 3/4	2 3/4[g]
×25.4	7.45	10.0	10	0.311	5/16	3/16	4.66	4 5/8	0.491	1/2	1 1/8	7 3/4	2 3/4[g]
S8×23	6.76	8.00	8	0.441	7/16	1/4	4.17	4 1/8	0.425	7/16	1	6	2 1/4[g]
×18.4	5.40	8.00	8	0.271	1/4	1/8	4.00	4	0.425	7/16	1	6	2 1/4[g]
S6×17.2	5.06	6.00	6	0.465	7/16	1/4	3.57	3 5/8	0.359	3/8	13/16	4 3/8	—
×12.5	3.66	6.00	6	0.232	1/4	1/8	3.33	3 3/8	0.359	3/8	13/16	4 3/8	—
S5×10	2.93	5.00	5	0.214	3/16	1/8	3.00	3	0.326	5/16	3/4	3 1/2	—
S4×9.5	2.79	4.00	4	0.326	5/16	3/16	2.80	2 3/4	0.293	5/16	3/4	2 1/2	—
×7.7	2.26	4.00	4	0.193	3/16	1/8	2.66	2 5/8	0.293	5/16	3/4	2 1/2	—
S3×7.5	2.20	3.00	3	0.349	3/8	3/16	2.51	2 1/2	0.260	1/4	5/8	1 3/4	—
×5.7	1.66	3.00	3	0.170	3/16	1/8	2.33	2 3/8	0.260	1/4	5/8	1 3/4	—

[g] The actual size, combination, and orientation of fastener components should be compared with the geometry of the cross-section to ensure compatibility.
— Flange is too narrow to establish a workable gage.

Table 1–3 (continued)
S Shapes
Properties

S SHAPES

Nom-inal Wt.	Compact Section Criteria		Axis X-X				Axis Y-Y				r_{ts}	h_o	Torsional Properties	
	$\frac{b_f}{2t_f}$	$\frac{h}{t_w}$	I	S	r	Z	I	S	r	Z			J	C_w
lb/ft			in.^{4}	in.^{3}	in.	in.^{3}	in.^{4}	in.^{3}	in.	in.^{3}	in.	in.	in.^{4}	in.^{6}
121	3.69	25.9	3160	258	9.43	306	83.0	20.6	1.53	36.3	1.94	23.4	12.8	11400
106	3.61	33.4	2940	240	9.71	279	76.8	19.5	1.57	33.4	1.93	23.4	10.1	10500
100	4.16	27.8	2380	199	9.01	239	47.4	13.1	1.27	24.0	1.66	23.1	7.59	6350
90	4.09	33.1	2250	187	9.21	222	44.7	12.5	1.30	22.4	1.66	23.1	6.05	5980
80	4.02	41.4	2100	175	9.47	204	42.0	12.0	1.34	20.8	1.67	23.1	4.89	5620
96	3.91	21.1	1670	165	7.71	198	49.9	13.9	1.33	24.9	1.71	19.4	8.40	4690
86	3.84	25.6	1570	155	7.89	183	46.6	13.2	1.36	23.1	1.71	19.4	6.65	4370
75	4.02	26.6	1280	128	7.62	152	29.5	9.25	1.16	16.7	1.49	19.2	4.59	2720
66	3.93	33.5	1190	119	7.83	139	27.5	8.78	1.19	15.4	1.49	19.2	3.58	2530
70	4.52	21.5	923	103	6.70	124	24.0	7.69	1.08	14.3	1.42	17.3	4.10	1800
54.7	4.34	33.2	801	89.0	7.07	104	20.7	6.91	1.14	12.1	1.42	17.3	2.33	1550
50	4.53	22.7	485	64.7	5.75	77.0	15.6	5.53	1.03	9.99	1.32	14.4	2.12	805
42.9	4.42	30.4	446	59.4	5.95	69.2	14.3	5.19	1.06	9.08	1.31	14.4	1.54	737
50	4.16	13.7	303	50.6	4.55	60.9	15.6	5.69	1.03	10.3	1.32	11.3	2.77	501
40.8	3.98	20.6	270	45.1	4.76	52.7	13.5	5.13	1.06	8.86	1.30	11.3	1.69	433
35	4.67	23.1	228	38.1	4.72	44.6	9.84	3.88	0.980	6.80	1.22	11.5	1.05	323
31.8	4.60	28.3	217	36.2	4.83	41.8	9.33	3.73	1.00	6.44	1.21	11.5	0.878	306
35	5.03	13.4	147	29.4	3.78	35.4	8.30	3.36	0.899	6.19	1.16	9.51	1.29	188
25.4	4.75	25.6	123	24.6	4.07	28.3	6.73	2.89	0.950	4.99	1.14	9.51	0.603	152
23	4.91	14.1	64.7	16.2	3.09	19.2	4.27	2.05	0.795	3.67	0.999	7.58	0.550	61.2
18.4	4.71	22.9	57.5	14.4	3.26	16.5	3.69	1.84	0.827	3.18	0.985	7.58	0.335	52.9
17.2	4.97	9.67	26.2	8.74	2.28	10.5	2.29	1.28	0.673	2.35	0.859	5.64	0.371	18.2
12.5	4.64	19.4	22.0	7.34	2.45	8.45	1.80	1.08	0.702	1.86	0.831	5.64	0.167	14.3
10	4.61	16.8	12.3	4.90	2.05	5.66	1.19	0.795	0.638	1.37	0.754	4.67	0.114	6.52
9.5	4.77	8.33	6.76	3.38	1.56	4.04	0.887	0.635	0.564	1.13	0.698	3.71	0.120	3.05
7.7	4.54	14.1	6.05	3.03	1.64	3.50	0.748	0.562	0.576	0.970	0.676	3.71	0.0732	2.57
7.5	4.83	5.38	2.91	1.94	1.15	2.35	0.578	0.461	0.513	0.821	0.638	2.74	0.0896	1.08
5.7	4.48	11.0	2.50	1.67	1.23	1.94	0.447	0.383	0.518	0.656	0.605	2.74	0.0433	0.838

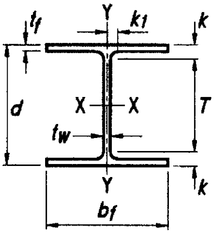


Table 1–4
HP Shapes
Dimensions

Shape	Area, A	Depth, d		Web			Flange				Distance			
				Thickness, t_w		$\frac{t_w}{2}$	Width, b_f		Thickness, t_f		k	k_1	T	Workable Gage
	in.^{2}	in.		in.		in.	in.		in.		in.	in.	in.	in.
HP14×117[f]	34.4	14.2	14 1/4	0.805	13/16	7/16	14.9	14 7/8	0.805	13/16	1 1/2	1 1/16	11 1/4	5 1/2
×102[f]	30.0	14.0	14	0.705	11/16	3/8	14.8	14 3/4	0.705	11/16	1 3/8	1		
×89[f]	26.1	13.8	13 7/8	0.615	5/8	5/16	14.7	14 3/4	0.615	5/8	1 5/16	15/16		
×73[c,f]	21.4	13.6	13 5/8	0.505	1/2	1/4	14.6	14 5/8	0.505	1/2	1 3/16	7/8		
HP12×84	24.6	12.3	12 1/4	0.685	11/16	3/8	12.3	12 1/4	0.685	11/16	1 3/8	1	9 1/2	5 1/2
×74[f]	21.8	12.1	12 1/8	0.605	5/8	5/16	12.2	12 1/4	0.610	5/8	1 5/16	15/16		
×63[f]	18.4	11.9	12	0.515	1/2	1/4	12.1	12 1/8	0.515	1/2	1 1/4	7/8		
×53[f]	15.5	11.8	11 3/4	0.435	7/16	1/4	12.0	12	0.435	7/16	1 1/8	7/8		
HP10×57[f]	16.8	9.99	10	0.565	9/16	5/16	10.2	10 1/4	0.565	9/16	1 1/4	15/16	7 1/2	5 1/2
×42[f]	12.4	9.70	9 3/4	0.415	7/16	1/4	10.1	10 1/8	0.420	7/16	1 1/8	13/16	7 1/2	5 1/2
HP8×36[f]	10.6	8.02	8	0.445	7/16	1/4	8.16	8 1/8	0.445	7/16	1 1/8	7/8	5 3/4	5 1/2

[c] Shape is slender for compression with F_y = 50 ksi.
[f] Shape exceeds compact limit for flexure with F_y = 50 ksi.

Table 1-4 (continued)
HP Shapes
Properties

HP SHAPES

Nom-inal Wt.	Compact Section Criteria		Axis X-X				Axis Y-Y				r_{ts}	h_o	$\frac{J}{S_x h_o}$	Torsional Properties	
	$\frac{b_f}{2t_f}$	$\frac{h}{t_w}$	I	S	r	Z	I	S	r	Z				J	C_w
lb/ft			in.^{4}	in.^{3}	in.	in.^{3}	in.^{4}	in.^{3}	in.	in.^{3}	in.	in.		in.^{4}	in.^{6}
117	9.25	14.2	1220	172	5.96	194	443	59.5	3.59	91.4	4.15	13.41	0.00348	8.02	19900
102	10.5	16.2	1050	150	5.92	169	380	51.4	3.56	78.8	4.10	13.31	0.00270	5.39	16800
89	11.9	18.5	904	131	5.88	146	326	44.3	3.53	67.7	4.05	13.22	0.00207	3.59	14200
73	14.4	22.6	729	107	5.84	118	261	35.8	3.49	54.6	4.00	13.11	0.00143	2.01	11200
84	8.97	14.2	650	106	5.14	120	213	34.6	2.94	53.2	3.41	11.60	0.00345	4.24	7140
74	10.0	16.1	569	93.8	5.11	105	186	30.4	2.92	46.6	3.38	11.52	0.00276	2.98	6160
63	11.8	18.9	472	79.1	5.06	88.3	153	25.3	2.88	38.7	3.33	11.43	0.00202	1.83	5000
53	13.8	22.3	393	66.7	5.03	74.0	127	21.1	2.86	32.2	3.29	11.35	0.00148	1.12	4080
57	9.05	13.9	294	58.8	4.18	66.5	101	19.7	2.45	30.3	2.84	9.43	0.00355	1.97	2240
42	12.0	18.9	210	43.4	4.13	48.3	71.7	14.2	2.41	21.8	2.77	9.28	0.00202	0.813	1540
36	9.16	14.2	119	29.8	3.36	33.6	40.3	9.88	1.95	15.2	2.26	7.58	0.00341	0.770	578

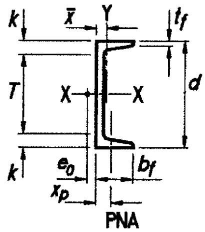


Table 1–5
C Shapes
Dimensions

Shape	Area, A	Depth, d		Web Thickness, t_w		Web $\frac{t_w}{2}$	Flange Width, b_f		Flange Thickness, t_f		Distance k	Distance T	Distance Workable Gage	r_{ts}	h_o
	in.^{2}	in.		in.		in.	in.		in.		in.	in.	in.	in.	in.
C15×50	14.7	15.0	15	0.716	11/16	3/8	3.72	3 3/4	0.650	5/8	1 7/16	12 1/8	2 1/4	1.17	14.4
×40	11.8	15.0	15	0.520	1/2	1/4	3.52	3 1/2	0.650	5/8	1 7/16	12 1/8	2	1.15	14.4
×33.9	10.0	15.0	15	0.400	3/8	3/16	3.40	3 3/8	0.650	5/8	1 7/16	12 1/8	2	1.13	14.4
C12×30	8.81	12.0	12	0.510	1/2	1/4	3.17	3 1/8	0.501	1/2	1 1/8	9 3/4	1 3/4[g]	1.01	11.5
×25	7.34	12.0	12	0.387	3/8	3/16	3.05	3	0.501	1/2	1 1/8	9 3/4	1 3/4[g]	1.00	11.5
×20.7	6.08	12.0	12	0.282	5/16	3/16	2.94	3	0.501	1/2	1 1/8	9 3/4	1 3/4[g]	0.983	11.5
C10×30	8.81	10.0	10	0.673	11/16	3/8	3.03	3	0.436	7/16	1	8	1 3/4[g]	0.925	9.56
×25	7.34	10.0	10	0.526	1/2	1/4	2.89	2 7/8	0.436	7/16	1	8	1 3/4[g]	0.911	9.56
×20	5.87	10.0	10	0.379	3/8	3/16	2.74	2 3/4	0.436	7/16	1	8	1 1/2[g]	0.894	9.56
×15.3	4.48	10.0	10	0.240	1/4	1/8	2.60	2 5/8	0.436	7/16	1	8	1 1/2[g]	0.869	9.56
C9×20	5.87	9.00	9	0.448	7/16	1/4	2.65	2 5/8	0.413	7/16	1	7	1 1/2[g]	0.848	8.59
×15	4.41	9.00	9	0.285	5/16	3/16	2.49	2 1/2	0.413	7/16	1	7	1 3/8[g]	0.824	8.59
×13.4	3.94	9.00	9	0.233	1/4	1/8	2.43	2 3/8	0.413	7/16	1	7	1 3/8[g]	0.813	8.59
C8×18.7	5.51	8.00	8	0.487	1/2	1/4	2.53	2 1/2	0.390	3/8	15/16	6 1/8	1 1/2[g]	0.800	7.61
×13.7	4.04	8.00	8	0.303	5/16	3/16	2.34	2 3/8	0.390	3/8	15/16	6 1/8	1 3/8[g]	0.774	7.61
×11.5	3.37	8.00	8	0.220	1/4	1/8	2.26	2 1/4	0.390	3/8	15/16	6 1/8	1 3/8[g]	0.756	7.61
C7×14.7	4.33	7.00	7	0.419	7/16	1/4	2.30	2 1/4	0.366	3/8	7/8	5 1/4	1 1/4[g]	0.738	6.63
×12.2	3.60	7.00	7	0.314	5/16	3/16	2.19	2 1/4	0.366	3/8	7/8	5 1/4	1 1/4[g]	0.721	6.63
×9.8	2.87	7.00	7	0.210	3/16	1/8	2.09	2 1/8	0.366	3/8	7/8	5 1/4	1 1/4[g]	0.698	6.63
C6×13	3.81	6.00	6	0.437	7/16	1/4	2.16	2 1/8	0.343	5/16	13/16	4 /8	1 3/8[g]	0.689	5.66
×10.5	3.08	6.00	6	0.314	5/16	3/16	2.03	2	0.343	5/16	13/16	4 3/8	1 1/8[g]	0.669	5.66
×8.2	2.39	6.00	6	0.200	3/16	1/8	1.92	1 7/8	0.343	5/16	13/16	4 3/8	1 1/8[g]	0.643	5.66
C5×9	2.64	5.00	5	0.325	5/16	3/16	1.89	1 7/8	0.320	5/16	3/4	3 1/2	1 1/8[g]	0.617	4.68
×6.7	1.97	5.00	5	0.190	3/16	1/8	1.75	1 3/4	0.320	5/16	3/4	3 1/2	—	0.584	4.68
C4×7.2	2.13	4.00	4	0.321	5/16	3/16	1.72	1 3/4	0.296	5/16	3/4	2 1/2	1[g]	0.563	3.70
×5.4	1.58	4.00	4	0.184	3/16	1/8	1.58	1 5/8	0.296	5/16	3/4	2 1/2	—	0.528	3.70
×4.5	1.38	4.00	4	0.125	1/8	1/16	1.58	1 5/8	0.296	5/16	3/4	2 1/2	—	0.524	3.70
C3×6	1.76	3.00	3	0.356	3/8	3/16	1.60	1 5/8	0.273	1/4	11/16	1 5/8	—	0.519	2.73
×5	1.47	3.00	3	0.258	1/4	1/8	1.50	1 1/2	0.273	1/4	11/16	1 5/8	—	0.495	2.73
×4.1	1.20	3.00	3	0.170	3/16	1/8	1.41	1 3/8	0.273	1/4	11/16	1 5/8	—	0.469	2.73
×3.5	1.09	3.00	3	0.132	1/8	1/16	1.37	1 3/8	0.273	1/4	11/16	1 5/8	—	0.455	2.73

[g] The actual size, combination, and orientation of fastener components should be compared with the geometry of the cross-section to ensure compatibility.

— Flange is too narrow to establish a workable gage.

Table 1–5 (continued)
C Shapes
Properties

C SHAPES

Nominal Wt.	Shear Ctr, e_o	Axis X-X				Axis Y-Y						Torsional Properties			
		I	S	r	Z	I	S	r	$\bar{x}$	Z	x_p	J	C_w	$\bar{r}_o$	H
lb/ft	in.	in.^{4}	in.^{3}	in.	in.^{3}	in.^{4}	in.^{3}	in.	in.	in.^{3}	in.	in.^{4}	in.^{6}	in.	
50	0.583	404	53.8	5.24	68.5	11.0	3.77	0.865	0.799	8.14	0.490	2.65	492	5.49	0.937
40	0.767	348	46.5	5.45	57.5	9.17	3.34	0.883	0.778	6.84	0.392	1.45	410	5.73	0.927
33.9	0.896	315	42.0	5.62	50.8	8.07	3.09	0.901	0.788	6.19	0.332	1.01	358	5.94	0.920
30	0.618	162	27.0	4.29	33.8	5.12	2.05	0.762	0.674	4.32	0.367	0.861	151	4.54	0.919
25	0.746	144	24.0	4.43	29.4	4.45	1.87	0.779	0.674	3.82	0.306	0.538	130	4.72	0.909
20.7	0.870	129	21.5	4.61	25.6	3.86	1.72	0.797	0.698	3.47	0.253	0.369	112	4.93	0.899
30	0.368	103	20.7	3.42	26.7	3.93	1.65	0.668	0.649	3.78	0.441	1.22	79.5	3.63	0.922
25	0.494	91.1	18.2	3.52	23.1	3.34	1.47	0.675	0.617	3.18	0.367	0.687	68.3	3.75	0.912
20	0.636	78.9	15.8	3.66	19.4	2.80	1.31	0.690	0.606	2.70	0.294	0.368	56.9	3.93	0.900
15.3	0.796	67.3	13.5	3.87	15.9	2.27	1.15	0.711	0.634	2.34	0.224	0.209	45.5	4.19	0.884
20	0.515	60.9	13.5	3.22	16.9	2.41	1.17	0.640	0.583	2.46	0.326	0.427	39.4	3.46	0.899
15	0.681	51.0	11.3	3.40	13.6	1.91	1.01	0.659	0.586	2.04	0.245	0.208	31.0	3.69	0.882
13.4	0.742	47.8	10.6	3.49	12.6	1.75	0.954	0.666	0.601	1.94	0.219	0.168	28.2	3.79	0.875
18.7	0.431	43.9	11.0	2.82	13.9	1.97	1.01	0.598	0.565	2.17	0.344	0.434	25.1	3.05	0.894
13.7	0.604	36.1	9.02	2.99	11.0	1.52	0.848	0.613	0.554	1.73	0.252	0.186	19.2	3.26	0.874
11.5	0.697	32.5	8.14	3.11	9.63	1.31	0.775	0.623	0.572	1.57	0.211	0.130	16.5	3.41	0.862
14.7	0.441	27.2	7.78	2.51	9.75	1.37	0.772	0.561	0.532	1.63	0.309	0.267	13.1	2.75	0.875
12.2	0.538	24.2	6.92	2.60	8.46	1.16	0.696	0.568	0.525	1.42	0.257	0.161	11.2	2.86	0.862
9.8	0.647	21.2	6.07	2.72	7.19	0.957	0.617	0.578	0.541	1.26	0.205	0.0996	9.15	3.03	0.846
13	0.380	17.3	5.78	2.13	7.29	1.05	0.638	0.524	0.514	1.35	0.318	0.237	7.19	2.37	0.858
10.5	0.486	15.1	5.04	2.22	6.18	0.860	0.561	0.529	0.500	1.14	0.256	0.128	5.91	2.48	0.842
8.2	0.599	13.1	4.35	2.34	5.16	0.687	0.488	0.536	0.512	0.987	0.199	0.0736	4.70	2.64	0.823
9	0.427	8.89	3.56	1.83	4.39	0.624	0.444	0.486	0.478	0.913	0.264	0.109	2.93	2.10	0.815
6.7	0.552	7.48	2.99	1.95	3.55	0.470	0.372	0.489	0.484	0.757	0.215	0.0549	2.22	2.26	0.791
7.2	0.386	4.58	2.29	1.47	2.84	0.425	0.337	0.447	0.459	0.695	0.266	0.0817	1.24	1.75	0.767
5.4	0.501	3.85	1.92	1.56	2.29	0.312	0.277	0.444	0.457	0.565	0.231	0.0399	0.921	1.88	0.741
4.5	0.587	3.65	1.83	1.63	2.12	0.289	0.265	0.457	0.493	0.531	0.321	0.0322	0.871	2.00	0.710
6	0.322	2.07	1.38	1.08	1.74	0.300	0.263	0.413	0.455	0.543	0.294	0.0725	0.462	1.40	0.690
5	0.392	1.85	1.23	1.12	1.52	0.241	0.228	0.405	0.439	0.464	0.245	0.0425	0.379	1.45	0.674
4.1	0.461	1.65	1.10	1.17	1.32	0.191	0.196	0.398	0.437	0.399	0.262	0.0269	0.307	1.53	0.655
3.5	0.493	1.57	1.04	1.20	1.24	0.169	0.182	0.394	0.443	0.364	0.296	0.0226	0.276	1.57	0.645

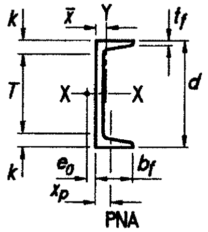


Table 1-6
MC Shapes
Dimensions

Shape	Area, A	Depth, d		Web Thickness, t_w		Web $\frac{t_w}{2}$	Flange Width, b_f		Flange Average Thickness, t_f		Distance k	Distance T	Distance Workable Gage	r_{ts}	h_o
	in.^{2}	in.		in.		in.	in.		in.		in.	in.	in.	in.	in.
MC18×58	17.1	18.0	18	0.700	11/16	3/8	4.20	4 1/4	0.625	5/8	1 7/16	15 1/8	2 1/2	1.35	17.4
×51.9	15.3	18.0	18	0.600	5/8	5/16	4.10	4 1/8	0.625	5/8	1 7/16			1.35	17.4
×45.8	13.5	18.0	18	0.500	1/2	1/4	4.00	4	0.625	5/8	1 7/16			1.34	17.4
×42.7	12.6	18.0	18	0.450	7/16	1/4	3.95	4	0.625	5/8	1 7/16	↓	↓	1.34	17.4
MC13×50	14.7	13.0	13	0.787	13/16	7/16	4.41	4 3/8	0.610	5/8	1 7/16	10 1/8	2 1/2	1.41	12.4
×40	11.8	13.0	13	0.560	9/16	5/16	4.19	4 1/8	0.610	5/8	1 7/16			1.38	12.4
×35	10.3	13.0	13	0.447	7/16	1/4	4.07	4 1/8	0.610	5/8	1 7/16			1.35	12.4
×31.8	9.35	13.0	13	0.375	3/8	3/16	4.00	4	0.610	5/8	1 7/16	↓	↓	1.34	12.4
MC12×50	14.7	12.0	12	0.835	13/16	7/16	4.14	4 1/8	0.700	11/16	1 5/16	9 3/8	2 1/2	1.37	11.3
×45	13.2	12.0	12	0.710	11/16	3/8	4.01	4	0.700	11/16	1 5/16			1.35	11.3
×40	11.8	12.0	12	0.590	9/16	5/16	3.89	3 7/8	0.700	11/16	1 5/16			1.33	11.3
×35	10.3	12.0	12	0.465	7/16	1/4	3.77	3 3/4	0.700	11/16	1 5/16		↓	1.30	11.3
×31	9.12	12.0	12	0.370	3/8	3/16	3.67	3 5/8	0.700	11/16	1 5/16	↓	2 1/4	1.28	11.3
MC12×10.6[c]	3.10	12.0	12	0.190	3/16	1/8	1.50	1 1/2	0.309	5/16	3/4	10 1/2	—	0.477	11.7
MC10×41.1	12.1	10.0	10	0.796	13/16	7/16	4.32	4 3/8	0.575	9/16	1 5/16	7 3/8	2 1/2[g]	1.44	9.43
×33.6	9.87	10.0	10	0.575	9/16	5/16	4.10	4 1/8	0.575	9/16	1 5/16	7 3/8	2 1/2[g]	1.40	9.43
×28.5	8.37	10.0	10	0.425	7/16	1/4	3.95	4	0.575	9/16	1 5/16	7 3/8	2 1/2[g]	1.36	9.43
MC10×25	7.35	10.0	10	0.380	3/8	3/16	3.41	3 3/8	0.575	9/16	1 5/16	7 3/8	2[g]	1.17	9.43
×22	6.45	10.0	10	0.290	5/16	3/16	3.32	3 3/8	0.575	9/16	1 5/16	7 3/8	2[g]	1.14	9.43
MC10×8.4[c]	2.46	10.0	10	0.170	3/16	1/8	1.50	1 1/2	0.280	1/4	3/4	8 1/2	—	0.486	9.72
×6.5[c]	1.95	10.0	10	0.152	1/8	1/16	1.17	1 1/8	0.202	3/16	9/16	8 7/8	—	0.364	9.80
MC9×25.4	7.47	9.00	9	0.450	7/16	1/4	3.50	3 1/2	0.550	9/16	1 1/4	6 1/2	2[g]	1.20	8.45
×23.9	7.02	9.00	9	0.400	3/8	3/16	3.45	3 1/2	0.550	9/16	1 1/4	6 1/2	2[g]	1.18	8.45
MC8×22.8	6.70	8.00	8	0.427	7/16	1/4	3.50	3 1/2	0.525	1/2	1 3/16	5 5/8	2[g]	1.20	7.48
×21.4	6.28	8.00	8	0.375	3/8	3/16	3.45	3 1/2	0.525	1/2	1 3/16	5 5/8	2[g]	1.18	7.48
MC8×20	5.88	8.00	8	0.400	3/8	3/16	3.03	3	0.500	1/2	1 1/8	5 3/4	2[g]	1.03	7.50
×18.7	5.50	8.00	8	0.353	3/8	3/16	2.98	3	0.500	1/2	1 1/8	5 3/4	2[g]	1.02	7.50
MC8×8.5	2.50	8.00	8	0.179	3/16	1/8	1.87	1 7/8	0.311	5/16	13/16	6 3/8	1 1/8[g]	0.624	7.69

[c] Shape is slender for compression with F_y = 36 ksi.
[g] The actual size, combination, and orientation of fastener components should be compared with the geometry of the cross-section to ensure compatibility.
— Flange is too narrow to establish a workable gage.

Table 1–6 (continued)
MC Shapes
Properties

MC18–MC8

Nom-inal Wt.	Shear Ctr, e_o	Axis X-X				Axis Y-Y						Torsional Properties		
		I	S	r	Z	I	S	r	$\bar{x}$	Z	x_p	J	C_w	$\bar{r}_o$
lb/ft	in.	in.^{4}	in.^{3}	in.	in.^{3}	in.^{4}	in.^{3}	in.	in.	in.^{3}	in.	in.^{4}	in.^{6}	in.
58	0.695	675	75.0	6.29	95.4	17.6	5.28	1.02	0.862	10.7	0.474	2.81	1070	6.56
51.9	0.797	627	69.6	6.41	87.3	16.3	5.02	1.03	0.858	9.86	0.424	2.03	985	6.70
45.8	0.909	578	64.2	6.55	79.2	14.9	4.77	1.05	0.866	9.14	0.374	1.45	897	6.87
42.7	0.969	554	61.5	6.64	75.1	14.3	4.64	1.07	0.877	8.82	0.349	1.23	852	6.97
50	0.815	314	48.3	4.62	60.8	16.4	4.77	1.06	0.974	10.2	0.566	2.96	558	5.07
40	1.03	273	41.9	4.82	51.2	13.7	4.24	1.08	0.963	8.66	0.452	1.55	462	5.32
35	1.16	252	38.8	4.95	46.5	12.3	3.97	1.09	0.980	8.04	0.396	1.13	412	5.50
31.8	1.24	239	36.7	5.05	43.4	11.4	3.79	1.10	1.00	7.69	0.360	0.937	380	5.64
50	0.741	269	44.9	4.28	56.5	17.4	5.64	1.09	1.05	10.9	0.613	3.23	411	4.77
45	0.845	251	41.9	4.36	52.0	15.8	5.30	1.09	1.04	10.1	0.550	2.33	373	4.88
40	0.952	234	39.0	4.46	47.7	14.2	4.98	1.10	1.04	9.31	0.490	1.69	336	5.01
35	1.07	216	36.0	4.59	43.2	12.6	4.64	1.11	1.05	8.62	0.428	1.24	297	5.18
31	1.17	202	33.7	4.71	39.7	11.3	4.37	1.11	1.08	8.15	0.425	1.00	267	5.34
10.6	0.284	55.3	9.22	4.22	11.6	0.378	0.307	0.349	0.269	0.635	0.129	0.0596	11.7	4.27
41.1	0.864	157	31.5	3.61	39.3	15.7	4.85	1.14	1.09	9.49	0.604	2.26	269	4.26
33.6	1.06	139	27.8	3.75	33.7	13.1	4.35	1.15	1.09	8.28	0.494	1.20	224	4.47
28.5	1.21	126	25.3	3.89	30.0	11.3	3.99	1.16	1.12	7.59	0.419	0.791	193	4.68
25	1.03	110	22.0	3.87	26.2	7.25	2.96	0.993	0.953	5.65	0.367	0.638	124	4.46
22	1.12	102	20.5	3.99	23.9	6.40	2.75	0.997	0.990	5.29	0.467	0.510	110	4.62
8.4	0.332	31.9	6.39	3.61	7.92	0.326	0.268	0.364	0.284	0.548	0.123	0.0413	7.00	3.68
6.5	0.182	22.9	4.59	3.43	5.90	0.133	0.137	0.262	0.194	0.284	0.0975	0.0191	2.76	3.46
25.4	0.986	87.9	19.5	3.43	23.5	7.57	2.99	1.01	0.970	5.70	0.415	0.691	104	4.08
23.9	1.04	84.9	18.9	3.48	22.5	7.14	2.89	1.01	0.981	5.51	0.390	0.599	98.0	4.15
22.8	1.04	63.8	15.9	3.09	19.1	7.01	2.81	1.02	1.01	5.37	0.419	0.572	75.2	3.84
21.4	1.09	61.5	15.4	3.13	18.2	6.58	2.71	1.02	1.02	5.18	0.452	0.495	70.8	3.91
20	0.843	54.4	13.6	3.04	16.4	4.42	2.02	0.867	0.840	3.86	0.367	0.441	47.8	3.58
18.7	0.889	52.4	13.1	3.09	15.6	4.15	1.95	0.868	0.849	3.72	0.344	0.380	45.0	3.65
8.5	0.542	23.3	5.82	3.05	6.95	0.624	0.431	0.500	0.428	0.875	0.156	0.0587	8.21	3.24

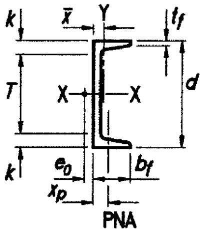


Table 1-6 (continued)
MC Shapes
Dimensions

Shape	Area, A	Depth, d		Web			Flange				Distance			r_{ts}	h_o
				Thickness, t_w		$\frac{t_w}{2}$	Width, b_f		Average Thickness, t_f		k	T	Workable Gage		
	in.^{2}	in.		in.		in.	in.		in.		in.	in.	in.	in.	in.
MC7×22.7	6.67	7.00	7	0.503	1/2	1/4	3.60	3 5/8	0.500	1/2	1 1/8	4 3/4	2[g]	1.23	6.50
×19.1	5.61	7.00	7	0.352	3/8	3/16	3.45	3 1/2	0.500	1/2	1 1/8	4 3/4	2[g]	1.18	6.50
MC6×18	5.29	6.00	6	0.379	3/8	3/16	3.50	3 1/2	0.475	1/2	1 1/16	3 7/8	2[g]	1.20	5.53
×15.3	4.49	6.00	6	0.340	5/16	3/16	3.50	3 1/2	0.385	3/8	7/8	4 1/4	2[g]	1.20	5.62
MC6×16.3	4.79	6.00	6	0.375	3/8	3/16	3.00	3	0.475	1/2	11/16	3 7/8	1 3/4[g]	1.03	5.53
×15.1	4.44	6.00	6	0.316	5/16	3/16	2.94	3	0.475	1/2	11/16	3 7/8	1 3/4[g]	1.01	5.53
MC6×12	3.53	6.00	6	0.310	5/16	3/16	2.50	2 1/2	0.375	3/8	7/8	4 1/4	1 1/2[g]	0.856	5.63
MC6×7	2.09	6.00	6	0.179	3/16	1/8	1.88	1 7/8	0.291	5/16	3/4	4 1/2	—	0.638	5.71
×6.5	1.95	6.00	6	0.155	1/8	1/16	1.85	1 7/8	0.291	5/16	3/4	4 1/2	—	0.630	5.71
MC4×13.8	4.03	4.00	4	0.500	1/2	1/4	2.50	2 1/2	0.500	1/2	1	2	—	0.852	3.50
MC3×7.1	2.11	3.00	3	0.312	5/16	3/16	1.94	2	0.351	3/8	13/16	1 3/8	—	0.657	2.65

[g] The actual size, combination, and orientation of fastener components should be compared with the geometry of the cross-section to ensure compatibility.

— Flange is too narrow to establish a workable gage.

Table 1–6 (continued)
MC Shapes
Properties

MC7–MC3

Nom-inal Wt.	Shear Ctr, e_o	Axis X-X				Axis Y-Y						Torsional Properties		
		I	S	r	Z	I	S	r	$\bar{x}$	Z	x_p	J	C_w	$\bar{r}_o$
lb/ft	in.	in.^{4}	in.^{3}	in.	in.^{3}	in.^{4}	in.^{3}	in.	in.	in.^{3}	in.	in.^{4}	in.^{6}	in.
22.7	1.01	47.4	13.5	2.67	16.4	7.24	2.83	1.04	1.04	5.38	0.477	0.625	58.3	3.53
19.1	1.15	43.1	12.3	2.77	14.5	6.06	2.55	1.04	1.08	4.85	0.579	0.407	49.3	3.70
18	1.17	29.7	9.89	2.37	11.7	5.88	2.47	1.05	1.12	4.68	0.644	0.379	34.6	3.46
15.3	1.16	25.3	8.44	2.38	9.91	4.91	2.01	1.05	1.05	3.85	0.511	0.223	30.0	3.41
16.3	0.930	26.0	8.66	2.33	10.4	3.77	1.82	0.887	0.927	3.47	0.465	0.336	22.1	3.11
15.1	0.982	24.9	8.30	2.37	9.83	3.46	1.73	0.883	0.940	3.30	0.543	0.285	20.5	3.18
12	0.725	18.7	6.24	2.30	7.47	1.85	1.03	0.724	0.704	1.97	0.294	0.155	11.3	2.80
7	0.583	11.4	3.81	2.34	4.50	0.603	0.439	0.537	0.501	0.865	0.174	0.0464	4.00	2.63
6.5	0.612	11.0	3.66	2.38	4.28	0.565	0.422	0.539	0.513	0.836	0.191	0.0412	3.75	2.68
13.8	0.643	8.85	4.43	1.48	5.53	2.13	1.29	0.727	0.849	2.40	0.508	0.373	4.84	2.23
7.1	0.574	2.72	1.81	1.14	2.24	0.666	0.518	0.562	0.653	0.998	0.414	0.0928	0.915	1.76

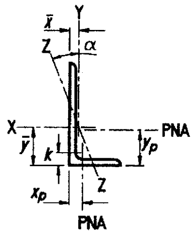


Table 1–7
Angles
Properties

Shape	k	Wt.	Area, A	Axis X-X						Flexural-Torsional Properties		
				I	S	r	$\bar{y}$	Z	y_p	J	C_w	$\bar{r}_o$
	in.	lb/ft	in.^{2}	in.^{4}	in.^{3}	in.	in.	in.^{3}	in.	in.^{4}	in.^{6}	in.
L8×8×1 1/8	1 3/4	56.9	16.7	98.1	17.5	2.41	2.40	31.6	1.05	7.13	32.5	4.29
×1	1 5/8	51.0	15.0	89.1	15.8	2.43	2.36	28.5	0.943	5.08	23.4	4.32
×7/8	1 1/2	45.0	13.2	79.7	14.0	2.45	2.31	25.3	0.832	3.46	16.1	4.36
×3/4	1 3/8	38.9	11.4	69.9	12.2	2.46	2.26	22.0	0.720	2.21	10.4	4.39
×5/8	1 1/4	32.7	9.61	59.6	10.3	2.48	2.21	18.6	0.606	1.30	6.16	4.42
×9/16	1 3/16	29.6	8.68	54.2	9.33	2.49	2.19	16.8	0.548	0.961	4.55	4.43
×1/2	1 1/8	26.4	7.75	48.8	8.36	2.49	2.17	15.1	0.490	0.683	3.23	4.45
L8×6×1	1 1/2	44.2	13.0	80.9	15.1	2.49	2.65	27.3	1.47	4.34	16.3	3.88
×7/8	1 3/8	39.1	11.5	72.4	13.4	2.50	2.60	24.3	1.41	2.96	11.3	3.92
×3/4	1 1/4	33.8	9.94	63.5	11.7	2.52	2.55	21.1	1.34	1.90	7.28	3.95
×5/8	1 1/8	28.5	8.36	54.2	9.86	2.54	2.50	17.9	1.27	1.12	4.33	3.98
×9/16	1 1/16	25.7	7.56	49.4	8.94	2.55	2.48	16.2	1.23	0.823	3.20	3.99
×1/2	1	23.0	6.75	44.4	8.01	2.55	2.46	14.6	1.20	0.584	2.28	4.01
×7/16	15/16	20.2	5.93	39.3	7.06	2.56	2.43	12.9	1.16	0.396	1.55	4.02
L8×4×1	1 1/2	37.4	11.0	69.7	14.0	2.51	3.03	24.3	2.47	3.68	12.9	3.75
×7/8	1 3/8	33.1	9.73	62.6	12.5	2.53	2.99	21.7	2.41	2.51	8.89	3.78
×3/4	1 1/4	28.7	8.44	55.0	10.9	2.55	2.94	18.9	2.34	1.61	5.75	3.80
×5/8	1 1/8	24.2	7.11	47.0	9.20	2.56	2.89	16.1	2.27	0.955	3.42	3.83
×9/16	1 1/16	21.9	6.43	42.9	8.34	2.57	2.86	14.6	2.23	0.704	2.53	3.84
×1/2	1	19.6	5.75	38.6	7.48	2.58	2.84	13.1	2.20	0.501	1.80	3.86
×7/16	15/16	17.2	5.06	34.2	6.59	2.59	2.81	11.6	2.16	0.340	1.22	3.87
L7×4×3/4	1 1/4	26.2	7.69	37.8	8.39	2.21	2.50	14.8	1.87	1.47	3.97	3.31
×5/8	1 1/8	22.1	6.48	32.4	7.12	2.23	2.45	12.5	1.80	0.868	2.37	3.34
×1/2	1	17.9	5.25	26.6	5.79	2.25	2.40	10.2	1.74	0.456	1.25	3.37
×7/16	15/16	15.7	4.62	23.6	5.11	2.26	2.38	9.03	1.70	0.310	0.851	3.38
×3/8	7/8	13.6	3.98	20.5	4.42	2.27	2.35	7.81	1.67	0.198	0.544	3.40
L6×6×1	1 1/2	37.4	11.0	35.4	8.55	1.79	1.86	15.4	0.918	3.68	9.24	3.18
×7/8	1 3/8	33.1	9.75	31.9	7.61	1.81	1.81	13.7	0.813	2.51	6.41	3.21
×3/4	1 1/4	28.7	8.46	28.1	6.64	1.82	1.77	11.9	0.705	1.61	4.17	3.24
×5/8	1 1/8	24.2	7.13	24.1	5.64	1.84	1.72	10.1	0.594	0.955	2.50	3.28
×9/16	1 1/16	21.9	6.45	22.0	5.12	1.85	1.70	9.18	0.538	0.704	1.85	3.29
×1/2	1	19.6	5.77	19.9	4.59	1.86	1.67	8.22	0.481	0.501	1.32	3.31
×7/16	15/16	17.2	5.08	17.6	4.06	1.86	1.65	7.25	0.423	0.340	0.899	3.32
×3/8	7/8	14.9	4.38	15.4	3.51	1.87	1.62	6.27	0.365	0.218	0.575	3.34
×5/16	13/16	12.4	3.67	13.0	2.95	1.88	1.60	5.26	0.306	0.129	0.338	3.35

Note: For compactness criteria, refer to the end of Table 1–7.

Table 1-7 (continued)
Angles
Properties

L8-L6

Shape	Axis Y-Y						Axis Z-Z			Tan α	Q_s
	I	S	r	$\bar{x}$	Z	x_p	I	S	r		$F_y = 36$ ksi
	in.^{4}	in.^{3}	in.	in.	in.^{3}	in.	in.^{4}	in.^{3}	in.		
L8×8×1 1/8	98.1	17.5	2.41	2.40	31.6	1.05	40.9	7.23	1.56	1.00	1.00
×1	89.1	15.8	2.43	2.36	28.5	0.943	36.8	6.51	1.56	1.00	1.00
×7/8	79.7	14.0	2.45	2.31	25.3	0.832	32.7	5.78	1.57	1.00	1.00
×3/4	69.9	12.2	2.46	2.26	22.0	0.720	28.5	5.04	1.57	1.00	1.00
×5/8	59.6	10.3	2.48	2.21	18.6	0.606	24.2	4.27	1.58	1.00	0.997
×9/16	54.2	9.33	2.49	2.19	16.8	0.548	22.0	3.88	1.58	1.00	0.959
×1/2	48.8	8.36	2.49	2.17	15.1	0.490	19.7	3.49	1.59	1.00	0.912
L8×6×1	38.8	8.92	1.72	1.65	16.2	0.816	21.3	4.84	1.28	0.542	1.00
×7/8	34.9	7.94	1.74	1.60	14.4	0.721	18.9	4.31	1.28	0.546	1.00
×3/4	30.8	6.92	1.75	1.56	12.5	0.624	16.5	3.78	1.29	0.550	1.00
×5/8	26.4	5.88	1.77	1.51	10.5	0.526	14.1	3.22	1.29	0.554	0.997
×9/16	24.1	5.34	1.78	1.49	9.52	0.476	12.8	2.94	1.30	0.556	0.959
×1/2	21.7	4.79	1.79	1.46	8.52	0.425	11.5	2.64	1.30	0.557	0.912
×7/16	19.3	4.23	1.80	1.44	7.50	0.374	10.2	2.35	1.31	0.559	0.850
L8×4×1	11.6	3.94	1.03	1.04	7.73	0.691	7.87	2.15	0.844	0.247	1.00
×7/8	10.5	3.51	1.04	0.997	6.77	0.612	7.01	1.93	0.846	0.252	1.00
×3/4	9.37	3.07	1.05	0.949	5.82	0.531	6.13	1.70	0.850	0.257	1.00
×5/8	8.11	2.62	1.06	0.902	4.86	0.448	5.24	1.47	0.856	0.262	0.997
×9/16	7.44	2.38	1.07	0.878	4.39	0.405	4.79	1.34	0.859	0.264	0.959
×1/2	6.75	2.15	1.08	0.854	3.91	0.363	4.32	1.22	0.863	0.266	0.912
×7/16	6.03	1.90	1.09	0.829	3.42	0.320	3.84	1.09	0.867	0.268	0.850
L7×4×3/4	9.00	3.01	1.08	1.00	5.60	0.550	5.64	1.71	0.855	0.324	1.00
×5/8	7.79	2.56	1.10	0.958	4.69	0.464	4.80	1.47	0.860	0.329	1.00
×1/2	6.48	2.10	1.11	0.910	3.77	0.376	3.95	1.21	0.866	0.334	0.965
×7/16	5.79	1.86	1.12	0.886	3.31	0.331	3.50	1.08	0.869	0.337	0.912
×3/8	5.06	1.61	1.12	0.861	2.84	0.286	3.05	0.942	0.873	0.339	0.840
L6×6×1	35.4	8.55	1.79	1.86	15.4	0.918	15.0	3.53	1.17	1.00	1.00
×7/8	31.9	7.61	1.81	1.81	13.7	0.813	13.3	3.13	1.17	1.00	1.00
×3/4	28.1	6.64	1.82	1.77	11.9	0.705	11.6	2.73	1.17	1.00	1.00
×5/8	24.1	5.64	1.84	1.72	10.1	0.594	9.83	2.32	1.17	1.00	1.00
×9/16	22.0	5.12	1.85	1.70	9.17	0.538	8.94	2.11	1.18	1.00	1.00
×1/2	19.9	4.59	1.86	1.67	8.22	0.481	8.04	1.89	1.18	1.00	1.00
×7/16	17.6	4.06	1.86	1.65	7.25	0.423	7.11	1.68	1.18	1.00	0.973
×3/8	15.4	3.51	1.87	1.62	6.26	0.365	6.17	1.45	1.19	1.00	0.912
×5/16	13.0	2.95	1.88	1.60	5.26	0.306	5.20	1.23	1.19	1.00	0.826

Note: For compactness criteria, refer to the end of Table 1–7.

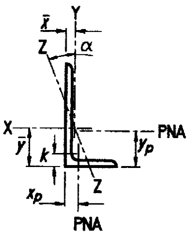


Table 1–7 (continued)
Angles
Properties

Shape	k	Wt.	Area, A	Axis X-X						Flexural-Torsional Properties		
				I	S	r	$\bar{y}$	Z	y_p	J	C_w	$\bar{r}_o$
	in.	lb/ft	in.^{2}	in.^{4}	in.^{3}	in.	in.	in.^{3}	in.	in.^{4}	in.^{6}	in.
L6×4×7/8	1 3/8	27.2	7.98	27.7	7.13	1.86	2.12	12.7	1.44	2.03	4.04	2.82
×3/4	1 1/4	23.6	6.94	24.5	6.23	1.88	2.07	11.1	1.38	1.31	2.64	2.85
×5/8	1 1/8	20.0	5.86	21.0	5.29	1.89	2.03	9.44	1.31	0.775	1.59	2.88
×9/16	1 1/16	18.1	5.31	19.2	4.81	1.90	2.00	8.59	1.28	0.572	1.18	2.90
×1/2	1	16.2	4.75	17.3	4.31	1.91	1.98	7.71	1.25	0.407	0.843	2.91
×7/16	15/16	14.3	4.18	15.4	3.81	1.92	1.95	6.81	1.22	0.276	0.575	2.93
×3/8	7/8	12.3	3.61	13.4	3.30	1.93	1.93	5.89	1.19	0.177	0.369	2.94
×5/16	13/16	10.3	3.03	11.4	2.77	1.94	1.90	4.96	1.16	0.104	0.217	2.96
L6×3 1/2×1/2	1	15.3	4.50	16.6	4.23	1.92	2.07	7.49	1.48	0.386	0.779	2.88
×3/8	7/8	11.7	3.42	12.9	3.23	1.93	2.02	5.74	1.41	0.168	0.341	2.90
×5/16	13/16	9.80	2.87	10.9	2.72	1.94	2.00	4.84	1.38	0.0990	0.201	2.92
L5×5×7/8	1 3/8	27.2	7.98	17.8	5.16	1.49	1.56	9.31	0.802	2.07	3.53	2.64
×3/4	1 1/4	23.6	6.94	15.7	4.52	1.50	1.52	8.14	0.698	1.33	2.32	2.67
×5/8	1 1/8	20.0	5.86	13.6	3.85	1.52	1.47	6.93	0.590	0.792	1.40	2.70
×1/2	1	16.2	4.75	11.3	3.15	1.53	1.42	5.66	0.479	0.417	0.744	2.73
×7/16	15/16	14.3	4.18	10.0	2.78	1.54	1.40	5.00	0.422	0.284	0.508	2.74
×3/8	7/8	12.3	3.61	8.76	2.41	1.55	1.37	4.33	0.365	0.183	0.327	2.76
×5/16	13/16	10.3	3.03	7.44	2.04	1.56	1.35	3.65	0.307	0.108	0.193	2.77
L5×3 1/2×3/4	1 3/16	19.8	5.81	13.9	4.26	1.55	1.74	7.60	1.12	1.09	1.52	2.36
×5/8	1 1/16	16.8	4.92	12.0	3.63	1.56	1.69	6.50	1.06	0.651	0.918	2.39
×1/2	15/16	13.6	4.00	9.96	2.97	1.58	1.65	5.33	0.997	0.343	0.491	2.42
×3/8	13/16	10.4	3.05	7.75	2.28	1.59	1.60	4.09	0.933	0.150	0.217	2.45
×5/16	3/4	8.70	2.56	6.58	1.92	1.60	1.57	3.45	0.901	0.0883	0.128	2.47
×1/4	11/16	7.00	2.06	5.36	1.55	1.61	1.55	2.78	0.868	0.0464	0.0670	2.48
L5×3×1/2	15/16	12.8	3.75	9.43	2.89	1.58	1.74	5.12	1.25	0.322	0.444	2.38
×7/16	7/8	11.3	3.31	8.41	2.56	1.59	1.72	4.53	1.21	0.220	0.304	2.39
×3/8	13/16	9.80	2.86	7.35	2.22	1.60	1.69	3.93	1.18	0.141	0.196	2.41
×5/16	3/4	8.20	2.40	6.24	1.87	1.61	1.67	3.32	1.15	0.0832	0.116	2.42
×1/4	11/16	6.60	1.94	5.09	1.51	1.62	1.64	2.68	1.12	0.0438	0.0606	2.43
L4×4×3/4	1 1/8	18.5	5.44	7.62	2.79	1.18	1.27	5.02	0.679	1.02	1.12	2.10
×5/8	1	15.7	4.61	6.62	2.38	1.20	1.22	4.28	0.576	0.610	0.680	2.13
×1/2	7/8	12.8	3.75	5.52	1.96	1.21	1.18	3.50	0.468	0.322	0.366	2.16
×7/16	13/16	11.3	3.31	4.93	1.73	1.22	1.15	3.10	0.413	0.220	0.252	2.18
×3/8	3/4	9.80	2.86	4.32	1.50	1.23	1.13	2.69	0.357	0.141	0.162	2.19
×5/16	11/16	8.20	2.40	3.67	1.27	1.24	1.11	2.26	0.300	0.0832	0.0963	2.21
×1/4	5/8	6.60	1.94	3.00	1.03	1.25	1.08	1.82	0.242	0.0438	0.0505	2.22

Note: For compactness criteria, refer to the end of Table 1–7.

Table 1-7 (continued)
Angles
Properties

L6-L4

Shape	Axis Y-Y						Axis Z-Z				Q_s
	I	S	r	$\bar{x}$	Z	x_p	I	S	r	Tan α	$F_y = 36$ ksi
	in.^{4}	in.^{3}	in.	in.	in.^{3}	in.	in.^{4}	in.^{3}	in.		
L6×4×7/8	9.70	3.37	1.10	1.12	6.26	0.665	5.82	1.90	0.854	0.421	1.00
×3/4	8.63	2.95	1.12	1.07	5.42	0.578	5.08	1.66	0.856	0.428	1.00
×5/8	7.48	2.52	1.13	1.03	4.56	0.488	4.32	1.42	0.859	0.435	1.00
×9/16	6.86	2.29	1.14	1.00	4.13	0.442	3.94	1.30	0.861	0.438	1.00
×1/2	6.22	2.06	1.14	0.981	3.69	0.396	3.55	1.17	0.864	0.440	1.00
×7/16	5.56	1.83	1.15	0.957	3.24	0.349	3.14	1.04	0.867	0.443	0.973
×3/8	4.86	1.58	1.16	0.933	2.79	0.301	2.73	0.908	0.870	0.446	0.912
×5/16	4.13	1.34	1.17	0.908	2.33	0.252	2.31	0.769	0.874	0.449	0.826
L6×3 1/2×1/2	4.24	1.59	0.968	0.829	2.88	0.376	2.58	0.914	0.756	0.343	1.00
×3/8	3.33	1.22	0.984	0.781	2.18	0.287	2.00	0.714	0.763	0.349	0.912
×5/16	2.84	1.03	0.991	0.756	1.82	0.241	1.70	0.609	0.767	0.352	0.826
L5×5×7/8	17.8	5.16	1.49	1.56	9.30	0.802	7.56	2.14	0.971	1.00	1.00
×3/4	15.7	4.52	1.50	1.52	8.14	0.698	6.59	1.86	0.972	1.00	1.00
×5/8	13.6	3.85	1.52	1.47	6.92	0.590	5.61	1.59	0.975	1.00	1.00
×1/2	11.3	3.15	1.53	1.42	5.66	0.479	4.60	1.30	0.980	1.00	1.00
×7/16	10.0	2.78	1.54	1.40	5.00	0.422	4.08	1.15	0.983	1.00	1.00
×3/8	8.76	2.41	1.55	1.37	4.33	0.365	3.55	1.00	0.986	1.00	0.983
×5/16	7.44	2.04	1.56	1.35	3.65	0.307	3.01	0.850	0.990	1.00	0.912
L5×3 1/2×3/4	5.52	2.20	0.974	0.993	4.07	0.582	3.22	1.22	0.744	0.464	1.00
×5/8	4.80	1.88	0.987	0.947	3.43	0.493	2.74	1.05	0.746	0.472	1.00
×1/2	4.02	1.55	1.00	0.901	2.79	0.400	2.25	0.862	0.750	0.479	1.00
×3/8	3.15	1.19	1.02	0.854	2.12	0.305	1.74	0.670	0.755	0.485	0.983
×5/16	2.69	1.01	1.02	0.829	1.77	0.256	1.47	0.569	0.758	0.489	0.912
×1/4	2.20	0.816	1.03	0.804	1.42	0.207	1.19	0.463	0.761	0.491	0.804
L5×3×1/2	2.55	1.13	0.824	0.746	2.08	0.375	1.55	0.645	0.642	0.357	1.00
×7/16	2.29	1.00	0.831	0.722	1.82	0.331	1.37	0.575	0.644	0.361	1.00
×3/8	2.01	0.874	0.838	0.698	1.57	0.286	1.20	0.503	0.646	0.364	0.983
×5/16	1.72	0.739	0.846	0.673	1.31	0.241	1.01	0.428	0.649	0.368	0.912
×1/4	1.41	0.600	0.853	0.648	1.05	0.194	0.825	0.350	0.652	0.371	0.804
L4×4×3/4	7.62	2.79	1.18	1.27	5.01	0.679	3.25	1.15	0.774	1.00	1.00
×5/8	6.62	2.38	1.20	1.22	4.28	0.576	2.76	0.975	0.774	1.00	1.00
×1/2	5.52	1.96	1.21	1.18	3.50	0.468	2.25	0.797	0.776	1.00	1.00
×7/16	4.93	1.73	1.22	1.15	3.10	0.413	2.00	0.706	0.777	1.00	1.00
×3/8	4.32	1.50	1.23	1.13	2.68	0.357	1.73	0.613	0.779	1.00	1.00
×5/16	3.67	1.27	1.24	1.11	2.26	0.300	1.46	0.517	0.781	1.00	0.997
×1/4	3.00	1.03	1.25	1.08	1.82	0.242	1.18	0.419	0.783	1.00	0.912

Note: For compactness criteria, refer to the end of Table 1–7.

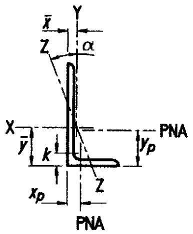


Table 1–7 (continued)
Angles
Properties

Shape	k	Wt.	Area, A	Axis X-X: I	Axis X-X: S	Axis X-X: r	Axis X-X: $\bar{y}$	Axis X-X: Z	Axis X-X: y_p	Flexural-Torsional Properties: J	Flexural-Torsional Properties: C_w	Flexural-Torsional Properties: $\bar{r}_o$
	in.	lb/ft	in.^{2}	in.^{4}	in.^{3}	in.	in.	in.^{3}	in.	in.^{4}	in.^{6}	in.
L4×3 1/2×1/2	7/8	11.9	3.50	5.30	1.92	1.23	1.24	3.46	0.497	0.301	0.302	2.03
×3/8	3/4	9.10	2.67	4.15	1.48	1.25	1.20	2.66	0.433	0.132	0.134	2.06
×5/16	11/16	7.70	2.25	3.53	1.25	1.25	1.17	2.24	0.401	0.0782	0.0798	2.08
×1/4	5/8	6.20	1.81	2.89	1.01	1.26	1.14	1.81	0.368	0.0412	0.0419	2.09
L4×3×5/8	1	13.6	3.89	6.01	2.28	1.23	1.37	4.08	0.810	0.529	0.472	1.91
×1/2	7/8	11.1	3.25	5.02	1.87	1.24	1.32	3.36	0.747	0.281	0.255	1.94
×3/8	3/4	8.50	2.48	3.94	1.44	1.26	1.27	2.60	0.683	0.123	0.114	1.97
×5/16	11/16	7.20	2.09	3.36	1.22	1.27	1.25	2.19	0.651	0.0731	0.0676	1.98
×1/4	5/8	5.80	1.69	2.75	0.988	1.27	1.22	1.77	0.618	0.0386	0.0356	1.99
L3 1/2×3 1/2×1/2	7/8	11.1	3.25	3.63	1.48	1.05	1.05	2.66	0.466	0.281	0.238	1.87
×7/16	13/16	9.80	2.87	3.25	1.32	1.06	1.03	2.36	0.412	0.192	0.164	1.89
×3/8	3/4	8.50	2.48	2.86	1.15	1.07	1.00	2.06	0.357	0.123	0.106	1.90
×5/16	11/16	7.20	2.09	2.44	0.969	1.08	0.979	1.74	0.301	0.0731	0.0634	1.92
×1/4	5/8	5.80	1.69	2.00	0.787	1.09	0.954	1.41	0.243	0.0386	0.0334	1.93
L3 1/2×3×1/2	7/8	10.2	3.00	3.45	1.45	1.07	1.12	2.61	0.480	0.260	0.191	1.75
×7/16	13/16	9.10	2.65	3.10	1.29	1.08	1.09	2.32	0.446	0.178	0.132	1.76
×3/8	3/4	7.90	2.30	2.73	1.12	1.09	1.07	2.03	0.411	0.114	0.0858	1.78
×5/16	11/16	6.60	1.93	2.33	0.951	1.09	1.05	1.72	0.375	0.0680	0.0512	1.79
×1/4	5/8	5.40	1.56	1.92	0.773	1.10	1.02	1.39	0.336	0.0360	0.0270	1.80
L3 1/2×2 1/2×1/2	7/8	9.40	2.75	3.24	1.41	1.08	1.20	2.52	0.736	0.234	0.159	1.66
×3/8	3/4	7.20	2.11	2.56	1.09	1.10	1.15	1.96	0.668	0.103	0.0714	1.69
×5/16	11/16	6.10	1.78	2.20	0.925	1.11	1.13	1.67	0.633	0.0611	0.0426	1.71
×1/4	5/8	4.90	1.44	1.81	0.753	1.12	1.10	1.36	0.596	0.0322	0.0225	1.72
L3×3×1/2	7/8	9.40	2.75	2.20	1.06	0.895	0.929	1.91	0.458	0.230	0.144	1.59
×7/16	13/16	8.30	2.43	1.98	0.946	0.903	0.907	1.70	0.405	0.157	0.100	1.60
×3/8	3/4	7.20	2.11	1.75	0.825	0.910	0.884	1.48	0.351	0.101	0.0652	1.62
×5/16	11/16	6.10	1.78	1.50	0.699	0.918	0.860	1.26	0.296	0.0597	0.0390	1.64
×1/4	5/8	4.90	1.44	1.23	0.569	0.926	0.836	1.02	0.239	0.0313	0.0206	1.65
×3/16	9/16	3.71	1.09	0.948	0.433	0.933	0.812	0.774	0.181	0.0136	0.00899	1.67
L3×2 1/2×1/2	7/8	8.50	2.50	2.07	1.03	0.910	0.995	1.86	0.494	0.213	0.112	1.46
×7/16	13/16	7.60	2.21	1.87	0.921	0.917	0.972	1.66	0.462	0.146	0.0777	1.48
×3/8	3/4	6.60	1.92	1.65	0.803	0.924	0.949	1.45	0.430	0.0943	0.0507	1.49
×5/16	11/16	5.60	1.67	1.41	0.681	0.932	0.925	1.23	0.397	0.0560	0.0304	1.51
×1/4	5/8	4.50	1.31	1.16	0.555	0.940	0.900	1.000	0.363	0.0296	0.0161	1.52
×3/16	9/16	3.39	0.996	0.899	0.423	0.947	0.874	0.761	0.328	0.0130	0.00705	1.54

Note: For compactness criteria, refer to the end of Table 1–7.

Table 1-7 (continued)
Angles
Properties

L4-L3

Shape	Axis Y-Y						Axis Z-Z				Q_s
	I	S	r	$\bar{x}$	Z	x_p	I	S	r	Tan α	F_y = 36 ksi
	in.^{4}	in.^{3}	in.	in.	in.^{3}	in.	in.^{4}	in.^{3}	in.		
L4×3½×½	3.76	1.50	1.04	0.994	2.69	0.438	1.80	0.719	0.716	0.750	1.00
×3/8	2.96	1.16	1.05	0.947	2.06	0.334	1.38	0.555	0.719	0.755	1.00
×5/16	2.52	0.980	1.06	0.923	1.74	0.281	1.17	0.470	0.721	0.757	0.997
×1/4	2.07	0.794	1.07	0.897	1.40	0.227	0.950	0.382	0.723	0.759	0.912
L4×3×5/8	2.85	1.34	0.845	0.867	2.45	0.498	1.59	0.720	0.631	0.534	1.00
×1/2	2.40	1.10	0.858	0.822	1.99	0.407	1.30	0.592	0.633	0.542	1.00
×3/8	1.89	0.851	0.873	0.775	1.52	0.311	1.01	0.460	0.636	0.551	1.00
×5/16	1.62	0.721	0.880	0.750	1.28	0.262	0.851	0.390	0.638	0.554	0.997
×1/4	1.33	0.585	0.887	0.725	1.03	0.211	0.691	0.318	0.639	0.558	0.912
L3½×3½×½	3.63	1.48	1.05	1.05	2.66	0.466	1.51	0.609	0.679	1.00	1.00
×7/16	3.25	1.32	1.06	1.03	2.36	0.412	1.34	0.540	0.681	1.00	1.00
×3/8	2.86	1.15	1.07	1.00	2.05	0.357	1.17	0.471	0.683	1.00	1.00
×5/16	2.44	0.969	1.08	0.979	1.74	0.301	0.989	0.400	0.685	1.00	1.00
×1/4	2.00	0.787	1.09	0.954	1.41	0.243	0.807	0.326	0.688	1.00	0.965
L3½×3×½	2.32	1.09	0.877	0.869	1.97	0.431	1.15	0.537	0.618	0.713	1.00
×7/16	2.09	0.971	0.885	0.846	1.75	0.382	1.03	0.478	0.620	0.717	1.00
×3/8	1.84	0.847	0.892	0.823	1.52	0.331	0.895	0.418	0.622	0.720	1.00
×5/16	1.58	0.718	0.900	0.798	1.28	0.279	0.761	0.356	0.624	0.722	1.00
×1/4	1.30	0.585	0.908	0.773	1.04	0.226	0.623	0.292	0.628	0.725	0.965
L3½×2½×½	1.36	0.756	0.701	0.701	1.39	0.395	0.782	0.420	0.532	0.485	1.00
×3/8	1.09	0.589	0.716	0.655	1.07	0.303	0.608	0.329	0.535	0.495	1.00
×5/16	0.937	0.501	0.723	0.632	0.900	0.256	0.518	0.281	0.538	0.500	1.00
×1/4	0.775	0.410	0.731	0.607	0.728	0.207	0.425	0.232	0.541	0.504	0.965
L3×3×½	2.20	1.06	0.895	0.929	1.91	0.458	0.924	0.436	0.580	1.00	1.00
×7/16	1.98	0.946	0.903	0.907	1.70	0.405	0.819	0.386	0.580	1.00	1.00
×3/8	1.75	0.825	0.910	0.884	1.48	0.351	0.712	0.336	0.581	1.00	1.00
×5/16	1.50	0.699	0.918	0.860	1.25	0.296	0.603	0.284	0.583	1.00	1.00
×1/4	1.23	0.569	0.926	0.836	1.02	0.239	0.491	0.231	0.585	1.00	1.00
×3/16	0.948	0.433	0.933	0.812	0.774	0.181	0.374	0.176	0.586	1.00	0.912
L3×2½×½	1.29	0.736	0.718	0.746	1.34	0.418	0.666	0.370	0.516	0.666	1.00
×7/16	1.17	0.656	0.724	0.724	1.19	0.370	0.591	0.329	0.516	0.671	1.00
×3/8	1.03	0.573	0.731	0.701	1.03	0.321	0.514	0.287	0.517	0.675	1.00
×5/16	0.888	0.487	0.739	0.677	0.873	0.271	0.437	0.244	0.518	0.679	1.00
×1/4	0.734	0.397	0.746	0.653	0.707	0.220	0.356	0.199	0.520	0.683	1.00
×3/16	0.568	0.303	0.753	0.627	0.536	0.167	0.272	0.153	0.521	0.687	0.912

Note: For compactness criteria, refer to the end of Table 1–7.

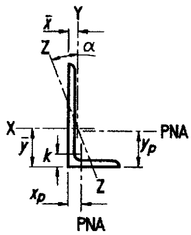
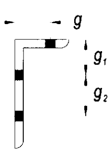


Table 1–7 (continued)
Angles
Properties

Shape	k	Wt.	Area, A	Axis X-X						Flexural-Torsional Properties		
				I	S	r	$\bar{y}$	Z	y_p	J	C_w	$\bar{r}_o$
	in.	lb/ft	in.^{2}	in.^{4}	in.^{3}	in.	in.	in.^{3}	in.	in.^{4}	in.^{6}	in.
L3×2×1/2	13/16	7.70	2.25	1.92	1.00	0.922	1.08	1.78	0.736	0.192	0.0908	1.39
×3/8	11/16	5.90	1.73	1.54	0.779	0.937	1.03	1.39	0.668	0.0855	0.0413	1.42
×5/16	5/8	5.00	1.46	1.32	0.662	0.945	1.01	1.19	0.633	0.0510	0.0248	1.43
×1/4	9/16	4.10	1.19	1.09	0.541	0.953	0.980	0.969	0.596	0.0270	0.0132	1.45
×3/16	1/2	3.07	0.902	0.847	0.414	0.961	0.952	0.743	0.556	0.0119	0.00576	1.46
L2 1/2×2 1/2×1/2	3/4	7.70	2.25	1.22	0.716	0.735	0.803	1.29	0.450	0.188	0.0791	1.30
×3/8	5/8	5.90	1.73	0.972	0.558	0.749	0.758	1.01	0.347	0.0833	0.0362	1.33
×5/16	9/16	5.00	1.46	0.837	0.474	0.756	0.735	0.853	0.293	0.0495	0.0218	1.35
×1/4	1/2	4.10	1.19	0.692	0.387	0.764	0.711	0.695	0.237	0.0261	0.0116	1.36
×3/16	7/16	3.07	0.900	0.535	0.295	0.771	0.687	0.529	0.180	0.0114	0.00510	1.38
L2 1/2×2×3/8	5/8	5.30	1.55	0.914	0.546	0.766	0.826	0.982	0.425	0.0746	0.0268	1.22
×5/16	9/16	4.50	1.31	0.790	0.465	0.774	0.803	0.839	0.391	0.0444	0.0162	1.23
×1/4	1/2	3.62	1.06	0.656	0.381	0.782	0.779	0.688	0.356	0.0235	0.00868	1.25
×3/16	7/16	2.75	0.809	0.511	0.293	0.790	0.754	0.529	0.318	0.0103	0.00382	1.26
L2 1/2×1 1/2×1/4	1/2	3.22	0.938	0.594	0.364	0.792	0.866	0.644	0.606	0.0209	0.00694	1.19
×3/16	7/16	2.47	0.715	0.464	0.280	0.801	0.839	0.497	0.568	0.00921	0.00306	1.20
L2×2×3/8	5/8	4.70	1.36	0.476	0.348	0.591	0.632	0.629	0.342	0.0658	0.0174	1.05
×5/16	9/16	3.92	1.15	0.414	0.298	0.598	0.609	0.537	0.290	0.0393	0.0106	1.06
×1/4	1/2	3.19	0.938	0.346	0.244	0.605	0.586	0.440	0.236	0.0209	0.00572	1.08
×3/16	7/16	2.44	0.715	0.271	0.188	0.612	0.561	0.338	0.180	0.00921	0.00254	1.09
×1/8	3/8	1.65	0.484	0.189	0.129	0.620	0.534	0.230	0.123	0.00293	0.000789	1.10



Workable Gages in Angle Legs, in.

Leg	8	7	6	5	4	3 1/2	3	2 1/2	2	1 3/4	1 1/2	1 3/8	1 1/4	1
g	4 1/2	4	3 1/2	3	2 1/2	2	1 3/4	1 3/8	1 1/8	1	7/8	7/8	3/4	5/8
g_1	3	2 1/2	2 1/4	2										
g_2	3	3	2 1/2	1 3/4										

Note: Other gages are permitted to suit specific requirements subject to clearances and edge distance limitations

Table 1–7 (continued)
Angles
Properties

L3-L2

Shape	Axis Y-Y						Axis Z-Z				Q_s
	I	S	r	$\bar{x}$	Z	x_p	I	S	r	Tan α	$F_y=36$ ksi
	in.^{4}	in.^{3}	in.	in.	in.^{3}	in.	in.^{4}	in.^{3}	in.		
L3×2×1/2	0.667	0.470	0.543	0.580	0.887	0.377	0.409	0.266	0.425	0.413	1.00
×3/8	0.539	0.368	0.555	0.535	0.679	0.291	0.318	0.209	0.426	0.426	1.00
×5/16	0.467	0.314	0.562	0.511	0.572	0.247	0.271	0.179	0.428	0.432	1.00
×1/4	0.390	0.258	0.569	0.487	0.463	0.200	0.223	0.149	0.431	0.437	1.00
×3/16	0.305	0.198	0.577	0.462	0.351	0.153	0.173	0.116	0.435	0.442	0.912
L2 1/2×2 1/2×1/2	1.22	0.716	0.735	0.803	1.29	0.450	0.521	0.295	0.481	1.00	1.00
×3/8	0.972	0.558	0.749	0.758	1.00	0.347	0.400	0.226	0.481	1.00	1.00
×5/16	0.837	0.474	0.756	0.735	0.853	0.293	0.339	0.192	0.481	1.00	1.00
×1/4	0.692	0.387	0.764	0.711	0.694	0.237	0.275	0.156	0.482	1.00	1.00
×3/16	0.535	0.295	0.771	0.687	0.528	0.180	0.210	0.119	0.482	1.00	0.983
L2 1/2×2×3/8	0.513	0.361	0.574	0.578	0.657	0.311	0.273	0.189	0.419	0.612	1.00
×5/16	0.446	0.309	0.581	0.555	0.557	0.264	0.233	0.161	0.420	0.618	1.00
×1/4	0.372	0.253	0.589	0.532	0.454	0.214	0.191	0.133	0.423	0.624	1.00
×3/16	0.292	0.195	0.597	0.508	0.347	0.164	0.149	0.104	0.426	0.628	0.983
L2 1/2×1 1/2×1/4	0.160	0.142	0.411	0.372	0.261	0.189	0.0975	0.0818	0.321	0.354	1.00
×3/16	0.126	0.110	0.418	0.347	0.198	0.145	0.0760	0.0644	0.324	0.360	0.983
L2×2×3/8	0.476	0.348	0.591	0.632	0.628	0.342	0.203	0.144	0.386	1.00	1.00
×5/16	0.414	0.298	0.598	0.609	0.536	0.290	0.173	0.122	0.386	1.00	1.00
×1/4	0.346	0.244	0.605	0.586	0.440	0.236	0.141	0.1000	0.387	1.00	1.00
×3/16	0.271	0.188	0.612	0.561	0.338	0.180	0.109	0.0771	0.389	1.00	1.00
×1/8	0.189	0.129	0.620	0.534	0.230	0.123	0.0751	0.0531	0.391	1.00	0.912

t	Compactness Criteria for Angles		
	Compression	Flexure	
	non-slender up to	compact up to	non-compact up to
	Width of angle leg, in.		
1 1/8	8	8	—
1	↓	↓	—
7/8	↓	↓	—
3/4	↓	↓	—
5/8	↓	↓	—
9/16	7	↓	—
1/2	6	7	8
7/16	5	6	↓
3/8	4	5	↓
5/16	4	4	↓
1/4	3	3 1/2	6
3/16	2	2 1/2	4
1/8	1 1/2	1 1/2	3

Note: Compactness criteria given for $F_y = 36$ ksi. $C_v = 1.0$ for all angles.

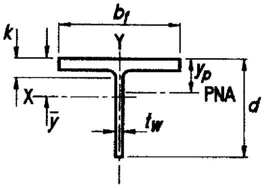


Table 1–8
WT Shapes
Dimensions

Shape	Area, A	Depth, d		Stem Thickness, t_w		Stem $\frac{t_w}{2}$	Stem Area	Flange Width, b_f		Flange Thickness, t_f		Distance k		Distance Workable Gage
	in.^{2}	in.		in.		in.	in.^{2}	in.		in.		in.	in.	in.
WT22×167.5[c]	49.2	22.0	22	1.03	1	1/2	22.6	15.9	16	1.77	1 3/4	2.56	2 5/8	5 1/2
×145[c]	42.7	21.8	21 3/4	0.865	7/8	7/16	18.9	15.8	15 7/8	1.58	1 9/16	2.36	2 7/16	
×131[c]	38.4	21.7	21 5/8	0.785	13/16	7/16	17.0	15.8	15 3/4	1.42	1 7/16	2.20	2 1/4	
×115[c,v]	33.8	21.5	21 1/2	0.710	11/16	3/8	15.2	15.8	15 3/4	1.22	1 1/4	2.01	2 1/16	
WT20×296.5[h]	87.2	21.5	21 1/2	1.79	1 13/16	15/16	38.5	16.7	16 3/4	3.23	3 1/4	4.41	4 1/2	7 1/2
×251.5[h]	73.9	21.0	21	1.54	1 9/16	13/16	32.3	16.4	16 3/8	2.76	2 3/4	3.94	4	
×215.5[h]	63.4	20.6	20 5/8	1.34	1 5/16	11/16	27.6	16.2	16 1/4	2.36	2 3/8	3.54	3 5/8	
×198.5[h]	58.4	20.5	20 1/2	1.22	1 1/4	5/8	25.0	16.1	16 1/8	2.20	2 3/16	3.38	3 1/2	
×186[h]	54.6	20.3	20 3/8	1.16	1 3/16	5/8	23.6	16.1	16 1/8	2.05	2 1/16	3.23	3 5/16	
×181[c,h]	53.3	20.3	20 1/4	1.12	1 1/8	9/16	22.7	16.0	16	2.01	2	3.19	3 1/4	
×162[c]	47.7	20.1	20 1/8	1.00	1	1/2	20.1	15.9	15 7/8	1.81	1 13/16	2.99	3 1/16	
×148.5[c]	43.7	19.9	19 7/8	0.930	15/16	1/2	18.5	15.8	15 7/8	1.65	1 5/8	2.83	2 15/16	
×138.5[c]	40.7	19.8	19 7/8	0.830	13/16	7/16	16.5	15.8	15 7/8	1.58	1 9/16	2.76	2 7/8	
×124.5[c]	36.7	19.7	19 3/4	0.750	3/4	3/8	14.8	15.8	15 3/4	1.42	1 7/16	2.60	2 11/16	
×107.5[c,v]	31.7	19.5	19 1/2	0.650	5/8	5/16	12.7	15.8	15 3/4	1.22	1 1/4	2.40	2 1/2	
×99.5[c,v]	29.2	19.3	19 3/8	0.650	5/8	5/16	12.6	15.8	15 3/4	1.07	1 1/16	2.25	2 5/16	
WT20×196[h]	57.6	20.8	20 3/4	1.42	1 7/16	3/4	29.4	12.4	12 3/8	2.52	2 1/2	3.70	3 13/16	7 1/2
×165.5[h]	48.7	20.4	20 3/8	1.22	1 1/4	5/8	24.9	12.2	12 1/8	2.13	2 1/8	3.31	3 3/8	
×163.5[h]	48.0	20.4	20 3/8	1.18	1 3/16	5/8	24.1	12.1	12 1/8	2.13	2 1/8	3.31	3 3/8	
×147[c]	43.1	20.2	20 1/4	1.06	1 1/16	9/16	21.4	12.0	12	1.93	1 15/16	3.11	3 3/16	
×139[c]	41.0	20.1	20 1/8	1.03	1	1/2	20.6	12.0	12	1.81	1 13/16	2.99	3 1/16	
×132[c]	38.8	20.0	20	0.960	15/16	1/2	19.2	11.9	11 7/8	1.73	1 3/4	2.91	3	
×117.5[c]	34.5	19.8	19 7/8	0.830	13/16	7/16	16.5	11.9	11 7/8	1.58	1 9/16	2.76	2 7/8	
×105.5[c]	31.0	19.7	19 5/8	0.750	3/4	3/8	14.8	11.8	11 3/4	1.42	1 7/16	2.60	2 11/16	
×91.5[c,v]	26.7	19.5	19 1/2	0.650	5/8	5/16	12.7	11.8	11 3/4	1.20	1 3/16	2.38	2 1/2	
×83.5[c,v]	24.6	19.3	19 1/4	0.650	5/8	5/16	12.5	11.8	11 3/4	1.03	1	2.21	2 5/16	
×74.5[c,v]	21.9	19.1	19 1/8	0.630	5/8	5/16	12.0	11.8	11 3/4	0.830	13/16	2.01	2 1/8	

[c] Shape is slender for compression with $F_y = 50$ ksi.
[h] Flange thickness greater than 2 in. Special requirements may apply per Specification Section A3.1c.
[v] Shear strength controlled by buckling effects ($C_v < 1.0$) with $F_y = 50$ ksi.

Table 1–8 (continued)
WT Shapes
Properties

WT22-WT20

Nominal Wt.	Compact Section Criteria		Axis X-X						Axis Y-Y				Q_s	Torsional Properties	
	$\frac{b_f}{2t_f}$	$\frac{h}{t_w}$	I	S	r	$\bar{y}$	Z	y_p	I	S	r	Z	$F_y = 50$ ksi	J	C_w
lb/ft			in.^{4}	in.^{3}	in.	in.	in.^{3}	in.	in.^{4}	in.^{3}	in.	in.^{3}		in.^{4}	in.^{6}
167.5	4.50	21.5	2170	131	6.63	5.53	234	1.54	600	75.2	3.49	118	0.822	37.2	438
145	5.02	25.2	1830	111	6.54	5.26	196	1.35	521	65.9	3.49	102	0.629	25.4	275
131	5.57	27.6	1640	99.4	6.53	5.19	176	1.22	462	58.6	3.47	90.9	0.526	18.6	200
115	6.45	30.2	1440	88.6	6.53	5.17	157	1.07	398	50.5	3.43	78.3	0.438	12.4	139
296.5	2.58	12.0	3310	209	6.16	5.66	379	2.61	1260	151	3.80	240	1.00	221	2340
251.5	2.98	13.7	2730	174	6.07	5.38	314	2.25	1020	124	3.72	197	1.00	138	1400
215.5	3.44	15.4	2290	148	6.01	5.18	266	1.95	843	104	3.65	164	1.00	88.2	881
198.5	3.66	16.8	2070	134	5.96	5.03	240	1.81	771	95.7	3.63	150	1.00	70.6	677
186	3.93	17.5	1930	126	5.95	4.98	225	1.70	709	88.3	3.60	138	1.00	57.7	558
181	3.99	18.1	1870	122	5.92	4.91	217	1.66	691	86.3	3.60	135	0.993	54.2	511
162	4.40	20.1	1650	108	5.88	4.77	192	1.50	609	76.6	3.57	119	0.893	39.6	362
148.5	4.80	21.4	1500	98.9	5.87	4.71	176	1.38	546	69.0	3.54	107	0.825	30.5	279
138.5	5.03	23.9	1360	88.6	5.78	4.50	157	1.29	522	65.9	3.58	102	0.699	25.7	218
124.5	5.55	26.3	1210	79.4	5.75	4.41	140	1.16	463	58.8	3.55	90.8	0.580	19.0	158
107.5	6.45	30.0	1030	68.0	5.71	4.28	120	1.01	398	50.5	3.54	77.8	0.445	12.4	101
99.5	7.39	29.7	988	66.5	5.81	4.47	117	0.929	347	44.1	3.45	68.2	0.452	9.12	83.5
196	2.45	14.7	2270	153	6.27	5.94	275	2.33	401	64.9	2.64	106	1.00	85.4	796
165.5	2.86	16.7	1880	128	6.21	5.74	231	2.00	322	52.9	2.57	85.7	1.00	52.5	484
163.5	2.85	17.3	1840	125	6.19	5.66	224	1.98	320	52.7	2.58	85.0	1.00	51.4	449
147	3.11	19.1	1630	111	6.14	5.51	199	1.80	281	46.7	2.55	75.0	0.945	38.2	322
139	3.31	19.6	1550	106	6.14	5.51	191	1.71	261	43.5	2.52	69.9	0.918	32.4	282
132	3.45	20.8	1450	99.2	6.11	5.41	178	1.63	246	41.3	2.52	66.0	0.855	27.9	233
117.5	3.77	23.9	1260	85.7	6.04	5.17	153	1.45	222	37.3	2.54	59.0	0.699	20.6	156
105.5	4.17	26.2	1120	76.7	6.01	5.08	137	1.31	195	33.0	2.51	52.1	0.581	15.2	113
91.5	4.92	30.0	955	65.7	5.98	4.97	117	1.13	165	28.0	2.49	44.0	0.445	9.65	71.2
83.5	5.76	29.7	899	63.7	6.05	5.19	115	1.10	141	23.9	2.40	37.8	0.454	6.99	62.9
74.5	7.11	30.3	815	59.7	6.10	5.45	108	1.72	114	19.4	2.29	30.9	0.435	4.66	51.9

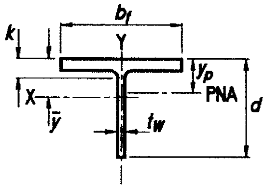


Table 1–8 (continued)
WT Shapes
Dimensions

Shape	Area, A	Depth, d		Stem Thickness, t_w		Stem $\frac{t_w}{2}$	Stem Area	Flange Width, b_f		Flange Thickness, t_f		Distance k		Distance Workable Gage
	in.²	in.		in.		in.	in.²	in.		in.		in.	in.	in.
WT18×400[h]	118	21.3	21 1/4	2.38	2 3/8	1 3/16	50.6	18.0	18	4.29	4 5/16	5.24	5 9/16	7 1/2
×326[h]	96.1	20.5	20 1/2	1.97	2	1	40.4	17.6	17 5/8	3.54	3 9/16	4.49	4 13/16	
×264.5[h]	77.8	19.9	19 7/8	1.61	1 5/8	13/16	32.0	17.2	17 1/4	2.91	2 15/16	3.86	4 3/16	
×243.5[h]	71.7	19.7	19 5/8	1.50	1 1/2	3/4	29.5	17.1	17 1/8	2.68	2 11/16	3.63	4	
×220.5[h]	64.9	19.4	19 3/8	1.36	1 3/8	11/16	26.4	17.0	17	2.44	2 7/16	3.39	3 3/4	
×197.5[h]	58.2	19.2	19 1/4	1.22	1 1/4	5/8	23.4	16.8	16 7/8	2.20	2 3/16	3.15	3 7/16	
×180.5	53.0	19.0	19	1.12	1 1/8	9/16	21.3	16.7	16 3/4	2.01	2	2.96	3 5/16	
×165[c]	48.5	18.8	18 7/8	1.02	1	1/2	19.2	16.6	16 5/8	1.85	1 7/8	2.80	3 1/8	
×151[c]	44.4	18.7	18 5/8	0.945	15/16	1/2	17.6	16.7	16 5/8	1.68	1 11/16	2.63	3	
×141[c]	41.5	18.6	18 1/2	0.885	7/8	7/16	16.4	16.6	16 5/8	1.57	1 9/16	2.52	2 7/8	
×131[c]	38.5	18.4	18 3/8	0.840	13/16	7/16	15.5	16.6	16 1/2	1.44	1 7/16	2.39	2 3/4	
×123.5[c]	36.3	18.3	18 3/8	0.800	13/16	7/16	14.7	16.5	16 1/2	1.35	1 3/8	2.30	2 5/8	
×115.5[c]	34.0	18.2	18 1/4	0.760	3/4	3/8	13.9	16.5	16 1/2	1.26	1 1/4	2.21	2 9/16	
WT18×128[c]	37.7	18.7	18 3/4	0.960	15/16	1/2	18.0	12.2	12 1/4	1.73	1 3/4	2.48	2 5/8	5 1/2
×116[c]	34.1	18.6	18 1/2	0.870	7/8	7/16	16.1	12.1	12 1/8	1.57	1 9/16	2.32	2 7/16	
×105[c]	30.9	18.3	18 3/8	0.830	13/16	7/16	15.2	12.2	12 1/8	1.36	1 3/8	2.11	2 5/16	
×97[c]	28.5	18.2	18 1/4	0.765	3/4	3/8	14.0	12.1	12 1/8	1.26	1 1/4	2.01	2 3/16	
×91[c]	26.8	18.2	18 1/8	0.725	3/4	3/8	13.2	12.1	12 1/8	1.18	1 3/16	1.93	2 1/8	
×85[c]	25.0	18.1	18 1/8	0.680	11/16	3/8	12.3	12.0	12	1.10	1 1/8	1.85	2	
×80[c]	23.5	18.0	18	0.650	5/8	5/16	11.7	12.0	12	1.02	1	1.77	1 15/16	
×75[c]	22.1	17.9	17 7/8	0.625	5/8	5/16	11.2	12.0	12	0.940	15/16	1.69	1 7/8	
×67.5[c,v]	19.9	17.8	17 3/4	0.600	5/8	5/16	10.7	12.0	12	0.790	13/16	1.54	1 11/16	
WT16.5×193.5[h]	57.0	18.0	18	1.26	1 1/4	5/8	22.6	16.2	16 1/4	2.28	2 1/4	3.07	3 3/16	5 1/2
×177[h]	52.1	17.8	17 3/4	1.16	1 3/16	5/8	20.6	16.1	16 1/8	2.09	2 1/16	2.88	2 15/16	
×159	46.8	17.6	17 5/8	1.04	1 1/16	9/16	18.3	16.0	16	1.89	1 7/8	2.68	2 3/4	
×145.5[c]	42.8	17.4	17 3/8	0.960	15/16	1/2	16.7	15.9	15 7/8	1.73	1 3/4	2.52	2 5/8	
×131.5[c]	38.7	17.3	17 1/4	0.870	7/8	7/16	15.0	15.8	15 3/4	1.57	1 9/16	2.36	2 7/16	
×120.5[c]	35.5	17.1	17 1/8	0.830	13/16	7/16	14.2	15.9	15 7/8	1.40	1 3/8	2.19	2 1/4	
×110.5[c]	32.6	17.0	17	0.775	3/4	3/8	13.1	15.8	15 3/4	1.28	1 1/4	2.06	2 1/8	
×100.5[c]	29.6	16.8	16 7/8	0.715	11/16	3/8	12.0	15.7	15 3/4	1.15	1 1/8	1.94	2	

[c] Shape is slender for compression with F_y = 50 ksi.
[h] Flange thickness greater than 2 in. Special requirements may apply per Specification Section A3.1c.
[v] Shear strength controlled by buckling effects (C_v < 1.0) with F_y = 50 ksi.

Table 1-8 (continued)
WT Shapes
Properties

WT18-WT16.5

Nom-inal Wt.	Compact Section Criteria		Axis X-X						Axis Y-Y				Q_s	Torsional Properties	
	$\frac{b_f}{2t_f}$	$\frac{h}{t_w}$	I	S	r	$\bar{y}$	Z	y_p	I	S	r	Z	$F_y = 50$ ksi	J	C_w
lb/ft			in.^{4}	in.^{3}	in.	in.	in.^{3}	in.	in.^{4}	in.^{3}	in.	in.^{3}		in.^{4}	in.^{6}
400	2.10	8.94	4090	264	5.89	5.80	491	3.28	2100	234	4.22	371	1.00	525	5810
326	2.48	10.4	3160	208	5.74	5.35	383	2.73	1610	184	4.10	290	1.00	295	3070
264.5	2.96	12.4	2440	164	5.60	4.96	298	2.26	1240	145	4.00	227	1.00	163	1600
243.5	3.19	13.1	2220	150	5.57	4.84	272	2.10	1120	131	3.96	206	1.00	128	1250
220.5	3.48	14.3	1980	134	5.52	4.69	242	1.91	997	117	3.92	184	1.00	96.6	914
197.5	3.83	15.7	1740	119	5.47	4.53	213	1.73	877	104	3.88	162	1.00	70.7	652
180.5	4.16	17.0	1570	107	5.43	4.42	192	1.59	786	94.0	3.85	146	1.00	54.1	491
165	4.49	18.5	1410	97.0	5.39	4.30	173	1.46	711	85.5	3.83	132	0.974	42.0	372
151	4.96	19.8	1280	88.8	5.37	4.22	158	1.33	648	77.8	3.82	120	0.909	32.1	285
141	5.29	21.0	1190	82.6	5.36	4.16	146	1.25	599	72.2	3.80	112	0.848	26.3	231
131	5.75	21.9	1110	77.5	5.36	4.14	137	1.16	545	65.8	3.76	102	0.799	20.8	185
123.5	6.11	22.9	1040	73.3	5.36	4.12	129	1.10	507	61.4	3.74	94.8	0.749	17.3	155
116	6.54	24.0	978	69.1	5.36	4.10	122	1.03	470	57.0	3.71	88.0	0.694	14.3	129
128	3.53	19.5	1210	87.4	5.66	4.92	156	1.54	264	43.2	2.65	68.5	0.922	26.4	205
116	3.86	21.3	1080	78.5	5.63	4.82	140	1.40	234	38.6	2.62	60.9	0.829	19.7	151
105	4.48	22.1	985	73.1	5.65	4.87	131	1.27	206	33.8	2.58	53.4	0.791	13.9	119
97	4.81	23.8	901	67.0	5.62	4.80	120	1.18	187	30.9	2.56	48.8	0.702	11.1	92.7
91	5.12	25.1	845	63.1	5.62	4.77	113	1.11	174	28.8	2.55	45.3	0.637	9.20	77.6
85	5.47	26.6	786	58.9	5.61	4.73	105	1.04	160	26.6	2.53	41.8	0.566	7.51	63.2
80	5.88	27.7	740	55.8	5.61	4.74	100	0.980	147	24.6	2.50	38.6	0.521	6.17	53.6
75	6.37	28.7	698	53.1	5.62	4.78	95.5	0.923	135	22.5	2.47	35.4	0.486	5.04	46.0
67.5	7.56	29.6	637	49.7	5.66	4.96	90.1	1.23	113	18.9	2.38	29.8	0.456	3.48	37.3
193.5	3.55	14.3	1460	107	5.07	4.27	193	1.76	810	100	3.77	156	1.00	73.9	615
177	3.85	15.3	1320	96.8	5.03	4.15	174	1.62	729	90.6	3.74	141	1.00	57.1	468
159	4.23	16.9	1160	85.8	4.99	4.02	154	1.46	645	80.7	3.71	125	1.00	42.1	335
145.5	4.60	18.1	1060	78.3	4.96	3.93	140	1.35	581	73.1	3.68	113	0.991	32.5	256
131.5	5.03	19.8	943	70.2	4.93	3.83	125	1.23	517	65.5	3.65	101	0.905	24.3	188
120.5	5.66	20.6	872	65.8	4.96	3.84	116	1.12	466	58.8	3.62	90.8	0.867	18.0	146
110.5	6.20	21.9	799	60.8	4.95	3.81	107	1.03	420	53.2	3.59	82.1	0.801	13.9	113
100.5	6.85	23.6	725	55.5	4.95	3.77	97.8	0.940	375	47.6	3.56	73.3	0.717	10.4	84.9

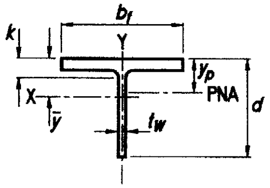


Table 1-8 (continued)
WT Shapes
Dimensions

Shape	Area, A	Depth, d		Stem: Thickness, t_w		Stem: $\frac{t_w}{2}$	Stem: Area	Flange: Width, b_f		Flange: Thickness, t_f		Distance: k		Distance: Workable Gage
	in.²	in.		in.		in.	in.²	in.		in.		in.	in.	in.
WT16.5×84.5[c]	24.8	16.9	16 7/8	0.670	11/16	3/8	11.3	11.5	11 1/2	1.22	1 1/4	1.92	2 1/8	5 1/2
×76[c]	22.4	16.7	16 3/4	0.635	5/8	5/16	10.6	11.6	11 5/8	1.06	1 1/16	1.76	1 15/16	
×70.5[c]	20.8	16.7	16 5/8	0.605	5/8	5/16	10.1	11.5	11 1/2	0.960	15/16	1.66	1 13/16	
×65[c]	19.2	16.5	16 1/2	0.580	9/16	5/16	9.60	11.5	11 1/2	0.855	7/8	1.56	1 3/4	
×59[c,v]	17.3	16.4	16 3/8	0.550	9/16	5/16	9.04	11.5	11 1/2	0.740	3/4	1.44	5/8	
WT15×195.5[h]	57.6	16.6	16 5/8	1.36	1 3/8	11/16	22.6	15.6	15 5/8	2.44	2 7/16	3.23	3 3/8	5 1/2
×178.5[h]	52.5	16.4	16 3/8	1.24	1 1/4	5/8	20.3	15.5	15 1/2	2.24	2 1/4	3.03	3 1/8	
×163[h]	47.9	16.2	16 1/4	1.14	1 1/8	9/16	18.5	15.4	15 3/8	2.05	2 1/16	2.84	2 15/16	
×146	42.9	16.0	16	1.02	1	1/2	16.3	15.3	15 1/4	1.85	1 7/8	2.64	2 3/4	
×130.5	38.4	15.8	15 3/4	0.930	15/16	1/2	14.7	15.2	15 1/8	1.65	1 5/8	2.44	2 9/16	
×117.5[c]	34.6	15.7	15 5/8	0.830	13/16	7/16	13.0	15.1	15	1.50	1 1/2	2.29	2 3/8	
×105.5[c]	31.1	15.5	15 1/2	0.775	3/4	3/8	12.0	15.1	15 1/8	1.32	1 5/16	2.10	2 1/4	
×95.5[c]	28.1	15.3	15 3/8	0.710	11/16	3/8	10.9	15.0	15	1.19	1 3/16	1.97	2 1/16	
WT15×86.5[c]	25.5	15.2	15 1/4	0.655	5/8	5/16	10.0	15.0	15	1.07	1 1/16	1.85	2	5 1/2
×74[c]	21.7	15.3	15 3/8	0.650	5/8	5/16	10.0	10.5	10 1/2	1.18	1 3/16	1.83	2 1/16	
×66[c]	19.4	15.2	15 1/8	0.615	5/8	5/16	9.32	10.5	10 1/2	1.00	1	1.65	1 7/8	
×62[c]	18.2	15.1	15 1/8	0.585	9/16	5/16	8.82	10.5	10 1/2	0.930	15/16	1.58	1 13/16	
×58[c]	17.1	15.0	15	0.565	9/16	5/16	8.48	10.5	10 1/2	0.850	7/8	1.50	1 3/4	
×54[c]	15.9	14.9	14 7/8	0.545	9/16	5/16	8.13	10.5	10 1/2	0.760	3/4	1.41	1 11/16	
×49.5[c]	14.5	14.8	14 7/8	0.520	1/2	1/4	7.71	10.5	10 1/2	0.670	11/16	1.32	1 9/16	
×45[c,v]	13.2	14.8	14 3/4	0.470	1/2	1/4	6.94	10.4	10 3/8	0.610	5/8	1.26	1 1/2	
WT13.5×269.5[h]	79.3	16.3	16 1/4	1.97	2	1	32.0	15.3	15 1/4	3.54	3 9/16	4.33	4 7/16	5 1/2[g]
×184[h]	54.2	15.2	15 1/4	1.38	1 3/8	11/16	21.0	14.7	14 5/8	2.48	2 1/2	3.27	3 3/8	5 1/2
×168[h]	49.5	15.0	15	1.26	1 1/4	5/8	18.9	14.6	14 1/2	2.28	2 1/4	3.07	3 3/16	
×153.5[h]	45.2	14.8	14 3/4	1.16	1 3/16	5/8	17.2	14.4	14 1/2	2.09	2 1/16	2.88	3	
×140.5	41.4	14.6	14 5/8	1.06	1 1/16	9/16	15.5	14.4	14 3/8	1.93	1 15/16	2.72	2 13/16	
×129	38.0	14.5	14 1/2	0.980	1	1/2	14.2	14.3	14 1/4	1.77	1 3/4	2.56	2 11/16	
×117.5	34.7	14.3	14 3/8	0.910	15/16	1/2	13.0	14.2	14 1/4	1.61	1 5/8	2.40	2 1/2	
×108.5	32.0	14.2	14 1/4	0.830	13/16	7/16	11.8	14.1	14 1/8	1.50	1 1/2	2.29	2 3/8	
×97[c]	28.6	14.1	14	0.750	3/4	3/8	10.5	14.0	14	1.34	1 5/16	2.13	2 1/4	
×89[c]	26.2	13.9	13 7/8	0.725	3/4	3/8	10.1	14.1	14 1/8	1.19	1 3/16	1.98	2 1/16	
×80.5[c]	23.8	13.8	13 3/4	0.660	11/16	3/8	9.10	14.0	14	1.08	1 1/16	1.87	2	
×73[c]	21.6	13.7	13 3/4	0.605	5/8	5/16	8.28	14.0	14	0.975	1	1.76	1 7/8	

[c] Shape is slender for compression with $F_y = 50$ ksi.
[g] The actual size, combination, and orientation of fastener components should be compared with the geometry of the cross-section to ensure compatibility.
[h] Flange thickness greater than 2 in. Special requirements may apply per Specification Section A3.1c.
[v] Shear strength controlled by buckling effects ($C_v < 1.0$) with $F_y = 50$ ksi.

Table 1–8 (continued)
WT Shapes
Properties

WT16.5-WT13.5

Nom-inal Wt.	Compact Section Criteria		Axis X-X						Axis Y-Y				Q_s	Torsional Properties	
	$\frac{b_f}{2t_f}$	$\frac{h}{t_w}$	I	S	r	$\bar{y}$	Z	y_p	I	S	r	Z	F_y = 50 ksi	J	C_w
lb/ft			in.^{4}	in.^{3}	in.	in.	in.^{3}	in.	in.^{4}	in.^{3}	in.	in.^{3}		in.^{4}	in.^{6}
84.5	4.71	25.2	649	51.1	5.12	4.21	90.8	1.08	155	27.0	2.50	42.1	0.628	8.81	55.4
76	5.48	26.4	592	47.4	5.14	4.26	84.5	0.967	136	23.6	2.47	36.9	0.575	6.16	43.0
70.5	6.01	27.5	552	44.7	5.15	4.29	79.8	0.901	123	21.3	2.43	33.4	0.528	4.84	35.4
65	6.73	28.5	513	42.1	5.18	4.36	75.6	0.832	109	18.9	2.38	29.7	0.492	3.67	29.3
59	7.76	29.9	469	39.2	5.20	4.47	70.8	0.862	93.5	16.3	2.32	25.6	0.448	2.64	23.4
195.5	3.19	12.2	1220	96.9	4.61	4.00	177	1.85	774	99.2	3.67	155	1.00	86.3	636
178.5	3.45	13.2	1090	87.2	4.56	3.87	159	1.70	693	89.6	3.64	140	1.00	66.6	478
163	3.75	14.2	981	78.8	4.52	3.76	143	1.56	622	81.0	3.60	126	1.00	51.2	361
146	4.12	15.7	861	69.6	4.48	3.62	125	1.41	549	71.9	3.58	111	1.00	37.5	257
130.5	4.59	17.0	765	62.4	4.46	3.54	112	1.27	480	63.3	3.53	97.9	1.00	26.9	184
117.5	5.02	18.9	674	55.1	4.41	3.41	98.2	1.15	427	56.8	3.51	87.5	0.955	20.1	133
105.5	5.74	20.0	610	50.5	4.43	3.39	89.5	1.03	378	50.1	3.49	77.2	0.899	14.1	96.4
95.5	6.35	21.6	549	45.7	4.42	3.34	80.8	0.935	336	44.7	3.46	68.9	0.816	10.5	71.2
86.5	7.04	23.2	497	41.7	4.42	3.31	73.5	0.851	299	39.9	3.42	61.4	0.733	7.78	53.0
74	4.44	23.6	466	40.6	4.63	3.84	72.2	1.04	114	21.7	2.28	33.9	0.715	7.24	37.6
66	5.27	24.6	421	37.4	4.66	3.90	66.8	0.921	98.0	18.6	2.25	29.2	0.662	4.85	28.5
62	5.65	25.8	396	35.3	4.66	3.90	63.1	0.867	90.4	17.2	2.23	27.0	0.602	3.98	23.9
58	6.17	26.6	373	33.7	4.67	3.94	60.4	0.815	82.1	15.6	2.19	24.6	0.567	3.21	20.5
54	6.89	27.4	349	32.0	4.69	4.01	57.7	0.757	73.0	13.9	2.15	21.9	0.534	2.49	17.3
49.5	7.80	28.5	322	30.0	4.71	4.09	54.4	0.912	63.9	12.2	2.10	19.3	0.492	1.88	14.3
45	8.52	31.4	290	27.1	4.69	4.04	49.0	0.835	57.3	11.0	2.09	17.3	0.405	1.41	10.5
269.5	2.15	8.25	1530	128	4.39	4.34	242	2.60	1060	138	3.65	218	1.00	247	1740
184	2.96	11.0	939	81.7	4.16	3.71	151	1.85	655	89.3	3.48	140	1.00	84.5	532
168	3.19	11.9	839	73.4	4.12	3.58	135	1.70	587	80.8	3.45	126	1.00	65.4	401
153.5	3.46	12.8	753	66.4	4.08	3.47	121	1.56	527	72.9	3.41	113	1.00	50.5	304
140.5	3.72	13.8	677	59.9	4.04	3.35	109	1.44	477	66.4	3.39	103	1.00	39.6	232
129	4.03	14.8	613	54.7	4.02	3.27	98.9	1.33	430	60.2	3.36	93.3	1.00	30.7	178
117.5	4.41	15.7	556	50.0	4.00	3.20	89.9	1.22	384	54.2	3.33	83.8	1.00	23.4	135
108.5	4.71	17.1	502	45.2	3.96	3.10	81.1	1.13	352	49.9	3.32	77.0	1.00	18.8	105
97	5.24	18.7	444	40.3	3.94	3.02	71.8	1.02	309	44.1	3.29	67.8	0.961	13.5	74.3
89	5.92	19.2	414	38.2	3.97	3.04	67.7	0.932	278	39.4	3.25	60.8	0.938	10.0	57.7
80.5	6.49	20.9	372	34.4	3.95	2.98	60.8	0.849	248	35.4	3.23	54.5	0.851	7.53	42.7
73	7.16	22.6	336	31.2	3.95	2.94	55.0	0.772	222	31.7	3.20	48.8	0.764	5.62	31.7

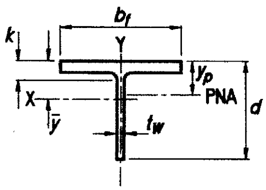


Table 1-8 (continued)
WT Shapes
Dimensions

Shape	Area, A	Depth, d		Stem Thickness, t_w		Stem $\frac{t_w}{2}$	Stem Area	Flange Width, b_f		Flange Thickness, t_f		Distance k		Distance Workable Gage
	in.^{2}	in.		in.		in.	in.^{2}	in.		in.		in.	in.	in.
WT13.5×64.5[c]	18.9	13.8	13 7/8	0.610	5/8	5/16	8.43	10.0	10	1.10	1 1/8	1.70	2	5 1/2
×57[c]	16.8	13.6	13 5/8	0.570	9/16	5/16	7.78	10.1	10 1/8	0.930	15/16	1.53	1 13/16	
×51[c]	15.0	13.5	13 1/2	0.515	1/2	1/4	6.98	10.0	10	0.830	13/16	1.43	1 3/4	
×47[c]	13.8	13.5	13 1/2	0.490	1/2	1/4	6.60	10.0	10	0.745	3/4	1.34	1 5/8	
×42[c]	12.4	13.4	13 3/8	0.460	7/16	1/4	6.14	10.0	10	0.640	5/8	1.24	1 9/16	
WT12×185[h]	54.4	14.0	14	1.52	1 1/2	3/4	21.3	13.7	13 5/8	2.72	2 3/4	3.22	3 5/8	5 1/2
×167.5[h]	49.2	13.8	13 3/4	1.38	1 3/8	11/16	19.0	13.5	13 1/2	2.48	2 1/2	2.98	3 3/8	
×153[h]	44.9	13.6	13 5/8	1.26	1 1/4	5/8	17.1	13.4	13 3/8	2.28	2 1/4	2.78	3 3/16	
×139.5[h]	41.0	13.4	13 3/8	1.16	1 3/16	5/8	15.5	13.3	13 1/4	2.09	2 1/16	2.59	3	
×125	36.8	13.2	13 1/8	1.04	1 1/16	9/16	13.7	13.2	13 1/8	1.89	1 7/8	2.39	2 13/16	
×114.5	33.6	13.0	13	0.960	15/16	1/2	12.5	13.1	13 1/8	1.73	1 3/4	2.23	2 5/8	
×103.5	30.4	12.9	12 7/8	0.870	7/8	7/16	11.2	13.0	13	1.57	1 9/16	2.07	2 1/2	
×96	28.1	12.7	12 3/4	0.810	13/16	7/16	10.3	13.0	13	1.46	1 7/16	1.96	2 3/8	
×88	25.8	12.6	12 5/8	0.750	3/4	3/8	9.47	12.9	12 7/8	1.34	1 5/16	1.84	2 1/4	
×81	23.9	12.5	12 1/2	0.705	11/16	3/8	8.81	13.0	13	1.22	1 1/4	1.72	2 1/8	
×73[c]	21.5	12.4	12 3/8	0.650	5/8	5/16	8.04	12.9	12 7/8	1.09	1 1/16	1.59	2	
×65.5[c]	19.3	12.2	12 1/4	0.605	5/8	5/16	7.41	12.9	12 /8	0.960	15/16	1.46	1 7/8	
×58.5[c]	17.2	12.1	12 1/8	0.550	9/16	5/16	6.67	12.8	12 3/4	0.850	7/8	1.35	1 3/4	
×52[c]	15.3	12.0	12	0.500	1/2	1/4	6.02	12.8	12 3/4	0.750	3/4	1.25	1 5/8	
WT12×51.5[c]	15.1	12.3	12 1/4	0.550	9/16	5/16	6.75	9.00	9	0.980	1	1.48	1 7/8	5 1/2
×47[c]	13.8	12.2	12 1/8	0.515	1/2	1/4	6.26	9.07	9 1/8	0.875	7/8	1.38	1 3/4	
×42[c]	12.4	12.1	12	0.470	1/2	1/4	5.66	9.02	9	0.770	3/4	1.27	1 11/16	
×38[c]	11.2	12.0	12	0.440	7/16	1/4	5.26	8.99	9	0.680	11/16	1.18	1 9/16	5 1/2[g]
×34[c]	10.0	11.9	11 7/8	0.415	7/16	1/4	4.92	8.97	9	0.585	9/16	1.09	1 1/2	5 1/2[g]
WT12×31[c]	9.11	11.9	11 7/8	0.430	7/16	1/4	5.10	7.04	7	0.590	9/16	1.09	1 1/2	3 1/2
×27.5[c,v]	8.10	11.8	11 3/4	0.395	3/8	3/16	4.66	7.01	7	0.505	1/2	1.01	1 7/16	3 1/2

[c] Shape is slender for compression with F_y = 50 ksi.
[g] The actual size, combination, and orientation of fastener components should be compared with the geometry of the cross-section to ensure compatibility.
[h] Flange thickness greater than 2 in. Special requirements may apply per Specification Section A3.1c.
[v] Shear strength controlled by buckling effects (C_v < 1.0) with F_y = 50 ksi.

Table 1–8 (continued)
WT Shapes
Properties

WT13.5-WT12

Nom-inal Wt.	Compact Section Criteria		Axis X-X						Axis Y-Y				Q_s	Torsional Properties	
	$\frac{b_f}{2t_f}$	$\frac{h}{t_w}$	I	S	r	$\bar{y}$	Z	y_p	I	S	r	Z	F_y = 50 ksi	J	C_w
lb/ft			in.^{4}	in.^{3}	in.	in.	in.^{3}	in.	in.^{4}	in.^{3}	in.	in.^{3}		in.^{4}	in.^{6}
64.5	4.55	22.6	323	31.0	4.13	3.39	55.1	0.945	92.2	18.4	2.21	28.8	0.763	5.55	24.0
57	5.41	23.9	289	28.3	4.15	3.42	50.4	0.832	79.3	15.8	2.18	24.6	0.698	3.65	17.5
51	6.03	26.3	258	25.3	4.14	3.37	45.0	0.750	69.6	13.9	2.15	21.7	0.578	2.63	12.6
47	6.70	27.5	239	23.8	4.16	3.41	42.4	0.692	62.0	12.4	2.12	19.4	0.530	2.01	10.2
42	7.78	29.0	216	21.9	4.18	3.48	39.2	0.621	52.8	10.6	2.07	16.6	0.475	1.40	7.79
185	2.51	9.21	779	74.7	3.78	3.57	140	1.99	581	85.1	3.27	133	1.00	100	553
167.5	2.73	10.0	686	66.3	3.73	3.42	123	1.82	513	75.9	3.23	119	1.00	75.6	405
153	2.94	10.8	611	59.4	3.69	3.29	110	1.67	460	68.6	3.20	107	1.00	58.4	305
139.5	3.18	11.5	546	53.6	3.65	3.18	98.8	1.54	412	61.9	3.17	96.3	1.00	45.1	230
125	3.49	12.7	478	47.2	3.61	3.05	86.5	1.39	362	54.9	3.14	85.2	1.00	33.2	165
114.5	3.79	13.6	431	42.9	3.58	2.96	78.1	1.28	326	49.7	3.11	77.0	1.00	25.5	125
103.5	4.14	14.8	382	38.3	3.55	2.87	69.3	1.17	289	44.4	3.08	68.6	1.00	19.1	91.3
96	4.43	15.7	350	35.2	3.53	2.80	63.5	1.09	265	40.9	3.07	63.1	1.00	15.3	72.5
88	4.81	16.8	319	32.2	3.51	2.74	57.8	1.00	240	37.2	3.04	57.3	1.00	11.9	55.8
81	5.31	17.7	293	29.9	3.50	2.70	53.3	0.921	221	34.2	3.05	52.6	1.00	9.22	43.8
73	5.92	19.0	264	27.2	3.50	2.66	48.2	0.833	195	30.3	3.01	46.6	0.946	6.70	31.9
65.5	6.70	20.2	238	24.8	3.52	2.65	43.9	0.750	170	26.5	2.97	40.7	0.885	4.74	23.1
58.5	7.53	22.1	212	22.3	3.51	2.62	39.2	0.672	149	23.2	2.94	35.7	0.793	3.35	16.4
52	8.50	24.1	189	20.0	3.51	2.59	35.1	0.600	130	20.3	2.91	31.2	0.692	2.35	11.6
51.5	4.59	22.3	204	22.0	3.67	3.01	39.2	0.841	59.7	13.3	1.99	20.7	0.781	3.53	12.3
47	5.18	23.6	186	20.3	3.67	2.99	36.1	0.764	54.5	12.0	1.98	18.7	0.715	2.62	9.57
42	5.86	25.6	166	18.3	3.67	2.97	32.5	0.685	47.2	10.5	1.95	16.3	0.609	1.84	6.90
38	6.61	27.2	151	16.9	3.68	3.00	30.1	0.622	41.3	9.18	1.92	14.3	0.541	1.34	5.30
34	7.66	28.6	137	15.6	3.70	3.06	27.9	0.560	35.2	7.85	1.87	12.3	0.489	0.932	4.08
31	5.97	27.6	131	15.6	3.79	3.46	28.4	1.28	17.2	4.90	1.38	7.85	0.525	0.850	3.92
27.5	6.94	29.8	117	14.1	3.80	3.50	25.6	1.53	14.5	4.15	1.34	6.65	0.449	0.588	2.93

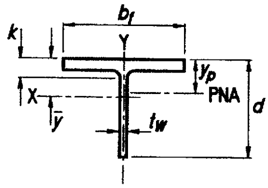


Table 1-8 (continued)
WT Shapes
Dimensions

Shape	Area, A	Depth, d		Stem: Thickness, t_w		Stem: $\frac{t_w}{2}$	Stem: Area	Flange: Width, b_f		Flange: Thickness, t_f		Distance: k		Distance: Workable Gage
	in.²	in.		in.		in.	in.²	in.		in.		in.	in.	in.
WT10.5×100.5	29.6	11.5	11 1/2	0.910	15/16	1/2	10.5	12.6	12 5/8	1.63	1 5/8	2.13	2 1/2	5 1/2
×91	26.8	11.4	11 3/8	0.830	13/16	7/16	9.43	12.5	12 1/2	1.48	1 1/2	1.98	2 3/8	
×83	24.4	11.2	11 1/4	0.750	3/4	3/8	8.43	12.4	12 3/8	1.36	1 3/8	1.86	2 1/4	
×73.5	21.6	11.0	11	0.720	3/4	3/8	7.94	12.5	12 1/2	1.15	1 1/8	1.65	2	
×66	19.4	10.9	10 7/8	0.650	5/8	5/16	7.09	12.4	12 1/2	1.04	1 1/16	1.54	1 15/16	
×61[c]	17.9	10.8	10 7/8	0.600	5/8	5/16	6.50	12.4	12 3/8	0.960	15/16	1.46	1 13/16	
×55.5[c]	16.3	10.8	10 3/4	0.550	9/16	5/16	5.92	12.3	12 3/8	0.875	7/8	1.38	1 3/4	
×50.5[c]	14.9	10.7	10 5/8	0.500	1/2	1/4	5.34	12.3	12 1/4	0.800	13/16	1.30	1 11/16	
WT10.5×46.5[c]	13.7	10.8	10 3/4	0.580	9/16	5/16	6.27	8.42	8 3/8	0.930	15/16	1.43	1 5/8	5 1/2
×41.5[c]	12.2	10.7	10 3/4	0.515	1/2	1/4	5.52	8.36	8 3/8	0.835	13/16	1.34	1 1/2	
×36.5[c]	10.7	10.6	10 5/8	0.455	7/16	1/4	4.83	8.30	8 1/4	0.740	3/4	1.24	1 7/16	
×34[c]	10.0	10.6	10 5/8	0.430	7/16	1/4	4.54	8.27	8 1/4	0.685	11/16	1.19	1 3/8	
×31[c]	9.13	10.5	10 1/2	0.400	3/8	3/16	4.20	8.24	8 1/4	0.615	5/8	1.12	1 5/16	
×27.5[c]	8.10	10.4	10 3/8	0.375	3/8	3/16	3.90	8.22	8 1/4	0.522	1/2	1.02	1 3/16	
×24[c,f,v]	7.07	10.3	10 1/4	0.350	3/8	3/16	3.61	8.14	8 1/8	0.430	7/16	0.930	1 1/8	
WT10.5×28.5[c,h]	8.37	10.5	10 1/2	0.405	3/8	3/16	4.26	6.56	6 1/2	0.650	5/8	1.15	1 5/16	3 1/2
×25[c]	7.36	10.4	10 3/8	0.380	3/8	3/16	3.96	6.53	6 1/2	0.535	9/16	1.04	1 1/4	3 1/2[g]
×22[c,v]	6.49	10.3	10 3/8	0.350	3/8	3/16	3.62	6.50	6 1/2	0.450	7/16	0.950	1 1/8	3 1/2[g]
WT9×155.5[h]	45.8	11.2	11 1/8	1.52	1 1/2	3/4	17.0	12.0	12	2.74	2 3/4	3.24	3 7/16	5 1/2
×141.5[h]	41.6	10.9	10 7/8	1.40	1 3/8	11/16	15.3	11.9	11 7/8	2.50	2 1/2	3.00	3 3/16	
×129[h]	37.9	10.7	10 3/4	1.28	1 1/4	5/8	13.7	11.8	11 3/4	2.30	2 5/16	2.70	3	
×117[h]	34.4	10.5	10 1/2	1.16	1 3/16	5/8	12.2	11.7	11 5/8	2.11	2 1/8	2.51	2 3/4	
×105.5	31.1	10.3	10 3/8	1.06	1 1/16	9/16	11.0	11.6	11 1/2	1.91	1 15/16	2.31	2 9/16	
×96	28.2	10.2	10 1/8	0.960	15/16	1/2	9.77	11.5	11 1/2	1.75	1 3/4	2.15	2 7/16	
×87.5	25.7	10.0	10	0.890	7/8	7/16	8.92	11.4	11 3/8	1.59	1 9/16	1.99	2 7/16	
×79	23.2	9.86	9 7/8	0.810	13/16	7/16	7.99	11.3	11 1/4	1.44	1 7/16	1.84	2 3/8	
×71.5	21.0	9.75	9 3/4	0.730	3/4	3/8	7.11	11.2	11 1/4	1.32	1 5/16	1.72	2 3/16	
×65	19.1	9.63	9 5/8	0.670	11/16	3/8	6.45	11.2	11 1/8	1.20	1 3/16	1.60	2 1/16	
×59.5	17.5	9.49	9 1/2	0.655	5/8	5/16	6.21	11.3	11 1/4	1.06	1 1/16	1.46	1 15/16	
×53	15.6	9.37	9 3/8	0.590	9/16	5/16	5.53	11.2	11 1/4	0.940	15/16	1.34	1 13/16	
×48.5	14.3	9.30	9 1/4	0.535	9/16	5/16	4.97	11.1	11 1/8	0.870	7/8	1.27	1 3/4	
×43[c]	12.7	9.20	9 1/4	0.480	1/2	1/4	4.41	11.1	11 1/8	0.770	3/4	1.17	1 5/8	
×38[c]	11.2	9.11	9 1/8	0.425	7/16	1/4	3.87	11.0	11	0.680	11/16	1.08	1 9/16	

[c] Shape is slender for compression with $F_y = 50$ ksi.
[f] Shape exceeds compact limit for flexure with $F_y = 50$ ksi.
[g] The actual size, combination, and orientation of fastener components should be compared with the geometry of the cross-section to ensure compatibility.
[h] Flange thickness greater than 2 in. Special requirements may apply per Specification Section A3.1c.
[v] Shear strength controlled by buckling effects ($C_v < 1.0$) with $F_y = 50$ ksi.

Table 1–8 (continued)
WT Shapes
Properties

WT10.5-WT9

Nominal Wt.	Compact Section Criteria		Axis X-X						Axis Y-Y				Q_s	Torsional Properties	
	$\frac{b_f}{2t_f}$	$\frac{h}{t_w}$	I	S	r	$\bar{y}$	Z	y_p	I	S	r	Z	$F_y = 50$ ksi	J	C_w
lb/ft			in.^{4}	in.^{3}	in.	in.	in.^{3}	in.	in.^{4}	in.^{3}	in.	in.^{3}		in.^{4}	in.^{6}
100.5	3.86	12.7	285	31.9	3.10	2.57	58.6	1.18	271	43.1	3.02	66.5	1.00	20.4	85.4
91	4.22	13.7	253	28.5	3.07	2.48	52.1	1.07	241	38.6	3.00	59.5	1.00	15.3	63.0
83	4.57	15.0	226	25.5	3.04	2.39	46.3	0.983	217	35.0	2.99	53.9	1.00	11.8	47.3
73.5	5.44	15.3	204	23.7	3.08	2.39	42.4	0.864	188	30.0	2.95	46.3	1.00	7.69	32.5
66	6.01	16.8	181	21.1	3.06	2.33	37.6	0.780	166	26.7	2.93	41.1	1.00	5.62	23.4
61	6.45	18.1	166	19.3	3.04	2.28	34.3	0.724	152	24.6	2.91	37.8	0.995	4.47	18.4
55.5	7.05	19.6	150	17.5	3.03	2.23	31.0	0.662	137	22.2	2.90	34.1	0.919	3.40	13.8
50.5	7.68	21.4	135	15.8	3.01	2.18	27.9	0.605	124	20.2	2.89	30.8	0.828	2.60	10.4
46.5	4.53	18.6	144	17.9	3.25	2.74	31.8	0.812	46.4	11.0	1.84	17.3	0.966	3.01	9.33
41.5	5.00	20.8	127	15.7	3.22	2.66	28.0	0.728	40.7	9.74	1.83	15.2	0.856	2.16	6.50
36.5	5.60	23.3	110	13.8	3.21	2.60	24.4	0.647	35.3	8.51	1.81	13.3	0.728	1.51	4.42
34	6.04	24.6	103	12.9	3.20	2.59	22.9	0.606	32.4	7.83	1.80	12.2	0.666	1.22	3.62
31	6.70	26.2	93.8	11.9	3.21	2.58	21.1	0.554	28.7	6.97	1.77	10.9	0.581	0.913	2.78
27.5	7.87	27.7	84.4	10.9	3.23	2.64	19.4	0.493	24.2	5.89	1.73	9.18	0.520	0.617	2.08
24	9.47	29.5	74.9	9.90	3.26	2.74	17.8	0.459	19.4	4.76	1.66	7.44	0.461	0.400	1.52
28.5	5.04	26.0	90.4	11.8	3.29	2.85	21.2	0.638	15.3	4.67	1.35	7.40	0.592	0.884	2.50
25	6.10	27.4	80.3	10.7	3.30	2.93	19.4	0.771	12.5	3.82	1.30	6.08	0.532	0.570	1.89
22	7.22	29.5	71.1	9.68	3.31	2.98	17.6	1.06	10.3	3.18	1.26	5.07	0.459	0.383	1.40
155.5	2.19	7.34	383	46.6	2.89	2.93	90.6	1.91	398	66.2	2.95	104	1.00	87.2	339
141.5	2.38	7.80	337	41.5	2.85	2.80	80.2	1.75	352	59.2	2.91	92.5	1.00	66.5	251
129	2.56	8.38	298	37.0	2.80	2.68	71.0	1.61	314	53.4	2.88	83.1	1.00	51.1	189
117	2.76	9.08	261	32.7	2.75	2.55	62.4	1.48	279	47.9	2.85	74.4	1.00	39.1	140
105.5	3.02	9.75	229	29.1	2.72	2.44	55.0	1.34	246	42.7	2.82	66.1	1.00	29.1	102
96	3.27	10.6	202	25.8	2.68	2.34	48.5	1.23	220	38.4	2.79	59.4	1.00	22.3	75.7
87.5	3.58	11.3	181	23.4	2.66	2.26	43.6	1.13	196	34.4	2.76	53.1	1.00	16.8	56.5
79	3.92	12.2	160	20.8	2.63	2.17	38.5	1.02	174	30.7	2.74	47.4	1.00	12.5	41.2
71.5	4.25	13.3	142	18.5	2.60	2.09	34.0	0.937	156	27.7	2.72	42.7	1.00	9.58	30.7
65	4.65	14.4	127	16.7	2.58	2.02	30.5	0.856	139	24.9	2.70	38.3	1.00	7.23	22.8
59.5	5.31	14.5	119	15.9	2.60	2.03	28.7	0.778	126	22.5	2.69	34.5	1.00	5.30	17.4
53	5.96	15.9	104	14.1	2.59	1.97	25.2	0.695	110	19.7	2.66	30.2	1.00	3.73	12.1
48.5	6.41	17.4	93.8	12.7	2.56	1.91	22.6	0.640	100	18.0	2.65	27.6	1.00	2.92	9.29
43	7.20	19.2	82.4	11.2	2.55	1.86	19.9	0.570	87.6	15.8	2.63	24.2	0.939	2.04	6.42
38	8.11	21.4	71.8	9.83	2.54	1.80	17.3	0.505	76.2	13.8	2.61	21.1	0.825	1.41	4.37

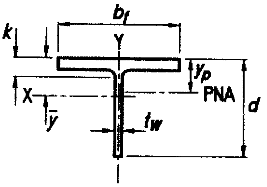


Table 1-8 (continued)
WT Shapes
Dimensions

Shape	Area, A	Depth, d		Stem				Flange				Distance		
				Thickness, t_w		$\frac{t_w}{2}$	Area	Width, b_f		Thickness, t_f		k		Workable Gage
	in.^{2}	in.		in.		in.	in.^{2}	in.		in.		in.	in.	in.
WT9×35.5[c]	10.4	9.24	9 1/4	0.495	1/2	1/4	4.57	7.64	7 5/8	0.810	13/16	1.21	1 1/2	3 1/2[g]
×32.5[c]	9.55	9.18	9 1/8	0.450	7/16	1/4	4.13	7.59	7 5/8	0.750	3/4	1.15	1 7/16	
×30[c]	8.82	9.12	9 1/8	0.415	7/16	1/4	3.78	7.56	7 1/2	0.695	11/16	1.10	1 3/8	
×27.5[c]	8.10	9.06	9	0.390	3/8	3/16	3.53	7.53	7 1/2	0.630	5/8	1.03	1 5/16	
×25[c]	7.33	9.00	9	0.355	3/8	3/16	3.19	7.50	7 1/2	0.570	9/16	0.972	1 1/4	↓
WT9×23[c]	6.77	9.03	9	0.360	3/8	3/16	3.25	6.06	6	0.605	5/8	1.01	1 1/4	3 1/2[g]
×20[c]	5.88	8.95	9	0.315	5/16	3/16	2.82	6.02	6	0.525	1/2	0.927	1 3/16	
×17.5[c,v]	5.15	8.85	8 7/8	0.300	5/16	3/16	2.66	6.00	6	0.425	7/16	0.827	1 1/8	↓
WT8×50	14.7	8.49	8 1/2	0.585	9/16	5/16	4.96	10.4	10 3/8	0.985	1	1.39	1 7/8	5 1/2
×44.5	13.1	8.38	8 3/8	0.525	1/2	1/4	4.40	10.4	10 3/8	0.875	7/8	1.28	1 3/4	
×38.5[c]	11.3	8.26	8 1/4	0.455	7/16	1/4	3.76	10.3	10 1/4	0.760	3/4	1.16	1 5/8	
×33.5[c]	9.84	8.17	8 1/8	0.395	3/8	3/16	3.23	10.2	10 1/4	0.665	11/16	1.07	1 9/16	↓
WT8×28.5[c]	8.39	8.22	8 1/4	0.430	7/16	1/4	3.53	7.12	7 1/8	0.715	11/16	1.12	1 3/8	3 1/2[g]
×25[c]	7.37	8.13	8 1/8	0.380	3/8	3/16	3.09	7.07	7 1/8	0.630	5/8	1.03	1 5/16	
×22.5[c]	6.63	8.07	8 1/8	0.345	3/8	3/16	2.78	7.04	7	0.565	9/16	0.967	1 1/4	↓
×20[c,h]	5.89	8.01	8	0.305	5/16	3/16	2.44	7.00	7	0.505	1/2	0.907	1 3/16	3 1/2
×18[c,h]	5.29	7.93	7 7/8	0.295	5/16	3/16	2.34	6.99	7	0.430	7/16	0.832	1 1/8	3 1/2
WT8×15.5[c]	4.56	7.94	8	0.275	1/4	1/8	2.18	5.53	5 1/2	0.440	7/16	0.842	1 1/8	3 1/2
×13[c,v]	3.84	7.85	7 7/8	0.250	1/4	1/8	1.96	5.50	5 1/2	0.345	3/8	0.747	1 1/16	3 1/2

[c] Shape is slender for compression with $F_y = 50$ ksi.
[g] The actual size, combination, and orientation of fastener components should be compared with the geometry of the cross-section to ensure compatibility.
[h] Flange thickness greater than 2 in. Special requirements may apply per Specification Section A3.1c.
[v] Shear strength controlled by buckling effects ($C_v < 1.0$) with $F_y = 50$ ksi.

Table 1–8 (continued)
WT Shapes
Properties

WT9-WT8

Nominal Wt.	Compact Section Criteria		Axis X-X						Axis Y-Y				Q_s	Torsional Properties	
	$\frac{b_f}{2t_f}$	$\frac{h}{t_w}$	I	S	r	$\bar{y}$	Z	y_p	I	S	r	Z	$F_y = 50$ ksi	J	C_w
lb/ft			in.^{4}	in.^{3}	in.	in.	in.^{3}	in.	in.^{4}	in.^{3}	in.	in.^{3}		in.^{4}	in.^{6}
35.5	4.71	18.7	78.2	11.2	2.74	2.26	20.0	0.683	30.1	7.89	1.70	12.3	0.965	1.74	3.96
32.5	5.06	20.4	70.7	10.1	2.72	2.20	18.0	0.629	27.4	7.22	1.69	11.2	0.877	1.36	3.01
30	5.44	22.0	64.7	9.29	2.71	2.16	16.5	0.583	25.0	6.63	1.68	10.3	0.797	1.08	2.35
27.5	5.98	23.2	59.5	8.63	2.71	2.16	15.3	0.538	22.5	5.97	1.67	9.26	0.734	0.830	1.84
25	6.57	25.3	53.5	7.79	2.70	2.12	13.8	0.489	20.0	5.35	1.65	8.28	0.623	0.619	1.36
23	5.01	25.1	52.1	7.77	2.77	2.33	13.9	0.558	11.3	3.71	1.29	5.84	0.636	0.609	1.20
20	5.73	28.4	44.8	6.73	2.76	2.29	12.0	0.489	9.55	3.17	1.27	4.97	0.495	0.404	0.788
17.5	7.06	29.5	40.1	6.21	2.79	2.39	11.2	0.450	7.67	2.56	1.22	4.02	0.460	0.252	0.598
50	5.29	14.5	76.8	11.4	2.28	1.76	20.7	0.706	93.1	17.9	2.51	27.4	1.00	3.85	10.4
44.5	5.92	16.0	67.2	10.1	2.27	1.70	18.1	0.631	81.3	15.7	2.49	24.0	1.00	2.72	7.19
38.5	6.77	18.2	56.9	8.59	2.24	1.63	15.3	0.549	69.2	13.4	2.47	20.5	0.990	1.78	4.61
33.5	7.70	20.7	48.6	7.36	2.22	1.56	13.0	0.481	59.5	11.6	2.46	17.7	0.863	1.19	3.01
28.5	4.98	19.1	48.7	7.77	2.41	1.94	13.8	0.589	21.6	6.06	1.60	9.42	0.942	1.10	1.99
25	5.61	21.4	42.3	6.78	2.40	1.89	12.0	0.521	18.6	5.26	1.59	8.15	0.826	0.760	1.34
22.5	6.23	23.4	37.8	6.10	2.39	1.86	10.8	0.471	16.4	4.67	1.57	7.22	0.726	0.555	0.974
20	6.93	26.2	33.1	5.35	2.37	1.81	9.43	0.421	14.4	4.12	1.56	6.36	0.581	0.396	0.673
18	8.12	26.9	30.6	5.05	2.41	1.88	8.93	0.378	12.2	3.50	1.52	5.42	0.554	0.272	0.516
15.5	6.28	28.9	27.5	4.64	2.45	2.02	8.27	0.413	6.20	2.24	1.17	3.51	0.480	0.230	0.366
13	7.97	31.4	23.5	4.09	2.47	2.09	7.36	0.372	4.79	1.74	1.12	2.73	0.406	0.130	0.243

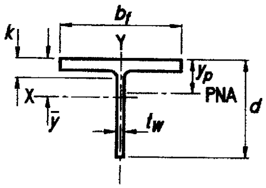


Table 1–8 (continued)
WT Shapes
Dimensions

Shape	Area, A	Depth, d		Stem: Thickness, t_w		Stem: $\frac{t_w}{2}$	Stem: Area	Flange: Width, b_f		Flange: Thickness, t_f		Distance: k		Distance: Workable Gage
	in.^{2}	in.		in.		in.	in.^{2}	in.		in.		in.	in.	in.
WT7×365[h]	107	11.2	11 1/4	3.07	3 1/16	1 9/16	34.4	17.9	17 7/8	4.91	4 15/16	5.51	6 3/16	7 1/2[g]
×332.5[h]	97.8	10.8	10 7/8	2.83	2 13/16	1 7/16	30.6	17.7	17 5/8	4.52	4 1/2	5.12	5 13/16	7 1/2[g]
×302.5[h]	88.9	10.5	10 1/2	2.60	2 5/8	1 5/16	27.1	17.4	17 3/8	4.16	4 3/16	4.76	5 7/16	7 1/2
×275[h]	80.9	10.1	10 1/8	2.38	2 3/8	1 3/16	24.1	17.2	17 1/4	3.82	3 13/16	4.42	5 1/8	
×250[h]	73.5	9.80	9 3/4	2.19	2 3/16	1 1/8	21.5	17.0	17	3.50	3 1/2	4.10	4 13/16	
×227.5[h]	66.9	9.51	9 1/2	2.02	2	1	19.2	16.8	16 7/8	3.21	3 3/16	3.81	4 1/2	
×213[h]	62.6	9.34	9 3/8	1.88	1 7/8	15/16	17.5	16.7	16 3/4	3.04	3 1/16	3.63	4 5/16	
×199[h]	58.5	9.15	9 1/8	1.77	1 3/4	7/8	16.2	16.6	16 5/8	2.85	2 7/8	3.44	4 1/8	
×185[h]	54.4	8.96	9	1.66	1 5/8	13/16	14.8	16.5	16 1/2	2.66	2 11/16	3.26	3 15/16	
×171[h]	50.3	8.77	8 3/4	1.54	1 9/16	13/16	13.5	16.4	16 3/8	2.47	2 1/2	3.07	3 3/4	
×155.5[h]	45.7	8.56	8 1/2	1.41	1 7/16	3/4	12.1	16.2	16 1/4	2.26	2 1/4	2.86	3 9/16	
×141.5[h]	41.6	8.37	8 3/8	1.29	1 5/16	11/16	10.8	16.1	16 1/8	2.07	2 1/16	2.67	3 3/8	
×128.5	37.8	8.19	8 1/4	1.18	1 3/16	5/8	9.62	16.0	16	1.89	1 7/8	2.49	3 3/16	
×116.5	34.2	8.02	8	1.07	1 1/16	9/16	8.58	15.9	15 7/8	1.72	1 3/4	2.32	3	
×105.5	31.0	7.86	7 7/8	0.980	1	1/2	7.70	15.8	15 3/4	1.56	1 9/16	2.16	2 7/8	
×96.5	28.4	7.74	7 3/4	0.890	7/8	7/16	6.89	15.7	15 3/4	1.44	1 7/16	2.04	2 3/4	
×88	25.9	7.61	7 5/8	0.830	13/16	7/16	6.32	15.7	15 5/8	1.31	1 5/16	1.91	2 5/8	
×79.5	23.4	7.49	7 1/2	0.745	3/4	3/8	5.58	15.6	15 5/8	1.19	1 3/16	1.79	2 1/2	
×72.5	21.3	7.39	7 3/8	0.680	11/16	3/8	5.03	15.5	15 1/2	1.09	1 1/16	1.69	2 3/8	
WT7×66	19.4	7.33	7 3/8	0.645	5/8	5/16	4.73	14.7	14 3/4	1.03	1	1.63	2 5/16	5 1/2
×60	17.7	7.24	7 1/4	0.590	9/16	5/16	4.27	14.7	14 5/8	0.940	15/16	1.54	2 1/4	
×54.5	16.0	7.16	7 1/8	0.525	1/2	1/4	3.76	14.6	14 5/8	0.860	7/8	1.46	2 3/16	
×49.5[f]	14.6	7.08	7 1/8	0.485	1/2	1/4	3.43	14.6	14 5/8	0.780	3/4	1.38	2 1/16	
×45[f]	13.2	7.01	7	0.440	7/16	1/4	3.08	14.5	14 1/2	0.710	11/16	1.31	2	
WT7×41	12.0	7.16	7 1/8	0.510	1/2	1/4	3.65	10.1	10 1/8	0.855	7/8	1.45	1 11/16	5 1/2
×37	10.9	7.09	7 1/8	0.450	7/16	1/4	3.19	10.1	10 1/8	0.785	13/16	1.38	1 5/8	
×34	9.99	7.02	7	0.415	7/16	1/4	2.91	10.0	10	0.720	3/4	1.31	1 9/16	
×30.5[c]	8.96	6.95	7	0.375	3/8	3/16	2.60	10.0	10	0.645	5/8	1.24	1 1/2	
WT7×26.5[c]	7.80	6.96	7	0.370	3/8	3/16	2.58	8.06	8	0.660	11/16	1.25	1 1/2	5 1/2
×24[c]	7.07	6.90	6 7/8	0.340	5/16	3/16	2.34	8.03	8	0.595	5/8	1.19	1 7/16	
×21.5[c]	6.31	6.83	6 7/8	0.305	5/16	3/16	2.08	8.00	8	0.530	1/2	1.12	1 3/8	

[c] Shape is slender for compression with F_y = 50 ksi.
[f] Shape exceeds compact limit for flexure with F_y = 50 ksi.
[g] The actual size, combination, and orientation of fastener components should be compared with the geometry of the cross-section to ensure compatibility.
[h] Flange thickness greater than 2 in. Special requirements may apply per Specification Section A3.1c.

Table 1–8 (continued)
WT Shapes
Properties

WT7

Nom-inal Wt.	Compact Section Criteria		Axis X-X						Axis Y-Y				Q_s	Torsional Properties	
	$\frac{b_f}{2t_f}$	$\frac{h}{t_w}$	I	S	r	$\bar{y}$	Z	y_p	I	S	r	Z	F_y = 50 ksi	J	C_w
lb/ft			in.^{4}	in.^{3}	in.	in.	in.^{3}	in.	in.^{4}	in.^{3}	in.	in.^{3}		in.^{4}	in.^{6}
365	1.82	3.65	739	95.4	2.62	3.47	211	3.00	2360	264	4.69	408	1.00	714	5250
332.5	1.95	3.82	622	82.1	2.52	3.25	182	2.77	2080	236	4.62	365	1.00	555	3920
302.5	2.09	4.03	524	70.6	2.43	3.05	157	2.55	1840	211	4.55	326	1.00	430	2930
275	2.25	4.25	442	60.9	2.34	2.85	136	2.35	1630	189	4.49	292	1.00	331	2180
250	2.43	4.47	375	52.7	2.26	2.67	117	2.16	1440	169	4.43	261	1.00	254	1620
227.5	2.62	4.72	321	45.9	2.19	2.51	102	1.99	1280	152	4.38	234	1.00	196	1210
213	2.75	4.98	287	41.4	2.14	2.40	91.7	1.88	1180	141	4.34	217	1.00	164	991
199	2.92	5.17	257	37.6	2.10	2.30	82.9	1.76	1090	131	4.31	201	1.00	135	801
185	3.10	5.41	229	33.9	2.05	2.19	74.4	1.65	994	121	4.27	185	1.00	110	640
171	3.31	5.69	203	30.4	2.01	2.09	66.2	1.54	903	110	4.24	169	1.00	88.3	502
155.5	3.59	6.07	176	26.7	1.96	1.97	57.7	1.41	807	99.4	4.20	152	1.00	67.5	375
141.5	3.89	6.49	153	23.5	1.92	1.86	50.4	1.29	722	89.7	4.17	137	1.00	51.8	281
128.5	4.23	6.97	133	20.7	1.88	1.75	43.9	1.18	645	80.7	4.13	123	1.00	39.3	209
116.5	4.62	7.50	116	18.2	1.84	1.65	38.2	1.08	576	72.5	4.10	110	1.00	29.6	154
105.5	5.06	8.02	102	16.2	1.81	1.57	33.4	0.980	513	65.0	4.07	98.9	1.00	22.2	113
96.5	5.45	8.70	89.8	14.4	1.78	1.49	29.4	0.903	466	59.3	4.05	90.1	1.00	17.3	87.2
88	5.97	9.17	80.5	13.0	1.76	1.43	26.3	0.827	419	53.5	4.02	81.3	1.00	13.2	65.2
79.5	6.54	10.1	70.2	11.4	1.73	1.35	22.8	0.751	374	48.1	4.00	73.0	1.00	9.84	47.9
72.5	7.11	10.9	62.5	10.2	1.71	1.29	20.2	0.688	338	43.7	3.98	66.2	1.00	7.56	36.3
66	7.15	11.4	57.8	9.57	1.73	1.29	18.6	0.658	274	37.2	3.76	56.5	1.00	6.13	26.6
60	7.80	12.3	51.7	8.61	1.71	1.24	16.5	0.602	247	33.7	3.74	51.2	1.00	4.67	20.0
54.5	8.49	13.6	45.3	7.56	1.68	1.17	14.4	0.548	223	30.6	3.73	46.3	1.00	3.55	15.0
49.5	9.34	14.6	40.9	6.88	1.67	1.14	12.9	0.500	201	27.6	3.71	41.8	—	2.68	11.1
45	10.2	15.9	36.5	6.16	1.66	1.09	11.5	0.456	181	25.0	3.70	37.8	1.00	2.03	8.31
41	5.92	14.0	41.2	7.14	1.85	1.39	13.2	0.593	74.1	14.6	2.48	22.4	1.00	2.53	5.63
37	6.41	15.7	36.0	6.25	1.82	1.32	11.5	0.541	66.9	13.3	2.48	20.2	1.00	1.93	4.19
34	6.97	16.9	32.6	5.69	1.81	1.29	10.4	0.498	60.7	12.1	2.46	18.4	1.00	1.50	3.21
30.5	7.75	18.5	28.9	5.07	1.80	1.25	9.15	0.448	53.7	10.7	2.45	16.4	0.972	1.09	2.29
26.5	6.11	18.8	27.6	4.94	1.88	1.38	8.87	0.484	28.8	7.15	1.92	11.0	0.957	0.967	1.46
24	6.75	20.3	24.9	4.49	1.88	1.35	8.00	0.440	25.7	6.40	1.91	9.80	0.883	0.723	1.07
21.5	7.54	22.4	21.9	3.98	1.86	1.31	7.05	0.395	22.6	5.65	1.89	8.64	0.776	0.522	0.751

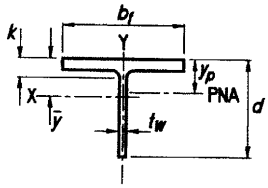


Table 1-8 (continued)
WT Shapes
Dimensions

Shape	Area, A	Depth, d		Stem: Thickness, t_w		Stem: $\frac{t_w}{2}$	Stem: Area	Flange: Width, b_f		Flange: Thickness, t_f		Distance: k		Distance: Workable Gage
	in.^{2}	in.		in.		in.	in.^{2}	in.		in.		in.	in.	in.
WT7×19[c]	5.58	7.05	7	0.310	5/16	3/16	2.19	6.77	6 3/4	0.515	1/2	0.915	1 1/4	3 1/2[g]
×17[c]	5.00	6.99	7	0.285	5/16	3/16	1.99	6.75	6 3/4	0.455	7/16	0.855	1 3/16	3 1/2
×15[c]	4.42	6.92	6 7/8	0.270	1/4	1/8	1.87	6.73	6 3/4	0.385	3/8	0.785	1 1/8	3 1/2
WT7×13[c]	3.85	6.96	7	0.255	1/4	1/8	1.77	5.03	5	0.420	7/16	0.820	1 1/8	2 3/4[g]
×11[c,v]	3.25	6.87	6 7/8	0.230	1/4	1/8	1.58	5.00	5	0.335	5/16	0.735	1 1/16	2 3/4[g]
WT6×168[h]	49.4	8.41	8 3/8	1.78	1 3/4	7/8	14.9	13.4	13 3/8	2.96	2 15/16	3.55	3 7/8	5 1/2
×152.5[h]	44.8	8.16	8 1/8	1.63	1 5/8	13/16	13.3	13.2	13 1/4	2.71	2 11/16	3.30	3 5/8	
×139.5[h]	41.0	7.93	7 7/8	1.53	1 1/2	3/4	12.1	13.1	13 1/8	2.47	2 1/2	3.07	3 3/8	
×126[h]	37.0	7.71	7 3/4	1.40	1 3/8	11/16	10.7	13.0	13	2.25	2 1/4	2.85	3 1/8	
×115[h]	33.9	7.53	7 1/2	1.29	1 5/16	11/16	9.67	12.9	12 7/8	2.07	2 1/16	2.67	2 15/16	
×105	30.9	7.36	7 3/8	1.18	1 3/16	5/8	8.68	12.8	12 3/4	1.90	1 7/8	2.50	2 13/16	
×95	27.9	7.19	7 1/4	1.06	1 1/16	9/16	7.62	12.7	12 5/8	1.74	1 3/4	2.33	2 5/8	
×85	25.0	7.02	7	0.960	15/16	1/2	6.73	12.6	12 5/8	1.56	1 9/16	2.16	2 7/16	
×76	22.4	6.86	6 7/8	0.870	7/8	7/16	5.96	12.5	12 1/2	1.40	1 3/8	2.00	2 5/16	
×68	20.0	6.71	6 3/4	0.790	13/16	7/16	5.30	12.4	12 3/8	1.25	1 1/4	1.85	2 1/8	
×60	17.6	6.56	6 1/2	0.710	11/16	3/8	4.66	12.3	12 3/8	1.11	1 1/8	1.70	2	
×53	15.6	6.45	6 1/2	0.610	5/8	5/16	3.93	12.2	12 1/4	0.990	1	1.59	1 7/8	
×48	14.1	6.36	6 3/8	0.550	9/16	5/16	3.50	12.2	12 1/8	0.900	7/8	1.50	1 13/16	
×43.5	12.8	6.27	6 1/4	0.515	1/2	1/4	3.23	12.1	12 1/8	0.810	13/16	1.41	1 11/16	
×39.5	11.6	6.19	6 1/4	0.470	1/2	1/4	2.91	12.1	12 1/8	0.735	3/4	1.33	1 5/8	
×36	10.6	6.13	6 1/8	0.430	7/16	1/4	2.63	12.0	12	0.670	11/16	1.27	1 9/16	
×32.5[f]	9.54	6.06	6	0.390	3/8	3/16	2.36	12.0	12	0.605	5/8	1.20	1 1/2	
WT6×29	8.52	6.10	6 1/8	0.360	3/8	3/16	2.19	10.0	10	0.640	5/8	1.24	1 1/2	5 1/2
×26.5	7.78	6.03	6	0.345	3/8	3/16	2.08	10.0	10	0.575	9/16	1.18	1 3/8	5 1/2
WT6×25	7.30	6.10	6 1/8	0.370	3/8	3/16	2.26	8.08	8 1/8	0.640	5/8	1.14	1 1/2	5 1/2
×22.5	6.56	6.03	6	0.335	5/16	3/16	2.02	8.05	8	0.575	9/16	1.08	1 3/8	
×20[c]	5.84	5.97	6	0.295	5/16	3/16	1.76	8.01	8	0.515	1/2	1.02	1 3/8	
WT6×17.5[c]	5.17	6.25	6 1/4	0.300	5/16	3/16	1.88	6.56	6 1/2	0.520	1/2	0.820	1 3/16	3 1/2
×15[c]	4.40	6.17	6 1/8	0.260	1/4	1/8	1.60	6.52	6 1/2	0.440	7/16	0.740	1 1/8	
×13[c]	3.82	6.11	6 1/8	0.230	1/4	1/8	1.41	6.49	6 1/2	0.380	3/8	0.680	1 1/16	

[c] Shape is slender for compression with F_y = 50 ksi.
[f] Shape exceeds compact limit for flexure with F_y = 50 ksi.
[g] The actual size, combination, and orientation of fastener components should be compared with the geometry of the cross-section to ensure compatibility.
[h] Flange thickness greater than 2 in. Special requirements may apply per Specification Section A3.1c.
[v] Shear strength controlled by buckling effects (C_v < 1.0) with F_y = 50 ksi.

Table 1–8 (continued)
WT Shapes
Properties

WT7-WT6

Nominal Wt.	Compact Section Criteria		Axis X-X						Axis Y-Y				Q_s	Torsional Properties	
	$\frac{b_f}{2t_f}$	$\frac{h}{t_w}$	I	S	r	$\bar{y}$	Z	y_p	I	S	r	Z	F_y = 50 ksi	J	C_w
lb/ft			in.^{4}	in.^{3}	in.	in.	in.^{3}	in.	in.^{4}	in.^{3}	in.	in.^{3}		in.^{4}	in.^{6}
19	6.57	22.7	23.3	4.22	2.04	1.54	7.45	0.412	13.3	3.94	1.55	6.07	0.758	0.398	0.554
17	7.41	24.5	20.9	3.83	2.04	1.53	6.74	0.371	11.6	3.45	1.53	5.32	0.668	0.284	0.400
15	8.74	25.6	19.0	3.55	2.07	1.58	6.25	0.329	9.79	2.91	1.49	4.49	0.609	0.190	0.287
13	5.98	27.3	17.3	3.31	2.12	1.72	5.89	0.383	4.45	1.77	1.08	2.76	0.538	0.179	0.207
11	7.46	29.9	14.8	2.91	2.14	1.76	5.20	0.325	3.50	1.40	1.04	2.19	0.448	0.104	0.134
168	2.26	4.74	190	31.2	1.96	2.31	68.4	1.84	593	88.6	3.47	137	1.00	120	481
152.5	2.45	5.02	162	27.0	1.90	2.16	59.1	1.69	525	79.3	3.42	122	1.00	92.0	356
139.5	2.66	5.18	141	24.1	1.86	2.05	51.9	1.56	469	71.3	3.38	110	1.00	70.9	267
126	2.89	5.52	121	20.9	1.81	1.92	44.8	1.42	414	63.6	3.34	97.9	1.00	53.5	195
115	3.11	5.86	106	18.5	1.77	1.82	39.4	1.31	371	57.5	3.31	88.4	1.00	41.6	148
105	3.37	6.23	92.1	16.4	1.73	1.72	34.5	1.21	332	51.9	3.28	79.7	1.00	32.1	112
95	3.65	6.78	79.0	14.2	1.68	1.62	29.8	1.10	295	46.5	3.25	71.2	1.00	24.3	82.1
85	4.03	7.31	67.8	12.3	1.65	1.52	25.6	0.994	259	41.2	3.22	62.9	1.00	17.7	58.3
76	4.46	7.88	58.5	10.8	1.62	1.43	22.0	0.896	227	36.4	3.19	55.6	1.00	12.8	41.3
68	4.96	8.49	50.6	9.46	1.59	1.35	19.0	0.805	199	32.1	3.16	48.9	1.00	9.21	28.9
60	5.57	9.24	43.4	8.22	1.57	1.28	16.2	0.716	172	28.0	3.13	42.7	1.00	6.42	19.7
53	6.17	10.6	36.3	6.92	1.53	1.19	13.6	0.637	151	24.7	3.11	37.5	1.00	4.55	13.6
48	6.76	11.6	32.0	6.12	1.51	1.13	11.9	0.580	135	22.2	3.09	33.7	1.00	3.42	10.1
43.5	7.48	12.2	28.9	5.60	1.50	1.10	10.7	0.527	120	19.9	3.07	30.2	1.00	2.54	7.34
39.5	8.22	13.2	25.8	5.03	1.49	1.06	9.49	0.480	108	17.9	3.05	27.1	1.00	1.91	5.43
36	8.99	14.2	23.2	4.54	1.48	1.02	8.48	0.439	97.5	16.2	3.04	24.6	1.00	1.46	4.07
32.5	9.92	15.5	20.6	4.06	1.47	0.985	7.50	0.398	87.2	14.5	3.02	22.0	1.00	1.09	2.97
29	7.82	16.9	19.1	3.76	1.50	1.03	6.97	0.426	53.5	10.7	2.51	16.2	1.00	1.05	2.08
26.5	8.69	17.5	17.7	3.54	1.51	1.02	6.46	0.389	47.9	9.58	2.48	14.5	1.00	0.788	1.53
25	6.31	16.5	18.7	3.79	1.60	1.17	6.88	0.452	28.2	6.97	1.96	10.6	1.00	0.855	1.23
22.5	7.00	18.0	16.6	3.39	1.59	1.13	6.10	0.408	25.0	6.21	1.95	9.47	0.998	0.627	0.885
20	7.77	20.2	14.4	2.95	1.57	1.09	5.28	0.365	22.0	5.50	1.94	8.38	0.885	0.452	0.620
17.5	6.31	20.8	16.0	3.23	1.76	1.30	5.71	0.394	12.2	3.73	1.54	5.73	0.855	0.369	0.437
15	7.41	23.7	13.5	2.75	1.75	1.27	4.83	0.337	10.2	3.12	1.52	4.78	0.708	0.228	0.267
13	8.54	26.6	11.7	2.40	1.75	1.25	4.20	0.295	8.66	2.67	1.51	4.08	0.567	0.150	0.174

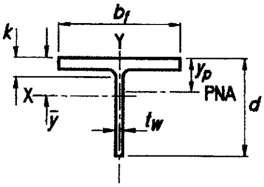


Table 1–8 (continued)
WT Shapes
Dimensions

Shape	Area, A	Depth, d		Stem Thickness, t_w		Stem $\frac{t_w}{2}$	Stem Area	Flange Width, b_f		Flange Thickness, t_f		Distance k		Distance Workable Gage
	in.^{2}	in.		in.		in.	in.^{2}	in.		in.		in.	in.	in.
WT6×11^c	3.24	6.16	6 1/8	0.260	1/4	1/8	1.60	4.03	4	0.425	7/16	0.725	15/16	2 1/4^g
×9.5^c	2.79	6.08	6 1/8	0.235	1/4	1/8	1.43	4.01	4	0.350	3/8	0.650	7/8	
×8^c	2.36	6.00	6	0.220	1/4	1/8	1.32	3.99	4	0.265	1/4	0.565	13/16	
×7^{c,v}	2.08	5.96	6	0.200	3/16	1/8	1.19	3.97	4	0.225	1/4	0.525	3/4	
WT5×56	16.5	5.68	5 5/8	0.755	3/4	3/8	4.29	10.4	10 3/8	1.25	1 1/4	1.75	1 15/16	5 1/2
×50	14.7	5.55	5 1/2	0.680	11/16	3/8	3.77	10.3	10 3/8	1.12	1 1/8	1.62	1 13/16	
×44	12.9	5.42	5 3/8	0.605	5/8	5/16	3.28	10.3	10 1/4	0.990	1	1.49	1 11/16	
×38.5	11.3	5.30	5 1/4	0.530	1/2	1/4	2.81	10.2	10 1/4	0.870	7/8	1.37	1 9/16	
×34	9.99	5.20	5 1/4	0.470	1/2	1/4	2.44	10.1	10 1/8	0.770	3/4	1.27	1 7/16	
×30	8.82	5.11	5 1/8	0.420	7/16	1/4	2.15	10.1	10 1/8	0.680	11/16	1.18	1 3/8	
×27	7.91	5.05	5	0.370	3/8	3/16	1.87	10.0	10	0.615	5/8	1.12	1 5/16	
×24.5	7.21	4.99	5	0.340	5/16	3/16	1.70	10.0	10	0.560	9/16	1.06	1 1/4	
WT5×22.5	6.63	5.05	5	0.350	3/8	3/16	1.77	8.02	8	0.620	5/8	1.12	1 5/16	
×19.5	5.73	4.96	5	0.315	5/16	3/16	1.56	7.99	8	0.530	1/2	1.03	1 3/16	
×16.5	4.85	4.87	4 7/8	0.290	5/16	3/16	1.41	7.96	8	0.435	7/16	0.935	1 1/8	
WT5×15	4.42	5.24	5 1/4	0.300	5/16	3/16	1.57	5.81	5 3/4	0.510	1/2	0.810	1 1/8	2 3/4^g
×13^c	3.81	5.17	5 1/8	0.260	1/4	1/8	1.34	5.77	5 3/4	0.440	7/16	0.740	1 1/16	
×11^c	3.24	5.09	5 1/8	0.240	1/4	1/8	1.22	5.75	5 3/4	0.360	3/8	0.660	15/16	
WT5×9.5^c	2.81	5.12	5 1/8	0.250	1/4	1/8	1.28	4.02	4	0.395	3/8	0.695	15/16	2 1/4^g
×8.5^c	2.50	5.06	5	0.240	1/4	1/8	1.21	4.01	4	0.330	5/16	0.630	7/8	
×7.5^c	2.21	5.00	5	0.230	1/4	1/8	1.15	4.00	4	0.270	1/4	0.570	13/16	
×6^{c,f}	1.77	4.94	4 7/8	0.190	3/16	1/8	0.938	3.96	4	0.210	3/16	0.510	3/4	
WT4×33.5	9.84	4.50	4 1/2	0.570	9/16	5/16	2.57	8.28	8 1/4	0.935	15/16	1.33	1 5/8	5 1/2
×29	8.54	4.38	4 3/8	0.510	1/2	1/4	2.23	8.22	8 1/4	0.810	13/16	1.20	1 1/2	
×24	7.05	4.25	4 1/4	0.400	3/8	3/16	1.70	8.11	8 1/8	0.685	11/16	1.08	1 3/8	
×20	5.87	4.13	4 1/8	0.360	3/8	3/16	1.49	8.07	8 1/8	0.560	9/16	0.954	1 1/4	
×17.5	5.14	4.06	4	0.310	5/16	3/16	1.26	8.02	8	0.495	1/2	0.889	1 3/16	
×15.5^f	4.56	4.00	4	0.285	5/16	3/16	1.14	8.00	8	0.435	7/16	0.829	1 1/8	
WT4×14	4.12	4.03	4	0.285	5/16	3/16	1.15	6.54	6 1/2	0.465	7/16	0.859	15/16	3 1/2
×12	3.54	3.97	4	0.245	1/4	1/8	0.971	6.50	6 1/2	0.400	3/8	0.794	7/8	3 1/2

[c] Shape is slender for compression with F_y = 50 ksi.
[f] Shape exceeds compact limit for flexure with F_y = 50 ksi.
[g] The actual size, combination, and orientation of fastener components should be compared with the geometry of the cross-section to ensure compatibility.
[v] Shear strength controlled by buckling effects (C_v < 1.0) with F_y = 50 ksi.

Table 1–8 (continued)
WT Shapes
Properties

WT6-WT4

Nominal Wt.	Compact Section Criteria		Axis X-X						Axis Y-Y				Q_s	Torsional Properties	
	$\frac{b_f}{2t_f}$	$\frac{h}{t_w}$	I	S	r	$\bar{y}$	Z	y_p	I	S	r	Z	$F_y = 50$ ksi	J	C_w
lb/ft			in.^{4}	in.^{3}	in.	in.	in.^{3}	in.	in.^{4}	in.^{3}	in.	in.^{3}		in.^{4}	in.^{6}
11	4.74	23.7	11.7	2.59	1.90	1.63	4.63	0.402	2.33	1.15	0.847	1.83	0.711	0.146	0.137
9.5	5.72	25.9	10.1	2.28	1.90	1.65	4.11	0.348	1.88	0.939	0.821	1.49	0.598	0.0899	0.0934
8	7.53	27.3	8.70	2.04	1.92	1.74	3.72	0.639	1.41	0.706	0.773	1.13	0.539	0.0511	0.0678
7	8.82	29.8	7.67	1.83	1.92	1.76	3.32	0.760	1.18	0.593	0.753	0.947	0.451	0.0350	0.0493
56	4.17	7.52	28.6	6.40	1.32	1.21	13.4	0.791	118	22.6	2.67	34.6	1.00	7.50	16.9
50	4.62	8.16	24.5	5.56	1.29	1.13	11.4	0.711	103	20.0	2.65	30.5	1.00	5.41	11.9
44	5.18	8.96	20.8	4.77	1.27	1.06	9.65	0.631	89.3	17.4	2.63	26.5	1.00	3.75	8.02
38.5	5.86	10.0	17.4	4.05	1.24	0.990	8.06	0.555	76.8	15.1	2.60	22.9	1.00	2.55	5.31
34	6.58	11.1	14.9	3.49	1.22	0.932	6.85	0.493	66.7	13.2	2.58	20.0	1.00	1.78	3.62
30	7.41	12.2	12.9	3.04	1.21	0.884	5.87	0.438	58.1	11.5	2.57	17.5	1.00	1.23	2.46
27	8.15	13.6	11.1	2.64	1.19	0.836	5.05	0.395	51.7	10.3	2.56	15.6	1.00	0.909	1.78
24.5	8.93	14.7	10.0	2.39	1.18	0.807	4.52	0.361	46.7	9.34	2.54	14.1	1.00	0.693	1.33
22.5	6.47	14.4	10.2	2.47	1.24	0.907	4.65	0.413	26.7	6.65	2.01	10.1	1.00	0.753	0.981
19.5	7.53	15.7	8.84	2.16	1.24	0.876	3.99	0.359	22.5	5.64	1.98	8.57	1.00	0.487	0.616
16.5	9.15	16.8	7.71	1.93	1.26	0.869	3.48	0.305	18.3	4.60	1.94	7.00	1.00	0.291	0.356
15	5.70	17.5	9.28	2.24	1.45	1.10	4.01	0.380	8.35	2.87	1.37	4.41	1.00	0.310	0.273
13	6.56	19.9	7.86	1.91	1.44	1.06	3.39	0.330	7.05	2.44	1.36	3.75	0.904	0.201	0.173
11	7.99	21.2	6.88	1.72	1.46	1.07	3.02	0.282	5.71	1.99	1.33	3.05	0.837	0.119	0.107
9.5	5.09	20.5	6.68	1.74	1.54	1.28	3.10	0.349	2.15	1.07	0.874	1.67	0.873	0.116	0.0796
8.5	6.08	21.1	6.06	1.62	1.56	1.32	2.90	0.311	1.78	0.887	0.844	1.40	0.843	0.0776	0.0610
7.5	7.41	21.7	5.45	1.50	1.57	1.37	2.71	0.305	1.45	0.723	0.810	1.15	0.810	0.0518	0.0475
6	9.43	26.0	4.35	1.22	1.57	1.36	2.20	0.322	1.09	0.551	0.785	0.869	0.593	0.0272	0.0255
33.5	4.43	7.89	10.9	3.05	1.05	0.936	6.29	0.594	44.3	10.7	2.12	16.3	1.00	2.51	3.56
29	5.07	8.58	9.12	2.61	1.03	0.874	5.25	0.520	37.5	9.13	2.10	13.9	1.00	1.66	2.28
24	5.92	10.6	6.85	1.97	0.986	0.777	3.94	0.435	30.5	7.51	2.08	11.4	1.00	0.977	1.30
20	7.21	11.5	5.73	1.69	0.988	0.735	3.25	0.364	24.5	6.08	2.04	9.24	1.00	0.558	0.715
17.5	8.10	13.1	4.82	1.43	0.968	0.688	2.71	0.321	21.3	5.31	2.03	8.05	1.00	0.384	0.480
15.5	9.19	14.0	4.28	1.28	0.969	0.668	2.39	0.285	18.5	4.64	2.02	7.03	1.00	0.267	0.327
14	7.03	14.1	4.23	1.28	1.01	0.734	2.38	0.315	10.8	3.31	1.62	5.04	1.00	0.268	0.230
12	8.12	16.2	3.53	1.08	0.999	0.695	1.98	0.272	9.14	2.81	1.61	4.28	1.00	0.173	0.144

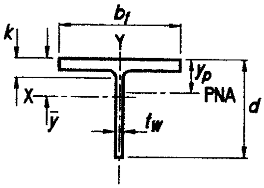


Table 1–8 (continued)
WT Shapes
Dimensions

Shape	Area, A	Depth, d		Stem: Thickness, t_w		Stem: $\frac{t_w}{2}$	Stem: Area	Flange: Width, b_f		Flange: Thickness, t_f		Distance: k		Distance: Workable Gage
	in.^{2}	in.		in.		in.	in.^{2}	in.		in.		in.	in.	in.
WT4×10.5	3.08	4.14	4 1/8	0.250	1/4	1/8	1.04	5.27	5 1/4	0.400	3/8	0.700	7/8	2 3/4[g]
×9	2.63	4.07	4 1/8	0.230	1/4	1/8	0.936	5.25	5 1/4	0.330	5/16	0.630	13/16	2 3/4[g]
WT4×7.5	2.22	4.06	4	0.245	1/4	1/8	0.993	4.02	4	0.315	5/16	0.615	13/16	2 1/4[g]
×6.5	1.92	4.00	4	0.230	1/4	1/8	0.919	4.00	4	0.255	1/4	0.555	3/4	↓
×5[c,f]	1.48	3.95	4	0.170	3/16	1/8	0.671	3.94	4	0.205	3/16	0.505	11/16	↓
WT3×12.5	3.67	3.19	3 1/4	0.320	5/16	3/16	1.02	6.08	6 1/8	0.455	7/16	0.705	15/16	3 1/2
×10	2.94	3.10	3 1/8	0.260	1/4	1/8	0.806	6.02	6	0.365	3/8	0.615	7/8	↓
×7.5[f]	2.21	3.00	3	0.230	1/4	1/8	0.689	5.99	6	0.260	1/4	0.510	3/4	↓
WT3×8	2.37	3.14	3 1/8	0.260	1/4	1/8	0.816	4.03	4	0.405	3/8	0.655	7/8	2 1/4[g]
×6	1.78	3.02	3	0.230	1/4	1/8	0.693	4.00	4	0.280	1/4	0.530	3/4	↓
×4.5[f]	1.34	2.95	3	0.170	3/16	1/8	0.502	3.94	4	0.215	3/16	0.465	11/16	↓
×4.25[f]	1.26	2.92	2 7/8	0.170	3/16	1/8	0.496	3.94	4	0.195	3/16	0.445	11/16	↓
WT2.5×9.5	2.78	2.58	2 5/8	0.270	1/4	1/8	0.695	5.03	5	0.430	7/16	0.730	13/16	2 3/4
×8	2.35	2.51	2 1/2	0.240	1/4	1/8	0.601	5.00	5	0.360	3/8	0.660	3/4	2 3/4
WT2×6.5	1.91	2.08	2 1/8	0.280	1/4	1/8	0.582	4.06	4	0.345	3/8	0.595	3/4	2 1/4

[c] Shape is slender for compression with $F_y = 50$ ksi.
[f] Shape exceeds compact limit for flexure with $F_y = 50$ ksi.
[g] The actual size, combination, and orientation of fastener components should be compared with the geometry of the cross-section to ensure compatibility.

Table 1–8 (continued)
WT Shapes
Properties

WT4-WT2

Nom-inal Wt.	Compact Section Criteria		Axis X-X						Axis Y-Y				Q_s	Torsional Properties	
	$\frac{b_f}{2t_f}$	$\frac{h}{t_w}$	I	S	r	$\bar{y}$	Z	y_p	I	S	r	Z	F_y = 50 ksi	J	C_w
lb/ft			in.^{4}	in.^{3}	in.	in.	in.^{3}	in.	in.^{4}	in.^{3}	in.	in.^{3}		in.^{4}	in.^{6}
10.5	6.59	16.6	3.90	1.18	1.12	0.831	2.11	0.292	4.88	1.85	1.26	2.84	1.00	0.141	0.0916
9	7.95	17.7	3.41	1.05	1.14	0.834	1.86	0.251	3.98	1.52	1.23	2.33	1.00	0.0855	0.0562
7.5	6.37	16.6	3.28	1.07	1.22	0.998	1.91	0.276	1.70	0.849	0.876	1.33	1.00	0.0679	0.0382
6.5	7.84	17.4	2.89	0.974	1.23	1.03	1.74	0.240	1.36	0.682	0.843	1.07	1.00	0.0433	0.0269
5	9.61	23.2	2.15	0.717	1.20	0.953	1.27	0.188	1.05	0.531	0.840	0.826	0.735	0.0212	0.0114
12.5	6.68	10.0	2.29	0.886	0.789	0.610	1.68	0.302	8.53	2.81	1.52	4.28	1.00	0.229	0.171
10	8.25	11.9	1.76	0.693	0.774	0.560	1.29	0.244	6.64	2.21	1.50	3.36	1.00	0.120	0.0858
7.5	11.5	13.0	1.41	0.577	0.797	0.558	1.03	0.185	4.66	1.56	1.45	2.37	1.00	0.0504	0.0342
8	4.98	12.1	1.69	0.685	0.844	0.676	1.25	0.294	2.21	1.10	0.966	1.69	1.00	0.111	0.0426
6	7.14	13.1	1.32	0.564	0.862	0.677	1.01	0.222	1.50	0.748	0.918	1.16	1.00	0.0449	0.0178
4.5	9.16	17.4	0.950	0.408	0.842	0.623	0.720	0.170	1.10	0.557	0.905	0.856	1.00	0.0202	0.00736
4.25	10.1	17.1	0.905	0.397	0.848	0.637	0.700	0.160	0.995	0.505	0.890	0.778	1.00	0.0166	0.00620
9.5	5.85	9.54	1.01	0.485	0.604	0.487	0.970	0.276	4.56	1.81	1.28	2.76	1.00	0.157	0.0775
8	6.94	10.4	0.845	0.413	0.599	0.458	0.801	0.235	3.75	1.50	1.26	2.28	1.00	0.0958	0.0453
6.5	5.88	7.43	0.526	0.321	0.524	0.440	0.616	0.236	1.93	0.950	1.00	1.46	1.00	0.0750	0.0233

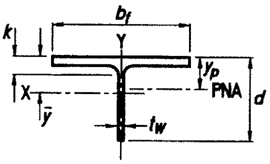


Table 1-9
MT Shapes
Dimensions

Shape	Area, A	Depth, d		Stem				Flange				Distance	
				Thickness, t_w		$\frac{t_w}{2}$	Area	Width, b_f		Thickness, t_f		k	Workable Gage
	in.^{2}	in.		in.		in.	in.^{2}	in.		in.		in.	in.
MT6.25×6.2[c,v]	1.80	6.27	6 1/4	0.1550	1/8	1/16	0.971	3.75	3 3/4	0.228	1/4	9/16	—
×5.8[c,v]	1.69	6.25	6 1/4	0.155	1/8	1/16	0.969	3.50	3 1/2	0.211	3/16	9/16	
MT6×5.9[c]	1.72	6.00	6	0.177	3/16	1/8	1.06	3.07	3 1/8	0.225	1/4	9/16	—
×5.4[c,v]	1.58	5.99	6	0.160	3/16	1/8	0.958	3.07	3 1/8	0.210	3/16	9/16	—
×5[c,v]	1.46	5.99	6	0.149	1/8	1/16	0.892	3.25	3 1/4	0.180	3/16	1/2	—
MT5×4.5[c]	1.32	5.00	5	0.157	3/16	1/8	0.785	2.69	2 3/4	0.206	3/16	9/16	—
×4[c]	1.17	4.98	5	0.141	1/8	1/16	0.701	2.69	2 3/4	0.182	3/16	9/16	—
MT5×3.75[c,v]	1.10	5.00	5	0.130	1/8	1/16	0.649	2.69	2 3/4	0.173	3/16	7/16	—
MT4×3.25[c,v]	0.953	4.00	4	0.135	1/8	1/16	0.540	2.28	2 1/4	0.189	3/16	9/16	—
×3.1[c]	0.904	4.00	4	0.129	1/8	1/16	0.516	2.28	2 1/4	0.177	3/16	7/16	—
MT3×2.2[c]	0.643	3.00	3	0.114	1/8	1/16	0.342	1.84	1 7/8	0.171	3/16	3/8	—
×1.85[c]	0.540	2.96	3	0.0980	1/8	1/16	0.290	2.00	2	0.129	1/8	5/16	—
MT2.5×9.45[t]	2.76	2.50	2 1/2	0.316	5/16	3/16	0.790	5.00	5	0.416	7/16	13/16	2 3/4[g]
MT2×3[f]	0.855	1.90	1 7/8	0.130	1/8	1/16	0.247	3.80	3 3/4	0.160	3/16	1/2	—

[c] Shape is slender for compression with F_y = 36 ksi.
[f] Shape exceeds compact limit for flexure with F_y = 36 ksi.
[g] The actual size, combination, and orientation of fastener components should be compared with the geometry of the cross-section to ensure compatibility.
[t] This shape has tapered flanges while all other MT-shapes have parallel flange surfaces.
[v] Shape does not meet the h/t_w limit for shear in Specification Section G2.1a with F_y = 36 ksi.
— Flange is too narrow to establish a workable gage.

Table 1–9 (continued)
MT Shapes
Properties

MT SHAPES

Nom-inal Wt.	Compact Section Criteria		Axis X-X						Axis Y-Y				Q_s	Torsional Properties	
	$\frac{b_f}{2t_f}$	$\frac{h}{t_w}$	I	S	r	$\bar{y}$	Z	y_p	I	S	r	Z	$F_y = 36$ ksi	J	C_w
lb/ft			in.^{4}	in.^{3}	in.	in.	in.^{3}	in.	in.^{4}	in.^{3}	in.	in.^{3}		in.^{4}	in.^{6}
6.2	8.22	40.4	7.29	1.61	2.01	1.74	2.92	0.372	1.00	0.536	0.746	0.839	0.340	0.0246	0.0284
5.8	8.29	40.3	6.94	1.57	2.03	1.84	2.86	0.808	0.756	0.432	0.669	0.684	0.342	0.0206	0.0268
5.9	6.81	33.9	6.61	1.61	1.96	1.89	2.89	1.13	0.543	0.354	0.561	0.575	0.483	0.0249	0.0337
5.4	7.30	37.4	6.03	1.46	1.95	1.86	2.63	1.05	0.506	0.330	0.566	0.532	0.397	0.0196	0.0250
5	9.03	40.2	5.62	1.36	1.96	1.86	2.45	1.08	0.517	0.318	0.594	0.509	0.344	0.0145	0.0202
4.5	6.53	31.8	3.47	1.00	1.62	1.54	1.81	0.808	0.336	0.250	0.505	0.403	0.548	0.0156	0.0138
4	7.39	35.3	3.08	0.894	1.62	1.52	1.61	0.809	0.296	0.220	0.502	0.354	0.446	0.0112	0.00989
3.75	7.77	38.4	2.91	0.836	1.63	1.51	1.51	0.759	0.281	0.209	0.505	0.334	0.376	0.00932	0.00792
3.25	6.03	29.6	1.57	0.558	1.29	1.18	1.01	0.472	0.188	0.165	0.444	0.264	0.633	0.00917	0.00463
3.1	6.44	31.0	1.50	0.533	1.29	1.18	0.967	0.497	0.176	0.154	0.441	0.247	0.578	0.00778	0.00403
2.2	5.39	26.3	0.579	0.268	0.949	0.841	0.483	0.190	0.0897	0.0973	0.374	0.155	0.779	0.00494	0.00124
1.85	7.75	30.2	0.483	0.226	0.945	0.827	0.409	0.174	0.0863	0.0863	0.400	0.136	0.609	0.00265	0.000754
9.45	6.01	7.91	1.05	0.528	0.617	0.512	1.03	0.276	4.35	1.74	1.26	2.66	1.00	0.156	0.0732
3	11.9	14.6	0.208	0.133	0.493	0.341	0.241	0.112	0.732	0.385	0.926	0.588	1.00	0.00919	0.00193

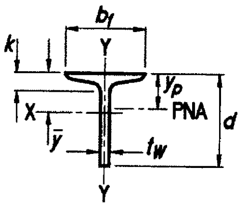


Table 1–10
ST Shapes
Dimensions

Shape	Area, A	Depth, d		Stem Thickness, t_w		Stem $\frac{t_w}{2}$	Stem Area	Flange Width, b_f		Flange Thickness, t_f		Distance k	Distance Workable Gage
	in.^{2}	in.		in.		in.	in.^{2}	in.		in.		in.	in.
ST12×60.5	17.8	12.3	12 1/4	0.800	13/16	7/16	9.80	8.05	8	1.09	1 1/16	2	4
×53	15.6	12.3	12 1/4	0.620	5/8	5/16	7.60	7.87	7 7/8	1.09	1 1/16	2	4
ST12×50	14.7	12.0	12	0.745	3/4	3/8	8.94	7.25	7 1/4	0.870	7/8	1 3/4	4
×45	13.2	12.0	12	0.625	5/8	5/16	7.50	7.13	7 1/8	0.870	7/8	1 3/4	4
×40[c]	11.7	12.0	12	0.500	1/2	1/4	6.00	7.00	7	0.870	7/8	1 3/4	4
ST10×48	14.1	10.2	10 1/8	0.800	13/16	7/16	8.12	7.20	7 1/4	0.920	15/16	1 3/4	4
×43	12.7	10.2	10 1/8	0.660	11/16	3/8	6.70	7.06	7	0.920	15/16	1 3/4	4
ST10×37.5	11.0	10.0	10	0.635	5/8	5/16	6.35	6.39	6 3/8	0.795	13/16	1 5/8	3 1/2[g]
×33	9.69	10.0	10	0.505	1/2	1/4	5.05	6.26	6 1/4	0.795	13/16	1 5/8	3 1/2[g]
ST9×35	10.3	9.00	9	0.711	11/16	3/8	6.40	6.25	6 1/4	0.691	11/16	1 1/2	3 1/2[g]
×27.35	8.02	9.00	9	0.461	7/16	1/4	4.15	6.00	6	0.691	11/16	1 1/2	3 1/2[g]
ST7.5×25	7.34	7.50	7 1/2	0.550	9/16	5/16	4.13	5.64	5 5/8	0.622	5/8	1 3/8	3 1/2[g]
×21.45	6.30	7.50	7 1/2	0.411	7/16	1/4	3.08	5.50	5 1/2	0.622	5/8	1 3/8	3 1/2[g]
ST6×25	7.32	6.00	6	0.687	11/16	3/8	4.12	5.48	5 1/2	0.659	11/16	1 7/16	3[g]
×20.4	5.96	6.00	6	0.462	7/16	1/4	2.77	5.25	5 1/4	0.659	11/16	1 7/16	3[g]
ST6×17.5	5.12	6.00	6	0.428	7/16	1/4	2.57	5.08	5 1/8	0.544	9/16	1 3/16	3[g]
×15.9	4.65	6.00	6	0.350	3/8	3/16	2.10	5.00	5	0.544	9/16	1 3/16	3[g]
ST5×17.5	5.14	5.00	5	0.594	5/8	5/16	2.97	4.94	5	0.491	1/2	1 1/8	2 3/4[g]
×12.7	3.73	5.00	5	0.311	5/16	3/16	1.56	4.66	4 5/8	0.491	1/2	1 1/8	2 3/4[g]
ST4×11.5	3.38	4.00	4	0.441	7/16	1/4	1.76	4.17	4 1/8	0.425	7/16	1	2 1/4[g]
×9.2	2.70	4.00	4	0.271	1/4	1/8	1.08	4.00	4	0.425	7/16	1	2 1/4[g]
ST3×8.6	2.53	3.00	3	0.465	7/16	1/4	1.40	3.57	3 5/8	0.359	3/8	13/16	—
×6.25	1.83	3.00	3	0.232	1/4	1/8	0.696	3.33	3 3/8	0.359	3/8	13/16	—
ST2.5×5	1.47	2.50	2 1/2	0.214	3/16	1/8	0.535	3.00	3	0.326	5/16	3/4	—
ST2×4.75	1.39	2.00	2	0.326	5/16	3/16	0.652	2.80	2 3/4	0.293	5/16	3/4	—
×3.85	1.13	2.00	2	0.193	3/16	1/8	0.386	2.66	2 5/8	0.293	5/16	3/4	—
ST1.5×3.75	1.10	1.50	1 1/2	0.349	3/8	3/16	0.524	2.51	2 1/2	0.260	1/4	5/8	—
×2.85	0.830	1.50	1 1/2	0.170	3/16	1/8	0.255	2.33	2 3/8	0.260	1/4	5/8	—

[c] Shape is slender for compression with F_y = 36 ksi
[g] The actual size, combination and orientation of fastener components should be compared with the geometry of the cross-section to ensure compatibility.
— Flange is too narrow to establish a workable gage.

Table 1–10 (continued)
ST Shapes
Properties

ST SHAPES

Nominal Wt.	Compact Section Criteria		Axis X-X						Axis Y-Y				Q_s	Torsional Properties	
	$\frac{b_f}{2t_f}$	$\frac{d}{t_w}$	I	S	r	$\bar{y}$	Z	y_p	I	S	r	Z	$F_y = 36$ ksi	J	C_w
lb/ft			in.^{4}	in.^{3}	in.	in.	in.^{3}	in.	in.^{4}	in.^{3}	in.	in.^{3}		in.^{4}	in.
60.5	3.69	15.3	259	30.1	3.82	3.63	54.5	1.26	41.5	10.3	1.53	18.1	1.00	6.38	27.5
53.0	3.61	19.8	216	24.1	3.72	3.28	43.3	1.02	38.4	9.76	1.57	16.7	1.00	5.05	15.0
50.0	4.16	16.1	215	26.3	3.83	3.84	47.5	2.16	23.7	6.55	1.27	12.0	1.00	3.76	19.5
45.0	4.09	19.2	190	22.6	3.79	3.60	41.1	1.42	22.3	6.27	1.30	11.2	1.00	3.01	12.1
40.0	4.02	24.0	162	18.6	3.72	3.30	33.6	0.909	21.0	6.00	1.34	10.4	0.878	2.44	6.94
48.0	3.91	12.7	143	20.3	3.18	3.13	36.9	1.35	25.0	6.93	1.33	12.5	1.00	4.16	15.0
43.0	3.84	15.4	124	17.2	3.13	2.91	31.1	0.972	23.3	6.59	1.36	11.6	1.00	3.30	9.17
37.5	4.02	15.7	109	15.8	3.15	3.07	28.6	1.34	14.8	4.62	1.16	8.36	1.00	2.28	7.21
33.0	3.93	19.8	92.9	12.9	3.10	2.81	23.4	0.841	13.7	4.39	1.19	7.70	1.00	1.78	4.02
35.0	4.52	12.7	84.5	14.0	2.87	2.94	25.1	1.78	12.0	3.84	1.08	7.17	1.00	2.02	7.03
27.4	4.34	19.5	62.3	9.60	2.79	2.51	17.3	0.737	10.4	3.45	1.14	6.06	1.00	1.16	2.26
25.0	4.53	13.6	40.5	7.72	2.35	2.25	14.0	0.826	7.79	2.76	1.03	4.99	1.00	1.05	2.02
21.5	4.42	18.2	32.9	5.99	2.29	2.01	10.8	0.605	7.13	2.59	1.06	4.54	1.00	0.765	0.995
25.0	4.16	8.73	25.1	6.04	1.85	1.84	11.0	0.758	7.79	2.84	1.03	5.16	1.00	1.36	1.97
20.4	3.98	13.0	18.9	4.27	1.78	1.58	7.71	0.577	6.74	2.57	1.06	4.43	1.00	0.842	0.787
17.5	4.67	14.0	17.2	3.95	1.83	1.65	7.12	0.543	4.92	1.94	0.980	3.40	1.00	0.524	0.556
15.9	4.60	17.1	14.8	3.30	1.78	1.51	5.94	0.480	4.66	1.87	1.00	3.22	1.00	0.438	0.364
17.5	5.03	8.42	12.5	3.62	1.56	1.56	6.58	0.673	4.15	1.68	0.899	3.10	1.00	0.633	0.725
12.7	4.75	16.1	7.79	2.05	1.45	1.20	3.70	0.403	3.36	1.44	0.950	2.49	1.00	0.300	0.173
11.5	4.91	9.07	5.00	1.76	1.22	1.15	3.19	0.439	2.13	1.02	0.795	1.84	1.00	0.271	0.168
9.20	4.71	14.8	3.49	1.14	1.14	0.942	2.07	0.336	1.84	0.922	0.827	1.59	1.00	0.167	0.0642
8.60	4.97	6.45	2.12	1.02	0.915	0.915	1.85	0.394	1.14	0.642	0.673	1.17	1.00	0.181	0.0772
6.25	4.64	12.9	1.26	0.547	0.831	0.692	1.01	0.271	0.901	0.541	0.702	0.930	1.00	0.0830	0.0197
5.00	4.61	11.7	0.671	0.348	0.677	0.570	0.650	0.239	0.597	0.398	0.638	0.686	1.00	0.0568	0.01000
4.75	4.77	6.13	0.462	0.319	0.575	0.553	0.592	0.250	0.444	0.317	0.564	0.565	1.00	0.0590	0.00995
3.85	4.54	10.4	0.307	0.198	0.522	0.448	0.381	0.204	0.374	0.281	0.576	0.485	1.00	0.0364	0.00457
3.75	4.83	4.30	0.200	0.187	0.426	0.432	0.351	0.219	0.289	0.230	0.513	0.411	1.00	0.0432	0.00496
2.85	4.48	8.82	0.114	0.0970	0.370	0.329	0.196	0.171	0.223	0.192	0.518	0.328	1.00	0.0216	0.00189

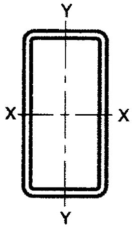


Table 1–11
Rectangular HSS
Dimensions and Properties

Shape	Design Wall Thick-ness, t	Nominal Wt.	Area, A	b/t	h/t	Axis X-X			
						I	S	r	Z
	in.	lb/ft	in.^{2}			in.^{4}	in.^{3}	in.	in.^{3}
HSS20×12×5/8	0.581	127.00	35.0	17.7	31.4	1880	188	7.33	230
×1/2	0.465	103.00	28.3	22.8	40.0	1550	155	7.39	188
×3/8	0.349	78.45	21.5	31.4	54.3	1200	120	7.45	144
×5/16	0.291	65.82	18.1	38.2	65.7	1010	101	7.48	122
HSS20×8×5/8	0.581	110.00	30.3	10.8	31.4	1440	144	6.89	185
×1/2	0.465	89.55	24.6	14.2	40.0	1190	119	6.96	152
×3/8	0.349	68.29	18.7	19.9	54.3	926	92.6	7.03	117
×5/16	0.291	57.31	15.7	24.5	65.7	786	78.6	7.07	98.6
HSS20×4×1/2	0.465	75.94	20.9	5.60	40.0	838	83.8	6.33	115
×3/8	0.349	58.07	16.0	8.46	54.3	657	65.7	6.42	89.3
×5/16	0.291	48.87	13.4	10.7	65.7	560	56.0	6.46	75.6
×1/4	0.233	39.48	10.8	14.2	82.8	458	45.8	6.50	61.5
HSS18×6×5/8	0.581	93.10	25.7	7.33	28.0	923	103	6.00	135
×1/2	0.465	75.94	20.9	9.90	35.7	770	85.6	6.07	112
×3/8	0.349	58.07	16.0	14.2	48.6	602	66.9	6.15	86.4
×5/16	0.291	48.87	13.4	17.6	58.9	513	57.0	6.18	73.1
×1/4	0.233	39.48	10.8	22.8	74.3	419	46.5	6.22	59.4
HSS16×12×5/8	0.581	110.00	30.3	17.7	24.5	1090	136	6.00	165
×1/2	0.465	89.55	24.6	22.8	31.4	904	113	6.06	135
×3/8	0.349	68.29	18.7	31.4	42.8	702	87.7	6.12	104
×5/16	0.291	57.38	15.7	38.2	52.0	595	74.4	6.15	87.7
HSS16×8×5/8	0.581	93.10	25.7	10.8	24.5	815	102	5.64	129
×1/2	0.465	75.94	20.9	14.2	31.4	679	84.9	5.70	106
×3/8	0.349	58.07	16.0	19.9	42.8	531	66.3	5.77	82.1
×5/16	0.291	48.87	13.4	24.5	52.0	451	56.4	5.80	69.4
×1/4	0.233	39.48	10.8	31.3	65.7	368	46.1	5.83	56.4
HSS16×4×5/8	0.581	76.09	21.0	3.88	24.5	539	67.3	5.06	92.9
×1/2	0.465	62.33	17.2	5.60	31.4	455	56.9	5.15	77.3
×3/8	0.349	47.86	13.2	8.46	42.8	360	45.0	5.23	60.2
×5/16	0.291	40.35	11.1	10.7	52.0	308	38.5	5.27	51.1
×1/4	0.233	32.66	8.96	14.2	65.7	253	31.6	5.31	41.7
×3/16	0.174	24.66	6.76	20.0	89.0	193	24.2	5.35	31.7

Note: For compactness criteria, refer to the end of Table 1-12.

Table 1-11 (continued)
Rectangular HSS
Dimensions and Properties

HSS20–HSS16

Shape	Axis Y-Y				Workable Flat		Torsion		Surface Area
	I	S	r	Z	Depth	Width	J	C	
	in.^{4}	in.^{3}	in.	in.^{3}	in.	in.	in.^{4}	in.^{3}	ft^2/ft
HSS20×12×5/8	851	142	4.930	162	17 3/16	9 3/16	1890	257	5.17
×1/2	705	117	4.99	132	17 3/4	9 3/4	1540	209	5.20
×3/8	547	91.1	5.04	102	18 5/16	10 5/16	1180	160	5.23
×5/16	464	77.3	5.07	85.8	18 5/8	10 5/8	997	134	5.25
HSS20×8×5/8	338	84.6	3.34	96.4	17 3/16	5 3/16	916	167	4.50
×1/2	283	70.8	3.39	79.5	17 3/4	5 3/4	757	137	4.53
×3/8	222	55.6	3.44	61.5	18 5/16	6 5/16	586	105	4.57
×5/16	189	47.4	3.47	52.0	18 5/8	6 5/8	496	88.3	4.58
HSS20×4×1/2	58.7	29.3	1.68	34.0	17 3/4	—	195	63.8	3.87
×3/8	47.6	23.8	1.73	26.8	18 5/16	2 5/16	156	49.9	3.90
×5/16	41.2	20.6	1.75	22.9	18 5/8	2 5/8	134	42.4	3.92
×1/4	34.3	17.1	1.78	18.7	18 7/8	2 7/8	111	34.7	3.93
HSS18×6×5/8	158	52.7	2.48	61.0	15 3/16	3 3/16	462	109	3.83
×1/2	134	44.6	2.53	50.7	15 3/4	3 3/4	387	89.9	3.87
×3/8	106	35.5	2.58	39.5	16 5/16	4 5/16	302	69.5	3.90
×5/16	91.3	30.4	2.61	33.5	16 9/16	4 9/16	257	58.7	3.92
×1/4	75.1	25.0	2.63	27.3	16 7/8	4 7/8	210	47.7	3.93
HSS16x12×5/8	700	117	4.80	135	13 3/16	9 3/16	1370	204	4.50
×1/2	581	96.8	4.86	111	13 3/4	9 3/4	1120	166	4.53
×3/8	452	75.3	4.91	85.5	14 5/16	10 5/16	862	127	4.57
×5/16	384	64.0	4.94	72.2	14 5/8	10 5/8	727	107	4.58
HSS16×8×5/8	274	68.6	3.27	79.2	13 3/16	5 3/16	681	132	3.83
×1/2	230	57.6	3.32	65.5	13 3/4	5 3/4	563	108	3.87
×3/8	181	45.3	3.37	50.8	14 5/16	6 5/16	436	83.4	3.90
×5/16	155	38.7	3.40	43.0	14 5/8	6 5/8	369	70.4	3.92
×1/4	127	31.7	3.42	35.0	14 7/8	6 7/8	300	57.0	3.93
HSS16×4×5/8	54.1	27.0	1.60	32.5	13 3/16	—	174	60.5	3.17
×1/2	47.0	23.5	1.65	27.4	13 3/4	—	150	50.7	3.20
×3/8	38.3	19.1	1.71	21.7	14 5/16	2 5/16	120	39.7	3.23
×5/16	33.2	16.6	1.73	18.5	14 5/8	2 5/8	103	33.8	3.25
×1/4	27.7	13.8	1.76	15.2	14 7/8	2 7/8	85.2	27.6	3.27
×3/16	21.5	10.8	1.78	11.7	15 3/16	3 3/16	65.5	21.1	3.28

—Flat depth or width is too small to establish a workable flat.

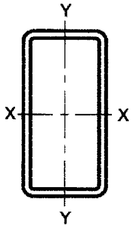


Table 1-11 (continued)
Rectangular HSS
Dimensions and Properties

Shape	Design Wall Thickness, *t*	Nominal Wt.	Area, *A*	*b/t*	*h/t*	Axis X-X *I*	Axis X-X *S*	Axis X-X *r*	Axis X-X *Z*
	in.	lb/ft	in.^{2}			in.^{4}	in.^{3}	in.	in.^{3}
HSS14×10×5/8	0.581	93.10	25.7	14.2	21.1	687	98.2	5.17	120
×1/2	0.465	75.94	20.9	18.5	27.1	573	81.8	5.23	98.8
×3/8	0.349	58.07	16.0	25.7	37.1	447	63.9	5.29	76.3
×5/16	0.291	48.87	13.4	31.4	45.1	380	54.3	5.32	64.6
×1/4	0.233	39.48	10.8	39.9	57.1	310	44.3	5.35	52.4
HSS14×6×5/8	0.581	76.09	21.0	7.33	21.1	478	68.3	4.77	88.7
×1/2	0.465	62.33	17.2	9.90	27.1	402	57.4	4.84	73.6
×3/8	0.349	47.86	13.2	14.2	37.1	317	45.3	4.91	57.3
×5/16	0.291	40.35	11.1	17.6	45.1	271	38.7	4.94	48.6
×1/4	0.233	32.66	8.96	22.8	57.1	222	31.7	4.98	39.6
×3/16	0.174	24.66	6.76	31.5	77.5	170	24.3	5.01	30.1
HSS14×4×5/8	0.581	67.59	18.7	3.88	21.1	373	53.3	4.47	73.1
×1/2	0.465	55.53	15.3	5.60	27.1	317	45.3	4.55	61.0
×3/8	0.349	42.75	11.8	8.46	37.1	252	36.0	4.63	47.8
×5/16	0.291	36.09	9.92	10.7	45.1	216	30.9	4.67	40.6
×1/4	0.233	29.25	8.03	14.2	57.1	178	25.4	4.71	33.2
×3/16	0.174	22.12	6.06	20.0	77.5	137	19.5	4.74	25.3
HSS12×10×1/2	0.465	69.14	19.0	18.5	22.8	395	65.9	4.56	78.8
×3/8	0.349	52.93	14.6	25.7	31.4	310	51.6	4.61	61.1
×5/16	0.291	44.62	12.2	31.4	38.2	264	44.0	4.64	51.7
×1/4	0.233	36.00	9.90	39.9	48.5	216	36.0	4.67	42.1
HSS12×8×5/8	0.581	76.13	21.0	10.8	17.7	397	66.1	4.34	82.1
×1/2	0.465	62.33	17.2	14.2	22.8	333	55.6	4.41	68.1
×3/8	0.349	47.82	13.2	19.9	31.4	262	43.7	4.47	53.0
×5/16	0.291	40.36	11.1	24.5	38.2	224	37.4	4.50	44.9
×1/4	0.233	32.60	8.96	31.3	48.5	184	30.6	4.53	36.6
×3/16	0.174	24.78	6.76	43.0	66.0	140	23.4	4.56	27.8
HSS12×6×5/8	0.581	67.62	18.7	7.33	17.7	321	53.4	4.14	68.8
×1/2	0.465	55.53	15.3	9.90	22.8	271	45.2	4.21	57.4
×3/8	0.349	42.72	11.8	14.2	31.4	215	35.9	4.28	44.8
×5/16	0.291	36.10	9.92	17.6	38.2	184	30.7	4.31	38.1
×1/4	0.233	29.19	8.03	22.8	48.5	151	25.2	4.34	31.1
×3/16	0.174	22.22	6.06	31.5	66.0	116	19.4	4.38	23.7

Note: For compactness criteria, refer to the end of Table 1-12.

Table 1-11 (continued)
Rectangular HSS
Dimensions and Properties

HSS14–HSS12

Shape	Axis Y-Y				Workable Flat		Torsion		Surface Area
	I	*S*	*r*	*Z*	Depth	Width	*J*	*C*	
	in.^{4}	in.^{3}	in.	in.^{3}	in.	in.	in.^{4}	in.^{3}	ft^2/ft
HSS14×10×5/8	407	81.5	3.98	95.1	11 3/16	7 3/16	832	146	3.83
×1/2	341	68.1	4.04	78.5	11 3/4	7 3/4	685	120	3.87
×3/8	267	53.4	4.09	60.7	12 5/16	8 5/16	528	91.8	3.90
×5/16	227	45.5	4.12	51.4	12 9/16	8 9/16	446	77.4	3.92
×1/4	186	37.2	4.14	41.8	12 7/8	8 7/8	362	62.6	3.93
HSS14×6×5/8	124	41.2	2.43	48.4	11 3/16	3 3/16	334	83.7	3.17
×1/2	105	35.1	2.48	40.4	11 3/4	3 3/4	279	69.3	3.20
×3/8	84.1	28.0	2.53	31.6	12 5/16	4 5/16	219	53.7	3.23
×5/16	72.3	24.1	2.55	26.9	12 9/16	4 9/16	186	45.5	3.25
×1/4	59.6	19.9	2.58	22.0	12 7/8	4 7/8	152	36.9	3.27
×3/16	45.9	15.3	2.61	16.7	13 3/16	5 3/16	116	28.0	3.28
HSS14×4×5/8	47.2	23.6	1.59	28.5	11 1/4	—	148	52.6	2.83
×1/2	41.2	20.6	1.64	24.1	11 3/4	—	127	44.1	2.87
×3/8	33.6	16.8	1.69	19.1	12 1/4	2 1/4	102	34.6	2.90
×5/16	29.2	14.6	1.72	16.4	12 5/8	2 5/8	87.7	29.5	2.92
×1/4	24.4	12.2	1.74	13.5	12 7/8	2 7/8	72.4	24.1	2.93
×3/16	19.0	9.48	1.77	10.3	13 1/8	3 1/8	55.8	18.4	2.95
HSS12×10×1/2	298	59.7	3.96	69.6	9 3/4	7 3/4	545	102	3.53
×3/8	234	46.9	4.01	54.0	10 5/16	8 5/16	421	78.3	3.57
×5/16	200	40.0	4.04	45.7	10 9/16	8 9/16	356	66.1	3.58
×1/4	164	32.7	4.07	37.2	10 7/8	8 7/8	289	53.5	3.60
HSS12×8×5/8	210	52.5	3.16	61.9	9 3/16	5 3/16	454	97.7	3.17
×1/2	178	44.4	3.21	51.5	9 3/4	5 3/4	377	80.4	3.20
×3/8	140	35.1	3.27	40.1	10 5/16	6 5/16	293	62.1	3.23
×5/16	120	30.1	3.29	34.1	10 9/16	6 9/16	248	52.4	3.25
×1/4	98.8	24.7	3.32	27.8	10 7/8	6 7/8	202	42.5	3.27
×3/16	75.7	18.9	3.35	21.1	11 1/8	7 1/8	153	32.2	3.28
HSS12×6×5/8	107	35.5	2.39	42.1	9 3/16	3 3/16	271	71.1	2.83
×1/2	91.1	30.4	2.44	35.2	9 3/4	3 3/4	227	59.0	2.87
×3/8	72.9	24.3	2.49	27.7	10 5/16	4 5/16	178	45.8	2.90
×5/16	62.8	20.9	2.52	23.6	10 9/16	4 9/16	152	38.8	2.92
×1/4	51.9	17.3	2.54	19.3	10 7/8	4 7/8	124	31.6	2.93
×3/16	40.0	13.3	2.57	14.7	11 3/16	5 3/16	94.6	24.0	2.95

—Flat depth or width is too small to establish a workable flat.

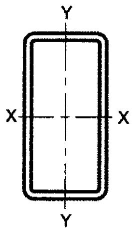


Table 1–11 (continued)
Rectangular HSS
Dimensions and Properties

Shape	Design Wall Thick-ness, *t*	Nominal Wt.	Area, *A*	*b/t*	*h/t*	Axis X-X			
						I	*S*	*r*	*Z*
	in.	lb/ft	in.^{2}			in.^{4}	in.^{3}	in.	in.^{3}
HSS12×4×5/8	0.581	59.11	16.4	3.88	17.7	245	40.8	3.87	55.5
×1/2	0.465	48.72	13.5	5.60	22.8	210	34.9	3.95	46.7
×3/8	0.349	37.61	10.4	8.46	31.4	168	28.0	4.02	36.7
×5/16	0.291	31.84	8.76	10.7	38.2	144	24.1	4.06	31.3
×1/4	0.233	25.79	7.10	14.2	48.5	119	19.9	4.10	25.6
×3/16	0.174	19.66	5.37	20.0	66.0	91.8	15.3	4.13	19.6
HSS12×3 1/2×3/8	0.349	36.34	10.0	7.03	31.4	156	26.0	3.94	34.7
×5/16	0.291	30.77	8.46	9.03	38.2	134	22.4	3.98	29.6
HSS12×3×5/16	0.291	29.71	8.17	7.31	38.2	124	20.7	3.90	27.9
×1/4	0.233	24.09	6.63	9.88	48.5	103	17.2	3.94	22.9
×3/16	0.174	18.38	5.02	14.2	66.0	79.6	13.3	3.98	17.5
HSS12×2×5/16	0.291	27.58	7.59	3.87	38.2	104	17.4	3.71	24.5
×1/4	0.233	22.39	6.17	5.58	48.5	86.9	14.5	3.75	20.1
×3/16	0.174	17.10	4.67	8.49	66.0	67.4	11.2	3.80	15.5
HSS10×8×5/8	0.581	67.62	18.7	10.8	14.2	253	50.5	3.68	62.2
×1/2	0.465	55.53	15.3	14.2	18.5	214	42.7	3.73	51.9
×3/8	0.349	42.72	11.8	19.9	25.7	169	33.9	3.79	40.5
×5/16	0.291	36.10	9.92	24.5	31.4	145	29.0	3.82	34.4
×1/4	0.233	29.19	8.03	31.3	39.9	119	23.8	3.85	28.1
×3/16	0.174	22.22	6.06	43.0	54.5	91.4	18.3	3.88	21.4
HSS10×6×5/8	0.581	59.11	16.4	7.33	14.2	201	40.2	3.50	51.3
×1/2	0.465	48.72	13.5	9.90	18.5	171	34.3	3.57	43.0
×3/8	0.349	37.61	10.4	14.2	25.7	137	27.4	3.63	33.8
×5/16	0.291	31.84	8.76	17.6	31.4	118	23.5	3.66	28.8
×1/4	0.233	25.79	7.10	22.8	39.9	96.9	19.4	3.69	23.6
×3/16	0.174	19.66	5.37	31.5	54.5	74.6	14.9	3.73	18.0
HSS10×5×3/8	0.349	35.06	9.67	11.3	25.7	120	24.1	3.53	30.4
×5/16	0.291	29.71	8.17	14.2	31.4	104	20.8	3.56	26.0
×1/4	0.233	24.09	6.63	18.5	39.9	85.8	17.2	3.60	21.3
×3/16	0.174	18.38	5.02	25.7	54.5	66.2	13.2	3.63	16.3

Note: For compactness criteria, refer to the end of Table 1-12.

Table 1-11 (continued)
Rectangular HSS
Dimensions and Properties

HSS12–HSS10

Shape	Axis Y-Y				Workable Flat		Torsion		Surface Area
	I	*S*	*r*	*Z*	Depth	Width	*J*	*C*	
	in.⁴	in.³	in.	in.³	in.	in.	in.⁴	in.³	ft²/ft
HSS12×4×$\frac{5}{8}$	40.4	20.2	1.57	24.5	$9\frac{3}{16}$	—	122	44.6	2.50
×$\frac{1}{2}$	35.3	17.7	1.62	20.9	$9\frac{3}{4}$	—	105	37.5	2.53
×$\frac{3}{8}$	28.9	14.5	1.67	16.6	$10\frac{5}{16}$	$2\frac{5}{16}$	84.1	29.5	2.57
×$\frac{5}{16}$	25.2	12.6	1.70	14.2	$10\frac{5}{8}$	$2\frac{5}{8}$	72.4	25.2	2.58
×$\frac{1}{4}$	21.0	10.5	1.72	11.7	$10\frac{7}{8}$	$2\frac{7}{8}$	59.8	20.6	2.60
×$\frac{3}{16}$	16.4	8.20	1.75	9.00	$11\frac{3}{16}$	$3\frac{3}{16}$	46.1	15.7	2.62
HSS12×3$\frac{1}{2}$×$\frac{3}{8}$	21.3	12.2	1.46	14.0	$10\frac{5}{16}$	—	64.7	25.5	2.48
×$\frac{5}{16}$	18.6	10.6	1.48	12.1	$10\frac{5}{8}$	—	56.0	21.8	2.50
HSS12×3×$\frac{5}{16}$	13.1	8.73	1.27	10.0	$10\frac{5}{8}$	—	41.3	18.4	2.42
×$\frac{1}{4}$	11.1	7.38	1.29	8.28	$10\frac{7}{8}$	—	34.5	15.1	2.43
×$\frac{3}{16}$	8.72	5.81	1.32	6.40	$11\frac{3}{16}$	$2\frac{3}{16}$	26.8	11.6	2.45
HSS12×2×$\frac{5}{16}$	5.10	5.10	0.820	6.05	$10\frac{5}{8}$	—	17.6	11.6	2.25
×$\frac{1}{4}$	4.41	4.41	0.845	5.08	$10\frac{7}{8}$	—	15.1	9.64	2.27
×$\frac{3}{16}$	3.55	3.55	0.872	3.97	$11\frac{3}{16}$	—	12.0	7.49	2.28
HSS10×8×$\frac{5}{8}$	178	44.5	3.09	53.3	$7\frac{3}{16}$	$5\frac{3}{16}$	346	80.4	2.83
×$\frac{1}{2}$	151	37.8	3.14	44.5	$7\frac{3}{4}$	$5\frac{3}{4}$	288	66.4	2.87
×$\frac{3}{8}$	120	30.0	3.19	34.8	$8\frac{5}{16}$	$6\frac{5}{16}$	224	51.4	2.90
×$\frac{5}{16}$	103	25.7	3.22	29.6	$8\frac{5}{8}$	$6\frac{5}{8}$	190	43.5	2.92
×$\frac{1}{4}$	84.7	21.2	3.25	24.2	$8\frac{7}{8}$	$6\frac{7}{8}$	155	35.3	2.93
×$\frac{3}{16}$	65.1	16.3	3.28	18.4	$9\frac{3}{16}$	$7\frac{3}{16}$	118	26.7	2.95
HSS10×6×$\frac{5}{8}$	89.4	29.8	2.34	35.8	$7\frac{3}{16}$	$3\frac{3}{16}$	209	58.6	2.50
×$\frac{1}{2}$	76.8	25.6	2.39	30.1	$7\frac{3}{4}$	$3\frac{3}{4}$	176	48.7	2.53
×$\frac{3}{8}$	61.8	20.6	2.44	23.7	$8\frac{5}{16}$	$4\frac{5}{16}$	139	37.9	2.57
×$\frac{5}{16}$	53.3	17.8	2.47	20.2	$8\frac{5}{8}$	$4\frac{5}{8}$	118	32.2	2.58
×$\frac{1}{4}$	44.1	14.7	2.49	16.6	$8\frac{7}{8}$	$4\frac{7}{8}$	96.7	26.2	2.60
×$\frac{3}{16}$	34.1	11.4	2.52	12.7	$9\frac{3}{16}$	$5\frac{3}{16}$	73.8	19.9	2.62
HSS10×5×$\frac{3}{8}$	40.6	16.2	2.05	18.7	$8\frac{5}{16}$	$3\frac{5}{16}$	100	31.2	2.40
×$\frac{5}{16}$	35.2	14.1	2.07	16.0	$8\frac{5}{8}$	$3\frac{5}{8}$	86.0	26.5	2.42
×$\frac{1}{4}$	29.3	11.7	2.10	13.2	$8\frac{7}{8}$	$3\frac{7}{8}$	70.7	21.6	2.43
×$\frac{3}{16}$	22.7	9.09	2.13	10.1	$9\frac{3}{16}$	$4\frac{3}{16}$	54.1	16.5	2.45

—Flat depth or width is too small to establish a workable flat.

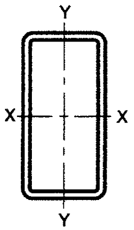


Table 1-11 (continued)
Rectangular HSS
Dimensions and Properties

Shape	Design Wall Thickness, *t*	Nominal Wt.	Area, *A*	*b/t*	*h/t*	Axis X-X			
						I	*S*	*r*	*Z*
	in.	lb/ft	in.^{2}			in.^{4}	in.^{3}	in.	in.^{3}
HSS10×4×5/8	0.581	50.60	14.0	3.88	14.2	149	29.9	3.26	40.3
×1/2	0.465	41.91	11.6	5.60	18.5	129	25.8	3.34	34.1
×3/8	0.349	32.51	8.97	8.46	25.7	104	20.8	3.41	27.0
×5/16	0.291	27.58	7.59	10.7	31.4	90.1	18.0	3.44	23.1
×1/4	0.233	22.39	6.17	14.2	39.9	74.7	14.9	3.48	19.0
×3/16	0.174	17.10	4.67	20.0	54.5	57.8	11.6	3.52	14.6
×1/8	0.116	11.55	3.16	31.5	83.2	39.8	7.97	3.55	9.95
HSS10×3 1/2×1/2	0.465	40.21	11.1	4.53	18.5	118	23.7	3.26	31.9
×3/8	0.349	31.23	8.62	7.03	25.7	96.1	19.2	3.34	25.3
×5/16	0.291	26.51	7.30	9.03	31.4	83.2	16.6	3.38	21.7
×1/4	0.233	21.54	5.93	12.0	39.9	69.1	13.8	3.41	17.9
×3/16	0.174	16.46	4.50	17.1	54.5	53.6	10.7	3.45	13.7
×1/8	0.116	11.13	3.04	27.2	83.2	37.0	7.40	3.49	9.37
HSS10×3×3/8	0.349	29.96	8.27	5.60	25.7	88.0	17.6	3.26	23.7
×5/16	0.291	25.45	7.01	7.31	31.4	76.3	15.3	3.30	20.3
×1/4	0.233	20.69	5.70	9.88	39.9	63.6	12.7	3.34	16.7
×3/16	0.174	15.82	4.32	14.2	54.5	49.4	9.87	3.38	12.8
×1/8	0.116	10.70	2.93	22.9	83.2	34.2	6.83	3.42	8.80
HSS10×2×3/8	0.349	27.41	7.58	2.73	25.7	71.7	14.3	3.08	20.3
×5/16	0.291	23.32	6.43	3.87	31.4	62.6	12.5	3.12	17.5
×1/4	0.233	18.99	5.24	5.58	39.9	52.5	10.5	3.17	14.4
×3/16	0.174	14.54	3.98	8.49	54.5	41.0	8.19	3.21	11.1
×1/8	0.116	9.85	2.70	14.2	83.2	28.5	5.70	3.25	7.65
HSS9×7×5/8	0.581	59.11	16.4	9.05	12.5	174	38.7	3.26	48.3
×1/2	0.465	48.72	13.5	12.1	16.4	149	33.0	3.32	40.5
×3/8	0.349	37.61	10.4	17.1	22.8	119	26.4	3.38	31.8
×5/16	0.291	31.84	8.76	21.1	27.9	102	22.6	3.41	27.1
×1/4	0.233	25.79	7.10	27.0	35.6	84.1	18.7	3.44	22.2
×3/16	0.174	19.66	5.37	37.2	48.7	64.7	14.4	3.47	16.9

Note: For compactness criteria, refer to the end of Table 1-12.

Table 1-11 (continued)
Rectangular HSS
Dimensions and Properties

HSS10–HSS9

Shape	Axis Y-Y				Workable Flat		Torsion		Surface Area
	I	*S*	*r*	*Z*	Depth	Width	*J*	*C*	
	in.^{4}	in.^{3}	in.	in.^{3}	in.	in.	in.^{4}	in.^{3}	ft^2/ft
HSS10×4×5/8	33.5	16.8	1.54	20.6	7 3/16	—	95.7	36.7	2.17
×1/2	29.5	14.7	1.59	17.6	7 3/4	—	82.6	31.0	2.20
×3/8	24.3	12.1	1.64	14.0	8 5/16	2 5/16	66.5	24.4	2.23
×5/16	21.2	10.6	1.67	12.1	8 5/8	2 5/8	57.3	20.9	2.25
×1/4	17.7	8.87	1.70	10.0	8 7/8	2 7/8	47.4	17.1	2.27
×3/16	13.9	6.93	1.72	7.66	9 3/16	3 3/16	36.5	13.1	2.28
×1/8	9.65	4.83	1.75	5.26	9 7/16	3 7/16	25.1	8.90	2.30
HSS10×3 1/2×1/2	21.4	12.2	1.39	14.7	7 3/4	—	63.2	26.5	2.12
×3/8	17.8	10.2	1.44	11.8	8 5/16	—	51.5	21.1	2.15
×5/16	15.6	8.92	1.46	10.2	8 5/8	—	44.6	18.0	2.17
×1/4	13.1	7.51	1.49	8.45	8 7/8	—	37.0	14.8	2.18
×3/16	10.3	5.89	1.51	6.52	9 3/16	2 11/16	28.6	11.4	2.20
×1/8	7.22	4.12	1.54	4.48	9 7/16	2 15/16	19.8	7.75	2.22
HSS10×3×3/8	12.4	8.28	1.22	9.73	8 5/16	—	37.8	17.7	2.07
×5/16	11.0	7.30	1.25	8.42	8 5/8	—	33.0	15.2	2.08
×1/4	9.28	6.19	1.28	6.99	8 7/8	—	27.6	12.5	2.10
×3/16	7.33	4.89	1.30	5.41	9 3/16	2 3/16	21.5	9.64	2.12
×1/8	5.16	3.44	1.33	3.74	9 7/16	2 7/16	14.9	6.61	2.13
HSS10×2×3/8	4.70	4.70	0.787	5.76	8 5/16	—	15.9	11.0	1.90
×5/16	4.24	4.24	0.812	5.06	8 5/8	—	14.2	9.56	1.92
×1/4	3.67	3.67	0.838	4.26	8 7/8	—	12.2	7.99	1.93
×3/16	2.97	2.97	0.864	3.34	9 3/16	—	9.74	6.22	1.95
×1/8	2.14	2.14	0.890	2.33	9 7/16	—	6.90	4.31	1.97
HSS9×7×5/8	117	33.5	2.68	40.5	6 3/16	4 3/16	235	62.0	2.50
×1/2	100	28.7	2.73	34.0	6 3/4	4 3/4	197	51.5	2.53
×3/8	80.4	23.0	2.78	26.7	7 5/16	5 5/16	154	40.0	2.57
×5/16	69.2	19.8	2.81	22.8	7 5/8	5 5/8	131	33.9	2.58
×1/4	57.2	16.3	2.84	18.7	7 7/8	5 7/8	107	27.6	2.60
×3/16	44.1	12.6	2.87	14.3	8 3/16	6 3/16	81.7	20.9	2.62

—Flat depth or width is too small to establish a workable flat.

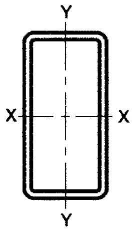


Table 1–11 (continued)
Rectangular HSS
Dimensions and Properties

Shape	Design Wall Thickness, *t*	Nominal Wt.	Area, *A*	*b/t*	*h/t*	Axis X-X			
						I	*S*	*r*	*Z*
	in.	lb/ft	in.^{2}			in.^{4}	in.^{3}	in.	in.^{3}
HSS9×5×5/8	0.581	50.60	14.0	5.61	12.5	133	29.6	3.08	38.5
×1/2	0.465	41.91	11.6	7.75	16.4	115	25.5	3.14	32.5
×3/8	0.349	32.51	8.97	11.3	22.8	92.5	20.5	3.21	25.7
×5/16	0.291	27.58	7.59	14.2	27.9	79.8	17.7	3.24	22.0
×1/4	0.233	22.39	6.17	18.5	35.6	66.1	14.7	3.27	18.1
×3/16	0.174	17.10	4.67	25.7	48.7	51.1	11.4	3.31	13.8
HSS9×3×1/2	0.465	35.11	9.74	3.45	16.4	80.8	18.0	2.88	24.6
×3/8	0.349	27.41	7.58	5.60	22.8	66.3	14.7	2.96	19.7
×5/16	0.291	23.32	6.43	7.31	27.9	57.7	12.8	3.00	16.9
×1/4	0.233	18.99	5.24	9.88	35.6	48.2	10.7	3.04	14.0
×3/16	0.174	14.54	3.98	14.2	48.7	37.6	8.35	3.07	10.8
HSS8×6×5/8	0.581	50.60	14.0	7.33	10.8	114	28.5	2.85	36.1
×1/2	0.465	41.91	11.6	9.90	14.2	98.2	24.6	2.91	30.5
×3/8	0.349	32.51	8.97	14.2	19.9	79.1	19.8	2.97	24.1
×5/16	0.291	27.58	7.59	17.6	24.5	68.3	17.1	3.00	20.6
×1/4	0.233	22.39	6.17	22.8	31.3	56.6	14.2	3.03	16.9
×3/16	0.174	17.10	4.67	31.5	43.0	43.7	10.9	3.06	13.0
HSS8×4×5/8	0.581	42.10	11.7	3.88	10.8	82.0	20.5	2.64	27.4
×1/2	0.465	35.11	9.74	5.60	14.2	71.8	17.9	2.71	23.5
×3/8	0.349	27.41	7.58	8.46	19.9	58.7	14.7	2.78	18.8
×5/16	0.291	23.32	6.43	10.7	24.5	51.0	12.8	2.82	16.1
×1/4	0.233	18.99	5.24	14.2	31.3	42.5	10.6	2.85	13.3
×3/16	0.174	14.54	3.98	20.0	43.0	33.1	8.27	2.88	10.2
×1/8	0.116	9.85	2.70	31.5	66.0	22.9	5.73	2.92	7.02
HSS8×3×1/2	0.465	31.71	8.81	3.45	14.2	58.6	14.6	2.58	20.0
×3/8	0.349	24.85	6.88	5.60	19.9	48.5	12.1	2.65	16.1
×5/16	0.291	21.19	5.85	7.31	24.5	42.4	10.6	2.69	13.9
×1/4	0.233	17.28	4.77	9.88	31.3	35.5	8.88	2.73	11.5
×3/16	0.174	13.26	3.63	14.2	43.0	27.8	6.94	2.77	8.87
×1/8	0.116	9.00	2.46	22.9	66.0	19.3	4.83	2.80	6.11

Note: For compactness criteria, refer to the end of Table 1-12.

Table 1-11 (continued)
Rectangular HSS
Dimensions and Properties

HSS9–HSS8

Shape	Axis Y-Y				Workable Flat		Torsion		Surface Area
	I	S	r	Z	Depth	Width	J	C	
	in.^{4}	in.^{3}	in.	in.^{3}	in.	in.	in.^{4}	in.^{3}	ft^2/ft
HSS9×5×5/8	52.0	20.8	1.92	25.3	6 3/16	2 3/16	128	42.5	2.17
×1/2	45.2	18.1	1.97	21.5	6 3/4	2 3/4	109	35.6	2.20
×3/8	36.8	14.7	2.03	17.1	7 5/16	3 5/16	86.9	27.9	2.23
×5/16	32.0	12.8	2.05	14.6	7 5/8	3 5/8	74.4	23.8	2.25
×1/4	26.6	10.6	2.08	12.0	7 7/8	3 7/8	61.2	19.4	2.27
×3/16	20.7	8.28	2.10	9.25	8 3/16	4 3/16	46.9	14.8	2.28
HSS9×3×1/2	13.2	8.81	1.17	10.8	6 3/4	—	40.0	19.7	1.87
×3/8	11.2	7.45	1.21	8.80	7 5/16	—	33.1	15.8	1.90
×5/16	9.88	6.59	1.24	7.63	7 5/8	—	28.9	13.6	1.92
×1/4	8.38	5.59	1.27	6.35	7 7/8	—	24.2	11.3	1.93
×3/16	6.64	4.42	1.29	4.92	8 3/16	2 3/16	18.9	8.66	1.95
HSS8×6×5/8	72.3	24.1	2.27	29.5	5 3/16	3 3/16	150	46.0	2.17
×1/2	62.5	20.8	2.32	24.9	5 3/4	3 3/4	127	38.4	2.20
×3/8	50.6	16.9	2.38	19.8	6 5/16	4 5/16	100	30.0	2.23
×5/16	43.8	14.6	2.40	16.9	6 5/8	4 5/8	85.8	25.5	2.25
×1/4	36.4	12.1	2.43	13.9	6 7/8	4 7/8	70.3	20.8	2.27
×3/16	28.2	9.39	2.46	10.7	7 3/16	5 3/16	53.7	15.8	2.28
HSS8×4×5/8	26.6	13.3	1.51	16.6	5 3/16	—	70.3	28.7	1.83
×1/2	23.6	11.8	1.56	14.3	5 3/4	—	61.1	24.4	1.87
×3/8	19.6	9.80	1.61	11.5	6 5/16	2 5/16	49.3	19.3	1.90
×5/16	17.2	8.58	1.63	9.91	6 5/8	2 5/8	42.6	16.5	1.92
×1/4	14.4	7.21	1.66	8.20	6 7/8	2 7/8	35.3	13.6	1.93
×3/16	11.3	5.65	1.69	6.33	7 3/16	3 3/16	27.2	10.4	1.95
×1/8	7.90	3.95	1.71	4.36	7 7/16	3 7/16	18.7	7.10	1.97
HSS8×3×1/2	11.7	7.81	1.15	9.64	5 3/4	—	34.3	17.4	1.70
×3/8	9.95	6.63	1.20	7.88	6 5/16	—	28.5	14.0	1.73
×5/16	8.81	5.87	1.23	6.84	6 5/8	—	24.9	12.1	1.75
×1/4	7.49	4.99	1.25	5.70	6 7/8	—	20.8	10.0	1.77
×3/16	5.94	3.96	1.28	4.43	7 3/16	2 3/16	16.2	7.68	1.78
×1/8	4.20	2.80	1.31	3.07	7 7/16	2 7/16	11.3	5.27	1.80

—Flat depth or width is too small to establish a workable flat.

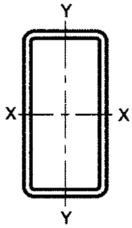


Table 1–11 (continued)
Rectangular HSS
Dimensions and Properties

Shape	Design Wall Thickness, *t*	Nominal Wt.	Area, *A*	*b/t*	*h/t*	Axis X-X			
						I	*S*	*r*	*Z*
	in.	lb/ft	in.^{2}			in.^{4}	in.^{3}	in.	in.^{3}
HSS8×2×3/8	0.349	22.30	6.18	2.73	19.9	38.2	9.56	2.49	13.4
×5/16	0.291	19.06	5.26	3.87	24.5	33.7	8.43	2.53	11.6
×1/4	0.233	15.58	4.30	5.58	31.3	28.5	7.12	2.57	9.68
×3/16	0.174	11.98	3.28	8.49	43.0	22.4	5.61	2.61	7.51
×1/8	0.116	8.15	2.23	14.2	66.0	15.7	3.93	2.65	5.19
HSS7×5×1/2	0.465	35.11	9.74	7.75	12.1	60.6	17.3	2.50	21.9
×3/8	0.349	27.41	7.58	11.3	17.1	49.5	14.1	2.56	17.5
×5/16	0.291	23.32	6.43	14.2	21.1	43.0	12.3	2.59	15.0
×1/4	0.233	18.99	5.24	18.5	27.0	35.9	10.2	2.62	12.4
×3/16	0.174	14.54	3.98	25.7	37.2	27.9	7.96	2.65	9.52
×1/8	0.116	9.85	2.70	40.1	57.3	19.3	5.52	2.68	6.53
HSS7×4×1/2	0.465	31.71	8.81	5.60	12.1	50.7	14.5	2.40	18.8
×3/8	0.349	24.85	6.88	8.46	17.1	41.8	11.9	2.46	15.1
×5/16	0.291	21.19	5.85	10.7	21.1	36.5	10.4	2.50	13.1
×1/4	0.233	17.28	4.77	14.2	27.0	30.5	8.72	2.53	10.8
×3/16	0.174	13.26	3.63	20.0	37.2	23.8	6.81	2.56	8.33
×1/8	0.116	9.00	2.46	31.5	57.3	16.6	4.73	2.59	5.73
HSS7×3×1/2	0.465	28.30	7.88	3.45	12.1	40.7	11.6	2.27	15.8
×3/8	0.349	22.30	6.18	5.60	17.1	34.1	9.73	2.35	12.8
×5/16	0.291	19.06	5.26	7.31	21.1	29.9	8.54	2.38	11.1
×1/4	0.233	15.58	4.30	9.88	27.0	25.2	7.19	2.42	9.22
×3/16	0.174	11.98	3.28	14.2	37.2	19.8	5.65	2.45	7.14
×1/8	0.116	8.15	2.23	22.9	57.3	13.8	3.95	2.49	4.93
HSS7×2×1/4	0.233	13.88	3.84	5.58	27.0	19.8	5.67	2.27	7.64
×3/16	0.174	10.70	2.93	8.49	37.2	15.7	4.49	2.31	5.95
×1/8	0.116	7.30	2.00	14.2	57.3	11.1	3.16	2.35	4.13
HSS6×5×1/2	0.465	31.71	8.81	7.75	9.90	41.1	13.7	2.16	17.2
×3/8	0.349	24.85	6.88	11.3	14.2	33.9	11.3	2.22	13.8
×5/16	0.291	21.19	5.85	14.2	17.6	29.6	9.85	2.25	11.9
×1/4	0.233	17.28	4.77	18.5	22.8	24.7	8.25	2.28	9.87
×3/16	0.174	13.26	3.63	25.7	31.5	19.3	6.44	2.31	7.62
×1/8	0.116	9.00	2.46	40.1	48.7	13.4	4.48	2.34	5.24

Note: For compactness criteria, refer to the end of Table 1-12.

Table 1-11 (continued)
Rectangular HSS
Dimensions and Properties

HSS8–HSS6

Shape	Axis Y-Y				Workable Flat		Torsion		Surface Area
	I	S	r	Z	Depth	Width	J	C	
	in.^{4}	in.^{3}	in.	in.^{3}	in.	in.	in.^{4}	in.^{3}	ft^2/ft
HSS8×2×3/8	3.73	3.73	0.777	4.61	6 5/16	—	12.1	8.65	1.57
×5/16	3.38	3.38	0.802	4.06	6 5/8	—	10.9	7.57	1.58
×1/4	2.94	2.94	0.827	3.43	6 7/8	—	9.36	6.35	1.60
×3/16	2.39	2.39	0.853	2.70	7 3/16	—	7.48	4.95	1.62
×1/8	1.72	1.72	0.879	1.90	7 7/16	—	5.30	3.44	1.63
HSS7×5×1/2	35.6	14.2	1.91	17.3	4 3/4	2 3/4	75.8	27.2	1.87
×3/8	29.3	11.7	1.97	13.8	5 5/16	3 5/16	60.6	21.4	1.90
×5/16	25.5	10.2	1.99	11.9	5 5/8	3 5/8	52.1	18.3	1.92
×1/4	21.3	8.53	2.02	9.83	5 7/8	3 7/8	42.9	15.0	1.93
×3/16	16.6	6.65	2.05	7.57	6 3/16	4 3/16	32.9	11.4	1.95
×1/8	11.6	4.63	2.07	5.20	6 7/16	4 7/16	22.5	7.79	1.97
HSS7×4×1/2	20.7	10.4	1.53	12.6	4 3/4	—	50.5	21.1	1.70
×3/8	17.3	8.63	1.58	10.2	5 5/16	2 5/16	41.0	16.8	1.73
×5/16	15.2	7.58	1.61	8.83	5 5/8	2 5/8	35.4	14.4	1.75
×1/4	12.8	6.38	1.64	7.33	5 7/8	2 7/8	29.3	11.8	1.77
×3/16	10.0	5.02	1.66	5.67	6 1/8	3 1/8	22.7	9.07	1.78
×1/8	7.03	3.51	1.69	3.91	6 7/16	3 7/16	15.6	6.20	1.80
HSS7×3×1/2	10.2	6.80	1.14	8.46	4 3/4	—	28.6	15.0	1.53
×3/8	8.71	5.81	1.19	6.95	5 5/16	—	23.9	12.1	1.57
×5/16	7.74	5.16	1.21	6.05	5 5/8	—	20.9	10.5	1.58
×1/4	6.60	4.40	1.24	5.06	5 7/8	—	17.5	8.68	1.60
×3/16	5.24	3.50	1.26	3.94	6 3/16	2 3/16	13.7	6.69	1.62
×1/8	3.71	2.48	1.29	2.73	6 7/16	2 7/16	9.48	4.60	1.63
HSS7×2×1/4	2.58	2.58	0.819	3.02	5 7/8	—	7.95	5.52	1.43
×3/16	2.10	2.10	0.845	2.39	6 3/16	—	6.35	4.32	1.45
×1/8	1.52	1.52	0.871	1.68	6 7/16	—	4.51	3.00	1.47
HSS6×5×1/2	30.8	12.3	1.87	15.2	3 3/4	2 3/4	59.8	23.0	1.70
×3/8	25.5	10.2	1.92	12.2	4 5/16	3 5/16	48.1	18.2	1.73
×5/16	22.3	8.91	1.95	10.5	4 5/8	3 5/8	41.4	15.6	1.75
×1/4	18.7	7.47	1.98	8.72	4 7/8	3 7/8	34.2	12.8	1.77
×3/16	14.6	5.84	2.01	6.73	5 3/16	4 3/16	26.3	9.76	1.78
×1/8	10.2	4.07	2.03	4.63	5 7/16	4 7/16	18.0	6.66	1.80

—Flat depth or width is too small to establish a workable flat.

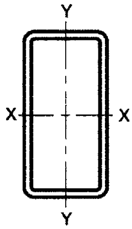
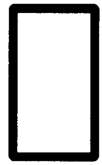


Table 1-11 (continued)
Rectangular HSS
Dimensions and Properties

Shape	Design Wall Thickness, *t*	Nominal Wt.	Area, *A*	*b/t*	*h/t*	Axis X-X			
						I	*S*	*r*	*Z*
	in.	lb/ft	in.^{2}			in.^{4}	in.^{3}	in.	in.^{3}
HSS6×4×1/2	0.465	28.30	7.88	5.60	9.90	34.0	11.3	2.08	14.6
×3/8	0.349	22.30	6.18	8.46	14.2	28.3	9.43	2.14	11.9
×5/16	0.291	19.06	5.26	10.7	17.6	24.8	8.27	2.17	10.3
×1/4	0.233	15.58	4.30	14.2	22.8	20.9	6.96	2.20	8.53
×3/16	0.174	11.98	3.28	20.0	31.5	16.4	5.46	2.23	6.60
×1/8	0.116	8.15	2.23	31.5	48.7	11.4	3.81	2.26	4.56
HSS6×3×1/2	0.465	24.90	6.95	3.45	9.90	26.8	8.95	1.97	12.1
×3/8	0.349	19.75	5.48	5.60	14.2	22.7	7.57	2.04	9.90
×5/16	0.291	16.93	4.68	7.31	17.6	20.1	6.69	2.07	8.61
×1/4	0.233	13.88	3.84	9.88	22.8	17.0	5.66	2.10	7.19
×3/16	0.174	10.70	2.93	14.2	31.5	13.4	4.47	2.14	5.59
×1/8	0.116	7.30	2.00	22.9	48.7	9.43	3.14	2.17	3.87
HSS6×2×3/8	0.349	17.20	4.78	2.73	14.2	17.1	5.71	1.89	7.93
×5/16	0.291	14.80	4.10	3.87	17.6	15.3	5.11	1.93	6.95
×1/4	0.233	12.18	3.37	5.58	22.8	13.1	4.37	1.97	5.84
×3/16	0.174	9.43	2.58	8.49	31.5	10.5	3.49	2.01	4.58
×1/8	0.116	6.45	1.77	14.2	48.7	7.42	2.47	2.05	3.19
HSS5×4×1/2	0.465	24.90	6.95	5.60	7.75	21.2	8.49	1.75	10.9
×3/8	0.349	19.75	5.48	8.46	11.3	17.9	7.17	1.81	8.96
×5/16	0.291	16.93	4.68	10.7	14.2	15.8	6.32	1.84	7.79
×1/4	0.233	13.88	3.84	14.2	18.5	13.4	5.35	1.87	6.49
×3/16	0.174	10.70	2.93	20.0	25.7	10.6	4.22	1.90	5.05
×1/8	0.116	7.30	2.00	31.5	40.1	7.42	2.97	1.93	3.50
HSS5×3×1/2	0.465	21.50	6.02	3.45	7.75	16.4	6.57	1.65	8.83
×3/8	0.349	17.20	4.78	5.60	11.3	14.1	5.65	1.72	7.34
×5/16	0.291	14.80	4.10	7.31	14.2	12.6	5.03	1.75	6.42
×1/4	0.233	12.18	3.37	9.88	18.5	10.7	4.29	1.78	5.38
×3/16	0.174	9.43	2.58	14.2	25.7	8.53	3.41	1.82	4.21
×1/8	0.116	6.45	1.77	22.9	40.1	6.03	2.41	1.85	2.93

Note: For compactness criteria, refer to the end of Table 1-12.

Table 1–11 (continued)
Rectangular HSS
Dimensions and Properties



HSS6–HSS5

Shape	Axis Y-Y				Workable Flat		Torsion		Surface Area
	I	*S*	*r*	*Z*	Depth	Width	*J*	*C*	
	in.^{4}	in.^{3}	in.	in.^{3}	in.	in.	in.^{4}	in.^{3}	ft^2/ft
HSS6×4×1/2	17.8	8.89	1.50	11.0	3 3/4	—	40.3	17.8	1.53
×3/8	14.9	7.47	1.55	8.94	4 5/16	2 5/16	32.8	14.2	1.57
×5/16	13.2	6.58	1.58	7.75	4 5/8	2 5/8	28.4	12.2	1.58
×1/4	11.1	5.56	1.61	6.45	4 7/8	2 7/8	23.6	10.1	1.60
×3/16	8.76	4.38	1.63	5.00	5 3/16	3 3/16	18.2	7.74	1.62
×1/8	6.15	3.08	1.66	3.46	5 7/16	3 7/16	12.6	5.30	1.63
HSS6×3×1/2	8.69	5.79	1.12	7.28	3 3/4	—	23.1	12.7	1.37
×3/8	7.48	4.99	1.17	6.03	4 5/16	—	19.3	10.3	1.40
×5/16	6.67	4.45	1.19	5.27	4 5/8	—	16.9	8.91	1.42
×1/4	5.70	3.80	1.22	4.41	4 7/8	—	14.2	7.39	1.43
×3/16	4.55	3.03	1.25	3.45	5 3/16	2 3/16	11.1	5.71	1.45
×1/8	3.23	2.15	1.27	2.40	5 7/16	2 7/16	7.73	3.93	1.47
HSS6×2×3/8	2.77	2.77	0.760	3.46	4 5/16	—	8.42	6.35	1.23
×5/16	2.52	2.52	0.785	3.07	4 5/8	—	7.60	5.58	1.25
×1/4	2.21	2.21	0.810	2.61	4 7/8	—	6.55	4.70	1.27
×3/16	1.80	1.80	0.836	2.07	5 3/16	—	5.24	3.68	1.28
×1/8	1.31	1.31	0.861	1.46	5 7/16	—	3.72	2.57	1.30
HSS5×4×1/2	14.9	7.43	1.46	9.35	2 3/4	—	30.3	14.5	1.37
×3/8	12.6	6.30	1.52	7.67	3 5/16	2 5/16	24.9	11.7	1.40
×5/16	11.1	5.57	1.54	6.67	3 5/8	2 5/8	21.7	10.1	1.42
×1/4	9.46	4.73	1.57	5.57	3 7/8	2 7/8	18.0	8.32	1.43
×3/16	7.48	3.74	1.60	4.34	4 3/16	3 3/16	14.0	6.41	1.45
×1/8	5.27	2.64	1.62	3.01	4 7/16	3 7/16	9.66	4.39	1.47
HSS5×3×1/2	7.18	4.78	1.09	6.10	2 3/4	—	17.6	10.3	1.20
×3/8	6.25	4.16	1.14	5.10	3 5/16	—	14.9	8.44	1.23
×5/16	5.60	3.73	1.17	4.48	3 5/8	—	13.1	7.33	1.25
×1/4	4.81	3.21	1.19	3.77	3 7/8	—	11.0	6.10	1.27
×3/16	3.85	2.57	1.22	2.96	4 3/16	2 3/16	8.64	4.73	1.28
×1/8	2.75	1.83	1.25	2.07	4 7/16	2 7/16	6.02	3.26	1.30

—Flat depth or width is too small to establish a workable flat.

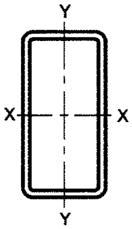


Table 1-11 (continued)
Rectangular HSS
Dimensions and Properties

Shape	Design Wall Thick-ness, t	Nominal Wt.	Area, A	b/t	h/t	Axis X-X			
						I	S	r	Z
	in.	lb/ft	in.^{2}			in.^{4}	in.^{3}	in.	in.^{3}
HSS5×2½×¼	0.233	11.33	3.14	7.73	18.5	9.40	3.76	1.73	4.83
×3/16	0.174	8.79	2.41	11.4	25.7	7.51	3.01	1.77	3.79
×⅛	0.116	6.02	1.65	18.6	40.1	5.34	2.14	1.80	2.65
HSS5×2×⅜	0.349	14.65	4.09	2.73	11.3	10.4	4.14	1.59	5.71
×5/16	0.291	12.67	3.52	3.87	14.2	9.35	3.74	1.63	5.05
×¼	0.233	10.48	2.91	5.58	18.5	8.08	3.23	1.67	4.27
×3/16	0.174	8.15	2.24	8.49	25.7	6.50	2.60	1.70	3.37
×⅛	0.116	5.60	1.54	14.2	40.1	4.65	1.86	1.74	2.37
HSS4×3×⅜	0.349	14.65	4.09	5.60	8.46	7.93	3.97	1.39	5.12
×5/16	0.291	12.67	3.52	7.31	10.7	7.14	3.57	1.42	4.51
×¼	0.233	10.48	2.91	9.88	14.2	6.15	3.07	1.45	3.81
×3/16	0.174	8.15	2.24	14.2	20.0	4.93	2.47	1.49	3.00
×⅛	0.116	5.60	1.54	22.9	31.5	3.52	1.76	1.52	2.11
HSS4×2½×⅜	0.349	13.37	3.74	4.16	8.46	6.77	3.38	1.35	4.48
×5/16	0.291	11.60	3.23	5.59	10.7	6.13	3.07	1.38	3.97
×¼	0.233	9.63	2.67	7.73	14.2	5.32	2.66	1.41	3.38
×3/16	0.174	7.51	2.06	11.4	20.0	4.30	2.15	1.44	2.67
×⅛	0.116	5.17	1.42	18.6	31.5	3.09	1.54	1.47	1.88
HSS4×2×⅜	0.349	12.09	3.39	2.73	8.46	5.60	2.80	1.29	3.84
×5/16	0.291	10.54	2.94	3.87	10.7	5.13	2.56	1.32	3.43
×¼	0.233	8.78	2.44	5.58	14.2	4.49	2.25	1.36	2.94
×3/16	0.174	6.87	1.89	8.49	20.0	3.66	1.83	1.39	2.34
×⅛	0.116	4.75	1.30	14.2	31.5	2.65	1.32	1.43	1.66
HSS3½×2½×⅜	0.349	12.09	3.39	4.16	7.03	4.75	2.72	1.18	3.59
×5/16	0.291	10.54	2.94	5.59	9.03	4.34	2.48	1.22	3.20
×¼	0.233	8.78	2.44	7.73	12.0	3.79	2.17	1.25	2.74
×3/16	0.174	6.87	1.89	11.4	17.1	3.09	1.76	1.28	2.18
×⅛	0.116	4.75	1.30	18.6	27.2	2.23	1.28	1.31	1.54
HSS3½×2×¼	0.233	7.93	2.21	5.58	12.0	3.17	1.81	1.20	2.36
×3/16	0.174	6.23	1.71	8.49	17.1	2.61	1.49	1.23	1.89
×⅛	0.116	4.32	1.19	14.2	27.2	1.90	1.09	1.27	1.34

Note: For compactness criteria, refer to the end of Table 1-12.

Table 1-11 (continued)
Rectangular HSS
Dimensions and Properties

HSS5–HSS3$\frac{1}{2}$

Shape	Axis Y-Y				Workable Flat		Torsion		Surface Area
	I	*S*	*r*	*Z*	Depth	Width	*J*	*C*	
	in.^{4}	in.^{3}	in.	in.^{3}	in.	in.	in.^{4}	in.^{3}	ft^2/ft
HSS5×2$\frac{1}{2}$×$\frac{1}{4}$	3.13	2.50	0.999	2.95	3$\frac{7}{8}$	—	7.93	4.99	1.18
×$\frac{3}{16}$	2.53	2.03	1.02	2.33	4$\frac{3}{16}$	—	6.26	3.89	1.20
×$\frac{1}{8}$	1.82	1.46	1.05	1.64	4$\frac{7}{16}$	—	4.40	2.70	1.22
HSS5×2×$\frac{3}{8}$	2.28	2.28	0.748	2.88	3$\frac{5}{16}$	—	6.61	5.20	1.07
×$\frac{5}{16}$	2.10	2.10	0.772	2.57	3$\frac{5}{8}$	—	5.99	4.59	1.08
×$\frac{1}{4}$	1.84	1.84	0.797	2.20	3$\frac{7}{8}$	—	5.17	3.88	1.10
×$\frac{3}{16}$	1.51	1.51	0.823	1.75	4$\frac{3}{16}$	—	4.15	3.05	1.12
×$\frac{1}{8}$	1.10	1.10	0.848	1.24	4$\frac{7}{16}$	—	2.95	2.13	1.13
HSS4×3×$\frac{3}{8}$	5.01	3.34	1.11	4.18	2$\frac{5}{16}$	—	10.6	6.59	1.07
×$\frac{5}{16}$	4.52	3.02	1.13	3.69	2$\frac{5}{8}$	—	9.41	5.75	1.08
×$\frac{1}{4}$	3.91	2.61	1.16	3.12	2$\frac{7}{8}$	—	7.96	4.81	1.10
×$\frac{3}{16}$	3.16	2.10	1.19	2.46	3$\frac{3}{16}$	—	6.26	3.74	1.12
×$\frac{1}{8}$	2.27	1.51	1.21	1.73	3$\frac{7}{16}$	—	4.38	2.59	1.13
HSS4×2$\frac{1}{2}$×$\frac{3}{8}$	3.17	2.54	0.922	3.20	2$\frac{5}{16}$	—	7.57	5.32	0.983
×$\frac{5}{16}$	2.89	2.32	0.947	2.85	2$\frac{5}{8}$	—	6.77	4.67	1.00
×$\frac{1}{4}$	2.53	2.02	0.973	2.43	2$\frac{7}{8}$	—	5.78	3.93	1.02
×$\frac{3}{16}$	2.06	1.65	0.999	1.93	3$\frac{1}{8}$	—	4.59	3.08	1.03
×$\frac{1}{8}$	1.49	1.19	1.03	1.36	3$\frac{7}{16}$	—	3.23	2.14	1.05
HSS4×2×$\frac{3}{8}$	1.80	1.80	0.729	2.31	2$\frac{5}{16}$	—	4.83	4.04	0.900
×$\frac{5}{16}$	1.67	1.67	0.754	2.08	2$\frac{5}{8}$	—	4.40	3.59	0.917
×$\frac{1}{4}$	1.48	1.48	0.779	1.79	2$\frac{7}{8}$	—	3.82	3.05	0.933
×$\frac{3}{16}$	1.22	1.22	0.804	1.43	3$\frac{3}{16}$	—	3.08	2.41	0.950
×$\frac{1}{8}$	0.898	0.898	0.830	1.02	3$\frac{7}{16}$	—	2.20	1.69	0.967
HSS3$\frac{1}{2}$×2$\frac{1}{2}$×$\frac{3}{8}$	2.77	2.21	0.904	2.82	—	—	6.16	4.57	0.900
×$\frac{5}{16}$	2.54	2.03	0.930	2.52	2$\frac{1}{8}$	—	5.53	4.03	0.917
×$\frac{1}{4}$	2.23	1.78	0.956	2.16	2$\frac{3}{8}$	—	4.75	3.40	0.933
×$\frac{3}{16}$	1.82	1.46	0.983	1.72	2$\frac{11}{16}$	—	3.78	2.67	0.950
×$\frac{1}{8}$	1.33	1.06	1.01	1.22	2$\frac{15}{16}$	—	2.67	1.87	0.967
HSS3$\frac{1}{2}$×2×$\frac{1}{4}$	1.30	1.30	0.766	1.58	2$\frac{3}{8}$	—	3.16	2.64	0.850
×$\frac{3}{16}$	1.08	1.08	0.792	1.27	2$\frac{11}{16}$	—	2.55	2.09	0.867
×$\frac{1}{8}$	0.795	0.795	0.818	0.912	2$\frac{15}{16}$	—	1.83	1.47	0.883

—Flat depth or width is too small to establish a workable flat.

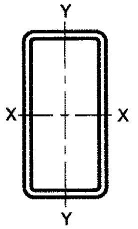


Table 1-11 (continued)
Rectangular HSS
Dimensions and Properties

Shape	Design Wall Thick-ness, *t*	Nominal Wt.	Area, *A*	*b/t*	*h/t*	Axis X-X			
						I	*S*	*r*	*Z*
	in.	lb/ft	in.^{2}			in.^{4}	in.^{3}	in.	in.^{3}
HSS3½×1½×¼	0.233	7.08	1.97	3.44	12.0	2.55	1.46	1.14	1.98
×3/16	0.174	5.59	1.54	5.62	17.1	2.12	1.21	1.17	1.60
×⅛	0.116	3.90	1.07	9.93	27.2	1.57	0.896	1.21	1.15
HSS3×2½×5/16	0.291	9.47	2.64	5.59	7.31	2.92	1.94	1.05	2.51
×¼	0.233	7.93	2.21	7.73	9.88	2.57	1.72	1.08	2.16
×3/16	0.174	6.23	1.71	11.4	14.2	2.11	1.41	1.11	1.73
×⅛	0.116	4.32	1.19	18.6	22.9	1.54	1.03	1.14	1.23
HSS3×2×5/16	0.291	8.41	2.35	3.87	7.31	2.38	1.59	1.01	2.11
×¼	0.233	7.08	1.97	5.58	9.88	2.13	1.42	1.04	1.83
×3/16	0.174	5.59	1.54	8.49	14.2	1.77	1.18	1.07	1.48
×⅛	0.116	3.90	1.07	14.2	22.9	1.30	0.867	1.10	1.06
HSS3×1½×¼	0.233	6.23	1.74	3.44	9.88	1.68	1.12	0.982	1.51
×3/16	0.174	4.95	1.37	5.62	14.2	1.42	0.945	1.02	1.24
×⅛	0.116	3.47	0.956	9.93	22.9	1.06	0.706	1.05	0.895
HSS3×1×3/16	0.174	4.31	1.19	2.75	14.2	1.07	0.713	0.947	0.989
×⅛	0.116	3.04	0.840	5.62	22.9	0.817	0.545	0.987	0.728
HSS2½×2×¼	0.233	6.23	1.74	5.58	7.73	1.33	1.06	0.874	1.37
×3/16	0.174	4.95	1.37	8.49	11.4	1.12	0.894	0.904	1.12
×⅛	0.116	3.47	0.956	14.2	18.6	0.833	0.667	0.934	0.809
HSS2½×1½×¼	0.233	5.38	1.51	3.44	7.73	1.03	0.822	0.826	1.11
×3/16	0.174	4.31	1.19	5.62	11.4	0.882	0.705	0.860	0.915
×⅛	0.116	3.04	0.840	9.93	18.6	0.668	0.535	0.892	0.671
HSS2½×1×3/16	0.174	3.67	1.02	2.75	11.4	0.646	0.517	0.796	0.713
×⅛	0.116	2.62	0.724	5.62	18.6	0.503	0.403	0.834	0.532
HSS2¼×2×3/16	0.174	4.63	1.28	8.49	9.93	0.859	0.764	0.819	0.952
×⅛	0.116	3.26	0.898	14.2	16.4	0.646	0.574	0.848	0.693
HSS2×1½×3/16	0.174	3.67	1.02	5.62	8.49	0.495	0.495	0.697	0.639
×⅛	0.116	2.62	0.724	9.93	14.2	0.383	0.383	0.728	0.475
HSS2×1×3/16	0.174	3.03	0.845	2.75	8.49	0.350	0.350	0.643	0.480
×⅛	0.116	2.19	0.608	5.62	14.2	0.280	0.280	0.679	0.366

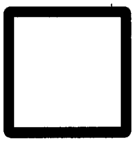
Note: For compactness criteria, refer to the end of Table 1-12.

Table 1-11 (continued)
Rectangular HSS
Dimensions and Properties

HSS3½–HSS2

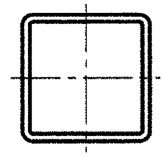
Shape	Axis Y-Y				Workable Flat		Torsion		Surface Area
	I	*S*	*r*	*Z*	Depth	Width	*J*	*C*	
	in.^{4}	in.^{3}	in.	in.^{3}	in.	in.	in.^{4}	in.^{3}	ft^2/ft
HSS3½×1½×¼	0.638	0.851	0.569	1.06	2⅜	—	1.79	1.88	0.767
×3/16	0.544	0.725	0.594	0.867	2 11/16	—	1.49	1.51	0.784
×⅛	0.411	0.548	0.619	0.630	2 15/16	—	1.09	1.08	0.800
HSS3×2½×5/16	2.18	1.74	0.908	2.20	—	—	4.34	3.39	0.833
×¼	1.93	1.54	0.935	1.90	—	—	3.74	2.87	0.850
×3/16	1.59	1.27	0.963	1.52	2 3/16	—	3.00	2.27	0.867
×⅛	1.16	0.931	0.990	1.09	2 7/16	—	2.13	1.59	0.883
HSS3×2×5/16	1.24	1.24	0.725	1.58	—	—	2.87	2.60	0.750
×¼	1.11	1.11	0.751	1.38	—	—	2.52	2.23	0.767
×3/16	0.932	0.932	0.778	1.12	2 3/16	—	2.05	1.78	0.784
×⅛	0.692	0.692	0.804	0.803	2 7/16	—	1.47	1.25	0.800
HSS3×1½×¼	0.543	0.725	0.559	0.911	1⅞	—	1.44	1.58	0.683
×3/16	0.467	0.622	0.584	0.752	2 3/16	—	1.21	1.28	0.700
×⅛	0.355	0.474	0.610	0.550	2 7/16	—	0.886	0.920	0.717
HSS3×1×3/16	0.173	0.345	0.380	0.432	2 3/16	—	0.526	0.792	0.617
×⅛	0.138	0.276	0.405	0.325	2 7/16	—	0.408	0.585	0.633
HSS2½×2×¼	0.930	0.930	0.731	1.17	—	—	1.90	1.82	0.683
×3/16	0.786	0.786	0.758	0.956	—	—	1.55	1.46	0.700
×⅛	0.589	0.589	0.785	0.694	—	—	1.12	1.04	0.717
HSS2½×1½×¼	0.449	0.599	0.546	0.764	—	—	1.10	1.29	0.600
×3/16	0.390	0.520	0.572	0.636	—	—	0.929	1.05	0.617
×⅛	0.300	0.399	0.597	0.469	—	—	0.687	0.759	0.633
HSS2½×1×3/16	0.143	0.285	0.374	0.360	—	—	0.412	0.648	0.534
×⅛	0.115	0.230	0.399	0.274	—	—	0.322	0.483	0.550
HSS2¼×2×3/16	0.713	0.713	0.747	0.877	—	—	1.32	1.30	0.659
×⅛	0.538	0.538	0.774	0.639	—	—	0.957	0.927	0.675
HSS2×1½×3/16	0.313	0.417	0.554	0.521	—	—	0.664	0.822	0.534
×⅛	0.244	0.325	0.581	0.389	—	—	0.496	0.599	0.550
HSS2×1×3/16	0.112	0.225	0.365	0.288	—	—	0.301	0.505	0.450
×⅛	0.0922	0.184	0.390	0.223	—	—	0.238	0.380	0.467

—Flat depth or width is too small to establish a workable flat.



HSS16–HSS8

Table 1–12
Square HSS
Dimensions and Properties



Shape	Design Wall Thickness, t	Nominal Wt.	Area, A	b/t	h/t	I	S	r	Z	Workable Flat	Torsion J	Torsion C	Surface Area
	in.	lb/ft	in.^{2}			in.^{4}	in.^{3}	in.	in.^{3}	in.	in.^{4}	in.^{3}	ft^2/ft
HSS16×16×5/8	0.581	127.00	35.0	24.5	24.5	1370	171	6.25	200	13 3/16	2170	276	5.17
×1/2	0.465	103.00	28.3	31.4	31.4	1130	141	6.31	164	13 3/4	1770	224	5.20
×3/8	0.349	78.45	21.5	42.8	42.8	873	109	6.37	126	14 5/16	1350	171	5.23
×5/16	0.291	65.82	18.1	52.0	52.0	739	92.3	6.39	106	14 5/8	1140	144	5.25
HSS14×14×5/8	0.581	110.00	30.3	21.1	21.1	897	128	5.44	151	11 3/16	1430	208	4.50
×1/2	0.465	89.55	24.6	27.1	27.1	743	106	5.49	124	11 3/4	1170	170	4.53
×3/8	0.349	68.24	18.7	37.1	37.1	577	82.5	5.55	95.4	12 5/16	900	130	4.57
×5/16	0.291	57.31	15.7	45.1	45.1	490	69.9	5.58	80.5	12 5/8	759	109	4.58
HSS12×12×5/8	0.581	93.14	25.7	17.7	17.7	548	91.4	4.62	109	9 3/16	885	151	3.83
×1/2	0.465	75.94	20.9	22.8	22.8	457	76.2	4.68	89.6	9 3/4	728	123	3.87
×3/8	0.349	58.03	16.0	31.4	31.4	357	59.5	4.73	69.2	10 5/16	561	94.6	3.90
×5/16	0.291	48.81	13.4	38.2	38.2	304	50.7	4.76	58.6	10 5/8	474	79.7	3.92
×1/4	0.233	39.40	10.8	48.5	48.5	248	41.4	4.79	47.6	10 7/8	384	64.5	3.93
×3/16	0.174	29.82	8.15	66.0	66.0	189	31.5	4.82	36.0	11 3/16	290	48.6	3.95
HSS10×10×5/8	0.581	76.13	21.0	14.2	14.2	304	60.8	3.80	73.2	7 3/16	498	102	3.17
×1/2	0.465	62.33	17.2	18.5	18.5	256	51.2	3.86	60.7	7 3/4	412	84.2	3.20
×3/8	0.349	47.82	13.2	25.7	25.7	202	40.4	3.92	47.2	8 5/16	320	64.8	3.23
×5/16	0.291	40.30	11.1	31.4	31.4	172	34.5	3.94	40.1	8 5/8	271	54.8	3.25
×1/4	0.233	32.60	8.96	39.9	39.9	141	28.3	3.97	32.7	8 7/8	220	44.4	3.27
×3/16	0.174	24.72	6.76	54.5	54.5	108	21.6	4.00	24.8	9 3/16	167	33.6	3.28
HSS9×9×5/8	0.581	67.62	18.7	12.5	12.5	216	47.9	3.40	58.1	6 3/16	356	81.6	2.83
×1/2	0.465	55.53	15.3	16.4	16.4	183	40.6	3.45	48.4	6 3/4	296	67.4	2.87
×3/8	0.349	42.72	11.8	22.8	22.8	145	32.2	3.51	37.8	7 5/16	231	52.1	2.90
×5/16	0.291	36.05	9.92	27.9	27.9	124	27.6	3.54	32.1	7 5/8	196	44.0	2.92
×1/4	0.233	29.19	8.03	35.6	35.6	102	22.7	3.56	26.2	7 7/8	159	35.8	2.93
×3/16	0.174	22.16	6.06	48.7	48.7	78.2	17.4	3.59	20.0	8 3/16	121	27.1	2.95
×1/8	0.116	14.95	4.09	74.6	74.6	53.5	11.9	3.62	13.6	8 7/16	82.0	18.3	2.97
HSS8×8×5/8	0.581	59.11	16.4	10.8	10.8	146	36.5	2.99	44.7	5 3/16	244	63.2	2.50
×1/2	0.465	48.72	13.5	14.2	14.2	125	31.2	3.04	37.5	5 3/4	204	52.4	2.53
×3/8	0.349	37.61	10.4	19.9	19.9	100	24.9	3.10	29.4	6 5/16	160	40.7	2.57
×5/16	0.291	31.79	8.76	24.5	24.5	85.6	21.4	3.13	25.1	6 5/8	136	34.5	2.58
×1/4	0.233	25.79	7.10	31.3	31.3	70.7	17.7	3.15	20.5	6 7/8	111	28.1	2.60
×3/16	0.174	19.61	5.37	43.0	43.0	54.4	13.6	3.18	15.7	7 3/16	84.5	21.3	2.62
×1/8	0.116	13.25	3.62	66.0	66.0	37.4	9.34	3.21	10.7	7 7/16	57.3	14.4	2.63

Note: For compactness criteria, refer to the end of Table 1-12.

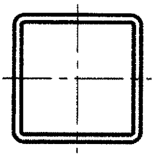
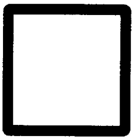


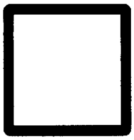
Table 1–12 (continued)
Square HSS
Dimensions and Properties



HSS7–HSS4 1/2

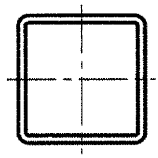
Shape	Design Wall Thickness, t	Nominal Wt.	Area, A	b/t	h/t	I	S	r	Z	Workable Flat	Torsion		Surface Area
											J	C	
	in.	lb/ft	in.^{2}			in.^{4}	in.^{3}	in.	in.^{3}	in.	in.^{4}	in.^{3}	ft^2/ft
HSS7×7×5/8	0.581	50.60	14.0	9.05	9.05	93.4	26.7	2.58	33.1	4 3/16	158	47.1	2.17
×1/2	0.465	41.91	11.6	12.1	12.1	80.5	23.0	2.63	27.9	4 3/4	133	39.3	2.20
×3/8	0.349	32.51	8.97	17.1	17.1	65.0	18.6	2.69	22.1	5 5/16	105	30.7	2.23
×5/16	0.291	27.54	7.59	21.1	21.1	56.1	16.0	2.72	18.9	5 5/8	89.7	26.1	2.25
×1/4	0.233	22.39	6.17	27.0	27.0	46.5	13.3	2.75	15.5	5 7/8	73.5	21.3	2.27
×3/16	0.174	17.06	4.67	37.2	37.2	36.0	10.3	2.77	11.9	6 3/16	56.1	16.2	2.28
×1/8	0.116	11.55	3.16	57.3	57.3	24.8	7.09	2.80	8.13	6 7/16	38.2	11.0	2.30
HSS6×6×5/8	0.581	42.10	11.7	7.33	7.33	55.2	18.4	2.17	23.2	3 3/16	94.9	33.4	1.83
×1/2	0.465	35.11	9.74	9.90	9.90	48.3	16.1	2.23	19.8	3 3/4	81.1	28.1	1.87
×3/8	0.349	27.41	7.58	14.2	14.2	39.5	13.2	2.28	15.8	4 5/16	64.6	22.1	1.90
×5/16	0.291	23.29	6.43	17.6	17.6	34.3	11.4	2.31	13.6	4 5/8	55.4	18.9	1.92
×1/4	0.233	18.99	5.24	22.8	22.8	28.6	9.54	2.34	11.2	4 7/8	45.6	15.4	1.93
×3/16	0.174	14.51	3.98	31.5	31.5	22.3	7.42	2.37	8.63	5 3/16	35.0	11.8	1.95
×1/8	0.116	9.85	2.70	48.7	48.7	15.5	5.15	2.39	5.92	5 7/16	23.9	8.03	1.97
HSS5 1/2×5 1/2×3/8	0.349	24.85	6.88	12.8	12.8	29.7	10.8	2.08	13.1	3 13/16	49.0	18.4	1.73
×5/16	0.291	21.16	5.85	15.9	15.9	25.9	9.43	2.11	11.3	4 1/8	42.2	15.7	1.75
×1/4	0.233	17.28	4.77	20.6	20.6	21.7	7.90	2.13	9.32	4 3/8	34.8	12.9	1.77
×3/16	0.174	13.23	3.63	28.6	28.6	17.0	6.17	2.16	7.19	4 11/16	26.7	9.85	1.78
×1/8	0.116	9.00	2.46	44.4	44.4	11.8	4.30	2.19	4.95	4 15/16	18.3	6.72	1.80
HSS5×5×1/2	0.465	28.30	7.88	7.75	7.75	26.0	10.4	1.82	13.1	2 3/4	44.6	18.7	1.53
×3/8	0.349	22.30	6.18	11.3	11.3	21.7	8.68	1.87	10.6	3 5/16	36.1	14.9	1.57
×5/16	0.291	19.03	5.26	14.2	14.2	19.0	7.62	1.90	9.16	3 5/8	31.2	12.8	1.58
×1/4	0.233	15.58	4.30	18.5	18.5	16.0	6.41	1.93	7.61	3 7/8	25.8	10.5	1.60
×3/16	0.174	11.96	3.28	25.7	25.7	12.6	5.03	1.96	5.89	4 3/16	19.9	8.08	1.62
×1/8	0.116	8.15	2.23	40.1	40.1	8.80	3.52	1.99	4.07	4 7/16	13.7	5.53	1.63
HSS4 1/2×4 1/2×1/2	0.465	24.90	6.95	6.68	6.68	18.1	8.03	1.61	10.2	2 1/4	31.3	14.8	1.37
×3/8	0.349	19.75	5.48	9.89	9.89	15.3	6.79	1.67	8.36	2 13/16	25.7	11.9	1.40
×5/16	0.291	16.91	4.68	12.5	12.5	13.5	6.00	1.70	7.27	3 1/8	22.3	10.2	1.42
×1/4	0.233	13.88	3.84	16.3	16.3	11.4	5.08	1.73	6.06	3 3/8	18.5	8.44	1.43
×3/16	0.174	10.68	2.93	22.9	22.9	9.02	4.01	1.75	4.71	3 11/16	14.4	6.49	1.45
×1/8	0.116	7.30	2.00	35.8	35.8	6.35	2.82	1.78	3.27	3 15/16	9.92	4.45	1.47

Note: For compactness criteria, refer to the end of Table 1-12.



HSS4–HSS2

Table 1–12 (continued)
Square HSS
Dimensions and Properties



Shape	Design Wall Thickness, *t*	Nominal Wt.	Area, *A*	*b/t*	*h/t*	*I*	*S*	*r*	*Z*	Workable Flat	Torsion		Surface Area
											J	*C*	
	in.	lb/ft	in.^{2}			in.^{4}	in.^{3}	in.	in.^{3}	in.	in.^{4}	in.^{3}	ft^2/ft
HSS4×4×1/2	0.465	21.50	6.02	5.60	5.60	11.9	5.97	1.41	7.70	—	21.0	11.2	1.20
×3/8	0.349	17.20	4.78	8.46	8.46	10.3	5.13	1.47	6.39	2 5/16	17.5	9.14	1.23
×5/16	0.291	14.78	4.10	10.7	10.7	9.14	4.57	1.49	5.59	2 5/8	15.3	7.91	1.25
×1/4	0.233	12.18	3.37	14.2	14.2	7.80	3.90	1.52	4.69	2 7/8	12.8	6.56	1.27
×3/16	0.174	9.40	2.58	20.0	20.0	6.21	3.10	1.55	3.67	3 3/16	10.0	5.07	1.28
×1/8	0.116	6.45	1.77	31.5	31.5	4.40	2.20	1.58	2.56	3 7/16	6.91	3.49	1.30
HSS3 1/2×3 1/2×3/8	0.349	14.65	4.09	7.03	7.03	6.49	3.71	1.26	4.69	—	11.2	6.77	1.07
×5/16	0.291	12.65	3.52	9.03	9.03	5.84	3.34	1.29	4.14	2 1/8	9.89	5.90	1.08
×1/4	0.233	10.48	2.91	12.0	12.0	5.04	2.88	1.32	3.50	2 3/8	8.35	4.92	1.10
×3/16	0.174	8.13	2.24	17.1	17.1	4.05	2.31	1.35	2.76	2 11/16	6.56	3.83	1.12
×1/8	0.116	5.60	1.54	27.2	27.2	2.90	1.66	1.37	1.93	2 15/16	4.58	2.65	1.13
HSS3×3×3/8	0.349	12.09	3.39	5.60	5.60	3.78	2.52	1.06	3.25	—	6.64	4.74	0.900
×5/16	0.291	10.53	2.94	7.31	7.31	3.45	2.30	1.08	2.90	—	5.94	4.18	0.917
×1/4	0.233	8.78	2.44	9.88	9.88	3.02	2.01	1.11	2.48	—	5.08	3.52	0.933
×3/16	0.174	6.85	1.89	14.2	14.2	2.46	1.64	1.14	1.97	2 3/16	4.03	2.76	0.950
×1/8	0.116	4.75	1.30	22.9	22.9	1.78	1.19	1.17	1.40	2 7/16	2.84	1.92	0.967
HSS2 1/2×2 1/2×5/16	0.291	8.40	2.35	5.59	5.59	1.82	1.46	0.880	1.88	—	3.20	2.74	0.750
×1/4	0.233	7.08	1.97	7.73	7.73	1.63	1.30	0.908	1.63	—	2.79	2.35	0.767
×3/16	0.174	5.57	1.54	11.4	11.4	1.35	1.08	0.937	1.32	—	2.25	1.86	0.784
×1/8	0.116	3.90	1.07	18.6	18.6	0.998	0.799	0.965	0.947	—	1.61	1.31	0.800
HSS2 1/4×2 1/4×1/4	0.233	6.23	1.74	6.66	6.66	1.13	1.01	0.806	1.28	—	1.96	1.85	0.683
×3/16	0.174	4.94	1.37	9.93	9.93	0.953	0.847	0.835	1.04	—	1.60	1.48	0.700
×1/8	0.116	3.47	0.956	16.4	16.4	0.712	0.633	0.863	0.755	—	1.15	1.05	0.717
HSS2×2×1/4	0.233	5.38	1.51	5.58	5.58	0.747	0.747	0.704	0.964	—	1.31	1.41	0.600
×3/16	0.174	4.30	1.19	8.49	8.49	0.641	0.641	0.733	0.797	—	1.09	1.14	0.617
×1/8	0.116	3.04	0.840	14.2	14.2	0.486	0.486	0.761	0.584	—	0.796	0.817	0.633

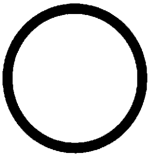
— Flat depth or width is too small to establish a workable flat.

Rectangular and Square HSS

Compactness Criteria

Nominal Wall Thickness	Compactness Criteria for Rectangular and Square HSS			
	Compression	Flexure		Shear
	non-slender up to	compact up to	compact up to	$C_v = 1.0$ up to
	Flange Width	Flange Width	Web Width	Web Depth
5/8	20	18	20	20
1/2	16	14	20	20
3/8	12	10	20	20
5/16	10	9	18	18
1/4	8	7	14	14
3/16	6	5	10	10
1/8	4	3 1/2	7	7

Note: Compactness criteria given for $F_y = 46$ ksi.



HSS20.000–
HSS10.000

Table 1–13
Round HSS
Dimensions and Properties

Shape	Design Wall Thick-ness, t	Nom-inal Wt.	Area, A	D/t	I	S	r	Z	Torsion	
									J	C
	in.	lb/ft	in.^{2}		in.^{4}	in.^{3}	in.	in.^{3}	in.^{4}	in.^{3}
HSS20.000×0.500	0.465	104.00	28.5	43.0	1360	136	6.91	177	2720	272
×0.375[f]	0.349	78.67	21.5	57.3	1040	104	6.95	135	2080	208
HSS18.000×0.500	0.465	93.54	25.6	38.7	985	109	6.20	143	1970	219
×0.375[f]	0.349	70.66	19.4	51.6	754	83.8	6.24	109	1510	168
HSS16.000×0.625	0.581	103.00	28.1	27.5	838	105	5.46	138	1680	209
×0.500	0.465	82.85	22.7	34.4	685	85.7	5.49	112	1370	171
×0.438	0.407	72.87	19.9	39.3	606	75.8	5.51	99.0	1210	152
×0.375	0.349	62.64	17.2	45.8	526	65.7	5.53	85.5	1050	131
×0.312[f]	0.291	52.32	14.4	55.0	443	55.4	5.55	71.8	886	111
×0.250[f]	0.233	42.09	11.5	68.7	359	44.8	5.58	57.9	717	89.7
HSS14.000×0.625	0.581	89.36	24.5	24.1	552	78.9	4.75	105	1100	158
×0.500	0.465	72.16	19.8	30.1	453	64.8	4.79	85.2	907	130
×0.375	0.349	54.62	15.0	40.1	349	49.8	4.83	65.1	698	100
×0.312	0.291	45.65	12.5	48.1	295	42.1	4.85	54.7	589	84.2
×0.250[f]	0.233	36.75	10.1	60.1	239	34.1	4.87	44.2	478	68.2
HSS12.750×0.500	0.465	65.48	17.9	27.4	339	53.2	4.35	70.2	678	106
×0.375	0.349	49.61	13.6	36.5	262	41.0	4.39	53.7	523	82.1
×0.250[f]	0.233	33.41	9.16	54.7	180	28.2	4.43	36.5	359	56.3
HSS10.750×0.500	0.465	54.79	15.0	23.1	199	37.0	3.64	49.2	398	74.1
×0.375	0.349	41.59	11.4	30.8	154	28.7	3.68	37.8	309	57.4
×0.250	0.233	28.06	7.70	46.1	106	19.8	3.72	25.8	213	39.6
HSS10.000×0.625	0.581	62.64	17.2	17.2	191	38.3	3.34	51.6	383	76.6
×0.500	0.465	50.78	13.9	21.5	159	31.7	3.38	42.3	317	63.5
×0.375	0.349	38.58	10.6	28.7	123	24.7	3.41	32.5	247	49.3
×0.312	0.291	32.31	8.88	34.4	105	20.9	3.43	27.4	209	41.9
×0.250	0.233	26.06	7.15	42.9	85.3	17.1	3.45	22.2	171	34.1
×0.188[f]	0.174	19.72	5.37	57.5	64.8	13.0	3.47	16.8	130	25.9

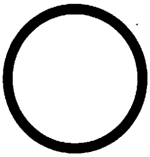
[f] Shape exceeds compact limit for flexure with $F_y = 42$ ksi.

Table 1–13 (continued)
Round HSS
Dimensions and Properties

HSS9.625–HSS6.875

Shape	Design Wall Thickness, *t*	Nominal Wt.	Area, *A*	*D*/*t*	*I*	*S*	*r*	*Z*	Torsion	
									J	*C*
	in.	lb/ft	in.^{2}		in.^{4}	in.^{3}	in.	in.^{3}	in.^{4}	in.^{3}
HSS9.625×0.500	0.465	48.77	13.4	20.7	141	29.2	3.24	39.0	281	58.5
×0.375	0.349	37.08	10.2	27.6	110	22.8	3.28	30.0	219	45.5
×0.312	0.291	31.06	8.53	33.1	93.0	19.3	3.30	25.4	186	38.7
×0.250	0.233	25.06	6.87	41.3	75.9	15.8	3.32	20.6	152	31.5
×0.188[f]	0.174	18.97	5.17	55.3	57.7	12.0	3.34	15.5	115	24.0
HSS8.625×0.625	0.581	53.45	14.7	14.8	119	27.7	2.85	37.7	239	55.4
×0.500	0.465	43.43	11.9	18.5	100	23.1	2.89	31.0	199	46.2
×0.375	0.349	33.07	9.07	24.7	77.8	18.0	2.93	23.9	156	36.1
×0.322	0.300	28.58	7.85	28.8	68.1	15.8	2.95	20.8	136	31.6
×0.250	0.233	22.38	6.14	37.0	54.1	12.5	2.97	16.4	108	25.1
×0.188[f]	0.174	16.96	4.62	49.6	41.3	9.57	2.99	12.4	82.5	19.1
HSS7.625×0.375	0.349	29.06	7.98	21.8	52.9	13.9	2.58	18.5	106	27.8
×0.328	0.305	25.59	7.01	25.0	47.1	12.3	2.59	16.4	94.1	24.7
HSS7.50×0.500	0.465	37.42	10.3	16.1	63.9	17.0	2.49	23.0	128	34.1
×0.375	0.349	28.56	7.84	21.5	50.2	13.4	2.53	17.9	100	26.8
×0.312	0.291	23.97	6.59	25.8	42.9	11.4	2.55	15.1	85.8	22.9
×0.250	0.233	19.38	5.32	32.2	35.2	9.37	2.57	12.3	70.3	18.7
×0.188	0.174	14.70	4.00	43.1	26.9	7.17	2.59	9.34	53.8	14.3
HSS7.000×0.500	0.465	34.74	9.55	15.1	51.2	14.6	2.32	19.9	102	29.3
×0.375	0.349	26.56	7.29	20.1	40.4	11.6	2.35	15.5	80.9	23.1
×0.312	0.291	22.31	6.13	24.1	34.6	9.88	2.37	13.1	69.1	19.8
×0.250	0.233	18.04	4.95	30.0	28.4	8.11	2.39	10.7	56.8	16.2
×0.188	0.174	13.69	3.73	40.2	21.7	6.21	2.41	8.11	43.5	12.4
×0.125[f]	0.116	9.19	2.51	60.3	14.9	4.25	2.43	5.50	29.7	8.49
HSS6.875×0.500	0.465	34.07	9.36	14.8	48.3	14.1	2.27	19.1	96.7	28.1
×0.375	0.349	26.06	7.16	19.7	38.2	11.1	2.31	14.9	76.4	22.2
×0.312	0.291	21.89	6.02	23.6	32.7	9.51	2.33	12.6	65.4	19.0
×0.250	0.233	17.71	4.86	29.5	26.8	7.81	2.35	10.3	53.7	15.6
×0.188	0.174	13.44	3.66	39.5	20.6	5.99	2.37	7.81	41.1	12.0

[f] Shape exceeds compact limit for flexure with $F_y = 42$ ksi.



HSS6.625–
HSS5.000

Table 1–13 (continued)
Round HSS
Dimensions and Properties

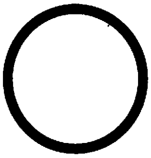
Shape	Design Wall Thick-ness, t	Nom-inal Wt.	Area, A	D/t	I	S	r	Z	Torsion	
									J	C
	in.	lb/ft	in.^{2}		in.^{4}	in.^{3}	in.	in.^{3}	in.^{4}	in.^{3}
HSS6.625×0.500	0.465	32.74	9.00	14.2	42.9	13.0	2.18	17.7	85.9	25.9
×0.432	0.402	28.60	7.86	16.5	38.2	11.5	2.20	15.6	76.4	23.1
×0.375	0.349	25.06	6.88	19.0	34.0	10.3	2.22	13.8	68.0	20.5
×0.312	0.291	21.06	5.79	22.8	29.1	8.79	2.24	11.7	58.2	17.6
×0.280	0.260	18.99	5.20	25.5	26.4	7.96	2.25	10.5	52.7	15.9
×0.250	0.233	17.04	4.68	28.4	23.9	7.22	2.26	9.52	47.9	14.4
×0.188	0.174	12.94	3.53	38.1	18.4	5.54	2.28	7.24	36.7	11.1
×0.125[f]	0.116	8.69	2.37	57.1	12.6	3.79	2.30	4.92	25.1	7.59
HSS6.000×0.500	0.465	29.40	8.09	12.9	31.2	10.4	1.96	14.3	62.4	20.8
×0.375	0.349	22.55	6.20	17.2	24.8	8.28	2.00	11.2	49.7	16.6
×0.312	0.291	18.97	5.22	20.6	21.3	7.11	2.02	9.49	42.6	14.2
×0.280	0.260	17.12	4.69	23.1	19.3	6.45	2.03	8.57	38.7	12.9
×0.250	0.233	15.37	4.22	25.8	17.6	5.86	2.04	7.75	35.2	11.7
×0.188	0.174	11.68	3.18	34.5	13.5	4.51	2.06	5.91	27.0	9.02
×0.125[f]	0.116	7.85	2.14	51.7	9.28	3.09	2.08	4.02	18.6	6.19
HSS5.563×0.500	0.465	27.06	7.45	12.0	24.4	8.77	1.81	12.1	48.8	17.5
×0.375	0.349	20.80	5.72	15.9	19.5	7.02	1.85	9.50	39.0	14.0
×0.258	0.240	14.63	4.01	23.2	14.2	5.12	1.88	6.80	28.5	10.2
×0.188	0.174	10.80	2.95	32.0	10.7	3.85	1.91	5.05	21.4	7.70
×0.134	0.124	7.78	2.12	44.9	7.84	2.82	1.92	3.67	15.7	5.64
HSS5.500×0.500	0.465	26.73	7.36	11.8	23.5	8.55	1.79	11.8	47.0	17.1
×0.375	0.349	20.55	5.65	15.8	18.8	6.84	1.83	9.27	37.6	13.7
×0.258	0.240	14.46	3.97	22.9	13.7	5.00	1.86	6.64	27.5	10.0
HSS5.000×0.500	0.465	24.05	6.62	10.8	17.2	6.88	1.61	9.60	34.4	13.8
×0.375	0.349	18.54	5.10	14.3	13.9	5.55	1.65	7.56	27.7	11.1
×0.312	0.291	15.64	4.30	17.2	12.0	4.79	1.67	6.46	24.0	9.58
×0.258	0.240	13.08	3.59	20.8	10.2	4.08	1.69	5.44	20.4	8.15
×0.250	0.233	12.69	3.49	21.5	9.94	3.97	1.69	5.30	19.9	7.95
×0.188	0.174	9.67	2.64	28.7	7.69	3.08	1.71	4.05	15.4	6.15
×0.125	0.116	6.51	1.78	43.1	5.31	2.12	1.73	2.77	10.6	4.25

[f] Shape exceeds compact limit for flexure with $F_y = 42$ ksi.

Table 1–13 (continued)
Round HSS
Dimensions and Properties

HSS4.500–HSS2.500

Shape	Design Wall Thickness, *t*	Nominal Wt.	Area, *A*	*D/t*	*I*	*S*	*r*	*Z*	Torsion *J*	Torsion *C*
	in.	lb/ft	in.^{2}		in.^{4}	in.^{3}	in.	in.^{3}	in.^{4}	in.^{3}
HSS4.500×0.375	0.349	16.54	4.55	12.9	9.87	4.39	1.47	6.03	19.7	8.78
×0.337	0.313	15.00	4.12	14.4	9.07	4.03	1.48	5.50	18.1	8.06
×0.237	0.220	10.80	2.96	20.5	6.79	3.02	1.52	4.03	13.6	6.04
×0.188	0.174	8.67	2.36	25.9	5.54	2.46	1.53	3.26	11.1	4.93
×0.125	0.116	5.85	1.60	38.8	3.84	1.71	1.55	2.23	7.68	3.41
HSS4.000×0.313	0.291	12.34	3.39	13.7	5.87	2.93	1.32	4.01	11.7	5.87
×0.250	0.233	10.00	2.76	17.2	4.91	2.45	1.33	3.31	9.82	4.91
×0.237	0.220	9.53	2.61	18.2	4.68	2.34	1.34	3.15	9.36	4.68
×0.226	0.210	9.12	2.50	19.0	4.50	2.25	1.34	3.02	9.01	4.50
×0.220	0.205	8.89	2.44	19.5	4.41	2.21	1.34	2.96	8.83	4.41
×0.188	0.174	7.66	2.09	23.0	3.83	1.92	1.35	2.55	7.67	3.83
×0.125	0.116	5.18	1.42	34.5	2.67	1.34	1.37	1.75	5.34	2.67
HSS3.500×0.313	0.291	10.66	2.93	12.0	3.81	2.18	1.14	3.00	7.61	4.35
×0.300	0.279	10.26	2.82	12.5	3.69	2.11	1.14	2.90	7.38	4.22
×0.250	0.233	8.69	2.39	15.0	3.21	1.83	1.16	2.49	6.41	3.66
×0.216	0.201	7.58	2.08	17.4	2.84	1.63	1.17	2.19	5.69	3.25
×0.203	0.189	7.15	1.97	18.5	2.70	1.54	1.17	2.07	5.41	3.09
×0.188	0.174	6.66	1.82	20.1	2.52	1.44	1.18	1.93	5.04	2.88
×0.125	0.116	4.51	1.23	30.2	1.77	1.01	1.20	1.33	3.53	2.02
HSS3.000×0.250	0.233	7.35	2.03	12.9	1.95	1.30	0.982	1.79	3.90	2.60
×0.216	0.201	6.43	1.77	14.9	1.74	1.16	0.992	1.58	3.48	2.32
×0.203	0.189	6.07	1.67	15.9	1.66	1.10	0.996	1.50	3.31	2.21
×0.188	0.174	5.65	1.54	17.2	1.55	1.03	1.00	1.39	3.10	2.06
×0.152	0.141	4.63	1.27	21.3	1.30	0.865	1.01	1.15	2.59	1.73
×0.134	0.124	4.11	1.12	24.2	1.16	0.774	1.02	1.03	2.32	1.55
×0.125	0.116	3.84	1.05	25.9	1.09	0.730	1.02	0.965	2.19	1.46
HSS2.875×0.250	0.233	7.02	1.93	12.3	1.70	1.18	0.938	1.63	3.40	2.37
×0.203	0.189	5.80	1.59	15.2	1.45	1.01	0.952	1.37	2.89	2.01
×0.188	0.174	5.40	1.48	16.5	1.35	0.941	0.957	1.27	2.70	1.88
×0.125	0.116	3.67	1.01	24.8	0.958	0.667	0.976	0.884	1.92	1.33
HSS2.500×0.250	0.233	6.01	1.66	10.7	1.08	0.862	0.806	1.20	2.15	1.72
×0.188	0.174	4.65	1.27	14.4	0.865	0.692	0.825	0.943	1.73	1.38
×0.125	0.116	3.17	0.869	21.6	0.619	0.495	0.844	0.660	1.24	0.990

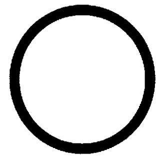


HSS2.375–
HSS1.660

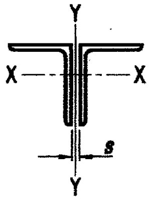
Table 1–13 (continued)
Round HSS
Dimensions and Properties

Shape	Design Wall Thick-ness, t	Nom-inal Wt.	Area, A	D/t	I	S	r	Z	Torsion J	Torsion C
	in.	lb/ft	in.^{2}		in.^{4}	in.^{3}	in.	in.^{3}	in.^{4}	in.^{3}
HSS2.375×0.250	0.233	5.68	1.57	10.2	0.910	0.766	0.762	1.07	1.82	1.53
×0.218	0.203	5.03	1.39	11.7	0.824	0.694	0.771	0.960	1.65	1.39
×0.188	0.174	4.40	1.20	13.6	0.733	0.617	0.781	0.845	1.47	1.23
×0.154	0.143	3.66	1.00	16.6	0.627	0.528	0.791	0.713	1.25	1.06
×0.125	0.116	3.01	0.823	20.5	0.527	0.443	0.800	0.592	1.05	0.887
HSS1.900×0.188	0.174	3.44	0.943	10.9	0.355	0.374	0.613	0.520	0.710	0.747
×0.145	0.135	2.72	0.749	14.1	0.293	0.309	0.626	0.421	0.586	0.617
×0.120	0.111	2.28	0.624	17.1	0.251	0.264	0.634	0.356	0.501	0.527
HSS1.660×0.140	0.130	2.27	0.625	12.8	0.184	0.222	0.543	0.305	0.368	0.444

Table 1–14
Pipe
Dimensions and Properties

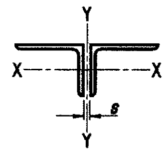


Shape	Nominal Wt.	Dimensions: Outside Diameter	Dimensions: Inside Diameter	Nominal Wall Thickness	Design Wall Thickness	Area	D/t	*I*	*S*	*r*	*J*	*Z*
	lb/ft	in.	in.	in.	in.	in.^{2}		in.^{4}	in.^{3}	in.	in.^{4}	in.^{3}
Standard Weight (Std.)												
Pipe 12 Std.	49.6	12.8	12.0	0.375	0.349	13.6	36.5	262	41.0	4.39	523	53.7
Pipe 10 Std.	40.5	10.8	10.0	0.365	0.340	11.1	31.6	151	28.1	3.68	302	36.9
Pipe 8 Std.	28.6	8.63	7.98	0.322	0.300	7.85	28.8	68.1	15.8	2.95	136	20.8
Pipe 6 Std.	19.0	6.63	6.07	0.280	0.261	5.22	25.4	26.5	7.99	2.25	52.9	10.6
Pipe 5 Std.	14.6	5.56	5.05	0.258	0.241	4.03	23.1	14.3	5.14	1.88	28.6	6.83
Pipe 4 Std.	10.8	4.50	4.03	0.237	0.221	2.97	20.4	6.82	3.03	1.51	13.6	4.05
Pipe 3$^1/_2$ Std.	9.12	4.00	3.55	0.226	0.211	2.51	19.0	4.52	2.26	1.34	9.04	3.03
Pipe 3 Std.	7.58	3.50	3.07	0.216	0.201	2.08	17.4	2.85	1.63	1.17	5.69	2.19
Pipe 2$^1/_2$ Std.	5.80	2.88	2.47	0.203	0.189	1.59	15.2	1.45	1.01	0.952	2.89	1.37
Pipe 2 Std.	3.66	2.38	2.07	0.154	0.143	1.00	16.6	0.627	0.528	0.791	1.25	0.713
Pipe 1$^1/_2$ Std.	2.72	1.90	1.61	0.145	0.135	0.750	14.1	0.293	0.309	0.626	0.586	0.421
Pipe 1$^1/_4$ Std.	2.27	1.66	1.38	0.140	0.130	0.620	12.8	0.184	0.222	0.543	0.368	0.305
Pipe 1 Std.	1.68	1.32	1.05	0.133	0.124	0.460	10.6	0.0830	0.126	0.423	0.166	0.177
Pipe $^3/_4$ Std.	1.13	1.05	0.824	0.113	0.105	0.310	10.0	0.0350	0.0671	0.336	0.0700	0.0942
Pipe $^1/_2$ Std.	0.850	0.840	0.622	0.109	0.101	0.230	8.32	0.0160	0.0388	0.264	0.0320	0.0555
Extra Strong (x-Strong)												
Pipe 12 x-Strong	65.5	12.8	11.8	0.500	0.465	17.9	27.4	339	53.2	4.35	678	70.2
Pipe 10 x-Strong	54.8	10.8	9.75	0.500	0.465	15.0	23.1	199	37.0	3.64	398	49.2
Pipe 8 x-Strong	43.4	8.63	7.63	0.500	0.465	11.9	18.5	100	23.1	2.89	199	31.0
Pipe 6 x-Strong	28.6	6.63	5.76	0.432	0.403	7.88	16.4	38.3	11.6	2.20	76.6	15.6
Pipe 5 x-Strong	20.8	5.56	4.81	0.375	0.349	5.72	15.9	19.5	7.02	1.85	39.0	9.50
Pipe 4 x-Strong	15.0	4.50	3.83	0.337	0.315	4.14	14.3	9.12	4.05	1.48	18.2	5.53
Pipe 3$^1/_2$ x-Strong	12.5	4.00	3.36	0.318	0.296	3.44	13.5	5.94	2.97	1.31	11.9	4.07
Pipe 3 x-Strong	10.3	3.50	2.90	0.300	0.280	2.83	12.5	3.70	2.11	1.14	7.40	2.91
Pipe 2$^1/_2$ x-Strong	7.67	2.88	2.32	0.276	0.257	2.11	11.2	1.83	1.27	0.930	3.66	1.77
Pipe 2 x-Strong	5.03	2.38	1.94	0.218	0.204	1.39	11.6	0.827	0.696	0.771	1.65	0.964
Pipe 1$^1/_2$ x-Strong	3.63	1.90	1.50	0.200	0.186	1.00	10.2	0.372	0.392	0.610	0.744	0.549
Pipe 1$^1/_4$ x-Strong	3.00	1.66	1.28	0.191	0.178	0.830	9.33	0.231	0.278	0.528	0.462	0.393
Pipe 1 x-Strong	2.17	1.32	0.957	0.179	0.166	0.600	7.92	0.101	0.154	0.410	0.202	0.221
Pipe $^3/_4$ x-Strong	1.48	1.05	0.742	0.154	0.143	0.410	7.34	0.0430	0.0818	0.325	0.0860	0.119
Pipe $^1/_2$ x-Strong	1.09	0.840	0.546	0.147	0.137	0.300	6.13	0.0190	0.0462	0.253	0.0380	0.0686
Double-Extra Strong (xx-Strong)												
Pipe 8 xx-Strong	72.5	8.63	6.88	0.875	0.816	20.0	10.6	154	35.8	2.78	308	49.9
Pipe 6 xx-Strong	53.2	6.63	4.90	0.864	0.805	14.7	8.23	63.5	19.2	2.08	127	27.4
Pipe 5 xx-Strong	38.6	5.56	4.06	0.750	0.699	10.7	7.96	32.2	11.6	1.74	64.4	16.7
Pipe 4 xx-Strong	27.6	4.50	3.15	0.674	0.628	7.64	7.17	14.7	6.53	1.39	29.4	9.50
Pipe 3 xx-Strong	18.6	3.50	2.30	0.600	0.559	5.16	6.26	5.79	3.31	1.06	11.6	4.89
Pipe 2$^1/_2$ xx-Strong	13.7	2.88	1.77	0.552	0.514	3.81	5.59	2.78	1.94	0.854	5.56	2.91
Pipe 2 xx-Strong	9.04	2.38	1.50	0.436	0.406	2.51	5.85	1.27	1.07	0.711	2.54	1.60



LLBB

Table 1–15
Double Angles
Properties



SLBB

Shape	Area	Axis Y-Y						LLBB			SLBB		
		Radius of Gyration						Q_s		r_x	Q_s		r_x
		LLBB			SLBB			Angles in Contact	Angles Sepa-rated		Angles in Contact	Angles Sepa-rated	
		Separation, *s*, in.			Separation, *s*, in.								
	in.^{2}	0	3/8	3/4	0	3/8	3/4			in.			in.
2L8×8×1 1/8	33.6	3.41	3.54	3.68	3.41	3.54	3.68	1.00	1.00	2.41	1.00	1.00	2.41
×1	30.2	3.39	3.52	3.66	3.39	3.52	3.66	1.00	1.00	2.43	1.00	1.00	2.43
×7/8	26.6	3.36	3.50	3.63	3.36	3.50	3.63	1.00	1.00	2.45	1.00	1.00	2.45
×3/4	23.0	3.34	3.47	3.61	3.34	3.47	3.61	1.00	1.00	2.46	1.00	1.00	2.46
×5/8	19.4	3.32	3.45	3.58	3.32	3.45	3.58	1.00	0.997	2.48	1.00	0.997	2.48
×9/16	17.5	3.31	3.44	3.57	3.31	3.44	3.57	1.00	0.959	2.49	1.00	0.959	2.49
×1/2	15.7	3.30	3.43	3.56	3.30	3.43	3.56	0.998	0.912	2.49	0.998	0.912	2.49
2L8×6×1	26.1	2.39	2.52	2.66	3.63	3.77	3.91	1.00	1.00	2.49	1.00	1.00	1.72
×7/8	23.1	2.37	2.50	2.63	3.61	3.75	3.89	1.00	1.00	2.50	1.00	1.00	1.74
×3/4	20.0	2.35	2.47	2.61	3.59	3.72	3.86	1.00	1.00	2.52	1.00	1.00	1.75
×5/8	16.8	2.33	2.45	2.59	3.57	3.70	3.84	1.00	0.997	2.54	1.00	0.997	1.77
×9/16	15.2	2.32	2.44	2.58	3.55	3.69	3.83	1.00	0.959	2.55	1.00	0.959	1.78
×1/2	13.6	2.31	2.43	2.56	3.54	3.68	3.81	1.00	0.912	2.55	0.998	0.912	1.79
×7/16	12.0	2.30	2.42	2.55	3.53	3.66	3.80	1.00	0.850	2.56	0.938	0.850	1.80
2L8×4×1	22.1	1.46	1.60	1.75	3.94	4.08	4.23	1.00	1.00	2.51	1.00	1.00	1.03
×7/8	19.6	1.44	1.57	1.72	3.91	4.06	4.21	1.00	1.00	2.53	1.00	1.00	1.04
×3/4	17.0	1.42	1.55	1.69	3.89	4.03	4.18	1.00	1.00	2.55	1.00	1.00	1.05
×5/8	14.3	1.39	1.52	1.66	3.86	4.00	4.15	1.00	0.997	2.56	1.00	0.997	1.06
×9/16	13.0	1.38	1.51	1.65	3.85	3.99	4.13	1.00	0.959	2.57	1.00	0.959	1.07
×1/2	11.6	1.38	1.50	1.63	3.83	3.97	4.12	1.00	0.912	2.58	0.998	0.912	1.08
×7/16	10.2	1.37	1.49	1.62	3.82	3.96	4.10	1.00	0.850	2.59	0.938	0.850	1.09
2L7×4×3/4	15.4	1.48	1.61	1.75	3.34	3.48	3.63	1.00	1.00	2.21	1.00	1.00	1.08
×5/8	13.0	1.45	1.58	1.73	3.31	3.46	3.60	1.00	1.00	2.23	1.00	1.00	1.10
×1/2	10.5	1.44	1.56	1.70	3.29	3.43	3.57	1.00	0.965	2.25	1.00	0.965	1.11
×7/16	9.27	1.43	1.55	1.68	3.28	3.42	3.56	1.00	0.912	2.26	0.998	0.912	1.12
×3/8	8.00	1.42	1.54	1.67	3.26	3.40	3.54	1.00	0.840	2.27	0.928	0.840	1.12
2L6×6×1	22.0	2.58	2.72	2.86	2.58	2.72	2.86	1.00	1.00	1.79	1.00	1.00	1.79
×7/8	19.5	2.56	2.70	2.84	2.56	2.70	2.84	1.00	1.00	1.81	1.00	1.00	1.81
×3/4	16.9	2.54	2.67	2.81	2.54	2.67	2.81	1.00	1.00	1.82	1.00	1.00	1.82
×5/8	14.3	2.52	2.65	2.79	2.52	2.65	2.79	1.00	1.00	1.84	1.00	1.00	1.84
×9/16	12.9	2.51	2.64	2.78	2.51	2.64	2.78	1.00	1.00	1.85	1.00	1.00	1.85
×1/2	11.5	2.50	2.63	2.76	2.50	2.63	2.76	1.00	1.00	1.86	1.00	1.00	1.86
×7/16	10.2	2.49	2.62	2.75	2.49	2.62	2.75	1.00	0.973	1.86	1.00	0.973	1.86
×3/8	8.76	2.48	2.60	2.74	2.48	2.60	2.74	0.998	0.912	1.87	0.998	0.912	1.87
×5/16	7.34	2.47	2.59	2.72	2.47	2.59	2.72	0.914	0.826	1.88	0.914	0.826	1.88

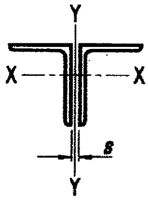
Note: For compactness criteria, refer to the end of Table 1–7

Table 1–15 (continued)
Double Angles
Properties

2L8–2L6

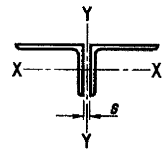
Shape	Flexural-Torsional Properties												Single Angle Properties	
	Long Legs Vertical						Short Legs Vertical							
	Back to Back of Angles, in.						Back to Back of Angles, in.						Area, A	r_z
	0		3/8		3/4		0		3/8		3/4			
	$\bar{r}_o$	H	$\bar{r}_o$	H	$\bar{r}_o$	H	$\bar{r}_o$	H	$\bar{r}_o$	H	$\bar{r}_o$	H	in.^{2}	in.
2L8×8×1 1/8	4.56	0.837	4.66	0.844	4.77	0.851	4.56	0.837	4.66	0.844	4.77	0.851	16.8	1.56
×1	4.56	0.834	4.66	0.841	4.77	0.848	4.56	0.834	4.66	0.841	4.77	0.848	15.1	1.56
×7/8	4.56	0.831	4.66	0.838	4.76	0.845	4.56	0.831	4.66	0.838	4.76	0.845	13.3	1.57
×3/4	4.56	0.829	4.66	0.836	4.76	0.843	4.56	0.829	4.66	0.836	4.76	0.843	11.5	1.57
×5/8	4.56	0.826	4.66	0.833	4.76	0.840	4.56	0.826	4.66	0.833	4.76	0.840	9.69	1.58
×9/16	4.56	0.825	4.65	0.832	4.75	0.839	4.56	0.825	4.65	0.832	4.75	0.839	8.77	1.58
×1/2	4.56	0.824	4.65	0.831	4.75	0.837	4.56	0.824	4.65	0.831	4.75	0.837	7.84	1.59
2L8×6×1	4.06	0.721	4.14	0.732	4.23	0.742	4.18	0.924	4.30	0.929	4.43	0.933	13.1	1.28
×7/8	4.07	0.718	4.14	0.728	4.23	0.739	4.17	0.922	4.29	0.926	4.42	0.930	11.5	1.28
×3/4	4.07	0.714	4.15	0.725	4.23	0.735	4.17	0.919	4.28	0.924	4.40	0.928	9.99	1.29
×5/8	4.08	0.712	4.16	0.722	4.24	0.732	4.16	0.917	4.27	0.921	4.39	0.926	8.41	1.29
×9/16	4.09	0.710	4.16	0.720	4.24	0.731	4.15	0.916	4.27	0.920	4.39	0.924	7.61	1.30
×1/2	4.09	0.709	4.16	0.719	4.24	0.729	4.15	0.915	4.26	0.919	4.38	0.923	6.80	1.30
×7/16	4.09	0.708	4.16	0.718	4.24	0.728	4.15	0.913	4.26	0.918	4.38	0.922	5.99	1.31
2L8×4×1	3.86	0.568	3.91	0.580	3.97	0.594	4.11	0.983	4.25	0.984	4.39	0.985	11.1	0.844
×7/8	3.87	0.566	3.92	0.577	3.98	0.590	4.09	0.981	4.22	0.982	4.37	0.984	9.79	0.846
×3/4	3.88	0.564	3.93	0.575	3.99	0.587	4.07	0.980	4.20	0.981	4.35	0.983	8.49	0.850
×5/8	3.89	0.562	3.94	0.573	3.99	0.585	4.05	0.979	4.18	0.980	4.32	0.981	7.16	0.856
×9/16	3.90	0.562	3.94	0.572	4.00	0.584	4.04	0.978	4.17	0.980	4.31	0.981	6.49	0.859
×1/2	3.90	0.561	3.95	0.571	4.00	0.583	4.03	0.978	4.16	0.979	4.30	0.980	5.80	0.863
×7/16	3.91	0.561	3.95	0.571	4.00	0.582	4.02	0.977	4.15	0.978	4.29	0.980	5.11	0.867
2L7×4×3/4	3.41	0.611	3.47	0.624	3.53	0.639	3.57	0.969	3.70	0.971	3.84	0.973	7.70	0.855
×5/8	3.42	0.608	3.47	0.621	3.54	0.635	3.55	0.967	3.68	0.969	3.82	0.971	6.50	0.860
×1/2	3.43	0.606	3.48	0.618	3.55	0.632	3.53	0.965	3.66	0.968	3.80	0.970	5.26	0.866
×7/16	3.43	0.605	3.49	0.617	3.55	0.630	3.53	0.964	3.66	0.967	3.79	0.969	4.63	0.869
×3/8	3.44	0.605	3.49	0.616	3.55	0.629	3.52	0.963	3.65	0.966	3.78	0.968	4.00	0.873
2L6×6×1	3.42	0.843	3.53	0.852	3.64	0.861	3.42	0.843	3.53	0.852	3.64	0.861	11.0	1.17
×7/8	3.42	0.839	3.53	0.848	3.63	0.857	3.42	0.839	3.53	0.848	3.63	0.857	9.75	1.17
×3/4	3.42	0.835	3.52	0.844	3.63	0.853	3.42	0.835	3.52	0.844	3.63	0.853	8.46	1.17
×5/8	3.42	0.831	3.52	0.840	3.62	0.849	3.42	0.831	3.52	0.840	3.62	0.849	7.13	1.17
×9/16	3.42	0.829	3.52	0.838	3.62	0.847	3.42	0.829	3.52	0.838	3.62	0.847	6.45	1.18
×1/2	3.42	0.827	3.52	0.836	3.62	0.846	3.42	0.827	3.52	0.836	3.62	0.846	5.77	1.18
×7/16	3.42	0.826	3.52	0.835	3.62	0.844	3.42	0.826	3.52	0.835	3.62	0.844	5.08	1.18
×3/8	3.42	0.824	3.51	0.833	3.61	0.842	3.42	0.824	3.51	0.833	3.61	0.842	4.38	1.19
×5/16	3.42	0.823	3.51	0.832	3.61	0.841	3.42	0.823	3.51	0.832	3.61	0.841	3.67	1.19

Note: For compactness criteria, refer to the end of Table 1–7



LLBB

Table 1–15 (continued)
Double Angles
Properties



SLBB

Shape	Area	Axis Y-Y Radius of Gyration LLBB Separation, *s*, in.			Axis Y-Y Radius of Gyration SLBB Separation, *s*, in.			LLBB Q_s		LLBB	SLBB Q_s		SLBB
								Angles in Contact	Angles Separated	r_x	Angles in Contact	Angles Separated	r_x
	in.^{2}	0	3/8	3/4	0	3/8	3/4			in.			in.
2L6×4×7/8	16.0	1.57	1.71	1.86	2.82	2.96	3.11	1.00	1.00	1.86	1.00	1.00	1.10
×3/4	13.9	1.55	1.68	1.83	2.80	2.94	3.08	1.00	1.00	1.88	1.00	1.00	1.12
×5/8	11.7	1.53	1.66	1.80	2.77	2.91	3.06	1.00	1.00	1.89	1.00	1.00	1.13
×9/16	10.6	1.52	1.65	1.79	2.76	2.90	3.04	1.00	1.00	1.90	1.00	1.00	1.14
×1/2	9.50	1.51	1.64	1.77	2.75	2.89	3.03	1.00	1.00	1.91	1.00	1.00	1.14
×7/16	8.36	1.50	1.62	1.76	2.74	2.88	3.02	1.00	0.973	1.92	1.00	0.973	1.15
×3/8	7.22	1.49	1.61	1.75	2.73	2.86	3.00	1.00	0.912	1.93	0.998	0.912	1.16
×5/16	6.05	1.48	1.60	1.74	2.72	2.85	2.99	1.00	0.826	1.94	0.914	0.826	1.17
2L6×3½×1/2	9.04	1.27	1.40	1.54	2.82	2.96	3.11	1.00	1.00	1.92	1.00	1.00	0.968
×3/8	6.88	1.26	1.38	1.52	2.80	2.94	3.08	1.00	0.912	1.93	0.998	0.912	0.984
×5/16	5.78	1.25	1.37	1.50	2.78	2.92	3.06	1.00	0.826	1.94	0.914	0.826	0.991
2L5×5×7/8	16.0	2.16	2.30	2.44	2.16	2.30	2.44	1.00	1.00	1.49	1.00	1.00	1.49
×3/4	14.0	2.13	2.27	2.41	2.13	2.27	2.41	1.00	1.00	1.50	1.00	1.00	1.50
×5/8	11.8	2.11	2.25	2.39	2.11	2.25	2.39	1.00	1.00	1.52	1.00	1.00	1.52
×1/2	9.58	2.09	2.22	2.36	2.09	2.22	2.36	1.00	1.00	1.53	1.00	1.00	1.53
×7/16	8.44	2.08	2.21	2.35	2.08	2.21	2.35	1.00	1.00	1.54	1.00	1.00	1.54
×3/8	7.30	2.07	2.20	2.34	2.07	2.20	2.34	1.00	0.983	1.55	1.00	0.983	1.55
×5/16	6.13	2.06	2.19	2.32	2.06	2.19	2.32	0.998	0.912	1.56	0.998	0.912	1.56
2L5×3½×3/4	11.6	1.39	1.53	1.68	2.33	2.47	2.62	1.00	1.00	1.55	1.00	1.00	0.974
×5/8	9.85	1.37	1.50	1.65	2.30	2.45	2.59	1.00	1.00	1.56	1.00	1.00	0.987
×1/2	8.01	1.35	1.48	1.62	2.28	2.42	2.57	1.00	1.00	1.58	1.00	1.00	1.00
×3/8	6.10	1.33	1.46	1.59	2.26	2.39	2.54	1.00	0.983	1.59	1.00	0.983	1.02
×5/16	5.12	1.32	1.44	1.58	2.25	2.38	2.52	1.00	0.912	1.60	0.998	0.912	1.02
×1/4	4.13	1.31	1.43	1.57	2.23	2.37	2.51	1.00	0.804	1.61	0.894	0.804	1.03
2L5×3×1/2	7.51	1.11	1.24	1.39	2.35	2.50	2.64	1.00	1.00	1.58	1.00	1.00	0.824
×7/16	6.62	1.10	1.23	1.38	2.34	2.48	2.63	1.00	1.00	1.59	1.00	1.00	0.831
×3/8	5.73	1.09	1.22	1.36	2.33	2.47	2.62	1.00	0.983	1.60	1.00	0.983	0.838
×5/16	4.81	1.08	1.21	1.35	2.32	2.46	2.60	1.00	0.912	1.61	0.998	0.912	0.846
×1/4	3.88	1.07	1.19	1.33	2.30	2.44	2.58	1.00	0.804	1.62	0.894	0.804	0.853

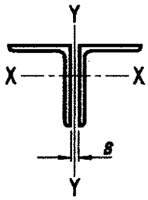
Note: For compactness criteria, refer to the end of Table 1–7

Table 1-15 (continued)
Double Angles
Properties

2L6–2L5

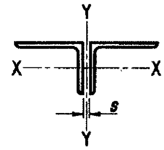
Shape	Flexural-Torsional Properties												Single Angle Properties	
	Long Legs Vertical						Short Legs Vertical							
	Back to Back of Angles, in.						Back to Back of Angles, in.						Area, A	r_z
	0		3/8		3/4		0		3/8		3/4			
	$\bar{r}_o$	H	$\bar{r}_o$	H	$\bar{r}_o$	H	$\bar{r}_o$	H	$\bar{r}_o$	H	$\bar{r}_o$	H	in.^{2}	in.
2L6×4×7/8	2.96	0.678	3.04	0.694	3.12	0.710	3.10	0.952	3.23	0.956	3.37	0.959	7.98	0.854
×3/4	2.97	0.673	3.04	0.688	3.12	0.705	3.09	0.949	3.22	0.953	3.35	0.957	6.94	0.856
×5/8	2.98	0.669	3.05	0.684	3.13	0.700	3.08	0.946	3.21	0.950	3.34	0.954	5.86	0.859
×9/16	2.98	0.667	3.05	0.682	3.13	0.697	3.07	0.945	3.20	0.949	3.33	0.953	5.31	0.861
×1/2	2.99	0.665	3.05	0.679	3.13	0.695	3.07	0.943	3.19	0.948	3.32	0.952	4.75	0.864
×7/16	2.99	0.663	3.06	0.678	3.13	0.693	3.06	0.942	3.19	0.946	3.31	0.950	4.18	0.867
×3/8	2.99	0.662	3.06	0.676	3.13	0.691	3.06	0.940	3.18	0.945	3.31	0.949	3.61	0.870
×5/16	3.00	0.661	3.06	0.674	3.13	0.689	3.05	0.939	3.17	0.944	3.30	0.948	3.03	0.874
2L6x31/2×1/2	2.94	0.615	2.99	0.630	3.06	0.646	3.04	0.964	3.17	0.967	3.31	0.969	4.52	0.756
×3/8	2.95	0.613	3.00	0.627	3.07	0.642	3.02	0.962	3.15	0.965	3.29	0.967	3.44	0.763
×5/16	2.95	0.612	3.00	0.625	3.07	0.641	3.02	0.960	3.14	0.964	3.28	0.966	2.89	0.767
2L5×5×7/8	2.85	0.845	2.96	0.856	3.07	0.866	2.85	0.845	2.96	0.856	3.07	0.866	8.02	0.971
×3/4	2.85	0.840	2.95	0.851	3.06	0.861	2.85	0.840	2.95	0.851	3.06	0.861	6.98	0.972
×5/8	2.85	0.835	2.95	0.846	3.06	0.857	2.85	0.835	2.95	0.846	3.06	0.857	5.90	0.975
×1/2	2.85	0.830	2.94	0.842	3.05	0.852	2.85	0.830	2.94	0.842	3.05	0.852	4.79	0.980
×7/16	2.85	0.828	2.94	0.839	3.05	0.850	2.85	0.828	2.94	0.839	3.05	0.850	4.22	0.983
×3/8	2.84	0.826	2.94	0.838	3.04	0.848	2.84	0.826	2.94	0.838	3.04	0.848	3.65	0.986
×5/16	2.84	0.825	2.94	0.836	3.04	0.847	2.84	0.825	2.94	0.836	3.04	0.847	3.07	0.990
2L5x31/2×3/4	2.49	0.699	2.57	0.717	2.66	0.736	2.60	0.943	2.73	0.949	2.86	0.953	5.82	0.744
×5/8	2.49	0.693	2.57	0.711	2.66	0.730	2.59	0.940	2.71	0.945	2.85	0.950	4.93	0.746
×1/2	2.50	0.688	2.58	0.705	2.66	0.724	2.58	0.936	2.70	0.942	2.83	0.947	4.00	0.750
×3/8	2.51	0.683	2.58	0.700	2.66	0.718	2.56	0.933	2.69	0.938	2.81	0.944	3.05	0.755
×5/16	2.51	0.682	2.58	0.698	2.66	0.716	2.56	0.931	2.68	0.937	2.81	0.942	2.56	0.758
×1/4	2.52	0.680	2.58	0.696	2.66	0.714	2.55	0.929	2.67	0.935	2.80	0.941	2.07	0.761
2L5×3×1/2	2.44	0.628	2.51	0.646	2.58	0.667	2.54	0.962	2.68	0.966	2.81	0.969	3.75	0.642
×7/16	2.45	0.626	2.51	0.644	2.58	0.664	2.54	0.961	2.67	0.964	2.80	0.968	3.31	0.644
×3/8	2.45	0.624	2.51	0.642	2.59	0.661	2.53	0.959	2.66	0.963	2.79	0.967	2.86	0.646
×5/16	2.46	0.623	2.52	0.640	2.59	0.659	2.52	0.958	2.65	0.962	2.78	0.965	2.41	0.649
×1/4	2.46	0.622	2.52	0.638	2.59	0.657	2.51	0.957	2.64	0.961	2.77	0.964	1.94	0.652

Note: For compactness criteria, refer to the end of Table 1-7



LLBB

Table 1–15 (continued)
Double Angles
Properties



SLBB

Shape	Area	Axis Y-Y						LLBB			SLBB		
		Radius of Gyration						Q_s		r_x	Q_s		r_x
		LLBB			SLBB			Angles in Contact	Angles Separated		Angles in Contact	Angles Separated	
		Separation, *s*, in.			Separation, *s*, in.								
	in.^{2}	0	3/8	3/4	0	3/8	3/4			in.			in.
2L4×4×3/4	10.9	1.73	1.88	2.03	1.73	1.88	2.03	1.00	1.00	1.18	1.00	1.00	1.18
×5/8	9.21	1.71	1.85	2.00	1.71	1.85	2.00	1.00	1.00	1.20	1.00	1.00	1.20
×1/2	7.49	1.69	1.83	1.97	1.69	1.83	1.97	1.00	1.00	1.21	1.00	1.00	1.21
×7/16	6.61	1.68	1.81	1.96	1.68	1.81	1.96	1.00	1.00	1.22	1.00	1.00	1.22
×3/8	5.71	1.67	1.80	1.94	1.67	1.80	1.94	1.00	1.00	1.23	1.00	1.00	1.23
×5/16	4.80	1.66	1.79	1.93	1.66	1.79	1.93	1.00	0.997	1.24	1.00	0.997	1.24
×1/4	3.87	1.65	1.78	1.91	1.65	1.78	1.91	0.998	0.912	1.25	0.998	0.912	1.25
2L4×3 1/2×1/2	7.01	1.44	1.57	1.72	1.75	1.89	2.03	1.00	1.00	1.23	1.00	1.00	1.04
×3/8	5.35	1.42	1.55	1.69	1.73	1.86	2.00	1.00	1.00	1.25	1.00	1.00	1.05
×5/16	4.50	1.40	1.53	1.68	1.72	1.85	1.99	1.00	0.997	1.25	1.00	0.997	1.06
×1/4	3.63	1.39	1.52	1.66	1.70	1.83	1.97	1.00	0.912	1.26	0.998	0.912	1.07
2L4×3×5/8	7.98	1.21	1.35	1.50	1.84	1.98	2.13	1.00	1.00	1.23	1.00	1.00	0.845
×1/2	6.51	1.19	1.32	1.47	1.81	1.95	2.10	1.00	1.00	1.24	1.00	1.00	0.858
×3/8	4.98	1.17	1.30	1.44	1.79	1.93	2.07	1.00	1.00	1.26	1.00	1.00	0.873
×5/16	4.19	1.16	1.29	1.43	1.78	1.91	2.06	1.00	0.997	1.27	1.00	0.997	0.880
×1/4	3.38	1.15	1.27	1.41	1.76	1.90	2.04	1.00	0.912	1.27	0.998	0.912	0.887
2L3 1/2×3 1/2×1/2	6.53	1.49	1.63	1.77	1.49	1.63	1.77	1.00	1.00	1.05	1.00	1.00	1.05
×7/16	5.77	1.48	1.61	1.76	1.48	1.61	1.76	1.00	1.00	1.06	1.00	1.00	1.06
×3/8	5.00	1.47	1.60	1.74	1.47	1.60	1.74	1.00	1.00	1.07	1.00	1.00	1.07
×5/16	4.21	1.46	1.59	1.73	1.46	1.59	1.73	1.00	1.00	1.08	1.00	1.00	1.08
×1/4	3.41	1.44	1.57	1.72	1.44	1.57	1.72	1.00	0.965	1.09	1.00	0.965	1.09
2L3 1/2×3×1/2	6.04	1.23	1.37	1.52	1.55	1.69	1.84	1.00	1.00	1.07	1.00	1.00	0.877
×7/16	5.34	1.22	1.36	1.51	1.54	1.67	1.82	1.00	1.00	1.08	1.00	1.00	0.885
×3/8	4.63	1.21	1.35	1.49	1.52	1.66	1.81	1.00	1.00	1.09	1.00	1.00	0.892
×5/16	3.91	1.20	1.33	1.48	1.51	1.65	1.79	1.00	1.00	1.09	1.00	1.00	0.900
×1/4	3.16	1.19	1.32	1.46	1.50	1.63	1.78	1.00	0.965	1.10	1.00	0.965	0.908
2L3 1/2×2 1/2×1/2	5.53	0.992	1.13	1.28	1.62	1.76	1.91	1.00	1.00	1.08	1.00	1.00	0.701
×3/8	4.25	0.970	1.11	1.25	1.59	1.73	1.88	1.00	1.00	1.10	1.00	1.00	0.716
×5/16	3.58	0.960	1.09	1.24	1.58	1.72	1.87	1.00	1.00	1.11	1.00	1.00	0.723
×1/4	2.90	0.950	1.08	1.22	1.57	1.70	1.85	1.00	0.965	1.12	1.00	0.965	0.731

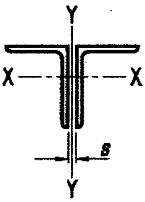
Note: For compactness criteria, refer to the end of Table 1–7

Table 1–15 (continued)
Double Angles
Properties

2L4–2L3$^1/_2$

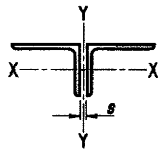
Shape	Flexural-Torsional Properties												Single Angle Properties	
	Long Legs Vertical						Short Legs Vertical							
	Back to Back of Angles, in.						Back to Back of Angles, in.						Area, A	r_z
	0		$^3/_8$		$^3/_4$		0		$^3/_8$		$^3/_4$			
	$\bar{r}_o$	H	$\bar{r}_o$	H	$\bar{r}_o$	H	$\bar{r}_o$	H	$\bar{r}_o$	H	$\bar{r}_o$	H	in.^{2}	in.
2L4×4×$^3/_4$	2.28	0.847	2.39	0.861	2.51	0.874	2.28	0.847	2.39	0.861	2.51	0.874	5.43	0.774
×$^5/_8$	2.28	0.841	2.39	0.854	2.50	0.868	2.28	0.841	2.39	0.854	2.50	0.868	4.61	0.774
×$^1/_2$	2.28	0.834	2.38	0.848	2.49	0.862	2.28	0.834	2.38	0.848	2.49	0.862	3.75	0.776
×$^7/_{16}$	2.28	0.832	2.38	0.846	2.49	0.859	2.28	0.832	2.38	0.846	2.49	0.859	3.30	0.777
×$^3/_8$	2.28	0.829	2.38	0.843	2.49	0.856	2.28	0.829	2.38	0.843	2.49	0.856	2.86	0.779
×$^5/_{16}$	2.28	0.826	2.37	0.840	2.48	0.854	2.28	0.826	2.37	0.840	2.48	0.854	2.40	0.781
×$^1/_4$	2.28	0.824	2.37	0.838	2.48	0.851	2.28	0.824	2.37	0.838	2.48	0.851	1.93	0.783
2L4×3$^1/_2$×$^1/_2$	2.14	0.784	2.23	0.802	2.33	0.819	2.16	0.882	2.28	0.893	2.40	0.904	3.50	0.716
×$^3/_8$	2.14	0.778	2.23	0.795	2.33	0.813	2.16	0.876	2.27	0.888	2.39	0.899	2.68	0.719
×$^5/_{16}$	2.14	0.775	2.23	0.792	2.33	0.810	2.16	0.874	2.26	0.885	2.38	0.896	2.25	0.721
×$^1/_4$	2.14	0.773	2.22	0.790	2.32	0.807	2.15	0.871	2.26	0.883	2.37	0.894	1.82	0.723
2L4×3×$^5/_8$	2.02	0.728	2.11	0.750	2.21	0.773	2.10	0.930	2.22	0.938	2.36	0.945	3.99	0.631
×$^1/_2$	2.02	0.721	2.11	0.743	2.20	0.765	2.09	0.925	2.21	0.933	2.34	0.940	3.25	0.633
×$^3/_8$	2.03	0.715	2.11	0.736	2.20	0.757	2.08	0.920	2.20	0.928	2.32	0.936	2.49	0.636
×$^5/_{16}$	2.03	0.712	2.11	0.733	2.20	0.754	2.07	0.918	2.19	0.926	2.32	0.934	2.09	0.638
×$^1/_4$	2.03	0.710	2.11	0.730	2.20	0.751	2.06	0.915	2.18	0.924	2.31	0.932	1.69	0.639
2L3$^1/_2$×3$^1/_2$×$^1/_2$	1.99	0.838	2.10	0.854	2.21	0.869	1.99	0.838	2.10	0.854	2.21	0.869	3.27	0.679
×$^7/_{16}$	1.99	0.835	2.09	0.851	2.21	0.866	1.99	0.835	2.09	0.851	2.21	0.866	2.89	0.681
×$^3/_8$	1.99	0.832	2.09	0.848	2.20	0.863	1.99	0.832	2.09	0.848	2.20	0.863	2.50	0.683
×$^5/_{16}$	1.99	0.829	2.09	0.845	2.20	0.860	1.99	0.829	2.09	0.845	2.20	0.860	2.10	0.685
×$^1/_4$	1.99	0.826	2.08	0.842	2.19	0.857	1.99	0.826	2.08	0.842	2.19	0.857	1.70	0.688
2L3$^1/_2$×3×$^1/_2$	1.85	0.780	1.94	0.801	2.05	0.822	1.88	0.892	2.00	0.904	2.13	0.915	3.02	0.618
×$^7/_{16}$	1.85	0.776	1.94	0.797	2.05	0.818	1.88	0.889	1.99	0.901	2.12	0.912	2.67	0.620
×$^3/_8$	1.85	0.773	1.94	0.794	2.05	0.814	1.88	0.885	1.99	0.898	2.11	0.910	2.32	0.622
×$^5/_{16}$	1.85	0.770	1.94	0.790	2.04	0.811	1.87	0.883	1.98	0.895	2.11	0.907	1.95	0.624
×$^1/_4$	1.85	0.767	1.94	0.787	2.04	0.807	1.87	0.880	1.98	0.893	2.10	0.905	1.58	0.628
2L3$^1/_2$×2$^1/_2$×$^1/_2$	1.75	0.706	1.83	0.732	1.93	0.759	1.82	0.938	1.95	0.946	2.08	0.953	2.76	0.532
×$^3/_8$	1.75	0.698	1.83	0.724	1.93	0.750	1.81	0.933	1.93	0.941	2.07	0.949	2.12	0.535
×$^5/_{16}$	1.76	0.695	1.83	0.720	1.92	0.746	1.80	0.930	1.92	0.939	2.06	0.947	1.79	0.538
×$^1/_4$	1.76	0.693	1.83	0.717	1.92	0.742	1.80	0.928	1.92	0.937	2.05	0.944	1.45	0.541

Note: For compactness criteria, refer to the end of Table 1–7



LLBB

Table 1–15 (continued)
Double Angles
Properties



SLBB

Shape	Area	Axis Y-Y						LLBB			SLBB		
		Radius of Gyration						Q_s		r_x	Q_s		r_x
		LLBB			SLBB			Angles in Contact	Angles Separated		Angles in Contact	Angles Separated	
		Separation, *s*, in.			Separation, *s*, in.								
	in.^{2}	0	3/8	3/4	0	3/8	3/4			in.			in.
2L3×3×1/2	5.50	1.29	1.43	1.58	1.29	1.43	1.58	1.00	1.00	0.895	1.00	1.00	0.895
×7/16	4.86	1.28	1.42	1.57	1.28	1.42	1.57	1.00	1.00	0.903	1.00	1.00	0.903
×3/8	4.22	1.27	1.41	1.55	1.27	1.41	1.55	1.00	1.00	0.910	1.00	1.00	0.910
×5/16	3.55	1.26	1.39	1.54	1.26	1.39	1.54	1.00	1.00	0.918	1.00	1.00	0.918
×1/4	2.87	1.25	1.38	1.52	1.25	1.38	1.52	1.00	1.00	0.926	1.00	1.00	0.926
×3/16	2.18	1.24	1.37	1.51	1.24	1.37	1.51	0.998	0.912	0.933	0.998	0.912	0.933
2L3×2 1/2×1/2	5.01	1.04	1.18	1.33	1.35	1.49	1.64	1.00	1.00	0.910	1.00	1.00	0.718
×7/16	4.44	1.02	1.16	1.32	1.34	1.48	1.63	1.00	1.00	0.917	1.00	1.00	0.724
×3/8	3.86	1.01	1.15	1.30	1.32	1.46	1.61	1.00	1.00	0.924	1.00	1.00	0.731
×5/16	3.25	1.00	1.14	1.29	1.31	1.45	1.60	1.00	1.00	0.932	1.00	1.00	0.739
×1/4	2.64	0.991	1.12	1.27	1.30	1.44	1.58	1.00	1.00	0.940	1.00	1.00	0.746
×3/16	2.00	0.980	1.11	1.25	1.29	1.42	1.57	1.00	0.912	0.947	0.998	0.912	0.753
2L3×2×1/2	4.53	0.795	0.940	1.10	1.42	1.56	1.72	1.00	1.00	0.922	1.00	1.00	0.543
×3/8	3.50	0.771	0.911	1.07	1.39	1.54	1.69	1.00	1.00	0.937	1.00	1.00	0.555
×5/16	2.96	0.760	0.897	1.05	1.38	1.52	1.67	1.00	1.00	0.945	1.00	1.00	0.562
×1/4	2.40	0.749	0.883	1.03	1.37	1.51	1.66	1.00	1.00	0.953	1.00	1.00	0.569
×3/16	1.83	0.739	0.869	1.02	1.35	1.49	1.64	1.00	0.912	0.961	0.998	0.912	0.577
2L2 1/2×2 1/2×1/2	4.50	1.09	1.23	1.39	1.09	1.23	1.39	1.00	1.00	0.735	1.00	1.00	0.735
×3/8	3.47	1.07	1.21	1.36	1.07	1.21	1.36	1.00	1.00	0.749	1.00	1.00	0.749
×5/16	2.93	1.05	1.19	1.34	1.05	1.19	1.34	1.00	1.00	0.756	1.00	1.00	0.756
×1/4	2.37	1.04	1.18	1.33	1.04	1.18	1.33	1.00	1.00	0.764	1.00	1.00	0.764
×3/16	1.80	1.03	1.17	1.31	1.03	1.17	1.31	1.00	0.983	0.771	1.00	0.983	0.771
2L2 1/2×2×3/8	3.11	0.815	0.957	1.11	1.13	1.27	1.42	1.00	1.00	0.766	1.00	1.00	0.574
×5/16	2.64	0.804	0.943	1.10	1.12	1.26	1.41	1.00	1.00	0.774	1.00	1.00	0.581
×1/4	2.14	0.794	0.930	1.08	1.10	1.24	1.39	1.00	1.00	0.782	1.00	1.00	0.589
×3/16	1.64	0.784	0.916	1.07	1.09	1.23	1.38	1.00	0.983	0.790	1.00	0.983	0.597
2L2 1/2×1 1/2×1/4	1.89	0.554	0.694	0.852	1.17	1.32	1.47	1.00	1.00	0.792	1.00	1.00	0.411
×3/16	1.45	0.543	0.679	0.834	1.16	1.30	1.45	1.00	0.983	0.801	1.00	0.983	0.418
2L2×2×3/8	2.73	0.865	1.01	1.17	0.865	1.01	1.17	1.00	1.00	0.591	1.00	1.00	0.591
×5/16	2.32	0.853	0.996	1.15	0.853	0.996	1.15	1.00	1.00	0.598	1.00	1.00	0.598
×1/4	1.89	0.842	0.982	1.14	0.842	0.982	1.14	1.00	1.00	0.605	1.00	1.00	0.605
×3/16	1.44	0.831	0.967	1.12	0.831	0.967	1.12	1.00	1.00	0.612	1.00	1.00	0.612
×1/8	0.982	0.818	0.951	1.10	0.818	0.951	1.10	0.998	0.912	0.620	0.998	0.912	0.620

Note: For compactness criteria, refer to the end of Table 1–7

Table 1–15 (continued)
Double Angles
Properties

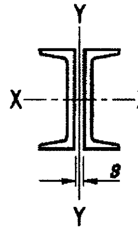
2L3–2L2

Shape	Flexural-Torsional Properties												Single Angle Properties	
	Long Legs Vertical						Short Legs Vertical						Area, A	r_z
	Back to Back of Angles, in.						Back to Back of Angles, in.							
	0		3/8		3/4		0		3/8		3/4			
	$\bar{r}_o$	H	$\bar{r}_o$	H	$\bar{r}_o$	H	$\bar{r}_o$	H	$\bar{r}_o$	H	$\bar{r}_o$	H	in.^{2}	in.
2L3×3×1/2	1.71	0.842	1.82	0.861	1.94	0.878	1.71	0.842	1.82	0.861	1.94	0.878	2.75	0.580
×7/16	1.71	0.838	1.82	0.857	1.94	0.874	1.71	0.838	1.82	0.857	1.94	0.874	2.43	0.580
×3/8	1.71	0.834	1.81	0.853	1.93	0.870	1.71	0.834	1.81	0.853	1.93	0.870	2.11	0.581
×5/16	1.71	0.830	1.81	0.849	1.93	0.866	1.71	0.830	1.81	0.849	1.93	0.866	1.78	0.583
×1/4	1.71	0.827	1.81	0.845	1.92	0.863	1.71	0.827	1.81	0.845	1.92	0.863	1.44	0.585
×3/16	1.71	0.823	1.80	0.842	1.91	0.859	1.71	0.823	1.80	0.842	1.91	0.859	1.09	0.586
2L3×2 1/2×1/2	1.57	0.774	1.66	0.800	1.78	0.824	1.61	0.905	1.73	0.918	1.86	0.929	2.51	0.516
×7/16	1.57	0.769	1.66	0.795	1.77	0.819	1.60	0.901	1.72	0.914	1.85	0.926	2.22	0.516
×3/8	1.57	0.764	1.66	0.790	1.77	0.815	1.60	0.897	1.72	0.911	1.85	0.923	1.93	0.517
×5/16	1.57	0.760	1.66	0.785	1.76	0.810	1.59	0.893	1.71	0.907	1.84	0.920	1.63	0.518
×1/4	1.57	0.756	1.66	0.781	1.76	0.806	1.59	0.890	1.70	0.904	1.83	0.917	1.32	0.520
×3/16	1.57	0.753	1.65	0.778	1.75	0.802	1.58	0.887	1.70	0.901	1.82	0.914	1.00	0.521
2L3×2×1/2	1.47	0.684	1.55	0.717	1.66	0.751	1.55	0.955	1.69	0.962	1.83	0.968	2.26	0.425
×3/8	1.48	0.675	1.55	0.707	1.65	0.739	1.54	0.949	1.67	0.957	1.81	0.963	1.75	0.426
×5/16	1.48	0.671	1.56	0.702	1.65	0.734	1.53	0.946	1.66	0.954	1.80	0.961	1.48	0.428
×1/4	1.48	0.668	1.56	0.698	1.65	0.730	1.52	0.944	1.65	0.952	1.79	0.959	1.20	0.431
×3/16	1.49	0.666	1.55	0.695	1.64	0.726	1.52	0.941	1.64	0.950	1.78	0.957	0.917	0.435
2L2 1/2×2 1/2×1/2	1.43	0.850	1.54	0.871	1.67	0.890	1.43	0.850	1.54	0.871	1.67	0.890	2.25	0.481
×3/8	1.42	0.839	1.53	0.861	1.65	0.881	1.42	0.839	1.53	0.861	1.65	0.881	1.73	0.481
×5/16	1.42	0.834	1.53	0.856	1.65	0.876	1.42	0.834	1.53	0.856	1.65	0.876	1.46	0.481
×1/4	1.42	0.829	1.52	0.852	1.64	0.872	1.42	0.829	1.52	0.852	1.64	0.872	1.19	0.482
×3/16	1.42	0.825	1.52	0.847	1.63	0.868	1.42	0.825	1.52	0.847	1.63	0.868	0.901	0.482
2L2 1/2×2×3/8	1.29	0.754	1.38	0.786	1.49	0.817	1.32	0.913	1.45	0.927	1.59	0.939	1.56	0.419
×5/16	1.29	0.748	1.38	0.781	1.49	0.812	1.32	0.909	1.44	0.923	1.58	0.936	1.32	0.420
×1/4	1.29	0.744	1.38	0.775	1.49	0.806	1.32	0.904	1.43	0.920	1.57	0.933	1.07	0.423
×3/16	1.29	0.740	1.38	0.771	1.48	0.801	1.31	0.901	1.43	0.916	1.56	0.929	0.818	0.426
2L2 1/2×1 1/2×1/4	1.22	0.630	1.29	0.669	1.38	0.712	1.27	0.962	1.40	0.969	1.55	0.975	0.947	0.321
×3/16	1.22	0.627	1.29	0.665	1.38	0.706	1.26	0.959	1.39	0.967	1.53	0.973	0.724	0.324
2L2×2×3/8	1.14	0.847	1.25	0.874	1.38	0.897	1.14	0.847	1.25	0.874	1.38	0.897	1.37	0.386
×5/16	1.14	0.841	1.25	0.868	1.37	0.891	1.14	0.841	1.25	0.868	1.37	0.891	1.16	0.386
×1/4	1.13	0.835	1.24	0.862	1.37	0.886	1.13	0.835	1.24	0.862	1.37	0.886	0.944	0.387
×3/16	1.13	0.830	1.24	0.857	1.36	0.882	1.13	0.830	1.24	0.857	1.36	0.882	0.722	0.389
×1/8	1.13	0.826	1.23	0.853	1.35	0.877	1.13	0.826	1.23	0.853	1.35	0.877	0.491	0.391

Note: For compactness criteria, refer to the end of Table 1–7

2C SHAPES

Table 1–16
2C Shapes
Properties



Shape	Area, A	Axis Y-Y												Axis X-X
		Separation, s, in.												
		0				3/8				3/4				
		I	S	r	Z	I	S	r	Z	I	S	r	Z	r_x
	in.^{2}	in.^{4}	in.^{3}	in.	in.^{3}	in.^{4}	in.^{3}	in.	in.^{3}	in.^{4}	in.^{3}	in.	in.^{3}	in.
2C15×50	29.4	40.7	11.0	1.18	30.7	50.5	12.9	1.31	36.2	62.4	15.3	1.46	41.7	5.24
×40	23.5	32.6	9.25	1.18	22.9	40.2	10.9	1.31	27.3	49.6	12.7	1.45	31.7	5.44
×33.9	19.9	28.5	8.38	1.20	19.0	35.1	9.78	1.33	22.7	43.1	11.4	1.47	26.4	5.63
2C12×30	17.6	18.2	5.75	1.02	15.1	23.3	6.94	1.15	18.4	29.6	8.36	1.30	21.7	4.29
×25	14.7	15.6	5.11	1.03	12.1	19.8	6.12	1.16	14.9	25.0	7.32	1.31	17.6	4.43
×20.7	12.2	13.6	4.64	1.06	10.0	17.2	5.51	1.19	12.3	21.7	6.55	1.34	14.6	4.61
2C10×30	17.6	15.3	5.04	0.931	15.3	20.2	6.27	1.07	18.6	26.3	7.73	1.22	21.9	3.42
×25	14.7	12.3	4.25	0.914	11.8	16.2	5.27	1.05	14.5	21.1	6.48	1.20	17.3	3.52
×20	11.7	9.91	3.62	0.918	8.84	13.0	4.44	1.05	11.0	16.9	5.43	1.20	13.2	3.66
×15.3	8.96	8.14	3.13	0.953	6.69	10.6	3.80	1.09	8.37	13.7	4.59	1.23	10.0	3.87
2C9×20	11.7	8.80	3.32	0.866	8.76	11.8	4.15	1.00	11.0	15.6	5.15	1.15	13.2	3.22
×15	8.81	6.86	2.76	0.882	6.25	9.10	3.41	1.02	7.90	12.0	4.19	1.17	9.55	3.40
×13.4	7.88	6.34	2.61	0.897	5.59	8.39	3.20	1.03	7.07	11.0	3.92	1.18	8.55	3.49
2C8×18.7	11.0	7.46	2.95	0.823	8.12	10.2	3.75	0.962	10.2	13.7	4.71	1.11	12.3	2.82
×13.7	8.07	5.51	2.35	0.826	5.49	7.47	2.95	0.962	7.00	10.0	3.68	1.11	8.52	2.99
×11.5	6.74	4.82	2.13	0.846	4.57	6.50	2.66	0.982	5.83	8.66	3.29	1.13	7.10	3.11
2C7×14.7	8.66	5.18	2.25	0.773	5.94	7.21	2.90	0.912	7.57	9.85	3.68	1.07	9.19	2.51
×12.2	7.19	4.30	1.96	0.773	4.69	5.97	2.51	0.911	6.04	8.14	3.17	1.06	7.39	2.60
×9.8	5.73	3.59	1.72	0.791	3.69	4.95	2.17	0.929	4.76	6.72	2.73	1.08	5.84	2.72
2C6×13	7.63	4.11	1.91	0.734	5.13	5.85	2.50	0.876	6.56	8.13	3.21	1.03	7.99	2.13
×10.5	6.15	3.26	1.60	0.728	3.86	4.63	2.08	0.867	5.02	6.43	2.67	1.02	6.17	2.22
×8.2	4.78	2.63	1.37	0.741	2.93	3.72	1.76	0.881	3.82	5.14	2.24	1.04	4.72	2.34
2C5×9	5.28	2.45	1.30	0.682	3.22	3.59	1.73	0.824	4.21	5.09	2.25	0.982	5.20	1.83
×6.7	3.93	1.86	1.06	0.688	2.36	2.71	1.40	0.831	3.09	3.84	1.81	0.989	3.83	1.95
2C4×7.2	4.26	1.75	1.02	0.641	2.52	2.63	1.38	0.786	3.32	3.81	1.82	0.946	4.12	1.47
×5.4	3.16	1.29	0.812	0.637	1.86	1.94	1.10	0.783	2.45	2.82	1.44	0.943	3.05	1.56
×4.5	2.76	1.25	0.789	0.673	1.95	1.86	1.05	0.820	2.47	2.66	1.36	0.981	2.98	1.63
2C3×6	3.52	1.33	0.833	0.614	2.12	2.06	1.15	0.764	2.78	3.03	1.54	0.927	3.44	1.08
×5	2.94	1.05	0.699	0.597	1.65	1.63	0.969	0.746	2.20	2.43	1.30	0.909	2.75	1.12
×4.1	2.41	0.842	0.597	0.591	1.43	1.32	0.827	0.741	1.88	1.97	1.10	0.905	2.33	1.17
×3.5	2.18	0.766	0.558	0.593	1.37	1.20	0.772	0.743	1.78	1.80	1.03	0.908	2.19	1.20

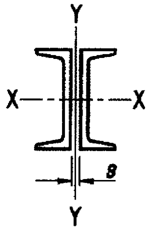
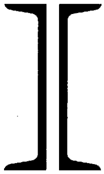


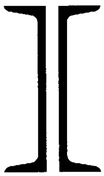
Table 1-17
2MC Shapes
Properties



2MC18–2MC6

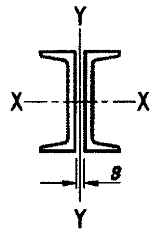
Shape	Area, *A*	Axis Y-Y, Separation, *s*, in. 0 *I*	0 *S*	0 *r*	0 *Z*	3/8 *I*	3/8 *S*	3/8 *r*	3/8 *Z*	3/4 *I*	3/4 *S*	3/4 *r*	3/4 *Z*	Axis X-X r_x
	in.^{2}	in.^{4}	in.^{3}	in.	in.^{3}	in.^{4}	in.^{3}	in.	in.^{3}	in.^{4}	in.^{3}	in.	in.^{3}	in.
2MC18×58	34.1	60.6	14.4	1.33	37.5	72.8	16.6	1.46	43.9	87.5	19.1	1.60	50.3	6.29
×51.9	30.5	55.0	13.4	1.34	32.7	65.9	15.4	1.47	38.4	79.0	17.6	1.61	44.1	6.40
×45.8	26.9	50.1	12.5	1.36	28.3	59.8	14.3	1.49	33.4	71.4	16.3	1.63	38.4	6.56
×42.7	25.1	47.8	12.1	1.38	26.4	57.0	13.8	1.51	31.1	67.9	15.7	1.64	35.8	6.65
2MC13×50	29.4	60.7	13.8	1.44	37.0	72.5	15.8	1.57	42.5	86.3	18.0	1.71	48.0	4.62
×40	23.5	49.1	11.7	1.45	28.0	58.4	13.4	1.58	32.4	69.4	15.2	1.72	36.8	4.82
×35	20.6	44.3	10.9	1.47	24.2	52.6	12.3	1.60	28.1	62.3	14.0	1.74	31.9	4.95
×31.8	18.7	41.5	10.4	1.49	22.1	49.2	11.7	1.62	25.6	58.2	13.3	1.76	29.1	5.06
2MC12×50	29.4	67.2	16.2	1.51	39.9	79.8	18.5	1.65	45.4	94.5	20.9	1.79	50.9	4.28
×45	26.4	59.9	14.9	1.51	34.6	71.1	16.9	1.64	39.6	84.1	19.2	1.79	44.5	4.36
×40	23.5	53.7	13.8	1.51	30.1	63.7	15.6	1.65	34.6	75.3	17.7	1.79	39.0	4.46
×35	20.5	48.0	12.7	1.53	26.0	56.8	14.4	1.66	29.9	67.1	16.2	1.81	33.7	4.59
×31	18.2	44.0	12.0	1.55	24.1	52.1	13.5	1.69	27.5	61.4	15.2	1.83	30.9	4.71
×10.6[c]	6.20	1.21	0.804	0.441	2.07	2.05	1.21	0.575	3.23	3.33	1.78	0.733	4.40	4.23
2MC10×41.1	24.2	60.0	13.9	1.58	33.6	70.7	15.7	1.71	38.1	83.1	17.7	1.85	42.6	3.60
×33.6	19.7	49.5	12.1	1.58	26.3	58.2	13.6	1.72	30.0	68.3	15.3	1.86	33.7	3.75
×28.5	16.7	43.5	11.0	1.61	22.2	51.1	12.3	1.75	25.3	59.8	13.8	1.89	28.5	3.88
2MC10×25	14.7	27.8	8.18	1.38	16.7	33.6	9.36	1.51	19.5	40.4	10.7	1.66	22.2	3.87
×22	12.9	25.4	7.67	1.40	16.6	30.7	8.76	1.54	19.0	36.8	10.0	1.69	21.4	3.98
2MC10×8.4[c]	4.91	1.05	0.700	0.462	1.70	1.75	1.03	0.596	2.62	2.79	1.49	0.753	3.54	3.61
×6.5[c]	3.90	0.414	0.354	0.326	0.947	0.835	0.615	0.463	1.68	1.53	0.990	0.626	2.41	3.43
2MC9×25.4	14.9	29.2	8.34	1.40	17.6	35.2	9.53	1.53	20.4	42.2	10.9	1.68	23.2	3.43
×23.9	14.0	27.8	8.05	1.41	16.5	33.4	9.19	1.54	19.1	40.1	10.5	1.69	21.8	3.48
2MC8×22.8	13.4	27.7	7.91	1.44	16.3	33.2	9.01	1.58	18.9	39.7	10.2	1.72	21.4	3.09
×21.4	12.6	26.3	7.63	1.45	16.0	31.6	8.68	1.59	18.4	37.7	9.86	1.73	20.7	3.13
2MC8×20	11.8	17.1	5.66	1.21	12.0	21.2	6.61	1.34	14.2	26.2	7.70	1.49	16.4	3.05
×18.7	11.0	16.2	5.45	1.21	11.2	20.1	6.35	1.35	13.3	24.8	7.39	1.50	15.4	3.09
2MC8×8.5	5.00	2.16	1.15	0.658	2.53	3.14	1.52	0.793	3.47	4.47	1.99	0.946	4.40	3.05
2MC7×22.7	13.3	29.0	8.06	1.47	17.1	34.7	9.16	1.61	19.6	41.3	10.4	1.76	22.1	2.67
×19.1	11.2	25.1	7.27	1.50	16.2	30.0	8.25	1.64	18.3	35.7	9.34	1.78	20.4	2.77
2MC6×18	10.6	25.0	7.13	1.54	16.2	29.8	8.07	1.68	18.2	35.3	9.11	1.83	20.1	2.37
×15.3	8.97	19.7	5.63	1.48	12.3	23.6	6.39	1.62	14.0	28.1	7.24	1.77	15.6	2.38

[c] Shape is slender for compression with F_y = 36 ksi.



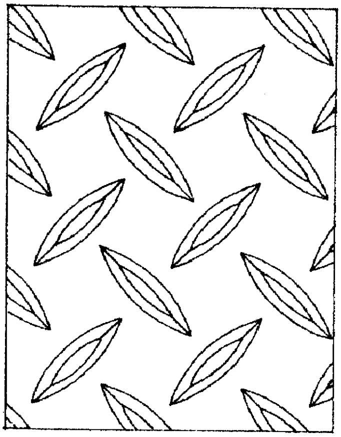
2MC6–2MC3

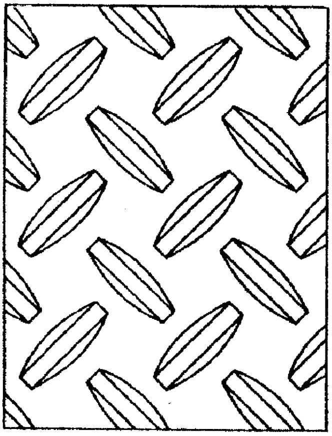
Table 1–17 (continued)
2MC Shapes
Properties



Shape	Area, A	Axis Y-Y												Axis X-X
		Separation, s, in.												
		0				3/8				3/4				r_x
		I	S	r	Z	I	S	r	Z	I	S	r	Z	
	in.^{2}	in.^{4}	in.^{3}	in.	in.^{3}	in.^{4}	in.^{3}	in.	in.^{3}	in.^{4}	in.^{3}	in.	in.^{3}	in.
2MC6×16.3	9.58	15.8	5.26	1.28	11.4	19.4	6.10	1.42	13.2	23.8	7.05	1.58	15.0	2.33
×15.1	8.88	14.8	5.02	1.29	11.4	18.2	5.82	1.43	13.1	22.3	6.71	1.58	14.7	2.37
2MC6×12	7.06	7.21	2.89	1.01	6.01	9.32	3.47	1.15	7.34	11.9	4.15	1.30	8.66	2.30
2MC6×7	4.18	2.25	1.20	0.734	2.46	3.19	1.55	0.873	3.24	4.41	1.96	1.03	4.03	2.34
×6.5	3.89	2.15	1.16	0.744	2.42	3.04	1.49	0.883	3.15	4.20	1.89	1.04	3.88	2.38
2MC4×13.8	8.06	10.1	4.03	1.12	8.90	12.9	4.81	1.27	10.4	16.3	5.68	1.42	11.9	1.48
2MC3×7.1	4.22	3.13	1.62	0.862	3.74	4.31	2.03	1.01	4.53	5.79	2.50	1.17	5.32	1.14

Table 1–18
Weights of Raised-Pattern Floor Plates





Gauge No.	Wt., lb/ft^2	Nominal Thickness, in.	Wt., lb/ft^2	Nominal Thickness, in.	Wt., lb/ft^2
18	2.40	1/8	6.16	1/2	21.5
16	3.00	3/16	8.71	9/16	24.0
14	3.75	1/4	11.3	5/8	26.6
13	4.50	5/16	13.8	3/4	31.7
12	5.25	3/8	16.4	7/8	36.8
		7/16	18.9	1	41.9

Note: Thickness is measured near the edge of the plate, exclusive of raised pattern.

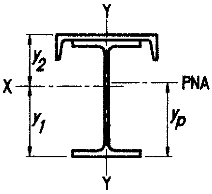


Table 1–19
W Shapes with Cap Channels
Properties

W-Shape	Channel	Total Wt.	Total Area	Axis X-X			
				I	$S_1 = \frac{I}{y_1}$	$S_2 = \frac{I}{y_2}$	r
		lb/ft	in.^{2}	in.^{4}	in.^{3}	in.^{3}	in.
W36×150	MC18×42.7	193	56.8	12000	553	831	14.6
	C15×33.9	184	54.2	11500	546	764	14.6
W33×141	MC18×42.7	184	54.1	10000	490	750	13.6
	C15×33.9	175	51.5	9580	484	689	13.6
W33×118	MC18×42.7	161	47.2	8280	400	656	13.2
	C15×33.9	152	44.6	7900	395	596	13.3
W30×116	MC18×42.7	159	46.8	6900	365	598	12.1
	C15×33.9	150	44.1	6590	360	544	12.2
W30×99	MC18×42.7	142	41.6	5830	304	533	11.8
	C15×33.9	133	39.0	5550	300	481	11.9
W27×94	C15×33.9	128	37.6	4530	268	435	11.0
W27×84	C15×33.9	118	34.7	4050	237	403	10.8
W24×84	C15×33.9	118	34.7	3340	217	367	9.82
	C12×20.7	105	30.8	3030	211	302	9.92
W24×68	C15×33.9	102	30.0	2710	173	321	9.51
	C12×20.7	88.7	26.1	2440	168	258	9.67
W21×68	C15×33.9	102	30.0	2180	156	287	8.52
	C12×20.7	88.7	26.1	1970	152	232	8.67
W21×62	C15×33.9	95.9	28.2	2000	142	272	8.41
	C12×20.7	82.7	24.3	1800	138	218	8.59
W18×50	C15×33.9	83.9	24.6	1250	100	211	7.12
	C12×20.7	70.7	20.7	1120	97.3	166	7.35
W16×36	C15×33.9	69.9	20.5	748	64.5	160	6.04
	C12×20.7	56.7	16.6	670	62.8	123	6.34
W14×30	C12×20.7	50.7	14.9	447	46.7	98.1	5.47
	C10×15.3	45.3	13.3	420	46.0	84.5	5.61
W12×26	C12×20.7	46.7	13.7	318	36.8	82.1	4.81
	C10×15.3	41.3	12.1	299	36.3	70.5	4.96

Note: Compactness criteria not addressed in this table.

Table 1–19 (continued)
W Shapes with Cap Channels
Properties

W-Shape	Channel	Axis X-X				Axis Y-Y			
		y_1	y_2	Z	y_p	I	S	r	Z
		in.	in.	in.^{3}	in.	in.^{4}	in.^{3}	in.	in.^{3}
W36×150	MC18×42.7	21.8	14.5	738	28.0	824	91.5	3.81	146
	C15×33.9	21.1	15.1	716	25.9	584	77.9	3.28	122
W33×141	MC18×42.7	20.4	13.3	652	27.0	800	88.9	3.85	142
	C15×33.9	19.8	13.9	635	24.9	561	74.8	3.30	118
W33×118	MC18×42.7	20.7	12.6	544	27.8	741	82.3	3.96	126
	C15×33.9	20.0	13.3	529	25.5	502	66.9	3.35	102
W30×116	MC18×42.7	18.9	11.5	492	26.1	718	79.8	3.92	124
	C15×33.9	18.3	12.1	480	23.8	479	63.8	3.29	100
W30×99	MC18×42.7	19.2	10.9	412	26.4	682	75.8	4.05	114
	C15×33.9	18.5	11.5	408	24.4	442	59.0	3.37	89.4
W27×94	C15×33.9	16.9	10.4	357	23.6	439	58.5	3.41	89.6
W27×84	C15×33.9	17.1	10.0	316	23.9	420	56.0	3.48	83.9
W24×84	C15×33.9	15.4	9.10	286	21.6	409	54.5	3.43	83.4
	C12×20.7	14.3	10.0	275	18.5	223	37.2	2.69	58.2
W24×68	C15×33.9	15.7	8.46	232	21.7	385	51.3	3.58	75.3
	C12×20.7	14.5	9.49	224	19.2	199	33.2	2.76	50.1
W21×68	C15×33.9	13.9	7.59	207	19.3	379	50.6	3.56	75.1
	C12×20.7	12.9	8.49	200	17.6	194	32.3	2.72	50.0
W21×62	C15×33.9	14.1	7.33	189	19.4	372	49.6	3.63	72.5
	C12×20.7	13.0	8.26	183	18.1	186	31.1	2.77	47.3
W18×50	C15×33.9	12.5	5.92	133	16.9	354	47.3	3.79	67.3
	C12×20.7	11.5	6.76	127	16.1	169	28.2	2.85	42.2
W16×36	C15×33.9	11.6	4.67	86.8	15.2	339	45.2	4.06	61.6
	C12×20.7	10.7	5.47	83.2	14.6	153	25.6	3.04	36.4
W14×30	C12×20.7	9.57	4.55	62.0	12.9	149	24.8	3.16	34.6
	C10×15.3	9.11	4.97	60.3	12.6	86.8	17.4	2.55	24.9
W12×26	C12×20.7	8.63	3.87	48.2	11.6	146	24.4	3.27	33.7
	C10×15.3	8.22	4.24	47.0	11.3	84.5	16.9	2.64	24.1

Note: Compactness criteria not addressed in this table.

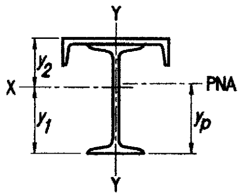


Table 1–20
S Shapes with Cap Channels
Properties

S-Shape	Channel	Total Wt.	Total Area	Axis X-X			
				I	$S_1 = \frac{I}{y_1}$	$S_2 = \frac{I}{y_2}$	r
		lb/ft	in.^{2}	in.^{4}	in.^{3}	in.^{3}	in.
S24×80	C12×20.7	101	29.5	2750	191	278	9.66
	C10×15.3	95.3	27.9	2610	188	252	9.67
S20×66	C12×20.7	86.7	25.5	1620	132	202	7.97
	C10×15.3	81.3	23.9	1530	129	181	8.00
S15×42.9	C10×15.3	58.2	17.1	615	65.7	105	6.00
	C8×11.5	54.4	16.0	583	64.7	93.9	6.04
S12×31.8	C10×15.3	47.1	13.8	314	40.2	71.2	4.77
	C8×11.5	43.3	12.7	297	39.6	63.0	4.84
S10×25.4	C10×15.3	40.7	11.9	185	27.5	52.7	3.94
	C8×11.5	36.9	10.8	175	27.1	46.3	4.02

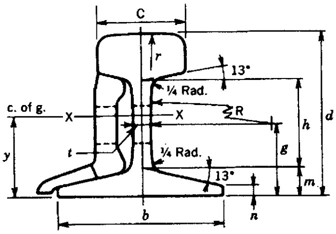
Note: Compactness criteria not addressed in this table.

Table 1–20 (continued)
S Shapes with Cap Channels
Properties

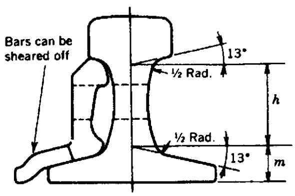
S-Shape	Channel	Axis X-X y_1	y_2	Z	y_p	Axis Y-Y I	S	r	Z
		in.	in.	in.^{3}	in.	in.^{4}	in.^{3}	in.	in.^{3}
S24×80	C12×20.7	14.4	9.90	256	18.1	171	28.5	2.41	46.4
	C10×15.3	13.9	10.4	246	16.5	109	21.8	1.98	36.8
S20×66	C12×20.7	12.3	7.99	180	16.0	156	26.1	2.48	41.0
	C10×15.3	11.8	8.44	173	14.4	94.7	18.9	1.99	31.3
S15×42.9	C10×15.3	9.37	5.87	87.6	12.8	81.5	16.3	2.18	25.0
	C8×11.5	9.01	6.21	86.5	11.6	46.8	11.7	1.71	18.7
S12×31.8	C10×15.3	7.82	4.42	54.0	10.6	76.5	15.3	2.36	22.3
	C8×11.5	7.50	4.72	52.4	10.3	41.8	10.5	1.82	16.1
S10×25.4	C10×15.3	6.73	3.51	37.2	9.03	73.9	14.8	2.49	20.9
	C8×11.5	6.45	3.77	36.1	8.82	39.2	9.81	1.90	14.6

Note: Compactness criteria not addressed in this table.

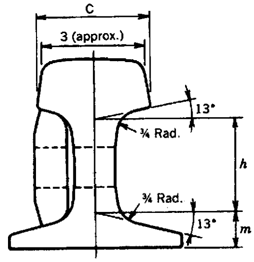
Table 1–21
Crane Rails
Dimensions and Properties



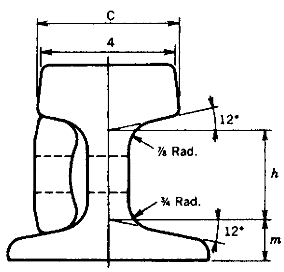
ASCE CRANE RAILS



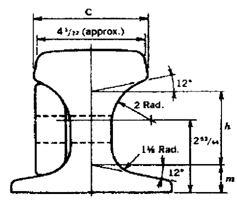
ASTM PROFILE 104



ASTM PROFILE 135



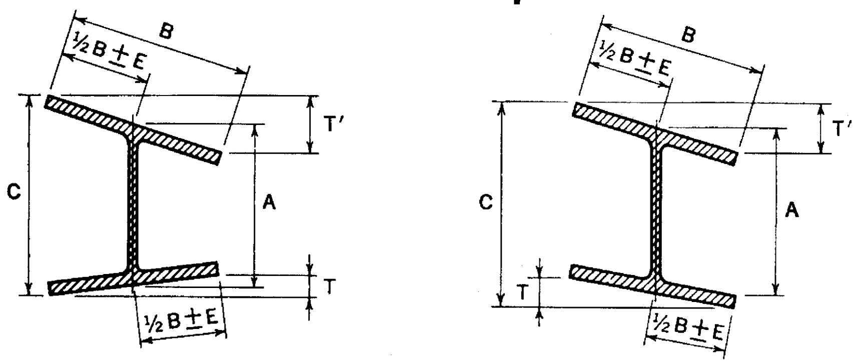
ASTM PROFILE 171



ASTM PROFILE 175

TYPE	Classification	Wt.	Depth, d	Gage, g	Base			Head		Web			Axis X-X				
					b	m	n	c	r	t	h	R	Area	I	S Head	S Base	y
		lb/yd	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.²	in.⁴	in.³	in.³	in.
ASCE	Light	30	3 1/8	1 25/64	3 1/8	17/32	11/64	1 11/16	12	21/64	1 23/32	12	3.00	4.10	2.55	—	—
		40	3 1/2	1 71/128	3 1/2	5/8	7/32	1 7/8	12	25/64	1 55/64	12	3.94	6.54	3.59	3.89	1.68
		50	3 7/8	1 23/32	3 7/8	11/16	1/4	2 1/8	12	7/16	2 1/16	12	4.90	10.1	5.10	—	1.88
		60	4 1/4	1 115/128	4 1/4	49/64	9/32	2 3/8	12	31/64	2 17/64	12	5.93	14.6	6.64	7.12	2.05
	—	70	4 5/8	2 3/64	4 5/8	13/16	9/32	2 7/16	12	33/64	2 15/32	12	6.81	19.7	8.19	8.87	2.22
		80	5	2 3/16	5	7/8	19/64	2 1/2	12	35/64	2 5/8	12	7.86	26.4	10.1	11.1	2.38
	Std.	85	5 3/16	2 17/64	5 3/16	57/64	19/64	2 9/16	12	9/16	2 3/4	12	8.33	30.1	11.1	12.2	2.47
		100	5 3/4	2 65/128	5 3/4	31/32	5/16	2 3/4	12	9/16	2 5/64	12	9.84	44.0	14.6	16.1	2.73
ASTM A759	Crane	104	5	2 7/16	5	1 1/16	1/2	2 1/2	12	1	2 7/16	3 1/2	10.3	29.8	10.7	13.5	2.21
		135	5 3/4	2 15/32	5 3/16	1 1/16	15/32	3 7/16	14	1 1/4	2 13/16	12	13.3	50.8	17.3	18.1	2.81
		171	6	2 5/8	6	1 1/4	5/8	4.3	Flat	1 1/4	2 3/4	Vert.	16.8	73.4	24.5	24.4	3.01
		175	6	2 21/32	6	1 9/64	1/2	4 1/4	18	1 1/2	3 7/64	Vert.	17.1	70.5	23.4	23.6	2.98

Table 1–22
ASTM A6 Tolerances for W Shapes and HP Shapes



Permissible Cross-Sectional Variations

Nominal Depth, in.	A Depth at Web Centerline, in. Over	A Depth at Web Centerline, in. Under	B Flange Width, in. Over	B Flange Width, in. Under	T + T′ Flanges Out of Square, Max. in.	E[a] Web Off Center, in.	C, Max. Depth at any Cross-Section over Theoretical Depth, in.
To 12, incl.	1/8	1/8	1/4	3/16	1/4	3/16	1/4
Over 12	1/8	1/8	1/4	3/16	5/16	3/16	1/4

Permissible Variations in Length

Nominal Depth[b], in.	Variations from Specified Length for Lengths Given, in.			
	30 ft and Under		Over 30 ft	
	Over	Under	Over	Under
Beams 24 in. and under	3/8	3/8	3/8 plus 1/16 for each additional 5 ft or fraction thereof	3/8
Beams over 24 in. All columns	1/2	1/2	1/2 plus 1/16 for each additional 5 ft or fraction thereof	1/2

Mill Straightness Tolerances[c]

Sizes	Length	Permissible Variation from Straight, in. Camber	Permissible Variation from Straight, in. Sweep
Flange width equal to or greater than 6 in.	All	$1/8 \text{ in.} \times \frac{\text{(total length, ft)}}{10}$	
Flange width less than 6 in.	All	$1/8 \text{ in.} \times \frac{\text{(total length, ft)}}{10}$	$1/8 \text{ in.} \times \frac{\text{(total length, ft)}}{5}$
Certain sections with a flange width approx. equal to depth & specified on order as columns[d]	45 ft and under	$1/8 \text{ in.} \times \frac{\text{(total length, ft)}}{10}$ with 3/8 in. max.	
	Over 45 ft	$3/8 \text{ in.} + \left[1/8 \text{ in.} \times \frac{\text{(total length, ft} - 45)}{10}\right]$	

Other Permissible Rolling Variations

Area and Weight	± 2.5 percent theoretical or specified amount.
Ends Out of Square	1/64 in., per in. of depth, or of flange width if it is greater than the depth.

[a] Variation of 5/16 in. max. for sections over 426 lb/ft.
[b] For shapes specified in the order for use as bearing piles, the permitted variations are plus 5 in. and minus 0 in.
[c] The tolerances herein are taken from ASTM A6 and apply to the straightness of members received from the rolling mill, measured as illustrated in Figure 1–1. For tolerance on induced camber and sweep, see Code of Standard Practice Section 6.4.4.
[d] Applies only to W8×31and heavier, W10×49 and heavier, W12×65 and heavier, W14×90 and heavier, HP8×36, HP10×57, HP12×74 and heavier, and HP14×102 and heavier. If other sections are specified on the order as columns, the tolerance will be subject to negotiation with the manufacturer.

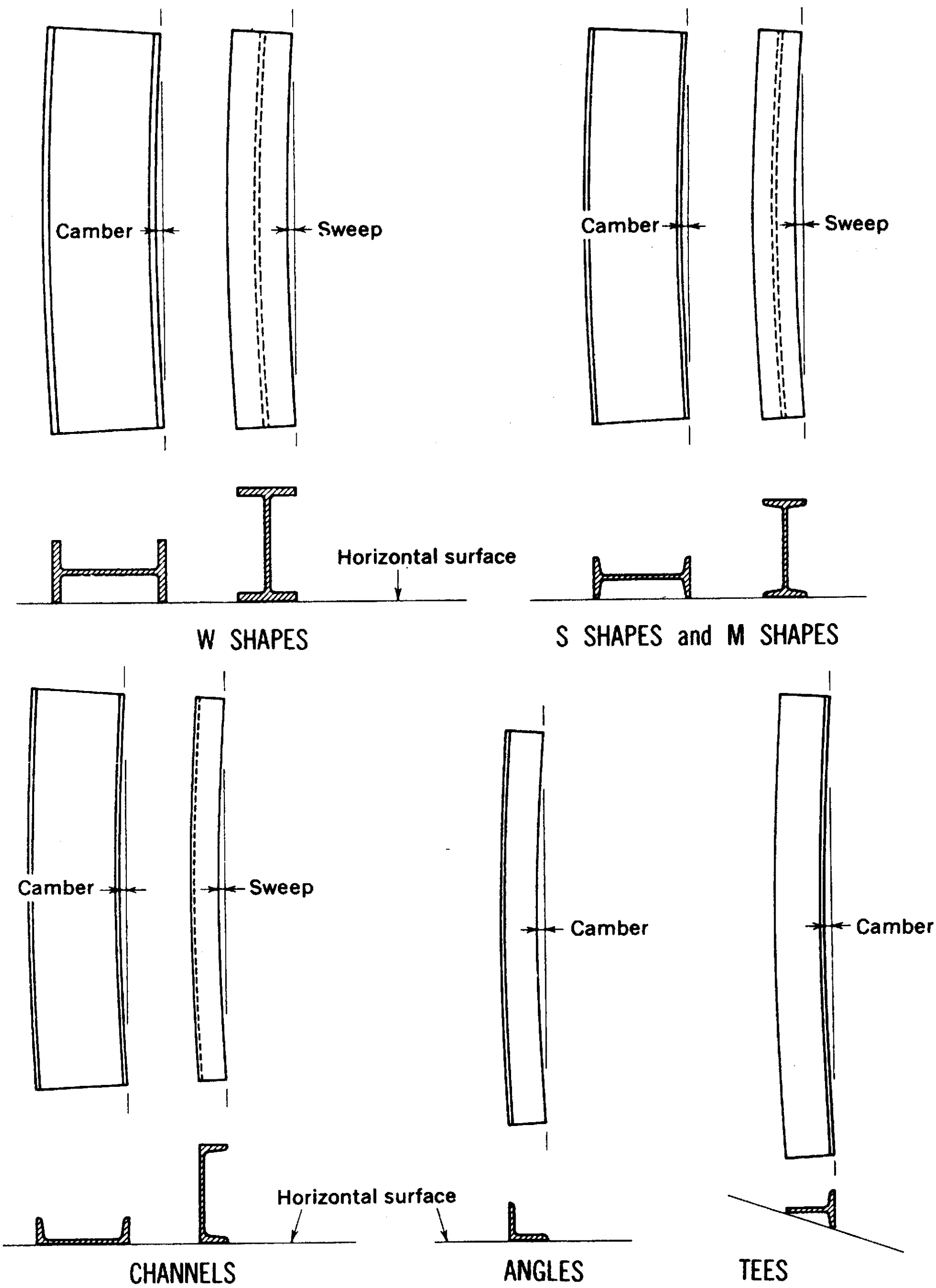
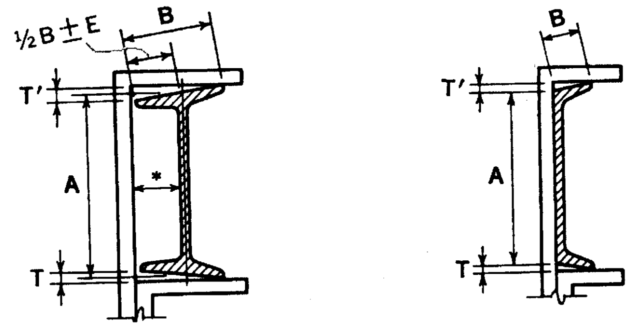


Figure 1–1. Positions for Measuring Straightness.

Table 1–23
ASTM A6 Tolerances for S Shapes, M Shapes, and Channels



*Back of square and centerline of web to be parallel when measuring "out-of-square"

Permissible Cross-Sectional Variations

Shape	Nominal Depth, in.	*A*[a] Depth, in.		*B* Flange Width, in.		*T* + *T′*[b] Flanges Out of Square, per in. of *B*, in.	*E* Web Off Center, in.
		Over	Under	Over	Under		
S shapes and M shapes	3 to 7, incl.	3/32	1/16	1/8	1/8	1/32	3/16
	Over 7 to 14, incl.	1/8	3/32	5/32	5/32		
	Over 14 to 24, incl.	3/16	1/8	3/16	3/16		
Channels	3 to 7, incl.	3/32	1/16	1/8	1/8	1/32	—
	Over 7 to 14, incl.	1/8	3/32	1/8	5/32		
	Over 14	3/16	1/8	1/8	3/16		

Permissible Variations in Length

Shape	Variations from Specified Length for Lengths Given[c], in.					
	5 to 10 ft, excl.	10 to 20 ft, excl.	20 to 30 ft, incl.	Over 30 to 40 ft, incl.	Over 40 to 65 ft, incl.	Over 65 ft
All	1	1 1/2	1 3/4	2 1/4	2 3/4	—

Mill Straightness Tolerances[d]

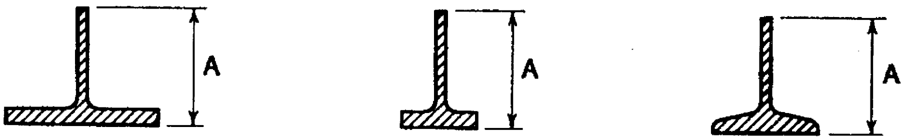
Camber	$\frac{1}{8}$ in. $\times$ $\frac{\text{(total length, ft)}}{10}$
Sweep	Due to the extreme variations in flexibility of these shapes, permitted variations for sweep are subject to negotiation between the manufacturer and purchaser for the individual sections involved.

Other Permissible Rolling Variations

Area and Weight	± 2.5 percent theoretical or specified amount.
Ends Out of Square	S Shapes, M Shapes and Channels 1/64 in., per in. of depth.

— Indicates that there is no requirement.
[a] ***A*** is measured at center line of web for beams and at back of web for channels.
[b] ***T*** + ***T′*** applies when flanges of channels are toed in or out.
[c] The permitted variation under the specified length is 0 in. for all lengths. There are no requirements for lengths over 65 ft.
[d] The tolerances herein are taken from ASTM A6 and apply to the straightness of members received from the rolling mill, measured as illustrated in Figure 1–1. For tolerance on induced camber and sweep, see Code of Standard Practice Section 6.4.4.

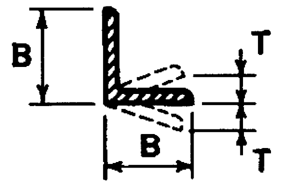
Table 1–24
ASTM A6 Tolerances for WT, MT, and ST Shapes



Permissible Variations in Depth	
Dimension A may be approximately one-half beam depth or any dimension resulting from off-center splitting or splitting on two lines, as specified in the order.	
Depth of Shape from which Tee is Split, in.	**Variations in Depth A, Over and Under**
To 6, excl.	1/8
6 to 16, excl.	3/16
16 to 20, excl.	1/4
20 to 24, excl.	5/16
24 and over	3/8
The above variations in depths of tees include the permissible variations in depth for the beams before splitting	
Mill Straightness Tolerances[a]	
Camber and Sweep	$\frac{1}{8}$ in. $\times$ $\frac{\text{(total length, ft)}}{5}$
Other Permissible Rolling Variations	
Other permissible variations in cross section as well as permissible variations in length, area, weight, ends out-of-square, and sweep will correspond to those of the beam before splitting.	

— Indicates that there is no requirement.
[a] The tolerances herein are taken from ASTM A6 and apply to the straightness of members received from the rolling mill, measured as illustrated in Figure 1–1. For tolerance on induced camber and sweep, see Code of Standard Practice Section 6.4.4.

Table 1–25
ASTM A6 Tolerances for Angles, Structural Size



Permissible Cross-Sectional Variations

Shape	Nominal Leg Size[a], in.	*B* Leg Size, in. Over	*B* Leg Size, in. Under	*T* Out of Square per in. of *B*, in.
Angles	3 to 4, incl.	1/8	3/32	3/128[b]
	Over 4 to 6, incl.	1/8	1/8	
	Over 6	3/16	1/8	

Permissible Variations in Length

Variations Over Specified Length for Lengths Given[c], in.

5 to 10 ft, excl.	10 to 20 ft, excl.	20 to 30 ft, incl.	Over 30 to 40 ft, incl.	Over 40 to 65 ft, incl.
1	1 1/2	1 3/4	2 1/4	2 3/4

Mill Straightness Tolerances[d]

Camber	$\frac{1}{8}$ in. $\times \frac{\text{(total length, ft)}}{5}$, applied to either leg
Sweep	Due to the extreme variations in flexibility of these shapes, permitted variations for sweep are subject to negotiation between the manufacturer and purchaser for the individual sections involved.

Other Permissible Rolling Variations

Area and Weight	± 2.5 percent theoretical or specified amount.
Ends Out of Square	3/128 in. per in. of leg length, or 1 1/2 degrees. Variations based on the longer leg of unequal angle.

[a] For unequal leg angles, longer leg determines classification.
[b] 3/128 in. per in. = 1 1/2 degrees.
[c] The permitted variation under the specified length is 0 in. for all lengths. There are no requirements for lengths over 65 ft.
[d] The tolerances herein are taken from ASTM A6 and apply to the straightness of members received from the rolling mill, measured as illustrated in Figure 1–1. For tolerance on induced camber and sweep, see Code of Standard Practice Section 6.4.4.

Table 1–26
ASTM A6 Tolerances for Angles, Bar Size[a]

Permissible Cross-Sectional Variations

Specified Leg Size[b], in.	Variations in Thickness for Thicknesses Given, Over and Under, in.			*B* Leg Size, Over and Under, in.	*T* Out of Square per Inch of *B*, in.
	3/16 and Under	Over 3/16 to 3/8 incl.	Over 3/8		
1 and Under	0.008	0.010	—	1/32	3/128[c]
Over 1 to 2, incl.	0.010	0.010	0.012	3/64	
Over 2 to 3, excl.	0.012	0.015	0.015	1/16	

Permissible Variations in Length

Section	Variations Over Specified Length for Lengths Given[d], in.				
	5 to 10 ft, excl.	10 to 20 ft, excl.	20 to 30 ft, incl.	Over 30 to 40 ft, incl.	40 to 65 ft, incl.
All bar-size angles	5/8	1	$1\frac{1}{2}$	2	$2\frac{1}{2}$

Mill Straightness Tolerances[e]

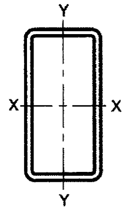
Camber	1/4 in. in any 5 ft, or 1/4 in. $\times \frac{(\text{total length, ft})}{5}$, applied to either leg
Sweep	Due to the extreme variations in flexibility of these shapes, permitted variations for sweep are subject to negotiation between the manufacturer and purchaser for the individual sections involved.

Other Permissible Rolling Variations

Ends Out of Square	3/128 in. per in. of leg length, or $1\frac{1}{2}$ degrees. Variations based on the longer leg of unequal angle.

— Indicates that there is no requirement.
[a] A member is "bar size" when its greatest cross-sectional dimension is less than 3 inches.
[b] For unequal angles, longer leg determines classification.
[c] 3/128 in. per in. = $1\frac{1}{2}$ degrees.
[d] The permitted variation under the specified length is 0 in. for all lengths. There are no requirements for lengths over 65 ft.
[e] The tolerances herein are taken from ASTM A6 and apply to the straightness of members received from the rolling mill, measured as illustrated in Figure 1–1. For tolerance on induced camber and sweep, see Code of Standard Practice Section 6.4.4.

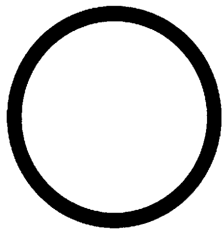
Table 1-27
Tolerances for Rectangular and Square HSS



<table>
<tr><th colspan="5">ASTM A500, ASTM A501, ASTM A618, and ASTM A847</th></tr>
<tr><td rowspan="3">Outside Dimensions</td><td colspan="4">The outside dimensions, measured across the flats at positions at least 2 in. from either end, shall not vary from the specified dimensions by more than the applicable amount given in the following table:</td></tr>
<tr><td colspan="2">Largest Outside Dimension Across Flats, in.</td><td colspan="2">Permissible Variation Over and Under Specified Dimensions[a,b], in.</td></tr>
<tr><td colspan="2">$2\frac{1}{2}$ and under
Over $2\frac{1}{2}$ to $3\frac{1}{2}$, incl.
Over $3\frac{1}{2}$ to $5\frac{1}{2}$, incl.
Over $5\frac{1}{2}$</td><td colspan="2">0.020
0.025
0.030
1 percent[c]</td></tr>
<tr><td rowspan="5">Length</td><td colspan="4">HSS are commonly produced in random lengths, in multiple lengths, and in definite cut lengths. When cut lengths are specified for HSS, the length tolerances shall be in accordance with the following table:</td></tr>
<tr><td colspan="4">Length tolerance for specified cut lengths, in.</td></tr>
<tr><td colspan="2">22 ft and under</td><td colspan="2">Over 22 to 44 ft, incl.</td></tr>
<tr><td>Over</td><td>Under</td><td>Over</td><td>Under</td></tr>
<tr><td>$\frac{1}{2}$</td><td>$\frac{1}{4}$</td><td>$\frac{3}{4}$</td><td>$\frac{1}{4}$</td></tr>
<tr><td>Wall Thickness</td><td colspan="4">ASTM A500 and ASTM A847 only: The tolerance for wall thickness exclusive of the weld area shall be plus and minus 10 percent of the nominal wall thickness specified. The wall thickness is to be measured at the center of the flat.</td></tr>
<tr><td>Weight</td><td colspan="4">ASTM A501 only: The weight of HSS, as specified in ASTM A501 Tables 4, 5, and 6, shall not be less than the specified value by more than 3.5 percent.</td></tr>
<tr><td>Mass</td><td colspan="4">ASTM A618 only: The mass shall not be less than the specified value by more than 3.5 percent.</td></tr>
<tr><td>Straightness</td><td colspan="4">The permissible variation for straightness shall be $\frac{1}{8}$ in. times the number of ft of total length divided by 5.</td></tr>
<tr><td>Squareness of Sides</td><td colspan="4">Adjacent sides may deviate from 90 degrees by a tolerance of plus or minus 2 degrees maximum.</td></tr>
<tr><td>Radius of Corners</td><td colspan="4">The radius of any outside corner of the section shall not exceed 3 times the specified wall thickness[d].</td></tr>
<tr><td rowspan="4">Twist</td><td colspan="4">The tolerances for twist with respect to axial alignment of the section shall be as shown in the following table:</td></tr>
<tr><td colspan="2">Specified Dimension of Longest Side, in.</td><td colspan="2">Maximum Twist per 3 ft and in Each Additional 3 ft, in.</td></tr>
<tr><td colspan="2">$1\frac{1}{2}$ and under
Over $1\frac{1}{2}$ to $2\frac{1}{2}$, incl.
Over $2\frac{1}{2}$ to 4, incl.
Over 4 to 6, incl.
Over 6 to 8, incl.
Over 8</td><td colspan="2">0.050
0.062
0.075
0.087
0.100
0.112</td></tr>
<tr><td colspan="4">Twist shall be determined by holding one end of the HSS down on a flat surface plate, measuring the height that each corner on the bottom side of the tubing extends above the surface plate near the opposite ends of the HSS, and calculating the difference in the measured heights of such corners.</td></tr>
</table>

[a] The respective outside dimension tolerances include the allowances for convexity and concavity.
[b] ASTM A500 and ASTM A847 HSS only: The tolerances given are for the large flat dimension only. For HSS having a ratio of outside large to small flat dimension less than 1.5, the tolerance on the small flat dimesion shall be identical to those given. For HSS having a ratio of outside large to small flat dimension in the range of 1.5 to 3.0 inclusive, the tolerance on the small flat dimesion shall be 1.5 times those given. For HSS having a ratio of outside large to small flat dimension greater than 3.0, the tolerance on the small flat dimension shall be 2.0 times those given.
[c] ASTM A500 HSS only: This value is 0.1 times the large flat dimension.
[d] ASTM A501 HSS only: The radius of any outside corner must not exceed 3 times the calculated nominal wall thickness.
[e] ASTM A500, ASTM A501, and ASTM A847 HSS only: For heavier sections it shall be permissible to use a suitable measuring device to determine twist. Twist measurements shall not be taken within 2 in. of the ends of the HSS.

Table 1–28
Tolerances for Round HSS and Pipe



<table>
<tr><th colspan="5">ASTM A53</th></tr>
<tr><td>Weight</td><td colspan="4">The weight as specified in ASTM A53 Table X2.2 and Table X2.3 or as calculated from the relevant equation in ANSI/ASME B36.10M shall not vary by more than ±10 percent. Note that the weight tolerance is determined from the weights of the customary lifts of pipe as produced for shipment by the mill, divided by the number of ft of pipe in the lift. On pipe sizes over 4 in. where individual lengths may be weighed, the weight tolerance is applicable to the individual length.</td></tr>
<tr><td>Diameter</td><td colspan="4">For pipe 2 in. and over in nominal diameter, the outside diameter shall not vary more than ± 1 percent from the standard specified.</td></tr>
<tr><td>Thickness</td><td colspan="4">The minimum wall thickness at any point shall not be more than 12.5 percent under the nominal wall thickness specified.</td></tr>
<tr><th colspan="5">ASTM A500 and ASTM A847</th></tr>
<tr><td>Diameter[a]</td><td colspan="4">For HSS 1.900 in. and under in nominal diameter, the outside diameter shall not vary more than ± 0.5 percent, rounded to the nearest 0.005 in., from the nominal diameter specified.
For HSS 2.000 in. and over in nominal diameter, the outside diameter shall not vary more than ± 0.75 percent, rounded to the nearest 0.005 in., from the nominal diameter specified.</td></tr>
<tr><td>Thickness</td><td colspan="4">The wall thickness at any point, excluding the weld seam of welded tubing, shall not be more than 10 percent under or over the nominal wall thickness specified.</td></tr>
<tr><th colspan="5">ASTM A501 and ASTM A618</th></tr>
<tr><td>Outside Dimensions</td><td colspan="4">For HSS $1\frac{1}{2}$ inches and under in nominal size, the outside diameter shall not vary more than $\frac{1}{64}$ in. over nor more than $\frac{1}{32}$ in. under the specified diameter.
For round hot-formed HSS 2 in. and over in nominal size, the outside diameter shall not vary more than ± 1 percent from the specified diameter.</td></tr>
<tr><td>Weight
(A501 only)</td><td colspan="4">The weight of HSS, as specified in ASTM A501 Tables 4, 5, and 6, shall not be less than the specifie value by more than 3.5 percent.</td></tr>
<tr><td>Mass
(A618 only)</td><td colspan="4">The mass of HSS shall not be less than the specified value by more than 3.5 percent. The mass tolerance shall be determined from individual lengths or, for HSS $4\frac{1}{2}$ in. and under in nominal size, shall be determined from masses of customary lifts produced by the mill.</td></tr>
<tr><th colspan="5">ASTM A500, ASTM A501, ASTM A618 and ASTM A847</th></tr>
<tr><td rowspan="5">Length</td><td colspan="4">HSS are commonly produced in random mill lengths, in multiple lengths, and in definite cut lengths. When cut lengths are specified for HSS, the length tolerances shall be in accordance with the following table:</td></tr>
<tr><td colspan="4">Length tolerance for specified cut lengths, in.</td></tr>
<tr><td colspan="2">22 ft and under</td><td colspan="2">Over 22 to 44 ft, incl.</td></tr>
<tr><td>Over</td><td>Under</td><td>Over</td><td>Under</td></tr>
<tr><td>$\frac{1}{2}$</td><td>$\frac{1}{4}$</td><td>$\frac{3}{4}$</td><td>$\frac{1}{4}$</td></tr>
<tr><td>Straightness</td><td colspan="4">The permissible variation for straightness of HSS shall be $\frac{1}{8}$ in. times the number of ft of total length divided by 5.</td></tr>
<tr><td colspan="5">[a] The outside diameter measurements shall be taken at least 2 in. from the end of the HSS.</td></tr>
</table>

Table 1–29
Rectangular Sheared Plates
Permissible Variations from Flatness
(Carbon Steel Only)

Specified Thickness, in.	Variations from Flatness for Specified Widths, in.							
	To 36, excl.	36 to 48, excl.	48 to 60, excl.	60 to 72, excl.	72 to 84, excl.	84 to 96, excl.	96 to 108, excl.	108 to 120, excl.
To 1/4, excl.	9/16	3/4	15/16	1 1/4	1 3/8	1 1/2	1 5/8	1 3/4
1/4 to 3/8, excl.	1/2	5/8	3/4	15/16	1 1/8	1 1/4	1 3/8	1 1/2
3/8 to 1/2, excl.	1/2	9/16	5/8	5/8	3/4	7/8	1	1 1/8
1/2 to 3/4, excl.	7/16	1/2	9/16	5/8	5/8	3/4	1	1
3/4 to 1, excl.	7/16	1/2	9/16	5/8	5/8	5/8	3/4	7/8
1 to 2, excl.	3/8	1/2	1/2	9/16	9/16	5/8	5/8	5/8
2 to 4, excl.	5/16	3/8	7/16	1/2	1/2	1/2	1/2	9/16
4 to 6, excl.	3/8	7/16	1/2	1/2	9/16	9/16	5/8	3/4
6 to 8, excl.	7/16	1/2	1/2	5/8	11/16	3/4	7/8	7/8

Notes:
1. The longer dimension specified is considered the length, and permissible variations in flatness along the length should not exceed the tabular amount for the specified width in plates up to 12 ft in length, or in any 12 ft for longer plates.
2. The flatness variations across the width should not exceed the tabular amount for the specified width.
3. When the longer dimension is under 36 in., the permissible variation should not exceed 1/4 in. When the longer dimension is from 36 to 72 in., inclusive, the permissible variation should not exceed 75 percent of the tabular amount for the specified width, but in no case less than 1/4 in.
4. These variations apply to plates which have a specified minimum tensile strength of not more than 60 ksi or comparable chemistry or hardness. The limits in the table are increased 50 percent for plates specified to a higher minimum tensile strength or comparable chemistry or hardness.
5. For plates 8 in. and over in thickness or 120 in. and over in width, see ASTM A6 Table 13.

Permissible Variations in Camber[a] for Carbon Steel Sheared and Gas Cut Rectangular Plates

Maximum permissible camber, in. (all thicknesses) = $\frac{1}{8}\text{ in.} \times \frac{\text{(total length, ft)}}{5}$

Permissible Variations in in Camber[a] for High-Strength Low-Alloy and Alloy Steel Sheared, Special-Cut, or Gas-Cut Rectangular Plates

Dimension, in.		Camber for Thicknesses and Widths Given
Thickness	Width	
To 2, incl.	All	$\frac{1}{8}\text{ in.} \times \frac{\text{(total length, ft)}}{5}$
Over 2 to 15, incl.	To 30, incl.	$\frac{3}{16}\text{ in.} \times \frac{\text{(total length, ft)}}{5}$
	Over 30 to 60, incl.	$\frac{1}{4}\text{ in.} \times \frac{\text{(total length, ft)}}{5}$

[a] Camber as it relates to plates is the horizontal edge curvature in the length, measured over the entire length of the plate in the flat position.

PART 2

GENERAL DESIGN CONSIDERATIONS

SCOPE

The specification requirements and other design considerations summarized in this Part apply in general to the design and construction of steel buildings. For seismic force resisting systems in which the seismic response modification factor, *R*, is taken greater than 3, the requirements in the AISC *Seismic Provisions for Structural Steel Buildings* also apply. The AISC *Seismic Provisions for Structural Steel Buildings* is available in Part 6 of the AISC *Seismic Design Manual* from the American Institute of Steel Construction, Inc. at www.aisc.org.

APPLICABLE SPECIFICATIONS, CODES, AND STANDARDS

Specifications, Codes, and Standards for Structural Steel Buildings

Subject to the requirements in the applicable building code and the contract documents, the design, fabrication, and erection of structural steel buildings is governed as indicated in the AISC Specification Sections A1 and B2 as follows:

1. ASCE 7: *Minimum Design Loads for Buildings and Other Structures,* SEI/ASCE 7-02. Available from the American Society of Civil Engineers, ASCE 7 provides the general requirements for loads, load factors, and load combinations.
2. AISC Specification: The 2005 AISC *Specification for Structural Steel Buildings,* included in Part 16 of this Manual and available at www.aisc.org, provides the general requirements for design and construction.
3. Code of Standard Practice: The 2005 AISC *Code of Standard Practice for Steel Buildings and Bridges,* included in Part 16 of this manual and available at www.aisc.org, provides the standard of custom and usage for the fabrication and erection of structural steel.

Other referenced standards include:

1. RCSC Specification: The 2004 RCSC *Specification for Structural Joints Using ASTM A325 or A490 Bolts,* reprinted in Part 16 of this Manual with the permission of the Research Council on Structural Connections and available at www.boltcouncil.org, provides the additional requirements specific to bolted joints with high-strength bolts.
2. AWS D1.1: *Structural Welding Code—Steel,* AWS D1.1:2004. Available from the American Welding Society, AWS D1.1 provides additional requirements specific to welded joints. Requirements for the proper specification of welds can be found in AWS A2.4: *Standard Symbols for Welding, Brazing, and Nondestructive Examination.*
3. ACI 318: *Building Code Requirements for Structural Concrete.* Available from the American Concrete Institute, ACI 318 provides additional requirements for reinforced concrete, including in composite design and the design of steel-to-concrete anchorage.

Various other specifications and standards from ASME, ASTM, and ACI are also referenced in AISC Specification Section A2.

Additional Requirements for Seismic Applications

The 2005 AISC *Seismic Provisions for Structural Steel Buildings* apply when the seismic response modification factor, *R*, is taken greater than 3, or when required by the applicable building code. This specification is available in Part 6 of the AISC *Seismic Design Manual* and at www.aisc.org. When R is taken equal to or less than 3, these additional requirements do not apply.

Other AISC Reference Documents

The following other AISC publications may be of use in the design and construction of structural steel buildings:

1. AISC *Design Examples* is a CD-based companion to this Manual and includes design examples outlining the application of design aids and Specification provisions developed in coordination with this Manual.
2. AISC's *Detailing for Steel Construction*, Second Edition, covers the standard practices and recommendations for steel detailing, including preparation of shop and erection drawings.
3. The AISC *Seismic Design Manual* provides guidance on steel design in seismic applications, in accordance with the AISC Seismic Provisions.

Additionally, the following AISC Design Guides are available at www.aisc.org for in-depth coverage of specific topics in steel design:

1. *Column Base Plates*, AISC Design Guide No. 1 (DeWolf, 1990).
2. *Design of Steel and Composite Buildings with Web Openings*, AISC Design Guide No. 2 (Darwin, 1990).
3. *Serviceability Design Considerations for Low-Rise Buildings*, AISC Design Guide No. 3 (West and Fisher, 2003).
4. *Extended End-Plate Moment Connections*, AISC Design Guide No. 4 (Murray, 2004).
5. *Design of Low- and Medium-Rise Steel Buildings*, AISC Design Guide No. 5 (Allison, 1991).
6. *Load and Resistance Factor Design of W-Shapes Encased in Concrete*, AISC Design Guide No. 6 (Griffis, 1992).
7. *Industrial Buildings: Roofs to Column Anchorage*, AISC Design Guide No. 7 (Fisher, 2005).
8. *Partially Restrained Composite Connections*, AISC Design Guide No. 8 (Leon, Hoffman, and Staeger, 1996).
9. *Torsional Analysis of Structural Steel Members*, AISC Design Guide No. 9 (Seaburg and Carter, 1997).
10. *Erection Bracing of Low-Rise Structural Steel Frames*, AISC Design Guide No. 10 (Fisher and West, 1997).
11. *Floor Vibrations Due to Human Activity*, AISC Design Guide No. 11 (Murray, Allen and Ungar, 1997).
12. *Modification of Existing Welded Steel Moment Frames for Seismic Resistance*, AISC Design Guide No. 12 (Gross, Engelhardt, Uang, Kasai, and Iwankiw, 1999).
13. *Wide-Flange Column Stiffening at Moment Connections: Wind and Seismic Applications*, AISC Design Guide No. 13 (Carter, 1999).
14. *Staggered Truss Framing Systems,* AISC Design Guide No. 14 (Wexler and Lin, 2001).
15. *AISC Rehabilitation and Retrofit Guide: A Reference for Historic Shapes and Specifications*, AISC Design Guide No. 15 (Brockenbrough, 2002).
16. *Flush and Extended Multiple-Row Moment End-Plate Connections*, AISC Design Guide No. 16 (Murray and Shoemaker, 2002).

17. *High-Strength Bolts—A Primer for Structural Engineers,* AISC Design Guide No. 17 (Kulak, 2002).
18. *Steel-Framed Open-Deck Parking Structures,* AISC Design Guide No. 18 (Churches, Troup, and Angeloff, 2003).
19. *Fire Resistance of Structural Steel Framing,* AISC Design Guide No. 19 (Ruddy, Marlo, Ioannides, and Alfawakhiri, 2003).

OSHA REQUIREMENTS

OSHA Safety and Health Standards for the Construction Industry, 29 CFR 1926 Part R Safety Standards for Steel Erection, must be addressed in the design, detailing, fabrication, and erection of steel structures. These regulations became effective on July 18, 2001, except for requirements for slip-resistance certification of painted surfaces (see "Walking/Working Surfaces" below), which are expected to become effective on July 18, 2006. A brief summary of selected provisions is available (Barger and West, 2001). The full text of the regulations should be consulted and can be found at www.osha.gov.

USING THE 2005 AISC SPECIFICATION

The 2005 AISC *Specification for Structural Steel Buildings* (AISC 360-05) unifies the design provisions formerly presented in the 1989 *Specification for Structural Steel Buildings: Allowable Stress Design and Plastic Design* and the 1999 *Load and Resistance Factor Design Specification for Structural Steel Buildings*. It also integrates into a single document the information previously provided in the 1993 *Load and Resistance Factor Design Specification for Single-Angle Members* and the 1997 *Specification for the Design of Steel Hollow Structural Sections*. This new unified specification, in combination with the 2005 *Seismic Provisions for Structural Steel Buildings* (AISC 341-05), brings together all of the provisions needed for the design of structural steel in buildings and other structures.

The 2005 AISC Specification presents two approaches for the design of structural steel members and connections. Chapter B establishes the general requirements for analysis and design. It states that, "designs shall be made according to the provisions for Load and Resistance Factor Design (LRFD) or to the provisions for Allowable Strength Design (ASD)." These two approaches are equally valid for any structure for which the Specification is applicable. There is no preference stated or implied in the provisions.

The required strength of structural members and connections may be determined by elastic, inelastic, or plastic analysis for the load combinations associated with either LRFD or ASD and as stipulated by the applicable building code. In all cases, the available strength must exceed the required strength. The AISC Specification gives provisions for determining the available strength as summarized below.

Load and Resistance Factor Design (LRFD)

Load and Resistance Factor Design according to the 2005 AISC Specification is essentially the same as LRFD according to the previous three LRFD specifications. Although some of the provisions have changed from previous specifications, the overall approach has remained constant. If there is a desire to use the LRFD provisions in the form of stresses, the strength provisions can be transformed into stress provisions by factoring out the appropriate section property.

The load combinations appropriate for LRFD are given in the applicable building code or, in its absence, ASCE 7 Section 2.3. For LRFD, the available strength is referred to as the design strength. All of the LRFD provisions are structured so that the design strength must equal or exceed the required strength. This is presented in Section B3.3 as

$$R_u \leq \phi R_n$$

In this equation, R_u is the required strength determined by analysis for the LRFD load combinations, R_n is the nominal strength determined according to the specification provisions, and ϕ is the resistance factor given by the specification for a particular limit-state. Throughout this Manual, tabulated values of ϕR_n, the design strength, are given for LRFD. These values are tabulated as blue numbers in columns with the heading LRFD.

Allowable Strength Design (ASD)

Allowable Strength Design is similar to what is known as Allowable Stress Design in that they are both carried out at the same load level. Thus, the same load combinations are used. The difference is that for strength design, the primary provisions are given in terms of forces or moments rather than stresses. In every situation, these strength provisions can be transformed into stress provisions by factoring out the appropriate section property.

The load combinations appropriate for ASD are given by the applicable building code or, in its absence, ASCE 7 Section 2.4. For ASD, the available strength is referred to as the allowable strength. All of the ASD provisions are structured so that the allowable strength must equal or exceed the required strength. This is presented in Section B3.4 as

$$R_a \leq R_n / \Omega$$

In this equation, R_a is the required strength determined by analysis for the ASD load combinations, R_n is the nominal strength determined according to the specification provisions, and Ω is the safety factor given by the specification for a particular limit-state. Throughout this Manual, tabulated values of R_n/Ω, the allowable strength, are given for ASD. These values are tabulated as black numbers on a green background in columns with the heading ASD.

DESIGN FUNDAMENTALS

It is commonly believed that ASD was an elastic design method based entirely in a stress format without limit-states and LRFD was an inelastic design method based entirely in a strength format with limit-states. Traditional ASD was based in limit-states principles too, but without the use of the term. Additionally, either method can be formulated in a stress or strength basis, and both take advantage of inelastic behavior. The 2005 AISC Specification highlights how similar LRFD and ASD are in its formulation, with identical provisions throughout for LRFD and ASD.

Design according to the 2005 Specification, whether it is according to LRFD or ASD, is based on limit states design principles, which define the boundaries of structural usefulness. Strength limit states relate to load carrying capability and safety. Serviceability limit-states relate to performance under normal service conditions. Structures must be proportioned so that no applicable strength or serviceability limit-state is exceeded.

Normally, several limit-states will apply in the determination of the nominal strength of a structural member or connection. The controlling limit-state is normally the one that results in the least available strength. As an example, the controlling limit-state for bending of a simple beam may be yielding, local buckling, or lateral-torsional buckling for strength, or deflection or vibration for serviceability. The tabulated values may either reflect a single limit-state or a combination of several limit-states. This will be clearly stated in the introduction to the particular tables.

Loads, Load Factors, and Load Combinations

Based on Specification Sections B3.3 and B3.4, the required strength (either P_u, M_u, V_u, etc. for LRFD or P_a, M_a, V_a, etc. for ASD) is determined for the appropriate load magnitudes, load factors, and load combinations given in the applicable building code. These are usually based on ASCE-7, which may be used when there is no applicable building code. The common loads found in building structures are:

D = dead load
L = live load due to occupancy
L_r = roof live load
S = snow load
R = nominal load due to initial rainwater or ice exclusive of the ponding contribution
W = wind load
E = earthquake load

Load and Resistance Factor Design

For LRFD, the required strength is determined from the following factored combinations[1], which are based on ASCE-7 Section 2.3:

$$1.4D \quad (1)$$
$$1.2D + 1.6L + 0.5(L_r \text{ or } S \text{ or } R) \quad (2)$$
$$1.2D + 1.6(L_r \text{ or } S \text{ or } R) + (0.5L \text{ or } 0.8W) \quad (3)$$
$$1.2D + 1.6W + 0.5L + 0.5(L_r \text{ or } S \text{ or } R) \quad (4)$$
$$1.2D \pm 1.0E + 0.5L + 0.2S \quad (5)$$
$$0.9D \pm (1.6W \text{ or } 1.0E) \quad (6)$$

The load combinations for LRFD recognize that, when several transient loads act in combination, only one assumes its maximum lifetime value[2], while the other(s) are at their "arbitrary-point-in-time" (APT) values. Each combination models the total design loading condition when a different load is at its maximum. Thus, the maximum-lifetime load effect is amplified by an amount that is proportional to its relative variability and the APT load effect(s) are factored to their mean value(s). With this approach, the margin of safety varies with the load combination yielding a more uniform reliability than would be expected when nominal loads are combined directly.

Dead load, D, is present in each load combination with a load factor of 1.2, except in load combination 1, where it is the dominant (only) load effect, and load combination 6, where it is reduced for calculation of the overturning or uplift effect. The 1.2 load factor accounts

[1] Exception: Per ASCE 7, the load factor on L in combinations 3, 4, and 5 shall equal 1.0 for garages, areas occupied as places of public assembly, and all areas where the live load is greater than 100 psf.

[2] Usually based upon a 50-year recurrence, except for seismic loads.

for the statistical variability of the dead load. The designer must independently account for other contributions to dead load, such as the weight of additional concrete, if any, added to adjust for concrete ponding effects (Ruddy, 1986) or differing framing elevations.

Allowable Strength Design

For ASD, the required strength is determined from the following combinations, which are also based on ASCE-7 Section 2.4:

$$D \quad (1)$$
$$D + L \quad (2)$$
$$D + (L_r \text{ or } S \text{ or } R) \quad (3)$$
$$D + 0.75L + 0.75(L_r \text{ or } S \text{ or } R) \quad (4)$$
$$D \pm (W \text{ or } 0.7E) \quad (5)$$
$$D + 0.75(W \text{ or } 0.7E) + 0.75L + 0.75(L_r \text{ or } S \text{ or } R) \quad (6)$$
$$0.6D \pm (W \text{ or } 0.7E) \quad (7)$$

The load combinations for ASD combine the code-specified nominal loads directly with no factors for those cases where loads with minimal variation with time are combined, cases 1, 2, and 3. For those cases where multiple time-variable loads are included, a 0.75 reduction factor is applied to the time-variable loads only. Since all of the safety in an ASD design comes through the introduction of the safety factor on the resistance side of the equation, each load case uses the same safety factor for a given limit-state.

In ASD, when considering members subjected to gravity loading only, it is clear that the controlling load combination is the one that adds the larger live load to the dead load. Thus, for a floor that does not carry roof load, the controlling combination will be $D + L$, while, for a roof, the controlling combination will be D + (L_r or S or R). For gravity columns, after live load reductions have been accounted for, the floor and roof live loads may be reduced to 0.75 of their nominal values. A similar reduction is permitted for live loads in combination with lateral loads.

Superposition of Loads in Load Combinations

Whether the loads themselves or the effects of those loads are used in these combinations, LRFD or ASD, the results are the same, provided the principle of superposition is valid. This is true when deflections are small and the stress-strain behavior is nominally elastic. However, when second-order effects are significant or the behavior is inelastic, superposition is not valid and the loads, rather than the load effects, should be used in these combinations.

Nominal Strengths, Resistance Factors, Safety Factors, and Available Strengths

The 2005 AISC Specification requires that the available strength must be greater than the required strength for any element. The available strength is a function of the nominal strength given by the specification and the corresponding resistance factor or safety factor. As discussed earlier, the required strength can be determined either with LRFD or ASD load combinations.

The available strength for LRFD is the design strength, which is calculated as the product of the resistance factor ϕ and the nominal strength (ϕP_n, ϕM_n, ϕV_n, etc.) The available strength for ASD is the allowable strength, which is calculated as the quotient of the nominal strength and the corresponding safety factor Ω (P_n/Ω, M_n/Ω, V_n/Ω, etc.)

In LRFD, the margin of safety for the loads is contained in the load factors, and resistance factors, ϕ, account for unavoidable variations in materials, design equations, fabrication, and erection. In ASD, a single margin of safety for all of these effects is contained in the safety factor, Ω.

The resistance factors, ϕ, and safety factors, Ω, in the AISC Specification are based upon research (Galambos et al., 1978), and the experience and judgment of the AISC Committee on Specifications. In general, ϕ is less than unity and Ω is greater than unity. The higher the variability in the test data for a given nominal strength, the lower its ϕ factor and the higher its Ω factor will be. Some examples of ϕ and Ω factors for steel members are as follows:

ϕ = 0.90 for limit-states involving yielding
ϕ = 0.75 for limit-states involving rupture
Ω = 1.67 for limit-states involving yielding
Ω = 2.00 for limit-states involving rupture

The general relationship between the safety factor, Ω, and the resistance factor, ϕ, is

$$\Omega = \frac{1.5}{\phi}$$

Serviceability

Serviceability requirements of the 2005 AISC Specification are found in Section B3.7 and Chapter L. The serviceability limit-states should be selected appropriately for the specific application, as discussed in the Specification Commentary to Chapter L. Serviceability limit-states and the appropriate load combinations for checking their conformance to serviceability requirements can be found in ASCE 7 Appendix B and its Commentary. It should be noted that the load combinations in ASCE 7 Sections 2.3 for LRFD and 2.4 for ASD are both for strength design, and are not necessarily appropriate for consideration of serviceability.

Guidance is also available in the Commentary on the 2005 AISC Specification, both in general and for specific criteria, including camber, deflection, drift, vibrations, wind induced motion, expansion and contraction, and connection slip. Additionally, the applicable building code may provide some further guidance or establish requirements. See also the serviceability discussions in Parts 3 through 6, AISC Design Guide No. 3 *Serviceability Design Considerations for Steel Buildings* (Fisher and West, 2004), and AISC Design Guide No. 11 *Floor Vibrations Due to Human Activity* (Murray et al., 1997).

Required Strength, Stability, Effective Length, and Second-Order Effects

As previously discussed, the Specification requires that the required strength must be less than or equal to the available strength in the design of every member and connection. Chapter C also requires that stability shall be provided for the structure as a whole and each of its elements. Any method that considers the influence of second-order effects, also known as P-delta effects, may be used. Thus, required strengths must be determined including second-order effects, as described in Specification Section C2.1 or Appendix 7. Note that Specification Section C2.1 and Appendix 7 permit an amplified first-order analysis as one method of second-order analysis.

Second-order effects are the additional forces, moments, and displacements resulting from the applied loads acting in their displaced positions as well as the changes from the undeformed to the deformed geometry of the structure. Second-order effects are obtained by considering equilibrium of the structure within its deformed geometry. There are numerous ways of accounting for these effects. The commentary to AISC Specification Appendix 7 provides some guidance on methods of second-order analysis and suggests several benchmark problems for checking the adequacy of analysis methods.

Since the mid-1960s, there have been provisions in the AISC Specifications to account for second-order effects. Initially, these provisions were embedded in the interaction equations. In past ASD Specifications, second-order effects were accounted for by the term

$$\frac{1}{1-\dfrac{f_a}{F'_e}}$$

found in the interaction equation. In the previous three LRFD Specifications, the factors B_1 and B_2 from Chapter C of those specifications were used to amplify moments to account for second-order effects. B_1 was used to account for the second-order effects due to member curvature and B_2 was used to account for second-order effects due to sidesway. In both specifications, more exact methods were permitted.

The 2005 AISC Specification fully integrates the provisions for stability design with specified methods of second-order analysis. Section C1.3a provides that in braced frames, the effective length factor, K, may be taken as 1.0 and Section C1.3c provides that for gravity-only framing systems, K may also be taken as 1.0. For moment frames, Section C1.3b requires that a critical buckling analysis be performed according to Section C2. The determination of effective length is directly linked to the approach taken for second-order analysis. This is discussed in more detail in Commentary Section C2. Section C2 of the Specification details the requirements for determination of required strengths and, along with Appendix 7, provides three approaches that may be followed.

- The *Direct Analysis Method* is provided in Appendix 7. This is the most comprehensive and, as the name suggests, most direct approach to incorporating all necessary factors in the analysis. Through the use of notional loads, reduced stiffness, and a second-order analysis, the design can be carried out with the forces and moments from the analysis and an effective length equal to the member length, $K = 1.0$.
- The *Effective Length Method* is given in Section C2.2a. In this method, all gravity-only load cases have a minimum lateral load equal to 0.2 percent of the story gravity load applied. A second-order analysis is carried out and, depending on the ratio of the second-order drift to the first-order drift, the effective length may be taken as the member length, $K = 1.0$, or may have to be determined from analysis.
- The *First-Order Analysis Method* is given in Section C2.2b. With this approach, second-order effects are captured through the application of an additional lateral load equal to at least 0.42 percent of the story gravity load applied in each load case. No further second-order analysis is necessary. The required strengths are taken as the forces and moments obtained from the analysis and the effective length factor is $K = 1.0$.

When a second-order analysis is called for in the above methods, Section C2.1a allows any method that properly considers P-delta effects. This may be a true second-order analysis or a simplified approach. One such method is the Amplified First-Order Elastic Analysis provided in Section C2.1b. This is a modified carry over of the B_1/B_2 approach used in the previous LRFD Specification, which was an extension of the simple approach taken in past ASD Specifications.

Simplified Determination of Required Strength

The features of each of the foregoing methods are summarized and compared in Table 2–1. When a fast, conservative solution is desired, the following simplification of the Effective Length Method can be used.

The Effective Length Method and the Amplified First-Order Elastic Analysis approach of Section C2.1b can be used to accomplish the second-order analysis. The User Note in Section C2.1b indicates that for members where the member amplification (P-δ) factor is small, that is, $B_1 \leq 1.05$, it is conservative to amplify the total moment and force by B_2. Thus, equations C2-1a and C2-1b become

LRFD	ASD
$M_r = B_1 M_{nt} + B_2 M_{lt} = B_2 M_u$ $P_r = P_{nt} + B_2 P_{lt} = B_2 P_u$	$M_r = B_1 M_{nt} + B_2 M_{lt} = B_2 M_a$ $P_r = P_{nt} + B_2 P_{lt} = B_2 P_a$

To use this Simplified Method, B_1 should not exceed B_2. For members not subject to transverse loading between their ends, it is very unlikely that B_1 would be greater than 1.0. In addition, the simplified approach is not valid if the amplification factor B_2>1.5. It is up to the engineer to ensure that the frame is proportioned appropriately to use this simplified approach. In most designs, it is not advisable to have a final structure where the second-order amplification is greater than 1.5, although it is acceptable. In those cases, one should consider stiffening the structure.

Step 1: Perform a first-order elastic analysis. Gravity load cases must include a minimum lateral load at each story equal to 0.002 times the story gravity load where the story gravity load is the load introduced at that story, independent of any loads from above.

Step 2: Establish the design story drift limit and determine the lateral load that produces that drift. This is intended to be a measure of the lateral stiffness of the structure.

Step 3: Determine the ratio of the total story gravity load to the lateral load determined in Step 2. For an ASD design, this ratio must be multiplied by 1.6 before entering the Table below.

Design Story Drift Limit	Load Ratio from Step 3 (times 1.6 for ASD, 1.0 for LRFD)										
	0	5	10	20	30	40	50	60	80	100	120
H/100	1	1.1	1.1	1.3	1.5	–	–	–	–	–	–
H/200	1	1	1.1	1.1	1.2	1.3	1.4	1.5	–	–	–
H/300	1	1	1	1.1	1.1	1.2	1.2	1.3	1.5	–	–
H/400	1	1	1	1.1	1.1	1.1	1.2	1.2	1.3	1.4	1.5
H/500	1	1	1	1	1.1	1.1	1.1	1.2	1.2	1.3	1.4

Step 4: Multiply all of the forces and moments from the first-order analysis by the value obtained from the Table below. Use the resulting forces and moments as the required strengths for the designs of all members and connections.

Step 5: For all cases where the multiplier is 1.1 or less, shown shaded in the table above, the effective length may be taken as the member length, $K = 1.0$. For cases where the multiplier is greater than 1.1 but does not exceed 1.5, determine the effective length factor through analysis, such as with the alignment charts of the Commentary. For cases where no value is shown for the multiplier, the structure must be stiffened in order to use this simplified approach.

Step 6: Ensure that the drift limit set in Step 2 is not exceeded and revise design as needed.

STABILITY BRACING

Beams, girders, and trusses must be restrained against rotation about their longitudinal axes at points of support (a basic assumption stated in the preamble of Specification Chapter F). Additionally, stability bracing with adequate strength and stiffness must be provided consistent with that assumed at braced points in the analysis for frames, columns, and beams (see Appendix 6). Some guidance for special cases follows:

Simple-Span Beams

In general, adequate lateral bracing is provided to the compression flange of a simple-span beam by the connections of infill beams, joists, concrete slabs, metal deck, concrete slabs on metal deck, and similar framing elements.

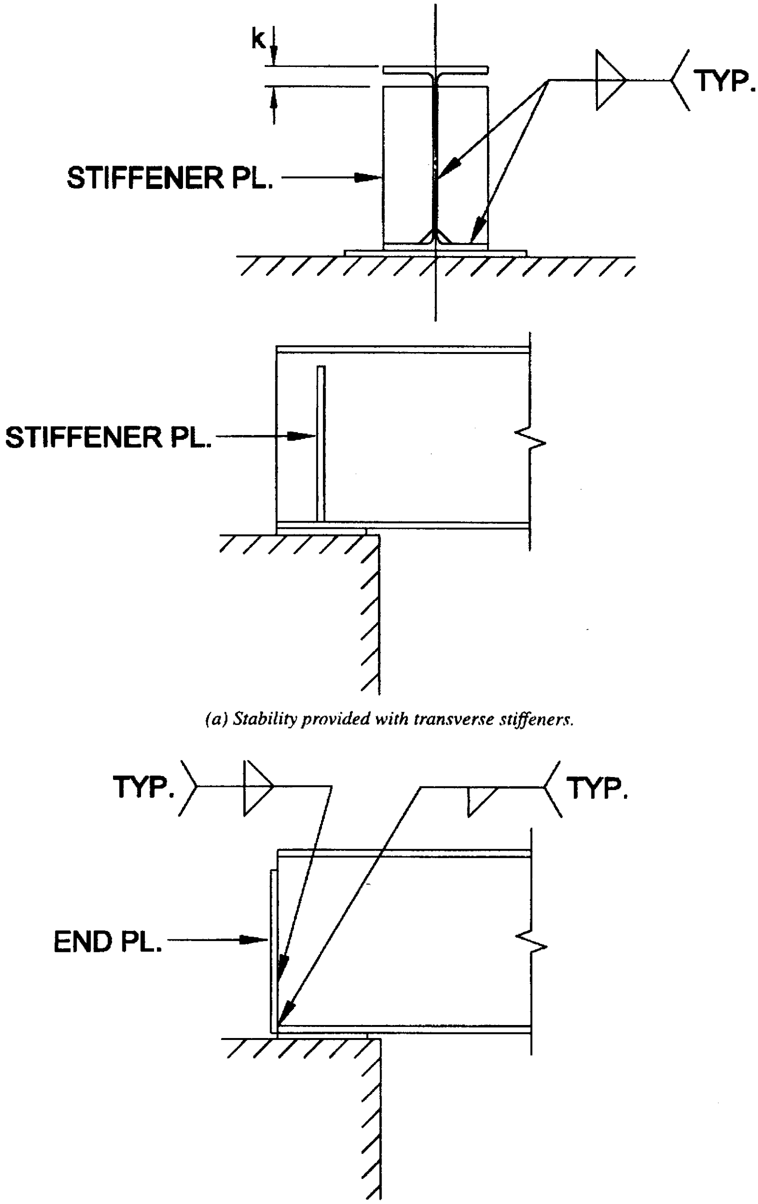
Beam Ends Supported on Bearing Plates

The stability of a beam end supported on a bearing plate can be provided in one of several ways (see Figure 2-1):

1. The beam end can be built into solid concrete or masonry using anchorage devices.
2. The beam top flange can be stabilized through interconnection with a floor or roof system, provided that system is itself anchored to prevent its translation relative to the beam bearing.
3. A top-flange stability connection can be provided.
4. An end-plate or transverse stiffeners located over the bearing plate extending to near the top-flange k-distance can be provided. Such stiffeners must be welded to the top of the bottom flange and to the beam web, but need not extend to or be welded to the top flange.

In each case, the beam and bearing plate must also be anchored to the support. For the design of beam bearing plates, see Part 14.

In atypical framing situations, such as when very deep beams are used, the strength and stiffness requirements in AISC Specification Appendix 6 can be applied to ensure the stability of the assembly. It may also be possible to demonstrate in a limited number of cases, such as with beams with thick webs and relatively shallow depths, that the beam has been properly designed without providing the details described above. In this case, the beam and bearing plate must still be anchored to the support. In any case, it should be noted that the assembly must also meet the requirements in AISC Specification Section J11.



(a) Stability provided with transverse stiffeners.

(b) Stability provided with an end-plate.

ANCHOR BEAM AND/OR BEARING PL. AS REQUIRED

Figure 2–1. Beam end supported on bearing plate.

Beams and Girders Framing Continuously Over Columns

Roof framing is commonly configured with cantilevered beams that frame continuously over the tops of columns to support drop-in beams between the cantilevered segments (Rongoe, 1996; CISC, 1989). It is also commonly desirable to provide an assembly in which the intersection of the beam and column can be considered a braced point for the design of both the continuous cantilevering beam and the column top. The required stability can be provided in several ways (see Figure 2–2):

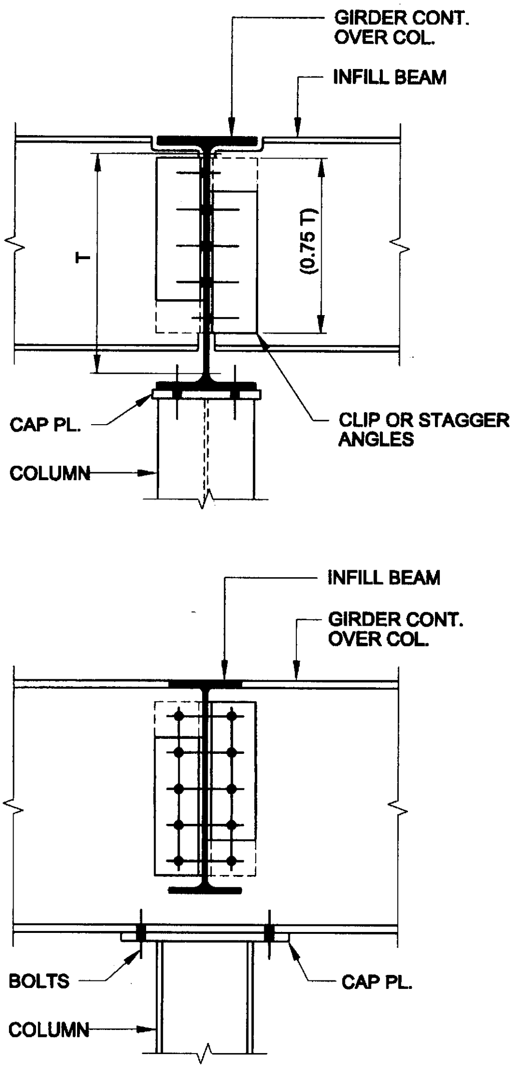


Figure 2–2a. Beam framing continuously over column top, stability provided with connections of infill beams.

1. When an infill beam frames into the continuous beam at the column top, the required stability normally can be provided by using connection element(s) for the infill beam that cover three-quarters or more of the T-dimension of the continuous beam. Alternatively, connection elements that cover less than three-quarters of the T-dimension of the continuous beam can be used in conjunction with partial-depth stiffeners in the beam web along with a moment connection between the column top and beam bottom to maintain alignment of the beam/column assembly. A cap plate of reasonable proportions and four bolts will normally suffice.

   In either case, note that OSHA requires that, if two framing infill beams share common holes through a column web or the web of a beam that frames continuously over the top of a column[3], the beam erected first must remain attached while connecting the second.

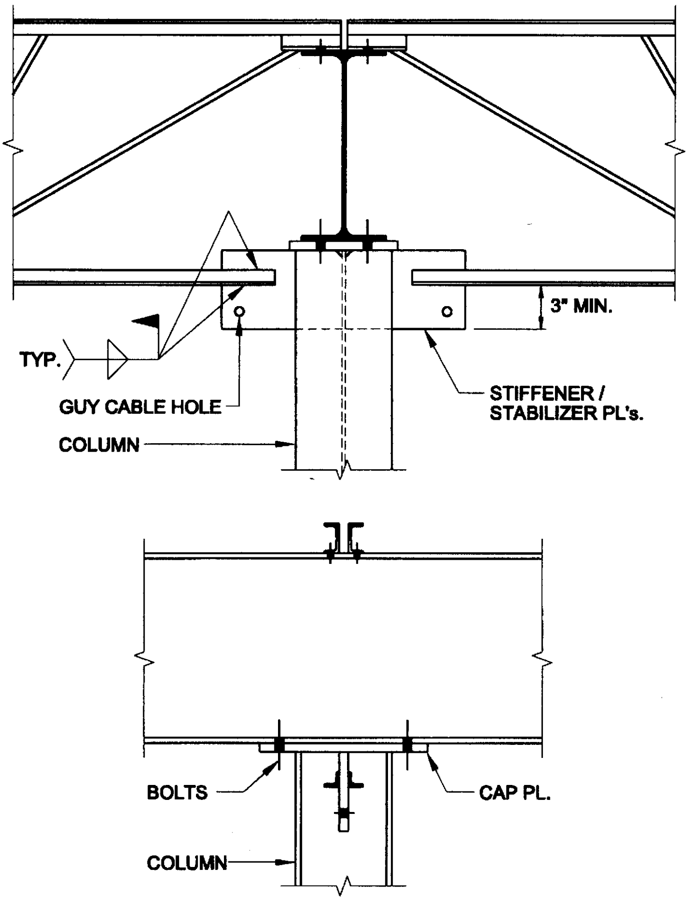


Figure 2–2b. Beam framing continuously over column top, stability provided with welded joist-chord extensions at column top.

[3] This requirement applies only at the location of the column, not at locations away from the column.

2. When joists frame into the continuous beam or girder, the required stability normally can be provided by using bottom chord extensions connected to the column top. The resulting continuity moments must be reported to the joist supplier for their use in the design of the joists and bridging. Note that the continuous beam must still be checked for the concentrated force due to the column reaction per AISC Specification Section J11.

   The position of the bottom chord extension relative to the column cap plate will affect the bottom chord connection detail. When the extension aligns with the cap plate, the load path and force transfer is direct. When the extension is below the column cap plate, the column must be designed to stabilize the beam bottom flange and the connection between the extension and the column must develop the continuity/ brace force. When the extension is above the column top, the beam web must have the necessary strength and stiffness to adequately brace the beam bottom/column top.

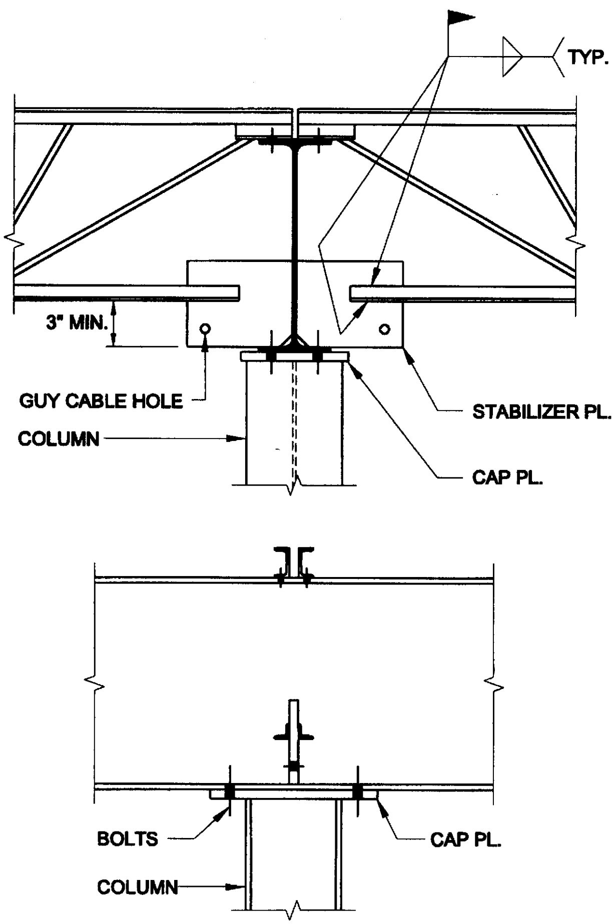


Figure 2–2c. Beam framing continuously over column top, stability provided with welded joist-chord extensions above column top.

3. If connection of the joist bottom chord extensions to the column must be avoided, the required stability can be provided with a diagonal brace that satisfies the strength and stiffness requirements in AISC Specification Appendix 6. Providing a relatively shallow angle with respect to the horizontal can minimize gravity-load effects in the diagonal brace.

   Alternatively, the required stability can be provided with stiffeners in the beam web along with a moment connection between the column top and beam bottom to maintain alignment of the beam/column assembly. A cap plate of reasonable proportions and four bolts will normally suffice.

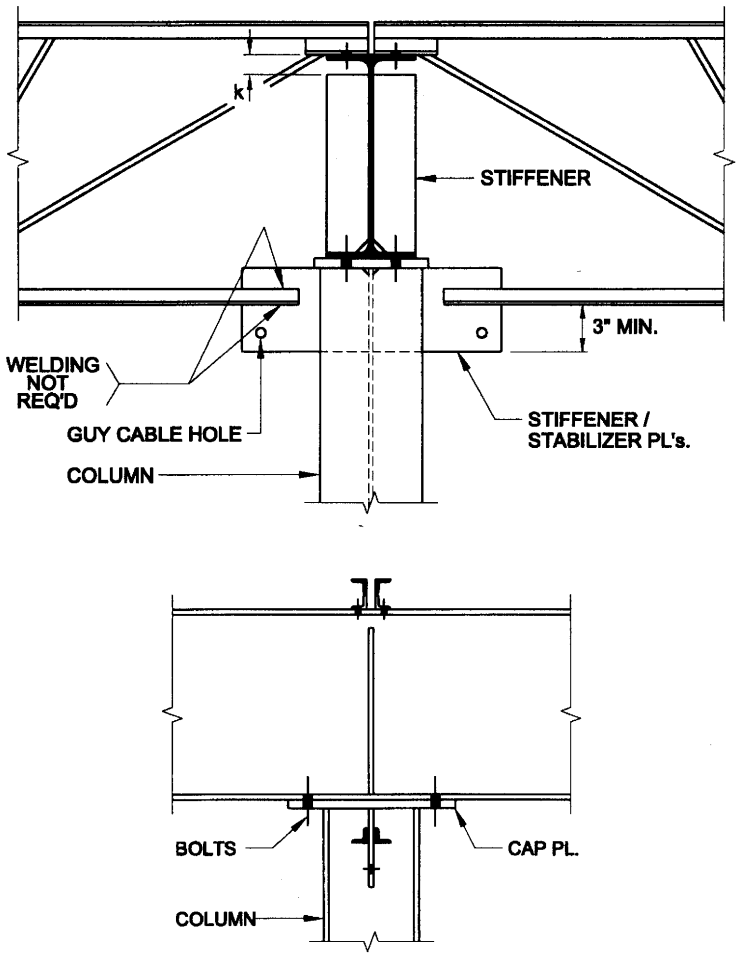


Figure 2–2d. Beam framing continuously over column top, stability provided with transverse stiffeners, joist-chord extensions located at column top not welded.

In atypical framing situations, such as when very deep girders are used, the strength and stiffness requirements in AISC Specification Appendix 6 can be applied for both the beam and the column to ensure the stability of the assembly. It may also be possible to demonstrate in a limited number of cases, such as with continuous beams with thick webs and relatively shallow depths, that the column and beam have been properly designed without providing infill beam connections, connected joist extensions, stiffeners, or diagonal braces as described above. In this case, a properly designed moment connection is still required between the beam bottom flange and the column top. In any case, it should be noted that the assembly must also meet the requirements in AISC Specification Section J11.

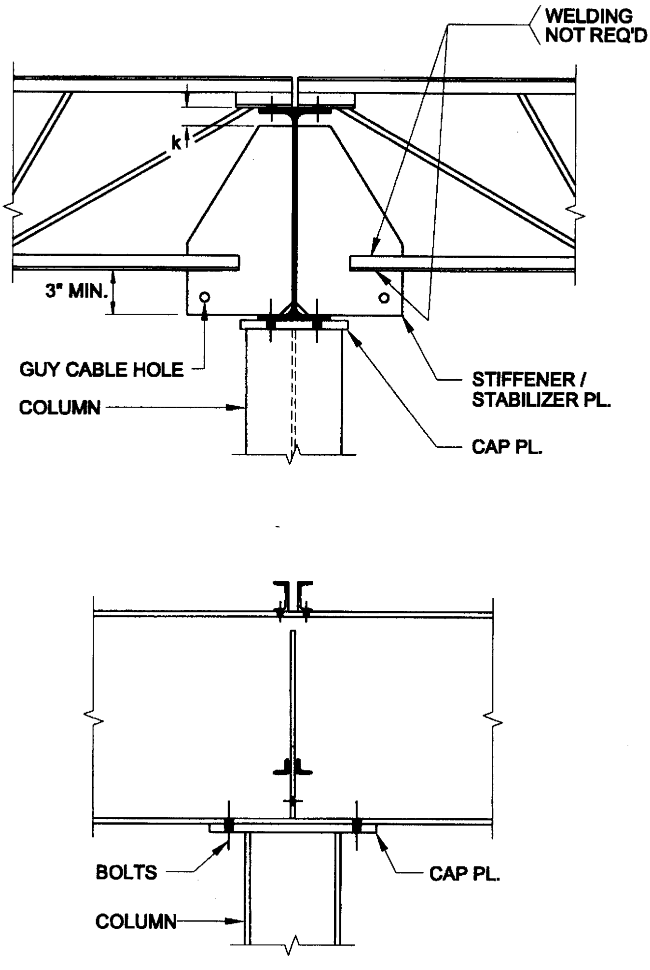


Figure 2–2e. Beam framing continuously over column top, stability provided with stiffener plates, joist-chord extensions located above column top not welded.

PROPERLY SPECIFYING MATERIALS

Availability

The general availability of structural shapes, HSS, and pipe is determined by an annual AISC survey of producers and summarized in AISC's *Modern Steel Construction* magazine. The availability summary for W-, M-, S-, and HP-shapes, channels, and angles is published in the January issue. The availability summary for HSS and pipe is published in the July issue. This information is also available at www.aisc.org.

Material Specifications

Applicable material specifications are as shown in the following tables:

- Structural shapes in Table 2–3.
- Plate and bar products in Table 2–4.
- Fastening products in Table 2–5.

Preferred material specifications are indicated in black shading. Other applicable material specifications are as shown in grey shading. The availability of grades other than the preferred material specification should be confirmed prior to their specification.

Cross-sectional dimensions and production tolerances are addressed as indicated under "Standard Mill Practices" in Part 1.

Other Products

Raised-Pattern Floor Plates

ASTM A786 is the standard specification for rolled steel floor plates. As floor-plate design is seldom controlled by strength considerations, ASTM A786 "commercial grade" is commonly specified. If so, per ASTM A786 Section 5.1.2, "the product will be supplied 0.33 percent maximum carbon and without specified mechanical properties." Alternatively, if a defined strength level is desired, ASTM A786 raised-pattern floor plate can be ordered to a defined plate specification, such as ASTM A36, A572, or A588; see ASTM A786 Sections 5.1.2, Section 8, and Appendix Table X1.1.

Sheet and Strip

Sheet and strip products, which are generally thinner than structural plate and bar products (see Table 2–2), are produced to such ASTM specifications as A570, A606, or A607.

Filler Metal

The appropriate filler metal for structural steel is as summarized in ANSI/AWS D1.1-2004 Table 3.1 for the various combinations of base metal specification, and grade and electrode specification. Weld strengths in this Manual are based upon a tensile strength level of 70 ksi.

Shear-Stud Connectors

As specified in ANSI/AWS D1.1 Chapter 7 (Section 7.2.6 and Table 7.1), Type B shear stud connectors made from ASTM A108 material are used for the interconnection of steel and concrete elements in composite construction (F_u = 65 ksi).

Open-Web Steel Joists

The AISC Code of Standard Practice does not include steel joists in its definition of structural steel. Steel joists are designed and fabricated per the requirements of specifications published by the Steel Joist Institute. Refer to SJI literature for further information.

Castellated Beams

Castellated beams, also known as cellular beams, are members constructed by cutting along a staggered pattern down the web of a wide-flange member, offsetting the resulting pieces such that the deepest points of the cut are in contact, and welding the two pieces together, thereby creating a member with holes along its web. Castellated beams are currently designed and fabricated as a proprietary product. For more information, contact the manufacturer.

Steel Castings and Forgings

Steel castings are specified as ASTM A27 grade 65-35 or ASTM A148 grade 80-35. Steel forgings are specified as ASTM A668.

Forged Steel Structural Hardware

Forged steel structural hardware products, such as clevises, turnbuckles, eye nuts, and sleeve nuts, are occasionally used in building design and construction. These products are generally forged according to ASTM A668 Class A requirements. ASTM A29, grade 1035 material is commonly used in the manufacture of clevises and turnbuckles. ASTM A29, grade 1030 material is commonly used in the manufacture of steel eye nuts and steel eye bolts. ASTM A29 grade 1018 material is commonly used in the manufacture of sleeve nuts. Other products, such as steel rod ends, steel yoke ends and pins, cotter pins, and coupling nuts are commonly provided generically as "carbon steel."

The dimensional and strength characteristics of these devices are fully described in the literature provided by their manufacturer. Note that manufacturers usually provide strength characteristics in terms of a "safe working load" with a safety factor as high as 5, assuming that the product will be used in rigging or similar applications subject to dynamic loading. The manufacturer's safe working load may be overly conservative for permanent installations and similar applications subject to static loading only.

If desired, the published safe working load can be converted into an available strength with reliability consistent with that of other statically loaded structural materials. In this case, the nominal strength, R_n, is determined as:

$$R_n = (\textit{safe working load}) \times (\textit{manufacturer's safety factor})$$

and the available strength, ϕR_n or R_n/Ω, is determined using

$$\phi = 0.50 \text{ (LRFD)} \qquad \Omega = 3.00 \text{ (ASD)}$$

Crane Rails

Crane rails are furnished to ASTM A759, ASTM A1 and/or manufacturer's specifications and tolerances.

Most manufacturers chamfer the top and sides of the crane-rail head at the ends, unless specified otherwise, to reduce chipping of the running surfaces. Often, crane rails are ordered as end-hardened, which improves the resistance of the crane-rail ends to impact that occurs as the moving wheel contacts it during crane operation. Alternatively, the entire rail can be ordered as heat-treated. When maximum wheel loading or controlled cooling is needed, refer to manufacturers' catalogs. Purchase orders for crane rails should be noted "for crane service."

Light 40-lb rails are available in 30-ft lengths, 60-lb rails in 30-, 33-, or 39-ft lengths, standard rails in 33- or 39-ft lengths, and crane rails up to 80 ft. Consult manufacturer for availability of other lengths. Rails should be arranged so that joints on opposite sides of the crane runway will be staggered with respect to each other and with due consideration to the wheelbase of the crane. Rail joints should not occur at crane girder splices. Odd lengths that must be included to complete a run or obtain the necessary stagger should be not less than 10 ft long. Rails are furnished with standard drilling in both standard and odd lengths, unless stipulated otherwise on the order.

CONTRACT DOCUMENT INFORMATION

Design Drawings, Specifications, and Other Contract Documents

CASE Document 962D *A Guideline Addressing Coordination and Completeness of Structural Construction Documents*, (Council of American Structural Engineers, American Council of Engineering Companies, 2003) provides comprehensive guidance on the preparation of structural design drawings.

Most provisions in the AISC Specification, RCSC Specification, AWS D1.1, and the Code of Standard Practice are written in mandatory language. Some provisions require the communication of information in the contract documents, some provisions are invoked only when specified in the contract documents, and some provisions require the approval of the owner's designated representative for design if they are to be used. Following is a summary of these provisions in the AISC Specification, RCSC Specification, and Code of Standard Practice:

Required Information

The following communication of information is required in the contract documents:

1. Required drawing information, per Code of Standard Practice Sections 3.1 and 3.1.1 through 3.1.6. and RCSC Specification Section 1.4 (bolting products and joint type).
2. Drawing numbers and revision numbers, per Code of Standard Practice Section 3.5.
3. Structural system description, per Code of Standard Practice Section 7.10.1.
4. Installation schedule for non-structural steel elements in the structural system, per Code of Standard Practice Section 7.10.2.
5. Project schedule, per Code of Standard Practice Section 9.5.1.

Information Required Only When Specified

The following provisions are invoked only when specified in the contract documents:

1. Special material notch-toughness requirements, per AISC Specification Section A3.1c and Section A3.1d.
2. Special connections requiring pretension, per AISC Specification Section J1.10.

3. Bolted joint requirements, per AISC Specification Section J3.1 and RCSC Specification Section 1.4.
4. Special cambering considerations, per AISC Specification Section L2.
5. Special contours and finishing requirements for thermal cutting, per AISC Specification Sections M2.2 and M2.3, respectively.
6. Corrosion protection requirements, if any, per AISC Specification Sections M3.1, M3.2, and M3.5, and Code of Standard Practice Sections 6.5, 6.5.2, and 6.5.3.
7. Responsibility for field touch-up painting, if painting is specified, per AISC Specification Section M4.6 and Code of Standard Practice Section 6.5.4.
8. Special quality assurance and inspection requirements, per AISC Specification Sections M5 and M5.3, and Code of Standard Practice Sections 8.1.3, 8.2, and 8.3.
9. Evaluation procedures, per AISC Specification Section B6.
10. Fatigue requirements, if any, per AISC Specification Section B3.9.
11. Modifications, if any, to the Code of Standard Practice, per Code of Standard Practice Section 1.1.
12. Submittal schedule for shop and erection drawings, per Code of Standard Practice Section 4.2.
13. Mill order timing, special mill testing, and special mill tolerances, per Code of Standard Practice Sections 5.1, 5.2, and 5.2, respectively.
14. Removal of backing bars and run-off-tabs, per Code of Standard Practice Section 6.3.2
15. Special erection mark requirements, per Code of Standard Practice Section 6.6.1.
16. Special delivery and erection sequences, per Code of Standard Practice Sections 6.7.1 and 7.1, respectively.
17. Special field splice requirements, per Code of Standard Practice Section 6.7.4.
18. Specials loads to be considered during erection, per Code of Standard Practice Section 7.10.3.
19. Special safety protection treatments, per Code of Standard Practice Section 7.11.1.
20. Identification of adjustable items, per Code of Standard Practice Section 7.13.1.3.
21. Cuts, alterations, and holes for other trades, per Code of Standard Practice Section 7.15.
22. Revisions to the contract, per Code of Standard Practice Section 9.3
23. Special terms of payment, per Code of Standard Practice Section 9.6.
24. Identification of architecturally exposed structural steel, per Code of Standard Practice Section 10.

Approvals Required

The following provisions require the approval of the owner's designated representative for design, if they are to be used:

1. Bolted-joint-related approvals per RCSC Commentary Section 1.4.
2. Use of electronic or other copies of the design drawings by the fabricator, per Code of Standard Practice Section 4.3.
3. Use of stock materials not conforming to specified ASTM specification, per Code of Standard Practice Section 5.2.3.
4. Correction of errors, per Code of Standard Practice Section 7.14.
5. Inspector-recommended deviations from contract documents, per Code of Standard Practice Section 8.5.6.
6. Contract price adjustment, per Code of Standard Practice Section 9.4.2.

Establishing Criteria for Connections

Code of Standard Practice Section 3.1.2 provides two methods for the establishment of connection criteria.

In the first, the complete design of all connections is shown in the structural design drawings. In this case, Code of Standard Practice Commentary Section 3.1.2 provides a summary of the information that must be included in the structural design drawings.

This method has the advantage that there is no need to provide connection loads, since the connections are completely designed in the structural design drawings. Additionally, it favors greater accuracy in the bidding process, since the connections are fully described in the contract documents.

In the second, the fabricator is allowed to select or complete the connections while preparing the shop and erection drawings, using the information provided by the owner's designated representative for design per Code of Standard Practice Section 3.1.2. In this case, Code of Standard Practice Commentary Section 3.1.2 clarifies the intention that connections that can be selected or completed by the fabricator include those for which tables appear in the contract documents or the Manual. Other connections should be shown in detail in the structural design drawings.

This method has the advantage that the fabricator's standard connections normally can be used, which often leads to project economy. However, the loads or other connection design criteria must be provided in the structural design drawings. Design loads and required strengths for connections should be provided in the structural design drawings and the design method used in the design of the frame (ASD or LRFD) must be indicated on the drawings.

In either method, the resulting shop and erection drawings must be submitted to the owner's designated representative for design for review and approval. Following is additional guidance for the communication of connection criteria to the connection designer.

Simple Shear Connections

The full force envelope should be given for each simple shear connection. Because of the potential for overestimation—and underestimation—inherent in approximate methods (Thornton, 1992), actual beam end reactions should be indicated on the design drawings. The most effective method to communicate this information is to place a numeric value at each end of each span in the framing plans.

In the past, beam end reactions were sometimes specified as a percentage of the tabulated uniform load in Manual Part 3. This practice can result in either over- or under-specification of connection reactions and should not be used. The inappropriateness of this practice is illustrated in the following four examples:

1. When beams are selected for serviceability considerations or for shape repetition, the uniform load tables will often result in heavier connections than would be required by the actual design loads.
2. When beams have relatively short spans, the uniform load tables will often result in heavier connections than would be required by the actual design loads.
3. When beams support other framing beams or other concentrated loads occur on girders supporting beams, the end reactions can be higher than 50 percent of the total uniform load.
4. For composite beams, the end reactions can be higher than 50 percent of the total uniform load. The percentage requirement can be increased for this condition, but the resulting approach is still subject to the above considerations.

Moment Connections

The full force envelope should be given for each moment connection. If the owner's designated representative for design can select the governing load combination, its effect alone should be provided. Otherwise, the effects of all appropriate load combinations should be indicated. Additionally, the maximum moment imbalance should also be given for use in the check of panel-zone web shear.

Because of the potential for overestimation—and underestimation—inherent in approximate methods, it is recommended that the actual beam end reactions (moment, shear, and other reactions, if any) be indicated in the structural design drawings. The most effective method to do so may be by tabulation for each joint and load combination.

Although not recommended, beam end reactions can be specified by more general criteria, such as by function of the beam strength. It should be noted, however, that there are several situations in which this approach is not appropriate. For example:

1. When beams are selected for serviceability considerations or for shape repetition, this approach will often result in heavier connections than would be required by the actual design loads.
2. When the column(s) or other members that frame at the joint could not resist the forces and moments determined from the criteria so specified, this approach will often result in heavier connections than would be required by the actual design loads.

In some cases, the structural analysis may require that the actual connections be configured to match the assumptions used in the model. For example, it may be appropriate to release weak-axis moments in a beam-column joint where only strong-axis beam moment strength is required. Such requirements should be indicated in the structural design drawings.

Truss Connections

The full force envelope should be given for each truss-member end connection. If the owner's designated representative for design can select the governing load combination for the entire truss, its effect alone should be provided. Otherwise, the effects of all appropriate load combinations should be indicated in tabular form. This approach will allow a clear understanding of all of the forces on any given joint.

Because of the potential for overestimation—and underestimation—inherent in approximate methods, it is recommended that the actual reactions at the truss member end (axial force and other reactions, if any) be indicated in the structural design drawings. It is also recommended that transfer forces, if any, be so indicated. The most effective method to do so may be by tabulation for each truss member end and load combination.

Although not recommended, truss member end reactions can be specified by more general criteria, such as by maximum member forces (tension or compression) or as a function of the member strength. It should be noted, however, that there are several situations in which such approaches are not appropriate. For example:

1. The specification of maximum member forces does not permit a check of the member forces at a joint if there are different load combinations governing the member designs at that joint. Nor does it reflect the possibility of load reversal as it may influence the design.
2. The specification of a percentage of member strength may not properly account for the interaction of forces at a joint or the transfer force through the joint. Additionally, it may not allow for a cross-check of all forces at a joint.

In either case, this approach will often result in heavier connections than would be required by the actual design loads.

Note that it is not necessary to specify a minimum connection strength as a percent of the member strength as a default. However, when trusses are shop assembled or field assembled on the ground for subsequent erection, consideration should be given to the loads that will be induced during handling, shipping, and erection.

Horizontal and Vertical Bracing Connections

The recommendations for truss connections above also apply in general to bracing connections with the following additional comments.

Bracing connections may involve the interaction of gravity and lateral loads on the frame. In some cases, such as V- and inverted V-bracing (also known as Chevron bracing), gravity loads alone may govern design of the braces and their connections. Thus, clarity in the specification of loads and reactions is critical to properly consider the potential interaction of gravity and lateral loads at floors and roofs.

Strut and Tie Connections

Floor and roof members in braced bays and adjacent bays may function as struts or ties in addition to carrying gravity loads. Therefore the recommendations for simple shear connections and bracing connections above apply in combination.

Column Splices

Column splices may resist moments, shears, and tensions in addition to gravity forces. Typical column splices are discussed in Part 14. As in the case of the other connections discussed above, unless the column splices are fully designed in the Construction Documents, forces and moments for the splice designs should be provided in the Construction Documents. Since column splices are located away from the girder/column joint and moments vary in the height of the column, an accurate assessment of the forces and moments at the column splices will usually significantly reduce their cost and complexity.

TOLERANCES

The effects of mill, fabrication, and erection tolerances all require consideration in the design and construction of structural steel buildings. However, the accumulation of the mill tolerances and fabrication tolerances shall not cause the erection tolerances to be exceeded, per Code of Standard Practice Section 7.12.

Mill Tolerances

Mill tolerances are those variations that could be present in the product as-delivered from the rolling mill. These tolerances are given as follows:

1. For structural shapes and plates, see ASTM A6.
2. For HSS, see ASTM A500 (or other applicable ASTM specification for HSS).
3. For pipe, see ASTM A53.

A summary of standard mill practices is also given in Part 1.

Fabrication Tolerances

Fabrication tolerances are generally provided in AISC Specification Section M2 and Code of Standard Practice Section 6.4. Additional requirements that govern fabrication are as follows:

1. Compression joint fit-up, per AISC Specification Section M4.4.
2. Roughness limits for finished surfaces, per Code of Standard Practice Section 6.2.2.
3. Straightness of projecting elements of connection materials, per Code of Standard Practice Section 6.3.1.
4. Finishing requirements at locations of removal of run-off tabs and similar devices, per Code of Standard Practice Section 6.3.2.

Erection Tolerances

Erection tolerances are generally provided in AISC Specification Section M4 and Code of Standard Practice Section 7.13. Note that the tolerances specified therein are predicated upon the proper installation of the following items by the owner's designated representative for construction:

1. Building lines and benchmarks, per Code of Standard Practice Section 7.4.
2. Anchorage devices, per Code of Standard Practice Section 7.5.
3. Bearing devices, per Code of Standard Practice Section 7.6.
4. Grout, per Code of Standard Practice Section 7.7.

Building Façade Tolerances

The preceding mill, fabrication, and erection tolerances can be maintained with standard equipment and workmanship. However, the accumulated tolerances for the structural steel and the building façade must be accounted for in the design so that the two systems can be properly mated in the field. This is normally accomplished by specifying adjustable connections in the contract documents, per Code of Standard Practice Section 7.13.1.3.

The required adjustability normally can be determined from the building façade tolerances and the accumulation of mill, fabrication, and erection tolerances at the mid-span point of the spandrel beam. The actual locations of the anchor-rod group and column base, the actual slope of the columns, and the actual sweep of the spandrel beam all affect the accumulation of tolerances in the structural steel at this critical location. Even if each of these is properly within the permitted envelope, significant variations will normally occur.

Figures 2–3a, 2–4a, and 2–5a illustrate details that are not recommended because they do not provide for adjustment. Figures 2–3b, 2–4b, and 2–5b illustrate recommended alternative details that do provide for adjustability. Note that diagonal structural and stability bracing elements have been omitted in these details to improve the clarity of presentation regarding adjustability. Also, note that all elements beyond the slab edge are normally not structural steel, per Code of Standard Practice Section 2.2, and are shown for the purposes of illustration only.

The bolted details in Figures 2–4b and 2–5b can be used to provide field adjustability with slotted holes as shown. Further adjustability can be provided in these details, if necessary, by removing the bolts and clamping the connection elements for field-welding. Alternatively, when the slab edge angle or plate in Figure 2–4b is shown as field-welded and identified as adjustable in the contract documents, it can be provided to within a horizontal tolerance of $\pm^3/_8$ in., per Code of Standard Practice Section 7.13.1.3. However, if the item were not shown as field-welded and identified as adjustable in the contract documents, it would likely be attached in the shop or attached in the field to facilitate the concrete pour and not be suitable to provide for the necessary adjustment.

With adjustable connections specified in design and provided in fabrication, the actions taken on the job site will allow for a successful façade installation. Per the Code of Standard Practice definition of established column line (see Code of Standard Practice Glossary), proper placement of this line by the owner's designated representative for construction based upon the actual anchor-rod/column-center locations will assure that all subcontractors are working from the same information. When sufficient adjustment cannot be accommodated within the adjustable connections provided, a common solution is to allow the building façade to deviate (or drift) from the theoretical location to follow the as-built locations of the structural steel framing and concrete floor slabs. A survey of the as-built locations of these elements can be used to adjust the placement of the building façade accordingly. In this case, the adjustable connections can serve to ensure that no abrupt changes occur in the façade.

CAMBER, SWEEP, AND STRAIGHTENING

Beam Camber and Sweep

Camber denotes a curve in the vertical plane. Sweep denotes a curve in the horizontal plane. Camber and sweep are provided in beams, when required, by the fabricator per Code of Standard Practice Section 6.4.4, either by cold bending or by hot bending.

Cambering and sweeping induce residual stresses similar to those that develop in rolled structural shapes, as elements of the shape cool from the rolling temperature at different rates. In general, these residual stresses do not affect the design strength of structural members, since the effect of residual stresses is considered in the provisions of the AISC Specification.

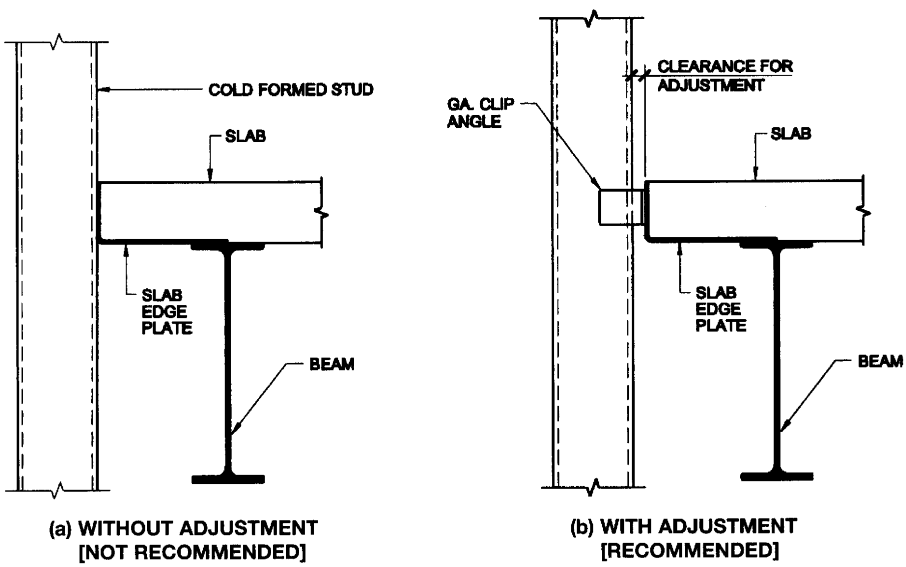


Figure 2–3. Attaching cold-formed steel façade systems to structural steel framing.

Cold Bending

The inelastic deformations required in common cold-bending operations, such as for beam cambering, normally fall well short of the strain-hardening range. Specific limitations on cold-bending capabilities should be obtained from those that provide the service. However, the following general guidelines may be useful in the absence of other information:

1. The minimum radius for camber induced by cold bending in members up to a nominal depth of 30 in. is between 10 and 14 times the depth of the member. Deeper members may require a larger minimum radius.
2. Cold bending may be used to provide sweep in members to practically any radius desired.
3. A length limit of 40 to 50 ft is practical.

When curvatures and the resulting inelastic deformations are significant and corrective measures are required, the effects of cold work on the strength and ductility of the structural steels largely can be eliminated by thermal stress relief or annealing.

Hot Bending

The controlled application of heat can be used in the shop and field to provide camber or sweep. The member is rapidly heated in selected areas that tend to expand, but are restrained by the adjacent cooler areas, causing inelastic deformations in the heated areas and a change in the shape of the cooled member.

The mechanical properties of steels are largely unaffected by such heating operations, provided the maximum temperature does not exceed the temperature limitations given in AISC Specification Section M2.1. Temperature-indicating crayons or other suitable means should be used during the heating process to ensure proper regulation of the temperature.

Heat curving induces residual stresses that are similar to those that develop in hot-rolled structural shapes as they cool from the rolling temperature because all parts of the shape do

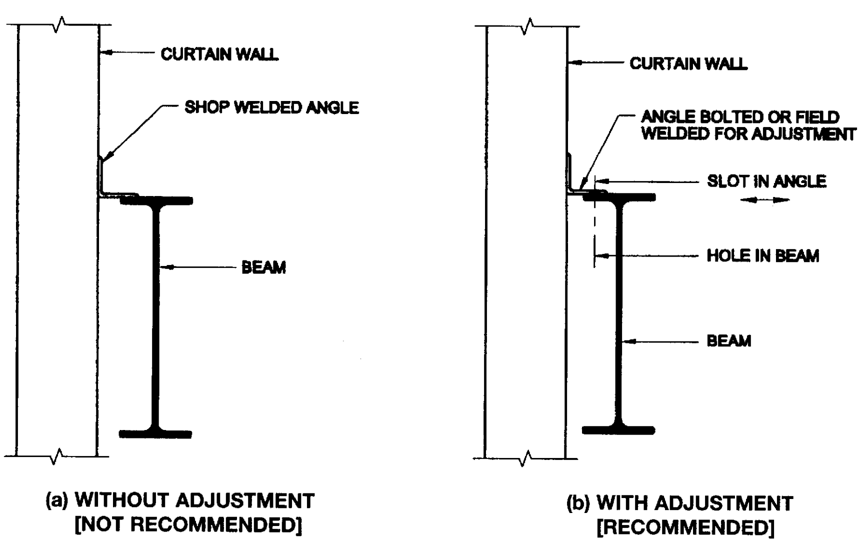


Figure 2–4. Attaching curtain-wall façade systems to structural steel framing.

not cool at the same rate. The residual stresses from heating operations generally do not affect the design strength of structural members, since the effect of residual stresses is considered in the provisions of the AISC Specification.

Truss Camber

Camber is provided in trusses, when required, by the fabricator per Code of Standard Practice Section 6.4.5, by geometric relocation of panel points and adjustment of member lengths based upon the camber requirements as specified in the contract documents.

Straightening

All structural shapes are straightened at the mill after rolling, either by rotary or gag straightening, to meet the aforementioned mill tolerances. Similar processes and/or the controlled application of heat can be used in the shop or field to straighten a curved or distorted member. These processes are normally applied in a manner similar to those used to induce camber and sweep, as described above.

FIRE PROTECTION AND ENGINEERING

Complete coverage of fire protection and engineering for steel structures is included in AISC Design Guide 19, *Fire Resistance of Structural Steel Framing* (Ruddy et. al., 2003).

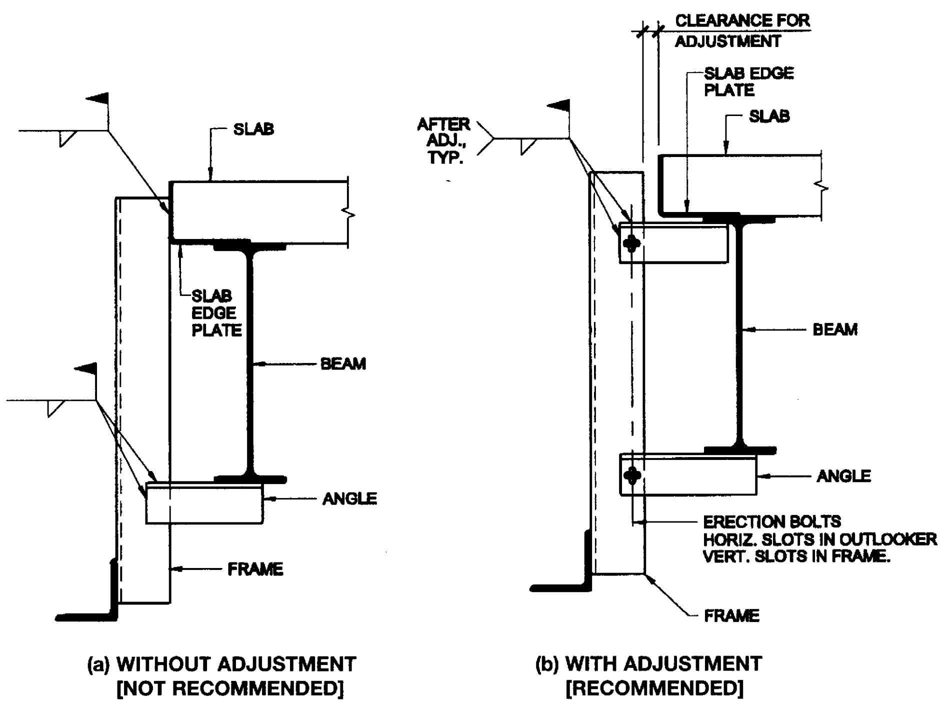


Figure 2–5. Attaching masonry façade systems to structural steel framing.

CORROSION PROTECTION

In building structures, corrosion protection is not required for steel that will be enclosed by building finish, coated with a contact-type fireproofing, or in contact with concrete. When enclosed, the steel is trapped in a controlled environment and the products required for corrosion are quickly exhausted, as indicated in AISC Commentary Section M3. A similar situation exists when steel is fireproofed or in contact with concrete. Accordingly, shop primer or paint is not required unless specified in the contract documents, per AISC Specification Section M3.1. Per Code of Standard Practice Section 6.5, steel that is to remain unpainted need only be cleaned of heavy deposits of oil and grease by appropriate means after fabrication.

Corrosion protection is required, however, in exterior exposed applications. Likewise, steel must be protected from corrosion in aggressively corrosive applications, such as a paper processing plant, a structure with oceanfront exposure, or when temperature changes can cause condensation. Corrosion should also be considered when connecting steel to dissimilar metals. Guidance on steel compatibility with metal fasteners is provided in Table 2–6.

When surface preparation other than the cleaning described above is required, an appropriate SSPC grade of cleaning should be specified in the contract documents. A summary of the SSPC surface preparation specifications (SSPC, 2000) is provided in Table 2–7. SSPC SP 2 is the normal grade of cleaning when cleaning is required.

For further information, refer to the publications of SSPC: The Society for Protective Coatings, the American Galvanizers Association (AGA), and the National Association of Corrosion Engineers International (NACE).

RENOVATION AND RETROFIT OF EXISTING STRUCTURES

The provisions in AISC Specification Section B6 govern the evaluation of existing structures. Historical data on available steel grades and hot-rolled structural shapes, including dimensions and properties, is available in AISC Design Guide 15 *Rehabilitation and Retrofit Guide* (Brockenbrough, 2002), and the companion database of historic shape properties from 1873-1999, titled *AISC Search Utility for Structural Steel Shapes* (AISC, 2003). See also Ricker (1988) and Tide (1990).

THERMAL EFFECTS

Expansion and Contraction

The average coefficient of expansion e for structural steel between 70 and 100 degrees F is 0.0000065 for each degree F. This value is a reasonable approximation of the coefficient of thermal expansion for temperatures less than 70 degrees F. For temperatures from 100 to 1,200 degrees F, the change in length per unit length per degree F, ε, is:

$$\varepsilon = (6.1 + 0.0019t)10^{-6}$$

where t is the initial temperature in degrees F. The coefficients of expansion for other building materials can be found in Table 17–11.

Although buildings are typically constructed of flexible materials, expansion joints are often required in roofs and the supporting structure when horizontal dimensions are large. The maximum distance between expansion joints is dependent upon many variables, including ambient temperature during construction and the expected temperature range during the lifetime of the building.

Figure 2–6 (Federal Construction Council, 1974) provides guidance based on design temperature change for maximum spacing of structural expansion joints in beam-and-column-framed buildings with pinned column bases and heated interiors. The report includes data for numerous cities and gives five modification factors to be applied as appropriate:

1. If the building will be heated only and will have pinned column bases, use the maximum spacing as specified;
2. If the building will be air-conditioned as well as heated, increase the maximum spacing by 15 percent, provided the environmental control system will run continuously;
3. If the building will be unheated, decrease the maximum spacing by 33 percent;
4. If the building will have fixed column bases, decrease the maximum spacing by 15 percent;
5. If the building will have substantially greater stiffness against lateral displacement in one of the plan dimensions, decrease the maximum spacing by 25 percent.

When more than one of these design conditions prevail in a building, the percentile factor to be applied is the algebraic sum of the adjustment factors of all the various applicable conditions. Most building codes include restrictions on location and maximum spacing of fire walls, which often become default locations for expansion joints.

The most effective expansion joint is a double line of columns that provides a complete and positive separation. Alternatively, low-friction sliding elements can be used. Such systems, however, are seldom totally friction-free and will induce some level of inherent restraint to movement.

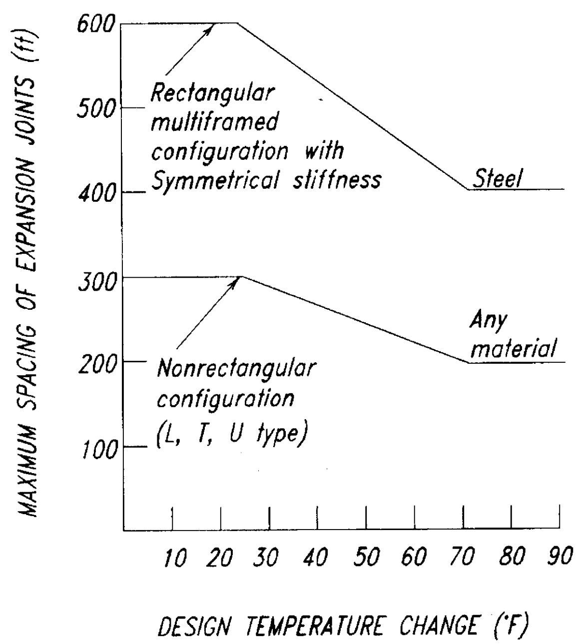


Figure 2–6. Recommended maximum expansion-joint spacing.

Elevated-Temperature Service

For applications involving short-duration loading at elevated temperature, the variations in yield strength, tensile strength, and modulus of elasticity are given AISC Design Guide 19. For applications involving long-duration loading at elevated temperatures, the effects of creep must also be considered. For further information, see Brockenbrough and Merritt (1999; pp. 1.20-1.22).

FATIGUE AND FRACTURE CONTROL

Avoiding Brittle Fracture

By definition, brittle fracture occurs by cleavage at a stress level below the yield strength. Generally, a brittle fracture can occur when there is a sufficiently adverse combination of tensile stress, temperature, strain rate, and geometrical discontinuity (notch). The exact combination of these conditions and other factors that will cause brittle fracture cannot be readily calculated. Consequently, the best guide in selecting steel material that is appropriate for a given application is experience.

The steels listed in AISC Specification Section A3.1a, Section A3.1c, and Section A3.1d have been successfully used in a great number of applications, including buildings, bridges, transmission towers, and transportation equipment, even at the lowest atmospheric temperatures encountered in the United States. Nonetheless, it is desirable to minimize the conditions that tend to cause brittle fracture: triaxial state-of-stress, increased strain rate, strain aging, stress risers, welding residual stresses, areas of reduced notch toughness, and low-temperature service.

1. Triaxial state-of-stress: While shear stresses are always present in a uniaxial or biaxial state-of-stress, the maximum shear stress approaches zero as the principal stresses approach a common value in a triaxial state-of-stress. A triaxial state-of-stress can also result from uniaxial loading when notches or geometrical discontinuities are present. A triaxial state-of-stress will cause the yield stress of the material to increase above its nominal value, resulting in brittle fracture by cleavage, rather than ductile shear deformations. As a result, in the absence of critical-size notches, the maximum stress is limited by the yield stress of the nearby unaffected material. Triaxial stress conditions should be avoided, when possible.
2. Increased strain rate: Gravity loads, wind loads, and seismic loads have essentially similar strain rates. Impact loads, such as those associated with heavy cranes, and blast loads normally have increased strain rates, which tend to increase the possibility of brittle fracture. Note, however, that a rapid strain rate or impact load is not a required condition for the occurrence of brittle fracture.
3. Strain aging: Cold-working of steel and the strain aging that normally results generally increases the likelihood of brittle fracture, usually due to a reduction in ductility and notch toughness. The effects of cold-work and strain aging can be minimized by selecting a generous forming radius to eliminate or minimize strain hardening.
4. Stress risers: Fabrication operations, such as flame-cutting and welding, may induce geometric conditions or discontinuities that are crack-like in nature, creating stress risers. Intersecting welds from multiple directions should be avoided with properly sized weld access holes to minimize the interaction of these various stress fields. Such conditions should be avoided, when possible, or removed or repaired when they occur.

5. Welding residual stresses: In the as-welded condition, residual stresses near the yield strength of the material will be present in any weldment. Residual stresses and the possible accompanying distortions can be minimized through controlled welding procedures and fabrication methods, including the proper positioning of the components of the joint prior to welding, the selection of welding sequences that will minimize distortions, the use of preheat as appropriate, the deposition of a minimum volume of weld metal with a minimum number of passes for the design condition, and proper control of interpass temperatures and cooling rates. In fracture-sensitive applications, notch toughness should be specified for both the base metal and the filler metal.
6. Areas of reduced notch toughness: Such areas can be found in the core areas of heavy shapes and plates and the k-Area of rotary-straightened W-shapes. Accordingly, AISC Specification Sections A3.1c and Section A3.1d include special requirements for material notch toughness.
7. Low-temperature service: While steel yield strength, tensile strength, modulus of elasticity, and fatigue strength increase as temperature decreases, ductility and toughness decrease. Furthermore, there is a temperature below which steel subjected to tensile stress may fracture by cleavage, with little or no plastic deformation, rather than by shear, which is usually preceded by considerable inelastic deformation. Note that cleavage and shear are used in the metallurgical sense to denote different fracture mechanisms.

When notch toughness is important, Charpy V-notch testing can be specified to ensure a certain level of energy absorption at a given temperature, such as 15 ft-lbs at 70 degrees F. Note that the appropriate test temperature may be higher than the lowest operating temperature depending upon the rate of loading. Although it is primarily intended for bridge-related applications, the information in ASTM A709 Section S83 (including Tables S1.1, S1.2, and S1.3) may be useful in determining the proper level of notch toughness that should be specified.

In many cases, weld metal notch toughness exceeds that of the base metal. Filler metals can be selected to meet a desired minimum notch toughness value. For each welding process, electrodes exist that have no specified notch toughness requirements. Such electrodes should not be assumed to possess any minimum notch toughness value. When notch toughness is necessary for a given application, the desired value or an appropriate electrode should be specified in the contract documents.

For further information, refer to Fisher et al. (1998), Barsom and Rolfe (1999), and Rolfe (1977).

Avoiding Lamellar Tearing

Although lamellar tearing is less common today, the restraint against solidified weld deposit contraction inherent in some joint configurations can impose a tensile strain high enough to cause separation or tearing on planes parallel to the rolled surface of the element being joined. The incidence of this phenomenon can be reduced or eliminated through greater understanding by designers, detailers, and fabricators of the inherent directionality of rolled steel, the importance of strains associated with solidified weld deposit contraction in the presence of high restraint (rather than externally applied design forces), and the need to adopt appropriate joint and welding details and procedures with proper weld metal for through-thickness connections.

Research by Melendrez and Dexter (Dexter and Melendrez, 2000) demonstrates that W-shapes are not susceptible to lamellar tearing or other through-thickness failures when welded tee joints are made to the flanges at locations away from member ends. When needed for other conditions, special production practices can be specified for steel plates to assist in reducing the incidence of lamellar tearing by enhancing through-thickness ductility. For further information, refer to ASTM A770. However, it must be recognized that it is more important and effective to properly design, detail, and fabricate to avoid highly restrained joints. AISC (1973) provides guidelines that minimize potential problems.

WIND AND SEISMIC DESIGN

In general, nearly all building design and construction can be classified into one of two categories: wind and low-seismic applications, and high-seismic applications.

Wind and Low-Seismic Applications

Wind and low-seismic applications are those in which the seismic response modification factor R may be taken as equal to or less than 3 for design purposes. Such buildings are designed to meet the provisions in the AISC Specification based upon the code-specified forces distributed throughout the framing, assuming a nominally elastic structural response. The resulting systems have normal levels of ductility.

The seismic response modification factor, R, essentially represents the ratio of the forces that would develop under the specified ground motion if the structure had an entirely linearly elastic response to the prescribed design forces (BSSC, 2001).

High-Seismic Applications

High-seismic applications are those in which R is taken greater than 3, and the building is designed to meet the provisions in both the Seismic Provisions and AISC Specification. Note that it does not matter if wind or earthquake controls in this case. The use of R greater than 3 in the calculation of the seismic base shear requires the use of a seismically detailed system that is compatible with R even if wind effects control. High-seismic design and construction will generally cost more than wind and low-seismic design and construction, as the resulting systems are designed to have high levels of ductility.

High-seismic lateral framing systems are configured to be capable of withstanding strong ground motions as they undergo controlled ductile deformations to dissipate energy. Consider the following three examples:

1. Special Concentrically Braced Frames (SCBF)—SCBF are generally configured so that any inelasticity will occur by tension yielding and/or compression buckling in the braces. The connections of the braces to the columns and beams, and between the columns and beams themselves must then be proportioned to remain nominally elastic, as they undergo these deformations.
2. Eccentrically Braced Frames (EBF)—EBF are generally configured so that any inelasticity will occur by shear yielding and/or flexural yielding in the link. The beam outside the link, connections, braces, and columns must then be proportioned to remain nominally elastic, as they undergo these deformations.

3. Special Moment Frames (SMF)—SMF are generally configured so that any inelasticity will occur by flexural yielding in the girders near, but away from, the connection of the girders to the columns. The connections of the girders to the columns and the columns themselves must then be proportioned to remain nominally elastic as they undergo these deformations. Intermediate Moment Frames (IMF) and Ordinary Moment Frames (OMF) are also configured to provide improved seismic performance, although successively lower than that for SMF.

The code-specified base accelerations used to calculate the seismic forces are not necessarily maximums, but rather, they represent the intensity of ground motions that have been selected by the code-writing authorities as reasonable for design purposes. Accordingly, the requirements in both the Seismic Provisions and the AISC Specification must be met so that the resulting frames can then undergo controlled deformations in a ductile, well-distributed manner.

The design provisions for high-seismic systems are also intended to result in distributed deformations throughout the frame, rather than the formation of story mechanisms, so as to increase the level of available energy dissipation and corresponding level of ground motion that can be withstood.

The member sizes in high-seismic frames will be larger than those in wind and low-seismic frames. The connections will also be much more robust so they can transmit the member-strength-driven force demands. Net sections will often require special attention so as to avoid having fracture limit-states control. Special material requirements, design considerations, and construction practices must be followed. For further information on the design and construction of high-seismic systems, see the Seismic Provisions, which are available from the American Institute of Steel Construction, Inc. at www.aisc.org.

Table 2–1
Summary Comparison of Methods for Stability Analysis and Design

	Direct Analysis Method	Effective Length Method	First-Order Analysis Method
Limitations on Use[1]	None	$\Delta_{2nd}/\Delta_{1st} \le 1.5$	$\Delta_{2nd}/\Delta_{1st} \le 1.5$ $\alpha P_r/P_y \le 0.5$
Analysis Type	Second-order elastic[2]		First-order elastic
Geometry of Structure	All three methods use the undeformed geometry in the analysis.		
Minimum or Additional Lateral Loads Required in the Analysis	Minimum[3]; 0.2% of the story gravity load	Minimum; 0.2% of the story gravity load	Additive; at least 0.42% of the story gravity load
Member Stiffnesses Used in the Analysis	Reduced *EA* and *EI*	Nominal *EA* and *EI*	
Design of Columns	$K = 1$ for all frames	$K = 1$ for braced frames. For moment frames, determine K from sidesway buckling analysis[4]	$K = 1$ for all frames[5]
Specification Reference for Method	Appendix 7	Section C2.2a	Section C2.2b

1 $\Delta_{2nd}/\Delta_{1st}$ is the ratio of second-order drift to first-order drift, which can be taken to be equal to B_2 calculated per Section C2.1b. $\Delta_{2nd}/\Delta_{1st}$ is determined using LRFD load combinations or a multiple of 1.6 times ASD load combinations.
2 Either a general second-order analysis method or second-order analysis by amplified first-order analysis (the "B_1-B_2 method" described in Section C2.1b) can be used.
3 This notional load is additive if $\Delta_{2nd}/\Delta_{1st} > 1.5$.
4 K=1 is permitted for moment frames when $\Delta_{2nd}/\Delta_{1st} \le 1.1$.
5 An additional amplification for member curvature effects is required for columns in moment frames.

Table 2–2
AISI Standard Nomenclature for Flat-Rolled Carbon Steel

Thickness, in.	Width, in.					
	To $3\frac{1}{2}$ incl.	Over $3\frac{1}{2}$ To 6	Over 6 To 8	Over 8 To 12	Over 12 To 48	Over 48
0.2300 & thicker	Bar	Bar	Bar	Plate	Plate	Plate
0.2299 to 0.2031	Bar	Bar	Strip	Strip	Sheet	Plate
0.2030 to 0.1800	Strip	Strip	Strip	Strip	Sheet	Plate
0.1799 to 0.0449	Strip	Strip	Strip	Strip	Sheet	Sheet
0.0448 to 0.0344	Strip	Strip	Hot-rolled sheet and strip not generally produced in these widths and thicknesses			
0.0343 to 0.0255	Strip					
0.0254 & thinner						

Table 2–3
Applicable ASTM Specifications for Various Structural Shapes

Steel Type	ASTM Designation		F_y Min. Yield Stress (ksi)	F_u Tensile Stress[a] (ksi)	Applicable Shape Series: W	M	S	HP	C	MC	L	HSS: Rect.	HSS: Round	Pipe
Carbon	A36		36	58-80[b]	▒	■	■	▒	■	■	■			
	A53 Gr. B		35	60										■
	A500	Gr. B	42	58									■	
			46	58								■		
		Gr. C	46	62									▒	
			50	62								▒		
	A501		36	58								▒	▒	
	A529[c]	Gr. 50	50	65-100	▒	▒	▒	▒	▒	▒	▒			
		Gr. 55	55	70-100	▒	▒	▒	▒	▒	▒	▒			
High-Strength Low-Alloy	A572	Gr. 42	42	60	▒	▒	▒	▒	▒	▒	▒			
		Gr. 50	50	65[d]	▒	▒	▒	■	▒	▒	▒			
		Gr. 55	55	70	▒	▒	▒	▒	▒	▒	▒			
		Gr. 60[e]	60	75	▒	▒	▒	▒	▒	▒	▒			
		Gr. 65[e]	65	80	▒	▒	▒	▒	▒	▒	▒			
	A618[f]	Gr. I & II	50[g]	70[g]								▒	▒	
		Gr. III	50	65								▒	▒	
	A913	50	50[h]	60[h]	▒	▒	▒	▒	▒	▒	▒			
		60	60	75	▒	▒	▒	▒	▒	▒	▒			
		65	65	80	▒	▒	▒	▒	▒	▒	▒			
		70	70	90	▒	▒	▒	▒	▒	▒	▒			
	A992		50-65[i]	65[i]	■	▒	▒	▒	▒	▒	▒			
Corrosion Resistant High-Strength Low-Alloy	A242		42[j]	63[j]	▒									
			46[k]	67[k]	▒			▒			▒			
			50[l]	70[l]	▒	▒	▒	▒	▒	▒	▒			
	A588		50	70	▒	▒	▒	▒	▒	▒	▒			
	A847		50	70								▒	▒	

■ = Preferred material specification.
▒ = Other applicable material specification, the availability of which should be confirmed prior to specification.
□ = Material specification does not apply.

[a] Minimum unless a range is shown.
[b] For shapes over 426 lb/ft, only the minimum of 58 ksi applies.
[c] For shapes with a flange thickness less than or equal to 1½ in. only. To improve weldability a maximum carbon equivalent can be specified (per ASTM Supplementary Requirement S78). If desired, maximum tensile stress of 90 ksi can be specified (per ASTM Supplementary Requirement S79).
[d] If desired, maximum tensile stress of 70 ksi can be specified (per ASTM Supplementary Requirement S91).
[e] For shapes with a flange thickness less than or equal to 2 in. only.
[f] ASTM A618 can also be specified as corrosion-resistant; see ASTM A618.
[g] Minimum applies for walls nominally ¾-in. thick and under. For wall thicknesses over ¾ in., F_y = 46 ksi and F_u = 67 ksi.
[h] If desired, maximum yield stress of 65 ksi and maximum yield-to-tensile strength ratio of 0.85 can be specified (per ASTM Supplementary Requirement S75).
[i] A maximum yield-to-tensile strength ratio of 0.85 and carbon equivalent formula are included as mandatory in ASTM A992.
[j] For shapes with a flange thickness greater than 2 in. only.
[k] For shapes with a flange thickness greater than 1½ in. and less than or equal to 2 in. only.
[l] For shapes with a flange thickness less than or equal to 1½ in. only.

Table 2–4
Applicable ASTM Specifications for Plates and Bars

Steel Type	ASTM Designation		F_y Min. Yield Stress (ksi)	F_u Tensile Stress[a] (ksi)	Plates and Bars: to 0.75 incl.	over 0.75 to 1.25	over 1.25 to 1.5	over 1.5 to 2 incl.	over 2 to 2.5 incl.	over 2.5 to 4 incl.	over 4 to 5 incl.	over 5 to 6 incl.	over 6 to 8 incl.	over 8
Carbon	A36		32	58-80										■
			36	58-80	■	■	■	■	■	■	■	■	■	
	A529	Gr. 50	50	70-100	▒	▒ b	▒ b	▒ b	▒ b					
		Gr. 55	55	70-100	▒	▒ b	▒ b							
High-Strength Low-Alloy	A572	Gr. 42	42	60	▒	▒	▒	▒	▒	▒	▒	▒		
		Gr. 50	50	65	▒	▒	▒	▒	▒	▒				
		Gr. 55	55	70	▒	▒	▒	▒						
		Gr. 60	60	75	▒	▒								
		Gr. 65	65	80	▒	▒								
Corrosion Resistant High-Strength Low-Alloy	A242		42	63				▒	▒	▒				
			46	67		▒	▒							
			50	70	▒									
	A588		42	63								▒	▒	
			46	67							▒			
			50	70	▒	▒	▒	▒	▒	▒				
Quenched and Tempered Alloy	A514[c]		90	100-130						▒	▒	▒		
			100	110-130	▒	▒	▒	▒	▒					
Quenched and Tempered Low-Alloy	A852[c]		70	90-110	▒	▒	▒	▒	▒	▒				

■ = Preferred material specification.
▒ = Other applicable material specification, the availability of which should be confirmed prior to specification.
□ = Material specification does not apply.

a Minimum unless a range is shown.
b Applicable to bars only above 1-in. thickness.
c Available as plates only.

Table 2–5
Applicable ASTM Specifications for Various Types of Structural Fasteners

ASTM Designation		F_y Min. Yield Stress (ksi)	F_u Tensile Stress[a] (ksi)	Diameter Range (in.)	High-Strength Bolts: Conventional	High-Strength Bolts: Twist-Off-Type Tension-Control[d]	Common Bolts	Nuts	Washers	Direct-Tension-Indicator Washers	Threaded Rods	Shear Stud Connectors	Anchor Rods: Hooked	Anchor Rods: Headed	Anchor Rods: Threaded & Nutted
A108		—	65	0.375 to 0.75, incl.								■			
A325[d]		—	105	over 1 to 1.5 incl.	■										
		—	120	0.5 to 1, incl.	■										
A490		—	150	0.5 to 1.5	■										
F1852		—	105	1.125		■									
		—	120	0.5 to 1, incl.		■									
A194 Gr. 2H		—	—	0.25 to 4				▒							
A563		—	—	0.25 to 4				■							
F436[b]		—	—	0.25 to 4					■						
F959		—	—	0.5 to 1.5						■					
A36		36	58-80	to 10							■		▒		▒
A193 Gr. B7[e]		—	100	over 4 to 7							▒		▒		▒
		—	115	over 2.5 to 4							▒		▒		▒
		—	125	2.5 and under							▒		▒		▒
A307	Gr. A	—	60	0.25 to 4			■							▒	
	Gr. C	—	58-80	0.25 to 4							▒		▒		▒
A354 Gr. BD		—	140	2.5 to 4 incl.							▒		▒	▒	▒
		—	150	0.25 to 2.5, incl.							▒		▒	▒	▒
A449		—	90	1.75 to 3 incl.	c						▒		▒	▒	▒
		—	105	1.125 to 1.5, incl.	c						▒		▒	▒	▒
		—	120	0.25 to 1, incl.	c						▒		▒	▒	▒
A572	Gr. 42	42	60	to 6							▒		▒		▒
	Gr. 50	50	65	to 4							▒		▒		▒
	Gr. 55	55	70	to 2							▒		▒		▒
	Gr. 60	60	75	to 1.25							▒		▒		▒
	Gr. 65	65	80	to 1.25							▒		▒		▒
A588		42	63	Over 5 to 8, incl.							▒		▒		▒
		46	67	Over 4 to 5, incl.							▒		▒		▒
		50	70	4 and under							▒		▒		▒
A687		105	150 max.	0.625 to 3							▒		▒		▒
F1554	Gr. 36	36	58-80	0.25 to 4									■	■	■
	Gr. 55	55	75-95	0.25 to 4									▒	▒	▒
	Gr. 105	105	125-150	0.25 to 3									▒	▒	▒

■ = Preferred material specification.
▒ = Other applicable material specification, the availability of which should be confirmed prior to specification.
☐ = Material specification does not apply.

— Indicates that a value is not specified in the material specification.
[a] Minimum unless a range is shown or maximum (max.) is indicated.
[b] Special washer requirements may apply per RCSC Specification Table 6.1 for some steel-to-steel bolting applications and per Part 14 for anchor-rod applications.
[c] See AISC Specification Section A3.3 for limitations on use of ASTM A449 bolts.
[d] When atmospheric corrosion resistance is desired, Type 3 can be specified.
[e] For anchor rods with temperature and corrosion resistance characteristics.

Table 2–6
Metal Fastener Compatibility to Resist Corrosion

Base Metal \ Fastener Metal	Zinc and Galvanized Steel	Aluminum and Aluminum Alloys	Steel and Cast Iron	Brasses, Copper, Bronzes, Monel	Martensitic Stainless Steel (Type 410)	Austenitic Stainless Steel (Type 302/304, 303, 305)
Zinc and Galvanized Steel	A	B	B	C	C	C
Aluminum and Aluminum Alloys	A	A	B	C	Not Recommended	B
Steel and Cast Iron	A, D	A	A	C	C	B
Terne (Lead-Tin) Plated Steel Sheets	A, D, E	A, E	A, E	C	C	B
Brasses, Copper, Bronzes, Monel	A, D, E	A, E	A, E	A	A	B
Ferritic Stainless Steel (Type 430)	A, D, E	A, E	A, E	A	A	A
Austenitic Stainless Steel (Type 302/304)	A, D, E	A, E	A, E	A, E	A	A

KEY

A. The corrosion of the base metal is not increased by the fastener.
B. The corrosion of the base metal is marginally increased by the fastener.
C. The corrosion of the base metal may be markedly increased by the fastener material.
D. The plating on the fastener is rapidly consumed, leaving the bare fastener metal.
E. The corrosion of the fastener is increased by the base metal.

NOTE: Surface Treatment and environment can change activity. For a more thorough understanding of metal corrosion in construction materials, please consult a full listing of the galvanic series of metals and alloys.

Note: Reprinted from the Specialty Steel Industry of North America Stainless Steel Fasteners Designer's Handbook.

Table 2–7
Summary of Surface Preparation Specifications

SSPC Specification No.	Title	Description
SP1	Solvent Cleaning	Removal of oil, grease, dirt, soil, salts, and contaminants by cleaning with solvent, vapor, alkali, emulson, or steam.
SP2	Hand-Tool Cleaning	Removal of all loose rust, loose mill scale, and loose paint to degree specified, by hand-chipping, scraping, sanding, and wire brushing.
SP3	Power-Tool Cleaning	Removal of all loose rust, loose mill scale, and loose paint to degree specified, by power-tool chipping, descaling, sanding, wire brushing, and grinding.
SP5/NACE No.1	Metal Blast Cleaning	Removal of all visible rust, mill scale, paint, and foreign matter by blast-cleaning by wheel or nozzle (dry or wet) using sand, grit, or shot. (For very corrosive atmospheres where high cost of cleaning is warranted.)
SP6/NACE No.3	Commercial Blast-Cleaning	Blast-cleaning until at least two-thirds of the surface area is free of all visible residues. (For conditions where thoroughly cleaned surface is required.)
SP7/NACE No. 4	Brush-Off Blast-Cleaning	Blast-cleaning of all except tightly adhering residues of mill scale, rust, and coatings, exposing numerous evenly distributed flecks of underlying metal.
SP8	Pickling	Complete removal of rust and mill scale by acid-pickling, duplex-pickling, or electrolytic pickling.
SP10/NACE No.2	Near-White Blast-Cleaning	Blast-cleaning to nearly White Metal cleanliness, until at least 95% of the surface area is free of all visible residues. (For high humidity, chemical atmosphere, marine, or other corrosive environments.)
SP11	Power-Tool Cleaning to Bare Metal	Complete removal of all rust, scale, and paint by power tools, with resultant surface profile.

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PART 3
DESIGN OF FLEXURAL MEMBERS

SCOPE

The specification requirements and other design considerations summarized in this Part apply to the design of flexural members subject to uniaxial flexure without axial forces or torsion. For the design of members subject to biaxial flexure and/or flexure in combination with axial tension or compression and/or torsion, see Part 6. For flexural members that are part of a seismic force resisting system in which the seismic response modification factor, R, is taken greater than 3, the requirements in the AISC *Seismic Provisions for Structural Steel Buildings* also apply. The AISC *Seismic Provisions for Structural Steel Buildings* is available in Part 6 of the AISC *Seismic Design Manual* from the American Institute of Steel Construction, Inc. at www.aisc.org.

SECTION PROPERTIES AND AREAS

For Flexure

Flexural design properties are based upon the full cross section with no reduction for bolt holes when the limitations in AISC Specification Section F13.1(a) are satisfied. Otherwise, the flexural design properties are based upon a flexural rupture check given in AISC Specification Section F13.1(b).

For Shear

For shear, the area is determined per AISC Specification Chapter G.

FLEXURAL STRENGTH

The nominal flexural strength of W-shapes is illustrated as a function of the unbraced length, L_b, in Figure 3–1. The available strength is determined as ϕM_n or M_n/Ω, which must equal or exceed the required strength (bending moment), M_u or M_a, respectively. The available flexural strength, ϕM_n or M_n/Ω, is determined per AISC Specification Chapter F. User Note F1.1 outlines the sections of Chapter F and the corresponding limit states applicable to each member type.

Braced, Compact Flexural Members

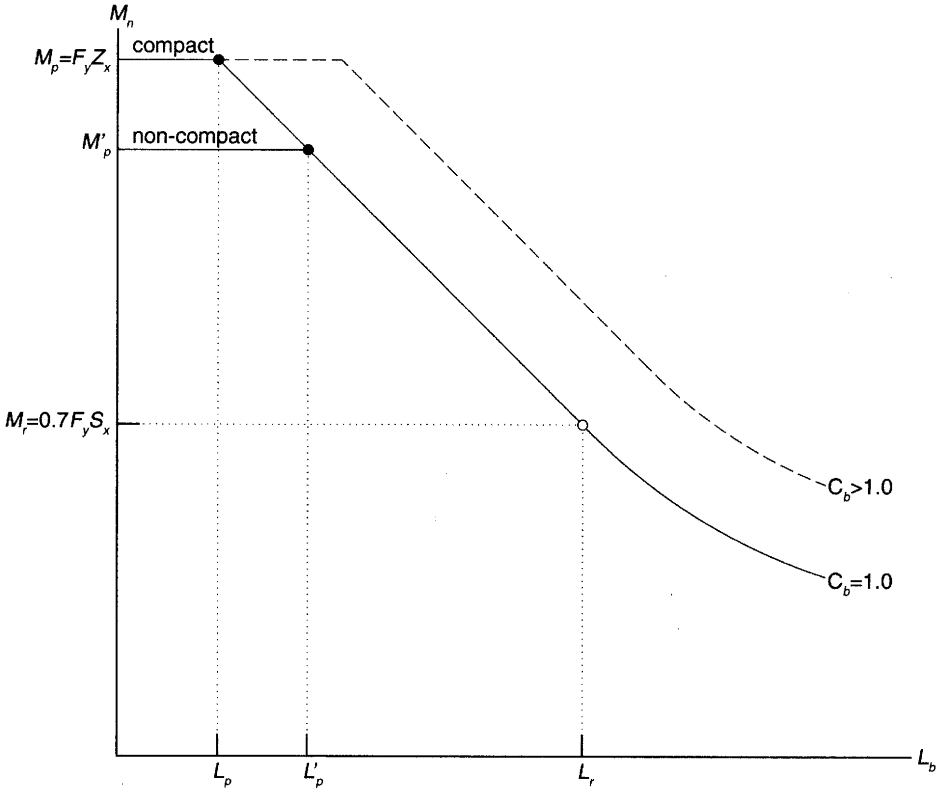
When flexural members are braced ($L_b \leq L_p$) and compact ($\lambda \leq \lambda_p$), yielding must be considered in the nominal moment strength of the member, in accordance with the requirements of AISC Specification Chapter F.

Unbraced Flexural Members

When flexural members are unbraced ($L_b > L_p$), have flange width-thickness ratios such that ($\lambda > \lambda_p$), or have web width-thickness ratios such that ($\lambda > \lambda_p$), lateral-torsional and elastic buckling effects must be considered in the calculation of the nominal moment strength of the member.

Non-Compact or Slender Cross-Sections

For flexural members that have width-thickness ratios such that ($\lambda > \lambda_p$), local buckling must be considered in the calculation of the nominal moment strength of the member.



$$L_p = 1.76 r_y \sqrt{\frac{E}{F_y}}$$

$$L_r = 1.95 r_{ts} \frac{E}{0.7F_y} \sqrt{\frac{Jc}{S_x h_o}} \sqrt{1 + \sqrt{1 + 6.76 \left(\frac{0.7F_y}{E} \frac{S_x}{J} \frac{h_o}{c} \right)^2}}$$

For non-compact cross-sections:

$$M'_p = M_p - \left(M_p - 0.7F_y S_x\right) \frac{\left(\lambda - \lambda_p\right)}{\left(\lambda_r - \lambda_p\right)}$$

$$L'_p = L_p + \left(L_r - L_p\right) \frac{\left(M_p - M'_p\right)}{\left(M_p - M_r\right)}$$

Figure 3–1. General available flexural strength of beams.

Available Flexural Strength for Weak-Axis Bending

The design of flexural members subject to weak-axis bending is similar to that for strong-axis bending, except that lateral-torsional buckling does not apply. See AISC Specification Section F6.

LOCAL BUCKLING

Determining the Width-Thickness Ratios of the Cross-Section

Flexural members are classified for flexure on the basis of the width-thickness ratios of the various elements of the cross-section. The width-thickness ratio λ is calculated for each element of the cross-section per AISC Specification Section B4.

Classification of Cross-Sections

Cross-sections are classified as follows:

- Flexural members are compact (the plastic moment can be reached without local buckling) when λ is equal to or less than λ_p and the flange(s) are continuously connected to the web(s).
- Flexural members are non-compact (local buckling will occur, but only after initial yielding) when λ exceeds λ_p but is equal to or less than λ_r.
- Flexural members are slender-element cross-sections (local buckling will occur prior to yielding) when λ exceeds λ_r.

The values of λ_p and λ_r are determined per AISC Specification Section B4.

LATERAL-TORSIONAL BUCKLING

Classification of Spans for Flexure

Flexural members bent about their strong axis are classified on the basis of the length L_b between braced points. Braced points are points at which support resistance against lateral-torsional buckling is provided per AISC Specification Appendix 6.3. Classifications are determined as follows:

- If $L_b \leq L_p$, flexural member is not subject to lateral-torsional buckling
- If $L_p < L_b \leq L_r$, flexural member is subject to inelastic lateral-torsional buckling
- If $L_b > L_r$, flexural member is subject to elastic lateral-torsional buckling

The values of L_p and L_r are determined per AISC Specification Chapter F. These values are presented in Tables 3–2, 3–6, 3–7, 3–8, and 3–9.

Lateral-torsional buckling does not apply to flexural members bent about their weak axis or HSS bent about either axis, per AISC Specification Sections F6, F7 and F8.

Consideration of Moment Gradient

When $L_b > L_p$, the moment gradient between braced points can be considered in the determination of the available strength using the beam bending coefficient C_b. In the case of a uniform moment between braced points causing single-curvature of the member, $C_b = 1$. This represents the worst case and C_b can be conservatively taken as unity for use with the maximum moment between braced points in all designs per AISC Specification Section F1. However, when desired, a non-uniform moment gradient between braced points can be considered using C_b calculated as given in AISC Specification Equation F1–1. Exceptions are provided as follows:

1. As an alternative, when the moment diagram between braced points is a straight line, C_b can be calculated as given in AISC Commentary Equation C–F1.1.
2. For cantilevered members where the free end is unbraced, C_b must be taken as unity per AISC Specification Section F1.
3. For tees with the stem in compression, C_b should be taken as unity as recommended in AISC Commentary Section F9.

AVAILABLE SHEAR STRENGTH

For flexural members, the available shear strength, ϕV_n or V_n/Ω, which must equal or exceed the required strength, V_u or V_a, respectively, is determined in accordance with the AISC Specification Chapter G.

STEEL W-SHAPE BEAMS WITH COMPOSITE SLABS

The following pertains to W-shapes with composite concrete slabs in regions of positive moment. For composite flexural members in regions of negative moment, see AISC Specification Chapter I. For further information on composite design and construction, see Viest et al. (1997).

Concrete Slab Effective Width

The effective width of a concrete slab acting compositely with a steel beam is determined per AISC Specification Section I3.1a.

Shear Stud Connectors

Material, placement and spacing requirements for shear stud connectors are given in AISC Specification Chapter I. The nominal shear strength, Q_n, of one shear stud connector is determined per AISC Specification Section I3.2d and is tabulated for common design conditions in Table 3–21.

Available Flexural Strength for Positive Moment

The available flexural strength of a composite beam subject to positive moment is determined per AISC Specification Section I3.2a assuming a uniform compressive stress of $0.85f_c'$ and zero tensile strength in the concrete, and a uniform stress of F_y in the tension area (and compression area, if any) of the steel section. The position of the plastic neutral axis (PNA) can then be determined by static equilibrium.

Per AISC Specification Section I3.2d, enough shear stud connectors must be provided between a point of maximum moment and the nearest point of zero moment to transfer the horizontal shear force V' between the steel beam and concrete slab, where V' is determined per AISC Specification Section I3.2d-1. For partial-composite design, the shear strength of the shear stud connectors ΣQ_n controls the available flexural strength of the composite flexural member.

Shored and Unshored Construction

The available flexural strength is identical for both shored and unshored construction. In unshored construction, issues such as lateral support during construction and construction-load deflection may require consideration.

Available Shear Strength

Per AISC Specification Section I3.1b, the available shear strength for composite beams is determined as illustrated previously for steel beams.

OTHER SPECIFICATION REQUIREMENTS AND DESIGN CONSIDERATIONS

The following other specification requirements and design considerations apply to the design of flexural members.

Special Requirements for Heavy Shapes and Plates

For beams with complete-joint-penetration groove welded joints and made from heavy shapes with a flange thickness exceeding 2 in., see AISC Specification Sections A3.1c

For built-up sections consisting of plates with a thickness exceeding 2-in., see Section A3.1d.

Serviceability

Serviceability requirements, per AISC Specification Chapter L, should be appropriate for the application. This includes an appropriate limit on the deflection of the flexural member and the vibration characteristics of the system of which the flexural member is a part. See also AISC Design Guide No. 3 *Serviceability Design Considerations for Low-Rise Buildings* (Fisher and West, 2004), AISC Design Guide No. 5 *Low- and Medium-Rise Steel Buildings* (Allison, 1991) and AISC Design Guide No. 11 *Floor Vibrations Due to Human Activity* (Murray, Allen and Ungar, 1997).

The maximum vertical deflection Δ, in., can be calculated using the equations given in Tables 3–22 and 3–23. Alternatively, for common cases of simple-span beams and I-shaped members and channels, the following equation can be used:

$$\Delta = ML^2 / (C_1 I_x)$$

where

M = maximum service-load moment, kip-ft
L = span length, ft
I_x = moment of inertia, in.^{4}
C_1 = loading constant (see Figure 3–2) which includes the numerical constants appropriate for the given loading pattern, E, which has units of ksi, and a ft-to-in. conversion factor of 1,728 in.^{3}/ft^3.

FLEXURAL DESIGN TABLES

Table 3–1. Beam Bending Coefficient C_b

Values of the beam bending coefficient C_b are given for various loading conditions on simple-span beams in Table 3–1.

W-SHAPE SELECTION TABLES

Table 3–2. W-Shapes—Selection by Z_x

W-shapes are sorted in descending order by strong-axis flexural strength and then grouped in ascending order by weight with the lightest W-shape in each range in bold. Strong-axis available strengths in flexure and shear are given for W-shapes with F_y = 50 ksi (ASTM A992). C_b is taken as unity.

For compact W-shapes, when $L_b \le L_p$, the strong-axis available flexural strength, M_{px}/Ω_b or $\phi_b M_{px}$, can be determined using the tabulated strength values. When $L_p < L_b \le L_r$, linearly interpolate between the available strength at L_p and the available strength at L_r as follows:

LRFD	ASD
$\phi_b M_n = C_b\,[\phi_b M_{px} - BF(L_b - L_p)] \le \phi_b M_{px}$	$\dfrac{M_n}{\Omega_b} = C_b\left[\dfrac{M_{px}}{\Omega_b} - BF(L_b - L_p)\right] \le \dfrac{M_{px}}{\Omega_b}$

When $L_b > L_r$, see Table 3–10. For non-compact W-shapes, the tabulated values of M_{px}/Ω_b, $\phi_b M_{px}$, and L_p have been adjusted to account for the non-compactness.

The strong-axis available shear strength, $\phi_v V_n$, or V_n/Ω_v, can be determined using the tabulated value.

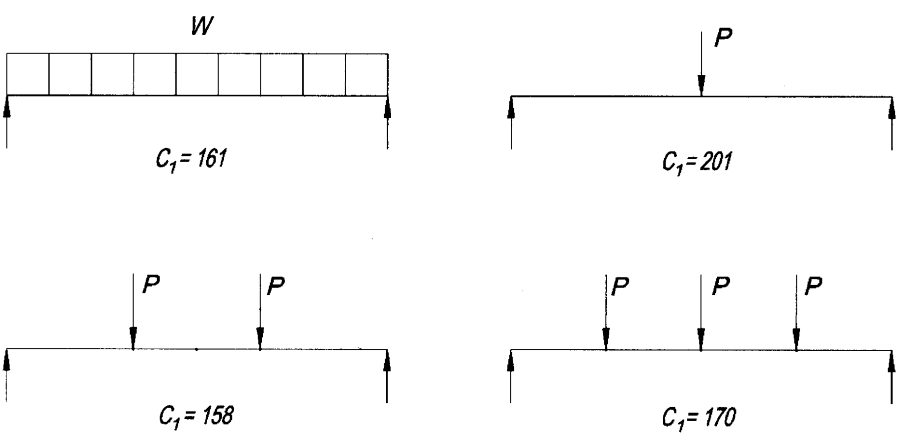


Figure 3–2. Loading constants for use in determining simple beam deflections.

Table 3–3. W-Shapes—Selection by I_x

W-shapes are sorted in descending order by strong-axis moment of inertia I_x and then grouped in ascending order by weight with the lightest W-shape in each range in bold.

Table 3–4. W-Shapes—Selection by Z_y

W-shapes are sorted in descending order by weak-axis flexural strength and then grouped in ascending order by weight with the lightest W-shape in each range in bold. Weak-axis available strengths in flexure are given for W-shapes with $F_y = 50$ ksi (ASTM A992). C_b is taken as unity.

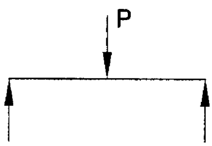
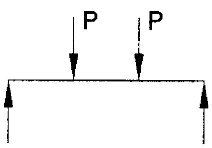
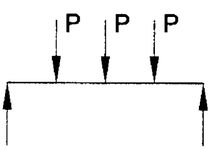
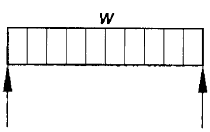
For non-compact W-shapes, the tabulated values of M_{py}/Ω_b and $\phi_b M_{py}$ have been adjusted to account for the non-compactness.

The weak-axis available shear strength must be checked independently.

Table 3–5. W-Shapes—Selection by I_y

W-shapes are sorted in descending order by weak-axis moment of inertia I_y and then grouped in ascending order by weight with the lightest W-shape in each range in bold.

Table 3–1
Values for C_b for Simply Supported Beams

Load	Lateral Bracing Along Span	C_b
	None Load at midpoint	1.32
	At load point	1.67 1.67
	None Loads at third points	1.14
	At load points Loads symmetrically placed	1.67 1.00 1.67
	None Loads at quarter points	1.14
	At load points Loads at quarter points	1.67 1.11 1.11 1.67
	None	1.14
	At midpoint	1.30 1.30
	At third points	1.45 1.01 1.45
	At quarter points	1.52 1.06 1.06 1.52
	At fifth points	1.56 1.12 1.00 1.12 1.56

Note: Lateral bracing must always be provided at points of support per AISC Specification Chapter F.

F_y = 50 ksi

Table 3-2
W Shapes
Selection by Z_x

Z_x

Shape	Z_x	M_{px}/Ω_b	$\phi_b M_{px}$	M_{rx}/Ω_b	$\phi_b M_{rx}$	BF	BF	L_p	L_r	I_x	V_{nx}/Ω_v	$\phi_v V_{nx}$
		kip-ft	kip-ft	kip-ft	kip-ft	kips	kips				kips	kips
	in.³	ASD	LRFD	ASD	LRFD	ASD	LRFD	ft	ft	in.⁴	ASD	LRFD
W36×800^h	**3650**	**9110**	13700	**5310**	7980	**47.5**	71.4	**14.9**	**94.8**	**64700**	**2030**	3040
W36×652^h	**2910**	**7260**	10900	**4300**	6460	**46.8**	70.4	**14.5**	**77.8**	**50600**	**1620**	2430
W40×593^h	**2760**	**6890**	10400	**4090**	6140	**55.5**	83.5	**13.4**	**63.8**	**50400**	**1540**	2310
W36×529^h	**2330**	**5810**	8740	**3480**	5220	**46.5**	70.0	**14.1**	**64.4**	**39600**	**1280**	1920
W40×503^h	**2310**	**5760**	8660	**3460**	5200	**54.7**	82.2	**13.1**	**55.3**	**41600**	**1290**	1940
W36×487^h	**2130**	**5310**	7990	**3200**	4800	**46.1**	69.3	**14.0**	**60.0**	**36000**	**1180**	1770
W40×431^h	**1960**	**4890**	7350	**2950**	4440	**53.6**	80.6	**12.9**	**49.0**	**34800**	**1110**	1660
W36×441^h	1910	4770	7160	2880	4330	45.2	68.0	13.8	55.5	32100	1060	1590
W27×539^h	1890	4720	7090	2740	4120	26.1	39.2	12.9	88.6	25600	1280	1920
W40×397^h	**1800**	**4490**	6750	**2720**	4100	**52.3**	78.7	**12.9**	**46.6**	**32000**	**999**	1500
W40×392^h	**1710**	**4270**	6410	**2510**	3780	**60.4**	90.8	**9.33**	**38.3**	**29900**	**1180**	1760
W36×395^h	1710	4270	6410	2600	3910	44.7	67.1	13.7	51.0	28500	937	1410
W40×372^h	**1680**	**4190**	6300	**2550**	3830	**51.6**	77.6	**12.7**	**44.5**	**29600**	**943**	1410
W14×730^h	1660	4140	6230	2240	3360	7.37	11.1	16.6	275	14300	1380	2060
W40×362^h	**1640**	**4090**	6150	**2480**	3730	**51.5**	77.4	**12.7**	**44.0**	**28900**	**908**	1360
W44×335	**1620**	**4040**	6080	**2460**	3700	**59.6**	89.6	**12.3**	**38.8**	**31100**	**902**	1350
W33×387^h	1560	3890	5850	2360	3540	38.4	57.7	13.3	53.3	24300	906	1360
W36×361^h	1550	3870	5810	2360	3540	43.7	65.7	13.6	48.1	25700	851	1280
W14×665^h	1480	3690	5550	2010	3020	7.12	10.7	16.3	253	12400	1220	1840
W40×324	**1460**	**3640**	5480	**2240**	3360	**49.1**	73.8	**12.6**	**41.3**	**25600**	**803**	1200
W30×391^h	1450	3620	5440	2180	3280	31.3	47.1	13.0	58.8	20700	903	1350
W40×331^h	1430	3570	5360	2110	3180	59.0	88.7	9.08	33.7	24700	995	1490
W33×354^h	1420	3540	5330	2170	3260	37.5	56.4	13.2	49.9	22000	825	1240
W44×290	**1410**	**3520**	5290	**2170**	3260	**54.9**	82.5	**12.3**	**37.0**	**27000**	**755**	1130
W40×327^h	1410	3520	5290	2100	3150	58.0	87.2	9.11	33.6	24500	963	1440
W36×330	1410	3520	5290	2170	3260	42.3	63.6	13.5	45.5	23300	768	1150
W40×297	1330	3320	4990	2040	3070	47.3	71.1	12.5	39.4	23200	741	1110
W30×357^h	1320	3290	4950	1990	2990	31.2	47.0	12.9	54.5	18700	813	1220
W14×605^h	1320	3290	4950	1820	2730	6.83	10.3	16.1	232	10800	1090	1630
W36×302	1280	3190	4800	1970	2970	40.5	60.9	13.5	43.6	21100	706	1060

ASD	LRFD
$\Omega_b = 1.67$ $\Omega_v = 1.50$	$\phi_b = 0.90$ $\phi_v = 1.00$

[h] Flange thickness greater than 2 in. Special requirements may apply per AISC Specification Section A3.1c.

Z_x

Table 3–2 (continued)
W Shapes
Selection by Z_x

F_y = 50 ksi

Shape	Z_x	M_{px}/Ω_b	$\phi_b M_{px}$	M_{rx}/Ω_b	$\phi_b M_{rx}$	BF	BF	L_p	L_r	I_x	V_{nx}/Ω_v	$\phi_v V_{nx}$
		kip-ft	kip-ft	kip-ft	kip-ft	kips	kips				kips	kips
	in.³	ASD	LRFD	ASD	LRFD	ASD	LRFD	ft	ft	in.⁴	ASD	LRFD
W44×262	**1270**	**3170**	**4760**	**1940**	**2910**	**52.5**	**79.0**	**12.3**	**35.7**	**24100**	**680**	**1020**
W40×294	1270	3170	4760	1890	2840	57.0	85.7	9.01	31.5	21900	856	1280
W33×318	1270	3170	4760	1940	2910	36.9	55.4	13.1	46.5	19500	731	1100
W40×277	1250	3120	4690	1920	2890	45.8	68.9	12.6	38.8	21900	659	988
W27×368[h]	1240	3090	4650	1850	2780	25.1	37.7	12.3	61.9	16200	839	1260
W40×278	1190	2970	4460	1780	2680	55.2	82.9	8.90	30.4	20500	823	1230
W36×282	1190	2970	4460	1830	2760	39.4	59.2	13.4	42.2	19600	657	985
W30×326[h]	1190	2970	4460	1820	2730	30.3	45.6	12.7	50.7	16800	739	1110
W14×550[h]	1180	2940	4430	1630	2440	6.67	10.0	15.9	213	9430	963	1450
W33×291	1160	2890	4350	1780	2680	36.0	54.1	13.0	43.9	17700	669	1000
W40×264	1130	2820	4240	1700	2550	54.1	81.4	8.90	29.7	19400	768	1150
W27×336[h]	1130	2820	4240	1700	2550	25.1	37.7	12.2	56.9	14600	756	1130
W24×370[h]	1130	2820	4240	1670	2510	19.9	29.9	11.6	69.2	13400	851	1280
W40×249	**1120**	**2790**	**4200**	**1730**	**2610**	**43.0**	**64.7**	**12.5**	**37.2**	**19600**	**591**	**886**
W44×230[v]	**1100**	**2740**	**4130**	**1700**	**2550**	**47.1**	**70.9**	**12.1**	**34.4**	**20800**	**547**	**823**
W36×262	1100	2740	4130	1700	2550	38.4	57.7	13.3	40.6	17900	619	929
W30×292	1060	2640	3980	1620	2440	29.8	44.8	12.6	46.9	14900	653	980
W14×500[h]	1050	2620	3940	1460	2200	6.42	9.65	15.6	196	8210	858	1290
W36×256	1040	2590	3900	1560	2350	46.5	70.0	9.36	31.5	16800	719	1080
W33×263	1040	2590	3900	1610	2410	34.6	51.9	12.9	41.6	15900	601	901
W36×247	1030	2570	3860	1590	2400	37.1	55.8	13.2	39.5	16700	587	880
W27×307[h]	1030	2570	3860	1550	2330	25.2	37.8	12.0	52.6	13100	687	1030
W24×335[h]	1020	2540	3830	1510	2270	20.1	30.2	11.4	63.0	11900	760	1140
W40×235	1010	2520	3790	1530	2300	51.0	76.7	8.97	28.4	17400	659	988
W40×215	**964**	**2410**	**3620**	**1500**	**2250**	**39.2**	**58.9**	**12.5**	**35.6**	**16700**	**507**	**760**
W36×231	963	2400	3610	1490	2240	35.8	53.7	13.1	38.6	15600	555	832
W30×261	943	2350	3540	1450	2180	29.2	43.9	12.5	43.4	13100	588	882
W33×241	940	2350	3530	1450	2180	33.2	49.8	12.8	39.7	14200	567	851
W36×232	936	2340	3510	1410	2120	44.6	67.1	9.25	29.9	15000	646	969
W27×281	936	2340	3510	1420	2140	24.6	36.9	12.0	49.2	11900	621	931
W14×455[h]	936	2340	3510	1320	1980	6.20	9.31	15.5	179	7190	767	1150
W24×306[h]	922	2300	3460	1380	2070	19.9	29.8	11.3	57.8	10700	684	1030
W40×211	**906**	**2260**	**3400**	**1370**	**2060**	**48.5**	**73.0**	**8.87**	**27.2**	**15500**	**591**	**886**

ASD	LRFD
$\Omega_b = 1.67$ $\Omega_v = 1.50$	$\phi_b = 0.90$ $\phi_v = 1.00$

[h] Flange thickness greater than 2 in. Special requirements may apply per AISC Specification Section A3.1c.

[v] Shape does not meet the h/t_w limit for shear in Specification Section G2.1a with F_y = 50 ksi, $\Omega_v = 1.67$, $\phi_v = 0.90$.

F_y = 50 ksi

Table 3–2 (continued)
W Shapes
Selection by Z_x

Z_X

Shape	Z_x	M_{px}/Ω_b	$\phi_b M_{px}$	M_{rx}/Ω_b	$\phi_b M_{rx}$	*BF*		L_p	L_r	I_x	V_{nx}/Ω_v	$\phi_v V_{nx}$
		kip-ft	kip-ft	kip-ft	kip-ft	kips	kips				kips	kips
	in.^{3}	ASD	LRFD	ASD	LRFD	ASD	LRFD	ft	ft	in.^{4}	ASD	LRFD
W40×199	**869**	**2170**	**3260**	**1340**	**2020**	**37.2**	**55.9**	**12.2**	**34.3**	**14900**	**503**	**754**
W14×426[h]	869	2170	3260	1230	1850	6.09	9.16	15.3	169	6600	700	1050
W33×221	857	2140	3210	1330	1990	31.8	47.8	12.7	38.2	12900	526	789
W27×258	852	2130	3200	1300	1960	24.2	36.4	11.9	45.9	10800	568	852
W30×235	847	2110	3180	1310	1960	28.3	42.5	12.4	40.9	11700	520	779
W24×279[h]	835	2080	3130	1250	1880	19.7	29.6	11.2	53.4	9600	620	930
W36×210	833	2080	3120	1260	1890	42.5	63.8	9.11	28.5	13200	609	914
W14×398[h]	801	2000	3000	1150	1720	5.96	8.96	15.2	158	6000	647	971
W40×183	**774**	**1930**	**2900**	**1180**	**1770**	**44.1**	**66.3**	**8.80**	**25.9**	**13200**	**507**	**760**
W33×201	773	1930	2900	1200	1800	30.2	45.3	12.6	36.8	11600	482	722
W27×235	772	1930	2900	1180	1780	23.9	35.9	11.8	42.9	9700	522	782
W36×194	767	1910	2880	1160	1740	40.6	61.0	9.04	27.6	12100	558	837
W18×311[h]	754	1880	2830	1090	1640	11.2	16.8	10.4	81.2	6970	679	1020
W30×211	751	1870	2820	1160	1750	27.0	40.7	12.3	38.7	10300	480	719
W24×250	744	1860	2790	1120	1690	19.5	29.3	11.1	48.6	8490	548	822
W14×370[h]	736	1840	2760	1060	1590	5.86	8.80	15.1	148	5440	593	890
W36×182	**718**	**1790**	**2690**	**1090**	**1640**	**39.1**	**58.8**	**9.01**	**27.0**	**11300**	**527**	**790**
W27×217	711	1770	2670	1100	1650	23.3	35.1	11.7	40.8	8910	472	708
W40×167	**693**	**1730**	**2600**	**1050**	**1580**	**41.8**	**62.9**	**8.48**	**24.8**	**11600**	**502**	**753**
W18×283[h]	676	1690	2540	987	1480	11.0	16.6	10.3	73.8	6170	612	918
W30×191	675	1680	2530	1050	1580	25.8	38.7	12.2	36.9	9200	436	653
W24×229	675	1680	2530	1030	1540	19.2	28.9	11.0	45.2	7650	500	749
W14×342[h]	672	1680	2520	975	1460	5.75	8.64	15.0	137	4900	540	810
W36×170	668	1670	2510	1010	1530	37.4	56.2	8.94	26.4	10500	492	738
W27×194	631	1570	2370	976	1470	22.5	33.8	11.6	38.2	7860	422	632
W33×169	629	1570	2360	959	1440	34.1	51.3	8.83	26.7	9290	453	680
W36×160	**624**	**1560**	**2340**	**947**	**1420**	**36.0**	**54.1**	**8.83**	**25.8**	**9760**	**468**	**702**
W18×258[h]	611	1520	2290	898	1350	11.0	16.5	10.2	67.4	5510	549	824
W30×173	607	1510	2280	945	1420	24.4	36.6	12.1	35.5	8230	399	598
W24×207	606	1510	2270	927	1390	18.9	28.5	10.9	41.8	6820	447	671
W14×311[h]	603	1500	2260	884	1330	5.63	8.46	14.8	125	4330	483	724
W12×336[h]	603	1500	2260	844	1270	4.80	7.22	12.3	150	4060	597	896

ASD	LRFD
$\Omega_b = 1.67$ $\Omega_v = 1.50$	$\phi_b = 0.90$ $\phi_v = 1.00$

[h] Flange thickness greater than 2 in. Special requirements may apply per AISC Specification Section A3.1c.

Z_x

Table 3–2 (continued)
W Shapes
Selection by Z_x

F_y = 50 ksi

Shape	Z_x	M_{px}/Ω_b	$\phi_b M_{px}$	M_{rx}/Ω_b	$\phi_b M_{rx}$	BF		L_p	L_r	I_x	V_{nx}/Ω_v	$\phi_v V_{nx}$
		kip-ft	kip-ft	kip-ft	kip-ft	kips	kips				kips	kips
	in.^{3}	ASD	LRFD	ASD	LRFD	ASD	LRFD	ft	ft	in.^{4}	ASD	LRFD
W40×149[v]	**598**	**1490**	**2240**	**896**	**1350**	**38.6**	**58.0**	**8.09**	**23.5**	**9800**	**432**	**650**
W36×150	581	1450	2180	880	1320	34.5	51.8	8.72	25.2	9040	448	672
W27×178	570	1420	2140	882	1330	21.7	32.7	11.5	36.3	7020	403	605
W33×152	559	1390	2100	851	1280	32.0	48.1	8.72	25.7	8160	425	638
W24×192	559	1390	2100	858	1290	18.7	28.0	10.8	39.6	6260	413	619
W18×234[h]	549	1370	2060	814	1220	10.8	16.2	10.1	61.5	4900	489	733
W14×283[h]	542	1350	2030	802	1200	5.53	8.31	14.7	114	3840	432	648
W12×305[h]	537	1340	2010	760	1140	4.66	7.00	12.1	137	3550	530	796
W21×201	530	1320	1990	805	1210	14.6	21.9	10.7	46.1	5310	419	629
W27×161	515	1280	1930	800	1200	20.8	31.3	11.4	34.7	6310	364	546
W33×141	**514**	**1280**	**1930**	**782**	**1180**	**30.4**	**45.8**	**8.58**	**25.0**	**7450**	**403**	**604**
W24×176	511	1270	1920	786	1180	18.3	27.6	10.7	37.4	5680	379	568
W36×135[v]	**509**	**1270**	**1910**	**767**	**1150**	**31.8**	**47.8**	**8.41**	**24.2**	**7800**	**383**	**576**
W30×148	500	1250	1880	761	1140	28.8	43.3	8.05	24.9	6680	399	598
W18×211	490	1220	1840	732	1100	10.7	16.1	9.96	55.8	4330	438	657
W14×257	487	1220	1830	725	1090	5.46	8.21	14.6	104	3400	385	577
W12×279[h]	481	1200	1800	686	1030	4.52	6.79	11.9	126	3110	485	728
W21×182	476	1190	1790	728	1090	14.3	21.6	10.6	42.6	4730	377	566
W24×162	468	1170	1760	723	1090	17.8	26.8	10.8	35.7	5170	353	529
W33×130	**467**	**1170**	**1750**	**709**	**1070**	**28.8**	**43.3**	**8.44**	**24.3**	**6710**	**384**	**576**
W27×146	464	1160	1740	723	1090	19.7	29.6	11.3	33.4	5660	331	497
W18×192	442	1100	1660	664	998	10.7	16.0	9.85	51.1	3870	391	586
W30×132	437	1090	1640	664	998	26.9	40.5	7.95	23.8	5770	373	559
W14×233	436	1090	1640	655	984	5.38	8.09	14.5	94.9	3010	343	515
W21×166	432	1080	1620	664	998	14.2	21.3	10.6	39.8	4280	337	506
W12×252[h]	428	1070	1610	617	927	4.40	6.62	11.8	114	2720	430	645
W24×146	418	1040	1570	648	974	17.1	25.8	10.6	33.7	4580	322	482
W33×118[v]	**415**	**1040**	**1560**	**627**	**942**	**26.7**	**40.2**	**8.19**	**23.5**	**5900**	**325**	**488**
W30×124	408	1020	1530	620	932	25.9	39.0	7.88	23.2	5360	353	529
W18×175	398	993	1490	601	903	10.6	15.9	9.75	46.7	3450	357	535
W27×129	395	986	1480	603	906	23.3	35.0	7.81	24.3	4760	337	506
W14×211	390	973	1460	590	887	5.31	7.99	14.4	86.4	2660	308	462
W12×230[h]	386	963	1450	561	843	4.32	6.49	11.7	105	2420	387	580

ASD	LRFD
$\Omega_b = 1.67$ $\Omega_v = 1.50$	$\phi_b = 0.90$ $\phi_v = 1.00$

[h] Flange thickness greater than 2 in. Special requirements may apply per AISC Specification Section A3.1c.

[v] Shape does not meet the h/t_w limit for shear in Specification Section G2.1a with F_y = 50 ksi, $\Omega_v = 1.67$, $\phi_v = 0.90$.

F_y = 50 ksi

Table 3–2 (continued)
W Shapes
Selection by Z_x

Z_x

Shape	Z_x	M_{px}/Ω_b	$\phi_b M_{px}$	M_{rx}/Ω_b	$\phi_b M_{rx}$	BF		L_p	L_r	I_x	V_{nx}/Ω_v	$\phi_v V_{nx}$
		kip-ft	kip-ft	kip-ft	kip-ft	kips	kips				kips	kips
	in.³	ASD	LRFD	ASD	LRFD	ASD	LRFD	ft	ft	in.⁴	ASD	LRFD
W30×116	**378**	**943**	**1420**	**575**	**864**	**24.7**	**37.2**	**7.74**	**22.6**	**4930**	**339**	**509**
W21×147	373	931	1400	575	864	13.8	20.7	10.4	36.3	3630	318	476
W24×131	370	923	1390	575	864	16.3	24.5	10.5	31.9	4020	296	444
W18×158	356	888	1340	541	814	10.5	15.7	9.68	42.8	3060	319	479
W14×193	355	886	1330	541	814	5.27	7.92	14.3	79.7	2400	276	413
W12×210	348	868	1310	510	767	4.24	6.38	11.6	96.0	2140	347	521
W30×108	**346**	**863**	**1300**	**522**	**785**	**23.7**	**35.6**	**7.59**	**22.0**	**4470**	**325**	**488**
W27×114	343	856	1290	522	785	21.7	32.6	7.70	23.1	4080	311	467
W21×132	333	831	1250	515	774	13.3	20.0	10.3	34.1	3220	284	426
W24×117	327	816	1230	508	764	15.3	23.1	10.4	30.4	3540	267	400
W18×143	322	803	1210	493	740	10.4	15.6	9.61	39.6	2750	285	427
W14×176	320	798	1200	491	738	5.22	7.84	14.2	73.2	2140	253	379
W30×99	**312**	**778**	**1170**	**470**	**706**	**22.2**	**33.3**	**7.42**	**21.4**	**3990**	**308**	**463**
W12×190	311	776	1170	459	690	4.18	6.28	11.5	87.3	1890	305	457
W21×122	307	766	1150	477	717	12.9	19.4	10.3	32.7	2960	260	390
W27×102	305	761	1140	466	701	20.2	30.3	7.59	22.2	3620	279	419
W18×130	290	724	1090	447	672	10.2	15.3	9.54	36.7	2460	258	387
W24×104	289	721	1080	451	677	14.3	21.5	10.3	29.2	3100	241	361
W14×159	287	716	1080	444	667	5.18	7.79	14.1	66.7	1900	223	335
W30×90[v]	**283**	**706**	**1060**	**428**	**643**	**20.5**	**30.9**	**7.38**	**20.9**	**3610**	**249**	**375**
W24×103	280	699	1050	428	643	18.2	27.4	7.03	21.9	3000	270	405
W21×111	279	696	1050	435	654	12.4	18.7	10.2	31.3	2670	237	355
W27×94	278	694	1040	424	638	19.1	28.8	7.49	21.6	3270	264	396
W12×170	275	686	1030	410	617	4.11	6.18	11.4	78.5	1650	269	404
W18×119	262	654	983	403	606	10.1	15.2	9.50	34.3	2190	249	373
W14×145	260	649	975	405	609	5.11	7.68	14.1	61.7	1710	201	302
W24×94	254	634	953	388	583	17.3	26.0	6.99	21.2	2700	250	376
W21×101	253	631	949	396	596	11.8	17.7	10.2	30.1	2420	214	320
W27×84	**244**	**609**	**915**	**372**	**559**	**17.6**	**26.4**	**7.31**	**20.8**	**2850**	**246**	**369**
W12×152	243	606	911	365	549	4.07	6.11	11.3	70.6	1430	239	358
W14×132	234	584	878	365	549	5.13	7.70	13.3	56.0	1530	189	284
W18×106	230	574	863	356	536	9.70	14.6	9.40	31.8	1910	221	332

ASD	LRFD
$\Omega_b = 1.67$ $\Omega_v = 1.50$	$\phi_b = 0.90$ $\phi_v = 1.00$

[v] Shape does not meet the h/t_w limit for shear in Specification Section G2.1a with F_y = 50 ksi, $\Omega_v = 1.67$, $\phi_v = 0.90$.

Z_x

Table 3–2 (continued)
W Shapes
Selection by Z_x

F_y = 50 ksi

Shape	Z_x	M_{px}/Ω_b	$\phi_b M_{px}$	M_{rx}/Ω_b	$\phi_b M_{rx}$	BF	BF	L_p	L_r	I_x	V_{nx}/Ω_v	$\phi_v V_{nx}$
		kip-ft	kip-ft	kip-ft	kip-ft	kips	kips				kips	kips
	in.³	ASD	LRFD	ASD	LRFD	ASD	LRFD	ft	ft	in.⁴	ASD	LRFD
W24×84	**224**	**559**	**840**	**342**	**515**	**16.2**	**24.3**	**6.89**	**20.3**	**2370**	**227**	**340**
W21×93	221	551	829	335	504	14.6	21.9	6.50	21.3	2070	251	376
W12×136	214	534	803	325	488	4.01	6.03	11.2	63.3	1240	212	318
W14×120	212	529	795	332	499	5.09	7.64	13.2	52.0	1380	171	256
W18×97	211	526	791	328	494	9.45	14.2	9.36	30.3	1750	199	298
W24×76	**200**	**499**	**750**	**307**	**462**	**15.0**	**22.5**	**6.78**	**19.6**	**2100**	**210**	**316**
W16×100	198	494	743	306	459	7.90	11.9	8.87	32.7	1490	199	298
W21×83	196	489	735	299	449	13.8	20.8	6.46	20.2	1830	221	331
W14×109	192	479	720	302	454	5.02	7.54	13.2	48.4	1240	150	226
W18×86	186	464	698	290	436	9.04	13.6	9.29	28.5	1070	177	265
W12×120	186	464	698	285	428	3.95	5.93	11.1	56.5	1530	186	279
W24×68	**177**	**442**	**664**	**269**	**404**	**14.1**	**21.2**	**6.61**	**18.8**	**1830**	**197**	**295**
W16×89	175	437	656	271	407	7.74	11.6	8.80	30.2	1300	176	264
W14×99[f]	173	430	646	274	412	4.89	7.35	13.5	45.3	1110	137	206
W21×73	172	429	645	264	396	12.9	19.4	6.39	19.2	1600	193	290
W12×106	164	409	615	253	381	3.93	5.90	11.0	50.7	933	157	236
W18×76	163	407	611	255	383	8.49	12.8	9.22	27.1	1330	155	232
W21×68	**160**	**399**	**600**	**245**	**368**	**12.5**	**18.8**	**6.36**	**18.7**	**1480**	**182**	**273**
W14×90[f]	157	382	573	250	375	4.80	7.22	15.2	42.6	999	123	185
W24x62	**153**	**382**	**574**	**229**	**344**	**16.0**	**24.1**	**4.87**	**14.4**	**1550**	**204**	**306**
W16×77	150	374	563	234	352	7.34	11.0	8.72	27.8	1110	150	225
W12×96	147	367	551	229	344	3.87	5.81	10.9	46.6	833	140	210
W10×112	147	367	551	220	331	2.68	4.02	9.47	64.3	716	172	257
W18×71	146	364	548	222	333	10.5	15.7	6.00	19.6	1170	183	274
W21×62	**144**	**359**	**540**	**222**	**333**	**11.6**	**17.4**	**6.25**	**18.1**	**1330**	**168**	**252**
W14×82	139	347	521	215	323	5.43	8.16	8.76	33.1	881	146	219
W24×55[v]	**134**	**334**	**503**	**199**	**299**	**14.8**	**22.2**	**4.73**	**13.9**	**1350**	**167**	**251**
W18×65	133	332	499	204	307	9.92	14.9	5.97	18.8	1070	165	248
W12×87	132	329	495	206	310	3.84	5.76	10.8	43.0	740	129	194
W16×67	130	324	488	204	307	6.91	10.4	8.69	26.1	954	129	194
W10×100	130	324	488	196	294	2.66	4.01	9.36	57.7	623	151	226
W21×57	129	322	484	194	291	13.4	20.1	4.77	14.3	1170	171	256

ASD	LRFD
Ω_b = 1.67 Ω_v = 1.50	ϕ_b = 0.90 ϕ_v = 1.00

[f] Shape exceeds compact limit for flexure with F_y = 50 ksi.

[v] Shape does not meet the h/t_w limit for shear in Specification Section G2.1a with F_y = 50 ksi, Ω_v = 1.67, ϕ_v = 0.90.

F_y = 50 ksi

Table 3–2 (continued)
W Shapes
Selection by Z_x

Z_x

Shape	Z_x	M_{px}/Ω_b	$\phi_b M_{px}$	M_{rx}/Ω_b	$\phi_b M_{rx}$	BF	BF	L_p	L_r	I_x	V_{nx}/Ω_v	$\phi_v V_{nx}$
		kip-ft	kip-ft	kip-ft	kip-ft	kips	kips				kips	kips
	in.^{3}	ASD	LRFD	ASD	LRFD	ASD	LRFD	ft	ft	in.^{4}	ASD	LRFD
W21×55	**126**	**314**	**473**	**192**	**289**	**10.8**	**16.3**	**6.11**	**17.4**	**1140**	**156**	**234**
W14×74	126	314	473	196	294	5.34	8.03	8.76	31.0	795	128	191
W18×60	123	307	461	189	284	9.64	14.5	5.93	18.2	984	151	227
W12×79	119	297	446	187	281	3.77	5.67	10.8	39.9	662	116	175
W14×68	115	287	431	180	270	5.20	7.81	8.69	29.3	722	117	175
W10×88	113	282	424	172	259	2.63	3.95	9.29	51.1	534	131	197
W18×55	**112**	**279**	**420**	**172**	**258**	**9.26**	**13.9**	**5.90**	**17.5**	**890**	**141**	**212**
W21×50	**110**	**274**	**413**	**165**	**248**	**12.2**	**18.3**	**4.59**	**13.6**	**984**	**158**	**237**
W12×72	108	269	405	170	256	3.72	5.59	10.7	37.4	597	105	158
W21×48[f]	**107**	**265**	**398**	**162**	**244**	**9.78**	**14.7**	**6.09**	**16.6**	**959**	**144**	**217**
W16×57	105	262	394	161	242	7.98	12.0	5.65	18.3	758	141	212
W14×61	102	254	383	161	242	4.96	7.46	8.65	27.5	640	104	156
W18×50	101	252	379	155	233	8.69	13.1	5.83	17.0	800	128	192
W10×77	97.6	244	366	150	225	2.59	3.90	9.18	45.2	455	112	169
W12×65[f]	96.8	237	356	154	231	3.60	5.41	11.9	35.1	533	94.5	142
W21×44	**95.4**	**238**	**358**	**143**	**214**	**11.2**	**16.8**	**4.45**	**13.0**	**843**	**145**	**217**
W16×50	92.0	230	345	141	213	7.59	11.4	5.62	17.2	659	124	185
W18×46	90.7	226	340	138	207	9.71	14.6	4.56	13.7	712	130	195
W14×53	87.1	217	327	136	204	5.27	7.93	6.78	22.2	541	103	155
W12×58	86.4	216	324	136	205	3.76	5.66	8.87	29.9	475	87.8	132
W10×68	85.3	213	320	132	199	2.57	3.86	9.15	40.6	394	97.8	147
W16×45	82.3	205	309	127	191	7.16	10.8	5.55	16.5	586	111	167
W18×40	**78.4**	**196**	**294**	**119**	**180**	**8.86**	**13.3**	**4.49**	**13.1**	**612**	**113**	**169**
W14×48	78.4	196	294	123	184	5.10	7.66	6.75	21.1	484	93.8	141
W12×53	77.9	194	292	123	185	3.65	5.48	8.76	28.2	425	83.2	125
W10×60	74.6	186	280	116	175	2.53	3.80	9.08	36.6	341	85.8	129
W16×40	**73.0**	**182**	**274**	**113**	**170**	**6.69**	**10.1**	**5.55**	**15.9**	**518**	**97.7**	**146**
W12×50	71.9	179	270	112	169	3.97	5.97	6.92	23.9	391	90.2	135
W8×67	70.1	175	263	105	159	1.73	2.60	7.49	47.7	272	103	154
W14×43	69.6	174	261	109	164	4.82	7.24	6.68	20.0	428	83.3	125
W10×54	66.6	166	250	105	158	2.49	3.74	9.04	33.7	303	74.7	112

ASD	LRFD
$\Omega_b = 1.67$ $\Omega_v = 1.50$	$\phi_b = 0.90$ $\phi_v = 1.00$

[f] Shape exceeds compact limit for flexure with F_y = 50 ksi.

Z_x

Table 3–2 (continued)
W Shapes
Selection by Z_x

F_y = 50 ksi

Shape	Z_x	M_{px}/Ω_b	$\phi_b M_{px}$	M_{rx}/Ω_b	$\phi_b M_{rx}$	*BF*		L_p	L_r	I_x	V_{nx}/Ω_v	$\phi_v V_{nx}$
		kip-ft	kip-ft	kip-ft	kip-ft	kips	kips				kips	kips
	in.³	ASD	LRFD	ASD	LRFD	ASD	LRFD	ft	ft	in.⁴	ASD	LRFD
W18×35	66.5	166	249	101	151	8.07	12.1	4.31	12.4	510	106	159
W12×45	64.2	160	241	101	151	3.83	5.75	6.89	22.4	348	80.8	121
W16×36	64.0	160	240	98.7	148	6.19	9.31	5.37	15.2	448	93.6	140
W14×38	61.5	153	231	95.4	143	5.39	8.10	5.47	16.2	385	87.4	131
W10×49	60.4	151	227	95.4	143	2.44	3.67	8.97	31.6	272	68.0	102
W8×58	59.8	149	224	90.8	137	1.70	2.56	7.42	41.7	228	89.3	134
W12×40	57.0	142	214	89.9	135	3.66	5.50	6.85	21.1	307	70.4	106
W10×45	54.9	137	206	85.8	129	2.59	3.89	7.10	26.9	248	70.7	106
W14×34	54.6	136	205	84.9	128	5.05	7.59	5.40	15.6	340	79.7	120
W16×31	54.0	135	203	82.4	124	6.76	10.2	4.13	11.9	375	87.3	131
W12×35	51.2	128	192	79.6	120	4.28	6.43	5.44	16.7	285	75.0	113
W8×48	49.0	122	184	75.4	113	1.68	2.53	7.35	35.2	184	68.0	102
W14×30	47.3	118	177	73.4	110	4.65	6.99	5.26	14.9	291	74.7	112
W10×39	46.8	117	176	73.5	111	2.51	3.77	6.99	24.2	209	62.5	93.7
W16×26[v]	44.2	110	166	67.1	101	5.96	8.96	3.96	11.2	301	70.5	106
W12×30	43.1	108	162	67.4	101	3.92	5.89	5.37	15.6	238	64.2	96.3
W14×26	40.2	100	151	61.7	92.7	5.32	7.99	3.81	11.1	245	70.9	106
W8×40	39.8	99.3	149	62.0	93.2	1.64	2.47	7.21	29.9	146	59.4	89.1
W10×33	38.8	96.8	146	61.1	91.9	2.39	3.59	6.85	21.8	171	56.4	84.7
W12×26	37.2	92.8	140	58.3	87.7	3.61	5.42	5.33	14.9	204	56.2	84.3
W10×30	36.6	91.3	137	56.6	85.0	3.08	4.62	4.84	16.1	170	62.8	94.2
W8×35	34.7	86.6	130	54.5	81.9	1.62	2.43	7.17	27.0	127	50.3	75.5
W14×22	33.2	82.8	125	50.6	76.1	4.75	7.14	3.67	10.4	199	63.2	94.8
W10×26	31.3	78.1	117	48.7	73.2	2.90	4.36	4.80	14.9	144	53.7	80.6
W8×31[f]	30.4	75.8	114	48.0	72.2	1.58	2.37	7.18	24.8	110	45.6	68.4
W12×22	29.3	73.1	110	44.4	66.7	4.65	6.99	3.00	9.17	156	64.0	96.0
W8×28	27.2	67.9	102	42.4	63.8	1.66	2.50	5.72	21.0	98.0	45.9	68.9
W10×22	26.0	64.9	97.5	40.5	60.9	2.68	4.02	4.70	13.8	118	48.8	73.2
W12×19	24.7	61.6	92.6	37.2	55.9	4.27	6.43	2.90	8.62	130	57.2	85.7
W8x24	23.1	57.6	86.6	36.5	54.9	1.59	2.39	5.69	19.0	82.7	38.9	58.3
W10×19	21.6	53.9	81.0	32.8	49.3	3.17	4.77	3.09	9.72	96.3	51.2	76.8
W8×21	20.4	50.9	76.5	31.8	47.8	1.86	2.79	4.45	14.8	75.3	41.4	62.1

ASD	LRFD
$\Omega_b = 1.67$	$\phi_b = 0.90$
$\Omega_v = 1.50$	$\phi_v = 1.00$

[f] Shape exceeds compact limit for flexure with F_y = 50 ksi.
[v] Shape does not meet the h/t_w limit for shear in Specification Section G2.1a with F_y = 50 ksi, $\Omega_v = 1.67$, $\phi_v = 0.90$.

F_y = 50 ksi

Table 3–2 (continued)
W Shapes
Selection by Z_x

Z_x

Shape	Z_x	M_{px}/Ω_b	$\phi_b M_{px}$	M_{rx}/Ω_b	$\phi_b M_{rx}$	BF	BF	L_p	L_r	I_x	V_{nx}/Ω_v	$\phi_v V_{nx}$
		kip-ft	kip-ft	kip-ft	kip-ft	kips	kips				kips	kips
	in.^{3}	ASD	LRFD	ASD	LRFD	ASD	LRFD	ft	ft	in.^{4}	ASD	LRFD
W12×16	**20.1**	**50.1**	**75.4**	**29.9**	**44.9**	**3.82**	**5.75**	**2.73**	**8.03**	**103**	**52.8**	**79.1**
W10×17	18.7	46.7	70.1	28.3	42.5	2.99	4.49	2.98	9.13	81.9	48.5	72.8
W12×14[v]	**17.4**	**43.4**	**65.2**	**26.0**	**39.1**	**3.42**	**5.15**	**2.66**	**7.74**	**88.6**	**42.8**	**64.3**
W8×18	17.0	42.4	63.8	26.5	39.9	1.74	2.61	4.34	13.50	61.9	37.4	56.2
W10×15	16.0	39.9	60.0	24.1	36.2	2.75	4.14	2.86	8.61	68.9	46.0	69.0
W8×15	13.6	33.9	51.0	20.6	31.0	1.92	2.88	3.09	10.00	48.0	39.7	59.6
W10×12[f]	**12.6**	**31.2**	**46.9**	**19.0**	**28.6**	**2.35**	**3.53**	**2.87**	**8.05**	**53.8**	**37.5**	**56.3**
W8×13	11.4	28.4	42.8	17.3	26.0	1.76	2.65	2.98	9.30	39.6	36.8	55.1
W8×10[f]	**8.9**	**21.9**	**32.9**	**13.6**	**20.5**	**1.52**	**2.28**	**3.14**	**8.56**	**30.8**	**26.8**	**40.2**

ASD	LRFD
$\Omega_b = 1.67$ $\Omega_v = 1.50$	$\phi_b = 0.90$ $\phi_v = 1.00$

[f] Shape exceeds compact limit for flexure with $F_y = 50$ ksi.
[v] Shape does not meet the h/t_w limit for shear in Specification Section G2.1a with $F_y = 50$ ksi, $\Omega_v = 1.67$, $\phi_v = 0.90$.

I_x

Table 3–3
W Shapes
Selection by I_x

Shape	I_x	Shape	I_x	Shape	I_x	Shape	I_x
	in.^{4}		in.^{4}		in.^{4}		in.^{4}
W36×800[h]	**64700**	**W44×230**	**20800**	**W40×167**	**11600**	**W33×118**	**5900**
		W30×391[h]	20700	W33×201	11600	W30×132	5770
W36×652[h]	**50600**	W40×278	20500	W36×182	11300	W24×176	5680
		W40×249	19600	W27×258	10800	W27×146	5660
W40×593[h]	**50400**	W36×282	19600	W14×605[h]	10800	W18×258[h]	5510
		W33×318	19500	W24×306[h]	10700	W14×370[h]	5440
W40×503[h]	**41600**	W40×264	19400	W36×170	10500	W30×124	5360
W36×529[h]	39600	W30×357[h]	18700	W30×211	10300	W21×201	5310
		W36×262	17900			W24×162	5170
W36×487[h]	**36000**	W33×291	17700	**W40×149**	**9800**		
		W40×235	17400	W36×160	9760	**W30×116**	**4930**
W40×431[h]	**34800**	W36×256	16800	W27×235	9700	W18×234[h]	4900
W36×441[h]	32100	W30×326[h]	16800	W24×279[h]	9600	W14×342[h]	4900
				W14×550[h]	9430	W27×129	4760
W40×397[h]	**32000**	**W40×215**	**16700**	W33×169	9290	W21×182	4730
		W36×247	16700	W30×191	9200	W24×146	4580
W44×335	**31100**	W27×368[h]	16200	W36×150	9040		
W40×392[h]	29900	W33×263	15900	W27×217	8910	**W30×108**	**4470**
W40×372[h]	29600	W36×231	15600	W24×250	8490	W18×211	4330
W40×362[h]	28900			W30×173	8230	W14×311[h]	4330
W36×395[h]	28500	**W40×211**	**15500**	W14×500[h]	8210	W21×166	4280
		W36×232	15000	W33×152	8160	W27×114	4080
W44×290	**27000**			W27×194	7860	W12×336[h]	4060
W36×361[h]	25700	**W40×199**	**14900**			W24×131	4020
W40×324	25600	W30×292	14900	**W36×135**	**7800**		
W27×539[h]	25600	W27×336[h]	14600	W24×229	7650	**W30×99**	**3990**
W40×331[h]	24700	W14×730[h]	14300	W33×141	7450	W18×192	3870
W40×327[h]	24500	W33×241	14200	W14×455[h]	7190	W14×283[h]	3840
W33×387[h]	24300	W24×370[h]	13400	W27×178	7020	W21×147	3630
				W18×311[h]	6970	W27×102	3620
W44×262	**24100**	**W40×183**	**13200**	W24×207	6820		
W36×330	23300	W36×210	13200				
W40×297	23200	W30×261	13100	**W33×130**	**6710**		
W33×354[h]	22000	W27×307[h]	13100	W30×148	6680		
W40×277	21900	W33×221	12900	W14×426[h]	6600		
W40×294	21900	W14×665[h]	12400	W27×161	6310		
W36×302	21100	W36×194	12100	W24×192	6260		
		W27×281	11900	W18×283[h]	6170		
		W24×335[h]	11900	W14×398[h]	6000		
		W30×235	11700				

[h] Flange thickness greater than 2 in. Special requirements may apply per AISC Specification Section A3.1c.

Table 3–3 (continued)
W Shapes
Selection by I_x

I_x

Shape	I_x	Shape	I_x	Shape	I_x	Shape	I_x
	in.^{4}		in.^{4}		in.^{4}		in.^{4}
W30×90	**3610**	**W24×68**	**1830**	**W21×44**	**843**	**W16×26**	**301**
W12×305[h]	3550	W21×83	1830	W12×96	833	W14×30	291
W24×117	3540	W18×97	1750	W18×50	800	W12×35	285
W18×175	3450	W14×145	1710	W14×74	795	W10×49	272
W14×257	3400	W12×170	1650	W16×57	758	W8×67	272
W27×94	3270	W21×73	1600	W12×87	740	W10×45	248
W21×132	3220			W14×68	722		
W12×279[h]	3110	**W24×62**	**1550**	W10×112	716	**W14×26**	**245**
W24×104	3100	W18×86	1530	W18×46	712	W12×30	238
W18×158	3060	W14×132	1530	W12×79	662	W8×58	228
W14×233	3010	W16×100	1490	W16×50	659	W10×39	209
W24×103	3000	W21×68	1480	W14×61	640		
W21×122	2960	W12×152	1430	W10×100	623	**W12×26**	**204**
		W14×120	1380				
W27×84	**2850**			**W18×40**	**612**	**W14×22**	**199**
W18×143	2750	**W24×55**	**1350**	W12×72	597	W8×48	184
W12×252[h]	2720	W21×62	1330	W16×45	586	W10×33	171
W24×94	2700	W18×76	1330	W14×53	541	W10×30	170
W21×111	2670	W16×89	1300	W10×88	534		
W14×211	2660	W14×109	1240	W12×65	533	**W12×22**	**156**
W18×130	2460	W12×136	1240			W8×40	146
W21×101	2420	W21×57	1170	**W16×40**	**518**	W10×26	144
W12×230[h]	2420	W18×71	1170				
W14×193	2400			**W18×35**	**510**	**W12×19**	**130**
		W21×55	**1140**	W14×48	484	W8×35	127
W24×84	**2370**	W16×77	1110	W12×58	475	W10×22	118
W18×119	2190	W14×99	1110	W10×77	455	W8×31	110
W14×176	2140	W18×65	1070	W16×36	448		
W12×210	2140	W12×120	1070	W14×43	428	**W12×16**	**103**
		W14×90	999	W12×53	425	W8×28	98.0
W24×76	**2100**			W10×68	394	W10×19	96.3
W21×93	2070	**W21×50**	**984**	W12×50	391		
W18×106	1910	W18×60	984	W14×38	385	**W12×14**	**88.6**
W14×159	1900					W8×24	82.7
W12×190	1890	**W21×48**	**959**	**W16×31**	**375**	W10×17	81.9
		W16×67	954	W12×45	348	W8×21	75.3
		W12×106	933	W10×60	341	W10×15	68.9
		W18×55	890	W14×34	340	W8×18	61.9
		W14×82	881	W12×40	307		
				W10×54	303	**W10×12**	**53.8**
						W8×15	48.0
						W8×13	39.6
						W8×10	**30.8**

[h] Flange thickness greater than 2 in. Special requirements may apply per AISC Specification Section A3.1c.

Z_y

Table 3–4
W Shapes
Selection by Z_y

F_y = 50 ksi

Shape	Z_y in.³	M_{py}/Ω_b kip-ft ASD	$\phi_b M_{py}$ kip-ft LRFD
W14×730[h]	**816**	**2040**	**3060**
W36×800	743	1850	2790
W14×665[h]	**730**	**1820**	**2740**
W14×605[h]	**652**	**1630**	**2450**
W14×550[h]	**583**	**1450**	**2190**
W36×652[h]	581	1450	2180
W14×500[h]	**522**	**1300**	**1960**
W40×593[h]	481	1200	1800
W14×455[h]	**468**	**1170**	**1760**
W36×529[h]	454	1130	1700
W27×539[h]	437	1090	1640
W14×426[h]	**434**	**1080**	**1630**
W36×487[h]	412	1030	1550
W14×398[h]	**402**	**1000**	**1510**
W40×503[h]	394	983	1480
W14×370[h]	**370**	**923**	**1390**
W36×441[h]	368	918	1380
W14×342[h]	**338**	**843**	**1270**
W40×431[h]	328	818	1230
W36×395[h]	325	811	1220
W33×387[h]	312	778	1170
W30×391[h]	310	773	1160
W14×311[h]	**304**	**758**	**1140**
W40×397[h]	300	749	1130
W36×361[h]	293	731	1100
W33×354[h]	282	704	1060
W30×357[h]	279	696	1050
W27×368[h]	279	696	1050
W40×372[h]	277	691	1040

Shape	Z_y in.³	M_{py}/Ω_b kip-ft ASD	$\phi_b M_{py}$ kip-ft LRFD
W14×283[h]	**274**	**684**	**1030**
W12×336[h]	274	684	1030
W40×362[h]	270	674	1010
W24×370[h]	267	666	1000
W36×330	265	661	994
W30×326[h]	252	629	945
W27×336[h]	252	629	945
W33×318	250	624	938
W14×257	**246**	**614**	**923**
W12×305[h]	244	609	915
W36×302	241	601	904
W40×324	239	596	896
W24×335[h]	238	594	893
W44×335	236	589	885
W27×307[h]	227	566	851
W33×291	226	564	848
W36×282	223	556	836
W30×292	223	556	836
W14×233	**221**	**551**	**829**
W12×279[h]	220	549	825
W40×297	215	536	806
W24×306[h]	214	534	803
W40×392[h]	212	519	780
W18×311[h]	207	516	776
W27×281	206	514	773
W44×290	205	511	769
W40×277	204	509	765
W36×262	204	509	765
W33×263	202	504	758

Shape	Z_y in.³	M_{py}/Ω_b kip-ft ASD	$\phi_b M_{py}$ kip-ft LRFD
W14×211	**198**	**494**	**743**
W30×261	196	489	735
W12×252[h]	196	489	735
W24×279[h]	193	482	724
W36×247	190	474	713
W27×258	187	467	701
W18×283[h]	185	462	694
W44×262	182	454	683
W40×249	182	454	683
W33×241	182	454	683
W14×193	**180**	**449**	**675**
W12×230[h]	177	442	664
W36×231	176	439	660
W30×235	175	437	656
W40×331[h]	172	423	636
W24×250	171	427	641
W27×235	168	419	630
W18×258[h]	166	414	623
W33×221	164	409	615
W14×176	**163**	**407**	**611**
W12×210	159	397	596
W44×230[f]	157	392	589
W40×215	156	389	585
W30×211	155	387	581
W27×217	154	384	578
W24×229	154	384	578
W40×294	150	373	561
W18×234[h]	149	372	559
W33×201	147	367	551

ASD	LRFD
$\Omega_b = 1.67$ $\Omega_v = 1.50$	$\phi_b = 0.90$ $\phi_v = 1.00$

[h] Flange thickness greater than 2 in. Special requirements may apply per AISC Specification Section A3.1c.

[f] Shape exceeds compact limit for flexure with F_y = 50 ksi.

F_y = 50 ksi

Table 3–4 (continued)
W Shapes
Selection by Z_y

Z_y

Shape	Z_y	M_{py}/Ω_b	$\phi_b M_{py}$
		kip-ft	kip-ft
	in.^{3}	ASD	LRFD
W14×159	**146**	**364**	**548**
W12×190	143	357	536
W40×278	140	348	523
W30×191	138	344	518
W40×199	137	342	514
W36×256	137	342	514
W24×207	137	342	514
W27×194	136	339	510
W21×201	133	332	499
W14×145	**133**	**332**	**499**
W40×264	132	329	4905
W18×211	132	329	495
W24×192	126	314	473
W12×170	126	314	473
W30×173	123	307	461
W36×232	122	304	458
W27×178	122	304	458
W21×182	119	297	446
W18×192	119	297	446
W40×235	118	294	443
W24×176	115	287	431
W14×132	**113**	**282**	**424**
W12×152	111	277	416
W27×161	109	272	409
W21×166	108	269	405
W36×210	107	267	401
W18×175	106	264	398
W40×211	105	262	394
W24×162	105	262	394
W14×120	**102**	**254**	**383**
W12×136	98.0	245	368
W36×194	97.7	244	366
W27×146	97.7	244	366
W18×158	94.8	237	356
W24×146	93.2	233	350

Shape	Z_y	M_{py}/Ω_b	$\phi_b M_{py}$
		kip-ft	kip-ft
	in.^{3}	ASD	LRFD
W14×109	**92.7**	**231**	**348**
W21×147	92.6	231	347
W36×182	90.7	226	340
W40×183	88.3	220	331
W18×143	85.4	213	320
W12×120	85.4	213	320
W33×169	84.4	211	317
W36×170	83.8	209	314
W14×99[f]	**83.6**	**207**	**311**
W21×132	82.3	205	309
W24×131	81.5	203	306
W36×160	77.3	193	290
W18×130	76.7	191	288
W40×167	76.0	190	285
W21×122	75.6	189	283
W14×90[f]	**75.6**	**181**	**273**
W12×106	75.1	187	282
W33×152	73.9	184	277
W24×117	71.4	178	268
W36×150	70.9	177	266
W10×112	69.2	173	260
W18×119	69.1	172	259
W21×111	68.2	170	256
W30×148	68.0	170	255
W12×96	67.5	168	253
W33×141	66.9	167	251
W24×104	62.4	156	234
W40×149	62.2	155	233
W21×101	61.7	154	231
W10×100	61.0	152	229
W18×106	60.5	151	227

Shape	Z_y	M_{py}/Ω_b	$\phi_b M_{py}$
		kip-ft	kip-ft
	in.^{3}	ASD	LRFD
W12×87	**60.4**	**151**	**227**
W36×135	59.7	149	224
W33×130	59.5	148	223
W30×132	58.4	146	219
W27×129	57.6	144	216
W18×97	55.3	138	207
W16×100	54.9	137	206
W12×79	**54.3**	**135**	**204**
W30×124	54.0	135	203
W10×88	53.1	132	199
W33×118	51.3	128	192
W27×114	49.3	123	185
W30×116	49.2	123	185
W12×72	**49.2**	**123**	**185**
W18×86	48.4	121	182
W16×89	48.1	120	180
W10×77	45.9	115	172
W14×82	44.8	112	168
W12×65[f]	**44.1**	**107**	**161**
W30×108	43.9	110	165
W27×102	43.4	108	163
W18×76	42.2	105	158
W24×103	41.5	104	156
W16×77	41.1	103	154
W14×74	40.5	101	152
W10×68	40.1	100	150
W27×94	38.8	96.8	146
W30×99	38.6	96.3	145
W24×94	37.5	93.6	141
W14×68	36.9	92.1	138
W16×67	35.5	88.6	133

ASD	LRFD
$\Omega_b = 1.67$ $\Omega_v = 1.50$	$\phi_b = 0.90$ $\phi_v = 1.00$

[f] Shape exceeds compact limit for flexure with F_y = 50 ksi.

Z_y

Table 3–4 (continued)
W Shapes
Selection by Z_y

F_y = 50 ksi

Shape	Z_y	M_{py}/Ω_b	$\phi_b M_{py}$
	in.^{3}	kip-ft ASD	kip-ft LRFD
W10×60	**35.0**	**87.3**	**131**
W30×90	34.7	86.6	130
W21×93	34.7	86.6	130
W27×84	33.2	82.8	125
W14×61	32.8	81.8	123
W8×67	32.7	81.6	123
W24×84	32.6	81.3	122
W12×58	**32.5**	**81.1**	**122**
W10×54	**31.3**	**78.1**	**117**
W21×83	30.5	76.1	114
W12×53	**29.1**	**72.6**	**109**
W24×76	28.6	71.4	107
W10×49	**28.3**	**70.6**	**106**
W8×58	27.9	69.6	105
W21×73	26.6	66.4	99.8
W18×71	24.7	61.6	92.6
W24×68	24.5	61.1	91.9
W21×68	24.4	60.9	91.5
W8×48	**22.9**	**57.1**	**85.9**
W18×65	22.5	56.1	84.4
W14×53	22.0	54.9	82.5
W21×62	21.7	54.1	81.4
W12×50	21.3	53.1	79.9
W18×60	20.6	51.4	77.3
W10×45	**20.3**	**50.6**	**76.1**
W14×48	19.6	48.9	73.5
W12×45	**19.0**	**47.4**	**71.3**
W16×57	18.9	47.2	70.9
W18×55	18.5	46.2	69.4

Shape	Z_y	M_{py}/Ω_b	$\phi_b M_{py}$
	in.^{3}	kip-ft ASD	kip-ft LRFD
W8×40	**18.5**	**46.2**	**69.4**
W21×55	18.4	45.9	69.0
W14×43	17.3	43.2	64.9
W10×39	**17.2**	**42.9**	**64.5**
W12×40	16.8	41.9	63.0
W18×50	16.6	41.4	62.3
W16×50	16.3	40.7	61.1
W8×35	**16.1**	**40.2**	**60.4**
W24×62	15.7	39.1	58.8
W21×48[f]	14.9	36.7	55.2
W21×57	14.8	36.9	55.5
W16×45	14.5	36.2	54.4
W8×31[f]	**14.1**	**35.1**	**52.8**
W10×33	14.0	34.9	52.5
W24×55	13.3	33.1	49.8
W16×40	12.7	31.7	47.6
W21×50	12.2	30.4	45.8
W14×38	12.1	30.2	45.4
W18×46	11.7	29.2	43.9
W12×35	11.5	28.7	43.1
W16×36	10.8	26.9	40.5
W14×34	10.6	26.4	39.8
W21×44	10.2	25.4	38.2
W8×28	**10.1**	**25.2**	**37.9**
W18×40	10.0	25.0	37.5
W12×30	9.56	23.9	35.9
W14×30	8.99	22.4	33.7
W10×30	8.84	22.1	33.2

Shape	Z_y	M_{py}/Ω_b	$\phi_b M_{py}$
	in.^{3}	kip-ft ASD	kip-ft LRFD
W8×24	**8.57**	**21.4**	**32.1**
W12×26	8.17	20.4	30.6
W18×35	8.06	20.1	30.2
W10×26	7.50	18.7	28.1
W16×31	7.03	17.5	26.4
W10×22	**6.10**	**15.2**	**22.9**
W8×21	**5.69**	**14.2**	**21.3**
W14×26	5.54	13.8	20.8
W16×26	5.48	13.7	20.6
W8×18	**4.66**	**11.6**	**17.5**
W14×22	4.39	11.0	16.5
W12×22	3.66	9.13	13.7
W10×19	3.35	8.36	12.6
W12×19	2.98	7.44	11.2
W10×17	**2.80**	**6.99**	**10.5**
W8×15	**2.67**	**6.66**	**10.0**
W10×15	**2.30**	**5.74**	**8.63**
W12×16	2.26	5.63	8.46
W8×13	**2.15**	**5.36**	**8.06**
W12×14	1.90	4.74	7.13
W10×12[f]	**1.74**	**4.30**	**6.46**
W8×10[f]	**1.66**	**4.07**	**6.12**

ASD	LRFD
$\Omega_b = 1.67$ $\Omega_v = 1.50$	$\phi_b = 0.90$ $\phi_v = 1.00$

[f] Shape exceeds compact limit for flexure with F_y = 50 ksi.

Table 3–5
W Shapes
Selection by I_y

Shape	I_y in.^{4}	Shape	I_y in.^{4}	Shape	I_y in.^{4}	Shape	I_y in.^{4}
W14×730[h]	**4720**	**W14×283[h]**	**1440**	**W14×193**	**931**	**W14×132**	**548**
W36×800[h]	4200	W40×372[h]	1420	W40×249	926	W21×201	542
		W36×330	1420	W44×262	923	W24×192	530
W14×665[h]	**4170**	W30×357[h]	1390	W24×306[h]	919	W36×256	528
		W40×362[h]	1380	W27×258	859	W40×278	521
W14×605[h]	**3680**	W27×368[h]	1310	W30×235	855	W12×170	517
		W36×302	1300	W33×221	840	W27×161	497
W14×550[h]	**3250**	W33×318	1290				
W36×652[h]	3230			**W14×176**	**838**	**W14×120**	**495**
		W14×257	**1290**	W12×252[h]	828	W40×264	493
W14×500[h]	**2880**	W30×326[h]	1240	W24×279[h]	823	W18×211	493
		W40×324	1220	W40×392[h]	803	W21×182	483
W14×455[h]	**2560**	W44×335	1200	W44×230	796	W24×176	479
W40×593[h]	2520	W36×282	1200	W40×215	796	W36×232	468
		W12×336[h]	1190	W18×311[h]	795	W12×152	454
W36×529[h]	**2490**	W27×336[h]	1180	W27×235	769		
		W33×291	1160	W30×211	757	**W14×109**	**447**
W14×426[h]	**2360**	W24×370[h]	1160	W33×201	749	W40×235	444
W36×487[h]	2250					W27×146	443
		W14×233	**1150**	**W14×159**	**748**	W24×162	443
W14×398[h]	**2170**	W30×292	1100	W12×230[h]	742	W18×192	440
W27×539[h]	2110	W40×297	1090	W24×250	724	W21×166	435
W40×503[h]	2040	W36×262	1090	W27×217	704	W36×210	411
W36×441[h]	1990	W27×307[h]	1050	W18×283[h]	704		
		W12×305[h]	1050	W40×199	695	**W14×99**	**402**
W14×370[h]	**1990**	W44×290	1040			W12×136	398
		W40×277	1040	**W14×145**	**677**	W24×146	391
W14×342[h]	**1810**	W33×263	1040	W30×191	673	W18×175	391
W36×395[h]	1750	W24×335[h]	1030	W12×210	664	W40×211	390
W40×431[h]	1690			W24×229	651	W21×147	376
W33×387[h]	1620	**W14×211**	**1030**	W40×331[h]	644	W36×194	375
		W36×247	1010	W40×327[h]	640		
W14×311[h]	**1610**	W30×261	959	W18×258[h]	628		
W36×361[h]	1570	W27×281	953	W27×194	619		
W30×391[h]	1550	W36×231	940	W30×173	598		
W40×397[h]	1540	W12×279[h]	937	W12×190	589		
W33×354[h]	1460	W33×241	933	W24×207	578		
				W40×294	562		
				W18×234[h]	558		
				W27×178	555		

[h] Flange thickness greater than 2 in. Special requirements may apply per AISC Specification Section A3.1c.

I_y

Table 3–5 (continued)
W Shapes
Selection by I_y

Shape	I_y in.^{4}	Shape	I_y in.^{4}	Shape	I_y in.^{4}	Shape	I_y in.^{4}
W14×90	**362**	**W12×65**	**174**	**W8×48**	**60.9**	**W8×28**	**21.7**
W36×182	347	W30×116	164	W18×71	60.3	W21×44	20.7
W18×158	347	W16×89	163	W14×53	57.7	W12×30	20.3
W12×120	345	W27×114	159	W21×62	57.5	W14×30	19.6
W24×131	340	W10×77	154	W12×50	56.3	W18×40	19.1
W21×132	333	W18×76	152	W18×65	54.8		
W40×183	331	W14×82	148			**W8×24**	**18.3**
W36×170	320	W30×108	146	**W10×45**	**53.4**	W12×26	17.3
W18×143	311	W27×102	139	W14×48	51.4	W10×30	16.7
W33×169	310	W16×77	138	W18×60	50.1	W18×35	15.3
W21×122	305	W14×74	134			W10×26	14.1
W12×106	301	W10×68	134	**W12×45**	**50.0**	W16×31	12.4
W24×117	297	W30×99	128				
W36×160	295	W27×94	124	**W8×40**	**49.1**	**W10×22**	**11.4**
W40×167	283	W14×68	121	W21×55	48.4		
W18×130	278	W24×103	119	W14×43	45.2	**W8×21**	**9.77**
W21×111	274	W16×67	119			W16×26	9.59
W33×152	273			**W10×39**	**45.0**	W14×26	8.91
W36×150	270	**W10×60**	**116**	W18×55	44.9		
W12×96	270	W30×90	115	W12×40	44.1	**W8×18**	**7.97**
W24×104	259	W24×94	109	W16×57	43.1	W14×22	7.00
W18×119	253	W14×61	107			W12×22	4.66
W21×101	248			**W8×35**	**42.6**	W10×19	4.29
W33×141	246	**W12×58**	**107**	W18×50	40.1	W12×19	3.76
		W27×84	106	W21×48	38.7		
W12×87	**241**			W16×50	37.2	**W10×17**	**3.56**
W10×112	236	**W10×54**	**103**				
W40×149	229			**W8×31**	**37.1**	**W8×15**	**3.41**
W30×148	227	**W12×53**	**95.8**	W10×33	36.6		
W36×135	225	W24×84	94.4	W24×62	34.5	**W10×15**	**2.89**
W18×106	220			W16×45	32.8	W12×16	2.82
W33×130	218	**W10×49**	**93.4**	W21×57	30.6		
		W21×93	92.9	W24×55	29.1	**W8×13**	**2.73**
W12×79	**216**	W8×67	88.6	W16×40	28.9	W12×14	2.36
W10×100	207	W24×76	82.5	W14×38	26.7		
W18×97	201	W21×83	81.4	W21×50	24.9	**W10×12**	**2.18**
W30×132	196	W8×58	75.1	W16×36	24.5		
		W21×73	70.6	W12×35	24.5	**W8×10**	**2.09**
W12×72	**195**	W24×68	70.4	W14×34	23.3		
W33×118	187	W21×68	64.7	W18×46	22.5		
W16×100	186						
W27×129	184						
W30×124	181						
W10×88	179						
W18×86	175						

[h] Flange thickness greater than 2 in. Special requirements may apply per AISC Specification Section A3.1c.

beam weight, which should be deducted when calculating the maximum uniform load the beam will support. C_b is taken as unity.

When the plotted curve is solid, the W-shape for that curve is the lightest cross-section for a given combination of available flexural strength and unbraced length. When the plotted curve is dashed, a lighter W-shape than that for the plotted curve exists. The plotted curves are arbitrarily terminated at a span-to-depth ratio of 30 in most cases.

L_p is indicated in each curve as a solid dot (•). L_r is indicated in each curve as an open dot (◦).

Tables 3–11. C- and MC-Shapes—Plots of Available Moment vs. Unbraced Length

Table 3–11 is similar to Table 3–10, except it covers C- and MC-shapes with F_y = 36 ksi (ASTM A36).

AVAILABLE FLEXURAL STRENGTH OF HSS

Table 3–12. Rectangular HSS—Available Flexural Strength

The available flexural strength is tabulated for rectangular HSS with F_y = 46 ksi (ASTM A500 grade B). For non-compact and slender cross-sections, the tabulated values of M_p/Ω_b and $\phi_b M_p$ have been adjusted to account for the non-compactness or slenderness.

Table 3–13. Square HSS—Available Flexural Strength

Table 3–13 is similar to Table 3–12, except it covers square HSS with F_y = 46 ksi (ASTM A500 grade B).

Table 3–14. Round HSS—Available Flexural Strength

Table 3–14 is similar to Table 3–12, except it covers round HSS with F_y = 42 ksi (ASTM A500 grade B).

Table 3–15. Pipe—Available Flexural Strength

Table 3–15 is similar to Table 3–12, except it covers Pipe with F_y = 35 ksi (ASTM A53 grade B).

STRENGTH OF OTHER FLEXURAL MEMBERS

Tables 3–16 and 3–17. Available Shear Stress in Plate Girders

The available shear stress for plate girders is plotted as a function of a/h and h/t_w in Tables 3–16 (for F_y = 36 ksi) and 3–17 (for F_y = 50 ksi). In part a of each table, tension-field action is neglected. In part b of each table, tension-field action is considered.

Table 3–18. Floor Plates

The recommended maximum uniformly distributed loads are given in Table 3–18 based upon simple-span bending between supports. Table 3–18a is for deflection-controlled applications and should be used with the appropriate serviceability load combinations. The tabulated values correspond to a maximum deflection of $L/100$. Table 3–18b is for flexural-strength-controlled applications and should be used with LRFD or ASD load combinations. The tabulated values correspond to a maximum bending stress of 24 ksi in LRFD and 16 ksi in ASD.

COMPOSITE BEAM SELECTION TABLES

Table 3–19. Composite W-Shapes

The available flexural strength is tabulated for W-shapes with $F_y = 50$ ksi (ASTM A992). The values tabulated are independent of the specific concrete flange properties. The designer can then select an appropriate combination of concrete strength and slab geometry.

The location of the plastic neutral axis (PNA) is uniquely determined by the horizontal shear force ΣQ_n at the interface between the steel section and the concrete slab. With the knowledge of the location of the PNA and the distance to the centroid of the concrete flange force ΣQ_n, the available flexural strength can be computed.

Available flexural strengths are tabulated for plastic neutral axis (PNA) locations at the seven locations shown. Five of these PNA locations are in the beam flange. The seventh PNA location is computed at the point where ΣQ_n equals $0.25F_yA_s$, and the sixth PNA location is at the midpoint between five and seven. Use of beams with a PNA below location seven is discouraged.

Table 3–19 can be used to design a composite beam by entering with a required flexural strength and determining the corresponding required ΣQ_n. Alternatively, Table 3–19 can be used to check the flexural strength of a composite beam by selecting a valid value of ΣQ_n, using Table 3–21. With the effective width of the concrete flange b determined per AISC *Specification* Section I3.1a, the appropriate value of the distance from concrete flange force to beam top flange $Y2$ can be determined as

$$Y_2 = Y_{con} - \frac{a}{2}$$

where

Y_{con} = distance from top of steel beam to top of concrete, in.

$$a = \frac{\Sigma Q_n}{0.85 f'_c b}$$

and the available flexural strength, $\phi_b M_n$ or M_n/Ω_b, can then be determined from Table 3–19. Values for the distance from the PNA to the beam top flange $Y1$ are also tabulated for convenience. The parameters $Y1$ and $Y2$ are illustrated in Figure 3–3. Note that the model of the steel beam used in the calculation of the available strength assumes that:

A_s = cross-sectional area of the steel section, in.^{2}
A_f = flange area = $b_f \times t_f$, in.^{2}
A_w = web area = $(d - 2k)t_w$, in.^{2}
$K_{dep} = k - t_f$, in.
$K_{area} = (A_s - 2A_f - A_w)/2$, in.^{2}

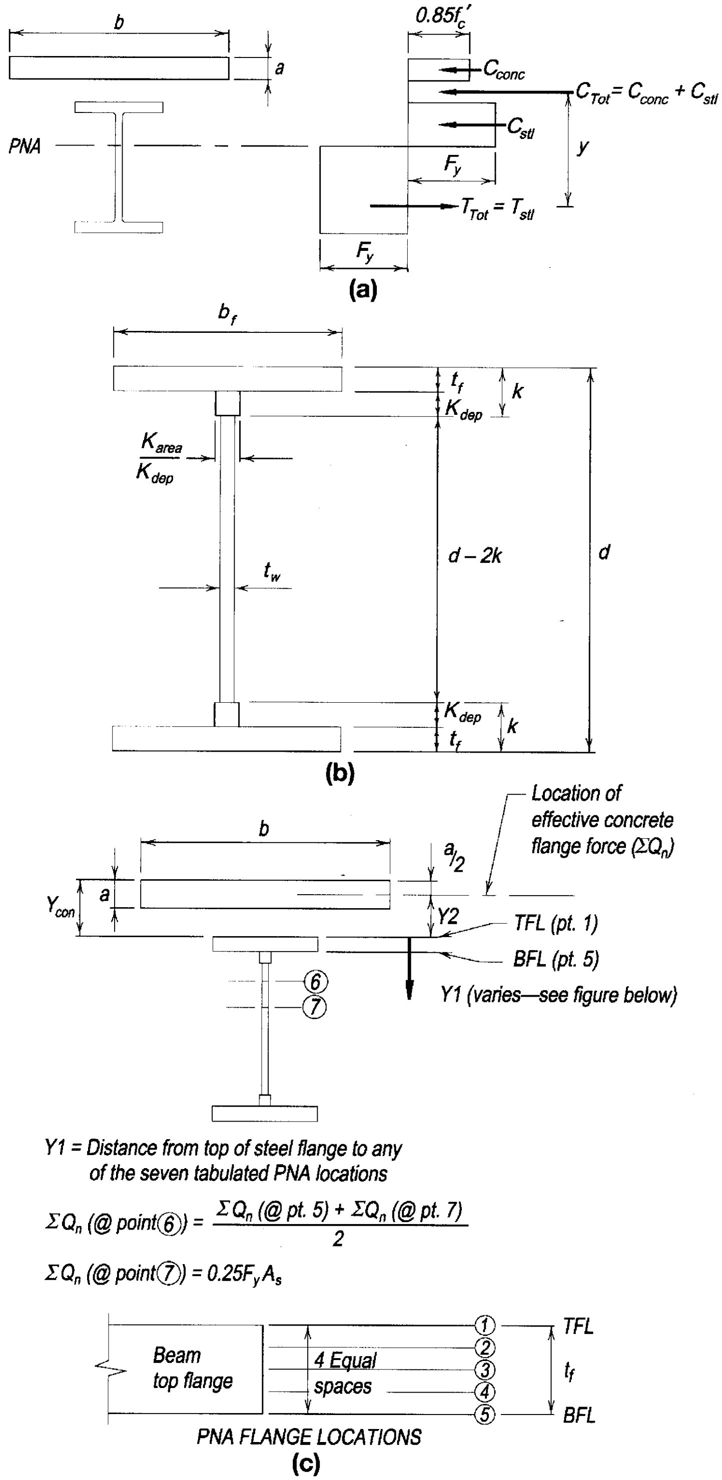


Figure 3–3. Strength design models for composite beams.

The beam end reactions for symmetrically loaded composite W-shapes can be determined as follows. When the properties of the composite concrete flange have been computed, ΣQ_n can be taken as the smaller of nQ_n, F_yA_s or $0.85f_c'A_c$. With $Y2$ taken as the distance from the top of the steel beam to the top of the concrete slab less $[\Sigma Q_n/(0.85f_c'b)]/2$, the value of available flexural strength, ϕ_bM_n or M_n/Ω_b, can be selected from Table 3-19 and the beam end reaction, R_u or R_a, can be determined as:

LRFD	ASD
$R_u = \phi_b M_n \dfrac{C_c}{L}$	$R_a = \dfrac{M_n}{\Omega_b}\dfrac{C_c}{L}$

where

C_c = coefficient from Figure 3–4

L = span length, ft

This value is then useful to check the shear strength.

When the properties of the composite concrete flange have not been computed, a conservative value for ΣQ_n can be taken as the smaller of F_sA_s or nQ_n, where n is the number of

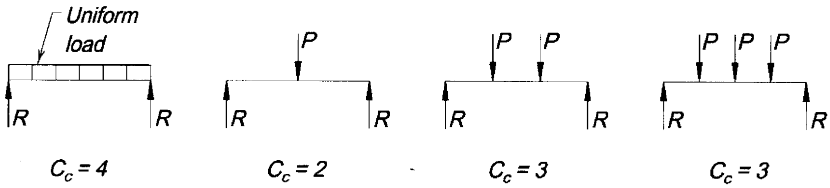


Figure 3–4. Coefficients for use in determining composite simple-beam end reactions.

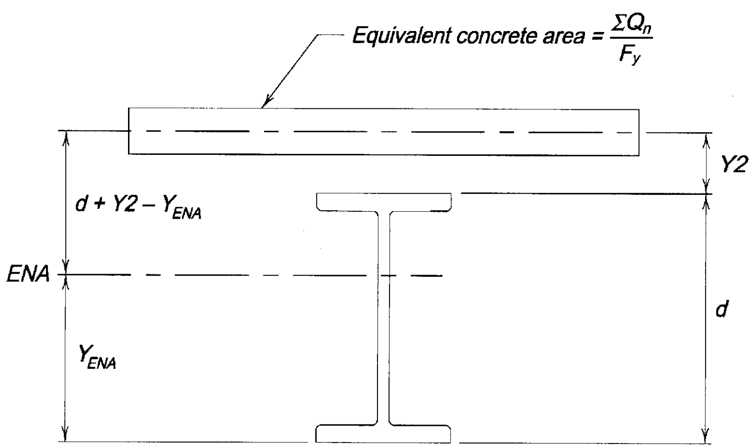


Figure 3–5. Deflection design model for composite beams.

shear stud connectors between the beam end and the point of maximum moment. In this case, $Y2$ is equal to the distance from the top of the steel beam to the top of the concrete slab.

Table 3–20. Lower-Bound Elastic Moments of Inertia

The lower-bound elastic moment of inertia of a composite beam can be used to calculate deflection. If calculated deflections using the lower-bound moment of inertia are acceptable, a more complete elastic analysis of the composite section can be avoided. The lower-bound elastic moment of inertia is based upon the area of the beam and an equivalent concrete area equal to $\Sigma Q_n/F_y$ as illustrated in Figure 3–5. The analysis includes only the horizontal shear force transferred by the shear connectors supplied. Thus, only the portion of the concrete flange used to balance ΣQ_n is included in the determination of the lower-bound moment of inertia.

The value for the lower bound moment of inertia can be calculated as illustrated in AISC Commentary Section I3.2a and Section I3.2b. The lower bound moment of inertia, therefore, is the moment of inertia of the cross-section at the required strength level. This is smaller than the corresponding moment of inertia at the service load where deflection is calculated.

Table 3–21. Nominal Horizontal Shear for One Shear Stud, Q_n

The nominal shear strength of stud shear connectors is given in Table 3–21, in accordance with AISC Specification Chapter I. Nominal horizontal shear strength values are presented based upon the position of the stud, profile of the deck, and orientation of the deck relative to the stud.

BEAM DIAGRAMS AND FORMULAS

Table 3–22a. Concentrated Load Equivalents

Concentrated load equivalents are given in Table 3–22a for beams with various support conditions and loading characteristics.

Table 3–22b. Cantilevered Beams

Coefficients are provided in Table 3–22b for cantilevered beams with various support conditions and loading characteristics.

Table 3-22c. Continuous Beams

Coefficients are provided in Table 3–22c for continuous beams with various support conditions and loading characteristics.

Table 3–23. Shears, Moments, and Deflections

Shears, moments and deflections are given in Table 3–23 for beams with various support conditions and loading characteristics.

F_y = 50 ksi

Table 3–6
Maximum Total Uniform Load, kips
W Shapes

W44

Shape		W44×							
		335		290		262		230[v]	
Design		ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft	17		2710						
	18	1800	2700	1510	2260	1360	2040		
	19	1700	2560	1480	2230	1330	2010		
	20	1620	2430	1410	2120	1270	1910	1090	1650
	21	1540	2310	1340	2010	1210	1810	1050	1570
	22	1470	2210	1280	1920	1150	1730	998	1500
	23	1410	2110	1220	1840	1100	1660	955	1430
	24	1350	2030	1170	1760	1060	1590	915	1370
	25	1290	1940	1130	1690	1010	1520	878	1320
	26	1240	1870	1080	1630	975	1470	844	1270
	27	1200	1800	1040	1570	939	1410	813	1220
	28	1150	1740	1010	1510	905	1360	784	1180
	29	1120	1680	970	1460	874	1310	757	1140
	30	1080	1620	938	1410	845	1270	732	1100
	32	1010	1520	879	1320	792	1190	686	1030
	34	951	1430	828	1240	746	1120	646	971
	36	898	1350	782	1180	704	1060	610	917
	38	851	1280	741	1110	667	1000	578	868
	40	808	1220	704	1060	634	953	549	825
	42	770	1160	670	1010	604	907	523	786
	44	735	1100	640	961	576	866	499	750
	46	703	1060	612	920	551	828	477	717
	48	674	1010	586	881	528	794	457	687
	50	647	972	563	846	507	762	439	660
	52	622	935	541	813	487	733	422	635
	54	599	900	521	783	469	706	407	611
	56	577	868	503	755	453	680	392	589
	58	558	838	485	729	437	657	379	569
	60	539	810	469	705	422	635	366	550
	62	522	784	454	682	409	615	354	532
	64	505	759	440	661	396	595	343	516
	66	490	736	426	641	384	577	333	500
	68	476	715	414	622	373	560	323	485
	70	462	694	402	604	362	544	314	471
	72	449	675	391	588	352	529	305	458
Beam Properties									
W_c/Ω_b	$\phi_b W_c$, kip-ft	32300	48600	28100	42300	25300	38100	22000	33000
M_p/Ω_b	$\phi_b M_p$, kip-ft	4040	6080	3520	5290	3170	4760	2740	4130
M_r/Ω_b	$\phi_b M_r$, kip-ft	2460	3700	2170	3260	1940	2910	1700	2550
BF	BF, kips	59.6	89.6	54.9	82.5	52.5	79.0	47.1	70.9
V_n/Ω_v	$\phi_v V_n$, kips	902	1350	755	1130	680	1020	547	823
Z_x, in.^{3}		1620		1410		1270		1100	
L_p, ft		12.3		12.3		12.3		12.1	
L_r, ft		38.8		37.0		35.7		34.4	

ASD	LRFD
$\Omega_b = 1.67$ $\Omega_v = 1.50$	$\phi_b = 0.90$ $\phi_v = 1.00$

[v] Shape does not meet the h/t_w limit for shear in Specification Section G2.1a with F_y = 50 ksi, $\Omega_v = 1.67$, $\phi_v = 0.90$.
Note: For beams laterally unsupported, see Table 3–10.
Available strength tabulated above heavy line is limited by available shear strength.

W40

Table 3–6 (continued)
Maximum Total Uniform Load, kips
W Shapes

F_y = 50 ksi

Shape	W40×											
	593[h]		503[h]		431[h]		397[h]		392[h]		372[h]	
Design	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft 14									2350	3530		
15									2280	3420		
16									2130	3210		
17	3080	4620	2580	3870	2210	3320			2010	3020	1890	2830
18	3060	4600	2560	3850	2170	3270	2000	3000	1900	2850	1860	2800
19	2900	4360	2430	3650	2060	3090	1890	2840	1800	2700	1760	2650
20	2750	4140	2310	3470	1960	2940	1800	2700	1710	2570	1680	2520
21	2620	3940	2200	3300	1860	2800	1710	2570	1630	2440	1600	2400
22	2500	3760	2100	3150	1780	2670	1630	2450	1550	2330	1520	2290
23	2400	3600	2000	3010	1700	2560	1560	2350	1480	2230	1460	2190
24	2300	3450	1920	2890	1630	2450	1500	2250	1420	2140	1400	2100
25	2200	3310	1840	2770	1560	2350	1440	2160	1370	2050	1340	2020
26	2120	3180	1770	2670	1500	2260	1380	2080	1310	1970	1290	1940
27	2040	3070	1710	2570	1450	2180	1330	2000	1260	1900	1240	1870
28	1970	2960	1650	2480	1400	2100	1280	1930	1220	1830	1200	1800
29	1900	2860	1590	2390	1350	2030	1240	1860	1180	1770	1160	1740
30	1840	2760	1540	2310	1300	1960	1200	1800	1140	1710	1120	1680
32	1720	2590	1440	2170	1220	1840	1120	1690	1070	1600	1050	1580
34	1620	2440	1360	2040	1150	1730	1060	1590	1000	1510	986	1480
36	1530	2300	1280	1920	1090	1630	998	1500	948	1430	931	1400
38	1450	2180	1210	1820	1030	1550	945	1420	898	1350	882	1330
40	1380	2070	1150	1730	978	1470	898	1350	853	1280	838	1260
42	1310	1970	1100	1650	931	1400	855	1290	813	1220	798	1200
44	1250	1880	1050	1580	889	1340	817	1230	776	1170	762	1150
46	1200	1800	1000	1510	850	1280	781	1170	742	1120	729	1100
48	1150	1730	961	1440	815	1230	749	1130	711	1070	699	1050
50	1100	1660	922	1390	782	1180	719	1080	683	1030	671	1010
52	1060	1590	887	1330	752	1130	691	1040	656	987	645	969
54	1020	1530	854	1280	724	1090	665	1000	632	950	621	933
56	984	1480	823	1240	699	1050	642	964	609	916	599	900
58	950	1430	795	1190	675	1010	619	931	588	884	578	869
60	918	1380	768	1160	652	980	599	900	569	855	559	840
62	889	1340	744	1120	631	948	579	871	551	827	541	813
64	861	1290	720	1080	611	919	561	844	533	802	524	788
66	835	1250	699	1050	593	891	544	818	517	777	508	764
68	810	1220	678	1020	575	865	528	794	502	754	493	741
70	787	1180	659	990	559	840	513	771	488	733	479	720
72	765	1150	640	962	543	817	499	750	474	713	466	700

Beam Properties

ASD	LRFD	593 ASD	593 LRFD	503 ASD	503 LRFD	431 ASD	431 LRFD	397 ASD	397 LRFD	392 ASD	392 LRFD	372 ASD	372 LRFD
W_c/Ω_b	$\phi_b W_c$, kip-ft	55100	82800	46100	69300	39100	58800	35900	54000	34100	51300	33500	50400
M_p/Ω_b	$\phi_b M_p$, kip-ft	6890	10400	5760	8660	4890	7350	4490	6750	4270	6410	4190	6300
M_r/Ω_b	$\phi_b M_r$, kip-ft	4090	6140	3460	5200	2950	4440	2720	4100	2510	3780	2550	3830
BF	BF, kips	55.5	83.5	54.7	82.2	53.6	80.6	52.3	78.7	60.4	90.8	51.6	77.6
V_n/Ω_v	$\phi_v V_n$, kips	1540	2310	1290	1940	1110	1660	999	1500	1180	1760	943	1410

	593	503	431	397	392	372
Z_x, in.^{3}	2760	2310	1960	1800	1710	1680
L_p, ft	13.4	13.1	12.9	12.9	9.33	12.7
L_r, ft	63.8	55.3	49.0	46.6	38.3	44.5

ASD	LRFD
$\Omega_b = 1.67$	$\phi_b = 0.90$
$\Omega_v = 1.50$	$\phi_v = 1.00$

[h] Flange thickness greater than 2 in. Special requirements may apply per AISC Specification Section A3.1c.

F_y = 50 ksi

Table 3–6 (continued)
Maximum Total Uniform Load, kips
W Shapes

W40

Shape	W40× 362^h ASD	362^h LRFD	331^h ASD	331^h LRFD	327^h ASD	327^h LRFD	324^h ASD	324^h LRFD	297 ASD	297 LRFD	294 ASD	294 LRFD
Span, ft												
14			1990	2990	1930	2890					1710	2570
15			1900	2860	1880	2820					1690	2540
16			1780	2680	1760	2640					1580	2380
17			1680	2520	1660	2490			1480		1490	2240
18	1820	2720	1590	2380	1560	2350	1610	2410	1470	2220	1410	2120
19	1720	2590	1500	2260	1480	2230	1530	2310	1400	2100	1330	2010
20	1640	2460	1430	2150	1410	2120	1460	2190	1330	2000	1270	1910
21	1560	2340	1360	2040	1340	2010	1390	2090	1260	1900	1210	1810
22	1490	2240	1300	1950	1280	1920	1320	1990	1210	1810	1150	1730
23	1420	2140	1240	1870	1220	1840	1270	1900	1150	1730	1100	1660
24	1360	2050	1190	1790	1170	1760	1210	1820	1110	1660	1060	1590
25	1310	1970	1140	1720	1130	1690	1170	1750	1060	1600	1010	1520
26	1260	1890	1100	1650	1080	1630	1120	1680	1020	1530	975	1470
27	1210	1820	1060	1590	1040	1570	1080	1620	983	1480	939	1410
28	1170	1760	1020	1530	1010	1510	1040	1560	948	1430	905	1360
29	1130	1700	984	1480	970	1460	1000	1510	915	1380	874	1310
30	1090	1640	951	1430	938	1410	971	1460	885	1330	845	1270
32	1020	1540	892	1340	879	1320	911	1370	830	1250	792	1190
34	963	1450	839	1260	828	1240	857	1290	781	1170	746	1120
36	909	1370	793	1190	782	1180	809	1220	737	1110	704	1060
38	861	1290	751	1130	741	1110	767	1150	699	1050	667	1000
40	818	1230	714	1070	704	1060	729	1100	664	998	634	953
42	779	1170	680	1020	670	1010	694	1040	632	950	604	907
44	744	1120	649	975	640	961	662	995	603	907	576	866
46	712	1070	620	933	612	920	634	952	577	867	551	828
48	682	1020	595	894	586	881	607	912	553	831	528	794
50	655	984	571	858	563	846	583	876	531	798	507	762
52	630	946	549	825	541	813	560	842	511	767	487	733
54	606	911	529	794	521	783	540	811	492	739	469	706
56	585	879	510	766	503	755	520	782	474	713	453	680
58	564	848	492	740	485	729	502	755	458	688	437	657
60	546	820	476	715	469	705	486	730	442	665	422	635
62	528	794	460	692	454	682	470	706	428	644	409	615
64	511	769	446	670	440	661	455	684	415	623	396	595
66	496	745	432	650	426	641	442	664	402	605	384	577
68	481	724	420	631	414	622	429	644	390	587	373	560
70	468	703	408	613	402	604	416	626	379	570	362	544
72	455	683	396	596	391	588	405	608	369	554	352	529

Beam Properties

ASD	LRFD	362^h ASD	362^h LRFD	331^h ASD	331^h LRFD	327^h ASD	327^h LRFD	324^h ASD	324^h LRFD	297 ASD	297 LRFD	294 ASD	294 LRFD
W_c/Ω_b	$\phi_b W_c$, kip-ft	32700	49200	28500	42900	28100	42300	29100	43800	26500	39900	25300	38100
M_p/Ω_b	$\phi_b M_p$, kip-ft	4090	6150	3570	5360	3520	5290	3640	5480	3320	4990	3170	4760
M_r/Ω_b	$\phi_b M_r$, kip-ft	2480	3730	2110	3180	2100	3150	2240	3360	2040	3070	1890	2840
BF	BF, kips	51.5	77.4	59.0	88.7	58.0	87.2	49.1	73.8	47.3	71.1	57.0	85.7
V_n/Ω_v	$\phi_v V_n$, kips	908	1360	995	1490	963	1440	803	1200	741	1110	856	1280
Z_x, in.^{3}		1640		1430		1410		1460		1330		1270	
L_p, ft		12.7		9.08		9.11		12.6		12.5		9.01	
L_r, ft		44.0		33.7		33.6		41.3		39.4		31.5	

ASD	LRFD	
$\Omega_b = 1.67$ $\Omega_v = 1.50$	$\phi_b = 0.90$ $\phi_v = 1.00$	Note: For beams laterally unsupported, see Table 3–10. Available strength tabulated above heavy line is limited by available shear strength.

W40

Table 3–6 (continued)
Maximum Total Uniform Load, kips
W Shapes

F_y = 50 ksi

Shape		W40×											
		278		277		264		249		235		215	
Design		ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft	14	1650	2470			1540	2300						
	15	1580	2380			1500	2260			1320	1980		
	16	1480	2230			1410	2120			1260	1890		
	17	1400	2100			1330	1990			1190	1780		
	18	1320	1980	1320	1980	1250	1880			1120	1680		
	19	1250	1880	1310	1970	1190	1780	1180	1770	1060	1590	1010	1520
	20	1190	1790	1250	1880	1130	1700	1120	1680	1010	1520	962	1450
	21	1130	1700	1190	1790	1070	1610	1060	1600	960	1440	916	1380
	22	1080	1620	1130	1700	1030	1540	1020	1530	916	1380	875	1310
	23	1030	1550	1080	1630	981	1470	972	1460	877	1320	837	1260
	24	990	1490	1040	1560	940	1410	931	1400	840	1260	802	1200
	25	950	1430	998	1500	902	1360	894	1340	806	1210	770	1160
	26	914	1370	960	1440	867	1300	860	1290	775	1170	740	1110
	27	880	1320	924	1390	835	1260	828	1240	747	1120	713	1070
	28	848	1280	891	1340	806	1210	798	1200	720	1080	687	1030
	29	819	1230	860	1290	778	1170	771	1160	695	1040	664	997
	30	792	1190	832	1250	752	1130	745	1120	672	1010	641	964
	32	742	1120	780	1170	705	1060	699	1050	630	947	601	904
	34	699	1050	734	1100	663	997	658	988	593	891	566	851
	36	660	992	693	1040	627	942	621	933	560	842	534	803
	38	625	939	657	987	594	892	588	884	531	797	506	761
	40	594	893	624	938	564	848	559	840	504	758	481	723
	42	566	850	594	893	537	807	532	800	480	721	458	689
	44	540	811	567	852	513	770	508	764	458	689	437	657
	46	516	776	542	815	490	737	486	730	438	659	418	629
	48	495	744	520	781	470	706	466	700	420	631	401	602
	50	475	714	499	750	451	678	447	672	403	606	385	578
	52	457	687	480	721	434	652	430	646	388	583	370	556
	54	440	661	462	694	418	628	414	622	373	561	356	536
	56	424	638	446	670	403	605	399	600	360	541	344	516
	58	410	616	430	647	389	584	385	579	348	522	332	499
	60	396	595	416	625	376	565	373	560	336	505	321	482
	62	383	576	402	605	364	547	361	542	325	489	310	466
	64	371	558	390	586	352	530	349	525	315	473	301	452
	66	360	541	378	568	342	514	339	509	305	459	292	438
	68	349	525	367	551	332	499	329	494	296	446	283	425
	70	339	510	356	536	322	484	319	480	288	433	275	413
	72	330	496	347	521	313	471	310	467	280	421	267	402
Beam Properties													
W_c/Ω_b	$\phi_b W_c$, kip-ft	23800	35700	25000	37500	22600	33900	22400	33600	20200	30300	19200	28900
M_p/Ω_b	$\phi_b M_p$, kip-ft	2970	4460	3120	4690	2820	4240	2790	4200	2520	3790	2410	3620
M_r/Ω_b	$\phi_b M_r$, kip-ft	1780	2680	1920	2890	1700	2550	1730	2610	1530	2300	1500	2250
BF	BF, kips	55.2	82.9	45.8	68.9	54.1	81.4	43.0	64.7	51.0	76.7	39.2	58.9
V_n/Ω_v	$\phi_v V_n$, kips	823	1230	659	988	768	1150	591	886	659	988	507	760
Z_x, in.^{3}		1190		1250		1130		1120		1010		964	
L_p, ft		8.90		12.6		8.90		12.5		8.97		12.5	
L_r, ft		30.4		38.8		29.7		37.2		28.4		35.6	

ASD	LRFD
$\Omega_b = 1.67$	$\phi_b = 0.90$
$\Omega_v = 1.50$	$\phi_v = 1.00$

[h] Flange thickness greater than 2 in. Special requirements may apply per AISC Specification Section A3.1c.
[v] Shape does not meet the h/t_w limit for shear in Specification Section G2.1a with F_y = 50 ksi, $\Omega_v = 1.67$, $\phi_v = 0.90$.

F_y = 50 ksi

Table 3–6 (continued)
Maximum Total Uniform Load, kips
W Shapes

W40–W36

Shape		W40×										W36×	
		211		199		183		167		149^v		800^h	
Design		ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft	13							1000	1510	865	1300		
	14							988	1490	853	1280		
	15	1180	1770			1010	1520	922	1390	796	1200		
	16	1130	1700			966	1450	865	1300	746	1120		
	17	1060	1600	1010	1510	909	1370	814	1220	702	1060		
	18	1000	1510	964	1450	858	1290	768	1160	663	997	4050	6080
	19	952	1430	913	1370	813	1220	728	1090	628	944	3830	5760
	20	904	1360	867	1300	772	1160	692	1040	597	897	3640	5480
	21	861	1290	826	1240	736	1110	659	990	568	854	3470	5210
	22	822	1240	788	1190	702	1060	629	945	543	815	3310	4980
	23	786	1180	754	1130	672	1010	601	904	519	780	3170	4760
	24	753	1130	723	1090	644	968	576	866	497	747	3040	4560
	25	723	1090	694	1040	618	929	553	832	477	718	2910	4380
	26	696	1050	667	1000	594	893	532	800	459	690	2800	4210
	27	670	1010	642	966	572	860	512	770	442	664	2700	4060
	28	646	971	619	931	552	829	494	743	426	641	2600	3910
	29	624	937	598	899	533	801	477	717	412	619	2510	3780
	30	603	906	578	869	515	774	461	693	398	598	2430	3650
	32	565	849	542	815	483	726	432	650	373	561	2280	3420
	34	532	799	510	767	454	683	407	611	351	528	2140	3220
	36	502	755	482	724	429	645	384	578	332	498	2020	3040
	38	476	715	456	686	407	611	364	547	314	472	1920	2880
	40	452	680	434	652	386	581	346	520	298	449	1820	2740
	42	431	647	413	621	368	553	329	495	284	427	1730	2610
	44	411	618	394	593	351	528	314	473	271	408	1660	2490
	46	393	591	377	567	336	505	301	452	259	390	1580	2380
	48	377	566	361	543	322	484	288	433	249	374	1520	2280
	50	362	544	347	521	309	464	277	416	239	359	1460	2190
	52	348	523	334	501	297	447	266	400	230	345	1400	2110
	54	335	503	321	483	286	430	256	385	221	332	1350	2030
	56	323	485	310	466	276	415	247	371	213	320	1300	1960
	58	312	469	299	449	266	400	238	358	206	309	1260	1890
	60	301	453	289	435	257	387	231	347	199	299	1210	1830
	62	292	438	280	420	249	375	223	335	193	289	1180	1770
	64	283	425	271	407	241	363	216	325	187	280	1140	1710
	66	274	412	263	395	234	352	210	315	181	272	1100	1660
	68	266	400	255	383	227	341	203	306	176	264	1070	1610
	70	258	388	248	372	221	332	198	297	171	256	1040	1560
	72	251	377	241	362	215	323	192	289	166	249	1010	1520
Beam Properties													
W_c/Ω_b	$\phi_b W_c$, kip-ft	18100	27200	17300	26100	15400	23200	13800	20800	11900	17900	72900	110000
M_p/Ω_b	$\phi_b M_p$, kip-ft	2260	3400	2170	3260	1930	2900	1730	2600	1490	2240	9110	13700
M_r/Ω_b	$\phi_b M_r$, kip-ft	1370	2060	1340	2020	1180	1770	1050	1580	896	1350	5310	7980
BF	BF, kips	48.5	73.0	37.2	55.9	44.1	66.3	41.8	62.9	38.6	58.0	47.5	71.4
V_n/Ω_v	$\phi_v V_n$, kips	591	886	503	754	507	760	502	753	432	650	2030	3040
Z_x, in.^{3}		906		869		774		693		598		3650	
L_p, ft		8.87		12.2		8.80		8.48		8.09		14.9	
L_r, ft		27.2		34.3		25.9		24.8		23.5		94.8	

ASD	LRFD
$\Omega_b = 1.67$	$\phi_b = 0.90$
$\Omega_v = 1.50$	$\phi_v = 1.00$

Note: For beams laterally unsupported, see Table 3–10.
Available strength tabulated above heavy line is limited by available shear strength.

W36

Table 3-6 (continued)
Maximum Total Uniform Load, kips
W Shapes

F_y = 50 ksi

Shape	W36×											
	652[h]		529[h]		487[h]		441[h]		395[h]		361[h]	
Design	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft 18	3230	4850	2560	3840	2360	3540	2110	3170	1870	2810	1700	2550
19	3060	4590	2450	3680	2240	3360	2010	3020	1800	2700	1630	2450
20	2900	4370	2330	3500	2130	3200	1910	2870	1710	2570	1550	2330
21	2770	4160	2210	3330	2020	3040	1820	2730	1630	2440	1470	2210
22	2640	3970	2110	3180	1930	2900	1730	2600	1550	2330	1410	2110
23	2530	3800	2020	3040	1850	2780	1660	2490	1480	2230	1350	2020
24	2420	3640	1940	2910	1770	2660	1590	2390	1420	2140	1290	1940
25	2320	3490	1860	2800	1700	2560	1520	2290	1370	2050	1240	1860
26	2230	3360	1790	2690	1640	2460	1470	2200	1310	1970	1190	1790
27	2150	3230	1720	2590	1570	2370	1410	2120	1260	1900	1150	1720
28	2070	3120	1660	2500	1520	2280	1360	2050	1220	1830	1100	1660
29	2000	3010	1600	2410	1470	2200	1310	1980	1180	1770	1070	1600
30	1940	2910	1550	2330	1420	2130	1270	1910	1140	1710	1030	1550
32	1820	2730	1450	2180	1330	2000	1190	1790	1070	1600	967	1450
34	1710	2570	1370	2060	1250	1880	1120	1690	1000	1510	910	1370
36	1610	2430	1290	1940	1180	1780	1060	1590	948	1430	859	1290
38	1530	2300	1220	1840	1120	1680	1000	1510	898	1350	814	1220
40	1450	2180	1160	1750	1060	1600	953	1430	853	1280	773	1160
42	1380	2080	1110	1660	1010	1520	908	1360	813	1220	737	1110
44	1320	1980	1060	1590	966	1450	866	1300	776	1170	703	1060
46	1260	1900	1010	1520	924	1390	829	1250	742	1120	673	1010
48	1210	1820	969	1460	886	1330	794	1190	711	1070	645	969
50	1160	1750	930	1400	850	1280	762	1150	683	1030	619	930
52	1120	1680	894	1340	818	1230	733	1100	656	987	595	894
54	1080	1620	861	1290	787	1180	706	1060	632	950	573	861
56	1040	1560	830	1250	759	1140	681	1020	609	916	552	830
58	1000	1510	802	1210	733	1100	657	988	588	884	533	802
60	968	1460	775	1170	709	1070	635	955	569	855	516	775
62	937	1410	750	1130	686	1030	615	924	551	827	499	750
64	908	1360	727	1090	664	998	596	895	533	802	483	727
66	880	1320	705	1060	644	968	578	868	517	777	469	705
68	854	1280	684	1030	625	940	561	843	502	754	455	684
70	830	1250	664	999	607	913	545	819	488	733	442	664
72	807	1210	646	971	590	888	529	796	474	713	430	646
Beam Properties												
W_c/Ω_b / $\phi_b W_c$, kip-ft	58100	87300	46500	69900	42500	63900	38100	57300	34100	51300	30900	46500
M_p/Ω_b / $\phi_b M_p$, kip-ft	7260	10900	5810	8740	5310	7990	4770	7160	4270	6410	3870	5810
M_r/Ω_b / $\phi_b M_r$, kip-ft	4300	6460	3480	5220	3200	4800	2880	4330	2600	3910	2360	3540
BF / BF, kips	46.8	70.4	46.5	70.0	46.1	69.3	45.2	68.0	44.7	67.1	43.7	65.7
V_n/Ω_v / $\phi_v V_n$, kips	1620	2430	1280	1920	1180	1770	1060	1590	937	1410	851	1280
Z_x, in.^{3}	2910		2330		2130		1910		1710		1550	
L_p, ft	14.5		14.1		14.0		13.8		13.7		13.6	
L_r, ft	77.8		64.4		60.0		55.5		51.0		48.1	

ASD	LRFD
$\Omega_b = 1.67$	$\phi_b = 0.90$
$\Omega_v = 1.50$	$\phi_v = 1.00$

[h] Flange thickness greater than 2 in. Special requirements may apply per AISC Specification Section A3.1c.

F_y = 50 ksi

Table 3–6 (continued)
Maximum Total Uniform Load, kips
W Shapes

W36

Shape		W36× 330		302		282		262		247		231	
Design		ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft	17							1240	1860	1170	1760	1110	1660
	18	1540	2310	1410	2120	1310	1970	1220	1830	1140	1720	1070	1610
	19	1480	2230	1340	2020	1250	1880	1160	1740	1080	1630	1010	1520
	20	1410	2120	1280	1920	1190	1790	1100	1650	1030	1550	961	1440
	21	1340	2010	1220	1830	1130	1700	1050	1570	979	1470	915	1380
	22	1280	1920	1160	1750	1080	1620	998	1500	934	1400	874	1310
	23	2020	1220	1840	1110	1670	1030	1550	955	1430	894	1340	836
	24	1170	1760	1060	1600	990	1490	915	1370	857	1290	801	1200
	25	1130	1690	1020	1540	950	1430	878	1320	822	1240	769	1160
	26	1080	1630	983	1480	914	1370	844	1270	791	1190	739	1110
	27	1040	1570	946	1420	880	1320	813	1220	761	1140	712	1070
	28	1010	1510	912	1370	848	1280	784	1180	734	1100	686	1030
	29	970	1460	881	1320	819	1230	757	1140	709	1070	663	996
	30	938	1410	852	1280	792	1190	732	1100	685	1030	641	963
	32	879	1320	798	1200	742	1120	686	1030	642	966	601	903
	34	828	1240	751	1130	699	1050	646	971	605	909	565	850
	36	782	1180	710	1070	660	992	610	917	571	858	534	803
	38	741	1110	672	1010	625	939	578	868	541	813	506	760
	40	704	1060	639	960	594	893	549	825	514	773	481	722
	42	670	1010	608	914	566	850	523	786	489	736	458	688
	44	640	961	581	873	540	811	499	750	467	702	437	657
	46	612	920	555	835	516	776	477	717	447	672	418	628
	48	586	881	532	800	495	744	457	687	428	644	400	602
	50	563	846	511	768	475	714	439	660	411	618	384	578
	52	541	813	491	738	457	687	422	635	395	594	370	556
	54	521	783	473	711	440	661	407	611	381	572	356	535
	56	503	755	456	686	424	638	392	589	367	552	343	516
	58	485	729	440	662	410	616	379	569	354	533	331	498
	60	469	705	426	640	396	595	366	550	343	515	320	482
	62	454	682	412	619	383	576	354	532	332	498	310	466
	64	440	661	399	600	371	558	343	516	321	483	300	451
	66	426	641	387	582	360	541	333	500	311	468	291	438
	68	414	622	376	565	349	525	323	485	302	454	283	425
	70	402	604	365	549	339	510	314	471	294	441	275	413
	72	391	588	355	533	330	496	305	458	286	429	267	401
Beam Properties													
W_c/Ω_b	$\phi_b W_c$, kip-ft	28100	42300	25500	38400	23800	35700	22000	33000	20600	30900	19200	28900
M_p/Ω_b	$\phi_b M_p$, kip-ft	3520	5290	3190	4800	2970	4460	2740	4130	2570	3860	2400	3610
M_r/Ω_b	$\phi_b M_r$, kip-ft	2170	3260	1970	2970	1830	2760	1700	2550	1590	2400	1490	2240
BF	BF, kips	42.3	63.6	40.5	60.9	39.4	59.2	38.4	57.7	37.1	55.8	35.8	53.7
V_n/Ω_v	$\phi_v V_n$, kips	768	1150	706	1060	657	985	619	929	587	880	555	832
Z_x, in.^{3}		1410		1280		1190		1100		1030		963	
L_p, ft		13.5		13.5		13.4		13.3		13.2		13.1	
L_r, ft		45.5		43.6		42.2		40.6		39.5		38.6	

ASD	LRFD	
$\Omega_b = 1.67$ $\Omega_v = 1.50$	$\phi_b = 0.90$ $\phi_v = 1.00$	Note: For beams laterally unsupported, see Table 3–10. Available strength tabulated above heavy line is limited by available shear strength.

W36

Table 3–6 (continued)
Maximum Total Uniform Load, kips
W Shapes

F_y = 50 ksi

Shape		W36×											
		256		232		210		194		182		170	
Design		ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft	13					1220	1830	1120	1670	1050	1580	984	1480
	14	1440	2160	1290	1940	1190	1790	1090	1640	1020	1540	952	1430
	15	1380	2080	1250	1870	1110	1670	1020	1530	955	1440	889	1340
	16	1300	1950	1170	1760	1040	1560	957	1440	896	1350	833	1250
	17	1220	1840	1100	1650	978	1470	901	1350	843	1270	784	1180
	18	1150	1730	1040	1560	924	1390	851	1280	796	1200	741	1110
	19	1090	1640	983	1480	875	1320	806	1210	754	1130	702	1050
	20	1040	1560	934	1400	831	1250	765	1150	717	1080	667	1000
	21	988	1490	890	1340	792	1190	729	1100	682	1030	635	954
	22	944	1420	849	1280	756	1140	696	1050	651	979	606	911
	23	903	1360	812	1220	723	1090	666	1000	623	937	580	871
	24	865	1300	778	1170	693	1040	638	959	597	898	556	835
	25	830	1250	747	1120	665	1000	612	920	573	862	533	802
	26	798	1200	719	1080	639	961	589	885	551	828	513	771
	27	769	1160	692	1040	616	926	567	852	531	798	494	742
	28	741	1110	667	1000	594	893	547	822	512	769	476	716
	29	716	1080	644	968	573	862	528	793	494	743	460	691
	30	692	1040	623	936	554	833	510	767	478	718	444	668
	32	649	975	584	878	520	781	478	719	448	673	417	626
	34	611	918	549	826	489	735	450	677	422	634	392	589
	36	577	867	519	780	462	694	425	639	398	598	370	557
	38	546	821	492	739	438	658	403	606	377	567	351	527
	40	519	780	467	702	416	625	383	575	358	539	333	501
	42	494	743	445	669	396	595	365	548	341	513	317	477
	44	472	709	425	638	378	568	348	523	326	490	303	455
	46	451	678	406	610	361	543	333	500	312	468	290	436
	48	432	650	389	585	346	521	319	479	299	449	278	418
	50	415	624	374	562	333	500	306	460	287	431	267	401
	52	399	600	359	540	320	481	294	443	276	414	256	385
	54	384	578	346	520	308	463	284	426	265	399	247	371
	56	371	557	334	501	297	446	273	411	256	385	238	358
	58	358	538	322	484	287	431	264	397	247	371	230	346
	60	346	520	311	468	277	417	255	384	239	359	222	334
	62	335	503	301	453	268	403	247	371	231	347	215	323
	64	324	488	292	439	260	390	239	360	224	337	208	313
	66	315	473	283	425	252	379	232	349	217	326	202	304
	68	305	459	275	413	245	368	225	338	211	317	196	295
	70	297	446	267	401	238	357	219	329	205	308	190	286
	72	288	433	259	390	231	347	213	320	199	299	185	278
Beam Properties													
W_c/Ω_b	$\phi_b W_c$, kip-ft	20800	31200	18700	28100	16600	25000	15300	23000	14300	21500	13300	20000
M_p/Ω_b	$\phi_b M_p$, kip-ft	2590	3900	2340	3510	2080	3120	1910	2880	1790	2690	1670	2510
M_r/Ω_b	$\phi_b M_r$, kip-ft	1560	2350	1410	2120	1260	1890	1160	1740	1090	1640	1010	1530
BF	BF, kips	46.5	70.0	44.6	67.1	42.5	63.8	40.6	61.0	39.1	58.8	37.4	56.2
V_n/Ω_v	$\phi_v V_n$, kips	719	1080	646	969	609	914	558	837	527	790	492	738
Z_x, in.^{3}		1040		936		833		767		718		668	
L_p, ft		9.36		9.25		9.11		9.04		9.01		8.94	
L_r, ft		31.5		29.9		28.5		27.6		27.0		26.4	

ASD	LRFD
$\Omega_b = 1.67$	$\phi_b = 0.90$
$\Omega_v = 1.50$	$\phi_v = 1.00$

h Flange thickness greater than 2 in. Special requirements may apply per AISC Specification Section A3.1c.
v Shape does not meet the h/t_w limit for shear in Specification Section G2.1a with F_y = 50 ksi, $\Omega_v = 1.67$, $\phi_v = 0.90$.

F_y = 50 ksi

Table 3–6 (continued)
Maximum Total Uniform Load, kips
W Shapes

W36–W33

Shape		W36×						W33×					
		160		150		135^v		387^h		354^h		318	
Design		ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft	12			896									
	13	936	1400	892	1340	766	1150						
	14	890	1340	828	1250	726	1090						
	15	830	1250	773	1160	677	1020						
	16	778	1170	725	1090	635	954						
	17	733	1100	682	1030	598	898	1810	2720	1650	2470	1460	2190
	18	692	1040	644	968	564	848	1730	2600	1570	2370	1410	2120
	19	656	985	610	917	535	804	1640	2460	1490	2240	1330	2010
	20	623	936	580	872	508	764	1560	2340	1420	2130	1270	1910
	21	593	891	552	830	484	727	1480	2230	1350	2030	1210	1810
	22	566	851	527	792	462	694	1420	2130	1290	1940	1150	1730
	23	542	814	504	758	442	664	1350	2030	1230	1850	1100	1660
	24	519	780	483	726	423	636	1300	1950	1180	1780	1060	1590
	25	498	749	464	697	406	611	1250	1870	1130	1700	1010	1520
	26	479	720	446	670	391	587	1200	1800	1090	1640	975	1470
	27	461	693	430	646	376	566	1150	1730	1050	1580	939	1410
	28	445	669	414	623	363	545	1110	1670	1010	1520	905	1360
	29	429	646	400	601	350	527	1070	1610	977	1470	874	1310
	30	415	624	387	581	339	509	1040	1560	945	1420	845	1270
	32	389	585	362	545	317	477	973	1460	886	1330	792	1190
	34	366	551	341	513	299	449	916	1380	834	1250	746	1120
	36	346	520	322	484	282	424	865	1300	787	1180	704	1060
	38	328	493	305	459	267	402	819	1230	746	1120	667	1000
	40	311	468	290	436	254	382	778	1170	709	1070	634	953
	42	297	446	276	415	242	364	741	1110	675	1010	604	907
	44	283	425	264	396	231	347	708	1060	644	968	576	866
	46	271	407	252	379	221	332	677	1020	616	926	551	828
	48	259	390	242	363	212	318	649	975	590	888	528	794
	50	249	374	232	349	203	305	623	936	567	852	507	762
	52	240	360	223	335	195	294	599	900	545	819	487	733
	54	231	347	215	323	188	283	577	867	525	789	469	706
	56	222	334	207	311	181	273	556	836	506	761	453	680
	58	215	323	200	301	175	263	537	807	489	734	437	657
	60	208	312	193	291	169	255	519	780	472	710	422	635
	62	201	302	187	281	164	246	502	755	457	687	409	615
	64	195	293	181	272	159	239	487	731	443	666	396	595
	66	189	284	176	264	154	231	472	709	429	645	384	577
	68	183	275	171	256	149	225	458	688	417	626	373	560
	70	178	267	166	249	145	218	445	669	405	609	362	544
	72	173	260	161	242	141	212	432	650	394	592	352	529
Beam Properties													
W_c/Ω_b	$\phi_b W_c$, kip-ft	12500	18700	11600	17400	10200	15300	31100	46800	28300	42600	25300	38100
M_p/Ω_b	$\phi_b M_p$, kip-ft	1560	2340	1450	2180	1270	1910	3890	5850	3540	5330	3170	4760
M_r/Ω_b	$\phi_b M_r$, kip-ft	947	1420	880	1320	767	1150	2360	3540	2170	3260	1940	2910
BF	BF, kips	36.0	54.1	34.5	51.8	31.8	47.8	38.4	57.7	37.5	56.4	36.9	55.4
V_n/Ω_v	$\phi_v V_n$, kips	468	702	448	672	383	576	906	1360	825	1240	731	1100
Z_x, in.^{3}		624		581		509		1560		1420		1270	
L_p, ft		8.83		8.72		8.41		13.3		13.2		13.1	
L_r, ft		25.8		25.2		24.2		53.3		49.9		46.5	

ASD	LRFD
$\Omega_b = 1.67$	$\phi_b = 0.90$
$\Omega_v = 1.50$	$\phi_v = 1.00$

Note: For beams laterally unsupported, see Table 3–10.
Available strength tabulated above heavy line is limited by available shear strength.

Table 3–6 (continued)
Maximum Total Uniform Load, kips
W Shapes

W33

F_y = 50 ksi

Shape		W33×											
		291		263		241		221		201		169	
Design		ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft	13											906	1360
	14											897	1350
	15											837	1260
	16					1130	1700	1050	1580	963	1440	785	1180
	17	1340	2010	1200	1800	1100	1660	1010	1510	908	1360	739	1110
	18	1290	1930	1150	1730	1040	1570	950	1430	857	1290	697	1050
	19	1220	1830	1090	1640	987	1480	900	1350	812	1220	661	993
	20	1160	1740	1040	1560	938	1410	855	1290	771	1160	628	944
	21	1100	1660	988	1490	893	1340	815	1220	735	1100	598	899
	22	1050	1580	944	1420	853	1280	778	1170	701	1050	571	858
	23	1010	1510	903	1360	816	1230	744	1120	671	1010	546	820
	24	965	1450	865	1300	782	1180	713	1070	643	966	523	786
	25	926	1390	830	1250	750	1130	684	1030	617	928	502	755
	26	891	1340	798	1200	722	1080	658	989	593	892	483	726
	27	858	1290	769	1160	695	1040	634	952	571	859	465	699
	28	827	1240	741	1110	670	1010	611	918	551	828	448	674
	29	798	1200	716	1080	647	972	590	887	532	800	433	651
	30	772	1160	692	1040	625	940	570	857	514	773	418	629
	32	724	1090	649	975	586	881	535	803	482	725	392	590
	34	681	1020	611	918	552	829	503	756	454	682	369	555
	36	643	967	577	867	521	783	475	714	429	644	349	524
	38	609	916	546	821	494	742	450	677	406	610	330	497
	40	579	870	519	780	469	705	428	643	386	580	314	472
	42	551	829	494	743	447	671	407	612	367	552	299	449
	44	526	791	472	709	426	641	389	584	351	527	285	429
	46	503	757	451	678	408	613	372	559	335	504	273	410
	48	482	725	432	650	391	588	356	536	321	483	262	393
	50	463	696	415	624	375	564	342	514	309	464	251	377
	52	445	669	399	600	361	542	329	494	297	446	241	363
	54	429	644	384	578	347	522	317	476	286	429	232	349
	56	413	621	371	557	335	504	305	459	276	414	224	337
	58	399	600	358	538	323	486	295	443	266	400	216	325
	60	386	580	346	520	313	470	285	429	257	387	209	315
	62	373	561	335	503	303	455	276	415	249	374	202	304
	64	362	544	324	488	293	441	267	402	241	362	196	295
	66	351	527	315	473	284	427	259	390	234	351	190	286
	68	340	512	305	459	276	415	252	378	227	341	185	278
	70	331	497	297	446	268	403	244	367	220	331	179	270
	72	322	483	288	433	261	392	238	357	214	322	174	262
Beam Properties													
W_c/Ω_b	$\phi_b W_c$, kip-ft	23200	34800	20800	31200	18800	28200	17100	25700	15400	23200	12600	18900
M_p/Ω_b	$\phi_b M_p$, kip-ft	2890	4350	2590	3900	2350	3530	2140	3210	1930	2900	1570	2360
M_r/Ω_b	$\phi_b M_r$, kip-ft	1780	2680	1610	2410	1450	2180	1330	1990	1200	1800	959	1440
BF	BF, kips	36.0	54.1	34.6	51.9	33.2	49.8	31.8	47.8	30.2	45.3	34.1	51.3
V_n/Ω_v	$\phi_v V_n$, kips	669	1000	601	901	567	851	526	789	482	722	453	680
Z_x, in.^{3}		1160		1040		940		857		773		629	
L_p, ft		13.0		12.9		12.8		12.7		12.6		8.83	
L_r, ft		43.9		41.6		39.7		38.2		36.8		26.7	

ASD	LRFD
$\Omega_b = 1.67$	$\phi_b = 0.90$
$\Omega_v = 1.50$	$\phi_v = 1.00$

[h] Flange thickness greater than 2 in. Special requirements may apply per AISC Specification Section A3.1c.

[v] Shape does not meet the h/t_w limit for shear in Specification Section G2.1a with F_y = 50 ksi, $\Omega_v = 1.67$, $\phi_v = 0.90$.

F_y = 50 ksi

Table 3–6 (continued)
Maximum Total Uniform Load, kips
W Shapes

W33–W30

Shape		W33×								W30×			
		152		141		130		118^v		391^h		357^h	
Design		ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft	12			806	1210	768	1150	649	976				
	13	851	1280	789	1190	717	1080	637	958				
	14	797	1200	733	1100	666	1000	592	889				
	15	744	1120	684	1030	621	934	552	830				
	16	697	1050	641	964	583	876	518	778	1810	2710	1630	2440
	17	656	986	603	907	548	824	487	732	1700	2560	1550	2330
	18	620	932	570	857	518	778	460	692	1610	2420	1460	2200
	19	587	883	540	812	491	737	436	655	1520	2290	1390	2080
	20	558	839	513	771	466	701	414	623	1450	2180	1320	1980
	21	531	799	489	734	444	667	394	593	1380	2070	1250	1890
	22	507	762	466	701	424	637	377	566	1320	1980	1200	1800
	23	485	729	446	670	405	609	360	541	1260	1890	1150	1720
	24	465	699	427	642	388	584	345	519	1210	1810	1100	1650
	25	446	671	410	617	373	560	331	498	1160	1740	1050	1580
	26	429	645	395	593	359	539	319	479	1110	1670	1010	1520
	27	413	621	380	571	345	519	307	461	1070	1610	976	1470
	28	398	599	366	551	333	500	296	445	1030	1550	941	1410
	29	385	578	354	532	321	483	286	429	998	1500	909	1370
	30	372	559	342	514	311	467	276	415	965	1450	878	1320
	32	349	524	321	482	291	438	259	389	904	1360	823	1240
	34	328	493	302	454	274	412	244	366	851	1280	775	1160
	36	310	466	285	428	259	389	230	346	804	1210	732	1100
	38	294	441	270	406	245	369	218	328	762	1140	693	1040
	40	279	419	256	386	233	350	207	311	724	1090	659	990
	42	266	399	244	367	222	334	197	296	689	1040	627	943
	44	254	381	233	350	212	318	188	283	658	989	599	900
	46	243	365	223	335	203	305	180	271	629	946	573	861
	48	232	349	214	321	194	292	173	259	603	906	549	825
	50	223	335	205	308	186	280	166	249	579	870	527	792
	52	215	323	197	297	179	269	159	239	557	837	507	762
	54	207	311	190	286	173	259	153	231	536	806	488	733
	56	199	299	183	275	166	250	148	222	517	777	470	707
	58	192	289	177	266	161	242	143	215	499	750	454	683
	60	186	280	171	257	155	234	138	208	482	725	439	660
	62	180	270	165	249	150	226	134	201	467	702	425	639
	64	174	262	160	241	146	219	129	195	452	680	412	619
	66	169	254	155	234	141	212	126	189	439	659	399	600
	68	164	247	151	227	137	206	122	183	426	640	387	582
	70	159	240	147	220	133	200	118	178	413	621	376	566
	72	155	233	142	214	129	195	115	173	402	604	366	550
Beam Properties													
W_c/Ω_b	$\phi_b W_c$, kip-ft	11200	16800	10300	15400	9320	14000	8280	12500	28900	43500	26300	39600
M_p/Ω_b	$\phi_b M_p$, kip-ft	1390	2100	1280	1930	1170	1750	1040	1560	3620	5440	3290	4950
M_r/Ω_b	$\phi_b M_r$, kip-ft	851	1280	782	1180	709	1070	627	942	2180	3280	1990	2990
BF	BF, kips	32.0	48.1	30.4	45.8	28.8	43.3	26.7	40.2	31.3	47.1	31.2	47.0
V_n/Ω_v	$\phi_v V_n$, kips	425	638	403	604	384	576	325	488	903	1350	813	1220
Z_x, in.^{3}		559		514		467		415		1450		1320	
L_p, ft		8.72		8.58		8.44		8.19		13.0		12.9	
L_r, ft		25.7		25.0		24.3		23.5		58.8		54.5	

ASD	LRFD
$\Omega_b = 1.67$	$\phi_b = 0.90$
$\Omega_v = 1.50$	$\phi_v = 1.00$

Note: For beams laterally unsupported, see Table 3–10.
Available strength tabulated above heavy line is limited by available shear strength.

Table 3–6 (continued)
Maximum Total Uniform Load, kips
W Shapes

W30

F_y = 50 ksi

Shape		W30× 326[h]		292		261		235		211		191	
Design		ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft	15									959	1440	871	1310
	16	1480	2220	1310	1960	1180	1760	1040	1560	937	1410	842	1270
	17	1400	2100	1240	1870	1110	1660	994	1490	882	1330	793	1190
	18	1320	1980	1180	1770	1050	1570	939	1410	833	1250	749	1130
	19	1250	1880	1110	1670	991	1490	890	1340	789	1190	709	1070
	20	1190	1790	1060	1590	941	1410	845	1270	750	1130	674	1010
	21	1130	1700	1010	1510	896	1350	805	1210	714	1070	642	964
	22	1080	1620	962	1450	856	1290	768	1160	681	1020	612	920
	23	1030	1550	920	1380	818	1230	735	1100	652	980	586	880
	24	990	1490	882	1330	784	1180	704	1060	625	939	561	844
	25	950	1430	846	1270	753	1130	676	1020	600	901	539	810
	26	914	1370	814	1220	724	1090	650	977	577	867	518	779
	27	880	1320	784	1180	697	1050	626	941	555	834	499	750
	28	848	1280	756	1140	672	1010	604	908	535	805	481	723
	29	819	1230	730	1100	649	976	583	876	517	777	465	698
	30	792	1190	705	1060	627	943	564	847	500	751	449	675
	32	742	1120	661	994	588	884	528	794	468	704	421	633
	34	699	1050	622	935	554	832	497	747	441	663	396	596
	36	660	992	588	883	523	786	470	706	416	626	374	563
	38	625	939	557	837	495	744	445	669	394	593	355	533
	40	594	893	529	795	471	707	423	635	375	563	337	506
	42	566	850	504	757	448	674	403	605	357	536	321	482
	44	540	811	481	723	428	643	384	578	341	512	306	460
	46	516	776	460	691	409	615	368	552	326	490	293	440
	48	495	744	441	663	392	589	352	529	312	469	281	422
	50	475	714	423	636	376	566	338	508	300	451	269	405
	52	457	687	407	612	362	544	325	489	288	433	259	389
	54	440	661	392	589	349	524	313	471	278	417	250	375
	56	424	638	378	568	336	505	302	454	268	402	241	362
	58	410	616	365	548	325	488	291	438	258	388	232	349
	60	396	595	353	530	314	472	282	424	250	375	225	338
	62	383	576	341	513	304	456	273	410	242	363	217	327
	64	371	558	331	497	294	442	264	397	234	352	211	316
	66	360	541	321	482	285	429	256	385	227	341	204	307
	68	349	525	311	468	277	416	249	374	220	331	198	298
	70	339	510	302	454	269	404	242	363	214	322	192	289
	72	330	496	294	442	261	393	235	353	208	313	187	281
Beam Properties													
W_c/Ω_b	$\phi_b W_c$, kip-ft	23800	35700	21200	31800	18800	28300	16900	25400	15000	22500	13500	20300
M_p/Ω_b	$\phi_b M_p$, kip-ft	2970	4460	2640	3980	2350	3540	2110	3180	1870	2820	1680	2530
M_r/Ω_b	$\phi_b M_r$, kip-ft	1820	2730	1620	2440	1450	2180	1310	1960	1160	1750	1050	1580
BF	BF, kips	30.3	45.6	29.8	44.8	29.2	43.9	28.3	42.5	27.0	40.7	25.8	38.7
V_n/Ω_v	$\phi_v V_n$, kips	739	1110	653	980	588	882	520	779	480	719	436	653
Z_x, in.^{3}		1190		1060		943		847		751		675	
L_p, ft		12.7		12.6		12.5		12.4		12.3		12.2	
L_r, ft		50.7		46.9		43.4		40.9		38.7		36.9	

ASD	LRFD
$\Omega_b = 1.67$	$\phi_b = 0.90$
$\Omega_v = 1.50$	$\phi_v = 1.00$

[h] Flange thickness greater than 2 in. Special requirements may apply per AISC Specification Section A3.1c.

F_y = 50 ksi

Table 3–6 (continued)
Maximum Total Uniform Load, kips
W Shapes

W30

Shape		W30× 173		148		132		124		116		108	
Design		ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft	10											**650**	975
	11					**746**	1120	**706**	1060	**678**	1020	**628**	944
	12			**797**	1200	**727**	1090	**679**	1020	**629**	945	**576**	865
	13			**768**	1150	**671**	1010	**626**	942	**580**	872	**531**	798
	14			**713**	1070	**623**	936	**582**	874	**539**	810	**493**	741
	15	**798**	1200	**665**	1000	**582**	874	**543**	816	**503**	756	**460**	692
	16	**757**	1140	**624**	938	**545**	819	**509**	765	**472**	709	**432**	649
	17	**713**	1070	**587**	882	**513**	771	**479**	720	**444**	667	**406**	611
	18	**673**	1010	**554**	833	**485**	728	**452**	680	**419**	630	**384**	577
	19	**638**	958	**525**	789	**459**	690	**429**	644	**397**	597	**363**	546
	20	**606**	911	**499**	750	**436**	656	**407**	612	**377**	567	**345**	519
	21	**577**	867	**475**	714	**415**	624	**388**	583	**359**	540	**329**	494
	22	**551**	828	**454**	682	**396**	596	**370**	556	**343**	515	**314**	472
	23	**527**	792	**434**	652	**379**	570	**354**	532	**328**	493	**300**	451
	24	**505**	759	**416**	625	**363**	546	**339**	510	**314**	473	**288**	433
	25	**485**	728	**399**	600	**349**	524	**326**	490	**302**	454	**276**	415
	26	**466**	700	**384**	577	**335**	504	**313**	471	**290**	436	**266**	399
	27	**449**	674	**370**	556	**323**	486	**302**	453	**279**	420	**256**	384
	28	**433**	650	**356**	536	**312**	468	**291**	437	**269**	405	**247**	371
	29	**418**	628	**344**	517	**301**	452	**281**	422	**260**	391	**238**	358
	30	**404**	607	**333**	500	**291**	437	**271**	408	**251**	378	**230**	346
	32	**379**	569	**312**	469	**273**	410	**254**	383	**236**	354	**216**	324
	34	**356**	536	**294**	441	**257**	386	**240**	360	**222**	334	**203**	305
	36	**337**	506	**277**	417	**242**	364	**226**	340	**210**	315	**192**	288
	38	**319**	479	**263**	395	**230**	345	**214**	322	**199**	298	**182**	273
	40	**303**	455	**250**	375	**218**	328	**204**	306	**189**	284	**173**	260
	42	**288**	434	**238**	357	**208**	312	**194**	291	**180**	270	**164**	247
	44	**275**	414	**227**	341	**198**	298	**185**	278	**171**	258	**157**	236
	46	**263**	396	**217**	326	**190**	285	**177**	266	**164**	247	**150**	226
	48	**252**	379	**208**	313	**182**	273	**170**	255	**157**	236	**144**	216
	50	**242**	364	**200**	300	**174**	262	**163**	245	**151**	227	**138**	208
	52	**233**	350	**192**	288	**168**	252	**157**	235	**145**	218	**133**	200
	54	**224**	337	**185**	278	**162**	243	**151**	227	**140**	210	**128**	192
	56	**216**	325	**178**	268	**156**	234	**145**	219	**135**	203	**123**	185
	58	**209**	314	**172**	259	**150**	226	**140**	211	**130**	196	**119**	179
	60	**202**	303	**166**	250	**145**	219	**136**	204	**126**	189	**115**	173
	62	**195**	294	**161**	242	**141**	211	**131**	197	**122**	183	**111**	167
	64	**189**	285	**156**	234	**136**	205	**127**	191	**118**	177	**108**	162
	66	**184**	276	**151**	227	**132**	199	**123**	185	**114**	172	**105**	157
	68	**178**	268	**147**	221	**128**	193	**120**	180	**111**	167	**102**	153
	70	**173**	260	**143**	214	**125**	187	**116**	175	**108**	162	**98.7**	148
	72	**168**	253	**139**	208	**121**	182	**113**	170	**105**	158	**95.9**	144
Beam Properties													
W_c/Ω_b	$\phi_b W_c$, kip-ft	**12100**	18200	**9980**	15000	**8720**	13100	**8140**	12200	**7540**	11300	**6910**	10400
M_p/Ω_b	$\phi_b M_p$, kip-ft	**1510**	2280	**1250**	1880	**1090**	1640	**1020**	1530	**943**	1420	**863**	1300
M_r/Ω_b	$\phi_b M_r$, kip-ft	**945**	1420	**761**	1140	**664**	998	**620**	932	**575**	864	**522**	785
BF	BF, kips	**24.4**	36.6	**28.8**	43.3	**26.9**	40.5	**25.9**	39.0	**24.7**	37.2	**23.7**	35.6
V_n/Ω_v	$\phi_v V_n$, kips	**399**	598	**399**	598	**373**	559	**353**	529	**339**	509	**325**	488
Z_x, in.^{3}		607		500		437		408		378		346	
L_p, ft		12.1		8.05		7.95		7.88		7.74		7.59	
L_r, ft		35.5		24.9		23.8		23.2		22.6		22.0	

ASD	LRFD	
$\Omega_b = 1.67$	$\phi_b = 0.90$	Note: For beams laterally unsupported, see Table 3–10.
$\Omega_v = 1.50$	$\phi_v = 1.00$	Available strength tabulated above heavy line is limited by available shear strength.

W30–W27

Table 3–6 (continued)
Maximum Total Uniform Load, kips
W Shapes

F_y = 50 ksi

Shape	W30× 99		W30× 90[v]		W27× 539[h]		W27× 368[h]		W27× 336[h]		W27× 307[h]	
Design	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft 10	617	925										
11	566	851	499	749								
12	519	780	471	708								
13	479	720	435	653								
14	445	669	403	606	2560	3840	1680	2520	1510	2270		
15	415	624	377	566	2510	3780	1650	2480	1500	2260	1370	2060
16	389	585	353	531	2360	3540	1550	2330	1410	2120	1280	1930
17	366	551	332	499	2220	3340	1460	2190	1330	1990	1210	1820
18	346	520	314	472	2100	3150	1380	2070	1250	1880	1140	1720
19	328	493	297	447	1990	2980	1300	1960	1190	1780	1080	1630
20	311	468	282	425	1890	2840	1240	1860	1130	1700	1030	1550
21	297	446	269	404	1800	2700	1180	1770	1070	1610	979	1470
22	283	425	257	386	1710	2580	1130	1690	1030	1540	934	1400
23	271	407	246	369	1640	2470	1080	1620	981	1470	894	1340
24	259	390	235	354	1570	2360	1030	1550	940	1410	857	1290
25	249	374	226	340	1510	2270	990	1490	902	1360	822	1240
26	240	360	217	327	1450	2180	952	1430	867	1300	791	1190
27	231	347	209	314	1400	2100	917	1380	835	1260	761	1140
28	222	334	202	303	1350	2030	884	1330	806	1210	734	1100
29	215	323	195	293	1300	1960	853	1280	778	1170	709	1070
30	208	312	188	283	1260	1890	825	1240	752	1130	685	1030
32	195	293	177	265	1180	1770	773	1160	705	1060	642	966
34	183	275	166	250	1110	1670	728	1090	663	997	605	909
36	173	260	157	236	1050	1580	688	1030	627	942	571	858
38	164	246	149	223	993	1490	651	979	594	892	541	813
40	156	234	141	212	943	1420	619	930	564	848	514	773
42	148	223	134	202	898	1350	589	886	537	807	489	736
44	142	213	128	193	857	1290	563	845	513	770	467	702
46	135	203	123	185	820	1230	538	809	490	737	447	672
48	130	195	118	177	786	1180	516	775	470	706	428	644
50	125	187	113	170	754	1130	495	744	451	678	411	618
52	120	180	109	163	725	1090	476	715	434	652	395	594
54	115	173	105	157	699	1050	458	689	418	628	381	572
56	111	167	101	152	674	1010	442	664	403	605	367	552
58	107	161	97.4	146	650	978	427	641	389	584	354	533
60	104	156	94.1	142	629	945	413	620	376	565	343	515
62	100	151	91.1	137	608	915	399	600	364	547	332	498
64	97.3	146	88.3	133	589	886	387	581	352	530	321	483
66	94.4	142	85.6	129	572	859	375	564	342	514	311	468
68	91.6	138	83.1	125	555	834	364	547	332	499	302	454
70	89.0	134	80.7	121	539	810	354	531	322	484	294	441
72	86.5	130	78.5	118	524	788	344	517	313	471	286	429
Beam Properties												
W_c/Ω_b / $\phi_b W_c$, kip-ft	6230	9360	5650	8490	37700	56700	24800	37200	22600	33900	20600	30900
M_p/Ω_b / $\phi_b M_p$, kip-ft	778	1170	706	1060	4720	7090	3090	4650	2820	4240	2570	3860
M_r/Ω_b / $\phi_b M_r$, kip-ft	470	706	428	643	2740	4120	1850	2780	1700	2550	1550	2330
BF / BF, kips	22.2	33.3	20.5	30.9	26.1	39.2	25.1	37.7	25.1	37.7	25.2	37.8
V_n/Ω_v / $\phi_v V_n$, kips	308	463	249	375	1280	1920	839	1260	756	1130	687	1030
Z_x, in.^{3}	312		283		1890		1240		1130		1030	
L_p, ft	7.42		7.38		12.9		12.3		12.2		12.0	
L_r, ft	21.4		20.9		88.6		61.9		56.9		52.6	

ASD	LRFD
$\Omega_b = 1.67$	$\phi_b = 0.90$
$\Omega_v = 1.50$	$\phi_v = 1.00$

[h] Flange thickness greater than 2 in. Special requirements may apply per AISC Specification Section A3.1c.

[v] Shape does not meet the h/t_w limit for shear in Specification Section G2.1a with F_y = 50 ksi, $\Omega_v = 1.67$, $\phi_v = 0.90$.

Table 3–6 (continued)
Maximum Total Uniform Load, kips
W Shapes

F_y = 50 ksi

W27

Shape		W27× 281		258		235		217		194		178	
Design		ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft	14			1140		1040	1560			843		806	1210
	15	1240	1860	1130	1700	1030	1540	944	1420	840	1260	758	1140
	16	1170	1760	1060	1600	963	1450	887	1330	787	1180	711	1070
	17	1100	1650	1000	1500	906	1360	835	1250	741	1110	669	1010
	18	1040	1560	945	1420	856	1290	788	1190	700	1050	632	950
	19	983	1480	895	1350	811	1220	747	1120	663	996	599	900
	20	934	1400	850	1280	770	1160	710	1070	630	947	569	855
	21	890	1340	810	1220	734	1100	676	1020	600	901	542	814
	22	849	1280	773	1160	700	1050	645	970	572	860	517	777
	23	812	1220	739	1110	670	1010	617	927	548	823	495	743
	24	778	1170	709	1070	642	965	591	889	525	789	474	713
	25	747	1120	680	1020	616	926	568	853	504	757	455	684
	26	719	1080	654	983	593	891	546	820	484	728	438	658
	27	692	1040	630	947	571	858	526	790	466	701	421	633
	28	667	1000	607	913	550	827	507	762	450	676	406	611
	29	644	968	586	881	531	799	489	736	434	653	392	590
	30	623	936	567	852	514	772	473	711	420	631	379	570
	32	584	878	531	799	482	724	443	667	394	592	356	534
	34	549	826	500	752	453	681	417	627	370	557	335	503
	36	519	780	472	710	428	643	394	593	350	526	316	475
	38	492	739	448	673	406	609	373	561	331	498	299	450
	40	467	702	425	639	385	579	355	533	315	473	284	428
	42	445	669	405	609	367	551	338	508	300	451	271	407
	44	425	638	386	581	350	526	323	485	286	430	259	389
	46	406	610	370	556	335	503	309	464	274	412	247	372
	48	389	585	354	533	321	483	296	444	262	394	237	356
	50	374	562	340	511	308	463	284	427	252	379	228	342
	52	359	540	327	492	296	445	273	410	242	364	219	329
	54	346	520	315	473	285	429	263	395	233	351	211	317
	56	334	501	304	456	275	414	253	381	225	338	203	305
	58	322	484	293	441	266	399	245	368	217	326	196	295
	60	311	468	283	426	257	386	237	356	210	316	190	285
	62	301	453	274	412	249	374	229	344	203	305	184	276
	64	292	439	266	399	241	362	222	333	197	296	178	267
	66	283	425	258	387	233	351	215	323	191	287	172	259
	68	275	413	250	376	227	341	209	314	185	278	167	251
	70	267	401	243	365	220	331	203	305	180	270		
	72	259	390	236	355								
Beam Properties													
W_c/Ω_b	$\phi_b W_c$, kip-ft	18700	28100	17000	25600	15400	23200	14200	21300	12600	18900	11400	17100
M_p/Ω_b	$\phi_b M_p$, kip-ft	2340	3510	2130	3200	1930	2900	1770	2670	1570	2370	1420	2140
M_r/Ω_b	$\phi_b M_r$, kip-ft	1420	2140	1300	1960	1180	1780	1100	1650	976	1470	882	1330
BF	BF, kips	24.6	36.9	24.2	36.4	23.9	35.9	23.3	35.1	22.5	33.8	21.7	32.7
V_n/Ω_v	$\phi_v V_n$, kips	621	931	568	852	522	782	472	708	422	632	403	605
Z_x, in.^{3}		936		852		772		711		631		570	
L_p, ft		12.0		11.9		11.8		11.7		11.6		11.5	
L_r, ft		49.2		45.9		42.9		40.8		38.2		36.3	

ASD	LRFD	
$\Omega_b = 1.67$	$\phi_b = 0.90$	Note: For beams laterally unsupported, see Table 3–10.
$\Omega_v = 1.50$	$\phi_v = 1.00$	Available strength tabulated above heavy line is limited by available shear strength.

Table 3–6 (continued)
Maximum Total Uniform Load, kips
W Shapes

W27

F_y = 50 ksi

Shape		W27× 161		146		129		114		102		94	
Design		ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft	10									558	837	528	791
	11					674	1010	622	933	553	832	504	758
	12					657	988	571	858	507	763	462	695
	13			663		606	912	527	792	468	704	427	642
	14	728	1090	662	994	563	846	489	735	435	654	396	596
	15	685	1030	617	928	526	790	456	686	406	610	370	556
	16	642	966	579	870	493	741	428	643	380	572	347	521
	17	605	909	545	819	464	697	403	605	358	538	326	491
	18	571	858	515	773	438	658	380	572	338	508	308	463
	19	541	813	487	733	415	624	360	542	320	482	292	439
	20	514	773	463	696	394	593	342	515	304	458	277	417
	21	489	736	441	663	375	564	326	490	290	436	264	397
	22	467	702	421	633	358	539	311	468	277	416	252	379
	23	447	672	403	605	343	515	298	447	265	398	241	363
	24	428	644	386	580	329	494	285	429	254	381	231	348
	25	411	618	370	557	315	474	274	412	244	366	222	334
	26	395	594	356	535	303	456	263	396	234	352	213	321
	27	381	572	343	516	292	439	254	381	225	339	206	309
	28	367	552	331	497	282	423	245	368	217	327	198	298
	29	354	533	319	480	272	409	236	355	210	316	191	288
	30	343	515	309	464	263	395	228	343	203	305	185	278
	32	321	483	289	435	246	370	214	322	190	286	173	261
	34	302	454	272	409	232	349	201	303	179	269	163	245
	36	286	429	257	387	219	329	190	286	169	254	154	232
	38	271	407	244	366	207	312	180	271	160	241	146	219
	40	257	386	232	348	197	296	171	257	152	229	139	209
	42	245	368	221	331	188	282	163	245	145	218	132	199
	44	234	351	210	316	179	269	156	234	138	208	126	190
	46	223	336	201	303	171	258	149	224	132	199	121	181
	48	214	322	193	290	164	247	143	214	127	191	116	174
	50	206	309	185	278	158	237	137	206	122	183	111	167
	52	198	297	178	268	152	228	132	198	117	176	107	160
	54	190	286	172	258	146	219	127	191	113	169	103	154
	56	184	276	165	249	141	212	122	184	109	163	99.1	149
	58	177	266	160	240	136	204	118	177	105	158	95.7	144
	60	171	258	154	232	131	198	114	172	101	153	92.5	139
	62	166	249	149	225	127	191	110	166	98.2	148	89.5	135
	64	161	241	145	218	123	185	107	161	95.1	143	86.7	130
	66	156	234	140	211	119	180	104	156	92.2	139	84.1	126
	68	151	227	136	205	116	174	101	151				
Beam Properties													
W_c/Ω_b	$\phi_b W_c$, kip-ft	10300	15500	9260	13900	7880	11900	6850	10300	6090	9150	5550	8340
M_p/Ω_b	$\phi_b M_p$, kip-ft	1280	1930	1160	1740	986	1480	856	1290	761	1140	694	1040
M_r/Ω_b	$\phi_b M_r$, kip-ft	800	1200	723	1090	603	906	522	785	466	701	424	638
BF	BF, kips	20.8	31.3	19.7	29.6	23.3	35.0	21.7	32.6	20.2	30.3	19.1	28.8
V_n/Ω_v	$\phi_v V_n$, kips	364	546	331	497	337	506	311	467	279	419	264	396
Z_x, in.^{3}		515		464		395		343		305		278	
L_p, ft		11.4		11.3		7.81		7.70		7.59		7.49	
L_r, ft		34.7		33.4		24.3		23.1		22.2		21.6	

ASD	LRFD	
$\Omega_b = 1.67$	$\phi_b = 0.90$	[h] Flange thickness greater than 2 in. Special requirements may apply per AISC Specification Section A3.1c.
$\Omega_v = 1.50$	$\phi_v = 1.00$	

F_y = 50 ksi

Table 3–6 (continued)
Maximum Total Uniform Load, kips
W Shapes

W27–W24

Shape	W27×		W24×									
	84		370[h]		335[h]		306[h]		279[h]		250	
Design	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft 9	491	737										
10	487	732										
11	443	665										
12	406	610										
13	375	563	1700	2550	1520	2280	1370	2050	1240	1860	1100	1640
14	348	523	1610	2420	1450	2190	1310	1980	1190	1790	1060	1590
15	325	488	1500	2260	1360	2040	1230	1840	1110	1670	990	1490
16	304	458	1410	2120	1270	1910	1150	1730	1040	1570	928	1400
17	286	431	1330	1990	1200	1800	1080	1630	980	1470	874	1310
18	271	407	1250	1880	1130	1700	1020	1540	926	1390	825	1240
19	256	385	1190	1780	1070	1610	969	1460	877	1320	782	1170
20	244	366	1130	1700	1020	1530	920	1380	833	1250	743	1120
21	232	349	1070	1610	969	1460	876	1320	794	1190	707	1060
22	221	333	1030	1540	925	1390	837	1260	758	1140	675	1010
23	212	318	981	1470	885	1330	800	1200	725	1090	646	970
24	203	305	940	1410	848	1280	767	1150	694	1040	619	930
25	195	293	902	1360	814	1220	736	1110	667	1000	594	893
26	187	282	867	1300	783	1180	708	1060	641	963	571	858
27	180	271	835	1260	754	1130	682	1020	617	928	550	827
28	174	261	806	1210	727	1090	657	988	595	895	530	797
29	168	252	778	1170	702	1060	635	954	575	864	512	770
30	162	244	752	1130	679	1020	613	922	556	835	495	744
32	152	229	705	1060	636	956	575	864	521	783	464	698
34	143	215	663	997	599	900	541	814	490	737	437	656
36	135	203	627	942	566	850	511	768	463	696	413	620
38	128	193	594	892	536	805	484	728	439	659	391	587
40	122	183	564	848	509	765	460	692	417	626	371	558
42	116	174	537	807	485	729	438	659	397	596	354	531
44	111	166	513	770	463	695	418	629	379	569	338	507
46	106	159	490	737	443	665	400	601	362	545	323	485
48	101	153	470	706	424	638	383	576	347	522	309	465
50	97.4	146	451	678	407	612	368	553	333	501	297	446
52	93.7	141	434	652	392	588	354	532	321	482	286	429
54	90.2	136	418	628	377	567	341	512	309	464	275	413
56	87.0	131	403	605	364	546	329	494	298	447	265	399
58	84.0	126	389	584	351	528	317	477	287	432	256	385
60	81.2	122	376	565	339	510	307	461	278	418	248	372
62	78.6	118	364	547	328	494	297	446	269	404	240	360
64	76.1	114	352	530	318	478	288	432	260	391	232	349
66	73.8	111	342	514	308	464	279	419	253	380		
68			332	499	299	450						

Beam Properties

ASD	LRFD	W27×84 ASD	LRFD	370[h] ASD	LRFD	335[h] ASD	LRFD	306[h] ASD	LRFD	279[h] ASD	LRFD	250 ASD	LRFD
W_c/Ω_b	$\phi_b W_c$, kip-ft	4870	7320	22600	33900	20400	30600	18400	27700	16700	25100	14900	22300
M_p/Ω_b	$\phi_b M_p$, kip-ft	609	915	2820	4240	2540	3830	2300	3460	2080	3130	1860	2790
M_r/Ω_b	$\phi_b M_r$, kip-ft	372	559	1670	2510	1510	2270	1380	2070	1250	1880	1120	1690
BF	BF, kips	17.6	26.4	19.9	29.9	20.1	30.2	19.9	29.8	19.7	29.6	19.5	29.3
V_n/Ω_v	$\phi_v V_n$, kips	246	369	851	1280	760	1140	684	1030	620	930	548	822
Z_x, in.^{3}		244		1130		1020		922		835		744	
L_p, ft		7.31		11.6		11.4		11.3		11.2		11.1	
L_r, ft		20.8		69.2		63.0		57.8		53.4		48.6	

ASD	LRFD
$\Omega_b = 1.67$	$\phi_b = 0.90$
$\Omega_v = 1.50$	$\phi_v = 1.00$

Note: For beams laterally unsupported, see Table 3–10.
Available strength tabulated above heavy line is limited by available shear strength.

Table 3–6 (continued)
Maximum Total Uniform Load, kips
W Shapes

W24

F_y = 50 ksi

Shape		W24×											
		229		207		192		176		162		146	
Design		ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft	12											643	
	13	999	1500	895	1340	825	1240	757	1140	705	1060	642	965
	14	962	1450	864	1300	797	1200	729	1100	667	1000	596	896
	15	898	1350	806	1210	744	1120	680	1020	623	936	556	836
	16	842	1270	756	1140	697	1050	637	958	584	878	521	784
	17	793	1190	712	1070	656	986	600	902	549	826	491	738
	18	749	1130	672	1010	620	932	567	852	519	780	464	697
	19	709	1070	637	957	587	883	537	807	492	739	439	660
	20	674	1010	605	909	558	839	510	767	467	702	417	627
	21	642	964	576	866	531	799	486	730	445	669	397	597
	22	612	920	550	826	507	762	464	697	425	638	379	570
	23	586	880	526	790	485	729	443	667	406	610	363	545
	24	561	844	504	758	465	699	425	639	389	585	348	523
	25	539	810	484	727	446	671	408	613	374	562	334	502
	26	518	779	465	699	429	645	392	590	359	540	321	482
	27	499	750	448	673	413	621	378	568	346	520	309	464
	28	481	723	432	649	398	599	364	548	334	501	298	448
	29	465	698	417	627	385	578	352	529	322	484	288	432
	30	449	675	403	606	372	559	340	511	311	468	278	418
	32	421	633	378	568	349	524	319	479	292	439	261	392
	34	396	596	356	535	328	493	300	451	275	413	245	369
	36	374	563	336	505	310	466	283	426	259	390	232	348
	38	355	533	318	478	294	441	268	403	246	369	220	330
	40	337	506	302	455	279	419	255	383	234	351	209	314
	42	321	482	288	433	266	399	243	365	222	334	199	299
	44	306	460	275	413	254	381	232	348	212	319	190	285
	46	293	440	263	395	243	365	222	333	203	305	181	273
	48	281	422	252	379	232	349	212	319	195	293	174	261
	50	269	405	242	364	223	335	204	307	187	281	167	251
	52	259	389	233	350	215	323	196	295	180	270	160	241
	54	250	375	224	337	207	311	189	284	173	260	155	232
	56	241	362	216	325	199	299	182	274	167	251	149	224
	58	232	349	209	313	192	289	176	264	161	242	144	216
	60	225	338	202	303	186	280	170	255	156	234	139	209
	62	217	327	195	293	180	270	165	247	151	226		
	64	211	316	189	284								
Beam Properties													
W_c/Ω_b	$\phi_b W_c$, kip-ft	13500	20300	12100	18200	11200	16800	10200	15300	9340	14000	8340	12500
M_p/Ω_b	$\phi_b M_p$, kip-ft	1680	2530	1510	2270	1390	2100	1270	1920	1170	1760	1040	1570
M_r/Ω_b	$\phi_b M_r$, kip-ft	1030	1540	927	1390	858	1290	786	1180	723	1090	648	974
BF	BF, kips	19.2	28.9	18.9	28.5	18.7	28.0	18.3	27.6	17.8	26.8	17.1	25.8
V_n/Ω_v	$\phi_v V_n$, kips	500	749	447	671	413	619	379	568	353	529	322	482
Z_x, in.^{3}		675		606		559		511		468		418	
L_p, ft		11.0		10.9		10.8		10.7		10.8		10.6	
L_r, ft		45.2		41.8		39.6		37.4		35.7		33.7	
ASD	LRFD												
$\Omega_b = 1.67$	$\phi_b = 0.90$												
$\Omega_v = 1.50$	$\phi_v = 1.00$												

F_y = 50 ksi

Table 3–6 (continued)
Maximum Total Uniform Load, kips
W Shapes

W24

Shape		W24× 131		117		104		103		94		84	
Design		ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft	9											453	680
	10							540	809	501	751	447	672
	11							508	764	461	693	406	611
	12	592	889	534	801	481	722	466	700	422	635	373	560
	13	568	854	502	755	444	667	430	646	390	586	344	517
	14	528	793	466	701	412	619	399	600	362	544	319	480
	15	492	740	435	654	385	578	373	560	338	508	298	448
	16	462	694	408	613	361	542	349	525	317	476	279	420
	17	434	653	384	577	339	510	329	494	298	448	263	395
	18	410	617	363	545	320	482	310	467	282	423	248	373
	19	389	584	344	516	304	456	294	442	267	401	235	354
	20	369	555	326	491	288	434	279	420	253	381	224	336
	21	352	529	311	467	275	413	266	400	241	363	213	320
	22	336	505	297	446	262	394	254	382	230	346	203	305
	23	321	483	284	427	251	377	243	365	220	331	194	292
	24	308	463	272	409	240	361	233	350	211	317	186	280
	25	295	444	261	392	231	347	224	336	203	305	179	269
	26	284	427	251	377	222	333	215	323	195	293	172	258
	27	274	411	242	363	214	321	207	311	188	282	166	249
	28	264	396	233	350	206	310	200	300	181	272	160	240
	29	255	383	225	338	199	299	193	290	175	263	154	232
	30	246	370	218	327	192	289	186	280	169	254	149	224
	32	231	347	204	307	180	271	175	263	158	238	140	210
	34	217	326	192	289	170	255	164	247	149	224	132	198
	36	205	308	181	273	160	241	155	233	141	212	124	187
	38	194	292	172	258	152	228	147	221	133	201	118	177
	40	185	278	163	245	144	217	140	210	127	191	112	168
	42	176	264	155	234	137	206	133	200	121	181	106	160
	44	168	252	148	223	131	197	127	191	115	173	102	153
	46	161	241	142	213	125	188	121	183	110	166	97.2	146
	48	154	231	136	204	120	181	116	175	106	159	93.1	140
	50	148	222	131	196	115	173	112	168	101	152	89.4	134
	52	142	213	126	189	111	167	107	162	97.5	147	86.0	129
	54	137	206	121	182	107	161	103	156	93.9	141	82.8	124
	56	132	198	117	175	103	155	99.8	150	90.5	136	79.8	120
	58	127	191	113	169	99.5	149	96.4	145	87.4	131	77.1	116
	60	123	185	109	164	96.1	145	93.1	140	84.5	127	74.5	112
Beam Properties													
W_c/Ω_b	$\phi_b W_c$, kip-ft	7390	11100	6530	9810	5770	8670	5590	8400	5070	7620	4470	6720
M_p/Ω_b	$\phi_b M_p$, kip-ft	923	1390	816	1230	721	1080	699	1050	634	953	559	840
M_r/Ω_b	$\phi_b M_r$, kip-ft	575	864	508	764	451	677	428	643	388	583	342	515
BF	BF, kips	16.3	24.5	15.3	23.1	14.3	21.5	18.2	27.4	17.3	26.0	16.2	24.3
V_n/Ω_v	$\phi_v V_n$, kips	296	444	267	400	241	361	270	405	250	376	227	340
Z_x, in.^{3}		370		327		289		280		254		224	
L_p, ft		10.5		10.4		10.3		7.03		6.99		6.89	
L_r, ft		31.9		30.4		29.2		21.9		21.2		20.3	

ASD	LRFD
$\Omega_b = 1.67$	$\phi_b = 0.90$
$\Omega_v = 1.50$	$\phi_v = 1.00$

Note: For beams laterally unsupported, see Table 3–10.
Available strength tabulated above heavy line is limited by available shear strength.

Table 3-6 (continued) Maximum Total Uniform Load, kips

W Shapes

W24–W21

F_y = 50 ksi

Shape		W24× 76		W24× 68		W24× 62		W24× 55[v]		W21× 201		W21× 182	
Design		ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft	7					408	612						
	8			394	591	382	574	334	503				
	9	421	631	393	590	339	510	297	447				
	10	399	600	353	531	305	459	267	402				
	11	363	545	321	483	278	417	243	365				
	12	333	500	294	443	254	383	223	335	838	1260	754	1130
	13	307	462	272	408	235	353	206	309	814	1220	731	1100
	14	285	429	252	379	218	328	191	287	756	1140	679	1020
	15	266	400	236	354	204	306	178	268	705	1060	633	952
	16	250	375	221	332	191	287	167	251	661	994	594	893
	17	235	353	208	312	180	270	157	236	622	935	559	840
	18	222	333	196	295	170	255	149	223	588	883	528	793
	19	210	316	186	279	161	242	141	212	557	837	500	752
	20	200	300	177	266	153	230	134	201	529	795	475	714
	21	190	286	168	253	145	219	127	191	504	757	452	680
	22	181	273	161	241	139	209	122	183	481	723	432	649
	23	174	261	154	231	133	200	116	175	460	691	413	621
	24	166	250	147	221	127	191	111	168	441	663	396	595
	25	160	240	141	212	122	184	107	161	423	636	380	571
	26	154	231	136	204	117	177	103	155	407	612	365	549
	27	148	222	131	197	113	170	99.1	149	392	589	352	529
	28	143	214	126	190	109	164	95.5	144	378	568	339	510
	29	138	207	122	183	105	158	92.2	139	365	548	328	492
	30	133	200	118	177	102	153	89.2	134	353	530	317	476
	32	125	188	110	166	95.4	143	83.6	126	331	497	297	446
	34	117	176	104	156	89.8	135	78.7	118	311	468	279	420
	36	111	167	98.1	148	84.8	128	74.3	112	294	442	264	397
	38	105	158	93.0	140	80.4	121	70.4	106	278	418	250	376
	40	99.8	150	88.3	133	76.3	115	66.9	101	264	398	238	357
	42	95.0	143	84.1	126	72.7	109	63.7	95.7	252	379	226	340
	44	90.7	136	80.3	121	69.4	104	60.8	91.4	240	361	216	325
	46	86.8	130	76.8	115	66.4	99.8	58.1	87.4	230	346	207	310
	48	83.2	125	73.6	111	63.6	95.6	55.7	83.8	220	331	198	298
	50	79.8	120	70.7	106	61.1	91.8	53.5	80.4	212	318	190	286
	52	76.8	115	67.9	102	58.7	88.3	51.4	77.3	203	306	183	275
	54	73.9	111	65.4	98.3	56.6	85.0	49.5	74.4	196	294	176	264
	56	71.3	107	63.1	94.8	54.5	82.0	47.8	71.8	189	284	170	255
	58	68.8	103	60.9	91.6	52.7	79.1	46.1	69.3				
Beam Properties													
W_c/Ω_b	$\phi_b W_c$, kip-ft	3990	6000	3530	5310	3050	4590	2670	4020	10600	15900	9500	14300
M_p/Ω_b	$\phi_b M_p$, kip-ft	499	750	442	664	382	574	334	503	1320	1990	1190	1790
M_r/Ω_b	$\phi_b M_r$, kip-ft	307	462	269	404	229	344	199	299	805	1210	728	1090
BF	BF, kips	15.0	22.5	14.1	21.2	16.0	24.1	14.8	22.2	14.6	21.9	14.3	21.6
V_n/Ω_v	$\phi_v V_n$, kips	210	316	197	295	204	306	167	251	419	629	377	566
Z_x, in.^{3}		200		177		153		134		530		476	
L_p, ft		6.78		6.61		4.87		4.73		10.7		10.6	
L_r, ft		19.6		18.8		14.4		13.9		46.1		42.6	

ASD	LRFD
$\Omega_b = 1.67$	$\phi_b = 0.90$
$\Omega_v = 1.50$	$\phi_v = 1.00$

[v] Shape does not meet the h/t_w limit for shear in Specification Section G2.1a with F_y = 50 ksi, $\Omega_v = 1.67$, $\phi_v = 0.90$.

F_y = 50 ksi

Table 3–6 (continued)
Maximum Total Uniform Load, kips
W Shapes

W21

Shape	W21×											
	166		147		132		122		111		101	
Design	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft 11			635	953	568	851	520	780	473	710	427	641
12	674	1010	620	933	554	833	511	768	464	698	421	633
13	663	997	573	861	511	768	471	708	428	644	388	584
14	616	926	532	799	475	714	438	658	398	598	361	542
15	575	864	496	746	443	666	409	614	371	558	337	506
16	539	810	465	699	415	624	383	576	348	523	316	474
17	507	762	438	658	391	588	360	542	328	492	297	446
18	479	720	414	622	369	555	340	512	309	465	281	422
19	454	682	392	589	350	526	323	485	293	441	266	399
20	431	648	372	560	332	500	306	461	278	419	252	380
21	411	617	355	533	317	476	292	439	265	399	240	361
22	392	589	338	509	302	454	279	419	253	380	230	345
23	375	563	324	487	289	434	266	400	242	364	220	330
24	359	540	310	466	277	416	255	384	232	349	210	316
25	345	518	298	448	266	400	245	368	223	335	202	304
26	332	498	286	430	256	384	236	354	214	322	194	292
27	319	480	276	414	246	370	227	341	206	310	187	281
28	308	463	266	400	237	357	219	329	199	299	180	271
29	297	447	257	386	229	344	211	318	192	289	174	262
30	287	432	248	373	222	333	204	307	186	279	168	253
32	269	405	233	350	208	312	191	288	174	262	158	237
34	254	381	219	329	195	294	180	271	164	246	149	223
36	240	360	207	311	185	278	170	256	155	233	140	211
38	227	341	196	294	175	263	161	242	147	220	133	200
40	216	324	186	280	166	250	153	230	139	209	126	190
42	205	309	177	266	158	238	146	219	133	199	120	181
44	196	295	169	254	151	227	139	209	127	190	115	173
46	187	282	162	243	144	217	133	200	121	182	110	165
48	180	270	155	233	138	208	128	192	116	174	105	158
50	172	259	149	224	133	200	123	184	111	167	101	152
52	166	249	143	215	128	192	118	177	107	161	97.1	146
54	160	240	138	207	123	185	113	171				
56	154	231										
Beam Properties												
W_c/Ω_b / $\phi_b W_c$, kip-ft	8620	13000	7450	11200	6650	9990	6130	9210	5570	8370	5050	7590
M_p/Ω_b / $\phi_b M_p$, kip-ft	1080	1620	931	1400	831	1250	766	1150	696	1050	631	949
M_r/Ω_b / $\phi_b M_r$, kip-ft	664	998	575	864	515	774	477	717	435	654	396	596
BF / BF, kips	14.2	21.3	13.8	20.7	13.3	20.0	12.9	19.4	12.4	18.7	11.8	17.7
V_n/Ω_v / $\phi_v V_n$, kips	337	506	318	476	284	426	260	390	237	355	214	320
Z_x, in.^{3}	432		373		333		307		279		253	
L_p, ft	10.6		10.4		10.3		10.3		10.2		10.2	
L_r, ft	39.8		36.3		34.1		32.7		31.3		30.1	

ASD	LRFD
$\Omega_b = 1.67$	$\phi_b = 0.90$
$\Omega_v = 1.50$	$\phi_v = 1.00$

Note: For beams laterally unsupported, see Table 3–10.
Available strength tabulated above heavy line is limited by available shear strength.

W21

Table 3–6 (continued)
Maximum Total Uniform Load, kips
W Shapes

F_y = 50 ksi

Shape		W21×									
		93		83		73		68		62	
Design		ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft	8	502	752	441	662	387	580	363	545	336	504
	9	490	737	435	653	381	573	355	533	319	480
	10	441	663	391	588	343	516	319	480	287	432
	11	401	603	356	535	312	469	290	436	261	393
	12	368	553	326	490	286	430	266	400	240	360
	13	339	510	301	452	264	397	246	369	221	332
	14	315	474	279	420	245	369	228	343	205	309
	15	294	442	261	392	229	344	213	320	192	288
	16	276	414	245	368	215	323	200	300	180	270
	17	259	390	230	346	202	304	188	282	169	254
	18	245	368	217	327	191	287	177	267	160	240
	19	232	349	206	309	181	272	168	253	151	227
	20	221	332	196	294	172	258	160	240	144	216
	21	210	316	186	280	163	246	152	229	137	206
	22	201	301	178	267	156	235	145	218	131	196
	23	192	288	170	256	149	224	139	209	125	188
	24	184	276	163	245	143	215	133	200	120	180
	25	176	265	156	235	137	206	128	192	115	173
	26	170	255	150	226	132	198	123	185	111	166
	27	163	246	145	218	127	191	118	178	106	160
	28	158	237	140	210	123	184	114	171	103	154
	29	152	229	135	203	118	178	110	166	99.1	149
	30	147	221	130	196	114	172	106	160	95.8	144
	32	138	207	122	184	107	161	99.8	150	89.8	135
	34	130	195	115	173	101	152	93.9	141	84.5	127
	36	123	184	109	163	95.4	143	88.7	133	79.8	120
	38	116	174	103	155	90.3	136	84.0	126	75.6	114
	40	110	166	97.8	147	85.8	129	79.8	120	71.9	108
	42	105	158	93.1	140	81.7	123	76.0	114	68.4	103
	44	100	151	88.9	134	78.0	117	72.6	109	65.3	98.2
	46	95.9	144	85.0	128	74.6	112	69.4	104	62.5	93.9
	48	91.9	138	81.5	122	71.5	107	66.5	100	59.9	90.0
	50	88.2	133	78.2	118	68.7	103	63.9	96.0	57.5	86.4
	52	84.8	128	75.2	113	66.0	99.2	61.4	92.3	55.3	83.1
	54	81.7	123								
Beam Properties											
W_c/Ω_b	$\phi_b W_c$, kip-ft	4410	6630	3910	5880	3430	5160	3190	4800	2870	4320
M_p/Ω_b	$\phi_b M_p$, kip-ft	551	829	489	735	429	645	399	600	359	540
M_r/Ω_b	$\phi_b M_r$, kip-ft	335	504	299	449	264	396	245	368	222	333
BF	BF, kips	14.6	21.9	13.8	20.8	12.9	19.4	12.5	18.8	11.6	17.4
V_n/Ω_v	$\phi_v V_n$, kips	251	376	221	331	193	290	182	273	168	252
Z_x, in.^{3}		221		196		172		160		144	
L_p, ft		6.50		6.46		6.39		6.36		6.25	
L_r, ft		21.3		20.2		19.2		18.7		18.1	

ASD	LRFD
$\Omega_b = 1.67$	$\phi_b = 0.90$
$\Omega_v = 1.50$	$\phi_v = 1.00$

[f] Shape does not meet compact limit for flexure with F_y = 50 ksi.

Table 3–6 (continued)
Maximum Total Uniform Load, kips
W Shapes

F_y = 50 ksi

W21

Shape		W21× 57		55		50		48[f]		44	
Design		ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft	6					317	475			289	434
	7	341	512			314	471	289	433	272	409
	8	322	484	312	468	274	413	265	398	238	358
	9	286	430	279	420	244	367	235	354	212	318
	10	257	387	251	378	220	330	212	318	190	286
	11	234	352	229	344	200	300	193	289	173	260
	12	215	323	210	315	183	275	177	265	159	239
	13	198	298	193	291	169	254	163	245	146	220
	14	184	276	180	270	157	236	151	227	136	204
	15	172	258	168	252	146	220	141	212	127	191
	16	161	242	157	236	137	206	132	199	119	179
	17	151	228	148	222	129	194	125	187	112	168
	18	143	215	140	210	122	183	118	177	106	159
	19	136	204	132	199	116	174	111	168	100	151
	20	129	194	126	189	110	165	106	159	95.2	143
	21	123	184	120	180	105	157	101	152	90.7	136
	22	117	176	114	172	99.8	150	96.3	145	86.6	130
	23	112	168	109	164	95.5	143	92.1	138	82.8	124
	24	107	161	105	158	91.5	138	88.3	133	79.3	119
	25	103	155	101	151	87.8	132	84.7	127	76.2	114
	26	99.0	149	96.7	145	84.4	127	81.5	122	73.2	110
	27	95.4	143	93.1	140	81.3	122	78.5	118	70.5	106
	28	92.0	138	89.8	135	78.4	118	75.6	114	68.0	102
	29	88.8	133	86.7	130	75.7	114	73.0	110	65.7	98.7
	30	85.8	129	83.8	126	73.2	110	70.6	106	63.5	95.4
	32	80.5	121	78.6	118	68.6	103	66.2	99.5	59.5	89.4
	34	75.7	114	74.0	111	64.6	97.1	62.3	93.6	56.0	84.2
	36	71.5	108	69.9	105	61.0	91.7	58.8	88.4	52.9	79.5
	38	67.8	102	66.2	99.5	57.8	86.8	55.7	83.8	50.1	75.3
	40	64.4	96.8	62.9	94.5	54.9	82.5	53.0	79.6	47.6	71.6
	42	61.3	92.1	59.9	90.0	52.3	78.6	50.4	75.8	45.3	68.1
	44	58.5	88.0	57.2	85.9	49.9	75.0	48.1	72.4	43.3	65.0
	46	56.0	84.1	54.7	82.2	47.7	71.7	46.0	69.2	41.4	62.2
	48	53.6	80.6	52.4	78.8	45.7	68.8	44.1	66.3	39.7	59.6
	50	51.5	77.4	50.3	75.6	43.9	66.0	42.4	63.7	38.1	57.2
	52	49.5	74.4	48.4	72.7	42.2	63.5				
Beam Properties											
W_c/Ω_b	$\phi_b W_c$, kip-ft	2570	3870	2510	3780	2200	3300	2120	3180	1900	2860
M_p/Ω_b	$\phi_b M_p$, kip-ft	322	484	314	473	274	413	265	398	238	358
M_r/Ω_b	$\phi_b M_r$, kip-ft	194	291	192	289	165	248	162	244	143	214
BF	BF, kips	13.4	20.1	10.8	16.3	12.2	18.3	9.78	14.7	11.2	16.8
V_n/Ω_v	$\phi_v V_n$, kips	171	256	156	234	158	237	144	217	145	217
Z_x, in.^{3}		129		126		110		107		95.4	
L_p, ft		4.77		6.11		4.59		6.09		4.45	
L_r, ft		14.3		17.4		13.6		16.6		13.0	

ASD	LRFD
$\Omega_b = 1.67$	$\phi_b = 0.90$
$\Omega_v = 1.50$	$\phi_v = 1.00$

Note: For beams laterally unsupported, see Table 3–10.
Available strength tabulated above heavy line is limited by available shear strength.

Table 3–6 (continued)
Maximum Total Uniform Load, kips
W Shapes

W18

F_y = 50 ksi

Shape		W18× 311[h]		283[h]		258[h]		234[h]		211		192	
Design		ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft	11	1360	2040	1220	1840	1100	1650	977	1470	876	1310	781	1170
	12	1250	1890	1120	1690	1020	1530	913	1370	815	1230	735	1110
	13	1160	1740	1040	1560	938	1410	843	1270	752	1130	679	1020
	14	1070	1620	964	1450	871	1310	783	1180	699	1050	630	947
	15	1000	1510	900	1350	813	1220	731	1100	652	980	588	884
	16	941	1410	843	1270	762	1150	685	1030	611	919	551	829
	17	885	1330	794	1190	717	1080	645	969	575	865	519	780
	18	836	1260	750	1130	678	1020	609	915	543	817	490	737
	19	792	1190	710	1070	642	965	577	867	515	774	464	698
	20	752	1130	675	1010	610	917	548	824	489	735	441	663
	21	717	1080	643	966	581	873	522	784	466	700	420	631
	22	684	1030	613	922	554	833	498	749	445	668	401	603
	23	654	983	587	882	530	797	476	716	425	639	384	577
	24	627	943	562	845	508	764	457	686	408	613	368	553
	25	602	905	540	811	488	733	438	659	391	588	353	530
	26	579	870	519	780	469	705	421	633	376	565	339	510
	27	557	838	500	751	452	679	406	610	362	544	327	491
	28	537	808	482	724	436	655	391	588	349	525	315	474
	29	519	780	465	699	421	632	378	568	337	507	304	457
	30	502	754	450	676	407	611	365	549	326	490	294	442
	31	485	730	435	654	393	591	353	531	315	474	285	428
	32	470	707	422	634	381	573	342	515	306	459	276	414
	33	456	685	409	615	370	555	332	499	296	445	267	402
	34	443	665	397	596	359	539	322	484	288	432	259	390
	35	430	646	386	579	348	524	313	471	279	420	252	379
	36	418	628	375	563	339	509	304	458	272	408	245	368
	37	407	611	365	548	330	495	296	445	264	397	238	358
	38	396	595	355	534	321	482	288	433	257	387	232	349
	39	386	580	346	520	313	470	281	422	251	377	226	340
	40	376	566	337	507	305	458	274	412	245	368	221	332
	42	358	539	321	483	290	436	261	392	233	350	210	316
	44	342	514	307	461	277	417	249	374	222	334	201	301
	46	327	492	293	441	265	398	238	358	213	320	192	288
	48	314	471	281	422	254	382	228	343	204	306	184	276
	50	301	452	270	406	244	367	219	329	196	294	176	265
Beam Properties													
W_c/Ω_b	$\phi_b W_c$, kip-ft	15000	22600	13500	20300	12200	18300	11000	16500	9780	14700	8820	13300
M_p/Ω_b	$\phi_b M_p$, kip-ft	1880	2830	1690	2540	1520	2290	1370	2060	1220	1840	1100	1660
M_r/Ω_b	$\phi_b M_r$, kip-ft	1090	1640	987	1480	898	1350	814	1220	732	1100	664	998
BF	BF, kips	11.2	16.8	11.0	16.6	11.0	16.5	10.8	16.2	10.7	16.1	10.7	16.0
V_n/Ω_v	$\phi_v V_n$, kips	679	1020	612	918	549	824	489	733	438	657	391	586
Z_x, in.^{3}		754		676		611		549		490		442	
L_p, ft		10.4		10.3		10.2		10.1		9.96		9.85	
L_r, ft		81.2		73.8		67.4		61.5		55.8		51.1	

ASD	LRFD
$\Omega_b = 1.67$	$\phi_b = 0.90$
$\Omega_v = 1.50$	$\phi_v = 1.00$

[h] Flange thickness greater than 2 in. Special requirements may apply per AISC Specification Section A3.1c.

Table 3–6 (continued)
Maximum Total Uniform Load, kips
W Shapes

F_y = 50 ksi

W18

Shape	W18× 175		158		143		130		119		106	
Design	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft 10									497	746	442	663
11	713	1070	639	958	569	854	516	774	475	715	417	627
12	662	995	592	890	536	805	482	725	436	655	383	575
13	611	918	547	822	494	743	445	669	402	605	353	531
14	567	853	508	763	459	690	413	621	374	561	328	493
15	530	796	474	712	428	644	386	580	349	524	306	460
16	497	746	444	668	402	604	362	544	327	491	287	431
17	467	702	418	628	378	568	340	512	308	462	270	406
18	441	663	395	593	357	537	322	483	291	437	255	383
19	418	628	374	562	338	508	305	458	275	414	242	363
20	397	597	355	534	321	483	289	435	261	393	230	345
21	378	569	338	509	306	460	276	414	249	374	219	329
22	361	543	323	485	292	439	263	395	238	357	209	314
23	345	519	309	464	279	420	252	378	227	342	200	300
24	331	497	296	445	268	403	241	362	218	328	191	288
25	318	478	284	427	257	386	232	348	209	314	184	276
26	306	459	273	411	247	372	223	335	201	302	177	265
27	294	442	263	396	238	358	214	322	194	291	170	256
28	284	426	254	381	230	345	207	311	187	281	164	246
29	274	412	245	368	222	333	200	300	180	271	158	238
30	265	398	237	356	214	322	193	290	174	262	153	230
31	256	385	229	345	207	312	187	281	169	254	148	223
32	248	373	222	334	201	302	181	272	163	246	143	216
33	241	362	215	324	195	293	175	264	158	238	139	209
34	234	351	209	314	189	284	170	256	154	231	135	203
35	227	341	203	305	184	276	165	249	149	225	131	197
36	221	332	197	297	179	268	161	242	145	218	128	192
37	215	323	192	289	174	261	156	235	141	212	124	186
38	209	314	187	281	169	254	152	229	138	207	121	182
39	204	306	182	274	165	248	148	223	134	202	118	177
40	199	299	178	267	161	242	145	218	131	197	115	173
42	189	284	169	254	153	230	138	207	125	187	109	164
44	181	271	161	243	146	220	132	198	119	179	104	157
46	173	260	154	232	140	210	126	189	114	171	99.8	150
48	166	249	148	222	134	201	121	181				
50	159	239										

Beam Properties

		175 ASD	175 LRFD	158 ASD	158 LRFD	143 ASD	143 LRFD	130 ASD	130 LRFD	119 ASD	119 LRFD	106 ASD	106 LRFD
W_c/Ω_b	$\phi_b W_c$, kip-ft	7940	11900	7110	10700	6430	9660	5790	8700	5230	7860	4590	6900
M_p/Ω_b	$\phi_b M_p$, kip-ft	993	1490	888	1340	803	1210	724	1090	654	983	574	863
M_r/Ω_b	$\phi_b M_r$, kip-ft	601	903	541	814	493	740	447	672	403	606	356	536
BF	BF, kips	10.6	15.9	10.5	15.7	10.4	15.6	10.2	15.3	10.1	15.2	9.70	14.6
V_n/Ω_v	$\phi_v V_n$, kips	357	535	319	479	285	427	258	387	249	373	221	332

	175	158	143	130	119	106
Z_x, in.^{3}	398	356	322	290	262	230
L_p, ft	9.75	9.68	9.61	9.54	9.50	9.40
L_r, ft	46.7	42.8	39.6	36.7	34.3	31.8

ASD	LRFD
$\Omega_b = 1.67$	$\phi_b = 0.90$
$\Omega_v = 1.50$	$\phi_v = 1.00$

Note: For beams laterally unsupported, see Table 3–10.
Available strength tabulated above heavy line is limited by available shear strength.

W18

Table 3–6 (continued)
Maximum Total Uniform Load, kips
W Shapes

F_y = 50 ksi

Shape		W18× 97		86		76		71		65		60	
Design		ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft	7							366	549				
	8							364	548	330	495	303	454
	9							324	487	295	443	273	410
	10	398	597	353	530	310	464	291	438	265	399	246	369
	11	383	575	338	507	296	445	265	398	241	363	223	335
	12	351	528	309	465	271	407	243	365	221	332	205	308
	13	324	487	286	429	250	376	224	337	204	307	189	284
	14	301	452	265	399	232	349	208	313	190	285	175	264
	15	281	422	248	372	217	326	194	292	177	266	164	246
	16	263	396	232	349	203	306	182	274	166	249	153	231
	17	248	372	218	328	191	288	171	258	156	235	144	217
	18	234	352	206	310	181	272	162	243	147	222	136	205
	19	222	333	195	294	171	257	153	231	140	210	129	194
	20	211	317	186	279	163	245	146	219	133	200	123	185
	21	201	301	177	266	155	233	139	209	126	190	117	176
	22	191	288	169	254	148	222	132	199	121	181	112	168
	23	183	275	161	243	141	213	127	190	115	173	107	160
	24	175	264	155	233	136	204	121	183	111	166	102	154
	25	168	253	149	223	130	196	117	175	106	160	98.2	148
	26	162	243	143	215	125	188	112	168	102	153	94.4	142
	27	156	234	138	207	120	181	108	162	98.3	148	90.9	137
	28	150	226	133	199	116	175	104	156	94.8	143	87.7	132
	29	145	218	128	192	112	169	100	151	91.5	138	84.7	127
	30	140	211	124	186	108	163	97.1	146	88.5	133	81.8	123
	31	136	204	120	180	105	158	94.0	141	85.6	129	79.2	119
	32	132	198	116	174	102	153	91.1	137	83.0	125	76.7	115
	33	128	192	113	169	98.6	148	88.3	133	80.4	121	74.4	112
	34	124	186	109	164	95.7	144	85.7	129	78.1	117	72.2	109
	35	120	181	106	159	93.0	140	83.3	125	75.8	114	70.1	105
	36	117	176	103	155	90.4	136	80.9	122	73.7	111	68.2	103
	37	114	171	100	151	87.9	132	78.8	118	71.7	108	66.4	99.7
	38	111	167	97.7	147	85.6	129	76.7	115	69.9	105	64.6	97.1
	39	108	162	95.2	143	83.4	125	74.7	112	68.1	102	63.0	94.6
	40	105	158	92.8	140	81.3	122	72.9	110	66.4	99.8	61.4	92.3
	42	100	151	88.4	133	77.5	116	69.4	104	63.2	95.0	58.5	87.9
	44	95.7	144	84.4	127	73.9	111	66.2	99.5	60.3	90.7	55.8	83.9
	46	91.6	138					63.4	95.2				
Beam Properties													
W_c/Ω_b	$\phi_b W_c$, kip-ft	4210	6330	3710	5580	3250	4890	2910	4380	2650	3990	2460	3690
M_p/Ω_b	$\phi_b M_p$, kip-ft	526	791	464	698	407	611	364	548	332	499	307	461
M_r/Ω_b	$\phi_b M_r$, kip-ft	328	494	290	436	255	383	222	333	204	307	189	284
BF	BF, kips	9.45	14.2	9.04	13.6	8.49	12.8	10.5	15.7	9.92	14.9	9.64	14.5
V_n/Ω_v	$\phi_v V_n$, kips	199	298	177	265	155	232	183	274	165	248	151	227
Z_x, in.^{3}		211		186		163		146		133		123	
L_p, ft		9.36		9.29		9.22		6.00		5.97		5.93	
L_r, ft		30.3		28.5		27.1		19.6		18.8		18.2	

ASD	LRFD
$\Omega_b = 1.67$	$\phi_b = 0.90$
$\Omega_v = 1.50$	$\phi_v = 1.00$

F_y = 50 ksi

Table 3–6 (continued)
Maximum Total Uniform Load, kips
W Shapes

W18–W16

Shape		W18×										W16×	
		55		50		46		40		35		100	
Design		ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft	6					260	390	226	338	212	319		
	7	283	424	255	383	259	389	224	336	190	285		
	8	279	420	252	379	226	340	196	294	166	249		
	9	248	373	224	337	201	302	174	261	147	222	397	596
	10	224	336	202	303	181	272	156	235	133	200	395	594
	11	203	305	183	275	165	247	142	214	121	181	359	540
	12	186	280	168	253	151	227	130	196	111	166	329	495
	13	172	258	155	233	139	209	120	181	102	153	304	457
	14	160	240	144	216	129	194	112	168	94.8	143	282	424
	15	149	224	134	202	121	181	104	157	88.5	133	263	396
	16	140	210	126	189	113	170	97.8	147	83.0	125	247	371
	17	132	198	119	178	106	160	92.1	138	78.1	117	232	349
	18	124	187	112	168	101	151	86.9	131	73.7	111	220	330
	19	118	177	106	159	95.3	143	82.4	124	69.9	105	208	313
	20	112	168	101	152	90.5	136	78.2	118	66.4	99.8	198	297
	21	106	160	96.0	144	86.2	130	74.5	112	63.2	95.0	188	283
	22	102	153	91.6	138	82.3	124	71.1	107	60.3	90.7	180	270
	23	97.2	146	87.7	132	78.7	118	68.0	102	57.7	86.7	172	258
	24	93.1	140	84.0	126	75.4	113	65.2	98.0	55.3	83.1	165	248
	25	89.4	134	80.6	121	72.4	109	62.6	94.1	53.1	79.8	158	238
	26	86.0	129	77.5	117	69.6	105	60.2	90.5	51.1	76.7	152	228
	27	82.8	124	74.7	112	67.1	101	58.0	87.1	49.2	73.9	146	220
	28	79.8	120	72.0	108	64.7	97.2	55.9	84.0	47.4	71.3	141	212
	29	77.1	116	69.5	104	62.4	93.8	54.0	81.1	45.8	68.8	136	205
	30	74.5	112	67.2	101	60.3	90.7	52.2	78.4	44.2	66.5	132	198
	31	72.1	108	65.0	97.7	58.4	87.8	50.5	75.9	42.8	64.4	127	192
	32	69.9	105	63.0	94.7	56.6	85.0	48.9	73.5	41.5	62.3	124	186
	33	67.7	102	61.1	91.8	54.9	82.5	47.4	71.3	40.2	60.5	120	180
	34	65.8	98.8	59.3	89.1	53.2	80.0	46.0	69.2	39.0	58.7	116	175
	35	63.9	96.0	57.6	86.6	51.7	77.7	44.7	67.2	37.9	57.0	113	170
	36	62.1	93.3	56.0	84.2	50.3	75.6	43.5	65.3	36.9	55.4	110	165
	37	60.4	90.8	54.5	81.9	48.9	73.5	42.3	63.6	35.9	53.9	107	161
	38	58.8	88.4	53.1	79.7	47.6	71.6	41.2	61.9	34.9	52.5	104	156
	39	57.3	86.2	51.7	77.7	46.4	69.8	40.1	60.3	34.0	51.2	101	152
	40	55.9	84.0	50.4	75.8	45.3	68.0	39.1	58.8	33.2	49.9	98.8	149
	42	53.2	80.0	48.0	72.1	43.1	64.8	37.3	56.0	31.6	47.5	94.1	141
	44	50.8	76.4	45.8	68.9	41.1	61.8	35.6	53.5	30.2	45.3		
Beam Properties													
W_c/Ω_b	$\phi_b W_c$, kip-ft	2240	3360	2020	3030	1810	2720	1560	2350	1330	2000	3950	5940
M_p/Ω_b	$\phi_b M_p$, kip-ft	279	420	252	379	226	340	196	294	166	249	494	743
M_r/Ω_b	$\phi_b M_r$, kip-ft	172	258	155	233	138	207	119	180	101	151	306	459
BF	BF, kips	9.26	13.9	8.69	13.1	9.71	14.6	8.86	13.3	8.07	12.1	7.90	11.9
V_n/Ω_v	$\phi_v V_n$, kips	141	212	128	192	130	195	113	169	106	159	199	298
Z_x, in.^{3}		112		101		90.7		78.4		66.5		198	
L_p, ft		5.90		5.83		4.56		4.49		4.31		8.87	
L_r, ft		17.5		17.0		13.7		13.1		12.4		32.7	

ASD	LRFD	
$\Omega_b = 1.67$	$\phi_b = 0.90$	Note: For beams laterally unsupported, see Table 3–10.
$\Omega_v = 1.50$	$\phi_v = 1.00$	Available strength tabulated above heavy line is limited by available shear strength.

W16

Table 3–6 (continued)
Maximum Total Uniform Load, kips
W Shapes

F_y = 50 ksi

Shape	W16× 89		77		67		57		50	
Design	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft 7							283	424	247	371
8							262	394	230	345
9	352	528	301	451			233	350	204	307
10	349	525	299	450	258	387	210	315	184	276
11	318	477	272	409	236	355	191	286	167	251
12	291	438	250	375	216	325	175	263	153	230
13	269	404	230	346	200	300	161	242	141	212
14	250	375	214	321	185	279	150	225	131	197
15	233	350	200	300	173	260	140	210	122	184
16	218	328	187	281	162	244	131	197	115	173
17	205	309	176	265	153	229	123	185	108	162
18	194	292	166	250	144	217	116	175	102	153
19	184	276	158	237	137	205	110	166	96.6	145
20	175	263	150	225	130	195	105	158	91.8	138
21	166	250	143	214	124	186	99.8	150	87.4	131
22	159	239	136	205	118	177	95.3	143	83.5	125
23	152	228	130	196	113	170	91.1	137	79.8	120
24	146	219	125	188	108	163	87.3	131	76.5	115
25	140	210	120	180	104	156	83.8	126	73.5	110
26	134	202	115	173	99.8	150	80.6	121	70.6	106
27	129	194	111	167	96.1	144	77.6	117	68.0	102
28	125	188	107	161	92.7	139	74.9	113	65.6	98.6
29	120	181	103	155	89.5	134	72.3	109	63.3	95.2
30	116	175	99.8	150	86.5	130	69.9	105	61.2	92.0
31	113	169	96.6	145	83.7	126	67.6	102	59.2	89.0
32	109	164	93.6	141	81.1	122	65.5	98.4	57.4	86.3
33	106	159	90.7	136	78.6	118	63.5	95.5	55.6	83.6
34	103	154	88.1	132	76.3	115	61.6	92.6	54.0	81.2
35	99.8	150	85.5	129	74.1	111	59.9	90.0	52.5	78.9
36	97.0	146	83.2	125	72.1	108	58.2	87.5	51.0	76.7
37	94.4	142	80.9	122	70.1	105	56.6	85.1	49.6	74.6
38	91.9	138	78.8	118	68.3	103	55.2	82.9	48.3	72.6
39	89.6	135	76.8	115	66.5	100	53.7	80.8	47.1	70.8
40	87.3	131	74.9	113	64.9	97.5	52.4	78.8	45.9	69.0
Beam Properties										
W_c/Ω_b / $\phi_b W_c$, kip-ft	3490	5250	2990	4500	2590	3900	2100	3150	1840	2760
M_p/Ω_b / $\phi_b M_p$, kip-ft	437	656	374	563	324	488	262	394	230	345
M_r/Ω_b / $\phi_b M_r$, kip-ft	271	407	234	352	204	307	161	242	141	213
BF / BF, kips	7.74	11.6	7.34	11.0	6.91	10.4	7.98	12.0	7.59	11.4
V_n/Ω_v / $\phi_v V_n$, kips	176	264	150	225	129	194	141	212	124	185
Z_x, in.^{3}	175		150		130		105		92.0	
L_p, ft	8.80		8.72		8.69		5.65		5.62	
L_r, ft	30.2		27.8		26.1		18.3		17.2	

ASD	LRFD
$\Omega_b = 1.67$	$\phi_b = 0.90$
$\Omega_v = 1.50$	$\phi_v = 1.00$

[v] Shape does not meet the h/t_w limit for shear in Specification Section G2.1a with F_y = 50 ksi, $\Omega_v = 1.67$, $\phi_v = 0.90$.

F_y = 50 ksi

Table 3–6 (continued)
Maximum Total Uniform Load, kips
W Shapes

W16

Shape	W16× 45		40		36		31		26[v]	
Design	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft 6					187	281	175	262	141	212
7	223	334	195	293	182	274	154	231	126	189
8	205	309	182	274	160	240	135	203	110	166
9	183	274	162	243	142	213	120	180	98.0	147
10	164	247	146	219	128	192	108	162	88.2	133
11	149	224	132	199	116	175	98.0	147	80.2	121
12	137	206	121	183	106	160	89.8	135	73.5	111
13	126	190	112	168	98.3	148	82.9	125	67.9	102
14	117	176	104	156	91.2	137	77.0	116	63.0	94.7
15	110	165	97.1	146	85.2	128	71.9	108	58.8	88.4
16	103	154	91.1	137	79.8	120	67.4	101	55.1	82.9
17	96.6	145	85.7	129	75.1	113	63.4	95.3	51.9	78.0
18	91.3	137	80.9	122	71.0	107	59.9	90.0	49.0	73.7
19	86.5	130	76.7	115	67.2	101	56.7	85.3	46.4	69.8
20	82.1	123	72.9	110	63.9	96.0	53.9	81.0	44.1	66.3
21	78.2	118	69.4	104	60.8	91.4	51.3	77.1	42.0	63.1
22	74.7	112	66.2	99.5	58.1	87.3	49.0	73.6	40.1	60.3
23	71.4	107	63.4	95.2	55.5	83.5	46.9	70.4	38.4	57.7
24	68.4	103	60.7	91.3	53.2	80.0	44.9	67.5	36.8	55.3
25	65.7	98.8	58.3	87.6	51.1	76.8	43.1	64.8	35.3	53.0
26	63.2	95.0	56.0	84.2	49.1	73.8	41.5	62.3	33.9	51.0
27	60.8	91.4	54.0	81.1	47.3	71.1	39.9	60.0	32.7	49.1
28	58.7	88.2	52.0	78.2	45.6	68.6	38.5	57.9	31.5	47.4
29	56.6	85.1	50.2	75.5	44.0	66.2	37.2	55.9	30.4	45.7
30	54.8	82.3	48.6	73.0	42.6	64.0	35.9	54.0	29.4	44.2
31	53.0	79.6	47.0	70.6	41.2	61.9	34.8	52.3	28.5	42.8
32	51.3	77.2	45.5	68.4	39.9	60.0	33.7	50.6	27.6	41.4
33	49.8	74.8	44.2	66.4	38.7	58.2	32.7	49.1	26.7	40.2
34	48.3	72.6	42.9	64.4	37.6	56.5	31.7	47.6	25.9	39.0
35	46.9	70.5	41.6	62.6	36.5	54.9	30.8	46.3	25.2	37.9
36	45.6	68.6	40.5	60.8	35.5	53.3	29.9	45.0	24.5	36.8
37	44.4	66.7	39.4	59.2	34.5	51.9	29.1	43.8	23.8	35.8
38	43.2	65.0	38.3	57.6	33.6	50.5	28.4	42.6	23.2	34.9
39	42.1	63.3	37.4	56.2	32.8	49.2	27.6	41.5	22.6	34.0
40	41.1	61.7	36.4	54.8						

Beam Properties

ASD	LRFD	45 ASD	45 LRFD	40 ASD	40 LRFD	36 ASD	36 LRFD	31 ASD	31 LRFD	26 ASD	26 LRFD
W_c/Ω_b	$\phi_b W_c$, kip-ft	1640	2470	1460	2190	1280	1920	1080	1620	882	1330
M_p/Ω_b	$\phi_b M_p$, kip-ft	205	309	182	274	160	240	135	203	110	166
M_r/Ω_b	$\phi_b M_r$, kip-ft	127	191	113	170	98.7	148	82.4	124	67.1	101
BF	BF, kips	7.16	10.8	6.69	10.1	6.19	9.31	6.76	10.2	5.96	8.96
V_n/Ω_v	$\phi_v V_n$, kips	111	167	97.7	146	93.6	140	87.3	131	70.5	106

	45	40	36	31	26
Z_x, in.^{3}	82.3	73.0	64.0	54.0	44.2
L_p, ft	5.55	5.55	5.37	4.13	3.96
L_r, ft	16.5	15.9	15.2	11.9	11.2

ASD	LRFD
$\Omega_b = 1.67$	$\phi_b = 0.90$
$\Omega_v = 1.50$	$\phi_v = 1.00$

Note: For beams laterally unsupported, see Table 3–10.
Available strength tabulated above heavy line is limited by available shear strength.

W14

Table 3–6 (continued)
Maximum Total Uniform Load, kips
W Shapes

F_y = 50 ksi

Shape		W14×											
		730[h]		665[h]		605[h]		550[h]		500[h]		455[h]	
Design		ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft	12	2750	4130	2450	3670	2170	3260	1930	2890	1720	2580	1530	2300
	13	2550	3830	2270	3420	2030	3050	1810	2720	1610	2420	1440	2160
	14	2370	3560	2110	3170	1880	2830	1680	2530	1500	2250	1330	2010
	15	2210	3320	1970	2960	1760	2640	1570	2360	1400	2100	1250	1870
	16	2070	3110	1850	2780	1650	2480	1470	2210	1310	1970	1170	1760
	17	1950	2930	1740	2610	1550	2330	1390	2080	1230	1850	1100	1650
	18	1840	2770	1640	2470	1460	2200	1310	1970	1160	1750	1040	1560
	19	1740	2620	1550	2340	1390	2080	1240	1860	1100	1660	983	1480
	20	1660	2490	1480	2220	1320	1980	1180	1770	1050	1580	934	1400
	21	1580	2370	1410	2110	1250	1890	1120	1690	998	1500	890	1340
	22	1510	2260	1340	2020	1200	1800	1070	1610	953	1430	849	1280
	23	1440	2170	1280	1930	1150	1720	1020	1540	911	1370	812	1220
	24	1380	2080	1230	1850	1100	1650	981	1480	873	1310	778	1170
	25	1330	1990	1180	1780	1050	1580	942	1420	838	1260	747	1120
	26	1270	1920	1140	1710	1010	1520	906	1360	806	1210	719	1080
	27	1230	1840	1090	1640	976	1470	872	1310	776	1170	692	1040
	28	1180	1780	1060	1590	941	1410	841	1260	749	1130	667	1000
	29	1140	1720	1020	1530	909	1370	812	1220	723	1090	644	968
	30	1100	1660	985	1480	878	1320	785	1180	699	1050	623	936
	31	1070	1610	953	1430	850	1280	760	1140	676	1020	603	906
	32	1040	1560	923	1390	823	1240	736	1110	655	984	584	878
	33	1000	1510	895	1350	798	1200	714	1070	635	955	566	851
	34	975	1460	869	1310	775	1160	693	1040	616	926	549	826
	35	947	1420	844	1270	753	1130	673	1010	599	900	534	802
	36	920	1380	821	1230	732	1100	654	983	582	875	519	780
	37	896	1350	798	1200	712	1070	637	957	566	851	505	759
	38	872	1310	777	1170	693	1040	620	932	552	829	492	739
	39	850	1280	757	1140	676	1020	604	908	537	808	479	720
	40	828	1250	739	1110	659	990	589	885	524	788	467	702
	42	789	1190	703	1060	627	943	561	843	499	750	445	669
	44	753	1130	671	1010	599	900	535	805	476	716	425	638
	46	720	1080	642	965	573	861	512	770	456	685	406	610
	48	690	1040	615	925	549	825	491	738	437	656		
	50	663	996	591	888	527	792	471	708				
Beam Properties													
W_c/Ω_b	$\phi_b W_c$, kip-ft	33100	49800	29500	44400	26300	39600	23600	35400	21000	31500	18700	28100
M_p/Ω_b	$\phi_b M_p$, kip-ft	4140	6230	3690	5550	3290	4950	2940	4430	2620	3940	2340	3510
M_r/Ω_b	$\phi_b M_r$, kip-ft	2240	3360	2010	3020	1820	2730	1630	2440	1460	2200	1320	1980
BF	BF, kips	7.37	11.1	7.12	10.7	6.83	10.3	6.67	10.0	6.42	9.65	6.20	9.31
V_n/Ω_v	$\phi_v V_n$, kips	1380	2060	1220	1840	1090	1630	963	1450	858	1290	767	1150
Z_x, in.^{3}		1660		1480		1320		1180		1050		936	
L_p, ft		16.6		16.3		16.1		15.9		15.6		15.5	
L_r, ft		275		253		232		213		196		179	

ASD	LRFD
$\Omega_b = 1.67$	$\phi_b = 0.90$
$\Omega_v = 1.50$	$\phi_v = 1.00$

[h] Flange thickness greater than 2 in. Special requirements may apply per AISC Specification Section A3.1c.

Table 3–6 (continued)
Maximum Total Uniform Load, kips
W Shapes

F_y = 50 ksi

W14

Shape		W14× 426[h]		W14× 398[h]		W14× 370[h]		W14× 342[h]		W14× 311[h]		W14× 283[h]	
Design		ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft	12	1400	2100	1290	1940	1190	1780	1080	1620	966	1450	864	1300
	13	1330	2010	1230	1850	1130	1700	1030	1550	926	1390	832	1250
	14	1240	1860	1140	1720	1050	1580	958	1440	860	1290	773	1160
	15	1160	1740	1070	1600	979	1470	894	1340	802	1210	721	1080
	16	1080	1630	999	1500	918	1380	838	1260	752	1130	676	1020
	17	1020	1530	940	1410	864	1300	789	1190	708	1060	636	956
	18	964	1450	888	1340	816	1230	745	1120	669	1000	601	903
	19	913	1370	841	1260	773	1160	706	1060	633	952	569	856
	20	867	1300	799	1200	735	1100	671	1010	602	905	541	813
	21	826	1240	761	1140	700	1050	639	960	573	861	515	774
	22	788	1190	727	1090	668	1000	610	916	547	822	492	739
	23	754	1130	695	1040	639	960	583	877	523	787	470	707
	24	723	1090	666	1000	612	920	559	840	501	754	451	678
	25	694	1040	640	961	588	883	537	806	481	724	433	650
	26	667	1000	615	924	565	849	516	775	463	696	416	625
	27	642	966	592	890	544	818	497	747	446	670	401	602
	28	619	931	571	858	525	789	479	720	430	646	386	581
	29	598	899	551	829	507	761	463	695	415	624	373	561
	30	578	869	533	801	490	736	447	672	401	603	361	542
	31	560	841	516	775	474	712	433	650	388	584	349	525
	32	542	815	500	751	459	690	419	630	376	565	338	508
	33	526	790	484	728	445	669	406	611	365	548	328	493
	34	510	767	470	707	432	649	395	593	354	532	318	478
	35	496	745	457	687	420	631	383	576	344	517	309	465
	36	482	724	444	668	408	613	373	560	334	502	301	452
	37	469	705	432	649	397	597	363	545	325	489	292	439
	38	456	686	421	632	387	581	353	531	317	476	285	428
	39	445	668	410	616	377	566	344	517	309	464	277	417
	40	434	652	400	601	367	552	335	504	301	452	270	407
	42	413	621	381	572	350	526	319	480	287	431		
	44	394	593	363	546	334	502						
	46	377	567										
Beam Properties													
W_c/Ω_b	$\phi_b W_c$, kip-ft	17300	26100	16000	24000	14700	22100	13400	20200	12000	18100	10800	16300
M_p/Ω_b	$\phi_b M_p$, kip-ft	2170	3260	2000	3000	1840	2760	1680	2520	1500	2260	1350	2030
M_r/Ω_b	$\phi_b M_r$, kip-ft	1230	1850	1150	1720	1060	1590	975	1460	884	1330	802	1200
BF	BF, kips	6.09	9.16	5.96	8.96	5.86	8.80	5.75	8.64	5.63	8.46	5.53	8.31
V_n/Ω_v	$\phi_v V_n$, kips	700	1050	647	971	593	890	540	810	483	724	432	648
Z_x, in.^{3}		869		801		736		672		603		542	
L_p, ft		15.3		15.2		15.1		15.0		14.8		14.7	
L_r, ft		169		158		148		137		125		114	

ASD	LRFD
$\Omega_b = 1.67$	$\phi_b = 0.90$
$\Omega_v = 1.50$	$\phi_v = 1.00$

Note: For beams laterally unsupported, see Table 3–10.
Available strength tabulated above heavy line is limited by available shear strength.

W14

Table 3–6 (continued)
Maximum Total Uniform Load, kips
W Shapes

F_y = 50 ksi

Shape	W14× 257		233		211		193		176		159	
Design	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft 12	770	1150	687	1030	616	924	551	827	505	758	446	670
13	748	1120	669	1010	599	900	545	819	491	738	441	662
14	694	1040	622	934	556	836	506	761	456	686	409	615
15	648	974	580	872	519	780	472	710	426	640	382	574
16	608	913	544	818	487	731	443	666	399	600	358	538
17	572	859	512	769	458	688	417	626	376	565	337	506
18	540	812	483	727	432	650	394	592	355	533	318	478
19	512	769	458	688	410	616	373	561	336	505	302	453
20	486	731	435	654	389	585	354	533	319	480	286	431
21	463	696	414	623	371	557	337	507	304	457	273	410
22	442	664	396	595	354	532	322	484	290	436	260	391
23	423	635	378	569	338	509	308	463	278	417	249	374
24	405	609	363	545	324	488	295	444	266	400	239	359
25	389	584	348	523	311	468	283	426	255	384	229	344
26	374	562	335	503	299	450	273	410	246	369	220	331
27	360	541	322	484	288	433	262	394	237	356	212	319
28	347	522	311	467	278	418	253	380	228	343	205	308
29	335	504	300	451	268	403	244	367	220	331	198	297
30	324	487	290	436	259	390	236	355	213	320	191	287
31	314	471	281	422	251	377	229	344	206	310	185	278
32	304	457	272	409	243	366	221	333	200	300	179	269
33	295	443	264	396	236	355	215	323	194	291	174	261
34	286	430	256	385	229	344	208	313	188	282	168	253
35	278	417	249	374	222	334	202	304	182	274	164	246
36	270	406	242	363	216	325	197	296	177	267	159	239
37	263	395	235	354	210	316	192	288	173	259	155	233
38	256	384	229	344	205	308	186	280	168	253		
39	249	375	223	335	200	300						
40	243	365	218	327								
Beam Properties												
W_c/Ω_b | $\phi_b W_c$, kip-ft	9720	14600	8700	13100	7780	11700	7090	10700	6390	9600	5730	8610
M_p/Ω_b | $\phi_b M_p$, kip-ft	1220	1830	1090	1640	973	1460	886	1330	798	1200	716	1080
M_r/Ω_b | $\phi_b M_r$, kip-ft	725	1090	655	984	590	887	541	814	491	738	444	667
BF | BF, kips	5.46	8.21	5.38	8.09	5.31	7.99	5.27	7.92	5.22	7.84	5.18	7.79
V_n/Ω_v | $\phi_v V_n$, kips	385	577	343	515	308	462	276	413	253	379	223	335
Z_x, in.^{3}	487		436		390		355		320		287	
L_p, ft	14.6		14.5		14.4		14.3		14.2		14.1	
L_r, ft	104		94.9		86.4		79.7		73.2		66.7	

ASD	LRFD
$\Omega_b = 1.67$ $\Omega_v = 1.50$	$\phi_b = 0.90$ $\phi_v = 1.00$

[f] Shape does not meet compact limit for flexure with F_y = 50 ksi.

F_y = 50 ksi

Table 3–6 (continued)
Maximum Total Uniform Load, kips
W Shapes

W14

Shape		W14×											
		145		132		120		109		99[f]		90[f]	
Design		ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft	12	402	603	378	567	342	513	301	451	275	412	247	370
	13	399	600	359	540	326	489	295	443	264	397	235	353
	14	371	557	334	501	302	454	274	411	246	369	218	328
	15	346	520	311	468	282	424	255	384	229	344	203	306
	16	324	488	292	439	264	398	240	360	215	323	191	287
	17	305	459	275	413	249	374	225	339	202	304	180	270
	18	288	433	259	390	235	353	213	320	191	287	170	255
	19	273	411	246	369	223	335	202	303	181	272	161	241
	20	259	390	234	351	212	318	192	288	172	258	153	229
	21	247	371	222	334	202	303	182	274	164	246	145	218
	22	236	355	212	319	192	289	174	262	156	235	139	209
	23	226	339	203	305	184	277	167	250	149	225	133	199
	24	216	325	195	293	176	265	160	240	143	215	127	191
	25	208	312	187	281	169	254	153	230	137	207	122	183
	26	200	300	180	270	163	245	147	222	132	199	117	176
	27	192	289	173	260	157	236	142	213	127	191	113	170
	28	185	279	167	251	151	227	137	206	123	185	109	164
	29	179	269	161	242	146	219	132	199	119	178	105	158
	30	173	260	156	234	141	212	128	192	115	172	102	153
	31	167	252	151	226	137	205	124	186	111	167	98.5	148
	32	162	244	146	219	132	199	120	180	107	161	95.4	143
	33	157	236	142	213	128	193	116	175	104	157	92.5	139
	34	153	229	137	206	124	187	113	169	101	152	89.8	135
	35	148	223	133	201	121	182	109	165	98.2	148	87.2	131
	36	144	217	130	195	118	177						
Beam Properties													
W_c/Ω_b	$\phi_b W_c$, kip-ft	5190	7800	4670	7020	4230	6360	3830	5760	3440	5170	3050	4590
M_p/Ω_b	$\phi_b M_p$, kip-ft	649	975	584	878	529	795	479	720	430	646	382	573
M_r/Ω_b	$\phi_b M_r$, kip-ft	405	609	365	549	332	499	302	454	274	412	250	375
BF	BF, kips	5.11	7.68	5.13	7.70	5.09	7.64	5.02	7.54	4.89	7.35	4.80	7.22
V_n/Ω_v	$\phi_v V_n$, kips	201	302	189	284	171	256	150	226	137	206	123	185
Z_x, in.^{3}		260		234		212		192		173		157	
L_p, ft		14.1		13.3		13.2		13.2		13.5		15.2	
L_r, ft		61.7		56.0		52.0		48.4		45.3		42.6	

ASD	LRFD	
$\Omega_b = 1.67$	$\phi_b = 0.90$	Note: For beams laterally unsupported, see Table 3–10.
$\Omega_v = 1.50$	$\phi_v = 1.00$	Available strength tabulated above heavy line is limited by available shear strength.

W14

Table 3–6 (continued)
Maximum Total Uniform Load, kips
W Shapes

F_y = 50 ksi

Shape		W14×											
		82		74		68		61		53		48	
Design		ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft	8									206	309	188	281
	9	292	438	255	383	233	350	208	313	193	290	174	261
	10	277	417	251	378	230	345	204	306	174	261	156	235
	11	252	379	229	344	209	314	185	278	158	238	142	214
	12	231	348	210	315	191	288	170	255	145	218	130	196
	13	213	321	193	291	177	265	157	235	134	201	120	181
	14	198	298	180	270	164	246	145	219	124	187	112	168
	15	185	278	168	252	153	230	136	204	116	174	104	157
	16	173	261	157	236	143	216	127	191	109	163	97.8	147
	17	163	245	148	222	135	203	120	180	102	154	92.1	138
	18	154	232	140	210	128	192	113	170	96.6	145	86.9	131
	19	146	219	132	199	121	182	107	161	91.5	138	82.4	124
	20	139	209	126	189	115	173	102	153	86.9	131	78.2	118
	21	132	199	120	180	109	164	96.9	146	82.8	124	74.5	112
	22	126	190	114	172	104	157	92.5	139	79.0	119	71.1	107
	23	121	181	109	164	99.8	150	88.5	133	75.6	114	68.0	102
	24	116	174	105	158	95.6	144	84.8	128	72.4	109	65.2	98.0
	25	111	167	101	151	91.8	138	81.4	122	69.5	105	62.6	94.1
	26	107	160	96.7	145	88.3	133	78.3	118	66.9	101	60.2	90.5
	27	103	154	93.1	140	85.0	128	75.4	113	64.4	96.8	58.0	87.1
	28	99.1	149	89.8	135	82.0	123	72.7	109	62.1	93.3	55.9	84.0
	29	95.7	144	86.7	130	79.2	119	70.2	106	59.9	90.1	54.0	81.1
	30	92.5	139	83.8	126	76.5	115	67.9	102	58.0	87.1	52.2	78.4
	31	89.5	135	81.1	122	74.0	111	65.7	98.7	56.1	84.3	50.5	75.9
	32	86.7	130	78.6	118	71.7	108	63.6	95.6	54.3	81.7	48.9	73.5
	33	84.1	126	76.2	115	69.6	105	61.7	92.7	52.7	79.2	47.4	71.3
	34	81.6	123	74.0	111	67.5	101	59.9	90.0	51.1	76.9	46.0	69.2
	35	79.3	119	71.9	108	65.6	98.6						
Beam Properties													
W_c/Ω_b	$\phi_b W_c$, kip-ft	2770	4170	2510	3780	2300	3450	2040	3060	1740	2610	1560	2350
M_p/Ω_b	$\phi_b M_p$, kip-ft	347	521	314	473	287	431	254	383	217	327	196	294
M_r/Ω_b	$\phi_b M_r$, kip-ft	215	323	196	294	180	270	161	242	136	204	123	184
BF	BF, kips	5.43	8.16	5.34	8.03	5.20	7.81	4.96	7.46	5.27	7.93	5.10	7.66
V_n/Ω_v	$\phi_v V_n$, kips	146	219	128	191	117	175	104	156	103	155	93.8	141
Z_x, in.^{3}		139		126		115		102		87.1		78.4	
L_p, ft		8.76		8.76		8.69		8.65		6.78		6.75	
L_r, ft		33.1		31.0		29.3		27.5		22.2		21.1	
ASD	LRFD												
$\Omega_b = 1.67$ $\Omega_v = 1.50$	$\phi_b = 0.90$ $\phi_v = 1.00$												

Table 3–6 (continued)
Maximum Total Uniform Load, kips
W Shapes

F_y = 50 ksi

W14

Shape	W14× 43		38		34		30		26		22	
Design	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft 5									142	213	126	190
6					159	239	149	224	134	201	110	166
7			175	262	156	234	135	203	115	172	94.7	142
8	167	250	153	231	136	205	118	177	100	151	82.8	125
9	154	232	136	205	121	182	105	158	89.2	134	73.6	111
10	139	209	123	185	109	164	94.4	142	80.2	121	66.3	99.6
11	126	190	112	168	99.1	149	85.8	129	72.9	110	60.2	90.5
12	116	174	102	154	90.8	137	78.7	118	66.9	101	55.2	83.0
13	107	161	94.4	142	83.8	126	72.6	109	61.7	92.8	51.0	76.6
14	99.2	149	87.7	132	77.8	117	67.4	101	57.3	86.1	47.3	71.1
15	92.6	139	81.8	123	72.7	109	62.9	94.6	53.5	80.4	44.2	66.4
16	86.8	130	76.7	115	68.1	102	59.0	88.7	50.1	75.4	41.4	62.3
17	81.7	123	72.2	109	64.1	96.4	55.5	83.5	47.2	70.9	39.0	58.6
18	77.2	116	68.2	103	60.5	91.0	52.5	78.8	44.6	67.0	36.8	55.3
19	73.1	110	64.6	97.1	57.4	86.2	49.7	74.7	42.2	63.5	34.9	52.4
20	69.5	104	61.4	92.3	54.5	81.9	47.2	71.0	40.1	60.3	33.1	49.8
21	66.2	99.4	58.5	87.9	51.9	78.0	45.0	67.6	38.2	57.4	31.6	47.4
22	63.1	94.9	55.8	83.9	49.5	74.5	42.9	64.5	36.5	54.8	30.1	45.3
23	60.4	90.8	53.4	80.2	47.4	71.2	41.0	61.7	34.9	52.4	28.8	43.3
24	57.9	87.0	51.1	76.9	45.4	68.3	39.3	59.1	33.4	50.3	27.6	41.5
25	55.6	83.5	49.1	73.8	43.6	65.5	37.8	56.8	32.1	48.2	26.5	39.8
26	53.4	80.3	47.2	71.0	41.9	63.0	36.3	54.6	30.9	46.4	25.5	38.3
27	51.5	77.3	45.5	68.3	40.4	60.7	35.0	52.6	29.7	44.7	24.5	36.9
28	49.6	74.6	43.8	65.9	38.9	58.5	33.7	50.7	28.7	43.1	23.7	35.6
29	47.9	72.0	42.3	63.6	37.6	56.5	32.6	48.9	27.7	41.6	22.9	34.3
30	46.3	69.6	40.9	61.5	36.3	54.6	31.5	47.3	26.7	40.2	22.1	33.2
31	44.8	67.4	39.6	59.5	35.2	52.8	30.5	45.8	25.9	38.9	21.4	32.1
32	43.4	65.2	38.4	57.7	34.1	51.2	29.5	44.3	25.1	37.7	20.7	31.1
33	42.1	63.3	37.2	55.9	33.0	49.6	28.6	43.0	24.3	36.5	20.1	30.2
34	40.9	61.4	36.1	54.3	32.1	48.2	27.8	41.7	23.6	35.5	19.5	29.3
35			35.1	52.7								
Beam Properties												
W_c/Ω_b / $\phi_b W_c$, kip-ft	1390	2090	1230	1850	1090	1640	944	1420	802	1210	663	996
M_p/Ω_b / $\phi_b M_p$, kip-ft	174	261	153	231	136	205	118	177	100	151	82.8	125
M_r/Ω_b / $\phi_b M_r$, kip-ft	109	164	95.4	143	84.9	128	73.4	110	61.7	92.7	50.6	76.1
BF / BF, kips	4.82	7.24	5.39	8.10	5.05	7.59	4.65	6.99	5.32	7.99	4.75	7.14
V_n/Ω_v / $\phi_v V_n$, kips	83.3	125	87.4	131	79.7	120	74.7	112	70.9	106	63.2	94.8
Z_x, in.^{3}	69.6		61.5		54.6		47.3		40.2		33.2	
L_p, ft	6.68		5.47		5.40		5.26		3.81		3.67	
L_r, ft	20.0		16.2		15.6		14.9		11.1		10.4	

ASD	LRFD	
$\Omega_b = 1.67$	$\phi_b = 0.90$	Note: For beams laterally unsupported, see Table 3–10.
$\Omega_v = 1.50$	$\phi_v = 1.00$	Available strength tabulated above heavy line is limited by available shear strength.

Table 3–6 (continued)
Maximum Total Uniform Load, kips
W Shapes

W12

F_y = 50 ksi

Shape		W12× 336[h]		305[h]		279[h]		252[h]		230[h]		210	
Design		ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft	9					**970**	1460	**860**	1290	**774**			
	10	**1190**	1790	**1060**	1590	**960**	1440	**854**	1280	**770**	1160	**694**	1040
	11	**1090**	1640	**974**	1460	**873**	1310	**777**	1170	**700**	1050	**631**	949
	12	**1000**	1510	**893**	1340	**800**	1200	**712**	1070	**642**	965	**579**	870
	13	**926**	1390	**825**	1240	**739**	1110	**657**	988	**593**	891	**534**	803
	14	**860**	1290	**766**	1150	**686**	1030	**610**	917	**550**	827	**496**	746
	15	**802**	1210	**715**	1070	**640**	962	**570**	856	**514**	772	**463**	696
	16	**752**	1130	**670**	1010	**600**	902	**534**	803	**482**	724	**434**	653
	17	**708**	1060	**631**	948	**565**	849	**503**	755	**453**	681	**409**	614
	18	**669**	1000	**595**	895	**533**	802	**475**	713	**428**	643	**386**	580
	19	**633**	952	**564**	848	**505**	759	**450**	676	**406**	609	**366**	549
	20	**602**	905	**536**	806	**480**	722	**427**	642	**385**	579	**347**	522
	21	**573**	861	**510**	767	**457**	687	**407**	611	**367**	551	**331**	497
	22	**547**	822	**487**	732	**436**	656	**388**	584	**350**	526	**316**	475
	23	**523**	787	**466**	700	**417**	627	**371**	558	**335**	503	**302**	454
	24	**501**	754	**447**	671	**400**	601	**356**	535	**321**	483	**289**	435
	25	**481**	724	**429**	644	**384**	577	**342**	514	**308**	463	**278**	418
	26	**463**	696	**412**	620	**369**	555	**329**	494	**296**	445	**267**	402
	27	**446**	670	**397**	597	**356**	534	**316**	476	**285**	429	**257**	387
	28	**430**	646	**383**	575	**343**	515	**305**	459	**275**	414	**248**	373
	29	**415**	624	**370**	556	**331**	498	**295**	443	**266**	399	**240**	360
	30	**401**	603	**357**	537	**320**	481	**285**	428	**257**	386	**232**	348
	31	**388**	584	**346**	520	**310**	465	**276**	414	**249**	374	**224**	337
	32	**376**	565	**335**	503	**300**	451	**267**	401	**241**	362	**217**	326
	33	**365**	548	**325**	488	**291**	437	**259**	389	**233**	351	**210**	316
	34	**354**	532	**315**	474	**282**	424	**251**	378	**227**	341	**204**	307
	35	**344**	517	**306**	460	**274**	412	**244**	367	**220**	331	**198**	298
	36	**334**	502	**298**	447	**267**	401	**237**	357	**214**	322	**193**	290
	37	**325**	489	**290**	435	**259**	390	**231**	347	**208**	313		
	38	**317**	476	**282**	424	**253**	380	**225**	338				
	39	**309**	464	**275**	413	**246**	370						
	40	**301**	452	**268**	403								
	41	**294**	441										
	42	**287**	431										
Beam Properties													
W_c/Ω_b	$\phi_b W_c$, kip-ft	**12000**	18100	**10700**	16100	**9600**	14400	**8540**	12800	**7700**	11600	**6950**	10400
M_p/Ω_b	$\phi_b M_p$, kip-ft	**1500**	2260	**1340**	2010	**1200**	1800	**1070**	1610	**963**	1450	**868**	1310
M_r/Ω_b	$\phi_b M_r$, kip-ft	**844**	1270	**760**	1140	**686**	1030	**617**	927	**561**	843	**510**	767
BF	BF, kips	**4.80**	7.22	**4.66**	7.00	**4.52**	6.79	**4.40**	6.62	**4.32**	6.49	**4.24**	6.38
V_n/Ω_v	$\phi_v V_n$, kips	**597**	896	**530**	796	**485**	728	**430**	645	**387**	580	**347**	521
Z_x, in.^{3}		603		537		481		428		386		348	
L_p, ft		12.3		12.1		11.9		11.8		11.7		11.6	
L_r, ft		150		137		126		114		105		96.0	

ASD	LRFD
$\Omega_b = 1.67$	$\phi_b = 0.90$
$\Omega_v = 1.50$	$\phi_v = 1.00$

[h] Flange thickness greater than 2 in. Special requirements may apply per AISC Specification Section A3.1c.

F_y = 50 ksi

Table 3–6 (continued)
Maximum Total Uniform Load, kips
W Shapes

W12

Shape	W12× 190		170		152		136		120		106	
Design	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft 9									373	559		
10	610	915	539	808	477	716	424	636	371	558	315	472
11	564	848	499	750	441	663	388	584	338	507	298	447
12	517	777	457	687	404	608	356	535	309	465	273	410
13	478	718	422	635	373	561	329	494	286	429	252	378
14	443	666	392	589	346	521	305	459	265	399	234	351
15	414	622	366	550	323	486	285	428	248	372	218	328
16	388	583	343	516	303	456	267	401	232	349	205	308
17	365	549	323	485	285	429	251	378	218	328	193	289
18	345	518	305	458	269	405	237	357	206	310	182	273
19	327	491	289	434	255	384	225	338	195	294	172	259
20	310	467	274	413	243	365	214	321	186	279	164	246
21	296	444	261	393	231	347	203	306	177	266	156	234
22	282	424	250	375	220	331	194	292	169	254	149	224
23	270	406	239	359	211	317	186	279	161	243	142	214
24	259	389	229	344	202	304	178	267	155	233	136	205
25	248	373	220	330	194	292	171	257	149	223	131	197
26	239	359	211	317	187	280	164	247	143	215	126	189
27	230	346	203	306	180	270	158	238	138	207	121	182
28	222	333	196	295	173	260	153	229	133	199	117	176
29	214	322	189	284	167	251	147	221	128	192	113	170
30	207	311	183	275	162	243	142	214	124	186	109	164
31	200	301	177	266	156	235	138	207	120	180	106	159
32	194	292	172	258	152	228	133	201	116	174	102	154
33	188	283	166	250	147	221	129	195				
34	183	274	161	243	143	214						
35	177	267	157	236								

Beam Properties

ASD	LRFD	190 ASD	190 LRFD	170 ASD	170 LRFD	152 ASD	152 LRFD	136 ASD	136 LRFD	120 ASD	120 LRFD	106 ASD	106 LRFD
W_c/Ω_b	$\phi_b W_c$, kip-ft	6210	9330	5490	8250	4850	7290	4270	6420	3710	5580	3270	4920
M_p/Ω_b	$\phi_b M_p$, kip-ft	776	1170	686	1030	606	911	534	803	464	698	409	615
M_r/Ω_b	$\phi_b M_r$, kip-ft	459	690	410	617	365	549	325	488	285	428	253	381
BF	BF, kips	4.18	6.28	4.11	6.18	4.07	6.11	4.01	6.03	3.95	5.93	3.93	5.90
V_n/Ω_v	$\phi_v V_n$, kips	305	457	269	404	239	358	212	318	186	279	157	236

Property	190	170	152	136	120	106
Z_x, in.^{3}	311	275	243	214	186	164
L_p, ft	11.5	11.4	11.3	11.2	11.1	11.0
L_r, ft	87.3	78.5	70.6	63.3	56.5	50.7

ASD	LRFD
$\Omega_b = 1.67$	$\phi_b = 0.90$
$\Omega_v = 1.50$	$\phi_v = 1.00$

Note: For beams laterally unsupported, see Table 3–10.
Available strength tabulated above heavy line is limited by available shear strength.

W12

Table 3-6 (continued)
Maximum Total Uniform Load, kips
W Shapes

F_y = 50 ksi

Shape		W12×											
		96		87		79		72		65[f]		58	
Design		ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft	9											176	263
	10	280	419	258	387	233	349	211	316	189	284	172	259
	11	267	401	240	360	216	325	196	295	172	259	157	236
	12	245	368	220	330	198	298	180	270	158	237	144	216
	13	226	339	203	305	183	275	166	249	146	219	133	199
	14	210	315	188	283	170	255	154	231	135	204	123	185
	15	196	294	176	264	158	238	144	216	126	190	115	173
	16	183	276	165	248	148	223	135	203	119	178	108	162
	17	173	259	155	233	140	210	127	191	112	168	101	152
	18	163	245	146	220	132	198	120	180	105	158	95.8	144
	19	154	232	139	208	125	188	113	171	99.8	150	90.8	136
	20	147	221	132	198	119	179	108	162	94.8	142	86.2	130
	21	140	210	125	189	113	170	103	154	90.3	136	82.1	123
	22	133	200	120	180	108	162	98.0	147	86.2	130	78.4	118
	23	128	192	115	172	103	155	93.7	141	82.4	124	75.0	113
	24	122	184	110	165	99.0	149	89.8	135	79.0	119	71.9	108
	25	117	176	105	158	95.0	143	86.2	130	75.8	114	69.0	104
	26	113	170	101	152	91.4	137	82.9	125	72.9	110	66.3	99.7
	27	109	163	97.6	147	88.0	132	79.8	120	70.2	106	63.9	96.0
	28	105	158	94.1	141	84.8	128	77.0	116	67.7	102	61.6	92.6
	29	101	152	90.9	137	81.9	123	74.3	112	65.4	98.3	59.5	89.4
	30	97.8	147	87.8	132	79.2	119	71.9	108	63.2	95.0	57.5	86.4
	31	94.6	142	85.0	128								
Beam Properties													
W_c/Ω_b	$\phi_b W_c$, kip-ft	2930	4410	2630	3960	2380	3570	2160	3240	1900	2850	1720	2590
M_p/Ω_b	$\phi_b M_p$, kip-ft	367	551	329	495	297	446	269	405	237	356	216	324
M_r/Ω_b	$\phi_b M_r$, kip-ft	229	344	206	310	187	281	170	256	154	231	136	205
BF	BF, kips	3.87	5.81	3.84	5.76	3.77	5.67	3.72	5.59	3.60	5.41	3.76	5.66
V_n/Ω_v	$\phi_v V_n$, kips	140	210	129	194	116	175	105	158	94.5	142	87.8	132
Z_x, in.^{3}		147		132		119		108		96.8		86.4	
L_p, ft		10.9		10.8		10.8		10.7		11.9		8.87	
L_r, ft		46.6		43.0		39.9		37.4		35.1		29.9	

ASD	LRFD
$\Omega_b = 1.67$	$\phi_b = 0.90$
$\Omega_v = 1.50$	$\phi_v = 1.00$

[f] Shape does not meet compact limit for flexure with F_y = 50 ksi.

Table 3-6 (continued)
Maximum Total Uniform Load, kips
W Shapes

F_y = 50 ksi

W12

Shape		W12× 53		50		45		40		35		30	
Design		ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft	6									150	225	128	193
	7			180	271	162	242			146	219	123	185
	8			179	270	160	241	141	211	128	192	108	162
	9	166	250	159	240	142	214	126	190	114	171	95.6	144
	10	155	234	144	216	128	193	114	171	102	154	86.0	129
	11	141	212	130	196	116	175	103	155	92.9	140	78.2	118
	12	130	195	120	180	107	161	94.8	143	85.2	128	71.7	108
	13	120	180	110	166	98.6	148	87.5	132	78.6	118	66.2	99.5
	14	111	167	103	154	91.5	138	81.3	122	73.0	110	61.4	92.4
	15	104	156	95.7	144	85.4	128	75.8	114	68.1	102	57.4	86.2
	16	97.2	146	89.7	135	80.1	120	71.1	107	63.9	96.0	53.8	80.8
	17	91.5	137	84.4	127	75.4	113	66.9	101	60.1	90.4	50.6	76.1
	18	86.4	130	79.7	120	71.2	107	63.2	95.0	56.8	85.3	47.8	71.8
	19	81.8	123	75.5	114	67.4	101	59.9	90.0	53.8	80.8	45.3	68.1
	20	77.7	117	71.8	108	64.1	96.3	56.9	85.5	51.1	76.8	43.0	64.7
	21	74.0	111	68.3	103	61.0	91.7	54.2	81.4	48.7	73.1	41.0	61.6
	22	70.7	106	65.2	98.0	58.2	87.5	51.7	77.7	46.5	69.8	39.1	58.8
	23	67.6	102	62.4	93.8	55.7	83.7	49.5	74.3	44.4	66.8	37.4	56.2
	24	64.8	97.4	59.8	89.9	53.4	80.3	47.4	71.3	42.6	64.0	35.8	53.9
	25	62.2	93.5	57.4	86.3	51.3	77.0	45.5	68.4	40.9	61.4	34.4	51.7
	26	59.8	89.9	55.2	83.0	49.3	74.1	43.8	65.8	39.3	59.1	33.1	49.7
	27	57.6	86.6	53.2	79.9	47.5	71.3	42.1	63.3	37.9	56.9	31.9	47.9
	28	55.5	83.5	51.3	77.0	45.8	68.8	40.6	61.1	36.5	54.9	30.7	46.2
	29	53.6	80.6	49.5	74.4	44.2	66.4	39.2	59.0	35.2	53.0	29.7	44.6
	30	51.8	77.9	47.8	71.9	42.7	64.2			34.1	51.2	28.7	43.1
	31									33.0	49.5		

Beam Properties

		53 ASD	53 LRFD	50 ASD	50 LRFD	45 ASD	45 LRFD	40 ASD	40 LRFD	35 ASD	35 LRFD	30 ASD	30 LRFD
W_c/Ω_b	$\phi_b W_c$, kip-ft	1550	2340	1440	2160	1280	1930	1140	1710	1020	1540	860	1290
M_p/Ω_b	$\phi_b M_p$, kip-ft	194	292	179	270	160	241	142	214	128	192	108	162
M_r/Ω_b	$\phi_b M_r$, kip-ft	123	185	112	169	101	151	89.9	135	79.6	120	67.4	101
BF	BF, kips	3.65	5.48	3.97	5.97	3.83	5.75	3.66	5.50	4.28	6.43	3.92	5.89
V_n/Ω_v	$\phi_v V_n$, kips	83.2	125	90.2	135	80.8	121	70.4	106	75.0	113	64.2	96.3
Z_x, in.^{3}		77.9		71.9		64.2		57.0		51.2		43.1	
L_p, ft		8.76		6.92		6.89		6.85		5.44		5.37	
L_r, ft		28.2		23.9		22.4		21.1		16.7		15.6	

ASD	LRFD	
$\Omega_b = 1.67$	$\phi_b = 0.90$	Note: For beams laterally unsupported, see Table 3–10.
$\Omega_v = 1.50$	$\phi_v = 1.00$	Available strength tabulated above heavy line is limited by available shear strength.

W12

Table 3–6 (continued)
Maximum Total Uniform Load, kips
W Shapes

F_y = 50 ksi

Shape		W12×										W10×	
		26		22		19		16		14[f]		112	
Design		ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft	3							106	158				
	4			128	192	114	171	100	151	85.6	129		
	5			117	176	98.6	148	80.2	121	69.5	104		
	6	112	169	97.5	147	82.2	124	66.9	101	57.9	87.0		
	7	106	159	83.5	126	70.4	106	57.3	86.1	49.6	74.6		
	8	92.8	140	73.1	110	61.6	92.6	50.1	75.4	43.4	65.2	343	515
	9	82.5	124	65.0	97.7	54.8	82.3	44.6	67.0	38.6	58.0	326	490
	10	74.3	112	58.5	87.9	49.3	74.1	40.1	60.3	34.7	52.2	293	441
	11	67.5	101	53.2	79.9	44.8	67.4	36.5	54.8	31.6	47.5	267	401
	12	61.9	93.0	48.7	73.3	41.1	61.8	33.4	50.3	28.9	43.5	245	368
	13	57.1	85.8	45.0	67.6	37.9	57.0	30.9	46.4	26.7	40.2	226	339
	14	53.0	79.7	41.8	62.8	35.2	52.9	28.7	43.1	24.8	37.3	210	315
	15	49.5	74.4	39.0	58.6	32.9	49.4	26.7	40.2	23.2	34.8	196	294
	16	46.4	69.8	36.6	54.9	30.8	46.3	25.1	37.7	21.7	32.6	183	276
	17	43.7	65.6	34.4	51.7	29.0	43.6	23.6	35.5	20.4	30.7	173	259
	18	41.3	62.0	32.5	48.8	27.4	41.2	22.3	33.5	19.3	29.0	163	245
	19	39.1	58.7	30.8	46.3	25.9	39.0	21.1	31.7	18.3	27.5	154	232
	20	37.1	55.8	29.2	44.0	24.7	37.1	20.1	30.2	17.4	26.1	147	221
	21	35.4	53.1	27.8	41.9	23.5	35.3	19.1	28.7	16.5	24.9	140	210
	22	33.8	50.7	26.6	40.0	22.4	33.7	18.2	27.4	15.8	23.7	133	200
	23	32.3	48.5	25.4	38.2	21.4	32.2	17.4	26.2	15.1	22.7	128	192
	24	30.9	46.5	24.4	36.6	20.5	30.9	16.7	25.1	14.5	21.7	122	184
	25	29.7	44.6	23.4	35.2	19.7	29.6	16.0	24.1	13.9	20.9	117	176
	26	28.6	42.9	22.5	33.8	19.0	28.5	15.4	23.2	13.4	20.1	113	170
	27	27.5	41.3	21.7	32.6	18.3	27.4	14.9	22.3	12.9	19.3	109	163
	28	26.5	39.9	20.9	31.4	17.6	26.5	14.3	21.5	12.4	18.6	105	158
	29	25.6	38.5	20.2	30.3	17.0	25.6	13.8	20.8	12.0	18.0		
	30	24.8	37.2	19.5	29.3	16.4	24.7						
Beam Properties													
W_c/Ω_b	$\phi_b W_c$, kip-ft	743	1120	585	879	493	741	401	603	347	522	2930	4410
M_p/Ω_b	$\phi_b M_p$, kip-ft	92.8	140	73.1	110	61.6	92.6	50.1	75.4	43.4	65.2	367	551
M_r/Ω_b	$\phi_b M_r$, kip-ft	58.3	87.7	44.4	66.7	37.2	55.9	29.9	44.9	26.0	39.1	220	331
BF	BF, kips	3.61	5.42	4.65	6.99	4.27	6.43	3.82	5.75	3.42	5.15	2.68	4.02
V_n/Ω_v	$\phi_v V_n$, kips	56.2	84.3	64.0	96.0	57.2	85.7	52.8	79.1	42.8	64.3	172	257
Z_x, in.^{3}		37.2		29.3		24.7		20.1		17.4		147	
L_p, ft		5.33		3.00		2.90		2.73		2.66		9.47	
L_r, ft		14.9		9.17		8.62		8.03		7.74		64.3	

ASD	LRFD
$\Omega_b = 1.67$	$\phi_b = 0.90$
$\Omega_v = 1.50$	$\phi_v = 1.00$

[f] Shape does not meet compact limit for flexure with F_y = 50 ksi.

F_y = 50 ksi

Table 3–6 (continued)
Maximum Total Uniform Load, kips
W Shapes

W10

Shape		W10×											
		100		88		77		68		60		54	
Design		ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft	8	**302**	453	**262**	393	**225**	337	**196**	293	**172**	258	**149**	224
	9	**288**	433	**251**	377	**216**	325	**189**	284	**165**	249	**148**	222
	10	**259**	390	**226**	339	**195**	293	**170**	256	**149**	224	**133**	200
	11	**236**	355	**205**	308	**177**	266	**155**	233	**135**	203	**121**	182
	12	**216**	325	**188**	283	**162**	244	**142**	213	**124**	186	**111**	166
	13	**200**	300	**173**	261	**150**	225	**131**	197	**115**	172	**102**	154
	14	**185**	279	**161**	242	**139**	209	**122**	183	**106**	160	**95.0**	143
	15	**173**	260	**150**	226	**130**	195	**114**	171	**99.3**	149	**88.6**	133
	16	**162**	244	**141**	212	**122**	183	**106**	160	**93.1**	140	**83.1**	125
	17	**153**	229	**133**	199	**115**	172	**100**	151	**87.6**	132	**78.2**	118
	18	**144**	217	**125**	188	**108**	163	**94.6**	142	**82.7**	124	**73.9**	111
	19	**137**	205	**119**	178	**103**	154	**89.6**	135	**78.4**	118	**70.0**	105
	20	**130**	195	**113**	170	**97.4**	146	**85.1**	128	**74.5**	112	**66.5**	99.9
	21	**124**	186	**107**	161	**92.8**	139	**81.1**	122	**70.9**	107	**63.3**	95.1
	22	**118**	177	**103**	154	**88.6**	133	**77.4**	116	**67.7**	102	**60.4**	90.8
	23	**113**	170	**98.1**	147	**84.7**	127	**74.0**	111	**64.7**	97.3	**57.8**	86.9
	24	**108**	163	**94.0**	141	**81.2**	122	**70.9**	107	**62.0**	93.2	**55.4**	83.2
	25	**104**	156	**90.2**	136	**77.9**	117	**68.1**	102	**59.6**	89.5	**53.2**	79.9
	26	**99.8**	150	**86.7**	130	**74.9**	113	**65.5**	98.4				
	27	**96.1**	144	**83.5**	126								
Beam Properties													
W_c/Ω_b	$\phi_b W_c$, kip-ft	**2590**	3900	**2260**	3390	**1950**	2930	**1700**	2560	**1490**	2240	**1330**	2000
M_p/Ω_b	$\phi_b M_p$, kip-ft	**324**	488	**282**	424	**244**	366	**213**	320	**186**	280	**166**	250
M_r/Ω_b	$\phi_b M_r$, kip-ft	**196**	294	**172**	259	**150**	225	**132**	199	**116**	175	**105**	158
BF	BF, kips	**2.66**	4.01	**2.63**	3.95	**2.59**	3.90	**2.57**	3.86	**2.53**	3.80	**2.49**	3.74
V_n/Ω_v	$\phi_v V_n$, kips	**151**	226	**131**	197	**112**	169	**97.8**	147	**85.8**	129	**74.7**	112
Z_x, in.^{3}		130		113		97.6		85.3		74.6		66.6	
L_p, ft		9.36		9.29		9.18		9.15		9.08		9.04	
L_r, ft		57.7		51.1		45.2		40.6		36.6		33.7	

ASD	LRFD
$\Omega_b = 1.67$	$\phi_b = 0.90$
$\Omega_v = 1.50$	$\phi_v = 1.00$

Note: For beams laterally unsupported, see Table 3–10.
Available strength tabulated above heavy line is limited by available shear strength.

W10

Table 3–6 (continued)
Maximum Total Uniform Load, kips
W Shapes

F_y = 50 ksi

Shape		W10×											
		49		45		39		33		30		26	
Design		ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft	5									126	188	107	161
	6							113	169	122	183	104	156
	7			141	212	125	187	111	166	104	157	89.3	134
	8	136	204	137	206	117	176	96.8	146	91.3	137	78.1	117
	9	134	201	122	183	104	156	86.1	129	81.2	122	69.4	104
	10	121	181	110	165	93.4	140	77.4	116	73.1	110	62.5	93.9
	11	110	165	99.6	150	84.9	128	70.4	106	66.4	99.8	56.8	85.4
	12	100	151	91.3	137	77.8	117	64.5	97.0	60.9	91.5	52.1	78.2
	13	92.7	139	84.3	127	71.9	108	59.6	89.5	56.2	84.5	48.1	72.2
	14	86.1	129	78.3	118	66.7	100	55.3	83.1	52.2	78.4	44.6	67.1
	15	80.4	121	73.1	110	62.3	93.6	51.6	77.6	48.7	73.2	41.7	62.6
	16	75.3	113	68.5	103	58.4	87.8	48.4	72.8	45.7	68.6	39.0	58.7
	17	70.9	107	64.5	96.9	54.9	82.6	45.6	68.5	43.0	64.6	36.8	55.2
	18	67.0	101	60.9	91.5	51.9	78.0	43.0	64.7	40.6	61.0	34.7	52.2
	19	63.5	95.4	57.7	86.7	49.2	73.9	40.8	61.3	38.4	57.8	32.9	49.4
	20	60.3	90.6	54.8	82.4	46.7	70.2	38.7	58.2	36.5	54.9	31.2	47.0
	21	57.4	86.3	52.2	78.4	44.5	66.9	36.9	55.4	34.8	52.3	29.8	44.7
	22	54.8	82.4	49.8	74.9	42.5	63.8	35.2	52.9	33.2	49.9	28.4	42.7
	23	52.4	78.8	47.6	71.6	40.6	61.0	33.7	50.6	31.8	47.7	27.2	40.8
	24	50.2	75.5	45.7	68.6	38.9	58.5	32.3	48.5	30.4	45.8	26.0	39.1
	25	48.2	72.5	43.8	65.9					29.2	43.9	25.0	37.6
	26									28.1	42.2		
Beam Properties													
W_c/Ω_b	$\phi_b W_c$, kip-ft	1210	1810	1100	1650	934	1400	774	1160	731	1100	625	939
M_p/Ω_b	$\phi_b M_p$, kip-ft	151	227	137	206	117	176	96.8	146	91.3	137	78.1	117
M_r/Ω_b	$\phi_b M_r$, kip-ft	95.4	143	85.8	129	73.5	111	61.1	91.9	56.6	85.0	48.7	73.2
BF	BF, kips	2.44	3.67	2.59	3.89	2.51	3.77	2.39	3.59	3.08	4.62	2.90	4.36
V_n/Ω_v	$\phi_v V_n$, kips	68.0	102	70.7	106	62.5	93.7	56.4	84.7	62.8	94.2	53.7	80.6
Z_x, in.^{3}		60.4		54.9		46.8		38.8		36.6		31.3	
L_p, ft		8.97		7.10		6.99		6.85		4.84		4.80	
L_r, ft		31.6		26.9		24.2		21.8		16.1		14.9	

ASD	LRFD
$\Omega_b = 1.67$	$\phi_b = 0.90$
$\Omega_v = 1.50$	$\phi_v = 1.00$

[f] Shape does not meet compact limit for flexure with F_y = 50 ksi.

F_y = 50 ksi

Table 3–6 (continued)
Maximum Total Uniform Load, kips
W Shapes

W10–W8

Shape	W10×										W8×	
	22		19		17		15		12[f]		67	
Design	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft 3					97.1	146	92.0	138	75.0	113		
4			102	154	93.3	140	79.8	120	62.4	93.8		
5	97.6	146	86.2	130	74.7	112	63.9	96.0	49.9	75.0		
6	86.5	130	71.9	108	62.2	93.5	53.2	80.0	41.6	62.5	205	308
7	74.1	111	61.6	92.6	53.3	80.1	45.6	68.6	35.7	53.6	200	300
8	64.9	97.5	53.9	81.0	46.7	70.1	39.9	60.0	31.2	46.9	175	263
9	57.7	86.7	47.9	72.0	41.5	62.3	35.5	53.3	27.7	41.7	155	234
10	51.9	78.0	43.1	64.8	37.3	56.1	31.9	48.0	25.0	37.5	140	210
11	47.2	70.9	39.2	58.9	33.9	51.0	29.0	43.6	22.7	34.1	127	191
12	43.2	65.0	35.9	54.0	31.1	46.8	26.6	40.0	20.8	31.3	117	175
13	39.9	60.0	33.2	49.8	28.7	43.2	24.6	36.9	19.2	28.9	108	162
14	37.1	55.7	30.8	46.3	26.7	40.1	22.8	34.3	17.8	26.8	99.9	150
15	34.6	52.0	28.7	43.2	24.9	37.4	21.3	32.0	16.6	25.0	93.3	140
16	32.4	48.8	26.9	40.5	23.3	35.1	20.0	30.0	15.6	23.5	87.5	131
17	30.5	45.9	25.4	38.1	22.0	33.0	18.8	28.2	14.7	22.1	82.3	124
18	28.8	43.3	24.0	36.0	20.7	31.2	17.7	26.7	13.9	20.8	77.7	117
19	27.3	41.1	22.7	34.1	19.6	29.5	16.8	25.3	13.1	19.7	73.6	111
20	25.9	39.0	21.6	32.4	18.7	28.1	16.0	24.0	12.5	18.8	70.0	105
21	24.7	37.1	20.5	30.9	17.8	26.7	15.2	22.9	11.9	17.9	66.6	100
22	23.6	35.5	19.6	29.5	17.0	25.5	14.5	21.8	11.3	17.1	63.6	95.6
23	22.6	33.9	18.7	28.2	16.2	24.4	13.9	20.9	10.9	16.3		
24	21.6	32.5	18.0	27.0	15.6	23.4	13.3	20.0	10.4	15.6		
25	20.8	31.2	17.2	25.9	14.9	22.4	12.8	19.2				

Beam Properties

ASD	LRFD	22 ASD	22 LRFD	19 ASD	19 LRFD	17 ASD	17 LRFD	15 ASD	15 LRFD	12[f] ASD	12[f] LRFD	67 ASD	67 LRFD
W_c/Ω_b	$\phi_b W_c$, kip-ft	519	780	431	648	373	561	319	480	250	375	1400	2100
M_p/Ω_b	$\phi_b M_p$, kip-ft	64.9	97.5	53.9	81.0	46.7	70.1	39.9	60.0	31.2	46.9	175	263
M_r/Ω_b	$\phi_b M_r$, kip-ft	40.5	60.9	32.8	49.3	28.3	42.5	24.1	36.2	19.0	28.6	105	159
BF	BF, kips	2.68	4.02	3.17	4.77	2.99	4.49	2.75	4.14	2.35	3.53	1.73	2.60
V_n/Ω_v	$\phi_v V_n$, kips	48.8	73.2	51.2	76.8	48.5	72.8	46.0	69.0	37.5	56.3	103	154
Z_x, in.^{3}		26.0		21.6		18.7		16.0		12.6		70.1	
L_p, ft		4.70		3.09		2.98		2.86		2.87		7.49	
L_r, ft		13.8		9.72		9.13		8.61		8.05		47.7	

ASD	LRFD
$\Omega_b = 1.67$	$\phi_b = 0.90$
$\Omega_v = 1.50$	$\phi_v = 1.00$

Note: For beams laterally unsupported, see Table 3-10.
Available strength tabulated above heavy line is limited by available shear strength.

W8

Table 3-6 (continued)
Maximum Total Uniform Load, kips
W Shapes

F_y = 50 ksi

Shape		W8×											
		58		48		40		35		31[f]		28	
Design		ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft	5											91.9	138
	6	179	268			119	178	101	151	91.2	137	90.5	136
	7	171	256	136	204	113	171	98.9	149	86.6	130	77.6	117
	8	149	224	122	184	99.3	149	86.6	130	75.8	114	67.9	102
	9	133	199	109	163	88.3	133	77.0	116	67.4	101	60.3	90.7
	10	119	179	97.8	147	79.4	119	69.3	104	60.6	91.1	54.3	81.6
	11	109	163	88.9	134	72.2	109	63.0	94.6	55.1	82.8	49.4	74.2
	12	99.5	149	81.5	122	66.2	99.5	57.7	86.8	50.5	75.9	45.2	68.0
	13	91.8	138	75.2	113	61.1	91.8	53.3	80.1	46.6	70.1	41.8	62.8
	14	85.3	128	69.9	105	56.7	85.3	49.5	74.4	43.3	65.1	38.8	58.3
	15	79.6	120	65.2	98.0	53.0	79.6	46.2	69.4	40.4	60.7	36.2	54.4
	16	74.6	112	61.1	91.9	49.7	74.6	43.3	65.1	37.9	56.9	33.9	51.0
	17	70.2	106	57.5	86.5	46.7	70.2	40.7	61.2	35.7	53.6	31.9	48.0
	18	66.3	99.7	54.3	81.7	44.1	66.3	38.5	57.8	33.7	50.6	30.2	45.3
	19	62.8	94.4	51.5	77.4	41.8	62.8	36.5	54.8	31.9	48.0	28.6	42.9
	20	59.7	89.7	48.9	73.5	39.7	59.7	34.6	52.1	30.3	45.6	27.1	40.8
	21	56.8	85.4	46.6	70.0								
Beam Properties													
W_c/Ω_b	$\phi_b W_c$, kip-ft	1190	1790	978	1470	794	1190	693	1040	606	911	543	816
M_p/Ω_b	$\phi_b M_p$, kip-ft	149	224	122	184	99.3	149	86.6	130	75.8	114	67.9	102
M_r/Ω_b	$\phi_b M_r$, kip-ft	90.8	137	75.4	113	62.0	93.2	54.5	81.9	48.0	72.2	42.4	63.8
BF	BF, kips	1.70	2.56	1.68	2.53	1.64	2.47	1.62	2.43	1.58	2.37	1.66	2.50
V_n/Ω_v	$\phi_v V_n$, kips	89.3	134	68.0	102	59.4	89.1	50.3	75.5	45.6	68.4	45.9	68.9
Z_x, in.^{3}		59.8		49.0		39.8		34.7		30.4		27.2	
L_p, ft		7.42		7.35		7.21		7.17		7.18		5.72	
L_r, ft		41.7		35.2		29.9		27.0		24.8		21.0	

ASD	LRFD
$\Omega_b = 1.67$	$\phi_b = 0.90$
$\Omega_v = 1.50$	$\phi_v = 1.00$

[f] Shape does not meet compact limit for flexure with F_y = 50 ksi.

F_y = 50 ksi

Table 3–6 (continued)
Maximum Total Uniform Load, kips
W Shapes

W8

Shape	W8× 24		21		18		15		13		10[f]	
Design	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft 3							79.5	119	73.5	110	53.7	80.5
4			82.8	124	74.9	112	67.9	102	56.9	85.5	43.7	65.7
5	77.7	117	81.4	122	67.9	102	54.3	81.6	45.5	68.4	35.0	52.6
6	76.8	115	67.9	102	56.6	85.0	45.2	68.0	37.9	57.0	29.2	43.8
7	65.9	99.0	58.2	87.4	48.5	72.9	38.8	58.3	32.5	48.9	25.0	37.6
8	57.6	86.6	50.9	76.5	42.4	63.8	33.9	51.0	28.4	42.8	21.9	32.9
9	51.2	77.0	45.2	68.0	37.7	56.7	30.2	45.3	25.3	38.0	19.4	29.2
10	46.1	69.3	40.7	61.2	33.9	51.0	27.1	40.8	22.8	34.2	17.5	26.3
11	41.9	63.0	37.0	55.6	30.8	46.4	24.7	37.1	20.7	31.1	15.9	23.9
12	38.4	57.7	33.9	51.0	28.3	42.5	22.6	34.0	19.0	28.5	14.6	21.9
13	35.5	53.3	31.3	47.1	26.1	39.2	20.9	31.4	17.5	26.3	13.5	20.2
14	32.9	49.5	29.1	43.7	24.2	36.4	19.4	29.1	16.3	24.4	12.5	18.8
15	30.7	46.2	27.1	40.8	22.6	34.0	18.1	27.2	15.2	22.8	11.7	17.5
16	28.8	43.3	25.4	38.2	21.2	31.9	17.0	25.5	14.2	21.4	10.9	16.4
17	27.1	40.8	24.0	36.0	20.0	30.0	16.0	24.0	13.4	20.1	10.3	15.5
18	25.6	38.5	22.6	34.0	18.9	28.3	15.1	22.7	12.6	19.0	9.72	14.6
19	24.3	36.5	21.4	32.2	17.9	26.8	14.3	21.5	12.0	18.0	9.21	13.8
20			20.4	30.6	17.0	25.5	13.6	20.4				
Beam Properties												
W_c/Ω_b / $\phi_b W_c$, kip-ft	461	693	407	612	339	510	271	408	228	342	175	263
M_p/Ω_b / $\phi_b M_p$, kip-ft	57.6	86.6	50.9	76.5	42.4	63.8	33.9	51.0	28.4	42.8	21.9	32.9
M_r/Ω_b / $\phi_b M_r$, kip-ft	36.5	54.9	31.8	47.8	26.5	39.9	20.6	31.0	17.3	26.0	13.6	20.5
BF / BF, kips	1.59	2.39	1.86	2.79	1.74	2.61	1.92	2.88	1.76	2.65	1.52	2.28
V_n/Ω_v / $\phi_v V_n$, kips	38.9	58.3	41.4	62.1	37.4	56.2	39.7	59.6	36.8	55.1	26.8	40.2
Z_x, in.^{3}	23.1		20.4		17.0		13.6		11.4		8.87	
L_p, ft	5.69		4.45		4.34		3.09		2.98		3.14	
L_r, ft	19.0		14.8		13.5		10.0		9.30		8.56	

ASD	LRFD	
$\Omega_b = 1.67$ $\Omega_v = 1.50$	$\phi_b = 0.90$ $\phi_v = 1.00$	Note: For beams laterally unsupported, see Table 3–10. Available strength tabulated above heavy line is limited by available shear strength.

Table 3–7
Maximum Total Uniform Load, kips
S Shapes

S24–S20

F_y = 36 ksi

Shape		S24× 121		S24× 106		S24× 100		S24× 90		S24× 80		S20× 96	
Design		ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft	6					515	772					468	702
	7	564	847			491	737	432	648			407	611
	8	550	826			429	645	399	599	346	518	356	535
	9	489	734	437	656	382	574	354	533	326	490	316	475
	10	440	661	401	603	343	516	319	480	293	441	285	428
	11	400	601	365	548	312	469	290	436	267	401	259	389
	12	366	551	334	502	286	430	266	400	244	367	237	356
	13	338	508	308	464	264	397	245	369	226	339	219	329
	14	314	472	286	430	245	369	228	343	209	315	203	305
	15	293	441	267	402	229	344	213	320	195	294	190	285
	16	275	413	251	377	215	323	199	300	183	275	178	267
	17	259	389	236	354	202	304	188	282	172	259	167	252
	18	244	367	223	335	191	287	177	266	163	245	158	238
	19	231	348	211	317	181	272	168	252	154	232	150	225
	20	220	330	200	301	172	258	160	240	147	220	142	214
	21	209	315	191	287	164	246	152	228	140	210	136	204
	22	200	300	182	274	156	235	145	218	133	200	129	194
	23	191	287	174	262	149	224	139	208	127	192	124	186
	24	183	275	167	251	143	215	133	200	122	184	119	178
	25	176	264	160	241	137	206	128	192	117	176	114	171
	26	169	254	154	232	132	199	123	184	113	169	109	164
	27	163	245	149	223	127	191	118	178	109	163	105	158
	28	157	236	143	215	123	184	114	171	105	157	102	153
	29	152	228	138	208	118	178	110	165	101	152	98.1	147
	30	147	220	134	201	114	172	106	160	97.7	147	94.9	143
	32	137	207	125	188	107	161	99.7	150	91.6	138	88.9	134
	34	129	194	118	177	101	152	93.8	141	86.2	130	83.7	126
	36	122	184	111	167	95.4	143	88.6	133	81.4	122	79.0	119
	38	116	174	106	159	90.4	136	84.0	126	77.2	116	74.9	113
	40	110	165	100	151	85.9	129	79.8	120	73.3	110	71.1	107
	42	105	157	95.5	143	81.8	123	76.0	114	69.8	105	67.8	102
	44	99.9	150	91.1	137	78.1	117	72.5	109	66.6	100	64.7	97.2
	46	95.6	144	87.2	131	74.7	112	69.4	104	63.7	95.8	61.9	93.0
	48	91.6	138	83.5	126	71.6	108	66.5	99.9	61.1	91.8	59.3	89.1
	50	88.0	132	80.2	121	68.7	103	63.8	95.9	58.6	88.1	56.9	85.5
	52	84.6	127	77.1	116	66.1	99.3	61.4	92.2	56.4	84.7		
	54	81.4	122	74.3	112	63.6	95.6	59.1	88.8	54.3	81.6		
	56	78.5	118	71.6	108	61.3	92.2	57.0	85.6	52.4	78.7		
	58	75.8	114	69.1	104	59.2	89.0	55.0	82.7	50.5	76.0		
	60	73.3	110	66.8	100	57.2	86.0	53.2	79.9	48.9	73.4		
Beam Properties													
W_c/Ω_b	$\phi_b W_c$, kip-ft	4400	6610	4010	6030	3430	5160	3190	4800	2930	4410	2850	4280
M_p/Ω_b	$\phi_b M_p$, kip-ft	550	826	501	753	429	645	399	599	366	551	356	535
M_r/Ω_b	$\phi_b M_r$, kip-ft	324	488	302	454	250	376	235	353	220	331	207	312
BF	BF, kips	11.3	17.1	10.9	16.4	11.6	17.5	11.4	17.1	10.8	16.2	7.62	11.4
V_n/Ω_v	$\phi_v V_n$, kips	282	423	219	328	257	386	216	324	173	259	234	351
Z_x, in.^{3}		306		279		239		222		204		198	
L_p, ft		6.37		6.54		5.29		5.41		5.58		5.54	
L_r, ft		26.2		24.8		20.7		19.8		19.1		25.0	

ASD	LRFD
$\Omega_b = 1.67$	$\phi_b = 0.90$
$\Omega_v = 1.50$	$\phi_v = 1.00$

Note: Beams must be laterally supported if Table 3–7 is used.
Available strength tabulated above heavy line is limited by available shear strength.

F_y = 36 ksi

Table 3–7 (continued)
Maximum Total Uniform Load, kips
S Shapes

S20–S15

Shape	S20×						S18×				S15×	
	86		75		66		70		54.7		50	
Design	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft 4							369	553			238	356
5			366	549			356	536			221	333
6	386	579	364	547	291	436	297	446	239	358	184	277
7	376	565	312	469	285	429	255	383	214	321	158	238
8	329	494	273	410	250	375	223	335	187	281	138	208
9	292	439	243	365	222	334	198	298	166	250	123	185
10	263	395	218	328	200	300	178	268	149	225	111	166
11	239	359	199	298	182	273	162	243	136	204	101	151
12	219	329	182	274	166	250	149	223	125	187	92.2	139
13	202	304	168	253	154	231	137	206	115	173	85.1	128
14	188	282	156	235	143	214	127	191	107	160	79.0	119
15	175	264	146	219	133	200	119	179	99.6	150	73.8	111
16	164	247	137	205	125	188	111	167	93.4	140	69.2	104
17	155	233	128	193	118	177	105	158	87.9	132	65.1	97.8
18	146	220	121	182	111	167	99.0	149	83.0	125	61.5	92.4
19	138	208	115	173	105	158	93.8	141	78.7	118	58.2	87.5
20	131	198	109	164	99.9	150	89.1	134	74.7	112	55.3	83.2
21	125	188	104	156	95.1	143	84.9	128	71.2	107	52.7	79.2
22	120	180	99.3	149	90.8	136	81.0	122	67.9	102	50.3	75.6
23	114	172	95.0	143	86.9	131	77.5	116	65.0	97.7	48.1	72.3
24	110	165	91.0	137	83.2	125	74.3	112	62.3	93.6	46.1	69.3
25	105	158	87.4	131	79.9	120	71.3	107	59.8	89.9	44.3	66.5
26	101	152	84.0	126	76.8	115	68.5	103	57.5	86.4	42.6	64.0
27	97.4	146	80.9	122	74.0	111	66.0	99.2	55.4	83.2	41.0	61.6
28	93.9	141	78.0	117	71.3	107	63.6	95.7	53.4	80.2	39.5	59.4
29	90.7	136	75.3	113	68.9	104	61.4	92.4	51.5	77.5	38.2	57.4
30	87.7	132	72.8	109	66.6	100	59.4	89.3	49.8	74.9	36.9	
32	82.2	124	68.3	103	62.4	93.8	55.7	83.7	46.7	70.2	34.6	52.0
34	77.4	116	64.2	96.6	58.8	88.3	52.4	78.8	44.0	66.1	32.5	48.9
36	73.1	110	60.7	91.2	55.5	83.4	49.5	74.4	41.5	62.4	30.7	46.2
38	69.2	104	57.5	86.4	52.6	79.0	46.9	70.5	39.3	59.1		
40	65.7	98.8	54.6	82.1	49.9	75.1	44.6	67.0	37.4	56.2		
42	62.6	94.1	52.0	78.2	47.6	71.5	42.4	63.8	35.6	53.5		
44	59.8	89.8	49.6	74.6	45.4	68.2	40.5	60.9	34.0	51.1		
46	57.2	85.9	47.5	71.4	43.4	65.3						
48	54.8	82.4	45.5	68.4	41.6	62.6						
50	52.6	79.1	43.7	65.7	40.0	60.0						
Beam Properties												
W_c/Ω_b / $\phi_b W_c$, kip-ft	2630	3950	2180	3280	2000	3000	1780	2680	1490	2250	1110	1660
M_p/Ω_b / $\phi_b M_p$, kip-ft	329	494	273	410	250	375	223	335	187	281	138	208
M_r/Ω_b / $\phi_b M_r$, kip-ft	195	293	161	242	150	225	130	195	112	168	81.4	122
BF / BF, kips	7.55	11.3	7.76	11.7	7.50	11.3	6.11	9.19	5.99	9.00	4.09	6.14
V_n/Ω_v / $\phi_v V_n$, kips	193	289	183	274	145	218	184	276	119	179	119	178
Z_x, in.^{3}	183		152		139		124		104		77.0	
L_p, ft	5.66		4.83		4.95		4.50		4.75		4.29	
L_r, ft	23.4		19.3		18.3		19.7		17.3		18.2	

ASD	LRFD
$\Omega_b = 1.67$ $\Omega_v = 1.50$	$\phi_b = 0.90$ $\phi_v = 1.00$

Note: Beams must be laterally supported if Table 3–7 is used.
Available strength tabulated above heavy line is limited by available shear strength.

Table 3–7 (continued)
Maximum Total Uniform Load, kips
S Shapes

S15–S10

F_y = 36 ksi

Shape		S15×		S12×								S10×	
		42.9		50		40.8		35		31.8		35	
Design		ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft	2											171	257
	3			237	356							170	255
	4			219	329	160	240	148	222	121		127	191
	5	178	266	175	263	151	228	128	193	120	181	102	153
	6	166	249	146	219	126	190	107	161	100	150	84.8	127
	7		142	214	125	188	108	163	91.6	138	85.8	129	72.7
	8	124	187	109	164	94.7	142	80.1	120	75.1	113	63.6	95.6
	9	110	166	97.2	146	84.2	126	71.2	107	66.7	100	56.5	85.0
	10	99.4	149	87.5	132	75.7	114	64.1	96.3	60.1	90.3	50.9	76.5
	11	90.4	136	79.6	120	68.9	103	58.3	87.6	54.6	82.1	46.2	69.5
	12	82.9	125	72.9	110	63.1	94.9	53.4	80.3	50.1	75.2	42.4	63.7
	13	76.5	115	67.3	101	58.3	87.6	49.3	74.1	46.2	69.5	39.1	58.8
	14	71.0	107	62.5	94.0	54.1	81.3	45.8	68.8	42.9	64.5	36.3	54.6
	15	66.3	99.6	58.3	87.7	50.5	75.9	42.7	64.2	40.0	60.2	33.9	51.0
	16	62.2	93.4	54.7	82.2	47.3	71.1	40.1	60.2	37.5	56.4	31.8	47.8
	17	58.5	87.9	51.5	77.4	44.6	67.0	37.7	56.7	35.3	53.1	29.9	45.0
	18	55.2	83.0	48.6	73.1	42.1	63.2	35.6	53.5	33.4	50.2	28.3	42.5
	19	52.3	78.7	46.1	69.2	39.9	59.9	33.7	50.7	31.6	47.5	26.8	40.2
	20	49.7	74.7	43.8	65.8	37.9	56.9	32.0	48.2	30.0	45.1	25.4	38.2
	21	47.4	71.2	41.7	62.6	36.1	54.2	30.5	45.9	28.6	43.0	24.2	36.4
	22	45.2	67.9	39.8	59.8	34.4	51.7	29.1	43.8	27.3	41.0	23.1	34.8
	23	43.2	65.0	38.1	57.2	32.9	49.5	27.9	41.9	26.1	39.3	22.1	33.2
	24	41.4	62.3	36.5	54.8	31.6	47.4	26.7	40.1	25.0	37.6	21.2	31.9
	25	39.8	59.8	35.0	52.6	30.3	45.5	25.6	38.5	24.0	36.1	20.3	30.6
	26	38.2	57.5	33.7	50.6	29.1	43.8	24.7	37.1	23.1	34.7		
	27	36.8	55.4	32.4	48.7	28.1	42.2	23.7	35.7	22.2	33.4		
	28	35.5	53.4	31.3	47.0	27.0	40.7	22.9	34.4	21.5	32.2		
	29	34.3	51.5	30.2	45.4	26.1	39.3	22.1	33.2	20.7	31.1		
	30	33.1	49.8	29.2	43.8	25.2	37.9	21.4	32.1	20.0	30.1		
	32	31.1	46.7										
	34	29.2	44.0										
	36	27.6	41.5										
Beam Properties													
W_c/Ω_b	$\phi_b W_c$, kip-ft	994	1490	875	1320	757	1140	641	963	601	903	509	765
M_p/Ω_b	$\phi_b M_p$, kip-ft	124	187	109	164	94.7	142	80.1	120	75.1	113	63.6	95.6
M_r/Ω_b	$\phi_b M_r$, kip-ft	74.7	112	63.6	95.6	56.7	85.2	47.9	72.0	45.5	68.4	37.0	55.6
BF	BF, kips	3.99	6.00	2.22	3.34	2.31	3.48	2.46	3.69	2.42	3.63	1.51	2.27
V_n/Ω_v	$\phi_v V_n$, kips	88.8	133	119	178	79.8	120	74.0	111	60.5	90.7	85.5	128
Z_x, in.^{3}		69.2		60.9		52.7		44.6		41.8		35.4	
L_p, ft		4.41		4.29		4.41		4.08		4.16		3.74	
L_r, ft		16.8		24.9		20.8		17.2		16.4		21.4	

ASD	LRFD	
$\Omega_b = 1.67$ $\Omega_v = 1.50$	$\phi_b = 0.90$ $\phi_v = 1.00$	Note: Beams must be laterally supported if Table 3–7 is used. Available strength tabulated above heavy line is limited by available shear strength.

Table 3-7 (continued)
Maximum Total Uniform Load, kips
S Shapes

F_y = 36 ksi

S10–S5

Shape		S10× 25.4		S8× 23		S8× 18.4		S6× 17.2		S6× 12.5		S5× 10	
Design		ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft	2			102	152			75.4	113			30.8	46.2
	3			92.0	138	62.4	93.7	50.3	75.6	40.1	60.1	27.1	40.8
	4	89.6	134	69.0	104	59.3	89.1	37.7	56.7	30.4	45.6	20.3	30.6
	5	81.3	122	55.2	82.9	47.4	71.3	30.2	45.4	24.3	36.5	16.3	24.5
	6	67.8	102	46.0	69.1	39.5	59.4	25.1	37.8	20.2	30.4	13.6	20.4
	7	109	58.1	87.3	39.4	59.2	33.9	50.9	21.6	32.4	17.3	26.1	11.6
	8	50.8	76.4	34.5	51.8	29.6	44.6	18.9	28.4	15.2	22.8	10.2	15.3
	9	45.2	67.9	30.7	46.1	26.3	39.6	16.8	25.2	13.5	20.3	9.04	13.6
	10	40.7	61.1	27.6	41.5	23.7	35.6	15.1	22.7	12.1	18.3	8.13	12.2
	11	37.0	55.6	25.1	37.7	21.6	32.4	13.7	20.6	11.0	16.6	7.39	11.1
	12	33.9	50.9	23.0	34.6	19.8	29.7	12.6	18.9	10.1	15.2	6.78	10.2
	13	31.3	47.0	21.2	31.9	18.2	27.4	11.6	17.4	9.34	14.0		
	14	29.1	43.7	19.7	29.6	16.9	25.5	10.8	16.2	8.67	13.0		
	15	27.1	40.8	18.4	27.6	15.8	23.8	10.1	15.1	8.10	12.2		
	16	25.4	38.2	17.2	25.9	14.8	22.3						
	17	23.9	36.0	16.2	24.4	13.9	21.0						
	18	22.6	34.0	15.3	23.0	13.2	19.8						
	19	21.4	32.2	14.5	21.8	12.5	18.8						
	20	20.3	30.6	13.8	20.7	11.9	17.8						
	21	19.4	29.1										
	22	18.5	27.8										
	23	17.7	26.6										
	24	16.9	25.5										
	25	16.3	24.5										
Beam Properties													
W_c/Ω_b	$\phi_b W_c$, kip-ft	407	611	276	415	237	356	151	227	121	183	81.3	122
M_p/Ω_b	$\phi_b M_p$, kip-ft	50.8	76.4	34.5	51.8	29.6	44.6	18.9	28.4	15.2	22.8	10.2	15.3
M_r/Ω_b	$\phi_b M_r$, kip-ft	30.9	46.5	20.4	30.6	18.1	27.2	11.0	16.5	9.23	13.9	6.16	9.26
BF	BF, kips	1.58	2.38	0.948	1.42	0.974	1.46	0.459	0.691	0.515	0.775	0.341	0.512
V_n/Ω_v	$\phi_v V_n$, kips	44.8	67.2	50.8	76.2	31.2	46.8	40.2	60.3	20.0	30.1	15.4	23.1
Z_x, in.^{3}		28.3		19.2		16.5		10.5		8.45		5.66	
L_p, ft		3.95		3.31		3.44		2.80		2.92		2.66	
L_r, ft		16.5		18.2		15.3		19.9		14.5		14.4	

ASD	LRFD
$\Omega_b = 1.67$	$\phi_b = 0.90$
$\Omega_v = 1.50$	$\phi_v = 1.00$

Note: Beams must be laterally supported if Table 3–7 is used.
Available strength tabulated above heavy line is limited by available shear strength.

S4–S3

Table 3–7 (continued)
Maximum Total Uniform Load, kips
S Shapes

F_y = 50 ksi

Shape		S4×				S3×			
		9.5		7.7		7.5		5.7	
Design		ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft	2	29.0	43.6	22.2	33.4	16.9	25.4	13.9	21.0
	3	19.4	29.1	16.8	25.2	11.3	16.9	9.29	14.0
	4	14.5	21.8	12.6	18.9	8.44	12.7	6.97	10.5
	5	11.6	17.5	10.1	15.1	6.75	10.2	5.58	8.38
	6	9.68	14.5	8.38	12.6	5.63	8.46	4.65	6.98
	7	17.5	8.29	12.5	7.19	4.82	7.25	3.98	5.99
	8	7.26	10.9	6.29	9.45				
	9	6.45	9.70	5.59	8.40				
	10	5.81	8.73	5.03	7.56				
Beam Properties									
W_c/Ω_b	$\phi_b W_c$, kip-ft	58.1	87.3	50.3	75.6	33.8	50.8	27.9	41.9
M_p/Ω_b	$\phi_b M_p$, kip-ft	7.26	10.9	6.29	9.45	4.22	6.35	3.49	5.24
M_r/Ω_b	$\phi_b M_r$, kip-ft	4.25	6.39	3.81	5.73	2.44	3.67	2.10	3.16
BF	BF, kips	0.190	0.286	0.202	0.304	0.0899	0.135	0.102	0.154
V_n/Ω_v	$\phi_v V_n$, kips	18.8	28.2	11.1	16.7	15.1	22.6	7.34	11.0
Z_x, in.^{3}		4.04		3.50		2.35		1.94	
L_p, ft		2.35		2.40		2.14		2.16	
L_r, ft		18.2		14.7		22.0		15.7	

ASD	LRFD	
$\Omega_b = 1.67$ $\Omega_v = 1.50$	$\phi_b = 0.90$ $\phi_v = 1.00$	Note: Beams must be laterally supported if Table 3–7 is used. Available strength tabulated above heavy line is limited by available shear strength.

F_y = 36 ksi

Table 3–8
Maximum Total Uniform Load, kips
C Shapes

C15–C12

Shape		C15×						C12×					
		50		40		33.9		30		25		20.7	
Design		ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft	3	278	418					158	238	120	181		
	4	246	370	202	303	155	233	121	182	106	159	87.5	132
	5	197	296	165	248	146	219	97.1	146	84.4	127	73.5	111
	6	164	247	138	207	122	183	80.9	122	70.3	106	61.3	92.1
	7	141	211	118	177	104	157	69.4	104	60.3	90.6	52.5	79.0
	8	123	185	103	155	91.2	137	60.7	91.2	52.8	79.3	46.0	69.1
	9	109	164	91.8	138	81.0	122	54.0	81.1	46.9	70.5	40.9	61.4
	10	98.5	148	82.6	124	72.9	110	48.6	73.0	42.2	63.4	36.8	55.3
	11	89.5	135	75.1	113	66.3	99.7	44.2	66.4	38.4	57.7	33.4	50.2
	12	82.1	123	68.9	104	60.8	91.4	40.5	60.8	35.2	52.9	30.6	46.1
	13	75.8	114	63.6	95.5	56.1	84.3	37.4	56.2	32.5	48.8	28.3	42.5
	14	70.3	106	59.0	88.7	52.1	78.3	34.7	52.1	30.1	45.3	26.3	39.5
	15	65.7	98.7	55.1	82.8	48.6	73.1	32.4	48.7	28.1	42.3	24.5	36.8
	16	61.6	92.5	51.7	77.6	45.6	68.5	30.4	45.6	26.4	39.6	23.0	34.5
	17	57.9	87.1	48.6	73.1	42.9	64.5	28.6	42.9	24.8	37.3	21.6	32.5
	18	54.7	82.2	45.9	69.0	40.5	60.9	27.0	40.6	23.4	35.2	20.4	30.7
	19	51.8	77.9	43.5	65.4	38.4	57.7	25.6	38.4	22.2	33.4	19.4	29.1
	20	49.2	74.0	41.3	62.1	36.5	54.8	24.3	36.5	21.1	31.7	18.4	27.6
	21	46.9	70.5	39.4	59.1	34.7	52.2	23.1	34.8	20.1	30.2	17.5	26.3
	22	44.8	67.3	37.6	56.5	33.2	49.8	22.1	33.2	19.2	28.8	16.7	25.1
	23	42.8	64.4	35.9	54.0	31.7	47.7	21.1	31.7	18.4	27.6	16.0	24.0
	24	41.0	61.7	34.4	51.8	30.4	45.7	20.2	30.4	17.6	26.4	15.3	23.0
	25	39.4	59.2	33.1	49.7	29.2	43.9	19.4	29.2	16.9	25.4	14.7	22.1
	26	37.9	56.9	31.8	47.8	28.1	42.2	18.7	28.1	16.2	24.4	14.1	21.3
	27	36.5	54.8	30.6	46.0	27.0	40.6	18.0	27.0	15.6	23.5	13.6	20.5
	28	35.2	52.9	29.5	44.4	26.1	39.2	17.3	26.1	15.1	22.7	13.1	19.7
	29	34.0	51.0	28.5	42.8	25.2	37.8	16.7	25.2	14.6	21.9	12.7	19.1
	30	32.8	49.3	27.5	41.4	24.3	36.5	16.2	24.3	14.1	21.1	12.3	18.4
	31	31.8	47.8	26.7	40.1	23.5	35.4						
	32	30.8	46.3	25.8	38.8	22.8	34.3						
	33	29.8	44.9	25.0	37.6	22.1	33.2						
	34	29.0	43.5	24.3	36.5	21.5	32.2						
	35	28.1	42.3	23.6	35.5	20.8	31.3						
	36	27.4	41.1	23.0	34.5	20.3	30.5						
	37	26.6	40.0	22.3	33.6	19.7	29.6						
Beam Properties													
W_c/Ω_b	$\phi_b W_c$, kip-ft	985	1480	826	1240	729	1100	486	730	422	634	368	553
M_p/Ω_b	$\phi_b M_p$, kip-ft	123	185	103	155	91.2	137	60.7	91.2	52.8	79.3	46.0	69.1
M_r/Ω_b	$\phi_b M_r$, kip-ft	67.7	102	58.4	87.8	52.8	79.3	33.9	51.0	30.2	45.4	27.1	40.7
BF	BF, kips	3.48	5.23	3.63	5.45	3.57	5.37	2.18	3.27	2.22	3.33	2.15	3.23
V_n/Ω_v	$\phi_v V_n$, kips	139	209	101	152	77.6	117	79.2	119	60.1	90.3	43.8	65.8
Z_x, in.^{3}		68.5		57.5		50.8		33.8		29.4		25.6	
L_p, ft		3.60		3.68		3.75		3.17		3.24		3.32	
L_r, ft		19.5		16.0		14.5		15.5		13.4		12.1	

ASD	LRFD
$\Omega_b = 1.67$	$\phi_b = 0.90$
$\Omega_v = 1.67$	$\phi_v = 1.00$

Note: Beams must be laterally supported if Table 3–8 is used.
Available strength tabulated above heavy line is limited by available shear strength.

Table 3–8 (continued)
Maximum Total Uniform Load, kips
S Shapes

C10–C9

F_y = 36 ksi

Shape		C10×								C9×	
		30		25		20		15.3		20	
Design		ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft	2	174	262	136	205	98.0	147			104	157
	3	128	193	111	166	92.9	140	62.1	93.3	81.2	122
	4	96.1	144	82.9	125	69.7	105	57.2	86.0	60.9	91.5
	5	76.9	116	66.3	99.6	55.7	83.8	45.7	68.8	48.7	73.2
	6	64.1	96.3	55.3	83.0	46.4	69.8	38.1	57.3	40.6	61.0
	7	54.9	82.5	47.4	71.2	39.8	59.8	32.7	49.1	34.8	52.3
	8	48.0	72.2	41.4	62.3	34.8	52.4	28.6	43.0	30.4	45.7
	9	42.7	64.2	36.8	55.4	31.0	46.5	25.4	38.2	27.1	40.7
	10	38.4	57.8	33.2	49.8	27.9	41.9	22.9	34.4	24.3	36.6
	11	34.9	52.5	30.1	45.3	25.3	38.1	20.8	31.3	22.1	33.3
	12	32.0	48.1	27.6	41.5	23.2	34.9	19.1	28.7	20.3	30.5
	13	29.6	44.4	25.5	38.3	21.4	32.2	17.6	26.4	18.7	28.1
	14	27.5	41.3	23.7	35.6	19.9	29.9	16.3	24.6	17.4	26.1
	15	25.6	38.5	22.1	33.2	18.6	27.9	15.2	22.9	16.2	24.4
	16	24.0	36.1	20.7	31.1	17.4	26.2	14.3	21.5	15.2	22.9
	17	22.6	34.0	19.5	29.3	16.4	24.6	13.5	20.2	14.3	21.5
	18	21.4	32.1	18.4	27.7	15.5	23.3	12.7	19.1	13.5	20.3
	19	20.2	30.4	17.4	26.2	14.7	22.0	12.0	18.1	12.8	19.3
	20	19.2	28.9	16.6	24.9	13.9	20.9	11.4	17.2	12.2	18.3
	21	18.3	27.5	15.8	23.7	13.3	19.9	10.9	16.4	11.6	17.4
	22	17.5	26.3	15.1	22.6	12.7	19.0	10.4	15.6	11.1	16.6
	23	16.7	25.1	14.4	21.7	12.1	18.2	9.95	14.9		
	24	16.0	24.1	13.8	20.8	11.6	17.5	9.53	14.3		
	25	15.4	23.1	13.3	19.9	11.1	16.8	9.15	13.8		

Beam Properties

ASD	LRFD	30 ASD	30 LRFD	25 ASD	25 LRFD	20 ASD	20 LRFD	15.3 ASD	15.3 LRFD	C9×20 ASD	C9×20 LRFD
W_c/Ω_b	$\phi_b W_c$, kip-ft	384	578	332	498	279	419	229	344	243	366
M_p/Ω_b	$\phi_b M_p$, kip-ft	48.0	72.2	41.4	62.3	34.8	52.4	28.6	43.0	30.4	45.7
M_r/Ω_b	$\phi_b M_r$, kip-ft	26.0	39.1	22.9	34.4	19.8	29.8	16.9	25.4	17.0	25.6
BF	BF, kips	1.27	1.91	1.40	2.10	1.48	2.23	1.45	2.18	1.13	1.70
V_n/Ω_v	$\phi_v V_n$, kips	87.0	131	68.0	102	49.0	73.7	31.0	46.7	52.2	78.4

	C10×30	C10×25	C10×20	C10×15.3	C9×20
Z_x, in.^{3}	26.7	23.1	19.4	15.9	16.9
L_p, ft	2.78	2.81	2.87	2.96	2.66
L_r, ft	20.1	16.1	13.0	11.0	14.5

ASD	LRFD
$\Omega_b = 1.67$	$\phi_b = 0.90$
$\Omega_v = 1.67$	$\phi_v = 1.00$

Note: Beams must be laterally supported if Table 3–8 is used.
Available strength tabulated above heavy line is limited by available shear strength.

F_y = 36 ksi

Table 3–8 (continued)
Maximum Total Uniform Load, kips
C Shapes

C9–C8

Shape		C9×				C8×					
		15		13.4		18.5		13.7		11.5	
Design		ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft	2	66.4	99.7			99.9	150	62.7	94.2		
	3	65.3	98.2	54.2	81.5	66.6	100	52.5	78.9	45.5	68.4
	4	49.0	73.7	45.2	68.0	49.9	75.1	39.4	59.2	34.6	52.0
	5	39.2	58.9	36.2	54.4	40.0	60.0	31.5	47.3	27.7	41.6
	6	32.7	49.1	30.2	45.3	33.3	50.0	26.2	39.4	23.1	34.7
	7	28.0	42.1	25.8	38.8	28.5	42.9	22.5	33.8	19.8	29.7
	8	24.5	36.8	22.6	34.0	25.0	37.5	19.7	29.6	17.3	26.0
	9	21.8	32.7	20.1	30.2	22.2	33.4	17.5	26.3	15.4	23.1
	10	19.6	29.5	18.1	27.2	20.0	30.0	15.7	23.7	13.8	20.8
	11	17.8	26.8	16.4	24.7	18.2	27.3	14.3	21.5	12.6	18.9
	12	16.3	24.6	15.1	22.7	16.6	25.0	13.1	19.7	11.5	17.3
	13	15.1	22.7	13.9	20.9	15.4	23.1	12.1	18.2	10.6	16.0
	14	14.0	21.0	12.9	19.4	14.3	21.4	11.2	16.9	9.88	14.9
	15	13.1	19.6	12.1	18.1	13.3	20.0	10.5	15.8	9.22	13.9
	16	12.3	18.4	11.3	17.0	12.5	18.8	9.84	14.8	8.65	13.0
	17	11.5	17.3	10.6	16.0	11.8	17.7	9.26	13.9	8.14	12.2
	18	10.9	16.4	10.1	15.1	11.1	16.7	8.75	13.1	7.69	11.6
	19	10.3	15.5	9.52	14.3	10.5	15.8	8.29	12.5	7.28	10.9
	20	9.80	14.7	9.05	13.6	9.99	15.0	7.87	11.8	6.92	10.4
	21	9.34	14.0	8.61	12.9						
	22	8.91	13.4	8.22	12.4						
Beam Properties											
W_c/Ω_b	$\phi_b W_c$, kip-ft	196	295	181	272	200	300	157	237	138	208
M_p/Ω_b	$\phi_b M_p$, kip-ft	24.5	36.8	22.6	34.0	25.0	37.5	19.7	29.6	17.3	26.0
M_r/Ω_b	$\phi_b M_r$, kip-ft	14.2	21.4	13.4	20.1	13.8	20.8	11.3	17.1	10.2	15.4
BF	BF, kips	1.18	1.78	1.16	1.75	0.822	1.24	0.909	1.37	0.903	1.36
V_n/Ω_v	$\phi_v V_n$, kips	33.2	49.9	27.1	40.8	50.4	75.7	31.4	47.1	22.8	34.2
Z_x, in.^{3}		13.6		12.6		13.9		11.0		9.63	
L_p, ft		2.74		2.77		2.49		2.55		2.59	
L_r, ft		11.4		10.7		16.1		11.7		10.4	

ASD	LRFD	
$\Omega_b = 1.67$	$\phi_b = 0.90$	Note: Beams must be laterally supported if Table 3–8 is used.
$\Omega_v = 1.67$	$\phi_v = 1.00$	Available strength tabulated above heavy line is limited by available shear strength.

C7–C6

Table 3–8 (continued)
Maximum Total Uniform Load, kips
C Shapes

F_y = 36 ksi

Shape		C7× 14.7		C7× 12.2		C7× 9.8		C6× 13		C6× 10.5	
Design		ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft	2	70.0	105	56.9	85.5	38.0	57.2	52.4	78.7	44.4	66.8
	3	46.7	70.2	40.5	60.9	34.4	51.7	34.9	52.5	29.6	44.5
	4	35.0	52.6	30.4	45.7	25.8	38.8	26.2	39.4	22.2	33.4
	5	28.0	42.1	24.3	36.5	20.7	31.0	21.0	31.5	17.8	26.7
	6	23.3	35.1	20.3	30.5	17.2	25.9	17.5	26.2	14.8	22.3
	7	20.0	30.1	17.4	26.1	14.8	22.2	15.0	22.5	12.7	19.1
	8	17.5	26.3	15.2	22.8	12.9	19.4	13.1	19.7	11.1	16.7
	9	15.6	23.4	13.5	20.3	11.5	17.2	11.6	17.5	9.87	14.8
	10	14.0	21.1	12.2	18.3	10.3	15.5	10.5	15.7	8.89	13.4
	11	12.7	19.1	11.1	16.6	9.39	14.1	9.52	14.3	8.08	12.1
	12	11.7	17.5	10.1	15.2	8.61	12.9	8.73	13.1	7.40	11.1
	13	10.8	16.2	9.35	14.1	7.94	11.9	8.06	12.1	6.83	10.3
	14	10.0	15.0	8.68	13.1	7.38	11.1	7.48	11.2	6.35	9.54
	15	9.34	14.0	8.11	12.2	6.88	10.3	6.98	10.5	5.92	8.90
	16	8.75	13.2	7.60	11.4	6.45	9.70				
	17	8.24	12.4	7.15	10.7	6.07	9.13				
Beam Properties											
W_c/Ω_b	$\phi_b W_c$, kip-ft	140	211	122	183	103	155	105	157	88.9	134
M_p/Ω_b	$\phi_b M_p$, kip-ft	17.5	26.3	15.2	22.8	12.9	19.4	13.1	19.7	11.1	16.7
M_r/Ω_b	$\phi_b M_r$, kip-ft	9.78	14.7	8.70	13.1	7.63	11.5	7.26	10.9	6.34	9.52
BF	BF, kips	0.620	0.932	0.664	0.998	0.674	1.01	0.413	0.620	0.458	0.688
V_n/Ω_v	$\phi_v V_n$, kips	37.9	57.0	28.4	42.7	19.0	28.6	33.9	51.0	24.4	36.6
Z_x, in.^{3}		9.75		8.46		7.19		7.29		6.18	
L_p, ft		2.34		2.37		2.40		2.18		2.20	
L_r, ft		14.8		12.1		10.2		16.3		12.6	

ASD	LRFD
$\Omega_b = 1.67$	$\phi_b = 0.90$
$\Omega_v = 1.67$	$\phi_v = 1.00$

Note: Beams must be laterally supported if Table 3–8 is used.
Available strength tabulated above heavy line is limited by available shear strength.

F_y = 36 ksi

Table 3–8 (continued)
Maximum Total Uniform Load, kips
C Shapes

C6–C4

Shape		C6×		C5×				C4×			
		8.2		9		6.7		7.2		5.4	
Design		ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft	2	31.0	46.7	31.6	47.4	24.6	36.9	20.4	30.7	16.5	24.8
	3	24.7	37.1	21.0	31.6	17.0	25.6	13.6	20.5	11.0	16.5
	4	18.5	27.8	15.8	23.7	12.8	19.2	10.2	15.3	8.24	12.4
	5	14.8	22.3	12.6	19.0	10.2	15.3	8.17	12.3	6.59	9.91
	6	12.4	18.6	10.5	15.8	8.50	12.8	6.81	10.2	5.49	8.26
	7	10.6	15.9	9.02	13.6	7.29	11.0	5.83	8.77	4.71	7.08
	8	9.26	13.9	7.89	11.9	6.38	9.58	5.10	7.67	4.12	6.19
	9	8.23	12.4	7.02	10.5	5.67	8.52	4.54	6.82	3.66	5.50
	10	7.41	11.1	6.31	9.49	5.10	7.67	4.08	6.14	3.30	4.95
	11	6.74	10.1	5.74	8.63	4.64	6.97				
	12	6.18	9.28	5.26	7.91	4.25	6.39				
	13	5.70	8.57								
	14	5.29	7.96								
	15	4.94	7.43								

Beam Properties

W_c/Ω_b	$\phi_b W_c$, kip-ft	74.1	111	63.1	94.9	51.0	76.7	40.8	61.4	33.0	49.5
M_p/Ω_b	$\phi_b M_p$, kip-ft	9.26	13.9	7.89	11.9	6.38	9.58	5.10	7.67	4.12	6.19
M_r/Ω_b	$\phi_b M_r$, kip-ft	5.48	8.23	4.47	6.72	3.76	5.66	2.88	4.33	2.42	3.64
BF	BF, kips	0.477	0.717	0.289	0.435	0.314	0.471	0.165	0.249	0.185	0.279
V_n/Ω_v	$\phi_v V_n$, kips	15.5	23.3	21.0	31.6	12.3	18.5	16.6	25.0	9.52	14.3
Z_x, in.^{3}		5.16		4.39		3.55		2.84		2.29	
L_p, ft		2.23		2.02		2.04		1.86		1.85	
L_r, ft		10.2		13.9		10.4		15.3		11.0	

ASD	LRFD
$\Omega_b = 1.67$ $\Omega_v = 1.67$	$\phi_b = 0.90$ $\phi_v = 1.00$

Note: Beams must be laterally supported if Table 3–8 is used.
Available strength tabulated above heavy line is limited by available shear strength.

C4–C3

Table 3–8 (continued)
Maximum Total Uniform Load, kips
C Shapes

F_y = 36 ksi

Shape		C4×		C3×							
		4.5		6		5		4.1		3.5	
Design		ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft	2	12.9	19.4	12.5	18.8	10.9	16.4	9.50	14.3	8.88	13.3
	3	10.2	15.3	8.34	12.5	7.28	10.9	6.33	9.52	5.92	8.90
	4	7.62	11.5	6.25	9.40	5.46	8.21	4.75	7.14	4.44	6.67
	5	6.10	9.16	5.00	7.52	4.37	6.56	3.80	5.71	3.55	5.34
	6	5.08	7.64	4.17	6.26	3.64	5.47	3.17	4.76	2.96	4.45
	7	4.35	6.54	3.57	5.37	3.12	4.69	2.71	4.08	2.54	3.81
	8	3.81	5.73								
	9	3.39	5.09								
	10	3.05	4.58								
Beam Properties											
W_c/Ω_b	$\phi_b W_c$, kip-ft	30.5	45.8	25.0	37.6	21.8	32.8	19.0	28.5	17.8	26.7
M_p/Ω_b	$\phi_b M_p$, kip-ft	3.81	5.73	3.13	4.70	2.73	4.10	2.37	3.57	2.22	3.34
M_r/Ω_b	$\phi_b M_r$, kip-ft	2.30	3.45	1.74	2.61	1.55	2.33	1.39	2.08	1.31	1.97
BF	BF, kips	0.185	0.278	0.0760	0.114	0.0860	0.129	0.0933	0.140	0.0952	0.143
V_n/Ω_v	$\phi_v V_n$, kips	6.47	9.72	13.8	20.8	10.0	15.0	6.60	9.91	5.12	7.70
Z_x, in.^{3}		2.12		1.74		1.52		1.32		1.24	
L_p, ft		1.90		1.72		1.69		1.66		1.64	
L_r, ft		10.1		20.0		15.4		12.3		11.2	

ASD	LRFD
$\Omega_b = 1.67$	$\phi_b = 0.90$
$\Omega_v = 1.67$	$\phi_v = 1.00$

Note: Beams must be laterally supported if Table 3–8 is used.
Available strength tabulated above heavy line is limited by available shear strength.

F_y = 36 ksi

Table 3–9
Maximum Total Uniform Load, kips
MC Shapes

MC18–MC13

Shape		MC18×								MC13×			
		58		51.9		45.8		42.7		50		40	
Design		ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft	3									265	398	188	283
	4	326	490	279	420	233	350			219	328	184	277
	5	274	412	251	377	228	342	210	315	175	263	147	221
	6	228	343	209	314	190	285	180	270	146	219	123	184
	7	196	294	179	269	163	244	154	232	125	188	105	158
	8	171	257	157	236	142	214	135	203	109	164	92.0	138
	9	152	229	139	209	126	190	120	180	97.1	146	81.8	123
	10	137	206	125	188	114	171	108	162	87.4	131	73.6	111
	11	125	187	114	171	103	155	98.1	147	79.5	119	66.9	101
	12	114	172	105	157	94.8	142	89.9	135	72.8	109	61.4	92.2
	13	105	158	96.5	145	87.5	132	83.0	125	67.2	101	56.6	85.1
	14	97.9	147	89.6	135	81.3	122	77.1	116	62.4	93.8	52.6	79.0
	15	91.4	137	83.6	126	75.8	114	72.0	108	58.3	87.6	49.1	73.8
	16	85.7	129	78.4	118	71.1	107	67.5	101	54.6	82.1	46.0	69.2
	17	80.6	121	73.8	111	66.9	101	63.5	95.4	51.4	77.3	43.3	65.1
	18	76.1	114	69.7	105	63.2	95.0	60.0	90.1	48.6	73.0	40.9	61.5
	19	72.1	108	66.0	99.2	59.9	90.0	56.8	85.4	46.0	69.1	38.7	58.2
	20	68.5	103	62.7	94.2	56.9	85.5	54.0	81.1	43.7	65.7	36.8	55.3
	21	65.3	98.1	59.7	89.8	54.2	81.4	51.4	77.3	41.6	62.6	35.1	52.7
	22	62.3	93.6	57.0	85.7	51.7	77.7	49.1	73.7	39.7	59.7	33.5	50.3
	23	59.6	89.6	54.5	81.9	49.5	74.3	46.9	70.5	38.0	57.1	32.0	48.1
	24	57.1	85.8	52.3	78.5	47.4	71.2	45.0	67.6	36.4	54.7	30.7	46.1
	25	54.8	82.4	50.2	75.4	45.5	68.4	43.2	64.9	35.0	52.5	29.4	44.3
	26	52.7	79.2	48.2	72.5	43.8	65.8	41.5	62.4	33.6	50.5	28.3	42.6
	27	50.8	76.3	46.4	69.8	42.1	63.3	40.0	60.1	32.4	48.7	27.3	41.0
	28	48.9	73.6	44.8	67.3	40.6	61.1	38.5	57.9	31.2	46.9	26.3	39.5
	29	47.3	71.0	43.2	65.0	39.2	59.0	37.2	55.9	30.1	45.3	25.4	38.2
	30	45.7	68.7	41.8	62.8	37.9	57.0	36.0	54.1	29.1	43.8	24.5	36.9
	32	42.8	64.4	39.2	58.9	35.5	53.4	33.7	50.7	27.3	41.1	23.0	34.6
	34	40.3	60.6	36.9	55.4	33.5	50.3	31.7	47.7				
	36	38.1	57.2	34.8	52.4	31.6	47.5	30.0	45.1				
	38	36.1	54.2	33.0	49.6	29.9	45.0	28.4	42.7				
	40	34.3	51.5	31.4	47.1	28.4	42.7	27.0	40.6				
	42	32.6	49.0	29.9	44.9	27.1	40.7	25.7	38.6				
	44	31.1	46.8	28.5	42.8	25.9	38.9	24.5	36.9				
Beam Properties													
W_c/Ω_b	$\phi_b W_c$, kip-ft	1370	2060	1250	1880	1140	1710	1080	1620	874	1310	736	1110
M_p/Ω_b	$\phi_b M_p$, kip-ft	171	257	157	236	142	214	135	203	109	164	92.0	138
M_r/Ω_b	$\phi_b M_r$, kip-ft	94.4	142	87.6	132	80.8	121	77.4	116	60.8	91.4	52.7	79.3
BF	BF, kips	5.18	7.78	5.25	7.89	5.21	7.84	5.14	7.73	2.09	3.15	2.29	3.44
V_n/Ω_v	$\phi_v V_n$, kips	163	245	140	210	116	175	105	157	132	199	94.2	142
Z_x, in.^{3}		95.4		87.3		79.2		75.1		60.8		51.2	
L_p, ft		4.23		4.30		4.39		4.44		4.40		4.49	
L_r, ft		19.1		17.5		16.2		15.6		27.6		21.7	

ASD	LRFD
Ω_b = 1.67	ϕ_b = 0.90
Ω_v = 1.67	ϕ_v = 1.00

Note: Beams must be laterally supported if Table 3–9 is used.
Available strength tabulated above heavy line is limited by available shear strength.

MC13–MC12

Table 3–9 (continued)
Maximum Total Uniform Load, kips
MC Shapes

F_y = 36 ksi

Shape		MC13×				MC12×							
		35		31.8		50		45		40		35	
Design		ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft	3					259	390	220	331	183	275		
	4	150	226	126	190	203	305	187	281	171	257	144	217
	5	134	201	125	188	162	244	149	225	137	206	124	186
	6	111	167	104	156	135	203	124	187	114	172	103	155
	7	95.4	143	89.1	134	116	174	107	160	97.8	147	88.6	133
	8	83.4	125	78.0	117	101	152	93.4	140	85.6	129	77.5	117
	9	74.2	111	69.3	104	90.2	136	83.0	125	76.1	114	68.9	104
	10	66.8	100	62.4	93.8	81.2	122	74.7	112	68.5	103	62.0	93.2
	11	60.7	91.2	56.7	85.2	73.8	111	67.9	102	62.3	93.6	56.4	84.7
	12	55.6	83.6	52.0	78.1	67.6	102	62.2	93.6	57.1	85.8	51.7	77.7
	13	51.4	77.2	48.0	72.1	62.4	93.8	57.5	86.4	52.7	79.2	47.7	71.7
	14	47.7	71.7	44.6	67.0	58.0	87.1	53.4	80.2	48.9	73.5	44.3	66.6
	15	44.5	66.9	41.6	62.5	54.1	81.3	49.8	74.8	45.7	68.6	41.3	62.1
	16	41.7	62.7	39.0	58.6	50.7	76.2	46.7	70.2	42.8	64.3	38.8	58.3
	17	39.3	59.0	36.7	55.2	47.7	71.8	43.9	66.0	40.3	60.6	36.5	54.8
	18	37.1	55.7	34.7	52.1	45.1	67.8	41.5	62.4	38.0	57.2	34.5	51.8
	19	35.1	52.8	32.8	49.4	42.7	64.2	39.3	59.1	36.0	54.2	32.6	49.1
	20	33.4	50.2	31.2	46.9	40.6	61.0	37.3	56.1	34.2	51.5	31.0	46.6
	21	31.8	47.8	29.7	44.7	38.7	58.1	35.6	53.5	32.6	49.0	29.5	44.4
	22	30.3	45.6	28.4	42.6	36.9	55.5	34.0	51.0	31.1	46.8	28.2	42.4
	23	29.0	43.6	27.1	40.8	35.3	53.0	32.5	48.8	29.8	44.8	27.0	40.5
	24	27.8	41.8	26.0	39.1	33.8	50.8	31.1	46.8	28.5	42.9	25.8	38.8
	25	26.7	40.1	25.0	37.5	32.5	48.8	29.9	44.9	27.4	41.2	24.8	37.3
	26	25.7	38.6	24.0	36.1	31.2	46.9	28.7	43.2	26.3	39.6	23.9	35.9
	27	24.7	37.2	23.1	34.7	30.1	45.2	27.7	41.6	25.4	38.1	23.0	34.5
	28	23.8	35.8	22.3	33.5	29.0	43.6	26.7	40.1	24.5	36.8	22.2	33.3
	29	23.0	34.6	21.5	32.3	28.0	42.1	25.8	38.7	23.6	35.5	21.4	32.1
	30	22.3	33.4	20.8	31.3	27.1	40.7	24.9	37.4	22.8	34.3	20.7	31.1
	32	20.9	31.4	19.5	29.3								
Beam Properties													
W_c/Ω_b	$\phi_b W_c$, kip-ft	668	1000	624	938	812	1220	747	1120	685	1030	620	932
M_p/Ω_b	$\phi_b M_p$, kip-ft	83.4	125	78.0	117	101	152	93.4	140	85.6	129	77.5	117
M_r/Ω_b	$\phi_b M_r$, kip-ft	48.7	73.3	46.2	69.4	56.5	84.9	52.7	79.2	49.1	73.7	45.3	68.1
BF	BF, kips	2.33	3.50	2.32	3.48	1.66	2.50	1.77	2.66	1.86	2.80	1.92	2.88
V_n/Ω_v	$\phi_v V_n$, kips	75.2	113	63.1	94.8	130	195	110	166	91.6	138	72.2	108
Z_x, in.^{3}		46.5		43.4		56.5		52.0		47.7		43.2	
L_p, ft		4.55		4.59		4.53		4.55		4.58		4.61	
L_r, ft		19.5		18.3		31.6		27.5		24.2		21.4	

ASD	LRFD
$\Omega_b = 1.67$	$\phi_b = 0.90$
$\Omega_v = 1.67$	$\phi_v = 1.00$

Note: Beams must be laterally supported if Table 3–9 is used.
Available strength tabulated above heavy line is limited by available shear strength.

F_y = 36 ksi

Table 3–9 (continued)
Maximum Total Uniform Load, kips
MC Shapes

MC12–MC10

Shape		MC12×				MC10×							
		31		10.6		41.1		33.6		28.5		25	
Design		ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft	2			59.0	88.6	206	309						
	3			55.7	83.7	188	283	149	224	110	165	98.3	148
	4	115	173	41.8	62.8	141	212	121	182	108	162	94.0	141
	5	114	172	33.4	50.2	113	170	97.0	146	86.2	130	75.2	113
	6	95.2	143	27.9	41.9	94.1	141	80.8	121	71.8	108	62.7	94.2
	7	81.6	123	23.9	35.9	80.6	121	69.3	104	61.6	92.6	53.7	80.7
	8	71.4	107	20.9	31.4	70.5	106	60.6	91.1	53.9	81.0	47.0	70.6
	9	63.5	95.4	18.6	27.9	62.7	94.2	53.9	81.0	47.9	72.0	41.8	62.8
	10	57.1	85.8	16.7	25.1	56.4	84.8	48.5	72.9	43.1	64.8	37.6	56.5
	11	51.9	78.0	15.2	22.8	51.3	77.1	44.1	66.3	39.2	58.9	34.2	51.4
	12	47.6	71.5	13.9	20.9	47.0	70.7	40.4	60.7	35.9	54.0	31.3	47.1
	13	43.9	66.0	12.9	19.3	43.4	65.2	37.3	56.1	33.2	49.8	28.9	43.5
	14	40.8	61.3	11.9	17.9	40.3	60.6	34.6	52.1	30.8	46.3	26.9	40.4
	15	38.1	57.2	11.1	16.7	37.6	56.5	32.3	48.6	28.7	43.2	25.1	37.7
	16	35.7	53.6	10.4	15.7	35.3	53.0	30.3	45.6	26.9	40.5	23.5	35.3
	17	33.6	50.5	9.83	14.8	33.2	49.9	28.5	42.9	25.4	38.1	22.1	33.2
	18	31.7	47.7	9.29	14.0	31.4	47.1	26.9	40.5	23.9	36.0	20.9	31.4
	19	30.1	45.2	8.80	13.2	29.7	44.6	25.5	38.4	22.7	34.1	19.8	29.7
	20	28.6	42.9	8.36	12.6	28.2	42.4	24.2	36.4	21.6	32.4	18.8	28.3
	21	27.2	40.9	7.96	12.0	26.9	40.4	23.1	34.7	20.5	30.9	17.9	26.9
	22	26.0	39.0	7.60	11.4	25.7	38.6	22.0	33.1	19.6	29.4	17.1	25.7
	23	24.8	37.3	7.27	10.9	24.5	36.9	21.1	31.7	18.7	28.2	16.3	24.6
	24	23.8	35.8	6.96	10.5	23.5	35.3	20.2	30.4	18.0	27.0	15.7	23.5
	25	22.8	34.3	6.69	10.0	22.6	33.9	19.4	29.2	17.2	25.9	15.0	22.6
	26	22.0	33.0	6.43	9.66								
	27	21.2	31.8	6.19	9.31								
	28	20.4	30.7	5.97	8.97								
	29	19.7	29.6	5.76	8.66								
	30	19.0	28.6	5.57	8.37								
Beam Properties													
W_c/Ω_b	$\phi_b W_c$, kip-ft	571	858	167	251	564	848	485	729	431	648	376	565
M_p/Ω_b	$\phi_b M_p$, kip-ft	71.4	107	20.9	31.4	70.5	106	60.6	91.1	53.9	81.0	47.0	70.6
M_r/Ω_b	$\phi_b M_r$, kip-ft	42.4	63.8	11.6	17.4	39.6	59.5	34.9	52.5	31.8	47.8	27.7	41.6
BF	BF, kips	1.91	2.88	2.76	4.16	1.00	1.50	1.14	1.71	1.22	1.83	1.29	1.94
V_n/Ω_v	$\phi_v V_n$, kips	57.4	86.3	29.5	44.3	103	155	74.4	112	55.0	82.6	49.1	73.9
Z_x, in.^{3}		39.7		11.6		39.3		33.7		30.0		26.2	
L_p, ft		4.63		1.45		4.74		4.80		4.84		4.13	
L_r, ft		19.8		4.82		35.7		27.3		23.0		19.1	

ASD	LRFD	
$\Omega_b = 1.67$ $\Omega_v = 1.67$	$\phi_b = 0.90$ $\phi_v = 1.00$	Note: Beams must be laterally supported if Table 3–9 is used. Available strength tabulated above heavy line is limited by available shear strength.

Table 3–9 (continued)
Maximum Total Uniform Load, kips
MC Shapes

MC10–MC8

F_y = 36 ksi

Shape		MC10×						MC9×				MC8×	
		22		8.4		6.5		25.4		23.9		22.8	
Design		ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft	2			44.0	66.1	39.3	59.1						
	3			37.9	57.0	28.3	42.5	105	157	93.1	140	88.4	133
	4	75.0	113	28.4	42.8	21.2	31.9	84.4	127	80.8	121	68.5	103
	5	68.7	103	22.8	34.2	17.0	25.5	67.5	102	64.6	97.1	54.8	82.3
	6	57.3	86.1	19.0	28.5	14.1	21.2	56.3	84.6	53.9	81.0	45.6	68.6
	7	49.1	73.8	16.3	24.4	12.1	18.2	48.2	72.5	46.2	69.4	39.1	58.8
	8	43.0	64.6	14.2	21.4	10.6	15.9	42.2	63.5	40.4	60.7	34.2	51.4
	9	38.2	57.4	12.6	19.0	9.42	14.2	37.5	56.4	35.9	54.0	30.4	45.7
	10	34.4	51.7	11.4	17.1	8.48	12.7	33.8	50.8	32.3	48.6	27.4	41.2
	11	31.2	47.0	10.3	15.5	7.71	11.6	30.7	46.1	29.4	44.2	24.9	37.4
	12	28.6	43.0	9.48	14.3	7.06	10.6	28.1	42.3	26.9	40.5	22.8	34.3
	13	26.4	39.7	8.75	13.2	6.52	9.80	26.0	39.0	24.9	37.4	21.1	31.7
	14	24.5	36.9	8.13	12.2	6.06	9.10	24.1	36.3	23.1	34.7	19.6	29.4
	15	22.9	34.4	7.59	11.4	5.65	8.49	22.5	33.8	21.5	32.4	18.3	27.4
	16	21.5	32.3	7.11	10.7	5.30	7.96	21.1	31.7	20.2	30.4	17.1	25.7
	17	20.2	30.4	6.69	10.1	4.99	7.49	19.9	29.9	19.0	28.6	16.1	24.2
	18	19.1	28.7	6.32	9.50	4.71	7.08	18.8	28.2	18.0	27.0	15.2	22.9
	19	18.1	27.2	5.99	9.00	4.46	6.71	17.8	26.7	17.0	25.6	14.4	21.7
	20	17.2	25.8	5.69	8.55	4.24	6.37	16.9	25.4	16.2	24.3	13.7	20.6
	21	16.4	24.6	5.42	8.14	4.04	6.07	16.1	24.2	15.4	23.1		
	22	15.6	23.5	5.17	7.77	3.85	5.79	15.4	23.1	14.7	22.1		
	23	14.9	22.5	4.95	7.44	3.69	5.54						
	24	14.3	21.5	4.74	7.13	3.53	5.31						
	25	13.7	20.7	4.55	6.84	3.39	5.10						
Beam Properties													
W_c/Ω_b	$\phi_b W_c$, kip-ft	344	517	114	171	84.8	127	338	508	323	486	274	412
M_p/Ω_b	$\phi_b M_p$, kip-ft	43.0	64.6	14.2	21.4	10.6	15.9	42.2	63.5	40.4	60.7	34.2	51.4
M_r/Ω_b	$\phi_b M_r$, kip-ft	25.8	38.7	8.03	12.1	5.77	8.67	24.6	36.9	23.7	35.7	20.0	30.1
BF	BF, kips	1.29	1.93	1.76	2.65	1.94	2.92	0.966	1.45	0.983	1.48	0.720	1.08
V_n/Ω_v	$\phi_v V_n$, kips	37.5	56.4	22.0	33.0	19.7	29.5	52.4	78.7	46.6	70.0	44.2	66.4
Z_x, in.^{3}		23.9		7.92		5.90		23.5		22.5		19.1	
L_p, ft		4.15		1.52		1.09		4.19		4.20		4.26	
L_r, ft		17.5		5.03		3.58		22.5		21.2		24.0	

ASD	LRFD
Ω_b = 1.67	ϕ_b = 0.90
Ω_v = 1.67	ϕ_v = 1.00

Note: Beams must be laterally supported if Table 3–9 is used.
Available strength tabulated above heavy line is limited by available shear strength.

F_y = 36 ksi

Table 3–9 (continued)
Maximum Total Uniform Load, kips
MC Shapes

MC8–MC7

Shape	MC8× 21.4		MC8× 20		MC8× 18.7		MC8× 8.5		MC7× 22.7		MC7× 19.1	
Design	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft 2			82.8	124			37.0	55.7	91.1	137		
3	77.6	117	78.5	118	73.1	110	33.3	50.0	78.4	118	63.7	95.8
4	65.5	98.4	58.9	88.5	56.2	84.5	25.0	37.5	58.8	88.3	52.1	78.4
5	52.4	78.7	47.1	70.8	45.0	67.6	20.0	30.0	47.0	70.7	41.7	62.7
6	43.6	65.6	39.3	59.0	37.5	56.3	16.6	25.0	39.2	58.9	34.8	52.2
7	37.4	56.2	33.7	50.6	32.1	48.3	14.3	21.4	33.6	50.5	29.8	44.8
8	32.7	49.2	29.5	44.3	28.1	42.2	12.5	18.8	29.4	44.2	26.1	39.2
9	29.1	43.7	26.2	39.3	25.0	37.5	11.1	16.7	26.1	39.3	23.2	34.8
10	26.2	39.4	23.6	35.4	22.5	33.8	9.98	15.0	23.5	35.3	20.9	31.3
11	23.8	35.8	21.4	32.2	20.4	30.7	9.07	13.6	21.4	32.1	19.0	28.5
12	21.8	32.8	19.6	29.5	18.7	28.2	8.32	12.5	19.6	29.4	17.4	26.1
13	20.1	30.3	18.1	27.2	17.3	26.0	7.68	11.5	18.1	27.2	16.0	24.1
14	18.7	28.1	16.8	25.3	16.1	24.1	7.13	10.7	16.8	25.2	14.9	22.4
15	17.5	26.2	15.7	23.6	15.0	22.5	6.65	10.0	15.7	23.6	13.9	20.9
16	16.4	24.6	14.7	22.1	14.1	21.1	6.24	9.38	14.7	22.1	13.0	19.6
17	15.4	23.2	13.9	20.8	13.2	19.9	5.87	8.83	13.8	20.8	12.3	18.4
18	14.5	21.9	13.1	19.7	12.5	18.8	5.55	8.33				
19	13.8	20.7	12.4	18.6	11.8	17.8	5.25	7.90				
20	13.1	19.7	11.8	17.7	11.2	16.9	4.99	7.50				

Beam Properties

ASD	LRFD	MC8× 21.4 ASD	LRFD	MC8× 20 ASD	LRFD	MC8× 18.7 ASD	LRFD	MC8× 8.5 ASD	LRFD	MC7× 22.7 ASD	LRFD	MC7× 19.1 ASD	LRFD
W_c/Ω_b	$\phi_b W_c$, kip-ft	262	394	236	354	225	338	99.8	150	235	353	209	313
M_p/Ω_b	$\phi_b M_p$, kip-ft	32.7	49.2	29.5	44.3	28.1	42.2	12.5	18.8	29.4	44.2	26.1	39.2
M_r/Ω_b	$\phi_b M_r$, kip-ft	19.3	29.1	17.1	25.7	16.5	24.8	7.32	11.0	17.0	25.6	15.5	23.3
BF	BF, kips	0.735	1.10	0.769	1.16	0.783	1.18	0.967	1.45	0.488	0.734	0.530	0.797
V_n/Ω_v	$\phi_v V_n$, kips	38.8	58.3	41.4	62.2	36.5	54.9	18.5	27.8	45.5	68.4	31.9	47.9

Property	MC8× 21.4	MC8× 20	MC8× 18.7	MC8× 8.5	MC7× 22.7	MC7× 19.1
Z_x, in.^{3}	18.2	16.4	15.6	6.95	16.4	14.5
L_p, ft	4.26	3.61	3.62	2.08	4.34	4.32
L_r, ft	22.5	19.7	18.5	7.42	29.6	24.3

ASD	LRFD
$\Omega_b = 1.67$	$\phi_b = 0.90$
$\Omega_v = 1.67$	$\phi_v = 1.00$

Note: Beams must be laterally supported if Table 3–9 is used.
Available strength tabulated above heavy line is limited by available shear strength.

Table 3–9 (continued)
Maximum Total Uniform Load, kips
MC Shapes

MC6

F_y = 36 ksi

Shape	MC6×									
	18		15.3		16.3		15.1		12	
Design	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft 2	58.8	88.4	52.8	79.3	58.2	87.5	49.0	73.7	48.1	72.3
3	56.1	84.3	47.5	71.4	49.6	74.6	47.1	70.8	35.8	53.8
4	42.1	63.2	35.6	53.5	37.2	56.0	35.3	53.1	26.8	40.3
5	33.7	50.6	28.5	42.8	29.8	44.8	28.3	42.5	21.5	32.3
6	28.0	42.2	23.7	35.7	24.8	37.3	23.5	35.4	17.9	26.9
7	24.0	36.1	20.3	30.6	21.3	32.0	20.2	30.3	15.3	23.1
8	21.0	31.6	17.8	26.8	18.6	28.0	17.7	26.5	13.4	20.2
9	18.7	28.1	15.8	23.8	16.5	24.9	15.7	23.6	11.9	17.9
10	16.8	25.3	14.2	21.4	14.9	22.4	14.1	21.2	10.7	16.1
11	15.3	23.0	12.9	19.5	13.5	20.3	12.8	19.3	9.76	14.7
12	14.0	21.1	11.9	17.8	12.4	18.7	11.8	17.7	8.95	13.4
13	12.9	19.5	11.0	16.5	11.5	17.2	10.9	16.3	8.26	12.4
14	12.0	18.1	10.2	15.3	10.6	16.0	10.1	15.2	7.67	11.5
15	11.2	16.9	9.49	14.3	9.93	14.9	9.42	14.2	7.16	10.8

Beam Properties

ASD	LRFD	18 ASD	18 LRFD	15.3 ASD	15.3 LRFD	16.3 ASD	16.3 LRFD	15.1 ASD	15.1 LRFD	12 ASD	12 LRFD
W_c/Ω_b	$\phi_b W_c$, kip-ft	168	253	142	214	149	224	141	212	107	161
M_p/Ω_b	$\phi_b M_p$, kip-ft	21.0	31.6	17.8	26.8	18.6	28.0	17.7	26.5	13.4	20.2
M_r/Ω_b	$\phi_b M_r$, kip-ft	12.4	18.7	10.6	16.0	10.9	16.4	10.4	15.7	7.84	11.8
BF	BF, kips	0.356	0.536	0.372	0.559	0.371	0.557	0.381	0.572	0.416	0.625
V_n/Ω_v	$\phi_v V_n$, kips	29.4	44.2	26.4	39.7	29.1	43.7	24.5	36.9	24.1	36.2

	18	15.3	16.3	15.1	12
Z_x, in.^{3}	11.7	9.91	10.4	9.83	7.47
L_p, ft	4.39	4.36	3.69	3.68	3.02
L_r, ft	28.5	23.7	24.5	22.6	16.4

ASD	LRFD
$\Omega_b = 1.67$	$\phi_b = 0.90$
$\Omega_v = 1.67$	$\phi_v = 1.00$

Note: Beams must be laterally supported if Table 3–9 is used.
Available strength tabulated above heavy line is limited by available shear strength.

F_y = 36 ksi

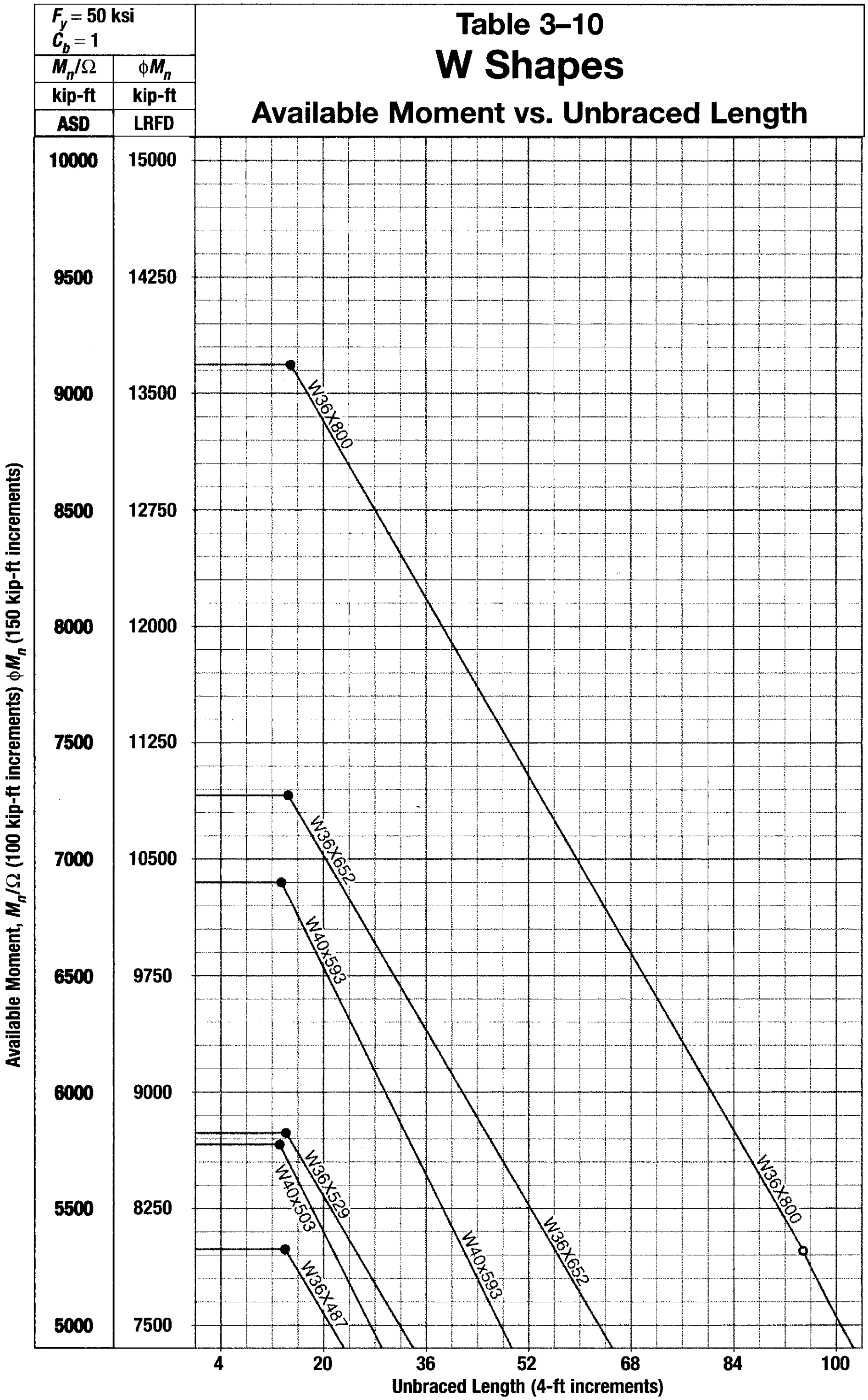
Table 3-9 (continued)
Maximum Total Uniform Load, kips
MC Shapes

MC6–MC3

Shape		MC6×				MC4×		MC3×	
		7		6.5		13.8		7.1	
Design		ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Span, ft	2	27.8	41.8	24.1	36.2	39.8	59.8	16.1	24.2
	3	21.6	32.4	20.5	30.8	26.5	39.9	10.7	16.1
	4	16.2	24.3	15.4	23.1	19.9	29.9	8.04	12.1
	5	12.9	19.4	12.3	18.5	15.9	23.9	6.44	9.67
	6	10.8	16.2	10.3	15.4	13.3	19.9	5.36	8.06
	7	9.24	13.9	8.79	13.2	11.4	17.1	4.60	6.91
	8	8.09	12.2	7.69	11.6	9.94	14.9		
	9	7.19	10.8	6.84	10.3	8.84	13.3		
	10	6.47	9.72	6.16	9.25	7.95	12.0		
	11	5.88	8.84	5.60	8.41				
	12	5.39	8.10	5.13	7.71				
	13	4.98	7.48	4.73	7.12				
	14	4.62	6.94	4.40	6.61				
	15	4.31	6.48	4.10	6.17				
Beam Properties									
W_c/Ω_b	$\phi_b W_c$, kip-ft	64.7	97.2	61.6	92.5	79.5	120	32.2	48.4
M_p/Ω_b	$\phi_b M_p$, kip-ft	8.09	12.2	7.69	11.6	9.94	14.9	4.02	6.05
M_r/Ω_b	$\phi_b M_r$, kip-ft	4.79	7.20	4.60	6.92	5.57	8.36	2.28	3.42
BF	BF, kips	0.490	0.736	0.486	0.730	0.126	0.190	0.0747	0.112
V_n/Ω_v	$\phi_v V_n$, kips	13.9	20.9	12.0	18.1	25.9	38.9	12.1	18.2
Z_x, in.^{3}		4.50		4.28		5.53		2.24	
L_p, ft		2.23		2.24		3.03		2.34	
L_r, ft		8.97		8.60		37.7		25.7	

ASD	LRFD
$\Omega_b = 1.67$ $\Omega_v = 1.67$	$\phi_b = 0.90$ $\phi_v = 1.00$

Note: Beams must be laterally supported if Table 3–9 is used.
Available strength tabulated above heavy line is limited by available shear strength.



F_y = 50 ksi
C_b = 1
M_n/Ω
ϕM_n
kip-ft
kip-ft
ASD
LRFD
Table 3–10
W Shapes
Available Moment vs. Unbraced Length
10000 15000
9500 14250
9000 13500
8500 12750
8000 12000
7500 11250
7000 10500
6500 9750
6000 9000
5500 8250
5000 7500
Available Moment, M_n/Ω (100 kip-ft increments) ϕM_n (150 kip-ft increments)
W36X800
W36X652
W40x593
W36X529
W40x503
W36X487
4
20
36
52
68
84
100
Unbraced Length (4-ft increments)

Table 3–10 (continued)
W Shapes
Available Moment vs. Unbraced Length

F_y = 50 ksi
C_b = 1

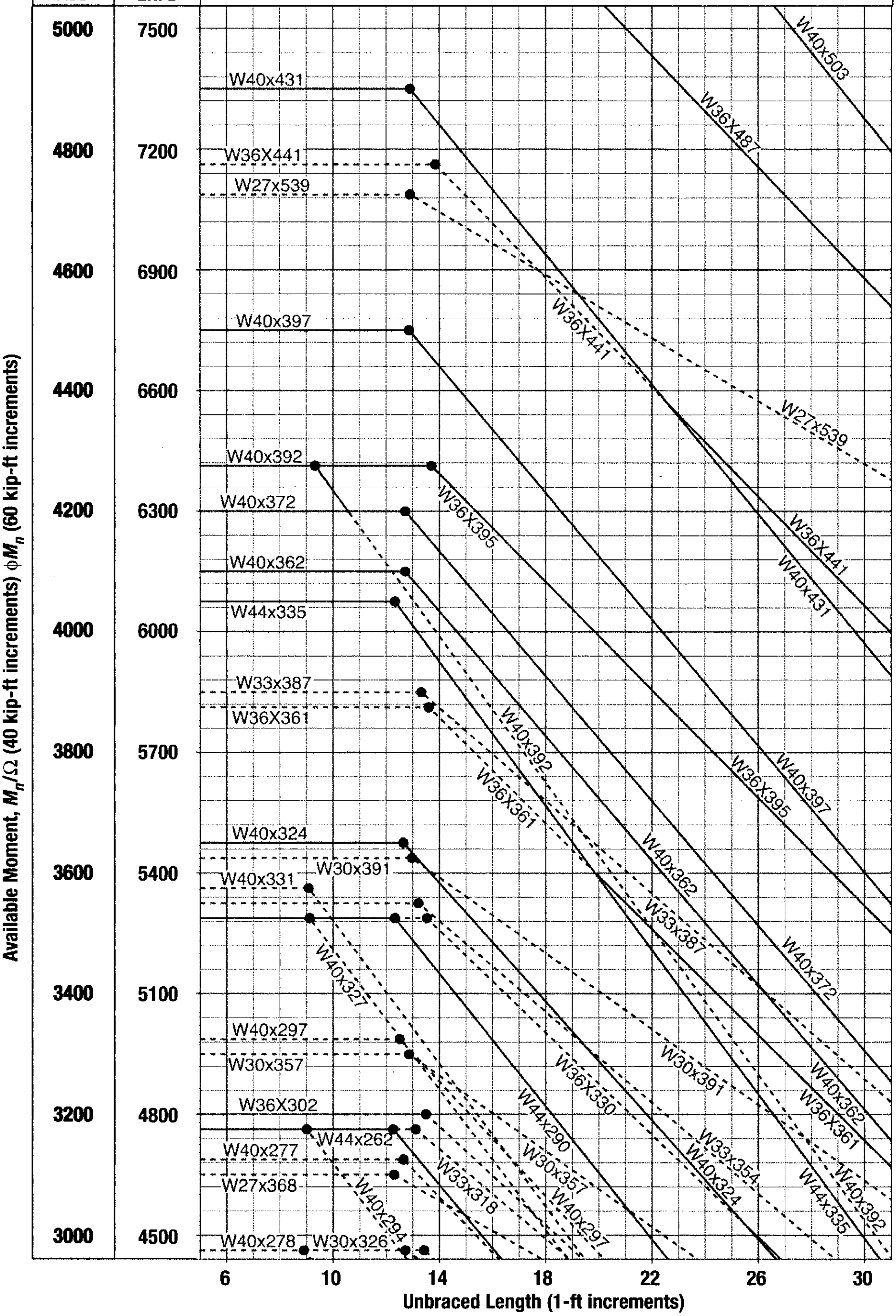


Table 3–10 (continued)
W Shapes
Available Moment vs. Unbraced Length

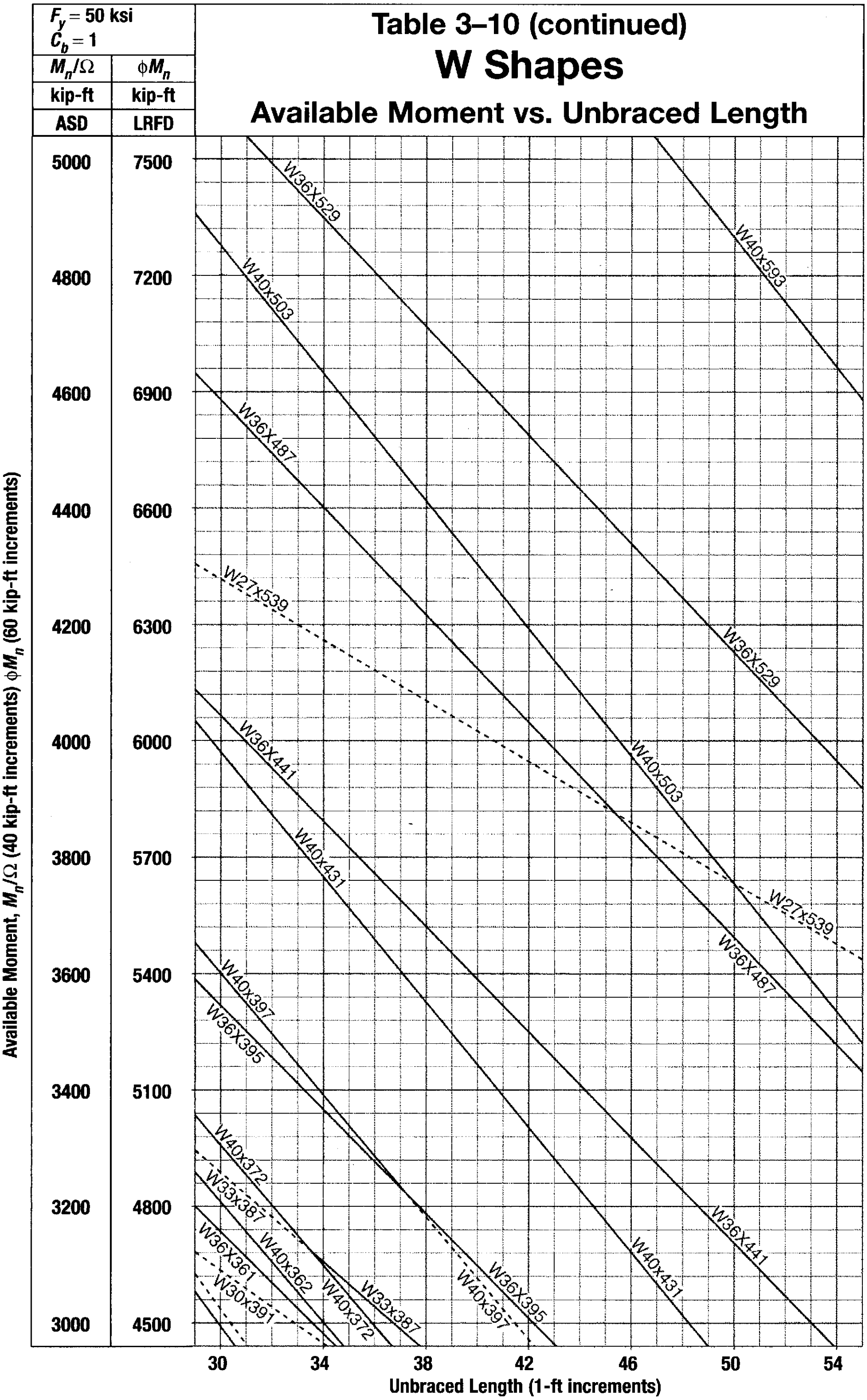
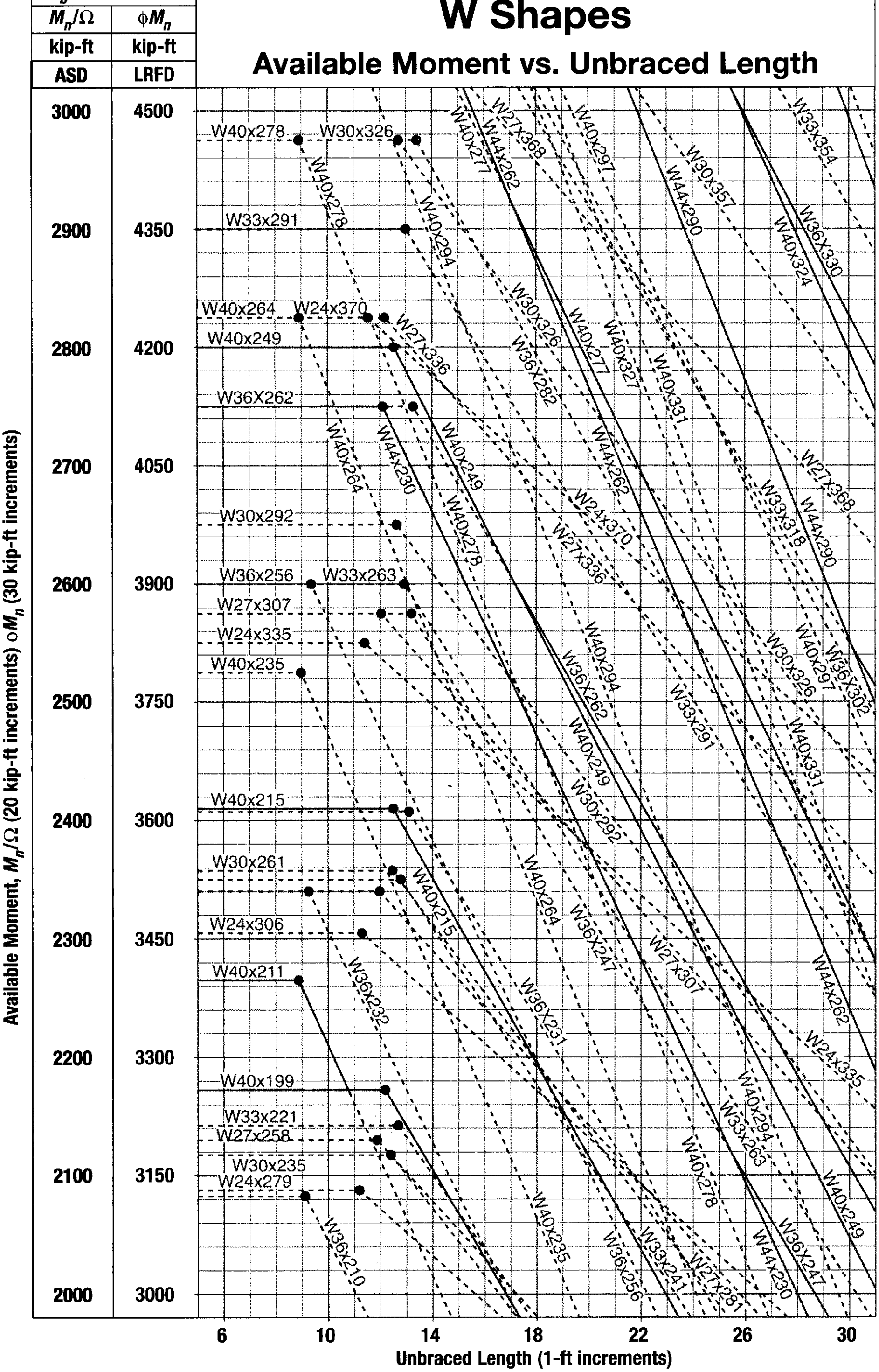


Table 3–10 (continued)
W Shapes
Available Moment vs. Unbraced Length

F_y = 50 ksi
C_b = 1



F_y = 50 ksi
C_b = 1

Table 3–10 (continued)
W Shapes
Available Moment vs. Unbraced Length

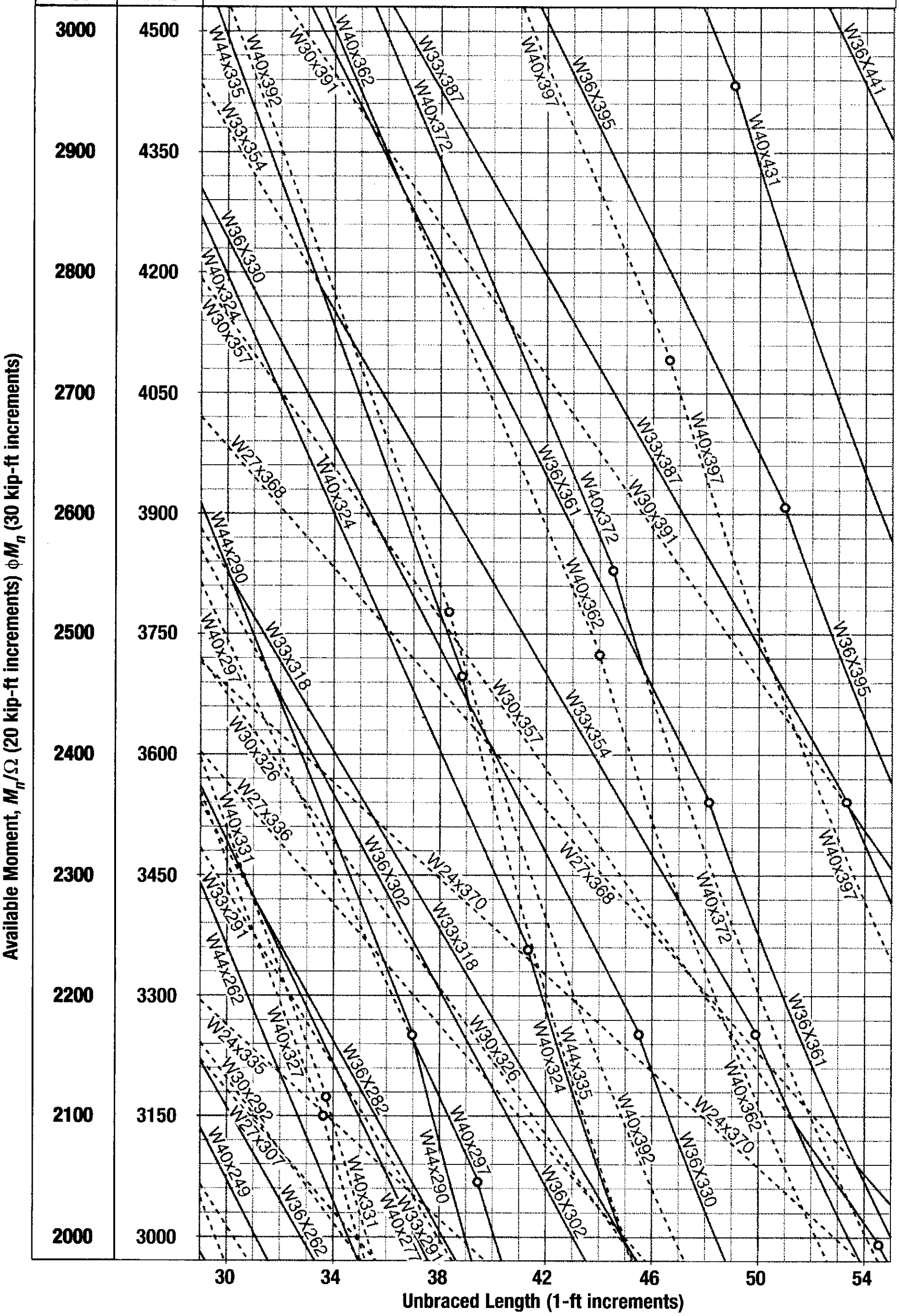
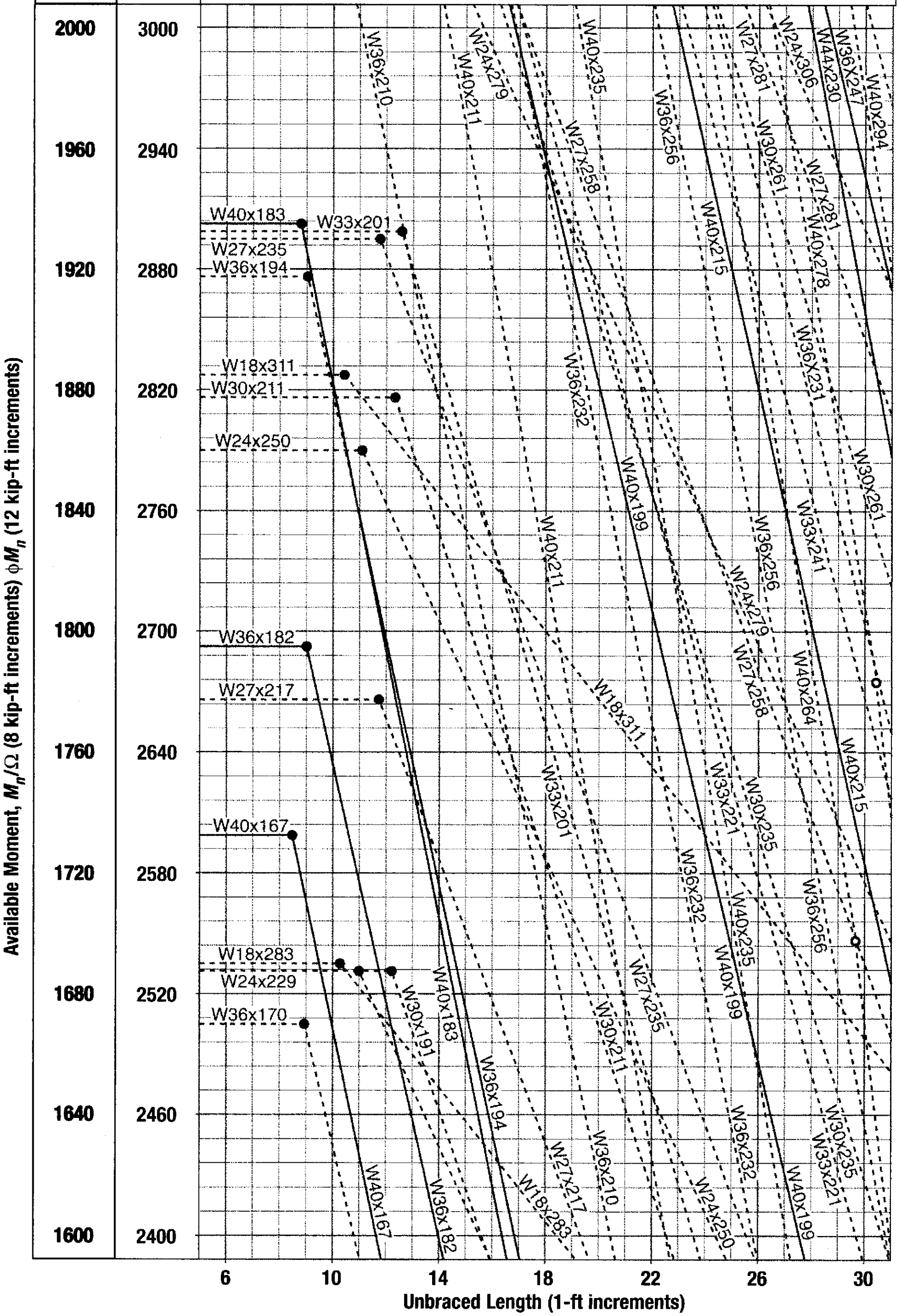
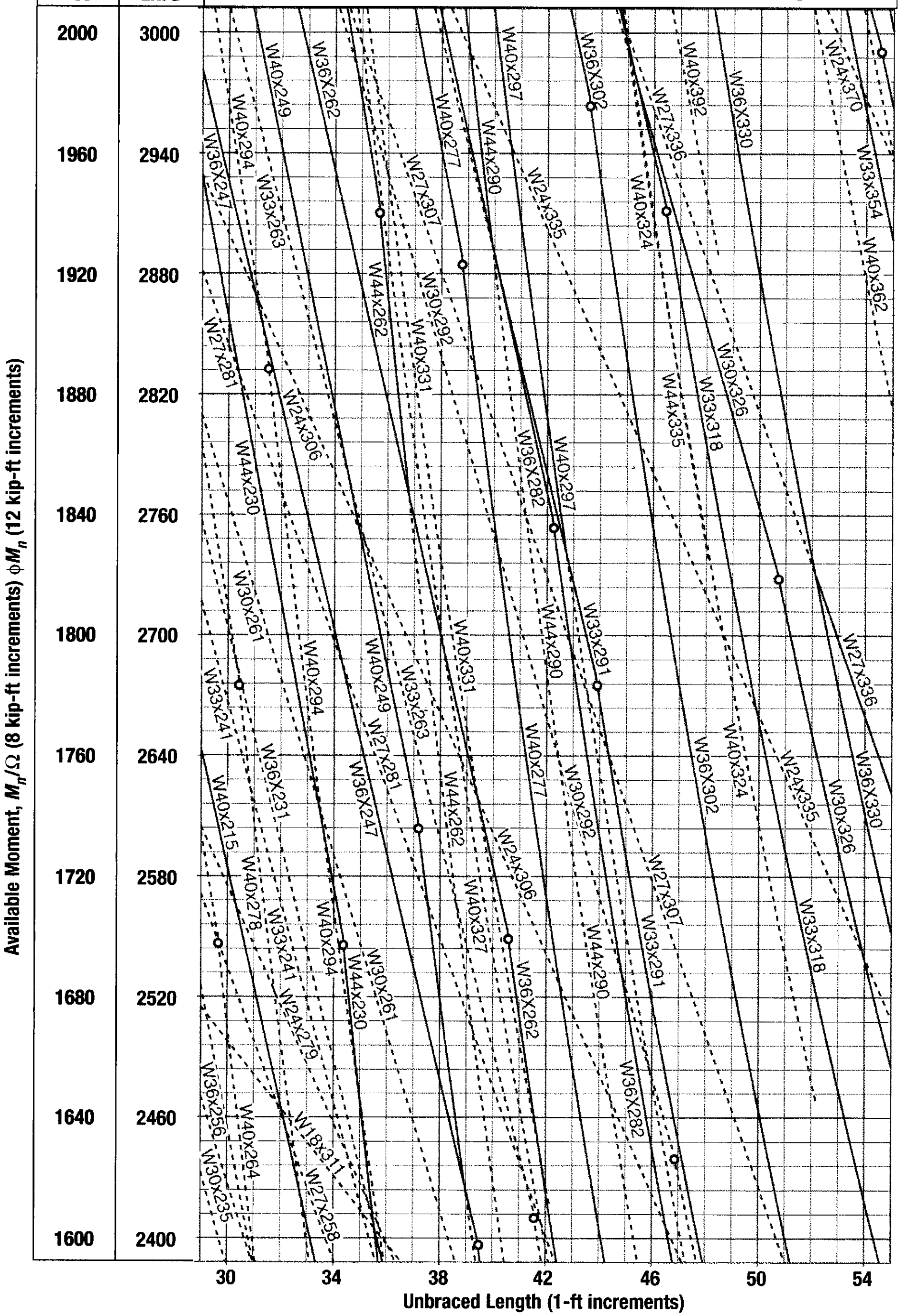


Table 3–10 (continued)
W Shapes
Available Moment vs. Unbraced Length

F_y = 50 ksi
C_b = 1



F_y = 50 ksi C_b = 1		Table 3–10 (continued)
M_n/Ω	ϕM_n	**W Shapes**
kip-ft	kip-ft	
ASD	LRFD	**Available Moment vs. Unbraced Length**



F_y = 50 ksi
C_b = 1

M_n/Ω	ϕM_n
kip-ft	kip-ft
ASD	LRFD

Table 3–10 (continued)
W Shapes
Available Moment vs. Unbraced Length

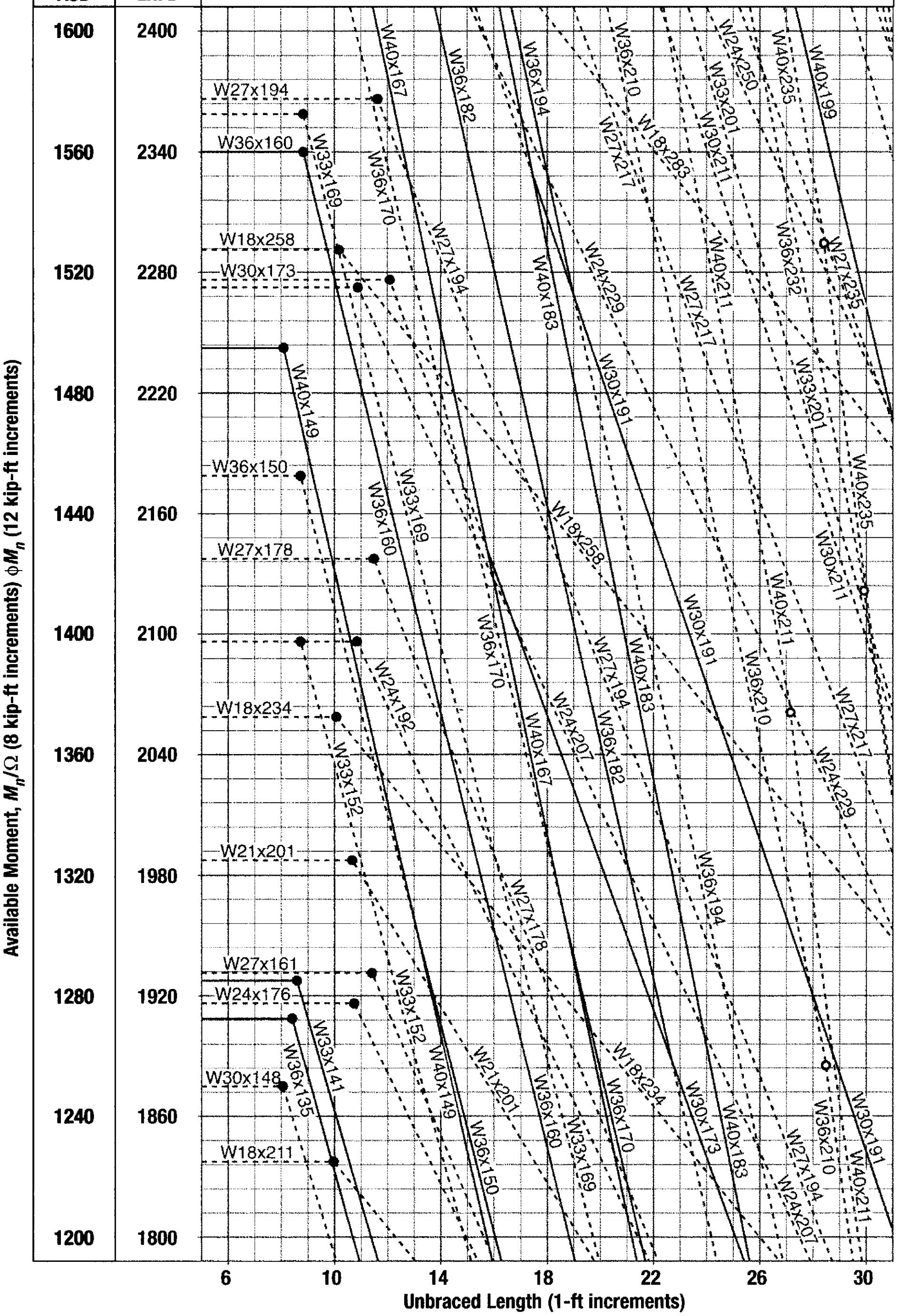
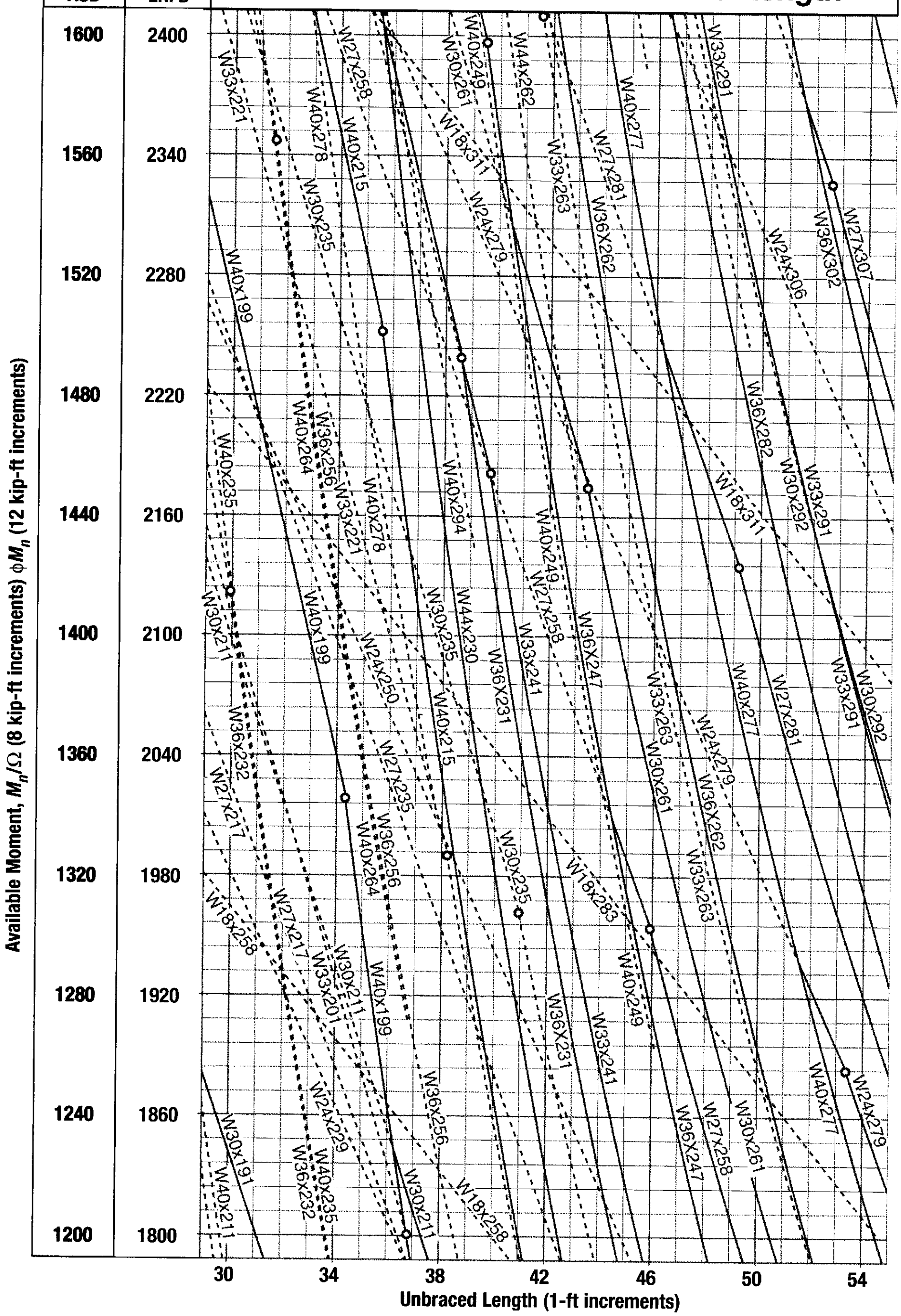


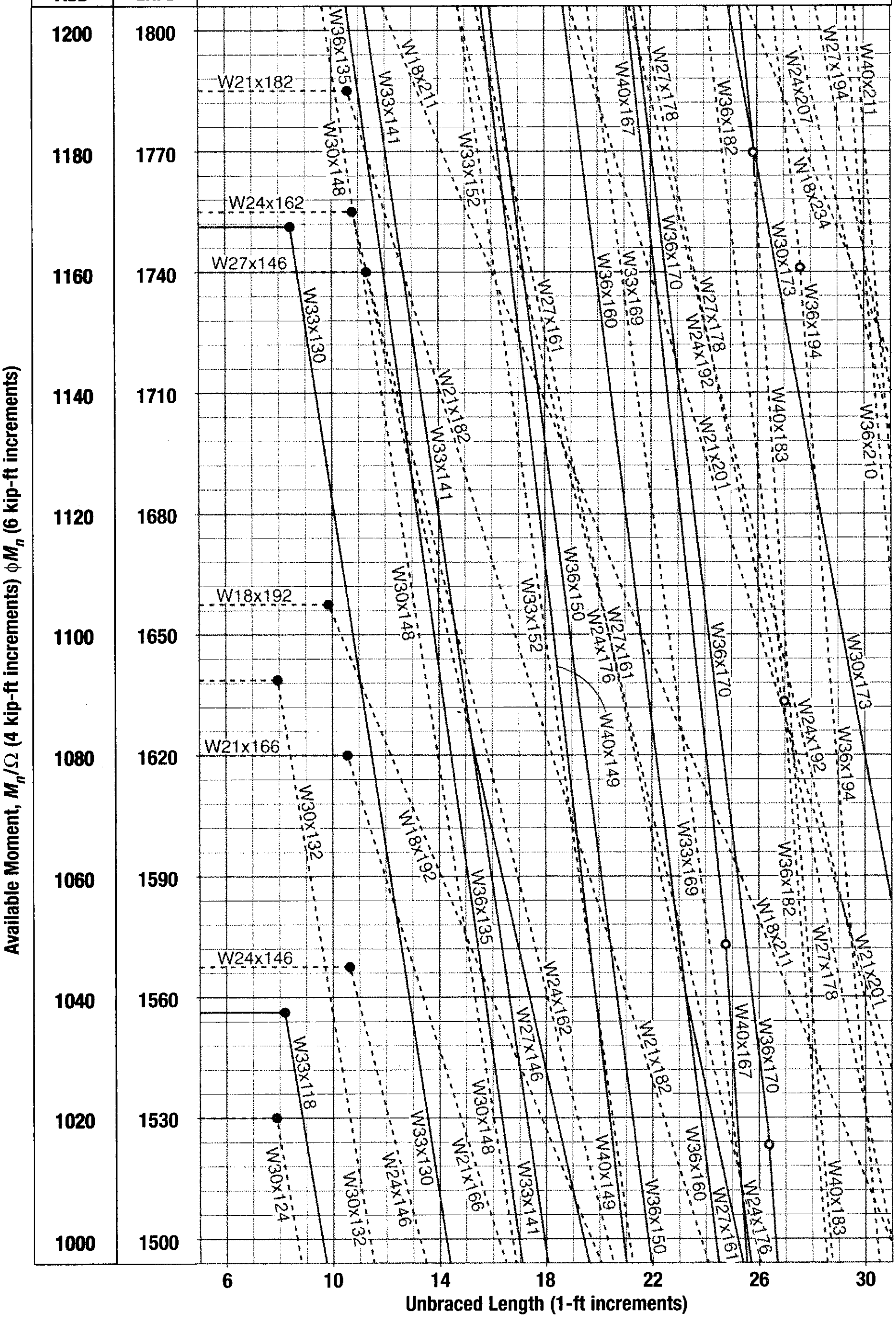
Table 3–10 (continued)
W Shapes
Available Moment vs. Unbraced Length

F_y = 50 ksi, C_b = 1



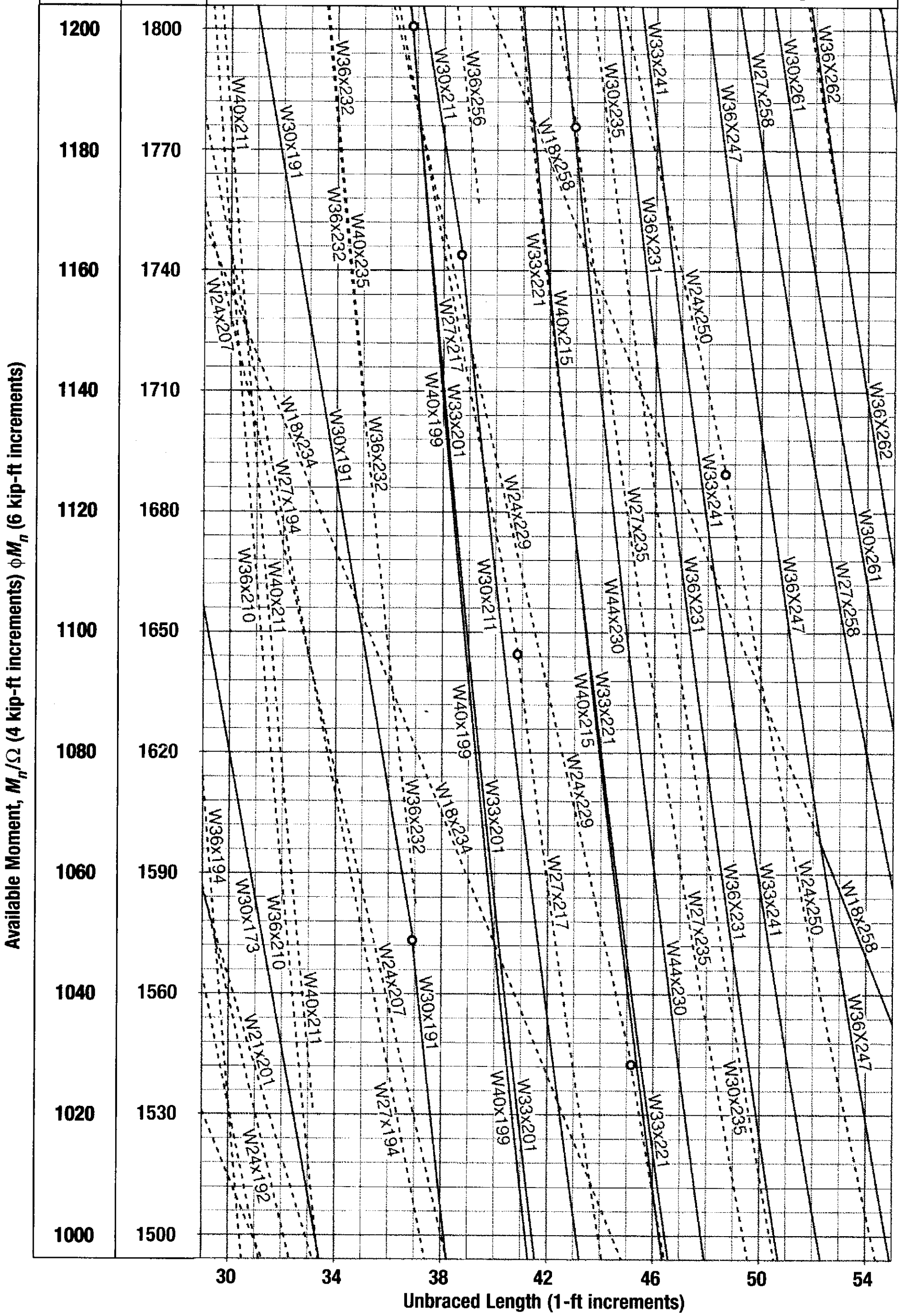
F_y = 50 ksi C_b = 1	
M_n/Ω	ϕM_n
kip-ft	kip-ft
ASD	LRFD

Table 3–10 (continued)
W Shapes
Available Moment vs. Unbraced Length

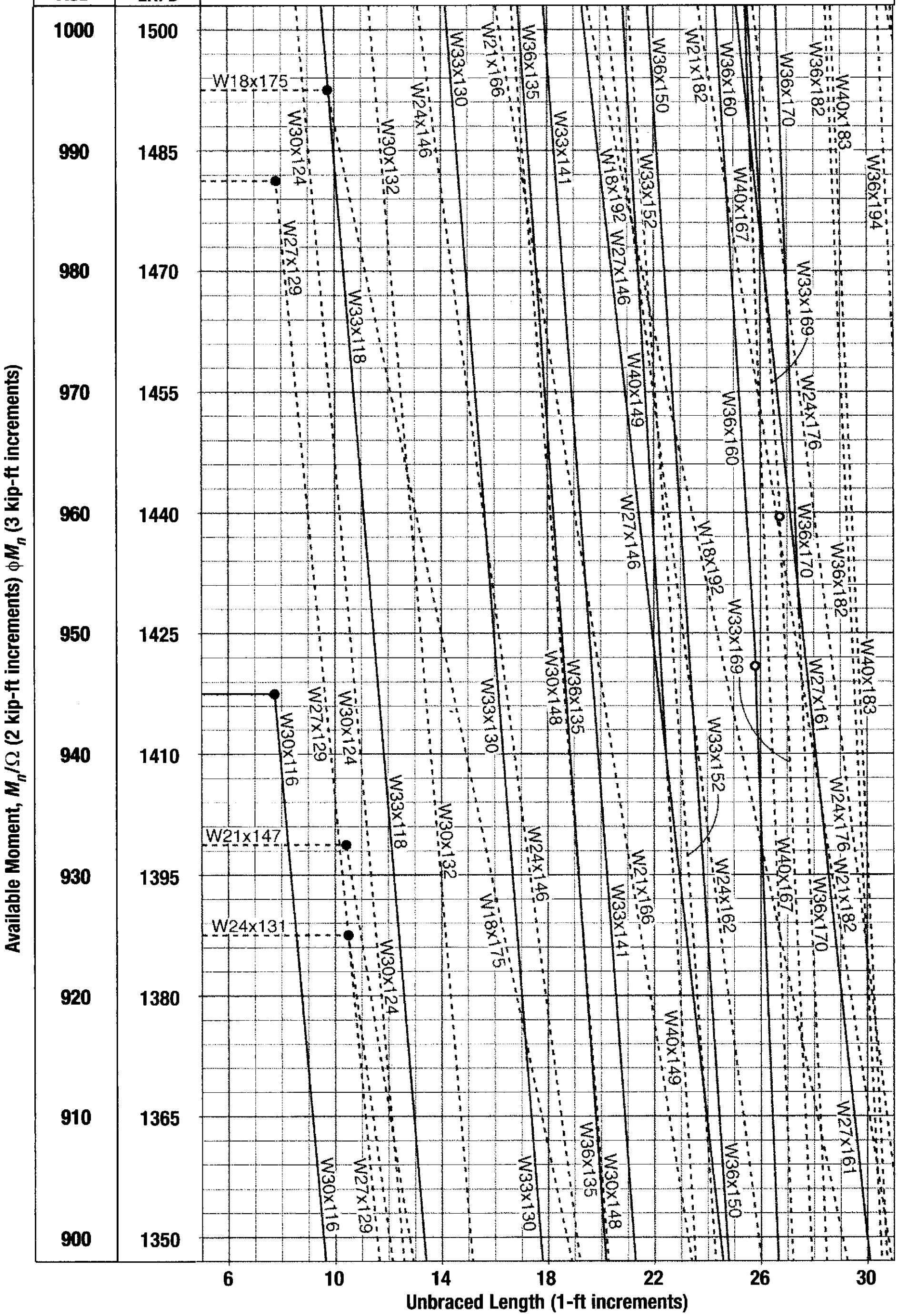


F_y = 50 ksi
C_b = 1

Table 3–10 (continued)
W Shapes
Available Moment vs. Unbraced Length



F_y = 50 ksi C_b = 1		
M_n/Ω	ϕM_n	**Table 3–10 (continued)** **W Shapes** **Available Moment vs. Unbraced Length**
kip-ft	kip-ft	
ASD	LRFD	



F_y = 50 ksi C_b = 1	
M_n/Ω	ϕM_n
kip-ft	kip-ft
ASD	LRFD

Table 3–10 (continued)
W Shapes
Available Moment vs. Unbraced Length

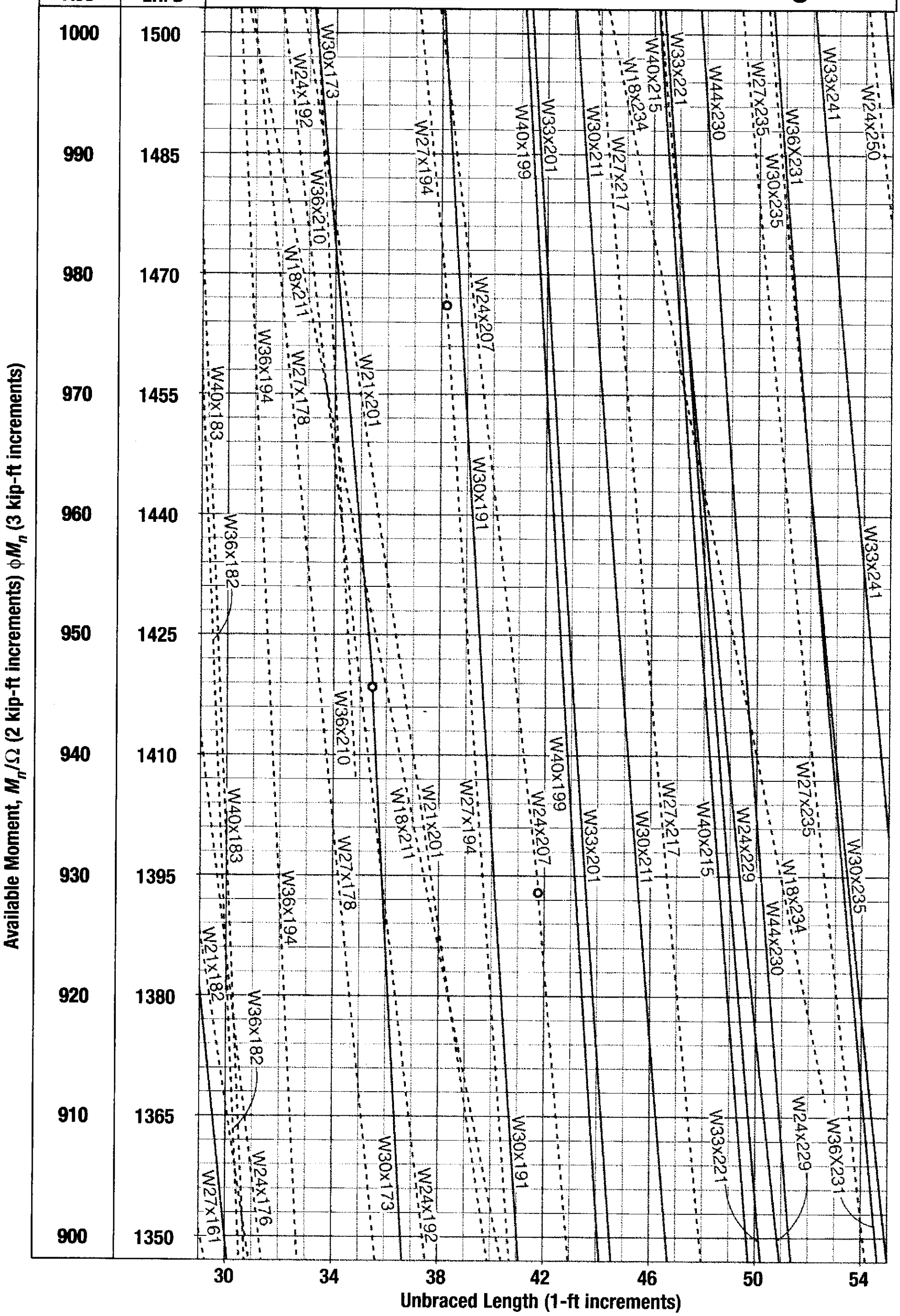


Table 3–10 (continued)
W Shapes
Available Moment vs. Unbraced Length

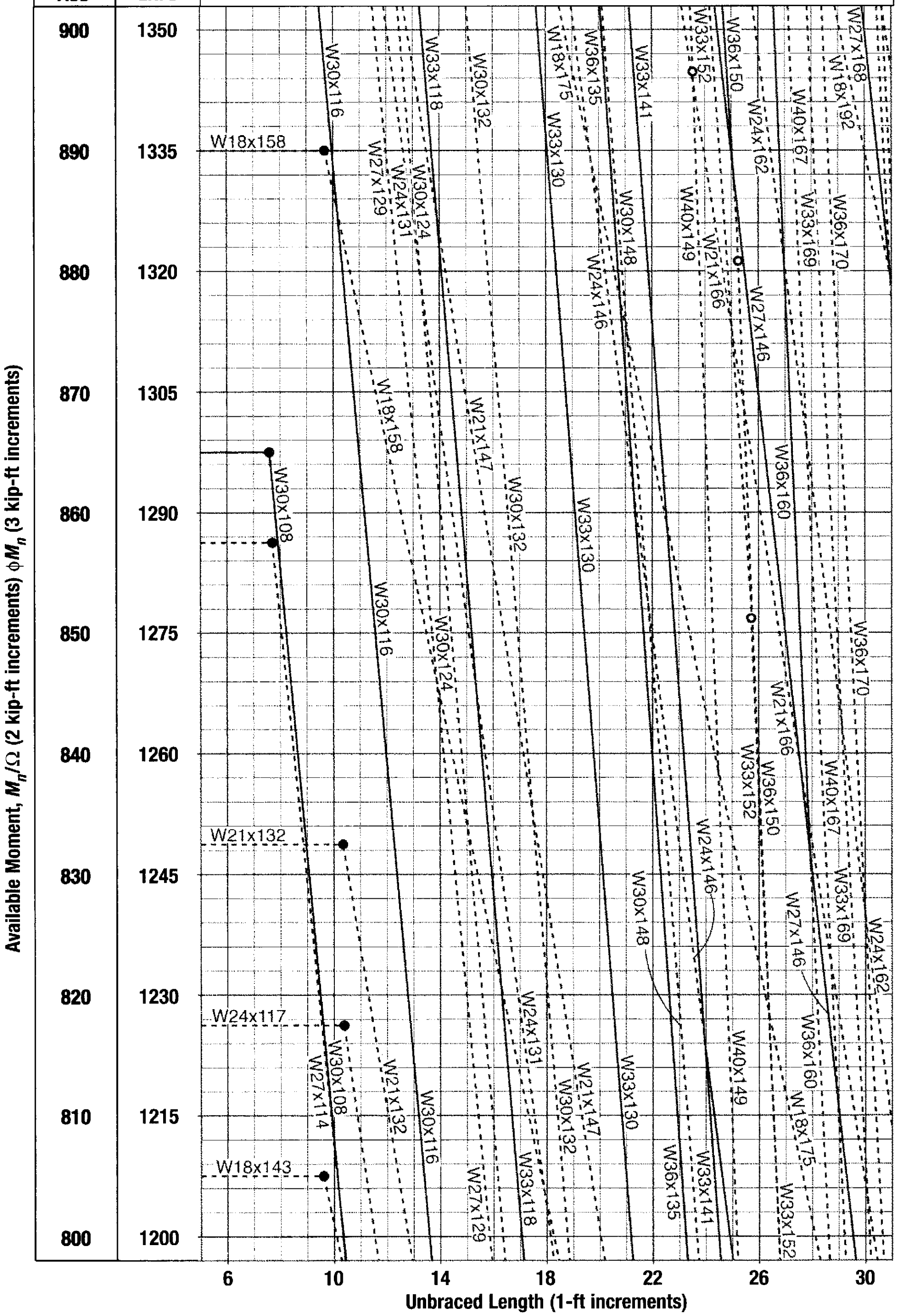
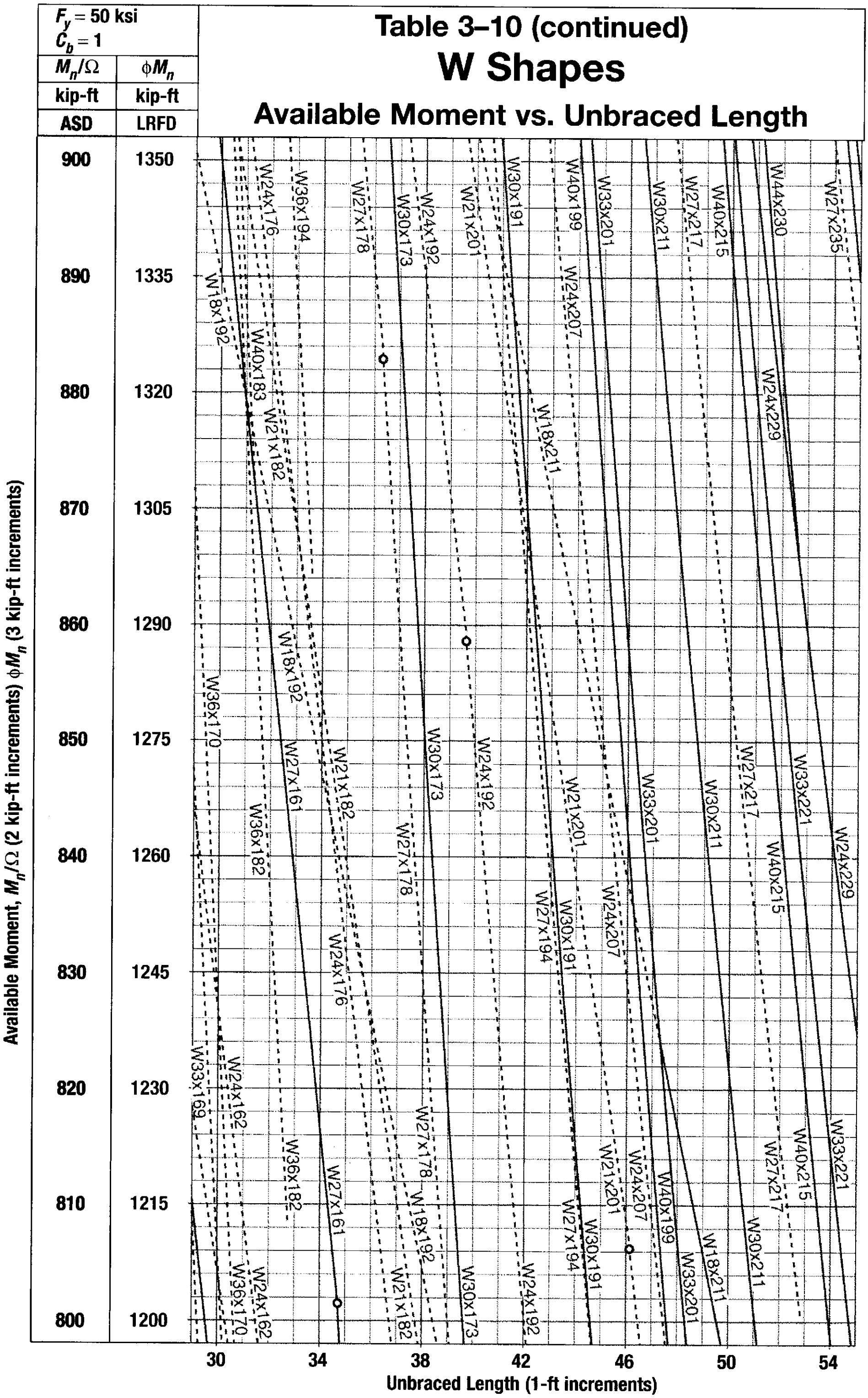


Table 3–10 (continued)
W Shapes
Available Moment vs. Unbraced Length



$F_y = 50$ ksi
$C_b = 1$

M_n/Ω	ϕM_n
kip-ft	kip-ft
ASD	LRFD

Table 3–10 (continued)
W Shapes
Available Moment vs. Unbraced Length

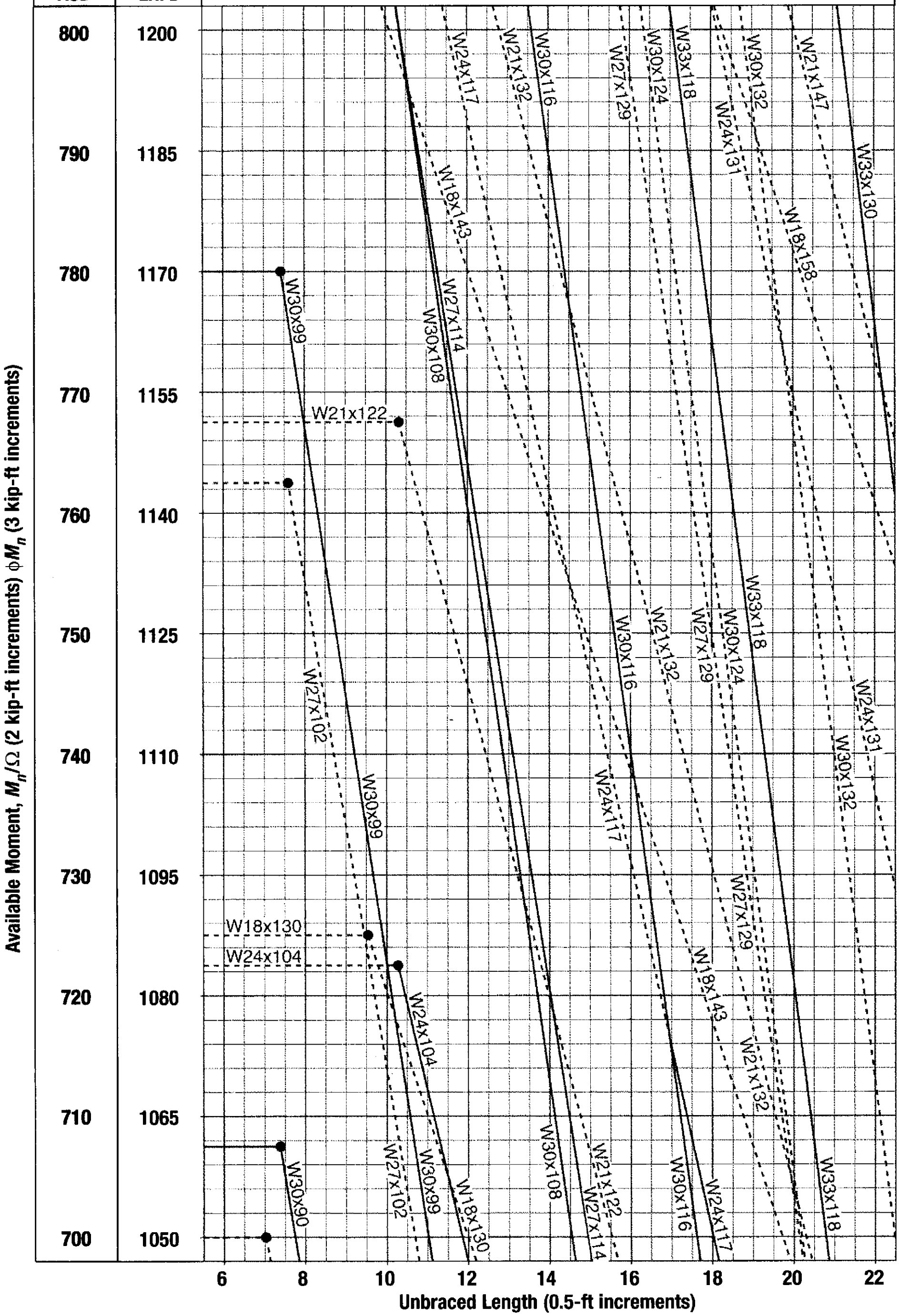


Table 3–10 (continued)
W Shapes
Available Moment vs. Unbraced Length

F_y = 50 ksi
C_b = 1

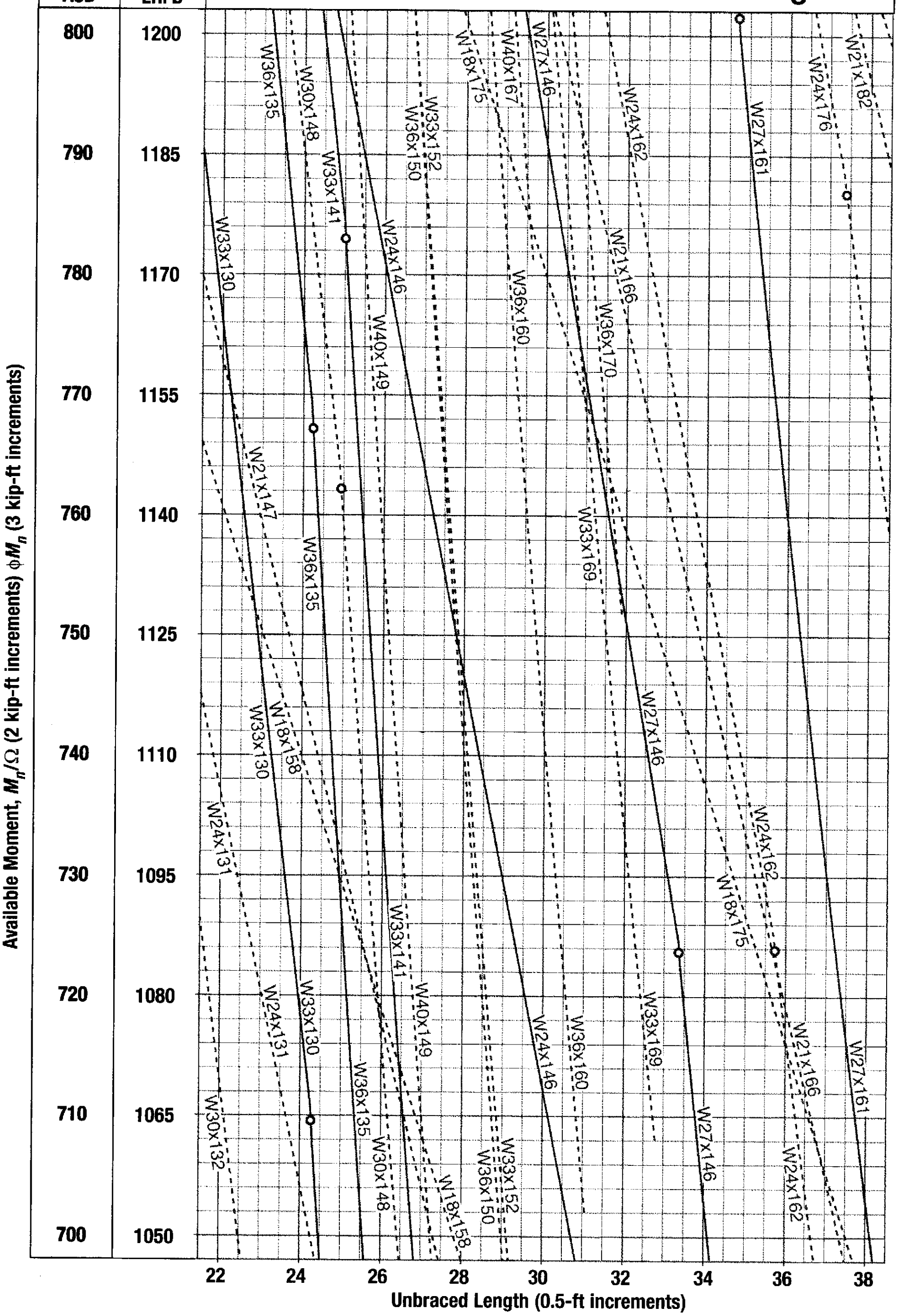


Table 3–10 (continued)
W Shapes
Available Moment vs. Unbraced Length

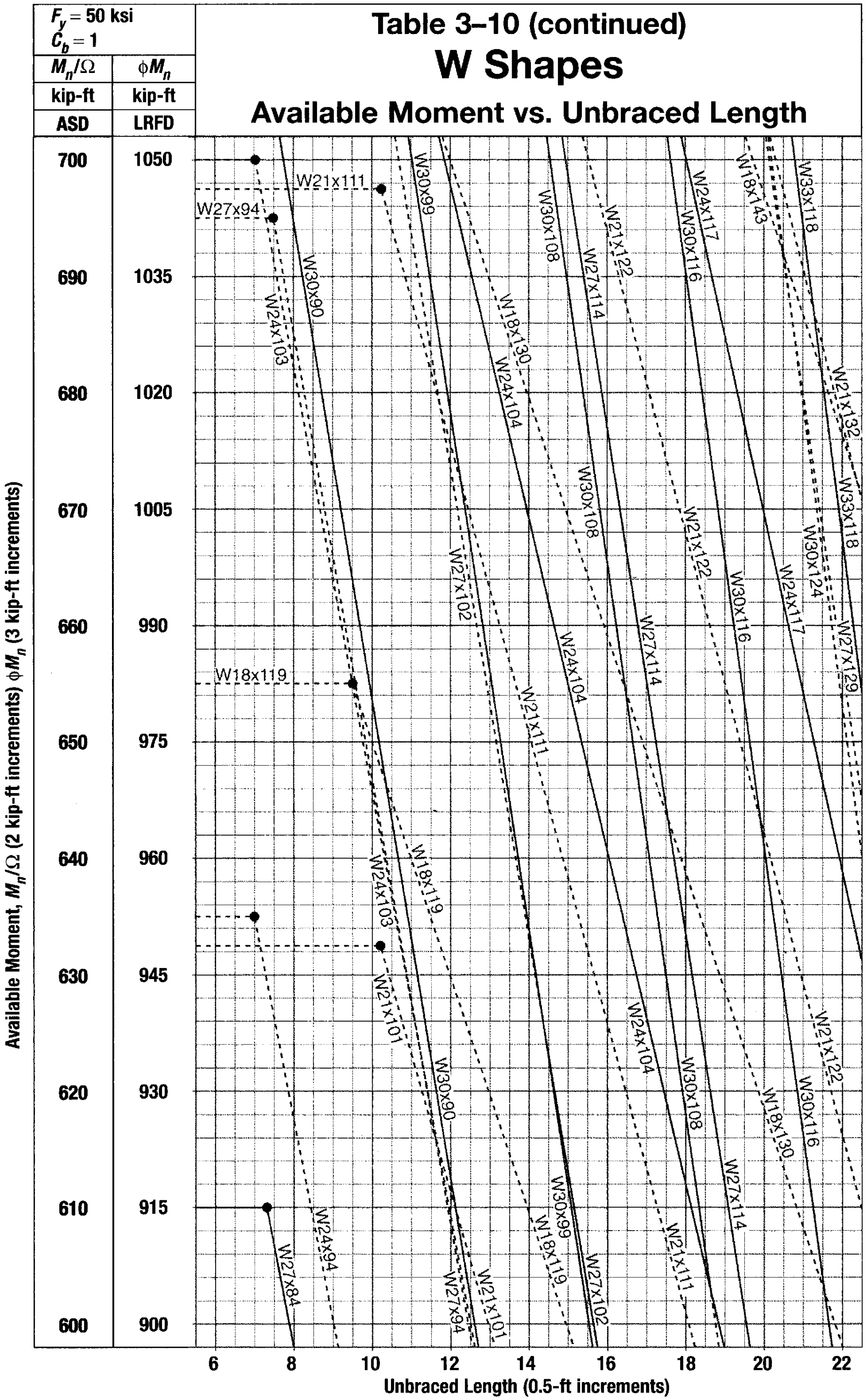


Table 3–10 (continued)
W Shapes
Available Moment vs. Unbraced Length

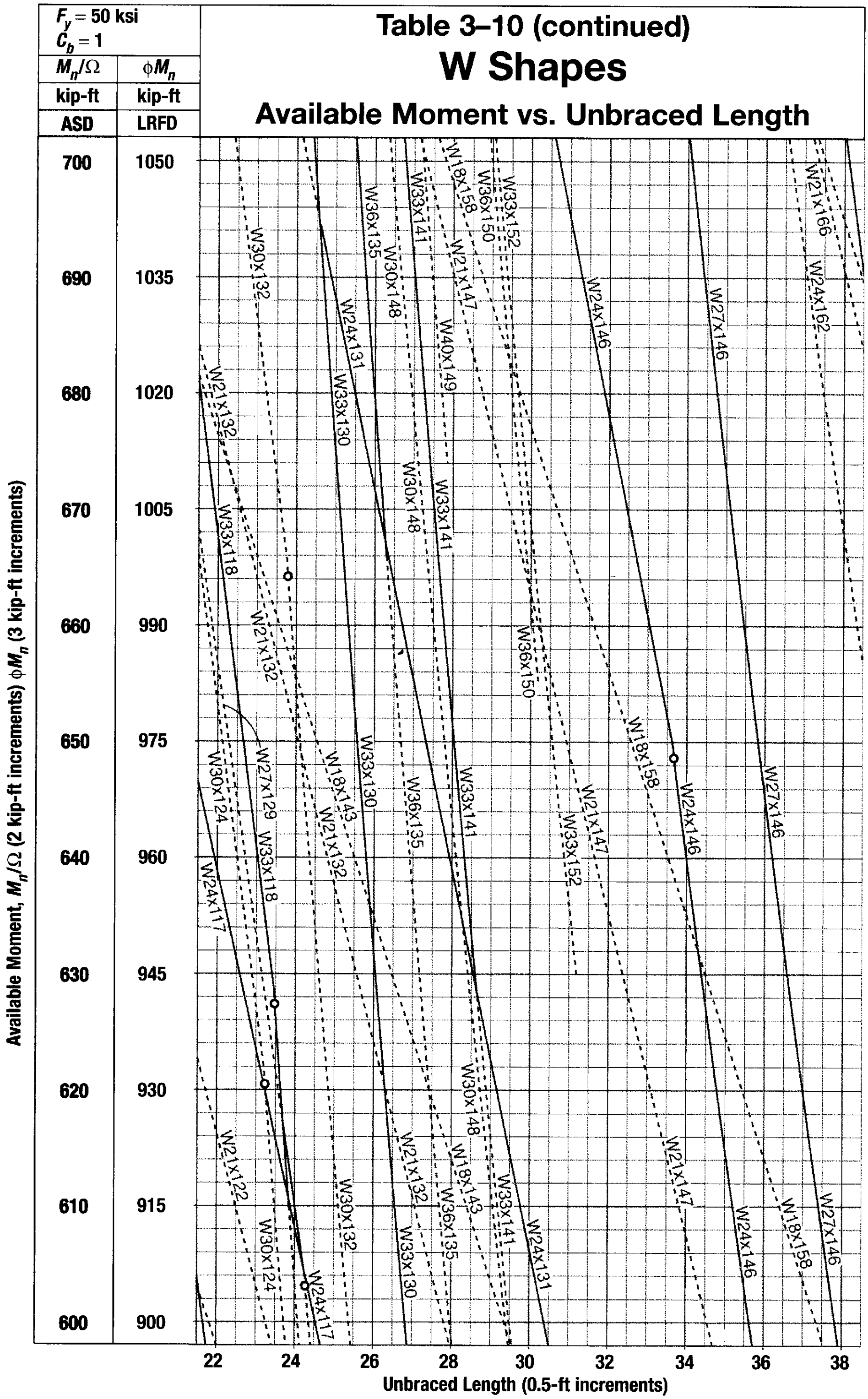
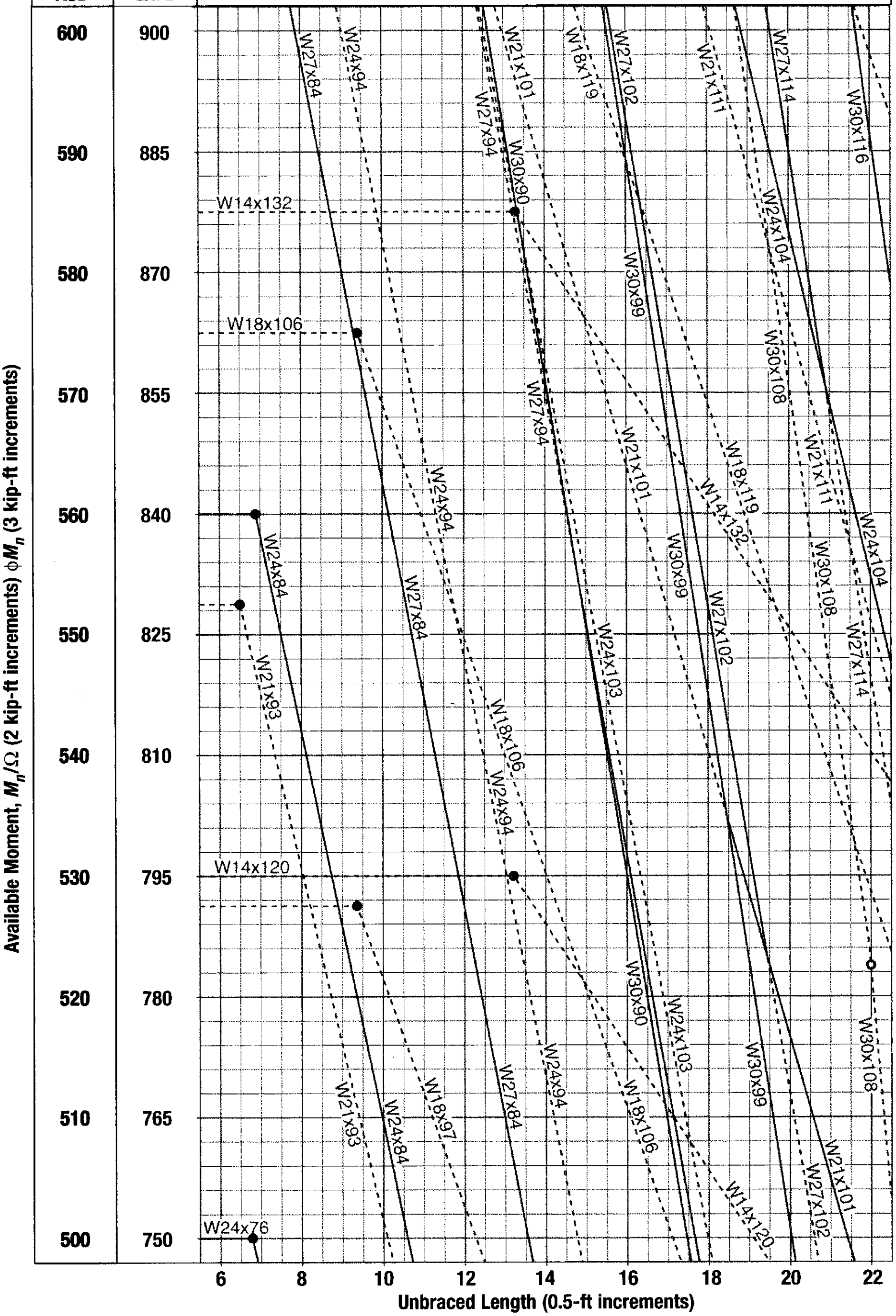


Table 3–10 (continued)
W Shapes
Available Moment vs. Unbraced Length

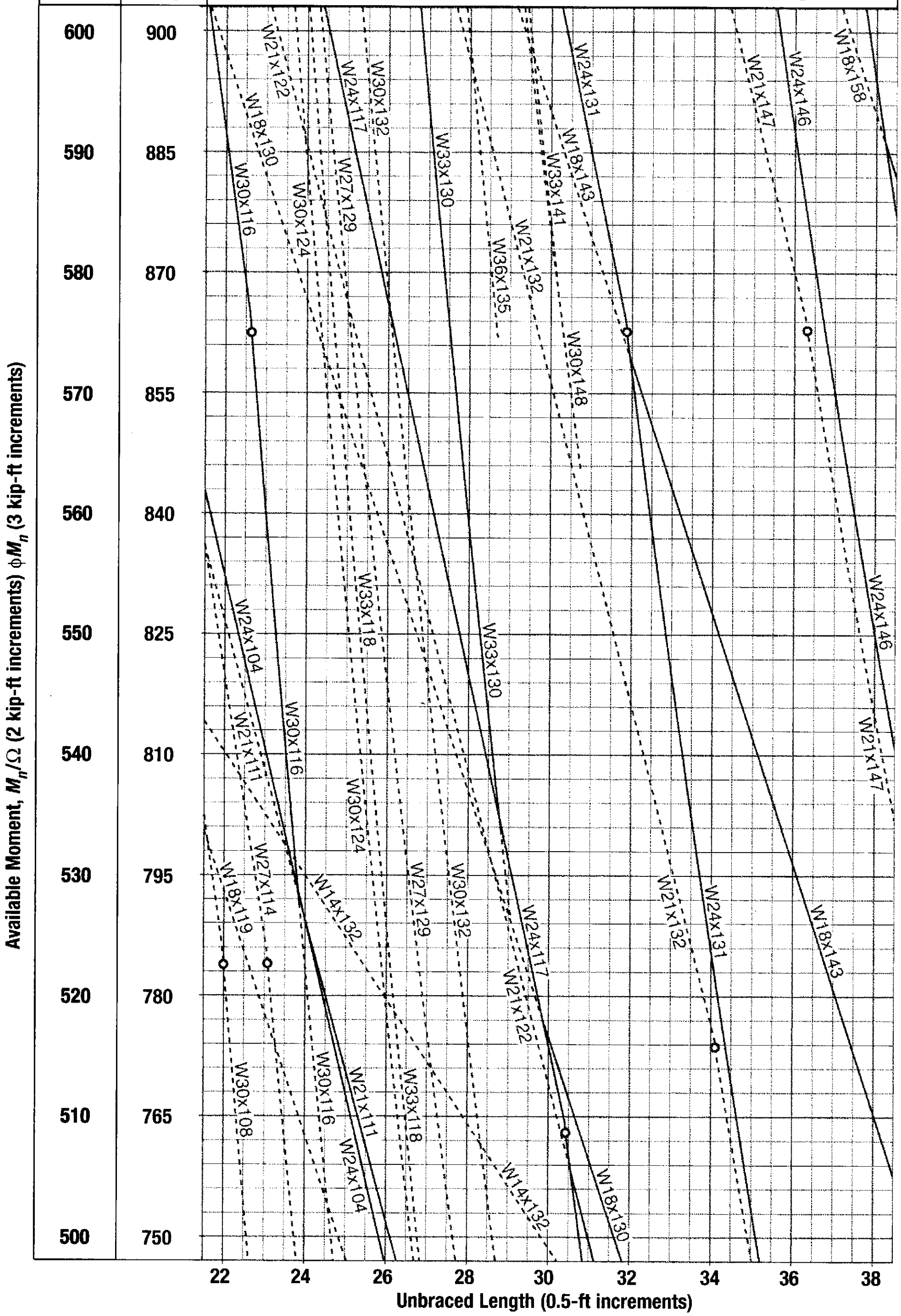
$F_y = 50$ ksi
$C_b = 1$

M_n/Ω	ϕM_n
kip-ft	kip-ft
ASD	LRFD

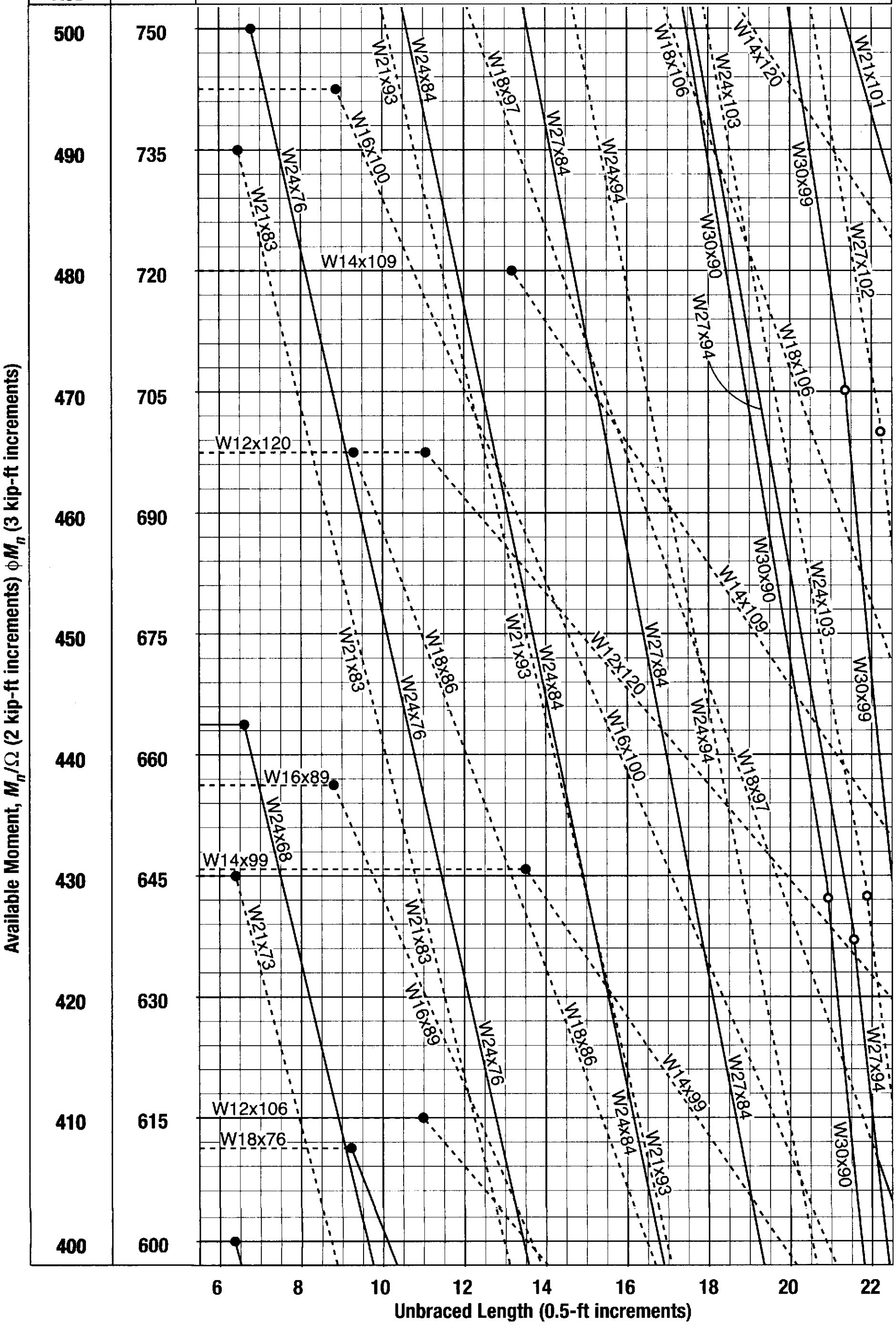


F_y = 50 ksi C_b = 1	
M_n/Ω	ϕM_n
kip-ft	kip-ft
ASD	LRFD

Table 3–10 (continued)
W Shapes
Available Moment vs. Unbraced Length



F_y = 50 ksi C_b = 1		Table 3–10 (continued)
M_n/Ω	ϕM_n	**W Shapes**
kip-ft	kip-ft	**Available Moment vs. Unbraced Length**
ASD	LRFD	



$F_y = 50$ ksi $C_b = 1$		Table 3–10 (continued)
M_n/Ω	ϕM_n	**W Shapes**
kip-ft	kip-ft	
ASD	LRFD	**Available Moment vs. Unbraced Length**