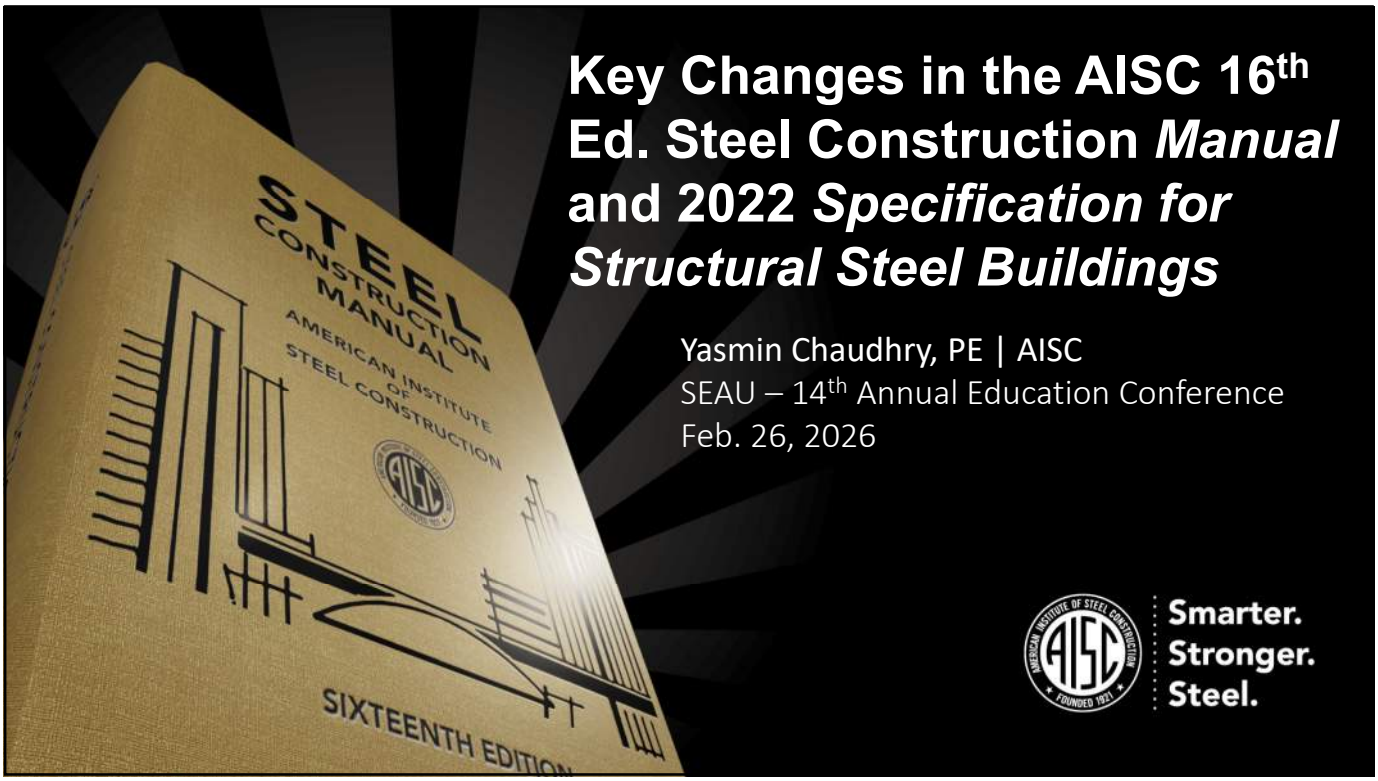


Key Changes in the AISC 16th Ed. Steel Construction *Manual* and 2022 *Specification for Structural Steel Buildings*

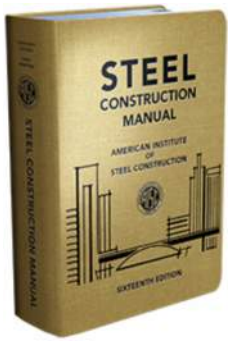
Yasmin Chaudhry, PE | AISC

SEAU – 14th Annual Education Conference
Feb. 26, 2026

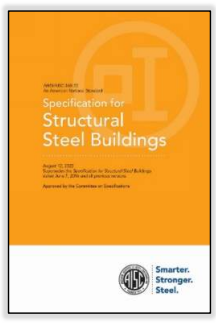
Smarter. Stronger. Steel.

1

Overview



- *Specification* vs. *Manual*
- *Specification* & *Manual* Development Process
- Highlights of Changes to the *Manual & Specification*
- *Manual* Companion Resources
- Find out more…

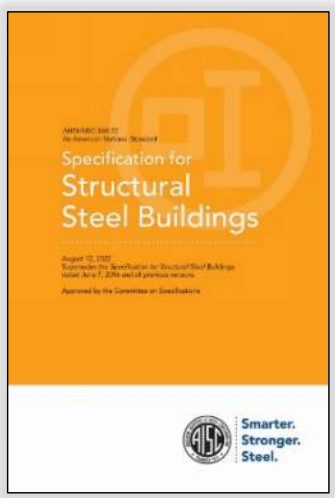


2

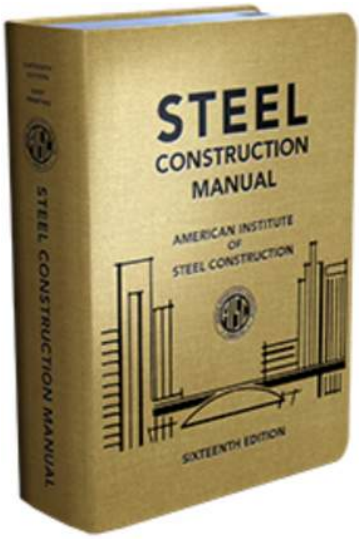
2

Are the *Specification* and the *Manual* the same thing?

2022



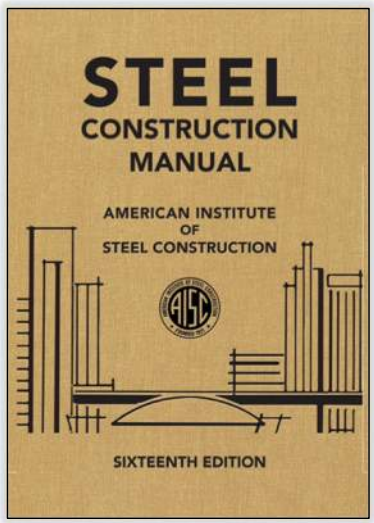
16th Edition



3

3

Standards in Part 16 of the AISC *Steel Construction Manual*



AISC 360-22 *Specification for Structural Steel Buildings*

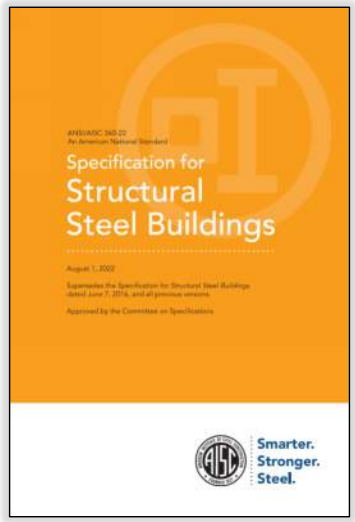
2020 *Specification for Structural Joints Using High-Strength Bolts*

AISC 303-22 *Code of Standard Practice for Steel Buildings and Bridges*

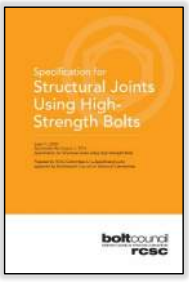
4

4

Referenced Specifications, Codes, and Standards in Section A2 of the AISC *Specification*

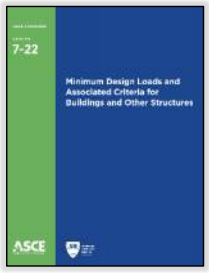


AWS D1.1/D1.1M: 2020

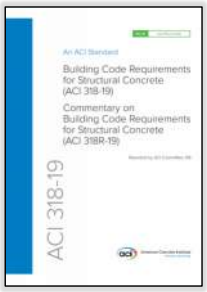


2020 *RCSC*

AISC 303-22



ASCE 7-22



ACI 318-19

5

5

Specification Development Process

Approved by the AISC Committee on Specifications (COS)

- 45 members
- 12 Task Committees
- Approves AISC 360, AISC 341, AISC N690, & AISC 342
- Follows American National Standards Institute (ANSI) accredited procedures

6

6

Specification Development Process

What does ANSI Accredited mean?

- Balanced committee:
  1/3 Industry, 1/3 General Interest, 1/3 Consultants
- Balloting Process
  Ballot participation: 67%
  Ballot approval: 75%
- 45-day public review period
- Must address all PR comments

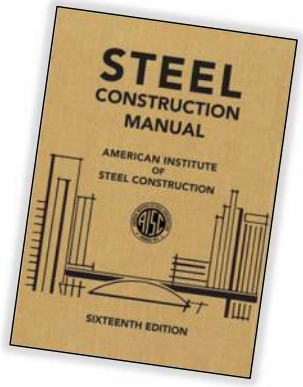
7

7

Manual Development Process

Approved by the AISC Committee on Manuals (COM)

- 30 Members
- Mix of Industry, General Interest, and Consultants
- Approves *Steel Construction Manual* & *Seismic Design Manual*
- 3 Subcommittees:
  M1 – Member and System Design
  M2 – Connection Design
  M3 – Seismic Design (SDM)



8

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AISC *Specification* Contents

Symbols, Glossary, Abbreviations

Chapter A – General Provisions

Chapter B – Design Requirements

Chapter C – Design for Stability

Chapter D – Design of Members for Tension

Chapter E – Design of Members for Compression

Chapter F – Design of Members for Flexure

Chapter G – Design of Members for Shear

Chapter H – Design of Members for Combined Forces & Torsion

Chapter I – Design of Composite Members

Chapter J – Design of Connections

Chapter K – Additional Requirements for HSS and Box-Section Connections

Chapter L – Design for Serviceability

Chapter M – Fabrication and Erection

Chapter N – Quality Control and Quality Assurance

Appendix 1 – Design by Advanced Analysis

NEW Appendix 2 – Design of Filled Composite Members (High-Strength)

Appendix 3 – Fatigue

Appendix 4 – Structural Design for Fire Conditions

Appendix 5 – Evaluation of Existing Structures

Appendix 6 – Member Stability Bracing

Appendix 7 – Alternative Methods of Design for Stability

Appendix 8 – Approximate Analysis

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Symbols, Glossary, Abbreviations

Chapter A – G ons

GENERAL

Chapter B – Design Requirements

Chapter C – Design for Stability

Chapter D – Design of Members for Tension

Chapter E – D bers for C

MEMBER DESIGN

Chapter F – D bers for Flexure

Chapter G – Design of Members for Shear

Chapter H – Design of Members for Combined Forces & Torsion

Chapte Members

COMPOSITE DESIGN

Chapter J – Design of Connections

Chapt ts for ection Connections

CONNECTION DESIGN

Chapter L – Design for Serviceability

Chapter M – Fabrication and Erection

Chapter N – Quality A

FABRICATION AND ERECTION

Appendix 1 – Design by Advanced Analysis

Appendix 2 – Design of Filled Composite Members (High-Strength)

Appendix 3 – Fatigue

Appendix 4 – Structural Design for Fire Conditions

Appendix 5 – ng Structures

OTHER TOPICS

Appendix 6 – Member Stability Bracing

Appendix 7 – Alternative Methods of Design for Stability

Appendix 8 – Approximate Analysis

10

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Where has scope increased?

Chapter A	General Provisions	40%
Chapter B	Design Requirements	*
Chapter C	Design for Stability	*
Chapter D	Design of Members for Tension	*
Chapter E	Design of Members for Compression	*
Chapter F	Design of Members for Flexure	*
Chapter G	Design of Members for Shear	*
Chapter H	Design of Members for Combined Forces & Torsion	*
Chapter I	Design of Composite Members	19%
Chapter J	Design of Connections	*
Chapter K	Additional Requirements for HSS and Box-Section Connections	*
Chapter L	Design for Serviceability	*
Chapter M	Fabrication and Erection	*
Chapter N	Quality Control and Quality Assurance	*
Appendix 1	Design by Advanced Analysis	*
Appendix 2	Design of Filled Composite Members (High-Strength)	N/A--New Appendix
Appendix 3	Fatigue	*
Appendix 4	Structural Design for Fire Conditions	236%
Appendix 5	Evaluation of Existing Structures	*
Appendix 6	Member Stability Bracing	*
Appendix 7	Alternative Methods of Design for Stability	*
Appendix 8	Approximate Analysis	*

Table: Page Count Percentage Change 2016 to 2022

NEW

* 1-page increase or less

11

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AISC *Manual* Contents

Part 1 – Dimensions and Properties

Part 2 – General Design Considerations

Part 3 – Design of Flexural Members

Part 4 – Design of Compression Members

Part 5 – Design of Tension Members

Part 6 – Design of Members Subject to Combined Forces

Part 7 – Design Considerations for Bolts

Part 8 – Design Considerations for Welds

Part 9 – Design of Connecting Elements

Part 10 – Design of Simple Shear Connections

Part 11 – Design of Moment Connections

Part 12 – Design of Simple Connections for Combined Forces

Part 13 – Design of Bracing Connections and Truss Connections

Part 14 – Design of Beam Bearing Plates, Column Base Plates, Anchor Rods, and Column Splices

Part 15 – Design of Hanger Connections, Bracket Plates, and Crane Rain Connections

Part 16 – Specifications and Codes

Part 17 – Miscellaneous Data and Mathematical Info

Part 18 – Symbols and Index

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AISC *Manual* Contents

GENERAL

Part 1 – Dimensions and Properties
Part 2 – General Design Considerations

MEMBER DESIGN

Part 3 – Design of Flexural Members
Part 4 – Design of Compression Members
Part 5 – Design of Tension Members
Part 6 – Design of Members Subject to Combined Forces

CONNECTION DESIGN

Part 7 – Design Considerations for Bolts
Part 8 – Design Considerations for Welds
Part 9 – Design of Connecting Elements
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OTHER TOPICS

Part 16 – Specifications and Codes
Part 17 – Miscellaneous Data and Mathematical Information
Part 18 – Symbols and Index

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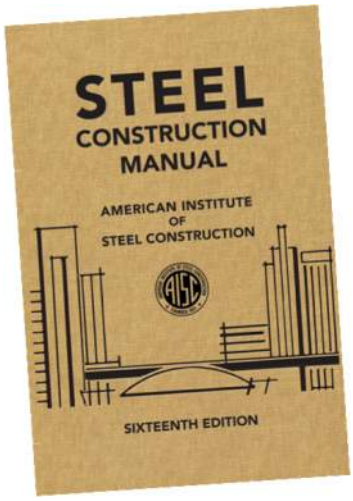

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Design of Tension Members 5
Design of Members Subject to Combined Forces 6
Design Considerations for Bolts 7
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Design of Beam Bearing Plates, Col. Base Plates, Anchor Rods, and Col. Splices 14
Design of Hanger Connections, Bracket Plates, and Crane Rail Connections 15
Specifications and Codes 16
Miscellaneous Data and Mathematical Information 17
Symbols and Index 18

PART 1 – DIMENSIONS AND PROPERTIES

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Part 1 – Dimensions and Properties

All shapes updated to ASTM A6/A6M-19

****222 NEW SHAPES****

15

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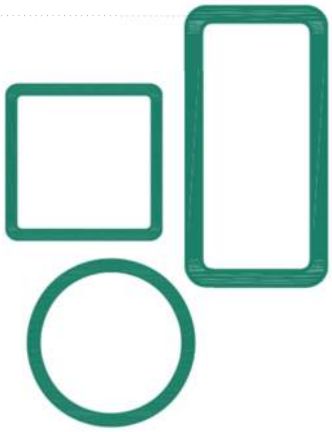
Part 1 – Dimensions and Properties

All shapes updated to ASTM A6/A6M-19

New W-shapes
(6)

Removed M-shapes
(2)

New WT-shapes
(6)



New HSS Shapes
(210)

16

16

Part 1 – Dimensions and Properties

NEW W-shapes:

W44×408 W44×368
W36×387 W36×350
W36×318 W36×286

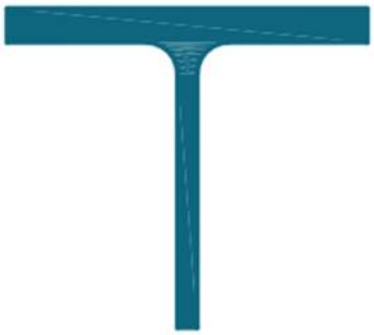
17

17

Part 1 – Dimensions and Properties

NEW WT-shapes:

WT22×204 WT22×184
WT18×193.5 WT18×175
WT18×159 WT18×143



18

18

Part 1 – Dimensions and Properties

REMOVED M-Shapes:

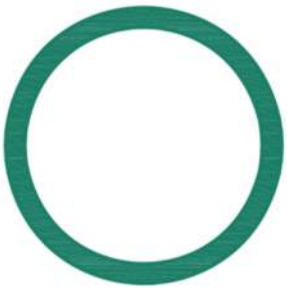
~~M4×3.45~~ ~~M4×3.2~~

19

19

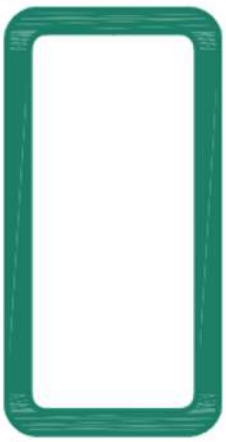
Part 1 – Dimensions and Properties

210 NEW HSS Shapes:



New rounds
(64)

New squares
(16)



New rectangles
(130)

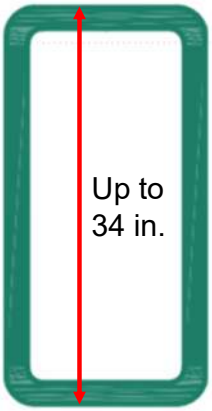
20

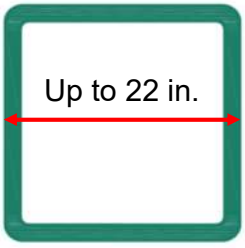
20

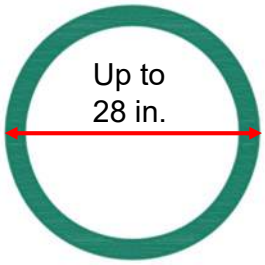
Part 1 – Dimensions and Properties

210 NEW HSS Shapes:

- Include thicker walled sections (up to 1 in.)
- Rectangular sections up to 34 in. deep
- Square sections up to 22 in.
- Round sections up to 28 in. diameter

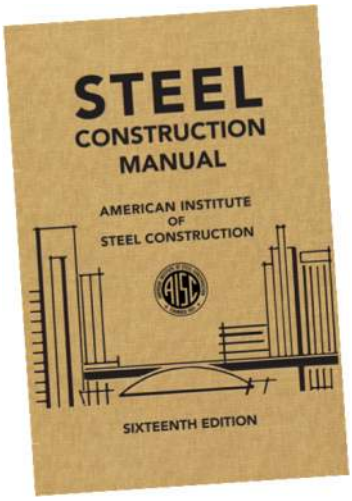






21

21



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PART 2 – GENERAL DESIGN CONSIDERATIONS

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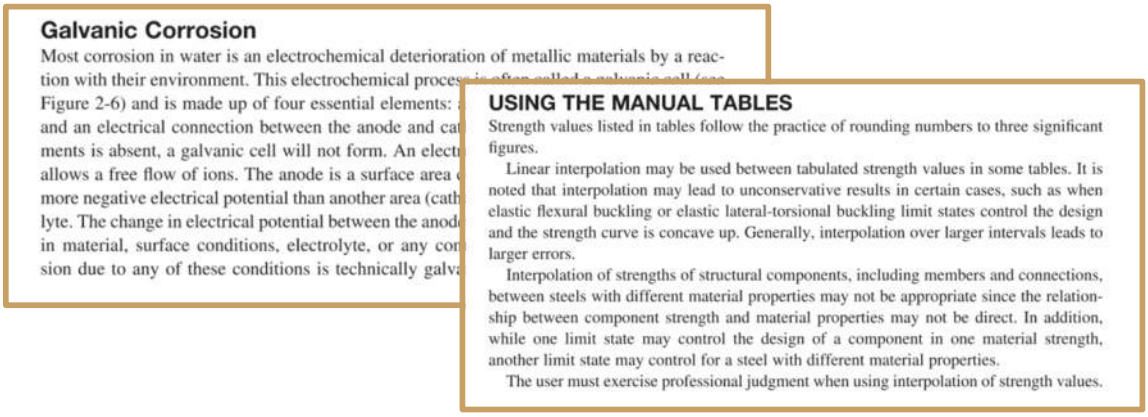
Part 2 – General Design Considerations

NEW

- Section on *Galvanic Corrosion*
- Section on *Using the Manual Tables* → Interpolation



Galvanic Corrosion

Most corrosion in water is an electrochemical deterioration of metallic materials by a reaction with their environment. This electrochemical proces
Figure 2-6) and is made up of four essential elements:
and an electrical connection between the anode and cat
ments is absent, a galvanic cell will not form. An electr
allows a free flow of ions. The anode is a surface area
more negative electrical potential than another area (cath
lyte. The change in electrical potential between the anod
in material, surface conditions, electrolyte, or any con
sion due to any of these conditions is technically galva

USING THE MANUAL TABLES

Strength values listed in tables follow the practice of rounding numbers to three significant figures.

Linear interpolation may be used between tabulated strength values in some tables. It is noted that interpolation may lead to unconservative results in certain cases, such as when elastic flexural buckling or elastic lateral-torsional buckling limit states control the design and the strength curve is concave up. Generally, interpolation over larger intervals leads to larger errors.

Interpolation of strengths of structural components, including members and connections, between steels with different material properties may not be appropriate since the relationship between component strength and material properties may not be direct. In addition, while one limit state may control the design of a component in one material strength, another limit state may control for a steel with different material properties.

The user must exercise professional judgment when using interpolation of strength values.

23

23

Part 2 – General Design Considerations

NEW

- Section on *Galvanic Corrosion*
- Section on *Using the Manual Tables* → Interpolation

UPDATES

- Preferred materials
- Info required on contract/construction docs

24

24

A *NEW* Table A3.1 was added to the *Specification*

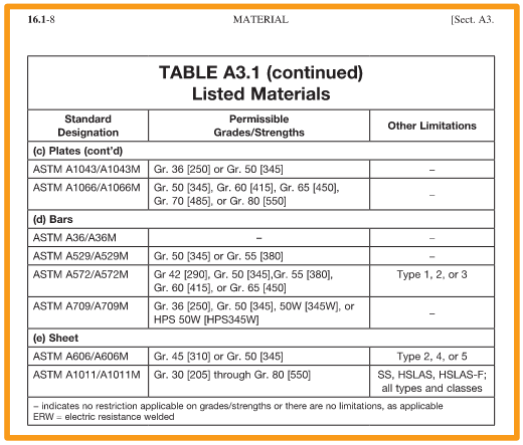
Sect. A3.] MATERIAL 16.1-7

TABLE A3.1
Listed Materials

Standard Designation	Permissible Grades/Strengths	Other Limitations
(a) Hot-Rolled Shapes		
ASTM A36/A36M	–	–
ASTM A529/A529M	Gr. 50 [345] or Gr. 55 [380]	–
ASTM A572/A572M	Gr. 42 [290], Gr. 50 [345], Gr. 55 [380], Gr. 60 [415], or Gr. 65 [450]	Type 1, 2, or 3
ASTM A588/A588M	–	–
ASTM A709/A709M	Gr. 36 [250], Gr. 50 [345], Gr. 50S [345S], Gr. 50W [345W], QST 50 [QST345], QST 50S [QST345S], QST 65 [QST450], or QST 70 [QST485]	–
ASTM A913/A913M	Gr. 50 [345], Gr. 60 [415], Gr. 65 [450], Gr. 70 [485], or Gr. 80 [550]	–
ASTM A992/A992M	–	–
ASTM A1043/A1043M	Gr. 36 [250] or Gr. 50 [345]	–
(b) Hollow Structural Sections (HSS)		
ASTM A53/A53M	Gr. B	–
ASTM A500/A500M	Gr. B, Gr. C, or Gr. D	–
ASTM A501/A501M	Gr. B	ERW or seamless
ASTM A618/A618M	Gr. Ia, Gr. Ib, Gr. II, or Gr. III	ERW or seamless
ASTM A847/A847M	–	–
ASTM A1065/A1065M	Gr. 50 [345] or Gr. 50W [345W]	A572, A588, or A709 HPS 50W [345W]
ASTM A1085/A1085M[a]	Gr. A	–
(c) Plates		
ASTM A36/A36M	–	–
ASTM A283/A283M	Gr. C or Gr. D	–
ASTM A514/A514M	–	See Note [b].
ASTM A529/A529M	Gr. 50 [345] or Gr. 55 [380]	–
ASTM A572/A572M	Gr. 42 [290], Gr. 50 [345], Gr. 55 [380], Gr. 60 [415], or Gr. 65 [450]	Type 1, 2, or 3
ASTM A588/A588M	–	–
ASTM A709/A709M	Gr. 36 [250], Gr. 50 [345], Gr. 50W [345W], HPS 50W [HPS345W], HPS 70W [HPS485W], or HPS 100W [HPS 690W]	–

– indicates no restriction applicable on grades/strengths or there are no limitations, as applicable
ERW – electric resistance welded
[a]ASTM A1085/A1085M material is only available in Grade A, therefore it is permitted to specify ASTM A1085/A1085M without any grade designation.
[b]For welded construction, the steel producer shall be contacted for recommendations on minimum and maximum preheat limits, and minimum and maximum heat input limits.

Specification for Structural Steel Buildings, August 1, 2022
AMERICAN INSTITUTE OF STEEL CONSTRUCTION



16.1-8 MATERIAL [Sect. A3.

TABLE A3.1 (continued)
Listed Materials

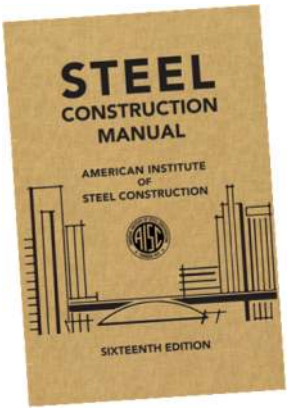
Standard Designation	Permissible Grades/Strengths	Other Limitations
(c) Plates (cont'd)		
ASTM A1043/A1043M	Gr. 36 [250] or Gr. 50 [345]	–
ASTM A1066/A1066M	Gr. 50 [345], Gr. 60 [415], Gr. 65 [450], Gr. 70 [485], or Gr. 80 [550]	–
(d) Bars		
ASTM A36/A36M	–	–
ASTM A529/A529M	Gr. 50 [345] or Gr. 55 [380]	–
ASTM A572/A572M	Gr 42 [290], Gr. 50 [345],Gr. 55 [380], Gr. 60 [415], or Gr. 65 [450]	Type 1, 2, or 3
ASTM A709/A709M	Gr. 36 [250], Gr. 50 [345], 50W [345W], or HPS 50W [HPS345W]	–
(e) Sheet		
ASTM A606/A606M	Gr. 45 [310] or Gr. 50 [345]	Type 2, 4, or 5
ASTM A1011/A1011M	Gr. 30 [205] through Gr. 80 [550]	SS, HSLAS, HSLAS-F; all types and classes

– indicates no restriction applicable on grades/strengths or there are no limitations, as applicable
ERW – electric resistance welded

25

25

Part 2 – General Design Considerations

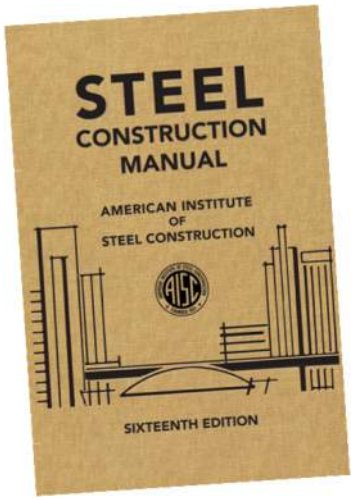


****BIG CHANGE****

Preferred Materials

26

26



Are you properly specifying materials?

27

27

15th Ed

Table 2-4
Applicable ASTM Specifications for Various Structural Shapes

Steel Type	ASTM Designation		F_y Yield Stress[a] (ksi)	F_u Tensile Stress[a] (ksi)	Applicable Shape Series: W	M	S	HP	C	MC	L	HSS: Rect.	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	Gr. A	36	58		□	□		□	□	□	□	□	□
		Gr. B	50	70		□	□		□	□	□	□	□	□
	A529[f]	Gr. 50	50	65–100		□	□		□	□	□	□	□	□
		Gr. 55	55	70–100		□	□		□	□	□	□	□	□
	A709	36	36	58–80[b]		□	□		□	□	□	□	□	□
	A1043[d,i]	36	36–52	58		□	□		□	□	□	□	□	□
		50	50–65	65		□	□		□	□	□	□	□	□
	A1085	Gr. A	50	65		□	□		□	□	□	□	□	□
High-Strength Low-Alloy	A572	Gr. 42	42	60		□	□		□	□	□	□	□	□
		Gr. 50	50	65		□	□	■	□	□	□	□	□	□
		Gr. 55	55	70		□	□		□	□	□	□	□	□
		Gr. 60[e]	60	75		□	□		□	□	□	□	□	□
		Gr. 65[e]	65	80		□	□		□	□	□	□	□	□
	A618[f]	Gr. Ia[g], Ib & II	50[j]	70[j]		□	□		□	□	□	□	□	□
		Gr. III	50	65		□	□		□	□	□	□	□	□
	A709	50	50	65		□	□		□	□	□	□	□	□
		50S	50–65	65		□	□		□	□	□	□	□	□
		50W	50	70		□	□		□	□	□	□	□	□
	A913	50	50[j]	65[e]		□	□		□	□	□	□	□	□
		60	60	75		□	□		□	□	□	□	□	□
		65	65	80		□	□		□	□	□	□	□	□
		70	70	90		□	□		□	□	□	□	□	□
	A992		50[j]	65[e]	■	□	□		□	□	□	□	□	□
	A1065[k]	Gr. 50[j]	50	60		□	□		□	□	□	□	□	□

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

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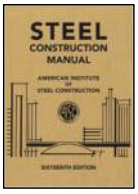

Table 2-4
Applicable ASTM Specifications for Various Structural Shapes

Steel Type	ASTM Designation		F_{ys} Yield Stress[a], ksi	F_{us} Tensile Stress[a], ksi	Applicable Shape Series: W	M	S	HP	C	MC	L	HSS: Rectangular	Round	Pipe
Carbon	A36/A36M		36	58–80[b]										■
	A53/A53M Gr. B		35	60										□
	A500/ A500M	Gr. B	46	58										
		Gr. C	50	62								■	■	
		Gr. D	36	58										
	A501/ A501M[c]	Gr. B	46	65										
	A529/ A529M[d]	Gr. 50	50	65–100										
		Gr. 55	55	70–100										
	A709/A709M	Gr. 36	36	58–80[b]										
	A1043/ A1043M[e,f]	Gr. 36	36–52	58										
		Gr. 50	50–65	65										
	A1085/ A1085M	Gr. A	50–70	65										
High-Strength Low-Alloy	A572/ A572M[d]	Gr. 42	42	60										
		Gr. 50	50	65		■	■				■			
		Gr. 55	55	70										
		Gr. 60[e]	60	75										
		Gr. 65[e]	65	80										
	A618/ A618M[d]	Gr. Ia[g], Ib & II	50[j]	70[k]										
		Gr. III	50	65										
	A709/ A709M	Gr. 50	50	65										
		Gr. 50S	50–65	65										
		Gr. 50W	50	70										
	A913/ A913M	Gr. 50	50	65										
		Gr. 60	60	75										
		Gr. 65	65	80										
		Gr. 70	70	90										
		Gr. 80	80	95										
	A992/A992M		50–65	65	■				■					
	A1065/ A1065M[f]	Gr. 50	50	60										

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

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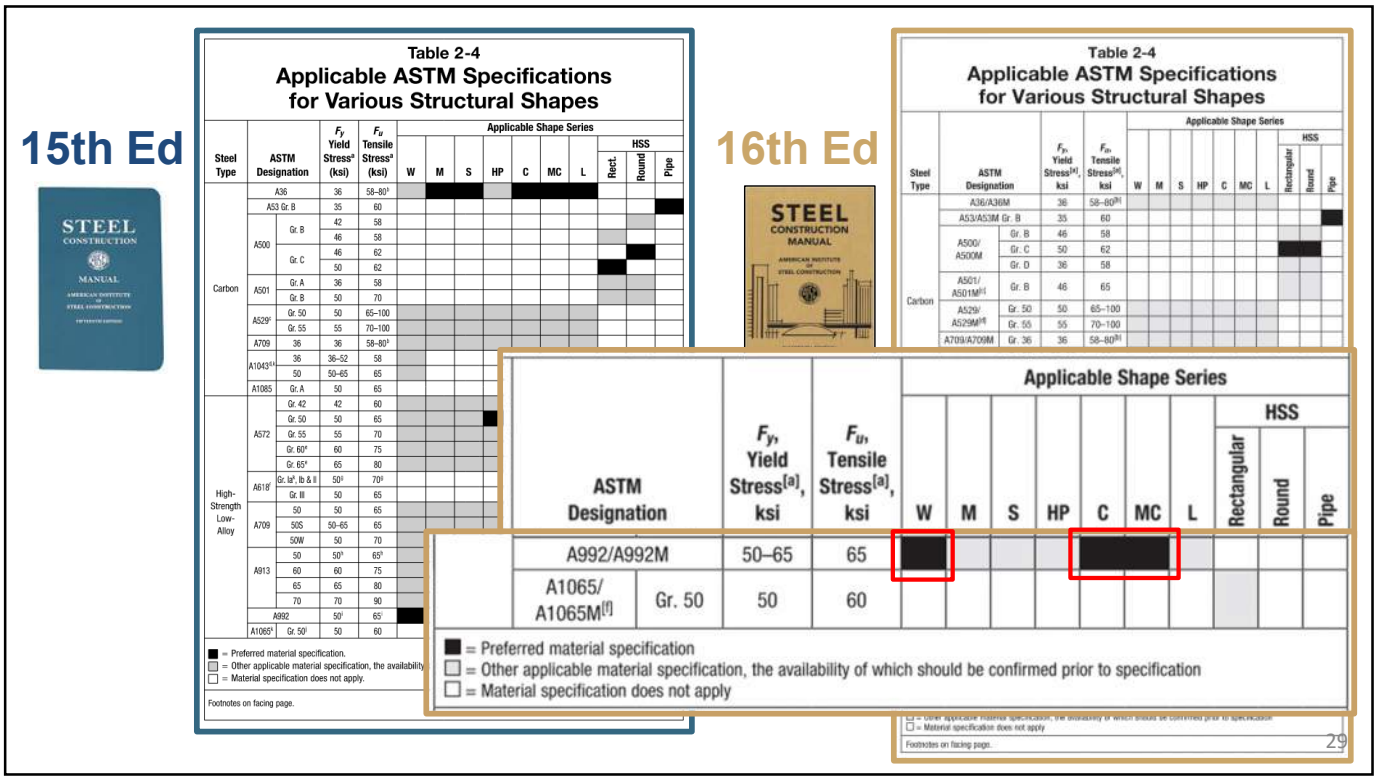

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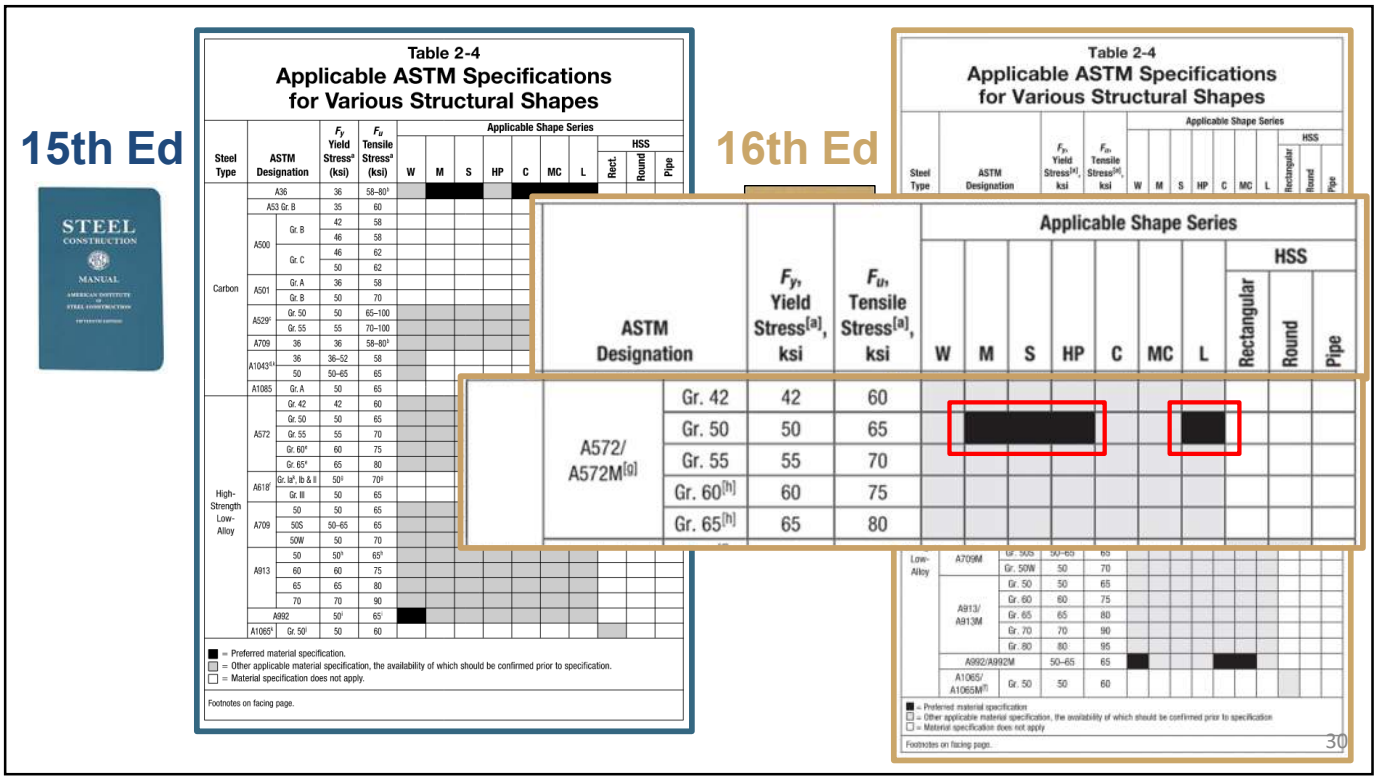

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Table 2-4
Applicable ASTM Specifications for Various Structural Shapes

Steel Type	ASTM Designation		F_y, Yield Stress[a], ksi	F_u, Tensile Stress[a], ksi	Applicable Shape Series: W	M	S	HP	C	MC	L	HSS: Rectangular	Round	Pipe
Carbon	A36/A36M		36	58–80[b]										
	A53/A53M Gr. B		35	60										■
	A500/A500M	Gr. B	46	58										
		Gr. C	50	62								■		
		Gr. D	36	58										
	A501/A501M[c]	Gr. B	46	65										
	A529/A529M[d]	Gr. 50	50	65–100										
		Gr. 55	55	70–100										
	A709/A709M	Gr. 36	36	58–80[b]										
	A1043/A1043M[e,f,h]	Gr. 36	36–52	58										
		Gr. 50	50–65	65										
	A1085/A1085M	Gr. A	50–70	65										
High-Strength Low-Alloy	A572/A572M[d]	Gr. 42	42	60										
		Gr. 50	50	65	■			■		■				
		Gr. 55	55	70										
		Gr. 60[h]	60	75										
		Gr. 65[h]	65	80										
	A618/A618M[d,i]	Gr. Ia[f], Ib & II	50[i]	70[i]										
		Gr. III	50	65										
	A709/A709M	Gr. 50	50	65										
		Gr. 50S	50–65	65										
		Gr. 50W	50	70										
	A913/A913M	Gr. 50	50	65										
		Gr. 60	60	75										
		Gr. 65	65	80										
		Gr. 70	70	90										
		Gr. 80	80	95										
	A992/A992M		50–65	65	■			■						
	A1065/A1065M[f]	Gr. 50	50	60										

The preferred material specification for W-, M-, S-, HP-, C-, MC- and L-shapes is 50 ksi material.

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Table 2-4
Applicable ASTM Specifications for Various Structural Shapes

Steel Type	ASTM Designation		F_y, Yield Stress[a], ksi	F_u, Tensile Stress[a], ksi	Applicable Shape Series: W	M	S	HP	C	MC	L	HSS: Rectangular	Round	Pipe
Carbon	A36/A36M		36	58–80[b]										
	A53/A53M Gr. B		35	60										■
	A500/A500M	Gr. B	46	58										
		Gr. C	50	62								■		
		Gr. D	36	58										
	A501/A501M[c]	Gr. B	46	65										
	A529/A529M[d]	Gr. 50	50	65–100										
		Gr. 55	55	70–100										
	A709/A709M	Gr. 36	36	58–80[b]										
	A1043/	Gr. 36	36–52	58										
	A992/A992M		50–65	65	■			■						
	A1065/A1065M[f]	Gr. 50	50	60										

The preferred material specification for all HSS shapes is A500 Grade C, 50 ksi material.

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Table 2-4
Applicable ASTM Specifications for Various Structural Shapes

Steel Type	ASTM Designation		F_y, Yield Stress[a], ksi	F_u, Tensile Stress[a], ksi	Applicable Shape Series: W	M	S	HP	C	MC	L	HSS: Rectangular	Round	Pipe
Carbon	A36/A36M		36	58–80[b]										
	A53/A53M Gr. B		35	60										■
	A500/A500M	Gr. B	46	58										
		Gr. C	50	62								■	■	
		Gr. D	36	58										
	A501/A501M[c]	Gr. B	46	65										
	A529/A529M[d]	Gr. 50	50	65–100										
		Gr. 55	55	70–100										
	A709/A709M	Gr. 36	36	58–80[b]										
	A1043/	Gr. 36	36–52	58										
	A992/A992M		50–65	65	■			■						
	A1065/A1065M[f]	Gr. 50	50	60										

The preferred material specification for pipe is still A53 Grade B, 35 ksi material.

PIPE

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There is generally no structural advantage to use pipe instead of round HSS.

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Table 2-5
Applicable ASTM Specifications for Plates and Bars

Steel Type	ASTM Designation		F_y Yield Stress[a] (ksi)	F_u Tensile Stress[a] (ksi)	Plates and Bars, in. to 0.75 incl.	over 0.75 to 1.25 incl.	over 1.25 to 1.5 incl.	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	■	■	■	■	■	■	■	■	■	
	A283[a]	Gr. C	30	55–75					d					
		Gr. D	33	60–80					d					
	A529	Gr. 50	50	65–100	b	b	b	b	b					
		Gr. 55	55	70–100	c	c	c	c	c					
	A709	Gr. 36	36	58–80										
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										
	A709	Gr. 50	50	65										
	A1043[a]	Gr. 36	36–52	58										
		Gr. 50	50–65	65										
	A1066[a]	Gr. 50	50	65										
		Gr. 60	60	75										
		Gr. 65	65	80						f				
		Gr. 70	70	85										
		Gr. 80	80	90	g									
Corrosion Resistant High-Strength Low-Alloy	A242[e]		42	63										
			46	67										
			50	70										
	A588		42[e]	63										
			46[e]	67										
			50	70										

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

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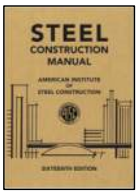

Table 2-5
Applicable ASTM Specifications for Plates and Bars

Steel Type	ASTM Designation		F_y, Yield Stress[a], ksi	F_u, Tensile Stress[a], ksi	Thickness, t, in. to 0.75	over 0.75 to 1.25	over 1.25 to 1.5	over 1.5 to 2	over 2 to 2.5	over 2.5 to 4	over 4 to 5	over 5 to 6	over 6 to 8	over 8
Carbon	A36/A36M		32	58–80										■
		36 Connecting elements	36	58–80							■	■	■	
		36 All other applications	36	58–80	■	■	■	■	■	■	■	■	■	
	A283/A283M[b]	Gr. C	30	55–75					[c]					
		Gr. D	33	60–80					[c]					
	A529/A529M	Gr. 50	50	65–100	[d]	[d]	[d]	[d]	[d]	[d]				
		Gr. 55	55	70–100	[e]	[e]	[e]	[e]	[e]					
	A709/A709M	Gr. 36	36	58–80										
High-Strength Low-Alloy	A572/A572M[f]	Gr. 42	42	60										
		Gr. 50[g]	50	65	■	■	■	■	■	■				
		Gr. 55	55	70										
		Gr. 60[h]	60	75										
		Gr. 65	65	80										
	A709/A709M	Gr. 50	50	65										
	A1043/A1043M[b]	Gr. 36	36–52	58										
		Gr. 50	50–65	65										
	A1066/A1066M	Gr. 50	50	65										
		Gr. 60	60	75										
		Gr. 65	65	80							[f]			
		Gr. 70	70	85										
		Gr. 80	80	90	[g]									
Corrosion Resistant High-Strength Low-Alloy	A588/A588M		42[h]	63										
			46[h]	67										
			50	70										

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

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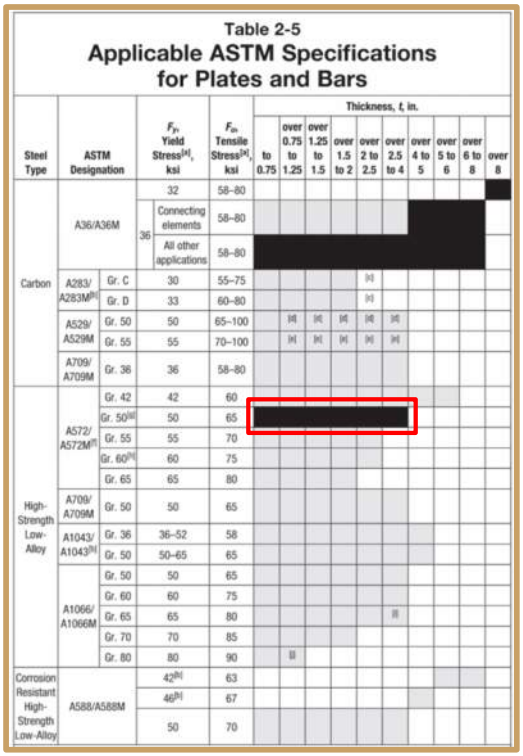

The preferred material specification for structural plate up to 4 in. thick is ASTM A572 Grade 50.

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Table 2-5
Applicable ASTM Specifications for Plates and Bars

Steel Type	ASTM Designation		F_y, Yield Stress[a], ksi	F_u, Tensile Stress[a], ksi	Thickness, t, in. to 0.75	over 0.75 to 1.25	over 1.25 to 1.5	over 1.5 to 2	over 2 to 2.5	over 2.5 to 4	over 4 to 5	over 5 to 6	over 6 to 8	over 8
Carbon	A36/A36M		32	58–80										
		36 Connecting elements	36	58–80										
		36 All other applications	36	58–80										
	A283/A283M[b]	Gr. C	30	55–75					[c]					
		Gr. D	33	60–80					[c]					
	A529/A529M	Gr. 50	50	65–100		[d]	[d]	[d]	[d]	[d]				
		Gr. 55	55	70–100		[e]	[e]	[e]	[e]	[e]				
	A709/A709M	Gr. 36	36	58–80										
	A572/A572M[f]	Gr. 42	42	60										
		Gr. 50[g]	50	65										
		Gr. 55	55	70										
		Gr. 60[h]	60	75										

The preferred material specification for ctural plate up to 4 nick is ASTM A572 le 50.

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Part 2 – General Design Considerations

Updates to Contract Document Information

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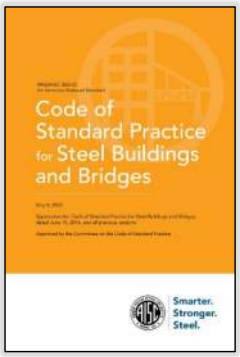
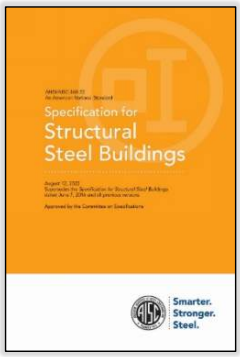
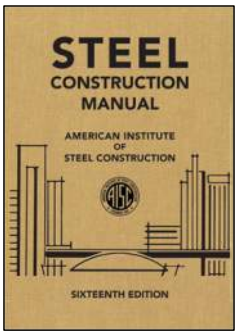
Part 2 – General Design Considerations

Updates to Contract Document Information







Changes to AISC *Code of Standard Practice* Sections 3.1 and 3.2

Changes to AISC *Specification* Sections A4 and A5

Manual changes:

- *Required Information*
- *Information Required Only When Specified*
- *Approvals Required*

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Specification Section A4. Structural Design Documents and Specifications

6. **Headed Stud Anchors**

Steel headed stud anchors shall conform to the requirements of the *Structural Welding Code—Steel* (AWS D1.1/D1.1M).

Manufacturer's certification shall constitute sufficient evidence of conformity with AWS D1.1/D1.1M.

A4. STRUCTURAL DESIGN DRAWINGS AND SPECIFICATIONS

The structural design drawings and specifications shall meet the requirements of the *Code of Standard Practice*.

User Note: The *Code of Standard Practice* uses the term "design documents" in place of "design drawings" to generalize the term and to reflect both paper drawings and electronic models. Similarly, "fabrication documents" is used in place of "shop drawings," and "erection documents" is used in place of "erection drawings." The use of "drawings" in this standard is not intended to create a conflict.

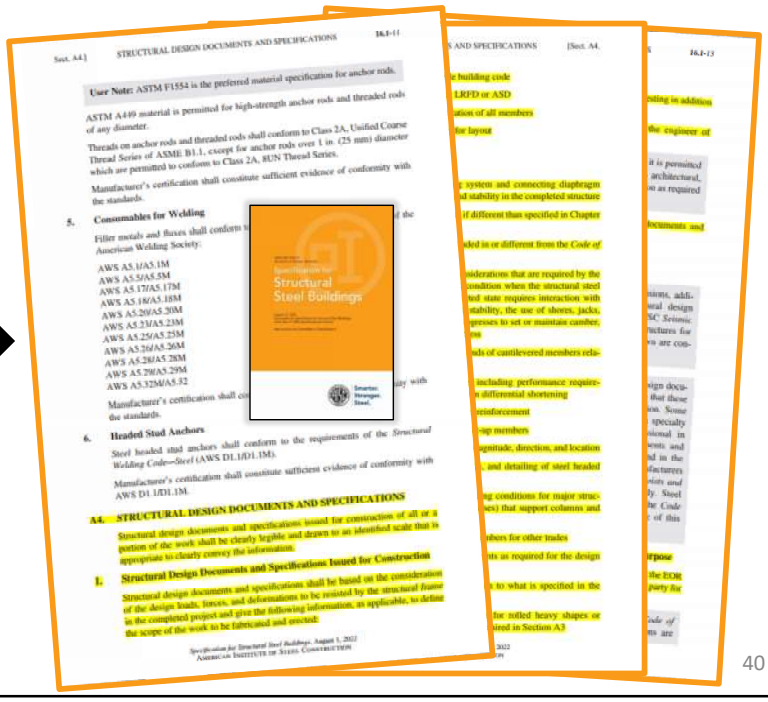
User Note: Provisions in this Specification contain information that is to be shown on design drawings. These include:

- Section A3.1c: Rolled heavy shapes where alternate core Charpy V-notch toughness (CVN) is required
- Section A3.1d: Built-up heavy shapes where CVN toughness is required
- Section D3.1: Locations of connections using pretensioned bolts

Other information needed by the fabricator or erector should be shown on design drawings, including:

- Fatigue details requiring nondestructive testing
- Risk category (Chapter N)
- Indication of *complete-joint-penetration* (CJP) groove welds subject to tension (Chapter N)

Specification for Structural Steel Buildings, July 7, 2016
American Institute of Steel Construction



Sect. A4.] STRUCTURAL DESIGN DOCUMENTS AND SPECIFICATIONS 16.1-11

User Note: ASTM F1554 is the preferred material specification for anchor rods.

ASTM A449 material is permitted for high-strength anchor rods and threaded rods of any diameter.

Threads on anchor rods and threaded rods shall conform to Class 2A, Unified Course Thread Series of ASME B1.1, except for anchor rods over 1 in. (25 mm) diameter which are permitted to conform to Class 2A, 8UN Thread Series.

Manufacturer's certification shall constitute sufficient evidence of conformity with the standards.

5. **Consumables for Welding**

Filler metals and fluxes shall conform to the requirements of the *Structural Welding Code—Steel* (AWS D1.1/D1.1M).

Manufacturer's certification shall constitute sufficient evidence of conformity with AWS D1.1/D1.1M.

6. **Headed Stud Anchors**

Steel headed stud anchors shall conform to the requirements of the *Structural Welding Code—Steel* (AWS D1.1/D1.1M).

Manufacturer's certification shall constitute sufficient evidence of conformity with AWS D1.1/D1.1M.

A4. STRUCTURAL DESIGN DOCUMENTS AND SPECIFICATIONS

Structural design documents and specifications issued for construction of all or a portion of the work shall be clearly legible and drawn to an identified scale that is appropriate to clearly convey the information.

1. **Structural Design Documents and Specifications Issued for Construction**

Structural design documents and specifications shall be based on the consideration of the design loads, forces, and deformations to be resisted by the structural frame in the completed project and give the following information, as applicable, to define the scope of the work to be fabricated and erected:

Specification for Structural Steel Buildings, August 1, 2022
American Institute of Steel Construction

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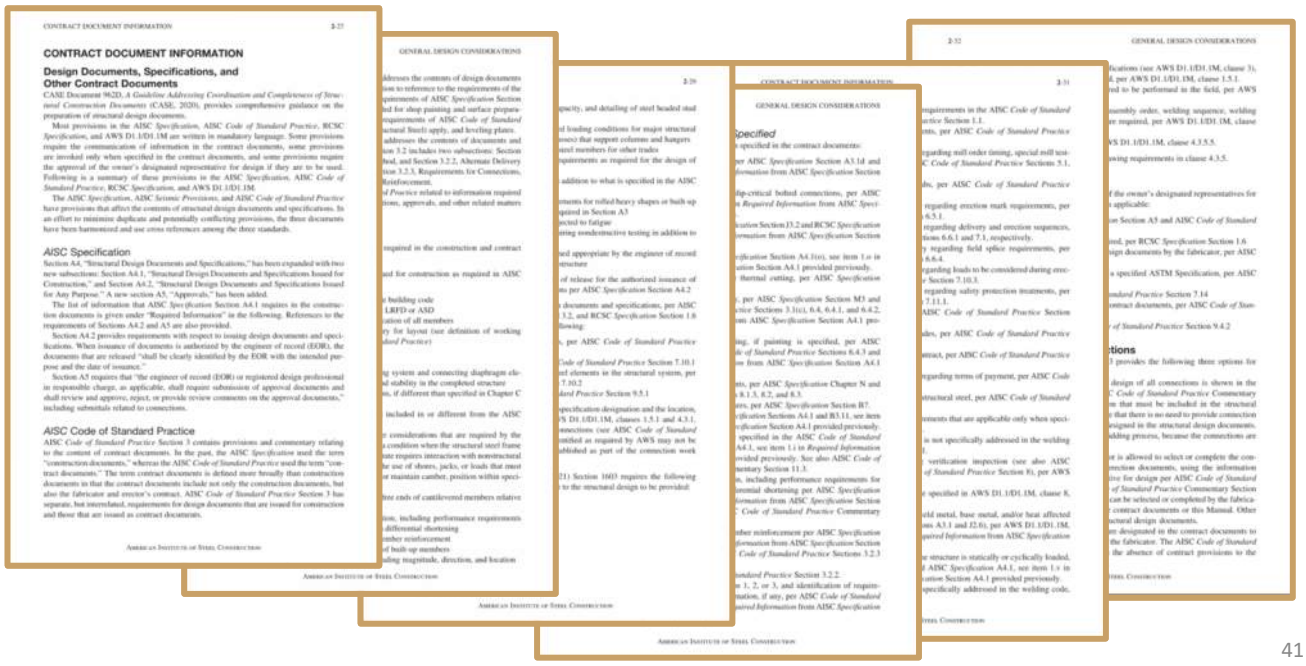
Manual Updated Section on Contract Document Information



CONTRACT DOCUMENT INFORMATION

Design Documents, Specifications, and Other Contract Documents

CASE Document 962D, *A Guideline Addressing Coordination and Completeness of Structural Construction Documents* (CASE, 2020), provides comprehensive guidance on the preparation of structural design documents.

Most provisions in the AISC *Specification*, AISC *Code of Standard Practice*, RCSC *Specification*, and AWS D1.1/D1.1M 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*, AISC *Code of Standard Practice*, RCSC *Specification*, and AWS D1.1/D1.1M.

The AISC *Specification*, AISC *Seismic Provisions*, and AISC *Code of Standard Practice* have provisions that affect the contents of structural design documents and specifications. In an effort to minimize duplicate and potentially conflicting provisions, the three documents have been harmonized and use cross references among the three standards.

AISC Specification

Section A4, "Structural Design Documents and Specifications," has been expanded with two new subsections: Section A4.1, "Structural Design Documents and Specifications Issued for Construction," and Section A4.2, "Structural Design Documents and Specifications Issued for Any Purpose." A new section A5, "Approvals," has been added.

The list of information that AISC *Specification* Section A4.1 requires in the construction documents is given under "Required Information" in the following. References to the requirements of Sections A4.2 and A5 are also provided.

Section A4.2 provides requirements with respect to issuing design documents and specifications. When issuance of documents is authorized by the engineer of record (EOR), the documents that are released "shall be clearly identified by the EOR with the intended purpose and the date of issuance."

Section A5 requires that "the engineer of record (EOR) or registered design professional in responsible charge, as applicable, shall require submission of approval documents and shall review and approve, reject, or provide review comments on the approval documents," including submittals related to connections.

AISC Code of Standard Practice

AISC *Code of Standard Practice* Section 3 contains provisions and commentary relating to the content of contract documents. In the past, the AISC *Specification* used the term "construction documents," whereas the AISC *Code of Standard Practice* used the term "contract documents." The term contract documents is defined more broadly than construction documents in that the contract documents include not only the construction documents, but also the fabricator and erector's contract. AISC *Code of Standard Practice* Section 3 has separate, but interrelated, requirements for design documents that are issued for construction and those that are issued as contract documents.

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Part 2 – General Design Considerations

NEW Table 2-8

Accompanies new text section on Galvanic Corrosion

Table 2-8
Galvanic Corrosion Potential Between Steel and Common Construction Metals

Member Material	Fastener Material					
	Stainless Steel	Copper	Brass	Carbon Steel or Iron	Aluminum	Galvanized Steel (Zinc)
	Electrical Potential[a], volts					
	–0.05 to –0.25	–0.36	–0.25 to –0.4	–0.61	–0.79	–1.03
Carbon Steel or Iron	Member may corrode	Member may corrode	Member may corrode	–	Fastener may corrode	No significant corrosion
Galvanized Steel (Zinc)	Member may corrode	Member may corrode	Member may corrode	No significant corrosion	No significant corrosion	–
Stainless Steel	–	No significant corrosion	No significant corrosion	Fastener likely to corrode	Fastener likely to corrode	Fastener likely to corrode

– Indicates similar metals; galvanic corrosion is generally not a concern for this condition.
[a]Electrical potential values from the ASM Handbook, Volume 13 (ASM, 2016)

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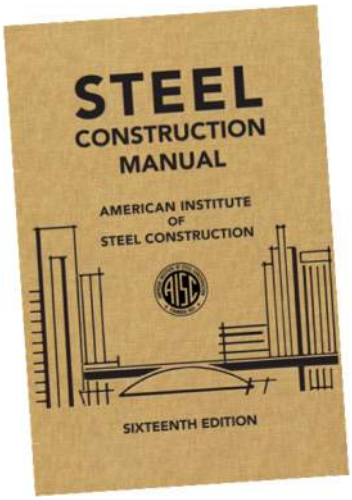

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PARTS 3, 4, 5 – DESIGN OF FLEXURAL, COMPRESSION, AND TENSION MEMBERS

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Part 3 – Design of Flexural Members
Part 4 – Design of Compression Members
Part 5 – Design of Tension Members

UPDATES

- Tables updated to 50 ksi material
- Some table layouts changed

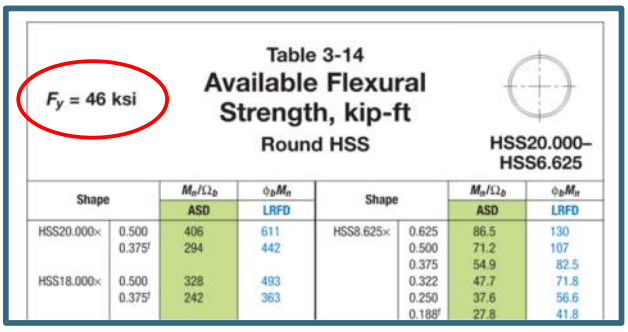

Table 3-14
Available Flexural Strength, kip-ft
Round HSS

F_y = 46 ksi

HSS20.000–HSS6.625

Shape		M_n/Ω_b ASD	$\phi_b M_n$ LRFD	Shape		M_n/Ω_b ASD	$\phi_b M_n$ LRFD
HSS20.000×	0.500	406	611	HSS8.625×	0.625	86.5	130
	0.375[f]	294	442		0.500	71.2	107
					0.375	54.9	82.5
HSS18.000×	0.500	328	493		0.322	47.7	71.8
	0.375[f]	242	363		0.250	37.6	56.6
					0.188[f]	27.8	41.8

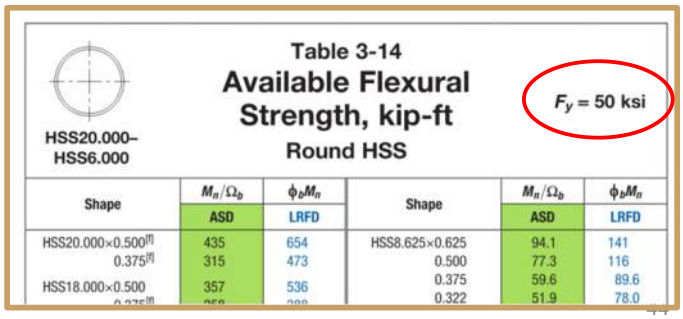

Table 3-14
Available Flexural Strength, kip-ft
Round HSS

HSS20.000–HSS6.000

F_y = 50 ksi

Shape	M_n/Ω_b ASD	$\phi_b M_n$ LRFD	Shape	M_n/Ω_b ASD	$\phi_b M_n$ LRFD
HSS20.000×0.500[f]	435	654	HSS8.625×0.625	94.1	141
0.375[f]	315	473	0.500	77.3	116
HSS18.000×0.500	357	536	0.375	59.6	89.6
			0.322	51.9	78.0

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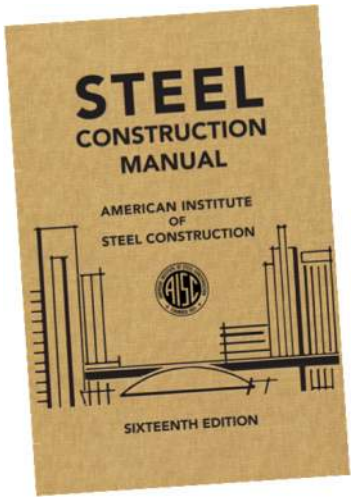

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PART 6 – DESIGN OF MEMBERS SUBJECT TO COMBINED FORCES

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Part 6 – Design of Members Subject to Combined Forces

NEW Table 6-5

Beam-Column Structural Analysis

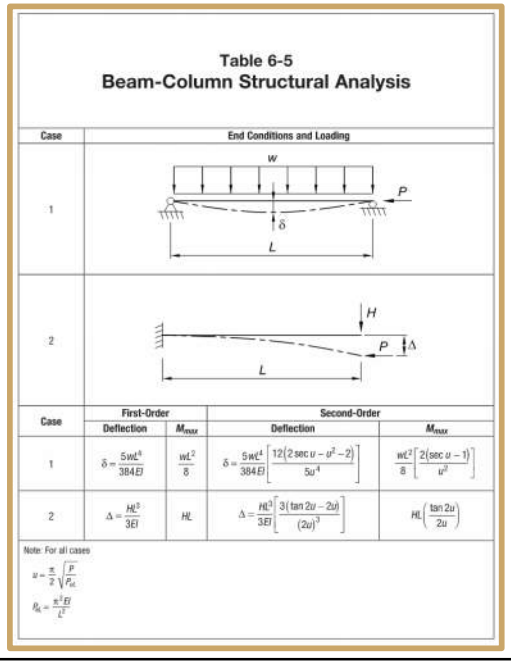

Table 6-5
Beam-Column Structural Analysis

Case	End Conditions and Loading			
1				
2				
Case	**First-Order**		**Second-Order**	
	Deflection	M_{max}	**Deflection**	M_{max}
1	$\delta = \frac{5wL^4}{384EI}$	$\frac{wL^2}{8}$	$\delta = \frac{5wL^4}{384EI}\left[\frac{12\left(2\sec u - u^2 - 2\right)}{5u^4}\right]$	$\frac{wL^2}{8}\left[\frac{2(\sec u - 1)}{u^2}\right]$
2	$\Delta = \frac{HL^3}{3EI}$	HL	$\Delta = \frac{HL^3}{3EI}\left[\frac{3(\tan 2u - 2u)}{(2u)^3}\right]$	$HL\left(\frac{\tan 2u}{2u}\right)$

Note: For all cases

$u = \frac{\pi}{2}\sqrt{\frac{P}{P_{el}}}$

$P_{el} = \frac{\pi^2 EI}{L^2}$

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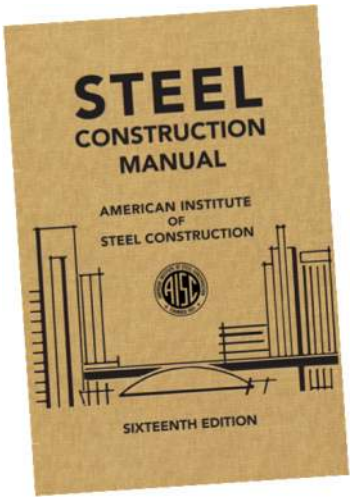

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PART 7 – DESIGN CONSIDERATIONS FOR BOLTS

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Part 7 – Design Considerations for Bolts

NEW

- Bolt specification and group

UPDATES

- Bolt group designations

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Specification Chapter J – Design of Connections

Section J3. Bolts, Threaded Parts, and Bolted Connections

Group A → Group 120

Group B → Group 150

Group 144 (NEW!)

Group C → Group 200 bolts

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Part 7 – Design Considerations for Bolts

Group 120 bolts (formerly Group A)

ASTM F3125 Grades A325 and F1852

ASTM A354 Grade BC

F_u = 120 ksi

Group 144 bolts (NEW!)

ASTM F3148 Grade 144

F_u = 144 ksi

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Part 7 – Design Considerations for Bolts

<u>Group 150 bolts</u> (formerly Group B)

ASTM F3125 Grades A490 and F2280

ASTM A354 Grade BD

F_u = 150 ksi

<u>Group 200 bolts</u> (formerly Group C)

ASTM F3043 and F3111

F_u = 200−215 ksi

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ASTM F3148 is a new bolt standard for spline drive bolts where the spline is used to pretension the bolt, but it does not twist off.

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Part 7 – Design Considerations for Bolts

Group 144: ASTM F3148 Grade 144

- Fixed-spline drive bolting assembly
- Mechanical galvanizing & some zinc/aluminum coatings permitted
- Same bolt pretension as Group 150
- Combined method of installation: See RCSC *Specification*
  - + Similar to turn of the nut method

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Part 7 – Design Considerations for Bolts

Table 7-2
Available Tensile Strength of Bolts, kips

Nominal Bolt Diameter, *d*, in.			5/8		3/4		7/8		1	
Nominal Bolt Area, in.^{2}			0.307		0.442		0.601		0.785	
Designation	F_{nt}/Ω (ksi)	ϕF_{nt} (ksi)	r_n/Ω	ϕr_n	r_n/Ω	ϕr_n	r_n/Ω	ϕr_n	r_n/Ω	ϕr_n
	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Group 120	45.0	67.5	13.8	20.7	19.9	29.8	27.1	40.6	35.3	53.0
Group 144	54.0	81.0	16.6	24.9	23.9	35.8	32.5	48.7	42.4	63.6
Group 150	56.5	84.8	17.3	26.0	25.0	37.4	34.0	51.0	44.4	66.6
Group 200	75.0	113	–	–	–	–	–	–	58.9	88.4
A307	22.5	33.8	6.90	10.4	9.94	14.9	13.5	20.3	17.7	26.5

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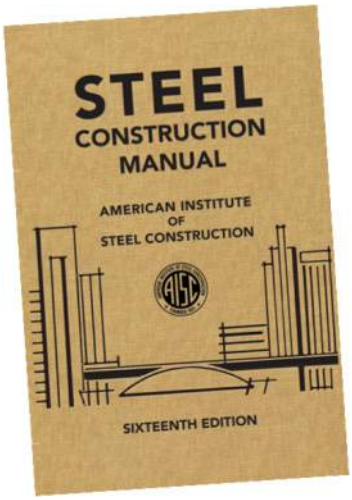

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PART 8 – DESIGN CONSIDERATIONS FOR WELDS

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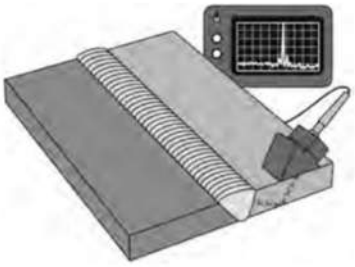
Part 8 – Design Considerations for Welds

NEW

- Information on Phased Array Ultrasonic Testing (PAUT)



8-8 DESIGN CONSIDERATIONS FOR WELDS

Phased array ultrasonic testing (PAUT) is a UT technique that uses the sequential discharge of multiple transducers in a single search unit to adjust the focus and angle of the sound path through the inspected element. Return signals are recorded electronically and processed to be displayed in a variety of display formats. The recorded return signals encoded with the location of the search unit can be maintained to form a record of the inspection. PAUT is an ultrasonic method and therefore it finds the same type of discontinuity that normal UT finds but encoding and directional control of the sound path can offer the opportunity for improved results. The method requires special equipment and extra training of the technician beyond normal UT training. PAUT is recognized in AWS D1.1/D1.1M, Annex H. Where previously radiographic inspection was selected primarily to obtain a physical record of the inspection, PAUT may now be used because it also generates a record of the inspection results.

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Part 8 – Design Considerations for Welds

NEW

- Information on Phased Array Ultrasonic Testing (PAUT)

UPDATES

- Clarification on analysis methods for *Eccentrically Loaded Weld Groups*
- Additional guidance for weld clearances

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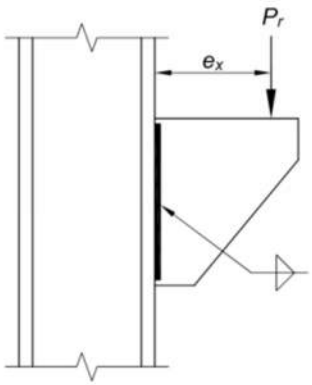
Part 8 – Design Considerations for Welds

Clarification on analysis methods for *Eccentrically Loaded Weld Groups*

Plastic Method – two options:

1. Conventional
2. Optimum

Note: The plastic method only applies to welds with eccentricity *normal* to the plane of the faying surface



(b) Eccentricity normal to the plane of the faying surface

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Part 8 – Design Considerations for Welds

Clarification on analysis methods for Eccentrically Loaded Weld Groups

Conventional Plastic Method

Two options are presented for the combination of normal force and moment on the weld in order to determine the equivalent normal force, N_{equiv}.

1. Conventional Plastic Method (CPM)
   This method is the simplest approach where both normal force and moment are distributed along the length of the weld. The stress distribution is shown in Figure 8-9(a). The equivalent normal force is:

$$N_{equiv} = N_r + \frac{4M_r}{l_w} \qquad (8\text{-}27a)$$

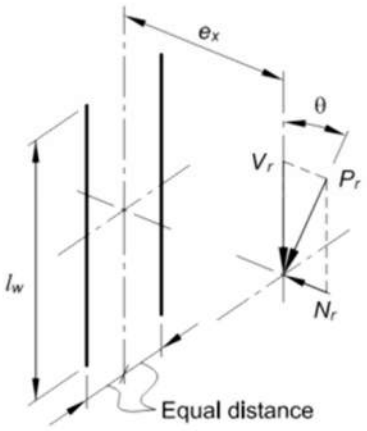

Fig. 8-8. Plastic method geometry.

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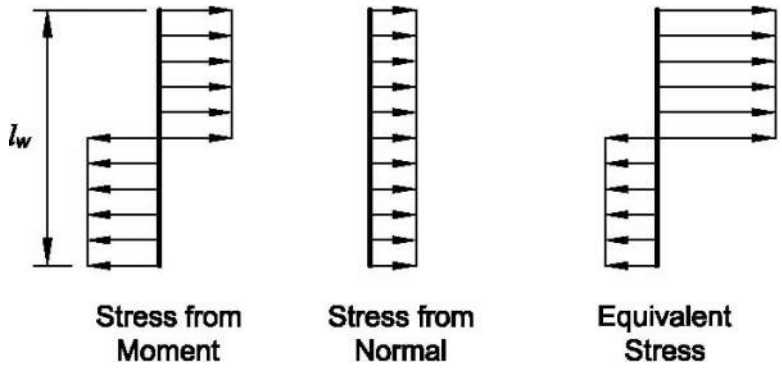
Part 8 – Design Considerations for Welds

Clarification on analysis methods for Eccentrically Loaded Weld Groups

Conventional Plastic Method:



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Part 8 – Design Considerations for Welds

Clarification on analysis methods for Eccentrically Loaded Weld Groups

Optimum Plastic Method

2. Optimum Plastic Method (OPM)
This method calculates the stress based on a plastic normal stress distribution. This method can be used only when N_r is nonzero. If $N_r = 0$, use the CPM. As shown in Figure 8-9(b), a dedicated length, l_a, is assigned to carry the normal force. The magnitude of stress from the normal force and moment are equal inside and outside l_a. The equivalent normal force is:

$$N_{equiv} = \left(\frac{l_w}{l_a}\right) N_r \qquad \text{(8-27b)}$$

where

$$l_a = 2\sqrt{\left(\frac{M_r}{N_r}\right)^2 + \left(\frac{l_w}{2}\right)^2} - 2\left(\frac{M_r}{N_r}\right), \text{ in.} \qquad \text{(8-28)}$$

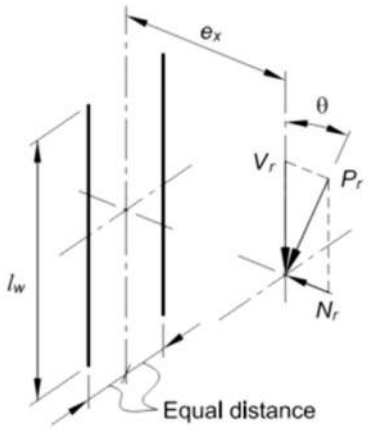

Fig. 8-8. Plastic method geometry.

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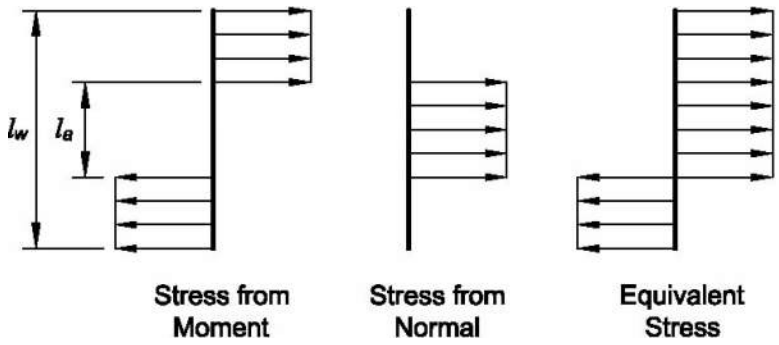
Part 8 – Design Considerations for Welds

Clarification on analysis methods for Eccentrically Loaded Weld Groups

Optimum Plastic Method:



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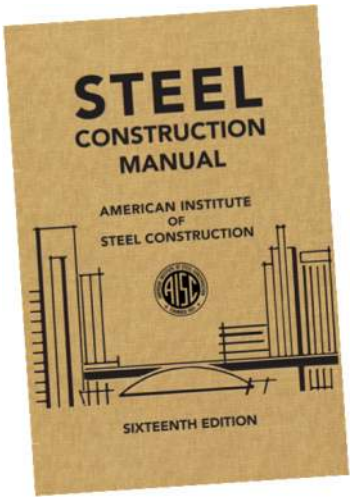

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PART 9 – DESIGN OF CONNECTING ELEMENTS

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Part 9 – Design of Connecting Elements

NEW

- Table 9-2b Plastic Section Modulus for Coped W-Shapes
- Section on Biaxial Stresses on Connection Elements

UPDATES

- Block Shear Rupture tables (Table 9-3a thru 9-3c) updated to remove 36 ksi
- Prying Action section provides additional clarification and more simplified approach

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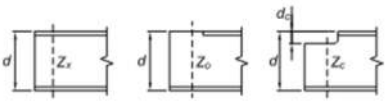
Part 9 – Design of Connecting Elements

NEW Table 9-2b

Table 9-2b
Plastic Section Modulus for Coped W-Shapes



Shape	d, in.	t_f, in.	Z_x, in.^{3}	Z_o, in.^{3}	Z_c, in.^{3} d_c, in. 2	3	4	5	6	7	8	9	10
W44×408	44.8	2.17	2000	1090	–	959	918	877	837	797	758	720	683
×368	44.4	1.97	1800	969	892	854	817	780	744	709	674	639	606
×335	44.0	1.77	1620	886	816	781	747	713	680	648	616	585	554
×290	43.6	1.58	1410	746	685	656	627	598	570	542	515	488	461
×262	43.3	1.42	1270	670	615	588	562	536	511	486	461	437	413
×230	42.9	1.22	1100	591	543	519	496	473	451	429	407	385	364
W40×655	43.6	3.54	3080	1640	–	–	1370	1310	1240	1180	1120	1060	996
×593	43.0	3.23	2760	1460	–	–	1220	1160	1100	1050	989	934	880
×503	42.1	2.76	2320	1220	–	1060	1010	961	912	864	817	771	725
×431	41.3	2.36	1960	1020	–	892	849	807	766	725	685	645	606
×397	41.0	2.20	1800	928	–	807	768	729	691	653	617	580	545
×372	40.6	2.05	1680	866	–	752	715	679	643	608	574	540	507
×362	40.6	2.01	1640	839	–	728	693	658	623	589	555	522	490
×324	40.2	1.81	1460	740	674	641	610	578	547	517	487	458	429
×297	39.8	1.65	1330	674	614	584	555	526	498	470	443	416	390
×277	39.7	1.58	1250	609	554	526	499	473	447	421	396	372	348
×249	39.4	1.42	1120	545	494	470	446	422	399	376	353	331	309
×215	39.0	1.22	964	465	422	401	380	359	339	319	300	281	263
×199	38.7	1.07	869	447	407	387	367	348	329	310	292	274	257
W40×392	41.6	2.52	1710	1020	–	893	852	812	773	734	696	659	622

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Part 9 – Design of Connecting Elements

NEW Section on Biaxial Stresses on Connection Elements

Bi-Axial Stresses on Connection Elements

For rectangular connection elements with in-plane and out-of-plane loads, a plastic interaction equation for any possible load combination was developed by Dowswell (2015).

Alternatively, when the applied member stress is known, the biaxial state of stress can be evaluated on an elastic basis using the general form of the von Mises equation. The von Mises equation, with planar stresses, may be expressed as follows:

$$F_{cr}^2 = f_r^2 + f_n^2 + f_r f_n + 3f_v^2 \qquad (9\text{-}3)$$

This approach is intended for assessment of stress at local attachments to the webs and flanges of members in locations away from discontinuities and stress concentrations on an elastic basis, and to assess the need for stiffeners at these attachment points. When performing such an assessment, Equation 9-3 can be expressed as follows to determine the available local stress transverse to the member axis at the point of attachment:

$$f_r = -\left(\frac{f_n}{2}\right) + \sqrt{F_{cr}^2 - 3(c_2 f_v)^2 - 0.75 f_n^2} \qquad (9\text{-}4)$$

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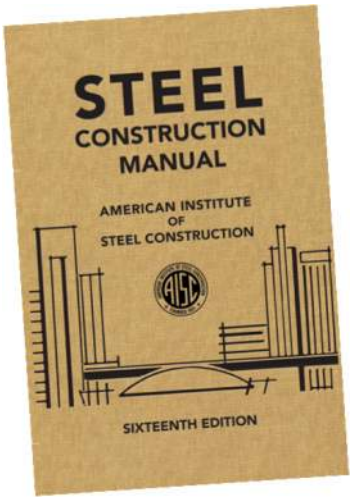

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PART 10 – DESIGN OF SIMPLE SHEAR CONNECTIONS

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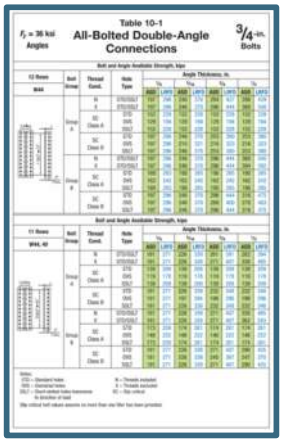
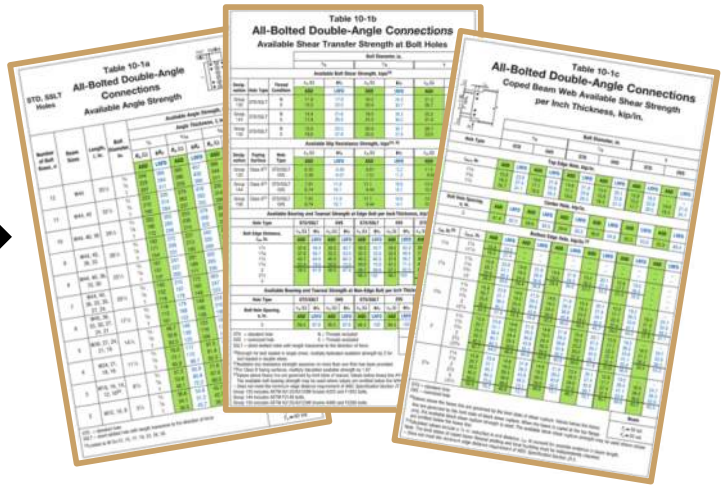
Part 10 – Design of Simple Shear Connections

NEW

- Tables 10-1, 10-4, 10-10, and 10-12 split into 3 new tables





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Part 10 – Design of Simple Shear Connections

NEW

- Tables 10-1, 10-4, 10-10, and 10-12 split into 3 new tables

UPDATE

- Tables updated to add Group 144 and Group 150 bolts:
  - Table 10-5 Bolted Unstiffened Seated Connections
  - Table 10-7 Stiffened Seated Connections
- Table 10-15 updated from 46 ksi to 50 ksi

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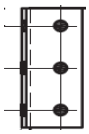
Part 10 – Design of Simple Shear Connections

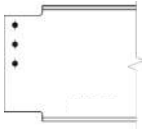
Table 10-1 All-Bolted Double-Angle Connections split into 3 new tables:

- Table 10-1a: Available Angle Strength



- Table 10-1b: Available Shear Transfer Strength at Bolt Holes

- Table 10-1c: Coped Beam Web Available Shear Strength



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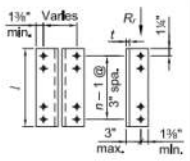
All-Bolted Double-Angle Connection

Table 10-1a − Available Angle Strength

- Shear yielding
- Shear rupture
- Block shear rupture

Table 10-1a
All-Bolted Double-Angle Connections
Available Angle Strength

STD, SSLT Holes



Number of Bolt Rows, *n*	Beam Sizes	Length, *l*, in.	Bolt Diameter, in.	Available Angle Strength, kips							
				Angle Thickness, *t*, in.							
				¼		5/16		⅜		½	
				R_n/Ω	ϕR_n	R_n/Ω	ϕR_n	R_n/Ω	ϕR_n	R_n/Ω	ϕR_n
				ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
12	W44	35½	¾	244	366	305	457	366	548	488	731
			⅞	229	344	286	430	344	516	458	687
			1	207	311	259	388	311	466	414	622
11	W44, 40	32½	¾	223	335	279	418	335	502	446	669
			⅞	210	314	262	393	314	472	419	629
			1	190	284	237	355	284	426	379	569
10	W44, 40, 36	29½	¾	202	303	253	379	303	455	405	607
			⅞	190	285	238	356	285	428	380	570
			1	172	258	215	322	258	387	344	516
9	W44, 40, 36, 33	26½	¾	182	272	227	340	272	409	363	545
			⅞	171	256	213	320	256	384	341	512
			1	154	231	193	289	231	347	308	463
			¾	161	241	201	302	241	362	322	483

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All-Bolted Double-Angle Connection

Table 10-1b – Available Shear Transfer Strength at Bolt Holes

- Bolt shear strength
- Bearing/tearout strength at edge bolt
- Bearing/tearout strength at non-edge bolt

Table 10-1b
All-Bolted Double-Angle Connections
Available Shear Transfer Strength at Bolt Holes

			Bolt Diameter, in.					
			¾		⅞		1	
Available Bolt Shear Strength, kips[a]								
Design-nation	Hole Type	Thread Condition	r_n/Ω	ϕr_n	r_n/Ω	ϕr_n	r_n/Ω	ϕr_n
			ASD	LRFD	ASD	LRFD	ASD	LRFD
Group 120	STD/SSLT	N	11.9	17.9	16.2	24.3	21.2	31.8
		X	15.0	22.5	20.4	30.7	26.7	40.0
Group 144	STD/SSLT	N	14.4	21.6	19.5	29.3	25.5	38.3
		X	17.9	26.9	24.3	36.5	31.8	47.7
Group 150	STD/SSLT	N	15.0	22.5	20.4	30.7	26.7	40.0
		X	18.6	27.8	25.2	37.9	33.0	49.5
Available Slip Resistance Strength, kips[a, b]								
Design-nation	Faying Surface	Hole Type	r_n/Ω	ϕr_n	r_n/Ω	ϕr_n	r_n/Ω	ϕr_n
			ASD	LRFD	ASD	LRFD	ASD	LRFD
Group 120	Class A[c]	STD/SSLT	6.33	9.49	8.81	13.2	11.5	17.3
		OVS	5.39	8.07	7.51	11.2	9.82	14.7
Group 144	Class A[c]	STD/SSLT	7.91	11.9	11.1	16.6	14.5	21.7
		OVS	6.74	10.1	9.44	14.1	12.3	18.4
Group 150	Class A[c]	STD/SSLT	7.91	11.9	11.1	16.8	14.5	21.7
		OVS	6.74	10.1	9.44	14.1	12.3	18.4
Available Bearing and Tearout Strength at Edge Bolt per Inch Thickness, kip/in.[d]								
Hole Type			STD/SSLT		OVS		STD/SSLT	
Bolt Edge Distance, l_{em}, in.			r_n/Ω	ϕr_n	r_n/Ω	ϕr_n	r_n/Ω	ϕr_n
			ASD	LRFD	ASD	LRFD	ASD	LRFD
1¼			32.9	49.4	30.5	45.7	30.5	45.7
1⅝			37.8	56.7	35.3	53.0	35.3	53.0
1½			42.7	64.0	40.2	60.3	40.2	60.3
1¾			47.5	71.3	45.0	67.5	47.5	71.3
2			58.5	87.8	58.5	87.8	58.7	85.9
2½							68.3	102
3								
Available Bearing and Tearout Strength at Non-Edge Bolt per Inch Thickness, kip/in.								
Hole Type			STD/SSLT		OVS		STD/SSLT	
Bolt Hole Spacing, *s*, in.			r_n/Ω	ϕr_n	r_n/Ω	ϕr_n	r_n/Ω	ϕr_n
			ASD	LRFD	ASD	LRFD	ASD	LRFD
3			58.5	87.8	58.5	87.8	68.3	102

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All-Bolted Double-Angle Connection

Table 10-1b – Available Shear Transfer Strength at Bolt Holes

- Bolt shear strength
- Bearing/tearout at edge
- Bearing/tearout at non-edge

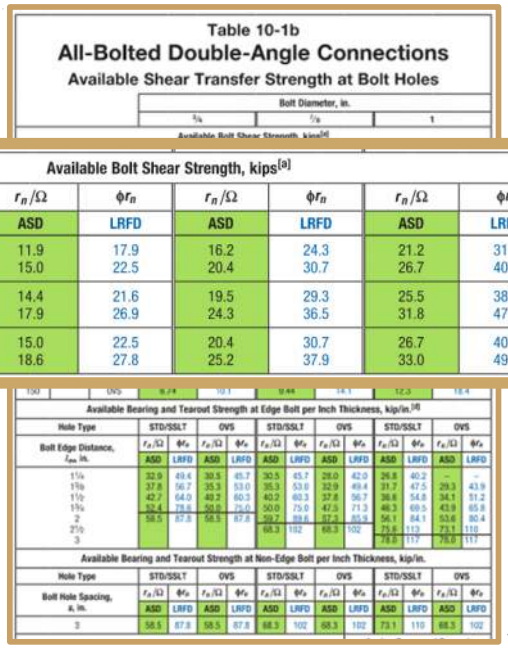

Table 10-1b
All-Bolted Double-Angle Connections
Available Shear Transfer Strength at Bolt Holes

Available Bolt Shear Strength, kips[a]

Design-nation	Hole Type	Thread Condition	r_n/Ω ASD	ϕr_n LRFD	r_n/Ω ASD	ϕr_n LRFD	r_n/Ω ASD	ϕr_n LRFD
Group 120	STD/SSLT	N	11.9	17.9	16.2	24.3	21.2	31.8
		X	15.0	22.5	20.4	30.7	26.7	40.0
Group 144	STD/SSLT	N	14.4	21.6	19.5	29.3	25.5	38.3
		X	17.9	26.9	24.3	36.5	31.8	47.7
Group 150	STD/SSLT	N	15.0	22.5	20.4	30.7	26.7	40.0
		X	18.6	27.8	25.2	37.9	33.0	49.5

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All-Bolted Double-Angle Connection

Table 10-1b – Available Shear Transfer Strength at Bolt Holes

- Bolt shear strength
- Bearing/tearout strength at edge bolt
- Bearing/tearout strength at non-edge bolt

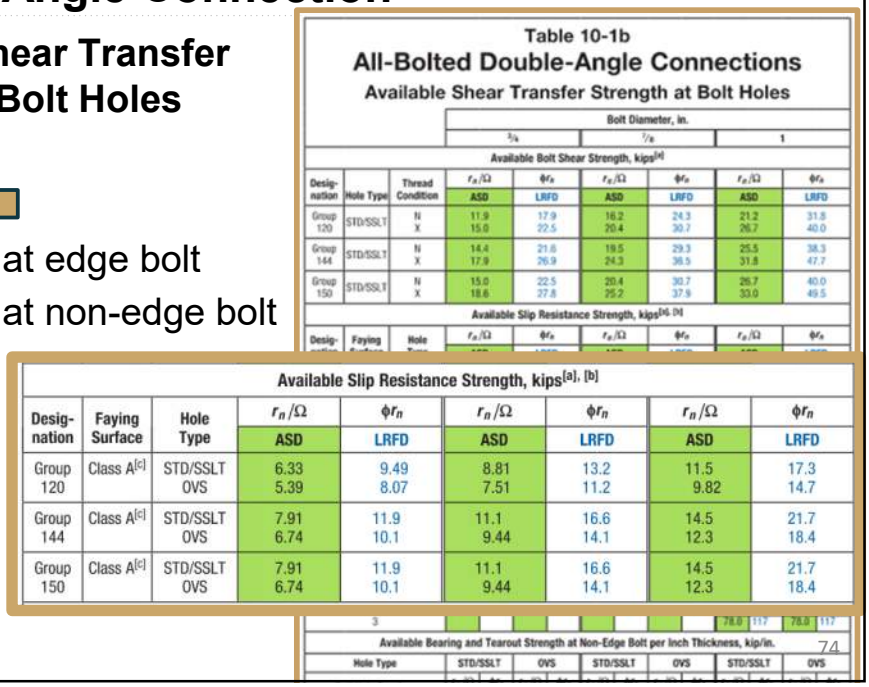

Table 10-1b
All-Bolted Double-Angle Connections
Available Shear Transfer Strength at Bolt Holes

Available Slip Resistance Strength, kips[a], [b]

Design-nation	Faying Surface	Hole Type	r_n/Ω ASD	ϕr_n LRFD	r_n/Ω ASD	ϕr_n LRFD	r_n/Ω ASD	ϕr_n LRFD
Group 120	Class A[c]	STD/SSLT	6.33	9.49	8.81	13.2	11.5	17.3
		OVS	5.39	8.07	7.51	11.2	9.82	14.7
Group 144	Class A[c]	STD/SSLT	7.91	11.9	11.1	16.6	14.5	21.7
		OVS	6.74	10.1	9.44	14.1	12.3	18.4
Group 150	Class A[c]	STD/SSLT	7.91	11.9	11.1	16.6	14.5	21.7
		OVS	6.74	10.1	9.44	14.1	12.3	18.4

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All-Bolted Double-Angle Connection

Table 10-1b – Available Shear Transfer Strength at Bolt Holes

- Bolt shear strength
- Bearing/tearout strength at edge bolt
- Bearing/tearout strength at non-edge bolt

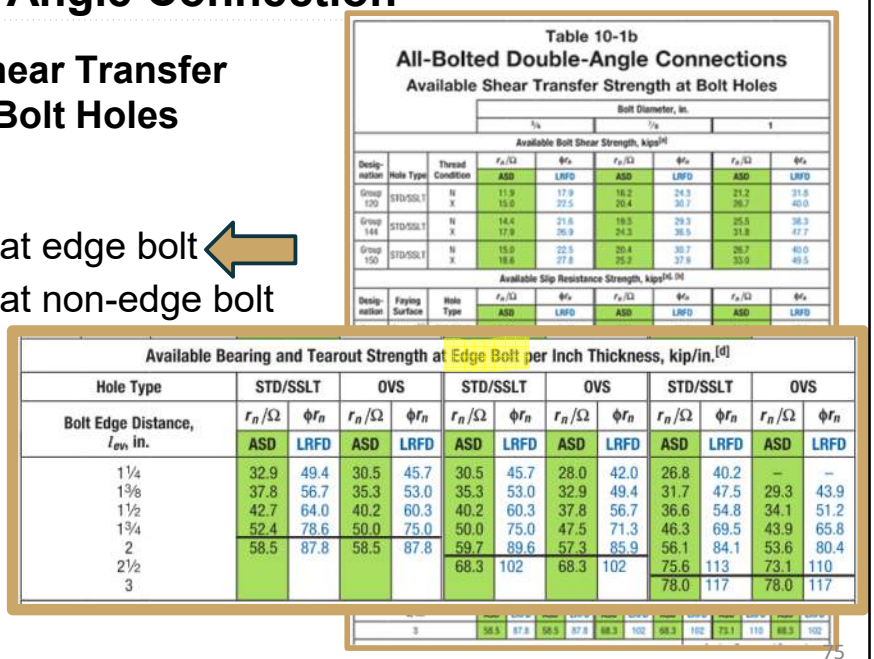

Table 10-1b
All-Bolted Double-Angle Connections
Available Shear Transfer Strength at Bolt Holes

Available Bolt Shear Strength, kips[a]

Design-nation	Hole Type	Thread Condition	Bolt Diameter, in. ¾ ASD	¾ LRFD	⅞ ASD	⅞ LRFD	1 ASD	1 LRFD
Group 120	STD/SSLT	N	11.9	17.9	16.2	24.3	21.2	31.8
		X	15.0	22.5	20.4	30.7	26.7	40.0
Group 144	STD/SSLT	N	14.4	21.6	19.5	29.3	25.5	38.3
		X	17.9	26.9	24.3	36.5	31.8	47.7
Group 150	STD/SSLT	N	15.0	22.5	20.4	30.7	26.7	40.0
		X	18.6	27.8	25.2	37.9	33.0	49.5

Available Slip Resistance Strength, kips[a, b]

Design-nation	Faying Surface	Hole Type	Bolt Diameter, in. ¾ ASD	¾ LRFD	⅞ ASD	⅞ LRFD	1 ASD	1 LRFD
Group 120	Class A[c]	STD/SSLT	6.33	9.49	8.81	13.2	11.5	17.3
		OVS	5.39	8.07	7.51	11.2	9.82	14.7
Group 144	Class A[c]	STD/SSLT	7.91	11.9	11.1	16.6	14.5	21.7
		OVS	6.74	10.1	9.44	14.1	12.3	18.4
Group 150	Class A[c]	STD/SSLT	7.91	11.9	11.1	16.6	14.5	21.7
		OVS	6.74	10.1	9.44	14.1	12.3	18.4

Available Bearing and Tearout Strength at Edge Bolt per Inch Thickness, kip/in.[d]

Hole Type	STD/SSLT		OVS		STD/SSLT		OVS		STD/SSLT		OVS	
Bolt Edge Distance, l_{ev}, in.	r_n/Ω ASD	ϕr_n LRFD	r_n/Ω ASD	ϕr_n LRFD	r_n/Ω ASD	ϕr_n LRFD	r_n/Ω ASD	ϕr_n LRFD	r_n/Ω ASD	ϕr_n LRFD	r_n/Ω ASD	ϕr_n LRFD
1¼	32.9	49.4	30.5	45.7	30.5	45.7	28.0	42.0	26.8	40.2	–	–
1⅜	37.8	56.7	35.3	53.0	35.3	53.0	32.9	49.4	31.7	47.5	29.3	43.9
1½	42.7	64.0	40.2	60.3	40.2	60.3	37.8	56.7	36.6	54.8	34.1	51.2
1¾	52.4	78.6	50.0	75.0	50.0	75.0	47.5	71.3	46.3	69.5	43.9	65.8
2	58.5	87.8	58.5	87.8	59.7	89.6	57.3	85.9	56.1	84.1	53.6	80.4
2½					68.3	102	68.3	102	75.6	113	73.1	110
3									78.0	117	78.0	117

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All-Bolted Double-Angle Connection

Table 10-1b – Available Shear Transfer Strength at Bolt Holes

- Bolt shear strength
- Bearing/tearout strength at edge bolt
- Bearing/tearout strength at non-edge bolt

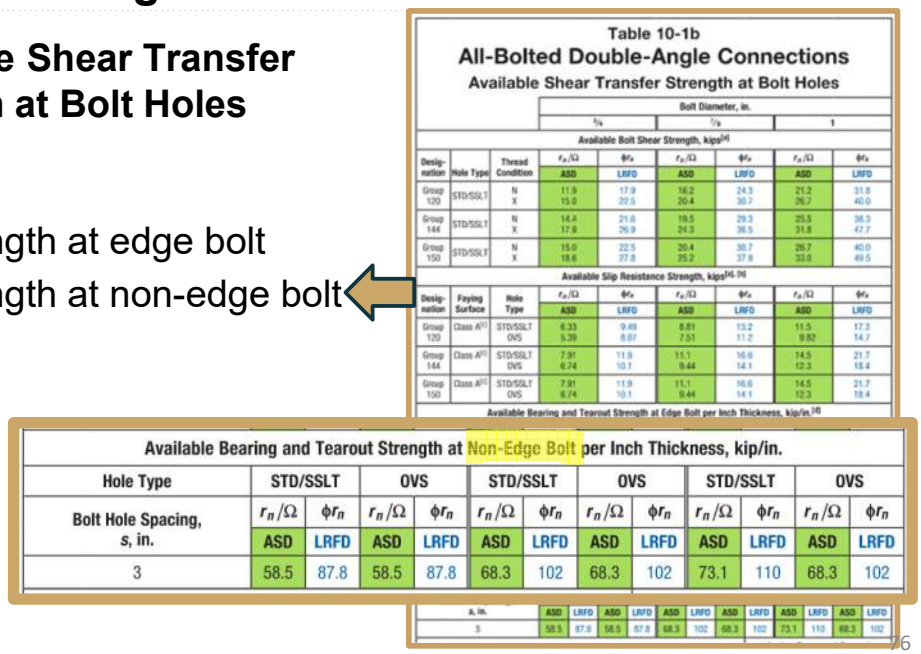

Table 10-1b
All-Bolted Double-Angle Connections
Available Shear Transfer Strength at Bolt Holes

Available Bolt Shear Strength, kips[a]

Design-nation	Hole Type	Thread Condition	Bolt Diameter, in. ¾ ASD	¾ LRFD	⅞ ASD	⅞ LRFD	1 ASD	1 LRFD
Group 120	STD/SSLT	N	11.9	17.9	16.2	24.3	21.2	31.8
		X	15.0	22.5	20.4	30.7	26.7	40.0
Group 144	STD/SSLT	N	14.4	21.6	19.5	29.3	25.5	38.3
		X	17.9	26.9	24.3	36.5	31.8	47.7
Group 150	STD/SSLT	N	15.0	22.5	20.4	30.7	26.7	40.0
		X	18.6	27.8	25.2	37.9	33.0	49.5

Available Slip Resistance Strength, kips[a, b]

Design-nation	Faying Surface	Hole Type	Bolt Diameter, in. ¾ ASD	¾ LRFD	⅞ ASD	⅞ LRFD	1 ASD	1 LRFD
Group 120	Class A[c]	STD/SSLT	6.33	9.49	8.81	13.2	11.5	17.3
		OVS	5.39	8.07	7.51	11.2	9.82	14.7
Group 144	Class A[c]	STD/SSLT	7.91	11.9	11.1	16.6	14.5	21.7
		OVS	6.74	10.1	9.44	14.1	12.3	18.4
Group 150	Class A[c]	STD/SSLT	7.91	11.9	11.1	16.6	14.5	21.7
		OVS	6.74	10.1	9.44	14.1	12.3	18.4

Available Bearing and Tearout Strength at Non-Edge Bolt per Inch Thickness, kip/in.

Hole Type	STD/SSLT		OVS		STD/SSLT		OVS		STD/SSLT		OVS	
Bolt Hole Spacing, s, in.	r_n/Ω ASD	ϕr_n LRFD	r_n/Ω ASD	ϕr_n LRFD	r_n/Ω ASD	ϕr_n LRFD	r_n/Ω ASD	ϕr_n LRFD	r_n/Ω ASD	ϕr_n LRFD	r_n/Ω ASD	ϕr_n LRFD
3	58.5	87.8	58.5	87.8	68.3	102	68.3	102	73.1	110	68.3	102

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All-Bolted Double-Angle Connection

Table 10-1c – Coped Beam Web Available Shear Strength

- Shear yielding
- Shear rupture
- Block shear rupture

Table 10-1c
All-Bolted Double-Angle Connections
Coped Beam Web Available Shear Strength
per Inch Thickness, kip/in.

Hole Type	Bolt Diameter, in.											
	3/4				7/8				1			
	STD		OVS		STD		OVS		STD		OVS	
Top Edge Hole, kip/in.												
$l_{ev,t}$, in.	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
1¼	15.8	23.8	14.6	21.9	14.6	21.9	13.4	20.1	12.8	19.2	–	–
1⅜	18.3	27.4	17.1	25.6	17.1	25.6	15.8	23.8	15.2	22.9	14.0	21.0
1½	20.7	31.1	19.5	29.3	19.5	29.3	18.3	27.4	17.7	26.5	16.5	24.7
Center Hole, kip/in.												
Bolt Hole Spacing, s, in.	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
3	41.4	62.2	39.0	58.5	39.0	58.5	36.6	54.8	35.3	53.0	32.9	49.4
Bottom Edge Hole, kip/in.[a]												
l_{eh}, in.[b]	$l_{ev,b}$, in.	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
1¼	1¼	15.8	23.8	–	–	–	–	–	–	–	–	–	–
	≥1½	18.3	27.4	–	–	–	–	–	–	–	–	–	–
1½	1¼	15.8	23.8	14.6	21.9	14.6	21.9	13.4	20.1	12.8	19.2	–	–
	1½	20.7	31.1	19.5	29.3	19.5	29.3	18.3	27.4	17.7	26.5	–	–
	1¾	25.6	38.4	24.4	36.6	24.4	36.6	22.3	33.5	21.3	32.0	–	–
	≥2	26.4	39.6	24.4	36.6							–	–
	1¼	15.8	23.8	14.6	21.9	14.6	21.9	13.4	20.1	12.8	19.2	–	–

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All-Bolted Double-Angle Connection

Table 10-1c – Coped Beam Web Available Shear Strength

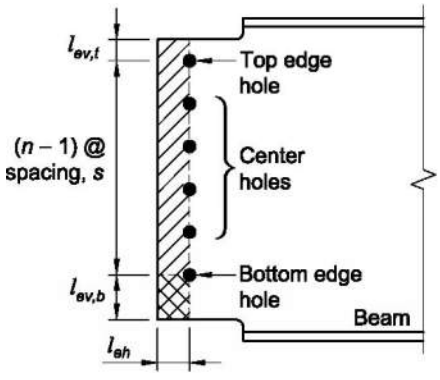

Table 10-1c
All-Bolted Double-Angle Connections
Coped Beam Web Available Shear Strength
per Inch Thickness, kip/in.

Top Edge Hole, kip/in.												
$l_{ev,t}$, in.	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
1¼	15.8	23.8	14.6	21.9	14.6	21.9	13.4	20.1	12.8	19.2	–	–
1⅜	18.3	27.4	17.1	25.6	17.1	25.6	15.8	23.8	15.2	22.9	14.0	21.0
1½	20.7	31.1	19.5	29.3	19.5	29.3	18.3	27.4	17.7	26.5	16.5	24.7

Bolt Hole Spacing, s, in.	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
3	41.4	62.2	39.0	58.5	39.0	58.5	36.6	54.8	35.3	53.0	32.9	49.4
Bottom Edge Hole, kip/in.[a]												
l_{eh}, in.[b]	$l_{ev,b}$, in.	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
1¼	1¼	15.8	23.8	–	–	–	–	–	–	–	–	–	–
	≥1½	18.3	27.4	–	–	–	–	–	–	–	–	–	–
1½	1¼	15.8	23.8	14.6	21.9	14.6	21.9	13.4	20.1	12.8	19.2	–	–
	1½	20.7	31.1	19.5	29.3	19.5	29.3	18.3	27.4	17.7	26.5	–	–
	1¾	25.6	38.4	24.4	36.6	24.4	36.6	22.3	33.5	21.3	32.0	–	–
	≥2	26.4	39.6	24.4	36.6							–	–
	1¼	15.8	23.8	14.6	21.9	14.6	21.9	13.4	20.1	12.8	19.2	–	–

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All-Bolted Double-Angle Connection

Table 10-1c – Coped Beam Web Available Shear Strength

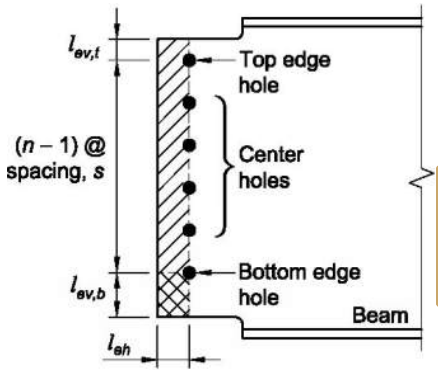

Table 10-1c
All-Bolted Double-Angle Connections
Coped Beam Web Available Shear Strength per Inch Thickness, kip/in.

Bolt Diameter, in.												
	¾				⅞				1			
Hole Type	STD		OVS		STD		OVS		STD		OVS	
Top Edge Hole, kip/in.												
$l_{ev,t}$, in.	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
1¼	15.8	23.8	14.6	21.9	14.6	21.9	13.4	20.1	12.8	19.2	–	–

Center Hole, kip/in.

Bolt Hole Spacing, s, in.	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
3	41.4	62.2	39.0	58.5	39.0	58.5	36.6	54.8	35.3	53.0	32.9	49.4

l_{eh}, in.[b]	$l_{ev,b}$, in.	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
1¼	1¼	15.8	23.8	–	–	–	–	–	–	–	–	–	–
	≥1½	18.3	27.4	–	–	–	–	–	–	–	–	–	–
1½	1¼	15.8	23.8	14.6	21.9	14.6	21.9	13.4	20.1	12.8	19.2	–	–
	1½	20.7	31.1	19.5	29.3	19.5	29.3	18.3	27.4	17.7	26.5	–	–
	1¾	25.6	38.4	24.4	36.6	24.4	36.6	22.3	33.5	21.3	32.0	–	–
	≥2	26.4	39.6	24.4	36.6							–	–
	1¼	15.8	23.8	14.6	21.9	14.6	21.9	13.4	20.1	12.8	19.2	–	–

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All-Bolted Double-Angle Connection

Table 10-1c – Coped Beam Web Available Shear Strength

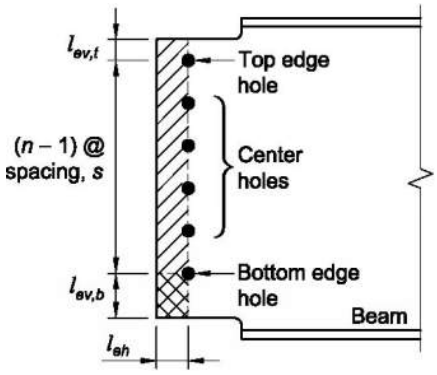

Table 10-1c
All-Bolted Double-Angle Connections
Coped Beam Web Available Shear Strength per Inch Thickness, kip/in.

Bolt Diameter, in.												
	¾				⅞				1			
Hole Type	STD		OVS		STD		OVS		STD		OVS	
Top Edge Hole, kip/in.												
$l_{ev,t}$, in.	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
1¼	15.8	23.8	14.6	21.9	14.6	21.9	13.4	20.1	12.8	19.2	–	–
1⅜	18.3	27.4	17.1	25.6	17.1	25.6	15.8	23.8	15.2	22.9	14.0	21.0
1½	20.7	31.1	19.5	29.3	19.5	29.3	18.3	27.4	17.7	26.5	16.5	24.7

Bottom Edge Hole, kip/in.[a]

l_{eh}, in.[b]	$l_{ev,b}$, in.	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
1¼	1¼	15.8	23.8	–	–	–	–	–	–	–	–	–	–
	≥1½	18.3	27.4	–	–	–	–	–	–	–	–	–	–
1½	1¼	15.8	23.8	14.6	21.9	14.6	21.9	13.4	20.1	12.8	19.2	–	–
	1½	20.7	31.1	19.5	29.3	19.5	29.3	18.3	27.4	17.7	26.5	–	–
	1¾	25.6	38.4	24.4	36.6	24.4	36.6	22.3	33.5	21.3	32.0	–	–
	≥2	26.4	39.6	24.4	36.6							–	–
	1¼	15.8	23.8	14.6	21.9	14.6	21.9	13.4	20.1	12.8	19.2	–	–

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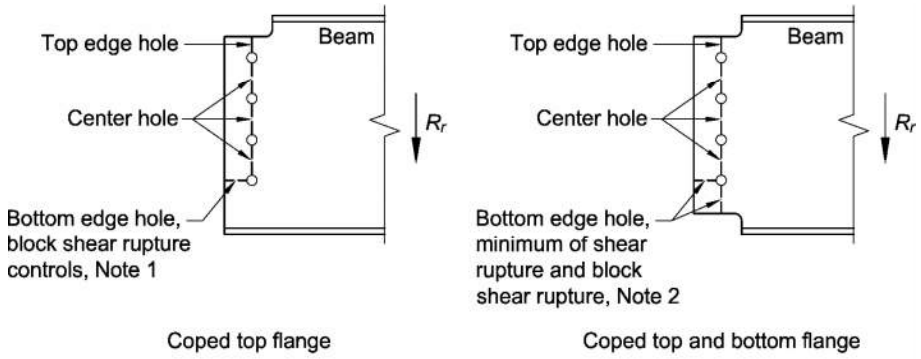
All-Bolted Double-Angle Connection

Table 10-1c – Coped Beam Web Available Shear Strength



Note 1: Use Table 10-1c (Bottom Edge Hole) value under heavy line
Note 2: Use Table 10-1c (Bottom Edge Hole) value given for l_{eh} and $l_{ev,b}$

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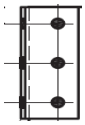
All-Bolted Double-Angle Connection

Table limit states summary:

Table 10-1a

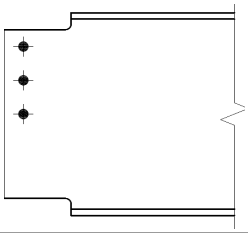


Angle
Shear yielding
Shear rupture
Block shear rupture

Table 10-1b

Shear Transfer
Shear strength
Angle brg/tearout
Web brg/tearout

Table 10-1c



Beam Web
Shear yielding
Shear rupture
Block shear rupture

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Part 10 – Design of Simple Shear Connections

Also split into 3 tables:

Table 10-4 Shear End-Plate Connections
Table 10-10 Single Plate Connections
Table 10-12 Bolted/Welded Single-Angle Connections

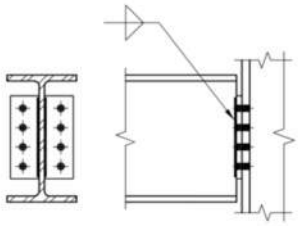


Fig. 10-7. Shear end-plate connections.

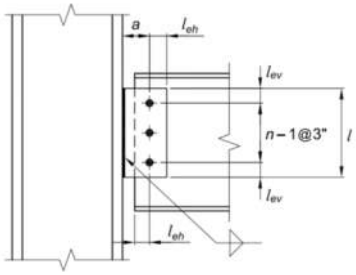
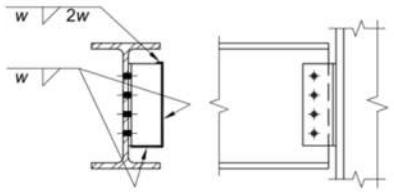


Fig. 10-12. Single-plate connection—conventional configuration.



(c) Bolted/welded, angle welded to support

Fig. 10-14. Single-angle connections.

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Part 10 – Design of Simple Shear Connections

Table 10-4 Shear End-Plate Connections

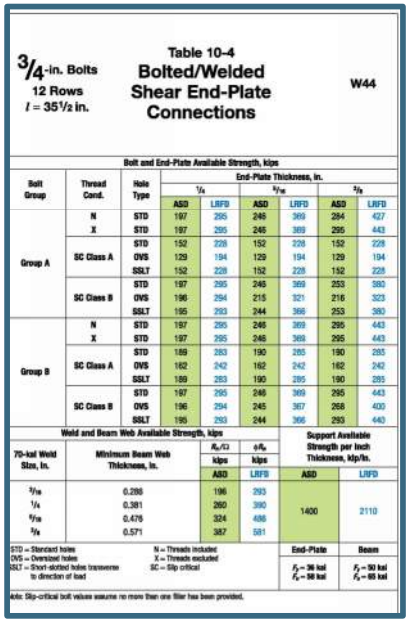

Table 10-4
Bolted/Welded Shear End-Plate Connections
W44

3/4-in. Bolts
12 Rows
l = 35½ in.

Bolt and End-Plate Available Strength, kips

Bolt Group	Thread Cond.	Hole Type	End-Plate Thickness, in. 1/4 ASD	1/4 LRFD	5/16 ASD	5/16 LRFD	3/8 ASD	3/8 LRFD
Group A	N	STD	197	295	246	369	294	427
	X	STD	197	295	246	369	295	443
	SC Class A	STD	152	228	152	228	152	228
		OVS	129	194	129	194	129	194
		SSLT	152	228	152	228	152	228
	SC Class B	STD	197	295	246	369	253	380
		OVS	196	294	215	321	216	323
		SSLT	195	293	244	366	253	380
Group B	N	STD	197	295	246	369	295	443
	X	STD	197	295	246	369	295	443
	SC Class A	STD	189	283	190	285	190	285
		OVS	162	242	162	242	162	242
		SSLT	189	283	190	285	190	285
	SC Class B	STD	197	295	246	369	295	443
		OVS	196	294	245	367	268	400
		SSLT	195	293	244	366	293	440

Weld and Beam Web Available Strength, kips

70-ksi Weld Size, in.	Minimum Beam Web Thickness, in.	R_n/Ω kips ASD	ϕR_n kips LRFD	Support Available Strength per Inch Thickness, kip/in. ASD	LRFD
5/16	0.286	196	293	1400	2110
1/4	0.381	260	390		
5/16	0.476	324	486		
3/8	0.571	387	581		

STD = Standard holes
OVS = Oversized holes
SSLT = Short-slotted holes transverse to direction of load
N = Threads included
X = Threads excluded
SC = Slip critical

End-Plate	Beam
F_y = 36 ksi F_u = 58 ksi	F_y = 50 ksi F_u = 65 ksi

Note: Slip-critical bolt values assume no more than one filler has been provided.

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Part 10 – Design of Simple Shear Connections

Table 10-4 Shear End-Plate Connections

Table 10-4a
Shear End-Plate Connections
Available End-Plate Strength

STD, SSLT Holes

Number of Bolt Rows, n	Beam Size	Length, L, in.	Bolt Diameter, in.	Available End-Plate Strength, kips							
				End-Plate Thickness, t, in.							
				1/4		5/16		3/8		1/2	
				R_n/Ω ASD	ϕR_n LRFD	R_n/Ω ASD	ϕR_n LRFD	R_n/Ω ASD	ϕR_n LRFD	R_n/Ω ASD	ϕR_n LRFD
12	W44	35 1/2	3/4	244	366	305	457	366	548	488	731
			7/8	229	344	286	430	344	516	458	687
			1	207	311	259	388	311	466	414	622
11	W44, 40	32 1/2	3/4	223	335	279	418	335	502	446	669
			7/8	210	314	262	393	314	472	419	629
			1	190	284	237	355	284	426	379	569
10	W44, 40, 36	29 1/2	3/4	202	303	253	379	303	455	405	607
			7/8	190	285	238	356	285	428	380	570
			1	172	258	215	322	258	387	344	516
9	W44, 40, 36, 33	26 1/2	3/4	182	272	227	340	272	409	363	545
			7/8	171	256	213	320	256	384	341	512
			1	154	231	193	289	231	347	308	463
8	W44, 40, 36, 33, 30	23 1/2	3/4	161	241	201	302	241	362	322	483
			7/8	151	227	189	283	227	340	302	453
			1	137	205	171	256	205	307	273	410
7	W44, 40, 36, 33, 30, 27, 24	20 1/2	3/4	140	210	175	263	210	315	280	420
			7/8	132	197	165	247	197	296	263	395
			1	119	178	148	223	178	267	238	356
6	W44, 40, 36, 33, 30, 27, 24, 21	17 1/2	3/4	119	179	148	224	179	269	239	358
			7/8	112	168	140	210	168	252	224	336
			1	101	152	126	190	152	228	202	303
5	W30, 27, 24, 21, 18	14 1/2	3/4	98.7	148	123	185	148	222	197	296
			7/8	92.6	139	116	174	139	208	185	278
			1	83.5	125	104	157	125	188	167	250
4	W24, 21, 18, 16	11 1/2	3/4	78.0	117	97.5	146	117	176	196	234
			7/8	73.1	110	91.4	137	110	165	146	219
			1	65.8	98.7	82.3	123	98.7	148	132	197
3	W16, 18, 14, 12, 10[a]	8 1/2	3/4	57.3	85.9	71.6	107	85.9	129	115	172
			7/8	53.6	80.4	67.0	101	80.4	121	107	161
			1	48.1	72.2	60.2	90.3	72.2	108	96.3	144
2	W12, 10, 8	5 1/2	3/4	36.6	54.8	45.7	68.6	54.8	82.3	73.1	110
			7/8	34.1	51.2	42.7	64.0	51.2	76.8	68.3	102
			1	30.5	45.7	38.1	57.1	45.7	68.6	60.9	91.4

STD = standard hole
SSLT = short-slotted hole with length transverse to the direction of force.
[a]Limited to W10×12, 15, 17, 19, 22, 26, 30.

End-Plate
F_y = 50 ksi
F_u = 65 ksi

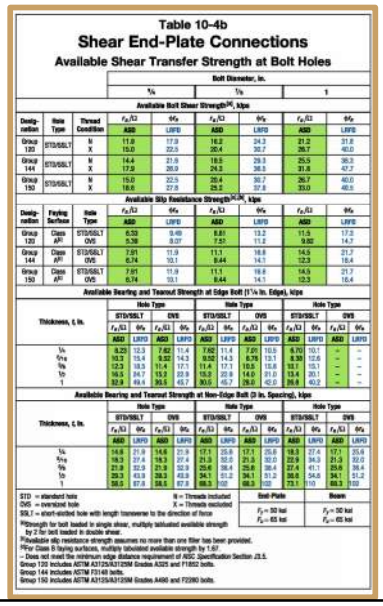

Table 10-4b
Shear End-Plate Connections
Available Shear Transfer Strength at Bolt Holes

Design-nation	Hole Type	Thread Condition	Available Bolt Shear Strength[b,c], kips					
			Bolt Diameter, in.					
			3/4		7/8		1	
			r_n/Ω ASD	ϕr_n LRFD	r_n/Ω ASD	ϕr_n LRFD	r_n/Ω ASD	ϕr_n LRFD
Group 120	STD/SSLT	N	11.8	17.9	16.2	24.3	21.2	31.8
		X	15.0	22.5	20.4	30.7	26.7	40.0
Group 144	STD/SSLT	N	14.4	21.5	19.5	29.3	25.5	38.3
		X	17.9	26.9	24.5	36.8	31.8	47.7
Group 150	STD/SSLT	N	15.0	22.5	20.4	30.7	26.7	40.0
		X	18.6	27.9	25.2	37.8	33.0	49.5

Design-nation	Faying Surface	Hole Type	Available Slip Resistance[b,d,e], kips					
			r_n/Ω ASD	ϕr_n LRFD	r_n/Ω ASD	ϕr_n LRFD	r_n/Ω ASD	ϕr_n LRFD
Group 120	Class A[f]	STD/SSLT	6.33	9.49	8.81	13.2	11.6	17.3
		OVS	5.38	8.07	7.52	11.2	9.82	14.7
Group 144	Class A[f]	STD/SSLT	7.91	11.9	11.1	16.8	14.5	21.7
		OVS	6.74	10.1	9.44	14.1	12.3	18.4
Group 150	Class A[f]	STD/SSLT	7.91	11.9	11.1	16.8	14.5	21.7
		OVS	6.74	10.1	9.44	14.1	12.3	18.4

Available Bearing and Tearout Strength at Edge Bolt (1 1/4 in. Edge), kips

Thickness, t, in.	Hole Type							
	STD/SSLT		OVS		STD/SSLT		OVS	
	r_n/Ω ASD	ϕr_n LRFD	r_n/Ω ASD	ϕr_n LRFD	r_n/Ω ASD	ϕr_n LRFD	r_n/Ω ASD	ϕr_n LRFD
1/4	6.29	12.3	7.62	11.4	7.62	11.4	7.01	10.5
5/16	10.3	15.4	9.32	14.3	9.32	14.3	8.78	13.1
3/8	12.3	18.3	11.4	17.1	11.4	17.1	10.5	15.8
1/2	16.3	24.7	15.2	22.9	15.2	22.9	14.0	21.0
1	32.9	49.4	30.5	45.7	30.5	45.7	28.0	42.0

Thickness, t, in.	Hole Type							
	STD/SSLT		OVS		STD/SSLT		OVS	
	r_n/Ω ASD	ϕr_n LRFD	r_n/Ω ASD	ϕr_n LRFD	r_n/Ω ASD	ϕr_n LRFD	r_n/Ω ASD	ϕr_n LRFD
1/4	14.8	21.9	14.8	21.9	17.1	25.8	17.1	25.8
5/16	18.3	27.4	18.3	27.4	21.3	32.0	21.3	32.0
3/8	21.8	32.9	21.8	32.9	25.6	38.4	25.6	38.4
1/2	29.3	43.9	29.3	43.9	34.1	51.2	34.1	51.2
1	58.5	87.8	58.5	87.8	68.3	102	68.3	102

STD = standard hole
OVS = oversized hole
SSLT = short-slotted hole with length transverse to the direction of force
[b]Strength for bolt loaded in single shear, multiply tabulated available strength by 2 for bolt loaded in double shear.
[d]Available slip resistance-strength assumes no more than one filler has been provided.
[e]For Class B faying surfaces, multiply tabulated available strength by 1.67
– = Does not meet the minimum edge distance requirement of AISC Specification Section J3.5.
Group 120 includes ASTM A325/A325M Grades A325 and F1852 bolts.
Group 144 includes ASTM F3148 bolts.
Group 150 includes ASTM A325/A325M Grades A490 and F2280 bolts.

N = Threads included
X = Threads excluded

End-Plate
F_y = 50 ksi
F_u = 65 ksi

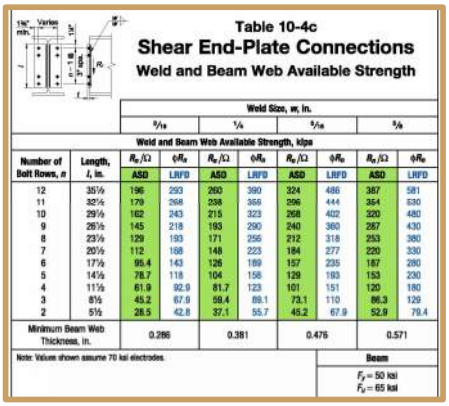

Table 10-4c
Shear End-Plate Connections
Weld and Beam Web Available Strength

Number of Bolt Rows, n	Length, L, in.	Weld Size, w, in.							
		5/16		1/4		5/16		3/8	
		Weld and Beam Web Available Strength, kips							
		R_n/Ω ASD	ϕR_n LRFD	R_n/Ω ASD	ϕR_n LRFD	R_n/Ω ASD	ϕR_n LRFD	R_n/Ω ASD	ϕR_n LRFD
12	35 1/2	196	293	260	390	324	486	387	581
11	32 1/2	179	268	238	356	296	444	354	530
10	29 1/2	162	243	215	323	268	402	320	480
9	26 1/2	145	218	193	290	240	360	287	430
8	23 1/2	129	193	171	256	212	318	253	380
7	20 1/2	112	168	148	223	184	277	220	330
6	17 1/2	95.4	143	126	189	157	235	187	280
5	14 1/2	78.7	118	104	156	129	193	153	230
4	11 1/2	61.9	92.9	81.7	123	101	151	120	180
3	8 1/2	45.2	67.9	59.4	89.1	73.1	110	86.3	129
2	5 1/2	28.5	42.8	37.1	55.7	45.2	67.9	52.9	79.4
Minimum Beam Web Thickness, in.		0.286		0.381		0.476		0.571	

Note: Values shown assume 70 ksi electrodes.

Beam
F_y = 50 ksi
F_u = 65 ksi

Part 10 – Design of Simple Shear Connections

Table 10-10 Single Plate Connections

Table 10-10a
F_y = 36 ksi Plate
Single-Plate Connections
Bolt, Weld and Single-Plate Available Strengths, kips
3/4-in. Bolts

n	Bolt Group	Thread Cond.	Hole Type	Plate Thickness, in.											
				1/4		5/16		3/8		7/16		1/2		5/16	
				ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
12 (d = 36 1/2)	Group A	N	STD	100	150	125	188	–	–	–	–	–	–	–	–
			SSLT	99.5	149	124	167	138	208	138	208	–	–	–	–
		X	STD	100	150	125	188	–	–	–	–	–	–	–	–
			SSLT	99.5	149	124	167	149	224	174	261	–	–	–	–
	Group B	N	STD	100	150	125	188	–	–	–	–	–	–	–	–
			SSLT	99.5	149	124	167	149	224	174	261	–	–	–	–
		X	STD	100	150	125	188	–	–	–	–	–	–	–	–
			SSLT	99.5	149	124	167	149	224	174	261	–	–	–	–
11 (d = 32 1/2)	Group A	N	STD	92.1	138	115	173	–	–	–	–	–	–	–	–
			SSLT	91.4	137	114	171	126	190	126	190	–	–	–	–
		X	STD	92.1	138	115	173	–	–	–	–	–	–	–	–
			SSLT	91.4	137	114	171	137	206	159	239	–	–	–	–
	Group B	N	STD	92.1	138	115	173	–	–	–	–	–	–	–	–
			SSLT	91.4	137	114	171	137	206	159	239	–	–	–	–
		X	STD	92.1	138	115	173	–	–	–	–	–	–	–	–
			SSLT	91.4	137	114	171	137	206	160	240	–	–	–	–
10 (d = 29 1/2)	Group A	N	STD	84.0	126	105	157	–	–	–	–	–	–	–	–
			SSLT	83.3	125	104	156	115	172	115	172	–	–	–	–
		X	STD	84.0	126	105	157	–	–	–	–	–	–	–	–
			SSLT	83.3	125	104	156	125	187	145	217	–	–	–	–
	Group B	N	STD	84.0	126	105	157	–	–	–	–	–	–	–	–
			SSLT	83.3	125	104	156	125	187	145	217	–	–	–	–
		X	STD	84.0	126	105	157	–	–	–	–	–	–	–	–
			SSLT	83.3	125	104	156	125	187	146	219	–	–	–	–
9 (d = 26 1/2)	Group A	N	STD	75.9	114	94.8	142	–	–	–	–	–	–	–	–
			SSLT	75.2	113	94.0	141	103	155	103	155	–	–	–	–
		X	STD	75.9	114	94.8	142	–	–	–	–	–	–	–	–
			SSLT	75.2	113	94.0	141	113	169	130	194	–	–	–	–
	Group B	N	STD	75.9	114	94.8	142	–	–	–	–	–	–	–	–
			SSLT	75.2	113	94.0	141	113	169	130	194	–	–	–	–
		X	STD	75.9	114	94.8	142	–	–	–	–	–	–	–	–
			SSLT	75.2	113	94.0	141	113	169	132	197	–	–	–	–
Weld Size, in.				5/16		1/4		5/16		5/16		3/8		3/8	

STD = Standard holes
SSLT = Short-slotted holes transverse to direction of load
– = Indicates that the plate thickness is greater than the maximum given in Table 10-9.

N = Threads included
X = Threads excluded

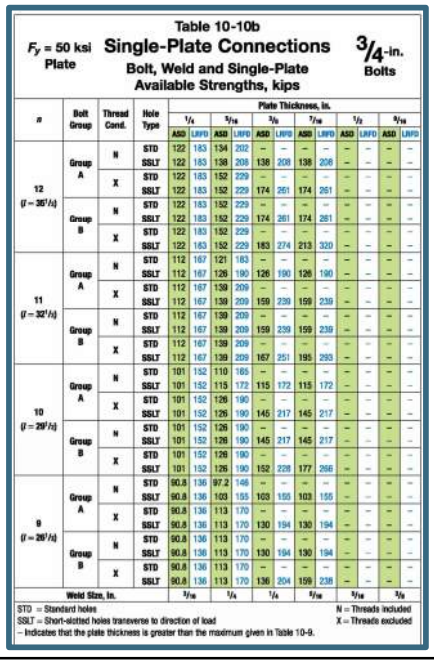

Table 10-10b
F_y = 50 ksi Plate
Single-Plate Connections
Bolt, Weld and Single-Plate Available Strengths, kips
3/4-in. Bolts

n	Bolt Group	Thread Cond.	Hole Type	Plate Thickness, in.											
				1/4		5/16		3/8		7/16		1/2		5/16	
				ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
12 (d = 36 1/2)	Group A	N	STD	122	183	134	202	–	–	–	–	–	–	–	–
			SSLT	122	183	138	208	138	208	138	206	–	–	–	–
		X	STD	122	183	152	229	–	–	–	–	–	–	–	–
			SSLT	122	183	152	229	174	261	174	261	–	–	–	–
	Group B	N	STD	122	183	152	229	–	–	–	–	–	–	–	–
			SSLT	122	183	152	229	174	261	174	261	–	–	–	–
		X	STD	122	183	152	229	–	–	–	–	–	–	–	–
			SSLT	122	183	152	229	183	274	213	320	–	–	–	–
11 (d = 32 1/2)	Group A	N	STD	112	167	121	183	–	–	–	–	–	–	–	–
			SSLT	112	167	126	190	126	190	126	190	–	–	–	–
		X	STD	112	167	139	209	–	–	–	–	–	–	–	–
			SSLT	112	167	139	209	159	239	159	239	–	–	–	–
	Group B	N	STD	112	167	139	209	–	–	–	–	–	–	–	–
			SSLT	112	167	139	209	159	239	159	239	–	–	–	–
		X	STD	112	167	139	209	–	–	–	–	–	–	–	–
			SSLT	112	167	139	209	167	251	195	293	–	–	–	–
10 (d = 29 1/2)	Group A	N	STD	101	152	110	165	–	–	–	–	–	–	–	–
			SSLT	101	152	115	172	115	172	115	172	–	–	–	–
		X	STD	101	152	126	190	–	–	–	–	–	–	–	–
			SSLT	101	152	126	190	145	217	145	217	–	–	–	–
	Group B	N	STD	101	152	126	190	–	–	–	–	–	–	–	–
			SSLT	101	152	126	190	145	217	145	217	–	–	–	–
		X	STD	101	152	126	190	–	–	–	–	–	–	–	–
			SSLT	101	152	126	190	152	228	177	266	–	–	–	–
9 (d = 26 1/2)	Group A	N	STD	90.8	136	97.2	146	–	–	–	–	–	–	–	–
			SSLT	90.8	136	103	155	103	155	103	155	–	–	–	–
		X	STD	90.8	136	113	170	–	–	–	–	–	–	–	–
			SSLT	90.8	136	113	170	130	194	130	194	–	–	–	–
	Group B	N	STD	90.8	136	113	170	–	–	–	–	–	–	–	–
			SSLT	90.8	136	113	170	130	194	130	194	–	–	–	–
		X	STD	90.8	136	113	170	–	–	–	–	–	–	–	–
			SSLT	90.8	136	113	170	136	204	159	238	–	–	–	–
Weld Size, in.				5/16		1/4		5/16		5/16		3/8		3/8	

STD = Standard holes
SSLT = Short-slotted holes transverse to direction of load
– = Indicates that the plate thickness is greater than the maximum given in Table 10-9.

N = Threads included
X = Threads excluded

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Part 10 – Design of Simple Shear Connections

Table 10-10 Single Plate Connections

Table 10-10a
Single Plate Connections
Plate and Weld Available Strength, kips
STD Holes

Number of Bolt Rows, n	Bolt Diameter, in.	t_c, in.	t_{min}, in.	t_{dm}, in.	Plate Thickness, t_p, in. ¼ ASD	¼ LRFD	5/16 ASD	5/16 LRFD	⅜ ASD	⅜ LRFD	7/16 ASD	7/16 LRFD	½ ASD	½ LRFD
12	¾	26½	1¼	1⅛	122	183	152	229	–	–	–	–	–	–
	⅞	38	1½	1¼	117	176	146	219	176	263	–	–	–	–
	1	36½	1½	2	108	163	136	203	163	244	190	285	–	–
11	¾	32½	1¼	1⅛	112	167	139	209	–	–	–	–	–	–
	⅞	33	1½	1¼	107	161	134	201	161	241	–	–	–	–
	1	33½	1½	2	99.6	149	125	187	149	224	174	262	–	–
10	¾	28½	1¼	1⅛	101	152	126	190	–	–	–	–	–	–
	⅞	30	1½	1¼	97.5	146	122	183	146	219	–	–	–	–
	1	30½	1½	2	90.6	136	113	170	136	204	159	238	–	–
9	¾	26½	1¼	1⅛	90.8	136	113	170	–	–	–	–	–	–
	⅞	27	1½	1¼	87.8	132	110	165	132	197	–	–	–	–
	1	27½	1½	2	82.0	123	102	154	123	184	143	215	–	–
8	¾	23½	1¼	1⅛	80.4	121	101	151	–	–	–	–	–	–
	⅞	24	1½	1¼	78.0	117	97.5	146	117	176	–	–	–	–
	1	24½	1½	2	73.1	110	91.4	137	110	165	128	192	–	–
7	¾	20½	1¼	1⅛	70.1	105	87.6	131	–	–	–	–	–	–
	⅞	21	1½	1¼	68.3	102	85.3	128	102	154	–	–	–	–
	1	21½	1½	2	64.3	96.4	80.4	121	96.4	145	113	169	–	–
6	¾	17½	1¼	1⅛	59.7	89.6	74.6	112	–	–	–	–	–	–
	⅞	18	1½	1¼	58.5	87.8	73.1	110	87.8	132	–	–	–	–
	1	18½	1½	2	55.5	83.2	69.3	104	83.2	125	97.0	146	–	–
5	¾	14½	1¼	1⅛	49.4	74.0	61.7	92.5	74.0	111	86.4	130	–	–
	⅞	15	1½	1¼	48.8	73.1	60.8	91.4	73.1	110	85.3	128	97.5	146
	1	15½	1½	2	46.6	69.9	58.3	87.4	69.9	105	81.6	122	93.2	140
4	¾	11½	1¼	1⅛	39.0	58.5	48.8	73.1	58.5	87.8	68.3	102	–	–
	⅞	12	1½	1¼	39.0	58.5	48.8	73.1	58.5	87.8	68.3	102	78.0	117
	1	12½	1½	2	37.8	56.7	47.2	70.8	56.7	85.0	66.1	99.2	75.6	113
3	¾	8½	1¼	1⅛	28.6	43.0	35.8	53.7	43.0	64.4	50.1	75.2	–	–
	⅞	9	1½	1¼	29.3	43.9	36.6	54.8	43.9	65.8	51.2	76.8	58.5	87.8
	1	9½	1½	2	28.8	43.4	36.2	54.3	43.4	65.1	50.7	76.0	57.8	86.8
2	¾	5½	1¼	1⅛	18.3	27.4	22.8	34.3	27.4	41.1	32.0	48.0	–	–
	⅞	6	1½	1¼	19.5	29.3	24.4	36.6	29.3	43.9	34.1	51.2	39.0	58.5
	1	6½	1½	2	20.1	30.2	25.1	37.7	30.2	45.3	35.2	52.8	40.2	60.3
Weld Size, w, in.					5/16		¾		¼		5/16		5/16	

STD = standard hole
– Indicates that the plate thickness is greater than the maximum given in Table 10-9.

Plate
F_y = 50 ksi
F_u = 65 ksi

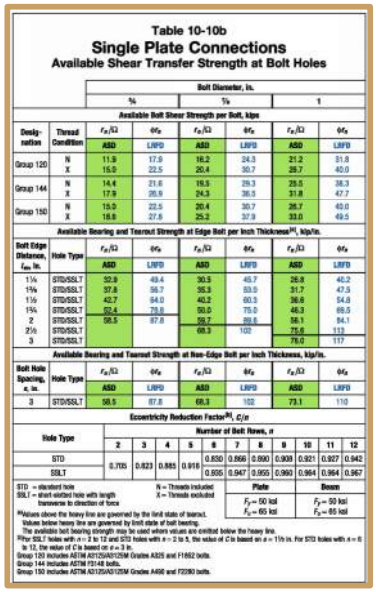

Table 10-10b
Single Plate Connections
Available Shear Transfer Strength at Bolt Holes

		Bolt Diameter, in. ¾		⅞		1	
Available Bolt Shear Strength per Bolt, kips							
Designation	Thread Condition	r_n/Ω ASD	ϕr_n LRFD	r_n/Ω ASD	ϕr_n LRFD	r_n/Ω ASD	ϕr_n LRFD
Group 120	N	11.9	17.9	16.2	24.3	21.2	31.8
	X	15.0	22.5	20.4	30.7	26.7	40.0
Group 144	N	14.4	21.6	19.5	29.3	25.5	38.3
	X	17.9	26.9	24.3	36.5	31.8	47.7
Group 150	N	15.0	22.5	20.4	30.7	26.7	40.0
	X	18.6	27.6	25.2	37.9	33.0	49.5
Available Bearing and Tearout Strength at Edge Bolt per Inch Thickness[a], kip/in.							
Bolt Edge Distance, l_{ev}, in.	Hole Type	r_n/Ω ASD	ϕr_n LRFD	r_n/Ω ASD	ϕr_n LRFD	r_n/Ω ASD	ϕr_n LRFD
1¼	STD/SSLT	32.9	49.4	30.5	45.7	28.8	43.2
1½	STD/SSLT	37.8	56.7	35.3	53.0	31.7	47.5
1⅝	STD/SSLT	42.7	64.0	40.2	60.3	38.8	54.8
1¾	STD/SSLT	52.4	78.8	50.0	75.0	46.3	69.5
2	STD/SSLT	58.5	87.8	59.7	89.6	56.1	84.1
2½	STD/SSLT			68.3	102	75.6	113
3	STD/SSLT					75.0	117
Available Bearing and Tearout Strength at Non-Edge Bolt per Inch Thickness, kip/in.							
Bolt Hole Spacing, s_c, in.	Hole Type	r_n/Ω ASD	ϕr_n LRFD	r_n/Ω ASD	ϕr_n LRFD	r_n/Ω ASD	ϕr_n LRFD
3	STD/SSLT	58.5	87.8	68.3	102	73.1	110

Eccentricity Reduction Factor[b], C_1/n

Hole Type	Number of Bolt Rows, n 2	3	4	5	6	7	8	9	10	11	12
STD	0.705	0.823	0.885	0.918	0.930	0.866	0.890	0.908	0.921	0.927	0.942
SSLT					0.935	0.947	0.955	0.960	0.964	0.964	0.967

STD = standard hole
SSLT = short-slotted hole with length transverse to direction of force
N = Threads included
X = Threads excluded

[a]Values above the heavy line are governed by the limit state of tearout. Values below heavy line are governed by limit state of bolt bearing. The available bolt bearing strength may be used where values are omitted below the heavy line.
[b]For SSLT holes with $n = 2$ to 12 and STD holes with $n = 2$ to 5, the value of C_1 is based on $a = 1\frac{1}{2}$ in. For STD holes with $n = 6$ to 12, the value of C_1 is based on $a = 3$ in.
Group 120 includes ASTM A325/A325M Grades A325 and F1852 bolts.
Group 144 includes ASTM F3148 bolts.
Group 150 includes ASTM A325/A325M Grades A490 and F2280 bolts.

	Plate	Beam
	F_y = 50 ksi F_u = 65 ksi	F_y = 50 ksi F_u = 65 ksi

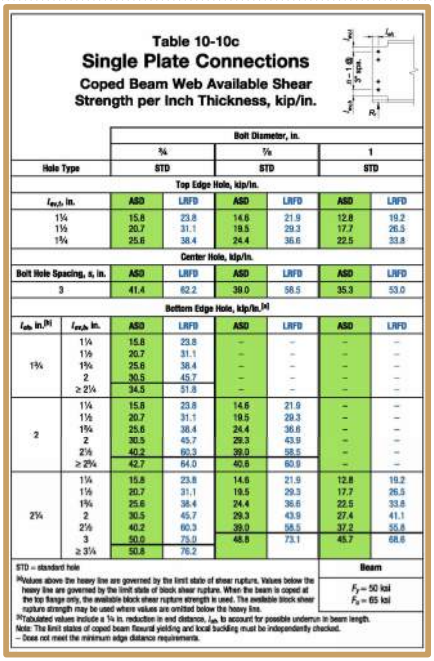

Table 10-10c
Single Plate Connections
Coped Beam Web Available Shear Strength per Inch Thickness, kip/in.

	Bolt Diameter, in. ¾		⅞		1	
Hole Type	STD		STD		STD	
Top Edge Hole, kip/in.						
$l_{ev,t}$, in.	ASD	LRFD	ASD	LRFD	ASD	LRFD
1¼	15.8	23.8	14.6	21.9	12.8	19.2
1½	20.7	31.1	19.5	29.3	17.7	26.5
1¾	25.6	38.4	24.4	36.6	22.5	33.8
Center Hole, kip/in.						
Bolt Hole Spacing, s, in.	ASD	LRFD	ASD	LRFD	ASD	LRFD
3	41.4	62.2	39.0	58.5	35.3	53.0
Bottom Edge Hole, kip/in.[a]						
l_{ev}, in.[b]	l_{evb}, in.	ASD	LRFD	ASD	LRFD	ASD	LRFD
1¾	1¼	15.8	23.8	–	–	–	–
	1½	20.7	31.1	–	–	–	–
	1¾	25.6	38.4	–	–	–	–
	2	30.5	45.7	–	–	–	–
	≥ 2¼	34.5	51.8	–	–	–	–
2	1¼	15.8	23.8	14.6	21.9	–	–
	1½	20.7	31.1	19.5	29.3	–	–
	1¾	25.6	38.4	24.4	36.6	–	–
	2	30.5	45.7	29.3	43.9	–	–
	2½	40.2	60.3	39.0	58.5	–	–
	≥ 2¾	42.7	64.0	40.6	60.9	–	–
2½	1¼	15.8	23.8	14.6	21.9	12.8	19.2
	1½	20.7	31.1	19.5	29.3	17.7	26.5
	1¾	25.6	38.4	24.4	36.6	22.5	33.8
	2	30.5	45.7	29.3	43.9	27.4	41.1
	2½	40.2	60.3	39.0	58.5	37.2	55.8
	3	50.0	75.0	48.8	73.1	45.7	68.6
	≥ 3¼	50.8	76.2				

STD = standard hole
[a]Values above the heavy line are governed by the limit state of shear rupture. Values below the heavy line are governed by the limit state of block shear rupture. When the beam is coped at the top flange only, the available block shear rupture strength is used. The available block shear rupture strength may be used where values are omitted below the heavy line.
[b]Tabulated values include a ⅛ in. reduction in end distance. l_{ev} to account for possible undercut in beam length.
Note: The limit states of coped beam flexural yielding and local buckling must be independently checked.
– Does not meet the minimum edge distance requirements.

	Beam
	F_y = 50 ksi F_u = 65 ksi

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Part 10 – Design of Simple Shear Connections

Table 10-12 Bolted/Welded Single-Angle Connections

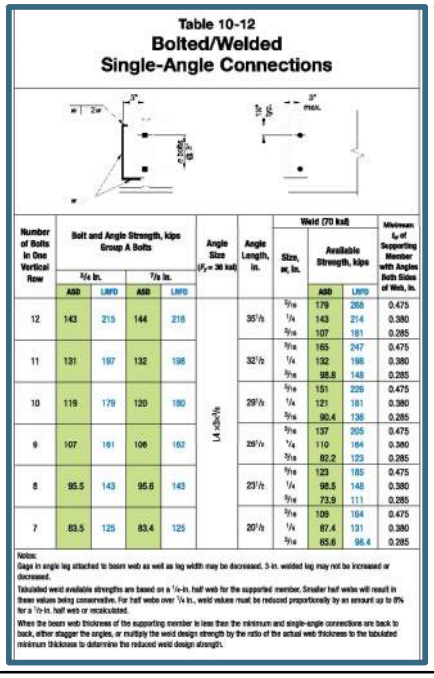

Table 10-12
Bolted/Welded
Single-Angle Connections

Number of Bolts in One Vertical Row	Bolt and Angle Strength, kips Group A Bolts ¾ in. ASD	¾ in. LRFD	⅞ in. ASD	⅞ in. LRFD	Angle Size (F_y = 36 ksi)	Angle Length, in.	Weld (70 ksi) Size, w, in.	Available Strength, kips ASD	Available Strength, kips LRFD	Minimum t_p of Supporting Member with Angles Both Sides of Web, in.
12	143	215	144	216	L4 x 3½ x ⅝	35½	5/16	179	268	0.475
							¼	143	214	0.380
							3/16	107	161	0.285
11	131	197	132	198		32½	5/16	165	247	0.475
							¼	132	198	0.380
							3/16	98.8	148	0.285
10	119	179	120	180		29½	5/16	151	226	0.475
							¼	121	181	0.380
							3/16	90.4	136	0.285
9	107	161	108	162		26½	5/16	137	205	0.475
							¼	110	164	0.380
							3/16	82.2	123	0.285
8	95.5	143	95.6	143		23½	5/16	123	185	0.475
							¼	98.5	148	0.380
							3/16	73.9	111	0.285
7	83.5	125	83.4	125		20½	5/16	109	164	0.475
							¼	87.4	131	0.380
							3/16	65.6	98.4	0.285

Notes:
Gage in angle leg attached to beam web as well as leg width may be decreased. 3-in. welded leg may not be increased or decreased.
Tabulated weld available strengths are based on a ¼-in. half web for the supported member. Smaller half webs will result in these values being conservative. For half webs over ¼ in., weld values must be reduced proportionally by an amount up to 8% for a ½-in. half web or recalculated.
When the beam web thickness of the supporting member is less than the minimum and single-angle connections are back to back, either stagger the angles, or multiply the weld design strength by the ratio of the actual web thickness to the tabulated minimum thickness to determine the reduced weld design strength.

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Part 10 – Design of Simple Shear Connections

Table 10-12 Bolted/Welded Single-Angle Connections

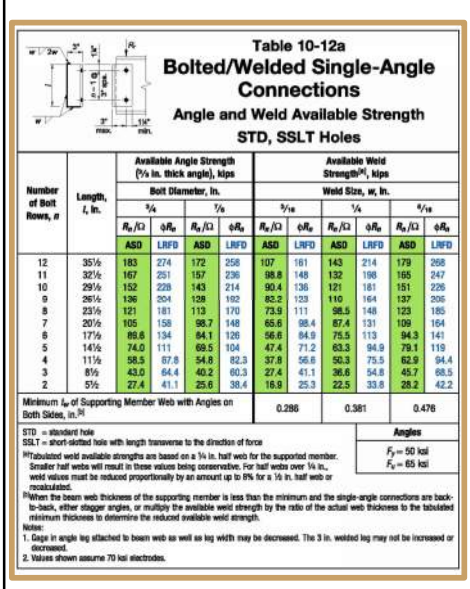

Table 10-12a
Bolted/Welded Single-Angle Connections
Angle and Weld Available Strength
STD, SSLT Holes

Number of Bolt Rows, *n*	Length, *l*, in.	Available Angle Strength (5/16 in. thick angle), kips				Available Weld Strength[b], kips					
		Bolt Diameter, in.				Weld Size, *w*, in.					
		3/4		7/8		5/16		1/4		5/16	
		R_n/Ω	ϕR_n	R_n/Ω	ϕR_n	R_n/Ω	ϕR_n	R_n/Ω	ϕR_n	R_n/Ω	ϕR_n
		ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
12	35½	183	274	172	258	107	161	143	214	179	268
11	32½	167	251	157	236	98.8	148	132	198	165	247
10	29½	152	228	143	214	90.4	136	121	181	151	226
9	26½	136	204	128	192	82.2	123	110	164	137	206
8	23½	121	181	113	170	73.9	111	98.5	148	123	185
7	20½	105	158	98.7	148	65.6	98.4	87.4	131	109	164
6	17½	89.6	134	84.1	126	56.6	84.9	75.5	113	94.3	141
5	14½	74.0	111	69.5	104	47.4	71.2	63.3	94.9	79.1	119
4	11½	58.5	87.8	54.8	82.3	37.8	56.8	50.3	75.5	62.9	94.4
3	8½	43.0	64.4	40.2	60.3	27.4	41.1	36.6	54.8	45.7	68.5
2	5½	27.4	41.1	25.6	38.4	16.9	25.3	22.5	33.8	28.2	42.2
Minimum t_w of Supporting Member Web with Angles on Both Sides, in.[c]						0.286		0.381		0.476	

STD = standard hole
SSLT = short-slotted hole with length transverse to the direction of force

[b] Tabulated weld available strengths are based on a ¼ in. fillet weld for the supported member. Smaller fillet welds will result in these values being conservative. For fillet welds over ¼ in., weld values must be reduced proportionally by an amount up to 8% for a ⅛ in. fillet weld or recalculated.

[c] When the beam web thickness of the supporting member is less than the minimum and the single-angle connections are back-to-back, either stagger angles, or multiply the available weld strength by the ratio of the actual web thickness to the tabulated minimum thickness to determine the reduced available weld strength.

Angles
F_y = 50 ksi F_y = 65 ksi

Notes:
1. Gage in angle leg attached to beam web as well as leg width may be decreased. The 3 in. welded leg may not be increased or decreased.
2. Values shown assume 70 ksi electrodes.

Table 10-12b
Bolted/Welded Single-Angle Connections
Available Shear Transfer Strength at Bolt Holes

Bolt Group	Thread Condition	Bolt Diameter, in. 3/4 r_n/Ω ASD	3/4 ϕr_n LRFD	7/8 r_n/Ω ASD	7/8 ϕr_n LRFD
Available Bolt Shear Strength, kips					
Group 120	N	11.9	17.9	16.2	24.3
	X	15.0	22.5	20.4	30.7
Available Bearing and Tearout Strength at Edge Bolt per Inch Thickness[a], kip/in.					
Bolt Edge Distance, l_{em}, in.	Hole Type				
1¼	STD/SSLT	32.9	49.4	30.5	45.7
1⅜	STD/SSLT	37.8	56.7	35.3	53.0
1½	STD/SSLT	42.7	64.0	40.2	60.3
1¾	STD/SSLT	52.4	78.6	50.0	75.0
2	STD/SSLT	58.5	87.8	59.7	89.6
2½	STD/SSLT			68.3	102
Available Bearing and Tearout Strength at Non-Edge Bolt per Inch Thickness, kip/in.					
Bolt Hole Spacing, *s*, in.	Hole Type				
3	STD/SSLT	58.5	87.8	68.3	102

STD = standard hole
SSLT = short-slotted hole with length transverse to direction of force
N = Threads included
X = Threads excluded

[a] Values above heavy line are governed by limit state of bearing. Values below heavy line are governed by limit state of bolt bearing. The available bolt bearing strength may be used where values are omitted below the heavy line.

Group 120 includes ASTM A3125/A3125M Grades A325 and F1852.

Angle	Beam
F_y = 50 ksi F_u = 65 ksi	F_y = 50 ksi F_u = 65 ksi

Table 10-12c
Bolted/Welded Single-Angle Connections
Coped Beam Web Available Shear Strength per Inch Thickness, kip/in.

Hole Type	Bolt Diameter, in. 3/4 STD ASD	3/4 STD LRFD	7/8 STD ASD	7/8 STD LRFD
Top Edge Hole, kip/in.				
$l_{em,t}$, in.				
1¼	15.8	23.8	14.6	21.9
1⅜	18.3	27.4	17.1	25.6
1½	20.7	31.1	19.5	29.3
Center Hole, kip/in.				
Bolt Hole Spacing, *s*, in.				
3	41.4	62.2	39.0	58.5
Bottom Edge Hole[a], kip/in.				
l_{em}, in.[b] / $l_{em,b}$, in.				
1¼ / 1¼	15.8	23.8	–	–
1¼ / ≥ 1½	18.3	27.4	–	–
1⅜ / 1⅜	15.8	23.8	14.6	21.9
1⅜ / 1½	20.7	31.1	19.5	29.3
1⅜ / 1¾	25.6	38.4	24.4	36.6
1⅜ / ≥ 2	28.4	39.6		
1½ / 1½	15.8	23.8	14.6	21.9
1½ / 1¾	20.7	31.1	19.5	29.3
1½ / 2	25.6	38.4	24.4	36.6
1½ / ≥ 2¼	30.5	45.7	29.3	43.9
2 / 2	34.5	51.8	32.5	48.8
2 / 2¼	15.8	23.8	14.6	21.9
2 / 2½	20.7	31.1	19.5	29.3
2 / 2¾	25.6	38.4	24.4	36.6
2 / 3	30.5	45.7	29.3	43.9
2 / ≥ 3½	40.2	60.3	39.0	58.5
2 / ≥ 2¾	42.7	64.0	40.6	60.9

STD = standard hole

[a] Values above the heavy line are governed by the limit state of shear rupture. Values below the heavy line are governed by the limit state of block shear rupture. When the beam is coped at the top flange only, the available block shear rupture strength is used. The available block shear rupture strength may be used where values are omitted below the heavy line.

[b] Tabulated values include a ¼ in. reduction in end distance, l_{em}, to account for possible underrun in beam length.

Note: The limit states of coped beam flexural yielding and local buckling must be independently checked.

– Does not meet minimum edge distance requirements of *AISC Specification* Section J3.5.

Beam
F_y = 50 ksi F_u = 65 ksi

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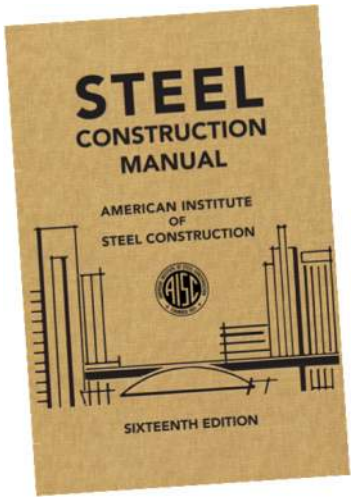

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PART 11 – DESIGN OF MOMENT CONNECTIONS

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Part 11 – Design of Moment Connections

PART 11

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Part 11 – Design of Moment Connections

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PART 11

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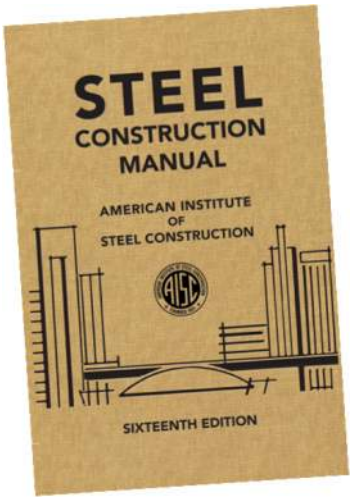

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NEW PART 12 – DESIGN OF SIMPLE CONNECTIONS FOR COMBINED FORCES

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NEW Part 12

- Provides guidance for simple shear connections under various force combinations
- Design examples included in Manual Companion resources

PART 12

DESIGN OF SIMPLE CONNECTIONS FOR COMBINED FORCES

SCOPE 12-2
SIMPLE SHEAR CONNECTIONS SUBJECTED TO AXIAL FORCE 12-2
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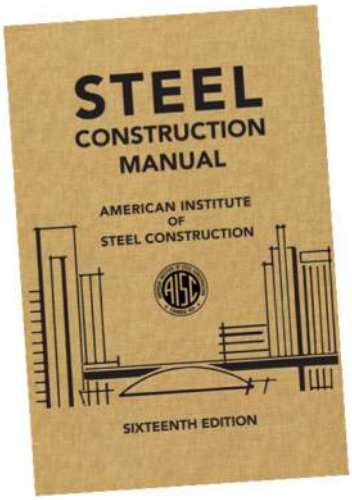

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PART 13 – DESIGN OF BRACING CONNECTIONS AND TRUSS CONNECTIONS

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Part 13 – Design of Bracing Connections and Truss Connections

NEW

- Chevron Bracing Connections section
- Horizontal Bracing Connections section
  - Wrap-around gusset plates
  - Table 13-1 Wrap-Around Gusset Plates Available Flexural Strength

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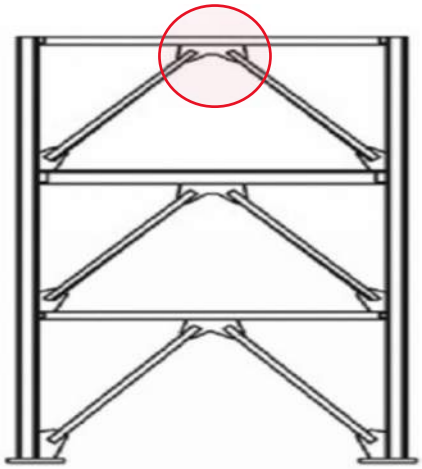
Part 13 – Design of Bracing Connections and Truss Connections

Chevron Effect

- Forces local to gusset region
- Eccentricity of joint between gusset/beam and work point of brace centerlines
- Beam shear is primary concern



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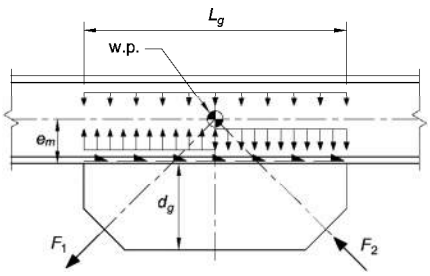
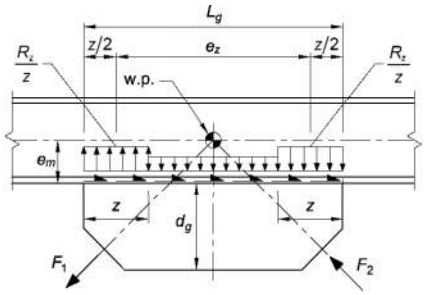
Part 13 – Design of Bracing Connections and Truss Connections

Chevron Effect — 2 Methods to analyze local shear forces:

Uniform Stress Method



Concentrated Stress Method



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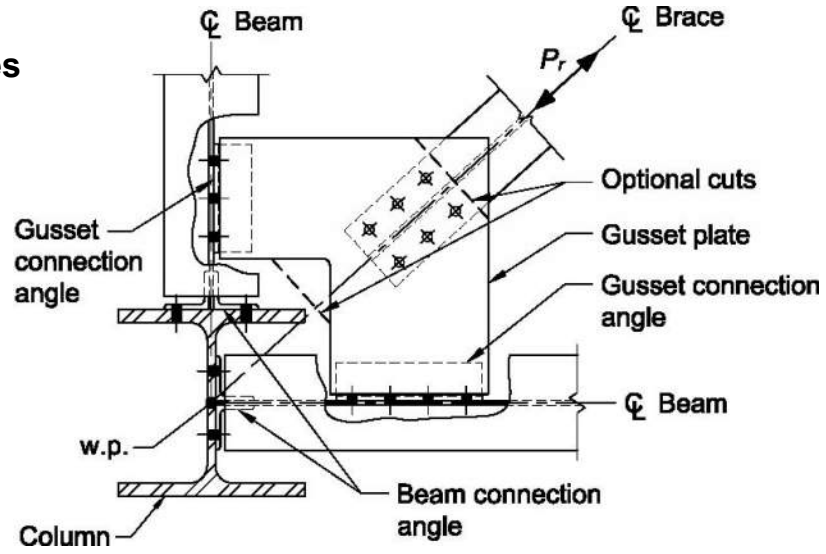
Part 13 – Design of Bracing Connections and Truss Connections

Wrap-Around Gusset Plates



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Part 13 – Design of Bracing Connections and Truss Connections

Design aid for ⅜ in. and ½ in. thick gusset plates.

Provides available flexural strengths of the gusset "legs" for tension and compression loading.

Table 13-1
Wrap-Around Gusset Plates
Gusset Plate Leg
Available Flexural Strength, kip-in.
F_y = 50 ksi Plate

Gusset Plate Thickness, in.	Case	L_{b1} or L_{b2}, in.	Gusset Leg Length, d_1 or d_2, in.									
			6½		9½		12½		15½		18½	
			ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
⅜	Tension	–	119	178	253	381	439	659	674	1010	961	1440
	Compression	8	106	160	214	321	346	520	496	746	655	985
		9	105	157	208	313	334	502	473	710	596	896
		10	103	155	203	305	322	483	449	676	536	806
		11	101	152	197	297	309	465	409	614	488	733
		12	99.5	149	192	289	297	447	375	563	447	672
		13	97.7	147	187	281	279	419	346	520	413	620
		14	96.0	144	181	272	259	389	321	483	383	576
		15	94.3	142	176	264	242	363	300	450	358	538
		16	92.6	139	170	256	227	341	281	422	335	504
		17	90.8	137	162	244	213	320	264	397	316	474
		18	89.1	134	153	230	201	303	250	375	298	448
		19	87.4	131	145	218	191	287	237	356	282	424
		20	85.6	129	138	207	181	272	225	338	268	403
		22	82.2	124	125	188	165	248	204	307	244	367
		24	78.5	118	115	173	151	227	187	281	224	336
		26	72.5	109	106	159	139	210	173	260	206	310
		28	67.3	101	98.4	148	129	195	161	241	192	288
		30	62.8	94.4	91.8	138	121	182	150	225	179	269

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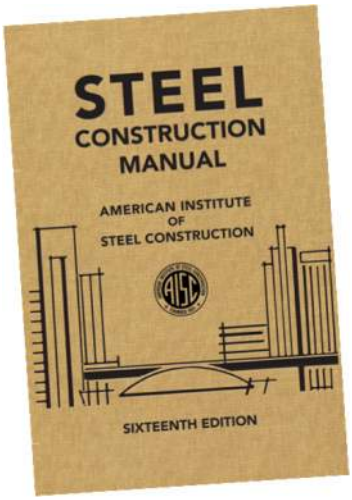

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PART 14 – DESIGN OF BEAM BEARING PLATES, COL. BASE PLATES, ANCHOR RODS, AND COL. SPLICES

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Part 14 – Design of Beam Bearing Plates, Anchor Rods, and Column Splices

UPDATES

- Table 14-1 and Table 14-2 swapped places
- Table 14-1 Recommended Sizes for Washers and Anchor Rod Holes in Base Plates
  - Updated to distinguish between anchor rod grades
  - Thicker washers now required for higher strength anchor rods
- Table 14-2 Finish Allowances

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Part 14 – Design of Beam Bearing Plates, Anchor Rods, and Column Splices

15th Ed

Table 14-2
Recommended Sizes for Washers and Anchor Rod Holes in Base Plates

Anchor Rod Diameter	Hole Diameter	Washer Size	Min. Washer Thickness	Anchor Rod Diameter	Hole Diameter	Washer Size	Min. Washer Thickness
in.	in.	in.	in.	in.	in.	in.	in.
3/4	1 5/16	2	1/4	1 1/2	2 3/8	4	1/2
7/8	1 9/16	2 1/2	5/16	1 3/4	2 7/8	4 1/2	5/8
1	1 7/8	3	3/8	2	3 1/4	5	3/4
1 1/4	2 1/8	3 1/2	1/2	2 1/2	3 3/4	5 1/2	7/8

Notes:
1. Hole sizes provided are based on anchor rod size and correlate with ACI 117 (ACI, 2010).
2. Circular or square washers meeting the washer size are acceptable.
3. Clearance must be considered when choosing an appropriate anchor rod hole location, noting effects such as the position of the rod in the hole with respect to the column, weld size, and other interferences.
4. ASTM F844 washers are permitted instead of plate washers when hole clearances are limited to 5/16 in. for rod diameters up to 1 in., 1/2 in. for rod diameters over 1 in. up to 2 in., and 1 in. for rod diameters over 2 in. This exception should not be used unless the general contractor has agreed to meet smaller tolerances for anchor rod placement than those permitted in ACI 117.

16th Ed

Table 14-1
Recommended Sizes for Washers and Anchor Rod Holes in Base Plates

Anchor Rod Designation	Anchor Rod Diameter, in.	Hole Diameter, in.	Washer Width, in.	Min. Washer Thickness, in.
ASTM F1554 Grade 36	3/4	1 5/16	2	1/4
	7/8	1 9/16	2 1/2	5/16
	1	1 7/8	3	5/16
	1 1/4	2 1/8	3 1/2	3/8
	1 1/2	2 3/8	4	3/8
	1 3/4	2 7/8	4 1/2	3/4
	2	3 1/4	5	3/4
	2 1/2	3 3/4	5 1/2	3/4
ASTM F1554 Grade 55	3/4	1 5/16	2	1/4
	7/8	1 9/16	2 1/2	5/16
	1	1 7/8	3	5/16
	1 1/4	2 1/8	3 1/2	1/2
	1 1/2	2 3/8	4	1/2
	1 3/4	2 7/8	4 1/2	3/4
	2	3 1/4	5	3/4
	2 1/2	3 3/4	5 1/2	3/4
ASTM F1554 Grade 105	3/4	1 5/16	2	3/8
	7/8	1 9/16	2 1/2	1/2
	1	1 7/8	3	1/2
	1 1/4	2 1/8	3 1/2	5/8
	1 1/2	2 3/8	4	5/8
	1 3/4	2 7/8	4 1/2	3/4
	2	3 1/4	5	3/4
	2 1/2	3 3/4	5 1/2	7/8

Notes:
1. Hole sizes provided are based on anchor rod size and correlate with ACI 117 (ACI, 2010).
2. Circular or square washers meeting the washer width are acceptable. Washer plate material is ASTM A572/A572M Grade 50.
3. Clearance must be considered when choosing an appropriate anchor rod hole location, noting effects such as the position of the rod in the hole with respect to the column, weld size, and other interferences.
4. ASTM F844 washers may be used instead of plate washers when hole diameter is limited to rod diameter plus 5/16 in. for rod diameters up to 1 in., rod diameter plus 1/2 in. for rod diameters over 1 in. up to 2 in., and rod diameters plus 1 in. for rod diameters over 2 in. This exception should not be used unless the general contractor has agreed to meet tighter tolerances for anchor rod placement than those specified in ACI 117.

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Part 14 – Design of Beam Bearing Plates, Anchor Rods, and Column Splices

15th Ed

Table 14-2
Recommended Sizes for Washers and Anchor Rod Holes in Base Plates

Note 2: ... Washer plate material is ASTM A572 Grade 50.

3/4	1 5/16	2	1/4	1 1/2	2 3/8	4	1/2
7/8	1 9/16	2 1/2	5/16	1 3/4	2 7/8	4 1/2	5/8
1	1 7/8	3	3/8	2	3 1/4	5	3/4
1 1/4	2 1/8	3 1/2	1/2	2 1/2	3 3/4	5 1/2	7/8

Notes:
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16th Ed

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Anchor Rod Designation	Anchor Rod Diameter, in.	Hole Diameter, in.	Washer Width, in.	Min. Washer Thickness, in.
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	1	1 7/8	3	5/16
	1 1/4	2 1/8	3 1/2	3/8
	1 1/2	2 3/8	4	3/8
	1 3/4	2 7/8	4 1/2	3/4
	2	3 1/4	5	3/4
	2 1/2	3 3/4	5 1/2	3/4
ASTM F1554 Grade 55	3/4	1 5/16	2	1/4
	7/8	1 9/16	2 1/2	5/16
	1	1 7/8	3	5/16
	1 1/4	2 1/8	3 1/2	1/2
	1 1/2	2 3/8	4	1/2
	1 3/4	2 7/8	4 1/2	3/4
	2	3 1/4	5	3/4
	2 1/2	3 3/4	5 1/2	3/4
ASTM F1554 Grade 105	3/4	1 5/16	2	3/8
	7/8	1 9/16	2 1/2	1/2
	1	1 7/8	3	1/2
	1 1/4	2 1/8	3 1/2	5/8
	1 1/2	2 3/8	4	5/8
	1 3/4	2 7/8	4 1/2	3/4
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	2 1/2	3 3/4	5 1/2	7/8

Notes:
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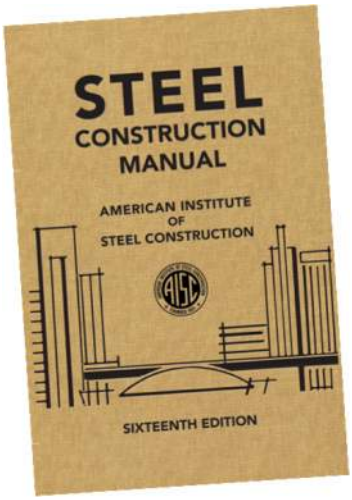

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PART 15 – DESIGN OF HANGER CONNECTIONS, BRACKET PLATES, AND CRANE RAIL CONNECTIONS

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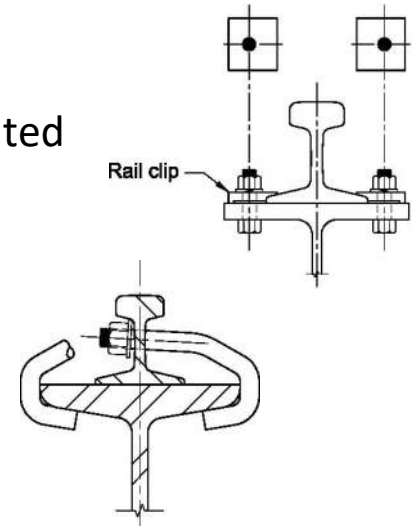
Part 15 – Design of Hanger Connections, Bracket Plates, and Crane Rail Connections

UPDATES

- Crane Rail Connections discussion updated



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Part 15 – Design of Hanger Connections, Bracket Plates, and Crane Rail Connections

UPDATES

- Tables removed:
  15-1; 15-4 thru 15-9

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Part 15 – Design of Hanger Connections, Bracket Plates, and Crane Rail Connections

UPDATES

- Tables removed:
  15-1; 15-4 thru 15-9

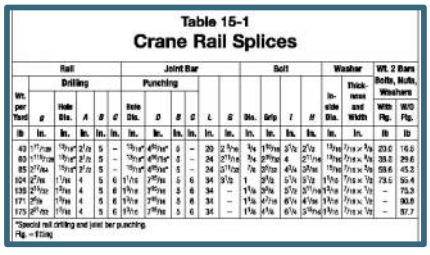

Table 15-1
Crane Rail Splices

Rail		Joint Bar						Bolt				Washer	Wt. 2 Bars Bolts, Nuts, Washers
Wt. per Yard	Drilling: d	Punching: Hole Dia.	A	B	d	Hole Dia.	D	B	G	L	G	Dia.	Grip	I	H	In-side Dia.	Thick-ness and Width	With Rig.	W/O Rig.
lb	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	lb	lb
40	1 17/32	1 9/16	2 1/2	5	–	1 9/16	4 25/32	6	–	20	2 3/16	3/4	1 19/32	3 1/2	2 1/2	1 9/32	7/16 × 1 3/4	23.0	16.6
60	1 11/32	1 9/16	2 1/2	5	–	1 9/16	4 25/32	6	–	24	2 7/16	3/4	2 25/32	4	2 7/16	1 9/32	7/16 × 1 3/4	33.0	29.6
85	2 7/64	1 9/16	2 1/2	5	–	1 9/16	4 25/32	5	–	24	2 17/32	7/8	2 7/32	4 3/4	2 7/16	1 5/16	7/16 × 1 3/4	59.6	45.2
104	2 7/64	1 7/16	4	5	6	1 1/16	2 25/32	5	6	34	3 1/2	1	3 5/32	5 1/2	3 1/2	1 1/16	7/16 × 1 1/2	73.5	55.4
130	2 5/32	1 7/16	4	5	6	1 1/16	2 25/32	5	6	34	–	1 1/8	3 5/16	5 1/2	3 7/16	1 1/16	7/16 × 1 1/2	–	73.3
171	2 5/16	1 7/16	4	5	6	1 1/16	2 25/32	5	6	34	–	1 1/8	4 1/16	6 1/4	4 1/16	1 1/16	7/16 × 1 1/2	–	90.8
175	2 5/32	1 7/16	4	5	6	1 1/16	2 25/32	5	6	34	–	1 1/8	4 1/16	6 1/4	5 25/32	1 1/16	7/16 × 1 1/2	–	97.7

*Special rail drilling and joint bar punching.
Rig. = Fitting

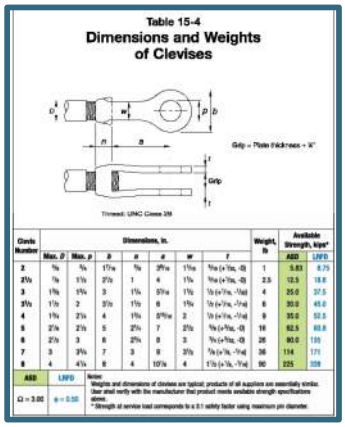

Table 15-4
Dimensions and Weights of Clevises

Grip = Plate thickness + ¼"

Thread: UNC Class 2B

Clevis Number	Dimensions, in. Max. D	Max. p	b	n	a	w	f	Weight, lb	Available Strength, kips* ASD	LRFD
2	⅞	⅞	1 7/16	⅞	3 5/16	1 1/16	9/16 (+1/16, -0)	1	5.83	8.75
2½	⅞	1 1/16	2 1/16	1	4	1 1/16	9/16 (+1/16, -0)	2.5	12.5	18.8
3	1 1/16	1 1/4	3	1 1/4	5 1/16	1 1/16	13/16 (+1/16, -1/64)	4	20.0	30.0
3½	1 1/16	2	3 1/16	1 1/16	6	1 1/16	13/16 (+1/16, -1/64)	6	30.0	45.0
4	1 1/16	2 1/16	4	1 1/16	5 15/16	2	1/2 (+1/16, -1/64)	9	35.0	52.5
5	2 1/16	2 1/16	5	2 1/16	7	2 1/16	9/16 (+1/16, -0)	16	62.5	93.8
6	2 1/16	3	6	2 1/16	8	3	9/16 (+1/16, -0)	26	90.0	135
7	3	3 1/16	7	3	9	3 1/16	9/16 (+1/16, -1/64)	36	114	171
8	4	4 1/16	8	4	10 1/16	4	1 1/16 (+1/16, -1/64)	90	225	338
ASD	LRFD									
Ω = 3.00	φ = 0.90									

Notes:
Weights and dimensions of clevises are typical; products of all suppliers are essentially similar. User shall verify with the manufacturer that product meets available strength specifications shown.
* Strength at service load corresponds to a 0.1 safety factor using maximum pin diameter.

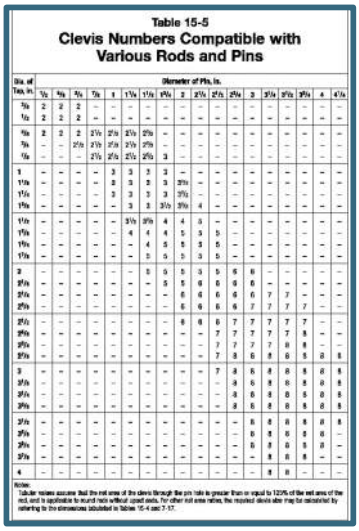

Table 15-5
Clevis Numbers Compatible with Various Rods and Pins

Dia. of Ten. in.	Diameter of Pin, in. ½	⅝	¾	⅞	1	1 1/16	1 1/8	1 3/16	1 ¼	1 5/16	1 ⅜	1 7/16	1 ½	1 9/16	1 ⅝	1 11/16	1 ¾
⅝	2	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
¾	2	2	2	–	–	–	–	–	–	–	–	–	–	–	–	–	–
⅞	2	2	2	2 1/16	2 1/16	2 1/16	–	–	–	–	–	–	–	–	–	–	–
1	–	2 1/16	2 1/16	2 1/16	2 1/16	2 1/16	–	–	–	–	–	–	–	–	–	–	–
1 ⅛	–	–	2 1/16	2 1/16	2 1/16	2 1/16	3	–	–	–	–	–	–	–	–	–	–
1 ¼	–	–	–	3	3	3	3	–	–	–	–	–	–	–	–	–	–
1 ⅜	–	–	–	3	3	3	3	3	–	–	–	–	–	–	–	–	–
1 ½	–	–	–	3	3	3	3	3 1/16	–	–	–	–	–	–	–	–	–
1 ⅝	–	–	–	–	3 1/16	3 1/16	4	4	3	–	–	–	–	–	–	–	–
1 ¾	–	–	–	–	4	4	4	5	5	5	–	–	–	–	–	–	–
1 ⅞	–	–	–	–	–	4	5	5	5	–	–	–	–	–	–	–	–
2	–	–	–	–	–	5	5	5	5	6	6	–	–	–	–	–	–
2 ⅛	–	–	–	–	–	–	5	5	6	6	6	–	–	–	–	–	–
2 ¼	–	–	–	–	–	–	–	6	6	6	6	7	7	–	–	–	–
2 ⅜	–	–	–	–	–	–	–	–	6	6	6	7	7	–	–	–	–
2 ½	–	–	–	–	–	–	–	–	6	6	6	7	7	–	–	–	–
2 ⅝	–	–	–	–	–	–	–	–	–	6	6	7	7	7	7	–	–
2 ¾	–	–	–	–	–	–	–	–	–	–	6	7	7	7	7	–	–
2 ⅞	–	–	–	–	–	–	–	–	–	–	–	7	7	7	8	8	–
3	–	–	–	–	–	–	–	–	–	–	–	7	8	8	8	8	8
3 ⅛	–	–	–	–	–	–	–	–	–	–	–	–	8	8	8	8	8
3 ¼	–	–	–	–	–	–	–	–	–	–	–	–	8	8	8	8	8
3 ⅜	–	–	–	–	–	–	–	–	–	–	–	–	8	8	8	8	8
3 ½	–	–	–	–	–	–	–	–	–	–	–	–	–	8	8	8	8
3 ⅝	–	–	–	–	–	–	–	–	–	–	–	–	–	8	8	8	8
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4	–	–	–	–	–	–	–	–	–	–	–	–	–	–	8	8	–

Notes:
Tabular values assume that the net area of the clevis through the pin hole is greater than or equal to 133% of the net area of the rod, and is sufficient to round rods without upset ends. For other rod area ratios, the required clevis size may be calculated by referring to the dimensions tabulated in Tables 15-4 and 7-17.

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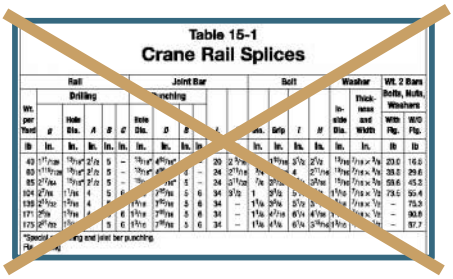
Part 15 – Design of Hanger Connections, Bracket Plates, and Crane Rail Connections

UPDATES

- Tables removed:
  15-1; 15-4 thru 15-9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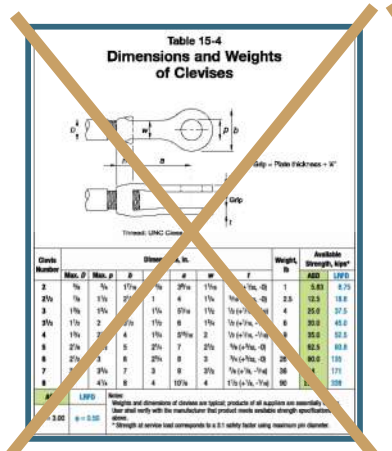
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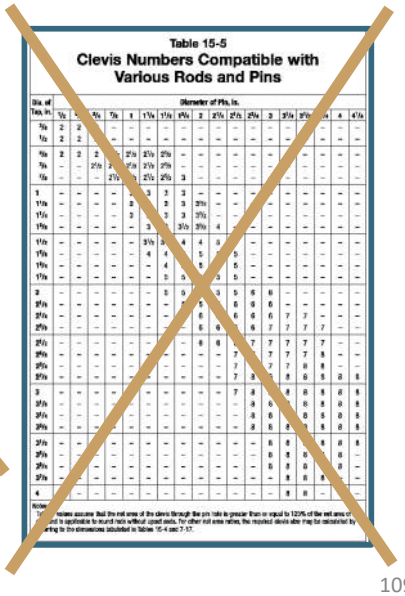
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Part 15 – Design of Hanger Connections, Bracket Plates, and Crane Rail Connections


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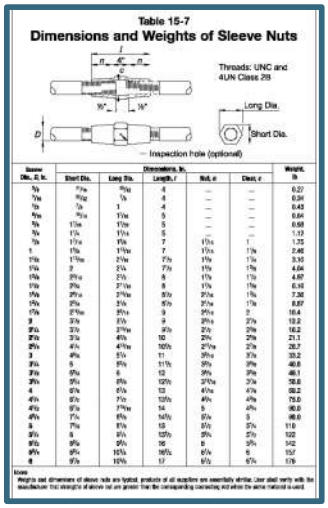
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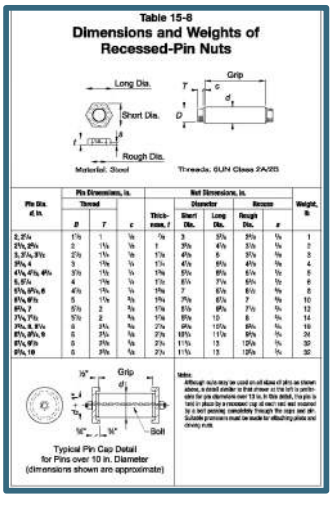
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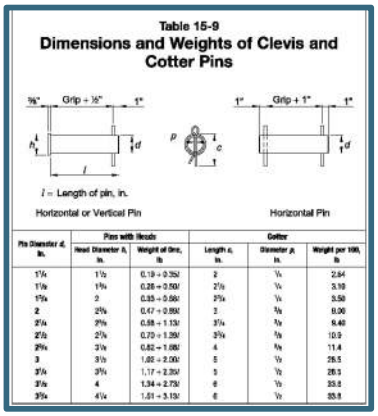
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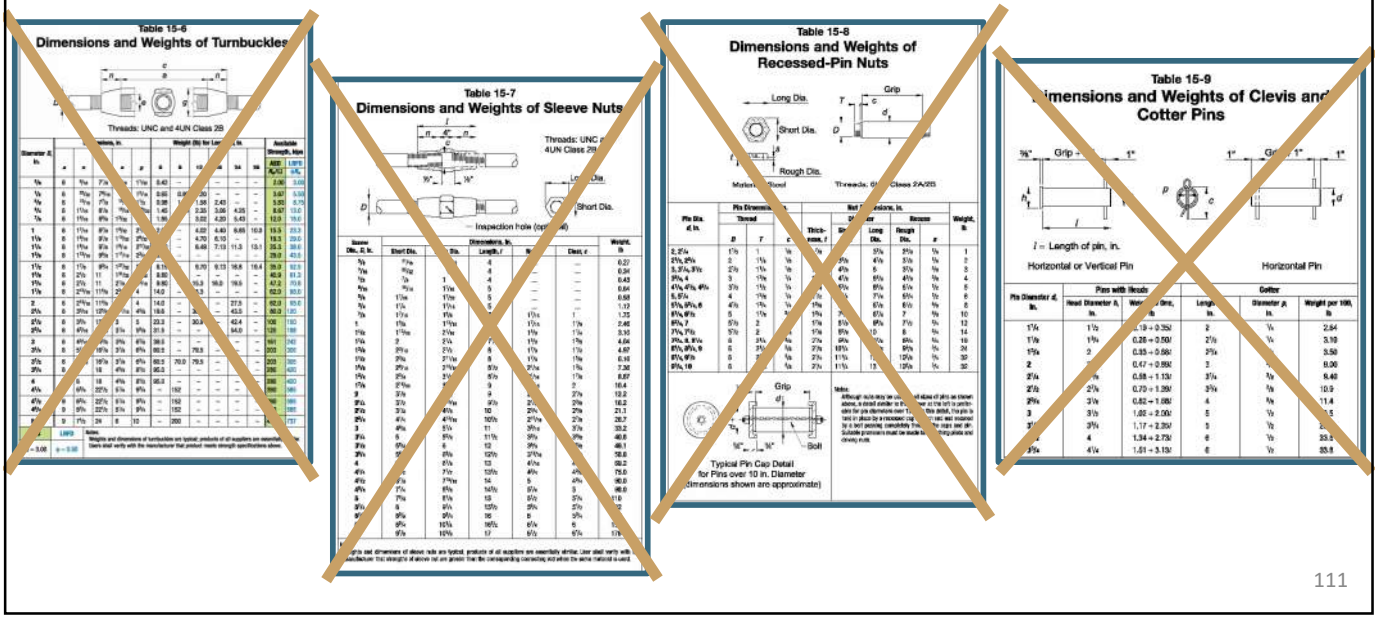

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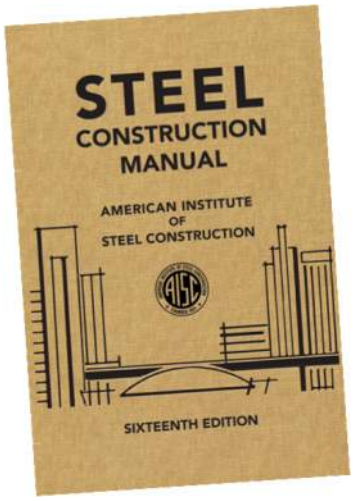

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Part 16 – Specifications and Codes

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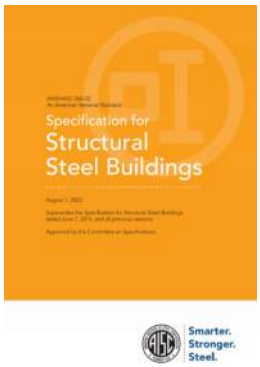
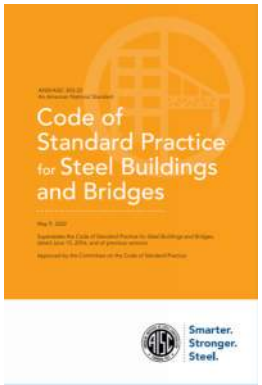
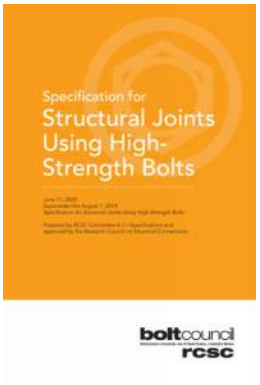
- 2022 AISC *Code of Standard Practice*
- 2020 RCSC *Specification for Structural Joints Using High-Strength Bolts*







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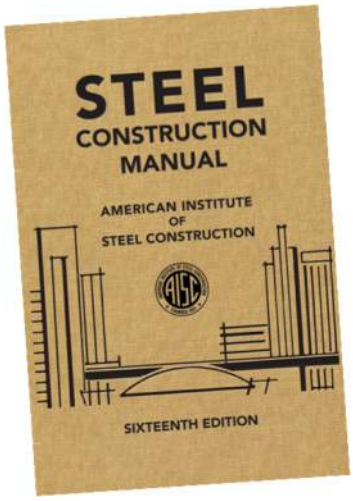

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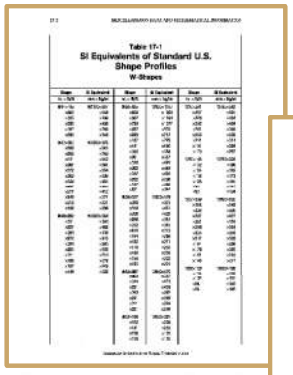
Part 17 – Miscellaneous Data and Mathematical Information

No major changes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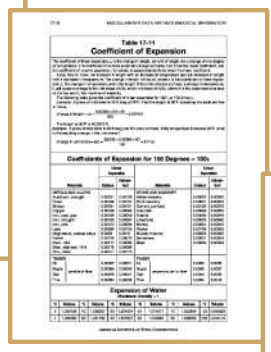
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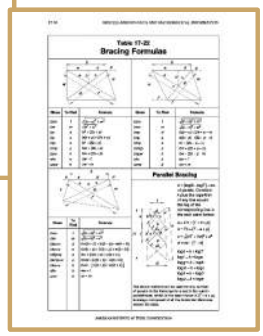
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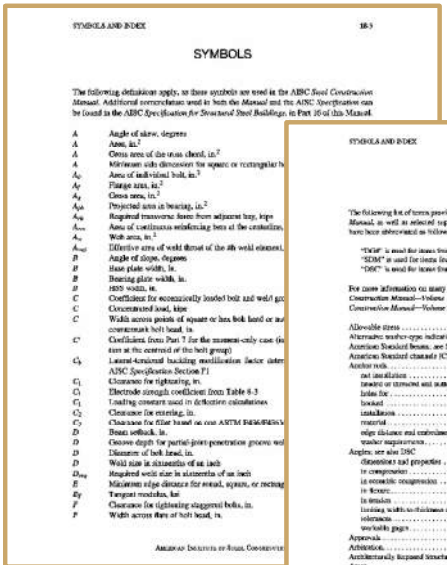
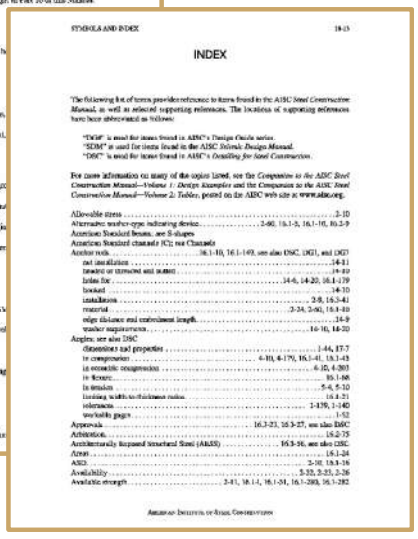
Did you know the *Manual* has a Symbols list??


SYMBOLS AND INDEX 16-3
SYMBOLS
The following definitions apply, as these symbols are used in the AISC *Steel Construction Manual*. Additional nomenclature used in both the *Manual* and the AISC *Specification* can be found in the AISC *Specification for Structural Steel Buildings*, in Part 16 of this *Manual*.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"DSM" is used for items found in AISC's *Design Guide* series.
"SDM" is used for items found in the AISC *Seismic Design Manual*.
"DSC" is used for items found in AISC's *Detailing for Steel Construction*.
For more information on many of the topics listed, see the *Companion to the AISC Steel Construction Manual—Volume 1: Design Examples* and the *Companion to the AISC Steel Construction Manual—Volume 2: Tables*, posted on the AISC web site at www.aisc.org.

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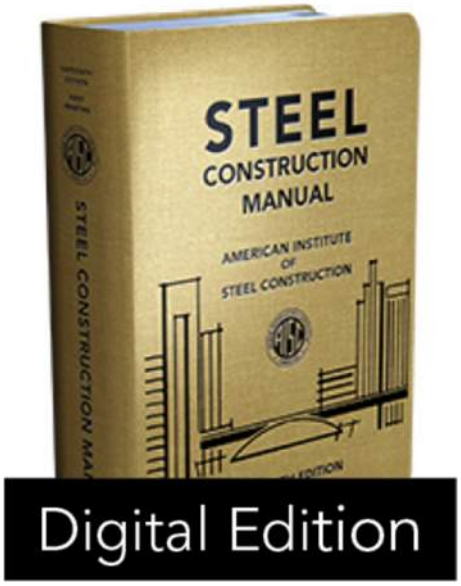

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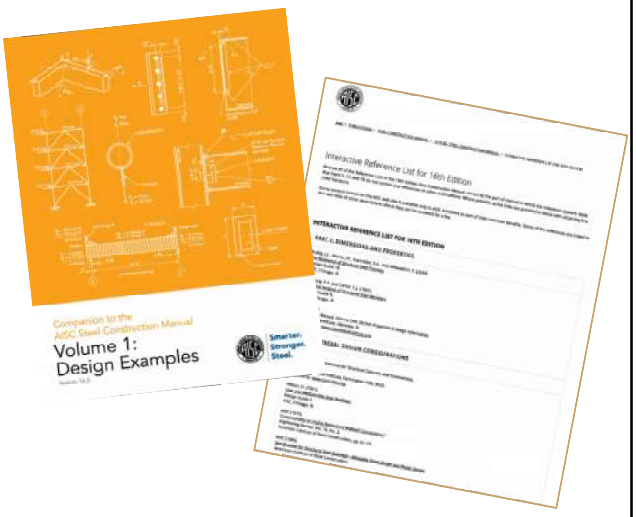
- Shapes Databases
- Interactive Reference List



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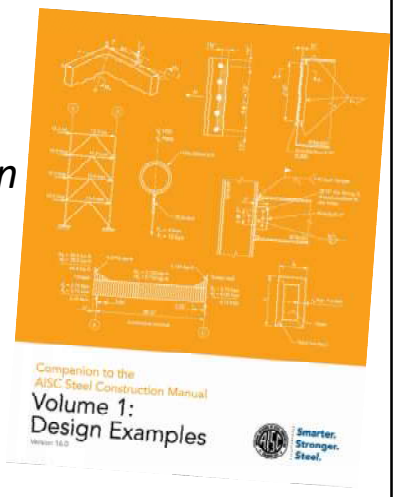

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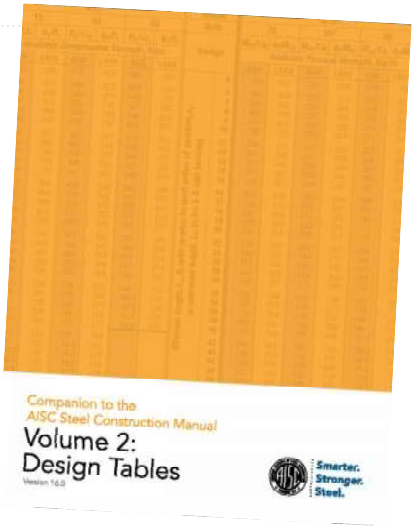

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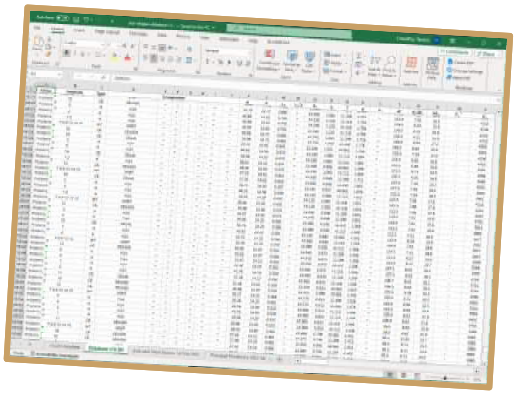
- Many useful properties not printed in the *Manual*
- Historic Database - historical shape info from 1873-2016



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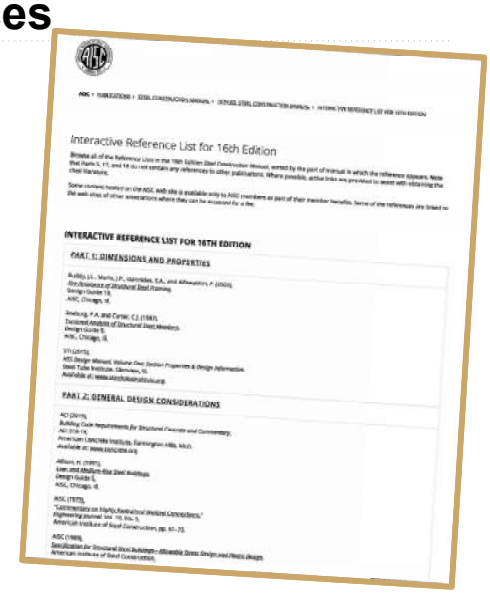
Interactive References List

- List of every reference in *Manual* by part
- Link to each reference


Interactive Reference List for 16th Edition

INTERACTIVE REFERENCE LIST FOR 16TH EDITION

PART 1: DIMENSIONS AND PROPERTIES

PART 2: GENERAL DESIGN CONSIDERATIONS

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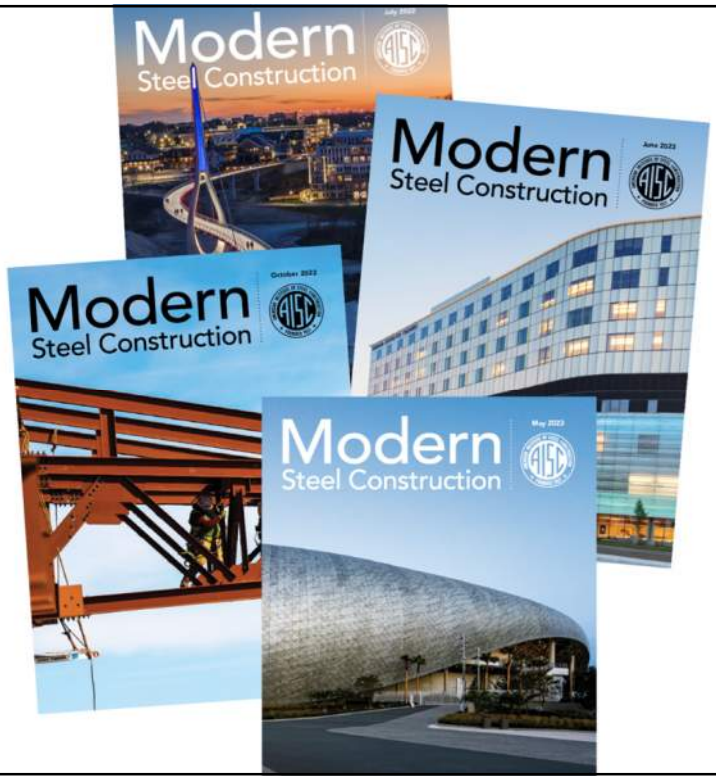

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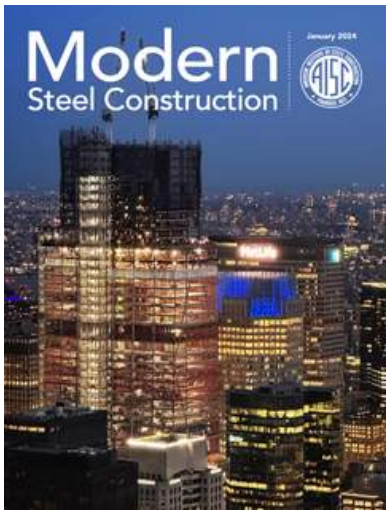

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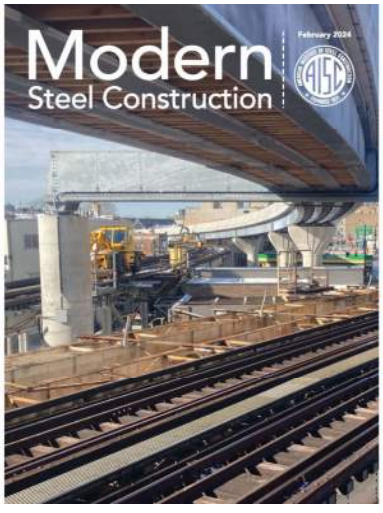
MSC articles—February 2024



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Comparison document found on the website

COMPARISON OF ANSI/AISC 360-22 TO ANSI/AISC 360-16
(Prepared by Michael Desch and Vyshnavi Gadhibandi)

This document summarizes the revisions contained in the 2022 AISC *Specification for Structural Steel Buildings* (ANSI/AISC 360-22) compared to the 2016 AISC *Specification for Structural Steel Buildings* (ANSI/AISC 360-16). Only Sections containing revisions are listed here. See the Commentary to the 2022 *Specification* for background on the revisions.

CHAPTER A
GENERAL PROVISIONS

A1. SCOPE
Quality has been added to the scope statement for ANSI/AISC 360.

A1.1. Seismic Applications
Fabrication, erection, and quality have been added to the scope statement for ANSI/AISC 341.

A1.2. Nuclear Applications
Quality has been added to the scope statement for ANSI/AISC N690.

A2. REFERENCED SPECIFICATIONS, CODES AND STANDARDS

The dates of existing referenced specifications have been updated in this Section, in addition to the following additions and deletions.

(a) American Concrete Institute (ACI)

The following reference has been added: ACI 216.1-14.

(b) American Institute of Steel Construction (AISC)

The following reference has been deleted:
ANSI/AISC N690s 1-15

(c) American Iron and Steel Institute (AISI) (new Section)

The following new referenced standards have been added:
AISI S923-20
AISI S924-20

(e) American Society of Mechanical Engineers (ASME) (was Section A2. (d))

The following new referenced standard has been added:
ASME B1.1-2019

(g) ASTM International (ASTM) (was Section A2. (f))

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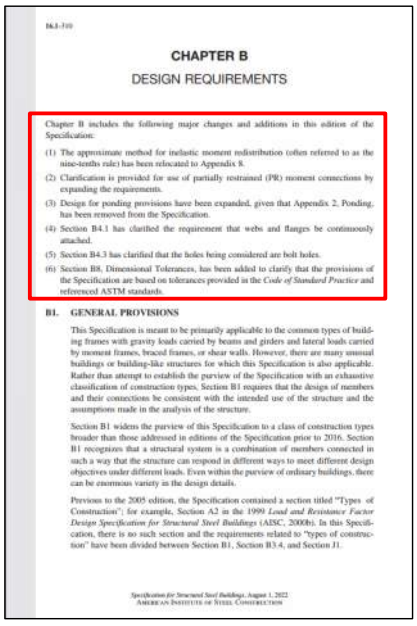
Updates listed in the preface to the *Specification* and for each chapter in the Commentary



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CHAPTER B
DESIGN REQUIREMENTS

Chapter B includes the following major changes and additions in this edition of the Specification:

(1) The approximate method for inelastic moment redistribution (often referred to as the nine-tenths rule) has been relocated to Appendix 8.
(2) Clarification is provided for use of partially restrained (PR) moment connections by expanding the requirements.
(3) Design for ponding provisions have been expanded, given that Appendix 2, Ponding, has been removed from the Specification.
(4) Section B4.1 has clarified the requirement that webs and flanges be continuously attached.
(5) Section B4.3 has clarified that the holes being considered are bolt holes.
(6) Section B8, Dimensional Tolerances, has been added to clarify that the provisions of the Specification are based on tolerances provided in the *Code of Standard Practice* and referenced ASTM standards.

B1. GENERAL PROVISIONS

This Specification is meant to be primarily applicable to the common types of building frames with gravity loads carried by beams and girders and lateral loads carried by moment frames, braced frames, or shear walls. However, there are many unusual buildings or building-like structures for which this Specification is also applicable. Rather than attempt to establish the purview of the Specification with an exhaustive classification of construction types, Section B1 requires that the design of members and their connections be consistent with the intended use of the structure and the assumptions made in the analysis of the structure.

Section B1 widens the purview of this Specification to a class of construction types broader than those addressed in editions of the Specification prior to 2016. Section B1 recognizes that a structural system is a combination of members connected in such a way that the structure can respond in different ways to meet different design objectives under different loads. Even within the purview of ordinary buildings, there can be enormous variety in the design details.

Previous to the 2005 edition, the Specification contained a section titled "Types of Construction"; for example, Section A2 in the 1999 *Load and Resistance Factor Design Specification for Structural Steel Buildings* (AISC, 2000b). In this Specification, there is no such section and the requirements related to "types of construction" have been divided between Section B1, Section B3.4, and Section J1.

Specification for Structural Steel Buildings, August 1, 2022
AMERICAN INSTITUTE OF STEEL CONSTRUCTION

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MSC article—March 2023

A Century and Counting

by Michael Desch, Vyshnavi Gudhibandi, and Cindi Duncan

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steelwise

A Century and Counting

BY MICHAEL DESCH, PHD, VYSHNAVI GUDHIBANDI, AND CYNTHIA DUNCAN

Nearly 100 years old, the AISC *Specification* contains some significant changes in its latest version, all geared toward better organization and easier reference.

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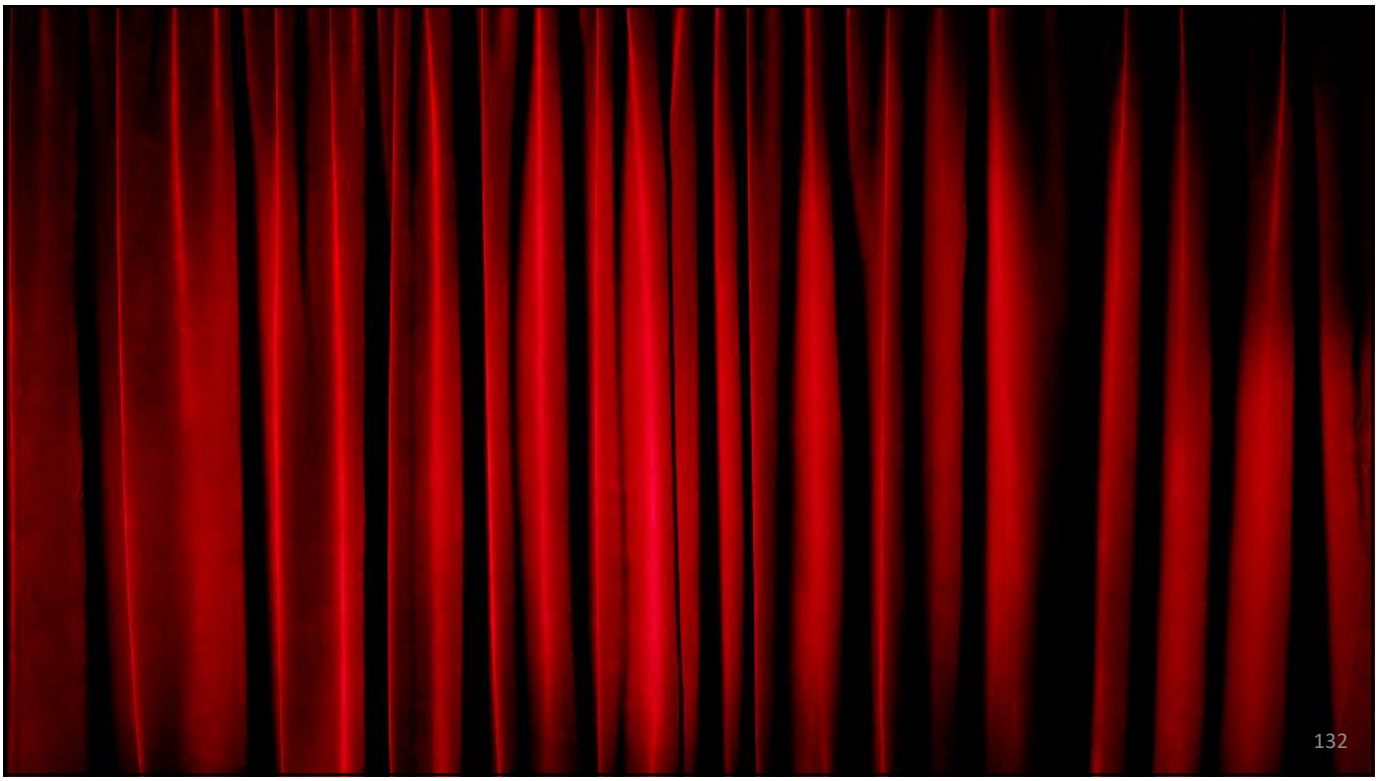

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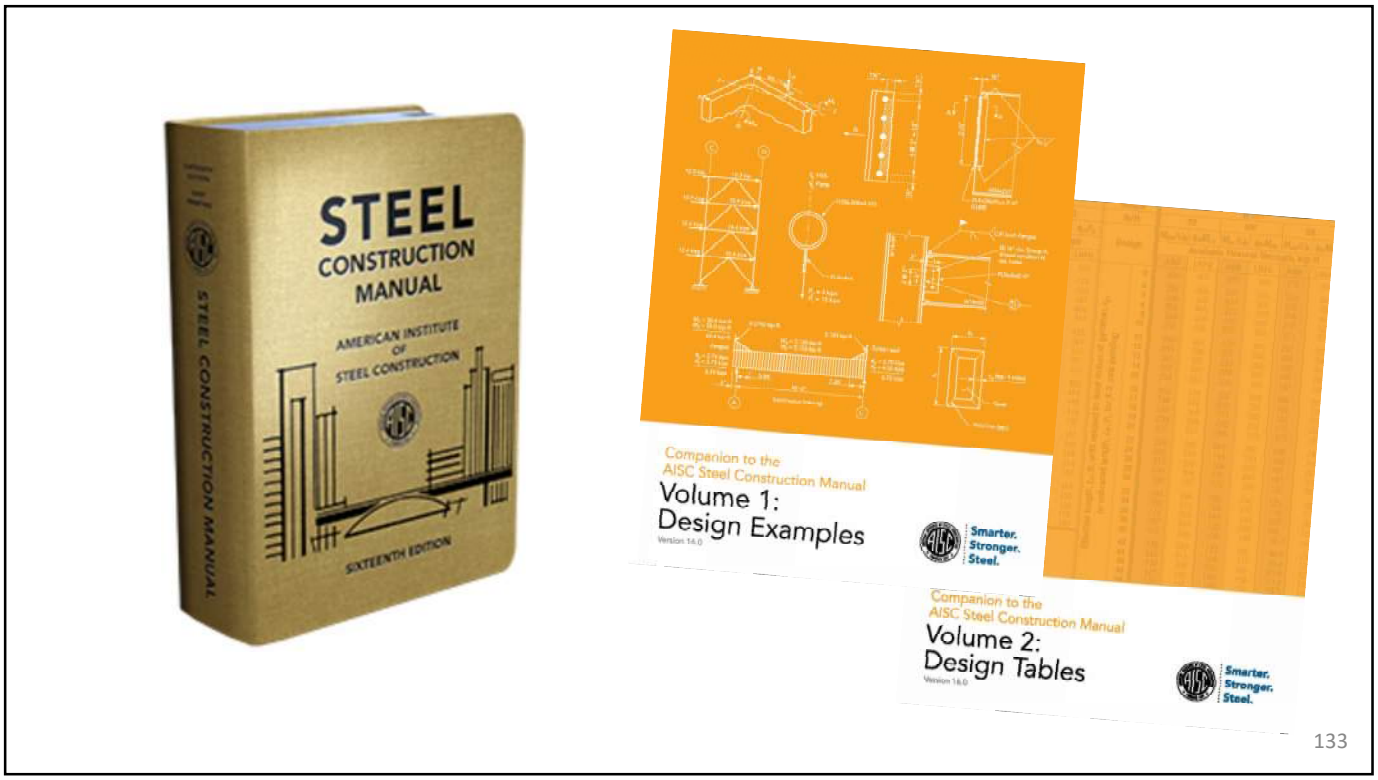

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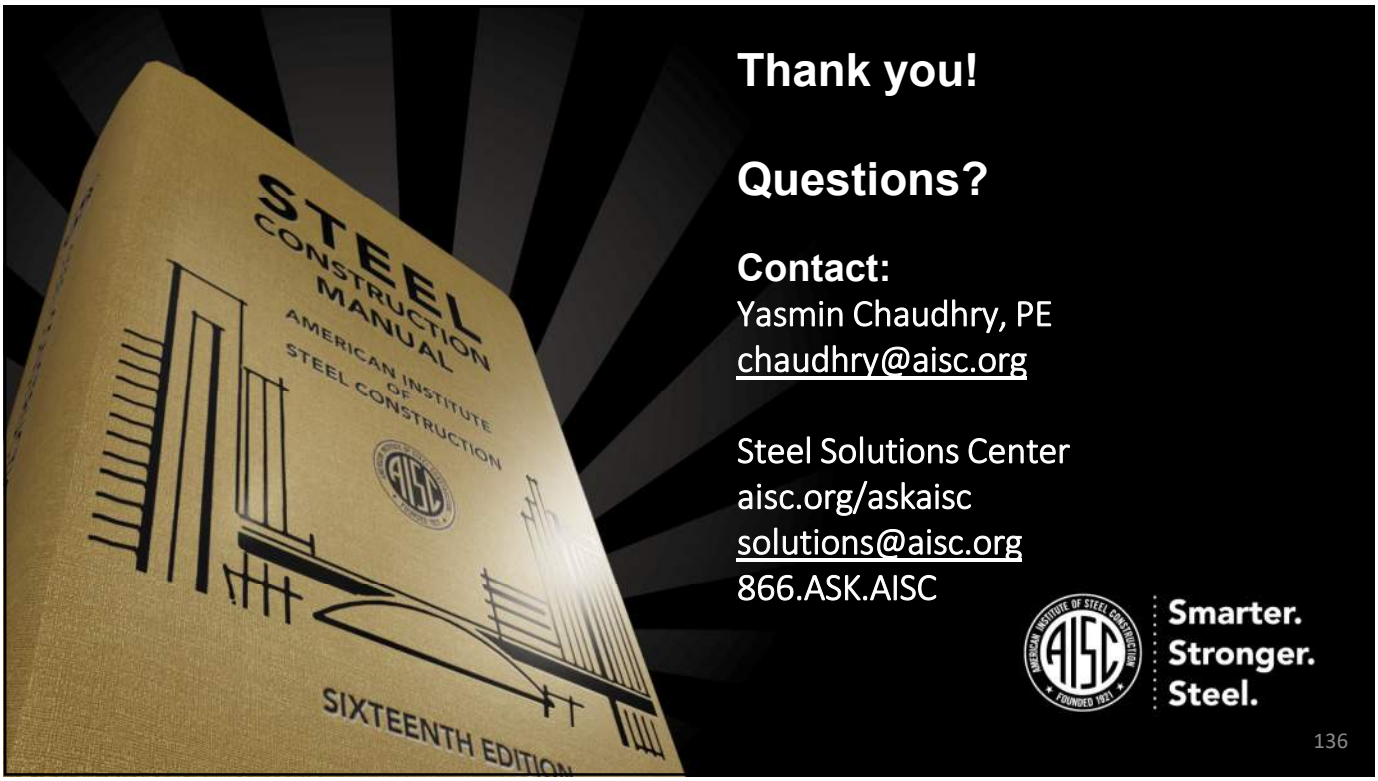

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