steelwise

ARE YOU PROPERLY SPECIFYING MATERIALS?

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Keeping tabs on ASTM specifications will help you make the right steel shape choices when designing and building your projects.

THE MATERIALS AND PRODUCTS used in building design and construction are almost universally designated by reference to an appropriate ASTM specification. This simplifies the design and construction process because you can define all the characteristics of a specified product. However, with dozens of ASTM specifications applicable in steel building construction alone it can be a challenge to keep the standard designations used in contracts current.

This article provides a summary of the common ASTM specifications used in steel building design and construction, including structural shapes, plate products, fastening products, and other products. This information is based on similar and more extensive information in the 14th Edition AISC *Steel Construction Manual*. You may also find it convenient to use the AISC publication *Selected ASTM Standards for Structural Steel Fabrication*, a compilation of more than 60 steel-related ASTM standards. (Both the AISC *Manual* and *Selected ASTM Standards* are available for purchase online at **www.aisc.org/bookstore**.)

Note that ASTM standards routinely include a section on ordering requirements that lists the variables in each standard that should be specified in a complete order or specification for the material. This is routine for the purchasing department at the local fabrication company, and may be of great interest to others as well.

Structural Shapes

See Summary in Table 1.

➤ W-Shapes

The preferred material specification for W-shapes is ASTM A992 (F_y = 50 ksi, F_u = 65 ksi). The availability of W-shapes in grades other than ASTM A992 should be confirmed prior to their specification. W-shapes with higher yield and tensile strength can be obtained by specifying ASTM A572 Grade 60, or 65, or ASTM A913 Grades 60, 65 or 70.

W-shapes with atmospheric corrosion resistance (weathering characteristics) can be obtained by specifying ASTM A588 Grade 50 or ASTM A242 Grade 42, 46 or 50. Other material specifications applicable to W-shapes include ASTM A36, ASTM A529 Grade 50 and 55, ASTM A572 Grade 42 and 50, and ASTM A913 Grade 50.

➤ M-Shapes and S-Shapes

The preferred material specification for M-shapes is in transition. ASTM A36 (F_y = 36 ksi, F_u = 58 ksi) remains common, but 50 ksi grades increasingly are being used, including ASTM A572 Grade 50, ASTM A529 Grade 50 or ASTM A992; each of these 50 ksi grades has F_y = 50 ksi and F_u = 65 ksi for these shapes. The availability of M-shapes in grades other than A36 should be confirmed prior to their specification.

M-shapes with a higher yield and tensile strength can be obtained by specifying ASTM A572 Grades 55, 60 and 65, ASTM A529 Grade 55, or ASTM A913 Grades 60, 65 or 70. M-shapes with atmospheric corrosion resistance (weathering characteristics) can be obtained by specifying ASTM A588 Grade 50 or ASTM A242 Grade 50. Other material specifications applicable to M- and S-shapes include ASTM A529 Grade 42, ASTM A572 Grade 42 and ASTM A913 Grade 50.

➤ Channels

The preceding comments for M-shapes apply equally to channels.

Note the MC12×14.3 that appears in the current ASTM A6 listing of standard shapes. Think of this new channel shape as a stair stringer—it has a 2⅛-in. flange width, which is wide enough to accept the handrail pipe and fillet weld around it.

➤ HP-Shapes

The preferred material specification for HP shapes is ASTM A572 Grade 50 (F_y = 50 ksi, F_u = 65 ksi); the availability of other grades should be confirmed prior to specification.

HP-shapes with atmospheric corrosion resistance (weathering characteristics) can be obtained by specifying ASTM A588 Grade 50 or ASTM A242 Grades 46 or 50. Other material specifications applicable to HP-shapes include ASTM A36, ASTM A529 Grades 50 or 55, ASTM A572 Grades 42, 55, 60 and 65, ASTM A913 Grades 50, 60, 65 and 70, and ASTM A992.

Note the new HP18- and HP16-series shapes that have been added to ASTM A6.

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Table 1

Applicable ASTM Specifications for Various Structural Shapes

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

[a] Minimum unless a range is shown.

[b] For shapes over 426 lb/ft, only the minimum of 58 ksi applies.

[c] For shapes with a flange thickness less than or equal to 1.5 in. only. To improve weldability a maximum carbon equivalent can be specified (per ASTM Supplementary Requirement S78). If desired, maximum tensile stress of 90 ksi can be specified (per ASTM Supplementary Requirement S79).

[d] If desired, maximum tensile stress of 70 ksi can be specified (per ASTM Supplementary Requirement S91).

[e] For shapes with a flange thickness less than or equal to 2 in. only.

[f] ASTM A618 can also be specified as corrosion-resistant; see ASTM A618.

[g] Minimum applies for walls nominally ¾-in. thick and under. For wall thicknesses over ¾ in., F_y = 46 ksi and F_u = 67 ksi.

[h] If desired, maximum yield stress of 65 ksi and maximum yield-to-tensile strength ratio of 0.85 can be specified (per ASTM Supplementary Requirement S75).

[i] A maximum yield-to-tensile strength ratio of 0.85 and carbon equivalent formula are included as mandatory in ASTM A992.

[j] For shapes with a flange thickness greater than 2 in. only.

[k] For shapes with a flange thickness greater than 1.5 in. and less than or equal to 2 in. only.

[l] For shapes with a flange thickness less than or equal to 1.5 in. only.

Preferred material specification.

Other applicable material specification, the availability of which should be confirmed prior to specification.

Material specification does not apply.

Angles

The preferred material specification for angles is in transition. ASTM A36 (F_y = 36 ksi, F_u = 58 ksi) remains common, but 50 ksi grades increasingly are being used, including ASTM A572 Grade 50, ASTM A529 Grade 50 or ASTM A992; each of these 50 ksi grades has F_y = 50 ksi and F_u = 65 ksi. The availability of angles in grades other than ASTM A36 should be confirmed prior to their specification.

Angles with higher yield and tensile strength can be obtained by specifying ASTM A572 Grades 55, 60 or 65, ASTM A529 Grade 55 and ASTM A913 Grades 60, 65 or 70. Angles with atmospheric corrosion resistance (weathering characteristics) can be obtained by specifying ASTM A588 Grade 50 or ASTM A242 Grades 46 or 50. Other material specifications applicable to angles include ASTM A529 Grade 42, ASTM A572 Grade 42 and ASTM A913 Grade 50.

Structural Tees

Structural tees are split from W-, M- and S-shapes to make WT-, MT- and ST-shapes respectively. For the preferred material specifications, as well as other suitable material specifications for structural tees, refer to the preceding sections on W-, M- or S-shapes as appropriate.

Rectangular (and Square) HSS

The preferred material specification for rectangular hollow structural sections (HSS) is ASTM A500 Grade B (F_y = 46 ksi, F_u = 58 ksi), although ASTM A500 Grade C (F_y = 50 ksi, F_u = 62 ksi) is very common. The availability of rectangular HSS in grades other than ASTM A500 Grade B should be confirmed prior to their specification.

Rectangular HSS with atmospheric resistance (weathering characteristics) can be obtained by specifying ASTM A847. Other material specifications applicable to rectangular HSS include ASTM A501 Grades A and B and ASTM A618.

Round HSS

The preferred material specification for round HSS is ASTM A500 Grade B (F_y = 42 ksi, F_u = 58 ksi), although ASTM A500 Grade C (F_y = 46 ksi, F_u = 62 ksi) is very common. The availability of round HSS in grades other than ASTM A500 Grade B should be confirmed prior to specification. Generally speaking, only round HSS with the same cross-sectional dimensions as

steel pipe are stocked and available. See the sidebar below "12 Tidbits" for further information.

Round HSS with atmospheric corrosion resistance (weathering characteristics) can be obtained by specifying ASTM A847. Other material specifications applicable to round HSS include ASTM A501 Grades A and B and ASTM A618.

➤ Steel Pipe

The material specification for steel pipe used in structural frames is ASTM A53 Grade B (F_y = 35 ksi, F_u = 60 ksi). In some regions, ASTM A53 material is more readily available than ASTM A500 for round cross-sections. See the sidebar "12 Tidbits" for further information.

Plate Products

See Summary in Table 2.

➤ Structural Plates

The preferred material specification for structural plates is in transition. ASTM A36 (F_y = 36 ksi for plate thickness equal to or less than 8 in., F_y = 32 ksi otherwise; F_u = 58 ksi) remains common, but 50 ksi grades increasingly are being used, including ASTM A572 Grade 50 (F_y = 50 ksi for plate thickness equal to or less than 4 in.; F_u = 65 ksi) and ASTM A529 Grade 50 (F_y= 50 ksi for plate thickness equal to or less than 1 in.; F_u = 70 ksi). The availability and cost effectiveness of structural plates in grades other than ASTM A36 should be confirmed prior to their specification. Note also that the availability of grades other than ASTM A36 varies through the range of thicknesses as shown in Table 2.

12 Important Tidbits for 2012

1. When in doubt, check it out. Have questions about availability? Contact a fabricator or the AISC Steel Solutions Center (**solutions@aisc.org**). Either one can keep you swimming in available steel.

2. Times change. ASTM A992 originally was introduced covering only W-shapes. A later revision to this ASTM standard expanded its scope to include other hot-rolled structural cross-sections, including channels, angles and M-shapes, allowing them to be made to ASTM A992. Nevertheless, A992 still is not common in shapes other than W-shapes.

3. Round HSS ≠ Steel Pipe. Know the difference between ASTM A500 and ASTM A53. ASTM A500 is for HSS (F_y = 42 ksi for Grade B; 46 ksi for Grade C). ASTM A53 is for steel pipe (F_y = 35 ksi).

4. Round HSS are similar to steel pipe. Know the similarity between available round HSS (ASTM A500) and steel pipe (ASTM A53). Generally speaking, only round HSS with the same cross-sectional dimensions as steel pipe are stocked and available. So avoid specifying a round HSS with a cross-section that does not match up to one of the steel pipe cross-sections. This is a lot easier than it sounds—just use round HSS with non-zero numbers after the decimal point. For example, HSS5.563×0.258 has the same cross-section as a Pipe 5 Std. And it will generally be available, while HSS5.000×0.250 is an HSS-only product and will require a mill-order quantity to obtain.

5. Properly designate your HSS. A round HSS is designated by nominal diameter and wall thickness, each expressed to three decimal places—for example, HSS5.563×0.258. A square or rectangular HSS is designated by nominal outside dimensions and wall thickness, each in rational numbers—for example, HSS5×3×⅜.

6. Properly designate your steel pipes. Use nominal pipe size (NPS) designation through NPS 12—for example, Pipe 5 Std., Pipe 5 x-strong or Pipe 5 xx-strong. Note that this notation has commonly been abbreviated as follows for the examples given: P5, PX5 and PXX5 respectively. Above NPS 12, use the format "Pipe" followed by diameter x nominal wall thickness, each expressed to three decimal places. For example, a standard-weight NPS 14 is designated Pipe 14.000×0.375. The latter format also applies to any steel pipe size smaller than NPS 12 that does not have an NPS size.

7. Don't confuse anchor rods with bolts. Do not specify your anchor rods as ASTM A325 or A490. The ASTM A325 and A490 standards cover headed bolts, with limited thread length, generally available only up to 8 in. in length, and governed by provisions for steel-to-steel structural joints only. You say you've always specified your anchorage devices this way and it's never been a problem? Well, the reality is that your fabricator has been awfully nice to not embarrass you by pointing out that you've specified a product that does not come in the length you likely specified—or as a hooked or longer-threaded rod. Use ASTM F1554, which covers hooked, headed and threaded/nutted rods in three strength grades.

8. Have all the information at your fingertips. More extensive information can be found in the 14th Edition AISC *Steel Construction Manual* and the AISC publication *Selected ASTM Standards for Structural Steel Fabrication*. Both are available at **www.aisc.org/bookstore**.

9. Remember to specify the alternate core location CVN requirement when you have heavy shapes or plates; see AISC *Specification* Sections A3.1c and A3.1d for further information.

10. When specifying weathering steel, ASTM A242 material typically is more difficult to acquire than ASTM A588 material.

11. Use the new MC12×14.3 for stair stringers. The handrail pipe sizes will fit—as will the fillet welds used to connect them on this new channel with a wider flange.

12. When in doubt, check it out. Oh wait, this is number 1. Well, it is important.

Table 2

Applicable ASTM Specifications for Plates and Bars

Steel Type	ASTM Designation		F_y Min. Yield Stress (ksi)	F_u Tensile Stress[a] (ksi)	Plates and Bars: to 0.75 incl.	0.75 to 1.25 incl.	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										
	A529	Gr. 50	50	70–100		[b]	[b]	[b]	[b]					
		Gr. 55	55	70–100		[b]	[b]							
High-Strength Low-Alloy	A572	Gr. 42	42	60										
		Gr. 50	50	65										
		Gr. 55	55	70										
		Gr. 60	60	75										
		Gr. 65	65	80										
Corrosion Resistant High-Strength Low-Alloy	A242		42	63										
			46	67										
			50	70										
	A588		42	63										
			46	67										
			50	70										
Quenched and Tempered Alloy	A514[c]		90	100–130										
			100	110–130										
Quenched and Tempered Low-Alloy	A852[c]		70	90–110										

[a] Minimum unless a range is shown.

[b] Applicable to bars only above 1-in. thickness.

[c] Available as plates only.

Preferred material specification.

Other applicable material specification, the availability of which should be confirmed prior to specification.

Material specification does not apply.

Structural plates with higher yield and tensile strength can be obtained by specifying ASTM A572 Grades 55, 60 or 65, ASTM A529 Grade 55, ASTM A514 Grades 90 or 100, or ASTM A852. Structural plates with atmospheric corrosion resistance (weathering characteristics) can be obtained by specifying ASTM A588 Grades 42, 46 or 50 or ASTM A242 Grades 42, 46 or 50. Other material specifications applicable to structural plates include ASTM A529 Grade 42 and ASTM A572 Grade 42.

➤ Structural Bars

The preceding comments for structural plates apply equally to structural bars, except that ASTM A529 Grade 50 provides for bars up to 2½ in. thick and neither ASTM A514 nor A852 are applicable.

➤ Raised-Pattern Floor Plates

ASTM A786 is the standard specification for rolled steel floor plates. As floor-plate design is seldom controlled by strength considerations, ASTM A786 "commercial grade" is commonly specified. If so, per ASTM A786 Section 5.1.3, "the product will be supplied with 0.33% maximum carbon and without specified mechanical properties." Alternatively, if a defined strength level is desired, ASTM A786 raised-pattern floor plate can be ordered to a defined plate specification such as ASTM A36, A572 or A588; see ASTM A786 Section 5.1.3 and Section 8.

➤ Sheet and Strip

Sheet and strip products, which generally are thinner than structural plate and bar products, are produced to such ASTM specifications as A606, A1008 or A1011. Previously A570 and A607 were listed; these standards have been withdrawn and the materials covered by them are now in A1008, A1011 and thicker materials in A1018. These are "umbrella" standards with many types and grades; the structural steel type is designated "SS" and the standards provide for grades from 25 or 30 to 80. Availability should be checked before specifying the grade.

Fastening Products

See Summary in Table 3.

➤ Conventional Bolts

The preferred material specification for conventional (heavy hex) high-strength bolts in steel-to-steel connections is ASTM A325, although ASTM A490 can be specified when higher strength is desired. In either case, Type 1 is the most commonly specified (medium-carbon steel). When atmospheric corrosion resistance is desired, Type 3 can be specified. While still formally permitted in the AISC *Specification*, the use of other material specifications in steel-to-steel bolting applications has become quite uncommon.

➤ Twist-Off Type Tension-Control Bolt Assemblies

There are two preferred material specifications for twist-off type tension-control bolt assemblies. ASTM F1852 offers a strength equivalent to that of ASTM A325 bolts and ASTM F2280 offers a strength equivalent to that of ASTM A490 bolts.

➤ Nuts

The preferred material specification for heavy-hex nuts is ASTM A563. The appropriate grade and finish is specified per ASTM A563 Table X1.1 according to the bolt or threaded part with which the nut will be used. For steel-to-steel structural bolting applications, the appropriate grade and finish is summarized in the RCSC *Specification* Section 2.4. If its availability can be confirmed prior to specification, ASTM A194 Grade 2H nuts are permitted as an alternative, as indicated in the RCSC *Specification* Table 2.1.

➤ Washers

The preferred material specification for hardened steel washers is ASTM F436. This specification provides for both flat and beveled washers. While standard ASTM F436 washers are sufficient in most applications, there are several specific applications when special washers are required. The special washer requirements in RCSC *Specification* Section 6 apply when oversized or slotted holes are used in the outer ply of a steel-to-steel structural joint. In anchor rod and other embedment applications, hole sizes generally are larger than those for steel-to-steel structural bolting applications. Accordingly, washers used in such applications generally are larger and might require design consideration for proper force transfer, particularly when the anchorage is subject to tension. Where anchor rods are used in holes larger than 1/16 in. bigger than the rod, ASTM F844 washers are permitted and they have a larger diameter than F436.

➤ Compressible-Washer-Type Direct-Tension Indicators

When bolted joints are specified as pretensioned or slip-critical and the direct-tension-indicator pretensioning method is used, ASTM F959 compressible-washer-type direct-tension indicators are specified. Type 325 is used with ASTM A325 high-strength bolts and Type 490 is used with ASTM A490 high-strength bolts. The use of these devices must conform to the requirements in the RCSC *Specification*, which provides detailed requirements for pre-installation verification (Section 7), installation (Section 8) and inspection (Section 9). The RCSC *Specification* also permits alternative washer-type indicating devices subject to the provision in Section 2.6.2.

➤ Anchor Rods

The preferred material specification for anchor rods is ASTM F1554, which covers hooked, headed, threaded and nutted anchor rods in three strength grades: 36, 55 and 105. ASTM F1554 Grade 55 is most commonly specified, although Grades 36 and 105 are normally available. ASTM F1554 Grade 36 may be welded, while Grade 55 may be welded if it is ordered with Supplement S1 and the carbon equivalent formula in Section S1.5.2.1. Grade 105 may not be welded, as the heat will detrimentally affect performance. Several other ASTM specifications also may be used. For applications involving rods that are not headed, ASTM A36, A193, A307, A354, A449, A572, A588 and A687 can be specified. Note that the ASTM A307 Grade C "anchor bolt" has been deleted from ASTM A307 and replaced by ASTM F1554 Grade 36. For applications involving headed rods A354 and A449 can be specified.

➤ Threaded Rods

The preferred material specification for threaded rods, whether provided with plain or upset ends, is ASTM A36. Other material specifications that can be specified include ASTM A193, A307, A354, A449, A572, A588 and A687. Note that ASTM A354 Grade BC and A449 are permitted to be used for bolts when the size required is outside the range of ASTM A325. ASTM A354 Grade BD is permitted when the size required is outside the range of ASTM A490. These standards are material standards, not bolt standards, so the desired dimensions have to be specified as per ANSI ASME B18.2.6 heavy hex Class 2A.

➤ Shear Stud Connectors

The preferred material specification for shear stud connectors used for the interconnection of steel and concrete elements in composite construction is ASTM A29 provided in a condition defined in ASTM A108. The mechanical requirements are stated in AWS D1.1 Table 7.1 for Type B (F_y = 50 ksi, F_u = 65 ksi).

➤ Forged Steel Structural Hardware

Forged steel structural hardware products, such as clevises, turnbuckles, eye nuts and sleeve nuts are occasionally used in building design and construction. These products are generally provided to AISI material specifications. AISI C-1035 is commonly used in the manufacture of clevises and turnbuckles. AISI C-1030 is commonly used in the manufacture of steel eye nuts and steel eye bolts. AISI C-1018 Grade 2 is commonly used in the manufacture of sleeve nuts. Other products, such as steel rod ends, steel yoke ends and pins, cotter pins and coupling nuts are provided generically as "carbon steel." The dimensional and strength characteristics of these devices are described in the literature provided by their manufacturers. Note that such information may be provided as a safe working load and based upon a factor of safety as high as five, assuming that the product will be used in rigging or similar applications subject to dynamic loading. If so, the tabular value might be overly conservative for permanent installations and similar applications subject to static loading only. In these applications, a factor of safety of three is more common.

➤ Filler Metal

The appropriate filler metal for structural steel is summarized in ANSI/AWS D1.1 Table 3.1 for the various combinations of base metal specification and grade, and electrode specification. A tensile strength level of 70 ksi is indicated for the majority of the commonly used steels in building construction.

Other Products

➤ Steel Castings and Forgings

Steel castings are specified as ASTM A27 Grade 65-35 or ASTM A216/A216M Grade WCB with supplementary requirement S11 Grade 80-35. Steel forgings are specified as ASTM A668.

➤ Crane Rails

Crane rails are furnished to ASTM A759, ASTM A1 and/or manufacturer's specifications and tolerances. Rail is designated by unit weight in units of pounds per yard. Dimensions of common rail are shown in the AISC 14th Edition *Manual* Table 1-21. Most manufacturers chamfer the top and sides of the crane rail head at the ends unless specified otherwise to reduce chipping of the running surfaces. Often crane rails are ordered as end-hardened, which improves the crane rail ends' resistance to impact from contact with the mov-

Table 3

Applicable ASTM Specifications for Various Types of Structural Fasteners

ASTM Designation		F_y Min. Yield Stress (ksi)	F_u Tensile Stress[a] (ksi)	Diameter Range (in.)	High-Strength Bolts: Conventional	High-Strength Bolts: Twist-Off-Type Tension-Control	Common Bolts	Nuts	Washers	Direct-Tension-Indicators	Threaded Rods	Shear Stud Connectors	Anchor Rods: Hooked	Anchor Rods: Headed	Anchor Rods: Threaded & Nutted
A108		—	60	0.375 to 0.75 incl.								■			
A325[d]		—	105	over 1 to 1.5 incl.	■										
		—	120	0.5 to 1 incl.	■										
A490[d]		—	150	0.5 to 1.5	■										
F1852[d]		—	105	1.125		■									
		—	120	0.5 to 1 incl.		■									
F2280[d]		—	150	0.5 to 1.125 incl.		■									
A194 Gr. 2H		—	—	0.25 to 4				▒							
A563		—	—	0.25 to 4				■							
F436[b]		—	—	0.25 to 4					■						
F959		—	—	0.5 to 1.5						■					
A36		36	58–80	to 10							■		▒		▒
A193 Gr. B7[e]		—	100	over 4 to 7							▒		▒		▒
		—	115	over 2.5 to 4							▒		▒		▒
		—	125	2.5 and under							▒		▒		▒
A307 Gr. A		—	60	0.25 to 4			■								
A354 Gr. BD		—	140	2.5 to 4 incl.							▒		▒	▒	▒
		—	150	0.25 to 2.5 incl.							▒		▒	▒	▒
A449		—	90	1.75 to 3 incl.	[c]						▒		▒	▒	▒
		—	105	1.125 to 1.5 incl.	[c]						▒		▒	▒	▒
		—	120	0.25 to 1 incl.	[c]						▒		▒	▒	▒
A572	Gr. 42	42	60	to 6							▒		▒		▒
	Gr. 50	50	65	to 4							▒		▒		▒
	Gr. 55	55	70	to 2							▒		▒		▒
	Gr. 60	60	75	to 1.25							▒		▒		▒
	Gr. 65	65	80	to 1.25							▒		▒		▒
A588		42	63	over 5 to 8 incl.							▒		▒		▒
		46	67	over 4 to 5 incl.							▒		▒		▒
		50	70	4 and under							▒		▒		▒
A687		105	150 max.	0.625 to 3							▒		▒		▒
F1554	Gr. 36	36	58–80	0.25 to 4									▒	▒	▒
	Gr. 55	55	75–95	0.25 to 4									■	■	■
	Gr. 105	105	125–150	0.25 to 3									▒	▒	▒

■ Preferred material specification.

▒ Other applicable material specification, the availability of which should be confirmed prior to specification.

□ Material specification does not apply.

— Indicates that a value is not specified in the material specification.

[a] Minimum unless a range is shown or maximum (max.) is indicated.

[b] Special washer requirements may apply per RCSC *Specification* Table 6.1 for some steel-to-steel bolting applications and per Part 14 for anchor-rod applications.

[c] See AISC *Specification* Section J3.1 for limitations on use of ASTM A449 bolts.

[d] When atmospheric corrosion resistance is desired, Type 3 can be specified.

[e] For anchor rods with temperature and corrosion resistance characteristics.

ing wheel during crane operation. Alternatively, the entire rail can be ordered as heat-treated. When maximum wheel loading or controlled cooling is needed, refer to manufacturer catalogs. Purchase orders for crane rails should be noted "for crane service." Light 40-lb rails are available in 30-ft lengths, standard rails in 33-ft or 39-ft lengths, and crane rails up to 80 ft. Consult manufacturer for availability of other lengths. Rails should be arranged so that joints on opposite sides of the crane runway will be staggered with respect to each other and with due consideration to the wheelbase of the crane. Rail joints should not occur at crane girder splices. Odd lengths that must be included to complete a run or obtain the necessary stagger should be not less than 10-ft long. Rails are furnished with standard drilling in both standard and odd lengths unless stipulated otherwise on the order. MSC