
Standard Specification for Structural Steel for Bridges

AASHTO Designation: M 270M/M 270-23

Technically Revised: 2023

Technical Subcommittee: 4f, Metals

ASTM Designation: A709/A709M-21



American Association of State Highway and Transportation Officials
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1. SCOPE

- 1.1. This specification covers carbon and high-strength low-alloy steel structural shapes, plates, and bars and quenched and tempered alloy steel, and stainless steel for structural plates intended for use in bridges. Twelve grades are available in five yield strength levels as follows:

Table 1—Yield Strength Levels

Grade SI [U.S.]	Yield Strength, MPa [ksi]
250 [36]	250 [36]
345 [50]	345 [50]
345S [50S]	345 [50]
QST 345 [QST 50]	345 [50]
QST 345S [QST 50S]	345 [50]
345W [50W]	345 [50]
345CR [50CR]	345 [50]
HPS 345W [HPS 50W]	345 [50]
QST 450 [QST 65]	450 [65]
QST 485 [QST 70]	485 [70]
HPS 485W [HPS 70W]	485 [70]
HPS 690W [HPS 100W]	690 [100]

- 1.1.1. Grades 250 [36], 345 [50], 345S [50S], 345W [50W], and 345CR [50CR], QST 345 [QST 50], QST 345S [QST 50S], QST 450 [QST 65] and QST 485 [QST 70] are also included in ASTM A36/A36M, A572/A572M, A992/A992M, A588/A588M, A514/A514M, and A1010/A1010. When the supplementary requirements of this specification are specified, they exceed the requirements of A36/A36M, A572/A572M, A992/A992M, A588/A588M, A514/A514M, and A1010/A1010M.
- 1.1.2. Grades 345W [50W], 345CR [50CR], HPS 345W [HPS 50W], HPS 485W [HPS 70W], and HPS 690W [HPS 100W] have enhanced atmospheric corrosion resistance (Section 13.1.2). Product availability is shown in Table 2.
- 1.2. Grade HPS 485W [HPS 70W] or HPS 690W [HPS 100W] shall not be substituted for Grade 250 [36], 345 [50], 345S [50S], 345W [50W], 345CR [50CR], or HPS 345W [HPS 50W]. Grade 345W [50W], 345CR [50CR], or HPS 345W [HPS 50W] shall not be substituted for Grade 250 [36], 345 [50], or 345S [50S] without agreement between the purchaser and supplier.

- 1.3. When the steel is to be welded, it is presupposed that a welding procedure suitable for the grade of steel and intended use or service will be utilized. See Appendix X3 of ASTM A6/A6M for information on weldability.

Table 2—Tensile and Hardness Requirements^a

Grade	Plate Thick- ness, mm [in.]	Structural Shape Flange or Leg Thickness, mm [in.]	Yield Point or Yield Strength, ^b MPa [ksi]	Tensile Strength, MPa [ksi]	Minimum Elongation, %				Reduction of Area ^{c,e} Min, %
					Plates and Bars ^{c,d}		Shapes ^d		
					200 mm or 8 in.	50 mm or 2 in.	200 mm or 8 in.	50 mm or 2 in.	
250 [36]	To 100 [4], incl	To 75 [3], incl	250 [36] min	400–550 [58–80]	20	23	20	21	—
		Over 75 [3]	250 [36] min	400 [58] min	— ^f	—	20	19	—
345 [50]	To 100 [4], incl	All	345 [50] min	450 [65] min	18	21	18	21 ^g	—
QST 345 [QST 50]	^a	All	345 [50]	450 [65]	—	—	18	21 ^g	—
345S [50S]	^h	All	345–450 [50–65] ^{i,j}	450 [65] h	—	—	18	21	—
QST 345S [50S]	^a	All	345–450 [50–65]	450 [65]	—	—	18	21	—
345W [50W] and HPS 345W [HPS 50W]	To 100 [4], incl	All	345 [50] min	485 [70] min	18	21	18	21 ^k	—
345CR [50CR]	To 50 [2], incl	^h	345 [50] min	485 [70] min	18	21	—	—	—
QST 450 [QST 65]	^a	All	450 [65]	550 [80] min	—	—	15	17	—
QST 485 [QST 70]	^a	All	485 [70]	620 [90] min	—	—	14	16	—
HPS 485W [HPS 70W]	To 100 [4], incl	^h	485 [70] ^b min	585–760 [85–110]	—	19 ^l	—	—	—
HPS 690W [HPS 100W]	To 65 [2½], incl	^h	690 [100] ^b min	760–895 [110–130]	—	18 ^l	—	—	^m
	Over 65 to 100 [2½ to 4] ⁿ	^h	620 [90] ^b	690–895 [100–130]	—	16 ^l	—	—	^m

^a See “Orientation” and “Preparation” under “Tension Tests” in ASTM A6/A6M.

^b Measure at 0.2 percent offset or 0.5 percent extension under load as described in Section 13 of T 244 or ASTM A370.

^c Elongation and reduction of area not required to be determined for floor plates.

^d For plates wider than 600 mm [24 in.], the elongation requirement is reduced two percentage points. See elongation requirement adjustments under the Tension Tests section of ASTM A6/A6M.

^e For plates wider than 600 mm [24 in.], the reduction of area requirement, where applicable, is reduced five percentage points.

^f Where “—” appears in this table, there is no requirement.

^g Elongation in 50 mm [2 in.], 19 percent minimum for shapes with flange thickness over 75 mm [3 in.].

^h Not applicable.

ⁱ The yield-to-tensile ratio shall be 0.87 or less for shapes that are tested from the web location; for all other shapes, the requirement is 0.85.

^j A maximum yield strength of 480MPa [70 ksi] is permitted for structural shapes that are required to be tested from the web location.

^k For wide flange shapes with flange thickness greater than 75 mm [3 in.], elongation in 50 mm [2 in.] of 18 percent minimum applies.

^l If measured on the Figure 3 (T 244) 40-mm [1½-in.] wide specimen, the elongation is determined in a 50-mm [2-in.] gauge length that includes the fracture and shows the greatest elongation.

^m 40 percent minimum applies if measured on the Figure 3 (T 244) 40-mm [1½-in.] wide specimen, 50 percent minimum applies if measured on the Figure 4 (T 244) 12.5-mm [½-in.] round specimen.

ⁿ Not applicable to fracture-critical Tension Components. (See Table 11.)

- 1.4. For structural products to be used as tension components requiring notch toughness testing, standardized requirements are provided in this standard. These requirements are based on American Association of State Highway and Transportation Officials (AASHTO) requirements for both fracture-critical and non-fracture-critical members.
- 1.5. Supplementary requirements are available but shall apply only if specified in the purchase order.
- 1.6. The values stated in either SI units or inch-pound units are to be regarded separately as standard. Within the text, the inch-pound units are shown in brackets. The values stated in each system are not exact equivalents; therefore, each system is to be used independently of the other, without combining values in any way.
- 1.7. For structural products cut from coiled product and furnished without heat treatment or with stress relieving only, the additional requirements of ASTM A6/A6M, including additional testing requirements and the reporting of additional tests, apply.

2. REFERENCED DOCUMENTS

- 2.1. *AASHTO Standards:*
- < T 243M/T 243, Sampling Procedure for Impact Testing of Structural Steel
 - < T 244, Mechanical Testing of Steel Products
- 2.2. *ASTM Standards:*
- < A6/A6M, Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling
 - < A36/A36M, Standard Specification for Carbon Structural Steel
 - < A370, Standard Test Methods and Definitions for Mechanical Testing of Steel Products
 - < A514/A514M, Standard Specification for High-Yield-Strength, Quenched and Tempered Alloy Steel Plate, Suitable for Welding
 - < A572/A572M, Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel
 - < A588/A588M, Standard Specification for High-Strength Low-Alloy Structural Steel, up to 50 ksi [345 MPa] Minimum Yield Point, with Atmospheric Corrosion Resistance
 - < A673/A673M, Standard Specification for Sampling Procedure for Impact Testing of Structural Steel
 - < A913/A913M, Standard Specification for High-Strength Low-Alloy Steel Shapes of Structural Quality, Produced by Quenching and Self-Tempering Process (QST)
 - < A992/A992M, Standard Specification for Structural Steel Shapes
 - < A1010/A1010M, Standard Specification for Higher-Strength Martensitic Stainless Steel Plate, Sheet, and Strip
 - < G101, Standard Guide for Estimating the Atmospheric Corrosion Resistance of Low-Alloy Steels

3. TERMINOLOGY

- 3.1. *Definitions of Terms Specific to This Standard:*
- 3.1.1. *fracture-critical member*—a main load-carrying member or tension component of a bending member the failure of which would be expected to cause collapse of a structure or bridge without multiple, redundant load paths.

- 3.1.2. *main load-carrying member*—a steel member designed to carry primary design loads, including dead, live, impact, and other loads.
- 3.1.3. *non-fracture-critical member*—a main load-carrying member the failure of which would not be expected to cause collapse of a structure or bridge with multiple, redundant load paths.
- 3.1.4. *nontension component*—a steel member that is not in tension under any design loading.
- 3.1.5. *secondary member*—a steel member used for aligning and bracing of main load-carrying members or for attaching utilities, signs, or other items to them, but not to directly support primary design loads.
- 3.1.6. *tension component*—a part or element of a fracture-critical or non-fracture-critical member that is in tension under various design loadings.

4. ORDERING REQUIREMENTS

- 4.1. *In addition to the items listed in the ordering information section of ASTM A6/A6M, the following items should be considered if applicable:*
- 4.1.1. Type of component (tension or non-tension, fracture-critical or non-fracture-critical) (see Section 10).
- 4.1.2. Impact testing temperature zone (see Table 3).

Table 3—Relationship between Impact Testing Temperature Zones and Minimum Service Temperatures

Zone	Minimum Service Temperature, °C [°F]
1	−18 [0]
2	Below −18 to −34 [0 to −30]
3	Below −34 to −51 [−30 to −60]

5. GENERAL REQUIREMENTS FOR DELIVERY

- 5.1. Material furnished under this specification shall conform to the requirements of the current edition of ASTM A6/A6M for the specific structural product unless a conflict exists, in which case this specification shall prevail.
- 5.2. Coils are excluded from qualification to this specification until they are processed into a finished structural product. “Structural products produced from coil” means structural products that have been cut to individual lengths from a coil. The processor controls, or is responsible for, the operations involved in the processing of a coil into a finished structural product. Such operations include decoiling, leveling or straightening, hot forming or cold forming (if applicable), cutting to length, testing, inspection, conditioning, heat treatment (if applicable), packaging, marking, loading for shipment, and certification. (See Note 1.)
- Note 1**—For structural products produced from coil and finished without heat treatment or with stress relieving only, two test results are to be reported for each qualifying coil. Additional requirements regarding structural products from coil are described in ASTM A6/A6M.