

SPECIFICATION FOR HOT-ROLLED STRUCTURAL STEEL, HIGH-STRENGTH LOW-ALLOY PLATE WITH IMPROVED FORMABILITY



SA-656/SA-656M



(23)

(Identical with ASTM Specification A656/A656M-18.)

Specification for Hot-Rolled Structural Steel, High-Strength Low-Alloy Plate with Improved Formability

1. Scope

1.1 This specification covers three types and five strength grades of high-strength low-alloy, hot-rolled structural steel plate for use in truck frames, brackets, crane booms, rail cars, and similar applications. Steels that conform to this specification offer improved formability. These steels are normally furnished in the as-rolled condition. The type and strength grade furnished is as agreed upon between the manufacturer and the purchaser. The types and strength grades are shown in the tables.

1.2 The maximum thickness of plates shall be as follows:

| Grade | Plate Thickness, max, in. [mm] |
|-------|-----------------------------------|
| 50 | 2 [50] |
| 60 | 1½ [40] |
| 70 | 1 [25] |
| 80 | 1 [25] |
| 100 | ½ [13] |

1.3 The values stated in either inch-pound units or SI units are to be regarded as standard. Within the text, the SI units are shown in brackets. The values stated in each system are not exact equivalents; therefore, each system must be used independently of the other. Combining values from the two systems may result in nonconformance with this specification.

1.4 For plates produced from coil and furnished without heat treatment or with stress relieving only, the additional requirements, including additional testing requirements and the reporting of additional test results, of Specification A6/A6M apply.

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 ASTM Standards:

A6/A6M Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling

3. General Requirements for Delivery

3.1 Plates furnished under this specification shall conform to the requirements of the current edition of Specification A6/A6M, for the specific plate ordered, unless a conflict exists, in which case this specification shall prevail.

3.2 Coils are excluded from qualification to this specification until they are processed into finished plates. Plates produced from coil means plates that have been cut to individual lengths from a coil. The processor directly controls, or is responsible for, the operations involved in the processing of a coil into finished plates. Such operations include decoiling, leveling, cutting to length, testing, inspection, conditioning, heat treatment (if applicable), packaging, marking, loading for shipment, and certification.

NOTE 1—For plates produced from coil and furnished without heat treatment or with stress relieving only, two test results are to be reported for each qualifying coil. Additional requirements regarding plate produced from coil are described in Specification A6/A6M.

4. Materials and Manufacture

4.1 The steel shall be made to fine grain practice.

5. Chemical Composition

5.1 Heat analyses shall conform to the chemical requirements given in Table 1. Dependent upon thickness, grade, and intended application, variations in the chemical composition are permitted within the limits given in Table 1 for the applicable type. Where it is of particular importance, the manufacturer should be consulted for specific chemical composition.

5.2 *Product Analysis*—If a product analysis is made, it shall conform to the requirements given in Table 1, subject to the product analysis tolerances of Specification A6/A6M.

TABLE 1 Chemical Requirements

NOTE 1—An ellipsis (...) indicates that element is not defined for that Type.

| Elements | Composition, % | | |
|----------------------------------|----------------|-----------------------|-----------------------|
| | Type 3 | Type 7 | Type 8 |
| Carbon, max ^A | 0.18 | 0.18 | 0.18 |
| Manganese, max ^A | 1.65 | 1.65 | 1.65 |
| Phosphorus, max | 0.025 | 0.025 | 0.025 |
| Sulfur, max | 0.030 | 0.030 | 0.030 |
| Silicon, max | 0.60 | 0.60 | 0.60 |
| Vanadium, max | 0.08 | 0.15 ^B | 0.15 ^C |
| Nitrogen, max | 0.030 | 0.030 | 0.030 |
| Columbium (niobium) ^D | 0.008–0.10 | 0.10 max ^B | 0.10 max ^C |
| Titanium, max | ... | ... | 0.15 ^C |

^A For each reduction of 0.01 percentage point below the specified maximum for carbon, an increase of 0.06 percentage points above the specified maximum for manganese is permitted, up to a maximum of 1.75 % for Grades 50, 60, and 70 [345, 415, and 485 MPa]; up to a maximum of 1.90 % for Grade 80 [550]; and up to a maximum of 2.10 % for Grade 100 [690].

^B The contents of columbium (niobium) and vanadium shall additionally be in accordance with one of the following:

Columbium (niobium) 0.008–0.10 % with vanadium <0.008 %;

Columbium (niobium) <0.008 % with vanadium 0.008–0.15 %; or

Columbium (niobium) 0.008–0.10 % with vanadium 0.008–0.15 % and columbium (niobium) plus vanadium not in excess of 0.20 %.

^C The sum of columbium (niobium), vanadium, and titanium shall be between 0.008 and 0.20 %.

^D Columbium and niobium are interchangeable names for the same element.

TABLE 2 Tensile Requirements^A

| | Grade 50 [345] | Grade 60 [415] | Grade 70 [485] | Grade 80 [550] | Grade 100 [690] |
|--------------------------------------|-------------------|-------------------|-------------------|-------------------|--------------------|
| Yield point, min, ksi [MPa] | 50 [345] | 60 [415] | 70 [485] | 80 [550] | 100 [690] |
| Tensile strength, min, ksi [MPa] | 60 [415] | 70 [485] | 80 [550] | 90 [620] | 110 [760] |
| Elongation in 8 in. [200 mm], min, % | 20 ^B | 17 ^B | 14 ^B | 12 ^B | 12 ^B |
| Elongation in 2 in. [50 mm], min, % | 23 ^B | 20 ^B | 17 ^B | 15 ^B | 15 ^B |

^A See Specimen Orientation under the Tension Tests section of Specification A6/A6M.

^B For plates wider than 24 in. [600 mm], the elongation requirement is reduced two percentage points for Grade 50 [345] and three percentage points for Grades 60, 70, 80, and 100 [415, 485, 550, and 690]. See Elongation Requirement Adjustments in the Tension Tests section of Specification A6/A6M.

5.3 Where 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 Specification A6/A6M for information on weldability.

5.4 Unless specifically ordered, the type is at the discretion of the producer.

6. Mechanical Properties

6.1 Tensile Properties:

6.1.1 The plates as represented by the test specimens shall conform to the requirements given in Table 2.

7. Keywords

7.1 high-strength low-alloy steel; steel plates; structural applications

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