



Designation: ~~A710/A710M – 02 (Reapproved 2013)~~ A710/A710M – 19

Standard Specification for Precipitation–Strengthened Low-Carbon Nickel-Copper- Chromium-Molybdenum-Columbium (Niobium) Alloy Structural Steel Plates¹

This standard is issued under the fixed designation A710/A710M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope-~~Scope~~*

1.1 This specification covers low-carbon ~~precipitation–strengthened~~ precipitation–strengthened nickel - copper - chromium - molybdenum - columbium (niobium) alloy steel plates for general applications. The alloys in this specification are strengthened by precipitation in various temperature ranges. Precipitation strengthening can occur upon air cooling after hot rolling, during normalizing, and by another heat treatment. These grades are not intended for use in applications above 900°F [~~540°C~~];[480°C].

1.2 Two grades, each with three classes, are provided as follows:

<u>Grade and Class</u>	<u>Condition</u>
Grade A, Class 1	as-rolled and precipitation heat treated
Grade A, Class 2	normalized and precipitation heat treated
Grade A, Class 3	quenched and precipitation heat treated
Grade B, Class 1	as-rolled
Grade B, Class 2	normalized
Grade B, Class 3	normalized and precipitation heat treated

1.3 Grade A provides minimum yield strength levels ranging from 50 to 85 ksi [345 to 585 MPa], depending on thickness and condition.

1.4 Grade A, Class 1, plates are limited to a maximum thickness of 3/4 in. [20 mm]. The maximum thickness of Grade A, Classes 2 and 3, is limited only by the capacity of the composition to meet the specified mechanical property requirements; however, current practice normally limits the maximum thickness to 8 in. [200 mm].

1.5 Mandatory notch toughness requirements are specified for Grade A, Class 1.

1.6 Grade B provides minimum yield strength levels ranging from 70 to 75 ksi [~~480~~485 to 515 MPa], depending on thickness and condition.

1.7 Grade B plates are limited to a maximum thickness of 2 in. [50 mm].

1.8 Mandatory notch toughness requirements are specified for the three classes of Grade B.

1.9 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 Specification **A6/A6M** for information on weldability.

1.10 The values stated in either inch-pound units or SI units are to be regarded separately 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 the specification.

1.11 *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.*

¹ This specification is under the jurisdiction of ASTM Committee **A01** on Steel, Stainless Steel and Related Alloys and is the direct responsibility of Subcommittee **A01.02** on Structural Steel for Bridges, Buildings, Rolling Stock and Ships.

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***A Summary of Changes section appears at the end of this standard**



2. Referenced Documents

2.1 ASTM Standards:²

[A6/A6M Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling](#)

[A370 Test Methods and Definitions for Mechanical Testing of Steel Products](#)

[A673/A673M Specification for Sampling Procedure for Impact Testing of Structural Steel](#)

iTeh Standards (<https://standards.itih.ai>) Document Preview

[ASTM A710/A710M-19](#)

<https://standards.itih.ai/catalog/standards/sist/c757a6f6-d8cb-47f1-96a3-6184586ac908/astm-a710-a710m-19>

² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

3. Terminology

3.1 Definitions of Terms Specific to This Standard:

3.1.1 *precipitation heat treatment*—a sub-critical temperature thermal treatment performed to cause precipitation of submicroscopical constituents, etc., so as to result in enhancement of some desirable property.

3.1.1 *precipitation strengthening*—strengthening caused by the precipitation of submicroscopic and/or microscopic constituents of an alloy at various temperatures, which results in the alteration of certain properties: a constituent from a supersaturated solid solution.

3.1.1.1 Discussion—

The Grade/Class combinations presented in this specification are considered to undergo precipitation strengthening when precipitation heat treated in accordance with the relevant requirements of Section 6.

3.1.3 *soak*—to hold at temperature after the material has attained the temperature throughout.

4. General Requirements for Delivery

4.1 Material furnished under this specification shall conform to the requirements of the current edition of Specification **A6/A6M**, for the ordered material, unless a conflict exists in which case this specification shall prevail.

5. Materials and Manufacture

5.1 The steel shall be made to fine grain practice.

NOTE 1—Because of the required minimum columbium (niobium) content in Table 1, all A710/A710M Grades and Classes meet fine grain practice. Grain size testing is not required, and a minimum requirement for any grain refining element, including aluminum, is not specified.

6. Heat Treatment

6.1 Grade A, Class 1 material shall be precipitation heat treated in the temperature range from 1000 to 1300°F [540 to 705°C] for a time to be determined by the material manufacturer.

6.2 Grade A, Class 2 material shall be normalized at a temperature in the range from 1600 to 1700°F [870 to 925°C] and then precipitation heat treated at a temperature in the range from 1000 to 1300°F [540 to 705°C] for a time to be determined by the material manufacturer.

6.3 Grade A, Class 3 material shall be quenched in water or oil from a temperature in the range from 1600 to 1700°F [870 to 925°C] and then precipitation heat treated at a temperature in the range from 1000 to 1300°F [540 to 705°C] for a time to be determined by the material manufacturer.

6.4 Grade B, Class 1 shall be hot-rolled.

6.5 Grade B, Class 2 shall be normalized after hot rolling by reheating to 1600 to 1700°F [870 to 925°C], and then cooled in still air.

TABLE 1 Chemical Requirements

NOTE 1—Where an ellipsis (...) appears in the table, there is no requirement.

Element	Composition, %	
	Grade A	Grade B
Carbon	0.07 max	0.03–0.09
Manganese	0.40–0.70	0.45–1.30
Phosphorus, max	0.025	0.025
Sulfur, max	0.025	0.025
Silicon	0.40 max	0.30–0.50
Nickel	0.70–1.00	0.80–1.00
Chromium	0.60–0.90	0.30 max
Molybdenum	0.15–0.25	0.25 max
Copper	1.00–1.30	1.25–1.50
Columbium (Niobium) ^A	0.02 min	0.02–0.06
Titanium	...	0.01–0.03

NOTE: Where an ellipsis (...) appears in the table, there is no requirement.

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