

ASTM - A387/A387M

Standard Specification for Pressure Vessel Plates, Alloy Steel, Chromium-Molybdenum

This specification covers chromium-molybdenum alloy steel plates intended primarily for welded boilers and pressure vessels designed for elevated temperature service.

❖ **Manufacture :-**

- Steelmaking Practice—The steel shall be killed.

❖ **Heat Treatment :-**

1. Except for Grade 91, all plates shall be thermally treated either by annealing, normalizing- and -tempering, or, when permitted by the purchaser, accelerated cooling from the austenitizing temperature by air blasting or liquid quenching, followed by tempering. Minimum tempering temperatures shall be as follows:

<u>Grade</u>	<u>Temperature, °F [°C]</u>
2, 12, and 11	1150 [620]
22, 22L, 21, 21L, and 9	1250 [675]
5	1300 [705]

2. Grade 91 plates shall be thermally treated, either by normalizing-and-tempering or by accelerated cooling from the austenitizing temperature by air blasting or liquid quenching, followed by tempering. Grade 91 plates shall be austenitized at 1900 to 1975°F [1040 to 1080°C] and shall be tempered at 1350 to 1470°F [730 to 800°C].
3. Grade 5, 9, 21, 21L, 22, 22L, and 91 plates ordered without the heat treatment required by point 1 shall be furnished in either the stressrelieved or the annealed condition.

❖ **Chemical Requirements :-**

- The steel shall conform to the requirements as to chemical composition shown in Table 1 unless otherwise modified in accordance with Supplementary requirement G.

❖ **Metallurgical Structure :-**

Product analysis	0.01
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^A The carbon content for plates over 5 in. [125 mm] in thickness is 0.17 max on product analysis.

❖ **Tension Test Requirements :-**

- The material as represented by the tension test specimens shall conform to the applicable requirements of Table 2 or Table 3, as specified on the order.
- A characteristic of certain types of alloy steels is a local disproportionate increase in the degree of necking down or contraction of the test specimens during the tension test, resulting in a decrease in the percentage of elongation as the gage length is increased. The effect is not so pronounced in thicker plates. For such material, if so stated in the applicable product specification for plates up to 3/4 in. [20 mm], inclusive, in thickness, if the percentage of elongation of an 8-in. [200-mm] gage length test specimen falls not more than 3 percentage points below the amount prescribed, the elongation shall be considered satisfactory if the percentage of elongation in 2 in. [50 mm] across the break is not less than 25 %.

Table 2- Tensile Requirements for Class 1 Plates

	Grades 2 and 12	Grade 11	Grades 22, 21, 5, 9, 21L, 22L
Tensile strength, ksi [MPa]	55 to 80 [380 to 550]	60 to 85 [415 to 585]	60 to 85 [415 to 585]
Yield strength, min, ksi [MPa]	33 [230]	35 [240]	30 [205]
Elongation in 8 in. [200 mm], min, %	18	19	...
Elongation in 2 in. [50 mm], min, %	22	22	18
Reduction of area, min, %	45 ^A 40 ^B

A Measured on round test specimens.

B Measured on flat specimen.

Table 3- Tensile Requirements for Class 2 Plates ^A

	Grade 2	Grade 11	Grade 12	Grades 22, 21, 5,9	Grade 91
Tensile strength, ksi [MPa]	70 to 90 [485 to 620]	75 to 100 [515 to 690]	65 to 85 [450 to 585]	75 to 100 [515 to 690]	85 to 110 [585 to 760]
Yield strength, min, ksi [MPa]/(0.2 % offset)	45 [310]	45 [310]	40 [275]	45 [310]	60 [415]
Elongation in 8 in. [200 mm], min, %	18	18	19
Elongation in 2 in. [50 mm], min, %	22	22	22	18	18

Reduction of area, min, %	45 ^B 40 ^C	...
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^A Not applicable to annealed material.

^B Measured on round test specimens. ^C Measured on flat specimen.

❖ **Supplementary Requirements :-** A.

Additional Tension Test.

B. Charpy V-Notch Impact Test.

C. Drop Weight Test (for Material 0.625 in. [16 mm] and over in Thickness).

D. High-Temperature Tension Test.

E. Ultrasonic Examination.

F. Magnetic Particle Examination.

G. Vacuum Carbon-Deoxidized Steel :- Material shall be vacuum carbon-deoxidized, in which case the silicon content at the time of vacuum deoxidizing shall be 0.12 % maximum, and the content of deoxidizers such as aluminum, zirconium, and titanium should be kept low enough to allow deoxidation by carbon.

Keyword

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- astm a387 grade 12
- astm a387 steel
- astm a387 grade 5
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