

ASTM A516 / ASME SA516

Standard Specification for Pressure Vessel Plates, Carbon Steel, for Moderate- and Lower-Temperature Service

This specification covers carbon steel plates intended primarily for service in welded pressure vessels where improved notch toughness is important.

A. General Requirements :-

1. Material supplied to this product specification shall conform to Specification A20/A20M
2. If the requirements of this specification are in conflict with the requirements of Specification A20/A20M, the requirements of this specification shall prevail.

B. Heat Treatment :-

1. Plates 1.50 in. [40 mm] and under in thickness are normally supplied in the as-rolled condition. The plates may be ordered normalized or stress relieved, or both.
2. Plates over 1.50 in. [40 mm] in thickness shall be normalized.
3. When notch-toughness tests are required on plates 1(1/2) in. [40 mm] and under in thickness, the plates shall be normalized unless otherwise specified by the purchaser.
4. If approved by the purchaser, cooling rates faster than those obtained by cooling in air are permissible for improvement of the toughness, provided the plates are subsequently tempered in the temperature range 1100 to 1300°F [595 to 705°C].

C. Chemical Composition :-

The steel shall conform to the chemical requirements given in Table 1.

Table 1

Elements	Composition, %			
	Grade 55 [Grade 380]	Grade 60 [Grade 415]	Grade 65 [Grade 450]	Grade 70 [Grade 485]
Carbon, max ^{A,B} :				
1/2 in. [12.5 mm] and under	0.18	0.21	0.24	0.27
Over 1/2 in. to 2 in. [12.5 to 50 mm], incl	0.2	0.23	0.26	0.28
Over 2 in. to 4 in. [50 to 100 mm], incl	0.22	0.25	0.28	0.3
Over 4 to 8 in. [100 to 200 mm], incl	0.24	0.27	0.29	0.31
Over 8 in. [200 mm]	0.26	0.27	0.29	0.31
Manganese ^B :				
1/2 in. [12.5 mm] and under:				
Heat analysis	0.60–0.90	0.60–0.90 ^C	0.85–1.20	0.85–1.20
Product analysis	0.55–0.98	0.55–0.98 ^C	0.79–1.30	0.79–1.30
Over 1/2 in. [12.5 mm]:				
Heat analysis	0.60–1.20	0.85–1.20	0.85–1.20	0.85–1.20
Product analysis	0.55–1.30	0.79–1.30	0.79–1.30	0.79–1.30
Phosphorus, max ^A	0.025	0.025	0.025	0.025
Sulfur, max ^A	0.025	0.025	0.025	0.025
Silicon:				
Heat analysis	0.15–0.40	0.15–0.40	0.15–0.40	0.15–0.40
Product analysis	0.13–0.45	0.13–0.45	0.13–0.45	0.13–0.45

^A Applies to both heat and product analyses.

^B For each reduction of 0.01 percentage point below the specified maximum for carbon, an increase of 0.06 percentage point above the specified maximum for manganese is permitted, up to a maximum of 1.50 % by heat analysis and 1.60 % by product analysis.

^C Grade 60 plates 1/2 in. [12.5 mm] and under in thickness may have 0.85–1.20 % manganese on heat analysis, and 0.79–1.30 % manganese on product analysis.

D. Mechanical Properties :-

1. Tension Test—The plates, as represented by the tension test specimens, shall conform to the requirements given in Table 2.

Table 2

Grade	55 [380]	60 [415]	65 [450]	70 [485]
Tensile strength, ksi [MPa]	55–75 [380–515]	60–80 [415–550]	65–85 [450–585]	70–90 [485–620]
Yield strength, min, ^A ksi [MPa]	30 [205]	32 [220]	35 [240]	38 [260]
Elongation in 8 in. [200 mm], min, % ^B	23	21	19	17
Elongation in 2 in. [50 mm], min, % ^B	27	25	23	21

^A Determined by either the 0.2 % offset method or the 0.5 % extension-under-load method.

^B See Specification A20/A20M for elongation adjustment.

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