

ASTM - A106/A106M

SPECIFICATION FOR SEAMLESS CARBON STEEL PIPE FOR HIGH-TEMPERATURE SERVICE

This specification covers seamless carbon steel pipe for high-temperature service in NPS 1/8 to NPS 48 [DN 6 to DN 1200] inclusive, with nominal wall thickness as given in ASME B36.10M. It shall be permissible to furnish pipe having other dimensions provided such pipe complies with all other requirements of this specification.

A. Heat Treatment:-

1. For pipe NPS 1 1/2 [DN 40] and under, it shall be permissible to furnish hot finished or cold drawn.
2. Unless otherwise specified, pipe NPS 2 [DN 50] and over shall be furnished hot finished.
3. When agreed upon between the manufacturer and the purchaser, it is permissible to furnish cold-drawn pipe.
4. Hot-finished pipe need not be heat treated.
5. Cold drawn pipe shall be heat treated after the final cold draw pass at a temperature of 1200°F (650°C) or higher.

B. Chemical Composition :-

The steel shall conform to the requirements as to chemical composition prescribed in Table 1.

Table 1

	Composition, %		
	A	B	C
Carbon, max^A	0.25	0.3	0.35
Manganese	0.27-0.93	0.29-1.06	0.29-1.06
Phosphorus, max.	0.035	0.035	0.035
Sulfur, max.	0.035	0.035	0.035
Silicon, min.	0.1	0.1	0.1
Chromium, max^B	0.4	0.4	0.4
Nickel, max^B	0.4	0.4	0.4
Molybdenum, max^B	0.15	0.15	0.15
Copper, max^B	0.4	0.4	0.4
Vanadium, max^B	0.08	0.08	0.08

^A For each reduction of 0.01% below the specified carbon maximum, an increase of 0.06% manganese above the specified maximum will be permitted up to a maximum of 1.35%. ^B These five elements combined shall not exceed 1%.

C. Tensile Requirements :-

The material shall conform to the requirements as to tensile properties given in Table 2.

D. Elongation :-

The minimum longitudinal elongation in 2 in. [50 mm] given in Table 2.

Table 2

	Grade A		Grade B		Grade C	
Tensile strength, min, psi (MPa)	48000 [330]		60000 [415]		70000 [485]	
Yield strength, min, psi (MPa)	30000 [205]		35000 [240]		40000 [275]	
Elongation in 2 in. [50 mm], min, %:	Longitudinal	Transverse	Longitudinal	Transverse	Longitudinal	Transverse
Basic minimum elongation transverse strip tests, and for all small sizes tested in full section	35	25	30	16.5	30	16.5
When standard round 2 in. [50 mm] gage length test specimen is used	28	20	22	12	22	12
For longitudinal strip tests	A		A		A	
For transverse strip tests, a deduction for each 1/32 in. [0.8 mm] decrease in wall thickness below 5/16 in. [7.9 mm] from the basic minimum elongation of the following percentage shall be made	1.25		1		1	

^A The minimum elongation in 2 in. [50 mm] shall be determined by the following equation:

$$e = 625000A^{0.2} / U^{0.9} \quad \text{for inch-pound units, and}$$

$$e = 1940A^{0.2} / U^{0.9} \quad \text{for SI units,}$$

where: e = minimum elongation in 2 in. [50 mm], %, rounded to the nearest 0.5%.

A = cross-sectional area of the tension test specimen, in.2 [mm2], based upon specified outside diameter or nominal specimen width and specified wall thickness rounded to the nearest 0.01 in.2 [mm2]. If the area thus calculated is greater than 0.75 in.2 [500 mm2], then the value 0.75 in.2 [500 mm2] shall be used, and U = specified tensile strength, psi [MPa].

E. Mechanical Tests Required :-

1. Bending Tests.
2. Flattening Tests.
3. Hydrostatic Test :- Where the hydrostatic test is performed, the lengths shall be marked with the letters "Test Pressure." Where specified in the purchase order, it shall be permissible for pipe to be furnished without the hydrostatic test and without the non-destructive electric test in this case, each length so furnished shall include the mandatory marking of the letters "NH."
4. Non-destructive Electric Test (NDE) :- As an alternative to the hydrostatic test at the option of the manufacturer or where specified in the purchase order as an alternative or addition to the hydrostatic test, the full body of each pipe shall be tested with a non-destructive electric test. For marking refer table 4.

The following information is for the benefit of the user of this specification:

- i. The ultrasonic testing referred to in this specification is capable of detecting the presence and location of significant longitudinally or circumferentially oriented imperfections. Ultrasonic testing is not necessarily capable of detecting short, deep imperfections.
- ii. The eddy current examination referenced in this specification has the capability of detecting significant imperfections, especially of the short abrupt type.
- iii. The flux leakage examination referred to in this specification is capable of detecting the presence and location of significant longitudinally or transversely oriented imperfections.
- iv. The hydrostatic test referred to in point E.2 has the capability of finding defects of a size permitting the test fluid to leak through the tube wall and may be either visually seen or detected by a loss of pressure

Table 3: Marking

Hydro	NDE	Marking
Yes	No	Test Pressure
No	Yes	NDE
No	No	NH
Yes	Yes	Test Pressure/NDE

F. Dimensions, Mass, and Permissible Variations :-

1. Mass — The mass of any length of pipe shall not vary more than 10% over and 3.5% under that specified. Unless otherwise agreed upon between the manufacturer and the purchaser, pipe in NPS 4 [DN 100] and smaller may be weighed in convenient lots; pipe larger than NPS 4 [DN 100] shall be weighed separately.
2. Diameter — Except for pipe ordered as special outside diameter tolerance pipe or as inside diameter tolerance pipe, variations in outside diameter shall not exceed those given in Table 4.
For pipe over 10 in. [250 mm] OD ordered as special outside diameter tolerance pipe, the outside diameter shall not vary more than 1% over or 1% under the specified outside diameter.
For pipe over 10 in. [250 mm] ID ordered as inside diameter tolerance pipe, the inside diameter shall not vary more than 1% over or 1% under the specified inside diameter.
3. Thickness — The minimum wall thickness at any point shall not be more than 12.5% under the specified wall thickness.

G. Lengths :-

1. The lengths required shall be specified in the order.

2. If definite lengths are not required, pipe may be ordered in single random lengths of 16 to 22 ft [4.8 to 6.7 m] with 5% 12 to 16 ft [3.7 to 4.8 m], or in double random lengths with a minimum average of 35 ft [10.7 m] and minimum length of 22 ft [6.7 m] with 5% 16 to 22 ft [4.8 to 6.7 m].

Table 4

NPS [DN Designator]	Permissible Variations in Outside Diameter			
	Over		Under	
	in.	mm	in.	mm
1/8 to 1(1/2) [6 to 40], incl	1/64 (0.015)	0.4	1/64 (0.015)	0.4
Over 1(1/2) to 4 [40 to 100], incl	1/32 (0.031)	0.8	1/32 (0.031)	0.8
Over 4 to 8 [100 to 200], incl	1/16 (0.062)	1.6	1/32 (0.031)	0.8
Over 8 to 18 [200 to 450], incl	3/32 (0.093)	2.4	1/32 (0.031)	0.8
Over 18 to 26 [450 to 650], incl	1/8 (0.125)	3.2	1/32 (0.031)	0.8
Over 26 to 34 [650 to 850], incl	5/32 (0.156)	4	1/32 (0.031)	0.8
Over 34 to 48 [850 to 1200], incl	3/16 (0.187)	4.8	1/32 (0.031)	0.8

H. Supplementary Tests :-

1. Transverse Tension Test.
2. Flattening Test, Standard.
3. Flattening Test, Enhanced.
4. Metal Structure and Etching Test.

Keyword :

- astm a106 grade b pipe dimensions pdf
- astm a106 grade b pdf
- astm a106 equivalent en standard
- astm a106 grade b yield strength
- astm a106 grade b pipe dimensions
- astm a106 grade b equivalent