ASTM A-106 PIPE

DOMESTIC MATERIAL

Diameter – Variations in outside diameter shall not exceed those specified in Table 4.

Thickness – The minimum wall thickness at any point shall not be more than 12.5 % under the nominal wall thickness specified.

TABLE 4 Variation in Outside Diameter

NPS Designator	Permissible Variations in Outside Diameter			
	Over		Under	
	In.	mm	in.	mm
1/8 to 1-1/2, incl.	1/64 (0.015)	0.40	1/64 (0.015)	0.40
Over 1-1/2 to 4, incl.	1/32 (0.031)	0.79	1/32 (0.031)	0.79
Over 4 to 8, incl.	1/16 (0.062)	1.59	1/32 (0.031)	0.79
Over 8 to 18, incl.	3/32 (0.093)	2.38	1/32 (0.031)	0.79
Over 18 to 26, incl.	1/8 (0.125)	3.18	1/32 (0.031)	0.79
Over 26 to 34, incl.	5/32 (0.156)	3.97	1/32 (0.031)	0.79
Over 34 to 48, incl.	3/16 (0.187)	4.76	1/32 (0.031)	0.79

FOREIGN MATERIAL

Subject to Producing Mill Tolerances

Generally O.D. ± 1 %

WALL ± 12-1/2 %

Check with your local MARMON/KEYSTONE BRANCH.

Tensile Requirements

	Grade A (Explanatory Note 2)		Grade B		Grade C	
Tensile strength, min, psi (MPa)	48 000 (330)		60 000 (415)		70 000 (485)	
Yield strength, min, psi (MPa)	30 000 (205)		35 000 (240)		40 000 (275)	
	Longitudinal	Transverse	Longitudinal	Transverse	Longitudinal	Transverse
Elongation in 2 in. or 50 mm, min, %:						
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. or 50 mm gage length test specimen is used	28	20	22	12	20	12
For longitudinal strip tests	*B*		*B*		*B*	
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[A]		1.00[A]		1.00[A]

[A] The following table gives the computed minimum values:

Wall Thickness		Elongation in 2 in. or 50 mm, min, %	
in.	mm	Grade A, Transverse	Grades B and C, Transverse
5/16 (0.312)	7.9	25.00	16.50
9/32 (0.281)	7.1	23.75	15.50
1/4 (0.250)	6.4	22.50	14.50
7/32 (0.219)	5.6	. . .	. . .
3/16 (0.188)	4.8	. . .	. . .
5/32 (0.156)	4.0	. . .	. . .
1/8 (0.125)	3.2	. . .	. . .
3/32 (0.094)	2.4	. . .	. . .
1/16 (0.062)	1.6	. . .	. . .

note – This table gives the computed minimum elongation values for each 1/32-in. (0.8-mm) decrease in wall thickness. Where the wall thickness lies between two values shown above, the minimum elongation value is determined by the following equation:

Grade	Direction of Test	Equation
A	Transverse	E=40t + 12.50
B and C	Transverse	E=32t + 6.50

where:

E = elongation in 2 in. or 50 mm, %, and
t = actual thickness of specimen, in.

B The minimum elongation in 2 in. (50.8 mm) shall be determined by the following equation: $e=625\,000\,A^{0.2}/U^{0.9}$

where:

e = minimum elongation in 2 in. (50.8 mm), %, in percent rounded to the nearest 0.5%.

A = cross-sectional area of the tension test specimen, in^2 , based on specified outside diameter or nominal specimen width and specified wall thickness rounded to the nearest 0.01 $in.^2$ If the area thus calculated is greater than 0.75 $in.^2$, then the value 0.75 shall be used, and

U = specified tensile strength, psi.

ASTM A-106 PIPE

Chemical Requirements

	Composition, %		
	Grade A	Grade B	Grade C
Carbon, max[A]	0.25	0.30	0.35
Manganese	0.27-0.93	0.29-1.06	0.29-1.06
Phosphorous, max	0.035	0.035	0.035
Sulfur, max	0.035	0.035	0.035
Silicon, min	0.10	0.10	0.10
Chrome, max[B]	0.40	0.40	0.40
Copper, max[B]	0.40	0.40	0.40
Molybdenum, max[B]	0.15	0.15	0.15
Nickel, max[B]	0.40	0.40	0.40
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%.

ASTM A-53 PIPE

Diameter – For pipe NPS 1-1/2 and under, the outside diameter at any point shall not vary more than ± 1/64 in. (0.40 mm) from the standard specified. For pipe NPS 2 and over, the outside diameter shall not vary more than ± 1 % from the standard specified.

Thickness – The minimum wall thickness at any point shall be not more than 12.5 % under the nominal wall thickness specified.

ASTM A-53 PIPE

TABLE 1 Chemical Requirements

	Composition, max, %								
	Carbon	Manganese	Phosphorus	Sulfur	Copper[A]	Nickel[A]	Chromium[A]	Molybdenum[A]	Vanadium[A]
Type S (seamless pipe)									
Open-hearth, electric furnace or basic oxygen:									
Grade A	0.25	0.95	0.05	0.045	0.40	0.40	0.40	0.15	0.08
Grade B	0.30	1.20	0.05	0.045	0.40	0.40	0.40	0.15	0.08
Type E (electric-resistance-welded)									
Open-hearth, electric furnace or basic oxygen:									
Grade A	0.25	0.95	0.05	0.045	0.40	0.40	0.40	0.15	0.08
Grade B	0.30	1.20	0.05	0.045	0.40	0.40	0.40	0.15	0.08
Type F (furnace-welded pipe)									
Open-hearth, electric furnace or basic oxygen:									
Grade A	0.30	1.20	0.05	0.045	0.40	0.40	0.40	0.15	0.08

[A] The combination of these five elements shall not exceed 1%.

TABLE 2 Tensile Requirements

	Type F	Types E and S	
	Open-Hearth, Basic Oxygen, or Electric-Furnace, Grade A	Grade A	Grade B
Tensile strength, min, psi (MPa)	48 000 (330)	48 000 (330)	60 000 (415)
Yield strength, min, psi, (MPa)	30 000 (205)	30 000 (205)	35 000 (240)
Elongation in 2 in.	*A*	*A*	*A*

[A] The minimum elongation is 2 in. (50.8 mm) shall be that determined by the following equation: $e = 625\,000\,A^{0.2}/U^{0.9}$ where:

e = minimum elongation in 2 in. (50.8 mm) in percent rounded to the nearest 0.5%,

A = cross-sectional area of the tension test specimen in square inches, based on specified outside diameter or nominal specimen width and specified wall thickness rounded to the nearest 0.01 in.^{2} If the area thus calculated is greater than 0.75 in.^{2}, then the value 0.75 shall be used, and

U = specified tensile strength, psi.