



# ASTM A335

ASTM A335 Seamless Ferritic Alloy Steel Pipe for High-Temperature Service. ASTM A335 standard is issued under the fixed designation A 335/A 335M; 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 preapprovals. A superscript epsilon (  $\epsilon$  ) indicates an editorial change since the last revision or preapprovals.

This specification covers seamless ferritic alloy-steel pipe for high-temperature service. The pipe shall be suitable for bending, flanging, and similar forming operations, and for fusion welding. The steel material shall conform to chemical composition, tensile property, and hardness requirements. Each length of pipe shall be subjected to the hydrostatic test. Also, each pipe shall be examined by a non-destructive examination method in accordance to the required practices. The range of pipe sizes that may be examined by each method shall be subjected to the limitations in the scope of the respective practices. The different mechanical test requirements for pipes, namely, transverse or longitudinal tension test, flattening test, and hardness or bend test are presented.

## 1.Scope

1.1 This specification covers nominal (average) wall seamless alloy-steel pipe intended for high-temperature service (Mote 1). Pipe ordered to this specification shall be suitable for bending, flanging (vanstoning), and similar forming operations, and for fusion welding. Selection will depend upon design, service conditions, mechanical properties, and high-temperature characteristics.

NOTE 1 A Appendix X1 lists the sizes and wall thicknesses of pipe which may be obtained under current commercial practice.

1.2 Several grades of ferritic steels (Note 2) are covered. Their compositions are given in Table 1.

### Note 2

A Ferritic steels in this specification are defined as low and intermediate-alloy steels containing up to and including 10% chromium.

1.3 Supplementary requirements (S1 to S7) of an optional nature are provided. These supplementary requirements call for additional tests to be made, and when desired, shall be so stated in the order together with the number of such tests required.

1.4 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 specification. The inch-pound units shall apply unless the "M" designation of this specification is specified in the order.

Note 3A The dimensionless designator NPS (nominal pipe size) has been substituted in this standard for such traditional terms as "nominal diameter," "size," and "nominal size."

### Chemical Composition:

Grade	C	Mn	P	S	Si	Mo
P1	0.10-0.20	0.30-0.80	0.025	0.025	0.10-0.50	0.44-0.65
P2	0.10-0.20	0.30-0.61	0.025	0.025	0.10-0.30	0.44-0.65
P5	0.15max	0.30-0.60	0.025	0.025	0.50max	0.45-0.65
P5b	0.15max	0.30-0.60	0.025	0.025	1.00-2.00	0.45-0.65
P5c	0.12max	0.30-0.60	0.025	0.025	0.50max	0.45-0.65
P9	0.15max	0.30-0.60	0.025	0.025	0.25-1.00	0.90-1.10
P11	0.05-0.15	0.30-0.60	0.025	0.025	0.50-1.00	0.44-0.65
P12	0.05-0.15	0.30-0.61	0.025	0.025	0.50max	0.44-0.65
P15	0.05-0.15	0.30-0.60	0.025	0.025	1.15-1.65	0.44-0.65
P21	0.05-0.15	0.30-0.60	0.025	0.025	0.50max	0.80-1.06
P22	0.05-0.15	0.30-0.60	0.025	0.025	0.50max	0.87-1.13
P23	0.04-0.10	0.10-0.60	0.030max	0.010max	0.50max	0.05-1.30

### Mechanical Properties

Mechanical properties	P1,P2	P12	P23	P91	P92,P11	P122
Tensile strength	380	415	510	585	620	620
Yield strength	205	220	400	415	440	400

Heat Treatment	A / N+T	N+T / Q+T	N+T
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## Material & Manufacture

Pipe may be either hot finished or cold drawn with the finishing heat treatment noted below.

## Heat Treatment Requirements

Grade	Heat Treatment Type P5, P9, P11, and P22	Normalizing Temperature Range F [C]	Subcritical Annealing or Tempering Temperature Range F [C]
A335 P5 (b,c)	Full or Isothermal Anneal		
	Normalize and Temper	*****	1250 [675]
	Subcritical Anneal (P5c only)	*****	1325 – 1375 [715 - 745]
A335 P9	Full or Isothermal Anneal		
	Normalize and Temper	*****	1250 [675]
A335 P11	Full or Isothermal Anneal		
	Normalize and Temper	*****	1200 [650]
A335 P22	Full or Isothermal Anneal		
	Normalize and Temper	*****	1250 [675]
A335 P91	Normalize and Temper	1900-1975 [1040 - 1080]	1350-1470 [730 - 800]
	Quench and Temper	1900-1975 [1040 - 1080]	1350-1470 [730 - 800]

## Mechanical Tests Specified

Transverse or Longitudinal Tension Test and Flattening Test, Hardness Test, or Bend Test

For material heat treated in a batch-type furnace, tests shall be made on 5% of the pipe from each treated lot.

For small lots, at least one pipe shall be tested.

For material heat treated by the continuous process, tests shall be made on a sufficient number of pipe to constitute 5% of the lot, but in no case less than 2 pipe.

Notes for Hardness Test:

P91 shall not have a hardness not exceeding 250 HB/265 HV [25HRC].

Notes for Bend Test:

For pipe whose diameter exceeds NPS 25 and whose diameter to wall thickness ratio is 7.0 or less shall be subjected to the bend test instead of the flattening test.

Other pipe whose diameter equals or exceeds NPS 10 may be given the bend test in place of the flattening test



subject to the approval of the purchaser.

The bend test specimens shall be bent at room temperature through 180 without cracking on the outside of the bent portion.

### Hydrostatic Test

The inside diameter of the bend shall be 1 inch [25 mm].

Each length of pipe shall be Hydro tested, at option of manufacture nondestructive electric testing can be used.

### Ordering Information

Orders for material under this specification should include the following, as required, to describe the desired material adequately:

Quantity	Feet, meters, or number of lengths
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Name of material	Seamless Alloy Steel Pipe
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Grade	P5, P9, P11, P22, P91
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Manufacture	Hot-finished or cold-drawn
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Size using one of the following:

NPS and Schedule Number

Outside Diameter and Nominal Wall Thickness

Outside Diameter and Minimum Wall Thickness

Inside Diameter and Nominal Wall Thickness

Inside Diameter and Minimum Wall Thickness

Length	Specific or Random
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End Finish

### Referenced Documents

- A999/A999M Specification for General Requirements for Alloy and Stainless Steel Pipe
- E213 Practice for Ultrasonic Examination of Metal Pipe and Tubing
- E309 Practice for Eddy-Current Examination of Steel Tubular Products Using Magnetic Saturation
- E381 Method of Macroetch Testing Steel Bars, Billets, Blooms, and Forgings
- E527 Practice for Numbering Metals and Alloys in the Unified Numbering System (UNS)
- E570 Practice for Flux Leakage Examination of Ferromagnetic Steel Tubular Products
- B36.10M Welded and Seamless Wrought Steel Pipe



- SAE J 1086 Practice for Numbering Metals and Alloys (UNS)
- SNT-TC-1A Recommended Practice for Nondestructive Personnel Qualification and Certification

## Read more information of seamless steel pipes

- [Why seamless steel pipe? Some benefits of Seamless Steel Pipe](#)
- [Seamless steel pipes for high temperature and pressure service](#)
- [GB5130-2008 Standard specification](#)
- [GB9948-2006, petroleum cracking tube seamless pipe](#)
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## Get in Touch

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