沧州博拓国际贸易有限公司

Cangzhou Botop International Co.,Ltd.

ASTM A335 P9 Specification

- Alloy Seamless Steel Pipe

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ASTM A335 P9 Introduction

ASTM A335 P9, also known as ASME SA335 P9, is a seamless ferritic alloy steel pipe for high-temperature service with UNS No. K90941.

The alloying elements are primarily chromium and molybdenum. The chromium content ranges from 8.00 - 10.00%, while the molybdenum content is in the range of 0.90% - 1.10%.

P9 has excellent strength and good corrosion resistance in high-temperature environments and is widely used in boilers, petrochemical equipment, and power stations where high-temperature and high-pressure environments are required.

Our Supply Range

- **Material:** ASTM A335 P9 / ASME SA335 P9 seamless alloy steel pipe.
- **Outside diameter:** 1/8"- 24".
- **Wall thickness:** ASME B36.10 requirements.
- **Schedule**: SCH10, SCH20, SCH30, SCH40, SCH60, SCH80, SCH100, SCH120, SCH140 and SCH160;
- **Identification**: STD (standard), XS (extra-strong), or XXS (double extra-strong).
- **Length:** Specific or random lengths.
- **Customization:** Non-standard outer diameter, wall thickness, length, etc. according to requirements.
- **Fittings:** We can provide the same material bends, stamping flanges, and other steel pipe-supporting products.
- **IBR certification:** An IBR certificate can be provided if required.
- **End:** Plain end, beveled end, or composite pipe end.
- **Packing:** wooden case, steel belt or steel wire packing, plastic or iron pipe end protector.
- **Transportation:** by marine or aviation.

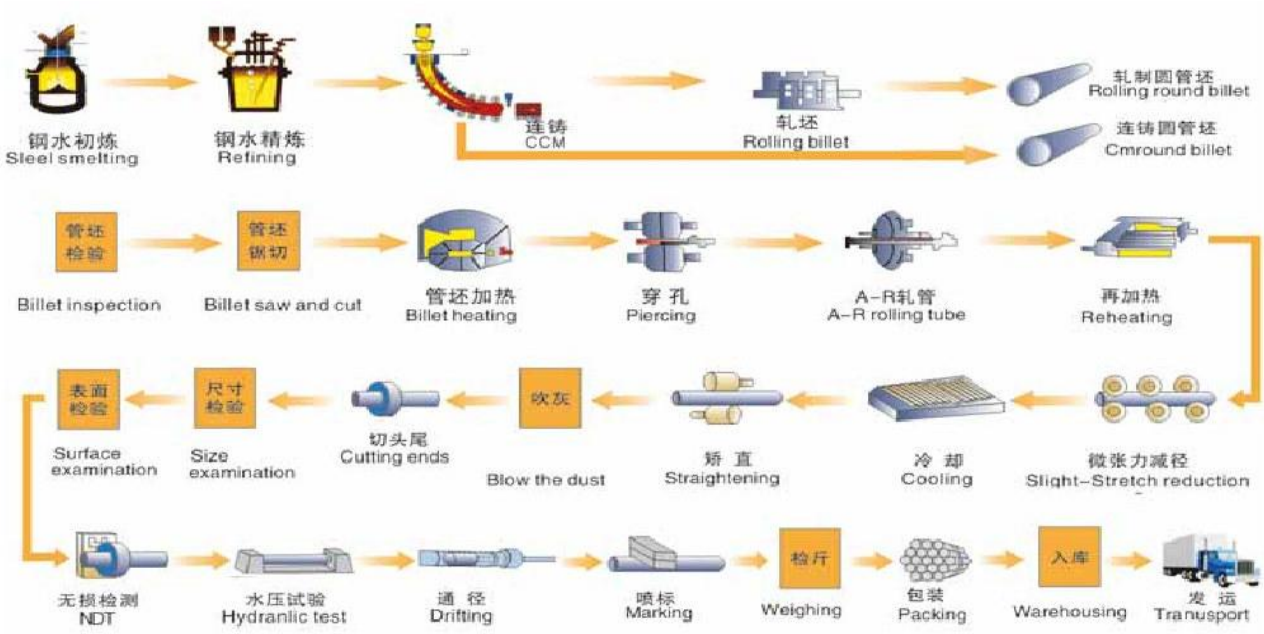
General Requirements

Unless otherwise specified in A335, materials furnished under this specification shall conform to the applicable requirements of the current edition of Specification A999/A999M.

ASTM A335 Manufacturing Processes

ASTM A335 steel pipe must be seamless.

Seamless steel pipe is a steel pipe with no welds throughout.



Since seamless steel pipe has no welded seams in its structure, it avoids the potential safety hazards that may be associated with weld quality issues. This feature allows the seamless pipe to withstand higher pressures, and its homogeneous internal structure further ensures the integrity and safety of the pipe in high-pressure environments.

In addition, the reliability of ASTM A335 tubing is enhanced by the addition of specific alloying elements for high-temperature and high-pressure conditions.

Heat Treatment

The types of heat treatments available for P9 material include full or isothermal annealing, as well as normalizing and tempering. The normalizing and tempering process has a tempering temperature of 1250°F [675°C].

Grade	Heat Treat Type	Normalizing Temperature, min or range °F [°C]	Cooling Media	Subcritical Annealing or Tempering Temperature, min or range °F [°C]
P9	full or isothermal anneal or	—	—	—
	normalize and temper	—	—	1250 [675]

ASTM A335 P9 Chemical Composition

The main alloying elements of P9 are Cr and Mo, which are **chromium-molybdenum alloys**.

Grade	UNS Designation	C (Carbon)	Mn (Manganese)	p (Phosphorus)	S (Sulfur)	Si (Silicon)	Cr (Chromium)	Mo (Molybdenum)
P9	K90941	0.15 max	0.30-0.60	0.025 max	0.025 max	0.25 - 1.00	8.00 - 10.00	0.90 - 1.10

- **Cr (Chromium)**: As the main element of the alloy, Cr provides excellent high-temperature strength and resistance to oxidation. It forms a dense chromium oxide film on the surface of the steel, increasing the stability and corrosion resistance of the pipe at high temperatures.
- **Mo (Molybdenum)**: The addition of Mo significantly improves the strength and toughness of alloys, especially in high-temperature environments. Mo also helps to improve the creep strength of the material, i.e. the ability to resist deformation under prolonged heat exposure.

ASTM A335 P9 Mechanical Properties

1. Tensile Property

P5, P5b, P5c, P9, P11, P15, P21, and P22: The tensile and yield strengths are the same.

P1, P2, P5, P5b, P5c,P9, P11, P12, P15, P21, and P22: The same elongation.

List	Classification		P9
Tensile strength ,min	ksi		60
	MPa		415
Yield strength ,min	ksi		30
	MPa		205
Elongation	Longitudinal	Elongation in 2 in. or 50 mm, (or 4D), min, %; Basic minimum elongation for wall 6 in. [8 mm] and over in thickness, strip tests, and for all small sizes tested in full section	30
		When standard round 2-in. or 50-mm gage length or proportionally smaller size specimen with the gage length equal to 4D (4 times the diameter) is used	22
		For strip tests a deduction for each 1/32 in. [0.8 mm] decrease in wall thickness below 5/16 in. [8 mm] from the basic minimum elongation of the following percentage points shall be made	1.50 A
	Transverse	Elongation in 2 in. or 50 mm, (or 4D), min, %; Basic minimum elongation for wall 6 in. [8 mm] and over in thickness, strip tests, and for all small sizes tested in full section	20
		When standard round 2-in. or 50-mm gage length or proportionally smaller size specimen with the gage length equal to 4D (4 times the diameter) is used	14
		For strip tests a deduction for each 1/32 in. [0.8 mm] decrease in wall thickness below 5/16 in. [8 mm] from the basic minimum elongation of the following percentage points shall be made	1.00 A

A Table 5 gives the calculated minimum values.

ASTM A335 P11 Mechanical Properties

Table 5 Calculated Minimum Elongation Values			
Wall Thickness		P9	
		Elongation in 2 in. or 50 mm, min, %	
in.	mm	Longitudinal	Transverse
5/16 (0.312)	8.0	30	20
9/32 (0.281)	7.2	28	19
1/4 (0.250)	6.4	27	18
7/32 (0.219)	5.6	26	—
3/16 (0.188)	4.8	24	—
5/32 (0.156)	4.0	22	—
1/8 (0.125)	3.2	21	—
3/32 (0.094)	2.4	20	—
1/16 (0.062)	1.6	18	—

Where the wall thickness lies between the two values above, the minimum elongation value is determined by the following formula:

Longitudinal, P9: E = 48t + 15.00 [E = 1.87t + 15.00]

Transverse, P9: E = 32t + 15.00 [E = 1.25t + 15.00]

where:

E = elongation in 2 in. or 50 mm, %,

t = actual thickness of specimens, in. [mm].

ASTM A335 P11 Mechanical Properties

2. Hardness

P9 does not require hardness testing.

P1, P2, P5, P5b, P5c, P9, P11, P12, P15, P21, P22, and P921: No hardness test is required.

3. Optional Experimental Programs

The following experimental items are not required test items, if necessary can be determined by negotiation.

Product Analysis

Flattening Test

Bend Test

Metal Structure and Etching Tests

Photomicrographs

Photomicrographs for Individual Pieces

Hydrostatic Test

- When the outside diameter > 10 in. [250 mm] and wall thickness ≤ 0.75 in. [19 mm], all shall be hydrostatically tested.
- The experimental pressure can be calculated using the following equation.

$$P = 2St/D$$

P = hydrostatic test pressure in psi [MPa];

S = pipe wall stress in psi or [MPa];

t = specified wall thickness, nominal wall thickness according to specified ANSI schedule number or 1.143 times the specified minimum wall thickness, in. [mm];

D = specified outside diameter, outside diameter corresponding to specified ANSI pipe size, or outside diameter calculated by adding 2t (as defined above) to the specified inside diameter, in. [mm].

- Experiment time: keep at least 5s, no leakage.

Nondestructive Examination

When the pipe is not to be hydrotested, a non-destructive test shall be performed on each pipe to detect defects.

Non-destructive testing of P9 material should be performed by one of the methods **E213**, **E309** or **E570**.

E213: Practice for Ultrasonic Testing of Metal Pipe and Tubing;

E309: Practice for Eddy Current Examination of Steel Tubular Products Using Magnetic Saturation;

E570: Practice for Flux Leakage Examination of Ferromagnetic Steel Tubular Products;

Dimensional Tolerances

Permissible Variations in Diameter

Diameter deviations can be classified according to either 1. based on the inner diameter or 2. based on the nominal or outer diameter.

1. Inner diameter: ±1%.

2. NPS [DN] or outside diameter: This conforms to the permissible deviations in the table below.

Permissible Variations in Outside Diameter			
NPS	DN	Permissible Variations	
		in.	mm
1/8 - 1 1/2， inch.	6 - 40， inch.	±1/64 (0.015)	±0.40
Over 1 1/2 to 4 inch.	Over 40 to 100 inch.	±1/32 (0.031)	±0.79
Over 4 to 8 inch.	Over 100 to 200 inch.	-1/32 (0.031) - +1/16 (0.062)	-0.79 - +1.59
Over 8 to 12 inch.	Over 200 to 300 inch.	-1/32 (0.031) - +3/32 (0.093)	-0.79 - +2.38
Over 12	Over 300	±1% of specified outside diameter	

Dimensional Tolerances

Permissible Variations in Wall Thickness

The thickness of the pipe wall at any point shall not exceed the specified tolerance.

Permitted Variations in Wall Thickness		
NPS	**DN**	**Tolerance, % form Specified**
1/8 to 2 1/2 incl. all t/D ratios	6 to 65 incl. all t/D ratios	-12.5 - +20.0
Above 2 1/2, t/D ≤ 5 %	Above 65, t/D ≤ 5 %	-12.5 - +22.5
Above 2 1/2, t/D ＞ 5 %	Above 65, t/D ＞ 5 %	-12.5 - +15.0
t = Specified Wall Thickness; D = Specified Outside Diameter.		

The minimum wall thickness and outside diameter for inspection for compliance with this requirement for pipe ordered by NPS [DN] and schedule number is shown in **ASME B36.10M**.

Marking

Contents of marking

- Manufacturer's name or trademark;
- Standard number (Year can be omitted);
- Grade;
- Length
- Additional symbol "S".
- The markings for hydrostatic pressure and non-destructive testing in the table below should also be included.

Ultrasonic	Flux Leakage	Eddy Current	Hydrostatic	Marking
No	No	No	Yes	Test Pressuer
Yes	No	No	No	UT
No	Yes	No	No	FL
No	No	Yes	No	EC
Yes	Yes	No	No	UT / FL
Yes	No	Yes	No	UT / EC
No	No	No	No	NH
Yes	No	No	Yes	UT / Test Pressuer
No	Yes	No	Yes	FL / Test Pressuer
No	No	Yes	Yes	EC / Test Pressuer
Test Pressuer is to be in psi [MPa].				

- Marking location: Marking should begin approximately 12 inches (300 mm) from the end of the pipe.

ASTM A335 P9 Applications

ASTM A335 P9 steel pipe is widely used in boilers, petrochemical equipment power stations, etc., which need to withstand high temperature and high pressure because of its superior high temperature and high-pressure resistance.

- **Boilers**: Especially in the main steam piping and reheater piping of supercritical and ultra-supercritical boilers for very high temperatures and pressures.
- Petrochemical equipment: Such as cracker pipes and high-temperature piping, which handle high-temperature vapors and chemicals, require materials with excellent temperature and corrosion resistance.
- **Power stations**: For main steam piping and high-pressure heaters, as well as for internal turbine piping to cope with long periods of high temperature and pressure.

ASTM A335 P9 Equivalent Material

P9 Materials have their own standard grades in different national standard systems.

- EN 10216-2: 10CrMo9-10;
- GB/T 5310: 12Cr2Mo;
- JIS G3462: STBA 26;
- ISO 9329: 12CrMo195;
- GOST 550: 12ChM;

Before selecting any equivalent material, it is recommended that detailed performance comparisons and testing be carried out to ensure that the alternative material will meet the requirements of the original design.

About Us

Since its establishment in 2014, **Botop Steel** has become a leading supplier of carbon steel pipe in Northern China, known for excellent service, high-quality products, and comprehensive solutions.

The company offers a variety of carbon steel pipes and related products, including seamless, ERW, LSAW, and SSAW steel pipe, as well as a complete lineup of pipe fittings and flanges. Its specialty products also include high-grade alloys and austenitic stainless steels, tailored to meet the demands of various pipeline projects.

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