

ASTM A335 and **ASME SA335** is a standard specification for seamless ferritic alloy-steel pipe intended for high-temperature service.

APP STOCKS A FULL RANGE OF A/SA335 PIPE IN:

- ✓ Grades P5, P9, P11, P22 & P91
- ✓ Schedules 20 through XXH
- ✓ NPS ¼" to 24" OD
- ✓ See **A691** for sizes above 24" OD

KEY CHARACTERISTICS

- ✓ **SEAMLESS CONSTRUCTION** - no weld seam, giving uniform strength around the circumference
- ✓ **HIGH - TEMPERATURE STRENGTH** - retains mechanical properties at elevated temperatures where carbon steel would fail
- ✓ **OXIDATION AND CREEP RESISTANCE** - resists scaling and slow deformation under sustained stress at heat
- ✓ **PRESSURE - BEARING CAPABILITY** - designed specifically for pressurized systems
- ✓ **WELDABLE** - though proper preheat and post-weld heat treatment (**PWHT**) are required

OUR VALUE-ADDED SERVICES

- ✓ Saw & Torch Cutting, Miter Cutting, Pipe Profiling
- ✓ Coating (FBE, Galvanizing & Prime/Paint)
- ✓ Pipe Beveling, Roll-Grooving & Threading
- ✓ Boring, Honing, OD Turning, Heat Treating & Plating
- ✓ ID & OD Cleaning
- ✓ In-House or 3rd Party Testing

* This information is provided for quick references, always consult applicable ASME, ASTM and Manufacture's standards.



PRIMARY APPLICATIONS & INDUSTRIES

- ✓ **POWER GENERATION** - The dominant user of **A335** pipe. Used extensively in coal, gas, and nuclear power plants for main steam lines, reheat lines, headers, and superheater/reheater tubing anywhere steam is at high pressure and temperature.
- ✓ **PETROLEUM REFINING & PETROCHEMICALS** - Used in process piping that handles hot hydrocarbons, hydrogen service, and high-pressure process streams. **P5** and **P9** grades see use in hydrogen-rich, sulfur-bearing environments due to their resistance to hydrogen attack (per Nelson curves).
- ✓ **CHEMICAL PROCESSING** - High-temperature reactor feed and effluent lines, heat exchanger connections, and piping in catalytic cracking units.
- ✓ **BOILERS & PRESSURE VESSELS** - As the **ASME SA335** designation implies, extensively used in boiler construction for steam distribution and connecting pressure vessels where the **ASME** code is the governing standard.
- ✓ **PULP & PAPER INDUSTRY** - Recovery boilers and high-pressure steam distribution within mills.
- ✓ **HEAT EXCHANGERS** - Connecting and manifold piping where elevated temperatures are sustained.

TENSILE REQUIREMENTS

	P5	P9	P11	P22	P91(1,2)	P91 type 1 and 2 shall have a hardness within the range of 190 to 250 [HBW] or 196 to 265 [HV] or 91 HRBW to 25 HRC.
TENSILE STRENGTH, MIN., PSI						
ksi	60	60	60	60	85	
MPa	415	415	415	415	585	
YIELD STRENGTH, MIN., PSI						
ksi	30	30	30	30	60	
MPa	205	205	205	205	415	

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CHEMICAL REQUIREMENTS

ELEMENT	GRADE	P5	P9	P11	P22	P91 (type1)	P91 type 1 shall also include the following:	P91 (type2)	P91 type 2 shall also include the following:	P91 type 2 continued:
	UNS	K41545	K90941	K11597	K21590	K91560		K91560		
CARBON		0.15 max	0.15 max	0.05 - 0.15	0.05 - 0.15	0.08 - 0.12	V at 0.18 - 0.25	Heat: 0.08 - 0.12 product: 0.07 - 0.13	V (heat) at 0.18 - 0.25 V (product) at 0.16 - 0.27	N / Al ratio \geq 4.0
MANGANESE		0.30 - 0.60	0.30 - 0.60	0.30 - 0.60	0.30 - 0.60	0.30 - 0.60	N at 0.030 - 0.070	0.30 - 0.50 ^D	N at 0.035 - 0.070 ^D	Sn at 0.010 max ^D
PHOSPHOROUS, MAX		0.025	0.025	0.025	0.025	0.020	Ni at 0.40 max	0.020 ^D	Ni at 0.20 max ^D	Sb at 0.003 max ^D
SULFUR, MAX		0.025	0.025	0.025	0.025	0.010	Al at 0.02 max	0.005 ^D	Al at 0.020 max ^D	As at 0.010 max ^D
SILICON		0.50 max	0.25 - 1.00	0.50 - 1.00	0.50 max	0.20 - 0.50	Cb at 0.06 - 0.10	0.20 - 0.40 ^D	Cb (heat) at 0.06 - 0.10 Cb (product) at 0.05 - 0.11	B at 0.001 max ^D
CHROMIUM		4.00 - 6.00	8.00 - 10.00	1.00 - 1.50	1.90 - 2.60	8.00 - 9.50	Ti at 0.01 max	8.00 - 9.50 ^D	Ti at 0.01 max ^D	W at 0.05 max ^D
MOLYBDENUM		0.45 - 0.65	0.90 - 1.10	0.44 - 0.65	0.87 - 1.13	0.85 - 1.05	Zr at 0.01 max	Heat: 0.85 - 1.05 product: 0.80 - 1.05	Zr at 0.01 max ^D	Cu at 0.10 max ^D

^D Applies to both heat and product analyses

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HEAT TREATMENT REQUIREMENTS

GRADE	HEAT TREATMENT TYPE	NORMALIZING TEMPERATURE RANGE F [C]	SUBCRITICAL ANNEALING OR TEMPERING TEMPERATURE RANGE F [C]
P5	Full or Isothermal Anneal, or Normalize and Temper	*****	1250 [675]
	Subcritical Anneal (P5c only)	*****	1325 - 1375 [715 - 745]
P9	Full or Isothermal Anneal, or Normalize and Temper	*****	1250 [675]
P11	Full or Isothermal Anneal, or Normalize and Temper	*****	1200 [650]
P22	Full or Isothermal Anneal, or Normalize and Temper	*****	1250 [675]
P91 (type 1 & 2)	Normalize and Temper, or Quench and Temper	1900 - 1975 [1040 - 1080]	1350 - 1470 [730 - 800]

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