

ASTM - A790/A790M

SPECIFICATION FOR SEAMLESS AND WELDED FERRITIC/AUSTENITIC STAINLESS STEEL PIPE

This specification covers seamless and straight-seam welded ferritic/austenitic steel pipe intended for general corrosive service, with particular emphasis on resistance to stress corrosion cracking.

❖ **Manufacture :-**

1. The pipe shall be made by the seamless or an automatic welding process, with no addition of filler metal in the welding operation.
2. At the manufacturer's option, pipe may be either hot-finished or cold-finished.

❖ **Heat Treatment :-**

All pipe shall be furnished in the heat-treated condition as shown in Table 1.

Table 1

UNS Designation	Type ^A	Temperature °F [°C]	Quench
S31200		1920–2010 [1050–1100]	Rapid cooling in water
S31260		1870–2010 [1020–1100]	Rapid cooling in air or water
S31500		1800–1900 [980–1040]	Rapid cooling in air or water
S31803		1870–2010 [1020–1100]	Rapid cooling in air or water
S32003		1850–2050 [1010–1120]	Rapid cooling in air or water
S32101		1870 [1020]	Quenched in water or rapidly cooled by other means
S32202		1870–1975 [1020–1080]	Rapid cooling in air or water
S32205	2205	1870–2010 [1020–1100]	Rapid cooling in air or water
S32304	2304	1700–1920 [925–1050]	Rapid cooling in air or water
S32506		1870–2050 [1020–1120]	Rapid cooling in air or water
S32520		1975–2050 [1080–1120]	Rapid cooling in air or water
S32550	255	1900 [1040] min	Rapid cooling in air or water
S32707		1975–2050 [1080–1120]	Rapid cooling in air or water
S32750	2507	1880–2060 [1025–1125]	Rapid cooling in air or water
S32760		1960–2085 [1070–1140]	Rapid cooling in air or water
S32808		1920–2100 [1050–1150]	Rapid cooling in air or water
S32900	329	1700–1750 [925–955]	Rapid cooling in air or water
S32906		1870–2100 [1020–1150]	Rapid cooling in air or water
S32950		1820–1880 [990–1025]	Air cool
S33207		1905–2085 [1040–1140]	Rapid cooling in water or by other means
S39274		1920–2060 [1025–1125]	Rapid cooling in air or water
S39277		1975–2155 [1080–1180]	Rapid cooling in air or water
S81921		1760–2010 [960–1100]	Rapid cooling in air or water
S82011		1850–2050 [1010–1120]	Rapid cooling in air or water

^A Common name, not a trademark, widely used, not associated with any one producer. 329 is an AISI number.

❖ **Chemical Composition :-**

The steel shall conform to the chemical requirements as prescribed in Table 2.

Table 2^A

UNS Designation ^B	Type ^C	C	Mn	P	S	Si	Ni	Cr	Mo	N	Cu	Others
S31200		0.03	2	0.045	0.03	1	5.5–6.5	24.0–26.0	1.2–2.0	0.14–0.20	...	...
S31260		0.03	1	0.03	0.03	0.75	5.5–7.5	24.0–26.0	2.5–3.5	0.10–0.30	0.2–0.8	W 0.1–0.5
S31500		0.03	1.2–2.0	0.03	0.03	1.4–2.0	4.2–5.2	18.0–19.0	2.5–3.0	0.05–0.10	...	...
S31803		0.03	2	0.03	0.02	1	4.5–6.5	21.0–23.0	2.5–3.5	0.08–0.20	...	...
S32003		0.03	2	0.03	0.02	1	3.0–4.0	19.5–22.5	1.5–2.0	0.14–0.20	...	...
S32101		0.04	4.0–6.0	0.04	0.03	1	1.35–1.7	21.0–22.0	0.1–0.8	0.20–0.25	0.1–0.8	...
S32202		0.03	2	0.04	0.01	1	1.0–2.8	21.5–24.0	0.45	0.18–0.26	...	...
S32205	2205	0.03	2	0.03	0.02	1	4.5–6.5	22.0–23.0	3.0–3.5	0.14–0.20	...	...
S32304	2304	0.03	2.5	0.04	0.04	1	3.0–5.5	21.5–24.5	0.05–0.6	0.05–0.20	0.05–0.6	...
S32506		0.03	1	0.04	0.015	0.9	5.5–7.2	24.0–26.0	3.0–3.5	0.08–0.20	...	W 0.05–0.30
S32520		0.03	1.5	0.035	0.02	0.8	5.5–8.0	24.0–26.0	3.0–5.0	0.20–0.35	0.5–3.0	...
S32550	255	0.04	1.5	0.04	0.03	1	4.5–6.5	24.0–27.0	2.9–3.9	0.10–0.25	1.5–2.5	...
S32707		0.03	1.5	0.035	0.01	0.5	5.5–9.5	26.0–29.0	4.0–5.0	0.30–0.50	1	Co 0.5–2.0
S32750	2507	0.03	1.2	0.035	0.02	0.8	6.0–8.0	24.0–26.0	3.0–5.0	0.24–0.32	0.5	...
S32760		0.05	1	0.03	0.01	1	6.0–8.0	24.0–26.0	3.0–4.0	0.20–0.30	0.5–1.0	W 0.50–1.00 40 min ^D
S32808		0.03	1.1	0.03	0.01	0.5	7.0–8.2	27.0–27.9	0.8–1.2	0.30–0.40	...	W 2.10–2.50
S32900	329	0.08	1	0.04	0.03	0.75	2.5–5.0	23.0–28.0	1.0–2.0	...	...	...
S32906		0.03	0.8–1.5	0.03	0.03	0.8	5.8–7.5	28.0–30.0	1.5–2.6	0.30–0.40	0.8	...
S32950		0.03	2	0.035	0.01	0.6	3.5–5.2	26.0–29.0	1.0–2.5	0.15–0.35	...	...
S33207		0.03	1.5	0.035	0.01	0.8	6.0–9.0	29.0–33.0	3.0–5.0	0.40–0.60	1	...
S39274		0.03	1	0.03	0.02	0.8	6.0–8.0	24.0–26.0	2.5–3.5	0.24–0.32	0.2–0.8	W 1.50–2.50
S39277		0.025	0.8	0.025	0.002	0.8	6.5–8.0	24.0–26.0	3.0–4.0	0.23–0.33	1.2–2.0	W 0.8–1.2
S81921		0.03	2.0–4.0	0.04	0.03	1	2.0–4.0	19.0–22.0	1.0–2.0	0.14–0.20	...	...
S82011		0.03	2.0–3.0	0.04	0.02	1	1.0–2.0	20.5–23.5	0.1–1.0	0.15–0.27	0.5	...

^A Maximum, unless a range or minimum is indicated. Where ellipses (...) appear in this table, there is no minimum and analysis for the element need not be determined or reported.

^B New designation established in accordance with Practice E527 and SAE J 1086.

^C Common name, not a trademark, widely used, not associated with any one producer. 329 is na AISI number. ^D

$$\%Cr + 3.3 \times \%Mo + 16 \times \%N.$$

❖ **Tensile and Hardness Properties :-**

The material shall conform to the tensile and hardness properties prescribed in Table 3.

Table 3

UNS Designation	Type ^A	Tensile Strength, min, ksi [MPa]	Yield Strength, min, ksi [MPa]	Elongation in 2 in. Or 50 mm, min, %	Hardness, max	
					HBW	HRC
S31200		100[690]	65[450]	25	280	...

S31260		100[690]	65[450]	25	...	...
S31500		92[630]	64[440]	30	290	30
S31803		90[620]	65[450]	25	290	30
S32003		95[655]	65[450]	25	290	30
S32101						
t ≤ 0.187 in. [5.00 mm]		101[700]	77[530]	30	290	...
t > 0.187 in. [5.00 mm]		94[650]	65[450]	30	290	...
S32202		94[650]	65[450]	30	290	30
S32205	2205	95[655]	65[450]	25	290	30
S32304	2304	87[600]	58[400]	25	290	30
S32506		90[620]	65[450]	18	302	32
S32520		112[770]	80[550]	25	310	...
S32550	255	110[760]	80[550]	15	297	31
S32707		133[920]	101[700]	25	318	34
S32750	2507	116[800]	80[550]	15	300	32
S32760 ^B		109[750]	80[550]	25	300	...
S32808		116[800]	80[550]	15	310	32
S32900	329	90[620]	70[485]	20	271	28
S32906						
Wall below 0.40 in. [10 mm]		116[800]	94[650]	25	300	32
Wall 0.40 in. [10 mm] and above		109[750]	80[550]	25	300	32
S32950		100[690]	70[480]	20	290	30
S33207						
Wall below 0.157 in. [4 mm]		138[950]	112[770]	15	336	36
Wall 0.157 in. [4 mm] and above		123[850]	101[700]	15	336	36
S39274		116[800]	80[550]	15	310	32
S39277		120[825]	90[620]	25	290	30
S81921		90[620]	65[450]	25	290	30
S82011						
Wall below 0.187 in. [5.00 mm]		101[700]	75[515]	30	293	31
Wall 0.187 in. [5.00 mm] and above		95[655]	65[450]	30	293	31

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Prior to A790/A790M – 04, the tensile strength value for UNS 32760 was 109–130 ksi [750–895 MPa].

❖ **Lengths :-**

1. Unless otherwise agreed upon, all sizes from NPS 1/8 to and including NPS 8 are available in a length up to 24 ft (see Note 3) with the permissible range of 15 to 24 ft.
2. If definite cut lengths are desired, the lengths required shall be specified in the order. No pipe shall be less than the specified length and no more than 1/4 in. [6 mm] over it.

❖ **Mechanical Tests :-**

1. Transverse or Longitudinal Tension Test.

2. Flattening Test.
3. Hardness Test.

❖ **Hydrostatic or Non-destructive Electric Test :-**

Each tube shall be subjected to the non-destructive electric test or the hydrostatic test. The type of test to be used shall be at the option of the manufacturer, unless otherwise specified in the purchase order.

1. Hydrostatic test

The hydrostatic test shall be in accordance with Specification A999/A999M, except that the value for S to be used in the calculation of the hydrostatic test pressure shall be equal to 50 % of the specified minimum yield strength of the pipe.

2. Non-destructive Electric Test:

Non-destructive electric tests shall be in accordance with Practices E213 or E309.

i. Ultrasonic—

- a. The ultrasonic testing (UT) can be performed to detect both longitudinally and circumferentially oriented defects.
- b. For examination by the ultrasonic method, the minimum nominal transducer frequency shall be 2.00 MHz and the maximum nominal transducer size shall be in. If the equipment contains a reject notice filter setting, this shall remain off during calibration and testing unless linearity can be demonstrated at that setting.
- c. For Ultrasonic Testing, the reference ID and OD notches shall be any one of the three common notch shapes shown in Practice E213, at the option of the manufacturer.

ii. Eddy-current testing (ET) —

- a. The eddy-current testing (ET) referenced in this specification (see Practice E426) has the capability of detecting significant discontinuities, especially the short abrupt type.
- b. The maximum eddy-current coil frequency used shall be as follows:
 - On specified walls up to 0.050 in.—100 KHz max
 - On specified walls up to 0.150 in.—50 KHz max
 - On specified walls over 0.150 in.—10 KHz max
- c. For Eddy-Current Testing, the reference standard shall contain, at the option of the manufacturer, any one of the following discontinuities:
 - Drilled Hole
 - Transverse Tangential Notch
 - Longitudinal Notch

❖ **Supplementary Tests :-**

1. Transverse Tension Tests.
2. Flattening Test.
3. Etching Tests.

Keyword

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