

ASTM A790 / A790M

Duplex Stainless Steel Pipe

Standard specification for seamless and welded ferritic/austenitic stainless steel pipe for general corrosive service, with particular emphasis on resistance to stress corrosion cracking.

Seamless & Welded

22 Grades

General Corrosive Service

SCC Resistant

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1 Scope & Application

Product Type

Seamless and straight-seam welded ferritic/austenitic (duplex) stainless steel pipe for general corrosive service.

Key Advantage

Superior resistance to **stress corrosion cracking (SCC)** compared to standard austenitic stainless steels — ideal for chloride-containing environments.

Temperature Limitation

⚠ **Not for prolonged elevated-temperature service.** Duplex stainless steels are susceptible to embrittlement at elevated temperatures. Generally limited to 300°C (570°F) max.

Dimensions

Pipe dimensions per **ANSI B36.19** (Stainless Steel Pipe). Other dimensions permitted if all other specification requirements are met.

Units

Inch-pound and SI units are stated separately. Each system is independent — do not mix values across systems. Inch-pound default unless "M" designation specified.

Welding Process

Automatic welding process **without filler metal** addition. Filler metal used only for weld repairs (Section 15, NPS 6+, wall ≥ 0.188 in.).

⚠ Embrittlement Warning

Duplex stainless steels can form detrimental intermetallic phases (sigma, chi) when exposed to temperatures between approximately 350°C and 950°C (660–1740°F) for extended periods. Not suitable for long-term elevated-temperature applications.

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Grade Overview

ASTM A790 covers 22 duplex stainless steel grades, grouped by alloy content and corrosion resistance level. The table below shows the most commonly specified grades for industrial applications.

Standard Duplex (22% Cr) — Most Popular

2205

UNS S32205 / S31803

The workhorse duplex grade. 22%Cr, 5%Ni, 3%Mo, 0.17%N. Balanced ferrite/austenite microstructure. Best combination of strength and corrosion resistance.

Tensile **95 ksi / 655 MPa**

Yield **65 ksi / 450 MPa**

Hardness **290 HBW / 30 HRC**

MOST POPULAR

S31803

ORIGINAL

UNS S31803

The original 2205 composition. Slightly narrower chemistry range than S32205. Still widely specified but S32205 is preferred for guaranteed weldability.

Tensile **90 ksi / 620 MPa**

Yield **65 ksi / 450 MPa**

Hardness **290 HBW / 30 HRC**

Lean Duplex — Economical SCC Resistance

2304

ECONOMICAL

UNS S32304

Low-Ni lean duplex. 23%Cr, 4%Ni. Excellent SCC resistance at lower cost than 2205. Good substitute for 304L/316L in chloride environments.

Tensile **87 ksi / 600 MPa**

Yield **58 ksi / 400 MPa**

Hardness **290 HBW / 30 HRC**

S32101

LEAN

UNS S32101

Ultra-lean duplex with Mn alloying. Lowest cost duplex option. Wall thickness dependent properties: $t \leq 0.187$ in. (101 ksi) vs $t > 0.187$ in. (94 ksi).

Tensile **94–101 ksi**

Yield **65–77 ksi**

Hardness **290 HBW max**

S32202

LEAN

UNS S32202

Low-Ni lean duplex with controlled N addition. Good alternative to 304L. Low S limit (0.010%).

Tensile **94 ksi / 650 MPa**

Yield **65 ksi / 450 MPa**

Hardness **290 HBW / 30 HRC**

S32003

LEAN

UNS S32003

Low-Mo lean duplex (1.5–2.0% Mo). Cost-effective for moderate corrosive environments.

Tensile **90 ksi / 620 MPa**

Yield **65 ksi / 450 MPa**

Hardness **290 HBW / 30 HRC**

Super Duplex (25% Cr) — High Strength & Premium Corrosion Resistance

2507

PREMIUM

UNS S32750

Leading super duplex. 25%Cr, 7%Ni, 4%Mo, 0.28%N. Exceptional pitting and crevice corrosion resistance. PREN typically >41. Offshore/seawater service.

Tensile **116 ksi / 800 MPa**

Yield **80 ksi / 550 MPa**

Hardness **300 HBW / 32 HRC**

S32760

PREMIUM

UNS S32760

W-alloyed super duplex with Cu addition. 25%Cr, 7%Ni, 3.5%Mo. PREN >40. Zeron 100 equivalent.

Tensile **109 ksi / 750 MPa**

Yield **80 ksi / 550 MPa**

Hardness **300 HBW max**

255

SUPER

UNS S32550

Cu-alloyed super duplex. 25%Cr, 6%Ni, 3.5%Mo, 2%Cu. Excellent in sulfuric/phosphoric acid. Ferralium 255.

Tensile **110 ksi / 760 MPa**

Yield **80 ksi / 550 MPa**

Hardness **297 HBW / 31 HRC**

S32707

SUPER

UNS S32707

Extreme super duplex. 27%Cr, 7%Ni, 4.5%Mo, 0.4%N, 1%Co. Highest strength in A790. PREN >50.

Tensile **133 ksi / 920 MPa**

Yield **101 ksi / 700 MPa**

Hardness **318 HBW / 34 HRC**

S39274

PREMIUM

UNS S39274

W-Cu super duplex. 25%Cr, 7%Ni, 3%Mo. Enhanced localised corrosion resistance for seawater piping systems.

Tensile **116 ksi / 800 MPa**

Yield **80 ksi / 550 MPa**

Hardness **310 HBW / 32 HRC**

S39277

SUPER

UNS S39277

Highest strength-to-weight super duplex. 25%Cr, 7%Ni, 3.5%Mo, W-Cu. Lowest S (0.002%).

Tensile **120 ksi / 825 MPa**

Yield **90 ksi / 620 MPa**

Hardness **290 HBW / 30 HRC**

S32906

SUPER

UNS S32906

High-Cr super duplex. 29%Cr, 7%Ni, 2%Mo. Wall thickness dependent properties at 10 mm threshold.

Tensile **109–116 ksi**

Yield **80–94 ksi**

Hardness **300 HBW / 32 HRC**

Hyper Duplex & Special Alloys

S33207

HYPER

UNS S33207

Hyper duplex. 31%Cr, 7%Ni, 4%Mo, 0.5%N. PREN >50. Wall thickness dependent: below 4 mm = 138 ksi; above = 123 ksi.

Tensile **123–138 ksi**

Yield **101–112 ksi**

Hardness **336 HBW / 36 HRC**

S31200

SPECIAL

UNS S31200

High-alloy duplex. 25%Cr, 6%Ni, 1.5%Mo, 0.17%N. Good combination of strength and moderate corrosion resistance.

Tensile **100 ksi / 690 MPa**

Yield **65 ksi / 450 MPa**

Hardness **280 HBW max**

S32520

SPECIAL

UNS S32520

High-Mo super duplex. 25%Cr, 6.5%Ni, 4%Mo, 0.28%N. Cu alloyed up to 3%. UR52N+ equivalent.

Tensile **112 ksi / 770 MPa**

Yield **80 ksi / 550 MPa**

Hardness **310 HBW max**

S32808

SPECIAL

UNS S32808

High-Cr, W-alloyed duplex. 27.5%Cr, 7.5%Ni, 1%Mo, 2.3%W, 0.35%N. High heat input welding tolerant.

Tensile **116 ksi / 800 MPa**

Yield **80 ksi / 550 MPa**

Hardness **310 HBW / 32 HRC**

Other Grades

329

UNS S32900

Early duplex grade. 25%Cr, 4%Ni, 1.5%Mo. Limited modern use — superseded by S31803/S32205 and S32304 for most applications.

Tensile **90 ksi / 620 MPa**

Yield **70 ksi / 485 MPa**

Hardness **271 HBW / 28 HRC**

S31260

UNS S31260

W-Cu alloyed duplex. 25%Cr, 6.5%Ni, 3%Mo. Specialised grade for specific chemical process environments.

Tensile **100 ksi / 690 MPa**

Yield **65 ksi / 450 MPa**

S31500

UNS S31500

Low-alloy duplex. 18.5%Cr, 4.7%Ni, 2.75%Mo. Lower Cr content than standard duplex. Good formability.

Tensile **92 ksi / 630 MPa**

Yield **64 ksi / 440 MPa**

Hardness **290 HBW / 30 HRC**

S32506

UNS S32506

W-alloyed duplex. 25%Cr, 6%Ni, 3.25%Mo, 0.14%N. Lower elongation than typical duplex grades (18% min).

Tensile **90 ksi / 620 MPa**

Yield **65 ksi / 450 MPa**

Hardness **302 HBW / 32 HRC**

S32950

UNS S32950

High-Cr duplex. 27.5%Cr, 4%Ni, 1.75%Mo. Unique air-cool heat treatment (not water quenched).

Tensile **100 ksi / 690 MPa**

Yield **70 ksi / 480 MPa**

Hardness **290 HBW / 30 HRC**

3 Chemical Composition

All values are percent maximum unless range is specified. Key alloying elements: **Cr** (corrosion resistance), **Ni** (austenite stabilizer), **Mo** (pitting resistance), **N** (strength + pitting resistance).

Standard & Lean Duplex Grades

UNS	Type	C	Mn	Cr	Ni	Mo	N	Other
S32205	2205	0.030	2.00	22.0–23.0	4.5–6.5	3.0–3.5	0.14–0.20	—
S31803	—	0.030	2.00	21.0–23.0	4.5–6.5	2.5–3.5	0.08–0.20	—
S32304	2304	0.030	2.50	21.5–24.5	3.0–5.5	0.05–0.60	0.05–0.20	Cu 0.05–0.60
S32101	—	0.040	4.0–6.0	21.0–22.0	1.35–1.70	0.10–0.80	0.20–0.25	Cu 0.10–0.80
S32202	—	0.030	2.00	21.5–24.0	1.00–2.80	0.45	0.18–0.26	—
S32003	—	0.030	2.00	19.5–22.5	3.0–4.0	1.50–2.00	0.14–0.20	—
S31500	—	0.030	1.20–2.00	18.0–19.0	4.2–5.2	2.50–3.00	0.05–0.10	Si 1.40–2.00
S32900	329	0.08	1.00	23.0–28.0	2.5–5.0	1.00–2.00	—	—

Super & Hyper Duplex Grades

UNS	Type	C	Cr	Ni	Mo	N	PREN*	Other
S32750	2507	0.030	24.0–26.0	6.0–8.0	3.0–5.0	0.24–0.32	≥42	Cu 0.5

UNS	Type	C	Cr	Ni	Mo	N	PREN*	Other
S32760	—	0.05	24.0– 26.0	6.0– 8.0	3.0–4.0	0.20– 0.30	≥40	Cu 0.50–1.00, W 0.50– 1.00
S32550	255	0.04	24.0– 27.0	4.5– 6.5	2.9–3.9	0.10– 0.25	≥36	Cu 1.50–2.50
S32707	—	0.030	26.0– 29.0	5.5– 9.5	4.0–5.0	0.30– 0.50	≥50	Co 0.5–2.0
S33207	—	0.030	29.0– 33.0	6.0– 9.0	3.0–5.0	0.40– 0.60	≥50	Cu 1.0
S32520	—	0.030	24.0– 26.0	5.5– 8.0	3.0–5.0	0.20– 0.35	≥38	Cu 0.5–3.00
S32906	—	0.030	28.0– 30.0	5.8– 7.5	1.50– 2.60	0.30– 0.40	≥38	Cu 0.80
S39274	—	0.030	24.0– 26.0	6.0– 8.0	2.5–3.5	0.24– 0.32	≥36	Cu 0.20–0.80, W 1.50– 2.50
S39277	—	0.025	24.0– 26.0	6.5– 8.0	3.0–4.0	0.23– 0.33	≥38	Cu 1.20–2.00, W 0.8– 1.2
S32808	—	0.030	27.0– 27.9	7.0– 8.2	0.80– 1.20	0.30– 0.40	≥36	W 2.10–2.50
S32506	—	0.030	24.0– 26.0	5.5– 7.2	3.0–3.5	0.08– 0.20	≥35	W 0.05–0.30
S31200	—	0.030	24.0– 26.0	5.5– 6.5	1.20– 2.00	0.14– 0.20	≥30	—
S32950	—	0.030	26.0– 29.0	3.5– 5.2	1.00– 2.50	0.15– 0.35	≥32	—
S31260	—	0.030	24.0– 26.0	5.5– 7.5	2.5–3.5	0.10– 0.30	≥34	Cu 0.20–0.80, W 0.10– 0.50

* PREN = %Cr + 3.3 × %Mo + 16 × %N (calculated at mid-range). Provided as indicative corrosion resistance ranking only. All values are weight percent. P ≤ 0.040, S ≤ 0.030 unless lower specified per grade. Si ≤ 1.00 typically.

4

Mechanical Properties

 Key Property Contrast

Duplex stainless steels deliver roughly **double the yield strength** of standard 300-series austenitics (304L: 25 ksi vs. 2205: 65 ksi). This enables wall thickness reduction and weight savings in pressure-containing applications.

UNS	Type	Tensile Strength (min)	Yield Strength (min)	Elongation (min)	Hardness (max)
S32205	2205	95 ksi [655 MPa]	65 ksi [450 MPa]	25%	290 HBW / 30 HRC
S32750	2507	116 ksi [800 MPa]	80 ksi [550 MPa]	15%	300 HBW / 32 HRC
S31803	—	90 ksi [620 MPa]	65 ksi [450 MPa]	25%	290 HBW / 30 HRC
S32304	2304	87 ksi [600 MPa]	58 ksi [400 MPa]	25%	290 HBW / 30 HRC
S32101	—	101/94 ksi* [700/650 MPa*]	77/65 ksi* [530/450 MPa*]	30%	290 HBW
S32202	—	94 ksi [650 MPa]	65 ksi [450 MPa]	30%	290 HBW / 30 HRC
S32003	—	90 ksi [620 MPa]	65 ksi [450 MPa]	25%	290 HBW / 30 HRC
S31500	—	92 ksi [630 MPa]	64 ksi [440 MPa]	30%	290 HBW / 30 HRC
S32760	—	109 ksi [750 MPa]	80 ksi [550 MPa]	25%	300 HBW
S32550	255	110 ksi [760 MPa]	80 ksi [550 MPa]	15%	297 HBW / 31 HRC
S32707	—	133 ksi [920 MPa]	101 ksi [700 MPa]	25%	318 HBW / 34 HRC
S33207	—	138/123 ksi* [950/850 MPa*]	112/101 ksi* [770/700 MPa*]	15%	336 HBW / 36 HRC

UNS	Type	Tensile Strength (min)	Yield Strength (min)	Elongation (min)	Hardness (max)
S32520	—	112 ksi [770 MPa]	80 ksi [550 MPa]	25%	310 HBW
S32906	—	116/109 ksi* [800/750 MPa*]	94/80 ksi* [650/550 MPa*]	25%	300 HBW / 32 HRC
S39274	—	116 ksi [800 MPa]	80 ksi [550 MPa]	15%	310 HBW / 32 HRC
S39277	—	120 ksi [825 MPa]	90 ksi [620 MPa]	25%	290 HBW / 30 HRC
S32808	—	116 ksi [800 MPa]	80 ksi [550 MPa]	15%	310 HBW / 32 HRC
S32900	329	90 ksi [620 MPa]	70 ksi [485 MPa]	20%	271 HBW / 28 HRC
S32950	—	100 ksi [690 MPa]	70 ksi [480 MPa]	20%	290 HBW / 30 HRC
S31200	—	100 ksi [690 MPa]	65 ksi [450 MPa]	25%	280 HBW
S32506	—	90 ksi [620 MPa]	65 ksi [450 MPa]	18%	302 HBW / 32 HRC
S31260	—	100 ksi [690 MPa]	65 ksi [450 MPa]	25%	—

* Wall thickness dependent: S32101 threshold at 0.187 in. [5.00 mm]; S33207 at 0.157 in. [4 mm]; S32906 at 0.40 in. [10 mm]. Thinner walls = higher strength requirement. Tested on 2 in. or 50 mm gage length at room temperature.

5

Heat Treatment

All pipe shall be furnished in the solution-annealed (heat-treated) condition. Rapid cooling (quenching) in water or air is mandatory after solution annealing to prevent intermetallic phase precipitation. **Exception:** S32950 is air cooled; S31260 permits air or water cooling.

Standard & Lean Duplex

UNS	Type	Temperature	Cooling Method
S32205	2205	1870–2010°F [1020–1100°C]	Rapid cool in air or water
S31803	—	1870–2010°F [1020–1100°C]	Rapid cool in air or water
S32304	2304	1700–1920°F [925–1050°C]	Rapid cool in air or water
S32101	—	1870°F [1020°C]	Water quench or rapid cool
S32202	—	1870–1975°F [1020–1080°C]	Rapid cool in air or water
S32003	—	1850–2050°F [1010–1120°C]	Rapid cool in air or water
S31500	—	1800–1900°F [980–1040°C]	Rapid cool in air or water
S32900	329	1700–1750°F [925–955°C]	Rapid cool in air or water

Super & Hyper Duplex

UNS	Type	Temperature	Cooling Method
S32750	2507	1880–2060°F [1025–1125°C]	Rapid cool in air or water
S32760	—	1960–2085°F [1070–1140°C]	Rapid cool in air or water
S32550	255	1900°F [1040°C] min	Rapid cool in air or water
S32707	—	1975–2050°F [1080–1120°C]	Rapid cool in air or water
S33207	—	1905–2085°F [1040–1140°C]	Water quench or rapid cool
S32520	—	1975–2050°F [1080–1120°C]	Rapid cool in air or water
S32906	—	1870–2100°F [1020–1150°C]	Rapid cool in air or water
S39274	—	1920–2060°F [1025–1125°C]	Rapid cool in air or water
S39277	—	1975–2155°F [1080–1180°C]	Rapid cool in air or water
S32808	—	1920–2100°F [1050–1150°C]	Rapid cool in air or water
S32506	—	1870–2050°F [1020–1120°C]	Rapid cool in air or water
S31200	—	1920–2010°F [1050–1100°C]	Rapid cool in water
S32950	—	1820–1880°F [990–1025°C]	Air cool (unique)
S31260	—	1870–2010°F [1020–1100°C]	Rapid cool in air or water

⚠ Seamless Pipe — Direct Quench Option

For seamless pipe (except S32950), an alternative to furnace heat treatment is permitted: immediately after hot forming — while the pipe temperature is still $\geq$ the specified minimum solution treatment temperature — each pipe may be individually quenched in water or rapidly cooled by other means. S32950 must be air cooled.

⚙ HT-O Provision (Welded Pipe — No Post-Weld Heat Treatment)

If specified in the purchase order, welded pipe fabricated from plate already heat-treated per Table 1 may be supplied without subsequent heat treatment, provided a sample passes **ASTM A923 Method B or C** (including base metal, weld metal, and HAZ). Pipe supplied under this provision shall be stenciled "**HT-O**". Not applicable to grades not listed in A923 Table 3.

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Testing & Inspection

1. Tension Test (Mandatory)

One transverse or longitudinal test per lot of ≤ 100 pipes. Two tests for lots > 100 pipes. Must meet Table 3 requirements.

2. Flattening Test (Mandatory)

5% of pipe from each heat-treated lot. For batch-furnace treatment: 5% of the lot. For continuous/quench treatment: 5% of lot, minimum 2 pipes. NPS ≥ 10 welded: transverse guided face bend test may substitute.

3. Hardness Test (Mandatory)

Brinell or Rockwell hardness on specimens from **two pipes per lot**. Must meet Table 3 maximums. Hardness is a critical quality indicator for duplex stainless steels.

4. Hydrostatic or NDT (Mandatory)

Each pipe — either hydrostatic test per A999/A999M (S = 50% of minimum yield) or nondestructive electric test (UT per E213 or ET per E426). Manufacturer's choice unless purchaser specifies.

5. Product Analysis (Optional)

Per S1: one analysis per 10 lengths (NPS > 5) or 10% of lengths (NPS < 5). Non-conforming lengths rejected.

6. Etching Tests (Optional — S4)

Per Method E381, cross-section etch from one or both ends. Must show sound, reasonably uniform material free of injurious laminations and cracks.

7. Transverse Tension (Optional — S2)

NPS > 8 only. One test from 10% of lengths per heat. Failed pipe rejected.

8. Flattening Per-Pipe (Optional — S3)

Flattening test on one end or both ends of **each** pipe (vs. 5% sampling). Number of tests per pipe to be specified in order.

NDT Test Details

Method	Standard	Notch Depth	Frequency
Ultrasonic (UT)	E213	≤ 12.5% wall or 0.004 in. (whichever greater)	≥ 2.00 MHz, transducer ≤ 1.5 in.
Eddy Current (ET)	E426	≤ 12.5% wall or 0.004 in. (whichever greater)	Wall ≤ 0.050 in. → 100 KHz; ≤ 0.150 in. → 50 KHz; > 0.150 in. → 10 KHz

ET reference standard: drilled hole, transverse tangential notch, or longitudinal notch — manufacturer's option. Signal-to-noise ratio must be ≥ 2.5:1. Re-standardization at start/end of each run and max every 4 hours.

7 Dimensions & Tolerances

Pipe dimensions per **ANSI B36.19** (Stainless Steel Pipe). Standard schedules: 5S, 10S, 40S, 80S. Schedules 5S and 10S wall thicknesses do not permit threading per ANSI B1.20.1.

Standard Dimensions (ANSI B36.19)

NPS	OD (in.)	OD (mm)	Sch 5S	Sch 10S	Sch 40S	Sch 80S
⅜	0.405	10.29	—	0.049	0.068	0.095
½	0.540	13.72	—	0.065	0.088	0.119
¾	0.675	17.15	—	0.065	0.091	0.126
1	0.840	21.34	0.065	0.083	0.109	0.147
1 ¼	1.050	26.67	0.065	0.083	0.113	0.154
1 ½	1.315	33.40	0.065	0.109	0.133	0.179
1 ¾	1.660	42.16	0.065	0.109	0.140	0.191
2	1.900	48.26	0.065	0.109	0.145	0.200
2 ½	2.375	60.33	0.065	0.109	0.154	0.218
3	2.875	73.03	0.083	0.120	0.203	0.276
3 ½	3.500	88.90	0.083	0.120	0.216	0.300
4	4.000	101.60	0.083	0.120	0.226	0.318
5	4.500	114.30	0.083	0.120	0.237	0.337
6	5.563	141.30	0.109	0.134	0.258	0.375
8	6.625	168.28	0.109	0.134	0.280	0.432
10	8.625	219.08	0.109	0.148	0.322	0.500
12	10.750	273.05	0.134	0.165	0.365	0.500
14	12.750	323.85	0.156	0.180	0.375	0.500

Length & Tolerances

Standard Random Length

NPS 1/8 to NPS 8: up to 24 ft, permissible range 15–24 ft. Short lengths acceptable per agreement.

Cut Length Tolerance

No pipe shall be less than the specified length and no more than +1/4 in. [6 mm] over it.

Jointers

No jointers are permitted unless otherwise specified in the purchase order.

Imperfection Repairs

Imperfections may be removed by grinding, provided wall thickness is not reduced below the minimum permitted by A999/A999M.

8 Ordering Information

Required Information	Optional Information
1. Quantity (feet, metres, or number of lengths)	Product analysis (Section 9)
2. Name of material: ferritic/austenitic steel pipe	Hydrostatic or NDT electric test selection (Section 14)
3. Process: seamless or welded	Test report required
4. Grade (see Table 1 in standard)	Supplementary requirements S1–S4
5. Size (NPS or OD + schedule / wall)	No final PWHT — HT-O provision (6.3.2)
6. Length (specific or random)	Marking: weight on NPS > 4

7. End finish (per A999/A999M)	A923 test method (B or C) for HT-O
8. Specification: ASTM A790/A790M	Special requirements

Example Order Descriptions

Example 1 – Standard Duplex (2205) Seamless Pipe 500 ft Ferritic/Austenitic Steel Pipe, Seamless, Grade S32205 (2205), NPS 6, Schedule 40S, Random Lengths 15–24 ft, Plain Ends, to ASTM A790/A790M, with Test Report and Product Analysis (S1).

Example 2 – Super Duplex (2507) Welded Pipe 200 ft Ferritic/Austenitic Steel Pipe, Welded, Grade S32750 (2507), NPS 10, Schedule 10S, Cut-to-Length 20 ft ±0, Beveled Ends, to ASTM A790/A790M, NDT by Ultrasonic Testing (E213), with Etching Test (S4).

Example 3 – Lean Duplex (2304) Welded Pipe, HT-O 1200 ft Ferritic/Austenitic Steel Pipe, Welded, Grade S32304 (2304), NPS 3, Schedule 10S, Random Lengths, Plain Ends, No Final PWHT (HT-O), ASTM A923 Method C pass required, to ASTM A790/A790M.

9 Key Takeaways

1

Dual Microstructure = Double Strength

Duplex stainless steels have a ferritic-austenitic microstructure that delivers ~2× the yield strength of standard 300-series austenitics. This means **thinner walls, lower weight, and cost savings** in pressure design.

2

SCC Resistance is the Differentiator

The primary reason to choose duplex over standard austenitic grades: **superior stress corrosion cracking resistance** in chloride-bearing environments where 304/316 would fail.

3 No Elevated Temperature

Duplex grades are **not suitable for prolonged service above ~300°C (570°F)**. Intermetallic phase (sigma, chi) precipitation leads to embrittlement. For high-temp, consider A312/A213 austenitic grades.

4 Heat Treatment is Critical

Solution annealing with **rapid quenching** is mandatory after any hot forming or welding. Slow cooling destroys corrosion resistance and toughness. Always specify heat treatment condition clearly.

5 Match Grade to Environment

Select grade by **chloride level and temperature**, not just strength. Lean duplex (2304, S32101) for moderate chlorides. Standard (2205) for seawater up to ~25°C. Super duplex (2507) for warm seawater and aggressive chemicals.

6 Weld Repairs are Permitted (with Rules)

Weld seam repairs with filler metal are permitted for NPS ≥ 6 , wall ≥ 0.188 in., $\leq 20\%$ of seam length. Use GTAW with matching or over-alloyed filler (ER2209 for 2205, ER2553 for S31200). Marked with "WR".

This guide is a condensed customer reference based on ASTM A790/A790M-09.

For complete requirements, consult the official ASTM A790/A790M standard.

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