

ASTM A790 UNS S31803 Seamless Pipe Specification

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ASTM A790 / ASME SA790 Standard Introduction

ASTM A790 / ASME SA790 covers seamless and straight-seam welded ferritic/austenitic duplex stainless steel pipes intended for general corrosive service, particularly where resistance to chloride stress corrosion cracking is required.

UNS S31803 (Duplex 2205) Material Description

UNS S31803, commonly referred to as Duplex 2205, is a duplex stainless steel with a balanced austenitic-ferritic microstructure. It provides high mechanical strength, good toughness, and excellent resistance to pitting, crevice corrosion, and chloride stress corrosion cracking.

Chemical Composition of UNS S31803 (wt.%)

| Element | Requirement |
|---------|-------------|
| C | 0.030 max |
| Mn | 2.00 max |
| Si | 1.00 max |
| P | 0.030 max |
| S | 0.020 max |
| Cr | 21.0 – 23.0 |
| Ni | 4.5 – 6.5 |
| Mo | 2.5 – 3.5 |
| N | 0.08 – 0.20 |

Mechanical Properties (Typical)

| Property | Minimum Requirement |
|-----------------------|---------------------|
| Tensile Strength | ≥ 620 MPa |
| Yield Strength (0.2%) | ≥ 450 MPa |
| Elongation | ≥ 25 % |
| Hardness | ≤ 290 HB |

Heat Treatment

ASTM A790 UNS S31803 seamless pipes shall be supplied in the solution annealed condition (typically 1020–1100°C) followed by rapid quenching in water or air to achieve the correct duplex microstructure and corrosion resistance.

Corrosion Resistance and PREN

UNS S31803 has a typical Pitting Resistance Equivalent Number (PREN) of approximately 34–35, providing very good resistance to pitting and crevice corrosion in chloride-containing environments.

UNS S31803 vs UNS S32205 Comparison

| Item | S31803 | S32205 |
|------|--------|--------|
|------|--------|--------|

| | | |
|----------------------|---------------------------|-----------------------------------|
| Cr (%) | 21.0 – 23.0 | 22.0 – 23.0 |
| Mo (%) | 2.5 – 3.5 | 3.0 – 3.5 |
| N (%) | 0.08 – 0.20 | 0.14 – 0.20 |
| PREN | ≈ 34–35 | ≈ 35–38 |
| Corrosion Resistance | Very good | Excellent |
| Typical Service | General corrosive service | More severe chloride environments |

Typical Applications

ASTM A790 UNS S31803 seamless pipes are widely used in oil and gas pipelines, offshore platforms, FPSO systems, desalination plants, chemical processing equipment, heat exchangers, pressure vessels, and piping systems exposed to seawater and chloride environments.

Inspection and Testing

Inspection and testing in accordance with ASTM A790 typically include chemical analysis, tensile testing, hardness testing, hydrostatic test or non-destructive electric test, eddy current testing, dimensional inspection, and visual examination.

Certification and Documentation

Each delivery of ASTM A790 UNS S31803 seamless pipe is normally supplied with EN 10204 3.1 Mill Test Certificate (MTC). Third-party inspection certificates (SGS, BV, TUV, DNV) and EN 10204 3.2 documentation can be provided upon request.



ASME B36.19 Stainless Steel Pipe Dimensions

ASTM A790 UNS S31803 seamless pipes are commonly manufactured according to ASME B36.19 dimensions for stainless steel piping.

| Nominal Pipe Size | | Outside Diameter (mm) | Nominal Wall Thickness Schedule | | | | | | | | | | | | | | | | |
|-------------------|------|-----------------------|---------------------------------|---------|--------|--------|--------|---------|---------|--------|--------|---------|--------|--------|---------|---------|---------|---------|---------|
| NPS | DN | | SCH 5s | SCH 10s | SCH 10 | SCH 20 | SCH 30 | SCH 40s | SCH STD | SCH 40 | SCH 60 | SCH 80s | SCH XS | SCH 80 | SCH 100 | SCH 120 | SCH 140 | SCH 160 | SCH XXS |
| 1/8 | 6 | 10.3 | | 1.24 | | | | 1.73 | 1.73 | 1.73 | | 2.41 | 2.41 | 2.41 | | | | | |
| 1/4 | 8 | 13.7 | | 1.65 | | | | 2.24 | 2.24 | 2.24 | | 3.02 | 3.02 | 3.02 | | | | | |
| 3/8 | 10 | 17.1 | | 1.65 | | | | 2.31 | 2,31 | 2.31 | | 3.20 | 3.20 | 3.20 | | | | | |
| 1/2 | 15 | 21.3 | 1.65 | 2.11 | | | | 2.77 | 2.77 | 2.77 | | 3.73 | 3.73 | 3.73 | | | | 4.78 | 7.47 |
| 3/4 | 20 | 26.7 | 1.65 | 2.11 | | | | 2.87 | 2.87 | 2.87 | | 3.91 | 3.91 | 3.91 | | | | 5.56 | 7.82 |
| 1 | 25 | 33.4 | 1.65 | 2.77 | | | | 3.38 | 3.38 | 3.38 | | 4.55 | 4.55 | 4.55 | | | | 6.35 | 9.09 |
| 1 1/4 | 32 | 42.2 | 1.65 | 2.77 | | | | 3.56 | 3.56 | 3,56 | | 4.85 | 4.85 | 4.85 | | | | 6.35 | 9.70 |
| 1 1/2 | 40 | 48.3 | 1.65 | 2.77 | | | | 3.68 | 3.68 | 3.68 | | 5.08 | 5.08 | 5.08 | | | | 7.14 | 10.15 |
| 2 | 50 | 60.3 | 1.65 | 2.77 | | | | 3.91 | 3.91 | 3.91 | | 5.54 | 5.54 | 5.54 | | | | 8.74 | 11.07 |
| 2 1/2 | 65 | 73 | 2.11 | 3.05 | | | | 5.16 | 5.16 | 5.16 | | 7.01 | 7.01 | 7.01 | | | | 9.53 | 14.02 |
| 3 | 80 | 88.9 | 2.11 | 3.05 | | | | 5.49 | 5.49 | 5.49 | | 7.62 | 7.62 | 7.62 | | | | 11.13 | 15.24 |
| 3 1/2 | 90 | 101.6 | 2.11 | 3.05 | | | | 5.74 | 5.74 | 5.74 | | 8.08 | 8.08 | 8.08 | | | | | |
| 4 | 100 | 114.3 | 2.11 | 3.05 | | | | 6.02 | 6.02 | 6.02 | | 8.56 | 8.56 | 8.56 | | 11.13 | | 13.49 | 17.12 |
| 5 | 125 | 141.3 | 2.77 | 3.40 | | | | 6.55 | 6.55 | 6.55 | | 9.53 | 9,53 | 9.53 | | 12.70 | | 15.88 | 19.05 |
| 6 | 150 | 168.3 | 2.77 | 3.40 | | | | 7.11 | 7.11 | 7.11 | | 10.97 | 10.97 | 10.97 | | 14.27 | | 18.26 | 21.95 |
| 8 | 200 | 219.1 | 2.77 | 3.76 | | 6.35 | 7.04 | 8.18 | 8.18 | 8.18 | 10.31 | 12.70 | 12.70 | 12.70 | 15.09 | 18.26 | 20.62 | 23.01 | 22.23 |
| 10 | 250 | 273.1 | 3.40 | 4.19 | | 6.35 | 7.80 | 9.27 | 9.27 | 9.27 | 12.70 | 12.70 | 12.70 | 15.09 | 18.26 | 21.44 | 25.40 | 28.58 | 25.40 |
| 12 | 300 | 323.9 | 3.96 | 4.57 | | 6.35 | 8.38 | 9.53 | 9.53 | 10.31 | 14.27 | 12.70 | 12.70 | 17.48 | 21.44 | 25.40 | 28.58 | 33.32 | 25.40 |
| 14 | 350 | 355.6 | 3.96 | 4.78 | 6.35 | 7.92 | 9.53 | | 9.53 | 11.13 | 15.09 | | 12.70 | 19.05 | 23.83 | 27.79 | 31.75 | 35.71 | |
| 16 | 400 | 406.4 | 4.19 | 4.78 | 6.35 | 7.92 | 9.53 | | 9.53 | 12.70 | i6.66 | | 12.70 | 21.44 | 26.19 | 30.96 | 36.53 | 40.49 | |
| 18 | 450 | 457.2 | 4.19 | 4.78 | 6.35 | 7.92 | 11.13 | | 9.53 | 14.27 | 19.05 | | 12.70 | 23.83 | 29.36 | 34.93 | 39.67 | 45.24 | |
| 20 | 500 | 508 | 4.78 | 5.54 | 6.35 | 9.53 | 12.70 | | 9.53 | 15.09 | 20.62 | | 12.70 | 26.19 | 32.54 | 38.10 | 44.45 | 50.01 | |
| 22 | | 559 | 4.78 | 5.54 | 6.35 | 9.53 | 12.70 | | 9.53 | | 22.23 | | 12.70 | 28.58 | 34.93 | 41.28 | 47.63 | 53.98 | |
| 24 | 600 | 610 | 5.54 | 6.35 | 6.35 | 9.53 | 14.27 | | 9.53 | 17.48 | 24.61 | | 12.70 | 30.96 | 38.89 | 46.02 | 52.37 | 59.54 | |
| 26 | | 660 | | | 7.92 | 12.70 | | | 9.53 | | | | 12.70 | | | | | | |
| 28 | 700 | 711 | | | 7.92 | 12.70 | 15.88 | | 9.53 | | | | 12.70 | | | | | | |
| 30 | | 762 | 6.35 | 7.92 | 7.92 | 12.70 | 15.88 | | 9.53 | | | | 12.70 | | | | | | |
| 32 | 800 | 813 | | | 7.92 | 12.70 | 15.88 | | 9.53 | 17.48 | | | 12.70 | | | | | | |
| 34 | | 884 | | | 7.92 | 12.70 | 15.88 | | 9.53 | 17.48 | | | 12.70 | | | | | | |
| 36 | 900 | 914 | | | 7.92 | 12.70 | 15.88 | | 9.53 | 19.05 | | | 12.70 | | | | | | |
| 38 | | 965 | | | | | | | 9.53 | | | | 12.70 | | | | | | |
| 40 | 1000 | 1016 | | | | | | 9.53 | | 12.70 | | | | | | | | | |
| 42 | | 1067 | | | | 12.70 | 15.88 | | 9.53 | 19.05 | | | 12.70 | | | | | | |
| 44 | 1100 | 1118 | | | | | | | 9.53 | | | | 12.70 | | | | | | |
| 46 | | 1168 | | | | | | | 9.53 | | | | 12.70 | | | | | | |
| 48 | 1200 | 1219 | | | | | | | 9.53 | | | 12.70 | | | | | | | |
| 52 | | 1321 | | | | | | | | | | | | | | | | | |
| 56 | 1422 | | | | | | | | | | | | | | | | | | |
| 60 | 1524 | | | | | | | | | | | | | | | | | | |