Procurement White Paper

2205 Duplex Stainless Steel

UNS S32205 / S31803 | Duplex (austenitic-ferritic) stainless steel for chloride-driven corrosion resistance and high-strength fasteners and chemical processing equipment.

Audience: procurement, sourcing, and quality teams supporting chemical processing equipment, piping, and corrosion-resistant fasteners.

At-a-glance	
What it is Duplex (austenitic-ferritic) stainless steel engineered for high strength and improved resistance to chloride pitting/crevice corrosion and chloride stress-corrosion cracking versus 300-series austenitics.	**Typical reasons to buy** High corrosion performance in many chloride-bearing services; ~2× yield strength vs. common austenitics can enable thinner sections; strong choice for piping, pressure equipment, and corrosion-resistant fasteners when properly specified.
Common supply forms Plate/sheet/strip, bar/rod, pipe/tube (seamless & welded), fittings/flanges, and machined fasteners (bolts, studs, nuts).	**Key identifiers** UNS S32205 (modern 2205 chemistry) and UNS S31803 (earlier designation). Often ordered to ASTM A240 (plate), ASTM A276/A479 (bar), ASTM A790/A789 (pipe/tube), ASTM A182/A815 (forgings/fittings).

This document is a purchasing guide (not an engineering design standard). Final material selection, code compliance, and welding procedures must be validated for the specific service environment and applicable standards.

Version 1.3 | February 17, 2026

1. Executive summary

2205 duplex stainless steel is widely selected for process environments where chlorides, erosion-corrosion, and chloride stress-corrosion cracking (SCC) can drive unplanned downtime and lifecycle cost. Relative to common austenitic stainless steels, 2205 typically offers improved resistance to pitting/crevice corrosion and higher mechanical strength, enabling thinner sections or higher allowable loads when design standards permit.

For procurement, the biggest value is achieved when the RFQ and receiving plan reduce three common failure modes: (1) accepting the wrong chemistry (e.g., S31803 that does not meet the intended limits), (2) receiving product not in the correct solution-annealed condition, and (3) welding/fabrication choices that degrade duplex phase balance and corrosion performance.

2. Quick specification snapshot

Use these identifiers and notes as a starting point. Always purchase to the latest revision of the governing standard and rely on MTR values for acceptance.

Identifier	Typical / minimum values (check latest standard & MTRs)
UNS designation	S32205 (often used for '2205'); S31803 may be acceptable only when chemistry meets the intended limits.
Nominal chemistry (typical)	Cr ~22%, Ni ~5–6%, Mo ~3%, N ~0.15–0.22 (typical ranges vary by standard and producer).
Pitting resistance metric	PREN = Cr + 3.3(Mo) + 16(N). Duplex 2205 is commonly associated with PREN ~35 (typical).
Typical minimum mechanicals (plate/bar)	Yield strength ~450 MPa (65 ksi) min; tensile ~620 MPa (90 ksi) min; elongation ~25% min (varies by product form/standard).
Weld filler metals (common)	ER2209 / E2209 are widely used for duplex 2205 welds (confirm WPS/PQR and service conditions).
Temperature note	Many suppliers caution that 2205 is not generally recommended for continuous service above ~600°F (~315°C) due to potential phase embrittlement.

Procurement takeaways

- **Prefer UNS S32205** when possible to reduce variability; if S31803 is offered, require chemistry meet the intended limits and document equivalency on the MTR.
- **Call out solution-annealed condition** and require full heat/lot traceability for pressure parts and fasteners.

- **Align welding requirements** to qualified WPS/PQR; specify ER2209/E2209 (or site-approved alternative) and require filler metal certs and lot traceability.
- **Mind temperature limits**: many suppliers caution against continuous service above ~600°F due to potential embrittlement mechanisms.

3. Common product-form specifications

Use this table to cite typical purchasing standards by product form. Confirm the latest revision and any project/OEM overlays (e.g., NDE, impact, PMI, or sour-service constraints).

Product form (common)	Typical standards/specs to cite in RFQ	Procurement notes
Rod / Bar / Wire / Forging stock	ASTM A276 (bar); ASTM A479 (bar) For forgings/flanges: ASTM A182 (F51/F60) as applicable	Often the starting point for machined parts and fasteners. Specify condition (solution annealed) and require MTRs + heat/lot traceability.
Plate / Sheet / Strip	ASTM A240 (plate/sheet/strip)	Common for pressure equipment, linings, and fabrication. Confirm surface finish, flatness, and any project/OEM overlays.
Pipe / Tube (seamless & welded)	ASTM A790 (pipe); ASTM A789 (tube)	Specify OD/ID tolerances and NDE/pressure-test requirements if applicable. Align schedule and corrosion allowance with design.
Fittings & Flanges	ASTM A182 (forged flanges/fittings: F51/F60) ASTM A815 (wrought buttweld fittings)	Match fittings to the pipe/tube spec and schedule. Call out solution-annealed condition and documentation (MTRs, PMI if required).
Fasteners (bolts, studs, nuts)	Typically produced from bar to ASTM A276/A479; dimensional standards per application (e.g., ASME B18 series).	Define thread class, surface finish, lubrication/anti-galling plan, and traceability. Add supplemental testing (PMI, hardness, mechanicals) as needed.
Welding products	AWS A5.9 ER2209 (GTAW/GMAW) AWS A5.4 E2209 (SMAW) - confirm for service	Filler selection should align with qualified WPS/PQR and corrosion requirements. Require lot traceability and certs.

Product form (common)	Typical standards/specs to cite in RFQ	Procurement notes
All forms (sour-service / environmental constraints)	ISO 15156 / NACE MR0175 (when required by the project); other site standards as applicable	Do not assume compliance. If required, request supplier statement/certification tied to the relevant edition, environment, and product form.

4. Fasteners - procurement guidance

Duplex 2205 fasteners are often used where chloride exposure and higher joint loads make 300-series stainless fasteners a risk (SCC, pitting at the root, or insufficient strength). Because duplex stainless steels can be sensitive to thermal history and surface condition, fastener procurement should explicitly define condition, testing, and anti-galling controls.

Fastener RFQ controls (recommended)

- **Material:** specify UNS S32205 and the starting product form (typically bar to ASTM A276/A479) plus condition (solution annealed).
- **Dimensions:** include the governing dimensional standard (ASME B18 series or drawing), thread class, and gaging requirements.
- **Traceability:** require heat/lot traceability through finished fasteners and packaged lots; require MTRs for starting material and any processing records.
- **Verification:** add PMI on received lots (or 100% PMI for critical service); specify mechanical testing and hardness reporting by lot.
- **Surface & galling control:** define surface finish, cleaning/passivation requirements (if used), and lubrication/anti-galling policy for assembly.

5. Chemical processing - where 2205 is commonly used

2205 is frequently specified for chloride-bearing services in chemical processing and adjacent industries, including piping/tubing, heat exchanger components, tanks, and other wetted parts where pitting/crevice corrosion and SCC drive failures. Procurement should focus on the correct product standard (A240 vs A790/A789 vs A182/A815), documentation, and any code-mandated tests.

Key procurement risks in process equipment

- **Incorrect standard for the form:** e.g., buying to a generic stainless spec instead of duplex-appropriate pipe/tube standards (A790/A789).
- **Fabrication heat effects:** uncontrolled heat input or improper post-weld practices can reduce corrosion performance; require fabrication to qualified WPS/PQR.

- **Missing supplemental tests:** PMI, NDE, hydrotest, impact testing, or ferrite-related controls may be required by code, project, or service.
- **Sour-service assumptions:** if ISO 15156/NACE MR0175 applies, require compliance statements tied to the correct edition/environment and product form.

6. RFQ language (copy/paste)

Use the following as a starting point and tailor to your application and governing code.

- **Material:** Duplex stainless steel 2205, UNS S32205 (S31803 only if chemistry meets S32205 limits and is documented).
- **Standard:** Purchase to the applicable product specification (e.g., ASTM A240, A276/A479, A790/A789, A182/A815) with latest revision.
- **Condition:** Solution annealed; no thermal processing that degrades duplex phase balance unless approved by the purchaser.
- **Documentation:** Provide MTRs with full chemistry and mechanical test results; maintain heat/lot traceability to delivered items.
- **Supplemental:** PMI required (lot-based or 100% as specified); NDE/hydrotest/impact testing per code/project requirements.

7. Receiving inspection checklist

- **Paperwork:** confirm MTRs match PO/spec revision; verify heat/lot traceability and product form/condition.
- **Chemistry:** review Cr, Mo, N and the UNS designation; flag substitutions or out-of-range results.
- **Mechanical properties:** verify yield/tensile/elongation and any hardness limits required by project or sour-service language.
- **PMI:** perform PMI per plan; quarantine discrepancies.
- **Dimensional:** confirm OD/ID, wall, flatness, and surface finish; verify thread gaging for fasteners.
- **NDE/pressure tests:** confirm hydrotest/NDE reports when required for pipe/tube and pressure-retaining components.

8. References (selected)

1 Sandmeyer Steel Company. Specification Sheet: 2205 (UNS S32205/S31803), EN 1.4462. PDF: https://www.sandmeyersteel.com/wp-content/uploads/2205-Spec-Sheet.pdf

2 Outokumpu. Forta range datasheet - Duplex stainless steels. PDF: https://otke-cdn.outokumpu.com/-/media/files/products/forta/outokumpu-forta-range-datasheet.pdf

3 Rolled Alloys. 2205 Duplex Stainless Steel Datasheet. PDF: https://www.rolledalloys.com/wp-content/uploads/2205_Duplex-Stainless-Steel-Datasheet_rolled-alloys_USA.pdf

4 Nickel Systems. Materials reference pages (general overview and cross-reference). https://www.nickel-systems.com/