TECHNICAL DATA / ENGINEERING REFERENCE

316 Stainless Steel

Properties, corrosion behavior, manufacturing characteristics and material specifications

AISI / ASTM	UNS	EN	JIS
316	S31600	1.4401	SUS 316

Purpose	Concise technical reference for preliminary material selection. Final design and purchasing requirements should be verified against the applicable material standard and the actual service conditions.

NAITE TECH

www.naitetech.com
naiteservice@naitetech.com
+86 18018270716

Technical Reference | August 2026

1. Grade Overview

316 is a molybdenum-alloyed austenitic stainless steel selected when improved resistance to localized corrosion is required compared with 304, while retaining excellent formability and good fabrication capability.

Property	316 Stainless Steel
Stainless steel family	Austenitic
Primary engineering strength	Chloride corrosion resistance and fabrication versatility
General corrosion resistance	Excellent
Chloride corrosion resistance	Better than 304; severe service still requires evaluation
Machinability	Moderate
Weldability	Excellent
Formability	Excellent
Hardenable by heat treatment	No
Cold-work strengthening	Yes
Magnetic behavior	Generally low in annealed condition; may increase after cold work
Relative cost	$$$ - High

Typical applications

Chemical processing equipment / food and beverage equipment / tanks and vessels / pipe and tube components / valves and fittings / heat exchanger components / pump components / fluid handling equipment / coastal equipment / corrosion-resistant industrial components

Selection summary

Decision	Guidance
Choose 316 when	Better chloride resistance than 304 is required for general mechanical or fabricated components.
Consider 304 when	The environment is mild and lower alloy cost is more important.
Consider 316L when	Extensive welding or lower-carbon sensitization control is important.
Consider 2205 when	Higher strength and stronger resistance to chloride stress-corrosion cracking are required.
Consider 2507 when	Severe chloride or demanding seawater exposure requires substantially higher localized-corrosion resistance.

2. Chemical Composition & Mechanical Properties

Values below are presented with standard context. Requirements vary with product form, thickness, material condition and specification.

ASTM Type 316 / UNS S31600 - chemical composition limits

Element	ASTM / UNS Limit
Carbon (C)	<= 0.080%
Manganese (Mn)	<= 2.00%
Phosphorus (P)	<= 0.045%
Sulfur (S)	<= 0.030%
Silicon (Si)	<= 0.75%
Chromium (Cr)	16.0-18.0%
Nickel (Ni)	10.0-14.0%
Molybdenum (Mo)	2.00-3.00%
Nitrogen (N)	<= 0.10%
Iron (Fe)	Balance

Standards note EN 1.4401 composition limits and product-standard requirements are not identical in every detail to ASTM Type 316. Specify and purchase material to the standard required by the drawing or project.

Typical minimum mechanical properties - annealed flat product reference

Property	Reference Value
0.2% proof / yield strength	205 MPa minimum
Tensile strength	515 MPa minimum
Elongation in 50 mm	40% minimum

Engineering note The mechanical values shown are ASTM A240 reference values for annealed cold-rolled coil/sheet, hot-rolled coil/sheet and quarto plate. Bar, tube, pipe, forged stock and cold-worked products can have different requirements.

3. Physical Properties, Heat Treatment & Magnetic Response

Physical properties are typical values for 316 / 1.4401 at or near room temperature and are intended for engineering comparison rather than design-code substitution.

Physical Property	Typical Value
Density	8.0 kg/dm3 (8.0 g/cm3)
Elastic modulus at 20 C	Approx. 200 GPa
Thermal expansion, 20-100 C	Approx. 16.0 x 10^-6 /K
Thermal conductivity at 20 C	Approx. 15 W/(m x K)
Specific heat capacity at 20 C	Approx. 500 J/(kg x K)
Electrical resistivity at 20 C	Approx. 0.75 ohm x mm2/m (0.75 micro-ohm m)
Magnetizable in annealed condition	No / generally very low magnetic response

Heat treatment

Condition / Treatment	Engineering Effect
Conventional hardening	Not applicable. 316 cannot be hardened by conventional quenching and tempering.
Cold working	Increases strength and hardness; reduces ductility and may increase magnetic response.
Solution annealing	Typically about 1040-1120 C followed by sufficiently rapid cooling; exact procedure must follow the applicable specification.

Magnetic response

Annealed 316 is generally non-magnetic or only weakly magnetic. Cold deformation can produce a stronger magnetic response. A mild magnetic attraction alone should not be used as a definitive grade-identification method.

316 vs 316L	316 permits a higher maximum carbon content than 316L. The practical selection advantage of 316L is lower sensitization risk after welding or thermal exposure, not a universal increase in base-metal corrosion resistance.

4. Corrosion & Environmental Performance

The molybdenum addition gives 316 stronger resistance to chloride-induced pitting and crevice corrosion than 304. It is still not immune to localized corrosion, especially in warm, stagnant or crevice-rich chloride environments.

Environment	Suitability	Engineering Note
Indoor industrial	Excellent	Strong general corrosion performance.
Outdoor atmospheric	Excellent	Suitable for many exposed environments.
Freshwater	Excellent	Review chloride level and water chemistry when significant.
Food / beverage	Excellent	Commonly used where process and cleaning conditions are compatible.
Mild chemical service	Good / Evaluate	Confirm actual chemical, concentration and temperature.
Coastal atmosphere	Good	Generally a better starting point than 304.
Chloride process environment	Evaluate	Temperature, concentration and crevice geometry matter.
Direct seawater	Evaluate	Pitting and crevice corrosion can occur.
Stagnant seawater / tight crevices	Limited	Duplex grades may provide a larger corrosion margin.
Severe chloride service	Not preferred	Consider 2205 or 2507.

Key corrosion considerations

• Pitting: risk increases with chloride concentration and temperature.
• Crevice corrosion: gasket interfaces, deposits, threads and poorly drained joints require particular care.
• Stress-corrosion cracking: austenitic 316 can be susceptible under tensile stress in hot chloride environments.
• Sensitization: prolonged exposure in the carbide-precipitation range can reduce grain-boundary corrosion resistance; 316L is often preferred for extensive welded service.
• Surface condition: heat tint, embedded iron, rough surfaces and deposits can reduce practical corrosion performance.

Seawater note	316 is widely used in marine-related applications, but it should not be described as seawater-proof. Direct immersion requires evaluation of chlorides, temperature, oxygen, flow, crevices, stress and surface condition.

5. Manufacturing Characteristics

316 supports a broad range of machining and fabrication processes. Its austenitic work-hardening behavior is one of the most important manufacturing considerations.

Process	Compatibility	Material Consideration
CNC machining	Good	Work hardening and ductile chip formation require stable cutting engagement.
Turning / milling	Good	Use rigid setups, sharp tooling, controlled feed and suitable coolant.
Drilling / tapping	Good	Avoid rubbing; chip evacuation is important in deep or blind features.
Laser cutting	Excellent	Widely used for sheet and plate components.
Bending / forming	Excellent	High ductility; account for work hardening and springback.
Deep drawing / stamping	Excellent	Suitable in annealed condition; severe deformation may require staged forming.
Welding	Excellent	For extensive welded corrosion-resistant assemblies, 316L is often preferred.
Forging	Good	Controlled hot-working practice required.
Grinding / polishing	Excellent	Use stainless-dedicated abrasives when contamination control matters.
Metal 3D printing	Limited / review	316L is the much more common AM feedstock; confirm the actual powder specification.

Machining behavior

316 is not a free-machining stainless steel. It work-hardens readily and can produce long, ductile chips. Productive machining generally depends on rigid equipment, positive cutting action, adequate feed, sharp tooling and effective coolant or lubrication.

Welding & fabrication

316 can be TIG/GTAW, MIG/GMAW, resistance or laser welded using qualified stainless-steel procedures. Filler selection, heat input, shielding, weld geometry, heat-tint removal and post-weld cleaning should match the service requirements.

Grade selection	For machining-intensive parts in mild environments, 303 may improve productivity. For high strength, consider 17-4 PH or 2205. For extensive welded corrosion-resistant fabrication, evaluate 316L.

6. Standards, Material Forms & Surface Conditions

The grade designation alone is not a complete purchasing specification. Product form, standard, material condition and documentation should be identified where they are controlled requirements.

Common material designations

System	Designation
AISI / ASTM Type	316
UNS	S31600
EN material number	1.4401
EN designation	X5CrNiMo17-12-2
JIS	SUS 316

Common product specifications

Specification	Typical Product Context
ASTM A240 / A240M	Plate, sheet and strip
ASTM A276 / A276M	Bars and shapes
ASTM A479 / A479M	Bars and shapes for boiler / pressure-vessel applications
ASTM A312 / A312M	Austenitic stainless steel pipe
ASTM A269 / A269M	Austenitic stainless steel tubing for general service
EN 10088-2	Sheet, plate and strip
EN 10088-3	Bars, rods, wire, sections and related long products

Common material forms

Sheet / Plate / Coil / Round Bar / Flat Bar / Square Bar / Hex Bar / Tube / Pipe / Rod / Wire / Forged Stock

Common surface conditions

No. 1 / 2B / BA / No. 4 / Ground / Polished / Cold Drawn / Peeled / Turned

Purchasing example A controlled specification such as “316 / UNS S31600 / ASTM A276 / annealed” gives clearer engineering and purchasing information than simply “316 stainless steel”.

7. Material Quality, Traceability & Technical References

Material-control requirements should be defined during quotation and purchasing so they can be incorporated into sourcing, production and inspection planning.

Material control

Control	Typical Scope
Material grade verification	Confirm 316 / UNS S31600 / EN 1.4401 against drawing and purchase requirements.
Mill Test Report (MTR)	May include heat number, chemistry, mechanical properties, specification and condition.
Certificate of Conformity (CoC)	Available for applicable projects when agreed in advance.
Heat / lot traceability	Can be maintained where project traceability requirements apply.
Incoming inspection	Material identification, product form, dimensions, surface condition and documentation.
PMI / additional verification	May be specified where alloy verification is required; PMI does not replace all certificate or mechanical-property requirements.

Technical references

• ASTM International: A240/A240M, A276/A276M, A479/A479M, A312/A312M and A269/A269M as applicable to product form.
• EN: EN 10088-2 and EN 10088-3 for relevant stainless flat and long products.
• Outokumpu: Supra 316/4401 technical data and Supra range datasheet for typical properties and ASTM A240 reference values.
• British Stainless Steel Association (BSSA): engineering references on machining, corrosion mechanisms, seawater limitations and grade selection.
• Project documentation: drawing, purchase order, design code and customer specification take precedence over general reference data.

Engineering disclaimer	This datasheet is a general technical reference. Corrosion, pressure, fatigue, temperature, sanitary or regulatory applications require project-specific engineering assessment and the applicable governing standard.

Need help reviewing 316 stainless steel?

Send the part drawing, material specification, service environment, chloride or chemical exposure, manufacturing route, surface requirement and required certification. NAITE TECH can review whether 316 is an appropriate starting grade or whether 316L or another stainless steel should be considered.

Contact	NAITE TECH
Website	www.naitetech.com
Email	naiteservice@naitetech.com
Phone	+86 18018270716