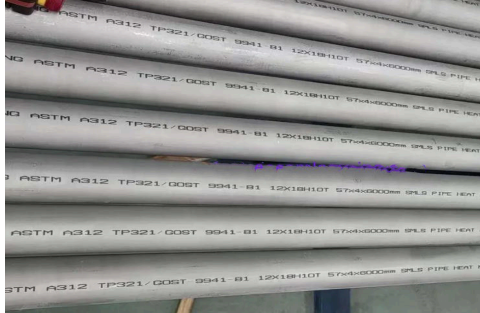


STAINLESS STEEL

SUS321

Equivalent Grades: UNS S32100 | EN 1.4541 | AISI 321 | X6CrNiTi18-10

PLATE	SHEET	COIL	PIPE	TUBE	BAR
					

Product Catalog & Technical Specification Sheet

Manufacturer & Supplier: GNEE Steel Co., Ltd.

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01

Introduction to SUS321

SUS321 is a titanium-stabilized austenitic stainless steel designed for service in the 425–900°C temperature range where standard unstabilized grades like SUS304 are susceptible to sensitization (chromium carbide precipitation at grain boundaries). The addition of titanium (minimum 5× carbon content) preferentially forms titanium carbides, tying up carbon and preventing it from reacting with chromium. This preserves chromium in solid solution, maintaining excellent intergranular corrosion resistance even after prolonged high-temperature exposure or welding. SUS321 is the preferred grade for applications involving temperatures of 425–900°C where both aqueous corrosion resistance and intergranular corrosion resistance are required.

What is SUS321?

SUS321 is a Japanese Industrial Standards (JIS) designation for a titanium-stabilized austenitic stainless steel. It is essentially SUS304 (17–19% chromium, 9–12% nickel) with the addition of titanium ($\text{Ti} \geq 5 \times \text{C}$, typically 0.15–0.70%). The titanium acts as a "carbon getter," preferentially forming stable titanium carbides (TiC) instead of chromium carbides (Cr_{23}C_6) when the steel is exposed to the sensitization temperature range (425–900°C). This stabilization mechanism prevents the depletion of chromium at grain boundaries that would otherwise make the steel susceptible to intergranular corrosion. SUS321 offers corrosion resistance comparable to SUS304 in most environments, with the critical advantage of maintaining that resistance after welding or high-temperature service.

Key Features

- Titanium-stabilized — prevents sensitization at 425–900°C by forming TiC instead of Cr carbides
- Excellent intergranular corrosion resistance after welding and prolonged high-temperature exposure
- Service temperature up to ~900°C (1650°F) for continuous operation
- Comparable aqueous corrosion resistance to SUS304 in the annealed condition
- No post-weld annealing required for intergranular corrosion resistance — Ti stabilization protects the HAZ
- Good oxidation resistance up to ~900°C in air
- Good high-temperature strength, particularly in the 425–900°C range
- Good weldability — use ER321 or ER347 filler for best results
- Excellent formability and fabricability similar to SUS304
- Non-magnetic in annealed condition (slightly magnetic after cold work)
- Stabilization is permanent — does not degrade over time or thermal cycling
- Fully austenitic structure ensures excellent ductility and toughness at all temperatures
- Good resistance to thermal fatigue and thermal shock
- 100% recyclable — environmentally sustainable material choice
- Cost-effective alternative to SUS316L for moderate-temperature welded applications

Typical Applications

SUS321 is widely used in applications involving sustained service in the 425–900°C range where standard SUS304 would suffer from sensitization and intergranular corrosion. Common applications include aircraft exhaust systems and engine components, expansion joints, furnace parts operating at moderate temperatures, welded pressure vessels and piping operating in the sensitization range, heat exchanger components, and automotive exhaust systems. Its stabilization mechanism makes it especially valuable for welded structures that cannot be post-weld solution annealed.

Executive Standards

Standard	Description	Application
JIS G4304 / G4305	Japanese Industrial Standard	Hot/cold rolled stainless steel plate/sheet
ASTM A240 / A240M	American Society for Testing Materials	Pressure vessel and general purpose plate/sheet
ASTM A312	Seamless and welded austenitic steel pipe	High-temperature and general service pipe
ASTM A213 / A269	Seamless and welded austenitic steel tube	Boiler, superheater, and heat exchanger tube
ASTM A276	Stainless steel bars and shapes	Hot/cold finished bars for general use
EN 10088-1/2/3	European Norm (Material No. 1.4541)	Stainless steel — semi-finished, sheet/plate, bar
GB/T 4237 / 4238	Chinese National Standard (06Cr18Ni11Ti)	Hot rolled stainless steel plate and sheet
GB/T 1220	Chinese National Standard	Stainless steel bars

Supply Capability

GNEE Steel maintains extensive inventory of SUS321 products in various forms, sizes, and finishes. Our integrated supply chain and partnerships with leading mills ensure reliable delivery for both standard and custom specifications. With monthly production capacity exceeding 1,200 tons of SUS321 products, we serve customers worldwide with competitive lead times and flexible MOQ requirements.

产品质量证明书 INSPECTION CERTIFICATE										
客户名称: 山西太钢不锈钢股份有限公司 Customer: TISCO (山西太钢不锈钢股份有限公司) 收货地址: 太原 Purchaser: 太原				合同号: 2024045 Contract No.: 2024045				产品名称: 无缝不锈钢管 Product Name: Seamless Stainless Steel Pipe		
规格: Φ114.3×3.0 Specification: Φ114.3×3.0		牌号 Grade: 06Cr18Ni11Ti		交货状态: 2B 表面 长度: 4-12 米 Condition: 2B Solid solution Pickling Max. Length: 12M		证书编号: 004497805293750 Certificate No.: 004497805293750				
重量: 24.378 Weight: 24.378				订单号: 2024045 Order No.: 2024045		备注: 符合 GB/T 1220-2007 标准 Remarks: Complies with GB/T 1220-2007 standard				
序号 No.	材料号 Material No.	尺寸 Size	规格 Dimensions (mm)		数量 Quantity	重量 Weight				
1	FA308-3000V01	A201180								
尺寸及重量: Acceptable Visual And Dimensions: 0.03 OK 0.1 OK 0.1 Total 1 24.378										
序号 No.	Max Min	C%	Si%	Mn%	P%	S%	Cr%	Ni%	W%	Nb%
1	H	0.025	0.58	0.90	0.034	0.001	17.35	9.11	0.263	0.01
序号 No.	检测方向 P/O	检测项目 Y 元素 检测 检测	检测项目 Z 元素 检测 检测	检测项目 T 元素 检测 检测	检测项目 B 元素 检测 检测	检测项目 Hardness 检测 检测				
1	228	578	61.0	70.5						

MILL TEST CERTIFICATE										Date (日期): 2024-04-15 No. (编号): 1910080001					
客户名称: (客户名称) Messer (客户名称)			液体输送用无缝不锈钢管 Stainless steel seamless tubes for fluid transport			(交货状态) Condition		QUICK-COOLING 急冷 Solution & Pickled (酸洗及钝化)		(表面状态) Surface condition		合格 Pass			
(订单号/合同号) Contract No.						(执行标准) Executive standard		(ASTM A312)		(尺寸公差) Size Tolerance		合格 Pass			
序号 No.	品名 Heart No.	规格 Grade	元素 Elements	Chemical composition (%) 化学成份										(证明) Lot No.	
				C	Si	Mn	P	S	Ni	Cr	Mo	Ti	Cu		
1	SA200418A01	73212H	(Result) (结果)	0.058	0.51	1.180	0.028	0.002	10.420	17.940	0.180	0.320	0.210	X19080001-21	
2	SA200418A02	73212H	(Result) (结果)	0.063	0.470	1.120	0.026	0.003	10.310	17.860	0.160	0.360	0.190	X19080001-21	
3	SA200418A03	73212H	(Result) (结果)	0.069	0.550	1.210	0.030	0.002	10.180	17.780	0.200	0.390	0.220	X19080001-21	
4	SA200418A04	73212H	(Result) (结果)	0.062	0.490	1.160	0.027	0.003	10.260	17.920	0.170	0.350	0.200	X19080001-21	
序号 No.	规格 Specifications	重量 Weight	数量 Amount	屈服强度 Y.S.		抗拉强度 T.S.		晶粒度 Gr.	腐蚀试验 Corrosion Test	压扁 Flattening Test	开平 Flaring Test	硬度 Hardness	水压 Hydrostatic Test	弯曲 Edgy current Test	超声波 Ultrasonic Test
				Y.S.	T.S.	Y.S.	T.S.								
1	25.4x2.77	952	180	568	263	48	合格 Pass	合格 Pass	合格 Pass	78	/	/	/	/	/
2	33.4x3.34	1526	180	562	258	49	合格 Pass	合格 Pass	合格 Pass	76	/	/	/	/	/
3	60.3x3.91	2865	180	575	269	46	合格 Pass	合格 Pass	合格 Pass	79	/	/	/	/	/
4	60.3x4.478	3480	180	580	274	45	合格 Pass	合格 Pass	合格 Pass	77	/	/	/	/	/
热处理温度 (℃): 900-1100°C Solution Temp (°C): 900-1100°C															
1. 如有疑问, 请向本证书中列出的生产商或经销商索取证书。 If any query, please, please clarify by phone call or fax, indicating the certificate number.															
2. 如有疑问, 请向本证书中列出的生产商或经销商索取证书。 This certificate is valid with the original stamp of the quality department. Photocopies are invalid.															
3. 本证书由生产商出具并加盖公章, 广 告 为 准。															
The original test sheet has been tested and comply with the terms of the certificate. The original certificate is the original certificate.															
														规格 (PC): 325024	

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Chemical Composition

The chemical composition of SUS321 is based on the SUS304 formula (17–19% chromium, 9–12% nickel) with the critical addition of titanium. The titanium content must be at least five times the carbon content ($Ti \geq 5 \times C$) to ensure complete stabilization. This ensures that titanium preferentially reacts with carbon to form stable titanium carbides (TiC), preventing the formation of chromium carbides ($Cr_{23}C_6$) that would deplete chromium at grain boundaries and cause intergranular corrosion.

Chemical Composition (wt. %) — JIS G4305 / ASTM A240

Element	Symbol	Minimum	Maximum	Typical Value	Purpose
Carbon	C	—	0.080	0.040	Controlled — titanium stabilization ties up carbon
Silicon	Si	—	1.000	0.40	Deoxidizer & oxidation resistance
Manganese	Mn	—	2.000	1.50	Austenite stabilizer & strength
Phosphorus	P	—	0.045	0.025	Impurity — controlled for toughness
Sulfur	S	—	0.030	0.010	Impurity — controlled for corrosion resistance
Chromium	Cr	17.00	19.00	18.00	Primary corrosion & oxidation resistance element
Nickel	Ni	9.00	12.00	10.50	Austenite stabilizer & ductility
Titanium	Ti	5×C	0.700	0.30	Stabilizer — prevents sensitization (TiC formation)
Iron	Fe	Balance	Balance	~69.0	Base metal matrix

Notes on Key Elements

Chromium (Cr): At 17–19%, chromium is the primary alloying element for corrosion resistance, identical to SUS304. Chromium forms a self-healing passive oxide layer (Cr_2O_3) on the steel surface, providing excellent resistance to oxidation and many corrosive environments. In SUS321, the titanium stabilization ensures chromium remains in solid solution even after high-temperature exposure, maintaining the full corrosion resistance of the alloy.

Nickel (Ni): At 9–12%, nickel stabilizes the austenitic (face-centered cubic) crystal structure at all temperatures, ensuring excellent ductility, toughness, and formability. The nickel content is the same range as SUS304, giving SUS321 similar general corrosion resistance and mechanical properties to SUS304 in the annealed condition.

Titanium (Ti): The defining element of SUS321. Titanium has a very strong affinity for carbon — much stronger than chromium. By adding titanium at a minimum of 5× the carbon content, titanium preferentially forms stable

titanium carbides (TiC) instead of chromium carbides ($\text{Cr}_{19}\text{C}_{11}$). This prevents the "sensitization" mechanism where chromium carbides precipitate at grain boundaries in the 425–900°C range, depleting the adjacent areas of chromium and making them susceptible to intergranular corrosion. The TiC carbides are stable up to very high temperatures, providing permanent protection that does not degrade over time or through thermal cycling.

Carbon (C): Limited to 0.08% maximum, the same as standard SUS304. In SUS321, carbon is not the concern it is in unstabilized grades because the titanium "ties up" the carbon as TiC. However, carbon content must still be controlled to ensure that the titanium addition is sufficient for complete stabilization ($\text{Ti} \geq 5 \times \text{C}$). Higher carbon contents require correspondingly higher titanium levels.

Manganese (Mn): An austenite stabilizer that partially substitutes for nickel while improving strength and hot workability. Also improves resistance to hot cracking during welding.

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Mechanical Properties

SUS321 exhibits mechanical properties very similar to SUS304 due to its comparable base composition (17–19% Cr, 9–12% Ni). The addition of titanium and the presence of TiC carbides provide slight improvements in high-temperature strength compared to unstabilized SUS304. The fully austenitic structure ensures excellent ductility and toughness at all temperatures, including cryogenic conditions. The stabilization mechanism ensures that mechanical properties are maintained after welding or high-temperature exposure without the degradation that would occur in sensitized SUS304.

Room Temperature Mechanical Properties (Annealed)

Property	Symbol	Minimum	Typical	Unit	Test Standard
Tensile Strength	σ_b / Rm	515	560–700	MPa	ASTM E8 / JIS Z2241
Yield Strength (0.2%)	$\sigma_{0.2}$ / Rp0.2	205	240–310	MPa	ASTM E8 / JIS Z2241
Elongation (50mm GL)	δ / A	40	45–55	%	ASTM E8 / JIS Z2241
Hardness (Rockwell B)	HRB	—	72–88	HRB	ASTM E18
Hardness (Brinell)	HB	≤217	146–180	HB	ASTM E10
Hardness (Vickers)	HV	—	150–185	HV	ASTM E92
Modulus of Elasticity	E	—	193	GPa	—
Shear Modulus	G	—	76	GPa	—
Poisson's Ratio	ν	—	0.29	—	—

Property Variations by Temper

Mechanical properties of SUS321 vary with cold working, similar to SUS304. The following table shows typical values for different tempers of cold-rolled sheet:

Temper Condition	Tensile Strength (MPa)	Yield Strength (MPa)	Elongation (%)	Hardness (HRB)
Annealed (Soft)	515–700	205–310	40–55	72–88
1/4 Hard	700–820	400–520	22–32	88–92
1/2 Hard	820–970	600–720	12–22	92–96
3/4 Hard	970–1120	770–900	6–12	96–100

Temper Condition	Tensile Strength (MPa)	Yield Strength (MPa)	Elongation (%)	Hardness (HRB)
Full Hard	1120–1300	940–1050	3–8	100–104

Key Notes

- SUS321 cannot be hardened by heat treatment — only by cold working (strain hardening)
- Mechanical properties at room temperature are comparable to SUS304 with slightly higher strength from TiC
- Superior to SUS304 for service in the 425–900°C range — TiC prevents sensitization and maintains properties
- Excellent ductility and toughness maintained from cryogenic to high temperatures
- No ductile-brittle transition temperature — remains tough down to cryogenic range
- The only heat treatment is solution annealing (typically 980–1150°C followed by rapid cooling)
- Solution annealing dissolves chromium carbides (but not TiC), restores ductility, and maximizes corrosion resistance
- Titanium carbides (TiC) are stable at solution annealing temperatures and provide permanent stabilization
- Higher work hardening rate than carbon steels — requires more power for forming operations

04

Physical Properties

The physical properties of SUS321 are very similar to SUS304 since the base composition (Cr 17–19%, Ni 9–12%) is essentially the same. The addition of a small amount of titanium (typically ~0.3%) causes only marginal changes in physical properties. These properties are important for design calculations, thermal expansion analysis, and compatibility with other materials.

Property	Value	Unit	Condition / Note
Density	7.99	g/cm³	At 20°C (room temperature)
Density	0.288	lb/in³	At 20°C (room temperature)
Melting Point Range	1400–1425	°C	Approximate solidus-liquidus
Melting Point Range	2552–2597	°F	Approximate solidus-liquidus
Specific Heat Capacity	500	J/kg·K	At 0–100°C
Thermal Conductivity	15.0	W/m·K	At 100°C
Thermal Conductivity	18.8	W/m·K	At 500°C
Coefficient of Thermal Expansion (CTE)	16.6 × 10 ^{−6}	/°C	At 0–100°C
Coefficient of Thermal Expansion (CTE)	18.0 × 10 ^{−6}	/°C	At 0–500°C
Electrical Resistivity	72 × 10 ^{−8}	Ω·m	At 20°C
Magnetic Permeability	< 1.01	—	In annealed condition (non-magnetic)
Modulus of Elasticity (E)	193	GPa	At room temperature
Poisson's Ratio	0.29	—	At room temperature

Thermal Expansion Coefficient by Temperature

Temperature Range (°C)	Mean CTE (×10 ^{−6} /°C)	Temperature Range (°F)	Mean CTE (×10 ^{−6} /°F)
0 – 100	16.6	32 – 212	9.2
0 – 200	17.2	32 – 392	9.6
0 – 300	17.7	32 – 572	9.8
0 – 400	18.0	32 – 752	10.0

Temperature Range (°C)	Mean CTE ($\times 10^{-6} / ^\circ\text{C}$)	Temperature Range (°F)	Mean CTE ($\times 10^{-6} / ^\circ\text{F}$)
0 – 500	18.2	32 – 932	10.1
0 – 600	18.6	32 – 1112	10.3
0 – 700	18.9	32 – 1292	10.5
0 – 800	19.2	32 – 1472	10.7
0 – 900	19.5	32 – 1652	10.8

Note: Thermal expansion values are important for designing high-temperature assemblies, expansion joints, and dissimilar-material connections. SUS321 has thermal expansion properties very similar to SUS304. The lower thermal conductivity compared to carbon steel means heat transfer is slower — important for heat exchanger design.

Magnetic Properties

SUS321 is essentially non-magnetic in the fully annealed condition due to its fully austenitic structure, with magnetic permeability typically less than 1.01. However, cold working (such as bending, drawing, or machining) can induce partial transformation of austenite to martensite, resulting in slight magnetic permeability. This effect is similar to SUS304 and can be reversed by annealing. For applications requiring strictly non-magnetic material, specify fully annealed condition.

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Corrosion Resistance

SUS321 provides corrosion resistance comparable to SUS304 in the annealed condition. Its key advantage over SUS304 is its resistance to intergranular corrosion (sensitization) after welding or exposure to the 425–900°C temperature range. The titanium stabilization mechanism ensures that chromium remains in solid solution, preserving the full corrosion resistance of the alloy even after thermal cycling. However, SUS321 does not contain molybdenum, so its resistance to chloride pitting and crevice corrosion is comparable to SUS304 — inferior to SUS316L in chloride environments.

Corrosion Resistance Rating by Environment

Environment	Resistance	Notes & Limitations
Atmospheric / Rural	Excellent	Equivalent to SUS304; decades of service life expected
Atmospheric / Urban	Excellent	Good resistance to urban and industrial pollution
Atmospheric / Marine (coastal)	Good	Comparable to SUS304; may pit in salt spray — not as good as SUS316L
Fresh Water (potable)	Excellent	Suitable for drinking water applications
Chlorinated Water (≤100 ppm Cl ⁻)	Good	Comparable to SUS304; pitting may occur at higher chloride levels
Salt Water / Seawater	Fair	Not recommended for prolonged immersion — pitting may occur
Food Acids (citric, acetic)	Very Good	Good resistance to most food acids
Dilute Sulfuric Acid	Fair – Good	Resistant at ambient temperatures and low concentrations
Nitric Acid (dilute)	Good	Resistant at low concentrations and ambient temperature
Phosphoric Acid	Good	Suitable at moderate concentrations and temperatures
Caustic Solutions (NaOH)	Good	Resistant up to ~30% concentration at room temperature
Organic Solvents	Excellent	Resistant to most alcohols, esters, ketones, hydrocarbons
Oxidizing Agents	Good	Good resistance due to chromium content
High-Temperature Oxidation	Good	Resistant up to ~900°C in air
Intergranular (as-welded)	Excellent	Ti stabilization prevents sensitization — key advantage over SUS304

Common Corrosion Types & SUS321 Performance

Uniform Corrosion

SUS321 exhibits uniform corrosion rates equivalent to SUS304 in most natural and industrial environments, since the base composition (Cr 17–19%, Ni 9–12%) is the same. Typical corrosion rates in atmospheric exposure are less than 0.002 mm/year. The titanium addition does not significantly affect uniform corrosion resistance but has a major beneficial effect on intergranular corrosion resistance.

Intergranular Corrosion (Sensitization) — THE KEY ADVANTAGE

This is the primary reason SUS321 exists. In standard SUS304, exposure to temperatures in the 425–900°C range causes chromium carbides ($\text{Cr}_{19}\text{C}_{11}$) to precipitate at grain boundaries, depleting the adjacent chromium below the 12% threshold needed for passivity. This "sensitization" makes the grain boundaries susceptible to intergranular corrosion, particularly in aggressive environments. In SUS321, titanium preferentially forms TiC carbides, consuming the carbon before it can react with chromium. This prevents chromium depletion and maintains full intergranular corrosion resistance — even after welding or prolonged high-temperature exposure. No post-weld solution annealing is required for intergranular corrosion resistance, making SUS321 ideal for welded structures that cannot be post-weld heat treated.

Pitting and Crevice Corrosion

SUS321 does not contain molybdenum, so its resistance to pitting and crevice corrosion in chloride environments is the same as SUS304 — inferior to SUS316L. The Pitting Resistance Equivalent Number (PREN) is approximately 18–20, calculated as $\text{PREN} = \% \text{Cr} + 3.3 \times \% \text{Mo} + 16 \times \% \text{N} \approx 18 + 0 + 0.2 \approx 18.2$. For chloride-containing environments, consider SUS316L or higher-alloyed grades.

Stress Corrosion Cracking (SCC)

Like SUS304, SUS321 is susceptible to chloride-induced stress corrosion cracking at temperatures above approximately 60°C (140°F) in the presence of tensile stress and high chloride concentrations. The titanium stabilization does not improve SCC resistance. For severe SCC conditions, duplex stainless steels or nickel alloys may be more appropriate.

Galvanic Corrosion

When SUS321 is coupled with less noble metals (e.g., carbon steel, aluminum, zinc) in an electrolyte, the less noble metal will corrode preferentially. Conversely, coupling with more noble metals (e.g., titanium, Hastelloy) accelerates attack on SUS321. Insulation or proper material pairing is recommended for dissimilar metal joints.

06

Temperature Performance

SUS321 is specifically designed for service in the 425–900°C temperature range where unstabilized SUS304 would suffer from sensitization. With maximum continuous service temperature of approximately 900°C (1650°F), SUS321 fills the gap between SUS304/SUS316L (max ~870°C) and SUS310S (max ~1150°C). The titanium carbides (TiC) provide excellent high-temperature stability, preventing sensitization and maintaining intergranular corrosion resistance throughout the service life of the component.

High-Temperature Mechanical Properties

Temperature (°C)	Tensile Strength (MPa)	Yield Strength 0.2% (MPa)	Elongation (%)
20 (Room Temp)	560–700	240–310	45–55
100	520–640	210–270	42–52
200	480–590	180–230	40–50
300	450–550	160–210	38–48
400	420–520	140–185	36–46
500	380–470	130–170	34–44
600	320–400	120–155	32–42
700	230–290	90–125	30–40
800	150–190	60–85	28–38
900	80–110	35–50	28–38

Temperature Comparison: SUS321 vs SUS304 vs SUS310S

The following comparison highlights the temperature performance differences between SUS321 and two other common austenitic grades. SUS321 occupies the moderate high-temperature niche, offering superior sensitization resistance to SUS304 and a more cost-effective alternative to SUS310S for applications below 900°C.

Property	SUS321	SUS304	SUS310S
Maximum Continuous Service Temp	900°C (1650°F)	870°C (1600°F)	1150°C (2100°F)
Maximum Intermittent Service Temp	925°C (1700°F)	925°C (1700°F)	1200°C (2190°F)
Oxidation Resistance (up to)	900°C	900°C	1150°C

Property	SUS321	SUS304	SUS310S
Sensitization Resistance	Excellent (Ti-stabilized)	Poor (unstabilized)	Good (low C)
Creep Strength (at 600°C, 10 ⁴ h)	~55 MPa	~50 MPa	~100 MPa
Hot Strength	Good	Good	Excellent
Thermal Expansion (0–100°C)	16.6 × 10 ⁻⁶ /°C	17.3 × 10 ⁻⁶ /°C	15.9 × 10 ⁻⁶ /°C
Thermal Conductivity (at 100°C)	15.0 W/m·K	16.2 W/m·K	14.2 W/m·K
Cryogenic Toughness	Excellent	Excellent	Good
Weld Decay Resistance	Excellent (Ti-stabilized)	Fair	Good (low C)
Post-Weld Annealing Needed	No (for IGC)	Yes (for thick sections)	Recommended
Typical High-Temp Applications	Aircraft exhausts, expansion joints	Furnace parts, heat exchangers	Furnace liners, kilns, radiant tubes

The Sensitization Temperature Range & Why SUS321 Excels

When austenitic stainless steels are heated in the 425–900°C range, chromium carbides (Cr₂₃C₆) can precipitate at grain boundaries. This "sensitization" depletes chromium adjacent to the grain boundaries below the 12% threshold needed for passivity, making those areas susceptible to intergranular corrosion. This occurs during:

- Welding — the heat-affected zone (HAZ) passes through the sensitization range
- Slow cooling through the 425–900°C range after solution annealing
- Prolonged service in the 425–900°C range (e.g., heat exchangers, exhaust systems)
- Stress relief heat treatments in the sensitization range

SUS321 prevents sensitization because titanium (Ti ≥ 5×C) preferentially forms stable titanium carbides (TiC) instead of chromium carbides. The TiC carbides are stable at sensitization temperatures, so chromium remains in solid solution. This makes SUS321 ideal for welded structures and components that operate in the 425–900°C range.

Low-Temperature Performance

SUS321 maintains excellent toughness and ductility at cryogenic temperatures due to its fully austenitic structure. Like all austenitic stainless steels, it does not exhibit a ductile-brittle transition and remains tough down to -196°C (-321°F) and below. Its cryogenic performance is comparable to SUS304.

Temperature (°C)	Tensile Strength (MPa)	Yield Strength (MPa)	Elongation (%)	Charpy V-Notch (J)
20	560–700	240–310	45–55	>250
0	620–760	280–350	42–52	>200
-50	730–870	320–400	40–50	>160
-100	830–970	380–460	35–45	>120
-196 (LN ₂)	980–1150	460–560	30–40	>80

Note: Values are typical for annealed material. Actual values may vary depending on product form, heat treatment, and testing direction.

07

Product Forms & Standards

GNEE Steel supplies SUS321 in a comprehensive range of product forms to meet diverse industrial requirements. All products are manufactured to internationally recognized standards and undergo rigorous quality inspection before shipment.

Plate & Sheet — ASTM A240 / A240M

ASTM A240 covers chromium and chromium-nickel stainless steel plate, sheet, and strip for pressure vessels and for general applications. SUS321 plate and sheet are available in various thicknesses, widths, and surface finishes for applications ranging from expansion joints to welded pressure vessel components.

Pipe — ASTM A312

ASTM A312 covers seamless, straight-seam welded, and heavily cold-worked welded austenitic stainless steel pipe intended for high-temperature and general corrosive service. Both seamless and welded SUS321 pipes are available in a wide range of sizes and schedules, commonly used in high-temperature piping and exhaust systems.

Tube — ASTM A213 / A269

ASTM A213: Covers seamless ferritic and austenitic alloy-steel boiler, superheater, and heat-exchanger tubes. SUS321 tubes under this standard are widely used in boiler and heat exchanger applications operating in the sensitization temperature range.

ASTM A269: Covers seamless and welded austenitic stainless steel tubing for general service, with emphasis on smooth interior surfaces suitable for fluid transport.

Bar — ASTM A276

ASTM A276 covers hot-finished or cold-finished bars including rounds, squares, and hexagons; and hot-forged or cold-finished bars of special shapes for use in corrosion-resisting and high-temperature service. SUS321 bars are available in various finishes and sizes for machining, fastener, and structural applications.

Fittings — ASTM A403

ASTM A403 covers wrought austenitic stainless steel fittings for pressure piping applications. Available fittings include elbows, tees, reducers, caps, and flanges in various sizes and pressure ratings. All fittings are manufactured from SUS321 and meet dimensional and material requirements of applicable standards.

Full Product Range Summary

Product Form	Key Standards	Available Types	Typical Applications
Plate / Sheet	ASTM A240, JIS G4304/G4305, EN 10088-2	Hot rolled, cold rolled, coil, strip	Expansion joints, welded vessels, exhaust components

Product Form	Key Standards	Available Types	Typical Applications
Pipe	ASTM A312, JIS G3459, EN 10216-5	Seamless, welded (ERW/LSAW)	High-temp piping, exhaust systems, process piping
Tube	ASTM A213, A269, JIS G3463	Seamless, welded, precision, U-bend	Heat exchangers, boilers, superheaters
Bar / Rod	ASTM A276, JIS G4303, EN 10088-3	Round, square, hexagonal, flat, wire	Fasteners, machined parts, furnace fixtures
Coil / Strip	ASTM A240, JIS G4305, EN 10088-2	Hot rolled coil, cold rolled coil, slit strip	Stamping, forming, roll-formed profiles
Fittings	ASTM A403, MSS SP-43, JIS B2311	Elbows, tees, reducers, caps, flanges	Welded piping systems, process connections
Wire	ASTM A580, JIS G4309, EN 10263-5	Spring wire, welding wire, weaving wire	Springs, welding, wire mesh, fasteners

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Size Range & Specifications

GNEE Steel offers SUS321 products in an extensive range of sizes. Below are our standard size ranges for each product form. Custom sizes are available upon request — please contact our sales team with your specific requirements.

Plate & Sheet Size Range

Parameter	Hot Rolled Plate	Cold Rolled Sheet	Coil / Strip
Thickness	3.0 – 100 mm	0.3 – 3.0 mm	0.2 – 6.0 mm
Thickness (inch)	0.118 – 4.0"	0.012 – 0.118"	0.008 – 0.236"
Width	1000 – 2500 mm	1000 – 1500 mm	20 – 1500 mm
Width (inch)	39.4 – 98.4"	39.4 – 59.1"	0.8 – 59.1"
Length	2000 – 12000 mm	2000 – 3000 mm	Coil weight: up to 20 MT
Length (inch)	78.7 – 472"	78.7 – 118"	—
Standard Sizes	1220×2440, 1500×3000, 1500×6000 mm	1000×2000, 1219×2438, 1220×2440 mm	Width: 1000, 1219, 1220, 1500 mm

Pipe & Tube Size Range

Parameter	Seamless Pipe (ASTM A312)	Welded Pipe (ASTM A312)	Tube (ASTM A213/A269)
Outer Diameter (OD)	6 – 610 mm	12.7 – 2032 mm	1.6 – 114.3 mm
OD (inch)	1/4 – 24"	1/2 – 80"	1/16 – 4.5"
Wall Thickness	1.2 – 60 mm	1.6 – 50 mm	0.5 – 12 mm
Wall Thickness (Sch.)	Sch 5S – Sch 160	Sch 5S – Sch XXS	BWG 8 – BWG 30
Length	Up to 12000 mm (40 ft)	Up to 12000 mm (40 ft)	Up to 12000 mm (40 ft)
Standard Lengths	6000 mm, 12000 mm	6000 mm, 12000 mm	6000 mm, 12000 mm, coils

Bar Size Range

Bar Type	Size Range	Standard Lengths	Finish Options
Round Bar	Ø 3.0 – 500 mm (0.12 – 20")	3000 – 6000 mm (10 – 20 ft)	Hot rolled, cold drawn, polished
Square Bar	3 × 3 – 200 × 200 mm	3000 – 6000 mm	Hot rolled, cold drawn, peeled
Hexagonal Bar	6 – 100 mm A/F	3000 – 6000 mm	Cold drawn, hot rolled
Flat Bar	Thickness: 3 – 100 mm Width: 10 – 500 mm	3000 – 6000 mm	Hot rolled, cold drawn, mill finish
Angle Bar	25×25×3 – 200×200×20 mm	3000 – 6000 mm	Hot rolled, pickled
Wire Rod / Wire	Ø 0.2 – 16 mm	Coils / Cut to length	Annealed, cold drawn, spring temper

Custom Sizes Available

In addition to standard sizes, GNEE Steel provides custom-cut dimensions to meet your exact project requirements. Our advanced cutting facilities include plasma cutting, laser cutting, waterjet cutting, and shearing for precision-cut blanks and components.

- Precision cutting services: laser, plasma, waterjet, shear, saw
- Custom coil slitting to narrow widths (minimum 20mm strip)
- Cut-to-length sheets and plates to your exact specifications
- Custom tube and pipe lengths from 100mm to 12000mm
- Bar cut-to-length with tight tolerances
- Special profiles and shapes available by request
- Minimum order quantities for custom sizes vary by product form

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Surface Finish Options

SUS321 is available in a variety of surface finishes, each suited to different applications based on aesthetic requirements, corrosion performance, and functional needs. The surface finish significantly affects appearance, cleanability, and corrosion resistance.

Finish	Description	Ra (µm)	Appearance	Typical Applications
No.1	Hot rolled, annealed & pickled. Scaled surface from hot rolling.	~3.2 – 6.3	Dull, matte silver-gray	Industrial equipment, structural, thick plate
2B	Cold rolled, annealed & pickled, skin-passed. Most common finish.	~0.2 – 0.8	Smooth, moderately reflective	General purpose, exhaust components, tanks
BA	Bright Annealed. Cold rolled, bright annealed in controlled atmosphere.	~0.05 – 0.2	Bright, highly reflective mirror-like	Automotive trim, decorative, specialty components
No.4	Brushed / satin finish. Polished with 120-180 grit abrasive.	~0.2 – 0.8	Uniform brushed lines, satin sheen	Kitchen equipment, appliances, architectural panels
HL	Hairline finish. Polished with finer abrasive (180-240 grit).	~0.1 – 0.4	Finer continuous lines, elegant satin	Elevators, architectural cladding, decorative panels
Mirror 8K	Mirror-polished. Polished with fine compounds to mirror finish.	~0.02 – 0.08	Near-perfect mirror reflection	Decorative, reflectors, mirrors, luxury applications

Detailed Finish Specifications

No. 1 Finish (Hot Rolled Annealed & Pickled)

Produced by hot rolling, annealing, and descaling (pickling) the steel. The surface has a dull, non-reflective appearance. This is the standard surface finish for hot-rolled plate and heavy-gauge products where surface aesthetics are not critical.

2B Finish (Cold Rolled — Bright Annealed & Pickled)

The most widely used surface finish for stainless steel sheet. Produced by cold rolling, followed by annealing and pickling, then a final light cold roll (skin pass) for a smooth, moderately reflective surface. 2B is the standard finish for sheet and coil used in general fabrication, exhaust systems, and process equipment.

BA Finish (Bright Annealed)

Produced by cold rolling followed by bright annealing in a controlled protective atmosphere (hydrogen/nitrogen mixture), which prevents oxidation during heat treatment. The result is a bright, highly reflective surface that requires no additional polishing.

No. 4 Finish (Brushed / Satin)

A mechanical polish applied with 120 to 180 grit abrasive belts or brushes, producing a uniform directional brushed pattern with a satin sheen. No. 4 finish is popular for equipment and architectural applications where a

consistent brushed appearance is desired.

HL Finish (Hairline)

Similar to No. 4 but produced with finer abrasives (typically 180-240 grit), resulting in finer, more uniform hairline-like scratches. HL finish offers a more refined and elegant appearance than No. 4.

Mirror 8K Finish

The highest level of polished finish, achieved through multi-stage mechanical polishing with progressively finer abrasives followed by buffing with polishing compounds. Used for decorative applications and reflectors.

Note: Surface finish availability may vary by product form, thickness, and size. Please consult with our sales team for specific availability and lead times for special surface finishes.

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Quality Control & Testing

At GNEE Steel, quality assurance is integrated into every stage of production — from raw material inspection to final product testing and certification. Our quality management system ensures that every SUS321 product meets or exceeds international standards and customer specifications, with particular attention to titanium content verification for stabilization confirmation.

Inspection & Testing Capabilities

Test Method	Description	Standard	Purpose
PMI Test (Positive Material Identification)	X-ray fluorescence (XRF) analysis to verify chemical composition including Cr and Ni.	ASTM E1019	Material grade verification, alloy identification
Spectrochemical Analysis	Laboratory OES analysis to verify precise composition including Ti and C content — critical for SUS321 verification.	ASTM E1019	Titanium content verification (Ti ≥ 5×C)
Tensile Test	Mechanical testing to determine tensile strength, yield strength, elongation.	ASTM E8 / E8M JIS Z2241	Mechanical property compliance verification
Hardness Test	Rockwell, Brinell, and Vickers hardness testing.	ASTM E10, E18, E92	Hardness verification, condition confirmation
Ultrasonic Testing (UT)	Non-destructive testing using sound waves to detect internal defects.	ASTM A388 / A577 EN 10160	Internal soundness, defect detection
Eddy Current Test	Electromagnetic NDT for surface and near-surface defects in tubes and bars.	ASTM E309 / E426 EN 10246	Surface defect detection
Dimensional Inspection	Precision measurement of thickness, width, length, diameter, tolerances.	ASTM / JIS / EN product standards	Dimensional compliance verification
Surface Inspection	Visual and automated optical inspection for surface defects.	Customer / standard specifications	Surface quality and finish verification
Hydrostatic Test	Pressure testing of pipes and tubes for integrity.	ASTM A312 / A213 EN 10216	Pressure boundary integrity verification
Intergranular Corrosion Test	Testing for sensitization resistance — critical for SUS321 verification.	ASTM A262 JIS G0571	Stabilization effectiveness verification

Certifications & Documents

All GNEE Steel products are accompanied by comprehensive documentation and certifications to provide full traceability and quality assurance for our customers.

Certificate / Document	Description	Applicable Standard
EN 10204 3.1 MTC	Material Test Certificate with chemical composition (including Ti and C), mechanical properties, and test results.	EN 10204 Type 3.1
EN 10204 3.2 MTC	Material Test Certificate with additional verification by an independent third-party inspector.	EN 10204 Type 3.2
SGS Inspection	Third-party inspection by SGS.	SGS Testing Services
BV Inspection	Third-party inspection by Bureau Veritas.	Bureau Veritas Standards
TUV Inspection	Third-party inspection by TUV.	TUV Rheinland / TUV SUD
Mill Test Report (MTR)	Comprehensive report including heat number, chemical analysis (with Ti verification), and mechanical test results.	ASTM / JIS / EN
ISO 9001:2015	Quality Management System certification.	ISO 9001:2015
PED 97/23/EC	Pressure Equipment Directive compliance.	EU PED Directive

Note: Third-party inspections (SGS, BV, TUV) are available upon customer request and are subject to additional fees and lead time. Please specify inspection requirements at the time of order placement.

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Applications & Industries

SUS321 is the preferred austenitic stainless steel for applications involving sustained service in the 425–900°C temperature range where unstabilized SUS304 would suffer from sensitization. Its titanium stabilization makes it especially valuable for welded structures and components that operate in or pass through the sensitization temperature range. Common industries include aerospace, automotive, chemical processing, power generation, and heat treatment.

Industry	Key Applications	Why SUS321?
Aerospace	Jet engine exhaust components, afterburner parts, structural brackets, casings, fasteners	Ti stabilization prevents sensitization in exhaust temperature range; good high-temp strength
Automotive	Exhaust manifolds, catalytic converter housings, turbocharger housings, flexible exhaust joints	Resists intergranular corrosion in welded exhaust; good oxidation resistance at exhaust temps
Chemical Processing	Welded pressure vessels, heat exchangers, piping operating at 425–900°C, column internals	Sensitization resistance after welding; no post-weld annealing needed for IGC resistance
Power Generation	Boiler casings, superheater tubing, stack liners, expansion joints, ductwork	Good high-temp strength; Ti stabilization maintains properties in sensitization range
Heat Treatment	Moderate-temperature furnace parts, baskets, trays, fixtures, conveyor components	Cost-effective for temperatures up to 900°C; TiC prevents property degradation
Oil & Gas Refining	Process piping, heat exchangers, reactor components in moderate high-temp service	Weld sensitization resistance; good general corrosion resistance
Food & Beverage	Welded piping, storage tanks, heat exchangers operating at moderate temperatures	Comparable to SUS304 with superior welded corrosion resistance
Pulp & Paper	Digester components, process piping, heat exchanger tubes in temperature range	Sensitization resistance after welding; cost-effective for moderate temp
Architecture & Construction	Expansion joints, welded structural components in temperature-cycling environments	Maintains corrosion resistance after thermal cycling; good weldability

Additional Application Areas

- Nuclear Industry: Welded piping and structural components where intergranular corrosion resistance after welding is critical for safety
- Pharmaceutical: Welded piping systems and vessels where post-weld solution annealing is impractical — Ti stabilization protects the HAZ
- Brewing & Dairy: Welded tanks, piping, and heat exchangers where sensitization could cause contamination or corrosion
- Railway & Transportation: Exhaust system components for diesel locomotives and rail vehicles
- Marine Engineering: Exhaust stacks and uptakes on ships, moderate-temperature structural components

- Industrial Furnaces: Moderate-temperature furnace components where SUS310S is over-specified — cost-effective alternative
- Heat Exchangers: Shell-and-tube exchangers operating at 425–900°C where welded tube-to-tubesheet joints need IGC resistance
- Welding Consumables: SUS321 can be used as filler metal for welding similar stabilized grades

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Grade Comparison Guide

Choosing the right stainless steel grade is critical for optimal performance and cost-effectiveness. The following comparisons help you understand how SUS321 compares to other common grades and select the most suitable material for your application.

SUS321 vs SUS304

SUS321 and SUS304 share the same base composition (17–19% Cr, 9–12% Ni). The critical difference is the addition of titanium ($Ti \geq 5 \times C$) in SUS321. This makes SUS321 superior for applications involving welding or service in the 425–900°C sensitization range. While SUS304 is the economical choice for general-purpose applications, SUS321 is preferred for welded structures and moderate-temperature service where intergranular corrosion resistance is required.

Property	SUS321	SUS304
Chromium (Cr)	17.0 – 19.0%	18.0 – 20.0%
Nickel (Ni)	9.0 – 12.0%	8.0 – 10.5%
Titanium (Ti)	$\geq 5 \times C$ (typ. 0.15–0.70%)	—
Carbon (max)	0.08%	0.08%
Tensile Strength (min)	515 MPa	520 MPa
Yield Strength (min)	205 MPa	205 MPa
Elongation (min)	40%	40%
Density	7.99 g/cm³	7.93 g/cm³
Sensitization Resistance	Excellent (Ti-stabilized)	Poor (unstabilized)
Intergranular Corrosion (welded)	Excellent	Fair – Poor
Post-Weld Annealing for IGC	Not required	Required (thick sections)
Max Continuous Service Temp	900°C (1650°F)	870°C (1600°F)
Chloride/Pitting Resistance	Moderate (PREN ~18)	Moderate (PREN ~18–20)
Cost	Slightly higher (~10–20% premium)	Lower (baseline)
Key Advantage	Ti stabilization — IGC resistance after welding	Cost-effective, versatile, widely available

SUS321 vs SUS316L

SUS321 and SUS316L address different corrosion problems: SUS321 prevents intergranular corrosion through titanium stabilization, while SUS316L prevents it through ultra-low carbon content and also adds molybdenum for superior chloride resistance. SUS316L is superior for chloride environments, while SUS321 is superior for moderate high-temperature service. For applications requiring both high-temperature stability and chloride resistance, consider SUS316Ti (the titanium-stabilized version of 316).

Property	SUS321	SUS316L
Chromium (Cr)	17.0 – 19.0%	16.0 – 18.5%
Nickel (Ni)	9.0 – 12.0%	10.0 – 14.0%
Molybdenum (Mo)	—	2.0 – 3.0%
Titanium (Ti)	≥ 5×C	—
Carbon (max)	0.08%	0.03%
Tensile Strength (min)	515 MPa	485 MPa
Yield Strength (min)	205 MPa	170 MPa
Elongation (min)	40%	40%
Density	7.99 g/cm³	7.98 g/cm³
IGC Resistance Mechanism	Ti stabilization (TiC)	Ultra-low carbon
Chloride Resistance	Moderate (PREN ~18)	Very Good (PREN ~24–27)
Max Continuous Service Temp	900°C (1650°F)	870°C (1600°F)
Post-Weld Annealing for IGC	Not required	Not required
Cost	Moderate	Moderate – Higher
Best For	Moderate high-temp, welded structures (425–900°C)	Chloride service, chemical, marine, pharma

SUS321 vs SUS310S

SUS321 and SUS310S both address high-temperature concerns but at very different levels. SUS321 is cost-effective for moderate high-temperature service up to 900°C, using titanium stabilization to prevent sensitization. SUS310S, with its much higher chromium (24–26%) and nickel (19–22%), offers far superior oxidation resistance up to 1150°C and better creep strength. For temperatures below 900°C, SUS321 is the economical choice; above 900°C, SUS310S becomes essential.

Property	SUS321 (1.4541)	SUS310S (1.4845)
Chromium (Cr)	17.0 – 19.0%	24.0 – 26.0%
Nickel (Ni)	9.0 – 12.0%	19.0 – 22.0%
Titanium (Ti)	≥ 5×C	—
Carbon (max)	0.08%	0.08%
Tensile Strength (min)	515 MPa	515 MPa
Yield Strength (min)	205 MPa	205 MPa
Elongation (min)	40%	40%
Max Continuous Service Temp	900°C (1650°F)	1150°C (2100°F)
Oxidation Resistance (up to)	900°C	1150°C
Creep Strength	Good	Excellent
IGC Resistance Mechanism	Ti stabilization	Low carbon
Carburization Resistance	Fair	Very Good
Cost	Moderate	Higher (premium high-temp grade)
Key Application	Aircraft exhausts, expansion joints, welded vessels	Furnace liners, kilns, radiant tubes

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Purchasing Guide

This purchasing guide helps you make informed decisions when sourcing SUS321 stainless steel products. From selecting the right specification to verifying material authenticity, GNEE Steel is committed to transparent and reliable supply.

How to Choose the Right SUS321 Specification

Selecting the correct specification ensures optimal performance and cost-efficiency. Consider the following factors when specifying SUS321 for your project:

Factor	What to Consider	Guidance
Product Form	Plate, sheet, coil, pipe, tube, bar, fitting?	Choose based on your application and fabrication method
Thickness / Size	What dimensions are required?	Check standard sizes first; custom sizes available but may cost more
Surface Finish	Is appearance important? What finish is needed?	2B for general industrial use; No.4/HL for decorative; Mirror 8K for premium
Service Temperature	What is the operating temperature range?	SUS321 is ideal for 425–900°C; below 425°C, SUS304 may suffice; above 900°C, consider SUS310S
Welding Requirement	Will the component be welded?	SUS321 is ideal for welded structures — Ti stabilization protects the HAZ without post-weld annealing
Corrosion Environment	What chemicals and chloride levels are present?	SUS321 ≈ SUS304 for aqueous corrosion; upgrade to SUS316L for chloride service
Standard / Specification	Which standard must it comply with?	Specify ASTM, JIS, EN, or GB standard and grade clearly (e.g., ASTM A240 321)
Certification Needs	What documentation is required?	Specify MTC 3.1, 3.2, third-party inspection (SGS/BV/TUV) at time of order
Ti Content Verification	How to confirm stabilization?	Request spectrochemical analysis verifying Ti ≥ 5×C on the MTC
Quantity & Lead Time	How much and how soon?	Standard sizes in stock ship faster; custom orders require more lead time

How to Verify Material Authenticity

Ensuring you receive genuine SUS321 material is critical, especially for applications where sensitization resistance is required. The key verification is the presence of titanium (Ti ≥ 5×C) — this is what distinguishes SUS321 from SUS304. Here are key methods:

Verification Method	Description	Reliability
Mill Test Certificate (MTC)	Official mill document showing heat number, full chemical composition (including Ti and C), and mechanical test results.	□□□□□
Spectrochemical Analysis	Laboratory OES analysis providing precise titanium and carbon content — critical for verifying $Ti \geq 5 \times C$ stabilization ratio.	□□□□□
PMI Testing (XRF)	Portable XRF can verify Cr and Ni but CANNOT detect carbon or low levels of titanium reliably — not sufficient alone for 321 vs 304.	□□□□□
Heat / Lot Number Traceability	Each coil/sheet/bundle has a unique heat number traceable to the mill MTC with full Ti and C data.	□□□□□
Intergranular Corrosion Test	ASTM A262 test to verify sensitization resistance — functional test confirming stabilization effectiveness.	□□□□□
Spark Test	Quick field test — grinding produces sparks. Cannot distinguish 321 from 304 reliably. Requires experienced operator.	□□□□□
Magnet Test	SUS321 is non-magnetic in annealed condition, same as SUS304. Not useful for distinguishing 321 from 304.	□□□□□

Required Certificates & Documentation

When purchasing SUS321 stainless steel, ensure you receive the appropriate documentation for quality assurance and regulatory compliance. Common requirements include:

- Mill Test Certificate (MTC) EN 10204 3.1: Standard for every order — includes chemical composition (with Ti and C verification), mechanical properties, and dimensional verification
- EN 10204 3.2 Certificate: For critical applications — third-party witnessed testing and independent verification of $Ti \geq 5 \times C$
- Third-Party Inspection Report: SGS, BV, or TUV inspection report as specified by customer
- Heat Treatment Report: Details of solution annealing process (980–1150°C followed by rapid cooling)
- NDT Inspection Report: Ultrasonic, eddy current, or hydrostatic test results as applicable
- Intergranular Corrosion Test Report: ASTM A262 test results confirming stabilization effectiveness
- Packing List & Commercial Invoice: Standard shipping and customs documentation
- Certificate of Origin: For customs clearance and trade compliance
- ISO 9001 Quality Certificate: Manufacturer quality system certification
- PED / Pressure Equipment Directive Certification: For pressure vessel applications (EU market)

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Frequently Asked Questions

Answers to common questions about SUS321 stainless steel. If you have additional questions, please contact our technical sales team for expert advice.

Q1. What is SUS321 stainless steel equivalent to?

SUS321 has several international equivalents: UNS S32100 (American), AISI 321 (American Iron and Steel Institute), EN 1.4541 / X6CrNiTi18-10 (European), 06Cr18Ni11Ti (Chinese GB), and SS 2337 (Swedish). All these grades have essentially the same chemical composition — 17–19% chromium, 9–12% nickel, with titanium at minimum 5× carbon content. The titanium stabilization is the defining feature of this grade.

Q2. What is the difference between SUS321 and SUS304?

SUS321 and SUS304 share the same base composition (17–19% Cr, 9–12% Ni). The key difference is the addition of titanium ($Ti \geq 5 \times C$) in SUS321. Titanium preferentially forms titanium carbides (TiC) instead of chromium carbides when heated in the 425–900°C range, preventing sensitization (chromium depletion at grain boundaries). This makes SUS321 highly resistant to intergranular corrosion after welding or high-temperature service, while SUS304 would be susceptible. SUS321 is typically 10–20% more expensive than SUS304.

Q3. Why is titanium added to SUS321?

Titanium is added to SUS321 as a "stabilizer." Titanium has a much stronger affinity for carbon than chromium. By adding titanium at a minimum of 5× the carbon content ($Ti \geq 5 \times C$), titanium preferentially forms stable titanium carbides (TiC) when the steel is exposed to the sensitization temperature range (425–900°C). This prevents chromium carbides ($Cr_{23}C_{12}$) from forming at grain boundaries, which would deplete chromium and cause intergranular corrosion. The TiC carbides are stable up to very high temperatures, providing permanent protection that does not degrade over time.

Q4. What is the maximum temperature for SUS321?

SUS321 can be used continuously at temperatures up to approximately 900°C (1650°F) in oxidizing environments. For intermittent service, the maximum is about 925°C (1700°F). This is slightly higher than SUS304 (870°C) because the TiC carbides provide some additional high-temperature stability. For temperatures above 900°C, consider SUS310S (up to 1150°C) or heat-resistant alloys. The key advantage of SUS321 is not its maximum temperature but its resistance to sensitization throughout the 425–900°C range.

Q5. Is SUS321 weldable?

Yes, SUS321 has excellent weldability and can be welded by all common methods: TIG (GTAW), MIG (GMAW), stick (SMAW), and spot welding. The recommended filler metal is ER347 (niobium-stabilized) rather than ER321, as the niobium provides better stabilization in the weld deposit. ER321 can also be used but ER347 is preferred. A key advantage of SUS321 is that post-weld solution annealing is NOT required for intergranular corrosion resistance — the titanium stabilization protects the heat-affected zone automatically.

Q6. Can SUS321 be hardened by heat treatment?

No, SUS321 (like all austenitic stainless steels) cannot be hardened by heat treatment. It can only be hardened by cold working (strain hardening). The only heat treatment used is solution annealing (typically 980–1150°C / 1796–2102°F followed by rapid cooling), which softens the material, restores ductility, dissolves any chromium carbides (but not the stable TiC carbides), and maximizes corrosion resistance.

Q7. What is the density of SUS321?

The density of SUS321 is approximately 7.99 g/cm³ (0.288 lb/in³ or 7990 kg/m³) at room temperature. This is slightly higher than SUS304 (7.93 g/cm³) due to the titanium addition. Density decreases slightly at elevated temperatures due to thermal expansion.

Q8. Is SUS321 magnetic?

SUS321 is essentially non-magnetic in the fully annealed condition, with magnetic permeability typically less than 1.01. However, cold working can induce partial transformation of austenite to martensite, resulting in slight magnetic permeability. This is similar to SUS304. Annealing restores the non-magnetic state.

Q9. What is the PREN value of SUS321?

The Pitting Resistance Equivalent Number (PREN) of SUS321 is approximately 18–20. Since SUS321 contains no molybdenum, the PREN is driven by chromium alone: $PREN = \%Cr + 3.3 \times \%Mo + 16 \times \%N \approx 18 + 0 + 0.2 \approx 18.2$. This is comparable to SUS304 (PREN ~18–20) and significantly lower than SUS316L (PREN ~24–27). For chloride environments, SUS316L is strongly preferred over SUS321.

Q10. SUS321 vs SUS316L — which should I choose?

Choose based on your primary concern: If you need intergranular corrosion resistance after welding in moderate high-temperature service (425–900°C), choose SUS321. If you need chloride/pitting corrosion resistance in marine or chemical environments, choose SUS316L. If you need BOTH, consider SUS316Ti (the titanium-stabilized version of 316) or use SUS316L with post-weld solution annealing. SUS321 is NOT a substitute for SUS316L in chloride service.

Q11. What standards apply to SUS321 pipe?

SUS321 pipe is covered by standards including: ASTM A312 (seamless and welded pipe for high-temperature and general corrosive service), ASTM A213 (seamless boiler, superheater, and heat-exchanger tubes), ASTM A269 (seamless and welded tube for general service), JIS G3459 (stainless steel pipes), JIS G3463 (stainless steel tubes for boiler and heat exchanger), and EN 10216-5 (seamless steel tubes for pressure purposes — stainless steel).

Q12. What filler metal should be used for welding SUS321?

The recommended filler metal for welding SUS321 is ER347 (niobium-stabilized) for TIG/MIG and E347-15 or E347-16 for stick welding. While ER321 (titanium-stabilized) filler is available, ER347 is generally preferred because niobium (columbium) has better stabilization characteristics in the weld pool — titanium can be lost during welding due to oxidation. For dissimilar welds between SUS321 and carbon steel, ER309 or E309 can be used. Preheating is not required.

Q13. When should I choose SUS321 over SUS304?

Choose SUS321 over SUS304 when: (1) the component will be welded and cannot be post-weld solution annealed, (2) the component will operate in the 425–900°C sensitization temperature range, (3) the application requires intergranular corrosion resistance after thermal cycling, or (4) the specification requires a stabilized grade. For general-purpose applications below 425°C without sensitization concerns, SUS304 is more economical and equally effective.

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Manufacturer Profile

GNEE Steel Co., Ltd. is a leading supplier and manufacturer of stainless steel products, headquartered in China with global distribution. With over 15 years of industry experience, we specialize in providing high-quality stainless steel materials to customers worldwide, serving industries including aerospace, automotive, chemical processing, power generation, and general manufacturing.

Available Products

- Stainless Steel Plate & Sheet: Hot rolled plate, cold rolled sheet, coil, strip — various finishes from No.1 to Mirror 8K
- Stainless Steel Pipe & Tube: Seamless pipe, welded pipe, precision tube, heat exchanger tube, U-bend tube
- Stainless Steel Bar & Wire: Round bar, square bar, hex bar, flat bar, angle bar, wire rod, wire mesh
- Stainless Steel Fittings & Flanges: Elbows, tees, reducers, caps, flanges (WN, SO, BL, SW, threaded)
- Available Grades: SUS304, 304L, 316, 316L, 321, 310S, 201, 430, 2205, 2507, and more
- Value-Added Services: Cutting, slitting, bending, welding, polishing, surface treatment, custom fabrication

Minimum Order Quantity (MOQ)

Product Form	Standard MOQ	Sample Order MOQ	Note
Plate / Sheet	500 kg	1 – 2 sheets	Small quantities available for stock sizes
Pipe / Tube	500 kg	10 – 50 meters	Small diameter tubes: lower MOQ possible
Bar / Rod	500 kg	10 – 50 kg	Cut-to-length samples available
Coil / Strip	1000 kg	100 – 500 kg	Slit strip: depends on width and gauge
Fittings / Flanges	10 pieces	1 – 5 pieces	Common sizes available from stock
Custom Fabrication	Project-based	—	Discuss with sales for custom requirements

Note: GNEE Steel offers flexible MOQ policies. We understand that every customer has unique requirements. Contact our sales team to discuss your specific needs — we will do our best to accommodate orders of all sizes.

Lead Time

Order Type	Standard Lead Time	Expedited Service	Note
Stock Items (ex-warehouse)	3 – 7 days	1 – 3 days	Ready to ship from inventory
Standard Production	10 – 20 days	7 – 12 days	For common sizes and specifications

Order Type	Standard Lead Time	Expedited Service	Note
Custom Size / Finish	15 – 30 days	—	Custom cutting, slitting, or special surface
Custom Fabrication	20 – 45 days	—	Depends on complexity and quantity
Sea Freight (to port)	20 – 35 days	—	Depending on destination port
Air Freight	5 – 10 days	3 – 5 days	For urgent small orders only
Express Courier (DHL/FedEx)	3 – 7 days	1 – 3 days	For samples and small packages

Contact GNEE Steel

Contact Method	Details
Company Name	GNEE Steel Co., Ltd.
Email	sales@gneestainless.com
Sales Email	sales@gneestainless.com
Telephone	+86 158 2468 7445
WhatsApp / WeChat	+86 158 2468 7445
Website	www.stainless-steels.com
Factory Location	Henan Province, China
Business Hours	Monday – Saturday: 9:00 – 18:00 (GMT+8)

Your Free Quote Today! Contact our experienced sales team for competitive pricing, technical consultation, and

Thank you for considering GNEE Steel as your stainless steel supplier. We look forward to serving you.