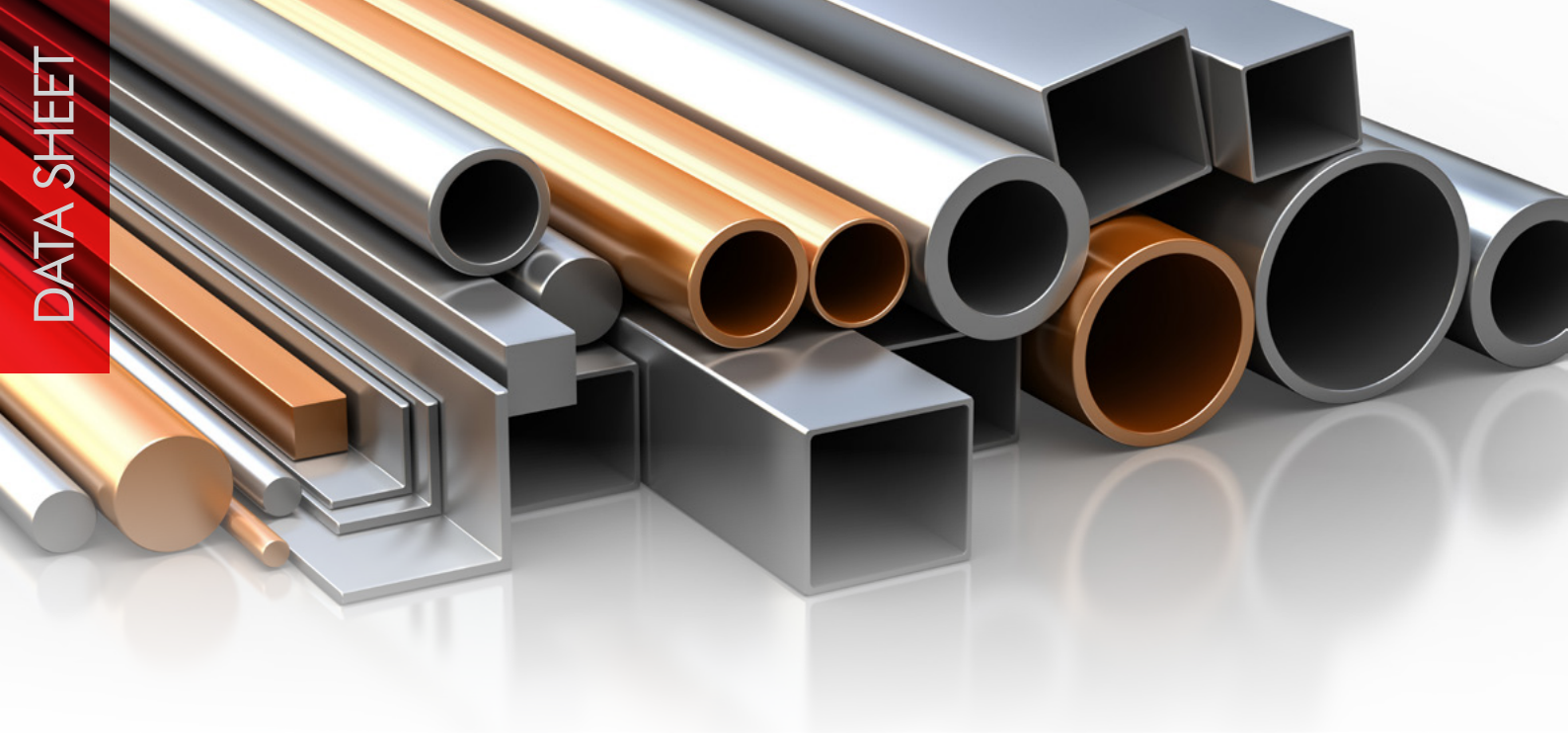
DATA SHEET




**Alloy 321** is titanium settled austenitic stainless steel with greater general corrosion resistance. It has phenomenal resistance to intergranular corrosion after presentation to temperatures in the chromium carbide precipitation scope of 800–1500°F (427–816°C). The alloy maintains oxidation to 1500°F (816°C) and has higher creep and stress rupture properties than alloys 304 and 304L. It also maintains good low temperature toughness.

**Alloy 321H** is the higher carbon (0.04–0.10) version of the alloy. It was produced to improve creep resistance and for higher strength at temperatures above 1000°F (537°C). In most occurrences, the carbon content of the plate enables dual certification. Alloy 321 cannot be hardened by heat treatment, just by cold working. It can be effectively welded and processed by standard shop fabrication practices.

## Applications

- Aircraft piston engine manifolds and exhaust stacks
- Expansion joints
- Thermal oxidizers
- Refinery equipment
- High temperature chemical process equipment
- Food Processing equipment and storage

## Characteristics

- Oxidation resistant to 1600°F
- Stabilized against weld heat affected zone (HAZ) intergranular corrosion
- Resists polythionic acid stress corrosion cracking



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# S. S. 321 / 321H

## Corrosion Resistance
Alloy 321 shows good general corrosion resistance that is similar to 304. It was created for use in the chromium carbide precipitation scope by 1800–1500°F (427–816°C) where un-stabilized alloys for example 304 are subject to intergranular attack. The alloy can be utilized in most diluted organic acids at moderate temperatures and in pure phosphoric acid at lower temperatures and up to 10% diluted solutions at high temperatures. Alloy 321 opposes polythionic acid stress corrosion cracking in hydrocarbon service. It can also be used in chloride or fluoride free caustic solutions at moderate temperatures. Alloy 321 does not perform well in chloride solutions, even in small concentrations, or in sulfuric acid service.

## Machining
304 stainless are not tougher than 321 stainless, this material will produce the same tough stringy chips. To work harden; slow speeds and heavy feeds will minimize this alloy's tendency.

## Welding
321 Stainless steels is promptly welded by all common technique, including submerged arc. Suitable weld fillers are most frequently specified as AWS E/ER 347 or E/ER 321. This alloy is mostly considered to have comparable weldability to 304 and 304L stainless with the prime difference being the titanium addition which removes or prevents carbide precipitation during welding.

## Hot Working
Working temperatures of 2100-2300 F (1149-1260 C) are suggested for forging, upsetting and other hot work process. Don't work this alloy at temperatures beneath 1700 F (927 C). Material must be water quenched or completely annealed after working to reattain maximum corrosion resistance.

## Cold Working
In spite of the fact that this material requires higher initial forces than 304 stainless steels, it is slightly tough and ductile and can be easily stamped, blanked, spun and drawn.

## Annealing
Annealing at 1800-2000 F (928-1093 C) air cool. This process will result in maximum ductility. For maximum corrosion resistance, see the note on settled anneal under corrosion.

## Hardening
This alloy doesn't harden by heat treating. High properties may only be obtained through cold reduction.

## Chemical Properties

| Grade | C | N | Si | P | S | Cr | Mn | Ni | Fe | Ti |
|---|---|---|---|---|---|---|---|---|---|---|
| **321** | 0.08 max | 0.10 max | 1.0 max | 0.045 max | 0.03 max | 17.0-19.0 | 2.0 max | 9.0-12.0 | Remainder | 5x(C+N)-0.70 |
| **321H** | 0.04-0.10 | 0.10 max | 1.0 max | 0.045 max | 0.03 max | 17.0-19.0 | 2.0 max | 9.0-12.0 | Remainder | 4x(C+N)-0.70 |



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# S. S. 321 / 321H

## Mechanical Properties

| Tensile Strength (ksi) | 0.2% Yield Strength (ksi) | Elongation% in 2 inches |
|---|---|---|
| 75 | 30 | 40 |

## Physical Properties

| Properties | Units | Temperature in °C |
|---|---|---|
| Density | 7.92 g/cm$^3$ | Room |
| Specific Heat | 0.12 Kcal/kg.C | 22° |
| Melting Range | 1371-1400 °C | - |
| Modulus of Elasticity | 193 KN/mm$^2$ | 20° |
| Electrical Resistivity | 72 µΩ.cm | Room |
| Coefficient of Expansion | 16.6 µm/m °C | 20-100° |
| Thermal Conductivity | 16.0 W/m-°K | 20° |

## ASTM Specifications

| Pipe / Tube (SMLS) | Sheet / Plate | Bar | Forging | Fitting |
|---|---|---|---|---|
| A 213, A 249 | A 167, A 240 | A 276 | A 182 | A 403 |

## Availability

| MANUFACTURING |
|---|
| Refractory Anchors |
| Fasteners |
| Custom Machining |
| Custom Fabrication |
| Piping / Spools |
| Stamped Parts |
| B/W Fittings |
| S/W Fittings |
| Flanges |
| Compression Fittings |

| RAW MATERIALS |
|---|
| Pipes |
| Tubes |
| Bars |
| Sheets |
| Plates |
| - |
| - |
| - |
| - |