

## Introduction

Cromgard C21 is a high strength, low nickel grade of stainless steel. The chemical composition is controlled to create a material with the structure and properties of more highly alloyed duplex grades of stainless steel but at a lower and more stable cost. Cromgard C21 has better corrosion resistance than Type 304L in most applications and performs as well as Type 316L in many environments while at the same time having the higher strength characteristics of duplex stainless steels.

When heat treated properly, Cromgard C21 has a microstructure of nearly

equal proportions of austenite and ferrite. The resulting microstructure and composition of Cromgard C21 provide stress corrosion cracking (SCC) resistance that is superior to that of austenitic stainless steels such as Type 304 or Type 316.

The yield strength of Cromgard C21 is more than double that of austenitic stainless steels such as grades 304L and 316L. This strength advantage often allows down gauging in the design, depending on Young's Modulus and buckling limitations.

## Applications

Cromgard C21 products are well suited for applications requiring high strength and good resistance to general corrosion. Its excellent strength, toughness, corrosion resistance and resistance to stress corrosion cracking (SCC) make Cromgard C21 suitable for applications such as:

- Subsea Oil & Gas
- Top Side Oil & Gas
- Pipes & Tubes
- Storage Tanks
- Power Generation
- Transport Tanks
- Heat Exchangers
- Cosmetic Architectural
- Structural Architectural

## Specifications Coverage

Cromgard C21 is covered in ASTM specifications A240 (plate, sheet and strip), A789 (welded tube) and A790 (welded pipe). In 2013 Cromgard C21 is anticipated for approval for ASME Boiler and Pressure Vessel Code use as well as other product forms.

## Corrosion Resistance

Cromgard C21 is resistant to dilute reducing acids and moderate concentrations of oxidizing acids. The alloy is also resistant to low concentrations of organic acids.

Plain and welded samples of Cromgard C21 were exposed for over 1000 hours in a salt fog cabinet per ASTM B117. No signs of rust or pitting were observed.

## ***Pitting Corrosion Resistance***

A relative determination of the resistance to chloride-ion pitting and crevice corrosion can be measured using the method described in ASTM Standard G 150. The temperature at which attack is first observed is called the critical pitting temperature (CPT) and can be used as a relative measure of pitting corrosion resistance. The CPT criterion is useful in ranking alloys, but does not necessarily indicate an absolute limiting temperature for the use of a particular alloy in chloride bearing environments. Test data shows that Cromgard C21 has a CPT of 72°F (22°C), which is slightly better than that of Type 316L.

The critical crevice corrosion temperature as measured by ASTM Standard G 48 usually follows the same trend among a group of alloys as the critical pitting temperature does.

Where pitting corrosion is anticipated, steel with high pitting resistance equivalents (PRE), such as Cromgard C21, should be considered.

The PRE number for Cromgard C21 is 26

---

## ***Atmospheric Corrosion***

The atmospheric corrosion resistance of Cromgard C21 is very good. Cromgard C21 more than sufficient in urban and industrial environments and is normally well suited for many marine environments .

---

## ***Welding***

Cromgard C21 can be welded by most methods used to weld stainless steels. Autogenous welding will increase the amount of ferrite present in the weldment and adjacent areas of the base metal. If Cromgard C21 is autogenously welded, the fabrication should be solution annealed to restore the desirable microstructure and hence the toughness. A nitrogen addition is recommended to preserve corrosion resistance and strength.

Commercially available overmatched filler metals are suggested for welding Cromgard C21. Such filler metals, like AWS E2209, contain more nickel than the base metal in order to produce a phase balance within the weld that is approximately the same as the base metal.

When Cromgard C21 is welded to different metals, a filler metal should be chosen that contains a quantity of austenite forming elements that is sufficient to produce a fully austenitic weld. Non-Filler metal welds should be heat treated for optimum corrosion resistance and formability.



## Chemical Composition

Element	Range
Carbon	0.030 max
Silicon	1.000 max
Manganese	2.000 - 3.000
Phosphorus	0.040 max
Sulfur	0.020 max
Chromium	20.500 - 23.500 max
Nickel	1.000 - 2.000
Nitrogen	0.150 - 0.270
Molybdenum	0.100 - 1.000
Iron	Balance

Per ASTM A240

## Mechanical Properties

Property	Value
Tensile Strength (ksi) ≤ 4.76 mm Thickness	100
Tensile Strength (ksi) > 4.76 mm Thickness	95
0.2% Proof Strength (ksi) ≤ 4.76 mm Thickness	75
0.2% Proof Strength (ksi) > 4.76 mm Thickness	65
Elongation*	30%

Per ASTM A240

Values are minimum unless stated

\* Elongation over a length of 50.8mm

## Physical Properties

Property	Value
Density (lb/in <sup>3</sup> )	0.28
Modulus of Elasticity	Tension (GPa) 200
Poisson's Ratio	0.31
Magnetic	Yes

Per ASTM A240



CROMMCAUS10252010

Note: This data sheet is intended as a source of information, and as an ongoing service for the benefit of Cromgard C21 users and specifiers. However, Cromption International cannot be held responsible either for the suitability of the steel in question for any particular purpose, or for the performance or selection of the steel, on the basis of the information contained herein or otherwise; unless Cromption International has specifically authorized the purpose or selection. Cromption International shall not be liable in the event of a breakdown or malfunction occurring due to faulty design, material or workmanship of the steel, whether based on the information contained herein or not, and shall not under any circumstances be liable for any damages, either direct or indirect, particularly consequential damages, including but not limited to damages for loss of profits arising from the installation and use of such steel.

Please visit us at [cromption.com](http://cromption.com)