Cromgard C21

CROMPION INTERNATIONAL

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^3)		0.28
Modulus of Elasticity	Tension (GPa)	200
Poisson's Ratio		0.31
Magnetic		Yes

Per ASTM A240

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