Cromgard C23

Introduction

Cromgard C23 has a microstructure, when heat treated properly, of nearly equal proportions of austenite and ferrite. This microstructure ensures that the grade is much more resistant to stress corrosion cracking (SCC) than austenitic stainless steels.

The yield strength of Cromgard C23 is more than double that of austenitic stainless steels such as grades 304L and 316L. This often allows down gauging in the design, depending on Young's Modulus and buckling limitations.

Cromgard C23 has a ductile to brittle transition temperature of about -40°C or lower. This grade can also become embrittled when exposed to temperatures between 300°C and 550°C. (475°C embrittlement) and 550°C and 1,000°C (sigma (σ) and chi (χ) phase formation). Thus, application temperatures are generally limited from -50°C to 300°C.

Applications

Cromgard C23 has similar general and pitting corrosion resistance to the grade 316L stainless steel. Its excellent strength, toughness, corrosion resistance and resistance to stress corrosion cracking (SCC) make Cromgard C23 suitable for applications such as process and storage tanks, food and beverage applications as well as several structural applications. Cromgard C23 should be used in applications requiring better corrosion resistance, such as environments containing chlorides and polluted marine environments, desalinization plants, etc.

Corrosion Resistance

Cromgard C23 generally has similar general corrosion resistance to the 316L grades of stainless steel. This grade of stainless steel should be considered in many applications where 316L may be specified or has been previously used.

Pitting Corrosion

Pitting resistance is important, mainly in applications involving contact with chloride solutions, particularly in the presence of oxidizing media. These conditions may be conducive to localized penetrations of the passive surface film on the steel and a single deep pit will be more damaging than a much greater number of relatively shallow pits.

Where pitting corrosion is anticipated, steel with high pitting resistance equivalents (PRE), such as Cromgard C23, should be considered. The PRE number for Cromgard C23 is 26

Atmospheric Corrosion

The atmospheric corrosion resistance of Cromgard C23 is unequalled by virtually all other uncoated engineering materials. Cromgard C23 more than sufficient in urban and industrial environments and is normally well suited for most marine environments .

Welding

Cromgard C23 has good weldability in most applications, provided that the recommended procedures are adopted. It can be welded with most standard welding methods (MMA/SMAW, MIG/GMAW, TIG/GTAW, FCAW SAW and PAW). If the material is autogenously welded, the fabrication should be solution annealed to restore the desirable microstructure and hence the toughness.

Only welding consumables specifically specified for the grade should be used to ensure that the deposited metal has the correctly balanced microstructure. Grade 2209 filler welding electrodes are recommended for optimum properties. Nitrogen, added to the shielding gas, will also assist in ensuring adequate austenite in the microstructure

The heat input should be controlled to between 1-2kJ/mm in order to keep the Heat Affected Zone (HAZ) narrow and to ensure there is at least 20% austenite in the HAZ. The interpass temperatures should not exceed 150°C. The lower coefficient of thermal expansion of the grade, compared to austenitic stainless steels, reduces distortion and the associated stresses.

Preheating, although not essential, is beneficial on the thicker gauge sections. Typical preheat temperatures are between 100°C and 250°C. Post weld heat treatment is not normally required, but solution annealing will restore the toughness and confer the optimum stress corrosion cracking resistance to the fabrication.

Chemical Composition

Element	Range (%)
Carbon	0.030 max
Silicon	1.000 max
Manganese	2.000 max
Phosphorus	0.035 max
Sulfur	0.015 max
Chromium	22.00 - 24.00
Nickel	3.500 - 5.500
Nitrogen	0.050 - 0.200
Molybdenum	0.100 - 0.600
Other	Cu-0.100 - 0.600

Per ASTM A240 & EN 1.4362

Mechanical Properties

Property	Value
Tensile Strength (ksi) ≤ 6mm Thickness	94
Tensile Strength (ksi) > 6mm Thickness	91
0.2% Proof Strength (ksi)) ≤ 6mm Thickness	65
0.2% Proof Strength (ksi)) > 6mm Thickness	58
Elongation*	25%

Per ASTM A240 and EN-10088-2
Values are minimum unless stated
* Elongation over a length of 50.8 mm

Physical Properties

Property		Value
Density (lb./in^3)		0.28
Modulus of Elasticity	Tension (GPa)	200
Specific Heat Capacity (J/kg K)		470
Thermal Conductivity	100° C (W/m K)	17.0
	500°C (W/m K)	21.1
Resistivity (x10-9 Ωm)		610
Coefficient of Thermal Expansion	0-100°C (x10-6 K-1)	13.0
	0-300°C (x10-6 K-1)	14.0
	0-500°C (x10-6 K-1)	14.5
	0-700°C (x10-6 K-1)	15.0
Melting Point (°C)		1410-1460
Magnetic		YES

Per ASTM A240 & EN 1.4362

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