

Introduction

Cromgard C20-1 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 C20-1 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 C20-1 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.

Cromgard C20-1 has similar general and pitting corrosion resistance to 304L stainless steel. The excellent strength, toughness, corrosion resistance and resistance to stress corrosion cracking (SCC) make Cromgard C20-1 suitable for applications such as process and storage tanks, some food and beverage applications as well as several structural applications.

Corrosion Resistance

Cromgard C20-1 generally has similar general corrosion resistance to that of the 304L grade of stainless steel. However, this is dependant on the corrosion media. For example, Cromgard C20-1 has significantly better corrosion resistance than 316L in sulphuric acid (H₂SO₄) solutions.

Atmospheric Corrosion

The atmospheric corrosion resistance of Cromgard C20-1 is unequalled by virtually all other uncoated engineering materials. Cromgard C20-1 is normally sufficient in urban and industrial environments.

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 equivalent number (PREN), such as Cromgard C20-1, should be considered. The PREN for Cromgard C20-1 is 22.5.

Welding

Cromgard C20-1 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	4.000 - 6.000 max
Phosphorous	0.035 max
Sulfur	0.015 max
Chromium	19.50 - 21.50
Nickel	1.000 - 3.000
Nitrogen	0.050 - 0.170
Molybdenum	0.600 max
Other	Cu - 1.000 max

Per ASTM A240

Mechanical Properties

Element	Range
Tensile Strength	90
0.2 % Proof Strength (ksi)	65
Elongation*	25%

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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 - 1560
Magnetic	Yes

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Note: This data sheet is intended as a source of information, and as an ongoing service for the benefit of Cromgard C20-1 users and specifiers. However, Crompton 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 Crompton International has specifically authorized the purpose or selection. Crompton 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.

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