

41003

STAINLESS STEEL



Coal Hopper Cars
Shipping Containers
Street Sweepers
Truck Frames

41003 STAINLESS STEEL is a ferritic stainless steel that provides excellent weldability, toughness, and fabricating characteristics. These properties make the material an excellent choice for applications such as tubing and sheet for bus frames, coal hopper cars, street sweepers, chutes, shipping containers, ISO shipping container frames and other equipment requiring low life-cycle costs.

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Product Description

Cleveland-Cliffs 41003 is an 11% chromium (Cr) ferritic stainless steel with low carbon (C) and nitrogen (N) and small additions of manganese (Mn) and nickel (Ni). Exposure to elevated temperatures, such as welding, leads to a refined grain structure of ferrite and low-carbon martensite. The alloy exhibits good impact resistance at low temperatures and is still ductile after rapid cooling from above the critical austenite temperature.

Composition		(wt %)
Carbon	(C)	0.03 max.
Manganese	(Mn)	1.50 max.
Phosphorus	(P)	0.040 max.
Sulfur	(S)	0.030 max.
Silicon	(Si)	1.00 max.
Chromium	(Cr)	10.50 – 12.50
Nickel	(Ni)	1.50 max.
Nitrogen	(N)	0.030 max.
Iron	(Fe)	Balance

AVAILABLE FORMS

Cleveland-Cliffs produces 41003 in coils and cut-to-length thicknesses from 0.050 – 0.250 in. (1.270 to 6.4 mm) in widths up to and including 48 in. (1219 mm). For other sizes, contact your Cleveland-Cliffs sales representative.

Values shown in this bulletin were established in U.S. customary units. The metric equivalents of U.S. customary units shown may be approximate.

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Mechanical Properties

TABLE 1 – TYPICAL MECHANICAL PROPERTIES

UTS, ksi. (MPa)	0.2% YS, ksi. (MPa)	Elongation % in 2 in. (50.8 mm)	Rockwell Hardness, B
75 (503)	50 (345)	26	80

TABLE 2 – MINIMUM PROPERTIES ACCEPTABLE FOR MATERIAL SPECIFICATION*

Condition	UTS, ksi. (MPa)	0.2% YS, ksi. (MPa)	Elongation % in 2 in. (50.8 mm)	Rockwell Hardness, C
Annealed	66 (455)	40 (275)	18.0	20

*ASTM A240

TABLE 3 – TYPICAL CHARPY V-NOTCH IMPACT PROPERTIES*

Sample Condition	Temperature, °F (°C)	Longitudinal Impact, ft. • lb./in. ² (J/cm ²)	Transverse Impact, ft. • lb./in. ² (J/cm ²)
Cold-Rolled + Annealed + Pickled	Room Temperature	975 (205)	642 (135)
Cold-Rolled + Annealed + Pickled	-22 (-30)	915 (192)	488 (103)

*Nominal 0.100 in. (2.5 mm) sheet.

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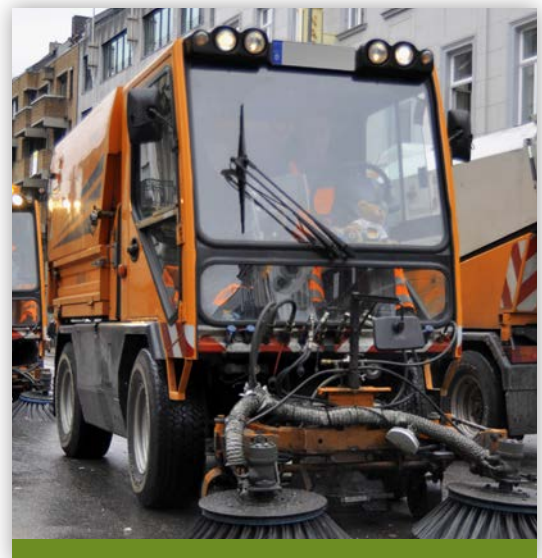
Properties

CORROSION RESISTANCE

The corrosion behavior of Cleveland-Cliffs 41003 provides moderate resistance to atmospheric and neutral chloride corrosion. However, it is not recommended for applications where surface appearance is critical, as it is prone to localized pitting corrosion. Like most 11 – 14% chromium alloys, in highly acidic environments, this grade can undergo uniform corrosive attack that will result in high corrosion rates. Caution should be exercised when considering this alloy in environments of such extreme conditions.

WELDABILITY

The ferritic class of stainless steels is generally considered to be weldable by common fusion and resistance techniques. Special consideration is required to avoid brittle weld fractures during fabrication by minimizing discontinuities, maintaining low weld heat input and occasionally warming the part somewhat before forming. Cleveland-Cliffs 41003 is considered to have better weldability in heavy sections compared to Type 409. This is due to the addition of manganese and nickel, which results in finer Heat-Affected Zones (HAZ) and weld structures that improve impact toughness and formability in heavy sections. When a weld filler is needed, AWS Classification ER/EC309L and E309LT0-3 wires are most often specified. Cleveland-Cliffs 41003 exhibits excellent tube welding characteristics due to its fine grain size, especially in sections over 0.100 in. (2.54 mm).



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Formability

Because of its low work hardening rate and finer grain structure, Cleveland-Cliffs 41003 exhibits excellent overall formability amongst the other ferritic stainless steels in the cold-rolled and annealed sheet form condition shown in Figure 1.

**FIGURE 1 – FORMING LIMIT CURVE
CLEVELAND-CLIFFS 41003, 0.061 IN. THICK**

Determined Using CamSys Localized Nodal Strain Measurement Method 0.1 in. Square Grid Pattern

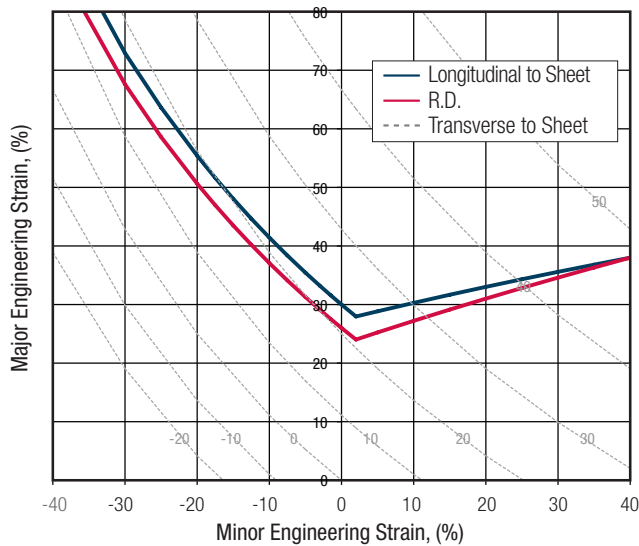


TABLE 4

Property*	Orientation to Sheet R.D.		
	L	D	T
0.2% YS, ksi. (MPa)	43.3 (299)	46.5 (320)	50.2 (346)
UTS, ksi. (MPa)	65.2 (450)	65.0 (448)	69.4 (478)
% El. in 2 in. (man'l)	30.9	34.9	30.1
n-Value (10% – Ult.)	0.192	0.192	0.180
Strength Coeff., ksi. (MPa)	108.9 (751)	108.2 (746)	113.4 (782)
HRBW	73.0		
ASTM Grain Size	8/8.5		
R	0.52	1.09	0.96
R _m	0.92		
delta r	0.35		
delta r (Max. – Min.)	0.57		
Ridging No.	1		
Olsen Cup Height	0.46 in. (11.7 mm)		
LDR	2.0		

*Tensile/Hardness Test (ASTM E8, E694, E18, A370)
Stretch r (plastic strain ratio) at 18% (ASTM E517)



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About Cleveland-Cliffs Inc.

Cleveland-Cliffs is the largest flat-rolled steel producer in North America. Founded in 1847 as a mine operator, Cliffs also is the largest manufacturer of iron ore pellets in North America. The Company is vertically integrated from mined raw materials and direct reduced iron to primary steelmaking and downstream finishing, stamping, tooling, and tubing. The Company serves a diverse range of markets due to its comprehensive offering of flat-rolled steel products and is the largest steel supplier to the automotive industry in North America. Headquartered in Cleveland, Ohio, Cleveland-Cliffs employs approximately 25,000 people across its mining, steel and downstream manufacturing operations in the United States and Canada.



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