
Stainless Steel 3CR12 Grade Data Sheet

3CR12

This "utility stainless steel" is a fairly recent modification of 12% chromium stainless steel grades 409 and 410. It has been developed as a readily fabricated, low cost grade, exhibiting good resistance to wet abrasion and mildly corrosive environments. This grade is covered by Euronorm designation 1.4003 and also ASTM UNS S40977 / S41003.

Corrosion Resistance

1.4003 is effective in many applications where carbon steel, galvanised, aluminised or painted steel or aluminium give unsatisfactory life. It is not attacked by strong alkalies, and often gives adequate resistance in mildly acidic conditions. Light surface rust can form in many atmospheres, making the material unsuitable for decorative applications.

1.4003 strongly resists chloride stress corrosion cracking, but is less resistant than 304 to pitting and crevice corrosion in chloride environments. 1.4003 is likely to resist water with chloride contents of up to 100 to 200 mg/L at ambient temperatures. The presence of sulphate or nitrate ions will reduce the corrosivity of chlorides. As the grade is not stabilised it can be susceptible to intergranular corrosion in certain circumstances.

Heat Resistance

In air 1.4003 offers scaling resistance to 620°C continuous or 730°C intermittent, but if under stress the temperature should be limited to 450°C continuous or 600°C intermittent. 1.4003 suffers negligible embrittlement after extended exposure at temperatures of 450-550°C; it can be used safely at these temperatures without loss of room temperature impact resistance.

Heat Treatment

Annealing

Heat to 700-750°C, soak for 1½ hours per 25mm section. Air cool. The maximum temperature of 750°C should not be exceeded. Annealing should usually be followed by pickling and passivating.

This grade should not be hardened by heat treatment; quenching treatments may reduce the corrosion resistance and mechanical properties.

Welding

1.4003 can be readily welded using similar techniques to austenitic stainless steels. Low heat input processes are preferred - particularly GTAW (TIG) and GMAW (MIG). Filler wire pre-qualified by AS 1554.6 (1.4003 referred to as "4003") is grade 309, but 309L, 309Mo, 316L and 308L have been successfully used. Argon plus 1-2% oxygen shielding gases are recommended.

Discolouration of the weld should be removed by pickling, except possibly in wear applications; effective purging and use of backing gases is often a better option.

Machining

1.4003 has a machinability similar to that of grade 430, i.e. about 60% of that of mild steel. The work hardening rate is lower than that of austenitic stainless steels, so reducing the need for special machining techniques.

Finishes

1.4003 is available in standard HRAP (Hot Rolled Annealed and Pickled) finish in plate, and 2B or 2D in coil and sheet.

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Typical Applications

Mining and mineral processing and transport equipment. Sugar processing equipment. Furnace and oven parts.

Specified Properties

These properties are specified for flat rolled product (plate, sheet and coil) in Euronorm EN 10088.2 1.4003 and ASTM A240/A240M S40977 and S41003. Similar but not necessarily identical properties apply for other products (1.4003 bar is covered by EN 10088-3), but this grade is almost exclusively a flat rolled product.

Composition Specification (%)

Grade		C	Mn	Si	P	S	Cr	Mo	Ni	N
1.4003 S40977	min.	-	-	-	-	-	10.50	-	0.30	-
	max.	0.030	1.50	1.00	0.040	0.015	12.50		1.00	0.030
S41003	min.	-	-	-	-	-	10.5	-	-	-
	max.	0.030	1.50	1.00	0.040	0.030	12.5		1.50	0.030

Mechanical Property Specification

Grade	Tensile Strength (MPa)	Yield Strength 0.2% Proof Stress (MPa) min.	Elongation (% in 50mm) min.	Hardness	
				Rockwell B (HR B) max.	Brinell (HB) max.
1.4003 (1)	450 - 650	280 (long), 320 (trans)	20	-	-
S40977	450 min.	280	18	HR B88	180
S41003	455 min.	275	18	HR C20	223

(1) Properties specified for cold rolled coil and hot rolled coil plate. Quarto plate has different values.

Physical Properties (Typical values in the annealed condition)

Grade	Density (kg/m ³)	Elastic Modulus (GPa)	Mean Coefficient of Thermal Expansion			Thermal Conductivity at 100°C (W/m.K)	Specific Heat 0-100°C (J/kg.K)	Electrical Resistivity (nΩ.m)
			20-100°C (µm/m/°C)	20-300°C (µm/m/°C)	20-500°C (µm/m/°C)			
1.4003	7700	220	10.4	11.2	11.9	25	430	600

Source: EN 10088-1

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Grade Specification Comparison

Grade	UNS No	Euronorm		Swedish SS	Japanese JIS
		No	Name		
1.4003	S41003 or S40977	1.4003	X2CrNi12	-	-

These comparisons are approximate only. The list is intended as a comparison of functionally similar materials **not** as a schedule of contractual equivalents. If exact equivalents are needed original specifications must be consulted.

Possible Alternative Grades

Grade	Why it might be chosen instead of 1.4003
3CR12Ti	Improved resistance to sensitisation and intergranular corrosion is needed.
304	Better corrosion resistance and fabrication properties are required.
Galvanised steel	A lower cost is required, and the reduced corrosion resistance and fabrication characteristics of galvanised steel are acceptable.
Weathering steel	A lower cost is required, and the reduced corrosion resistance and fabrication characteristics of weathering steel are acceptable.

Limitation of Liability

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