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## Stainless Steel 3CR12Ti Grade Data Sheet

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### 3CR12Ti

This "utility stainless steel" is a proprietary modification of Grade 409 12% chromium stainless steel. It has been developed as a readily fabricated, low cost grade, exhibiting good resistance to wet abrasion and mildly corrosive environments; the titanium stabilised composition results in excellent resistance to sensitisation in welding, particularly of thin sections.

There are no national specifications or international specifications covering this grade.

### Corrosion Resistance

3CR12Ti is effective in many applications where carbon steel, galvanised, aluminised or painted steel or aluminium give unsatisfactory life. It is not attacked by strong alkalis, and often gives adequate resistance in mildly acidic conditions. Light surface rust can form in many atmospheres, making the material unsuitable for decorative applications.

3CR12Ti strongly resists chloride stress corrosion cracking, but is less resistant than 304 or 430 to pitting and crevice corrosion in chloride environments. 3CR12Ti is likely to resist pitting in 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. 3CR12Ti is titanium stabilised to be more resistant to sensitisation and intergranular corrosion compared to alternative grades such as 3CR12 (1.4003).

### Heat Resistance

In air 3CR12Ti 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.

3CR12Ti suffers negligible embrittlement after extended exposure at temperatures of 450-550°C.

### 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

3CR12Ti is resistant to the sensitisation and intergranular corrosion that can occur in welding of unstabilised stainless steels. It can be welded using similar techniques to austenitic stainless steels. Low heat input processes are preferred - particularly GTAW (TIG) and GMAW (MIG). Filler wire recommended is grade 309L; this over-alloyed grade is important for welding 3CR12Ti to other steels, but 316L and 308L have also been successfully used when welding 3CR12Ti to itself. Heat inputs should be controlled to 0.5 to 1.5kJ/mm. 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. Standard stainless steel pickling pastes can cause higher attack than they do on austenitic grades; these should be used with caution.

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### Machining

3CR12Ti 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

3CR12Ti is available in standard No1 (“HRAP” – Hot Rolled Annealed and Pickled) finish in sheet, plate and coil down to 3mm thickness, and as cold rolled 2B finish in lighter gauges.

### Typical Applications

Mining and mineral processing and transport equipment. Rail wagons for coal and iron ore. Sugar processing equipment. Furnace and oven parts.

### Specified Properties

These properties are specified for flat rolled product (plate, sheet and coil). Similar but not necessarily identical properties apply to other products such as pipe and bar, but this grade is almost exclusively a flat rolled product.

### Composition Specification (%)

Grade		C	Mn	Si	P	S	Cr	Mo	Ni	Ti
3CR12Ti	min.	-	-	-	-	-	10.50	-	-	4(C+N)
	max.	0.030	2.00	1.00	0.040	0.030	12.50		1.50	0.6

These properties are specified for the proprietary grade 3CR12Ti. There are no national or international specifications covering this grade.

### Mechanical Property Specification

Grade	Thickness (mm)	Tensile Strength (MPa)	Yield Strength 0.2% Proof Stress (MPa)	Elongation (% in 50mm) min.	Hardness Brinell (HB) max.	Impact Energy (J/cm <sup>2</sup> )
3CR12Ti	<3	460 min.	280 min.	18	220	-
	3 – 4.5	460 min.	300 min.	18	220	-
	>4.5 - 12	460 min.	300 min.	20	220	-
	>12	460 min.	300 min.	20	250	-

These properties are specified for the proprietary grade 3CR12Ti. There are no national or international specifications covering this grade. Special properties are available for applications such as rail wagons.

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### Physical Properties (Typical values in the annealed condition)

Grade	Density (kg/m <sup>3</sup> )	Elastic Modules (GPa)	Mean Coefficient of Thermal Expansion			Thermal Conductivity		Specific Heat 0-100°C (J/kg.K)	Electrical Resistivity (nΩ.m)
			0-100°C (µm/m/°C)	0-300°C (µm/m/°C)	0-500°C (µm/m/°C)	at 100°C (W/m.K)	at 500°C (W/m.K)		
3CR12Ti	7700	200	11.1	11.7	12.3	30	40	480	678

### Grade Specification Comparison

Grade	UNS No	Euronorm		Swedish SS	Japanese JIS
		No	Name		

There are no national or international specifications covering the proprietary grade 3CR12Ti.

### Possible Alternative Grades

Grade	Why it might be chosen instead of 3CR12Ti
3CR12 (1.4003)	Requirement for a similar grade that is included in national standards and in pressure vessel codes. 1.4003 / 3CR12 is not weld stabilised.
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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