Stainless Steel 444 Grade Data Sheet

Grade 444

444 is a stabilised chromium-molybdenum ferritic stainless steel, combining very good corrosion resistance with good formability and weldability. Its excellent corrosion resistance enables it to replace grade 316 in many applications; domestic hot water cylinders are its largest field of application. Like all ferritic steels it is readily attracted to a magnet.

444 is most commonly available in sheet or coil up to about 2mm thick.

Corrosion Resistance

444 has good resistance in a wide variety of corrosive media. It attains its maximum corrosion resistance when in the highly polished or buffed condition.

The resistance of grade 444 to pitting and crevice corrosion in chloride environments is similar or superior to that of grade 316. Its PRE value of about 25 is at least as high as that of 316. Chloride stress corrosion cracking (SCC) resistance of 444 is very high, as it is for all ferritic grades.

The resistance of 444 to acids is generally lower than that of 316, but performance varies for different acids, and these should be considered on a case by case basis.

Heat Resistance

444 resists oxidation in intermittent service up to 920°C and to 870°C in continuous service but it may become brittle at room temperature after prolonged heating in the 400 – 500°C range. This effect can be corrected by subsequent annealing.

Heat Treatment

Annealing

Heat to approximately 925°C, hold for only a few minutes and then water quench or quickly air cool. Slow cooling from 500-400°C will cause embrittlement.

444 is not hardenable by thermal treatment.

Welding

Welding of 444 can be readily carried out by all the common electric processes. As 444 has very low carbon and nitrogen contents and is stabilised by additions of titanium and / or niobium it has good resistance to sensitisation and hence intergranular corrosion. Like most ferritic grades it is subject to significant grain growth in the heat affected zones of welds. Heat input should therefore be kept to a minimum, and welding of thicknesses over 2mm become more difficult.

Gas shielding of the arc, weld metal and back side of the weld is important to minimise air contact. Use Grade 316L (or 316LSi) filler rod, depending upon application. AS 1554.6 pre-qualifies welding (listed as Grade 444) with Grade 316L filler rods and electrodes.

Machining

444 is easier to machine than the standard austenitic grades such as 316, but the grade is not commonly available as a bar.

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Fabrication

444 has a higher yield strength, higher tensile strength and lower work hardening rate compared to 316. Some operations will therefore be easier, and some will require a little more force. The lower ductility of 444 restricts some very severe operations. It has quite good deep drawing capability; close to that of 316, but it has limited ability to stretch form. As these two processes are often combined in a single forming operation some changes to settings or tooling compared to the austenitic grades may be needed.

If very severe cold working is required, it may be necessary to carry out an intermediate anneal.

Typical Applications

Hot water cylinders, heat exchanger tubing, chemical process equipment, architectural panels.

Specified Properties

The composition and mechanical properties are specified for flat rolled product (plate, sheet and coil) in ASTM A240/A240M, for grade 444 (UNS S44400). Similar but not necessarily identical properties are specified for other products in their respective specifications.

Composition Specification (%)

Grade		C	Mn	Si	P	S	Cr	Mo	Ni	N	Ti+Nb
444	min.	-	-	-	-	-	17.5	1.75	-	-	0.20+4(C+N)
	max.	0.025	1.00	1.00	0.040	0.030	19.5	2.50	1.00	0.035	0.80

Mechanical Properties

Grade	Tensile Strength (MPa) min.	Yield Strength 0.2% Proof (MPa) min.	Elongation (% in 50mm) min.	Hardness		Cold Bend Traverse direction Bend radius = 1T
				Rockwell B (HR B) max.	Brinell (HB) max.	
444	415	275	20	96	217	180°

Physical Properties (Typical values in the annealed condition)

Grade	Density (kg/m³)	Elastic Modules (GPa)	Mean Coefficient of Thermal Expansion		Thermal Conductivity	Specific Heat	Electrical Resistivity (nΩ.m)
			0-100°C (µm/m/°C)	0-400°C (µm/m/°C)	at 100°C (W/m.K)	0-100°C (J/kg.K)	
444	7700	200	11.0	11.5	26.8	427	620

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Grade Specification Comparison

Grade	UNS No	Euronorm		Swedish SS	Japanese JIS
		No	Name		
444	S44400	1.4521	X2CrMoTi18-2	2326	SUS 444

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 444
316	Need the increased weldability, especially in heavy sections, or better stretch formability of 316. 316 is also available in sections above the 2 to 3mm upper limit for 444, and a wider range of products generally.
2304	2304 has better weldability in heavy sections, and higher strength that may alloy downgauging.
439	439 could be used if the corrosion resistance of 444 was not needed. Another low cost ferritic steel.