Stainless Steel F20S Grade Data Sheet

Grade F20S

F20S is a stabilised 20% chromium ferritic stainless steel, combining good corrosion resistance with high formability and weldability. This grade contains no nickel and is an economical alternative to grade 304 in many applications. Like all ferritic steels it is readily attracted to a magnet.

F20S is most commonly available in sheet or coil up to about 2mm thick.

Corrosion Resistance

F20S has good resistance in a wide variety of environments. The resistance of F20S to pitting and crevice corrosion in chloride environments is similar or superior to that of grade 304. Its PRE value of about 20 is above that of 304, confirmed by laboratory and service exposure testing. In outdoor exposure it performs similarly to 304. Chloride stress corrosion cracking (SCC) resistance of F20S is very high, as for all ferritic grades.

Its resistance to acids is generally slightly lower than that of 304, but performance varies for different acids.

Heat Resistance

F20S 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. F20S is not hardenable by thermal treatment.

Welding

Welding of F20S can be readily carried out by all the common electric processes. As F20S 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. Welding sections above 3mm is generally not recommended.

Gas shielding of the arc, weld metal and back side of the weld is important to minimise air contact. Shielding gases recommended for TIG (GTAW) are Argon or Argon + Helium. For MIG (GMAW) shielding is by Argon + 2% of Oxygen or Argon + 2% Carbon Dioxide or Argon + 2% CO2 + Helium. Use Grade 308L or 316L (or 316LSi) filler rod.

Machining

F20S is easier to machine than the standard austenitic grades such as 304, but the grade is not currently available as a bar.

Fabrication

F20S has a higher yield strength, lower tensile strength and lower work hardening rate compared to 304. Some operations will therefore be easier, and some will require a little more force.

Stainless Steel F20S Grade Data Sheet

Mechanical and physical properties are very similar to those of common carbon steels, so formability is also very familiar for those fabricators with experience in carbon steel.

The lower ductility of F20S restricts some very severe operations. F20S has very good drawing capability; exceeding that of 304, 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. Very severe cold working may not be possible, or may only be possible with an intermediate anneal.

Typical Applications

General sheet metal fabrication, bench tops, catering equipment, equipment cabinets, flues, process equipment, tank cladding.

Specified Properties

Because F20S is a very new alloy its properties are not yet included in any national or international specifications. The following composition and mechanical properties are typical, not specification limits.

Composition Specification (%) (Typical values)

Grade	C	Mn	Si	P	S	Cr	N	Ti+Nb
F20S	0.02	0.2	0.1	0.03	0.003	20	0.01	0.3
Note: Because of on-going product development some minor changes may be made to this composition.								

Mechanical Properties

Grade	Tensile Strength (MPa)	Yield Strength 0.2% Proof (MPa)	Elongation (% in 50mm) min.	Hardness Vickers HV
F20S	460	320	30	160
Note: Because of on-going product development some minor changes may be made to these properties.				

Physical Properties (Typical values in the annealed condition)

Grade	Density (kg/m^3)	Elastic Modules (GPa)	Mean Coefficient of Thermal Expansion 0-100°C (µm/m/°C)	Thermal Conductivity at 100°C (W/m.K)	Specific Heat 0-100°C (J/kg.K)	Electrical Resistivity (nΩ.m)
F20S	7750	205	10.5	23	440	600

Grade Specification Comparison

Grade	UNS No	Euronorm		Swedish SS	Japanese JIS
		No	Name		
F20S	-	-	-	-	-
Note: No national or international specifications cover this grade as yet.					

Stainless Steel F20S Grade Data Sheet

Possible Alternative Grades

Grade	Why it might be chosen instead of F20S
F18S	A lower cost than F20S is required and a slightly lower corrosion resistance can be tolerated. F18S is less readily available than F20S.
304	Better ductility is required for severe forming. Better weldability in heavy sections is needed. Product is required in thicknesses above those of F20S.
430	Lower cost is required, and reduced weldability, formability and corrosion resistance can be tolerated.
444	Higher corrosion resistance is required, particularly in chloride environments.