FERRINOX® 255

DATA SHEET

SUPER DUPLEX STAINLESS STEEL

TYPICAL APPLICATIONS

Defence	Control gear, shafts & weapons handling equipment in naval vessels. Tank bridging system components.
Oil & Gas	Pumps, valves, bolting, electrical connectors, pipework/flanges & wellhead equipment.
Nuclear	Mechanical handling equipment.
Chemical	Pumps, valves, fans, agitators, centrifuges, seals, boltings, filters, pipework/flanges & vessels.
Pollution Control	Equipment for flue gas de-sulphurisation (FGD) plant.
Leisure	Fittings used with AMINOX 255 super duplex steel strands to support flumes/ducting system. Swimming pool roof supports.
Marine	Shafts, seals, bolts & valves.

PRODUCT DESCRIPTION

FERRINOX® 255 is categorised as a super duplex (austenitic/ferritic) stainless steel. This high performance alloy combines high mechanical strength (typically up to over 600 MPa yield strength) and good ductility with outstanding corrosion resistance to marine environments and a wide, diverse range of industrial media. These attributes result in the widespread specification of FERRINOX 255 as an alternative to 300 series stainless steel (such as type 316), standard 22% Cr duplex steel, precipitation hardening stainless steels (typical 17/4PH) and the alloy can in some instances obviate the need to choose a much higher cost nickel based alloy.

The highly attractive combination of attributes provided by FERRINOX 255 has led to many years of successful application in Defence, Oil & Gas production, Chemicals processing, Pollution Control (FGD), Pulp & Paper Production, Architecture and Nuclear Engineering.

TECHNICAL DESCRIPTION

FERRINOX 255 is a stainless steel containing 25.5% chromium, 6% nickel with significant additions of molybdenum, copper and nitrogen and a PREn (pitting resistance equivalent) of ≥40.0. The copper content of 1.6% is particularly beneficial in promoting optimum resistance to corrosion in acidic environments. The chemical composition and mechanical properties conform to the requirements of UNS S32550, 1.4507 and several oil & gas industry specifications (see below). The microstructure is carefully controlled with a phase balance close to 50:50 austenite and ferrite with complete freedom from grain boundary carbides, sigma phase and other deleterious precipitates. Hardness is kept to a level which satisfies the requirements of NACE MR01-75 for sour service.

It should be stressed that, although the above standards form the basis for FERRINOX 255 supply, a consistent, optimised property combination is only achieved by the targeting of a much tighter composition window and detailed knowledge, gained from long term, volume supply, of metal processing techniques and heat treatment regimes. Rigorous testing carried out on all production batches, such as ASTM G-48A at 50^{0}C to demonstrate very high pitting resistance and notch ductility testing at minus 46^{0}C to confirm sub-zero suitability, also guarantees the absence of phases potentially deleterious to ductility, corrosion resistance and weldability.

MATERIAL SPECIFICATIONS

- FERRINOX 255 LT
- UNS S32550 in various ASTM product form specifications
- ASTM A182 F61
- EN 10088-3 1.4507
- NORSOK MDS D51 to D55, D57 & D58
- NACE MR01-75 (latest revision) / ISO 15156

PRODUCT ATTRIBUTES	CUSTOMER BENEFITS
High strength, min. 550 Mpa, 0.2% PS >20% higher than 22% Cr duplex >200% higher than 316L	Ability to reduce component weight/increase strength
Good ductility	Robust in use – can be cold formed
Outstanding pitting/crevice corrosion resistance	Ideal for oil & gas, defence, marine applications
Excellent corrosion resistance in acids	Ideal for chemical industry applications
Highly resistant to stress corrosion cracking	Suitable for highly loaded components in chloride environments
Good notch impact at ambient and sub-zero	Application possible down to around minus 50^{0}C
Good fatigue strength	Applicable for cyclically loaded components
High resistance to erosion, cavitation erosion and abrasion	Suitable for shafts and pump/valve components
Approved for sour service in NACE MR01-75	Resistant to cracking in H_2S/CO_2 environments

AVAILABILITY

Bar (stocked from 0.5” to 10” diameter), Forgings (blocks, rings and stepped forgings), Sheet, Plate, Pipe, Tube, Closed die forgings, Castings, Flanges, Bolting, Welding Consumables. Wire, strand and wire rope under tradename AMINOX® 255 (UK Patent 2354264B).

WELDABILITY

The welding of FERRINOX 255 presents no problems. We supply MMA electrodes and TIG/MIG wire for the welding of our product. Guidance notes are available upon request.

CORROSION RESISTANCE

FERRINOX 255 forms a highly resistant, tenacious oxide (passive) film at its surface. This is readily reformed in air if damaged.

The resistance to selective corrosion attack (pitting/crevice) in seawater and other chloride containing media is outstanding, as is its resistance to stress corrosion cracking.

FERRINOX 255 performs well in safety critical applications in the demanding environment presented by modern leisure complex pools.

The rate of general corrosion in many acids, for example, sulphuric, phosphoric, nitric acid, mixed acids and contaminated acids, for example, acid/halides, is generally at a very low level and much lower than is the case with many other stainless steels. Please consult our Technical Sales Dept. regarding suitability for specific service environments. In some cases it may be advisable to carry out corrosion testing on coupons of the alloy.

ELEVATED & SUB-ZERO TEMPERATURE PROPERTIES

FERRINOX 255 may be employed down to around minus 50^0C. The maximum continuous operating temperature is 275^0C.

MACHINABILITY

The machinability of FERRINOX 255 is good and complex shapes can be produced by a variety of processes. Machining guidelines and notes on stress relief (for tight tolerance machining) is available upon request.

TEST CERTIFICATION

All FERRINOX 255 is supplied with an inspection certificate to EN 10204 3.1. As standard, bar is supplied with ferrite certified at 35-55%, tested to ASTM G-48A at 50^0C (no pitting and weight loss <4.0 g/m^2), Charpy V-notch impact tested at minus 46^0C and ultrasonically tested.

CHEMICAL COMPOSITION %

Weight (%)	C	Mn	Si	S	P	Cr	Ni	Mo	Cu	N	Fe	PREn
Min.						24.00	5.50	3.00	1.50	0.15	Bal	40.0
Max	0.04	1.50	1.00	0.030	0.040	27.00	6.50	3.90	2.50	0.25		

PREn = Cr % + 3.3Mo% + 16N%

MINIMUM MECHANICAL PROPERTIES (FOR BAR)

Ultimate Tensile Strength	760 MPa	(110.3 ksi)
0.2% Proof Strength	550 MPa	(79.8 ksi)
Elongation	25 %	
Hardness	220 - 270 HB	
Charpy V-Notch Impact at 20°C	80 J	(59 ft.lb)
Charpy V-Notch Impact at minus 46°C	45 J av, 35 J single	(33 ft.lb av, 25.8 ft.lb single)

TYPICAL PHYSICAL PROPERTIES

Density at 20^0C	7.81	kg/dm^3
Specific Thermal Capacity at 20^0C	475	J.Kg^{-1}.K^{-1}
Mean Coefficient of Thermal Expansion at 20 - 100^0C	11.1	x 10^{-6} K^{-1}
Thermal Conductivity at 20^0C	14.2	W.m^{-1}.K^{-1}
Electrical Resistivity at 20^0C	0.80	Ω.mm^2 .m^{-1}
Magnetic Permeability	33	
Young's Modulus	199	GPa
Torsional Modulus	75	GPa
Poisson's Ratio	0.32	

TECHNICAL SALES ASSISTANCE

Our resident team of qualified metallurgists and engineers will be pleased to assist further on any technical topic.

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