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TECHNICAL DATA SHEET

ALLOY F255

UNS S32550 / W.Nr. 1.4507

Description

Alloy F255 is a highly alloyed, super duplex (ferrite-austenite) solid solution strengthened alloy, which provides high strength and wear resistance while offering superior corrosion resistance compared to 316 stainless steel. This alloy also offers better resistance to stress corrosion cracking as well as crevice and pitting corrosion than lower alloyed materials. Operating temperatures should be considered when selecting alloy F255 as secondary phases could form within higher temperature ranges. If the alloy is heat treated and allowed to soak between the temperatures of 1000°F and 1800°F, carbides (M₂₃C₆), nitrides (M₂N) and sigma phase can form. At temperatures approaching 900°F, alpha prime can form. The maximum continuous operating temperature according to ASME Boiler and Pressure Vessel Code, Section VIII is 500°F.

Industries & Applications

The combination of strength and wear resistance makes alloy F255 ideal for demanding applications in several different industries, including offshore oil and gas, pulp and paper, nuclear, marine, chemical processing and flue gas desulfurization. Alloy F255 can be a cost effective option for many applications, including oil & gas industry sub-sea equipment, chemical process industry equipment, pollution control scrubbers, marine seals, pumps and valves, bolts and fasteners, grain and vegetable processing equipment, pulp and paper bleaching components, water and sewage treatment and desalination equipment.

Resistance to Corrosion

Compared to typical austenitic alloys such as 304, 316 and 317 stainless steels, alloy F255 displays superior corrosion resistance in most media. Also, alloy F255 typically out performs duplex alloy 2205. Alloy F255 performs well in sulfuric, phosphoric and nitric acids. It also shows excellent resistance to organic acids such as acetic and formic acid. Highly reducing media should be avoided. Pitting resistance equivalent numbers (PREN) are typically used to compare the pitting resistance of various alloys. This number can be calculated from several different equations, which are based on specific alloying elements that contribute to the alloys pitting resistance. For duplex stainless steels the equation typically used to calculate the PREN is as shown below. A word of caution, the PREN is not a guarantee of the corrosion performance of any alloy and should only be used as a guide to help the user select potential alloys for specific use.

$$\text{PREN} = \% \text{Cr} + (3.3 \times \% \text{Mo}) + (16 \times \text{N})$$

Fabrication and Heat Treatment

Hot and cold forming can be performed on alloy F255 using traditional fabrication methods, although the user must keep in mind that alloy F255 has higher strength properties when compared to 316 stainless steel. Hot working the alloy should be between the temperatures of 1800°F and 2100°F, followed by an annealing heat treatment at 1950°F and water quench. Cold working the alloy to induce more than 10% deformation will require a similar heat treatment. For forming above 20% deformation, intermediate heat treatments should be performed. Machining alloy F255 can be performed using the same methods as traditional stainless steels. Carbide tipped tools are preferred. Stress relieving by heating to 675°F briefly, followed by rapid cooling can be performed on heavily machined components. Welding can be performed by TIG, MIG or SMAW and should be performed on material in the annealed condition. Preheat treatment is not necessary, but it is important to carefully clean the surfaces being welded. If pickling is the desired method for cleaning the surface, a solution with the following composition can be used:

15% HNO₃ + 2% HF (volume by volume) at a minimum temperature of 55°F

Post weld heat treatment is not necessary but preferred when welding heavy sections to optimize corrosion resistance.

Chemical Composition (%)

(Fe) Iron	Remainder
(Cr) Chromium	24.0 to 27.0
(Ni) Nickel	4.5 to 6.5
(Mo) Molybdenum	2.9 to 3.9
(Cu) Copper	1.5 to 2.5
(Mn) Manganese	1.50 max
(Si) Silicon	1.00 max
(N) Nitrogen	0.10 to 0.25
(P) Phosphorus	0.04 max
(C) Carbon	0.04 max
(S) Sulfur	0.030 max

Mechanical Properties

Product Form	Tensile (min. ksi)	0.2% Yield (min. ksi)	Elong. (min. %)	Hardness* (HB max)
Bar	110	80	15	297
Plate & Sheet	110	80	15	302
Pipe & Tube ¹	110	80	15	297

All properties in this table are for material in the solution annealed condition and are from the governing ASTM specification.

^{*}Hardness is shown for information purpose only.
¹Seamless and Welded

Physical Properties

Density @ Room Temp.	0.282 lb/in. ³
Poisson's Ratio	0.32
Elastic Modulus	28.9 X 10 ³ ksi
Torsional Modulus	10.9 X 10 ³ ksi
Specific Heat @ Room Temp.	0.114 Btu/lb•°F
Coefficient of Thermal Expansion @ 68°F to 212°F	6.17x 10 ⁻⁶ in/in•°F
Thermal Conductivity @ Room Temp.	98.5 Btu•in/ft ² •h•°F

The information contained in this technical data sheet is intended to be used as a guide and may be revised at any time without prior notice. The information is believed to be reliable and accurate, however Corrosion Materials does not make any warranty or assume any legal liability with respect to the accuracy, completeness or usefulness of the information.

Aqueous Corrosion Data

Media	Common Name	Test Temp.°F (°C)	Corrosion Rate (mpy)
10% C ₂ H ₄ O ₂	Acetic Acid	Boiling	0.2
50% C ₂ H ₄ O ₂	Acetic Acid	Boiling	0.0
C ₆ H ₈ O ₇	Citric Acid	Boiling	0.0
20% CH ₂ O ₂	Formic Acid	Boiling	0.4
40% CH ₂ O ₂	Formic Acid	Boiling	0.4
60% CH ₂ O ₂	Formic Acid	Boiling	0.1
88% CH ₂ O ₂	Formic Acid	Boiling	18
1% HCl	Hydrochloric Acid	77	0.0
2.5% HCl	Hydrochloric Acid	77	0.0
10% HNO ₃	Nitric Acid	Boiling	1.9
65% HNO ₃	Nitric Acid	Boiling	8.0
10% H ₃ PO ₃	Phosphoric Acid	150	0.0
30% H ₃ PO ₃	Phosphoric Acid	150	0.1
55% H ₃ PO ₃	Phosphoric Acid	150	0.0
85% H ₃ PO ₃	Phosphoric Acid	150	0.1
3% NaCl	Sodium Chloride	Boiling	0.4
50% NaOH	Sodium Hydroxide	Boiling	1.8
5% H ₂ SO ₄	Sulfuric Acid	Boiling	12
10% H ₂ SO ₄	Sulfuric Acid	Boiling	40
20% H ₂ SO ₄	Sulfuric Acid	150	0.0
ASTM Synthetic Sea Water		95	0.0
ASTM Synthetic Sea Water		122	0.1
ASTM Synthetic Sea Water		194	0.0

Charpy V-Notch Impact Test¹

Temp. (°F)	Notched Impact Energy ² (ft•lb) (J)	
68	184	250
-51	11	150

¹Average of three tests. ²Results listed are min values.

Applicable Specifications*

Form	ASTM	ASME
Bar	A479	SA479
Sheet & Plate	A240	SA240
Seamless & Welded Tube	A789	SA789
Seamless & Welded Pipe	A790	SA790

* EN10204-3.1 applies to all product forms.

Please contact Corrosion Materials for a complete list of items available from our extensive inventory, as well as our value-added processing services.

We supply a complete range of items in many alloys, including C-276, 22, B-2, B-3®, 200/201, 400, 405, K-500, 625, 600, 800H/HT®, 20, F255, 6B, Titanium Gr. 2 and Titanium Gr. 5.

Our machine shop, welding shop and processing departments are equipped with state-of-the-art manufacturing equipment allowing Corrosion Materials the ability to provide the service you desire along with the economic and technical advantages you need and deserve.

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