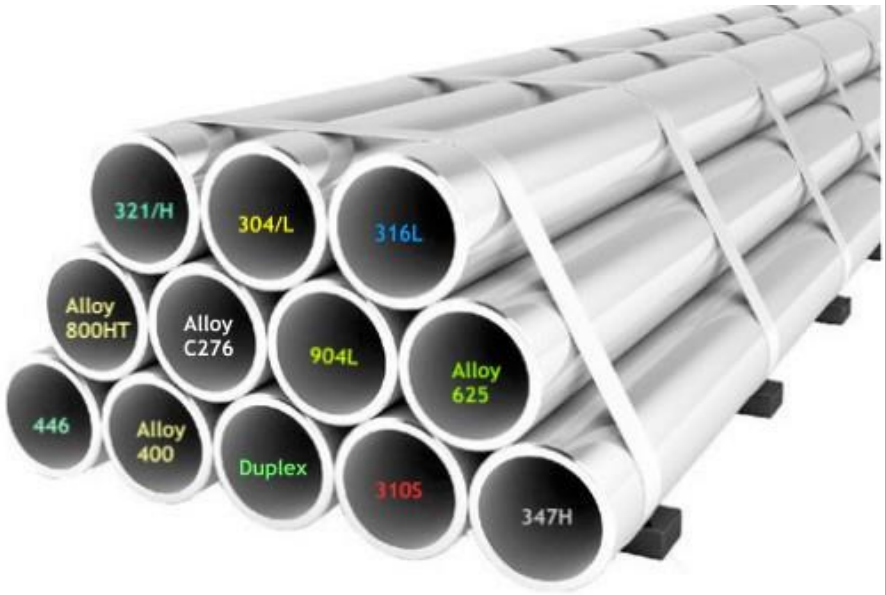
DUPLEX 2205 STAINLESS STEEL

Datasheet for Stainless Steel Duplex 2205

- Pipes & Tubes
- Sheets & Plates
- Bars & Rods, Forgings
- Fittings & Flanges
- Nuts & Bolts
- Valves



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Datasheet for Stainless Steel Duplex 2205

UNS S31803 (F51), UNS S32205 (F60), Alloy 2205, 1.4462

What is Duplex 2205 Stainless Steel?

- Duplex 2205 is a two-phase ferritic/austenitic - structures are approximately 50/50 austenite and ferrite and physical properties are a combination of the ferritic and the austenitic grades.
- It is the most widely used nitrogen enhanced duplex stainless steel grade and is characterized by high yield strength, double that of the standard austenitic stainless steel grades.
- Duplex 2205 stainless steel was developed to overcome common corrosion problems encountered with the 300 series stainless steels. It demonstrates good fatigue strength, as well as outstanding resistance to stress-corrosion cracking, crevice, pitting, erosion and general corrosion in severe environments.
- **Duplex 2205 stainless steel is not generally suitable for use at temperatures above 300°C as it suffers from precipitation of brittle micro-constituents, nor below -50°C because of its ductile-to-brittle-transition**.
- Duplex 2205 alloy finds applications due to both excellent corrosion resistance and high strength. “Duplex” describes a family of stainless steels that are neither fully austenitic, like 304 stainless, nor purely ferritic, like 430.

The Duplex family of Stainless Steels Consists of the following Grades & Designations:

- Lean Duplex SS – lower nickel and no molybdenum – 2101, 2102, 2202, 2304
- Duplex SS – higher nickel and molybdenum - 2205 (UNS S32205), 2003, 2404
- Super Duplex – 25 Chromium and higher nickel and molybdenum “plus” – 2507 (UNS S32750/UNS S32760)
- Hyper Duplex – More Cr, Ni, Mo and N - 2707

What is the Difference Between Duplex 2205 & Super Duplex Stainless Steels?

- Super Duplex stainless steel has all of the same benefits as Duplex Stainless Steel - the main difference being that this metal has a higher chromium, nitrogen and molybdenum content, which provides it with increased corrosion resistance.
- Duplex stainless steel is more durable with twice as much strength & better performance index than a regular traditional stainless steel. Hence a lighter product can bring about a better performance. The alloys used to arrive at duplex quality steel renders unique feature like high resistance to pitting, cracking & corrosion to the ultimate outcome thereby making duplex steel a much favored product in the stainless steel industry.

- The same material is used while manufacturing duplex stainless steel and super duplex stainless steel; however the alloying element usage ratio is different in both cases & change in ratio results in increased strength, & corrosion resistance. Many of the applications in which 904L grade has previously performed well can now be fulfilled at lower cost by duplex stainless steel 2205 (S31803 or S32205). Due to increased usage of Duplex stainless steels, SS 904L is used less commonly used these days.

Comparison Table of Duplex Stainless Steels and Relative Substitutes in Austenitic Stainless Steels

Duplex vs. Austenitic	
Duplex Grades	**Austenitic Grades**
2202 /2101/2102	304L
2304	316L
2003 /2404	317L, 317LMN
2205	904L
255 / 2507 / Z100 / 2707	6Mo Grades

Applications of Duplex 2205, UNS S31803, UNS S32205, 1.4462 Stainless Steels

Duplex 2205 type stainless steels must generally be used for applications which operate between -50ºF and +600ºF.

- Hydrometallurgy
- Water
- Structures
- Well screens for Oil and gas industry
- Processing equipment
- Transport, storage and Components for the chemical processing industry
- High chloride and marine environments
- Paper machines, liquor tanks, Screens and other components for the pulp and paper digesters
- Marine applications

- Chemical Plant, Chemical Tanker
- Seawater desalination Plant, Seawater pump
- Thermal power plant flue gas desulfurization plants
- Bridge

Properties, Limitations and Processing Characteristics of Duplex Stainless Steel

Characteristics

- Excellent mechanical properties
- High corrosion resistance
- Good fabricability
- Thinner gauges due to higher strength
- Weight savings!
- Better durability and reduced maintenance
- Longer service life!
- Cost efficient alloying (High N, low Ni)
- Cost stability
- Customer service and prefabrication
- Support and added value!
- Improved Cost Efficiency
- Duplex = Austenitic-Ferritic structure
- Higher mechanical strength than standard grades
- Good resistance to pitting and crevice corrosion
- Good weldability
- Higher fatigue resistance than standard grades
- High resistance to stress corrosion cracking and corrosion fatigue
- Low price for pitting and crevice corrosion resistance (price for PREN very low)
- High wear resistance
- Low thermal expansion
- High energy absorption

Processing/Welding

- Various welding methods are applicable in the same manner as with the standard austenitic stainless steels, including shielded metal arc welding, TIG welding, and plasma welding. Use of welding electrodes for Duplex 2205 is recommended. Preheating and postheating are not necessary. In welding, the interpass temperature should be no more than 100°C in order to prevent formation of intermetallic compounds.

Product Forms and Standards of Duplex 2205 Stainless Steel

Product Forms	**Material Standards**
Plates, Sheets & Strips	ASTM A240, EN 10088-2
Billets, Bars & Rods	ASTM A276, A479, A484, EN 10088-3
Forgings (Flanges & Fittings)	ASTM A182
Wires	ASTM A313, A580.
Seamless and Welded Pipes	ASTM A790 (Pipes), ASTM A790 (Tubes)
Wrought Buttweld Pipe Fittings	ASTM A815

- Metallica supplies Duplex stainless steel in various grades such as ASTM A790 UNS S32205, ASTM A182 F60 (Forgings), ASTM A815 UNS S32205/UNS S31803 (Buttweld Fittings), ASTM A240 UNS S32205/UNS S31803 (Sheets & Plates).

Equivalents of Duplex Stainless Steel

Standard	Duplex 2205
UNS	S31803 / S32205
Werkstoff Nr.	1.4462

Chemical, Mechanical & Physical Properties of Duplex Stainless Steel

Chemical Composition of Duplex 2205 (UNS S32205, 1.4462), UNS S31803

Grade		C	Mn	Si	P	S	Cr	Mo	Ni	N
2205 (S31803)	Min	-	-	-	-	-	21	2.5	4.5	0.08
	Max	0.03	2	1	0.03	0.02	23	3.5	6.5	0.2
2205 (S32205)	Min	-	-	-	-	-	22	3	4.5	0.14
	Max	0.03	2	1	0.03	0.02	23	3.5	6.5	0.2

Mechanical Properties of Duplex 2205 (UNS S32205, 1.4462), UNS S31803

- Duplex Stainless Steels have roughly twice the yield strength of their counterpart austenitic grades. This allows equipment designers to use thinner gauge material for vessel construction

Tensile Strength,min.	Yield Strength,min.	Elongation,min.	Hardness Brinell, max
Mpa	Mpa	%	HB
620	450	25	290

Physical Properties of Duplex 2205 (UNS S32205, 1.4462), UNS S31803

Density	7.8 g/cm3
Melting Point	1440 °C (2625 °F)

Fabrication Data and Other Properties of Duplex 2205 Stainless Steels

Hot Forming

- Most Duplex 2205 producers recommend a maximum hot forming temperature between 2010 and 2100°F (1100 to 1150°C). If the shape of the work piece is not compact, the edges may be significantly cooler than the bulk, and there is risk of cracking in the cooler regions.

Cold Forming

- Duplex 2205 has shown good formability in a variety of fabrications. The high strength of Duplex 2205 can pose problems. Even when the equipment has sufficient power, allowance must be made for higher spring-back caused by the grade's high strength. Although ductile enough to be formed by cold working, intermediate annealing may be necessary due to work hardening.

Forging

- Forging should be performed between 1750-2050° F followed by rapid cooling.

Annealing

- Annealing can be performed at a temperature range between 2020-2150° F followed by a rapid quench. Cooling at an accelerated rate avoids the formation of detrimental phases which form between 1400-1800° F.

Welding

- Welding can be done by gas tungsten-arc, gas metal-arc and shielded metal-arc processes.

Corrosion Resistance of Duplex 2205/UNS S32205/UNS 31803 Stainless Steels

- Similar to relative austenitic alloys (2202 and 2304 are similar to 304 & 316). General corrosion resistance can vary greatly with changes in concentration, pH, temperature and impurities. It is important to discuss these variables for any application!

- Grade 2205 stainless steel exhibits excellent corrosion resistance, much higher than that of grade 316. It resists localized corrosion types like intergranular, crevice and pitting. The Critical pitting temperature (*CPT*) of this type of stainless steel is around 35°C-45°C. This grade is resistant to chloride stress corrosion cracking (SCC) at temperatures of 150°C.
- Grade 2205 stainless steels are apt replacements to austenitic grades, especially in premature failure environments and marine environments.

What is the PREN of Duplex 2205 Stainless Steel?

- The PREN value of Duplex 2205/UNS S31803 / UNS S32205 stainless steel is typically around 35 levels, depending upon the content of alloying elements.

Stainless Steel Duplex 2205 Product Specification

Product	Duplex Stainless Steel
Equivalents	Duplex 2205, UNS S31803, F51 | UNS S32205, 1.4462, F60
Items	Pipe, Tubes, Tubing, Fittings, Flanges, Valves, Fasteners, Sheet, Square Bar, Threaded Bar, Plate, Hexagon Bar, Fasteners and Fixings, Round Bar, Flat Bar, Rebar, Angle, Tube & Pipe, Wire
Size	1/4" - 60"
Pipe Type	Seamless, Welded, ERW, Fabricated, Custom Size Pipes
Specifications	ASTM, ASME, DIN, GOST, JIS
Certification	EN 10204 3.1
Fittings Type	Butt Weld, Screwed & Socket Weld, Flanges, Instrumentation
Other Fittings	Elbows, Tees, Reducers, Caps, Stub Ends, Flanges (ANSI, Table E, D and H), Nuts, Bolts, Screws, Threaded Bars

Our Key Products

Duplex 2205 Sheet	Duplex 2205 Plate Cuttings/Profiles	Duplex 2205 Nuts, Bolts and Fasteners
Duplex 2205 Plate	Duplex 2205 Foil, Coil	Duplex 2205 Wire
Duplex 2205 Blocks/Slabs	Duplex 2205 Strip	Duplex 2205 Ingot
Duplex 2205 Rod/Bar	Duplex 2205 Pipes and Tubes	Duplex 2205 Forgings and Castings
Duplex 2205 Flanges	Duplex 2205 Forged Fittings	Duplex 2205 Buttweld Fittings

About Metallica Metals – The Steel Pipes Factory

- Established in 1975, the Metallica Metals Group (The Steel Pipes Factory) has its operations spread across major cities in India. We are a pioneer in the stainless steel pipes, nickel alloy products, titanium products, carbon steel pipes and alloy steel pipes manufacturing and processing industry. Our products including pipe fittings, flanges, pipes, sheet plates and valves are exported to over 70 countries across the world, while in India we have supplied to even the remote areas. With over 250 tons of sale in stainless steel and carbon steel pipes every day, Metallica has emerged as a prominent vendor for many buyers in India and Overseas
- More than 3000 tons ready from stock and new production ready in just a few weeks.
- Feel free to contact us on - Email: info@metallicametals.com | Tel: +91 8928722715 | +91-22-66581538, +91-22-67436694, +91-22-66109768

Our Key Products

STAINLESS STEEL & NICKEL ALLOYS

Pure Nickel Alloys
Monel Alloys (Ni-Cu Alloys)
Inconel (Ni-Cr-Mo) Alloys
Incoloy Alloys (Ni-Cr-Fe)
Hastelloy Alloys
Stainless Steel 304/304L
Stainless Steel 309S/309H
Stainless Steel 310/310S
Stainless Steel 316/316L
Stainless Steel 316Ti
Stainless Steel 317/317L
Stainless Steel 321/321H
Stainless Steel 347/347H
Stainless Steel 904L
Duplex Steels (UNS S32205, UNS S31803)
Super Duplex Steels (UNS S32760 / UNS S32750)
Stainless Steel 254 SMO (UNS S31254 / 1.4547)

INSTRUMENTATION TUBES & FITTINGS

Instrumentation Tube
Hydraulic Tubing
Seamless Tubing
Instrumentation Tube Fittings
Double Compression Tube Fittings
Precision Pipe Fittings
Needle & Guage Valves
Manifold Valves

PRODUCTS

Steel Sheet & Plate
Steel Coil & Strip
Steel Pipes
Steel Tubes
Electropolish Tube
Heat Exchanger Tubes
Steel Bars/Rods & Wire
Fasteners (Nut, Bolt, Washer)
Steel Angle Bars
Hex Steel Bars
Round Steel Bars & Rod
Flat Steel Bars
Forgings, Rings & Forged Blocks
Stainless Steel Pipe
Stainless Steel Seamless Pipe
Stainless Steel Welded Pipe
Stainless Steel Tubes
Stainless Steel Furnace Tubes

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