

Austenitic Brochure

Special **Austenitic**
Stainless Steels

for Corrosion Resistance & Heat Resistance Applications





Jindal Stainless

Strengthening our roots in Innovation, Integration, Leadership and Sustainable development.

A part of the 18 billion USD O P Jindal group, Jindal Stainless is India's largest fully integrated stainless steel manufacturer. It has grown from an indigenous single-unit stainless steel plant in Hisar, Haryana, to the present multi-location and multi-product conglomerate.

Leadership in stainless steel

Jindal Stainless is a globally recognized producer of stainless steel flat products in Austenitic, Ferritic, Martensitic and Duplex grades.

Its product range includes:

- Ferro Alloys
- Slabs & Blooms
- Hot Rolled Coils
- Plates
- Cold Rolled Coils
- Specialty Products such as Razor Blade Steel, Precision Strips and Coin Blanks.

Some of the Salient Features of the Company are:

- Largest Integrated stainless steel plant in India with a melting capacity of 1.8 million tons per year
- Global presence: Present in 65 countries
- Ferro alloy plant of 250,000 TPA, coke oven of 430,000 TPA and a 250MW captive power plant
- Pioneered the growth and development of cost effective Cr-Mn grades of SS (200 series)
- Producing more than 50 grades of stainless steel including Special Products like Razor Blade Steel, Coin Blanks (Cupronickel, Aluminum Bronze, Ferritic and Bi-metallic) and Precision Strips (as thin as 0.05mm)
- World class quality products and the widest product range:
 - Up to 1650mm wide strips and plates
 - Hot Rolled coils from 2mm to 10mm thick
 - Cold Rolled strips from 0.3mm to 5.0mm
 - Up to 80mm thick plates
 - ISO-9001:2000, ISO-14001 certified
 - OHSAS-18001
 - PED / TUV certified
 - AD 2000 certified



Fully Integrated Stainless Steel Plants

HISAR

- Hot Rolled Capacity : 0.80 MTPA
- Cold Rolled Capacity : 0.28 MTPA

The foundation of the largest stainless steel company in India was laid in Hisar, Haryana when the Jindal family decided to set up a stainless steel manufacturing plant in the early 1970's. By 1977-78 the plant was operational and it started to produce 10,000 MT per annum. In over three decades the Plant has progressed from 10,000 MT to 800,000 MT per annum and its product range includes; Slabs & Blooms, Hot Rolled Coils, Strips, Plates and Cold Rolled Coils.



Specialty Products Division

The Specialty Products Division of the company gives it the unique distinction of being the world's largest producer of high quality Precision Strips and stainless steel strips for razor blades. Apart from precision strips and razor blade stainless steel, the plant also produces coin blanks, serving the requirements of both, Indian and International mints.



JAJPUR PLANT, Odisha

- 1 MTPA Stainless Steel Melt Shop
- 1.6 MTPA Hot Rolling Mill
- 0.40 MTPA Cold Rolling Mill



In order to meet the rising demand for wider products, JSL set up a fully integrated stainless steel plant at Jajpur, Odisha. This plant is capable of producing unique and wide range of products both in terms of grades and dimensions. Hot Rolled Plates and Coils of 1650mm width and minimum thickness of 2mm of stainless steel can be produced as per the customers demand, also Cold Rolled Coils of minimum thickness of 0.3mm with maximum width of 1650mm can be

achieved based on customers' need. Company's Jajpur plant is one of its kinds and envisages complete integration from mining to cold rolling along with captive power plant. As a part of forward integration, production facilities for 2,50,000 tpa Ferro Alloys; 4,30,000 tpa Coke Oven; 250MW Captive Power Plant ; 1mtpa stainless steel Melt Shop, 1.6mtpa Hot Rolling Mill and 0.40 mtpa Cold Rolling Mill have been set-up and are in operation progressively since year 2005.

The plant has the best chosen and advanced state of the art technologies from world's reputed technology suppliers like SMS-DEMAG for Stainless Steel Melting & Casting, Siemens VAI for Hot Rolling and Andritz Sundwig for Cold Rolling manufacturing facilities.

VIZAG



In 1987, Ferro-Alloy division of Jindal Stainless was established to keep the smooth functioning of operations at JSL- Hisar.

Plant has an installed capacity of 40,000 tons per annum of High Carbon Ferro Chrome (HCFC). The plant is equipped with an ultra modern testing laboratory to ensure world-class quality standards. In addition to the domestic market, the company exports Ferro Chrome to various developed countries.

Expansion: Domestic and Global

PT JINDAL STAINLESS, INDONESIA

Jindal Stainless took over the stainless steel division of PT. Maspion, Indonesia in 2004 to get a foothold in the growing South East Asian market and thus, PT. Jindal Stainless Indonesia (PT. JSI) was born. Being the sole producer of stainless steel in Indonesia, PT Jindal Stainless not only caters to the local demand but is also exporting to the neighbouring countries.



It is an internationally certified organization - ISO 9001:2008: Quality Management System, AD 2000 W0: Pressure Equipment (Germany), PED/97/23/EC: Pressure Equipment (EU), which is capable of producing all the cold rolled grades – 200, 300 and 400 series - of stainless steel.

In a span of 9 years, not only has the plant expanded its capacity from 60,000 MTPA to 150,000 MTPA but, also numerous upgrade and revamping of electrical system of Z-1 Rolling mill from analogue to Digital drive and PLC has been done.

PT. Jindal Stainless enjoys an impressive domestic market share of 60% and is a major player in South East Asian market. It caters to almost all the market segments in the region: – Automobiles, Utensils, Fabrication, Pipes and Tubes, Palm Oil etc. A strong customer support to the extent of process adaptation and improvement has made PT. Jindal Stainless a market leader in South East Asian region.

IBER JINDAL S.L.

Jindal Stainless Service Centre

The service centre Iberjindal S.L., is a joint venture between Jindal Stainless and Fagor Industrial and is located in South Spain. The Service Centre offers customized formats & just-in-time services delivered to the doorstep of customers in Spain.

Stainless steel coils are directly provided by Jindal Stainless, India. The capacities of the Combo Line & the Polishing Line are 18,000 tons per annum & 14,500 tons per annum respectively.



Holistic solutions

JINDAL STAINLESS STEELWAY

Jindal Stainless Steelway Ltd., the domestic Jindal Stainless Service Centre network, offers convenient, customized, just-in-time services to the doorsteps of its customers. The company has partnered with Steelway s.r.l., a leading Italian company in the business of distribution and processing of steel, to service its valued customers with exact slit, cut to size, polished stainless steel sheets, coils and blanks conforming to highest standards of processing tolerances.

Some of the many services offered are :

1. Customized Stainless Steel Products
2. Inventory Management
3. Technical Value Engineering
4. Warehousing
5. Material Testing

In addition, a larger Service Centre will be set up in Jajpur, Odisha with the 1.6 million tons per annum integrated Stainless Steel Plant.

Our Service Centre facilities in Gurgaon, Mumbai, Chennai and Vadodara are installed with state-of-the-art machineries procured from world leading manufacturers such as FIMI & IMEAS of Italy and IDH & Daehwa of South Korea. Each Service Centre has a capacity of 135,000 tons per annum and in addition, Gurgaon Service Centre has a polishing capacity of 6,000 tons per annum.



JSL ARC

Stainless steel does a lot more for a building than just make it shine. It beats corrosion, increases strength and easily gets recycled. Which is why, buildings and infrastructural project not only get the chance to have longer life but also get to reduce their carbon footprint. At JSL ARC we zealously promote this Green Metal within the Architecture, Building and Construction (ABC) sectors in India.



Our range of technical support services including design, engineering work, fabrication of quality material, finishes and job site supervision by trained personnel. Our efforts have already been visible in the form of stainless steel seating, signage, modular kitchens, lighting and many other applications across India.

JSL LIFESTYLE

JSL Lifestyle Limited, a subsidiary of Jindal Stainless Limited, the company that creates spaces that speak of you using stainless Steel as the core ingredient, be it in modular kitchen, in kitchenware, in home and office accessories to cooking utensils. Spanning the different price points from the uber premium to everyday use, company has been formed with the sole vision.



Different brands under our umbrella are:

arttdinox

Stainless steel
Modular Kitchens

krome

Super Austenitic



Stainless Steel

Stainless steel - an anti-corrosive aesthetic product is produced with unique two stage liquid steel processing technology. It is the most recycled commodity with varied product life cycle depending upon usage. Stainless steel products offer immense market potential for industrial, infrastructure, transportation, home, architectural and construction applications.

Jindal Stainless Ltd. manufactures a wide variety of stainless steel of Austenitic, Ferritic, Martensitic & Duplex varieties. The company is endowed with state-of-the-art facilities for melting (Electric Arc Furnace), refining (AOD-VOD-LRF), continuous casting (Slabs & Blooms), hot rolling (4-Hi Twin Stand Steckel Mill), continuous annealing-pickling lines, cold rolling (20-Hi Sendzimir Mills) & finishing to manufacture stainless steel with excellent corrosion resistance, closed dimensional tolerances & high lustre.

Apart from Lean Austenitic stainless steels such as 301, 301L, 304, 304L, 304LN, 305, 316, 316L grades, Jindal Stainless also manufactures and supplies several highly corrosion resistant & heat resistant stainless steels. This brochure provides a preview of grades manufactured at Jindal Stainless that are endowed with exceptional corrosion resistance; grades like Super Austenitic stainless steels (UNS S31727, EN 1.4529) and heat resistant Austenitic stainless steels (309S, 310S, EN 1.4835) that find wide applications in high temperature environments.

317L

UNS S 31703, EN 1.4438

317L Austenitic stainless steel with its higher chromium & molybdenum content exhibits superior corrosion resistance relative to type 316L in strongly corrosive environment. This extra low carbon grade provides resistance to sensitization during welding and other thermal processes.

CHEMISTRY:

	C	Si	Mn	P	S	Ni	Cr	Mo	N
Min	-	-	-	-	-	11.0	18.0	3.0	-
Max	0.03	0.75	2.00	0.045	0.03	15.0	20.0	4.0	0.10

MECHANICAL PROPERTIES:

	0.2% proof stress (N/mm ²)	Tensile strength (N/mm ²)	Elongation (%)	Hardness (HRB)
Range	≥ 205	≥ 515	≥ 40	≤ 95
Typical values	264	588	55	85

PHYSICAL PROPERTIES:

Density (g/cm ³)	Modulus of elasticity (Gpa)	Thermal Conductivity (W/m-K)	Co-eff of Thermal Expansion (10 ⁻⁶ /°C)	Elastic Resistivity (micro-ohm-m)	Magnetic Permeability
8.0	200	14.6	16.5	0.79	1.003

WORKABILITY:

317L can be fabricated in a similar manner as more conventional Austenitic stainless steels 316 & 316L.

HEAT TREATMENT:

Heat treatment of 317L can be carried out in the range of 1080-1175°C followed by rapid water quenching. This grade is not hardenable.

WELDABILITY:

The use of an over alloyed filler is suggested to maintain corrosion resistance in the as-welded condition. Filler metals containing at least 6% molybdenum are suggested for welding Alloy 317L. The optimum corrosion resistance of welded 317L stainless steel is obtained by post weld annealing & pickling.

CORROSION RESISTANT STAINLESS STEEL

A P P L I C A T I O N S



INDUSTRY

Textile Industry, pulp paper Industry, chemical equipment



MARINE ENVIRONMENT

Marine environment applications: Boat rails, hardware and facades of buildings near the ocean which are exposed to salt spray.



CORROSION RESISTANCE:

- Low carbon content avoids Inter granular corrosion.
- Better corrosion resistance to type 316L in formic acid, oxalic acid & sulfuric acid environments.
- 317L (PREN>28) is less susceptible than 316L (PREN>23) to pitting corrosion in acidic solutions containing chlorides or other halide ions.
- 317L has a Critical Pitting Temperature (CPT) $\geq 19^{\circ}\text{C}$, higher than 316L (15°C) as per ASTM G48A test.
- Higher Critical Crevice Corrosion Temperature ($\geq 2^{\circ}\text{C}$) than 316L (-3°C) as per ASTM G48B test.



317LN

UNS S 31753, EN 1.4434

317LN Austenitic stainless steel having higher nitrogen content than 317L has superior corrosion resistance relative to type 317L in strongly corrosive environment.

This low carbon grade provides resistance to sensitization during welding and other thermal processes. 317LN has higher yield & tensile strength than 317L with similar elongation.

CHEMISTRY:

	C	Si	Mn	P	S	Ni	Cr	Mo	N
Min	-	-	-	-	-	11.0	18.0	3.0	0.10
Max	0.03	0.75	2.00	0.045	0.03	15.0	20.0	4.0	0.22

MECHANICAL PROPERTIES:

	0.2% proof stress (N/mm ²)	Tensile strength (N/mm ²)	Elongation (%)	Hardness (HRB)
Range	≥ 240	≥ 550	≥ 40	≤ 95
Typical values	296	605	48	89

PHYSICAL PROPERTIES:

Density (g/cm ³)	Modulus of elasticity (Gpa)	Thermal Conductivity	Co-eff of Thermal Expansion (W/m-K)	Elastic Resistivity (micro-ohm-m) (10 ⁻⁶ /°C)	Magnetic Permeability
8.0	200	14.6	16.5	0.79	1.003

WORKABILITY:

The mechanical properties of 317LN stainless steel are similar to those of more conventional Austenitic stainless steels and can be fabricated in a manner similar to 316L & 317L. The physical properties are similar to 317L.

HEAT TREATMENT:

Heat treatment of 317LN can be carried out in the range of 1080-1175°C followed by rapid water quenching. This grade is not hardenable.

WELDABILITY:

The use of an over alloyed filler is suggested to maintain corrosion resistance in the as-welded condition. Filler materials with a higher Molybdenum content should be used to improve the pitting corrosion resistance.

CORROSION RESISTANT STAINLESS STEEL

A P P L I C A T I O N S



INDUSTRY

Textile industry, pulp & paper industry, chemical equipment



MARINE ENVIRONMENT

Marine environment applications: Boat rails, hardware and facades of buildings near the ocean which are exposed to salt spray.



CORROSION RESISTANCE:

- Low carbon content avoids Inter granular corrosion.
- Excellent corrosion resistance to sulfuric acid, phosphoric acid & organic acid media than 316L & 317L.
- High Pitting (PREN>29) corrosion resistance compared to that of 316L & 317L
- Higher CPT $\geq 20^{\circ}\text{C}$ than 316L & 317L as per ASTM G48A test.
- Higher Critical Crevice Corrosion Temperature ($\geq 8^{\circ}\text{C}$) than 316L (-3°C) as per ASTM G48B test.



UNS S 31727

With excellent resistance to sulfuric acid dew point corrosion, UNS S 31727 is a high alloy Austenitic stainless steel custom-made for flue gas desulfurization systems & chimneys. This alloy is suitable for anti-pollution equipment and devices exposed to sulfuric acid environment.

CHEMISTRY:

	C	Si	Mn	P	S	Ni	Cr	Mo	Cu	N
Min	-	-	-	-	-	14.5	17.5	3.8	2.8	0.15
Max	0.03	1.00	1.00	0.03	0.03	16.5	19.0	4.5	4.0	0.21

MECHANICAL PROPERTIES:

	0.2% proof stress (N/mm ²)	Tensile strength (N/mm ²)	Elongation (%)	Hardness (HRB)
Range	≥ 245	≥ 550	≥ 35	≤ 96
Typical values	361	685	45	89

PHYSICAL PROPERTIES:

Density (g/cm ³)	Modulus of elasticity (Gpa)	Thermal Conductivity (W/m-K)	Co-eff of Thermal Expansion (10 ⁻⁶ /°C)	Elastic Resistivity (micro-ohm-m)
8.0	203	21.8	16.4	85

HEAT TREATMENT:

Heat treatment of UNS S31727 to be carried out in the range of 1100-1175°C followed by rapid water cooling.

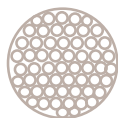
WORKABILITY:

UNS S31727 can be worked as any ordinary Austenitic stainless steel, though the deformation resistance of this product is slightly higher when working at room temperature.

WELDABILITY:

Weldability is similar to any ordinary Austenitic stainless steel. Pre-heating & post heating are not necessary.

A P P L I C A T I O N S



EXHAUST & HEAT TREATMENT

Chimneys, dampers of heavy oil boilers, exhaust gas heat exchangers, scrubbers, dilute sulfuric acid tanks, carbon black driers.

Any equipment that is routinely subjected to a sulfuric acid dew point.



CORROSION RESISTANCE:

- Low carbon content avoids Inter granular corrosion.
- Excellent resistance to sulfuric acid dew point corrosion & better than 316L, 317L.
- Better pitting corrosion resistance (PREN>32) than 316L & 317L.
- Higher CPT $\geq 35^{\circ}\text{C}$ than 316L & 317L as per ASTM G48C test.
- Better Stress Corrosion cracking resistance than 316L.



904L

UNS N 08904, EN 1.4539

With high levels of chromium, nickel, molybdenum and copper, 904L exhibits high levels of corrosion resistance. Low carbon level allows this grade to be used in as welded condition.

CHEMISTRY:

	C	Si	Mn	P	S	Ni	Cr	Mo	Cu	N
Min	-	-	-	-	-	23.0	19.0	4.0	1.0	-
Max	0.02	1.00	2.00	0.045	0.035	28.0	23.0	5.0	2.0	0.10

MECHANICAL PROPERTIES:

	0.2% proof stress (N/mm ²)	Tensile strength (N/mm ²)	Elongation (%)	Hardness (HRB)
Range	> 220	> 490	> 35	< 90
Typical values	285	568	42	78

PHYSICAL PROPERTIES:

Density (g/cm ³)	Modulus of elasticity (Gpa)	Thermal Conductivity (W/m-K)	Co-eff of Thermal Expansion (10 ⁻⁶ /°C)	Elastic Resistivity (micro-ohm-m)
8.0	195	12	16	1.0

HEAT TREATMENT:

904L should be heat treated in the range of 1080-1150°C followed by air cooling or water quenching. This grade is not hardenable.

WORKABILITY:

Austenitic stainless steels work harden quickly but with right choice of tools and tool settings, 904L can be machined appropriately.

WELDABILITY:

904L can be welded without pre-heating and post weld heat treatment. Welding should be carried out with low heat input. Welding is normally done using filler of the same composition as the base material.

CORROSION RESISTANT STAINLESS STEEL

A P P L I C A T I O N S



INDUSTRY

Process equipment in chemical industry, bleaching equipment in the pulp and paper industry, food and beverage, pharmaceuticals & Heat exchangers



MISCELLANEOUS & WATER MANAGEMENT

Flue gas cleaning, desalination, seawater handling, hydrometallurgy



CORROSION RESISTANCE:

- High resistance to dilute sulfuric acid (up to temperature of 35°C) & offers good resistance to phosphoric and acetic acid media.
- High resistance to pitting corrosion (PREN>33) in chloride solutions and sea water cooling than 316L, 317L & 317LN.
- High CPT $\geq 40^{\circ}\text{C}$ than 316L (15°C) & 317L (19 °C) as per ASTM G48A test.
- Onset of Critical Crevice corrosion temperature of type 904L (>20°C) is much higher than 316L & 317L as per ASTM G48B test.



EN 1.4529

UNS N 08926

EN 1.4529 (UNS NO8926) is a Special Austenitic stainless steel having an exceptional level of corrosion resistance especially to pitting in chloride environment.

CHEMISTRY:

	C	Si	Mn	P	S	Ni	Cr	Mo	Cu	N
Min	-	-	-	-	-	24.0	19.0	6.0	0.5	0.15
Max	0.02	0.50	2.00	0.030	0.010	26.0	21.0	7.0	1.5	0.25

MECHANICAL PROPERTIES:

	0.2% proof stress (N/mm ²)	Tensile strength (N/mm ²)	Elongation (%)
Range	≥ 295	≥ 650	≥ 35
Typical values	367	716	53

PHYSICAL PROPERTIES:

Density (g/cm ³)	Modulus of elasticity (Gpa)	Thermal Conductivity (W/m-K)	Co-eff of Thermal Expansion (10 ⁻⁶ /°C)	Elastic Resistivity (micro-ohm-m)
8.1	195	13	15.8	0.95

HEAT TREATMENT:

Heat Treatment should be carried out at 1100 - 1180°C followed by rapid water cooling.

WORKABILITY:

Forming operations are typical of Austenitic stainless steels. High strength requires higher loads to deform compared to conventional stainless steel. As the alloy exhibits high work-hardening rate, low cutting speeds should be used.

WELDABILITY:

Highly alloyed austenitic fillers such as Inconel 625 or Microfer S 6020 - FM 625 are suggested for best corrosion resistance. Low heat input and low inter-pass temperatures are most suitable.

A P P L I C A T I O N S



INDUSTRY

Offshore sea water desalination plants, sea water systems, chemical industry, production of sulfuric acid and phosphoric acid, sewage conditioning plants, mineral exploitation, flue gas de-sulfurisation systems, bleaching equipment in paper industry & pulp industry.



CORROSION RESISTANCE:

- Low carbon content results in exceptional resistance to inter granular corrosion.
- Superior resistance to Pitting Corrosion (PREN>41) in chloride environments.
- Very High Critical Pitting Temperature of 70°C, much superior to 904L as per ASTM G48A test.
- Critical Crevice Corrosion-Temperature (30°C) for onset of crevice corrosion attack much higher than 317L & 904L as per ASTM G48B test.
- High resistance to stress corrosion cracking.



309S

UNS S 30908, EN 1.4833, X12 Cr Ni 23-13

Type 309S is an Austenitic chromium-nickel stainless steel which is typically used for elevated temperature applications. Its high chromium & nickel contents provide superior resistance to oxidation, high corrosion resistance & good strength at both room and elevated temperatures. Type 309S having lower carbon content also minimizes carbide precipitation and thus improves weldability.

CHEMICAL COMPOSITION:

As per ASTM A240

		C	Mn	P	S	Si	Cr	Ni	Fe
309S	Min	-	-	-	-	-	22.0	12.	Balance
	Max	0.08	2.00	0.045	0.030	0.75	24.0	15.0	

MECHANICAL PROPERTIES:

		0.2% proof stress (N/mm ²)	Tensile strength (N/mm ²)	Elongation (%)	Hardness (HRB)
309S	As per ASTM A240	≥ 205	≥ 515	≥ 40	≤ 95
	Typical values	364	665	51	76

PHYSICAL PROPERTIES:

Density (g/cm ³)	Modulus of elasticity (Gpa)	Thermal Conductivity (W/m-K)	Co-eff of Thermal Expansion (10 ⁻⁶ /°C)	Specific Heat (W/m-K)	Elastic Resistivity (micro-ohm-m)
7.9	200	15.0	16.0	500	0.78

FABRICABILITY:

Due to good ductility & malleability, type 309S can be fabricated & machined easily to different shapes and structures.

CORROSION RESISTANCE:

Type 309S provides better corrosion resistance to marine atmosphere than type 304. It exhibits high resistance to sulfite liquors and is useful for handling nitric acid, nitric-sulphuric acid mixtures and acetic, citric and lactic acids.

HEAT TREATMENT:

Heat treatment should be carried out in the range of 1040-1100 °C in order to dissolve chromium carbide precipitates followed by water quenching or rapid air cooling. This grade is not hardenable through heat treatment.

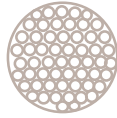
WELDABILITY:

Type 309S is generally considered to have weldability equal to most common alloys of austenitic variety like type 304. Welding rods conforming to specification AWS A 5.9 E309-16 may be used for welding this type of Grade.

HEAT RESISTANT STAINLESS STEEL

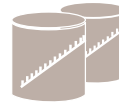
A P P L I C A T I O N S

Due to its excellent elevated temperature strength along with resistance to oxidation, it finds wide ranging use in:



EXHAUST & HEAT EXCHANGER

Furnace parts, conveyor belts & heating elements, carburizing - annealing boxes, heat exchangers, sulfite liquor handling equipment, kiln liners, oven linings, boiler baffles, refinery and chemical processing equipment, auto-exhaust parts.



OIL & GAS

Refinery and chemical processing equipment



ELEVATED TEMPERATURE OXIDATION RESISTANCE:

Generally considered Heat Resisting Alloys, Type 309S has a very high destructive scaling temperature of about 1090 °C thus exhibiting good scaling resistance in both continuous & intermittent service.



EN 1.4828

X15 Cr Ni Si 20-12, 309Si

EN 1.4828 is a heat resistant Cr-Ni-Si stainless steel with increased levels of Silicon as compared to type 309S. Its high chromium & nickel contents along with silicon provide superior resistance to oxidation & good strength at both room and elevated temperatures.

CHEMICAL COMPOSITION:

		C	Mn	P	S	Si	Cr	Ni	N	Fe
EN 1.4828	Min	-	-	-	-	1.50	19.0	11.0	-	Balance
	Max	0.20	2.00	0.045	0.015	2.50	21.0	13.0	0.11	

MECHANICAL PROPERTIES:

	0.2% proof stress (N/mm ²)	Tensile strength (N/mm ²)	Elongation (%)	Hardness (HV)
As per EN Standard	≥ 230	550-750	≥ 28	≤ 223
Typical Values	337	622	53	162

PHYSICAL PROPERTIES:

Density (g/cm ³)	Modulus of elasticity (Gpa)	Thermal Conductivity (W/m-K)	Co-eff of Thermal Expansion (10 ⁻⁶ /°C)	Specific Heat (W/m-K)	Elastic Resistivity (micro-ohm-m)
7.9	200	15	16.5	500	0.85

FABRICABILITY:

EN 1.4828 can be fabricated & machined easily to different shapes and structures.

CORROSION RESISTANCE:

In solution annealed condition, EN 1.4828 provides better corrosion resistance in marine atmosphere than type 304.

HEAT TREATMENT:

Heat treatment should be carried out in the range of 1040-1100°C followed by water quenching or rapid air cooling. This grade is not hardenable through heat treatment.

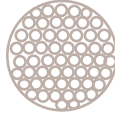
WELDABILITY:

EN 1.4828 can be easily welded with AISI E309 or E310 electrodes. Post weld solutioning treatment is desirable. Welding rods conforming to specification AWS A 5.9 ER 309 (mod.) may be used for welding this type of Grade.

HEAT RESISTANT STAINLESS STEEL

A P P L I C A T I O N S

Due to its excellent elevated temperature strength along with resistance to oxidation, it is used in:



EXHAUST & HEAT EXCHANGER

Furnace parts, conveyor belts & heating elements, Heat exchangers



OIL & GAS

Refinery and chemical processing equipment



ELEVATED TEMPERATURE OXIDATION RESISTANCE:

EN 1.4828 has a high destructive scaling temperature of above 1000°C thus exhibiting good scaling resistance in both continuous & intermittent service.



310S

UNS S 31008, EN 1.4845, X8 Cr Ni 25-21

Type 310S is a chromium-nickel Austenitic stainless steel having greater corrosion as well as oxidation resistance at elevated temperatures than type 309S.

CHEMICAL COMPOSITION:

As per ASTM A240

		C	Mn	P	S	Si	Cr	Ni	Fe
310S	Min	-	-	-	-	-	24.0	19.0	Balance
	Max	0.08	2.00	0.045	0.03	1.5	26.0	22.0	

MECHANICAL PROPERTIES:

	0.2% proof stress (N/mm ²)	Tensile strength (N/mm ²)	Elongation (%)	Hardness (HB)	Hardness (HRB)
As per ASTM A 240	≥ 205	≥ 515	≥ 40	≤ 217	≤ 95
Typical Values	364	654	53	152	80

PHYSICAL PROPERTIES:

Density (g/cm ³)	Modulus of elasticity (Gpa)	Thermal Conductivity (W/m-K)	Co-eff of Thermal Expansion (10 ⁻⁶ /°C)	Specific Heat (W/m-K)	Elastic Resistivity (micro-ohm-m)
7.9	200	15	15.5	500	0.85

FABRICABILITY:

Due to excellent ductility & malleability, type 310S can be fabricated & machined easily to different shapes and structures.

CORROSION RESISTANCE:

Type 310S provides better corrosion resistance to marine atmosphere than type 304 & 309S. This alloy has excellent resistance to oxidizing acids and common corrosion agents. It also has good resistance to molten salts & cyaniding salts.

HEAT TREATMENT:

Heat treatment should be carried out in the range of 1040-1150°C in order to dissolve chromium carbide precipitates followed by water quenching or rapid air cooling. This grade is not hardenable through heat treatment.

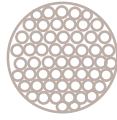
WELDABILITY:

Type 310S can be satisfactorily welded by shielded fusion and resistance welding processes. Resistance to intergranular corrosion can be restored by post weld annealing treatment. Oxy-acetylene welding is not recommended, since carbon pick up in the weld may occur. Welding rods conforming to specification AWS A 5.9 ER 310 (mod.) may be used for welding this type of Grade.

HEAT RESISTANT STAINLESS STEEL

A P P L I C A T I O N S

Due to its excellent elevated temperature strength along with resistance to oxidation, it is extensively used in:



EXHAUST & HEAT EXCHANGER

Annealing covers, kilns, gas or oil heater baffles, radiant Tubes, thermo-wells furnace parts, tube Hangers



ELEVATED TEMPERATURE OXIDATION RESISTANCE:

Type 310S is considered heat resisting-alloy because of its high destructive scaling temperature (1093°C). It exhibits good scaling resistance in both continuous (1093°C) and intermittent service (up to 1040°C).



314

UNS S 31400, EN 1.4841, X15 Cr Ni Si 25-21

Type 314 is a highly alloyed stainless steel designed for service at elevated temperatures. High Chromium and Nickel contents enable this alloy to resist oxidation in continuous service temperatures of up to 1200°C. Increased level of silicon in 314 than type 310S further improves oxidation resistance at higher temperature.

CHEMICAL COMPOSITION:

		C	Mn	P	S	Si	Cr	Ni	N	Fe
EN 1.4841	Min	-	-	-	-	1.50	24.0	19.0	-	Balance
	Max	0.20	2.00	0.045	0.015	2.50	26.0	22.0	0.11	

MECHANICAL PROPERTIES:

	0.2% proof stress (N/mm ²)	Tensile strength (N/mm ²)	Elongation % (min.)	Hardness (HV)
As per EN Standard	> 230	550-750	28	< 223
Typical Values	340	641	45	162

PHYSICAL PROPERTIES:

Density (g/cm ³)	Modulus of elasticity (Gpa)	Thermal Conductivity (W/m-K)	Co-eff of Thermal Expansion (10 ⁻⁶ /°C)	Specific Heat (W/m-K)	Elastic Resistivity (micro-ohm-m)
7.9	200	15	15.5	500	0.84

FABRICABILITY:

Due to high work hardening rate of Austenitic stainless steels, type 314 requires more power & rigid tool set ups and can be machined suitably with good supply of coolant.

CORROSION RESISTANCE:

Type 314 provides good resistance to moist air at elevated temperatures. High chromium & nickel contents result in superior resistance to carburizing atmospheres as compared to type 304.

HEAT TREATMENT:

Heat treatment should be carried out in the range of 1040-1150°C followed by water quenching or rapid air cooling.

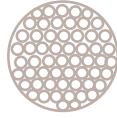
WELDABILITY:

Type 314 can be satisfactorily welded by shielded fusion and resistance welding processes. Welding rods conforming to specification AWS A 5.9 ER 310 (mod.) may be used for welding this type of Grade.

HEAT RESISTANT STAINLESS STEEL

A P P L I C A T I O N S

Due to its excellent elevated temperature strength along with resistance to oxidation, it is used in:



EXHAUST & HEAT EXCHANGER

Furnace parts, furnace conveyor belts, radiant tubes, annealing boxes, heat treating fixtures, insulation holding studs.



ELEVATED TEMPERATURE OXIDATION RESISTANCE:

In this grade, the standard 25-20 type 310S has been modified by the addition of silicon to impart increased resistance to oxidation even at continuous service temperature of 1200°C



EN 1.4835

UNS S 30815, EN 1.4835

EN 1.4835 is an Austenitic heat-resistant alloy with high strength and outstanding oxidation resistance. The use of rare-earth cerium in combination with silicon provides oxidation resistance to around 1100°C. Nitrogen, Carbon & dispersed rare earth metal oxides provide creep rupture strength comparable to nickel-base alloys.

CHEMICAL COMPOSITION:

As per ASTM A 240

		C	Mn	P	S	Si	Cr	Ni	N	Ce	Fe
EN	Min	0.05	-	-	-	1.40	20.0	10.0	0.14	0.03	Balance
1.4835	Max	0.10	0.80	0.040	0.030	2.00	22.0	12.0	0.20	0.08	

MECHANICAL PROPERTIES:

	0.2% proof stress (N/mm ²)	Tensile strength (N/mm ²)	Elongation (%)	Hardness (HB)	Hardness (HRB)
As per ASTM A240	≥ 310	≥ 600	≥ 40	≤ 217	≤ 95
Typical Values	413	703	50	181	88

PHYSICAL PROPERTIES:

Density (g/cm ³)	Modulus of elasticity (Gpa)	Thermal Conductivity (W/m-K)	Co-eff of Thermal Expansion (10 ⁻⁶ /°C)	Specific Heat (W/m-K)	Elastic Resistivity (micro-ohm-m)
7.8	200	15	17.0	500	0.85

FABRICABILITY:

Due to excellent ductility & malleability, EN 1.4835 can be readily sheared & machined easily to different shapes and structures.

HEAT TREATMENT:

Heat treatment should be carried out in the range of 1050-1150 °C followed by water quenching or rapid air cooling.

WELDABILITY:

EN 1.4835 can be readily welded using matching composition of EN 1.4835 welding electrodes to contain ferrite at about 3-6 FN. Gas metal arc welding shielding gas must be 99.95% argon. Use of Oxygen or Carbon-dioxide should be prohibited

HEAT RESISTANT STAINLESS STEEL

A P P L I C A T I O N S

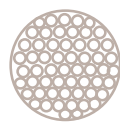
CORROSION RESISTANCE:

Compared to Austenitic stainless steel 304, EN 1.4835 has superior resistance to cyanide melts, neutral salt melts and also to metal melts, e.g. lead, at high temperatures. Its resistance to metal melts is to a great extent determined by the oxygen content of the melt. As with other alloyed steels, corrosion is greatest at the surface of the metal bath. EN 1.4835 is generally not used in conditions requiring great resistance to wet corrosion. The steel is, however more resistant than AISI 304 to stress corrosion cracking in chloride-bearing aqueous solutions. Its resistance in such environment is more or less the same as that of AISI 316.

ELEVATED TEMPERATURE OXIDATION RESISTANCE:

The micro alloy addition of cerium as well as silicon gives EN 1.4835 good oxidation resistance up to 1100°C, which is comparable to 310S stainless and superior to 309S stainless. Due to the additions of both cerium and nitrogen, the creep strength of EN 1.4835 is more than twice that of both 309 and 310 stainless at temperatures above 875°C.

EN 1.4835 has come to be extensively used in the metallurgical industry and in the petrochemical and power industries. Applications include the following:



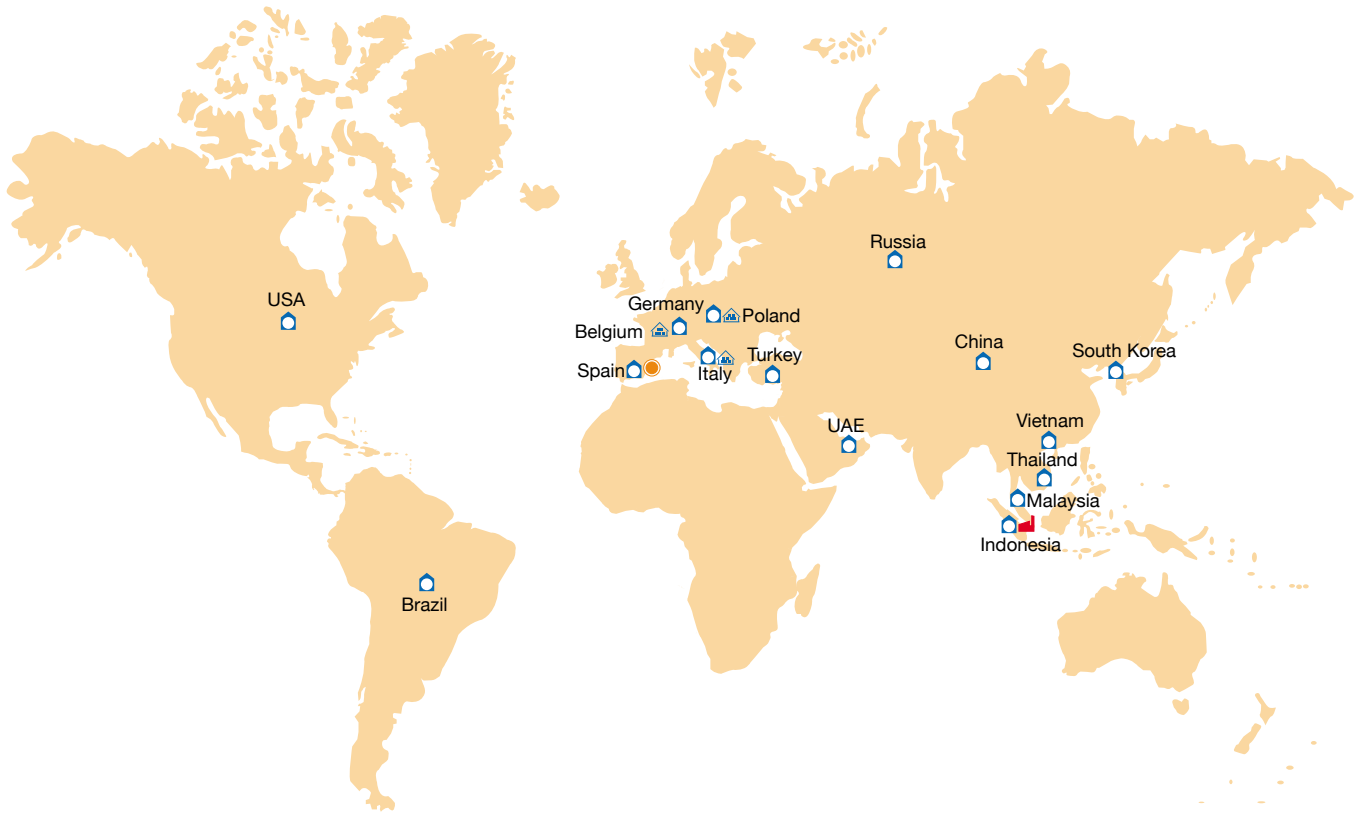
EXHAUST & HEAT EXCHANGER

- Tubes in waste-heat recovery systems in metallurgical industry, e.g. recuperators
- Tubes in heat treatment furnaces, e.g. radiation tubes, thermocouple protection tubes, burner components, furnace Rollers
- Tubes for injection of pulverised coal in blast furnaces
- Tubing for fluidised-bed combustion plants
- Furnace tubes for mud incineration plants tubes for carbon black process gas coolers/air heaters
- Tubes for the glass and cement industries Styrene reactor tubes
- EDC cracking tubes Convection tubes in ethylene cracking
- Air pre-heater tubes in sulphuric acid gas converters
- Burners, Boilers & Boiler Nozzles.
- Heat Exchangers, Stack Dampers

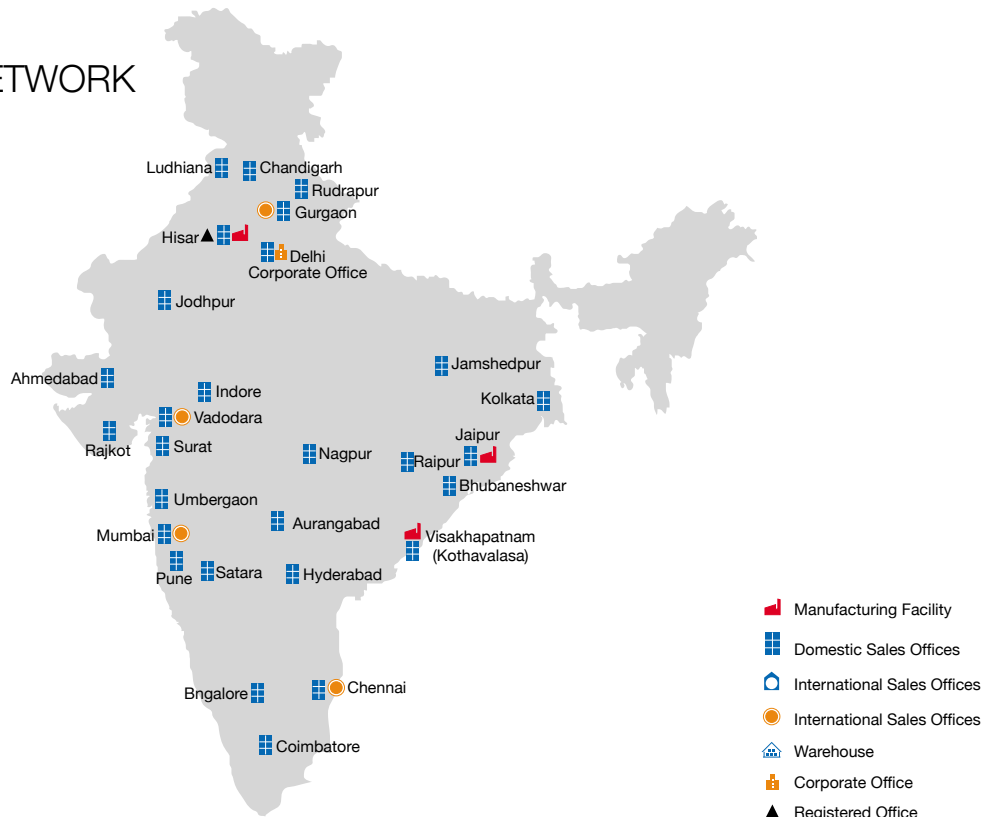


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OVERSEAS NETWORK



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