

Stainless Steel Reinforcements Bars

BIS certified as per IS 16651:2017

Chandan Steel Limited is India's fully integrated Stainless Steel Production House having accomplished numerous milestones and accredited with QMS ISO 9001:2015, PED 2014/68/EU, AD 2000-Merkblatt W0, BV Marine, ABS, DNV GL, Lloyd's Register, Norsok by TUV Nord.

The manufacturing operation were initiated in the year 1985 at Umbergaon, Gujarat. Since then, the company has been serving the global market successfully by exporting to more than 60 countries worldwide. As an established manufacturer of Stainless Steel products such as Seamless Tubes and Pipes, Forged Flanges and Long Products like Round bars, Reinforcement bars, Angles, Channels, Flat bars, Wire Rods and Wires, aided by state-of-the-art equipment, the brand name is famed across all business sectors globally. CSL continues making new forays in the global market and has commissioned a state-of-the-art Wire rod mill which enables Chandan Steel Limited to produce Wire rods ranging from 5.5 to 32mm.

Chandan Steel Limited have the advantage of having India's only in-house Stainless Steel making & refinement facilities besides complete infrastructure for converting round ingots to mother hollows followed by Pilgering & associated process to produce Stainless Steel Tubes along with other facilities producing SS Forged Flanges and SS Long Products. At present, the melting and refining capacity is enhanced to produce 120,000 MT/Annum. For years, CSL have maintained the tradition of concentrating on installation of the state-of-the-art equipment's, steadfast infrastructure and delivering quality material to the customers. Significant investment has been made in new capacity and infrastructure to serve the industry.

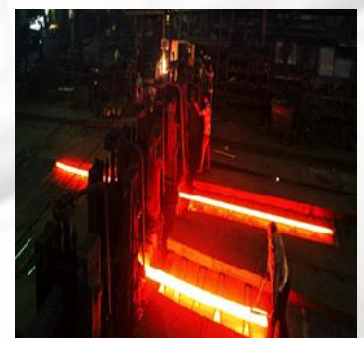
Chandan Steel Limited an integrated manufacturing set-up with in-house melting facility that ensures good quality steel making and prompt delivery.

- Capable to produce Grade A (1.4301), Grade B (1.4311), Grade C (1.4436), Grade D (1.4162), Grade E (1.4362), Grade F (1.4462) and Grade G (410L) and other grades.
- Annual Production Capacity 10,000 MT
- Supply Condition: Hot Rolled Pickled/Fully Passivated condition.
- Size Range 8mm to 40mm.
- Specification IS 16651:2017, BS 6744

INDIAN STANDARD IS 16651:2017 – 7 GRADES OF STAINLESS STEEL RECOMMENDED STRENGTH LEVELS SS 500, SS 550, SS 600, SS 650

Chemical Composition: -

Sl No.	Steel		International	C	Si	Mn	S	Cr	Ni	Mo	P	Cu	N
	Designation Number		Standard Designation	Max	Max	Max	Max	Min/Max	Min/Max	Min/Max	Max	Min/Max	Min/Max
(1)	(2)		(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
i)	A	Austenitic	1.4301	0.07	1.0	2.0	0.030	17.00/19.50	8.00/ 10.50	-	0.045	-	0.0/ 0.11
ii)	B		1.4311	0.03	1.0	2.0	0.030	17.50/19.50	8.50/ 11.50	-	0.045	-	0.12/ 0.22
iii)	C		1.4436	0.05	1.0	2.0	0.030	16.50/18.50	10.50/ 13.00	2.50/3.00	0.045	-	0.0/ 0.11
iv)	D	Austenitic-Ferritic	1.4162	0.04	1.0	4.0 to 6.0	0.015	21.00/22.00	1.35/ 1.70	0.10/0.80	0.040	0.10/0.80	0.20/ 0.25
v)	E		1.4362	0.03	1.0	2.0	0.015	22.00/24.50	3.50/ 5.50	0.10/0.60	0.035	0.10/0.60	0.05/ 0.20
vi)	F	Austenitic-Ferritic	1.4462	0.03	1.0	2.0	0.015	21.00/23.00	4.50/ 6.50	2.50/3.50	0.035	-	0.10/ 0.22
vii)	G		Ferritic	410L	0.03	1.0	1.0	0.030	11.00/13.50	0.0/ 0.60	-	0.040	-



Sl. No.	Properties	SS 500	SS 550	SS 600	SS 650
1	0.2% Proof Stress, min N/mm ²	500	550	600	650
2	% Elongation after fracture, min (GL 5.65 VA).	16.0	14.5	10.0	10.0
3	Tensile Strength, min N/mm ²	565 MPa min	600 MPa min	660 MPa min	715 MPa min

Grade G (410L) Ferritic stainless steel are mostly being used worldwide and In India, considering the life cycle costing. All Stainless Steel Grades can achieve 100 years of life in various corrosive environments with exceptions in marine splash zone and extremely critical regions.

STAINLESS STEEL REINFORCEMENT BARS

When one or more lanes of a bridge, overpass or elevated roadway are closed for repairs, which may take months to complete, traffic congestion and chaos result. As our infrastructure ages, concrete deterioration has become one of the most costly and widespread problems. The reason is corrosion attack on reinforcement bars. This is why specifying stainless steels for critical infrastructure represent the cost-effective choice, offering added benefits for both citizens and the environment.

Why is Stainless Steel Reinforcement bars superior?

- Stainless steel rebar substantially prolong the useful lifespan of those reinforced concrete structures exposed to corrosive conditions, such as marine environments as have coastal facilities, tunnels and parking garages.
- Stainless steel rebar combines strength, ductility, and toughness over a wide temperature range, including very low temperatures.
- Stainless steel rebar is supplied in accordance with standards IS 16651: 2017, BS 6744, which ensure an alloy's good corrosion resistance.
- Developed countries have adopted usage of SS Rebars for building bridges & flyovers.

Advantages of Stainless Steel Reinforcement bars

- Inherently good corrosion resistance.
- Reduced life cycle cost for concrete structures.
- Good strength.
- Good weld-ability.
- Good ductility.
- No coatings to chip, crack or degrade.
- No coating damage to repair.
- No "exposed" cut ends to coat or cover
- Capable of withstanding shipping, handling, bending.
- Magnetic or non-magnetic, depending on the alloy specified.
- Good high- and low-temperature mechanical properties.

Stainless Steel Reinforcements bars Applications:

Highway bridges	Local bridge/Tunnels	Highway ramps	Flyovers / overpasses	Underpasses
Hospital Facilities	Military Facilities	Marine Structures	Parking Garages	Historical Structures

Properties of Stainless Steel Reinforcing Bars

Selective substitution

Where a structure needs to withstand a corrosive environment, stainless steel rebar can replace carbon steel rebar in locations where corrosive agents may penetrate through the concrete cover. This selective substitution can greatly extend the service life of the structure.

A simple substitution of carbon steel rebar with stainless steel will mean:

- Identical rebar design and placement
- Identical development length
- Similar rebar pull-out strength
- Higher durability
- Lower maintenance cost

Life-cycle cost

In addition to the initial construction cost, a life cycle analysis takes into account future maintenance and rehabilitation/replacement costs. The selective use of stainless steel rebar will greatly reduce maintenance costs and postpone the need for any major rehabilitation or replacement of the structure. When 'disruption' costs are added to the maintenance costs, the benefits of using stainless steel rebar become increasingly compelling. For example, in the event of major repairs to strategic bridges or elevated highways, disruption costs can include:

- Wasted fuel, when vehicles are idling or are forced to take lengthy detours)
- Employees late for work
- Delayed deliveries of goods and freight
- Lower productivity
- Loss of revenue if traffic on toll bridges or highways is reduced or stopped.
- Additional use of concrete to repair.
- Repair & maintenance cost of Bridge.

Some of these costs are difficult to measure, but are likely to have major economic, environmental, and social impacts. Selective substitution with stainless steel rebar would have greatly reduced future maintenance costs and would have extended the service life of the bridge to 75-100 years. These significant savings could have been achieved with only a relatively modest increase in the initial project cost. The additional costs of selectively using stainless steel rebar depend on the size and complexity of the structure and the grade of stainless steel selected. For some bridges, the extra cost has been found to add between 1 percent and 3 percent to the total project cost.

Corrosion Resistance: -

- Corrosion resistance is important in construction materials, especially for infrastructure near coasts or at high altitude.
- SS Reinforcement bars are highly corrosion-resistant due to their chromium content, which forms a passive layer on the surface of the steel, protecting it from corrosion.
- This corrosion resistance makes SS Reinforcement bars more durable and longer lasting than mild steel reinforcement bars in harsh environments.
- The cost of corrosion in India is estimated to be very high, with infrastructure being a major contributor to this cost.
- SS Reinforcement bars have a corrosion rate of less than 0.5 microns per year, making them highly corrosion resistant.

Durability and lifespan: -

- Stainless steel reinforcement bars have a longer lifespan than mild steel reinforcement bars, which can lead to lower maintenance costs and longer service life for the infrastructure.
- The durability of stainless steel reinforcement bars is due to their corrosion resistance, as well as their high strength and ductility.
- These properties make stainless steel reinforcement bars a better choice for infrastructure near coasts or at high altitude, where harsh weather conditions can cause damage to mild steel reinforcement bars.
- Stainless steel reinforcement bars can have a lifespan of up to 100 years or more.
- The use of stainless steel reinforcement bars can reduce the lifecycle cost of a structure by up to 50% compared to mild steel reinforcement bars.
- Country like Japan also use SUS410 equivalent to "Grade G" of Indian Standard.

"Grade G" of Indian Standard is equivalent to Japan - SUS410

Road bridge refurbishment

Nou, Itoigawa, Niigata Prefecture, Japan

This concrete road bridge of a coastal road in the west of Japan had developed severe corrosion in its reinforcement. Besides the chloride-bearing marine atmosphere, the use of de-icing salts in winter was another cause of damage. For the refurbishment of the bridge, the selective

use of ferritic stainless steel was a rational and cost-saving choice. Out of the four spans of the bridge, only two were repaired, but needed to be replaced. The new concrete spans were cast on site and reinforced with type SUS410 (7% Chromium stainless steel), which ideally fulfilled both the corrosion resistance and cost reduction requirements. While the use of stainless steel reinforcement in new roads and bridges is not common, the case shows that the stainless steel option is also technically and economically viable in repair and renovation.

Details	
Reinforcement	Stainless
Stainless steel grade	SUS410
Reinforcement type	Reinforcement bar
Total quantity	60 t
Work environment	Sea side



"Grade G" of Indian Standard is equivalent to Japan - SUS410

Strength and Ductility: -

- Stainless steel reinforcement bars have high strength and ductility, making them suitable for use in high-stress applications, such as bridges and coastal roads.
- The strength of stainless steel reinforcement bars allows them to withstand high loads and stresses, while their ductility allows them to deform without breaking, which is important in seismic performance.
- The combination of strength and ductility makes stainless steel reinforcement bars a better choice for infrastructure near coasts or at high altitude, where high stress and seismic activity are common.
- The use of stainless steel reinforcement bars can improve the seismic performance of a structure, reducing the risk of collapse during earthquakes.

Rebar for Bridge @ NIPPON STEEL Stainless steel

Stainless steel against sea salt damage

1. Location : Japan
2. Grade/Product : SUS410 / Rebar
3. Competing Material : Carbon steel
4. Remarks of using stainless steel :
 - Corrosion Resistance @ > 100 years
 - Life Cycle Cost (LCC)
5. Quantity : 60ton



Corrosion of reinforcement



* Source: NIPPON STEEL STAINLESS STEEL

Environmental benefits:-

- Stainless steel reinforcement bars are recyclable, which can reduce the environmental impact of construction projects.
- Using durable materials like stainless steel reinforcement bars can also reduce the need for frequent maintenance and repairs, which can save resources and reduce waste.
- These environmental benefits make stainless steel reinforcement bars a better choice for sustainable construction.
- Stainless Steel is the world's most recycled material, with a recycling rate of around 88%.
- The use of durable materials like stainless steel can reduce the need for frequent maintenance and repairs, reducing waste and conserving resources.

Pamban Bridge -RVNL



CORROSION RESISTANCE EXPERIENCE:-

• Japan – Result of Accelerated Corrosion Test in Concrete



Germany – Top12 is equivalent to “Grade G” /410 of Indian Standard

Take a look at a field study how Top 12 compares to other rebar steels



Corrosion results after 12 years under real conditions in an Alps road tunnel (concrete cover: 10 mm)

Field tests in the Nardberg tunnel in Switzerland have shown impressively how different steels behave under high but common chloride loads from road traffic.

APPLICATIONS IN INDIA :-

Bijwasan–Dwarka –New Delhi –
New Station –Northern Railway



Construction of ROB on
Kalyan Shilphata (Kalyan Patripool) MSRDC



NW Railway Nawa Project –
Rajasthan-High Speed Trial Track



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