USER'S GUIDE

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Our technical advisory service is always freely available.
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The information in this booklet is for guidance only.
Specifications are subject to change.

Introduction

Salem Steel Plant, a special steels unit of Steel Authority of India Ltd., pioneered the supply of wider width stainless steel sheets / coils in India. The plant can produce Austenitic, ferritic, Martensitic and Low-nickel stainless steel in the form of coils and sheets with an installed capacity of 70,000 tonnes / year of cold rolled stainless steel and 1,86,000 / year tonnes of hot rolled stainless steel / carbon steel flat products. In addition, the country's first top-of-the-line stainless steel Blanking facility with a capacity of 3600 t / year of coin blanks and utility blanks / circles adds to the credit of the plant.

The products of Salem Steel plant are popularly called as 'SALEM STAINLESS' and well received in both national and international markets for its renowned quality standards. The plant is certified with ISO 9001:2000 for its Quality Management System, ISO14001:2004 for its Environmental Management System and OHSAS 18001:1999 for Occupational Health and Safety system.

The plant is facilitated with hot rolling mill which can roll both stainless & carbon steels and the mill caters mainly to the input needs of stainless steel coils for the cold rolling mills. Special grades of carbon steels other than Structural steels are also rolled from the facility includes Weathering steels, High strength low alloy steels etc., which are extensively used in industrial sectors.

Hot rolling mill complex is equipped with walking beam re-heating furnace, primary descaler, 4-hi reversing roughing mill, 4-high reversing steckel mill, down coiler, laminar cooling and roll grinding machines, procured from world renowned suppliers. The steckel mill, the mother unit of hot rolling with level - 2 automation is provided with hydraulic gauge setting and automatic gauge control. The continuously variable crown(CVC) controls the profile and flatness by roll shifting and Work roll bending system provide additional fine control of flatness of the strip.

Cold rolling mill complex is equipped with the most modern stainless steel production lines, sourced from leading manufacturers of the world. Coil build up line, Bell anneal furnaces Continuous annealing and pickling lines, Sendzimer Mills, Skinpass Mill, Strip grinding line, Slitting and shearing lines to produce coils /sheets with precise dimensional tolerance and flatness with superior metallurgical characteristics.

Ferritic and Martensitic stainless steel are annealed/softened at bell annealing furnaces and austenitic stainless steel is annealed/softened and descaled in continuous annealing & pickling lines using Ruthner neutral electrolytic pickling process and mixed acid pickling for superior surface finish. The coils are rolled in 20-High computerized sendzimer mills to required dimensional tolerances. A 2-high skin pass mill with elongation control and constant hydraulic roll force system ensures a product of bright finish and high flatness. A shearing line with precision roller levelers, electronic flying shear and vacuum piler facilitates defect-free piling of the leveled cut sheets. Coils of narrow width and smaller weight are produced by a precision slitting line equipped with latest features like in feed car, grip feed device, tension pad and interchangeable slitters.

The shearing and slitting lines have online continuous marking system to make the products customer-friendly. Salem Steel Plant's cold rolling mill complex also includes a resquaring shear, a recoiling line, a packing line for slit products and wider coils.

In addition to the common No1, 2D and 2B finishes, a wide range of finishes including No.3, No.4, No.8 (mirror)and special finishes like Moon Rock, Chequered, Honeykom, Macromatt, Aqualine, Frondz, Mystique, Linen, Fabrique finishes are also produced as per requirement.

PRODUCT RANGE : Hot Rolled Products

The hot rolled products include austenitic ,ferritic and low nickel grades of stainless steels and carbon steels of drawing quality, structural quality, high strength-low alloy steels and weathering steels.

Type of Product : Hot rolled Coil *

	Carbon Steel	Stainless Steel
Thickness	1.6 - 12.70 mm	2.0 - 8.0 mm
Width	1000 - 1275 mm	1000 - 1275 mm
Coil ID	762/610 mm	762/610 mm
Condition	As rolled	As rolled
Edge	Mill Edge	Mill Edge

*Cut to size/plate and higher thickness available by mutual discussion.

Carbon Steel : Standard product tolerance

Width Tolerance		+30 mm, -0 mm (For all width ranges)				
Thickness Tolerances		* (mm)				
Width (mm)		**Thickness Range (mm)**				
	1.6 -2.0	>2.0-3.0	>3.0-5.0	>5.0-8.0	>8.0-10.00	>10.0-12.7
1000-1250	±0.18	±0.20	±0.25	±0.30	±0.35	±0.50
>1250-1275	±0.20	±0.25	±0.30	±0.35	±0.40	±0.50

*Thickness measurements are taken at 20 mm from the edge.

Carbon Steels: Chemical Composition

Grades	% Chemical Composition													Deoxidation
	C	Mn	Si	S	P	Al	Cr	Ni	Cu	Nb	V	Ti	N	
IS 1079 Gr O	0.15 max	0.6 max	-	0.055 max	0.055 max	-	-	-	-	-	-	-	-	Semi Killed / Killed
IS 1079 Gr D	0.12 max	0.5 max	-	0.04 max	0.04 max	-	-	-	-	-	-	-	-	Semi Killed / Killed
IS 1079 Gr DD	0.1 max	0.4 max	-	0.035 max	0.035 max	0.02 min	-	-	-	-	-	-	-	Al Killed
IS 1079 Gr EDD	0.08 max	0.4 max	-	0.03 max	0.03 max	0.02 min	-	-	-	-	-	-	-	Al Killed
IS 2062 E250 A	0.23 max	1.5 max	0.40 max	0.045 max	0.045 max	-	-	-	-	-	-	-	-	Semi Killed / Killed
IS 2062 E250 B	0.22 max	1.5 max	0.40 max	0.045 max	0.045 max	-	-	-	-	-	-	-	-	Killed
IS 2062 E250 C	0.2 max	1.5 max	0.40 max	0.04 max	0.04 max	-	-	-	-	-	-	-	-	Killed
IS 2062 E250Cu C	0.2 max	1.5 max	0.40 max	0.04 max	0.04 max	-	-	-	0.2-0.35	-	-	-	-	Killed
IS 2062 E410	0.20 max	1.6 max	0.45 max	0.045 max	0.045 max	-	-	-	-	-	-	-	-	Killed
IS 2062 E450 D	0.22 max	1.6 max	0.45 max	0.045 max	0.045 max	-	-	-	-	-	-	-	-	Killed
IS 2062 E450 E	0.22 max	1.80 max	0.45 max	0.045 max	0.045 max	-	-	-	-	-	-	-	-	Killed
IS 5986 Fe410	0.20 max	1.20 max	-	0.040 max	0.040 max	-	-	-	-	-	-	-	-	Killed
IS 10748 Gr 1	0.10 max	0.50 max	-	0.040 max	0.040 max	-	-	-	-	-	-	-	-	killed
IRS M 41-97/ SAILCOR	0.1 max	0.25-0.45	0.28-0.72	0.03 max	0.075-0.14	0.08 max	0.35-0.60	0.20-0.47	0.3-0.6	-	-	-	-	Killed
SS 4012A-E34	0.1 max	0.7 max	0.2 max	0.03 max	0.03 max	0.02-0.05	-	-	-	0.055 max	0.095 max	0.045 max	-	Al Killed
SS 4012A-E38	0.1 max	1.0 max	0.4 max	0.03 max	0.03 max	0.02-0.05	-	-	-	0.055 max	0.095 max	0.045 max	-	Al Killed
SAILMA 350/350 Hi	0.25	1.50	0.40	0.055	0.055	0.01 min	-	-	-	-	-	-	-	Killed
SAILMA 410/410Hi	0.25	1.50	0.40	0.055	0.055	0.01 min	-	-	-	-	-	-	-	Killed
SAILMA 450/450 Hi	0.25	1.50	0.40	0.055	0.055	0.01 min	-	-	-	-	-	-	-	Killed

Micro Alloying elements like Nb, V, Ti may be present simply or in combination, the limits are given below:

Grade	Nb, V, Ti (max)
IS 2062 E250 A, B, C, Cu C IS 2062 E410 IS 2062 E450 D, IS 2062 E 450 E	0.25%
SAILMA350 SAILMA 350 Hi	0.20 %
SAILMA410 SAILMA 410 Hi	0.20 %
SAILMA450 SAILMA 450 Hi	0.20 %

Incidental element limit in grade IRSM-41/97/SAILCOR is as follows

Element	Limit
Mo	0.05 max
V	0.05 max
Al	0.08 max
Nb	0.04 max
Mo + V + Al + Nb	0.15 max

Maximum carbon equivalent for grades is as follows:

Grade	Carbon Equivalent (max)
IS 2062 E250 A	0.42
IS 2062 E250 B	0.41
IS 2062 E250 C	0.39
IS 2062 E410	0.44
IS 2062 E450 D	0.46
IS 2062 E450 E	0.48
IS 5986 Fe410	0.42

MECHANICAL PROPERTIES OF STANDARD GRADES

Grades	YS N/mm^2	UTS N/mm^2	% El (Min) GL= 5.65√So	Bend Test (t)	Hard R_B	Charpy V-Notch Impact Energy (min)
IS 1079 Gr O	-	-	-	2 t	-	-
IS 1079 Gr D	-	240- 400	25	1 t	-	-
IS 1079 Gr DD	-	260-390	28	Close	-	-
IS 1079 Gr EDD	-	260-380	32	Close	-	-
IS 2062 E250 A	250 min	410 min	23	3 t	-	-
IS 2062 E250 B	250 min	410 min	23	2 t	-	27 J at Room temp See Note
IS 2062 E250 C	250 min	410 min	23	2 t	-	27 J at Room temp See Note
IS2062E250Cu C	250 min	410 min	23	2 t	-	27 J at Room temp See Note
IS 2062 E410	410 min	540 min	23	2 t	-	50 J at Room temp See Note
IS 2062 E450 D	450 min	570 min	20	2 t	-	45 J at Room temp See Note
IS 2062 E450 E	450 min	590 min	20	2 t	-	45 J at Room temp See Note
IS 5986 Fe410	255 min	410-520	24 for t >3/0 mm *	2t	-	-
IS 10748 Grade I	170 min	290 min	30	T	-	-
SS 4012A E-34	334-412	392-490	27	Close (For 't'<7.0 mm) 0.5 t(For 't'=7.0)	-	-
SS4012A E-38	373-461	442-559	25	0.5 t	-	-
IRS M 41-97/ SAILCOR	340 min	480 min	22	1 t	-	-

't' : Nominal thickness of test piece, * : Elongation 15 min N in 80 mm GL for $t \leq 3.0$ mm

Note: For grade IS 2062 E250 B,IS 2062 E250 C,E410,E450 D,E450 E Impact Test shall be certified for product thickness of 12 mm or more. The testing temperature will be room temperature unless otherwise specified in the order.

Standard Product Tolerance: Hot Rolled Stainless Steel

Thickness Tolerance (For all width ranges)	
Thickness (mm)	**Tolerance (mm)**
2.00	**± 0.18**
2.25	**± 0.20**
2.50	**± 0.23**
3.00	**± 0.25**
3.50	**± 0.30**
4.00	**± 0.36**
5.00	**- 0.25, + 0.47**
6.00	**- 0.25, + 0.51**
8.00 & above	**- 0.25, + 0.75**

For specified thickness other than those shown, the tolerance for the next higher thickness shall apply.

Thickness measurements are taken at least 15 mm from the edge for Trimmed Edge (TE) and 25 mm from the edge for Mill Edge (ME) products.

Stainless Steels

Stainless Steel is a group of heat and corrosion resisting steels. They have in general a higher resistance to corrosion in some definite environment, as well as a higher resistance to scaling at high temperature.

Stainless Steel are iron-based alloys containing a minimum of 10.5% Chromium with or without other alloying elements. Based on the alloy content and the micro structure, stainless steels are classified into three major categories viz, Austenitic, Ferritic, and Martensitic.

Austenitic

This category of stainless steel contains 16 to 26% Chromium and 6 to22% Nickel. They are non- magnetic in annealed condition and have excellent corrosion resistance. They are not hardenable by heat treatment. However, they can develop high strength on cold working. They have excellent weldability, formability, hygiene factor and cryogenic properties. . On cold working they exhibit different degrees of magnetism. They are identified in the AISI 300 series

Ferritic

This category of stainless steel contains 10.5 to 30% chromium without any Nickel. They are Ferro magnetic in nature and generally not hardenable by heat treatment. These steels possess good resistance to stress corrosion cracking and moderate weldability &formability. They are identified in the AISI 400 series.

Martensitic

This group contains 11 to 14% chromium without any nickel, but with a higher carbon content compared to the Austenitic and ferritic stainless steels. They are ferro-magnetic in nature and are hardenable by heat treatment. They possess moderate corrosion resistance and are identified in the AISI 400 series.

PRODUCT RANGE : Cold Rolled Stainless Steels

Salem Steel Plant produces a wide range of cold rolled coils and cut lengths (sheets) in austenitic, ferritic and martensitic grades of stainless steel conforming to ASTM and various other specifications in a variety of sizes and finishes.

Product Specifications		
Coil	**Sizes (mm)**	
Dimension	Range (mm)	Standard sizes (mm)
Thickness	0.3 to 6.00	0.30, 0.40, 0.50, 0.55, 0.63, 0.70, 0.80,0.90,1.00,1.25,1.50,1.60, 2.00,2.50,2.80, 3.00, 3.15, 3.60, 4.00,5.00 6.00
Width (mm)	50 to 1250	1000, 1250
Inner Diameter		406, 508 or 610
	Sheet / Plate	
Dimension	Range (mm)	Standard sizes (mm)
Thickness	0.5 to 6.00	0.50, 0.55, 0.63, 0.70, 0.80, 0.90, 1.00, 1.25, 1.50, 1.60 2.00, 2.50, 2.80, 3.00, 3.15 3.60, 4.00, 5.00, 6.00
Width (mm)		600 to 1250, 1000, 1250
Length (mm)	500 to 4000	1500, 2000, 2500, 3000, 3500, 4000

- Supply of 0.1 and 0.2 mm thickness by mutual discussion.
- Supply of Non-standard and higher thickness by mutual discussion.
- Hot rolled, annealed, shot blasted and pickled stainless steel (No.1 finish) coils sheets/ plates are available in thicknesses of 2.00- 8.00 mm.

Surface Finishes - Stainless Steels

Finish	Description	Remarks
No:1	Hot rolled, annealed, shot blasted and pickled	Used where surface finish is not a critical
CR	Work hardened	used where higher hardness & strength is required
2D	Cold rolled, annealed and pickled	Uniform dull finish for applications
2B	Cold rolled, annealed, pickled & skinpassed	Bright smooth finish for general applications
No.3.	Cold rolled, annealed, pickled & polished with 100 to 120 grit abrasive	For decorative applications
No.4.	Cold rolled, annealed, pickled & polished with 120 to 150 grit abrasive	For decorative applications
No.8.	Cold rolled, annealed, pickled, skin passed & polished	As press plates, electronic equipment frames and decorative applications
Special Finishes	Cold rolled with special rolls, annealed, pickled and skin passed.	For decorative applications.
Dull Finish	Cold rolled, annealed and skin passed with 24 grit abrasive.	For decorative applications.

Coils and sheets can be supplied with surface protection film. Please contact for more information.

Dimensional Tolerances (Unit : 'mm')

Tolerances on Thickness - (Unit : 'mm')

Normal Tolerance (Code "N") – CRSS			Precision Tolerance (Code 'P')		Thickness Tolerance for No.1	
Thickness Range	Permitted Tol. on Thick for specified width		Thickness range	Permitted Tol. on thick (Total)	Thickness	Permitted Tol. (±) on thick
	≤1000	>1000 to ≤1275	0.30	0.040	2.00	0.18
≤0.30	± 0.030	-	> 0.30 to ≤ 0.50	0.060	2.25	0.20
>0.30 to ≤0.40	± 0.040	± 0.04	> 0.50 to ≤ 0.80	0.080	2.50	0.23
>0.40 to ≤0.50	± 0.045	± 0.050	> 0.80 to ≤ 1.00	0.090	3.00	0.25
>0.50 to ≤0.80	± 0.050	± 0.050	> 1.00 to ≤ 1.50	0.100	3.50	0.30
>0.80 to ≤1.00	± 0.055	± 0.060	> 1.50 to ≤ 2.00	0.120	5.00	-0.25, + 0.47
>1.00 to ≤1.50	± 0.080	± 0.080	> 2.00 to ≤ 2.50	0.160	6.00	-0.25, + 0.51
>1.50 to ≤2.00	± 0.10	± 0.10	> 2.50 to ≤ 3.00	0.200	8.00	-0.25, + 0.75
>2.00 to ≤2.5	± 0.10	± 0.11	> 3.00 to ≤ 4.00	0.240		
>2.50 to ≤3.00	± 0.13	± 0.13	**Close Tolerance (Code 'C')**			
>3.00 to ≤4.00	± 0.17	± 0.17	Any thickness closer than precision tolerance agreed by mutual discussion			
>4.00 to ≤5.00	± 0.17	± 0.17				
>5.00 to ≤6.00	± 0.17	± 0.20	**Normal Tol. for ME - ≥1000 : -0,+30 / <1000 : -0,+25**			

Tolerances on Width - (Unit : 'mm')

Normal Tolerance for sheets and coils (Code 'N') - CRSS Trimmed Edge

THICNESS	Permitted Tolerance on Width for specified width			
	≤250	>250 to ≤600	>600 to ≤1000	>1000 to ≤1250
≤1.00	+0.50,-0	+0.70,-0	+1.50,-0	+2.00,-0
>1.0 to ≤1.50	+0.70,-0	+1.00,-0	+1.50,-0	+2.00,-0
>1.5 to ≤2.50	+1.00,-0	+1.20,-0	+2.00,-0	+2.50,-0
>2.50 to ≤3.50	+1.20,-0	+1.50,-0	+3.00,-0	+3.00,-0
>3.50 to ≤6.00	+2.00,-0	+2.00,-0	+4.00,-0	+4.00,-0

Precision Tolerance on width (Trimmed Edge) CRSS coils (Code 'P'). Any width stricter than normal tolerance agreed by mutual discussion.

Normal Tolerance for sheets and coils (Code 'N') - No.1 Trimmed Edge

Tolerance on length-(Unit : 'mm')

Thick	Width	Permitted Tol. width	Normal Tolerance (Code 'N') - CRSS		Normal Tolerance (Code 'N') – No.1	
≤5.00	<1200	+2,-0	Specified Length	Permitted Tol. on length	Specified Length	Permitted Tol. on length
≤5.00	≥1200	+6,-0				
>5.00 to ≤6.00	<1200	+4,-0	≤2000	+5,-0	< 3000	+12 , - 0
>5.00 to ≤6.00	≥1200	+9,-0	>2000	+0.0025 x L, -0	≥ 3000	+0.005 x L, - 0

Tolerance on Flatness -(Unit : 'mm')

Tolerance for CRSS	10 mm max for all thicknesses and widths

Tolerance for No.1

Specified Thickness (mm)	Specified width(mm)	Permitted Tolerance(mm) on flatness
<5.0	< 900	13
<5.0	900-1275	19
≥5.0	≤1275	23

Standard Grades and Chemical Composition

Grade	% Chemical Composition (Ladle)								
	C (max)	Si (max)	Mn	Cr	Ni	P (max)	S (max)	N (max)	Other Elements
301	0.15	1.00	2.00 max	16.00–18.00	6.00-8.00	0.045	0.030	0.1	-
301L	0.03	1.00	2.00 max	16.00–18.00	6.00-8.00	0.045	0.030	0.2	-
304	0.07	0.70	2.00 max	17.5- 19.5	8.00-10.50	0.045	0.030	0.1	-
304L	0.03	0.75	2.00 max	17.5- 19.5	8.00-12.00	0.045	0.030	0.1	-
310S	0.08	1.50	2.00 max	24.00–26.00	19.00-22.0	0.045	0.030	-	-
316	0.08	0.75	2.00 max	16.00–18.00	10.00-14.00	0.045	0.030	0.1	Mo 2.0-3.0
316L	0.03	0.75	2.00 max	16.00–18.00	10.00-14.00	0.045	0.030	0.1	Mo 2.0-3.0
321	0.08	0.75	2.00 max	17.00–19.00	9.00-12.00	0.045	0.030	0.1	Ti=5x(C+N) Min/0.70 max
SSLNQ	0.12	0.75	10.5 max	14.5-15.5	0.30-1.00	0.075	0.015	0.20	Cu 2.0 max.
SSLN1	0.12	0.75	10.0 max	14.00–16.00	0.90-1.70	0.075	0.030	0.20	Cu 2.2 max
SSLN4	0.1	0.75	8.0 max	14.00–17.00	3.80-4.70	0.070	0.030	0.15	Cu 2.2 max
204Cu	0.15	1.00	6.50-9.00	15.5 – 17.5	1.5–3.5	0.060	0.030	0.25	Cu 2.0–4.0
409	0.03	1.00	1.00 max	10.50–11.70	0.50 max	0.04	0.02	0.03	Ti=6x(C+N) min / 0.50 max Nb 0.17 max
SS 409M	0.03	1.00	0.5-1.5	10.80-12.50	1.5 max	0.040	0.030	0.03	-
410S	0.08	1.00	1.00 max	11.50–13.50	0.6 max	0.040	0.030	-	-
420	0.15 min	1.00	1.00 max	12.00–14.00	0.75 max	0.040	0.030	-	Mo 0.5 max
430	0.12	1.00	1.00 max	16.00–18.00	0.75 max	0.040	0.030	-	-
439	0.03	1.00	1.00 max	17.00-19.00	0.5 max	0.040	0.030	0.03	Ti[0.2+4 (C+N)] Min /1.1 max Al 0.15 max

Mechanical Properties of Standard Grades in annealed condition

Grade	U.T.S. N/mm^2 Min	0.2% Proof Stress / YS N/mm^2 Min	% El (GL = 50 mm) Min	Hardness HR_B max	Cold Bend
301	515	205	40	95	Not required
301L	550	220	45	100	Not required
304	515	205	40	92	Not required
304L	485	170	40	92	Not required
310S	515	205	40	95	Not required
316	515	205	40	95	Not required
316L	485	170	40	95	Not required
321	515	205	40	95	Not required
204 Cu	650	310	40	-	Not required
SSLN4	600	275	40	96	Not required
409	380	170	20	88	180° 1 t
SS409M	450	275	22	92	180° 1 t
410S	415	205	22*	89	180° 1 t
420	690 max	-	15	96	Not required
430	450	205	22 *	89	180° 1 t
439	415	205	22	89	180° 1 t
* 20% Min for Thickness less than 1.27 mm					

Physical Properties* (Annealed Conditions) CRSS

Details	301	304/304L	316/316L	310S	430	409
Density (gm/cm^3)	7.9	7.9	8.0	7.9	7.7	7.7
Modules of Elasticity (kg/mm^2)	19700	19700	19700	20300	20300	20300
Specific Heat Capacity $Cal/gm/^0C$	0.12	0.12	0.12	0.12	0.11	0.11
Thermal conductivity ($Cal/cm^2/Sec/^0C/cm$ at 100^0c	0.039	0.039	0.037	0.033	0.0625	0.0595
Specific Electrical Resistance (u.cm3)	72	72	74	80	60	57
Coefficient of thermal expansion ($^0Cx10\text{-}6$, 0-500 ^0C)	19.8	18.4	16.0	16.9	11.34	11.52
Melting Range (^0C)	1400-1420	1400-1455	1370-1400	1400-1455	1430-1510	1430-1510

* For Guidance Only

Equivalent Specifications : Stainless steels

GRADE	IS INDIA	AISI USA	DIN GERMANY	AFNOR FRANCE	JIS JAPAN	BS BRITIAN	SIS SWEDEN	UNS	UNI ITALY
SS 301	X10 Cr 17Ni 7	301	1.4310	Z 12 CN 17-08	SUS 301	301 S 21	142331	S 30100	X12 Cr Ni 1707
SS 304	X02 Cr 19 Ni 10	304	1.4301	Z 6 CN 18-19	SUS 304	304 S 15	142333	S 30400	X5 Cr Ni 1810
SS 304L	-	304L	1.4306	Z 2 CN 18-10	SUS 304 L	304 S 11	142352	S 30303	X2 Cr Ni 1811
SS 310S	-	310S	1.4845	-	SUS 310 S	-	142361	S 31008	X6 Cr Ni 2520
SS 316	X04 Cr 17 Ni 12 Mo 2	316	1.4401	Z 6 CND 17-11	SUS 316	316 S 31	142347	S 31600	X8 Cr Ni Mo 1713
SS 316L	X02 Cr 17 Ni 12 Mo 2	316L	1.4404	Z 2 CND 17-12	SUS 316 L	316 S 31	142338	S 31603	X2 Cr Ni Mo 1712
SS 321	X04 Cr 18 Ni 10 Ti 20	321	1.4878	Z 6 CNT 18-12	SUS 321	321 S 31	142337	S 32100	X6 Cr Ni Ti1811
SS 409	-	409	1.4512	Z 5 CT 12	SUS 409	409 S 17	-	S 40900	-
SS 410S	-	410S	-	-	-	-	-	-	-
SS 430	X10 Cr 17	430	1.4016	Z 8 C 17	SUS 430	430 S 17	142320	S 43000	X12 Cr 17 C
SS 409M	-	-	-	-	-	HYFAB 3/12	-	-	-

Theoretical Mass : Stainless Steel

Size (1000 x 1000) MM Unit : Kg		
Thick (mm)	**300 series (Density: 8g/cc)**	**400 series (Density: 7.7 g/cc)**
0.30	2.40	2.31
0.40	3.20	3.08
0.50	4.00	3.85
0.63	4.00	3.85
0.70	5.04	4.85
0.80	5.60	5.39
0.90	6.4	6.16
1.00	8.00	7.70
1.25	10.00	9.63
1.60	12.80	12.32
2.00	16.00	15.40
2.50	20.00	19.25
3.00	24.00	23.10
4.00	32.00	30.80
5.00	40.00	38.50
6.00	48.00	46.20
8.00	64.00	61.60

* These weights are theoretical, for guidance only and are not to be used for commercial purpose, as there is a tolerance on thickness, width and length.

Gauge Conversion Table

S.W.G. Standard Wire Gauge
B.W.G. Birmingham (or Stubs Iron) Wire Gauge
B.G. Birmingham Gauge
B.S. American Brown and Sharpe's Gauge
U.S.G. United Standard Gauge
M.S.G. United States Manufacturer's Standard Gauge

No.	S.W.G.		B.W.G.		B.G.		B.S.		U.S.G.		M.S.G.	
	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm
0/3	.372	9.449	.425	10.795	.500	12.700	.410	10.404	.3750	9.53		
0/2	.348	8.839	.380	9.652	.445	11.308	.365	9.266	.3438	8.73		
0	.324	8.230	.340	8.636	.396	10.068	.325	8.252	.3125	7.94		
1	.300	7.620	.300	7.620	.353	8.971	.289	7.348	.2813	7.15		
2	.276	7.010	.294	7.214	.315	7.993	.258	6.543	.2656	6.75		
3	.252	6.401	.259	6.579	.280	7.122	.229	5.827	.2500	6.35		
4	.232	5.893	.238	6.045	.250	6.350	.204	5.189	.2344	5.95		
5	.212	5.385	.220	5.588	.223	5.651	.182	4.620	.2188	5.56		
6	.192	4.877	.203	5.156	.198	5.032	.162	4.115	.2031	5.16		
7	.176	4.470	.180	4.572	.176	4.480	.144	3.665	.1875	4.76		
8	.160	4.064	.165	4.191	.157	3.988	.129	3.264	.1719	4.37		
9	.144	3.658	.148	3.759	.140	3.551	.114	2.906	.1563	3.97	.1496	3.80
10	.128	3.251	.134	3.404	.125	3.157	.102	2.588	.1406	3.57	.1347	3.42
11	.116	2.946	.120	3.048	.111	2.827	.091	2.304	.1250	3.18	.1197	3.04
12	.104	2.642	.109	2.769	.099	2.517	.081	2.052	.1094	2.78	.1048	2.66

Contd.

No.	S.W.G.		B.W.G.		B.G.		B.S.		U.S.G.		M.S.G.	
	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm	Inch	mm
13	.092	2.337	.095	2.413	.088	2.240	.072	1.829	.0938	2.38	.0898	2.28
14	.080	2.032	.083	2.108	.079	1.994	.064	1.628	.0781	1.98	.0748	1.90
15	.072	1.829	.072	1.829	.070	1.775	.057	1.450	.0703	1.79	.0673	1.71
16	.064	1.626	.065	1.651	.063	1.587	.051	1.290	.0625	1.59	.0598	1.52
17	.056	1.422	.058	1.473	.056	1.412	.045	1.151	.0563	1.43	.0540	1.37
18	.048	1.219	.049	1.245	.050	1.257	.040	1.024	.0500	1.27	.0478	1.214
19	.040	1.016	.042	1.067	.0440	1.118	.0359	.912	.0438	1.11	.0418	1.062
20	.036	.914	.035	.889	.0392	.996	.0320	.813	.0375	.953	.0359	.912
21	.032	.813	.032	.813	.0349	.886	.0285	.724	.0344	.873	.0329	.835
22	.028	.711	.028	.711	.0313	.794	.0253	.643	.0313	.794	.0299	.760
23	.024	.610	.025	.635	.0278	.707	.0226	.574	.0281	.714	.0269	.683
24	.022	.559	.022	.559	.0248	.629	.0201	.511	.0250	.635	.0239	.607
25	.020	.508	.020	.508	.0220	.560	.0179	.455	.0219	.556	.0209	.531
26	.0180	.457	.018	.457	.0196	.498	.0159	.404	.0188	.478	.0179	.455
27	.0164	.417	.016	.406	.0175	.443	.0142	.361	.0172	.437	.0164	.417
28	.0148	.376	.014	.356	.0156	.397	.0126	.320	.0156	.396	.0149	.378
29	.0136	.345	.013	.330	.0139	.353	.0113	.287	.0141	.358	.0135	.343
30	.0124	.315	.012	.305	.0123	.312	.0100	.254	.0125	.318		

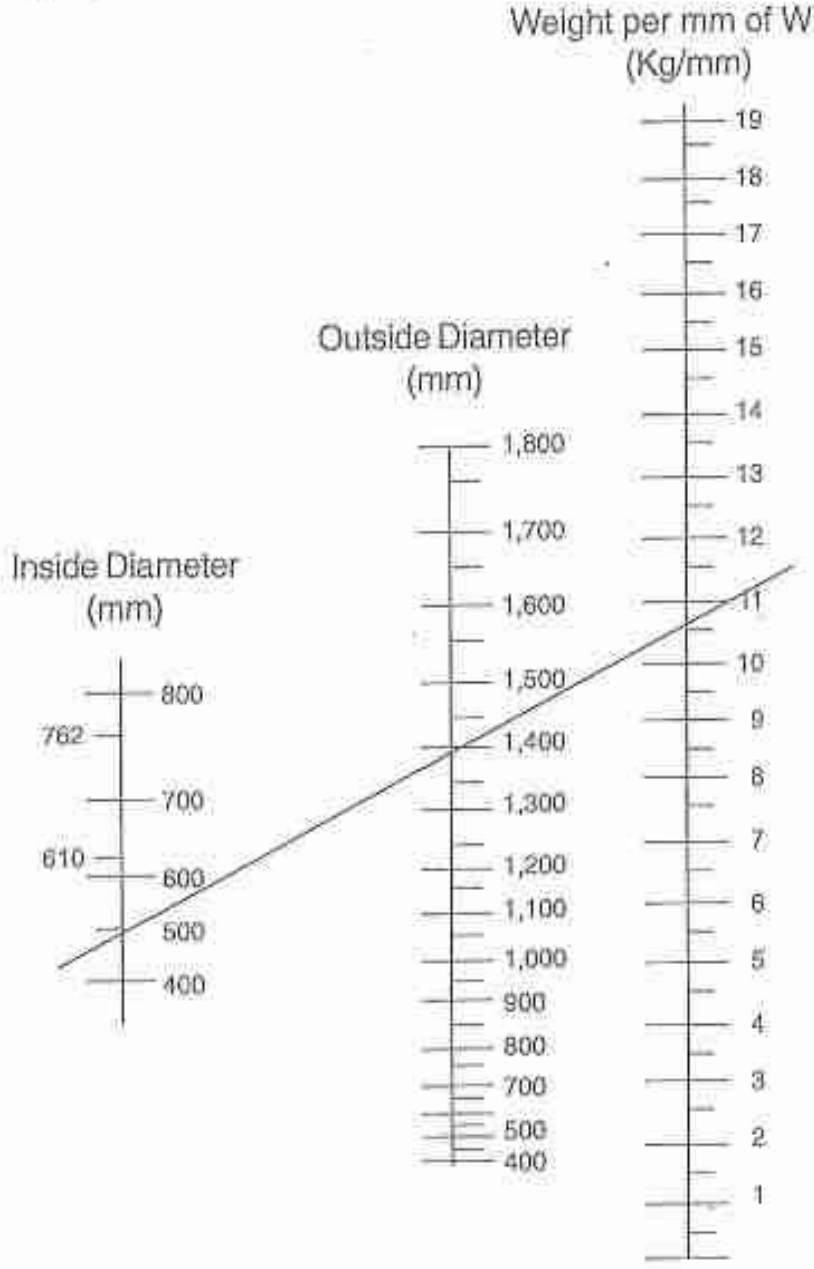
Hardness conversion *

HB	HV	HR_B	HR_C	HB	HV	HR_B	HR_C
118	125	68.5	-	269	284	-	27.6
121	127	70.0	-	275	292	-	28.7
123	130	71.0	-	285	301	-	29.9
126	132	72.0	-	295	310	-	31.0
128	135	73.0	-	302	319	-	32.1
131	137	74.0	-	312	329	-	33.2
134	140	75.0	-	321	339	-	34.3
137	143	76.5	-	331	350	-	35.4
140	147	77.5	-	341	360	-	36.6
143	150	78.5	-	352	372	-	37.8
146	153	79.5	-	363	383	-	39.1
149	156	81.0	-	375	396	-	40.4
152	159	82.0	-	388	410	-	41.8
156	163	83.0	-	402	425	-	43.1
159	167	84.0	-	415	440	-	44.5
163	171	85.0	-	430	457	-	45.8
166	175	86.0	-	444	474	-	47.2
170	178	87.0	-	-	495	-	48.7
175	183	88.0	-	-	516	-	50.3
179	188	89.0	-	-	535	-	51.4
183	192	90.0	-	-	553	-	52.5
187	196	90.5	-	-	560	-	53.0
192	202	91.5	-	-	577	-	54.0
197	207	93.0	-	-	595	-	55.0
202	212	93.5	-	-	613	-	56.0
207	218	94.5	-	-	633	-	57.0
212	222	95.5	-	-	653	-	58.0
217	228	96.5	-	-	674	-	59.0
229	234	97.5	19.0	-	697	-	60.0
229	241	98.5	20.5	-	720	-	61.0
235	247	99.0	21.6	-	746	-	62.0
241	253	100.0	22.8	-	772	-	63.0
248	261	101.0	24.1	-	800	-	64.0
255	269	-	25.4	-	832	-	65.0
262	276	-	26.4	-	-	-	-

- - * For guidance only

Unit Coil Weight Diagram

(Coil weight can be calculated by multiplying per millimeter unit weight by coil width)



Application: Hot Rolled Carbon Steels

Drawing Quality Steels - IS 1079D, DD, EDD

Drawing quality steels are low Carbon steels, meant for applications requiring ductility superior to that of general structural steel for cold forming, drawing and general engineering purposes.

DD and EDD quality has superior press formability.

Typical applications include transport and hoisting equipment, masts and towers, tubes etc,

Weathering Steels – SAILCOR

These steels are characterized by good atmospheric corrosion resistance and high yield strength. In 'as rolled' condition, weathering steels can be used in normal outdoor applications where the surface of the steel remains exposed to the atmosphere, becoming alternating wet and dry. In course of time, a protective layer is formed on the surface of the weathering steel. These are also well suited for steel structures which are to be painted. The weathering property prolongs life of paint, requiring minimum repainting. The resistance of weathering steels to combustion gases is better compared to general structural steels as also is their resistance to scaling at high temperature.

The hot rolled steel finds applications in railway wagons, coaches, freight containers, truck and bus bodies, material handling equipment, earth moving equipment and agricultural implements.

High Strength Low Alloys Steels

SAILMA-300/300HI, 350/350HI, 410/410HI, 450/450HI, E34, E38, IS2062-E410, E450-D, E450-E

These are high strength micro alloyed steels having a combination of desirable properties not attainable in conventional mild steel. These steels have higher yield strength, higher notch toughness, good fatigue properties, excellent weld ability and good formability.

These steels can be used for general structural applications, including ships, railway wagons and carriages, pressure vessels, pipes, heavy duty transport vehicles, earth moving equipment and storage tanks.

Structural Steel - IS 2062 / IS 5986.

These steels for general structural purpose are unalloyed and are characterized by their tensile strength and yield strength.

Welded tubes and pipes – IS 10748

Applications: Stainless Steels

Listed below are some typical uses of various grades of Stainless Steels. However, this is not an exhaustive list. Salem Steel Plant provides technical assistance in the selection of proper grade of stainless steel for your specific end uses.

SS 301

An austenitic stainless steel, it has the ability to attain high strength with some sacrifice of ductility through moderate or severe cold working. It can be used where high strength to weight ratio is required with good general corrosion resistance. By varying chemical composition within ASTM limits and temper rolling broad range of magnetic & mechanical properties can be achieved for a variety of applications. The susceptibility to carbide precipitation during welding restricts its use in many applications in favour of 304 grade. Transportation cars such as railway coaches, wagons, subway cars, electrical equipment and endless belts are some of the major applications where SS 301 is preferred.

SS 301 L

A Cr-Ni austenitic stainless steel, similar to SS301 with lower carbon (0.03%) and higher Nitrogen (0.20%), it has the ability to attain high strength without much sacrifice of ductility through moderate or severe cold working. It can be used where high strength to weight ratio is required with good general corrosion resistance & weldability. Broad range of mechanical properties with good Weldability can be achieved by temper rolling. Transportation cars such as railway coaches, wagons, fixtures for construction purposes, electrical equipment and endless belts are some of the major applications.

SS 304

The most widely used austenitic stainless steel with a nominal composition of 18% Chromium & 8% Nickel It has excellent general corrosion resistance and forming characteristics. It finds application in transport, chemical, petrochemical and fertilizers industries, dairy, food processing, pharmaceutical industries, hospital equipment, cryogenic vessels, households as utensils & appliances , heat exchangers, machinery in paper, pulp, textile and beverage industries. In architectural applications it is used for panels, curtain walls,

roofing etc. The weld ability of this grade is very good; it can be used in work hardened condition for uses requiring high strength.

SS 304L

An austenitic stainless steel similar to SS 304 with lower carbon level (0.03% max). Used in place of SS 304 for improved resistance to Intergranular corrosion and excellent Weldability. It is used for parts and structures which cannot be heat treated after welding. It has less tendency to work hardened by cold working.

SS 310S

This is an austenitic stainless steel with a higher Chromium and Nickel content. The restricted Carbon helps in better welding and formability. Because of their relatively high creep strength and mechanical properties at higher temperatures, these grades find applications where higher temperature and severe service conditions exist. They have high temperature scaling resistance but not good for high sulphur environments. Used for air heaters, annealing boxes, ovens, carburizing boxes, fire box sheets, furnace linings, furnace stacks and dampers, gas turbine parts, heat exchangers, kiln linings, nozzle diaphragm assemblies for turbo jet engines, oil burner parts, paper mill equipment, oil refinery equipment and recuperater.

SS 316

An austenitic stainless steel with 2 to 3% Molybdenum to have improved corrosion resistance, particularly apparent for pitting and crevice corrosion resistance in chloride environment. This grade has good oxidation resistance. Continuous use at 425-860 degree C is not recommended due to carbide precipitation. Typical applications include architectural trims, marine exteriors, chemical processing equipment, food processing equipment, petroleum refining equipment, pharmaceuticals equipment, photographic equipment, pulp & paper processing equipment and textile finishing equipment.

SS 316L

An austenitic stainless steel similar to SS 316 with lower carbon level (0.03%) to have better corrosion resistance and Weldability. Low carbon content also reduces work hardening and improves ductility for cold forging, drawing etc., Low hot strength than SS316.Typical applications include food processing, chemical and petrochemical equipment, brewery equipment, coastal architectural paneling ,laboratory equipments, heat exchangers, mining screens, chemical transportation containers etc.,.

SS 321

An austenitic stainless steel similar to SS 304 but stabilised with Titanium to avoid inter-granular corrosion. It has a good Weldability and is used for exhaust stacks and manifolds, pressure vessels, large mufflers for engines, expansion bellows, stack liners, thin wall tubes etc where no post heat treatment of welds is desired.

SS 409

It is a low alloyed straight Chromium Ferro-magnetic stainless steel. It replaces carbon steels and low alloy steels where elevated temperature corrosion resistance , medium strength & good formability are required. Titanium is added to improve the weldability. Typical application are fins in heater tubes, transformer and capacitor cases, dry fertilizer spreaders, automotive exhaust systems including mufflers, pipes and emission control units, shipping containers and farm equipment.

SS 409M

Type SS 409 M is a modified version of SS 409 with lower carbon content (0.03%). It replaces carbon steels and low alloy steels where higher strength, abrasion resistance, weld-ability and slide-ability are required. It posses good scaling &oxidation resistance at elevated temperature including sulphur bearing atmospheres. It finds application in bulk solids handling areas/bunkers, transport(wagons), petrochemical, sugar, agriculture, fishing, mining &quarrying, sewage plants and general engineering industries.

SS 410S

SS 410S is a ferritic stainless steel having 11% chromium minimum. It is mainly used for its high strength and wear resistance and in mild corrosive environment. Typical applications are furnace parts and burners operating at lower temperatures, tray supports, bubbles caps and internals in petroleum fractionating towers. It has moderate weldability and formability.

SS 420

SS 420 is a Martensitic Stainless Steel contains Carbon 0.15% min. and around 12% Chromium. It has good ductility in annealed condition and capable of being hardened to high hardness(~50HRC) by heat treatment. Weldability is poor. Typical applications are cutlery, knife blades, surgical equipments, needle valves, shear blades, scissors, hand tools.

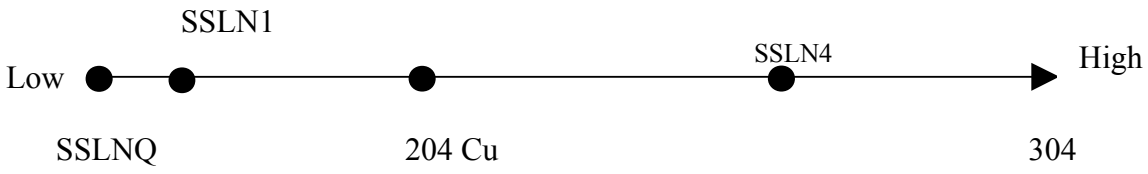
SS 430

SS 430, is a ferritic, non-hardenable plain chromium stainless steel with 16-18% Chromium content. It has good corrosion resistance & formability but less than that of SS304. Typical applications are decorative trims, refrigerators, cookers, stove elements, fasteners, flue linings, scientific apparatus storage vessels, solar water heaters, kitchenware, tableware, washing machine parts, building and construction hardware, automobile components etc.

Low-Nickel stainless steels (SSLNQ, SSLN1, 204Cu, SSLN4)

All grades belong to low nickel Chrome Manganese stainless steels commonly referred to 200 series. The Nickel content is replaced with Manganese, Nitrogen & Copper. These alloys are non magnetic in annealed condition and like SS 304 becomes mildly magnetic after cold working. It is recommended for applications of stainless steels exposed to normal atmospheric conditions and moderate drawing requirement. Typical applications are utensils , appliances, consumable durables, transport, food processing, building &constructions etc.

Performance with respect to formability, Weldability and general corrosion resistance, these grades can be rated in common scale as depicted below (indicative, not to the scale):



Stainless Steels Surface Finishes & Applications

Surface finish is an important element in any specification for stainless steel. For those applications in which appearance is important, finish is a design element and must be specified to avoid receiving a finish that is not appropriate for the application.

Finish - A Design Element

There are several good reasons for paying close attention to the finish designation. In architecture or other highly visible applications, the appearance of stainless steel is a critical design element and a misunderstanding or the wrong finish can alter the desired effect.

On the other hand, some fabrication operations in manufacturing stainless steel products such as deep drawing, rough surface/texture yield better results by holding lubricants for better lubrication.

The surface on stainless steel from the mill or steel warehouse is either the result of processes used in producing the basic mill form or it is the result of subsequent operations performed specifically to alter the surface condition or appearance.

Mill processes include hot rolling, cold rolling, annealing and pickling. These operations are intended to bring the steel product to a specific dimension and metallurgical condition and the resulting finish is generally referred to as a rolled (or unpolished) finish.

Subsequent mechanical operations, however, which include grinding, polishing and buffing are intended primarily to enhance the brightness of the surface.

Rolled finishes serve a very broad and practical use because they are usually the simplest to produce and they are generally the lowest in cost.

Standard Finishes

Stainless steel flat products are usually produced from cast slabs by hot rolling at steckel mill as hot rolled coils. Hot Rolled Coils are further processed at annealing& descaling line for softening and then cold rolled at Z-mill to specified thickness. The cold rolled coil is further annealed & descaled to get required surface finish.

Rolled product finishes are designated by a system of numbers No: 1,2D & 2B and mechanically polished finishes by No: 3, No: 4 & No: 8.Various other specific rolled pattern finishes are also in vogue. They are produced by rolling with special rolls in which designs are engraved / etched.

Surface Finish

No: 1 Finish/HRAP (Hot rolled, annealed and descaled/pickled)

Hot rolled coils are annealed ,shot blasted and pickled which results in a dull, slightly rough surface, quite suitable for industrial applications which generally involve a range of thicknesses.

Typical uses : Air heaters, annealing boxes, boiler baffles, ducts, carburizing boxes, coal & ore handling systems, crystallizing pans, fire box sheets, furnace supports, conveyors, lining, damper, stacks, gas turbine parts, heat exchanger tubing supports and baffles, incinerators, industrial over liners, kiln liners, oil burner parts, pipes, rail coach / wagon components, recuperators, refinery equipment, tube hangers etc.

Cold Rolled Finishes

The starting material for cold rolling is a No. 1 finish coil. Cold rolled material is supplied with the following standard mill finishes.

2D Finish (Cold rolled, annealed and descaled/pickled)

Cold rolled, annealed and pickled No.1 finish material results in a uniform dull finish, superior to No.1 finish suitable for industrial application and deep drawing .The dull surface (which may be polished after fabrication) retains the lubricant during the drawing operation.

Typical uses: Utensils & appliances,Automotive exhaust systems, builders' hardware, chemicals & petrochemical equipment, electric appliance parts, furnace parts, household ware, kitchen equipment, rail coach parts, trays & pans for chemical equipment etc.

2B Finish (Cold rolled, annealed, descaled/pickled and skinpassed)

2D finish material is given a light skin pass operation between polished rolls to get 2B finish, which is the most common finish for sheet material. It is brighter than 2Dfinish and is semi reflective which in turn depends on the grade of stainless steel. It is commonly used for most deep drawing operations and is more easily polished to the final finishes required than in a 2D finish.

Typical uses : Bake ware, chemical plant equipment, cookware, dairy & food processing machinery, drums, dryers, dye house equipment, flatware, laundry equipment, paper mill equipment, pharmaceutical equipment, plumbing fixtures, refrigeration equipment, steel metal products, small tanks, solar collector panels, washing machine parts, welded tubing & pipe for general service etc.

Mechanically Polished Finishes

The following are mechanically produced polished finishes, as well as standard mill finishes. They are also used to produce stainless steel articles and components that require aesthetics. It should be appreciated that factors such as hand polishing vs mechanical polishing, polishing a flat product as against a component of complex shape and thickness and composition of material can affect the visual appearance of the final surface.

No:3 Finish (Ground-100,120 abrasive)

This is a ground unidirectional uniform finish obtained with 100, 120 grit abrasive. It is a good intermediate or starting surface finish for use in such instances where the surface will require further polishing operations to a finer finish after subsequent fabrication or forming. It can also be used as a final finish in certain applications.

Typical uses: Architectural components, brewery equipment, food processing, institutional kitchen equipment.

No: 4 Finish (Ground-120,150 abrasive)

This is a ground unidirectional finish obtained with 120-150 grit abrasive. It is not highly reflective, but is a good general purpose finish on components which will suffer from fairly rough handling in service (e.g. restaurant equipment).

Typical uses : Appliances, architectural wall panels, beverage equipment, column cladding, dairy equipment, elevator door & interiors, escalator trim, furniture, hospital equipment, instrument or control panels, kitchen equipment, luggage handling equipment, mass transit equipment, restaurant equipment, sinks, sterilizers, store fronts, tankers, etc.

No: 8 Finish (Mirror finish)

A highly reflective finish that is commonly produced on sheet. It is obtained by polishing with rotating cloth mops and polishing soaps / paste containing fine abrasives. The directionality of polishing may be seen in the sheets. They have a high degree of reflectivity.

Typical uses: Architectural parts, press plates, reflectors etc.

Special Finishes

Moon Rock, Chequered, Striped, Hammer Tone, Pearl Plus, Honeykom, Macromatt, Aqualine, Frondz, Mystique, Linen, Epiderma, Fabrique finishes

* Special finishes are produced as per following route:
- Hard route → Work hardened condition
- Soft route → Cold rolled, annealed & pickled and skinpassed (either ground or un-ground)

Typical uses: Architectural panels, flooring, interior decoration, transport industry etc.

Dull Finish

This is produced by using a specific rough ground roll during skin passing of 2D finish material. It offers a matt surface with least reflectivity.

Typical uses: Architectural panels, counter tops, body for kitchen appliances etc.

Stainless Steel: Fabrication Guidelines

WELDING

Selection of Welding Processes

General Guidelines for selection of appropriate method of welding for different type of stainless steels in different thicknesses, keeping in view the advantages and limitations of the welding processes, are given below:

Welding Method	Recommended Thickness (mm)	Weldability		
		Austenitic	Ferritic	Martensitic
Shielded Metal Arc Welding (SMAW)	> 0.8	Easy to weld	Can be welded with care	Difficult to weld. &Requires special care
Gas Tungsten Arc Welding (GTAW)	< 3.0	Easy to weld	Can be welded with care	Can be welded with care.
Gas Metal Arc Welding (GMAW)	> 3.0	Easy to weld	Can be welded with care	Can be welded with care.
Submerged Arc Welding (SAW)	> 6.0	Can be welded with care	Can be welded with care	Can be welded with care.
Resistance Spot Welding	< 3.0	Easy to weld	Easy to weld	Can be welded with care.
Resistance Seam Welding	< 3.0	Easy to weld	Can be welded with care.	Difficult to weld &Requires special care.

Welding Processes of Typical Applications

Applications	Material	Process recommended
Jobs for static loading	Austenitic or Ferritic	Manual metal are welding MIG welding
Jobs for dynamic loading	Austenitic or Ferritic	MIG or TIG
Tanks for storing normal chemicals and less corrosive liquids	Austenitic or Ferritic	Manual metal are welding.
Tanks meant for highly corrosive liquids	Austenitic	TIG or MIG
Rocks and decorative panels	Ferritic	Resistance Welding
Welding on thin sheets and foils	Austenitic or Ferritic	TIG without filler or plasma arc welding
Welding of silencer pipes	Ferritic	Spot Welding (resistance) or TIG welding
Welding of small jobs using thin sheets for laboratory or space craft	Austenitic or Ferritic	Plasma arc welding or electron beam welding.

Precautions: Welding

In welding stainless steels the most important consideration is the retention of corrosion resistance in and around the weld. For good welding a number of factors must be given due consideration which are listed below :

Welding: Precautions

- Joint area to be welded, must be clean
- Joint area to be free of grease, oil, water, dirt, finger marks.
- Even an innocuous contaminant leads to weld porosity.
- Tack correctly to ensure consistent gap-width.
- Use good commercial solvent cleaner to clean weld area before welding.
- Arc-strikes adjacent to the weld to be avoided.
- Avoid excessive heat input.
- Weld speed should be fairly rapid.
- For heavy sections try to fill the joint in several passes.
- Grind the weld flush.

- Use stainless steel wire brush.
- All grinding discs and abrasives must be free of iron.
- Remove scales either mechanically or chemically by pickling with Nitric / Hydrofluoric acid mixtures.
- Don't use HYDROCHLORIC acid.
- Passivate with Nitric acid formulation.
- Wash thoroughly after passivation.
- Generally, avoid post-weld heat treatment.

Consumables

- Keep electrodes in prime conditions.
- Avoid contamination and dampness.
- Never strip an electrode of its coating and use it.
- Use only specific filler wires and not ordinary stainless steel wires or sheet trimmings.

Shielding Gas

Use pure Argon / Argon-Hydrogen mixtures depending on type of welding and thickness.

Austenitic Stainless Steels

- Good welding properties.
- Amenable to all welding processes.
- Limit heat input to avoid distortion.
- Select filler wire / electrode depending on grades to be welded.
- Low Carbon grades like 301L, 304L, 316L or stablised grades 321 recommended for application requiring extensive welding.

Ferritic Stainless Steels (430)

- Weldability not good.
- Normally use TIG welding process.
- Use austenitic electrodes / filler wire.
- Stabilised grades SS 439 recommended for application require extensive welding.

Ferritic Stainless Steels (409/409M)

- Weldability good.
- Amenable to all welding processes.
- Use austenitic filler wire / electrodes.
- Control heat input to low levels.
- Can be welded by SMA,GMA,GTA processes.

Martensitic Stainless Steels

- Weldability not good.

- In case of extreme necessity for welding, pre-heating and post-weld annually to be performed.

Low-nickel stainless steels (SSLNQ, SSLN1, 204Cu, SSLN4)

- Moderate welding properties

- Amenable to all welding processes

- Prone to Inter Granular Corrosion at Weldments if not properly heat treated after welding.

Deep Drawing

Austenitic grades have higher ductility compared to ferritic grades. Austenitic grades work hardened much faster during deep drawing and needs intermediate annealing before next draw.

General

- For best deep drawing results use annealed material.
- Requires more pressing power and produces more spring back.
- Interface friction between material and tool will be high.
- To avoid draw marks use self lubricating die inserts.
- Lubricants

  Light Draw : Oil / Vegetable Oils
  Severe Draw : Emulsion or Paste

- Use hydraulic press for precision work.
- Avoid contamination problems
- Inter annealing is required for heavy draw (Temp.1060 degree C for stabilised grades)
- Sensitization temperature range is 450-900 degree C.

Austenitics

- Hardness: About HRB 85
- Maximum first stage reduction : 40 - 45%
- Inter anneal to avoid excessive work hardening

Ferritics

- Hardness : About HRB 80
- Maximum first stage reduction : 31-35%
- Inter anneal to avoid excessive work hardening
- Use warm blanks (100-150O ◦C)

Low-nickel stainless steels (SSLN1, 204Cu, SSLN4)

- Hardness: about HRB100
- Maximum first stage reduction- 25-35 %
- Work Hardening rate is more than 300 series grades and drawability improves with higher Nickel content.
- Require inter annealing to avoid excessive work hardening

CORROSION RESISTANCE

Stainless steel has good corrosion resistance but not corrosion proof if it is not selected as per requirement. The corrosion resistance property is influenced by chemical composition (Cr, Mo, N), Finish, Design, Environment.

Corrosion of Stainless steel is generally attributed to breakdown of the passive film at the surface, at localized area or selective area. Common types of corrosion in stainless steel are as follows:

1. Uniform/General corrosion
2. Pitting corrosion
3. Crevice Corrosion
4. Intergranular corrosion (IGC)
5. Stress corrosion cracking (SCC)

1. Uniform/general corrosion

Uniform corrosion is having controlling mechanism when there is a uniform attack of material prevails (exposure to strong acid environment). Corrosion rate for different grades in different environment is available as published data for aiding the selection of the grade.

2. Pitting corrosion

Local or pitting corrosion is the most common mechanism by which stainless steel is likely to corrode. Rate of corrosion is influenced by presence of chlorides and temperature. The resistance is graded by its Pitting resistance equivalent number and calculated as PREN= %Cr+3.30%Mo+16%N.

3. **Crevice corrosion**

   It is a form of localized corrosion that can occur within crevice or at shielded surfaces where a stagnant solution is present. Such crevices can be formed at metal-metal or metal-non metal junctions, such as those associated with rivets, bolts, gaskets, valve seats, loose surface deposits etc.,

4. **Inter granular corrosion(IGC)**

   Corrosion along grain boundaries due to chromium carbide formation when exposed to a temperature range at 450-900^{0}C. The formation of carbide is influenced by % of carbon. Weld areas (HAZ) are generally susceptible to this form of corrosion. Selecting Low carbon grades or stabilized grades like 321 will solve the problem.

5. **Stress corrosion cracking(SCC)**

   The SCC caused by simultaneous presence of tensile stress and specific corrosive medium. Like pitting/Crevice corrosion presence of Chloride influence SCC but even traces of chloride is enough for SCC when the operating temperature of the material is above 60 degree C and with tensile stress.

Cleaning of stainless Steel

To keep stainless steel clean is to increase its service life. Apart from regular cleaning after fabrication care must also be taken to keep stainless steel clean before and after fabrication.

Contamination by contact with mild steel or alloy steel as well as sources of carbon contamination like varnish, paint, wax, marking pens etc., should be avoided. Cutting shears hold down pads, abrasive cut off wheels, toolings & equipment for roll forming, bending, drawing etc., shall be wiped off to make them free of adherent mild steel particles, oil or grease before use on the surface of stainless steel. The edges of thermally cut stainless steel should be cleaned by machining or grinding to remove surface contamination, particularly iron. Weldments with heat tints also need cleaning which can be done either mechanically, chemically or electrochemically. All weld spatter and flux or slag should be removed by using clean grinding wheels. Weldments should be smooth and passivated after cleaning and grinding.

Pickling / Passivation

De-scaling, and / or pickling is resorted to, for removal of tightly adhering oxide films resulting from thermal treatments of welding. The scales on stainless steels consist of oxides of Chromium, Nickel and / or other alloying elements in addition to iron. The following points may be kept in mind during pickling / passivation:

- Lubricants and other contaminations should be first removed.
- In case of metal rich scale use pre-conditioning step like sand shot-blasting.
- Use a mixed acid of nitric plus hydrofluoric for pickling.
- Follow pickling with thorough water wash.
- Passivate the stainless steel surface using Nitric acid followed by water rinsing and drying.

Effective Cleaning Methods

Condition of surface		Cleaning Agent	Method of Application
1.	Atmospheric and construction dirt.	Soap / detergent and water	Sponge or rag. Rinse with water, wipe dry.
2.	Heavier dirt containing Oil or grease	Organic solvents like acetone, benzene, xylene	Sponge or rag. Rinse with clean water, wipe dry. Observe safety rules (googles, gloves etc)
3.	Rust discoloration from other materials.	Commercial pickling pastes, diluted nitric acid (15% by volume)	Clean cloth or sponge – let stand for 20 min. Rinse and repeat if necessary. Observe safety rules (goggles, gloves etc.)
4.	Heat tint or heavy discoloration	5% oxalic acid (warm) 5-15% nitric acid or 5-10% phosphoric acid & follow with neutralizing rinse	Swab or immerse. Observe safety rules (goggles, gloves etc.)
5.	Oil grease, fatty acids (without swabbing).	4-6% solution of sodium metasilicate / trisodium phosphate.	No swabbing required.
6.	Oil grease, fatty acids (with swabbing).	Carbon tetrachloride, trichloroethylene, acetone, kerosene, gasoline, alcohol.	Rub with cloth. Observe safety rules (goggles, gloves etc.)
7.	Hand and fingerprint smears.	Calcium carbonate fine powder, wax-based polish	Rub with cloth.

Do's and Don'ts While Cleaning

- Use the mildest cleaning agent that does the job effectively.
- Follow the polishing lines when using abrasive cleaners.
- Rinse thoroughly after every cleaning operation.
- Wipe dry to avoid water marks
- Do not use an ordinary steel scraper or knife to remove dirt. This causes contamination. Use plastic or stainless steel tools.
- Do not allow chemicals or bleaching agents to remain in prolonged contact with stainless steel.
- Handle with clean gloves/cloths to guard against stains/finger print
- Avoid cleaning with chloride containing detergents/solvents.

Follow these tips carefully and you can be sure of your stainless steel looking good for years.

Installation of stainless steel components

Stainless steel, like most other materials, requires minimum cleaning to maintain the original finish. All it takes is a little care during installation and in service.

Keep the following points in mind to avoid problems at a later stage.

- Do not allow steel tools, containers or implements to lie on stainless surfaces. It might lead to galvanic action as a result of iron contamination.
- Spot passivation at risk areas should be done to keep off any potential corrosion hazards.
- Make sure it does not come in contact with corrosive chemicals and contaminated elements. This ensures an initial clean passivated surface.
- If the surface aspects are important, use protective coated stainless steel components.
- Avoid cross contamination by steel particles, weld spatter, contaminated grit, etc.

Right design and finish for minimum maintenance

The kind of finish required depends a great deal on the amount of physical contact the application warrants.

a. If there is constant contact, a special ground finish is ideal. It will not register fingerprints as easily as the more reflective finishes. It can be cleaned vigorously without any danger of its appearance being changed. Further, the finish can be reproduced after fabrication as this is obtained by grinding and polishing.

b. For areas not subjected to high traffic, use a lesser reflective finish like 2D for applications in flat areas. The slightly more reflective finish 2B is chosen for highlighting surface like clamp covers, windows, etc. which are normally above ground level.

   Since 2B and 2D are rolled finishes, they can't be matched by subsequent mechanical finishing. That is why special care should be taken to protect the surface during fabrication, transit and erection.

c. A textured finish is of great help in maintenance as it offers more protection against scratches dents and fingerprints. In areas such as free standing columns, doors, elevator panels etc, the use of textured stainless steel is recommended.

d. In large channels, the smoothest finish provides the desired appearance and rigidity. Use the ground impressions in the vertical direction. If used in horizontal direction, it accumulates more dirt and causes subsequent uneven streaking of lower areas.

e. Avoid designs that concentrate flow of water on an exterior surface since this too causes streaking.

f. Minimise horizontal surfaces and where necessary, make provisions to drain the dirt. Even joints should be so designed to minimise dirt accumulation.

g. Struts and clips made of dissimilar metals should be insulated to prevent bleeding of other metals onto stainless steel.

h. Fasteners should be concealed as much as possible for aesthetic reasons. Its level of corrosion resistance should be equal to that of stainless steel.

i. Avoid intricate designs. These collect dirt and make cleaning a difficult task.

Blanking Line

Salem Steel Plant indianised the process of stainless steel blanking, the first of its kind in India. The equipment for the Blanking Line was supplied by the leading manufacturers from Germany. The facilities include high-speed blanking press, rimming machine, annealing, pickling, polishing, counting and packing units.

Product Specifications

Product Grade Dimensions (mm)

Product	**Grade**	**Dimensions (mm)**	
		Dia	**Thickness**
Coin Blanks	SS 430	10 - 30	2.5 max
Utility Blanks	SS 304 / 430	450 max	0.3 to 2.5
* Scissels (by-product)			

* Note : The dimensions and grades of blanks as well as for scissels depend on the blank size requirement of the mints.

The blanks have a host of applications and can be utilised for medallions, commemorative coins and gift items, in addition to coin blanks. Utility blanks / circles find application in washing machines, pressure cookers and similar consumer durables, automobiles components, valve plates, washers etc.

The punched out strips called scissels are supplied in the form of coils / strips / cut lengths. Aesthetic and elegant, the scissels have a wide variety of applications and can be used for fencing, as a reinforcement material in thin concrete slabs for cupboard shelves upto 25 mm thickness, bracing material for reinforcement rods in concrete pipes and beams, cable trays in place of mild steel and for architectural applications in building and construction. The strong and sturdy scissels can also be used as conveyor belts for washing and drying utensils and as screens to sort tea in the tea industry.

Value Added Products

"Stainless steel in any form - that you can readily put to use" - in short describes the initiative of Salem Steel Plant for supplying of value added products. Kitchenware, kitchen equipment, architectural panelling, cladding and railing, welded pipes and tubes, stainless steel roofing sheets - these are but illustrations of products Salem Steel Plant can supply, the only need being volumes that would justify the value addition efforts.

Kitchenware

Crafted from the world-class Salem Stainless Steel, the kitchenware from Salem Steel Plant are indeed precious possessions that defy the laws of ageing - they pass on to your future generations with the same gleam and glory.

Brightening the meal times forever, SALEM STAINLESS kitchenware are available in various combination sets like

37 piece dinner sets
20 piece dinner sets
Travelling sets
Casseroles (assorted sizes)
Canister sets
Cups and saucers
Nasta set
Bhojan sets
Tiffin carriers (assorted sizes)
Lunch mates
Vacuum Flasks
Sharbet set
Condiment set

With "Salem Stainless", it goes without saying that you have for sure "FULL VALUE FOR YOUR MONEY".

Welded Pipes and Tubes

Salem Steel Plant undertakes supply of welded stainless steel tubes and pipes on conversion basis. Sourcing SS pipes and tubes from Salem Steel Plant has its advantages, for, you save on all the anxieties about quality of the raw material and the process of manufacture.

Manufactured out of "SALEM STAINLESS STEEL", through empanelled tube mills, conforming to strict QA regimes, the pipes and tubes guarantee you longer life and trouble free performance.

SS pipes and tubes can be supplied by SSP conforming to ASTM A249 / A312 / A358 in a choice of Austenitic and Ferritic grades.

Through the framework of empanelled tube mills, we can supply the widest range in diameter (½ inch OD to 16" OD) and in the required schedule specification.

The next time, when you have a bulk requirement for welded SS pipes and tubes, please don't hesitate to call Salem Steel Plant.

Stainless Steel for Roofing and Buildings

Fit-and-Forget, SS roofing sheets from Salem Steel Plant guarantee you freedom from periodic maintenance and replacements besides "caught-off guard" leakages. Designed to combat corrosion, stainless steel roofing sheets from Salem have a life of over 100 years. You have an option to have a colour coating on the trapezoidal profiled roofing sheets. We can also provide you assorted profiles for you to choose and adopt.

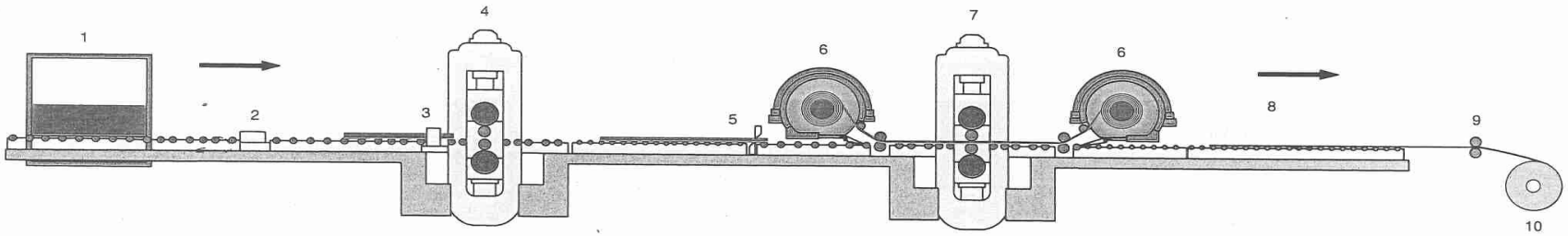
Cladding, Railing and Panelling for landmark buildings - Salem Steel Plant can step in and provide you one-stop solutions.

All that you need is available with us - the best stainless steel, exotic finishes and dependable fabricators who can translate your ideas into reality.

If you are planning your milestone project, we are in fact waiting to take-over all your anxieties on stainless steel fabrication and allow you to relax.

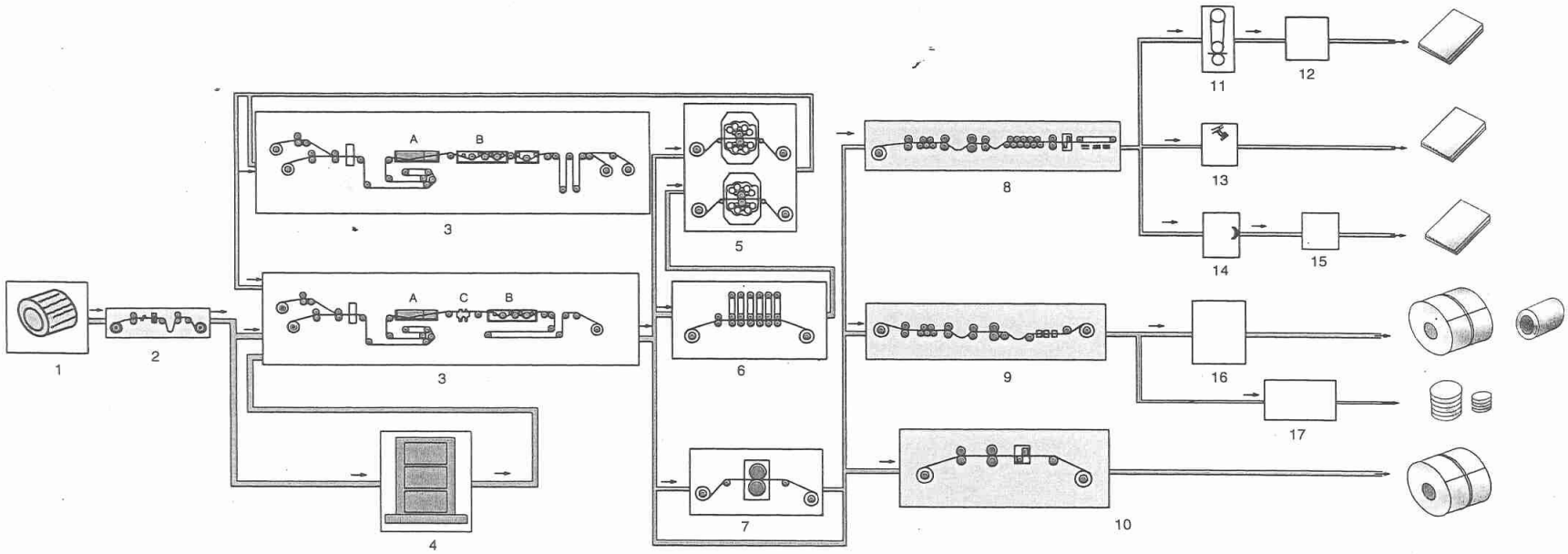
Kitchenware equipment for industrial establishments and institutions, liner plates for power plants, door frames, tanks, vessels, solid waste bins, milk cans, bus shelters or any other application -Salem Steel Plant can get them fabricated for you. We can assure you anxiety free procurement of stainless steel end products. Please call any of the offices given at the end of this booklet for your requirement of SS value added products.

HOT ROLLING PROCESS



1. Reheating Furnace
2. Descaler
3. Edger
4. Roughing Mill
5. Crop Shear
6. Coiler Furnace
7. Steckel Mill
8. Laminar Cooling
9. Pinch Roll
10. Down Coiler

COLD ROLLING PROCESS



1. Hot Rolled Coil
2. Coil Buildup Line
3. Annealing & Pickling Line
   - A - Annealing
   - B - Pickling
   - C - Shot Blasting
4. Bell Annealing Furnace
5. Sendzimir Mills
6. Strip Grinding Line
7. Skinpass Mill
8. Shearing Line
9. Slitting Line
10. Coil Inspection & Dividing Line
11. Sheet Grinding & Polishing Line
12. PVC Coating Unit
13. Sheet Packing Line
14. Stretcher Leveller
15. Resquaring Shear
16. Coil Packing Line
17. Blanking Line

Ordering Information

It is necessary to select the type of stainless steel that is best suited to the intended application. Please give detailed information about both use and service conditions so that we can supply products that fully satisfy your need as regards, price, delivery and product quality.

1. **Applicable standards**

   ASTM (designation number), DIN, JIS, IS or other standard specifications.

2. **Types of steel**
   ASTM (type number), DIN (WNR), JIS (SUS number) IS etc.

3. **Finishes**
   Designation of surface finish.

4. **Dimensions**
   Thickness, width and length (in case of cut sheets)

5. **Quantity**
   Weight, no. of sheets, if required

6. **Delivery time**

7. **Applications**

   Application, drawing ratio, process of fabrication (with or without annealing) grinding or polishing method, welding method, conditions of use (temperature, pressure, kind of liquid), and others.

8. **Special requirements**

   Indicate any special requirements regarding hardness, yield strength, tensile strength etc. The ASTM standard for example, specifies various sheet thickness, width, length and flatness tolerances. Please consult us about specifications that are not standard.

SSP Marketing Offices	
STEEL AUTHORITY OF INDIA LTD **SALEM STEEL PLANT** **"BANDHAN" GHB COMPLEX** **NEAR ANKUR BUS STOP** **NARANPURA** **AHMEDABAD 380 013** **PHONE: 079-27473356** **FAX : 079-27456894** **e-mail :sspahm@sail-steel.com**	**STEEL AUTHORITY OF INDIA LTD** **SALEM STEEL PLANT** **Jeevan Deep Building** **10, Sansad Marg** **NEW DELHI 110 001** **Phone : 011-23745060-63** **Fax : 011-23345443** **e-mail : sspmnd@sail-steel.com**
STEEL AUTHORITY OF INDIA LTD **SALEM STEEL PLANT** **CHERAN TOWERS, 2ND FLOOR** **81, ARTS COLLEGE ROAD** **COIMBATORE 641 018** **Phone : 0422-2218358** **Fax : 0422-2214417** **e-mail : sspcbe@sail-steel.com**	**STEEL AUTHORITY OF INDIA LTD** **SALEM STEEL PLANT** **III, FLOOR, VISL HOUSE** **8, J.C. ROAD** **BANGALORE 560 002** **Phone : 080-22248041 / 22248037** **Fax : 080-22248042** **e-mail : sspblr@sail-steel.com**
STEEL AUTHORITY OF INDIA LTD **SALEM STEEL PLANT** **SWASTIK CHAMBER, 219-220,** **2ND FLOOR, SION TROMBAY ROAD** **CHEMBUR** **MUMBAI 400 071** **Phone : 022-25299570/25227468/** **25299487** **Fax : 022-25276121/25299757** **e-mail :sspmum@sail-steel.com**	**STEEL AUTHORITY OF INDIA LTD** **SALEM STEEL PLANT** **Ispat Bhavan, 2nd FLoor** **No.5, Kodambakkam High Road** **Nungambakkam, Chennai-600034** **Phone : 044-28242120/28242127** **28242118/28242117** **Fax : 044-28243208** **e-mail :sspmaa@sail-steel.com**
STEEL AUTHORITY OF INDIA LTD **SALEM STEEL PLANT** **VEER SAVARKAR UDYOG BHAVAN** **NEAR BAL GANGADHAR RANG MANDIR** **SHIVAJI NAGAR** **PUNE 411 005** **Phone : 020-25539152/25533967** **Fax :020-25539548** **e-mail :ssppun@sail-steel.com**	**STEEL AUTHORITY OF INDIA LTD** **SALEM STEEL PLANT** **IISCO HOUSE, 7TH FLOOR** **50 JAWAHARLAL NEHRU ROAD** **KOLKATA 700 071** **PHONE: 033-22820027** **FAX :033-22903294** **e-mail: ssper3875@bsnl.in**

STEEL AUTHORITY OF INDIA LTD **SALEM STEEL PLANT** **TARAMANDAL COMPLEX,** **9TH FLOOR** **5-9-13, SAIFABAD** **HYDERABAD 500 004** **Phone :040-23234303** **Fax :040-23241582** **e-mail :ssphyd@sail-steel.com**	
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