सेल SAIL

# COLD ROLLED COILS & SHEETS

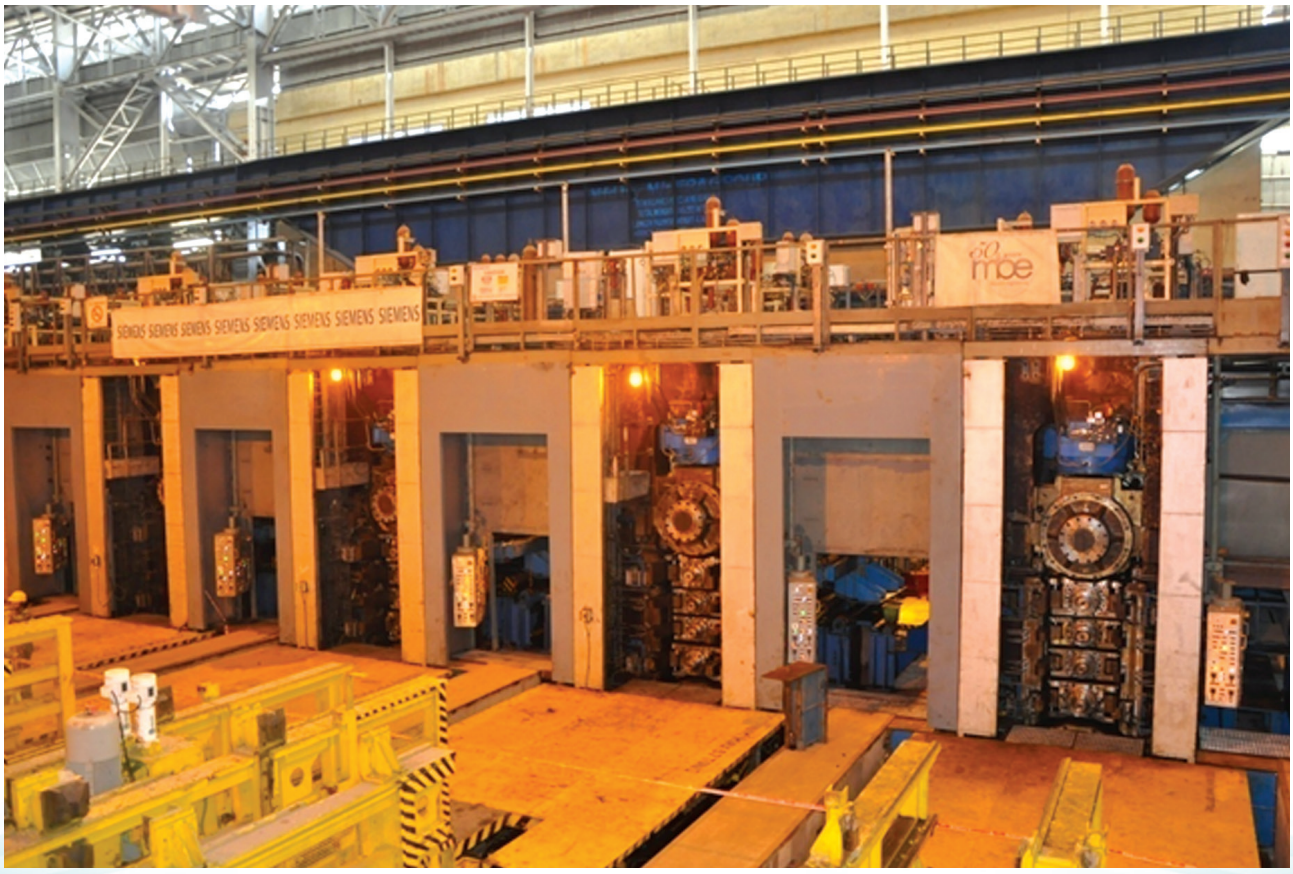
# Cold Rolled Products - Bokaro Steel Plant

The new cold rolling mill (CRM-III) at Bokaro Steel Plant, uses state-of-the-art technology to produce top quality Cold Rolled and Galvanized Products. It has a total capacity of 1.2 million tonne with 0.84 million tonne for CRCA and 0.36 million tonne of Galvanised Coils. The CRM-III complex houses following facilities.

## PLTCM (Pickling Line Tandem Cold Rolling Mill):

**Main features of PLTCM**

- Twin Pay off reel & twin Tension reel for endless rolling.
- Laser Welding.
- Scale Breaking Unit (Tension leveler cum scale breaker).
- Fully Automatic Pickle Liquor Analysis (FAPLAC) – shallow pickling tanks with turbulent HCL pickling.
- Turret type edge trimmer.
- 6 high Tandem cold mill with Intermediate Roll shifting.
- Quick Work Roll & Intermediate Roll changing with Strip in Mill.
- Automatic Gauge Control.
- Automatic shape control (SIFLAT).
- Selective cooling.



**BAF (Bell Annealing Furnace):** To improve mechanical properties lost during rolling, annealing is done. It has super high convection system which includes forward curved convection fan with matching diffuser for the best atmosphere circulation. 100% hydrogen gas is used for annealing, which gives bright and cleaner surface to CR Coils.

**ECL (Electrolytic Cleaning Line):** After rolling from PLTCM, the strip has emulsion on the surface. To clean this, the electrolytic cleaning line is used. First the strip is passed through a hot alkaline tank & then through a brush scrubber tank after which electrolytic cleaning is done in electrolytic cleaning tank. Two electrodes are dipped in alkaline solution to remove the ionised impurities from the surface. The product from this line has high quality surface finish & is mainly used in automotive industries.

**ECL Line has following advantages:**

After passing the CR Strip through the ECL the Oil and Iron are reduced to the extent as under :

Oil & Dirt (max) – <10 mg/$m_2$ for both sides

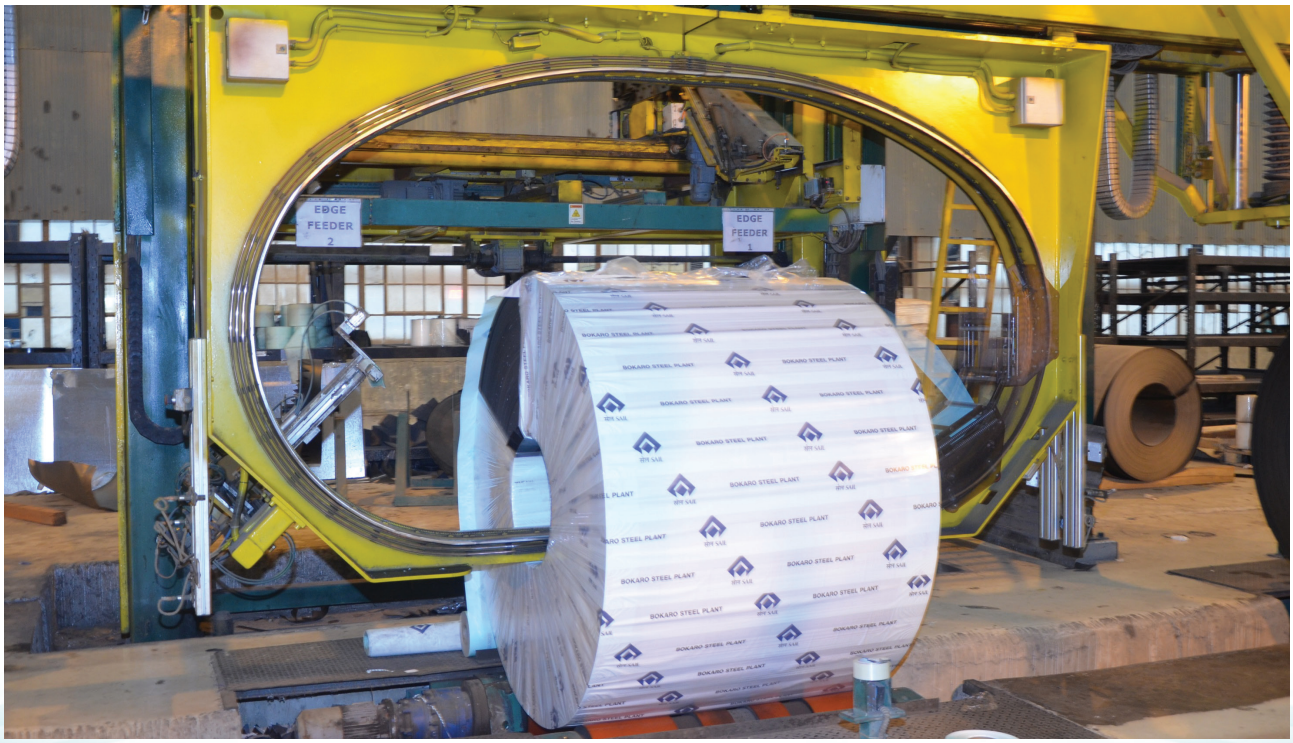
Iron Fines (max) – <20 mg/$m_2$ for both sides

**SPM (Skin Pass Mill):** It is a 4-HI Mill. It processes annealed coil of thickness 0.25 mm to 2 mm & produces final sellable product. Skin passing of the coil is done to remove yield point phenomena & paint ability in the coil. To control flatness, Shape meter roll is used in the line which provides automatic bending & tilting. Line has facility of Electrostatic oiler for oil coating in the strip to improve corrosion resistance. It also has provision of wet skin passing which enhances roll life & cleanliness of the strip.

**TLIL (Tension Leveller & Inspection Line):** The processed coil from SPM is directly transported to TLIL by a combination of walking beam conveyor, coil shuttle car & coil transfer cars. The shuttle car places the coil on the either of the two number floor mounted fixed coil saddle. Entry coil car pick up the coil & places on the cradle roller station where the coil width is measured & coil is aligned for de-banding operation.


**CPL (Coil Packaging Line):**

Coils are first packed with paper and high-density polythene and then secured with steel strapping. A coil is strapped with three eye and two circumferential straps. For identification, one sticker and one metallic tag with a sticker are provided. These are then loaded into wagons with the eye of the coil in horizontal position. Coils are then unitized by strapping.



## Rationalised sizes of CR Coils

| Thickness (mm) | Width (mm) |
|---|---|
| 0.40, 0.45 | 900, 1000 |
| 0.5, 0.55, 0.6, 0.63, 0.7 | 900, 1000, 1120, 1219, 1220, 1250 |
| 0.8, 0.9, 0.95 | 900, 914, 920, 1000, 1020, 1120, 1219, 1220, 1250, 1320, 1420 |
| 1.00, 1.2, 1.25, 1.4, 1.5, 1.6, 1.85, 1.9, 2.0 | 900, 914, 920, 1000, 1020, 1120, 1219, 1220, 1250, 1320, 1420, 1520, 1580 |
| **Bitumen Size** | |
| 0.63 | 876, 896, 1120 |
| **Barrel Size** | |
| 0.9 | 914, 920, 1225, 1320 |
| 1, 1.2, 1.25 | 914, 920, 1225, 1320, 1580 |

## Physical attributes of CR Coils

| | CRM I/II | CRM III |
|---|---|---|
| Inner diameter | 510 mm (thickness 0.63 mm and below and width up to 1020 mm) and 600 mm (for other sizes) | 508 mm |

## Size Range of Cold Rolled Coils

| Grade | Mill | Thickness (mm) | | Width (mm) | |
|---|---|---|---|---|---|
| | | Min | Max | Min | Max |
| IS 513 CR0 | CRM I/II/III | 0.4 | 2 | 900 | 1420 |
| IS 513 CR1 | CRM I/II | 0.4 | 2 | 900 | 1000 |
| | CRM I/II | 0.63 | 2 | 900 | 1250 |
| | CRM I/II | 0.8 | 2 | 900 | 1420 |
| | CRM I/II | 1 | 2 | 900 | 1580 |
| IS 513 CR2/3 | CRM III | 0.35 | 2 | 900 | 1000 |
| | CRM III | 0.4 | 2 | 900 | 1250 |
| | CRM III | 0.6 | 2 | 900 | 1320 |
| | CRM III | 0.8 | 2 | 900 | 1420 |
| | CRM III | 1 | 2 | 900 | 1520 |
| IS 513 CR4 | CRM III | 0.4 | 2 | 900 | 1250 |
| IS 11587 WR- Fe490C/IRSM 41 (SAILCOR) | CRM I & II/ CRM III | 1.6 | 2 | 1220 | 1280 |
| ISC 270 / 390 / 410 / 440 | CRM III | 1.2 | 2 | 1250 | 1280 |
| ISC 340W / 370W / 390W / 440W | CRM III | 0.8 | 2 | 1250 | 1280 |
| ISC 410LA / 440LA / 470LA | CRM III | 0.8 | 2 | 1250 | 1280 |

*If required some of the above grades can be supplied with Cu also.

## Rationalised sizes of Cold Rolled Sheets

| Thickness (mm) | Width (mm) | Length (mm) |
|---|---|---|
| 0.60, 0.63, 0.70 | 900, 1000, 1100, 1250 | 2000, 2500, 3000, 3600 |
| 0.80, 0.90 | 900, 1000, 1100, 1250, 1400 | 2000, 2500, 3000, 3600 |
| 1.00, 1.25, 1.50,1.60, 1.85, 2.00 | 900, 1000, 1100, 1250,1400, 1500 | 2000, 2500, 3000, 3600 |

CR coils/sheets are supplied in oiled/unoiled condition as per customers' requirements. Tolerance as per IS - 513/IS/ISO/16162 (2012). However, closer tolerances can be supplied on mutual agreement.

CR Sheets are packed in packets of 3 - 10 tonnes each and covered with high density polythene and paper. Thereafter, these are bound with steel straps. They also have stickers inside the packets and metal tags attached to the strips.

## Dimensional tolerances (IS - 513/IS/ISO - 16162 : 2012)

### Normal thickness tolerances for coils and sheets (mm)

| Specified width | Thickness tolerances for specified thicknesses [a, b, c, d, e] | | | | | | |
|---|---|---|---|---|---|---|---|
| | ≤ 0.4 | >0.4 ≤0.6 | >0.6 ≤0.8 | >0.8 ≤1.0 | >1.0 ≤1.2 | >1.2 ≤1.6 | >1.6 -2.0 |
| 600≤1200 | ±0.03 | ±0.04 | ±0.05 | ±0.06 | ±0.07 | ±0.09 | ±0.11 |
| >1200≤1500 | ±0.05 | ±0.05 | +0.05 | ±0.07 | ±0.08 | ±0.10 | ±0.12 |
| >1500≤1800 | – | ±0.06 | ±0.07 | ±0.08 | ±0.10 | ±0.12 | ±0.14 |

**(a)** The thickness tolerances for coils are the same as for sheets, but in cases where welds are present, the tolerances shall be double of those given over a length of 15m in the vicinity of the weld **(b)** For specified strength levels of Re = 360 N/mm$^2$ and greater, increase the thickness tolerances by 10%, applying normal rounding-off procedural **(c)** Thickness is measured at any point on the sheet not less than 25 mm from a side edge **(d)** The specified thickness range captions apply as a specific value **(e)** The tolerances provided in this table are based on normal thickness (tolerance over and under). For ordered thicknesses other than nominal, the total tolerance is twice the tabled value.

### Width tolerances for coils and sheets, not resquared

| Width tolerances | | Length tolerances | |
|---|---|---|---|
| Width | Tolerance | Width | Tolerance |
| ≤1200 mm | +3 mm / - 0 mm | ≤2000 mm | +10 mm / - 0 mm |
| >1200 mm ≤1500 mm | +5 mm / - 0 mm | >2000 mm ≤8000 mm | +0.5% of length / - 0 mm |
| > 1500 mm | +5 mm / - 0 mm | > 8000 mm | +40 mm / - 0 mm |

Note: For re-squared material, more restrictive tolerances are subject to negotiation.

## Chemical Composition: IS 513 Part - 1/2016

| Grade | Carbon | Manganese | Sulphur | Phosphorus |
|---|---|---|---|---|
| | % Max | % Max | % Max | % Max |
| CRO | 0.35 | 4.00 | 0.035 | 0.050 |
| CR1 | 0.15 | 1.00 | 0.035 | 0.080 |
| CR2 | 0.12 | 0.50 | 0.035 | 0.040 |
| CR3 | 0.10 | 0.45 | 0.030 | 0.025 |
| CR4 | 0.08 | 0.45 | 0.030 | 0.020 |
| ISC340W | 0.12 | 0.90 | 0.030 | 0.050 |
| ISC370W | 0.15 | 1.30 | 0.030 | 0.050 |
| ISC390W | 0.20 | 1.50 | 0.030 | 0.050 |
| ISC440W | 0.20 | 1.70 | 0.030 | 0.050 |

Al : 0.02% - 0.07% if Al-killed, Si : 0.1% (min) if Si killed, Si - 0.03% (min) Al - 0.01% (min) if Si-Al killed. MAE (Nb, V, Ti, B) can be added either singly or in combination. If B is added it should be 0.006% (min). Nitrogen content for grades CR0 & CR 1 : 0.012% (max); and for other grades 0.007% (max).

## Mechanical Properties : IS 513 Part - 1/2016 (at room temperature : coils & sheets)

| Grade | Yield Point or Proof Stress Mpa, Max | Tensile Strength Mpa, Max | Minimum Elongation | | Mean Plastic Strain Ratio r-Bar | Tensile Strain Hardening Component n-Value | Test Direction |
|---|---|---|---|---|---|---|---|
| | | | Gauge Length 80 mm | Gauge Length 50 mm | | | |
| CR1 | 280 | 410 | 27 | 28 | - | - | T |
| CR2 | 240 | 370 | 30 | 31 | - | - | T |
| CR3 | 220 | 350 | 34 | 35 | 1.3 min | 0.16 min | T |
| CR4 | 210 | 350 | 36 | 37 | 1.4 min | 0.19 min | T |

| Grade | Tensile Strength Mpa, Min | Yield Point or Proof Stress, Mpa (t >1.00 mm) | Min Elongation % (Gauge length-50mm t>1.00mm) |
|---|---|---|---|
| ISC 340W | 340 | 165-265 | 35-45 |
| ISC 370W | 370 | 185-285 | 32-42 |
| ISC 390W | 390 | 225-335 | 31-42 |
| ISC 440W | 440 | 265-370 | 28-40 |

## Chemical & Mechanical Properties : IS 513 Part - 2/2016

| Grade | Carbon | Manganese | Sulphur | Phosphorus |
|---|---|---|---|---|
| | % Max | % Max | % Max | % Max |
| ISC 410LA | 0.12 | 1.5 | 0.025 | 0.030 |
| ISC 440LA | 0.12 | 1.6 | 0.025 | 0.030 |
| ISC 470LA | 0.14 | 1.6 | 0.025 | 0.030 |

| Grade | Tensile Strength Mpa, Min | Yield Point or Proof Stress, Mpa t>0.70 mm | Min Elongation% Gauge length-80mm t>0.70 mm |
|---|---|---|---|
| ISC 410LA | 410 | 340-420 | 21 |
| ISC 440LA | 440 | 380-480 | 19 |
| ISC 470LA | 470 | 420-520 | 17 |

## Chemical & Mechanical Properties

| Production Grade | IS Specification Grade | Size | Brand Name | %C | %Mn | %P | %S | %Si |
|---|---|---|---|---|---|---|---|---|
| SAILCOR (Cold Rolled) | IS 11587: 1986 WR-Fe 490C | 1.6 mm to 2.0 mm | SAIL-COR-C | 0.12 max | 0.60 max | 0.070-0.150 | 0.035 max | 0.200-0.750 |

| %Al | %Cu | %Ni | %Cr | %V | YS | UTS | %El 50 mmGL | Application |
|---|---|---|---|---|---|---|---|---|
| 0.02 min | 0.25 - 0.55 | 0.65 max | 0.30-1.25 | ----- | 315 min | 450 min | 26% min | Cold Rolled Structural |

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STEEL AUTHORITY OF INDIA LIMITED
*There's a little bit of SAIL in everybody's life*

Contad - Nov 2023