

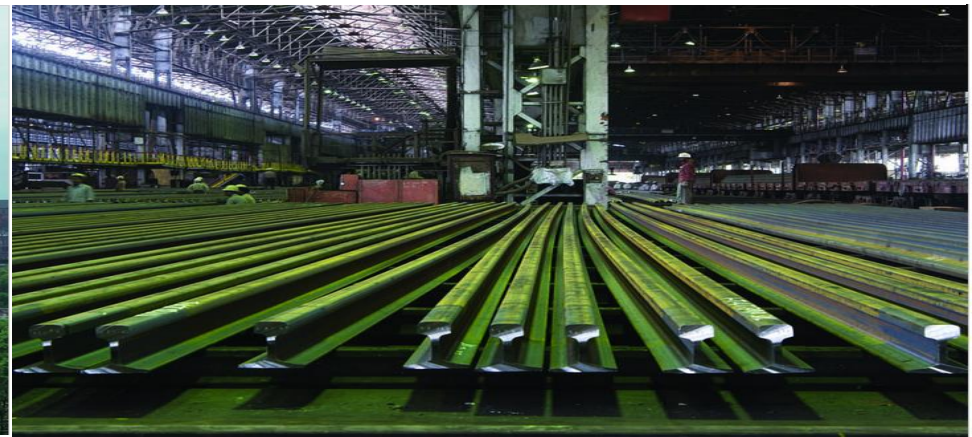


Products in SAIL for Pre fabricated Structures

Indian Institute of Metals: Seminar on Pre fabricated Structures for Urban and Rural Housing and Warehousing/ Logistic Support.



स्टील अथॉरिटी ऑफ इण्डिया लिमिटेड
STEEL AUTHORITY OF INDIA LIMITED



Presentation Structure

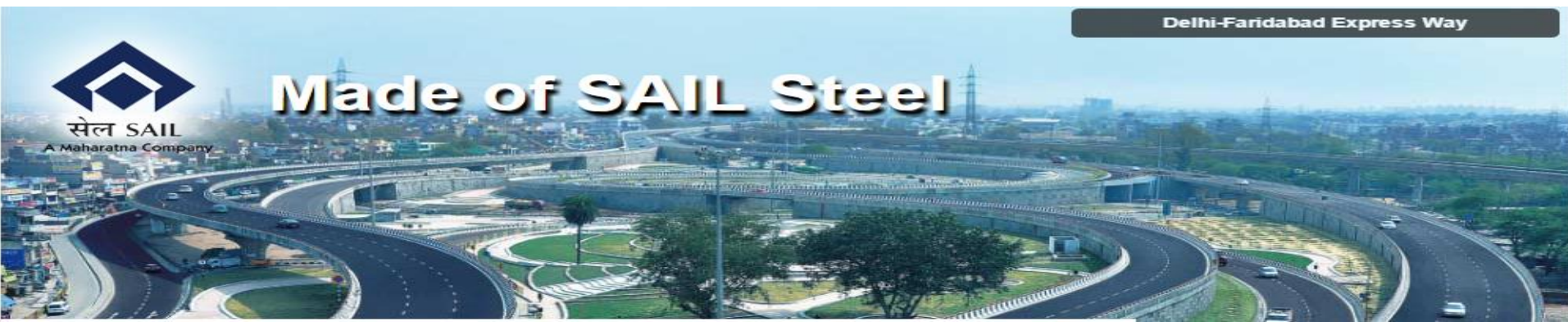
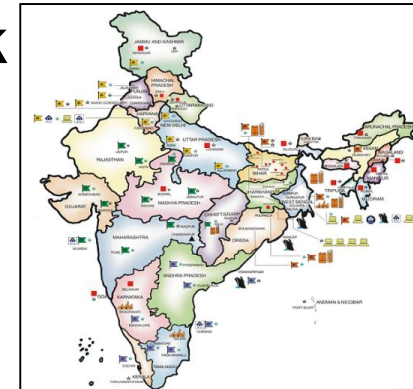


- Introduction about SAIL/Product Basket
- New Mills & Products post expansion
- SAIL products for Pre fabricated Structures
- Product Photographs
- Important clients in this segment
- Conclusion

SAIL – A Snapshot



- Among the seven “Maharatnas” of India’s Central Public Sector Enterprises
- Five Integrated Steel plants, three special steel plants & one Ferro-alloy plant
- Widest Product range & Marketing Net-work
- Crude Steel Production in 16-17 : 14.495 MT
- Sales in FY 17 : 13.110 MT



LOGISTICS NETWORK OF SAIL

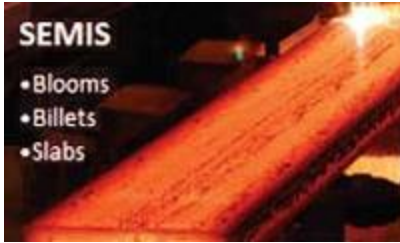


- **37 Branch Sales Offices**
- **44 Warehouses**
- **10 Customer Contact Offices**
- **Largest Retail Network with > 2000 Dealers**
- **Material movement from all Steel Plants by Rail primarily.**
- **Transportation arrangements from all warehouses to reach even the hinterland.**
- **About 2 Million tonne of steel made available to customers by Road movement in the country.**

PRODUCT CATALOGUE

SEMIS

- Blooms
- Billets
- Slabs



STRUCTURALS

- Beams/Joists
- Channels
- Angles
- Crane Rails
- Z-Type Sheet-piling Section



BARS, RODS & REBARS

- Bars, Rods & Rebars
- Wire Rods



HOT ROLLED PRODUCTS

- Coils & Sheets



PLATES



COLD ROLLED PRODUCTS

- Coils & Sheets



GALVANISED PRODUCTS

- Plain/Corrugated Sheets & Coils



PET PRODUCTS

- Pipes
- Electrical Steels



RAILWAY PRODUCTS

- Rails
- Wheels, Axles & Wheel Sets



SPECIAL STEELS

- Alloy Steels Plant
- Visvesvaraya Iron & Steel Plant
- Salem Steel Plant



PIG IRON



PARALLEL FLANGE BEAMS & STRUCTURALS



SAIL offers a wide range of products in Mild, Special and Alloy steel categories in around 500 grades and 5000 dimensions

POST EXPANSION: NEW PRODUCTS



Wider Width Plates

Rourkela Steel Plant

Parallel Flange Structures

Durgapur and IISCO Steel Plant

Long Rails

Bhilai Steel Plant

CR from New CRM

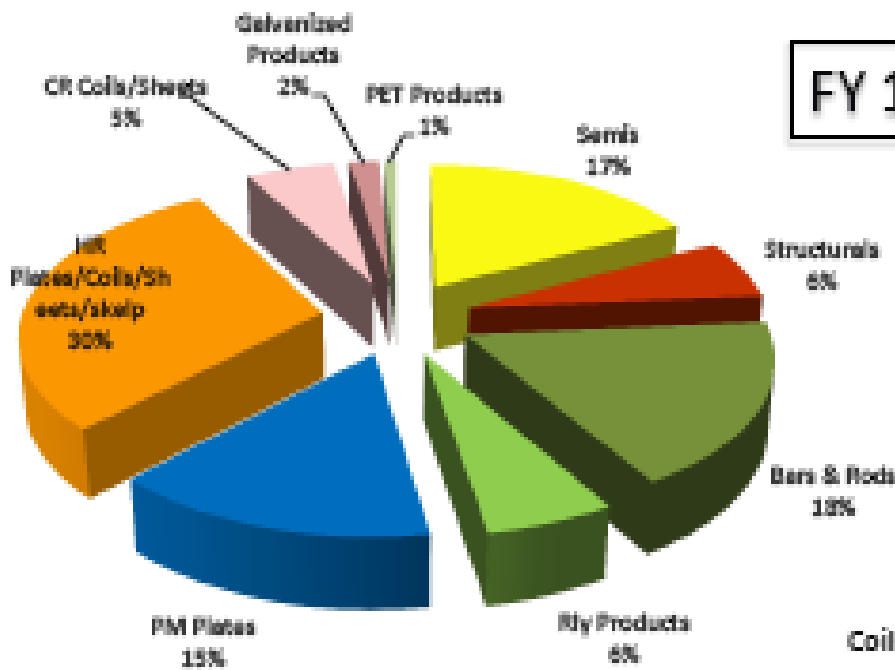
Bokaro Steel Plant

Special Quality Wire Rods & Rounds

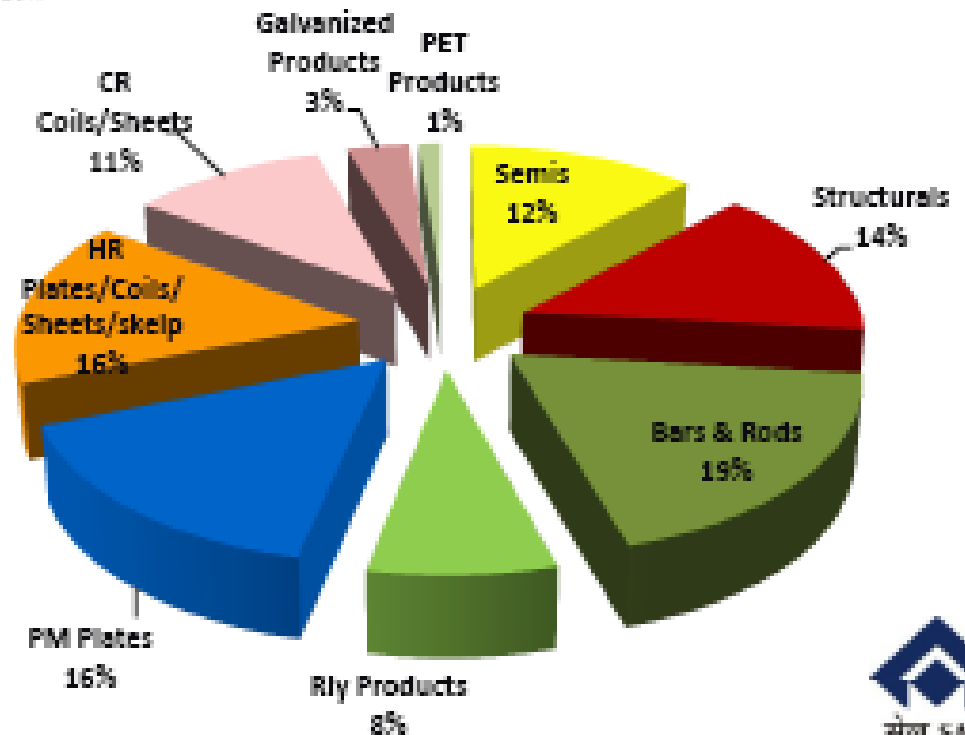
IISCO Steel Plant

PRODUCT MIX POST EXPANSION – SALEABLE STEEL

FY 17



Post Ongoing Expansion



PRODUCT MIX OF SAIL – POST EXPANSION



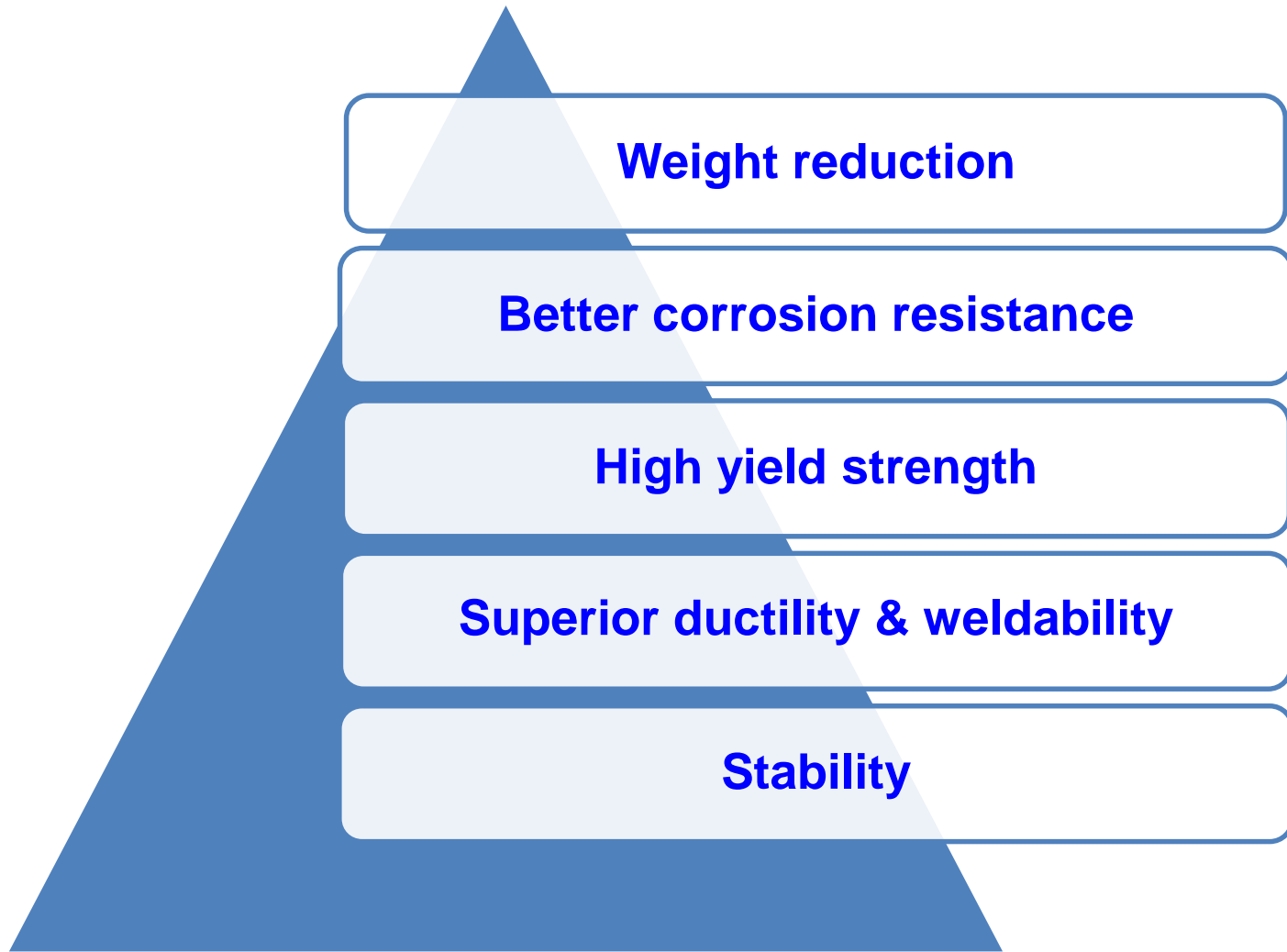
Category	Pre-Expansion Capacity(In MT)	Post Expansion Capacity(In MT)
Semis	1.7	2.4
Bars & Rods	1.6	3.6
Structural	0.7	2.8
Railway Products	1.0	1.5
Plates	1.8	3.1
Hot Rolled Products	4.1	3.0
Cold Rolled And Galvanised Products	1.4	2.7
Pipes & Electrical Steels	0.4	0.2
Special Steel Plants	0.6	0.6
TOTAL	13	20

NEW MILLS – SAIL

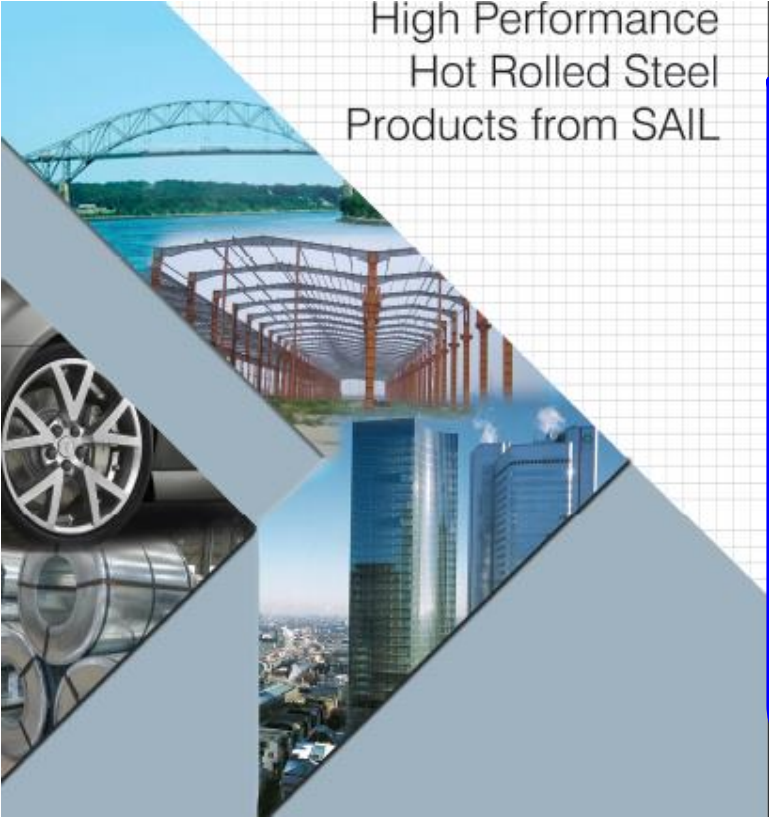


Plant	Mill	Capacity MTPA	Products
ISP	Universal Section Mill (USM)	0.85	Parallel Flange Beams upto 750 mm & Universal Channels and Angles
	Bar Mill	0.9	TMT
	Wire Rod Mill	0.55	Wire Rods
DSP	Med Structural Mill (MSM)	1	Parallel Flange Beams upto 270 mm & Channels and Angles
RSP	Plate Mill	1	Can produce plates upto width 4200mm
BSP	Bar & Rod mill	0.9	TMT (0.7 MTPA) & Wire Rods (0.2 MTPA)
	Universal Rail Mill	1.2	Rails including Head Hardened Rails
BSL	CR Mill	1.2	CR and Galvanized

LATEST TRENDS IN CONSTRUCTION



High Performance
Hot Rolled Steel
Products from SAIL



SERVICE

TO

NATION

**SEISMIC RESISTANT
STRUCTURALS AND TMT REBARS**



TMT: SIZES AVAILABLE FROM SAIL PLANTS



Different types of TMT bars available depending on various applications

- **Corrosion resistant – Coastal Areas (SAILTMT HCR)**
- **Earthquake resistant – Seismic Areas (SAILTMT EQR)**
- **Rock & Roof Bolt – Mining Areas**

DSP : 16, 20, 22, 25, 28 mm

ISP : 6,8,10,12,16, 20, 22, 25, 28, 32, 36 mm in Bar
: 8,10,12mm in coil form

BSP : 8 , 10, 12 in Coil Form (TMTC)
: 8 , 10, 12, 25 , 28, 32, 36, 40 & 45mm in Bar

Other Features:

Uniform Length : of 9 to 13.5 Mtr.

Bundled : Uniform Length Bundles with 7 to 9 Straps :

TENSILE PROPERTIES

Standard	IS:1786-2008	IS:1786-2008	IS:1786-2008 rev. 2012/ SAILEQR	IS:1786-2008 Under rev. 2016
Grade	Fe-500	Fe-500D	Fe-500S	Fe-500S
YS (MPa min.)	500	500	500	500
YS (MPa max.)	-	-	625	650
UTS/YS (min.)	545 (1.08)	565 (1.10)	- 1.25	- 1.25
Elongation (% min.)	12	16	18	16
Uniform Elongation (% min.)	-	5	8	8

TENSILE PROPERTIES OF SAIL SEISMIC REBARS

Diameter	YS, MPa	UTS, MPa	UTS/YS Ratio	Elongation %
16 mm	518 – 524	647 – 661	1.27 – 1.29	20 – 24
20 mm	519 – 526	647 – 667	1.26 – 1.29	23 – 25
25 mm	547 – 563	689 – 709	1.25 – 1.29	20 - 24

CHEMICAL COMPOSITION

Grade	C	S	P	S + P	MA Element
IS:1786 – 2008/ IS:1786 -2012 (Rev.1)					
Fe-500	0.30	0.055	0.055	0.105	0.30
Fe-500 D/ Fe-500S	0.25	0.040	0.040	0.075	0.30
SAIL EQR Grade					
Fe-500S	0.25	0.040	0.040	0.075	0.30

1. Carbon equivalent is restricted to 0.42% for plain C steel whereas it is 0.53% max. for alloyed steel.
2. Microalloying elements, like Nb, V, Ti may be added upto 0.30 wt% max.
3. Other alloying elements, like Cu, Cr, Mo, etc. may be added for improvement in allied properties.
4. P may be added upto 0.12% with mutual agreement with the customers if desired to improve allied properties.

ADVANTAGES OF SAIL EQR REBARS

- Low S & P ensures superior elongation and toughness.
- High strength with high ductility provide good formability/bendability during fabrication.
- High UTS/YS ratio in excess of 1.25 and high elongation ensures significantly improved capacity to absorb plastic energy in the event of a major earthquake.
- Microstructural engineering approach and optimized process parameters ensures high elongation and UTS/YS ratio, low variation in tensile properties.
- Superior corrosion resistance due to absence of torsional stress and specially designed alloy chemistry.
- Good high temperature thermal resistance due to unique chemistry and microstructure.

SAIL TMT – HCR - CHARACTERISTICS



▪ **STRENGTH :**

- BOND STRENGTH CONFORMS TO STIPULATION OF IS 1786
- GUARANTEES BETTER STRENGTH THAN COLD TWISTED DEFORMED BARS
- LOWER C, S & P THAN CONVENTIONAL HYSD BARS.
- DEFINITE YIELD POINT

▪ **BENDABILITY :**

- EXCELLENT BENDABILITY DUE TO UNIQUE FEATURE OF BETTER ELONGATION
- CAN WITHSTAND BENDING / REBENDING BETTER THAN CONVENTIONAL HYSD BARS

▪ **WELDABILITY :**

- NO LOSS OF STRENGTH AT WELD JOINTS
- EASILY WELDABLE TO HSYD BARS
- NO PRE OR POST HEATING REQUIRED DURING WELDING

▪ **FIRE RESISTANCE :**

- HIGH THERMAL STABILITY DUE TO HEAT TREATED STRUCTURE OF BARS AND TOTAL ABSENCE OF COLD WORKED STRUCTURAL ZONE
- SUITABLE FOR FIRE PRONE ZONES
- RESISTANCE EVEN UPTO 600°C

APPLICATIONS OF SAIL TMT HCR

- **Bridges and flyovers**
- **Dams and power plants**
- **Underground platforms**
- **Industrial structure**
- **High rise buildings**
- **General purpose concrete**
- **Reinforcement**
- **Areas prone to seismic activities**
- **TMT HCR recommended grade for aggressive atmospheric conditions – marine, blackish water, areas of excessive rainfall**

SAIL TMT– HCR - TESTED AND CERTIFIED BY



- **STRUCTURAL ENGINEERING RESEARCH CENTRE, CHENNAI**
- **CBRI , ROORKEE**
- **IIT , DELHI**
- **RDCIS , RANCHI**
- **NATIONAL TEST HOUSE , KOLKATA**
- **L BRANZ RESOURCE CENTRE FOR BUILDING EXCELLENCE , NEWZEALAND**

SATISFIED CUSTOMERS



- **INDIAN DEFENCE FORCES**
- **INDIAN RAILWAYS**
- **ELECTRICITY BOARDS**
- **NATIONAL THERMAL POWER CORPORATION**
- **NATIONAL HYDEL POWER CORPORATION**
- **NATIONAL HIGHWAY AUTHORITY OF INDIA**
- **LARSEN & TOUBRO**
- **HINDUSTAN CONSTRUCTION COMPANY**
- **INDO GULF FERTILISERS**
- **KANDLA PORT TRUST**
- **GUJARAT MINERAL DEVELOPMENT CORPORATION**
- **BHEL AND MANY OTHERS**

STRUCTURALS from New Mills of SAIL

Product Mix of MSM/USM



SL.	PRODUCT	MSM SIZE RANGE (mm)	USM SIZE RANGE (mm)
1.	BEAMS :		
	NPB IS 12778/(IPE) DIN 1025	100 – 300	240 – 750
	WPB IS 12778/(HE) DIN 1025	100 – 160	200 – 450
	ISMB IS 808	100 – 300	
2.	CHANNELS		
	UPN DIN 1026		200 – 400
	ISMC IS 808	100 – 300	200 – 400
3.	EQUAL ANGLES IS 808	90 – 200	150 – 200
4.	RCS AND ROUNDS	60 – 120	
5.	SPECIAL SECTIONS		Z-PILE, U-PILE

Parallel Flange vs. Conventional Beams

- **Product Flexibility**

Wide range of flange width / thickness and web thickness combination for any particular nominal depth

- **Mechanically More Efficient**

Higher axial load carrying capacity,

Higher section modulus and bending strength

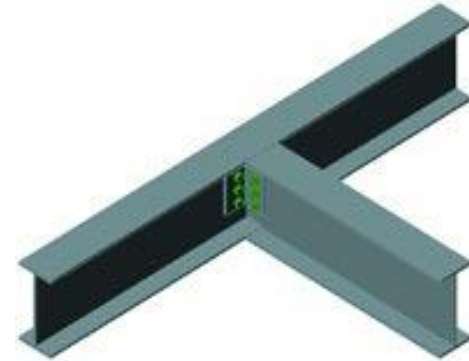
- **Economical**

Parallel flange sections offer substantial saving in material weight as compared to ISMB section when used as compression member or as flexural member

Saving of steel about 10-15% is achievable

- **Fabrication easier**

Direct bolting on flanges without tapered washers, butt welding of plates to the flange makes easier connection joint, resting of composite deck easier



Parallel Flange vs. Fabricated Beams

- **Cost Savings**

Higher strength to weight ratio leads to lighter structures and foundations

- **Fabrication Costs**

Cost of welding and wastage saved, less complicated fabrication. Saving in labour time with consequent cost-saving during construction

- **Construction Time**

Readily available sections makes construction faster

- **Product Quality**

Rolled sections are cheaper and of higher quality.

Expensive factory fabricated sections or low quality site fabricated sections can be avoided.

SECTIONS STABILISED

❖ USM, Burnpur:

- Angle 150x150x12
- Angle 200x200x12x16x20
- NPB 300x150x42.24
- NPB 300x150x49.32
- NPB 300x150x36.52
- NPB 400x180x66.3
- NPB 400x180x57.38
- NPB 400x180x75.66
- IPE 400R [400x180x84.00]
- NPB 450x190x77.57
- NPB 450x190x67.15
- IPE 450R [450x190x95.20]
- NPB 450x190x92.36
- IPE 450V [450x190x104.0]
- NPB 500x200x90.68
- NPB 500x200x79.36
- NPB 600x220x122.45
- WPB 300x300x117.03
- UPN 300

❖ MSM, Durgapur:

- MC 100x50 (9.56 kg/m)
- Angle 90x90x6/8
- MC 300x90x7.8 (36.3 kg/m)
- MB 100x50 (8.9 kg/m)
- NPB 100x55x8.1
- WPB 160x160x76.19
- WPB 160x160x23.84
- WPB 160x160x30.44
- WPB 160x160x42.59

- **Industrial buildings, Utilities buildings & Car park**
- **Columns, beams, portal frames, hangars, posts, monorails, crane girders**
- **Multi- storied steel building**
- **H-beams with composite construction of multi-storied buildings**
- **Road bridge composite construction**
- **Technological structures**
- **Railways**
- **Material handling systems**
- **Ports & harbors**
- **Offshore drilling rigs**

Key Clients



FEDDERS ELECTRIC & ENGINEERING LIMITED
(Formerly known as Fedders Lloyd Corporation Ltd.)



Key Clients



NEW PLATE MILL AT RSP – SIZE MIX



- **THICKNESS RANGE :6-100MM**
- **WIDTH RANGE- 1500-4100 MM**
- **LENGTH RANGE: 6300-15000 MM**
- **MAXIMUM WEIGHT OF PLATE :23 MT**

VARIETY OF GRADES



- IS 2062 E250, E300, E350 A, BR, B0, C WITH OR WITHOUT Cu
- IS 2062 E410 A , BR , B0 , C , E450 A, BR
- IS 5896-165,205,235,255,325,355,420,490, &560
- ASTM A36
- BOILER & PRESSURE VESSEL STEEL IS 2002(ALL GRADES)
- ASTM 515/516 ALL GRADES, ASTM537 CL-1, ASTM 202
- LLOYDS 360, 410 INCLUDING AR, FG
- API 5L GRADE (UPTO X-70)
- SHIP BUILDING (LL GR A, B)
- DMR 292 A, DMR 249 A & B
- HARDOX, WELDOX
- ASTM 517 Gr F
- ASTM 537 CI-I

ADVANTAGES OF RSP PLATE MILL PLATES



- **High strength with good weldability**
- **Combination of high strength and high ductility**
- **Scale free surface**
- **Close tolerances**
- **Improved flatness**
- **Very good profile & shape**

Key Clients

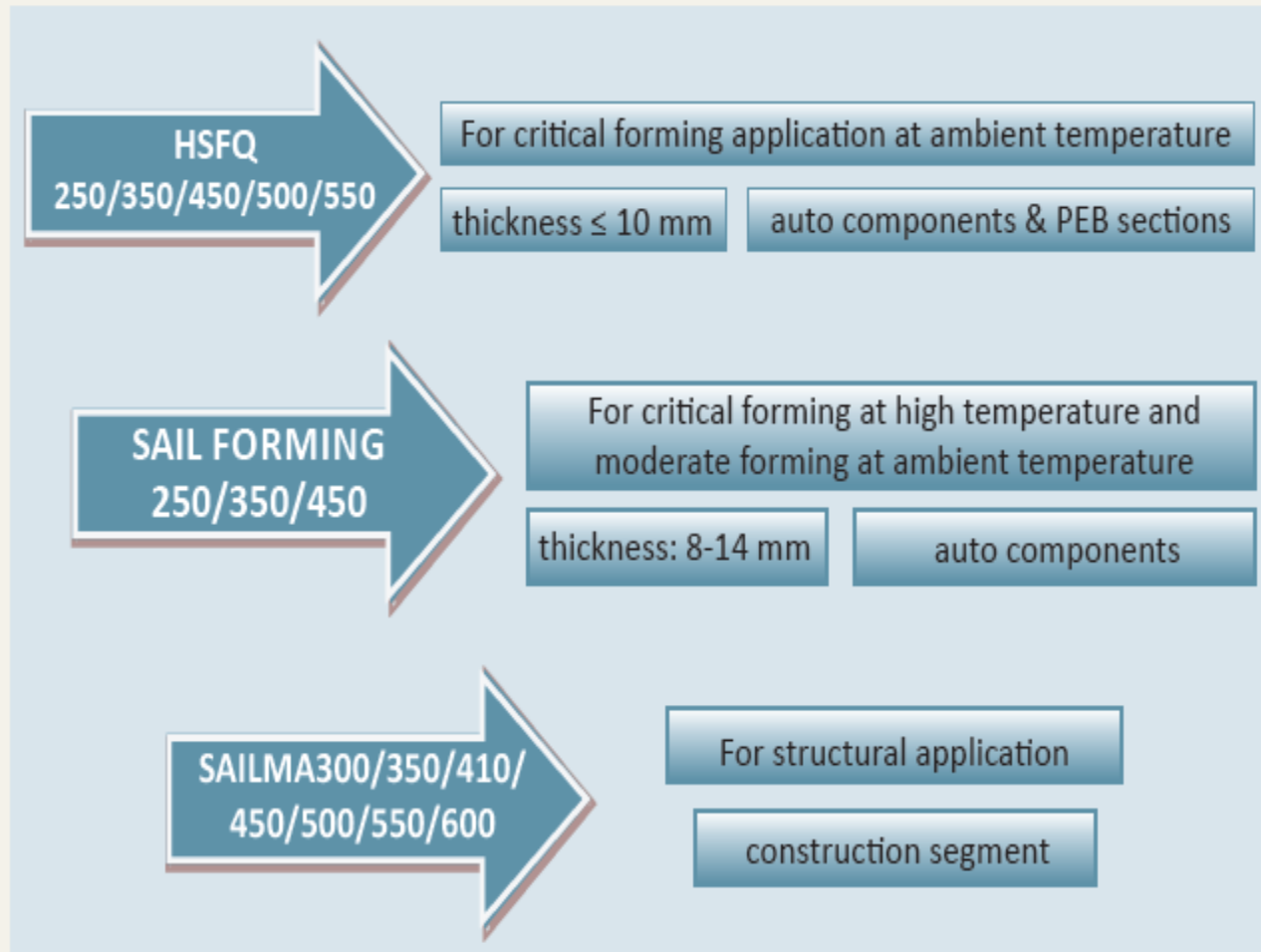
JCL INFRA LIMITED



Richa Industries Limited
DON'T JUST BUILD...CREATE

HSFQ being supplied in HR Coil form

Application based High Performance Steel



- **Lighter products**
- **Reduced Material cost**
- **Extended useful life**
- **Better Environment**

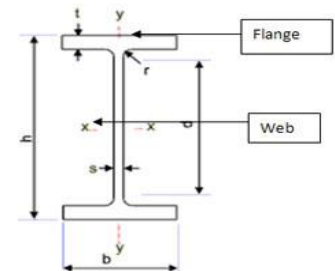
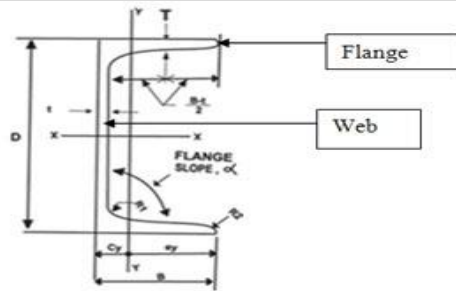
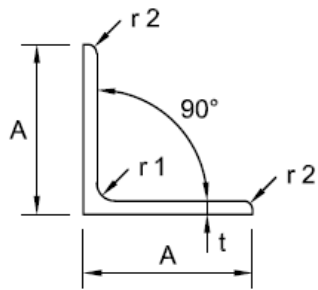
HIGH STRENGTH FORMABLE QUALITY GRADES



Chemical Composition

Grade	C max	Mn max	S max	P max	Al min	Si max	MAE max
HSFQ 250	0.12	1.00	0.020	0.025	0.020	0.25	-
HSFQ 350	0.12	1.20	0.020	0.025	0.020	0.25	0.03
HSFQ 450	0.12	1.40	0.020	0.025	0.020	0.40	0.05
HSFQ 500	0.12	1.50	0.020	0.025	0.020	0.50	0.10
HSFQ 550	0.12	1.60	0.020	0.025	0.020	0.50	0.15

Products from New Structural Mills



Angles

Channels

Beams

Products from New Structural Mills



Products from New Structural Mills



Products from RSP New Plate Mill



Products from RSP New Plate Mill



STEEL

#lovesteel

KEY STATISTICS - STEEL USE IN CONSTRUCTION

BUILDING OUR HOMES AND OUR FUTURES



worldsteel
ASSOCIATION

Let's talk about steel

TO FIND OUT MORE ABOUT STEEL IN CONSTRUCTION VISIT WORLDSTEEL.ORG

SAIL's INITIATIVES



- **Already developed new products for this segment.**
- **“SAIL Steel Gaon ki Ore” campaign launched in rural areas to create awareness and understanding.**
- **Rebar processing arrangements for making available cut & bent rebars in different sizes and shapes.**
- **Contacting Designers, Architects, Builders.**
- **Created capacity & has flexibility to innovate on new products as per requirements of the Pre – Fabricated Structure Industry.**
- **Provides optimized logistical solutions.**

Conclusion



- **We would like to establish the last line connectivity with the Designers, Architects, Builders, Fabricators, Government agencies.**
- **Our sincere endeavor to reach out our products to them so that together we achieve the mission of “HOUSING FOR ALL”.**

**SAIL BUILDS NOT JUST HOUSES BUT
HOMES**

JAMMU TO KATRA/UDHAMPUR



INS Vikrant- India's 1st Indigenous Aircraft Carrier



The Chenab Bridge Project



SAIL STEEL used in PSLV-25 for Mangalyaan (MOM)



Bandra Worli Sea Link In Mumbai



SAIL Steel used at AJC BOSE ROAD , KOLKATA



Koparkhairane Railway Station, Mumbai



Pontoon Bridge , Kumbh Mela



SAIL Steel used at New Airport, Raipur



NTPC Power
Plant, Sipat

" THANK YOU "

There's a little bit of SAIL in everybody's life



Additional Slides

Angle 150x150x12 at USM ISP



WPB 160 at MSM DSP



Comparison between PF and MB Section

More Choices to Design Engineers

MB 300 @ 46 kg/m	MB 250 @ 37.3 kg/m	MB 200 @ 24.2 kg/m
NPB 300x150x36.5	NPB 250x125x30.1	NPB 200x100x18.4
NPB 300x150x42.2	NPB 250x150x33.9	NPB 200x100x22.4
NPB 300x150x49.3	NPB 250x150x39.8	NPB 200x100x25.1
NPB 300x165x39.9	NPB 250x150x46	NPB 200x130x27.2
NPB 300x165x45.8	NPB 250x175x43.9	NPB 200x130x32
NPB 300x165x53.5		NPB 200x150x30.5
NPB 300x200x59.6		NPB 200x165x36.2
NPB 300x200x66.7		NPB 200x165x42
NPB 300x200x74.4		

Comparison of Section Property between PF and MB Section

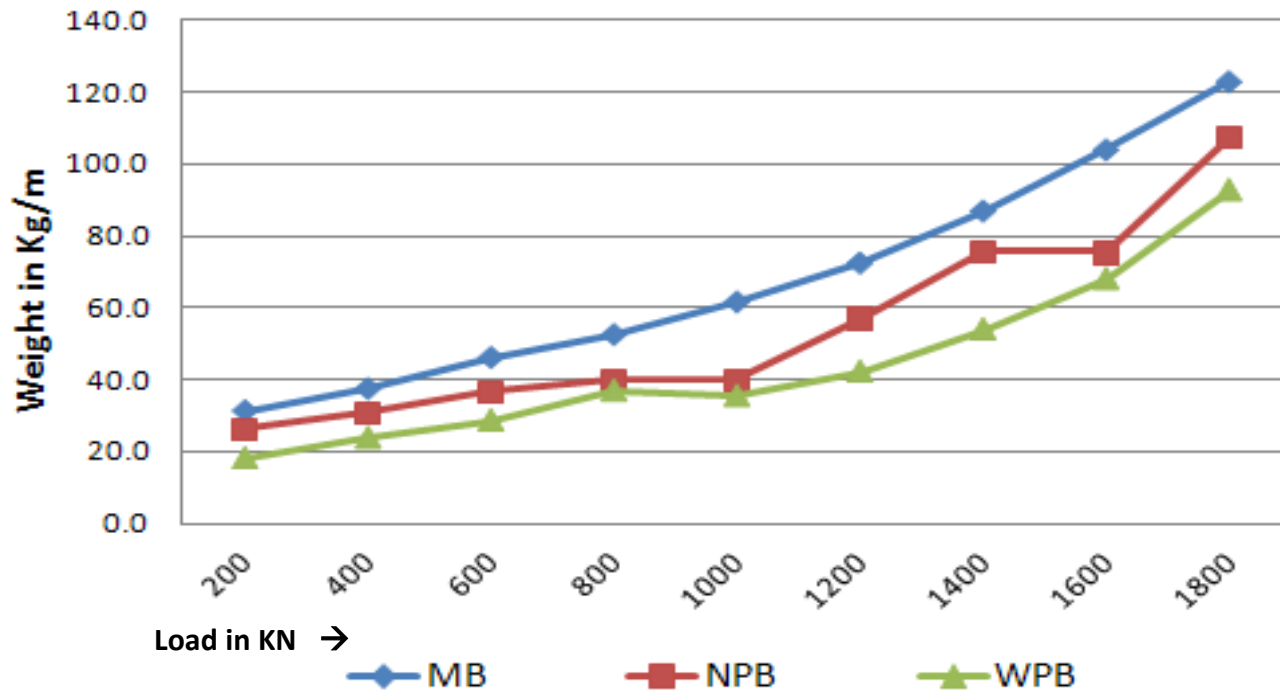


Section Designation		NPB 300x165x45.8	MB 300	
Overall Depth of Section, h	=	313	300	mm
Flange Width, b_f	=	166	140	mm
Flange Thickness, t_f	=	11.2	13.1	mm
Web Thickness, t_w	=	6.6	7.7	mm
Depth of Web, d	=	260.6	245.8	mm
Root radius	=	15	14	
Weight of Section, w	=	45.8	46	Kg/m
Area of Section, A	=	5829.5	5860	mm ²
Moment of Inertia, I_{zz}	=	102100427.7	89900000	mm ⁴
Moment of Inertia, I_{yy}	=	8549564.5	4860000	mm ⁴
Section Modulus, Z_{zz}	=	652398.9	599000	mm ³
Section Modulus, Z_{yy}	=	103006.8	69500	mm ³
Radius of gyration, r_{zz}	=	132.3	124	mm
Radius of gyration, r_{yy}	=	38.3	28.6	mm
Plastic Section Modulus, Z_{pz}		727.9	680.3	mm ³
Plastic Section Modulus, Z_{py}		158.8	133.6	mm ³

Higher Axial Compression Load Carrying Capacity in Parallel Flange Section

Weight vs. Axial Load Carrying Capacity

Effective Span 4 m , F_y 250



Example: To carry above 500 Kn compression Load by a member we require MB 400(IS808) @ 61.5 Kg/m (551 KN); NPB 200x165x35.7 @ 35.7 kg/m (548KN) resulting a saving in material by using PF sections. Nearest WPB section (WPB 180x180x35.5) can take 558 KN load.

WPB more effective and cost saving compared to MB section

[<< Back](#)

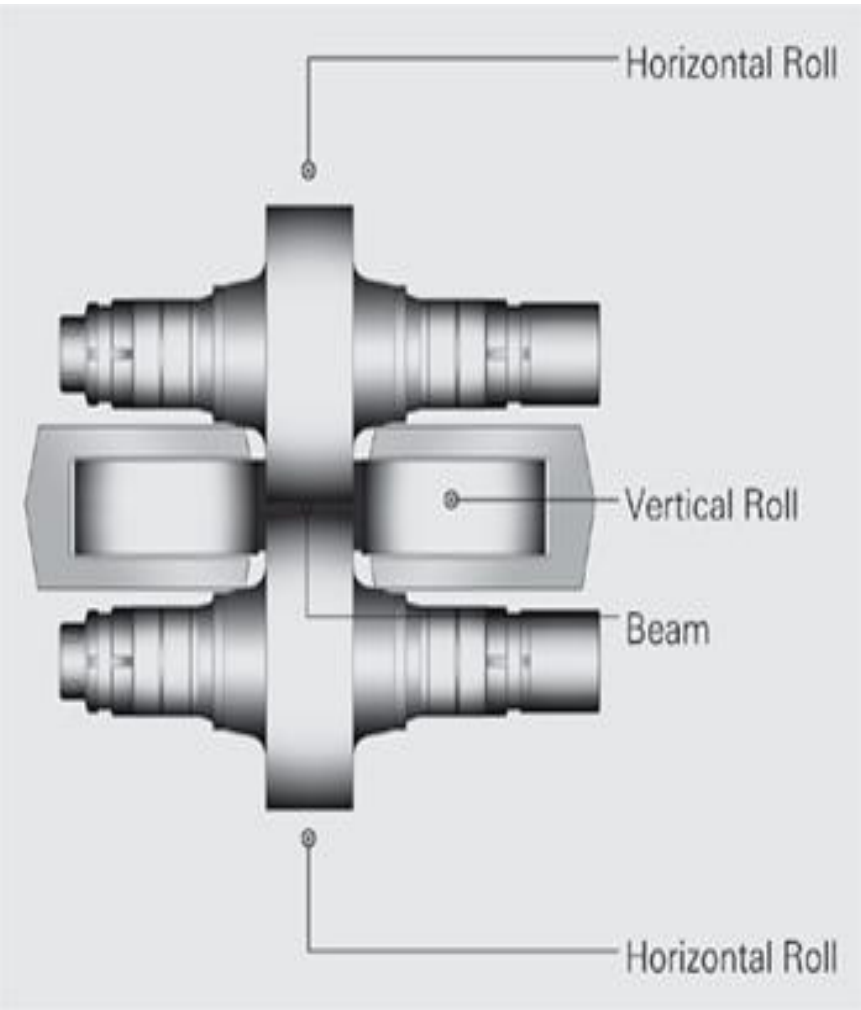
Bending Capacity for NPB and MB profiles

BM vs. weight of MB and NPB section - Span 6 m F_y 250

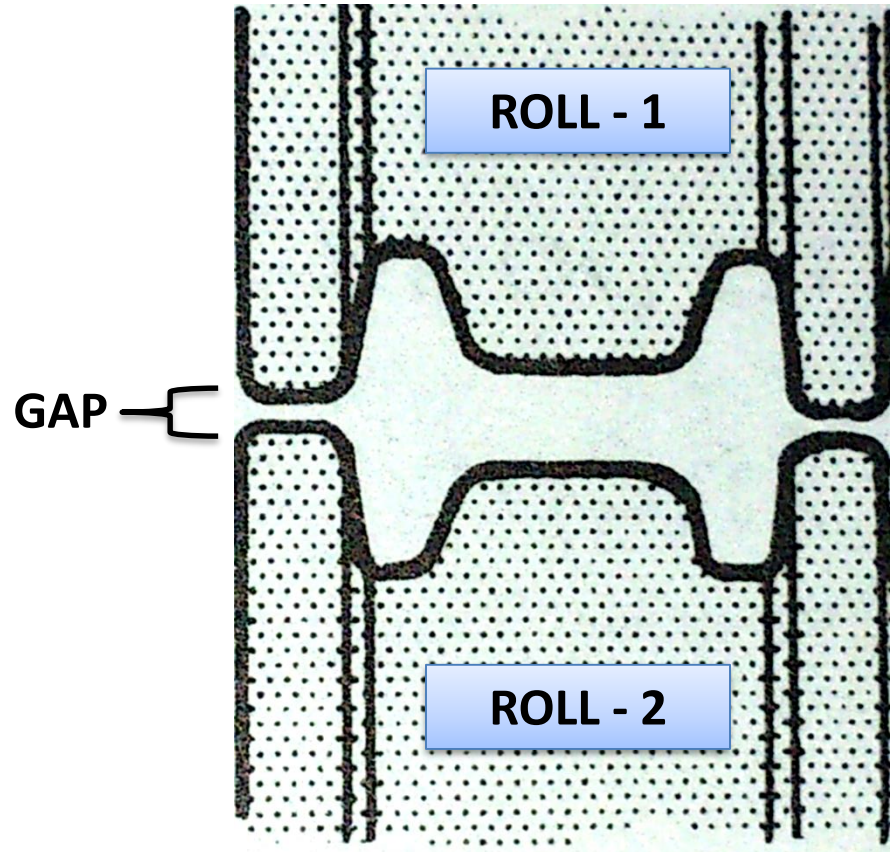
MB Section	Weight (kg/m)	Moment Capacity (kN-m)	Parallel Flange Section	Weight (kg/m)	Moment Capacity (kN-m)	Saving in Wt (%)
MB 250	37.3	42.2	NPB 300x150x36.5	36.5	45.3	2.1
MB 300	46.0	60.0	NPB 300x165x39.9	39.9	61.3	13.3
MB 350	52.4	73.9	NPB 300x150x49.3	49.3	76.6	5.9
MB 400	61.5	95.9	NPB 300x165x53.5	53.5	99.1	13.0
MB 450	72.4	132.4	NPB 350x170x66	66	133.9	8.8
MB 500	86.9	195.8	NPB 500x200x79.4	79.4	217.8	8.6
MB 550	104.0	274.5	NPB 550x210x92.1	92.1	288.1	11.4
MB 600	122.5	389.4	NPB 550x210x122.5	122.5	412.8	0.0

Splices and Connections





UNIVERSAL ROLLING TECHNOLOGY



CONVENTIONAL ROLLING