JINDAL PANTHER®
TMT REBARS

SAFER HOMES FOR A STRONGER NATION

A PRODUCT OF JINDAL STEEL & POWER LIMITED
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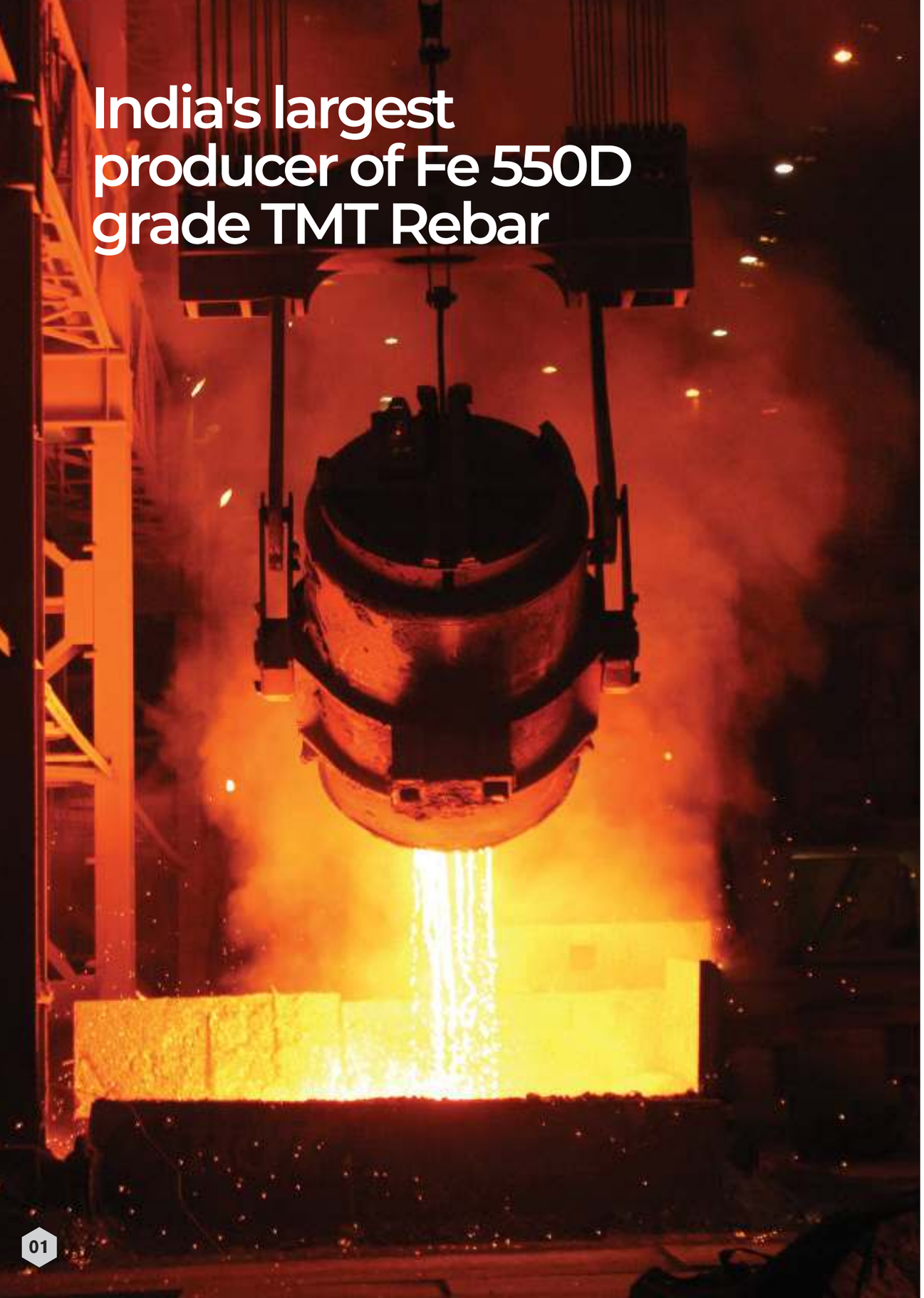
Fe 550D

JINDAL PANTHER®
TMT REBARS

Fe 550D

JINDAL PANTHER 550D

Unmatched Strength With Flexibility



India's largest producer of Fe 550D grade TMT Rebar

Welcome to the future of TMT Rebars

As we look to the future, we have anticipated what will be required for our country to achieve lean steel structure that is yet the strongest and brings value for money.

Steel offers the widest range of strength compared to other metals giving it significant advantage in construction. There are more than 200 grades of steel globally, and we take pride in offering Jindal Panther® Fe 550D - the strongest grade in TMT so far in practice.

This grade of steel is produced using a technology such that it has two desirable properties simultaneously, higher strength and higher ductility, thereby making it most suitable for earthquake resistant structures. Higher strength is achieved by the addition of certain alloying elements, keeping the percentage of carbon lower, thereby ensuring that the steel remains sufficiently ductile.

Ductility is the degree of plastic deformation before fracture or simply how much strain a material can hold before fracture.

Jindal Panther® Fe 550D has enhanced physical, chemical and mechanical properties as compared to the bars in other strength grades. This is achieved by highly controlled and advanced manufacturing processes at JSPL's own manufacturing plants, which gives:

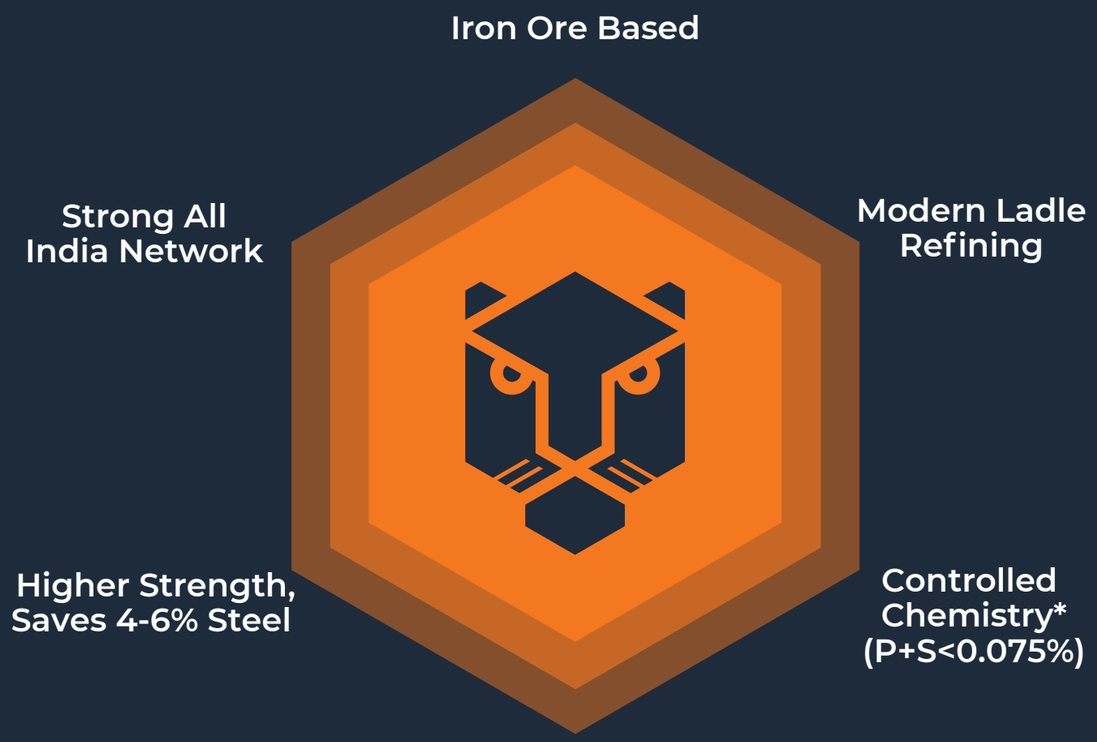
;

- **Enhanced Strength**
- **Rich Chemistry**
- **Cleaner Steel**
- **Minimum 5% Saving on Steel ***
- **Superior Properties**
- **World Class Technology**

* Subject to Design

Fe 550D

6mm - 40mm range



India's Largest Fe 550D Producer, IS: 1786, 550D Grade Compliant

*can be reduced further on request

Unmatched benefits of Fe 550D

Jindal Panther® Fe 550D TMT Rebars offer 32% higher strength than conventional steel (415 MPa vs 550 MPa)

Here's how stronger steel affects your construction

Reduction of Steel Consumption

Designing structures with Fe 550D reduces the steel consumption by 12-15% with optimisation, using consistent primary steel.

Reduction in Bar Congestion

Using stronger grade steel means reduction in bar diameter that results in increased bar spacing as fewer rebars are needed.

Reduction in Labour Cost

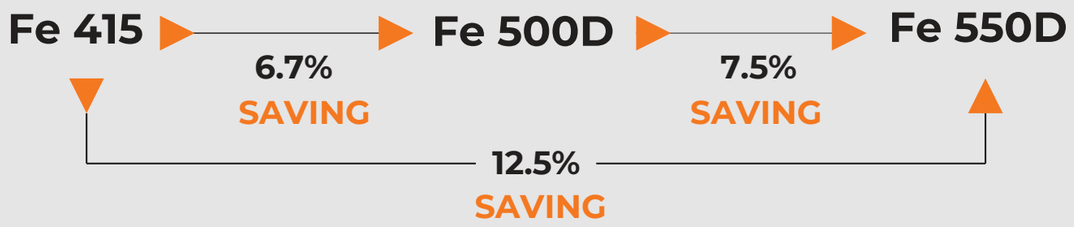
Using lesser steel requires less labour and saves on labour cost.

Faster Construction

Less time is wasted on placing/ tying of bars. And less weight on cranes improves construction efficiency.

Bigger Savings

When the same structure is constructed with 3 different grades of steel, there will be remarkable saving in case of use of Fe550D.



RIGHT TMT REBAR = HIGHER SAVING

Did you know, by using a better quality steel TMT rebar you can actually save money?

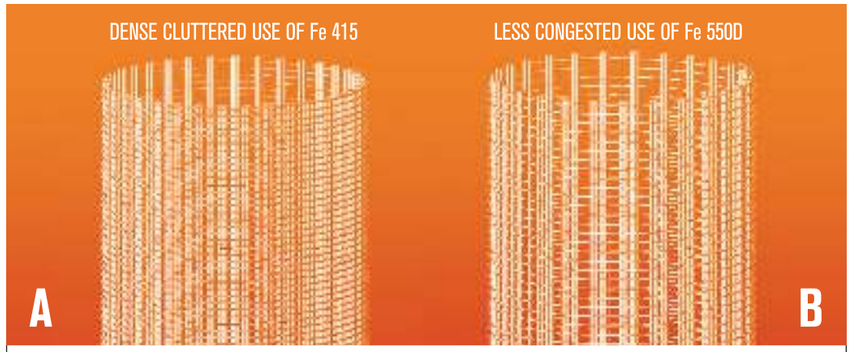
Steel TMT rebars are used in every RCC construction, be it for residential or commercial purpose, and account for roughly 25% of the total cost of construction.

With some smart thinking you can now not only make your construction stronger and longer-lasting but also make a saving.

All thanks to superior grade steel TMT rebars like Jindal Panther 550D. Read on to know how this happens.

Here's how higher grade Fe 550D TMT rebar saves your money.

- Higher grade steel TMT rebar like Jindal Panther Fe 550D has higher load bearing capacity while maintaining the same ductility as per BIS 1786.
- Better load bearing capacity of Fe 550D means lesser number of rebars required in total.
- It also translates into using TMT rebars with lesser diameter so less congestion.



COLUMN A USES MORE Fe 415 TMT REBARS AND IS CONGESTED
COLUMN B USES LESSER NUMBER OF Fe 550D TMT REBAR GIVING LESS CONGESTION*

THUMB RULE: 10% INCREASE IN STRENGTH = 1/2% REDUCTION IN CONSUMPTION

Jindal Panther Fe 500D & Fe 550D rebars conform to BIS standards & are even better on many parameters

Parameters	BIS Fe 500D	Jindal Panther Fe 500D	BIS Fe 550D	Jindal Panther Fe 550D
% Carbon	0.25	0.20-0.25	0.25	0.22-0.25
% Silicon		0.15-0.25		0.15-0.25
% Manganese		0.90-1.00		0.95-1.05
% Sulphur (max)	0.04	0.03	0.04	0.03
% Phosphorus (max)	0.04	0.03	0.04	0.03
% Sulphur + Phosphorus (max)	0.075	0.055	0.075	0.055
% Carbon Equivalent (CE)	0.42	0.35-0.40	0.42	0.35-0.41
Yield Stress (N/mm2) min	500	525	550	575
% Elongation	16	18	14.5	16 & Higher
Tensile Strength (N/mm2) min	565	600	600	645
UTS/YS Ratio	1.1	1.15	1.08	1.15

SHIFT FROM LOWER GRADE TMT TO HIGHER GRADE TMT = SAVE UP TO 22%

Size of TMT Bar (mm)	Per Mtr. Weight of bar
8	0.395
10	0.617
12	0.88
16	1.58
20	2.47
25	3.85
28	4.83
32	6.32
36	8

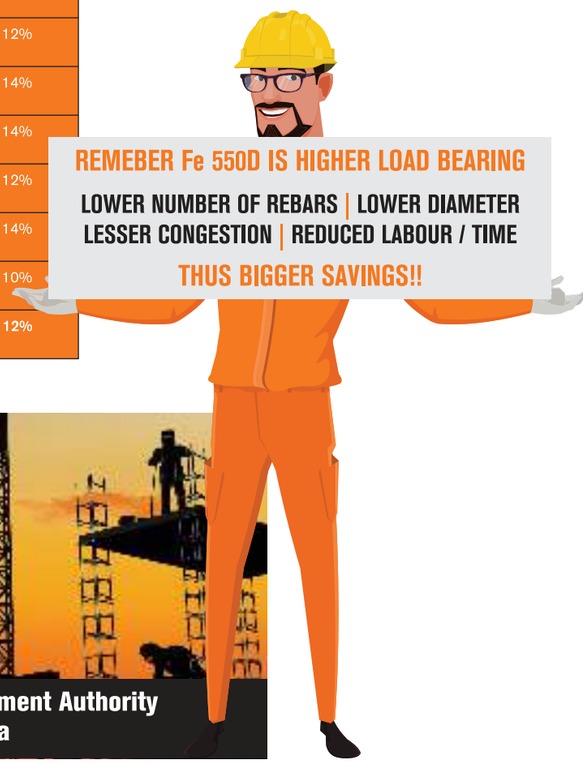
Comparative Summary for Slabs, Columns and Beams using Fe 415, Fe 500 and Fe 550D

Average savings for Slabs: 13% - 19%
Average savings for Columns: 8% - 22%
Average savings for Beams: 12% - 22%

SLAB					
Combinations	**Designed in Fe 415**	**Designed in Fe 500**	**Designed in Fe 550**	**Saving from 415 to 550**	**Saving from 500 to 550**
3mX3m slab (125mm thick)	56Kg	49Kg	45Kg	19%	8%
Reinforcement	8mm at spacing of 200mm	8mm at spacing of 225mm	8mm at spacing of 250mm		
4mX4m slab (125mm thick)	100Kg	92Kg	78Kg	22%	15%
Reinforcement	8mm at spacing of 185mm	8mm at spacing of 200mm	8mm at spacing of 250mm		
5mX5m slab (150mm thick)	181Kg	156Kg	130Kg	15%	16%
Reinforcement	8mm at spacing of 175mm	8mm at spacing of 185mm	8mm at spacing of 225mm		
			Average cost saving upto	19%	13%

COLUMN					
Size	**Designed in Fe 415**	**Designed in Fe 500**	**Designed in Fe 550**	**Saving from 415 to 550**	**Saving from 500 to 550**
230X350 Reinforcement	45Kg 4-20mm+ 4-12mm	38Kg 8-16mm	35Kg 4-16mm + 4-12mm	22%	8%
230X450 Reinforcement	58Kg 4-20mm+ 6-16mm	48Kg 10-16mm	43Kg 8-16mm+ 2-12mm	25%	10%
230X600 Reinforcement	88Kg 12-20mm	72Kg 8-20mm+ 4-16mm	67Kg 4-20mm+ 8-16mm	23%	7%
300X350 Reinforcement	58Kg 4-20mm+ 6-16mm	48Kg 10-16mm	44Kg 8-16mm+ 2-12mm	24%	8%
300X450 Reinforcement	83Kg 10-20mm+ 2-16mm	72Kg 6-20mm+ 6-16mm	67Kg 4-20mm+ 6-16mm	19%	7%
300X600 Reinforcement	113Kg 6-25mm+ 8-20mm	103Kg 14-20mm	93Kg 10-20mm+ 4-16mm	17%	9%
			Average cost saving upto	22%	8%

BEAM				
Designed in Fe 415	**Designed in Fe 500**	**Designed in Fe 550**	**Saving form 415 to 550**	**Saving form 500 to 550**
28Kg 6-16 dia	26Kg 4-16 dia+ 2-12dia	22Kg 2-16 dia+4-12 dia	21%	15%
52Kg 4-20 dia+ 2-16dia	48Kg 4-16 dia+ 2-20 dia	40Kg 6-16 dia	23%	16%
60Kg 3-20 dia + 3-16 dia	53Kg 2-20dia+3-16dia+1-12dia	46Kg 6-16 dia	23%	13%
26Kg 4-16dia +2-12dia	22Kg 4-12dia+2-16dia	20Kg 5-12dia+1-16dia	23%	9%
38Kg 6-16dia	35Kg 4-16dia +2-12dia	29Kg 4-12dia+2-16dia	23%	
56Kg 4-16dia+2-20dia	50Kg 6-16dia	46Kg 5-16dia+1-12dia	17%	8%
7Kg 6-16dia	25Kg 4-16dia +2-12dia	22Kg 4-12dia+2-16dia	18%	12%
38Kg 6-16dia	34Kg 4-16dia +2-12dia	29Kg 4-12dia+2-16dia	23%	14%
57Kg 4-16dia+2-20dia	50Kg 6-16dia	43Kg 4-16dia +2-12dia	23%	14%
27Kg 6-16dia	25Kg 4-16dia +2-12dia	22Kg 4-12dia+2-16dia	18%	12%
40Kg 6-16dia	35Kg 4-16dia +2-12dia	30Kg 4-12dia+2-16dia	25%	14%
57Kg 4-16dia+2-20dia	48Kg 6-16dia	43Kg 4-16dia +2-12dia	24%	10%
		Average cost saving upto	22%	12%



REMEBER Fe 550D IS HIGHER LOAD BEARING

LOWER NUMBER OF REBARS | LOWER DIAMETER
LESSER CONGESTION | REDUCED LABOUR / TIME

THUS BIGGER SAVINGS!!

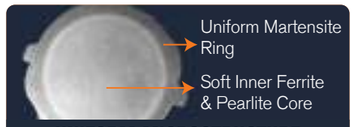
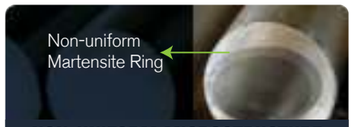
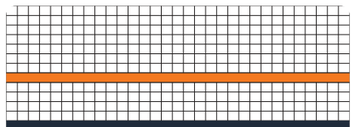
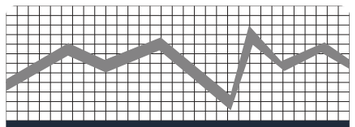
Live Project with FE 550D for Lucknow Development Authority under Pradhan Mantri Awas Yojna

DESCRIPTIONS	DIA-WISE STEEL CONSUMPTION							WEIGHT (in kg.)	STEEL CONSUMPTION (in kg.)	CONTRIBUTION Per SQ.FT (in kg.)	
	8	10	12	16	20	25	32			Fe 500D	Fe 550D
FOOTING	658.475	3193.080	246.145	332.332	381.630	0.000	0.000	4811.661	4907.895	0.300	0.259
2% extra for lap & chairs				96.233				96.233			
COLUMN											
Fe 500D	4972.563	3756.667	6841.6	2803.99	0	0	0	18374.82	18374.82	0.97	0.919
Fe 550D	4768.016	3943.333	7982.592	712.552	0	0	0	17406.493	17406.493		
BEAM											
Beam-500D	5443.664	0	6414.108	7267.568	1549.037	0	0	20674.378	20674.378	1.092	0.914
Beam-550D	5546.293	0	7798.414	3965.914	0	0	0	17310.621	17310.621		
SLAB											
Slab-500D	13256.32	0	0	0	0	0	0	13256.32	13256.32	0.7	0.7
Slab-550D	13256.32	0	0	0	0	0	0	13256.32	13256.32		
STAIR CASE	284.064	0	2651.264	0	0	0	0	2935.328	2935.328	0.155	0.155
Typical (G+3rd) Floor area (in squ. Ft.)			440				4	18937.6			
Total Steel consumption	48281.948	10893.08	31934.123	15082.357	1930.667	0	0				
OVER ALL STEEL CONSUMPTION AVERAGE PER SQ. FT.										3.22	2.947

5% - 8% average steel/cost saving in a building when using higher grade Fe 550D Jindal Panther TMT Rebars.

Compare and see how Jindal Panther® TMT Rebar is superior to scrap based rebar production in India

JINDAL PANTHER® TMT REBARS VERSUS OTHERS

JINDAL PANTHER® (Iron Ore Based TMT)	YOU GET			Others (Scrap Based TMT)	YOU GET
Surpasses minimum specified levels of Bureau of Indian Standards (BIS)	More value for money with upto 7% - 8% savings ✓	 SURPASSES STANDARDS	 INCONSISTENT IN QUALITY	Barely qualifies the minimum requirements of BIS	Less value for money and no savings
Uses virgin iron ore and deploys state-of-the-art steel making and refining processes	Highly clean & homogenous steel quality ✓	 IRON ORE	 SCRAP	Use scrap or ingots for steel melting without any secondary refining process	Uncertain chemical and mechanical properties due to inclusion of tramp elements
Steel is made using BF / DRI ☒ EAF / BOF / NOF ☒ LRF ☒ Concast route	A highly controlled steel chemistry with very low levels of sulphur & phosphorus ✓	 BF / DRI ☒ EAF / BOF / NOF ☒ LRF ☒ Concast Route	 INGOT	Follow the melting process of secondary steel through induction furnace route leading to no control over chemistry	Variations in chemical composition leading to structural instability
Rebars are manufactured using High Yield Quenching and Self Tempering (HYQST) Technology perfected by Siemens of USA / QST from SMS Meer of Germany	High strength and ductility due to fine grain multiphased composite structure ✓	 UNIFORM MICROSTRUCTURE	 NON-UNIFORM MICROSTRUCTURE	Use outdated rolling process & technology	Non-uniform grain size and inconsistent steel quality
Provides precise and uniform parallel rib pattern engraved through computer controlled notch making machines	Excellent bond strength with concrete ✓	 UNIFORM RIB PATTERN	 NON-UNIFORM RIB PATTERN	Use conventional machines for engraving ribs	'X' rib/non-uniform pattern which has low fatigue life and reduces bond strength with concrete
Meets UTS/YS (Ultimate Tensile Strength to Yield Strength) ratio and high percentage elongation	Superior earthquake resistant qualities due to high capability of absorbing energy ✓	 EARTHQUAKE RESISTANT	 NOT FOR SEISMIC ZONES	Use old technology leading to high variation in elongation	Much lower resistance to cyclic loading which is not recommended for seismic zones
Has predefined and transparent pricing	Fixed and uniform rates evidenced through a well displayed price list at our dealers' shops ✓	 UNIFORM PRICES	 FLUCTUATION IN PRICES	Costs are linked to raw material movement like scrap & ingot	Daily fluctuations in rates
Is a National Brand	World class quality ✓	 TRUSTWORTHY	 QUESTIONABLE	Are local/regional brands	Average quality

The Technical detail

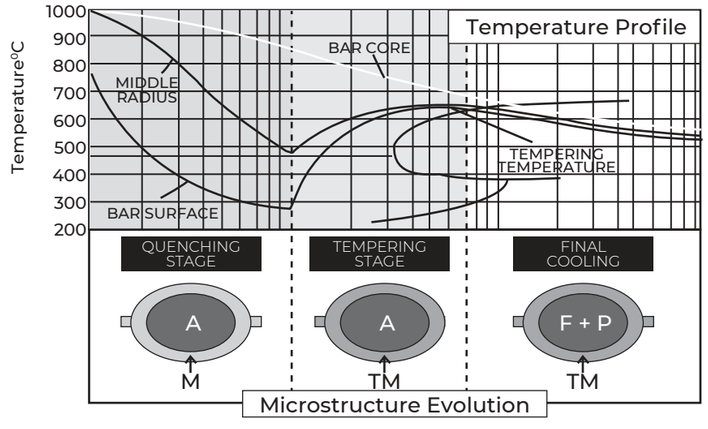
Jindal Panther® Fe550D Rebars are Thermo Mechanically Treated (TMT) Steel Bars produced through advance HYQST (High Yield Quenching and Self Tempering Process) /QST (Quenching and Self Tempering) process.

HYQST/QST process includes hot rolling of the billets in the most modern bar mill followed by water quenching, self tempering and atmospheric cooling. During quenching, the temperature of the rebar drops at a faster rate at the periphery leading to a harder surface, while the high temperature core gets cooled slowly. The thermal stresses generated during quenching are relieved by the heat released from the core during the next step called self Tempering. Finally atmospheric cooling at the cooling bed leads to a strong casing and a soft core in the rebars giving it significant strength and ductility.

The reason behind such unique combination of strength and ductility is that at a higher cooling rate, the surface attains a hard phase of steel known as Martensite while the core will have soft phases like Ferrite and Pearlite.

Metallurgical Aspect:

Steel can attain a wide variety of properties by altering its microstructure, which depends on its chemical composition as well as the thermal treatment it is subjected to. Rebars are having a combination of different microstructures which provides it both strength and ductility. At the periphery, it has a hard phase called Martensite. Although the outer layer is quenched, the inner core of the cross section is still hot and it is in Austenitic Phase at higher temperature. As the bar cools, heat flows from the centre of the bar to its surface, leading to varying cooling rate across

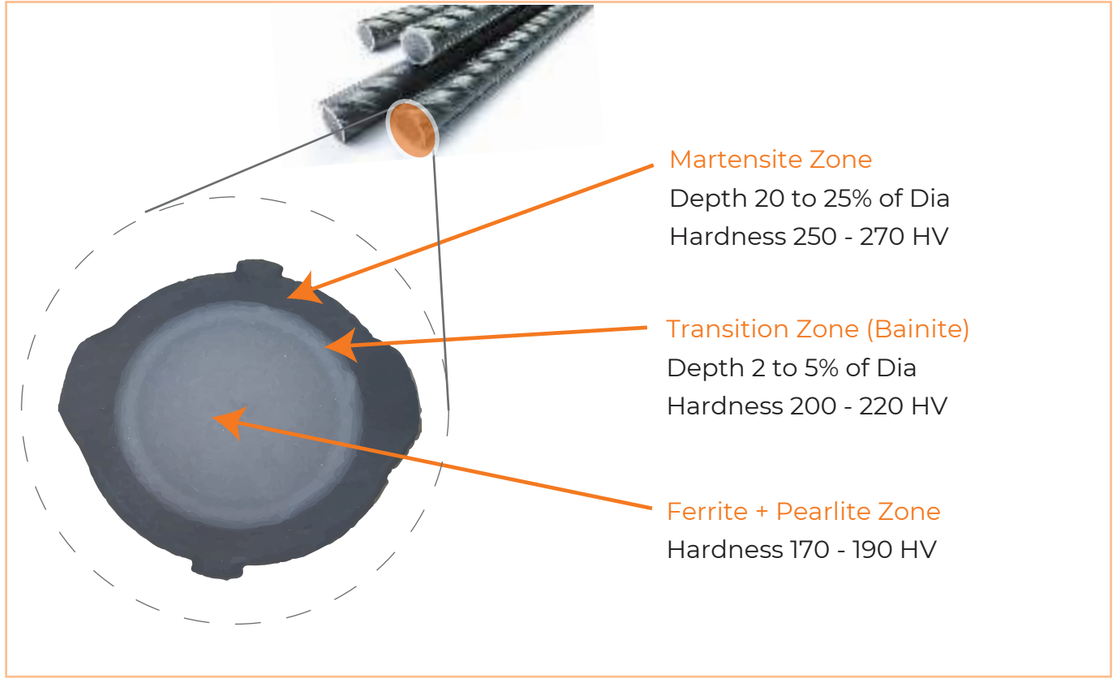


its cross section, the process known as self tempering. Thus it exhibits a variation in microstructure in the cross section, having strong and tough Martensite in the surface layer of the bar, an intermediate layer of Martensite and Bainite, and the core attains a soft Ferrite and Pearlite microstructure. Any thermal stress generated in Martensite during quenching is relieved in this process. Once this process is over, the TMT bars are subject to atmospheric cooling. This is done in order to equalise the temperature difference between the soft inner core and the tough exterior. The inner core remains soft giving the TMT bar superior ductility. This unique manufacturing technique and the absence of Cold stress make the rebar corrosion-resistant and boost its weldability.

Thus we can see high level of engineering and equipment with sophisticated controls are required to produce Thermo Mechanically Treated (TMT) Bars to achieve the above properties.

This HYQST/QST process delivers greater tensile strength to the rebars as well as higher elongation. This improves the bend/re-bend properties or the rebars, thus making it safe from natural calamities such as an earthquake. The special ribbed design of the TMT bars form a stronger bond with the concrete or cement. We can achieve higher mechanical properties with low alloying. It helps to reduce the steel weight.

JSPL is having level 2 automation systems for achieving the above microstructure and the desired mechanical properties. The advanced control systems in mills also help in attaining dimensional accuracy and consistency of the desired level.



Mechanical Properties:

YS (Yield Strength): min. 550 MPa

UTS (Ultimate Tensile Strength): min 605 MPa

Elongation: min 16%

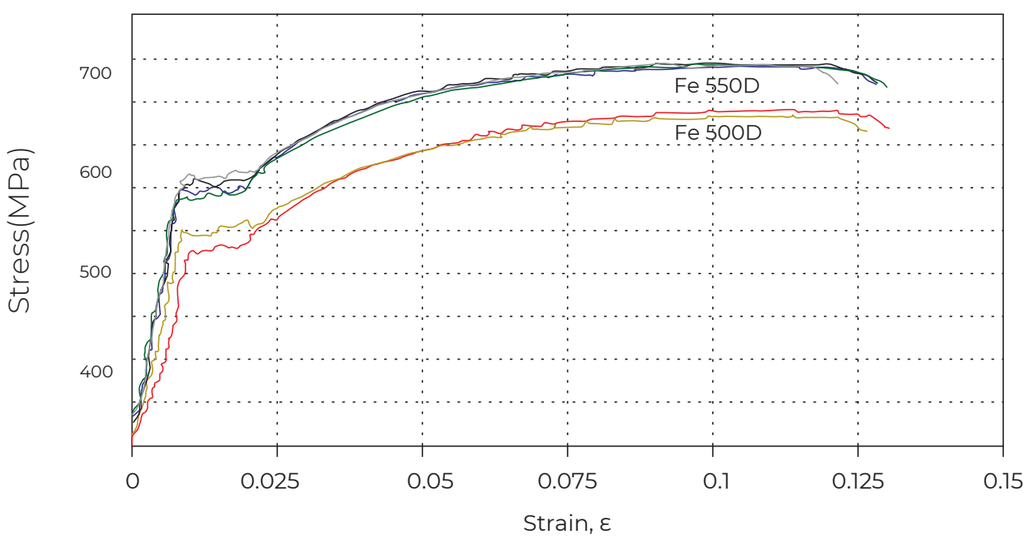
UTS/YS: min 1.10

JSPL is a primary and integrated steel producer. Thus it ensures clean steel with very low levels of detrimental Sulphur and Phosphorous, and low ppm of gaseous contents. Thus the TMT produced are having negligible internal defects and impurities.

Our Jindal Panther TMT Rebars can be used in extreme environments like Marine, coastal and saline conditions as well as in the high seismic zones.

Stress Strain Curve Comparison of **Fe 500D & Fe 550D**

STRESS STRAIN CURVE JSPL TMT REBARS FOR IS 1786 FE 550D AND FE

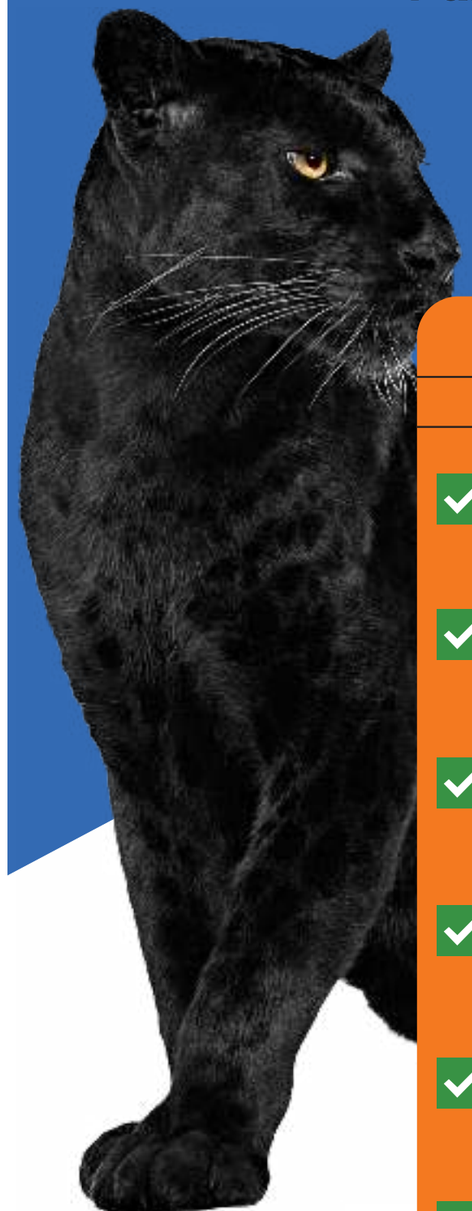


Fe 550D, Yield Strength (N/mm2) Min - 550 MPa (BIS) Actual - 575 MPa
% Elongation (Min)- 14.5 Guarantee - 18% Actual - 21.75%

Fe 500D Yield Strength (N/mm2) Min - 500 MPa (BIS) Actual - 530 MPa
% Elongation (Min)- 16.0 Guarantee - 18% Actual - 21.60%

Duplicate se Savdhaan

Asli Jindal Panther TMT Rebar ki Pehchaan
Panther ka Nishan



JINDAL PANTHER TMT REBAR

ORIGINAL	DUPLICATE
Will have Panther face embossing	Will not have such embossing
Will have only Fe 550D grade	Come mostly in Fe 415 & Fe 500
Will have prominent & even rib pattern	Have uneven or missing pattern
Will always have ISI mark & license no.	May or may not have these
Available at authorised Jindal Panther dealers	Available at untrustworthy sources
Manufactured only at Angul, Patratu & Raigarh	Produced by smaller mills illegally at different locations

Applications of Fe 550D

Due to changing application such as high rise buildings and long span structures, it has become imperative for innovative and conscientious steel makers to commercially produce grade Fe 550D - a grade vastly superior over the existing grade.

Modern Tall Buildings

Jindal Panther® Fe 550D TMT Rebar has been made to impart strength and superior ductility for construction of a stronger India.

This is achieved by using enhanced steel quality, superior chemical properties and better rolling techniques.

Armed with better ductility, Fe 550D provides enhanced seismic resistant properties for all construction based on RCC

Ports

Airports

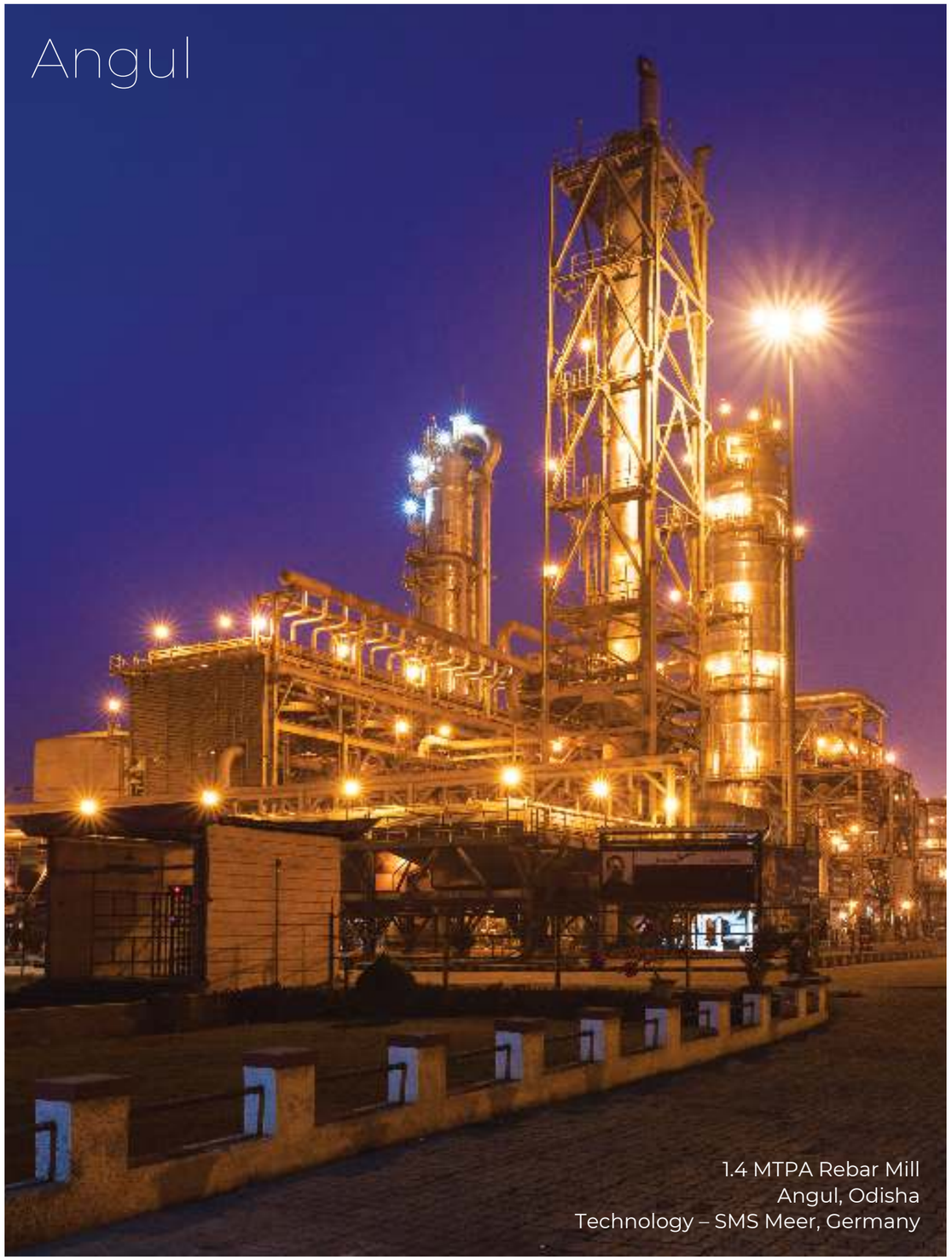
Rail & Metro Networks

Bridges

With an ever growing demand for stronger infrastructure, Jindal Panther® Fe 550D TMT Rebar finds extensive use in a variety of modern construction.

Our plants

Angul



1.4 MTPA Rebar Mill
Angul, Odisha
Technology – SMS Meer, Germany

Sohar

1.4 MTPA Rebar Mill
Sohar, Oman
Technology – Danieli,

Patratu

1.0 MTPA Rebar Mill
Patratu, Jharkhand
Technology – Morgan, USA

Key highlights of our plants
Patratu, Angul, Oman

Our plants are amongst the most modern across the world. Equipped with the latest technologies and infrastructure, they produce the finest quality steel and TMT rebars.

Some of the key features of our plants are:

Walking beam type reheating furnace

High pressure water de-scaling facility

Single strand high speed continuous mill

Interstand tension control rolling

Online rapid water quenching unit

Production of HYQST/HYST TMT rebars in straight length

Cooling beds of movable rack design

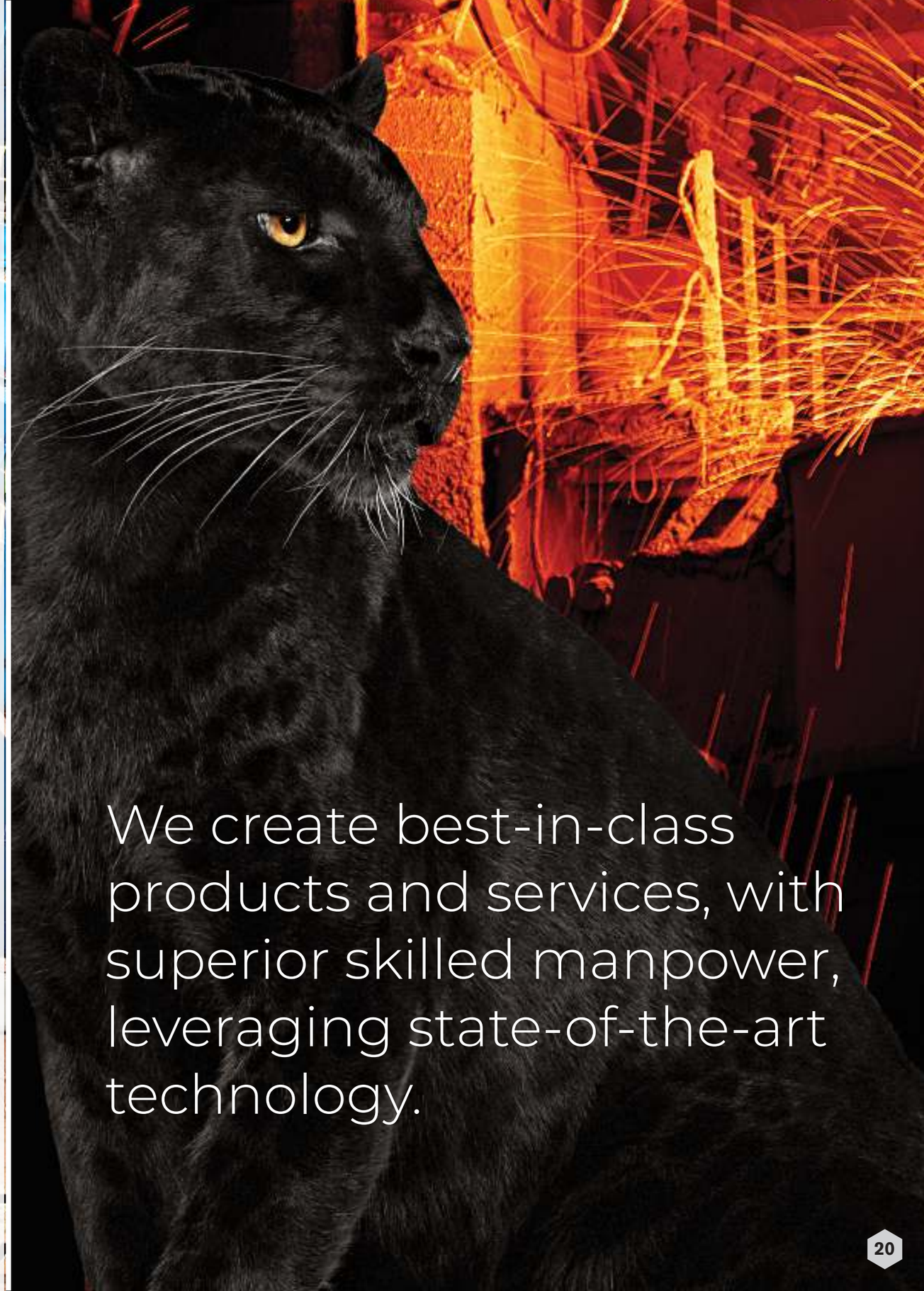
Uniformly air-cooling of TMT rebars

Transporting in a phased manner from the entry of the cooling bed to discharge side

Automatic mill shears for head/ tail cropping dividing, sampling or scrapping, and cutting-to-length

Automatic bundling & tying facilities for rolled product in straight length

Level 2 mill automation and control



We create best-in-class products and services, with superior skilled manpower, leveraging state-of-the-art technology.

Our process

Jindal Panther® Fe 550D TMT Rebars are manufactured using the unique iron making, steel making and rolling process, which makes them stronger, safer and more ductile than any other TMT rebars, thus ensuring utmost quality.

A rebar is not a rebar if it is not TMT

Thermo mechanical processing, also known as Thermo-Mechanical Treatment (TMT), is a metallurgical process that integrates work hardening and heat treatment into a single process, while the quenching process produces high strength bars from low carbon steel. The process presses the surface layer of the bar, which pressurises and deforms the crystal structure of the intermediate layers, and simultaneously begins to temper the quenched layers using the heat from the bar's core.

High Quality output from HYQST technology for Patratu and QST for Angul

Our rebar mill in Patratu is from Morgan, USA having High Yield Quenching and Self Tempering (HYQST) technology which is an internationally renowned Thermo Mechanical Treatment Technology. The rebar mill in Angul is from SMS MEER, Germany with the QST (Quenching and Self Tempering) technology. Both the mills with state-of-art technology ensures a robust process.

These techniques employs a special split style nozzle cooling process for producing fine grain multiphase composite rebar with superior strength and ductility.

Step 1: Quenching

The hot rolled bar from the finishing mill at 1050° Celsius is rapidly quenched by special split style nozzle cooling process. The quenching converts the bar surface layer to martensite, which causes it to shrink. The shrinkage pressurises the core helping it to form the correct crystal structures, while the core remains hot and austenite.

Step 2: Self Tempering

The bar leaves the quench box with a temperature gradient through its cross section and as the bar cools, heat flows from the bar centre to its surface and the bar heat and pressure correctly tempers an intermediate ring of martensite and bainite.

Step 3: Atmospheric Cooling

Finally, the slow cooling after quenching automatically tempers the austenite core to ferrite and pearlite on the cooling bed, that now has a strong and tough, tempered martensite on the surface layer of the bar, an intermediate layer of tough martensite and bainite and a refined, ferrite and pearlite core, giving it the ductile property.

A look at our
Lab Testing Equipment

JSPL has a state-of-art NABL accredited testing facility having latest testing equipment to ensure an almost Zero defect product. The facilities include: -

Optical Emission Spectrometers

Metal Analysers

XRay Fluorescence & X-Ray diffraction analysers

Leco Analysers for Carbon, Sulphur, Oxygen, Nitrogen and Hydrogen

Linder Test Apparatus for characteristics of Iron ore/Pellets

Gas Chromatographs

Universal Testing machines

Hardness Testers

Bend and Rebend Testing machines

Impact testing machines

Wet Analysis Laboratory

Optical microscopes.

This helps in having a proper quality check as well as ensures continual Research and Development for product upgradation.

Besides the latest computerised machines, our employees are trained and skilled to monitor the quality 24 x 7 to produce the finest TMT bars.

JSPL mills are accredited with latest integrated management systems ISO 9001:2015, ISO 14001:2015 and OHSAS 18001:2007. We are serving the premier quality Jindal Panther™ TMT rebars for Infrastructures – Airports, Roads, Bridges, Buildings, Refineries, Power Plants, Metros, Ports, Dams etc.

Sohar Plant is approved by UK CARES and DCL(Dubai Central Laboratory).

Angul Bar Mill is approved by UK CARES BS4449, Grade B500B.

Our network

The presence of Jindal Panther® is across the country through its network of stockyards, plants, distributors and dealers.

Additionally, our products are available online at http://shop.jindalpanther.com and can be accessed from the remotest areas of India.

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