

# ALL INDIA INDUCTION FURNACES ASSOCIATION



# AIIFA

## INDUCTION FURNACE NEWSLETTER

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### What's Inside

Priorities and Preparedness for Leadership in Production of Reinforcing Bars by Indian IFs & Re-Rolling Units



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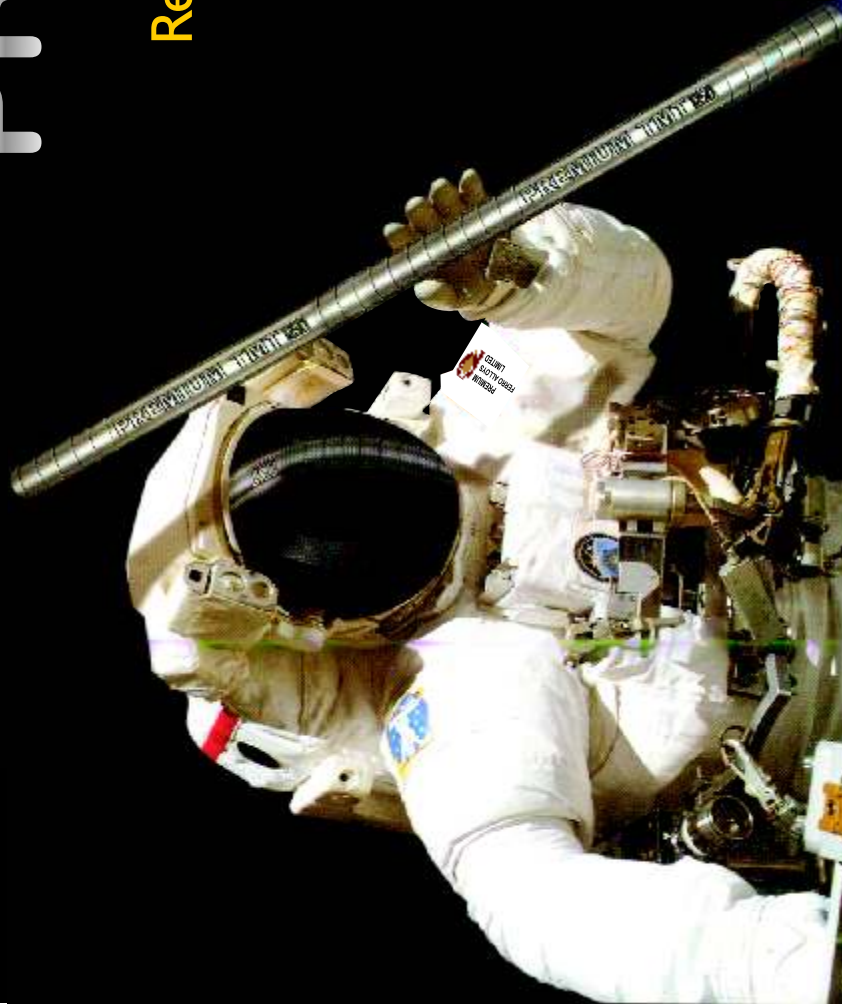
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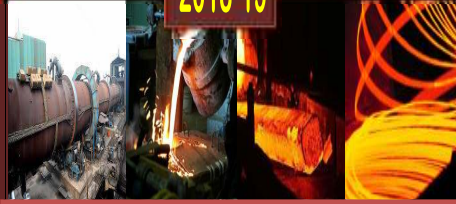
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## HANDBOOK ON INDIAN STEEL INDUSTRIES

(a directory of units producing steel through electrical route)

2018-19



Compiled by:



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# Priorities and Preparedness for Leadership in Production of Reinforcing Bars by Indian IFs & Re-Rolling Units

*Srikumar Chakraborty  
Metallurgical, Member of Consulting*

*Unique mechanical properties like high yield strength and impact value, ideal ratio of tensile and yield as 1.1, elongation about 12%, carbon equivalent maximum about 0.4, good bend ability and good fabrication properties of TMT rebar, the newer variety of cost-effective steel/ product developed in India, well combining with concrete structure at compressed state for their closure thermal coefficient values have popularized products all over the world. The global market for steel rebar though dominated by mostly construction and infra-structure industries in America but demand is fuelled in a greater ways by countries in Asia Pacific, Europe, Middle East & Africa, India and China. The rebar producers of India, both Major & Main Producers (TATA, SAIL, Vizag, Zindal, Essar etc) as well as rebar manufacturers of Indian Mini Steel Plants have established their products in most competitive ways with respect to Cost & Quality earning global reputation complying all processing standards meeting environment standard.*

*China, the global leader of leaders in steel production, of late came to a conclusion that Chinese induction furnaces are producing low quality steel ( getting feedback from consuming industries/ countries) as well as increasing the air pollution (GHG) at very high level. Accordingly, Govt of China decided for complete closure of such units numbering about 600 nos (nearly 100 million tonnes capacity) from Nov, 2017 and surplus scrap generated by this will be diverted to other steel making units like BOF and EAF.*

*Indian TMT rebar manufacturers and IFs should avail this opportunity. Further, most of the rebar producers from IF melting route in China were happily dumping their sub-standard products in various regions/ countries at below cost price to capture market. Many construction industries, at the same time, were utilizing such low cost products considering their own profit even sacrificing product qualities. Countries all over the world have taken measures for such dumping of products.*

Reinforcing steel bar i.e. rebar is widely used in the construction industry. Such rebar having deformed shapes with ribs like herringbone, spiral or crescent shaped long products either in coil or straight form can well combine with concrete in civil engineering construction for unique mechanical properties and tighter adherence for surface ridges. The feature that makes rebar so strong is the presence of many small ridges which help in keeping huge load of weight avoiding slipping. This is why proper threaded fastening is so important.

There is a certain way to thread rebar, and it entails milling the end pieces to a specified size and shape. This process can only be performed successfully with proper rebar tools. Attempting to insert threads without first measuring and trimming the ends could end up causing the structure to be offset and unstable. Rebar products, as tensioning device, assist in helping the concrete in a compressed state allowing the structure to carry heavy tensile load because of close thermal co-efficient values of concrete and steel in fluctuation of temperatures.

**The coefficient of thermal expansion of concrete and steel are almost equal, same for concrete =  $1.2 \times 10^{-5}/^{\circ}\text{C}$  and steel =  $1.1 \times 10^{-5}/^{\circ}\text{C}$ , respectively as such thermal expansion and contraction at higher temperature variation almost are equal.** The length of the steel conforms to the size of the surrounding concrete. Most people are familiar with reinforcing steel, commonly called "rebar". It is used in bridges, buildings, skyscrapers, homes, warehouses, and foundations to increase the strength of a concrete structure.

Rebar is used in concrete to provide additional strength, as concrete itself is weak in tension, while steel is strong in both tension and compression. Steel and concrete have similar coefficients of thermal expansion, so a concrete structural member reinforced with steel will experience minimal stress as the temperature changes with specific advantages over the materials like

1. Bending possible simplifying construction for providing rapid delivery of fabricated material,
2. Able to withstand rigors of construction for its robust shape,
3. At the end of designed structure life, re-cycling of rebar steel possible.
4. Well compatible with concrete, no need to be tied directly. Reinforcing steel is available at any part in the country from distribution center or dealers with the availability of sustainable credits.

Competiveness in the construction sector depends on raw material cost and material properties, project cost, quality of construction, timely completion implying the use of good quality reinforcing bars, cements and other materials which will, together, ensure reliability, durability, safety of the structures optimizing cost meeting environmental demands. All over the world, such reinforcement is done by deformed steel bars, or rebar where the design requirements are typically defined and met by some standards of rebar that define characteristics like chemical composition, mechanical properties like yield strength, ratio of tensile and yield strength, elongation, ductility etc.

The secondary steel sector, as mini steel plant in the capacity of MSME, in India has been primarily involved in recycling steel scrap either through the re-rolling route or melting steel scrap, sponge iron ( Ref: <https://loyds.in/sponge-iron>: Metallic Iron 82% Av., Metallization 92% Av., Sulphur 0.05%, Phosphorous 0.035 – 0.050%, Carbon 0.15- 0.25% -, Average being 0.2%, Gangue content- 5% Average.)/ scrap substitutes and making as ingot/billet by using induction furnace or electric arc furnace. A massive growth of the induction furnace industry for production of ingots was witnessed in the 1980s.

In the post-liberalization scenario, with the opening up of imports, re-rolling mills based on recycling of imported re-rollable steel scrap and ingots accounted for a significant proportion of the production of steel rebar in the country. (Ref. Bhupinder Singh and S.K. Kaushik). Most of the re-rolling units in the country source concast steel billets from major and main steel plants in the country where liquid steel is refined by modern refining technologies. Several mini steel plants have installed secondary refining units for better quality and continuous casting units. The billets feed rolling mills for production of rebar. Indian producers are very much conscious on steel quality and properties.

Induction furnace steel making units in mini steel plants is essentially a process of melting graded scrap and hardly any refining in furnace. It demands from suppliers the accurate information regarding the quality of all scrap, residual tramp elements, ferro-alloys and other additives with respective test results and take utmost care in selecting clean and proper scrap mix. Induction furnace is practically the only commercial process for making steels on a small scale and equipped with rolling mill and forging units at many places in the country. Ingots, produced by melting clean graded steel scrap, sponge iron, do not have the facility to refine the molten steel in the furnace where the end products are of inconsistent metallurgical properties and cleanliness. However, many units have installed secondary reeling and continuous casting facilities at their end.

The ingots, produced, are subsequently rolled into steel bars. A big percentage of the output of these units is employed for manufacturing rebar for dwelling units and commercial buildings where some customers require a limited tonnage of steel not caring more about the quality of the rebar for using those in non-priority areas.

A big role is played by the re-rolling mills for considerable contribution to the steel production in the country. There are around 2600 re-rolling mills registered in SME sector in India (All India Re-Rollers Association). The rolling capacities of these mills are mostly in the range of 8,000 to 80,000 tons per year who contribute more than 20 % of the total production of finished steel in the country playing a very important role in country's economy and prosperity.

Ministry of Steel awarded this year 26 mini steel units, Gold certificate to 12 cos. and Silver certificates to 14 cos. in the secondary steel sector, for the first time in recognition of their contribution to the national economy at



a function "MEMORABILIA", AIIFA's 32<sup>nd</sup> International Conference held on 22<sup>nd</sup> Oct, 2018 in New Delhi. In order to enhance their global competitiveness, Companies were awarded and encouraged all the units in secondary steel sector to become globally competitive with integrated units to achieve 300 million tones by the year 2030-31 and promised all necessary supports from Govt. in line.

**Demand & Competiveness:** India's steel production is expected to remain higher in the current financial year 2018-19 ( 2017-18 : 103.13 MT) backed by growth in domestic demand from user industries during the year. The user industries that drive the demand for steel is shown below: Industry Research , Sector-wise steel consumption in India 2015-16 (in %) Source: National Steel Policy 2017

1. Construction & infrastructure sector is the largest consumer of steel in India accounting for a noteworthy share of 62-65% of the total finished steel consumption,
2. This is followed by engineering & fabrication sector which had a second largest share of about 22.1% of the total finished steel consumption,
3. The automotive sector was the third largest consumer of steel with a share of 10-12%,
4. Other transport and packaging etc. having share of about 3.0% of total finished steel consumption.

In India, there is a huge potential, all areas of rebar processing have a great demand. The trend of processed steel will be changed, from job site to service centers, in the years to come. Indians are more open to Innovation and technology in the rebar processing industries like Construction & Infrastructure include buildings, highways & culverts, bridges, airports, ports, water transportation, pre-fabricated buildings, power projects, real estate – residential, commercial and industrial structure/ buildings. A notable portion of the steel manufactured in India (both flat and long variety) finds its usage either directly or indirectly in the infrastructure sector. A noteworthy proportion of long product consumption is led by real estate sector.

In the Union Budget 2018-19, infrastructure allocation for the financial year 2018-19 has been increased by 20.9% y-o-y to Rs.5.97 lakh crore from Rs.4.94 lakh crore in the corresponding period a year ago. The government thus continues its push towards infrastructure and construction which is likely to drive the demand for steel in India during 2018-19 and onwards, the sector being the largest consumer of steel in the country. Engineering & Fabrication involves industries engaged in various manufacturing activities.

The global steel rebar market is segmented into product type such as mild and deformed. The deformed steel is stronger than mild steel and has a relatively high tensile strength and is perfect for reinforcement in construction activities with its high bonding strength which is likely to fuel the growth of this segment in upcoming years.

Global steel rebar market is expected to register a 6.9% CAGR and likely to reach at USD 223.7 Billion by the end of 2024 gradually expanding market on the back of increasing construction activities across the globe along with rapid urbanization and infrastructure development. Further, the Asia Pacific steel rebar market is likely to grow at remarkable pace due to industrialization in Asian countries making Asia Pacific world's leading steel producer and consumer. Additionally, performance of India and China in this sector is likely to drive the growth in rebar market at a considerable pace. Global steel rebar market is expected to expand significantly in the next few years owing to the rapid industrialization in developing nations.

The newer rebar steel grades being introduced are Fe-500, Fe-550, and Fe-500D. Similarly, in terms of application, a newer range of steel rebar that is corrosion resistant, epoxy coated, and earthquake resistant is being used increasingly in applications than the conventional rebar. Based on application at the site of work, the steel rebar market can be segmented into mild steel bars and deformed steel bars. Mild steel bars are used to support the tensile stress of slab beams. Deformed steel bars come with deformity or lugs or ribs on the bar surface. It has higher tensile strength as compared to the mild steel rebar and avoids slippage, limits cracks in concrete, and also binds two materials strongly.

Based on its finish, the steel rebar market can be divided into black rebar, epoxy coated rebar, and fabricated rebar. The use of these finishes depends on the environmental conditions that the bars are subjected to face.

1. Conventional uncoated rebar is black rebar used at sites with minimum exposure to moisture, with minimum chances of catching rust or corrosion.
2. Epoxy rebar is usually found in marine applications where there is a high chance of corrosion due to salinity of water. Black rebar is the preferred rebar is widely used owing to its cost effectiveness.

In terms of end-use industry, the steel rebar market can be segregated into construction and infrastructure, manufacturing, and oil & gas industry. The construction and infrastructure sector dominates the steel rebar market. The segment is expected to expand during the forecast period due to the rapid development and industrialization in developing countries such as China and India. This is anticipated to result in real estate and infrastructural developments.

In terms of geography, the global steel rebar market ( as shown below ) can be segmented into Asia Pacific, Europe, Middle East & Africa, North America, and Latin America. The market for steel rebar is dominated by North America owing to the large number of construction activities in the region. Asia Pacific is also a key consumer in steel rebar, led by the rapid industrial and infrastructural development in developing countries such as India and China. This results in the need for steel rebar for housing, industrial construction, and other infrastructural construction.

TMT Rebar, the newer variety of steel in construction industry, has been accepted worldwide as new-generation-high-strength steel product having superior properties compared to ordinary rebar with respect better weldability, strength, ductility and bendability meeting highest quality standards at international level.

Currently, demand in the market and capacities are increasing continuously at an exponential rate. India is currently the world's third largest producer of crude steel after China and Japan. And proportionally rebar production is taking place in the same rate..

The globally competitive products for competitiveness are judged by product cost, quality and properties. However, the competitiveness is determined by the manufacturing process. The use of state-of-the-art production technology like thermo-mechanically treated rebar with the mild steel adding micro all provides the basis for good product quality.



As such, Indian manufactures are trying to assure high quality products using advanced technology and carefully selected material and the motivated/ trained workers/ staff.

To become competitive in line with reputed rebar producers, mini steel units should seriously consider the technological aspects for improvements in rebar production technology and secondary rebaring technique in steel making units in view of recent closure of about 600 nos induction furnace in China.

Increase in infrastructure spending on highways, bridges, buildings and public utilities are expected to propel global steel rebar market growth. Upsurge in smart city projects supported by government and private financing will support product penetration. As per industry estimates, global smart city projects valued over USD 14 billion in 2015, observing over 18% CAGR. Rapid business expansion globally will be key factor driving growth.

It may be noted that increase of healthcare facilities to a great extent across Europe and Japan owing to increase in geriatric population is likely to augment product demand in institutional sector where health sector in Europe accounted for 10% of GDP and 15% of public expenditure in 2016 which necessitates more educational infrastructure as well as service sectors boosting steel rebar market growth forcing steel manufacturers in adopting vertical integration strategy to avoid additional expenses gaining competitive advantage.

India's production of Bars & Rods, presently, is nearer to 35 million T, Out of which, around 12 Million T contributed from primary players like Tata Steel, JSW, SAIL, RINL and JSPL who are also going to raise its capacity in upcoming years and about 23 Million by secondary manufacturers.

The Rebar industry has been a main steel production units among the Finished Steel product categories consisting about 35 -38 percent of the total steel production in the country. The construction and infrastructure boom in the country in the past decade contributed to the rapid growth in the industry. The rebar industry is characterized by both primary and secondary players operating in the market. Integrated Steel Producers (ISPs) in the category of Major & Main Steel Producers like SAIL, Vizag Steel, Tata Steel, JSW, that produce from the pure iron ore account for about 30 percent of the total rebar market. The remaining 70 percent is catered by about 300-400 producers and the lead role is played by secondary producers like VISA, Essar, Bhushan, Jindal Steel & Power, Tulsyan, SRMB, Shyam Steel, B.K.Steel, Jai Balaji, Sujana, Kalika, Adhunik Industries, Kannappan Iron & Steel Co (KISCOL), Prime Gold Group, Huge rebar industries scattered in Chattisgarh and Odissa, etc. Medium and small players have regional presence catering to the demand in a particular region.

As per the Steel-360 research, about 10 MnT of additional capacity has been planned by Re-bar Industries across various regions in India. Chhattisgarh & Maharashtra are the two states that have been eyed as a centre for TMT production. In these states, many additional capacities have been added at present. However, Kalika TMT and a secondary manufacturer Raipur Alloys & Steels are going to expand its capacities by 0.19 Million T pa and 0.83 Million T pa respectively in near future.

The production cost of steel in china is a crucial subject for economist from all over the world. From last 1.5 years Indian industries are totally hampered by the Import of low price Chinese steel. In India minimum Cost of producing steel is 28 Rs/Kg on an average whereas china, somehow, manage to dump the steel in India at the Price 24 Rs/Kg.

In India, sometime there is a misrepresentation that any steel can be classified as Alloy Steel provided that it has Boron to an extent of 0.0008%, which is so minuscule to distinguish that it can be there in any form of steel and cannot be held as a criteria for such big classification purposes under Customs & Excise norms. Taking advantage of this, the manufacturers have intentionally specified Boron at about 0.0010% trying to meet the norms of Alloy Steel Bars and thereby completely avoiding the Quality Control order of BIS.

The distinctive patterns mentioned in the Test Certificate of the Chinese Mills and their Sales Contract clearly specify Rib patterns on the bars, which means that it cannot be used in the Engineering Industry (pertaining to Alloy Bars which are non-ribbed in nature) and being wrongly classified under Excise Chapter 7228.3019 as 'Other Alloy Bars in Straight form. Since the bars are ribbed during the rolling process, there is no mention of any ribs, grooves or indentations in any Excise or Customs chapters; except for Excise Chapter 7214 20 under which the customs officials needs to charge import duty. Only Excise sub-chapter 7214 20 clearly states

'Containing indentations, ribs, grooves or other deformations produced during the rolling process or twisted after rolling.' Some importers and dealers are taking such advantages doing harm to many producers, particularly Indian mini steel plants producing rebar. ( Ref: Steel 360 report)

Allover the world, steel users of rebar are worried about the production of sub-standard variety of rebar quality steel from China (It is reported products having low Yield Strength even coming around 300 MPa and below are dumped at cheaper rate in many countries ). This has forced Chinese Govt. as immediate action in shutting down around 600 induction furnace engaged in production of such grades on the ground of poor / sub-standard quality, low yield, low toughness associated with pollution problems. However, high strength grade production of rebar continuing with addition of V as micro alloy representing the companies and organizations involved in the manufacture of rebar. Use of vanadium and vanadium-containing products, today has been praised by the Standardization Administration of the People's Republic of China for new high strength rebar standard intended to reduce the use of substandard steel and make buildings in China more earthquake resistant (Released Report of CISA).

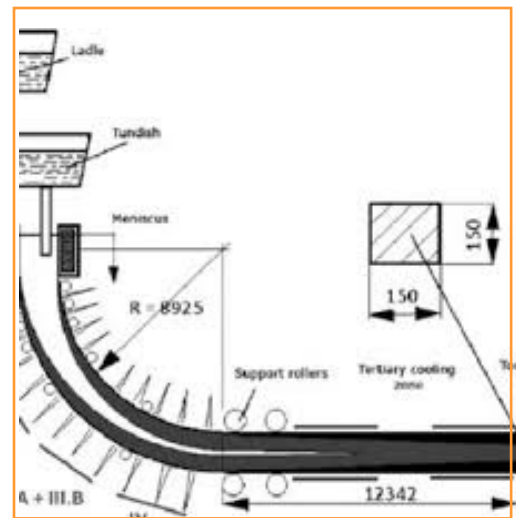
The new rebar standard, GB/T 1499.2-2018 released by the government of China on 6 February 2018, eliminates low strength Grade 2 (335MPa) rebar and authorizes 3 different high strength standards: Grade 3 (400MPa), Grade 4 (500MPa), and Grade 5 (600MPa). Professor Yang Caifu, of the Chinese Central Iron & Steel Research Institute (CIRSI) has taken the leads for joint venture with Vanitec/CISRI Vanadium Technology Centre noted that "for hot-rolled HS rebar, V content will be at 0.03% V in Grade 3, 0.06% V in Grade 4, and more than 0.1% in Grade 5 rebar so the implementation of the new standard will significantly promote the application of vanadium in Chinese rebar products." The implementation date for the new standard is 1 November, 2018. Professor Yang Caifu added that the concept for the new standard is widely accepted by the Chinese rebar producers. (Reference: News of John Hilbert of Vanitec)

**Upcoming primary players:** 30:70 is the market ratio of very large to large TMT manufacturers in India. A small portion of the very large manufacturers' production is utilized in government projects directly through contract and a large chunk of production is supplied via a very dense dealer network. One similarity among the primary manufacturers is that many are coming out with additional Bars & Rods capacity

Mostly, Premium grade TMT bars are utilized in government infrastructure projects through long/short term contracts. However such report offers a comprehensive evaluation of the market. It does so via in-depth qualitative insights, historical data, and verifiable projections about market size.

**Manufacturing Process of Steel Rebars:** Tested billets mostly in cross-section of 90 X 90 mm, 95 X 95 mm, 100 X 100mm, 115 X 115 mm, 125 X 125, 140 X 140 mm are ideally suited in the rolling mills and are fed in mills after re-heating the stock in re-heating furnace operated with the help of burning liquid or liquid and gaseous fuels for producing round bar of small sections. The liquid steel produced from conventional steel making routes like BOF, EOF, EAF and IF followed by secondary refining & continuous casting or ingot casting, satisfying quality are sourced by re-rolling units from mini steel plants, major and main steel plants in the country.

Sponge iron, an iron source relatively uniform in composition, and virtually free from tramp elements, is used increasingly in Induction furnaces in higher percentage in charge mix to dilute the contaminants present in the scrap used in the process. It has an associated energy value in the form of combined carbon, which has a tendency to increase furnace efficiency. For captive Sponge iron/DRI production facilities, there is an added advantage that the delivery of hot sponge iron/DRI to the induction furnace can reduce energy consumption to 16-20%.



General specifications for DRI/ Sponge Iron (ranges % by weight), Based on 65.5 — 68% Fe Iron Ore, Metallization 92-96%, Fe(Total) 86.1 – 93.5%, Fe (metallic) 81.0 – 87.9%, Carbon 1.0 – 4.5%, Sulphur 0.001 – 0.03%, P<sub>2</sub>O<sub>5</sub> 0.005 – 0.09%, Gangue 3.9 – 8.4%, Size (typical) 4 -20mm, Apparent Density 3.4 – 3.6 t/m<sup>3</sup>, Bulk Density 1.6 – 1.9 t/m<sup>3</sup>.

The billet casting units (shown in picture) in mini steel plants attached in line with induction furnace, LRF or AOD are providing greater flexibility in production of changing market demands extremely quickly ranging steel grades from simple construction steel (rebar) to state-of-the-art Special Bar Qualities (SBQ) for the automotive industry and other engineering applications, as well as high-grade wire products. Billet sections cover rectangular, square and round sections in different sizes. Direct charging of hot billets to the rolling mill, reduce the cost of reheating equipment and energy and slow cooling to allow for sufficient hydrogen diffusion optimizing caster throughput for maximum productivity with reduced billet-handling operations ensuring quality.

Brief Guidelines from Govt. for Setting up of TMT Unit : The New Industrial policy, Govt of India has opened up for private investment for iron and steel sector by removing it from the list of industries reserved for public sector. The policy exempts it from compulsory licensing. Imports of foreign technology, as well as foreign direct investments, are freely permitted up to certain limits under an automatic route. This type of manufacturing operation attracts many different types of registration and licenses from the different Govt. agency. Sometimes it differs according to the form of organization and investment raised by the manufacturing company. However, state laws and rules of statutory authorities need to be consulted to start up for necessary compliances.

### **The criteria for selecting location of IF /Rebar factory are:**

1. Registration of the willing firm with ROC. According to the management pattern and investment ratio, choosing the right form of business organization.
2. Trade License from the local authority has to be collected.
3. Project has to be registered under the ceiling of MSME.
4. For BIS certification of Rebar products, application is to be made
5. Apply for NOC from Pollution Control Board stating the process and fulfilling mandatory requirements
6. Obtain ISO Certification
7. Apply for Registration of VAT or any other related Financial Issues.

### **Different Processes Followed by Mini Steel Plants from Induction Furnace Steel**

1. Scrap → Melt in IF → Liq. Steel → LRF → Continuous Casting → CC Billet → Quality Std Billet → Hot Rolling → Re Bar from CC Billet
2. Scrap → Melt in IF → Liq. Steel → Continuous Casting → CC Billet → Normal Std Billet → Hot Rolling → Re Bar from CC Billet (W/O LRF)
3. Scrap → Melt in IF → Liq Steel → LRF/VD → Ingot Casting → Pencil Ingot → Hot Rolling → Re Bar from Pencil Ingot

In case of serial 1 & 2, Producers, mostly, do not require to heat the billets as concast end temperature is sufficient for taking hot reduction to make rebar saving fuel increasing productivity and yield. Only in case of serial 3, Producers need to heat the pencil ingots at hot working temperature in reheating furnace for rolling.

*To be continued.....*

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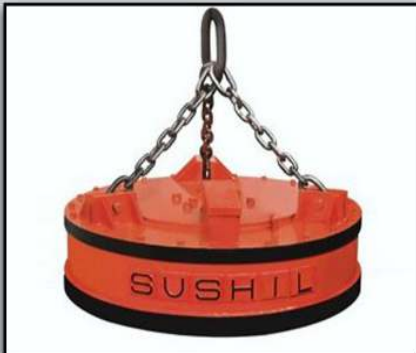
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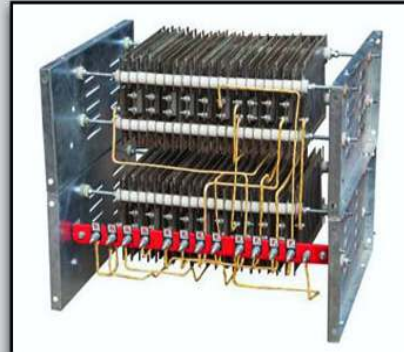
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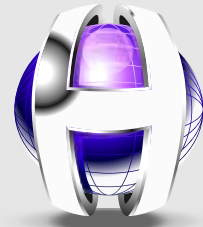
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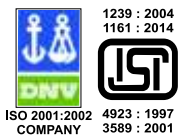
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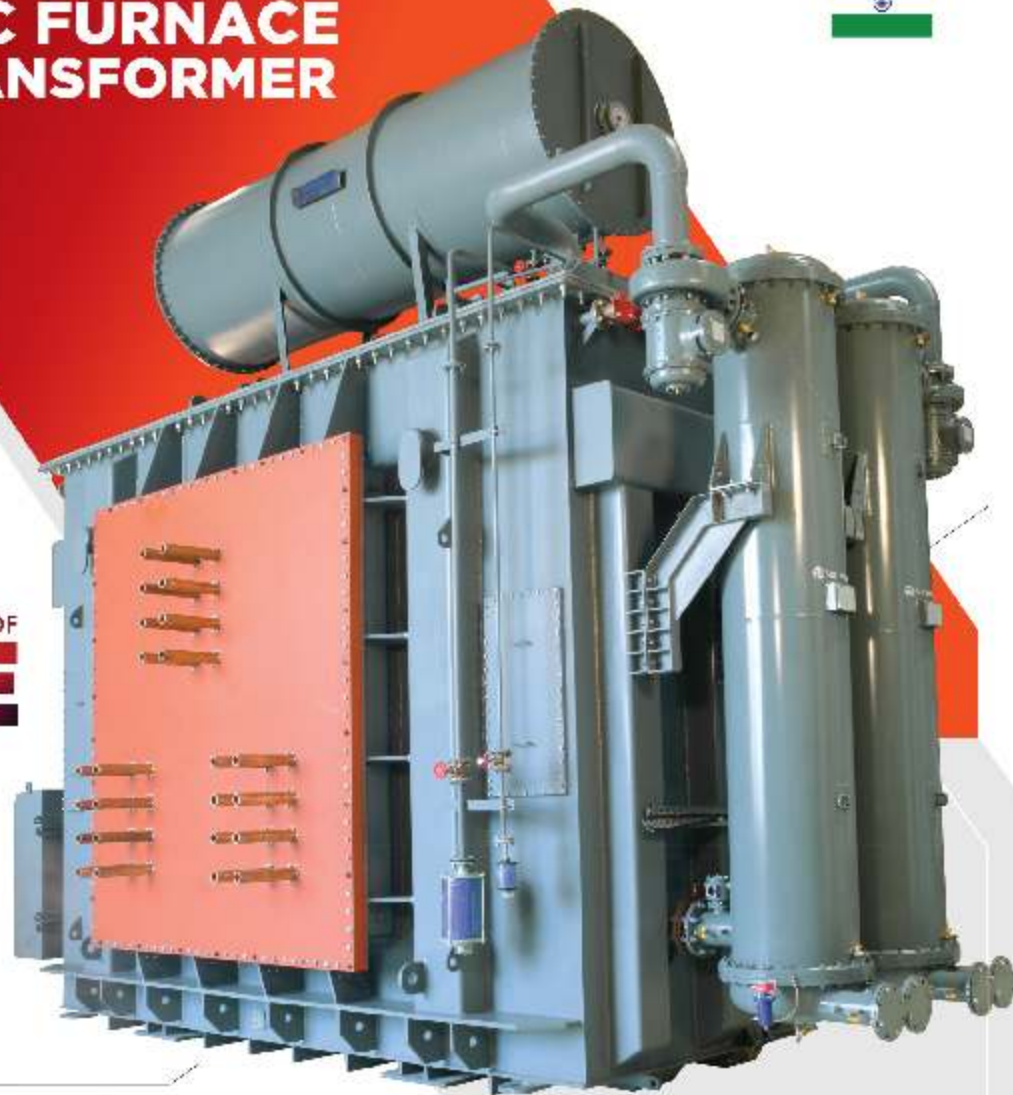


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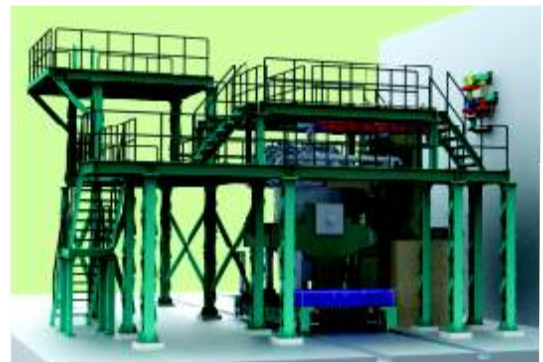
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