ALL INDIA INDUCTION FURNACES ASSOCIATION

AIIFA

Voice of Indian Sustainable Steel Manufacturing Sector

NEWSLETTER

VOL. No. XXIII

ISSUE No. 10, Oct. 2023

What's Inside

AIIFA SECRETARIAT:

504, Pearls Omaxe, Tower-1
Netaji Subhash Place,
Pitampura
Delhi-110034, INDIA
Tel: 011-42725051/27351345
M: 9810410186/9810410815
Email: aaiifa6@gmail.com
Website: www.aaiifa.org
Twitter: SteelEx_AIIFA
Instagram: steelex_aiifa
Facebook: SteelEx AIIFA
YouTube: AIIFA NEWS


ELITE CRANES
PERFECT LIFTING SOLUTIONS
Quality
Reliability
Sustainability


SWL. 20 TON.


SWL 70/25 TON


ELITE CRANES

LIFTLINE LI INDUSTRIES

YOUR ONE-STOP SUPPLIER FOR ALL NEEDS


Sintering Pre Heater

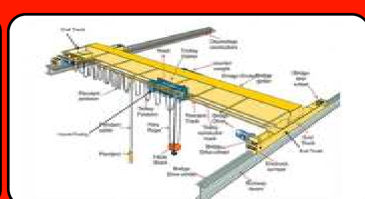
- Sintering Pre Heater
- Ladle Pre Heater
- Tundish Pre Heater

Electromagnet

- Scrap Lifting Circular Electromagnets
- Billet and Bars Lifting Rectangular Electromagnets
- Scrap Lifting Elliptical Electromagnets

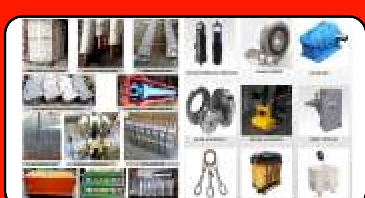

Cable Reeling Drum

- Cable Reeling Drum
- Lining Vibrators
- Electrical Control Panel

EOT Crane

- Single Girder EOT Crane
- Double Girder EOT Crane




Spare Parts & Accessories

- Spare Parts & Accessories of EOT Cranes
- Spare Parts & Accessories For Induction Furnace

Manufacturer & Exporters of EOT Cranes, Scrap Lifting Circular Electromagnets, Billets & Bar Lifting Rectangular Electromagnets, Induction Furnace Electric Sintering Heater, Ladle Electric Pre-Heater, TundishElectric Pre-Heater & All Components and Accessories related to EOT Cranes, Electromagnet & Steel Industries.

LIFTLINE LI INDUSTRIES

Works Office
Plot No-11, Nichi Mangali, Chandigarh Road,
Ludhiana – 141123, Punjab, India

Phone
+91 7626938310
+91 7626918013
+91 8700055427

Email
liftline8013@gmail.com
info@liftlinecranes.com
sale.liftline@gmail.com

Website
www.liftlinecranes.com

High Strengh Low Alloy Steel Re-rolled Products

Kamal Aggarwal
Hon. Secretary General, AIIFA

Introduction: The HSLA steels, often referred to as micro-alloyed steels, are low-carbon steels with increased strength by small amounts of alloying elements such as niobium, vanadium, titanium, molybdenum or boron, singly or in combinations. ATM A36 standard covers low-carbon steels that are commonly used in construction and other heavy industries where products are designated by both its chemical composition and mechanical properties, especially yield strength which must reach a minimum of 250 MPa. Mild steel can be transformed into high-strength low-alloy (HSLA) steel with the addition of a few alloys. Low alloy carbon steels are grouped as low carbon quenched and tempered steels, medium carbon ultra high strength steels, heat resistant chromium-molybdenum steels, and bearing steels.

Status of Rerolling at Different Periods (1990): Indian Steel re-rolling mills started production as low economic growth in the 1980s. It is seen that the remarkable environment change surrounded the Japanese society or steel industry in Japan in the middle of the 1990s and the international competitiveness was being lost so that the continuation of the company was asked which was not experienced conventionally. The technological innovation relating to production technology with cost competitiveness in India was felt to be urgently needed besides the appropriate response as the manufacturing industry came to be demanded for the environment change to surround the steel industry including the social need to the issues of earth environment, energy, and resources recycling.

In the ingot casting route, individual molds are filled with molten steel to produce steel ingots. The continuous casting method has a lot of benefits compared to the older ingot casting methods. Companies in the highly polluting steel-rerolling sector in India are introducing measures to improve energy efficiency as a result of a partnership between UNDP and the Ministry of Steel. In doing so, they are demonstrating that the industry can become more energy efficient, more environmentally conscious and more profitable. Mr. Haoliang Xu, Assistant Administrator and Regional Director, UNDP visited one such success story in Jaipur, Rajasthan and saw first-hand how the company has innovated to improve productivity and reduce specific fuel consumption.

Indian re-rolling units completed the crown-shape control technology in the 1980s. The concept for the crown-shape control is to make a strip crown into the target crown without strip shape disturbance simultaneously by predicting the strip shape with formulas to express the strip crown change and the shape change. As for the strip crown, the way to introduce the transcription rate and the heredity coefficient are well used in the hot strip rolling.)

Technology of Re-Rolling: Steel products are generally conducted for re-rolling at temperature 850–1200 °C where key principle is ensuring that the gap between the rollers is smaller than the metal's initial thickness of ingot or concast bloom/billet, facilitating forward motion through the rollers when the process decreases the metal's thickness while increasing its length and breadth, keeping the overall volume constant The HSLA range of products are available in hot and cold rolled carbon or HSLA grades. The various grades are identified by their yield strength. Hot rolled HSLA grades are suitable for Class 1 hot-dip galvanized coating in accordance with the international standard.

To achieve better mechanical properties, resistance to atmospheric corrosion than conventional carbon steels, good workability and better fabrication characteristics, High strength low alloy have been developed and gaining popularity in engineering and manufacturing industries. HSLA steels have yield strengths always greater than 275 MPa, chemical composition of a specific HSLA steel may vary for different product thicknesses to meet specified mechanical properties requirements for different applications.

Nowadays, it is a trend to replace conventional structural steels by using high-strength low alloy (HSLA) steels in order to reduce the weight of the structures. Usage of the HSLA steels instead of conventional carbon steels enables to save up to 20-25% of the structure weight while maintaining the high strength, stiffness and toughness of the structure. However, since the HSLA steels are based on ferritic microstructure, they are also attacked by common types of corrosion and therefore need to be protected in order to reach prolonged service life.

The low cost property wise HSLA group contains small amounts of alloying elements (0.05 to 0.15%), including Niobium (Nb), Vanadium (V), Titanium(Ti), Molybdenum(Mo), Zirconium (Zr), Boron (B) and few other rare-earth metals. They are used to refine the grain microstructure facilitating precipitation hardening.

High-strength low-alloy steels include many standard and proprietary grades designed to provide specific desirable combinations of properties such as strength, toughness, formability, weldability, and atmospheric corrosion resistance. These steels are not considered alloy steels, even though their desired properties are achieved by the use of small alloy additions.

HSLA steel is melted in either EAF or IF and initial shaped as cast ingot or concast billet/ bloom in continuous casting machine. Continuous casting billet/ blooms result in good surface compared to ingot route products. The billet/ blooms are rolled in rolling mill and cooled in normal condition. In case , hardness is specified by customer as annealed hardness , annealing treatment may be given to products. Since, HSLA steels are classified as a separate steel category, which is similar to as-rolled mild-carbon steel with enhanced mechanical properties obtained by the addition of small amounts of alloying elements, perhaps, special processing techniques such as controlled rolling and accelerated cooling methods may be given .

Category of HSLA steels: Common low carbon HSLA steels are produced for different industries as Nb, V, or N treated keeping carbon content 0.26 max. However, types being

1. Weathering steels, containing small amounts of alloying elements such as copper and phosphorus for improved atmospheric corrosion resistance and solid-solution strengthening.
2. Micro-alloyed ferrite-pearlite steels, which contain very small (generally, less than 0.10%) additions of strong carbide or carbonitride forming elements such as niobium, vanadium, and/or titanium for precipitation strengthening, grain refining and transformation temperature control
3. As-rolled pearlitic steels, which may include carbon-manganese steels but which may also have small additions of other alloying elements to enhance strength, toughness, formability, and weldability
4. low-carbon bainitic steels, which are low-carbon (= less than 0.05% C) steels with an excellent combination of high yield strengths, (as high as 690 MPa) weldability, formability, and good toughness
5. Dual-phase steels, which have a microstructure of martensite dispersed in a ferritic matrix and provide a good combination of ductility and high tensile strength
6. Inclusion-shape-controlled steels, which provide improved ductility and through-thickness toughness by the small additions of calcium, zirconium, or titanium, or perhaps rare earth elements so that the shape of the sulfide inclusions is changed from elongated stringers to small, dispersed, almost spherical globules These categories are not necessarily distinct groupings, as an HSLA steel may have characteristics from more than one grouping.

All the above types of steels can be inclusion shape controlled. Micro-alloyed ferrite-pearlite steel may also have additional alloys for corrosion resistance and solid-solution strengthening. s compositions of some HSLA steels covered in ASTM/ DIN/En steel specifications.

Hot Working by Re-Rolling: It is not exaggeration even if it is said that the quality became stable and pushed up market competitiveness to the first place in the world, because the system was well able to follow new steel grade or totally new rolling condition, which became a flexible computer control led system. A rolling technology is not only a rolling technology, and it goes without saying that it consists as synthesis technology such as hardware techniques of rolling mills or rolling rolls, measurement techniques to observe the rolling state, metallurgy-based software techniques to elaborate materials, control techniques to get highly precise thickness and shape even of rolled strips, and lubrication techniques to realize extension of roll life and reduce rolling load.

The most widely used metal forming process employed to shape steel ingots/ CC billets at temperature 1250-1300℃ to shape products like blooms, billets, sheets, plates, strips etc. by rolling. On the other hand, in re-rolling process, the shaping operation after heating in re-heating furnace the stock like bloom/ billet/ slab etc. from rolling at hot working temperature in rolling mill..

Rolling and Rerolling Concept: Rolling mill is a much larger unit compared to a re rolling mill in terms of variety of products like structural products e.g. channel, joist ,rail & track, rods etc. products. Volume of ingots with large cross section casting about 600x600mm or even more which are rolled into' blooms' (150x150 to 400x400). Further such blooms are rolled to billets (40x40 to 150x150) in the same mill. These billets, normally, are input for re rolling mills which usually produce the mild or alloy steel rods/ wires, flats, squares/ rounds etc. Those products are mainly used in civil construction work and also alloy steel in engineering / various manufacturing industries. The process of rolling however remains the same for rolling & re rolling. Some re rolling units, however, use the induction furnaces to prepare their own small ingots termed as pencil ingot to be rolled into rods, square etc. here the size of the unit is very small compared to rolling mills.

Hot re-rolling process of steel is shaping stock by roll pressed at very high temperature over i.e. 850/ 900℃ as finishing temperature depending upon steel grade (rolling temperature varying from 1200 to 950℃) depending on steel grades), which is above the re-crystallization temperature. For most steels rolling the rolled products are easier to form in these temperature range, and resulting in output that are easier to work with. In case of alloy steels, the re-rolling temperature is 1180/1150 – 950/900℃. To process hot rolled steel, re- rolling starts with a large, rectangular length of stock, called a billet or bloom which are heated and then sent for pre-processing, where it is flattened into a large roll. From there, it is kept at a high temperature and run through a series of rollers to achieve its finished dimensions. The white-hot strands of steel are pushed through the rollers at high speeds. For other forms, such as bars, flats or section products. Steel shrinks slightly as it cools.

Since hot rolled steel is cooled after processing, there is less control over its final shape, making it less suitable for precision applications. Hot rolled steel is often used in applications where minutely specific dimensions aren't crucial. Railroad tracks and construction projects often use hot rolled steel. Hot rolled steel can often be identified by the following characteristics:

A scaled surface—a remnant of cooling from extreme temperatures may be above 1300℃. Slightly rounded edges and corners for bar and plate products (due to shrinkage and less precise finishing).Slight distortions, where cooling may result in slightly trapezoidal forms, as opposed to perfectly squared angles

Hot rolled steel typically requires much less processing than cold rolled steel, which makes it a lot cheaper. Because hot rolled steel is allowed to cool at room temperature, it's essentially normalized—meaning it's free from internal stresses that can arise from quenching or work-hardening processes.

As overall material strength, and where surface finish isn't a key Hot rolled steel is ideal where dimensional tolerances aren't as important concern. Where surface finish is a concern, scaling can be removed by grinding, sand blasting, or acid-bath pickling. Once scaling has been removed, various brush or mirror finishes can also be applied. Descaled steel also offers a better surface for painting and other surface coatings.

The best rolling technology in the world was not realized only with the rolling theory, but it was stimulated with advancement of the neighboring techniques and it was made up technically. The role of the rolling theory is introduced to decide a pass schedule (including a draft schedule and the pass number) to get the aimed thickness/ shape from a certain thickness of stock, the methods are to decide by looking for the pass schedules from the past data and another one is a method to decide by calculating a pass schedule with the rolling theory. The former is a Western method, and the latter is the method that our country adopted.

Re-rolling in different grades of carbon, alloy steel and stainless steel based on the percentage of carbon and other alloying elements and mainly classified as:.

- Low-carbon, or mild steel contains 0.3 % or less carbon by volume.
- Medium-carbon steel contains 0.3% to 0.6% carbon.
- High-carbon steels contain more than 0.6% carbon,
- High strength low alloy steels (HSLA), Cr-Mo, Cr-Mo-Ni steel, Ball bearing steel
- Stainless Steel in types Austenitic, Ferritic, Martensitic, Duplex stainless steel,
- Tool (HW,CW, Dimensionally Stable steel/Die Steels of different grades .

Small amounts of other alloying materials such as Cr, Mo, Ni, Mn, W etc. are also added to produce many more grades of steel. These alloys modify the properties of the steel, such as tensile strength, ductility, malleability, durability, and thermal and electrical conductivity etc..Hot rolling also involves forming and rolling the steel slabs into a long strip while heated above its optimum rolling temperature. The red-hot slab is fed through a series of roll mills to form and stretch it into a thin strip/ sheet. After forming is complete, the steel strip/ sheet is water cooled and then wound into a coil. Different water-cooling rates develop different metallurgical properties in the steel.

Normalizing hot rolled steel at room temperature allows for increased strength and ductility. Annealing of rolled product is also done by heating rolled products to above the recrystallization temperature, soaking at that temperature and then cooling it in the furnace. Heating of the steel during annealing facilitates the movement of steel products, resulting in the disappearance of dislocations and formation of growth of new grains of various sizes. For specific grade products where both hardness, strength and impact properties are required, hardening & tempering is done. Hot rolled steel is typically used for construction, railroad tracks, sheet metal, automobile and different engineering / manufacturing industries.

Problems in Rerolling Mill – Indian Steel Re-Rolling mills often Face Problems as -? Mostly Operates with Old Equipments & Technology ? Resource Shortage ? Higher Cost of Input ? Input Quality ? Limited Product Range ? Low Yield ? High Energy Consumption ? Products mostly Serve Local Market ? Absence of Information Technology in the process ? Lack of Standard Operating Practice ? Inadequate Quality Control System ? Low Profit

Roll Pass Design in Re-Rolling Mill: Stock movement in rerolling mill in hot condition takes shape during path movement of steel products between the working rolls and rolling pass. The roll pass design generally means the cutting of grooves in the roll body through which steel to be rolled is made to pass sequentially to get the desired contour and size. Roll pass design is a set of methods for determining the dimensions, shape, number, and type of arrangement of rolling mill passes The quality and productivity of hot rolled bar steel products strongly depends on hot rolling parameters such as strain, strain rate, temperature, groove design and rolling sequence. It influences the metal deformation behavior within the pass and mill load requirement apart from roll wear.

A pass schedule is calculated near the capacity limit of a rolling mill by using rolling load and torque, and decided to adjust the calculated pass schedule so that the output does not worsen the flatness degree when it becomes thin near the last pass during flat/ strip rolling. Pass schedule shows a strength for the rolling condition in the range where it had a past experience at all, but it is not helpful in the case that a totally new steel grade and product are considerably different from the past experiences. However, it is a strength by the latter method that it can be done so without a problem in this case.

The metal flow behavior in a hot rolling process is a complex phenomenon, which is complicated due to tensorial stress distribution that is influenced by the material properties and deformation parameters. The knowledge of the in-process deformation and micro structural changes is critical for the optimization of the pass design, the pass schedule and ultimately, the properties of the as rolled product. Computer based FEM simulations incorporating deformation models can be used to develop optimum process sequences to obtain steels with sound quality, desirable microstructure and mechanical properties by controlling the hot rolling process parameters of bars, sections, flats etc. In the hot rolling of bars, the material characteristics, rolling load, angle of bite, the roll groove geometry and roll pass sequence etc influence metal deformation and properties.

Material Flow in Re-Rolling Mill: Flow Diagram shows Heating of Input in Reheating Furnace, Re-rolling and finishing of products. The transcription rate means how much the strip crown formed under the uniform rolling load transcribed into the strip crown after rolling, and the heredity coefficient means a constant to express how much the strip crown at the entry of the roll gap influences that after rolling. In the cold strip rolling, the strip crown at the entry of the roll gap is inherited approximately 100% except the edge-drop region of strip width. However, when there is non-uniformity in the width direction such that the length at some region of strips comes to be larger than that at other region after rolling, the longitudinal tensile stress of the former becomes smaller, and the rolling load per unit width grows bigger, and the roll deformation grows bigger too.

Inputs for Steel Re-Rolling Mills: Smaller size Ingot (pencil ingot), Bloom or Billets produced from Continuous Casting Units come out as output after hot rolling as input in re-rolling mill converted as output in shapes as Round, Square, Flat, TMT Bar, Wire & Rod, sections like Angle, Channel, Joists etc. Few products mostly flats are Cold Rolled in shapes against requirements.

Currently, secondary steel producers have a cumulative share of more than 70% in the rolled long product market. The role of the re-rolling industry in the overall production of the secondary steel sector for the supply of finished products is thus very important for country's industrial development and economic growth. Presently there are nearly 2000 working steel re-rolling mills in India that are adding strong muscles to the Indian steel sector. Maximum SRRM in India are running as family businesses or MSMEs/ SMEs. In India, the re-rolling sector began in Kanpur in 1928, with no substantial technical development in most units. As a result, the re-rolling industry in India is not very energy efficient and also has high level of emissions. Re-rolling mills contribute more than 10% of the overall emissions from the steel industry.

The production volume of long steel products across India was **approximately 48 million metric tons** in the fiscal year of 2019, steadily improving continuously as 2016 – 42 MT, 2017 – 44, 2018 – 45MT, 2019 – 48 MT, but production affected due to COVID-19 in 2020 and also first few months in 2021. Out of total tonnage, 70-75% long products come from secondary steel sectors. In terms of value, the long product steel market size is estimated to be USD 527.0 billion in 2020 and projected to reach USD 636.7billion by 2025, at a CAGR of 3.9% from 2020 to 2025.Increasing construction and infrastructure activities, industrialization, and rising population levels are the major factors responsible for the growth of the long steel market

Normally, basic rolling mill consists of two opposing rolls termed as a two-high rolling mill where rolls have different diameters in different ranges. In 2-high mill, configuration can be either reversing or non-reversing. In the non-reversing mill, the stock always passes through from the same side. The reversing mill allows the direction of roll rotation to be reversed, so that the work can be passed through in either direction permitting a series of reductions through the same set of rolls, simply by passing through the work from opposite directions multiple times as shown below in image-

The disadvantage of the reversing types is the significant angular momentum possessed by large rotating rolls and the associated technical problems involved in reversing the direction. To achieve a series of reductions, the stock can be passed through from either side by raising or lowering the bed after each pass. The equipment in a three-high rolling mill becomes more complicated, because an elevator mechanism is needed to raise and lower the work. As several of the previous equations indicate, advantages are gained in reducing roll diameter. Roll-work contact length is reduced with a lower roll radius leading to lower forces, torque, and power.

Major Defects in Re-Rolled Products originated from concast products: Defects of the continuous cast steel billet/ bloom are formed due to several factors which include material related factors, casting speeds and temperatures, mould oscillation, casting powder, segregation coefficient of solute elements, phase transformation, and mechanical and thermal stresses. Lap in re-rolled products is a surface defect causes by folding over, but not welding, the hot metal during the rolling process when sharp overfill or fin forms and is rolled back into the surface causing lap formation on surface and appear as crevice run lengthwise on the re-rolled steel products .Seams may be present in the input billet before bar rolling as a result of non-metallic inclusions in steel, cracking, tears, subsurface cracking or porosity. During continuous casting, loss of mold level control result in out-of-control conditions which can reseal while in the mold but leave a weakened surface.

The possible reasons for billet cracking during hot rolling such as a low Mn/S ratio, high casting speed, high degree of superheat, and high inclusion content in steel are appeared associated with large surface/internal defects, axial porosity, off-centered cavities/porosities, off-centered cracks, and inclusion bands. To prevent such defects in continuously cast steel billets and to reduce/eliminate split end problems. The casting parameters should include: (a) Mn/S ratio >35, (b) degree of superheat <60 °C, and © casting speed: <3.0m/min, where roll radius and initial thickness of the work piece should be optimized.

Actually, three problems associated with the production of high-alloy steel bar and rod by rolling in hand-operated mills which is taken place in India. In such mill, defects are mainly cracking, seam, laps split ends, and decarburization. Careful selection of pass sequence, taking into account all the manufacturing and product requirements, is essential in order to control the rate of rejection of rod and bar with these defects

Since the rolling operation is often the last process step, the rejection/scrap at rolling stage is very costly and hence the quality control of rolling process is very important. Severe competition in Indian steel re-rolling industries urges quality improvements in rolling processes. Among all the quality concerns, the surface integrity is an extremely important quality characteristic of the rolled products. Products with severe surface defects have to be scrapped. Therefore, it is highly desired to detect, reduce, and eventually eliminate the surface defects if possible. Unfortunately, the surface defects remain as the most troubling problems in the hot rolling process.

Major challenges to The Re-Rolling Industries: To the management of Re-rolling industry, The surface quality control fall into two aspects. Effective surface sensing system to measure the surface condition in real-time during production environments (high temperature, high speed, noise, and dirty conditions. Surface defects have been a long-standing troubled issue in hot rolling processes due to the ineffectiveness of existing detection methods. The root causes of surface defects in hot rolling processes are very complicated, surface defects may originate from multiple sources like non-metallic inclusion in raw material as mill as the nonmetallic impurities in the billet/ bloom during solidification as well as the mechanical failures in the rolling mills are all important potential sources of surface defects, moreover inclusions are stress raisers causing defects.

Indian Steel Re-Rolling mills produce the much needed functional items of everyday steel products and its chief clusters are mainly located in Raipur, Howrah, Ludhiana etc. besides products of main and major Indian steel plant. Key products that rolling mills manufacture are Thermo Mechanically Treated (TMT) Bars, Structural steel products like angles, plates, channels, rounds etc. Re-rolling mills serve the purpose as Secondary Steel Sector and as a complement to the primary steel producers. Steel industry , as finished steel, terms as long steel products and flat steel products e.g. refers and all structural steel products including wire, rod, rail, and bars as well as types of steel structural sections and girders.

The main objective of rolling is to decrease the thickness of the stock making desired profile. Rolled products are used for different engineering, constructional & fabrication purposes. As steel is not ductile at room temperature, heavier reductions require it to be heated to high temperatures 1200-1300? to make it ductile by converting its crystal structure from BCC to FCC. In re-rolling mills, this operation is called reheating process and is carried out in reheating furnaces.

Energy Efficiency in Steel Rolling Mill & Reduction of Green House Gases: Hot rolling operation is always preceded by reheating operation. This entire process of Rolling is associated with various safety hazards like hit / entanglement with moving stock, burns, slip & fall, exposure to dust, noise, heat & gas etc. Most hazards in rolling process arise from coming in contact with moving hot material, falling etc. Second threat is from emissions of reheating furnaces which contain toxic gases such as carbon monoxide, Sulphur dioxide, NOx etc. Also leakage of fuel gas like producer gas, Piped Natural Gas (PNG), Coal Bed Methane (CBM) etc is a constant threat.

The global development objective of the project was to increase the end-use efficiency of the re-rolling sector, thereby effecting a reduction in GHG emissions by the sector. To achieve this, the immediate aim of the project was defined as rapidly facilitating the adoption of EETs by rolling units by removing the barriers that inhibit technology upgrades in the sector. To accomplish this goal, the PMC first quantified the objective into specific targets that the project must meet. These are listed in Table 2. As Table 2 illustrates, the project aimed to considerably lower consumption of energy, targeting a 40% decrease in coal consumption alone, which is significant not only because coal is one of the largest sources of GHG emissions, but also because a vast majority of SRRM units – particularly the smaller ones – use coal as the primary source of energy.

Energy Efficiency Target in Re-Rolling Mills From Existing Level

Energy Cons. & Other Imp Parameters of Re-Rolling Units	Present Status	Target Set-Up
Oil Consumption Litre/T	42-45	<30
Coail Consumption Kg/T	70-80	45-55
Gas Consumption NM3?T	48	30
Scale Loss %	2.5-3.5	< 1
Power Cons. KWH/T	90-120	60-80
Yield %89-93	94-95	
Utilization %	65-70	80-85

Project of Energy Efficiency Program in Partnership Way: Government of India supported by Aus-Aid aims to upscale energy efficient interventions in the steel re-rolling mills sector and other sub-sectors of the small scale steel industry in India which will enable mitigation of GHG emissions leading to productivity improvement reducing cost from using energy in more efficient ways at all stages. The highlight of the Steel Up scaling Project is the overwhelming participation from secondary steel unit owners from across the country setting up target and achieving the same.

Conclusion: High-strength low-alloy steels are also considered **micro-alloyed steels because they are alloyed at low concentrations compared with other types of steels**. The yield strength normally vary as 250–600 MPa and they are used in automobiles, trucks and bridges amongst other applications. Preferably, finishing temperature during hot rolling should be maintained at lower side.

Energy-efficient production in steel re-rolling mill is simply reducing energy consumption in production, CO2 emissions and linking energy consumption, volume of production and control

measures taken. For Govt. and for re-rolling mills, global warming, rising energy prices, and customers' increasing ecological awareness have pushed energy efficient production to the top of the agenda. Governments and industries are both striving to identify the most effective measures to increase energy efficiency in production processes supported by necessary funding in the identified areas making road mapping projects.

MONTHLY MEETING GLIMPSE
"ISA Steel Conclave 2023"

"ISA Steel Conclave 2023" was organised by Indian Steel Association on **7th – 8th November, 2023** at **Hotel The Lalit,** New Delhi.

The main purpose of holding such a conclave was to cover pertinent issues like Steel demand dynamics, Steel Industry decarbonisation, New Export frontiers and connected challenges, Ensuring Quality Monitoring and Implementation, role of Artificial Intelligence, Road map for Small and Medium Steel Makers, Raw Materials and Steel Logistics.

Shri Kamal Aggarwal, Hon. Secretary General was also invited as a panelist in session on **"Roadmap for growth of the Medium Category steel makers and other available options."** The session was Chaired by **Shri Parmjeet Singh, Additional Industrial Advisor, MoS.**

The following panellists were present in this session:

1. Shri Amit Aggarwal, Moderator (McKinsey)
2. Shri Kamal Agarwal, Hon. Secretary General, (AIIFA)
3. Shri Arvind Kumar, Associate Vice President (Rungta Mines Ltd)
4. Shri Ashish Gupta, Chief Executive officer (Vedanta ESL Steel Ltd)
5. Shri Deependra Kashiva, Director General, SIMA

Key highlights as said by the Shri Kamal Aggarwal during the session are as under:

- Secondary Steel players will play an **important role** in 300 MT India's aspiration for 2030 especially in long products.
- **Price volatility** and **unavailability of raw materials** and energy sources is a burning issue and needs policy intervention. **Logistic costs** are at a higher end due to unfavourable economies of scale.
- Secondary Steel players can focus on **Energy Efficiency**, consistently **producing quality** products and **process improvement** using **Digital and Analytics**, where the players are lagging in adoption.

DESIGN ASPECTS OF DIFFERENT TYPES OF REHEATING FURNACES FOR RE-ROLLING SECTOR

P. Mishra
Sr. Exec. Director, AIIFA

Synopsis

The Article has explained the design aspects of various types of Reheating Furnaces for Rerolling Sector. While discussing about design aspects, the Article has also talked about different types of Reheating Furnaces.

Design aspects of Reheating Furnaces depend on various factors such as technical specifications; sizing of the furnace, which includes the length and width of the furnace; and the Refractory Lining of the furnace including ceramic fibre materials in different zones. These include Furnace Roof, Furnace Walls and Hearth. The design aspects also include Mild Steel Casing, which is provided as cladding for the Refractories; Combustion System like Fuel Oil Burners, Combustion Air Blower and Fuel Oil Heating & Pumping Station; Flue Exhaust System & Chimney; Charging/Discharging Equipment/Withdrawing Roller; Combustion Control System: Conventional/Programmatic Logic Controller; Air-Preheat System (Recuperator); and finally, Factors affecting Operating Efficiency. The Article has briefly discussed these design aspects of Reheating Furnaces.

Preamble

India is the world's second largest producer of steel, after China. The steel sector in India contributes around 2% to the GDP and provides employment to about 2.8 million people directly and indirectly. In 2022-23, the installed capacity and production of crude steel were 160million tonnes (Mt) and 126.26 Mt respectively with utilisation of 79%.

The crude steel production grew at 2.6% during the five-year period of 2018-19 to 2022-23 annually. As per NSP, 2017, Indian steel capacity is expected to grow up to 300 MTPA (Million tonne per annum) by 2030 with likely production of Crude steel at 255MT (with 82% capacity utilisation).

This demand for steel is likely to come from industries, residential and commercial construction, mega ports, affordable housing, urban development, highway construction, industrial corridors and other public infrastructure. The major clusters of steel industry are in Odisha, Chhattisgarh, Jharkhand, West Bengal, Karnataka, Maharashtra and AP. The presence of raw material and rail, road and port connectivity are the key factors for determining the steel producing facilities in these areas.

The large players are using BF-BOF route and the small players generally prefer coal based DRI due to their ability to use non metallurgical grade coal in steel production. Unlike in western world, gas based DRI is not popular in India due to low natural gas availability. India coal based DRI iron making have emission intensity of 2.55 TCO_2/TCS which is higher compared to world average of around 1.85TCO_2/TCS. Steel industry in India comprises of large, medium and small steel producers (including Alloy and Stainless-Steel sector) and a large SME sector operating in Sponge Iron/DRI, Rerolling, Foundry, Ferro Alloy sector spread in Mandi Gobindgarhin Punjab, Raipur in Chhattisgarh, Salem in Tamil Nadu, Howrah in West Bengal, Belagaon in Maharashtra and others.

Currently India is second largest producer of steel with 6.6% share in global steel production. Total steel production in the world stood at 1885 MT in the year 2022. China, Japan and USA are the 1^{st}, 3^{rd} and 4^{th} largest steel producers in world respectively.

Re-rolling Sector may be divided in number of sub-sectors depending upon the Annual production of the Re-rolling Units as follows:

a) Re-rolling Units with annual production of 10000 tons (Reheat Furnace rated at 5 tph).

b) Re-rolling units with annual production of 25000 tons (Reheat Furnace rated at 10 tph)

c) Re-rolling units with annual production of 40000 tons (Reheat Furnace rated at 15 tph)

d) Re-rolling units with annual production of 50000 tons (Reheat Furnace rated at 20 tph) etc.

Secondary Steel Industry mainly caters to production of Rebars and similar types of steel used in construction work.

Different Types of Reheating Furnaces

Reheating Furnaces for Re-rolling Industry are of many types:

- Chamber Type
- Pusher Type
- Walking Hearth
- Walking Beam Type

Different types of Reheating furnaces are used for different types of feed stock: e.g., pencil ingots, Concast / rolled billets, blooms, ingots. Re-rolling Mills in the Secondary Steel Industry mainly use Pusher Type Reheating Furnaces. Pusher Type Furnace may be Top Fired or Top & Bottom Fired depending on the cross section of the feed stock. Feed stock up to 150 mm X 150 mm cross section is usually heated in top fired Reheat Furnace. Feed stock with cross section exceeding 200 mm X 200 mm cross section is usually heated in top and bottom fired Reheat Furnace. For our Workshop today, we shall take up design of a 20 TPH Pusher Type Reheat Furnace.

Design of 20 TPH Reheating Furnace forRe-rolling Mill

1. Technical Specifications:

Capacity:	20 tons / hour
Reference Billet Size:	100 mm X 100 mm x 6 000 mm (single row) 100 mm X 100 mm X 3 000 mm (double row)
Fuel:	Furnace Oil (IS-1593) C.V. = 10 000 kcal/kg.
Furnace Temperature:	1 250 Deg. C
Billet Temperature:	200 Deg. C
Billet Charging:	End
Billet Discharge:	Sideways

2. Sizing of the Furnace: Useful Dimensions of the Furnace and Useful Length of the Furnace:

Weight of one 100 mm X 100 mm X 6 000 mm billet: 470 kgs. 20 tons shall have 43 billets. Heating Time (up to 1200 deg C) for 100 mm cross section mild steel billet: ~ 140 minutes Nos. of billets in the furnace: 43 X (140 / 60 = 2.33) = 100 Hence useful Length of the Furnace = 100 billets X 100 mm = 10 000 mm. From the centre line of billet discharge, ~ 800 mm gap is provided up to inside of the end wall of the Furnace. Hence the Furnace length between inside of the entry and end wall = 10 800 mm

Width of the Furnace:

Pusher Type Furnace needs ~ 250 mm clearance on either side inside the width of the Furnace, so that while pushing the feed stock does not damage the inside walls of the Furnace. If it is 2-row charging, gap of ~ 200 mm is provided between 2 rows of the billets to ensure that each row of billets is pushed upto discharge end without fouling with the other row. Hence width of the Furnace would be: 250 mm + 3 000 mm + 200 mm + 3 000 mm + 250 mm = 6 700 mm

Arch type roof is provided for Reheating Furnace with inside width of up to ~ 3 500 mm.

Hanging Roof is provided for higher width.

3. Refractory Lining in Different Zones:

The furnace is usually lined with conventional refractories and insulation materials including ceramic fiber materials broadly as follows:

Furnace Roof:

Soaking Zone:	250 mm thick special shaped bricks made of 60 % Alumina backed by 25 mm Insulating Castable.
Heating Zone:	250 mm thick special shaped bricks made of 38-40% Alumina (IS-8) backed by 25 mm Insulating Castable.

Furnace Walls

Discharge End Wall: 230 mm 60 % Alumina bricks backed by 115 mm hot face insulation bricks, 115 mm Mica insulation bricks, 75 mm block insulation / ceramic fibre blanket

Sidewalls >

1000deg C: 230 mm 60 % Alumina bricks backed by 115 mm hot face insulation bricks, 115 mm Mica insulation bricks, 75 mm block insulation / ceramic fibre blanket

Sidewalls <

1000deg C: 230 mm IS-8 quality fire bricks ,115 mm Cold face insulation bricks,115 mm Mica insulation bricks, 75 mm block insulation / ceramic fibre blanket

Charging end wall: 175 mm ceramic fibre module

Top Flue: 50 mm ceramic fibre blanket which shall be held in position by heat resisting studs and washers

Hearth:

Soaking Zone: 150 mm 80 % Alumina Bricks (Fusion cast bricks preferred), 75 mm 45 % Al203 firebricks, 230 mm Cold face insulation

Heating Zone >

1000° C: 150mm 50 % Al203 firebricks, 115 mm Hot Face Insulation Brick, 115 mm Cold Face Insulation Brick, 230 mm Mica Insulation brick

Heating Zone <

1000° C: 150 mm 45 % Al203 fire bricks,115 mm Hot Face Insulation Brick, 115 mm Cold Face Insulation Brick, 230 mm Mica Insulation brick

Door at charging end: 175 mm RT Ceramic fibre Module, 25 mm ceramic fibre blanket Rt128

Door at discharging end: 225 mm RT Ceramic fibre Module, 25 mm ceramic fibre blanket Rt128

Overhead flue upto}: 115 mm IS-6 quality fire bricks,115 mm mica insulating recuperator bricks, 50 mm calcium silicate block insulation

Lagging for Air Line: 75 mm thick rock / glass wool blanket covered with galvanised steel sheet cladding.

Refractory Lining is designed for outside wall temperature of ~ 60 degC over the ambientnear the Burners, roof and the Soaking Zone and ~ 50 degC over the ambient in rest of the Furnace.

4. Steel Casing:

Mild Steel Casing (IS 2062) is provided as cladding for the Refractories. 10 / 12 mm Steel Casing is necessary for Furnace Zones operating at 800 to 1200 deg C. 6 / 8 mm Steel Casing is adequate for the pre-heating zones of the Reheat Furnace. Steel Casing is suitably reinforced by channels and beams. Typically, steel required is ~ 0.5 tons / m2 of Overall Furnace Area. Steel Casing is usually painted with heat resisting aluminium paint to reduce radiation loss from the walls of the Reheat Furnace.

5. Combustion System:

5.1 Fuel Oil Burners:

Theoretically 18 kgs of fuel oil are required to heat one ton of mild steel billets to 1 200 deg. C. In actual practice this may vary from 30 kgs to 55 kgs. Typically, Combustion Systems of new Reheat Furnaces are, however, designed on the basis of specific fuel consumption of 40 kgs / ton. 20 TPH Reheat Furnace will accordingly have Combustion System designed for 800 kgs. of oil / hour. Typically, 20 TPH Reheat Furnace will have 3 Zones:

Preheating Zone

Heating Zone and

End Soaking Zone.

Preheating Zone often is unfired to recover heat from the hot combustion gases leaving the Furnace. Heating Zone is rated at 65 % to 70 % of the Total Heat Requirement. In this case ~ 520 kgs. End Soaking Zone will be rated at ~ 280 kgs. Since the inside of the end wall is 6 700 mm wide, there is adequate room to provide 6 Burners each rated at ~ 45 kgs of oil per hour in Soaking Zone.

Heating Zone will have 13 Burners each rated at 40 kgs of oil per hour. Heating Zone Burners may be located on both side walls of the Reheat Furnace in staggered arrangement. Hence total of 19 Burners of same size will be required for the Combustion System Burners Rated Capacity is achieved when combustion air is supplied to them at 300 to 400 mm water gauge at the Burners. The Burners should be suitable for air-preheat of ~ 300 deg. C to save ~ 15 % of fuel consumption. (~ 5 % of energy is saved with each 100 deg C preheating of combustion air)

5.2 Combustion AirBlower:

Theoretically ~ 11 nm3 of air are required for full combustion of 1 kg. of oil. In practice excess air is required to ensure full combustion of fuel oil. ~ 15 % excess air has been found adequate for proper burning of fuel oil. (Only 8 to 10 % excess air is required when gas instead of oil is the heating medium)

The Combustion Air Blower will accordingly be rated for capacity of 800 X 11 X 1.15 = 10 120 nm3 per hour. Ambient air temperature in day time often is 35 to 40 deg. C, hence air sucked in by the Combustion Air Blower is at that temperature. Hence the Combustion Air Blower capacity is further increased by ~ 15 % to take care of higher ambient temperature. Combustion Air Blower to be ordered should have rating of 10 120 x 1.15 = 11 640 m3 / hour. Static Air Pressure of the Blower = ~ 400 mm required at the Burner + pressure loss through the recuperator (typically ~ 200 mm WG) + pressure loss in the Combustion Air Piping (typically 200 to 300 mm WG) = .800 to 900 mm WG. (Typically, ~ 10 % of line pressure is thepressure loss of Control Valve). Hence the Combustion Air Blower will be rated for 11 640 m3 / hour at 900 mm WG static pressure

5.3 Fuel Oil Heating & Pumping Station:

Furnace Oil delivered at works normally has high viscosity. It is heated to about ~ 85-90 deg. C to lower the viscosity to ~ 1.5 deg. Engler. Normally electric heaters are used to heat the oil from ambient temperature to ~ 85-90 deg. C. Furnace Oil is normally stored in Tanks. It is to be supplied to the Burners mounted on the Reheat Furnace at ~ 1.5 to 2.0 atmospheres pressure. Required pressure is achieved by Fuel Oil Pump. Fuel Oil Heating & Pumping Stations are readily available in the Market.

6. Flue Exhaust System & Chimney:

Properly designed Flue Exhaust System & Chimney are necessary to ensure economic operation of Reheat Furnace as well to conform to applicable Pollution Norms. Flue Channel routing depends on the Layout of the Reheat Furnace with respect to the entire Plant Layout. Flue Channel leaving the Reheat Furnace is often underground. However, in case of high-water table in the plant area flue channel may be taken out from the roof of the Reheat Furnace. Flue Channel is usually lined with 230 mm of IS-6 Bricks followed by Red Bricks. Indian Standards are available for appropriate design of the Chimney. Chimney is to be provided with suitable tapings to analyse flue exhaust gases before they are discharged into the atmosphere. The bell portion of the Chimney (about 1/3 height of the Chimney) is usually lined with insulation castable suitable for 900°C. Insulation Castable is held my mild steel anchors welded to the chimney. The thickness of lining shall be ~ 150 mm.

7. Charging / Discharging Equipment / Withdrawing Roller:

Billets are usually charged into a Reheat Furnace by Hydraulic / Mechanical Pusher. Hydraulic Pusher has the advantage that same Hydraulic System (Power Pack) can also be used for Discharge Pusher as well as Withdrawing Roller. Number of Billets in the Reheat Furnace: 100 Additional Billets on the Charging Table / Charging Grid: 10 Total weight of 110 Billets (100 mm X 100 mm X 6 000 mm) to be pushed by the Pusher = 470 kgs X 110 = 51 700 kgs. Pushing Force required = 30 tons As the Reheat Furnace is designed for double row charging, it will be provided with 2 Hydraulic Cylinders. Typically, Hydraulic Power Pack is designed for 100 atmosphere pressures with operating pressure of 70 atmospheres. Hence 2 cylinders with diameter of 200 mm would be adequate for the Charging Pusher. Hydraulic Motor will be provided for (a) Side Discharge Pusher and (b) Withdrawing Roller.

8. Combustion Control System: Conventional / PLC Conventional: Conventional Control System consists of Temperature Control of each Zone: Temperature is measured in each zone by a thermocouple. The measurement is “fed” toTemperature Controller. The Controller commands opening / closing of the Control Valve located in Combustion Air Piping of the corresponding Zone. This causes variation in the pressure of the Combustion Air. An impulse piping from Combustion Air Piping controls opening / closing of the valve in fuel oil piping. (Ratiotrol)

Pressure Control of the Reheat Furnace Safety Controls for:

a) Excess Zonal Temperature

b) Low Air Pressure

c) Low Oil Pressure

d) High Preheat Temperature

e) High Flue Exhaust Temperature before Recuperator etc

Record of Temperatures in each zone, Combustion Air Temperature after Recuperator, Flue Gas Temperature before Recuperator etc.

PLC based:

Now-a-days Programmable Logic Controller (PLC) based control system is provided for all above functions. In this case, however, it is necessary to have more elaborate and exact measurements of combustion air flow and fuel oil measurement in each zone. PLC also has built in Ratio Control System. With Ratio Control System, it is possible to vary atmosphere inside the Reheat Furnace. This is however not necessary for Rebars. In addition, PLC can also take care of automatic sequential operation of the charging and discharging equipment for the movement of billets in and out of the Reheat Furnace and further to the mill roller table with associated safety auxiliary interlocks and automatic tracking of batches of charged materials through the furnace

Data Monitoring & Protection:

Back up protection for the zonal temperature, recuperator protection and monitoring and recording of data is accomplished by providing a 16-channel data scanner/monitor with high and low alarm capability together with a 132-column line printer.

This shall have following functions:

Monitoring the Zonal temperatures, flue gas temperatures before and after recuperator, hot air temperature after the recuperator. Excess temperature alarm for all four control zones inside the furnace. On / Off control of bleed of butterfly valve for protection of recuperator in case of excess combustion air temperature. On / Off control of dilution air butterfly valve for protection of recuperator in case of excess flue gas temperature.

Auxiliary Safety Protection:

Auxiliary furnace protection and audio-visual indication is provided for Combustion air failure and Hydraulic system fault by means of suitable pressure switches / sensors and fuel solenoid shut-off valve.

Field Sensors and Actuators: Necessary field sensors, thermocouples transmitters / transducers and actuators are provided for making the instrumentation and control system complete and reliable. The panel mounted instruments are housed in a floor mounted dust and vermin proof instrument panel. The panel also has necessary alarm annunciator /s switches, push buttons indicating lamps etc.

Safety Features: For the safe operation and long life of the furnace, following safety features are provided. Excess temperature control: In case the furnace temperature exceeds beyond set point, the fuel supply is shut off. The fuel supply can be re-started only with manually operated safetyshut off valve. Dilution air blower to safeguard the recuperator tubes. Hot air bleed off valve in case of over temperature of combustion air. In case of low combustion air pressure, the fuel supply shall be shut off. In case of low fuel pressure, the fuel supply shall shut off.

9. Air-Preheat System (Recuperator):

Flue Exhaust Gases leave Reheat Furnace at temperature of 600 to 700 deg.C. For economic operation of Reheat Furnace it is necessary to recover from Flue Exhaust Gases as much heat as possible. Recuperators are used to recover heat from Flue Exhaust Gases and preheat Combustion Air before it is led to the Burners. With Flue Exhaust Temperature of 600 to 700 deg C, Combustion Air Preheat obtained in the Recuperator is ~ 300 to 350 deg c. Generally, Combustion Air Preheat is restricted to < 400 deg C to facilitate use of mild steel for the Combustion Air Piping.

Recuperator may be ceramics / metallic. In Re-rolling Industry Reheat Furnaces generally metallic recuperators are used. Recuperator may be of cross flow type or parallel flow type. For Re-rolling Industry Reheat Furnaces - often operating on one 12-hours shift a day - parallel flow recuperator is recommended.

It may be noted that ~ 5 % fuel is saved for every 100 deg C pre-heating of Combustion Air. Hence with 300 deg C pre-heated Combustion Air at the Burners, ~ 15 % fuel oil will be saved.

10. Factors affecting Operating Efficiency:

a) There should be no leakages from Furnace Casing, Hot Air Piping, Fuel Oil Piping and Hydraulic Piping.

b) Operating Doors should be kept open - only when necessary- to minimum extent.

c) Hot Combustion Air Piping as well as Fuel Oil Piping should be properly insulated.

d) Thermocouples should be re-cal liberated once a month.

e) Reheat Furnace should normally operate with positive furnace pressure.

GST paid by the Recipient but not remitted to the Government by the Supplier does not provide ground for denying ITC

The Hon'ble Kerala High Court, in the case of ***M/s. Goparaj Gopalkrishnan Pillai v. State Tax Officer, Thripunithura & Ors. [WP(C) 29855 of 2023 dated October 5, 2023]*** allowed the writ petition and held that the Input Tax Credit **("ITC")** should not be denied on the ground that GST paid is not reflected in Form GSTR-2A due to non-remittance by Supplier. Therefore, the High Court set aside the Assessment Order to the extent of denial of ITC and directed the Revenue Department to examine the evidence placed on record by the assessee and pass fresh orders accordingly.

Facts:

M/s. Goparaj Gopalkrishnan Pillai **("the Petitioner")** is a registered dealer under the GST Act, 2017 and was alleged by the Revenue Department **("the Respondent")** that ITC as per Form GSTR-2A was Rs.65,39,776/-whereas the ITC availed and utilised as per Form GSTR-3B was Rs.98,44,815/-, therefore, the Petitioner has availed and utilised excess ITC of Rs.33,05,038/- for the Financial Year **("FY")** 2017-2018. The Respondent issued Show Cause Notice dated August 26, 2022 **("SCN")** to the Respondent for which response was filed by the Petitioner stating that, the Petitioner had mistakenly entered the GST amount of Rs.36,47,624.24/- instead of Rs. 3,64,724.24/- in GSTR-3B of December, 2017 and has not utilised ITC till date. The excess ITC of Rs. 22,922/- was deducted in GSTR-3B of August 2018.

Thereafter, the Revenue Department vide Assessment Order dated November 17, 2022 **("the Impugned Order")** rejected the claim of ITC of the Petitioner on the ground that supplier/dealer has neither remitted the tax collected on supply of goods to the Government nor uploaded the details of the supply in Form GSTR-1 on the portal and held that the Petitioner was not entitled to avail ITC on supplies for which the supplier has not remitted the tax collected to the Government. Therefore, the excess ITC of Rs.19,830/-, availed was disallowed and Interest and penalty of Rs. 12,742/- and Rs. 20,000/- were imposed respectively. Thus, the Respondent directed the Petitioner to pay the total amount of Rs. 52,572/-.

Aggrieved by the Impugned Order, the Petitioner filed an appeal before the Hon'ble Kerala High Court for setting aside the Impugned Order and SCN.

Issue:

Whether GST paid by the recipient but not remitted by the Supplier to the Government is ground for denying ITC?

Held:

The Kerala High Court in ***WP(C) 29855 of 2023*** held as under:

- Relying upon the judgement of the Hon'ble Kerala High Court in the case of ***M/s. Diya Agencies v. State Tax Officer [WP (C) 29769/2023 dated September 12, 2023],*** the High Court noted that, the amount of GST paid, not reflected in Form GSTR-2A should not be the sole basis for denial of the claim for ITC when there is evidence on record to prove that the claim of ITC is bonafide and genuine.
- Held that, the Impugned Order to the extent of denial of ITC of Rs.19,830/- was set aside, hence the Writ Petition is allowed.
- Directed that, the matter be remanded back to Respondent for the purpose of examination of the evidence and documents submitted by the Petitioner for claiming ITC. Thereby, the Petitioner should be allowed to avail ITC denied if the Respondent Officer is satisfied that the ITC claim is bonafide and genuine.
- Further directed that, the Petitioner shall appear before the Respondent Officer with evidence to support his claim for ITC and fresh orders be passed by the Respondent Officer after examination of Evidence, in accordance with law.

SUSHIL'S®

AN ISO 9001 : 2008 CERTIFIED CO.

www.jindaltransformers.com

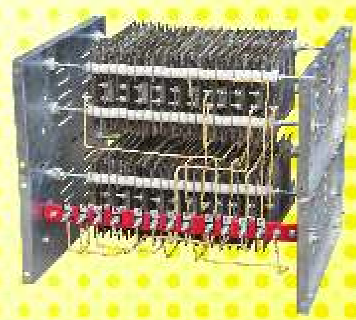
SUSHIL ELECTRICALS

Works & Office : F-9, Phase-VII, Focal Point, Ludhiana - 141 010 (Pb.) INDIA
Tel. : 0161 - 2676733, 2677822 Mobile :+91 - 98140 - 21233
E-mail : info@jindaltransformers.com, sushilelectricals@yahoo.com

Scrap Lifting Circular Electro Magnet - PLC Controlled

Ladle and Sintering Preheater with Bottom Heater

Automatic Servo Voltage Stabilizer & H.T. Transformer

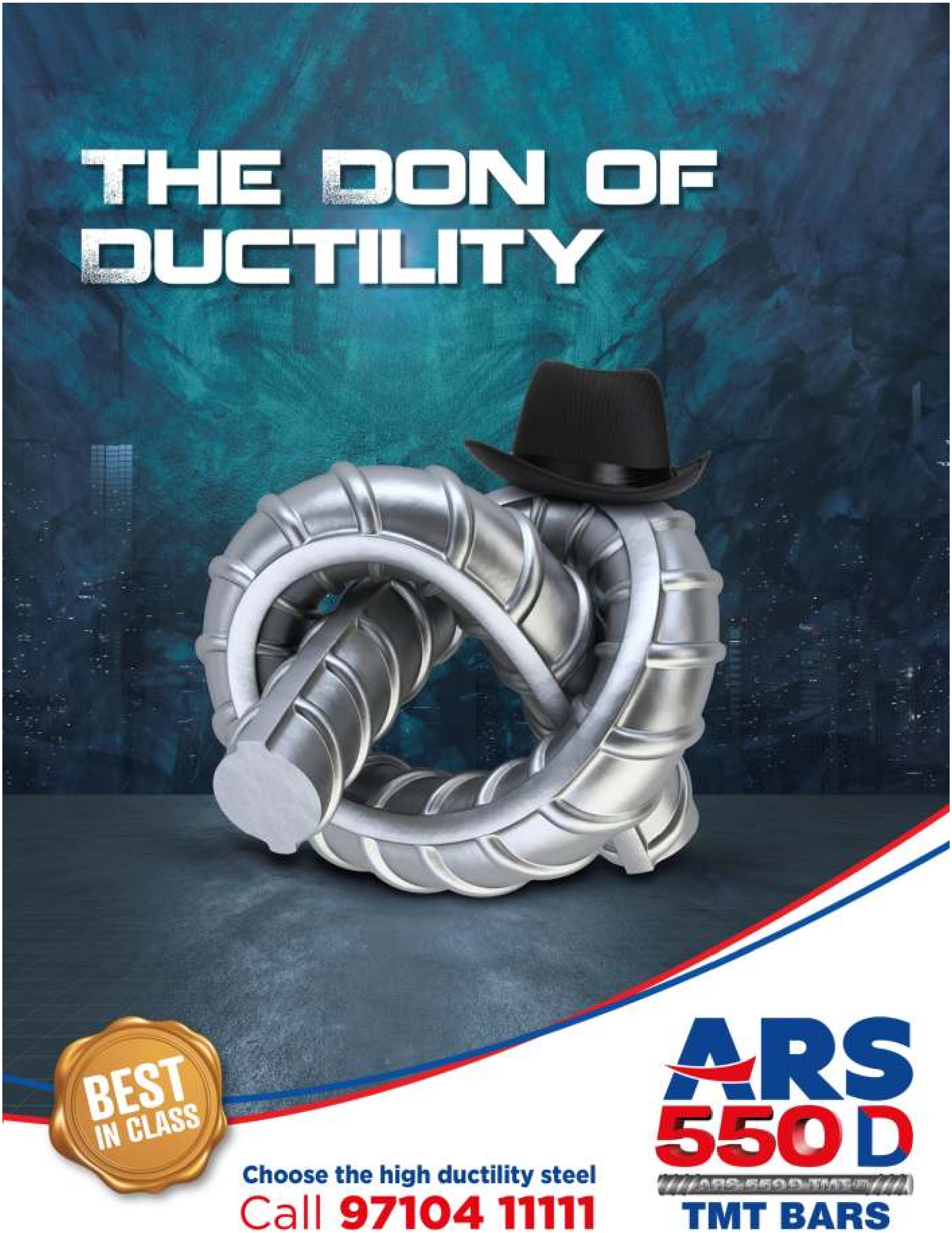


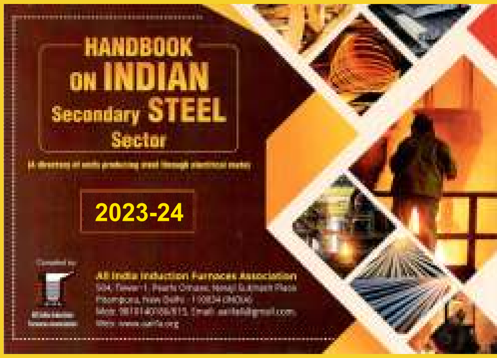
Heavy Duty Punch Grid Resistance Box

Manufacturer & Exporter of Scrap Lifting Circular Electro Magnet PLC controlled, Heavy Duty Elliptical Electro Magnets, Billets & Bar Lifting Rectangular Electro Magnets, Automatic Servo Voltage Stabilizers, Silicon Power Rectifiers, IGBT Base Rectifiers, Ladle & Sintering Preheater with Bottom Heater, Power & Distribution Transformers and Heavy Duty Punched Grid Resistance Box etc.


AIKOH
CHEMICALS
PRODUCT RANGE
Fluxes
Granular Fluxes
Tablet Grain Refiner
Tablet Degasser & NT Based
Master Alloy Ti, B
Mag Remover
Phosphoreus Copper
Coating G.D.C.
Die Release Agent H.P.D.C.
Plunger Lubricant
Copper & Brass Fluxes
Teeming Compound
Fluxes of Copper, Brass, Lead, Mg , Ferrous & Non Ferrous Metal
ABOUT US
Long Term Support
Strong R & D
Prompt Delivery
Consistent Quality
80 Years of Experience
Export to More than 75 Countries
• Technical Collaborations with M/s Aikoh Co. Japan
• Sales & Distribution with M/s JS Chemical INC, USA
• Technical Collaborations with M/s NTC Japan
SARU AIKOH CHEMICALS PVT LTD.
A-2, INDUSTRIAL ESTATE, PARTAPUR, MEERUT - 250 103 INDIA
E-mail: info@saruaikoh.com, customer.support@saruaikoh.com


THE
HIGHEST
POWERED
156 MVA
ARC FURNACE
TRANSFORMER
transformers & rectifiers (india) ltd
ISO 9001:2015 | ISO 14001:2015 BS OHSAS 18001:2007
MADE IN
INDIA
THE POWER OF
WE
Survey No. 427 P/3 4 and 431 P/1 2, Sarkhej Bavla Highway
Village: Moraiya, Taluka: Sanand, Dist: Ahmedabad - 382 213. Gujarat, India.
bijoyen.das@transformerindia.com | marketing@transformerindia.com
transformerindia.com


THE DON OF DUCTILITY
BEST IN CLASS
Choose the high ductility steel
Call 97104 11111
ARS 550 D
TMT BARS



NEW!!!
HANDBOOK ON INDIAN SECONDARY STEEL SECTOR

(a directory of units producing steel through electrical route)

Broadly Covered the following Parameters:

Segment covered: Electric Arc Furnace, Electric Induction Furnace, Rolling & Re-Rolling Mill, Sponge Iron and Ferro Alloy units

Distribution of Units: State-wise

Details Covered: Name of Unit, Factory Address, office Address, Director/ Contact Person with Name, Phone, Mobile No., Email Ids etc.,

Additional Information: Consultants, Equipment Manufacturers, Experts from individual sector

Details of on line payment is given below :

Yes Bank	:	G.F., D. Mall, Netaji Subhash Place
A/c No.	:	018494600000338
IFSC	:	YESB0000184

Claim your copy today:

Contact:

All India Induction Furnaces Association
504, Tower-1, Pearls Omaxe, Netaji Subhash Place
Pitampura, Delhi - 110034 Mob : 9810410186
Email: aaiifa6@gmail.com; web: www.aaiifa.org

Note: Price of Handbook Rs. 20,000/- exclusive of GST with effect from 1st April 2023