ALL INDIA INDUCTION FURNACES ASSOCIATION

AIIFA

INDUCTION FURNACE NEWSLETTER

VOL. No. XXII
ISSUE No. 10, Oct., 2022

What's Inside

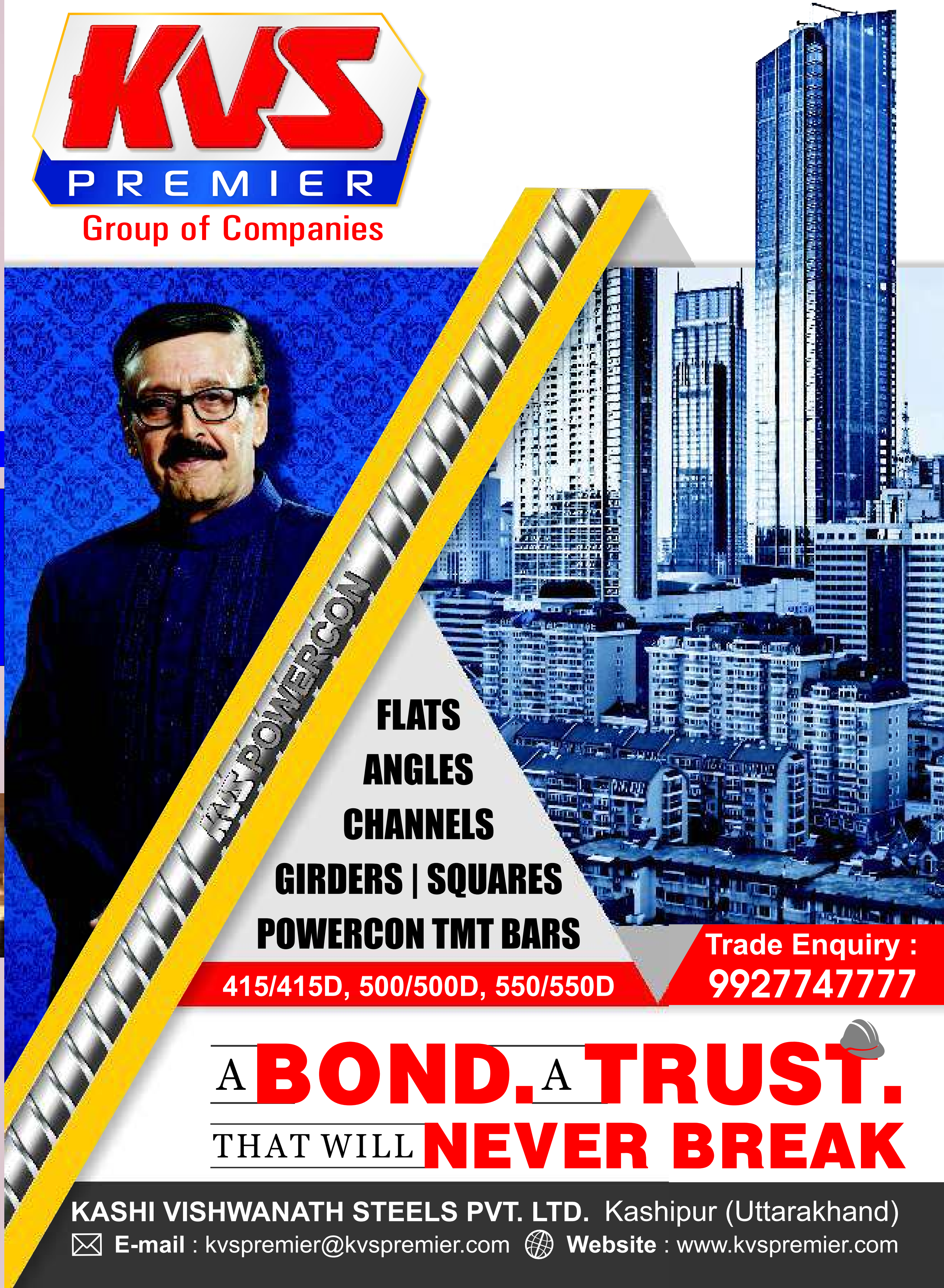
- Role & Responsibility for Improvement of Electric Induction Furnace Units - Advice of Quality Gurus
- Steel Sector News

AIIFA के सभी सदस्यों को दशहरा, दीपावली और भैया दूज की हार्दिक शुभकामनाएं

AIIFA SECRETARIAT:

504, Pearls Omaxe, Tower-1, Netaji Subhash Place, Pitampura, Delhi-110034 INDIA

Tel: 011-42725051/27351345/1347
Mobile : 9810410186
Email: aaiifa6@gmail.com
Website: www.aaiifa.org
Facebook A/c: aiifa1987 or 9810410186
twitter A/c : aiifa1987@gmail.com



KESRI ALLOYS
PRIVATE LIMITED

An IBR Approved
Manufacturer of Carbon Steel
Alloy Steel & Stainless Steel

Ingots | Billets | Rolled Bars

E-mail: info@ksl.in | Web.: www.ksl.in

Role & Responsibility for Improvement of Electric Induction Furnace Units - Advice of Quality Gurus

Kamal Aggarwal
Hon. Sec. General,AIIFA

Introduction: The production of steel is one of the most energy-intensive of all industrial activities, and also responsible for a good portion of the world's greenhouse gas emissions. On average, the production of one ton of steel generates about two tons of CO_2 emissions in the normal steel processing route whereas Induction Furnace steel making units are only exception to this. The average total emissions intensity from BOF is 2.8 t CO_2 per ton of steel (Ref: Watson, C. et al. (2003). almost entirely from fossil fuels. BOF is four times more emissions-intensive than the electric furnace process because of the large amount of heat and reducing materials required.

India is the second largest steel producer in the world after China having surpassed other large steel-making countries such as the Japan, United States, Russia, and South Korea over the previous decade, according to the World Steel Association. Currently 58% of India's steel was produced using electric-based methods—the second-highest proportion of electric-based steel production among major steel producers, behind only the United States. The main raw material for electric steel making process is scrap and sponge iron/direct reduced iron (DRI). The unique features of the steel industry in India particularly alloy and special steel are the large-scale use of induction furnaces compared to electric arc furnaces. About half of India's electric-based process steel is made using induction furnaces, operating at much smaller ranges, using alternating magnetic fields to induce an electric current by heating charge from electric resistance.

As part of the 2015 Paris Agreement to help reduce global temperature by 1.5 degree in the years to come, India committed itself to cut emissions intensity per unit of GDP by 33 to 35 per cent by 2030, accordingly the steel plants have started activities in line towards the national climate change priorities towards a low-carbon growth. The present operating system adopting the latest clean and energy efficient technologies is completely in different shape what was few decades ago as compared with the present. With most of the expansion of the industry yet to happen, India has had the benefit of adopting the latest clean and energy efficient steel technologies enabling strength and durability long product life spans to a green economy which is already underway presenting countless opportunities for positive change.

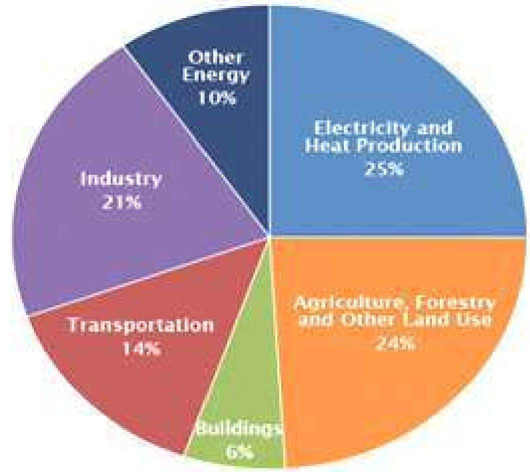
There are enough opportunities to produce cleaner steel in greener ways to get desired product quality and yield optimizing raw material quality and power consumption, conserving resources by suitable disposal methods in competitive and in economical ways searching the best practice, innovative ideas and learning effective practices from other leaders in the field as concept of bench marking. The increasing demand in recent years for high-quality steel products has led to the continuous improvement of steelmaking practices. There is a special interest in the control of non-metallic inclusions due to their harmful effect on the subsequent stages and their great influence on the properties of the final product.

Indian IF units are wholeheartedly trying to improve product quality and services in the

Industrial emission standards form an integral part of India's air quality strategy where standards are designed to tackle the environmental impacts of harmful emissions from industrial plants by setting legal requirements for acceptable concentrations of pollutants within the exhaust gases emitted by a facility, and also within ambient air at the site. Increasing or decreasing these standards will result in changes to the ambient concentrations of pollutants in the areas surrounding the facilities, and play a key role in the protection of human and ecological health. Therefore, a thorough and effective process for the development of standards must be in place to ensure that standards provide an adequate level of protection for nearby communities and ecosystems. (Reference CPCB Report)

According to the Environmental Protection Agency (EPA), Commonly, GHG emissions (total) in the developed countries from different sectors contribute as:

1. Electricity generation units about 24-26% where around 70% generation from burning fossil fuels - mostly coal, oil and natural gas where Coal accounts for about 77% of global carbon dioxide emissions,
2. Transportation accounts for about 12-16% primarily from burning fossil fuel for cars, trucks, ships, trains and planes,
3. Agricultural, Forestry and other Land Use Activities account for about 22-26%,
4. Commercial & Residential accounts for about 5-8%,
5. Various Industries contribute normally 20-22%,
6. Other Energy 8-12%



Global greenhouse gas emissions can also be broken down by the economic activities that lead to their production as shown in the chart.

Source: IPCC (2014); based on global emissions from 2010, detail sources from the Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. List of top five countries (as % of world) by 2014 emission.

Country	GHG emissions ($MtCO_2e$	% of global
China	12454.711	25.9
USA	6673.4497	14.75
European Union (28)	4224.5217	9.33
European Union (15)	3374.0348	7.45
India	2379.1668	6.43
World	45261.2517	100%

India is the third largest Greenhouse Gas (GHG) emitter, after USA and China excluding combined European Unions. This is mainly attributed by India's **energy sector contributing to level of 67%. Transport accounts for 6-12%, Agricultural activities 20%.**

The charge materials for steel making in Electric Induction Furnace are scrap, scrap substitute and ferro alloys. For better and efficient melting, the charge should preferably be metallurgical clean, free from oil, rust, grease slag lump/ oxides particularly for sponge iron and ferro-alloys and as dense as possible in shape. The contamination/ coatings in steel scrap coming from various sources disintegrate from steel comes out either as slag or becomes air borne metallurgical fumes causing air pollution. The light scrap, shredded scrap, HBI/ sponge iron may contain lot of tramp elements as impurities which enter into the steel. Though same do not affect production of rebars /TMT bars where tensile strength is the only consideration as in Fe 400/450D, 500/500D etc. but create problems in forgings or in bar products for various industrial applications. But, the units producing alloy steels face problems on heat treatment response on products in selective grades with impurities in steel.

During melting, power consumption, grade-wise tap temperature, super heat etc., ladle heating temperature, argon purging in liquid steel, teeming process parameters and additives data must be collected which are to be correlated with the quality and the results and same are to be investigated to find out source of origin for taking action by concerned personnel and management. After this, corrective action must be decided upon and taken (for example, defective products must be fully conditioned for defect rectification or rejected.

Secondary Refining Units Attached to ELECTRIC INDUCTION FURNACEs : Secondary Refining or Secondary Metallurgy is post steelmaking process performed at a separate station prior to ingot teeming / continuous casting to remove impurities, temperature adjustment in need, desulfurization etc. Few Electric Induction Furnace units have installed secondary refining facilities but lower capacity of the furnace is the constraint.

AOD unit is specially used in stainless steel to reduce carbon content at specification level where combined injection blowing of Argon & Oxygen mixture is made in liquid steel in a special converter. Usually this vessel is also used to 'build up' the liquid steel volume by approx. 10%.. **AOD** provides a better Cr yield than **VOD**.

The other refining equipment is Ladle Furnace (LF) positioned between the melting and continuous casting facilities as holding station also. It is used to exactly adjust the steel temperature, sulphur removal and composition adjustment to meet the casting demands. It can also be used to transfer liquid steel between the primary and secondary melting units as 'bumper vessel'. to build up volume for sequence casting. Ladle furnaces have a power supply via electrodes and are able to slightly increase the liquid steel temperature in need..

Vacuum Degassing **(VD)** process reduces the gas content, particularly hydrogen and carbon, as well as reducing non- metallic inclusions in the vacuum created.

Few units are planning to install Electro Slag Remelting **(ESR)** process used for the remelting and refining special alloy steels used for critical applications e.g. in medical implants, aerospace components or power plants, major industries adopted this process MIDHANI, Metal & Steel Factory, Ichapore, Bharat Forge/ Kalyani Steel, Supreme Special Steels (Khapoli).

Advantages of ELECTRIC INDUCTION FURNACE over EAFs : Electric Induction Furnace based mini steel plants with down stream processing units have many advantages like less land requirement, lower capital investment, better energy efficiency, proximity to customers or raw material availability sources and less dependence on logistics.

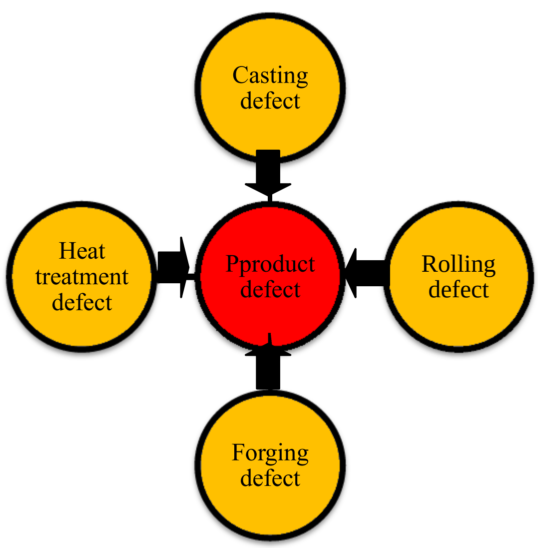
It is possible to melt steels of very low carbon in absence of electrode in Electric Induction Furnaces ensuring very low in gasses, alloying for testing taking place on the hot product in the rolling mill itself. As plants are being modernized and automated for greater efficiency, hot testing is becoming an integral part of the production process to identify the generating problematic sources avoiding production of waste material and prevents time and energy from being spent on defective products in later stages of production. Data on fuel consumption, rolling rate, yield etc are to be recorded for statistical analysis for taking action to improve process.

B. Forging of Ingot : It is observed that the most of the quality problems particularly in forgings are originated from the effects of shrinkage, porosity, segregation, non-metallic inclusions and cracks during liquid steel teeming or during solidification process of ingot in the mould. The origin and sources of the cracking or other defects in forged parts which are to be analyzed as evaluation of potential resolutions to the problem. The most significant process parameters like heating and soaking of stock in the hot forging process either by open-die or closed die method or in press input-output reduction ratios and suitable disposition after forging are to be strictly followed keeping grade wise and size wise data where **statistical analysis of data underlying relationships between forging process parameters heating & soaking stock and quality outcomes will be of much help adopting traditional process monitoring and quality control techniques like SPC.**

C. Continuous Casting : Quality of a continuous cast products depends on the process conditions during casting process. From the information available in the literature and different industries, the identified critical quality conditions like casting temperature, casting speed have to be satisfied to prevent defect formation during casting where each of these conditions are connected to one or more than one process parameters and the process parameter values are to be selected such that all quality conditions are satisfied simultaneously.(Reference: Managing quality in continuous casting process using product quality model and simulated annealing with proposed approaches by M.S. Kulkarnia, A. Subash Babu, (NITIE), Mumbai,Dept. Mech. Engg., IIT–Bombay). It is also shown that quality loss functions and multi-criteria optimization procedure to determine appropriate process parameter values for producing quality products in a continuous casting system.

D. Heat-treatment : Facilities like Annealing/ Normalizing, Hardening & Tempering process for products based on end-use applications of different steel grades and products, certain mechanical characteristics that signalize their hardness, tensile strength, yield point, notched-bar test toughness or corrosion resistance, are essential. Heat treatment is the last stage operation for products and is no less important. The proper method can alter the mechanical and physical properties of steel products without changing their shape.

During heating process in the heat treatment operation, heating schedule i.e. rate of heating, soaking, proper way of quenching and tempering is to be followed keeping data followed by statistical analysis for improvement. Occurrences of mechanical deficiencies during operation are to be controlled to avoid defects like brittleness, orange pills, decarb, warping/ deformation, uneven hardness, cooling fracture etc.



by making annual improvement part of the regular systems and processes of the company.

Dr. Philip Crosby (June 18, 1926 -Aug 21, 2001, expired at the age of 75) developed steps for an organization to follow in building an effective quality program as : 1. Management is committed to quality which should be clear to all. It is necessary to consistently produce conforming products and services at the optimum price. The device to accomplish this is the use of defect prevention techniques in the operating departments like Engineering, Project, Manufacturing, Quality Control, Purchasing, Sales and others. 2. Create quality improvement teams with representatives from all workgroups and functions for running the quality improvement program. 3. Measure processes to determine current and potential quality issues communicating current and potential nonconformance problems in a manner that permits objective evaluation and corrective action. 4. Calculate the cost of (poor) quality defining the ingredients of the COQ and explain its use as a management tool. 5. Raise quality awareness of all employees. 6. Take actions to correct quality issues.7. Monitor progress of quality improvement establishing zero defects. 8. Train supervisors in quality improvement.

Dr.Armand V. Feigenbaum (Apr 6, 1922 – Nov 13, 2014, expired at the age of 92) was an American quality control expert and businessman. He preached the idea -"Total quality control is an effective system for integrating the quality development, quality maintenance, and quality improvement efforts of the various groups in an organization so as to enable production and service at the most economical levels which allow full customer satisfaction." The quality cost, accountability for quality problem must be actively managed and have visibility at the highest levels of management.

Dr. H. James Harrington (Born on January 16, 1929 - June 25, 1998, expired at the age of 69) is a American author, engineer, entrepreneur, and consultant in performance improvement. Over his career he has developed many concepts, including poor-quality cost and business process improvement and established through research organizations around the world about the improvement efforts of work and organization's culture, environment, key performance drivers and behavioral patterns which will bring about the desired results.

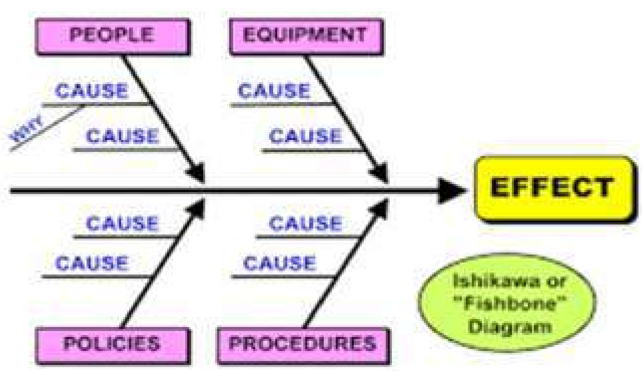
Dr. Kaoru Ishikawa, (July 13,1915- April 16, 1989, expired at age of 74) was best known for his basic quality tools and Fishbone Diagram. He suggested that all employees in the organization have greater role to play for total improvement maintaining that company-wide participation from the top management to the front-line staff as every area of an organization can affect quality, all areas should study statistical techniques and implement as required with internal and external Quality Audit programs. Going on to name areas such as engineering, design, manufacturing, sales, materials, clerical, planning, accounting, business and personnel that can not only improve internally but also provide the essential information to allow strategic management decisions to be made concerning the company to get benefits. Improvement of product quality and reliability reducing defects and reworking in the entire processing costs will help to provide more market opportunities and company's reputation and finally satisfy employees improving human relations.

Dr. Walter A. Shewhart (Mar, 18 1891 – Mar 1967 , expired at the age of 75) as of the teacher of Edwards Deming, he preached the importance of adapting management processes to create profitable situations for both businesses and consumers, promoting the utilization of his own creation statistical process control and SPC control chart. He ownership of the process. Continuous improvement can also focus on problems with customers or suppliers, such as customers who request frequent changes in shipping quantities and suppliers that to maintain high quality. The visual system for managing work as it moves through a process is called Kanban (Japanese Cocept), its being to identify potential bottlenecks in the operational process and fix them so work can flow through it cost-effectively at an optimal speed or throughput. This concept is related to lean and just-in-time (JIT) production, where it is used as a scheduling system that tells what to produce, when to produce it, and how much to produce. In both **Kaizen** and **Kanban**, employee involvement plays a big role in continuous improvement programs even changing work culture.

Role & Responsibilities :

1. Melt Shop → Melter, Pitside Operatot
2. Forge Shop → Heater, Forge / Smith
3. Rolling Mill → Heater, Roller
4. Heat treatment → Heat Treater

Jt Responsibility of Production Manager Metallursist



In case of too many failures or instances of occurrences of poor quality as material defect or processing defect, a plan must be devised studying cause-effect either at melting or at processing stages to improve the product quality or process and then that plan must be put into action involving the concerned area personnel. Finally, the QC process must be ongoing to ensure that remedial efforts and to immediately detect recurrences or new instances of trouble.

The same basic idea is behind the Japanese approach of Total Quality Control as

1. Plan (includes Juran's basic idea of a planning process),
2. Do (implementation of the plan),
3. Check (performance evaluation according to critical measures) and
4. Act (quality improvement efforts based on the lessons learned by experience. - Costin 1999: 11-12).

Managing quality-oriented process as Dr. Juran said -:

1. Quality Improvement,
2. Quality Planning and
3. Quality Control.

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

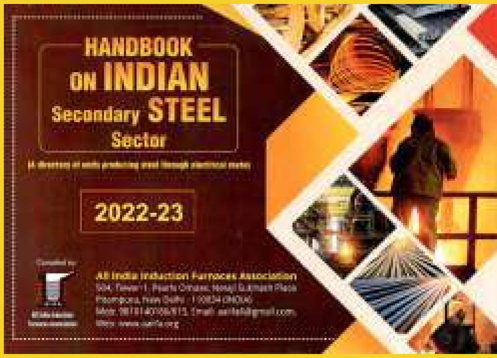
Ladle and Sintering Preheater with Bottom Heater

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.


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



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 2022