TATA STEEL

TATA eFee melts faster

Total Foundry Solutions

TATA STEEL

TATA eFee melts faster

Contents

Introduction

Tata Steel Metaliks Division has its state-of-the-art manufacturing plant at Kharagpur, West Bengal, which produces the finest quality Pig Iron and Ductile Iron Pipes in India. With focus on Safety and Sustainability, TSMD has been consistently fulfilling its vision of ***Reaching Tomorrow First*** through innovative and superior quality products and service offerings.

Combining customer-centricity with technical effciency, Tata Steel Metaliks Division is the supplier of choice through its end-to-end product and service offerings for customers. It is also taking significant steps in its journey of digital transformation by rapidly adopting Industry 4.0 principles and becoming a 'Digital Factory' in line with its vision.

Aligned with its legacy of sustainable value creation, Tata Steel Metaliks Division is steadily working on its long-term Sustainability Strategy of becoming Net Zero by 2045. Its high-impact Corporate Social Responsibility interventions aim to uplift the lives of communities with a focus on Education, Essential Amenities and Skill Development.

'TATA Ductura' is the Ductile Iron Pipe brand of TSMD that promises the Tata Assurance of Quality for its technically superior products along with commitment of timely delivery, easy installation and ethical business practices.

TSMD's energy efficient and environment friendly Pig Iron, marketed as 'Tata eFee' is a preferred raw material for manufacturing various kinds of castings by foundries due to its superior quality and customised specifications.

Raw Material Sources and Quality Checks

Sl. No.	Raw Material	Source	Quality Check
1.	Iron Ore Lump & Fines	Indigenous	Chemical & Physical Analysis
2.	Dolomite	Indigenous and imported	
3.	Quartzite	Indigenous	
4.	Limestone	Indigenous and imported	
5.	Sinter/ Pellet/Sponge Iron	Internal and indigenous	
6.	Fe-Si, Si-Mn, Fe-Mn	Indigenous	
7.	Pyroxenite	Indigenous and imported	
8.	Mn Ore	Indigenous	
9.	Coke & Coal	Internal, indigenous and imported	Proximate, Chemical & Physical Analysis

Incoming Raw Material Analysis

Iron Ore/Sinter/Pellet/Fluxes /Ferro Alloys/Coke/Coal

Sample collection from Rake/Truck

Sample preparation through Coning-Quartering or Increment-Reduction Method for Quantity Reduction

Chemical Analysis

Size reduction of sample using mortar and pestle

Iron Ore/Sinter/Pellet Fluxes/Ferro Alloys

Sample is dried to free it of moisture

Sample is taken in an identified bowl and run in a Vibratory Cup Mill to make it into fine powder

Sample is taken and Boric Acid is added to ground it in the Vibratory Cup Mill

Sample is put in a Hydraulic Press with a ring in it, the fines are then converted to pellets

The pellet is analysed in an X- Ray Fluorescence Machine

Coal & Coke

Sample is powdered

Powdered sample is air dried

Proximate & Ultimate Analysis performed using Muffle Furnace, Hot Air Oven & different chemicals

Fluxes/Ferro Alloys

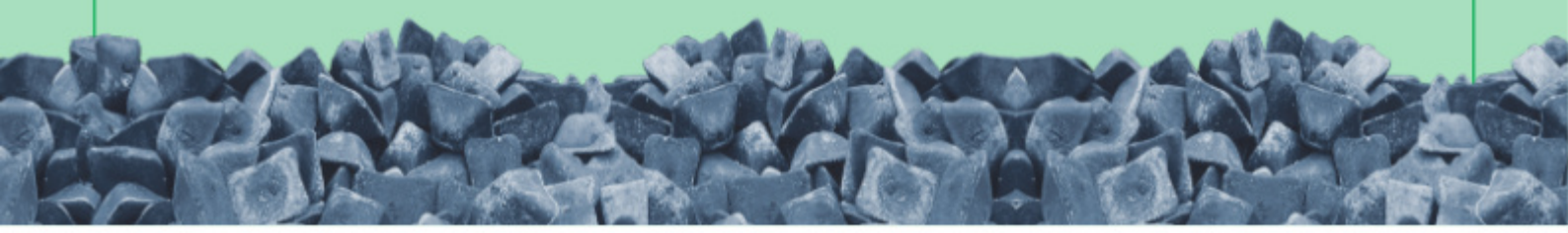
Wet Chemical Analysis

Physical Analysis

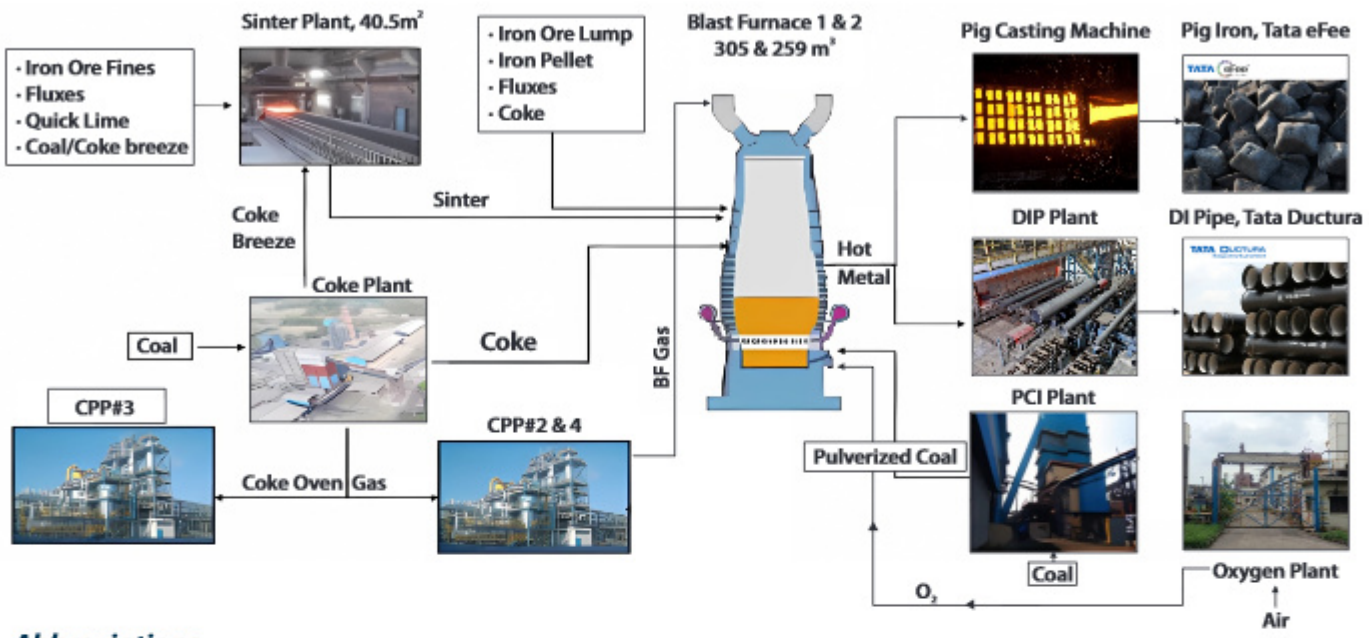
Sieve Analysis: To determine various size fractions and physical properties

Special Analysis: MICUM & CSR-CRI for Coke Tumbler & RDI-RI of Sinter, Iron Ore

Result declaration through SAP/QARM



Pig Iron Manufacturing Process



Abbreviations

- CPP: Captive Power Plant
- BF Gas: Blast Furnace Gas
- PCI: Pulverized Coal Injection

Hot Metal Sample Analysis

Hot Metal poured in PCM to convert to Pig Iron

Hot Metal sample collection at Cast House

Tests of Pig Iron

- Percentage of poor Pig analysis - Physical inspection of surface and size of Pig
- Composition cross checking through regular Chemical Analysis of special grades

Homogeneity Test

Multiple samples are collected at regular intervals from a running cast to further assure quality

Chilled cast sample is prepared by pouring into copper mould

Sample conveying through Pneumatic Conveying System along with Analysis Request Form

Sample surface is cleaned and made uniform with the help of a Polishing Machine

Sample is analysed through an Optical Emission Spectrometer

Confirmation of grade as per chemical composition. Results stored in ERP*

*ERP: Enterprise Resource Planning

What is Pig Iron?

Pig Iron is a metallic product obtained by the reduction of iron ores in the blast furnace.

It is a preferred metallic input because of the following benefits:

- Used to control C, Si, Mn, S & P in Grey and Ductile Iron casting production.
- Grey iron containing Pig Iron in the charge mix shows a lower chill tendency in thin sections.
- Valuable to the foundry, as a means of controlling and diluting the effects of various alloys and tramp elements.
- The only material having both controlled chemical analysis and shape.
- Its regular and consistent shape contributes to a better flow of charge materials down the cupola stack during the melting operation.

Pig Iron Selection Criteria

- Individual % of C, Si, Mn, S, P and Carbon equivalent as per the type of cast iron and grade to be made.
- Size and shape for easy charging into the cupola and higher surface area to weight ratio for faster melting.
- Diverse grades to best meet foundry needs.
- Clean material (oxidation and slag free).
- Continuous and quantity supplier for long periods.
- After Sales Service.

Selection Parameters

Major elements contributing to costs in the casting process are:

- Energy consumption through Coke, Fuels, Electricity, etc.
- Proper size mix of raw material (to avoid choking and energy wastage).
- Consistent chemistry of feed (Pig Iron, Scrap, Coke, Fluxes, etc.).

Inconsistent chemistry leads to casting quality deterioration, lower yield and higher energy consumption.

Pig Iron should be chosen based on:

- Uniformity of chemical composition
- Uniformity of shape and size
- Surface area to wt. ratio of Pig to minimize energy consumption

Chemical Composition of Pig Iron

The Pig Iron manufactured by Tata Steel Metaliks Division meets exact product and quality standards and is suitable for producing all kinds of castings in foundries.

Sl No	Grade		C	Si	Mn	S	P
1	TATA EFEE 101	FG-I	≥3.50	2.000 - 2.200	≥0.50	≤0.060	≤0.200
2	TATA EFEE 103	FG-II	≥3.50	2.201 - 2.500	≥0.50	≤0.060	≤0.200
3	TATA EFEE 201	SG	≥3.50	1.600 - 2.500	≤0.20	≤0.035	≤0.080
4	TATA EFEE 307	CG –Si-1.00 % Max	≥3.50	≤1.000	≤0.90	≤0.070	≤0.200
5	TATA EFEE 301	CG –Si-1.50 % Max	≥3.50	1.001 - 1.500	≥0.50	≤0.060	≤0.200
6	TATA EFEE 302	CG Spl. Appln	≥3.50	1.501 - 1.999	0.500 - 1.200	≤0.060	≤0.200
7	TATA EFEE 303	CG High silicon	≥3.50	2.501 - 3.000	≥0.50	≤0.060	≤0.200
8	TATA EFEE 304	CG Ultra High silicon	≥3.50	3.001 - 3.500	≥0.50	≤0.060	≤0.200
9	TATA EFEE 305	Ultra High phos	≥3.50	2.000 - 2.500	≥0.50	≤0.060	0.201 - 1.200

FG - Foundry Grade **CG - Customised Grade** **SG - Spheroidal Grade**

Why Tata eFee?

TATA eFee

Tata Steel Metaliks Division' Pig Iron brand, Tata eFee, is the organization's commitment towards building a sustainable environment through energy conservation.

The product is named as an amalgamation of its two core aspects – the *e* at the beginning and at the end symbolizes energy efficiency and environmental friendliness while *Fe* denotes the chemical symbol of iron. Developed and designed after extensive research, Tata eFee's USPs are:

- Melts faster than conventional pig iron
- Consumes lower coke rate in the cupola and lower power in the induction furnace
- High surface area to mass ratio
- Provides uniform void distribution in the cupola and highest packing density in the induction furnace
- Available in various grades with chemical properties as mentioned above

Benefits:

- Reduced energy in the form of electricity consumption in induction furnaces and coke consumption in cupolas
- Cost-competitive and environment-friendly, leading to sustainable growth
- Green approach through reduced carbon footprint
- Consistent and right specification results in lower rejections in foundries
- Low slag inclusions and chips & plates results in higher yield in foundries

TATA STEEL

TATA eFee melts faster

Tata eFee Benefits vs. Other Pig Iron

CUPOLA FURNACE

S.No.	FOUNDRY DETAILS (MANUFACTURERS)	NORMAL RUN DETAILS			DEMO RUN DETAILS		
		CHARGE MIX	COKE TO METAL RATIO	AVERAGE MELTING RATE TONS/HR	CHARGE MIX	COKE TO METAL RATIO	AVERAGE MELTING RATE TONS/HR
1	Industrial casting, Howrah	**Other Pig Iron:47%** C.I. Scrap: 29% and **FR:55%**	1:10	5.45-5.70	Tata eFee: 36%, **Other Pig Iron:12%** and C.I. Scrap:52%	1:10	6.03-7.26
2	Textile casting, Nagpur	**Other Pig Iron:1.55%** Best of competition Pig-2: 9%, Best of competition:5%, Tata Pig: 13% and FR:18%	1:6.33	4.32	Tata eFee:77% and FR:23%	1:7.25	4.34
3	Handpump casting, Howrah	**Other Pig Iron:43%** Tata Pig:22% and FR:35%	1:6.53	4.41	Tata eFee:67% and FR:33%	1:7.01	5.31
4	Industrial casting, Ahmedabad	**Other Pig Iron:83% CI Scrap+FR:17%**	1:10.25	1.19	Tata eFee:83%, C.I. Scrap+FR:17%	1:11.74	1.21
5	Submersible pump casting, Ahmedabad	**Other Pig Iron:50% CI Scrap+FR:50%**	1:11.30	1.30	Tata eFee:50%, C.I. Scrap+FR:50%	1:12.19	1.38
6	Pedestal fan casting, Punjab	**Other Pig Iron:36%** Best of competition Pig Iron:36% and FR:28%	1:6.72	3.50	Tata eFee: 65-74% and FR:26-35%	1:8.38	3.90

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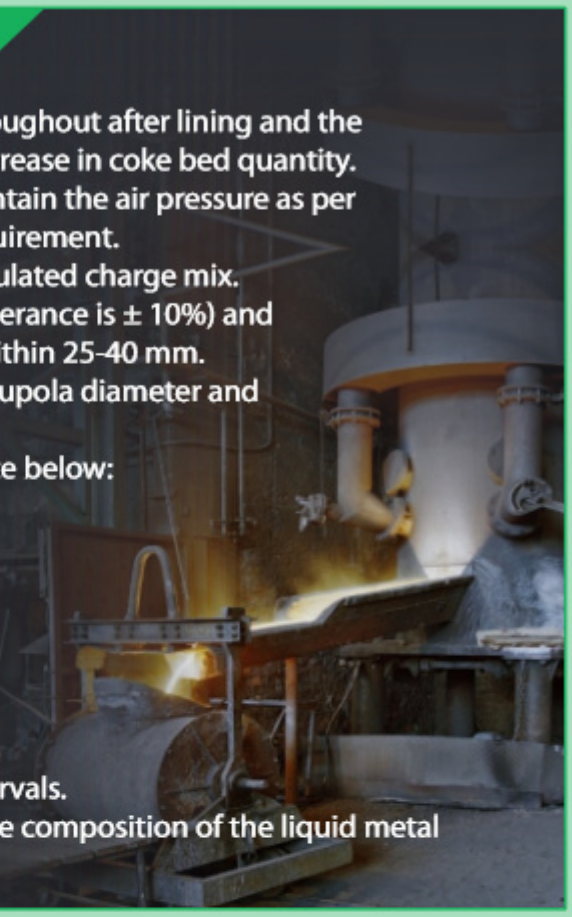
INDUCTION FURNACE

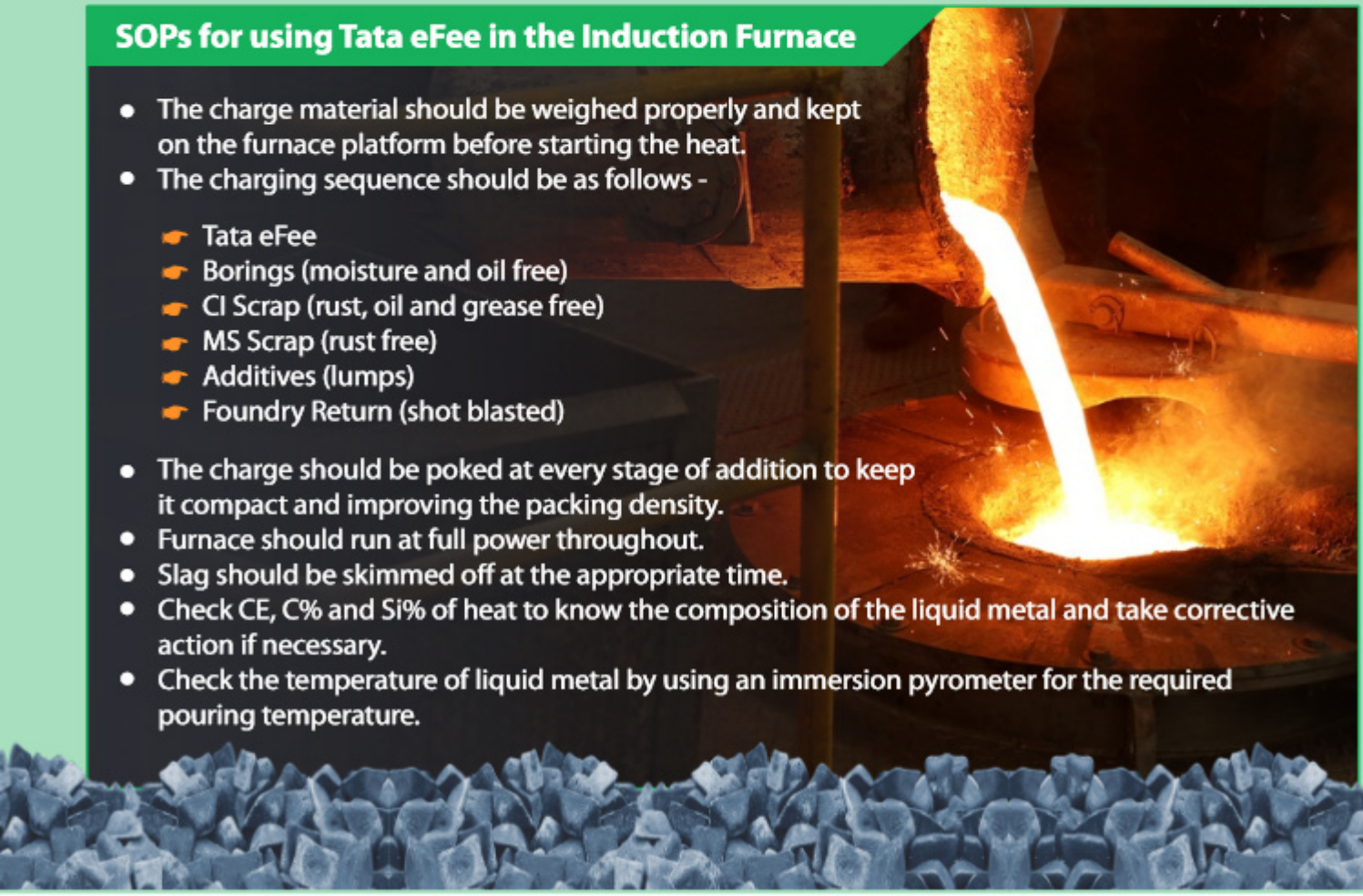
S.No.	FOUNDRY DETAILS (MANUFACTURERS)	NORMAL RUN DETAILS			DEMO RUN DETAILS			% INCREASE IN MELTING RATE	ENERGY SAVINGS %
		CHARGE MIX	ENERGY CONSUMED/TON OF METAL IN **kwh**	MELTING TIME IN MINUTES/ TON OF METAL	CHARGE MIX	ENERGY CONSUMED/TON OF METAL IN **kwh**	MELTING TIME IN MINUTES/ TON OF METAL		
1	Pump casting, Coimbatore	**Other Pig Iron:35%** C.I borings:10% **and FR:55%**	464	22	Tata eFee:35%, C.I borings:10% and **FR:55%**	460	20	**8.0**	**0.9**
2	Automobile casting, Howrah	**Other Pig Iron:30%** C.I borings: 20%, M.S: 20% and **FR:30%**	576	**26**	Tata eFee:30%, C.I borings: 20%, M.S: 20% and **FR:30%**	542	24	**7.4**	**5.9**
3	Pipe fitting casting, Nagpur	**Other Pig Iron:30%** CRCA:24%, DI Pipe Scrap: 25% and FR:21%	550	48	**Tate eFee:30%** CRCA:21%, DI Pipe Scrap:19%, M.S:10% and **FR:20%**	533	45	**4.9**	**3.1**
4		**Other Pig Iron:30%** CRCA:20%, DI Pipe Scrap: 20%, M.S: 10% and FR:20%	570	50				**8.7**	**6.5**
5		**Other Pig Iron:30%** CRCA:20%, DI Pipe Scrap: 20%, M.S: 10% and FR: 20%	545	46				**1.8**	**2.2**
6	Railway casting, West Bengal	CRCA:60%, and FR:40%	508	22	Tata eFee:40%, CRCA:20% and FR: 40%	495	22	**2.2**	**2.6**

SOPs for using Tata eFee in the Cupola Furnace



- The cupola inner diameter should be homogeneous throughout after lining and the combustion zone should be relined properly to avoid increase in coke bed quantity.
- Maintain the tuyeres opening as per calculated size. Maintain the air pressure as per cupola diameter and air quantity as per melting rate requirement.
- Weigh the raw material and consumables as per the calculated charge mix.
- Size of coke should be 1/10th of the cupola diameter (tolerance is ± 10%) and up to 36" of cupola diameter, limestone size should be within 25-40 mm.
- Size of any raw material should not exceed 1/3rd of the cupola diameter and the weight should be below 1/10th of the split charge.
- The charge should go into the cupola as per the sequence below:
  - Coke (moisture up to 5% max.)
  - Limestone
  - Tata eFee
  - CI Scrap (rust, oil and grease free)
  - Foundry Return (shot blasted)
  - MS Scrap (rust-free) + Additives (lumps)
- Check the temperature of the liquid metal at regular intervals.
- Check the CE, C% and Si% at regular intervals to know the composition of the liquid metal and take corrective action if necessary.

SOPs for using Tata eFee in the Induction Furnace



- The charge material should be weighed properly and kept on the furnace platform before starting the heat.
- The charging sequence should be as follows -
  - Tata eFee
  - Borings (moisture and oil free)
  - CI Scrap (rust, oil and grease free)
  - MS Scrap (rust free)
  - Additives (lumps)
  - Foundry Return (shot blasted)
- The charge should be poked at every stage of addition to keep it compact and improving the packing density.
- Furnace should run at full power throughout.
- Slag should be skimmed off at the appropriate time.
- Check CE, C% and Si% of heat to know the composition of the liquid metal and take corrective action if necessary.
- Check the temperature of liquid metal by using an immersion pyrometer for the required pouring temperature.

Casting Segments and Suitable Tata eFee grades

Agriculture and Tractor Castings

Agricultural equipment enhances productivity and reduces drudgery. For higher efficiency, it must be able to withstand extreme environmental conditions.

Applications:

- Irrigation Equipment
- Harvesting Machines
- Fencing Equipment
- Grain Processing Machines
- Diesel Engines
- Water Pumps
- Rice Hullers
- Tea Garden Machinery
- Tractor Parts (Transmission Housing, Clutch Housing, Gearbox Housing, Trumpet Housing etc).

Suitable Pig Iron grades -

- FG Tata eFee 103
- Tata eFee Aquawell

Engineering & Industrial Castings

Virtually nothing moves, turns, rolls or flies without cast metal products. The metal casting industry thus plays a key role in all major sectors of our economy.

Applications:

- Valves for Air and Water
- Electrical Motor Bodies
- Heavy Duty Gears and Gear Cases
- Turbine Cases
- Rolls for Rolling Mills
- Machine Tools
- Compressor Parts
- Doors & Door Hinges in Coke Oven Batteries

Suitable Pig Iron grades -

- FG Tata eFee 103
- FG–High Mn Tata eFee 104

Power Generation Castings

In our daily lives, electricity plays a vital part in running homes and businesses smoothly.

Applications:

- Windmill Castings (Main Carrier Housing, Rotor Hub, Blade Adaptor, Axle Pin)
- Steam Turbines
- Nuclear Reactor parts

Suitable Pig Iron grades -

- FG Tata eFee 103
- SSG Ultra Tata eFee 203

Ductile Iron Pipes and Fittings

Having a significantly long lifespan, Ductile Iron pipes are used for potable water transmission and distribution. Like DI pipes, DI pipe fittings are also used for varied purposes.

Applications:

- Drinking Water
- Chemicals / Petrochemicals
- Municipal
- Food, Beverage and Dairy
- Oil & Gas
- Power
- Process Instrumentation
- Pulp & Paper
- Marine & Dredging
- Sanitation
- Irrigation
- Residential
- Roads & Highway Construction
- Ventilation

Suitable Pig Iron grades -

- SSG Tata eFee 202
- SSG Ultra Tata eFee 203

Railways and Other Castings

Rail locomotives of electrical and diesel are used in the transportation of passengers, goods and materials.

Applications:

- Frames
- Housings
- Adaptors
- Inserts
- Signal Posts
- Crossing Stands
- Brake Shoes
- Gear Cases
- Covers and Generator Pulleys, etc

Suitable Pig Iron grades -

- FG Tata eFee 103
- Ultra High Phos. Tata eFee 305

Automobile Castings

From the engine to the brakes, metal castings are extensively used in automobiles.

Applications:

- Engine Blocks
- Piston Rings
- Cylinder Liners
- Manifolds
- Crank Shafts
- Fly Wheels
- Steering Boxes
- Brake Drums
- Clutch Plates
- Rocker Levers
- Cam Shafts
- Cylinder Heads

Suitable Pig Iron grade -

- FG–Low Phos Tata eFee 102

Sanitary Castings

Castings are consistently meeting the evolving needs of the sanitation industry and are enabling in driving the sector forward, apart from helping improve the sanitation of human communities.

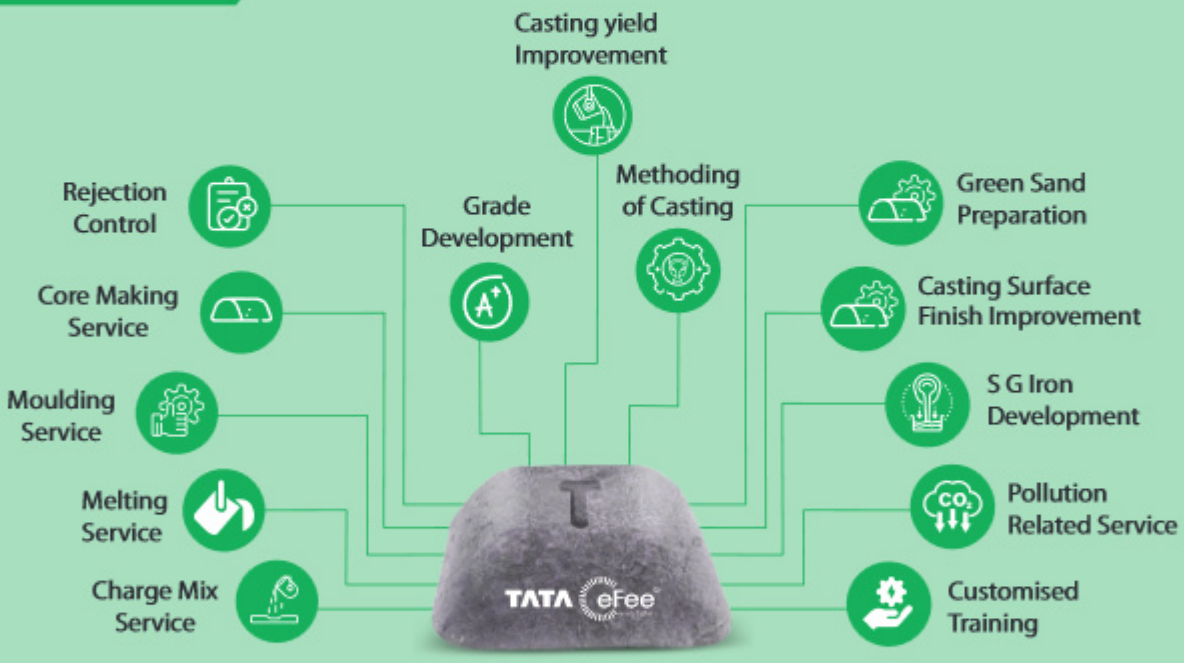
Applications:

- Manhole Covers and Frames
- Wash Basins
- Sinks
- Architectural decorative castings viz. Railings, Entrance Gates, Lamp Posts and Monuments
- Sitting Benches

Suitable Pig Iron grade -

- FG Tata eFee 103 • Basic grade Tata eFee 301 • High Phos Tata eFee 105

Technical Services



Charge Mix and Melting

- Suggesting suitable charge mix considering the chemistry required in casting, grade of the casting and melting unit.
- Cupola operations (coke bed preparation, charge materials' size & weight optimisation, advice on the cupola's charging sequence, air requirement, taphole preparation and inoculant addition) and improving its melt rate.
- Suggesting charging sequence in the induction furnace to achieve maximum recovery of additives and reduce power consumption.

Moulding & Core Making

- Suggesting and conducting demos of suitable moulding & core-making methods, depending on the casting's accuracy.
- Upgrading services from one system to another as per production requirements.
- Services to improve the casting's surface finish.
- Services to reduce non-conformities in the casting.
- Suggesting and conducting demos of suitable core-making methods depending on the core area's accuracy.
- Firming up SOPs.

Rejection Control

- Component-wise analysis of daily rejection and identifying components that contribute to rejection and their control.
- Identifying the root cause for rejection and taking preventive actions for control.
- Firming up SOPs to establish preventive actions for control of rejection percentage.

Grade Development

- Identifying casting grade as per customer quality requirements.
- Studying of present charge mix and other parameters.
- Proposing new charge mix and additions to achieve the required casting grade.
- Firming up SOPs to establish grade development production.

Methoding and Casting Yield Improvement

- Methoding and casting yield improvement provide good quality castings with optimum yield. The yield of casting is % of casting weight to the weight of metal poured in the mould.
- This involves calculating the number of castings on the match plate, primary and secondary runner calculation and ingate calculation. It also comprises feeder calculations to get good quality castings. The yield percentage depends on factors like the casting's shape, size, section thickness and charge mix.
- Providing gating system design drawings with all dimensions of primary & secondary runners, ingates, sprue, pouring basin, risers and feeders.

Green Sand Preparation and Casting Surface Finish Improvement

- Every foundry must have its set norms of sand properties to suit its working conditions. This can be achieved by analysing the data collected and critically co-relating it with casting defects.
- Improvement in the casting's surface finish through analysis of return sand, new sand, binder and additives and maintaining green sand properties.
- Development of SOPs for green sand preparation.

S G Iron Production and Development

- Selecting raw materials for Ductile Iron, composition according to grade requirements, desulphurization and carburization techniques.
- Selection of spheroidizing additives, fading of the spheroidizing effect and inoculation technique.
- Selection of the process, treatment technique, Mg alloy calculation, terminology, grades, etc.

Project-based Consultancy

- Modify combined blast to divided blast cupola.
- New product development (from methoding to approval by customer's customer).
- Rejection control.

Pollution Related

Services to control suspended particulate matter in cupola stack gases and to improve the efficiency of the pollution equipment.

Customised Training

Provide customized training in foundry processes as per the requirement of customers to process owners, supervisors and workers in areas like:

- Cupola preparation, operation and charge mix calculation
- S G Iron development and production
- Non-conformity analysis and implementation of corrective and preventive action
- Reduce percentage of production costs and non-conformities
- Safety

Testing Facility

The Customer Service Centre is equipped with a state-of-the-art laboratory to provide testing facilities for testing foundry raw materials and consumables.

- Coke and Coal: Ash, Volatile Matter, Carbon, Sulphur and Phosphorus
- Casting, Scrap & Pig Iron: Carbon, Silicon, Manganese, Sulphur, Phosphorus and Chromium
- Limestone: Calcium Oxide and Magnesium Oxide
- Graphite Powder, Fire Bricks and Ferro Alloys as per customer requirements

Tata eFee Technical Services – Before & After Results

CASE STUDY-1

PROBLEM: Cracks in casting

BEFORE

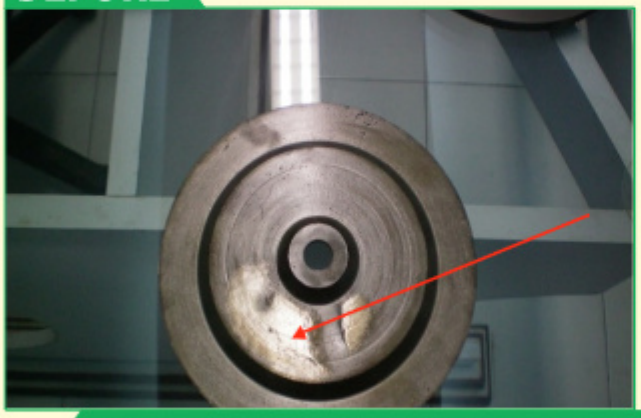
AFTER

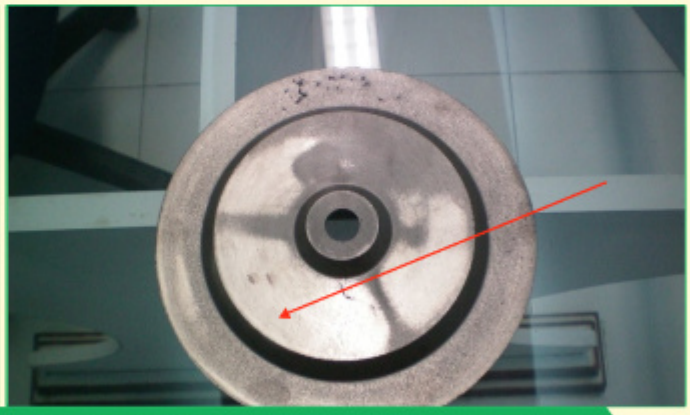
SOLUTION PROVIDED: Improvement in collapsibility of self-core

CASE STUDY-2

PROBLEM: Hard spots on casting surface

BEFORE





SOLUTION PROVIDED: Changes in inoculation quantity, size and addition method

AFTER

Safety

Tata Steel Metaliks Division believes in inculcating a culture of safety through risk-based thinking and behaviour-based safety. Our safety and health responsibilities are driven by a strong commitment to meet our goal of Zero Harm to our people, assets, the environment and the society at large. This is pursued through a robust safety management system with clearly identified safety strategies that puts accountability in the hands of the line managers. The safety strategy which begins from the leadership team is cascaded across workers (own and contractual).

Safety is a continuous process and we are committed to the learning and development of our employees in fields like:

- Process Safety
- Toolbox Talks
- Behavioural Safety
- On-the-job Training in Safety
- Felt Leadership

Similarly, our foundries too can follow these basic safety precautions at their workshop.

- Use masks to avoid excessive inhalation of dust.
- Wear protective clothing to stay safe from the heat radiating from the melting process. Wear protective clothes, glasses, shoes and gloves while handling molten metal for the casting process.
- Stay alert to prevent burn injuries from molten metal spillage.
- Provide proper ventilation for protection from molten metal fumes and gases during pouring.
- Avoid touching hot moulds and castings.
- Use earplugs to safeguard against heavy noise.
- Keep the work area clean.

Sustainability

Our philosophy of sustainable value creation is deeply rooted in the core values of the Tata Group. Underpinning this is a strong focus on Zero Harm along with resource efficiency, circular economy and caring for the community and our workforce. This is ensured through a broad spectrum of focused interventions in areas of Environment Management, Water Sustainability, Green House Gas (GHG) Emission Reduction, Use of Alternate Fuels and Community Development. The Company continues to serve customers through a portfolio of eco-friendly products with the environmental impact of its products being assessed through the Life Cycle Assessment (LCA) methodology.

Tata Steel Metaliks Division is GreenCo certified

Some key interventions undertaken include setting up solar power plants & solar water heating system, GHG emission profiling, local community development in areas of Education & Essential Amenities, operating a Skill Development Centre and Tata Steel Metaliks Division 300 Schools Project to transform access & quality of education for children in nearby villages, covering approx. 300 schools with the goal of making the area a child-labour-free zone.

Net Zero Carbon

Tata Steel Metaliks Division is committed to optimising water consumption and reducing carbon and energy footprint. Staying true to our legacy of sustainable value creation, we are one of the select few in the steel industry to participate in the Carbon Disclosure Project. Realising our aspirations, we are recalibrating our actions to be Net Zero by 2045.

Some of our mitigation plans for Net Zero are:

- Long-term plans for a consistent reduction in our carbon footprint.
- Usage of alternate fuels in blast furnaces (natural gas, hydrogen, biomass, etc.).
- Increase usage of renewable energy like solar power.
- Explore Carbon Capture Technologies.
- Use of circular economy and low carbon technologies in production process.

Foundry Quality Parameters

Moulding Sand

Sl. No.	Parameter	UOM	Value
1.	Moisture	%	3.2-3.8
2.	Permeability	%	160-190
3.	Green Compressive Strength	gms/cm^2	900-1200
4.	Compatibility	%	35-45
5.	Shatter Index	%	60-90
6.	Loss of Ignition	%	7.0-11.0
7.	Actual Clay	%	10.0-12.0
8.	Volatile Matter	%	3.0-4.5
9.	Dead Clay	%	2.0-5.0
10.	Fresh sand addition	%	6.0-10.0

Silica Sand

Sl. No.	Parameter	UOM	Value
1.	Silica	%	93-95
2.	Alumina	%	3.0 max
3.	Ca & Mg Oxide	%	1.5 max
4.	Clay Content	%	2.0 max
5.	Moisture	%	1.0 max

Coal Dust

Sl. No.	Parameter	UOM	Value
1.	Moisture	%	3-4
2.	Volatile Matter	%	32 min
3.	Ash	%	22 min
4.	Sulphur	%	1 max
5.	Fixed Carbon	%	balance

Coke

Sl. No.	Parameter	UOM	Value
1.	Moisture	%	8.0–12.0
2.	Volatile Matter	%	2.0-3.0
3.	Ash	%	12.0-30.0
4.	Sulphur	%	0.70 max
5.	Fixed Carbon	%	balance

Silica Sand Sieve Analysis

Sl. No.	Parameter	UOM	Value
1.	Retained on Sieve 300,212,150 Microns	%	70 min
2.	Retained on Sieve 850,600	%	4 max
3.	Retained on Sieve 75 and fines	%	4 max

Bentonite

Sl. No.	Parameter	UOM	Value
1.	Moisture	%	5.0-8.0 max
2.	pH Value	-	7.5-10.0
3.	Gel Index	%	50 min
4.	FSI	ml min	28 min - 30 max
5.	M.B. Value	mg/g min	350 - 400

Limestone

Sl. No.	Parameter	UOM	Value
1.	CaO	%	45 min
2.	SiO2	%	5 max

Ferro Silicon

Sl. No.	Parameter	UOM	Value
1.	Silicon	%	65 - 75
2.	Aluminium	%	1.0 max
3.	Calcium	%	0.5 - 1.0
4.	Size	mm	50 - 80

Ferro Manganese

Sl. No.	Parameter	UOM	Value
1.	Manganese	%	60-75
2.	Silicon	%	1.0-3.0
3.	Carbon	%	2.0-5.0
4.	Size	mm	40-75

Ferro Chromium

Sl. No.	Parameter	UOM	Value
1.	Chromium	%	55-60
2.	Silicon	%	1.0-3.0
3.	Carbon	%	2.0-5.0
4.	Size	mm	30 - 60

Graphite Electrode Carbon

Sl. No.	Parameter	UOM	Value
1.	Moisture	%	3.0 max
2.	Volatile Matter	%	2.0-3.0 max
3.	Ash	%	1.0 max
4.	Sulphur	%	0.3 max
5.	Carbon	%	98 min

Calcined Petroleum Coke

Sl. No.	Parameter	UOM	Value
1.	Moisture	%	1.0-3.0 max
2.	Volatile Matter	%	2.0-5.0 max
3.	Ash	%	1.0-3.0 max
4.	Sulphur	%	0.8 max
5.	Size	mm	0.5-10.0
6.	Carbon	%	balance

Grey Cast Iron Grades

GRADE	M Pa (=N/MM^2)	Kgf/mm^2	HARDNESS BHN
FG 150	150	15.3	130 to 180
FG 200	200	20.4	160 to 220
FG 220	220	22.44	180 to 220
FG 260	260	26.52	180 to 230
FG 300	300	30.6	180 to 230
FG 350	350	35.7	207 to 211
FG 400	400	40.8	207 to 270

As per Bureau of Indian Standards IS 210 : 2009.

SG / Ductile Iron Grades

ISO 1083 & IS 1865	ASTM A-536	SAEJ4 34	Tensile Strength (Mpa)	Yield Strength (Mpa)	El %	Hardness (BHN)
Ferritic Grade						
350/22	60-40-18	D4018	350	220	22	≤150
400/18			400	250	18	130 - 180
400/15			400	250	15	130 - 180
450/10			450	310	10	160 - 210
Ferritic + Pearlitic Grade						
500/7	70-50-05		500	320	7	160 - 240
	80-55-06	D5506	552	379	6	187 - 255
Pearlitic + Ferritic Grade						
600/3	80-60-03		600	370	3	190 - 270
Pearlitic Grade						
700/2	100-70-03	D7003	700	420	2	225 - 305

Induction Furnace

Do's & Don'ts of Induction Furnace Melting

DO'S	DON'TS
Keep the size of charging material to 1/3rd of the furnace crucible dia to avoid choking	Do not superheat the metal
Operate the furnace at full power and capacity. Maintain maximum compaction of charge material while charging	Do not hold the liquid metal in the furnace as it consumes power without an increase in production
Cycle time to be as short as possible by keeping the charge materials ready	Do not uncover the furnace unnecessarily
Maintain minimum holding periods for melt. Keep prepared moulds ready	Avoid long tapping time and frequent tapping to reduce radiation losses and operations at low power levels
Use pre-heat & well-insulated ladles for energy saving	Avoid long charging times and frequency

Cupola Furnace

Do's & Don'ts of Cupola Furnace Melting

DO'S	DON'TS
The bottom sand of the cupola should be free from iron particles and have proper moisture and clay content	Do not hold the molten metal inside the cupola for long periods as it consumes energy and changes the metallurgical properties of melt
Measure the bed coke height with a gauge and add fresh coke to bring the height to the required level, if needed	A blower should not be purchased without knowing CFM delivered
The leftover coke from the bed should be utilized in the next heat for optimum utilization	Once charging starts, do not stop until the cupola shaft is filled to the charging door level with charges and is maintained throughout the operation
Pre-heat all ladles thoroughly	The charge size should not be large
The raw material and consumables should be stored under cover and in individual bins	Do not charge more than 1/10th weight of split charge pieces in the cupola
The maximum size of any single piece should be 1/3rd of the cupola dia after lining repair Coke size should be 1/10th of cupola dia. Limestone should be 20 to 40 mm up to 36" of cupola dia	Charging of the cupola should not be done without weighing raw materials, coke and limestone
Instrumentation such as Volume Meter and Manometer should be provided to optimize the blast volume and pressure	The cupola should not run without pre-heating after the erection of new lining

Foundry's Non-Conformities and Control

Casting defects may be defined as those characteristics that create 'a deficiency or imperfection' contrary to the quality specification imposed by the design and service requirements. Several defects may occur during casting, considerably reducing the total output besides increasing the cost of production. It is therefore essential to understand the causes so that they may be suitably eliminated.

Some common types of defects encountered in castings, their causes and remedies are mentioned below.

Sl. No.	Defect Type	Root Causes	Suggested Remedies
1.	**Blow Holes:** Smooth and round holes clearly perceptible on the surface or subsurface of the casting. They can either be in the form of a cluster of many small holes or in the form of one large and smooth depression.	• Rusty, dirty, damp or improperly coated chaplets. • Entrapped air. • Excessive gas from moulding or coarse sand coupled with insufficient permeability or venting. • Reaction of the molten metal with moisture in the moulding sand. • Overheating of mould or core surfaces. • Excessive moisture in the sand.	• Use clean, dry and free from rust chaplets. • Give more venting and increase the permeability of the sand. • Ensure that cores are dry and properly baked. • Ensure that sand is properly mixed and free from local concentrations of binder and coal dust. • Reduce the moisture content of the sand.
2.	**Cold Shut:** Non-union of metal where two streams meet, leaving apparent cracks or surface wrinkles together with oxide films.	• Cold metal and/or interrupted pouring or unsuitable alloy composition giving a high freezing point. • Metal of too low fluidity.	• Increase pouring temperatures or size and number of ingates. • Check the composition of the alloy.
3.	**Mismatch or Shift:** Mismatch of the top and bottom parts of the mould causing inaccurate casting.	• Worn out moulding box and match plate causing the box to twist. • Worn out closing pins. • Mismatch in fixing top & bottom patterns on match plates.	• Moulding box pins and bushes should be regularly checked. • Ensure accuracy in fixing top and bottom patterns on the match plate.
4.	**Misplaced Core:** Misplaced core results in a variation of wall thickness.	• Oversized core prints allow the core to float or shift. • Rubbing or reduction of core prints prior to core assembly.	• Core prints should be of proper sizes. • Rubbing of core prints should be done with care.
5.	**Misrun:** An incompletely filled mould cavity.	• Insufficient fluidity in the metal. • Too low section thickness.	• Increase pouring temperature. • Increase section thickness if the design permits.

Customer Relationship Management – Analytics

As part of our digital transformation journey and customer-centric culture, we have integrated end-to-end CRM Salesforce by which all the marketing and sales-related processes are available on a single platform to manage the entire lead to cash cycle including after sales while enabling "Business on Mobile" for the customers.

Benefits to stakeholders are reduced lead time for activities, ease of access, effective utilization of financial instruments, transparency and a one-stop solution for all activities. The Platform offers real-time visibility of orders, sales-grade wise, invoices, payments, status of complaints, etc. to customers and partners through secured logins. CRM on mobile enhances flexibility and ease for our customers and enables us to respond to their specific needs with agility.

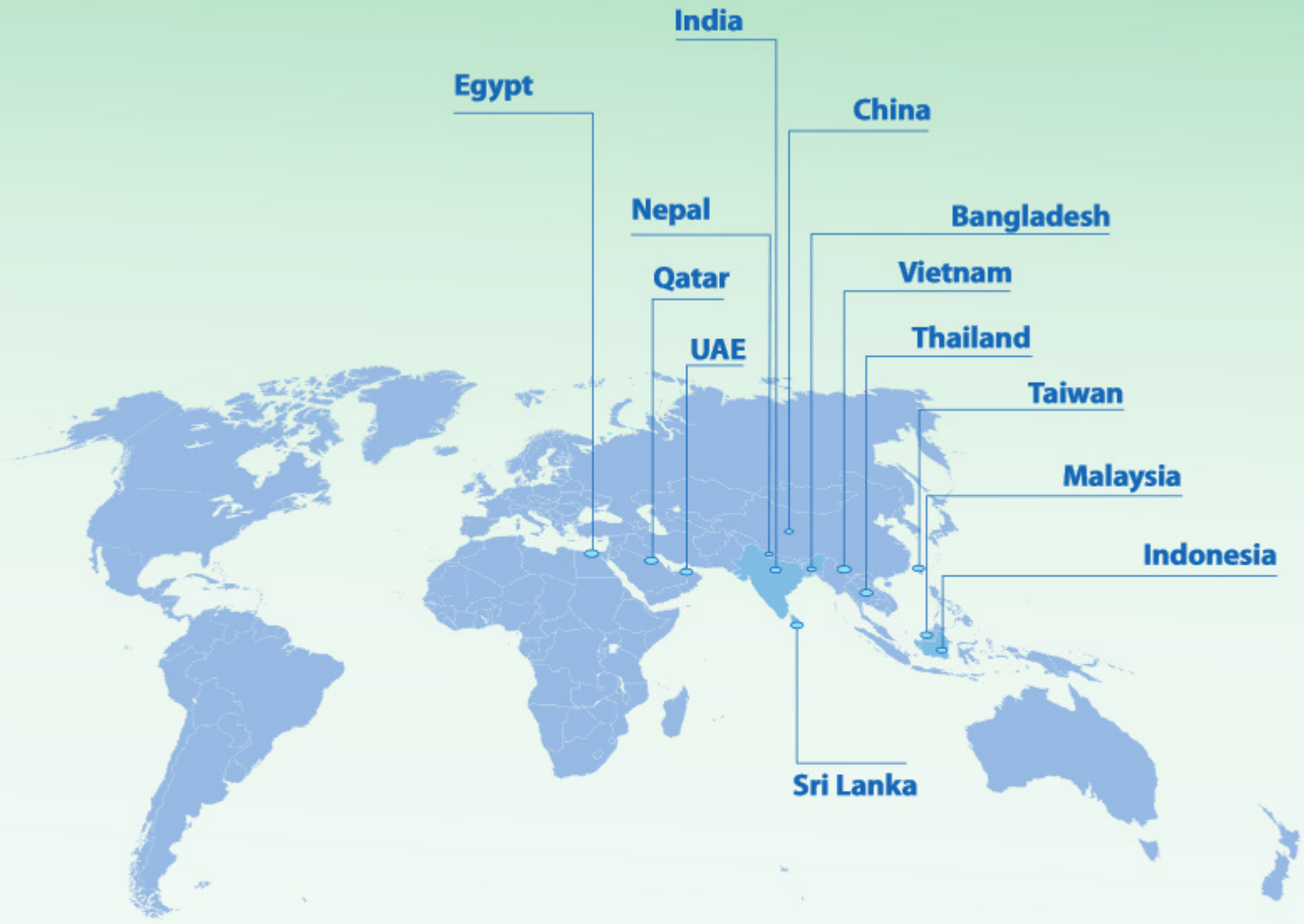
Initiatives by Tata Steel Metaliks Division

Tata Steel Metaliks Division cares and takes all the possible initiatives regarding the health of the foundry manpower by conducting Health Camps at their foundries.

TATA STEEL

TATA eFee melts faster

Tata eFee – Global Footprint



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