



# Medium Frequency Induction Melting Furnace



**ELECTROTHERM<sup>®</sup>**  
*The Leader in Steel Melt Shop and Foundry Technology*

## A Brief Profile of Electrotherm (India) Limited Engineering & Projects Division



Electrotherm (India) Limited, an ISO 9001:2015 certified, public limited company, was founded in 1983 to cater to the needs of all segments of steel industry, foundries and heat treatment industry. Today, Electrotherm is a well diversified conglomerate having businesses in the field of Engineering & Projects catering to steel and foundry industry; transformer manufacturing; steel making; ductile iron pipe making; manufacturing

of battery operated vehicles; renewable energy; transmission line tower and education.

The Engineering & Projects (E&P) division of Electrotherm is a leading designer and manufacturer of Induction Melting Furnaces, Electric Arc Furnaces, Metal Refining Konverters (AOD), Electrotherm Refining Furnaces (ERF) (patented for design & process), High Speed Continuous Casting Machine, Power Distribution and Furnace Transformers and other equipment for Steel Plants, Foundries, Induction Heating and Hardening equipment for Heat Treatment. The E&P division is a customer centric organization delivering total solutions. It is particularly renowned for providing end-to-end solutions for steel melt shops from iron ore to long product, supplying sturdy and highly efficient plant and machinery and rendering outstanding pre and post sales services to its customers around the world. Due to high level expertise and vast experience, Electrotherm (E&P) is the most preferred mini steel plant maker up to 1 million ton per year capacity through various alternative routes. Moreover, Electrotherm (E&P) is the only Indian company having CE marking for its Induction Furnaces, LRF and MRK, certified by UL Laboratories, USA.

The E&P division of Electrotherm has supplied over 4300 equipments for various applications, 2000 furnaces for steel, alloy steel and stainless steel making, 1550 furnaces for ferrous and non-ferrous foundries and around 750 equipment for heat-treatment applications. It has exported over 550 furnaces to 54 countries around the world. Besides, it has made several mini steel plants overseas on turnkey basis in countries like Turkey, Iran, Iraq, Saudi Arabia, Pakistan, Bangladesh and some African countries for capacities ranging from 50,000 TPA to 1,000,000 TPA.



The Electric Arc Furnaces of Electrotherm are designed and manufactured under technical collaboration with Vitkovice Heavy Machinery, Czech Republic. Rest of the major machineries, including Coal based DRI plants and power plant utilizing waste heat generated by rotary Kilns, are designed and manufactured by in-house expertise and facilities at Electrotherm.

Being a customer centric organization with focus on meeting changing needs of its customers, Electrotherm has full-fledged Research & Development Centre at its Corporate Office & Works in Ahmedabad with state of the art manufacturing set up and modern office complex.

# Solid State Power Supply Unit



Electrotherm has acquired word-wide recognition to design, develop and manufacture state-of-the-art Induction Melting Systems. Electrotherm offers medium frequency solid state power supply units from 3 kW to 36000kW catering to the needs of steel industry, foundries and heat-treatment Industry.

Electrotherm's medium frequency power supply unit consists of 6-pulse / 12-pulse / 24-pulse / 48-pulse rectifier, DC choke, current fed inverter, capacitor bank, furnace selector switches and DM water circulation unit.

Compact and yet spacious layout of converter and inverter assembly facilitates ease of maintenance. 12-pulse, 24-pulse and 48-pulse rectifier reduces total harmonic distortion.

The current fed inverter has the highest efficiency as current through the thyristor is very low. It uses less variety and numbers of power components ensuring long life of components, easy maintenance and low down time. The controlled rectifier acts as fast tripping electronic device for maximum safety of high speed control circuits and facilitates accurate power control at any desired level.

## Special Attributes:

- Highest efficiency of power supply unit up to 97%.
- Full power from start to end.
- Designed for fastest melting at lowest cost.
- Best quality and liberally rated components.
- Reliable multiple protection.
- Efficient and reliable closed-loop DM water cooling system.
- Earth leakage protection for operator safety.
- Built-in test facility.
- Safe and Convenient layout.
- Operate even under wide voltage fluctuation.
- Power factor up to 0.98.
- Less and easy maintenance.
- Suitable for operation on captive power plant.

## Optional

- PLC based control with touch screen MMI.
- Ramp-up and Ramp-down to avoid sudden loading / unloading of power supply unit.
- Auto Sintering.
- Energy Optimization.
- Facility to interface with computer for remote monitoring, operation and data logging.

# Solid State Power Supply Unit

## DC Choke

Electrotherm's large iron core DC choke reduces rate of rise of current to dangerous level and allows front-end thyristorized convertor stop current flow within 6-8 milliseconds. This protection is faster than any other circuit breaking device with minimum risk of fuse blowing and thyristor failures.



## DM Water Circulation Unit and Flow Monitoring System

Electrotherm uses DM water for cooling of power devices and copper conductors. Conductivity of DM water is continuously monitored and power supply unit is tripped in case conductivity exceeds the set limit. Stainless Steel sacrificial electrodes are used to prevent electrolysis of copper components. Magnet float assembly in conjunction with sensitive proximity switches are used to monitor flow in different paths. The DM water cooling system with flow monitoring mechanism ensures enhanced life of water cooled copper conductor and power components.



## Capacitor and Bus Bar

Electrotherm's capacitor bank, mounted on a robust steel structure and fitted with electrolytic grade copper bus tubes and flow monitoring switches for failsafe positive interlock in each capacitor's water circuit path, facilitates very easy maintenance and long life of capacitors.

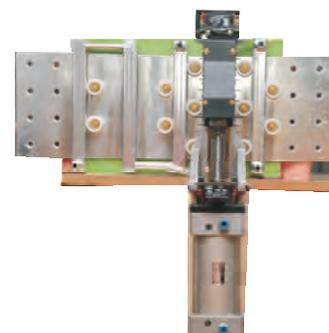
We provide 20% extra capacitors for achieving full power during entire lining life. We use capacitor connection / disconnection switches to adjust required KVAR in the circuit.

Pre-fabricated electrolytic grade copper bus bars from capacitor assembly to water cooled cables are used to minimize energy loss and installation time.



## Furnace Selector Switches

Electrotherm's patented, rugged, off - load, double-pole, double break, water cooled furnace isolating switches are known for their reliability. Switches are available in both manual and mechanized versions from 2KA to 15KA.



## Steel Frame Furnace

From 1 Ton to 80 Ton

### Induction Coil

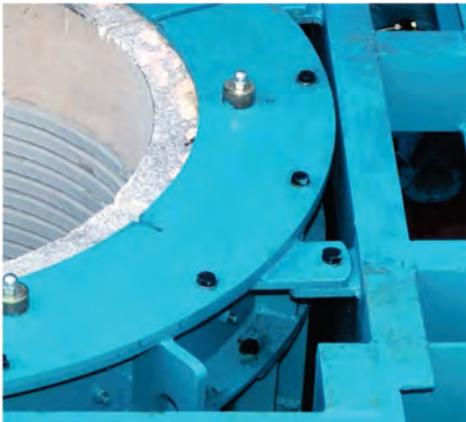
Electrotherm's induction furnace coil is made of electrolytic grade extruded copper in rectangular sections having high wall thickness and integrated passage for water flow. Special 'Step' coil is designed for maximum electrical efficiency and sturdiness. Optimum inter-turn spacing is maintained by FRP spacers between the turns and FRP flats on coil periphery. Bottom stainless steel cooling coils maintain uniform temperature gradient throughout the refractory, prevent over heating and enhance refractory life. Large magnetic shunts (Yokes) cover around 70% of coil periphery which minimizes stray loss and improve efficiency besides providing rigidity to coil cradle assembly.

### Top Ring

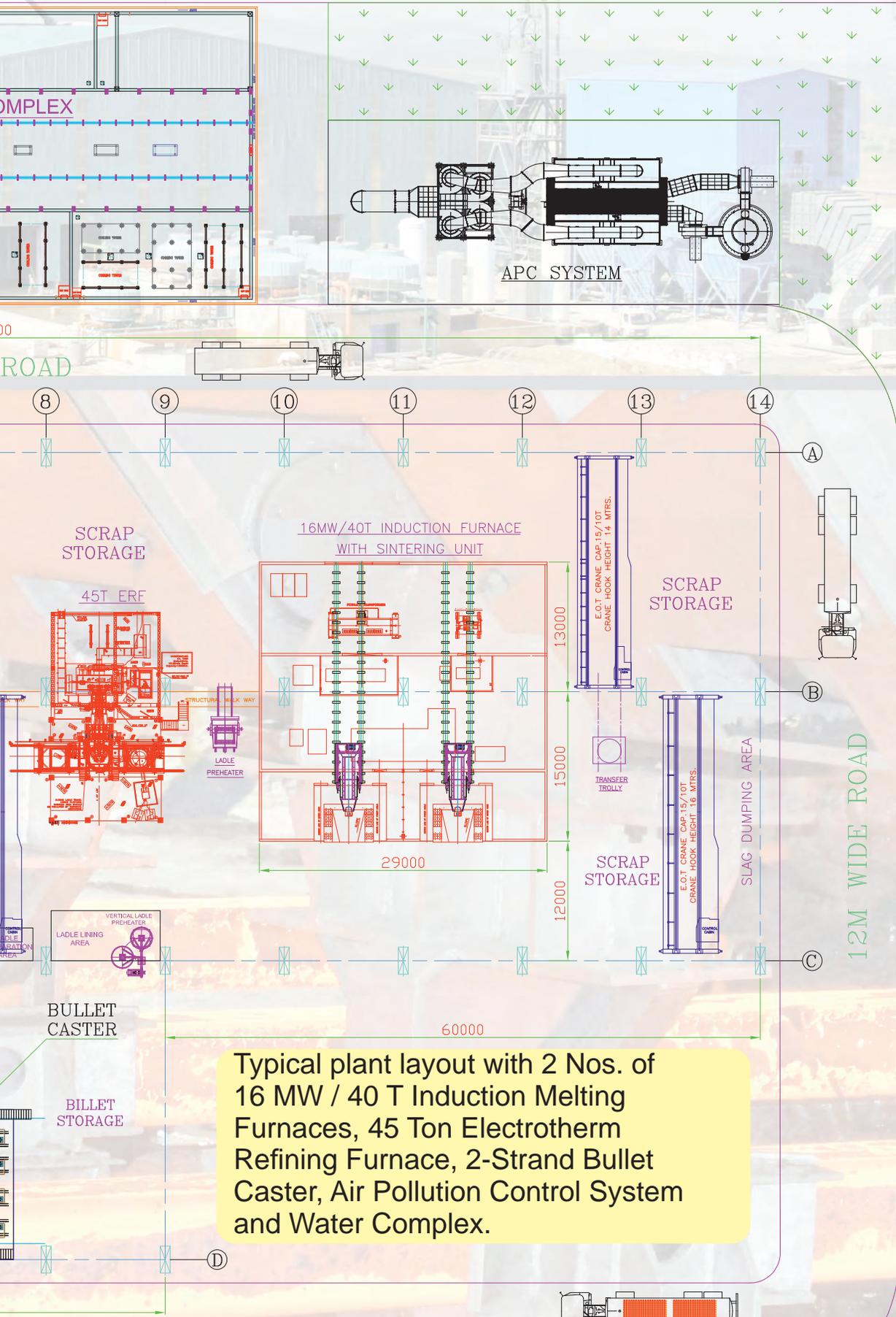
The top refractory blocks are made out of sintered castable refractory with stainless steel fibre for reinforcement and bolted with the top ring for easy dismantling of top block without breaking. Blocks can be replaced in parts.

### Bottom Ring

The bottom refractory blocks are made out of refractory cement and high alumina blocks which give longer life as compared to the bottom made out of only castable material.



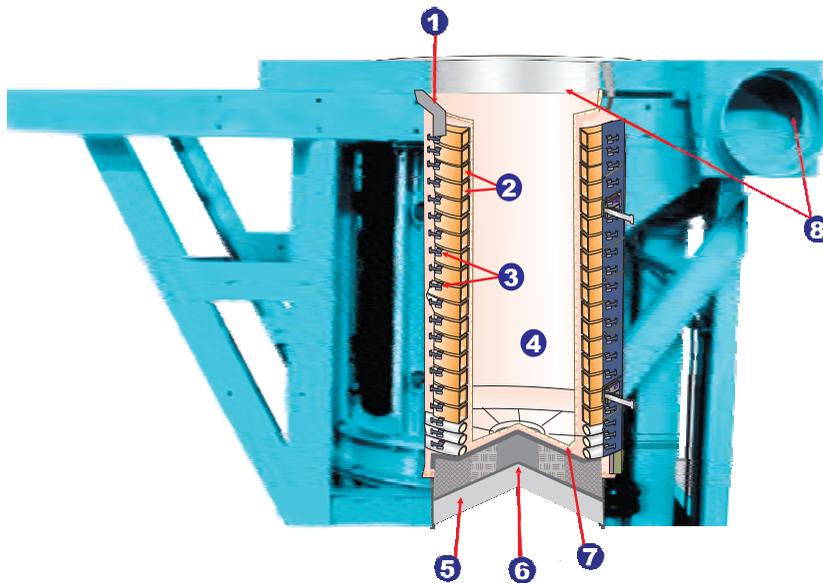




Typical plant layout with 2 Nos. of 16 MW / 40 T Induction Melting Furnaces, 45 Ton Electrotherm Refining Furnace, 2-Strand Bullet Caster, Air Pollution Control System and Water Complex.

# Coreless Induction Melting Furnace

## Cross Section of Steel Frame Furnace



### 1. Top-Block Assembly

2. Heavily extruded rectangular section coil ensures highest efficiency, strength and rigidity.

3. Yokes made out of CRGO Steel bolted through M.S. Channel to Support the power coil, guide the stray magnetic flux outside the coil and improve coil power factor

4. Bottom cooling coils evenly distribute temperature gradients through out the refractory to prevent overheating and extend refractory life

5. Bottom Block Assembly.

6. Lining Failure detection Probe

7. Former

8. Fume Extraction Ring (Optional)

### Optional Features :

- Lining push-out arrangement
- Fume extraction ring
- Load cell arrangement
- Hydraulically operated lid

### Special Attributes :

- Sturdy design for rugged steel plant application.
- Superior coil winding technique to ensure high efficiency and uniform lining cooling.
- Large magnetic shunts cover around 70% of coil periphery which
  - reduces stray losses
  - improves efficiency
  - prevents over heating of other steel parts
  - provides rigidity to coil assembly which supports the refractory
- Bottom stainless steel cooling coil distribute temperature uniformly throughout the refractory to prevent overheating and enhances refractory life.
- Special high voltage insulation to prevent inter-turn sparking.
- Thick farade shield prevents stray losses and directs energy in the charge.
- Free board above coil facilitates easy charging without affecting performance.
- Easy maintenance and accessibility and minimum down time.

## Performance Enhancing Equipment



### ET-EH Grabs

**ET-EH Grabs** are ideal for handling larger volumes of scrap. The design of the grab allows a very high gripping force, due to vertical and large cylinders and the geometry of the claws. Specially designed ET-EH Grabs can be mounted on cranes, wheeled loaders and tracked excavators.

The grab's innovative design allows the equipment to incorporate a very robust mechanism powered by in-built hydraulic system for grabbing the scrap. These grabs have independent claws, each one set in motion by double acting cylinder. This allows the equipment to have a good grip on loose material & non-symmetrical objects.



### Lining Vibrator

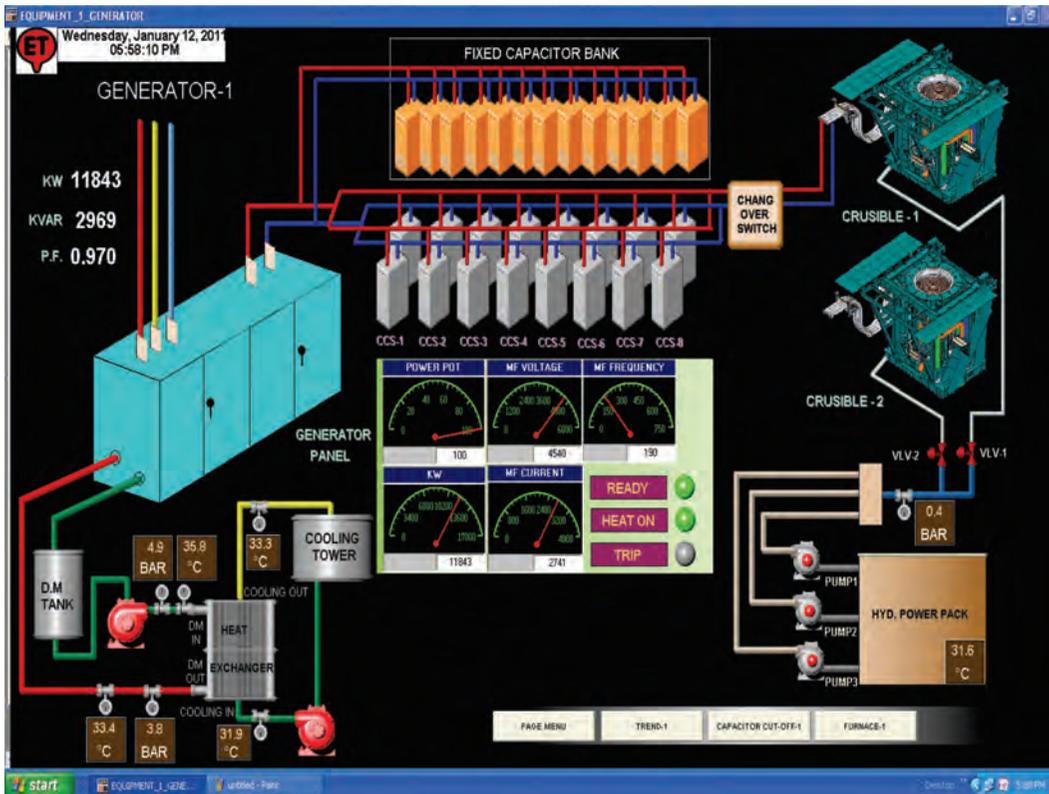
Electrotherm has introduced customized lining solutions to Induction Furnaces with its newly developed Lining Vibrator. Lining Vibrator ensures compact and uniform lining throughout the furnace which in-turn increases the lining life and hence productivity and simultaneously also decrease the manpower requirement.



### Vibratory Feeder

Productivity of a melt shop depends on efficient charging system. Electrotherm has designed and developed mechanized charging of sized scrap through vibratory feeders. These vibratory feeders are designed to move along their axis to feed the scrap directly into furnace mouth continuously at the desired rate. Vibratory feeder can be refilled in situ while it feeds the furnace.

# SCADA Based Furnace Automation



- Supervisory Control and Data Acquisition (SCADA) System for Induction Furnace with option of interfacing with Central Plant Automation
- Display of important electrical parameters like power, current, voltage, frequency, KVA, KVAR, power factor, power consumption, etc.
- Display of water circuit parameters like temperature, pressure, flow etc.
- Display of metal weight and metal temperature
- Display of interlocks and safety, fault diagnosis and alarm generation
- Automatic control of KVA demand by intelligent program on instantaneous basis through furnace power regulation
- Power optimization by automatic connection and disconnection of medium frequency capacitors depending on load and lining condition
- Data storage, logging, trending and retrieval of historical data
- Remote web access through internet from any location in the world
- Fibre optic network for faster and noise-free communication



# GLOBAL NETWORK - ENGINEERING & PROJECTS



## The Range of Products and Services:

- Induction Melting Furnaces for mini steel plants
- Induction Melting / Holding Furnaces for ferrous and non-ferrous foundries
- Electric Arc Furnaces
- Electrotherm Refining Furnaces (ERF)
- Metal Refining Konverters (MRK)
- High Speed Continuous Casting Machines
- Coal based Rotary Kiln (Sponge Iron) Plant
- Coal based Tunnel Kiln (Sponge Iron) Plant
- Turnkey Projects for steel melt shop for producing billets / ingots
- Turnkey Projects for Integrated Plant through DRI – SMS route
- Plant design and engineering
- Plant Automation
- Productivity Improvement Equipment (PIE) for improving plant productivity, end product's quality and plant efficiency



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