

# Total Solutions for Melt Shop



## 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.

## Induction Melting Furnace

Electrotherm is recognized and known for designing, developing and manufacturing state of the art induction melting system for foundry application and steel making. Electrotherm through its latest, most energy efficient digital technology in the form of DIFOC offers Induction Furnace now upto the range of 36,000 KW power supply coupled with 80 ton. Electrotherm since its inception has maintained leadership in design, developing and manufacturing the largest and most efficient Induction Melting Furnaces.



## Metal Refining Konverter (MRK)<sup>®</sup>

Metal Refining Konverter (MRK<sup>®</sup>) is metallurgical equipment used for decarburizing high carbon steel to produce stainless steel, low carbon alloy steel and even plain carbon steel. MRK is an improvised version of conventional Argon Oxygen Decarburization (AOD) process for economical steelmaking.

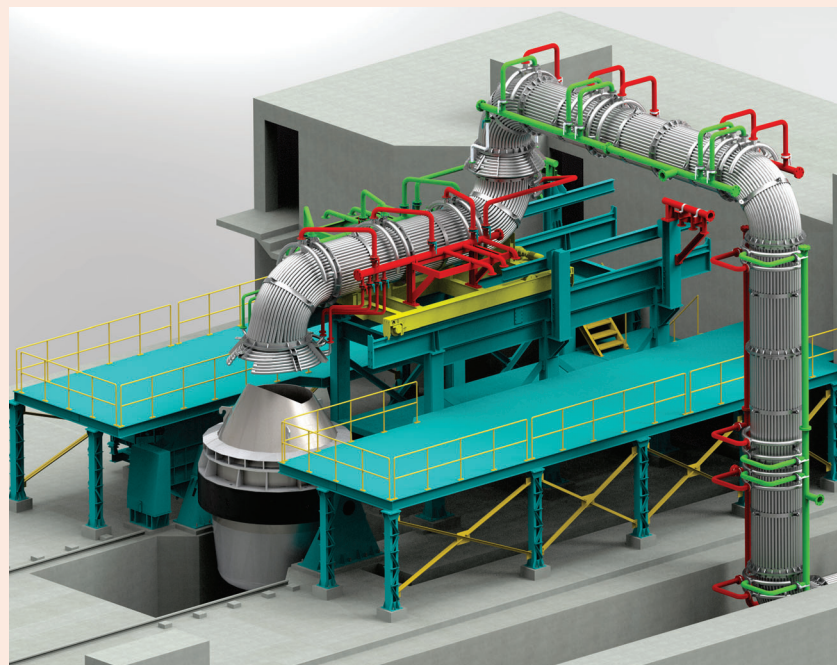
Capacity: 10 ton to 150 ton



### ADVANTAGES OF ET – MRK

- PLC based Gas Mixing Station of MRK gives flow measurements compensated for pressure and temperature variation. This avoids, "OVER OXIDATION" of liquid metal.
- Transducer used for accurate flow and pressure measurement in Gas Mixing Station of MRK enables high turn down ratio which results in low process gas and refractory consumption and high recovery of alloying elements.
- Reduced cost of production by using dry air (-80°C dew point) as process gas.
- PLC based MRK process control software uses unique blowing pattern selection system which reduces oxygen, nitrogen consumption and idle time during process.
- Fully suspended drive mechanism to minimize vibration to the foundation and surrounding.
- By-pass valve for safe operation.
- Overall process display on touch screen HMI.
- Recording facility helps improved traceability, quality, reliability and repeatability.
- Printout of recorded data of gases and pressure help in monitoring each heat making process and composition.
- Online costing of heat can be monitored from remote places.

- Boiler quality, stress relieved MS plates are used for fabrication of MRK vessel. All the welding joints are ultrasonically tested for higher strength.
- Thruster type and spring applied air retract disk break are used for faster response time. Dual breaks used also provide greater safety in terms of operation.
- Trunion ring and shaft are specially fabricated from special alloys and all welded portions are completely X-ray scanned.
- Fume extraction and pollution control system is provided with PLC based controls of valves.
- Planetary gear box has been used to optimize space.
- Feeding system for continuous charging of Ferro alloys and scrap at a controlled ratio.
- Torque arm is used to absorb vibration on foundation & gear box.
- Jerk - less rotation with angular position encoder.



## Electrotherm Refining Furnace<sup>®</sup>

Traditional Ladle Refining Furnace (LRF) is used to de-sulphurize steel, adjust its chemical composition and raise the temperature of molten metal besides acting as a buffer between the melting and casting equipment. Electrotherm Refining Furnace (ERF) is specially designed metallurgical equipment to de-phosphorize steel besides performing other processes as done by LRF. It facilitates tapping at lower temperature, which in turn increases production and refractory life of melting equipment and reduces power consumption, thereby reducing the cost of steel making. ERF provides greater flexibility to steel maker in overall plant operation. The concept is user friendly and can produce high quality structural steel, low alloy steel and other value added steels through Induction Furnace - ERF route using even very high percentage of sponge Iron / DRI as raw material.



### ELdFOS PROCESS

- Electrotherm Refining Furnace with ELdFOS process is used for the following:
- De-phosphization of steel by as much as 50 points
- De-sulphurization of steel by as much as 50 points
- Removal of metallic inclusions to make clean steel
- Reduction of gas content by feeding Aluminium / CaSi wire to produce "killed" steel. Oxygen level of 30 ppm can be obtained
- Homogenization of temperature and composition of molten steel by gentle stirring
- Degassing treatment of steel to achieve low gas content (oxygen, nitrogen and hydrogen)
- Holding of molten steel while sustaining temperature / superheating for sequencing on the CCM

### SPECIAL ATTRIBUTES

- Specially designed system for removal of slag with phosphorus
- Use of Servo valves and hydraulic cylinders for electrode regulation provides very precise control ensuring electrode consumption as low as 0.3 -0.4 kg/ ton
- SCADA based PLC control for electrode regulation system provides impedance control, anti-resonant control, auto deadband adjustment, etc., ensuring precise control of power and virtually constant power from input
- Reduces flicker and harmonics and improves power factor up to 0.90 even without any compensation
- Ease in operation due to stationary electrode arms and moving ladle car, which is maintenance free and faster for taking sequence heat
- High level automation through PLC. Once the process parameters are set, ERF operates automatically with high level of consistency
- Rate of superheating after stabilization of temperature in the ladle can be up to 4.5°C/min
- SCADA based controls for gas purging system, with imported flow meter, pressure control valves and flow control valves for Argon purging minimizing the use of argon gas and achieving uniform temperature gradient through molten steel

## Continuous Casting Machine

Electrotherm developed High Speed Modular Caster for existing ingot making plants with smaller shed height and / or smaller capacity furnaces. This caster is suitable for heat size as small as 5 ton and modules are available for casting sections from 80 mm x 80 mm to 160 mm x 160 mm. Large radius and multi-point straightening Bullet Caster are specially designed for casting larger sections at very high throughput and lowest possible operating cost. Electrotherm casters are most suitable for direct rolling of hot billets without any intermediate re-heating.

After the success of its High Speed Modular Casters, Electrotherm has taken a giant leap in the direction of providing optimal solution for casting bigger sections of steel billet at higher speed, better quality and lower cost of operation. This high tech caster with multiple radius is bound to play an important role in redefining the industry by improving productivity and optimizing the cost of operation. Our casters are equipped with features like rigid dummy bar, automatic secondary cooling system, multi point unbending and straightening of billet for lower stress and better quality and best in class process automation. High speed caster ensures direct rolling of billets saving huge operating cost. Based on operational requirements our casters are ready to be equipped with ladle turret, twin ladle car, turnover cooling bed, automatic gas cutting or billet shearing machines, automatic mould level controller etc.



### 6 / 11 CASTER & BULLET CASTER

- High speed billet / bloom caster through multi-point unbending and optimized secondary cooling
- Widest range of billet / bloom casting through same equipment – 100 mm x 100 mm up to 200 mm x 250 mm
- Larger radius caster for section beyond 200 mm x 200 mm up to 400 mm x 400 mm
- High quality billets / blooms with respect to dimension, internal and surface quality
- Higher operational flexibility
- Rigid dummy bar for enhanced productivity and quick re-stranding



## Air Pollution Control System

Electrotherm developed state-of-the-art Air Pollution Control System (APCS) has been specially designed for induction furnaces based steelmaking plants. The APCS is highly effective and efficient without interfering continuous feeding to the furnace and meeting stringent exhaust gas norms of the country of installation. For sophisticated foundries and steelmaking plants with high quality scrap, double acting fume hood integrated with modern scrap feeding system is also available which captures fumes even during scrap charging and tapping of the liquid steel.

Electrotherm offers complete solution for air pollution even for most stringent norms and meeting emissions standards of even 20 mgm/Nm<sup>3</sup> depending on statutory requirement and various pollution boards.

Electrotherm design team with its vast experience and understanding of the melting operations have developed various kind of pollution hoods suitable for different operating needs, charge mixes and charging methodology.

- Dish Antenna type Fume Capturing Hood
- Double Action Fume Hood
- Canopy type Hood
- Dog House with poking, charging and tapping solutions



- Our specially designed side draft hoods are meant to ensure highly effective and efficient suction of fumes even while feeding scrap through magnet or grab or poking of scrap during melting operations.



## Coal Based DRI Plant & Captive Power Plant

Electrotherm's Coal-based Direct Reduced Iron (DRI) making plant through Rotary Kiln (SL/RN Process) with versatile design adaptable to use wide range of raw materials' grades enables integrated plants to produce alternative raw material for steelmaking. The flue gas is utilized to generate power through Waste Heat Recovery Boiler and plant is made pollution-free with highly effective dust suppression, collection and filtering system.

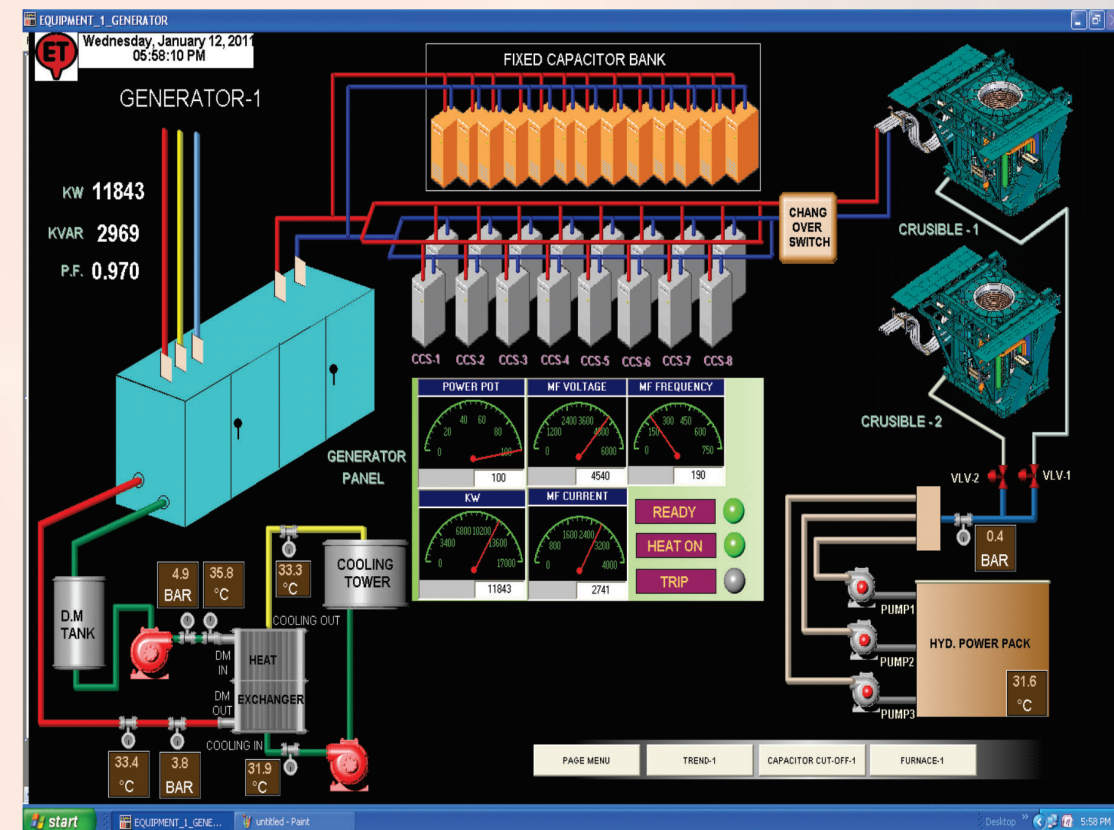


### SPECIAL ATTRIBUTES

- Intelligent raw material proportioning system
- Versatile design adaptable to use wide range of raw materials' grades
- Facility to substitute natural gas for some portion of coal
- Advanced instrumentation and automation system to reduce utilities' consumptions
- Reduced electricity consumption due to selection of efficient and sturdy equipment
- Advanced energy balance monitoring system reducing specific consumptions
- High combustion efficient through gas monitoring system
- Highly engineered plant layout for minimal material handling and smooth material flow
- Highly efficient plant and process design for maximum waste heat recovery either to generate power or to pre-heat iron ore
- Pollution free plant with highly effective dust suppression and collection system
- It also provides complete solutions for generating power by utilizing the hot flue gases emitted during the reduction process



## SCADA Based Furnace Automation

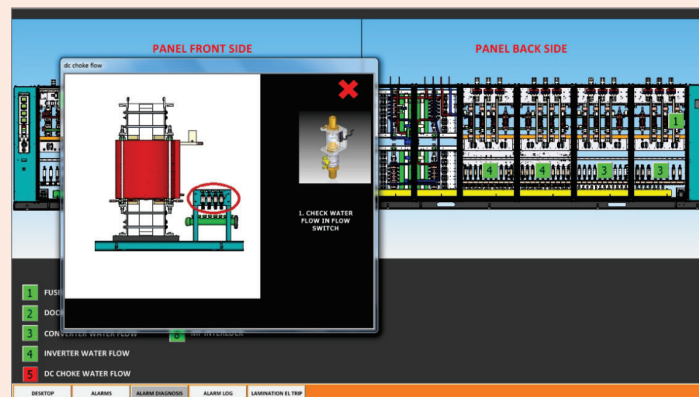
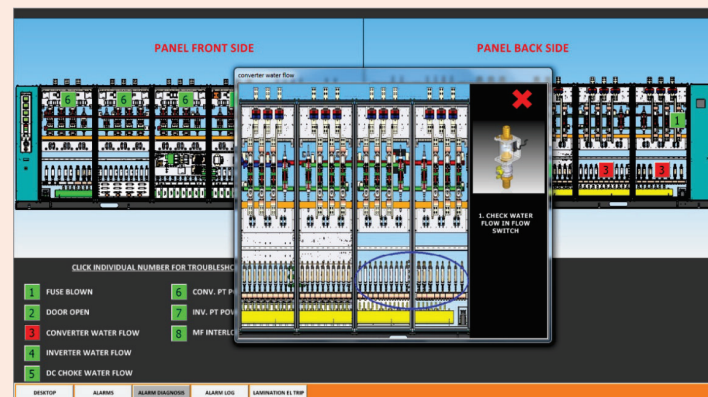
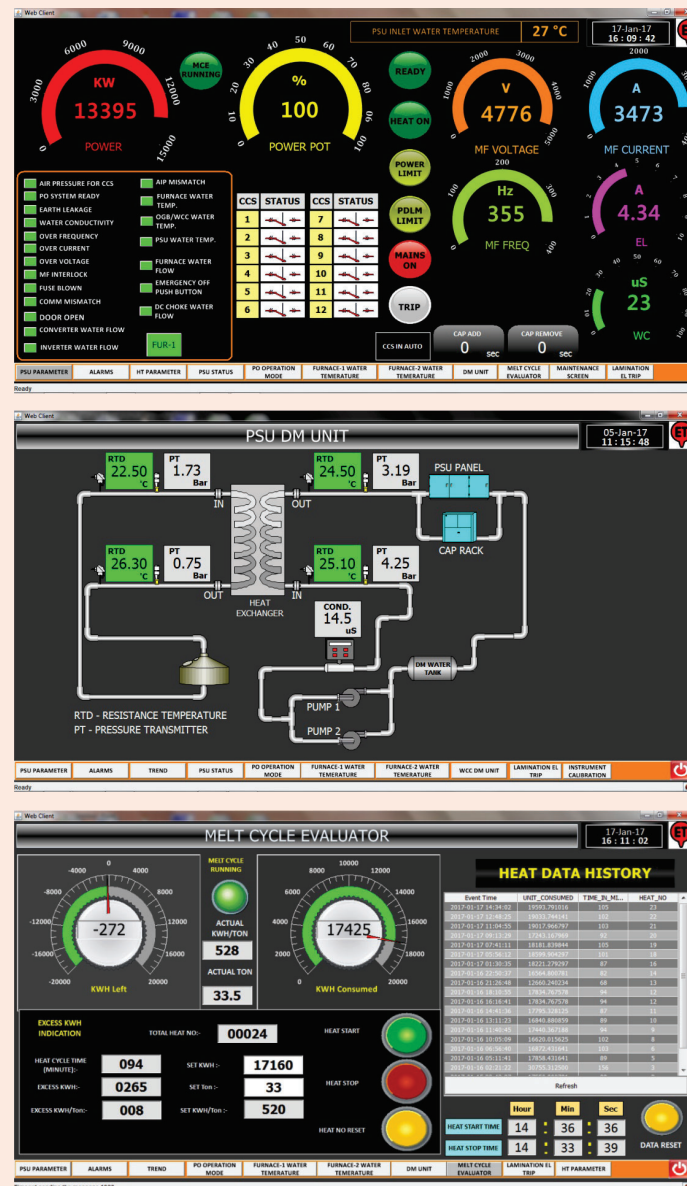


- Supervisory Control and Data Acquisition (SCADA) System for Induction Furnace with option of interfacing with Central Plant Automation
- Display of important electrical parameters like power, current, voltage, frequency, KVA, KVAR, power factor, power consumption, etc.
- Display of water circuit parameters 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

# DiFOC<sup>®</sup> Solid State Frequency Converter with Microprocessor based Digital Control

The latest in-house development of technology, DiFOC<sup>®</sup>, offers numerous special attributes, viz.

- Microprocessor based Digital Control for Solid State Frequency Converter
- Performs all controlling, regulating and protecting functions of converter and inverter
- Fibre optic communication between controller and thyristor modules
- Real-time digital display of all operating parameters
- Energy monitoring and data logging system
- Built-in melt cycle evaluator when coupled with load cells automatically controls the energy required for melting and superheating
- Ethernet port facility for connectivity to SCADA system/remote computer
- Globally accessible equipment through secured Ethernet connectivity
- Internal self-test, remote diagnosis and tele-support
- User friendly system through language selection in GUI
- Remote diagnosis & self testing
- Data Logging for 10 Years



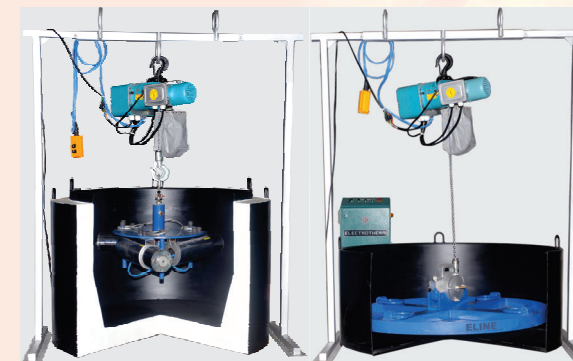
# Productivity Improvement Equipment



## 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.