

**INTECO**  
**FUCHS**



**WE ARE  
ELECTRIC ARC FURNACE**





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„We want to serve you with our know how and the best tailor made technology possible.“

## INTECO'S MISSION

- › providing **SOLUTIONS**  
equipment and process technology from one single supplier
- › seeking **INNOVATION**  
continuous investment in R&D as a strategy to support or create products and leadership
- › managing **COMPLEXITY**  
enowned capability to manage complex projects in global scenarios
- › being **FLEXIBLE & WILLING**  
responding quickly to your requirements to achieve customer satisfaction
- › playing **FAIR**  
establishing a long term relationship with you





# ELECTRIC ARC FURNACE



INTECO's design solutions for its EAF units are focused on development of heavy-duty equipment capable of withstanding both high electrical and chemical melting power density without impairing quality of steel, reliability of equipment, environment and overall safety of all furnace operations.

Tailor made design and development activities form the basis to start from following the path marked by the future EAF technology requirements and trends.

Thanks to the acquisition of the worldwide known FUCHS Technology, INTECO enhances its capabilities reaching excellence in the designing technique and operation technology of Electric Arc Furnaces and Ladle Furnaces, providing the market with the most advanced and innovative equipment for meltshops.

## Features

- › Tapping weights from 2 to more than 300 t
- › Split Fe-Cu water cooled upper shell panels and roof panels
- › Three points or single point roof lifting
- › Swing bridge with roller bearing or king pin
- › Copper or aluminum conductive arms
- › Combined raw material input design (Scrap, DRI/HBI, Hot Metal)
- › Hot heel size from 0% to 40% tapping weight according to selected raw material
- › UHP index from 0.5 to 1.5 MVA/t
- › From single charge to multi bucket charge
- › Tapping systems with EBT tap hole or tapping spout
- › Tailor made design and process technology dimensioning in function of raw materials mix



## USP's of INTECO Design

- › INTECO as unique supplier of all technical packages (full stream know-how)
- › Patented Telescope EAF (with a 165 t tap EAF reference)
- › Advanced and patented integrated scrap preheating and EAF solutions
- › Ultra High Chemical Power input (UHChP) furnaces
- › Integrated INTECO PTI solutions for fuel and oxygen Injection
- › Integrated INTECO PTI solutions for injection of solid materials (carbon, lime, FeSi, Al powder etc.)
- › INTECO PTI SwingDoor™ system for EAF deslagging control and overall performance improvement
- › Enhanced design for the water-cooled components for increased safety and service life
- › Integrated INTECO atec ISEC electrode control
- › Integrated melting process control
- › Integrated INTECO atec IFOB furnace optimization box
- › Safe operations
- › In-house design of furnace auxiliaries
- › Integrated INTECO IMAS metal application suite





# SPECIAL STEELMAKING EAF

## Our Technology

- › Carbon and oxygen injection technologies
- › Power input to 120 MW
- › Single bucket charging due to telescopic feature
- › Tight furnace with minimum shell and roof openings
- › Special spout design for fast tapping
- › Special furnace design to allow tilting angle of up to 40°
- › Swing door to control slag flow

## Your Advantage

- › Minimized power-off time and increased productivity
- › Reduced consumption of electrical power and electrodes
- › Increased yield
- › High metallic yield and power input due to improved foaming slag practice
- › Controlled deslagging – stops slag flow by door closing



# TELESCOPE EAF

This furnace benefits from the scrap preheating effect of the burner gas generated during the melt down process due to the high scrap column in the shell. Its major advantage compared to existing single charge furnaces is the fact that the design eliminates the need for longer or/and thicker electrodes to avoid electrode breakage due to the electrode length required for the higher shell of such furnaces.

## Our Technology

- › Rigid, reliable and proven INTECO FUCHS-design
- › Gantry swivelling: no big roller bearing, swivelling is realized by 2 slide bearings
- › Electrode stroke is the same than in conventional EAF-applications
- › Additional required stroke for high shell is realized by a gantry stroke
- › Gantry stroke lifts the complete gantry with the electrode support structure & roof

## Your Advantage

- › Innovative EAF concept for single bucket application, even with scrap density down to 0.5 t/m³
- › Telescope principle for gantry & roof lifting minimized electrode length
- › Minimized power-off time
- › Highest operational safety
- › High electrical & chemical energy input leads to shortest power-on time
- › High productivity







### Your Advantage

- › Reduction of total energy input
- › Decreasing electrode consumption
- › Reduction of power-on & power-off time
- › Reduction of conversion cost
- › Increasing productivity
- › One bucket operation at a scrap density of 0,5 t/m<sup>3</sup> depending on the plant situation
- › Reduction of the electrical energy consumption of 30 – 40 kWh/t of liquid steel due to scrap preheating
- › Better utilization of burner energy due to the higher scrap column
- › Less electrode breakages compared to other single bucket technologies
- › Telescope-EAF-principle leads to maximized charging volume without increase of electrode length
- › Less total- and electrical energy input due to scrap preheating
- › More powerful arc from the beginning of the heat  
= higher average power input and shorter power on time as compared to other single bucket technologies

# COSS FURNACE

## CONTINUOUS OPTIMIZED SHAFT SYSTEM

INTECO Fuchs introduced another scrap preheating furnace type, the Continuous Optimized Shaft System (COSS) to capitalize on the advantages of the current system (flat bath operation, improved power input at the beginning of the heat, low noise, smaller transformer power, less flicker control requirements and short power off times), as well as a higher scrap preheating efficiency of the shaft furnace.

### Our Technology

- › Controlled scrap quantity input through weighing system installed between wheels and COSS frame
- › Controlled preheating temperature through off gas regulation system
- › Controlled scrap input related to the transformer capacity through regulation of pusher speed
- › Flat bath operation: Constant high energy input, lowest flicker generation and less noise generation

### Your Advantage

- › Reduced electrical energy consumption by scrap preheating
- › Reduced electrode consumption of approx. 10%
- › Decreased tap-to-tap-time leads to higher productivity
- › Independence of bucket charging from melting process:  
Charging causes no power-off time, no reactions & explosions caused by charging
- › Reduction of dust amount
- › Improved temperature control of off-gas-temperature
- › Less dust on EAF working platform – better working conditions



**PATENTED**



# TECHNOLOGY PACKAGE

- › SwingDoor System™
- › Chemical Energy System
- › Material Injection System
- › Temperature Measurements & Metallurgical Sampling
- › INTECO Furnace Optimization Box (IFOB)
- › INTECO Smart Electrode Control (ISEC)
- › Furnace Automation
- › INTECO Metals and Application Suite - Level 2 (IMAS)



# SWINGDOOR SYSTEM



The INTECO PTI SwingDoor™ is designed for modern EAF operation. The system is specifically made to allow the EAF to operate with a closed slag door which notably improves operator safety. The position of the SwingDoor™ prevents scrap from accumulating in the slag door area and furnace breast. The new system does not require the slag door area to be cleaned during the EAF melting cycle. It is designed to maintain a thick layer of slag in the furnace. This improves efficiency, reduces energy and additive consumption allowing the operator to control the slag level in the furnace during the whole melting time.

## Your Advantage

- › Avoids furnace door tunnel
- › Charging and melting with door closed
- › No scrap falling to EAF breast
- › Self clearing feature with integrated burner – no scrap pushing from the door
- › Controlled deslagging – stops slag flow by door closing
- › Up to 1 m consistent slag layer in the furnace
- › Improved yield and energy use
- › Reliable robust design – low maintenance
- › Easy installation for any furnace shell
- › Fast payback
- › Main purpose: Operator safety





# CHEMICAL ENERGY SYSTEM



## Combined burner and supersonic oxygen injector

The INTECO PTI JetBurner™ is both a standard oxy-fuel burner and a gas shrouded supersonic oxygen injector. The JetBurner™ produces a highly efficient flame and enables the oxygen to travel in a tight stream over a large distance.

## Oxygen only supersonic injectors

While not as efficient as the shrouded oxygen injector, the oxygen-only, supersonic injectors provide highly velocity oxygen to processes that cannot use or do not have a combustible gas available.

## Special application burners & Injectors

Some processes cannot use the standard PTI burner. For these processes, INTECO PTI has developed special application burner/injectors. INTECO PTI can design a burner to fit the unique aspects of your process.

## Material injectors

INTECO PTI has developed a supersonic oxygen injector that allows material injection during process. This injector clears an area inside the furnace so that material can be injected through the burner without blocking of the injection port or build-up within the furnace. Burner only applications are also available.

## Annulus Burner

The PTI Annulus Injector is an innovative technology that combines material injection with both burner mode and supersonic oxygen injection. The material is center fed through the burner injector to allow high flow rates of material that are delivered directly to the slag metal interface.



## Jetbox

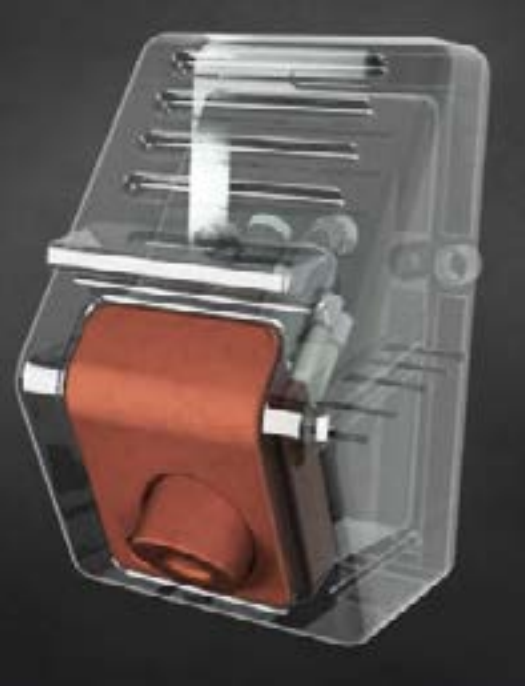
INTECO PTI's concept has promoted the most aggressive introduction of oxygen and chemical energy into the Electric Arc Furnace (EAF) resulting in dramatic efficiency and utilization improvements. To employ this concept safely, INTECO PTI invented a unique water-cooled copper box (JetBOx™) which houses the burner and injector very low inside the EAF at a steep angle. The JetBOx™ is designed to position the burner and oxygen injection as close to the steel bath as possible for the highest injection efficiency with no fear of damage to the EAF as it provides excellent cooling protection and is capable of withstanding the impact of falling scrap and splashing of slag and molten metal. INTECO PTI is continuously improving the design and quality of the JetBOx™ product to enhance the already long life cycle.

The JetBOXes™ are situated just above the last course of refractory bricks with their front face in line with the hot face of bricks. This location provides the following advantages for the EAF operations:

- › Enables better energy transfer into the scrap while in melting mode
- › Minimizes plugging from splashing slag and molten metal during EAF operation
- › Eliminates overheating problems in adjacent panels by moving the burner further from the panels' hot face
- › Promotes higher oxygen efficiency due to shorter jet length and the ability to use the optimal injection angle
- › Allows carbon and lime injection to be applied closer to the molten bath promoting better foamy slag and minimizing material losses
- › Significant energy savings due to closed slag door operation







## Replaceable Front Face Jetbox™

The replaceable front face JetBOx™ is designed to reduce the cost of ownership of the JetBOx™. As most damage occurs on the front face, that face is now replaceable. This allows for two cost reductions! First, the cost of replacing the front face block is much lower than replacing the whole JetBOx™. Second, the cost to repair the front face is much lower than repairing the whole JetBOx™. A third advantage of this new technology is the ability to replace the front face from outside of the EAF without removing the JetBOx™ from the EAF sidewall.

The replacable front face JetBOx™ has three built in thermowells that hold thermocouples. These thermocouples directly measure the temperature of the copper. Direct measurement of the copper during the operation allows very fast detection of back flash during burner or super-sonuc mode. Fast detection of a back flash occurrence allows the burner mode to be reduced and damage to the front face is also reduced.

INTECO PTI can provide both standard and wireless thermocopples for back flash detection.

JetBOx™ replaceable front face benefits:

- › Lower maintenance cost
- › Longer life
- › Faster replacement



# MATERIAL INJECTION SYSTEM



## Carbon Injection Unit

INTECO PTI's carbon injection system is designed to balance your carbon distribution while minimizing your carbon consumption. By injecting carbon to multiple points within your EAF, it provides a more consistent foamy slag and a more homogenous steel bath. Since the carbon injection system is fully automatic, it frees up valuable operator time to concentrate on steelmaking. The system can also be customized for multiple injection points, all from a single vessel. With fewer vessels required, floor space and money can be saved.

The main features and advantages of INTECO PTI's carbon injection system are:

- › Closed loop flow control
- › Carbon flow rate control
- › Multiple injection points
- › Self-adjusting & self-diagnostic
- › Delivers uninterrupted flow of carbon to the EAF
- › Plugging resistant
- › Injector integrates with existing operation system



## Lime Injection Unit

INTECO PTI's lime injection system is designed to balance your lime distribution while minimizing your lime consumption. By injecting lime directly to the molten bath, the lime dissolves into the slag almost instantly. As a result, the removal of phosphorus occurs earlier in the process. The lime injection system saves money by reducing lime usage, as well as the amount of housekeeping required in the meltshop and the amount of lime lost to the baghouse.

The main features and advantages of INTECO PTI's Lime Injection system are:

- › Environmentally clean
- › Reduces lime consumption
- › Reduces housekeeping problems
- › Reduces lime lost to the baghouse
- › Integrates with existing operation systems
- › Closed loop control
- › Designs to inject through INTECO PTI's annulus burner
- › Anti-plugging technology
- › Self diagnostic
- › PLC controlled
- › Injects up to 100% of EAF lime needs





# TEMPERATURE MEASUREMENT & METALLURGICAL SAMPLING



Based on its JetBox™ technology, PTI has developed a unique TempBox™ device that addresses the safety issues related to taking temperature measurements and metallurgical samples. The conventional method of measuring the steel parameters through the slag door requires the slag door area be cleaned and, with the slag door open, cold air infiltrates into the EAF increasing energy usage. An open slag door is a potential safety hazard from exposure to possible wild slag reactions inside the EAF and heat.

INTECO PTI solved the potential safety problems associated with conventional temperature and metallurgical sampling by using a JetBox™ type of device through the EAF sidewall. This approach protects the operator from exposure to both heat and metal splashing and ensures the EAF door remains closed, saving considerable energy. The TempBox™ unit accommodates semi-automated and fully-automated temperature and metallurgical sampling through the side wall and provides a safe environment for steel making personnel.

## Your Advantage

- › Improves operator safety
- › Holds more slag in the EAF longer with closed slag door operation
- › Reduces yield loss
- › Takes temperature & metallurgical samples earlier in the process
- › Improved sample quality and reliability

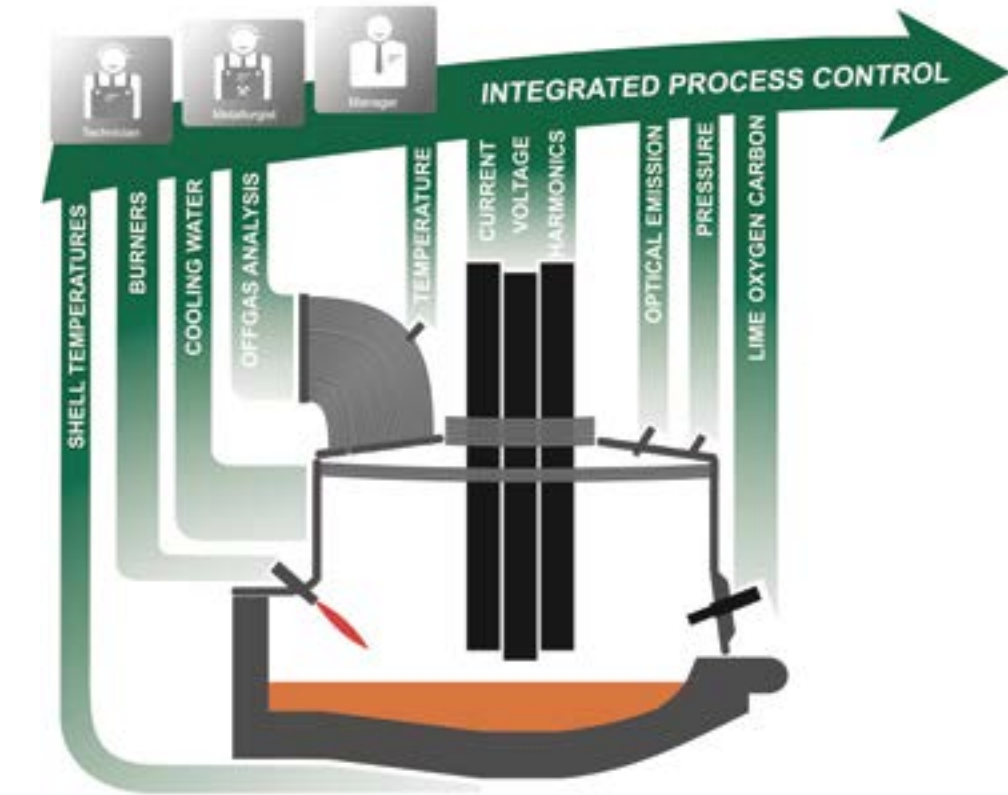


# FURNACE OPTIMIZATION BOX (IFOB)

The INTECO Furnace Optimization Box represents a cutting edge technology for a holistic and sustainable furnace control and optimization. The system continuously collects all relevant furnace data and actively controls the electrical and chemical energy input for optimizing the overall energy balance of the process in a holistic manner. The applied approach accounts for an open platform which is based on widely configurable dynamic operating profiles with fully customizable fuzzy logic engines.

## Your Advantage

- › Reduction of total energy input
- › Decreasing electrode consumption
- › Reduction of power-on time
- › Reduction of the conversion cost
- › Increasing productivity
- › Simple integration in existing furnaces
- › Scalability for future extensions – high investment security
- › Open architecture – no black box
- › Integrated trending and heat reporting – KPI
- › Ideally support a continuous improvement process





# SMART ELECTRODE CONTROL (ISEC)

The new INTECO Smart Electrode Controller is based on a state of the art digital processor which allows a high speed transmission and calculation of the actual values. It is essential to optimize the energy input to the steel bath and to minimize the electrode and refractory consumption. The ISEC is based on a standard hardware controller with standard I/O modules without any moveable parts like hard disc. For flexible operation and fast diagnostics a modern web based visualization system is integrated. This HMI works natively in the browser, without the need for any installation or plug-ins. It can be operated with any device like PC, touch panel, windows mobile devices, iPhone and many more.

## Your Advantage

- › Non-linear impedance controller with a current guided set point and advanced impedance calculation (considers arc reactance)
- › On-line furnace circle diagram with actual and historic values
- › Integrated Foaming slag manager (THD based)
- › Automatic valve linearization (adjustment procedure)
- › Automatic short circuit test procedure
- › Compact size (482 x 690 x 330mm)
- › Integrated heat report
- › Sampling of measuring system: 2,5 kHz
- › Calculation of harmonics
- › Web based HMI

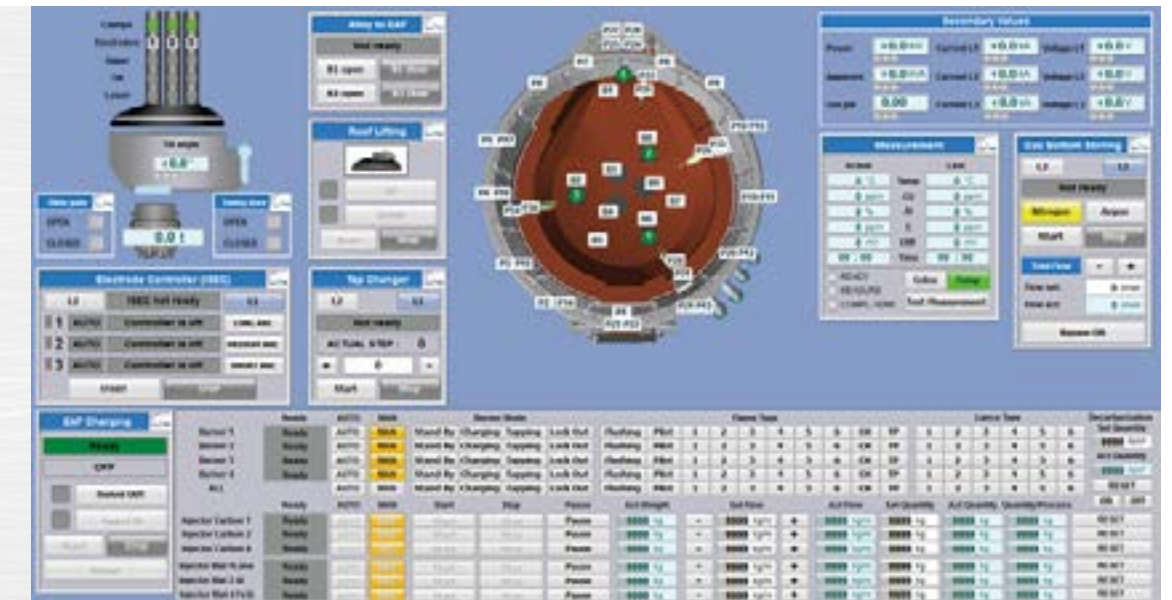


# FURNACE AUTOMATION

Having a good overview is a key factor for operators, especially in critical situations. INTECO's furnace automation is designed to react automatically whenever this is possible and to provide relevant information to the operator whenever it is on him to decide the next step. Putting the clear priority on operability, safety and maintenance the system provides the ideal view on relevant information for all parties. Based on the latest generation of SIEMENS hard- and software the system comprises proven technology with state of the art technologies for automation.

## Your Advantage

- › Operating profiles for electrode control, burners and injection
- › Mixed manual/automatic burner, electrode and injection control
- › Automatic flash-back regulation (sensors required)
- › Cold furnace mode
- › Tapping mode with automatic tapping program
- › Charging mode with burner clogging protection
- › Extended maintenance information
- › Heat reporting





# METALS AND APPLICATION SUITE - LEVEL 2

INTECOS's intelligent process automation system of IMAS includes metallurgical/process models as well as set-point control models. The figure on the right illustrates the concept of this system, which automatically controls the complete process of the Electric Arc Furnace. The intelligent process automation system covers three layers:

- › Process supervision
- › Set-point control
- › Process optimization

## Initial Conditions

Based on the initial conditions of the EAF process and the target conditions, the different process (metallurgical) models calculate the current state in terms of (1) chemical composition of the steel bath and slag, (2) weight of the steel bath and slag and (3) temperature of the steel bath. The initial conditions considered in the process model are the weight, types and chemistry of the actual basket set-up. The target temperature and chemistry for the handover are further input parameters of the models. Additionally, the chemical composition and prices of alloy and flux materials are necessary for the calculations.

## Process Supervision

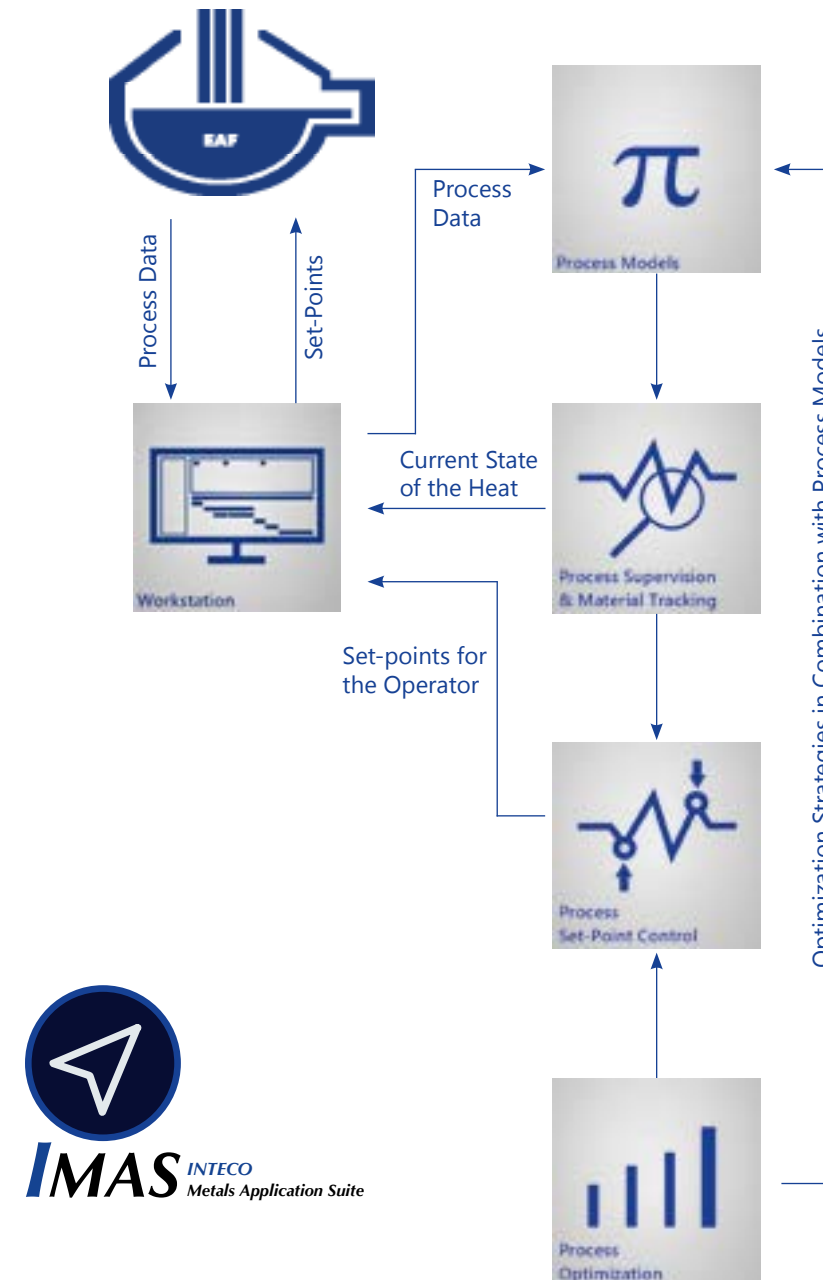
The results of the process model are displayed on the process unit (HMI or UI for the operator). In doing so, process supervision (i.e. the first layer of process automation) by the operator can be realized. Since the current state of the melt is continuously displayed on the process unit, the operator can actively take appropriate actions to the ongoing process.

## Set-Point Control

Besides manual control of the process by the operator, the system provides fully automatic or semi-automatic set-point control. Furthermore, a static, semi-static (metallurgical actions) and dynamic set-point control can be realized. Based on the process schedule, different static set-points such as material additions (e.g. slag formers) can be defined. Semi-static set-points can be calculated on the demand of the operator based on the actual state of the heat (e.g. cost-optimized alloy calculation). The dynamic set-point control accesses the results of the process supervision (i.e. the dynamically calculated current state of the heat) and is realized by the INTECO Furnace Box (IFOB), which is a part of the intelligent process automation system for the EAF. The IFOB enables the administration of the operating profiles. The following parameters can be defined in combination with steps, triggers and rules:

- › Arc length
- › Transformer tap
- › Reactor tap
- › Burner power
- › Burner flame
- › Oxygen injection
- › Carbon injection
- › Lime injection
- › Dedusting

Consequently, the operating profiles are optimized by transparent fuzzy logic controllers. Those fuzzy rules will be adjusted during commissioning to fit the actual requirements of the production and equipment. The open system architecture allows a permanent improvement of the optimization procedure.



## Process Models:

- › Charge calculation
- › Alloy calculation
- › Power input and energy balance model
- › Mass balance model
- › Tapping addition model

## Process Supervision:

Current status of the melt regarding

- › Mass of melt and slag
- › Chemical composition of melt and slag
- › Temperature of melt

## Process Set-Points:

- › Electric energy
- › Oxygen
- › Carbon
- › Burner
- › Post-combustion
- › Material additions

## Process Optimization:

- › Optimized gas, oxygen and carbon input
- › Minimize electrode and energy consumption
- › Control of post-combustion
- › Optimize process stability



# REFRACTORY GUNNING MANIPULATOR



The INTECO TBR Refractory Gunning Manipulator is most appropriate for fast, refractory-saving repair of your EAF. The gunning head below the lance can rotate endlessly as well as the injector pipe can be swivelled into an optimized angle to the surface.

These adjustments allow both: Repair of side wall (e.g. slag zone) and furnace hearth.

## Our Technology

- › Hydraulic lifted beam
- › Endless rotating lance
- › Optimized rebound angle
- › Mechanical dosing system
- › Hand-held remote controlled operation
- › Manual gunning (basic version)
- › Semi- or fully automatic mode (optionally)

## Your Advantage

- › Fast repair of hot EAF refractory lining
- › Reproducible results
- › Optimized adhesion of repair material
- › Minimized consumption of repair material
- › Suitable for Wall and Hearth repair
- › Suitable for each kind of gunning material



# INTECO SERVICES

The services and supplies of INTECO can be summarized as follows:

## Pre-investment Studies

Important aspects of such consultancy assignments may involve new greenfield projects, project expansion or retrofit programs, process route evaluation as well as independent assessments and appraisals for financing purposes. Such consultancy starts with a simple basic engineering and may continue up to full range investigations.

## Engineering

INTECO provides preliminary, basic and detailed engineering for entire plants including mechanical and electrical engineering as well as automation. All mechanical engineering design work is carried out by modern and state-of-the-art 3D CAD systems. All engineering services are executed in-house at INTECO.

INTECO's design is tailor made for the aimed application and is of "single source" from "one hand", i.e. the individual units, components and systems are designed in a manner to support overall objectives set-forth for the entire performance of the whole system. There is no limitation in the layouting of INTECO plants. No matter if standard plants can be used or tailor made design is required, INTECO engineers will develop the right solution. To this end, the INTECO Design Team pays careful attention to coordinate and adopt the requirements and interfaces between all components of an plant, facilitating the synchronized and proper functioning of all units involved in harmony.

## Project & Construction Management

In more than 40 years of operation INTECO has been executing numerous of EPCM, EPC and turn key projects worldwide. INTECO engineers are specialized in assisting customers in project management for new plants or in revamping of existing operations.

## Supply of Equipment & Complete Plants





INTECO with full commitment to the steel industry supplies equipment consisting of comparatively small auxiliary machinery and apparatus to fairly large process units as well as complete equipment and facilities for Micro- and Mini Steelmaking Plants for the Alloy- and Special Steel making industry. The design of all INTECO supplied equipment and plants are backed up by INTECO's strong background in process technology. All designs therefore are made to suit the particular process and operating requirements. We plan, design, supply as well as install and commission a broad range of process units.





## Training

Beside the INTECO in-house metallurgists, we are cooperating for training and start up of our equipment with a number of metallurgists from external steel plants. Certainly training in similar plants can be organized.



# MOST RECENT REFERENCES

<b>TianMa</b> China	Green field EAF installation with a PTI Chemical Package, PTI SwingDoor™, ISEC Electrode Regulator 60t	
<b>Gloria</b> Taiwan	Complete meltshop supplied by INTECO, based on 55t EAF Major revamping of the 35t EAF, LF, fume treatment system including INTECO's process automation system	
<b>Metal Ravne</b> Slovenia	EAF major revamping with new PTI Chemical Package, PTI SwingDoor™, ISEC Electrode Regulator 45t	
<b>Grupo FRISA</b> Mexico	Green field EAF installation, part of a complete melt-shop supplied by INTECO 50t	

<b>Taewoong Special Steel</b> South Korea	Green field EAF installation, part of a complete melt-shop supplied by INTECO 150t	
<b>Shagang ZSJ</b> China	Revamping of an existing FUCHS Shaft OBT EAF (100t) to a Shaft EBT EAF (120t)	
<b>Gunung Garuda</b> Indonesia	150t COSS Furnace Installation	
<b>Bastug Metallurgy</b> Turkey	165t Telescope EAF Installation	



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