High productivity with
ELECTRIC ARC FURNACES
SMS Demag has been supplying the necessary plant and equipment since the early beginnings of industrial electric steel-making.

**Experienced Design**

Until today, we have designed, built and commissioned over 1275 electric arc furnaces, worldwide in all sizes and for a large variety of requirements.

**Tailor-Made Solutions**

Based on this, we can claim to rank among the most experienced and successful plant engineering and manufacturing companies supplying the electric steel-making sector. Both, customer feedback and continuous research and development, ensure state-of-the-art technology of electric arc furnaces, resulting in:

- Production efficiency
- Quality improvement
- Cost reduction
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Carbon steel
Special steel
Stainless steel
Cast iron / Hot metal
SMS Demag Electric Arc Furnaces are known worldwide for their availability and robustness. Our furnace design reflects constant improvements and responds to our customers’ demands.

- High productivity
- Low production cost
- Reliable operation
- Low maintenance

1. **Power Conducting Arms (PCA)**
   Power-conducting electrode arms, made of copper-clad steel or aluminium feature low impedance for high power input.

2. **Roof lifting arms**
   The roof lifting arms are arranged in V-form for three-point roof lifting. One arm is shorter than the other, so that after automatic uncoupling of the roof lift hooks, the gantry with lifted arms can be slewed off with the off-gas elbow still on the roof. With such an arrangement, the complete roof can be replaced within a short time, resulting in high productivity and low downtime.
Water-cooled panels  
The newly designed tube-gap-tube steel panels ensure a long service life due to excellent slag retaining conditions.

Reduced slag-door tunnel  
The new small tunnel depth reduces the amount of scrap in the door area.

Exchangeable shell  
An exchangeable shell can be installed. This allows a short production stop and a higher plant availability.

EBT tapping system  
The pneumatic taphole cylinder is located below the EBT corner and directly activates the selfcleaning taphole opening mechanism resulting in a reliable operation and secures the opening of the taphole.

Large bearing for roof and electrode slewing  
Kingpin and wheels with rail are replaced by a large bearing as known from a caster turret. This bearing is arranged outside the furnace centerline, thus allowing shortest possible electrode arms resulting in less electrical losses thus reducing production cost.

Mast guiding  
The electrode masts are aligned and guided during their stroke motion by four guide roller assemblies. The proven system allows for easy alignment and low maintenance cost.
The SMS Demag AC furnace has proven its capability worldwide at many installations since the beginning of the electric steelmaking process. Over the years, the AC furnace has been improved in design and further developed. Today's AC furnaces are ultra high-powered furnaces with specific transformer ratings up to and more than 1 MVA/t.

**HIGH-IMPEDANCE furnace**

Today, high-impedance furnaces are state of the art. High-impedance furnaces are provided with low reactances on the secondary side and an additional reactor on the primary side of the furnace transformer.

The additional reactance on the primary side of these furnaces features:
- Reduction in electrode current
- Reduction in operation cost
- Reduction in the disturbances to the electrical supply network

**POWER CONDUCTING ARMS (PCA)**

This development has been proven by the use of:
- Copper-clad electrode arms
- Aluminium electrode arms

These furnaces have advantages such as:
- Increased power input (i.e. in connection with reconstructions)
- Fewer secondary conductor losses

**AC FURNACE TECHNOLOGY suitable for:**
- Single furnaces
- Twin-shell furnaces
- CONARC® furnaces
- Scrap preheater furnaces

**MAIN FEATURES of AC high-impedance furnaces**
- Reduced energy consumption
- Reduced electrode consumption
- Fewer electrode breakages
- Stable arc operation
- Fewer mechanical forces acting on the electrodes and electrode arms
- Fewer network disturbances
SMS Demag is the world leader in DC technology as proven by the most productive furnaces in the world. SMS Demag DC EAFs can be equipped with pin-type bottom electrode systems or billet-type bottom electrode systems. Today, SMS Demag furnaces have proven their capability worldwide in a large number of installations.

**MAIN FEATURES of SMS Demag DC furnace operation**

- Reduced electrode consumption
- Reduced energy consumption
- Improved thermal and metallurgical homogenisation of the melt
- Intensified stirring
- Lower network disturbances compared to AC furnaces
- Possibility of connecting to weak electrical networks
- Computer simulation for avoiding arc deflection resulting in perfect bus bar routing

**DC TECHNOLOGY suitable for:**

- Single furnaces
- Twin-shell furnaces
- CONARC® furnaces
- Scrap preheater furnaces

### Pin-type bottom electrodes

- Lowest operating cost
- Air-cooled bottom electrode
- Bottom electrode featuring a large number of simple steel pins
- Large contact surface
- Life time exceeds refractory life time of lower shell
- No intermediate repairs

### Billet-type bottom electrodes

- Spray-water-cooled bottom electrode for intensive cooling
- Bottom electrode featuring a steel/copper combination for thermal balance
- Monitoring and control of each bottom electrode, with the possibility of individual current setting for each electrode
The SMS Demag CONARC® furnace combines the conventional CONverter process with electric ARC steelmaking in a furnace with two identical shells. The furnace is equipped with one set of electrodes which are connected to a transformer and can be slewed alternatively to each of the two shells. Oxygen is injected through a water-cooled top lance which can also be slewed from one shell to the other.

The process is split into two stages:
- The converter process, during which the liquid iron is decarburised by injection of oxygen through the top lance.
- The electric arc process, during which the electrical energy for melting of the solid charge and for superheating of the bath to tapping temperature is used.

The typical process starts with the charging of hot metal into a “liquid heel”; a small part of the previous melt is kept in the furnace. After the top lance has been brought into position, the oxygen blow is initiated.

During the converter phase, the contents of carbon, silicon, manganese and phosphorus in the bath are reduced. These reactions are exothermic, i.e. they generate heat. Cold material like DRI or scrap is added to the furnace to utilise this energy and to avoid overheating of the bath.

After completion of the decarburisation process, the top lance is slewed away and the electrodes are brought into operating position. In the arcing phase, the remaining solid charge material like scrap or sponge iron is fed into the bath until the desired tapping weight is reached.

The temperature of the bath is then increased to the required value, whereupon the heat is tapped into a ladle.

**ADVANTAGES**
- Highest flexibility regarding material input. Scrap, hot metal or sponge iron percentage can be fixed according to steel quality and/or availability and/or unit prices
- Utmost flexibility with respect to energy sources (electricity, coal, fuel, gas)
- Smooth network disturbances
SOLUTIONS
- Carbon steel
- Stainless steel

MODERN PROVEN EQUIPMENT
- Oxygen-blowing top lance (BOF technology)
- State-of-the-art arcing process (EAF technology)

THE CONARC® PROCESS FEATURES:
- Single-shell CONARC® furnaces
- Twin-shell CONARC® furnaces
- Scrap preheating systems
- Oxygen top lances
- Oxygen/carbon injection systems
Electric Arc Furnaces

SCRAP PREHEATING SYSTEMS

The SMS Demag basic concept features a scrap preheating chamber with finger sets. Below the finger stage there is a post-combustion chamber serving as an initial safety element of the scrap preheating concept. All conditions for charge material, e.g. scrap and hot metal, are flexible to meet customer’s demands. The basic requirement that the scrap be charged into the centre of the furnace shell is assured.

PROCESS TECHNOLOGY

The process technology benefits from the basic scrap preheating concept:
- The technology is convincingly logical at ultra-low consumption figures for electrical energy and electrode graphite.
- The post-combustion chamber below the scrap chamber guarantees the complete combustion of all CO/CO₂ gases generated in the furnace shell, so that a maximum quantity of heat is transferred to the scrap and the risk of CO/CO₂ explosions is minimised.

PROCESS EVALUATION

Considering the overall operating costs the scrap preheating process is very customer specific. Only under special preconditions this process will provide cost savings. Therefore detailed feasibility evaluation will be provided before following up this process route.
CONTIARC® furnaces for cast iron production

Based on years of process know-how and experience, SMS Demag has created a completely new melting reactor which brings benefits through lowest production cost.

The CONTIARC® mainly consists of a melting reactor with an inner electrode holding and guiding system inside a central water-cooled shaft, which serves to protect the electrode.

The CONTIARC® is fed continuously with material in a ring between the central shaft and the outer furnace vessel, where the charged material is continuously preheated by the rising process gas in a counter-current flow, whilst the material continuously moves down. Located below the central shaft is a “free-melting volume” in the form of a cavern.

In 2001 SMS Demag commissioned the first CONTIARC® furnace for the production of cast iron.

**TECHNICAL DATA, REFERENCE PLANT**

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The state-of-the-art EAF are used today only as a melting machine. Beside decarburisation and dephosphorisation, all metallurgical work is done in downstream units.

The EAF itself should operate only as an efficiency melting unit for liquid steel. Therefore it is essential necessary to use the best technology components, which ensure this modern steelmaking practice. For example the Acoustic Slag foaming Control (ASC) system makes it possible to cover the electric arcs in an optimised way with foaming slag by controlling the carbon & oxygen injection unit.

TECHNOLOGY COMPONENTS

- Clean steel automation package (Clean steel cook book)
- Slag free tapping / shrouded tapping (EBT with slag retaining device / inert-gas atmosphere)
- SULC automation package (Super Ultra Low Carbon process technology and automation package)
- Steel temperature tracking system
- Digital electrode regulation system
Process control of the furnaces is based on programmable logic controllers (PLC’s). All necessary open- and closed-loop control functions are designed to meet both process and safety requirements.

EAF’s today are operated and monitored via state-of-the-art Windows-based visualisation systems. Hardware platforms used include industrial type PC’s or commercial office PC’s running under Windows NT.

The furnace process control system supplied by SMS Demag helps to make furnace operation efficient and comfortable. A hierarchical structure of clearly arranged operator displays as well as interlock displays, alarm lists and trend displays allow furnace operators to rapidly detect the current status of the furnace and to appropriately intervene.

Level 2 process control will assist the furnace operator to perform perfect and cost optimised production. The process models starts at the scrap yard and follows up to the tapped liquid steel.

The process models will serve either by individual process dialog screens or through common HMI dialog mask serving for level 1 (Basic automation) and Level 2 (Process models).
Whenever SMS Demag receives an order for steelmaking equipment, the engineering services and know-how transfer are mutually agreed upon between both parties already in the project phase. Thanks to our experience, there is no question that we know that this is the fundamental basis for successful production equipment.

**ENGINEERING/STUDIES**

Modern engineering tools including stress analysis enable SMS Demag to design their equipment at the highest quality level. Further engineering services and/or studies can be agreed for:

- Layout and principal arrangement of the new equipment
- Optimisation of material tracking
- Interface check with existing steel shop equipment
- Verifying of production capacity, main technical indexes
- Simulation of existing production/material flow to optimise equipment usage
- Network studies
The second step of the know-how transfer is an off-site training of the customer’s engineers, technicians and skilled workers.

Here, the key personnel are given theoretical and practical training by SMS Demag’s former customers as well as their contract partners of today, who operate similar equipment.

The theoretical and practical training will include:
- Classification of scrap, alloys and slag agents
- Calculation of charge mix
- Practical furnace operation
- Metallurgical steel quality performance
- EBT tapping practice
- Safety instructions
- Maintenance training
- Trouble shooting

The main target of training on the customers’ site is to familiarise their personnel with hands-on operation of the supplied machines and equipment. The operators and maintenance personnel are trained step by step to prepare them for successful operation of the equipment. This training will start with the cold function test and will end with start-up of liquid steel production, thereby attaining the target production and performance figures.