

The electric arc furnace of the future

# Setting the Pace for the Future of Technology

Based on 40 years of experience in electric steelmaking, Siemens VAI focuses on the main areas for continual improvement, including optimizing consumption parameters, reducing tap-to-tap times and fulfilling the requirements of maximum automation. This results in following developments with respect to maximum operator safety, minimum manual operations, increased process flexibility, and lower offgas and electrical emissions.

## High efficiency with advanced injection technologies

The use of advanced Siemens VAI Refining Combined Burner (Simetal<sup>CIS</sup> RCB) technology and the application of post-combustion practice promote high bath turbulence and, consequently, a high heat transfer and scrap-melting rate. Since 1995, up to 100 furnaces – conventional EAFs and shaft furnaces, both AC and DC EAFs, for the production of carbon steel, stainless steel or specialty steels – were equipped with RCB technology. Excellent results have been achieved with this technology worldwide.

Designed for low maintenance, the RCB itself is made of two parts – a water-cooled copper front part and a rear part supporting the injection nozzles and quick media connections – which can be easily dismantled by removing a coupling strap. The oxygen mixing chamber is built inside the burner mouth to improve flame stability, and supported by central oxygen injection that leads to a more



250 t Ultimate EAF

powerful flame compared to a conventional burner.

Multipoint supersonic oxygen injection results in strong bath stirring and compositional and temperature homogeneity. Due to the angle and length of the laminar stream, oxygen injection is far more efficient than in other systems, which enables very low carbon content to be achieved quickly with favorable oxygen consumption rates. In addition to the shorter power-on time, the bath and slag oxidization levels can be carefully controlled.

Until now, RCB technology was available using natural gas, LPG and even coke oven gas as an energy source. With our latest development – the Simetal<sup>CIS</sup> RCB Oil – now even light diesel oil can be used if no natural gas is available. A specially designed spray nozzle combines oil and oxygen to provide efficient heating. In addition, a special molded burner flame optimizes the heat transfer. Special safety aspects have been integrated in the injector, including easy-to-operate control, for the highest level of on-the-job safety.



### Modular Injection Panel

In day-to-day operations, especially when using heavy scrap, oxygen flashbacks can occur with the result of severe damage. Due to their monolithic construction, conventional nose panels must then be completely replaced or repaired. Therefore, Siemens VAI has developed a new, easy-to-maintain design in a modular structure that combines side pieces with a front and cover plate, and each sensitive part can be replaced. The front plate in particular can be removed quickly using an exchange device attached to a crane. This allows it to be lifted quickly and easily towards the center of the furnace so that a new front plate can then be inserted and connected. Furthermore, there is no need to cool down the furnace before initiating the procedure. Additionally, a temperature sensor can be installed directly into the front plate for better thermal control and safety. The newly designed front plate has optimized water circulation, which allows safe and efficient cooling and ensures optimal heat discharge.

### Holistic process transparency

The environmental-control system Simetal<sup>CIS</sup> Offgas Analyzing System introduces a new holistic process model and reacts faster to the current process conditions. To gain close to real-time data from the furnace, the system uses two independent modules: Lomas (low-maintenance gas-analyzing system) and SAM (single air measurement of velocity and flow).

An automatic probe takes samples from the furnace atmosphere and measures the content of carbon monoxide, carbon dioxide, hydrogen and oxygen. With the proven analyzing technology and extremely short response time, Lomas provides highest reliability and availability and fast and easy detection of dangerous situations, e.g., increased concentration of carbon monoxide and hydrogen that can lead to explosions. SAM uses triboelectric cross-correlation technology to provide reliable gas-flow data within an extremely short response time. It measures the transport velocity of dust particles from the air pre-heater and determines the gas volumetric flow.

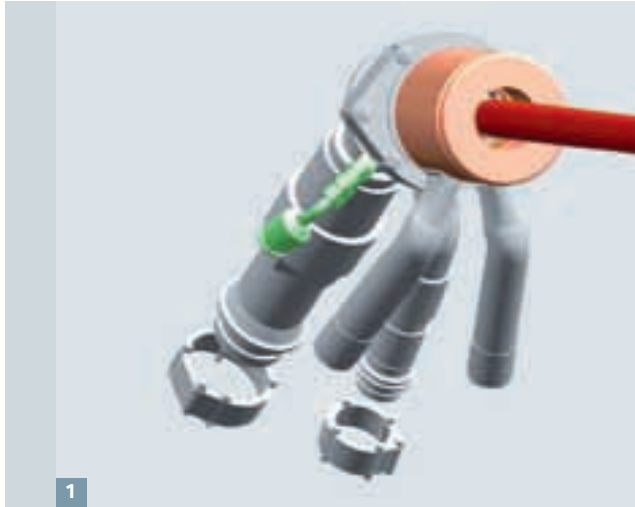
The analyzed data are used in a holistic process model to control the injection of gas, oxygen and carbon and to provide an optimized use of ingredients at a given point in time and in the required quantity. The main difference between the Siemens VAI model and most existing systems is the reaction corresponding to the actual process conditions – in other words, the actual furnace behavior. This is a significant step forward, especially when compared to the usual rigid control diagrams.

In this way, the Offgas Analyzing System saves electric and fossil energy, reduces the tap-to-tap time and makes the process even more transparent.

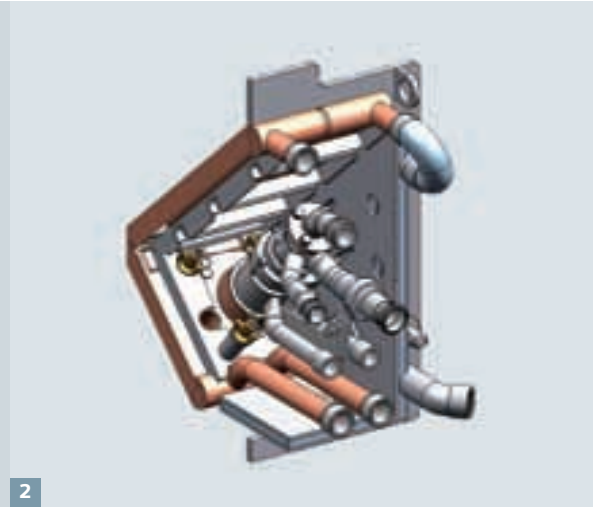
### Special robotic solutions ensure safety

In a steelworks environment, particularly where hot liquid metal is produced or processed, operators are exposed to dangerous working conditions. Siemens VAI has developed different robotic solutions to ensure the highest level of on-the-job safety and minimized power-off times.

The most flexible system – the LiquiRob – is based on an industrial six-axis robot with different tools to take care of a number of tasks. A possible working area is the tapping zone for automatic removal of the crown on the taphole after tapping using a special cutter. Taphole observation by means of a camera system is also possible. Thanks to its six-axis configuration, the system is flexible enough to implement further tools for taphole cleaning, such as oxygen lances or ramming scrap in the case of a taphole being blocked by scrap. Another working area for LiquiRob is right in front of the slag door. The system can handle different tools >>

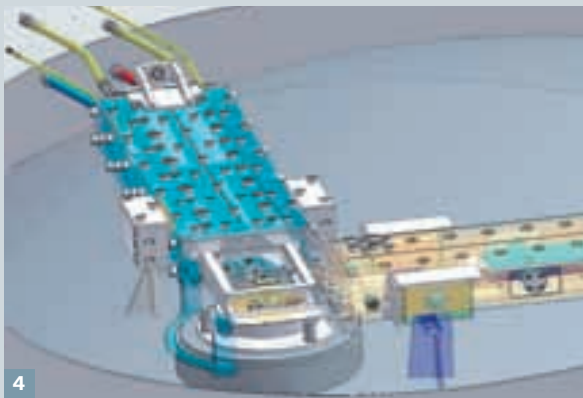


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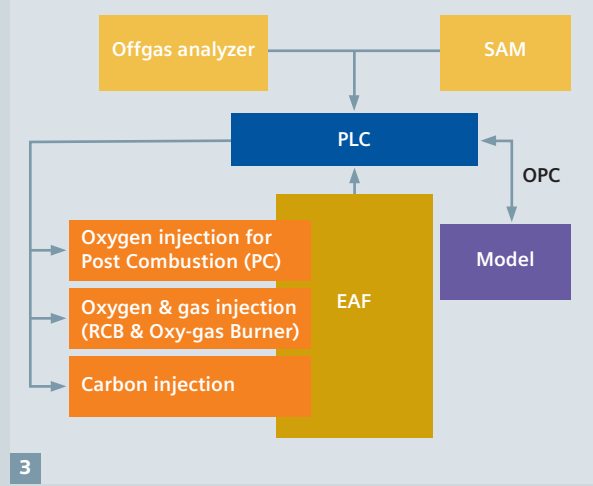


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- 1 RCB – oil application
- 2 Modular injection panel – the new radical design concept
- 3 Simetal<sup>CIS</sup> Offgas Analyzing System – layout principle
- 4 Taphole Scraper – position on the lower shell of the EAF
- 5 Slag Door Pusher – application for slag-door cleaning
- 6 Sampler – application through hole for taphole refilling



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>> to take temperature measurements or extract probes for sampling. With the included protection suit, cartridge magazine and motion controller, the system provides maximum operator safety and reduces manual operations to a minimum. In combination with a cartridge test, the hitting rate during sampling increases. Using this system provides maximum process flexibility and lowered cycle time based on optimized power-off time.

Scraper, Pusher and Sampler are further special solutions for taphole cleaning, slag-door cleaning and temperature and probe sampling. The Scraper is a device designed to automatically remove the crown on the taphole with a special cutter, and it uses a camera system for taphole observation. The steel-maker gets knowledge about whether or not the taphole is blocked by slag or scrap from remote pulpit

and about taphole wear and prediction for next taphole sleeve exchange or safe sand filling. The Pusher, either fully integrated into the working platform or as rail-based solution, provides semi-automatic slag-door cleaning and repeatable results for sill management and deslagging operation. The Sampler provides trouble-free temperature measuring and sampling under power-on in less than one minute. Based on proven, simple and flexible technology and a maximum range of 5.8 m, the system can be installed in any kind of furnace area. ■

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## Have a look –

The innovative approach that saves time and money:  
Simetal<sup>CIS</sup> RCB Modular Injection Panel video

