SIMETAL Ultimate

Leading EAF technology from a single source – powerful, flexible, environmentally compatible
Searching for the ultimate high-performance EAF

**Your challenge:**
The global demand for steel continues to grow – and if you intend to be part of this boom, you will have to boost the throughput and production volume of your plant.

What you need now is an electric arc furnace that’s totally top-of-the-line. That combines **high capacity** with maximum availability. That **flexibly** processes different charge materials. And that can produce a range of steel types – without long preparation times that slow down production.

At the same time, it’s crucial to **reduce costs** both when investing and during ongoing operations. To do this, you need simple, consistent operation, components with a long service life, ease of maintenance, and reduced personnel requirements.

And naturally, you also need to limit the impact your plant has on the environment – to ensure that you can comply with all regulations into the future and to fulfill your responsibility for ensuring a clean **environment**.

**Is there one solution that meets all these needs?**
## Standard is not Ultimate – comparing two types of EAF

<table>
<thead>
<tr>
<th>Conventional 120-t EAF</th>
<th>Ultimate 120-t EAF</th>
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</thead>
<tbody>
<tr>
<td><strong>Productivity</strong> 1.2 million tons per year</td>
<td><strong>Productivity</strong> 1.8 million tons per year</td>
</tr>
<tr>
<td>• at 320 net production days/year</td>
<td>• at 320 net production days/year</td>
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<tr>
<td><strong>2-bucket charge</strong></td>
<td><strong>1-bucket charge</strong></td>
</tr>
<tr>
<td>• scrap bucket 130 m³</td>
<td>• scrap bucket 185 m³</td>
</tr>
<tr>
<td>• furnace volume 145 m³</td>
<td>• furnace volume 210 m³</td>
</tr>
<tr>
<td>• w/c panel height up to 2.8 m</td>
<td>• w/c panel height up to 3.4 m</td>
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<tr>
<td><strong>Transformer design</strong> up to 1,000 kVA/t</td>
<td><strong>Transformer design</strong> up to 1,500 kVA/t</td>
</tr>
<tr>
<td>• 120 MVA for 120 tons tapping weight</td>
<td>• 180 MVA for 120 tons tapping weight</td>
</tr>
<tr>
<td>• secondary voltage up to 1,200 V</td>
<td>• secondary voltage up to 1,500 V</td>
</tr>
<tr>
<td><strong>Utilization of chemical energy</strong></td>
<td><strong>Utilization of chemical energy</strong></td>
</tr>
<tr>
<td>• 3 oxygen gas burners</td>
<td>• 3 oxygen gas burners</td>
</tr>
<tr>
<td>• 3 refining combined burners (RCB)</td>
<td>• 5 refining combined burners (RCB)</td>
</tr>
<tr>
<td>• 2 carbon injectors</td>
<td>• 4 carbon injectors</td>
</tr>
<tr>
<td></td>
<td>• 4 postcombustion injectors</td>
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SIMETAL Ultimate – the best from 40 years of experience

Our solution:
SIMETAL Ultimate bundles over 40 years of experience and innovative strength from Siemens VAI in the field of electric arc furnaces. Just about everything is “ultimate” in this new generation. State-of-the-art electric steel production technology and design features deliver maximum furnace performance – in terms of both quantity and quality.

Productivity: more energy input, greater performance
Extremely high energy input rates of up to 1,500 kVA/t liquid, innovative RCB technology to boost performance, and an enlarged furnace for single-bucket charging – only SIMETAL Ultimate offers all of these features in this combination. The result is extremely short tap-to-tap times – and therefore a real boost in productivity. At a capacity of 120 tons, for example, SIMETAL Ultimate delivers the same productivity as a 180-t standard EAF – or 50% more productivity at the same tapping weight.

Flexibility: it processes everything
Whether you’re working with 100 percent scrap or any combination of scrap, sponge iron, and/or hot metal – the charging materials can be loaded as desired in the required proportions. This extreme flexibility provides a solid basis for high throughput as well as reduced operating costs, because SIMETAL Ultimate cost-effectively processes whatever is available on the spot markets.

Availability: top results
SIMETAL automation enables simple, reliable operation. The use of well-designed, high-quality components ensures maximum availability. And all components, from hydraulics to electrode control, have power reserves.

Investment: down with costs, up with earnings
What does top performance mean in terms of investment costs? It means that SIMETAL Ultimate delivers 50% more productivity compared with standard EAFs – with the same building, crane, and ladle furnaces, and therefore significantly reduced investment costs.

Advantages of SIMETAL Ultimate
- Cost savings – low investment and conversion costs thanks to highly efficient use of space, energy, raw material, and personnel
- Highest production output – 50 percent more productivity compared with standard EAFs
- Maximum throughput – due to extreme flexibility with raw materials and finished products
- Highest availability – through simple and reliable operation with sophisticated automation and sturdy mechanical components
- Environmental compliance – thanks to the efficient use of energy and application of environmental technologies
Produce, produce, produce: SIMETAL Ultimate – maximum toughness, maximum availability

Really robust: the mechanical design
The mechanical engineering is designed for steady and exceptionally low-wear operation, with maintenance and repair limited as much as possible to planned periods. And when maintenance is needed, then it’s fast, efficient, and cost-effective. How does SIMETAL Ultimate make this possible?

Here are a few of the ways:
- The prismatic roller guide system for electrode columns – for minimized vibration and electrode breakage
- The sturdy, heavy construction of the tilt platform – for a long service life
- The special way the panel is affixed to the shell cage – to avoid panel movements
- The sealing between panels – for optimal tightness of the furnace
- The construction of the slag zone panel – for increased service life of the refractory in the slag zone, which minimizes refractory repair times
- The gantry design with a single-point roof lifting system – for easy access during maintenance

Smart operations: the automation
The automation in SIMETAL Ultimate supports efficient operation, slows down mechanical wear, and helps ensure top quality for the produced steel – for example, with optional infrared slag detection and robot-controlled cleaning.

An overview:
- Optional slag door pusher and cleaning robot – for efficient operation and maintenance
- Tapping from the main pulpit – for safe and easy operation
- Automatic scrap bucket positioning, controlled by main pulpit – for highest precision and efficient processes
- Optional slag detection using an infrared identification system (IRIS) – the precise and efficient way to improve steel quality
- Automatic sand filling – for minimizing personnel requirements
Your ultimate advantage

All key mechanical components and the automation are made by Siemens VAI. And you can be certain that as the EAF market leader, we deliver proven, superior technology. Our own workshops ensure that spare parts are always available right away – anywhere in the world.
From 90 to 320 tons: data, facts, background

The SIMETAL Ultimate concept features a larger diameter, which permits single-bucket charging – thereby reducing the power-off time by about two minutes. It also ensures an improved radius-to-power-input ratio for an optimized refractory index.

The transformer delivers 1.3 to 1.5 MVA/t liquid, of which up to 1.2 MW of active energy per ton of liquid can be used. RCB technology allows the complete exploitation of the chemical energy, regardless of whether an oxygen or carbon lance is used.
Start-up curve of 90-/120-t EAF

Start-up curve of 320-t EAF
In electric steel production, oxygen plays a crucial role on the exothermic reactions that support the melting and refining process. These reactions are also responsible for heat distribution in the liquid metal. The goal is to find the process routes and mechanical components with the highest availability. In 1995, we developed Refining Combined Burner (RCB) technology that combined a conventional oxy/gas burner with a supersonic oxygen injection lance.

**Injection process management**
Based on RCB technology, this high-power performance package operates completely automatically in accordance with the EAF process. The system includes oxy/gas burners and postcombustion oxygen injectors, and permits the injection of not only carbon but also any kind of fine material such as FeSi, FeCr, and dust. The injection process enables flexible and profitable solutions for any production route, ranging from 100% scrap to DRI/HBI or hot metal for carbon and stainless steel production.

**RCB technology**
The innovative RCB system is especially designed to optimize the injection of oxygen and carbon into the EAF. It ideally complements the electric arc energy input with additional exothermic energy created by chemical reactions of fuel or gas, oxygen, and carbon injected into the furnace. The complete RCB unit includes a nose panel that houses the RCB and the carbon injection lance.
The unique design of the nose panel provides a number of advantages compared with other systems:

- The distance between the oxygen/carbon streams and refractories minimizes refractory wear
- Ideal distance of the lance tip from the steel bath to enable a supersonic, laminar oxygen stream for a distance up to 1.8 meters; the nose panel positions allow a multipoint injection for a strong stirring of the bath
- Nose panel geometry that enables an oxygen and carbon impact angle for deep penetration into the slag and steel bath for intensive reactions
- Powerful and efficient burners
- Recovery of postcombustion energy within the EAF

**Main benefits:**
With more than 80 successfully operating RCB installations worldwide, the benefits can be summarized as follows:

- Ideal for all furnace types with varying raw-material inputs and produced steel qualities
- Highly effective O2 input into steel bath at high penetration speeds in support of scrap melting
- High degree of bath agitation and heat generation for elimination of cold spots
- Efficient carbon/oxygen injection for faster and more consistent buildup of foamy slag
- Shorter power-on time and considerably lower conversion costs
- Closed-door operation for reduced energy losses and false-air intake
- Possibility for steel decarburization and recarbonization, if required
- High degree of personnel safety
- Fast return on investment
Excellence from experience – selected success stories with SIMETAL Ultimate

### Success stories – showing how our technology delivers excellent results

<table>
<thead>
<tr>
<th></th>
<th>NMLK – Kaluga Minimill, Russia</th>
<th>Revda – Maksi Group, Russia</th>
<th>Çolakoğlu Metalurji A.S., Gebze, Turkey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transformer:</td>
<td>740 – 1,350 V 150 MVA</td>
<td>740 – 1,025 V 100 MVA + 20%</td>
<td>800 – 1,600 V 240 MVA + 20%</td>
</tr>
<tr>
<td>Tapping weight:</td>
<td>120 t</td>
<td>90 t</td>
<td>120 t</td>
</tr>
<tr>
<td>Oxygen total:</td>
<td>40 Nm³/t</td>
<td>33 Nm³/t</td>
<td>39 Nm³/t</td>
</tr>
<tr>
<td>Gas:</td>
<td>5 Nm³/t</td>
<td>5 Nm³/t</td>
<td>6.5 Nm³/t</td>
</tr>
<tr>
<td>Electrical energy:</td>
<td>350 kWh/t</td>
<td>325 kWh/t</td>
<td>334 kWh/t</td>
</tr>
<tr>
<td>TTT:</td>
<td>36 min</td>
<td>36 min</td>
<td>45 min</td>
</tr>
<tr>
<td>Productivity:</td>
<td>200 t/h</td>
<td>150 t/h</td>
<td>159 t/h</td>
</tr>
<tr>
<td>Production:</td>
<td></td>
<td>350 t/h</td>
<td>2,400,000 t/yr</td>
</tr>
<tr>
<td>RCB:</td>
<td>5 RCB/3.5 MW O₂ 2,500 Nm³/h</td>
<td>3 RCB/3.5 MW O₂ 2,000 Nm³/h</td>
<td>10 RCB/3.5 MW O₂ 2,750 Nm³/h</td>
</tr>
<tr>
<td>Burner:</td>
<td>2 burners; 3.5 MW</td>
<td>4 burners; 3.5 MW</td>
<td></td>
</tr>
<tr>
<td>Carbon injectors:</td>
<td>4 x 60 kg/min</td>
<td>3 x 60 kg/min</td>
<td>3 x 60 kg/min</td>
</tr>
<tr>
<td>PC O₂ injectors:</td>
<td>4 x 400 Nm³/h</td>
<td></td>
<td>4 x 400 Nm³/h</td>
</tr>
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</table>
SIMETAL EAF Ultimate epitomizes the 40 years of experience in plant construction. The integration of Voestalpine Industrieanlagenbau GmbH – and therefore VAIFuchs GmbH as well – into Siemens AG raised our expertise in complete systems to new heights. The success stories presented below provide just a brief impression of our comprehensive experience.

### The heart of a new minimill

**Customer:** NMLK – Kaluga Minimill, Russia  
**Plant type:** 120-t EAF Ultimate  
**Our solution:** Single-bucket-charged EAF with high power input  
**The result:** Ultimate productivity at low cost to feed highly productive minimill

### Ultimate charging

**Customer:** Revda – Maksi Group, Russia  
**Plant type:** 320-t EAF Ultimate  
**Our solution:** Replace the traditional Siemens-Martin furnace with a totally optimized production line for steel billets. We supported the customer during the complete integration of the system; in addition, we developed a structured financing package together with the customer.  
**The result:** The project was executed very quickly, considering the materials available. The designed capacity was achieved after only six months, which resulted in an extremely short start-up curve. This system has proven how Ultimate technology increases productivity in practice. This was just one of the many reasons that VAI Fuchs was awarded two more orders for the same equipment, this time for the entire production line.

### The world’s most productive furnace utilizing scrap metal

**Customer:** Çolakoğlu Metalurji A.S., Gebze, Turkey  
**Plant type:** 250-t EAF Ultimate  
**Our solution:** Among the world’s largest and most productive electric arc furnaces utilizing scrap metal; the development of this furnace has enabled us to implement an economical minimill concept for the production of flat steel products as well.  
**The result:** Minimized investment and optimized consumption charges