Evaporative cooling system of the waste gas duct for an electric arc furnace with steam transfer to the in-house steamork network.

THE PROJECT
GMH has a DC electric arc furnace producing exhaust gas temperatures of up to 1800 °C. The exhaust gas contains combustible parts which burn in the waste gas duct as well as liquid slag and steel. The previous cooling system was a combination of a cold water cooling system for the heavily burdened first element in the waste gas duct and an older evaporative cooling system for the remaining distance.

After an operation time of approximately 25 years this system showed considerable signs of deterioration and was proving difficult to maintain. Due to the discontinuous operation mode of the furnace the absorbed heat could not be used. GMH decided to build a new cooling system which did not have the problems of the current one.

OUR SOLUTION
It was decided to replace the whole cooling system. The new system, including the first element of the waste gas duct, was completely designed as evaporative cooling system.

• Extremely high exhaust gas temperatures in the first two elements of the waste gas duct and the tilting construction of the first element, which can be moved to the side while the furnace is loaded.

• Despite the typical variations of a charge furnace the steam generation should be as continuous as possible. This is achieved using intermediary steam storage.

• A generous spatial separation of furnace and cooling system considerably simplifies maintenance works during ongoing production.

• A quick automatic pressure relief of the isolated first two elements in the event of damage considerably increases the general plant safety.

• The switch of the cooling system was carried out during a very short scheduled maintenance downtime.

ABOUT THE CUSTOMER
GMH arose in April 1993 from the former Klöckner Edelstahl GmbH. Within a very short time period it turned into an independent, medium-sized company using the latest technology. Today GMH forms the major part of the Georgsmarienhütte group. GMH offers its customers the required high-level of flexibility and security with in-house sourcing of materials, production and processing. The 12 year history of the Georgsmarienhütte group shows that steel production can be profitable; even given the relatively high German production costs. In 2006 the group had a turnover of 2.255 million €.

2006 also showed an increase in profits compared to 2005 to a level of 112 million €, with 8.904 employees.
CUSTOMER’S ADVANTAGE

GMH has two advantages in the modernization of the cooling system:

On the one hand the plant availability is increased due to the more robust and easy to maintain evaporative cooling system.

On the other hand the new cooling system, which includes the extremely thermally loaded first element of the waste gas duct in the steam generation achieves a steam power of at least 20 t/h. The produced steam is mainly led directly to the vacuum stream degassing process.

Calculating with a value of 27 € for a ton of steam and assuming an average of 6,000 operation hours of the furnace per year, a gain of up to 3.2 million €/year is possible.

FACTS AND FIGURES:

<table>
<thead>
<tr>
<th>Plant type:</th>
<th>electric arc furnace 140 t/h with cooled waste gas duct</th>
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</thead>
<tbody>
<tr>
<td>Year of completion:</td>
<td>2009</td>
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<tr>
<td>Duration of project:</td>
<td>15 months</td>
</tr>
<tr>
<td>Gained steam quantity:</td>
<td>20 t/h</td>
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<tr>
<td>Steam parameters (pressure/temperature):</td>
<td>13–20,5 bar saturated steam</td>
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<tr>
<td>Project volume:</td>
<td>approx. 4.5 million €</td>
</tr>
<tr>
<td>Additional costs compared to simple cooling:</td>
<td>approx. 600,000 €</td>
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<tr>
<td>Value of heat recovered as steam:</td>
<td>approx. 3.2 million €/year</td>
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