Replacement of three LD (BOF) converters at voestalpine Stahl

voestalpine Stahl decided to replace three converters in LD3 steel plant in Linz, Austria. The goal was to increase the annual production capacity of good slabs from 5.4 to 6Mt. Because of extremely limited space and the need to keep the steel shop operating, this challenging project called for the application of innovative and exceptional solutions in design, transportation, dismantling and re-erection.

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Siemens VAI and voestalpine Stahl

When Siemens VAI was awarded the project for the replacement of the three converters, the company knew it was going to be one of its toughest jobs. Built in the early 1970s, the steel plant was designed for the operation of only two 110t converters. Over the years the converters were replaced with ever larger units and a third converter was added, finally making 3x160t in total. These three converters then had to be dismantled and exchanged with three 180t converters. Furthermore, the customer asked that all replacement work for each converter be carried out during ongoing operation of the other two converters. A tight time period of only seven weeks was foreseen for each converter exchange. This had to be co-ordinated with the scheduled shutdowns of two blast furnaces in the steelworks.

PROJECT IMPLEMENTATION
A Siemens VAI team of specialists worked closely with the customer’s project team. A highly detailed installation schedule, precise logistics co-ordinated with onsite and

Official site opening – January 7, 2009
Delivery of first converter to site – January 8, 2009
Shutdown of old converter No. 1 – March 2, 2009
First heat – April 27, 2009
Final acceptance certificate (FAC) – July 20, 2009
(FAC: RS 4.2.11)
Delivery of second converter to site – March 30, 2009
Shutdown of old converter No. 2 – June 7, 2009
First heat – August 21, 2009
FAC – December 14, 2009
Delivery of third converter to site – September 3, 2009
Shutdown of old converter No. 3 – January 11, 2009
First heat – February 26, 2010
FAC – April 26, 2010

Table 1 Chronology of converter replacement

Fig 1 Dismantling of the old converters
Fig 2 Transport of the pre-assembled converter by bay crane to the installation site
Fig 3 Converter in operation
STEELMAKING AND CASTING

thermal deformations of the converter and trunnion ring.

In addition to increasing the converter size, another key factor for boosting productivity was the extension of converter lining life from 3,000 to 4,000 heats per campaign. This increase was made possible by the application of an improved lining concept. Simetal slag stoppers were also installed to minimise slag carry-over during tapping. New ladle alloy and additive systems were also installed to ensure optimum charging techniques and steel de-oxidation.

Figures 1-3 illustrate some phases in the project.

START-UP AND OPERATIONAL RESULTS

The entire project was characterised by the close and excellent co-operation between voestalpine Stahl and Siemens VAI. Converter No. 1 was started on April 27, 2009, No. 2 on August 21, 2009, and No. 3 on February 26, 2010 (see Table 1). A total of 30 heats were tapped from converter No. 3 on startup day, illustrating the high immediate plant availability. Ramp-up of each of the converters to required production output was quickly achieved.

Table 2 shows a comparison of the operational performance of the old and new converters. Very similar monthly production figures were attained, with 209 fewer heats. Production and metallurgical expectations were fully met, and even partially exceeded.

Helmut Lechner was project leader at Siemens VAI and Herbert Moser was head of converter steelmaking during the project, now head of continuous casting at voestalpine Stahl, both at Linz, Austria.

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Table 2 Comparison of operational performance

<table>
<thead>
<tr>
<th>Plant parameters</th>
<th>Old converters</th>
<th>New converters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comparison time</td>
<td>May 2008</td>
<td>April 2010</td>
</tr>
<tr>
<td>Steel output (good slabs), t</td>
<td>467,087</td>
<td>464,753</td>
</tr>
<tr>
<td>Number of heats per month</td>
<td>2,951</td>
<td>2,742</td>
</tr>
<tr>
<td>Average heat size, t</td>
<td>158.3</td>
<td>169.5*</td>
</tr>
<tr>
<td>Heats per day</td>
<td>95.2</td>
<td>91.4</td>
</tr>
<tr>
<td>Average tap-to-tap time, min</td>
<td>31.5</td>
<td>33.7</td>
</tr>
<tr>
<td>Blowing time, min</td>
<td>13.4</td>
<td>13.8</td>
</tr>
<tr>
<td>C content in steel at end of blow, %</td>
<td>0.032</td>
<td>0.026</td>
</tr>
<tr>
<td>O₂ content in steel at end of blow, ppm</td>
<td>670</td>
<td>636</td>
</tr>
<tr>
<td>Fe content of slag, %</td>
<td>21.7</td>
<td>17.5</td>
</tr>
<tr>
<td>Metallic yield, %</td>
<td>90.5</td>
<td>91.6</td>
</tr>
</tbody>
</table>

*Converter heat sizes will be gradually increased to nominal capacity, co-ordinated with the start-up of the new CC7 Caster scheduled by September 2011.

operational conditions, and tight project management were essential for the success of this project. More than 500 pre-assembly, dismantling and installation steps had to be carefully timed and carried out. The equipment and systems to be installed included the converter shells, trunnion rings and bearings, converter suspension systems, pedestals, tilting drives, rotary joints, ladle alloy and additive systems, pneumatic slag stoppers, doghouses, off-gas hoods, and electrical and Level 1 automation systems.

The manufactured converters were shipped to the harbour facilities adjacent to voestalpine Stahl via the Rhine-Main-Danube Canal. Each trunnion ring was delivered in four parts and the converter vessels in three sections. In order to keep converter downtime to a minimum, onsite pre-assembly work had to be maximised. The weight of the pre-assembled converter units was kept to under 250t so they could be safely transported by the bay crane to the installation site.

The existing converter foundations had to be partly renewed to provide space for the increased converter size. In a special technique applied for the first time, the top section of each foundation was sheared off with a diamond-studded cable saw and replaced with a new reinforced foundation cap. A special trunnion bearing was also installed to support the increased horizontal forces of the new converters. As a result, total renewal of the foundations was not necessary.

Because of the extremely restricted space, a new, highly compact and maintenance-free converter suspension system – known as Simetal Compact Link – was developed to allow use of converters with the largest possible reaction volume. This innovative solution features two horizontal links and eight vertical lamellae that accommodate