Slab-Caster Upgrade at UGINE & ALZ Genk, Belgium.

Innovative Solutions in Project Management and Initial Operational Results

G. Moermans, J. Steegmans, R. Weckx, B. Berger, J. Lanschützer, O. Schulz, M. Thalhammer

In November 2000 the Belgian stainless-steel producer UGINE & ALZ Belgium nv, a company of the Arcelor Group, awarded VAI a contract for the upgrading and expansion of their steelmaking plant. The overall project included the revamping and supply of new equipment and systems for the steelmaking, continuous casting and environmental-protection facilities.
An essential part of this ambitious modernization program was the upgrading and expansion of the existing single-strand slab caster, with an output of 600,000 t/a, to a combined single- or twin-strand slab caster with a nominal production capacity of 1.2 million tons—the world's largest stainless-steel slab caster. All upgrading and installation activities had to be carried out within an extremely tight caster shut-down period of 21 days only in order to minimize production losses.
This paper discusses the innovative project-management solutions implemented in combination with extensive preassembly activities and workshop testing to assure the successful outcome of this project. Initial productivity and slab-quality results are also presented.

INTRODUCTION

In 2000 UGINE & ALZ Belgium nv (UGINE & ALZ), the Belgian-based stainless-steel producer of the Arcelor Group, decided to double their annual production capacity from 600,000 tons to 1,200,000 tons. A significant portion of the investment was for the upgrading and capacity expansion of the existing continuous-casting facility (Figure 1).
VAI was selected to implement this project on the basis of the offered technology and their experience in the modernization of slab-casting machines. The caster was to be expanded to allow for both single and twin-casting capability—which is not so common for stainless steel slab producers—with single-slab widths of 1,040–2,100 mm and twin-slab widths of 2 x 900–1,050 mm at thicknesses of 160 and 200 mm (Figure 2). The increased caster capacity was commensurate with the higher steel plant output resulting from the installation of a new electric arc furnace and AOD converter as part of the overall project awarded to VAI.
The new casting machine is larger than the old one, wider (max. 2,330 mm) because of the necessity of twin casting, requires a longer metallurgical length (23.9 m) because of the increased ca-

Figure 1: Layout of the Slab Caster Before Upgrading.

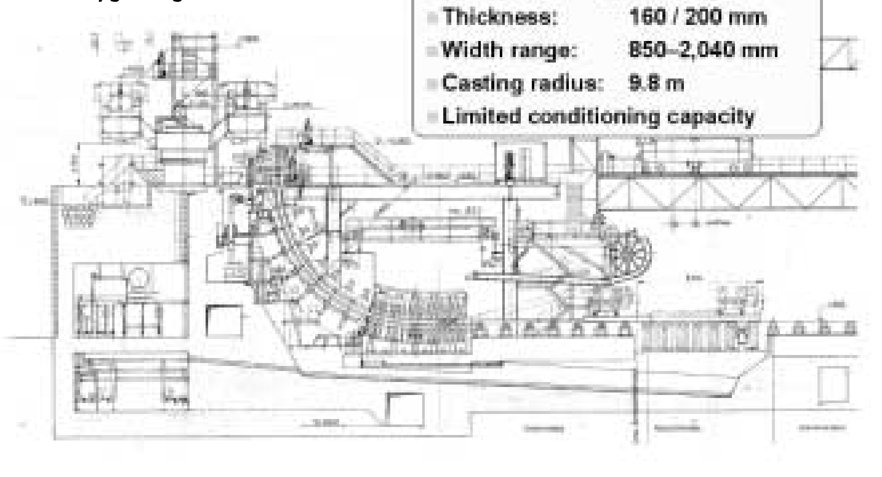
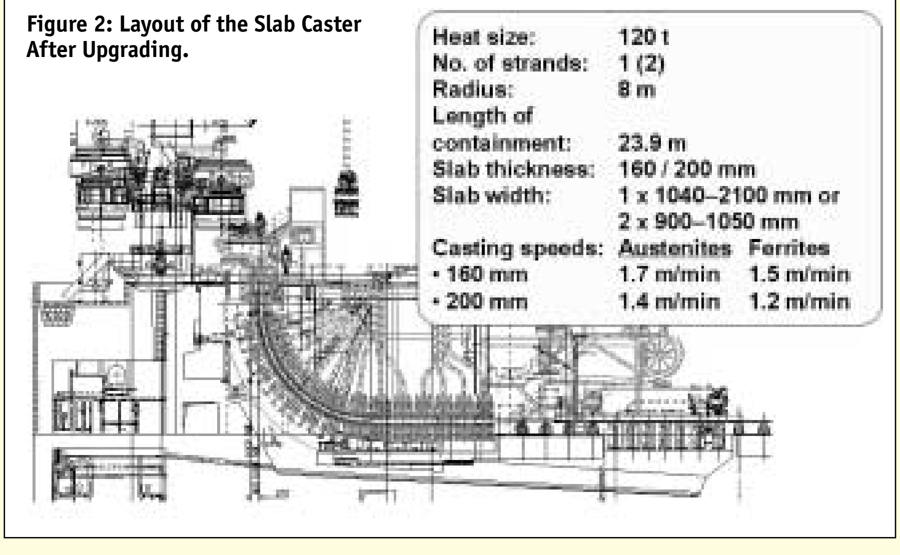


Figure 2: Layout of the Slab Caster After Upgrading.



G. Moermans, J. Steegmans, R. Weckx
UGINE & ALZ Genk nv
Genk/Belgium

B. Berger, J. Lanschützer, O. Schulz, M. Thalhammer
VOEST ALPINE Industrieanlagenbau GmbH & Co (VAI)
Linz/Austria

sting speeds, and is higher because of the increased vertical length for product-quality optimization. Therefore, enormous effort and innovative solutions were necessary to accomplish all caster upgrading and expansion activities, including cold testing, within an extremely tight time schedule.
In order to minimize the production losses during the caster upgrading—estimated to be at EUR 500,000/day—It was agreed that the time for the execution of all revamping activities had to be limited to 21 days only. This, of course, meant an immense coordination and logistical challenge for the project management team. Immediately following the contract awardance a VAI project management team was therefore assembled to ensure that the slab caster stoppage could be limited to within the specified time restraints. The following project activities were initiated:

- Nomination of a highly experienced caster team comprising 6 key persons with an average age of 47 years and an average of 23 years of experience in the implementation of continuous-casting projects
- Detailed investigation of all caster-relevant factors (existing equipment and installations, operational procedures, potential bottlenecks, etc.) within the caster area to eliminate any unforeseen situations
- Extraordinary detailed engineering, taking into consideration all aspects of prefabrication, equipment pre-assembly, pre-installation and factory testing
- Detailed planning of all steps for caster dismantling and re-installation
- Specification of detailed organizational and implementation steps to optimize working efficiency.

ENGINEERING PHASE

During the engineering phase special precautions were taken to ensure that the equipment installation could be carried out within the shortest time possible. Detailed surveying of the existing machine foundations were conducted. The steel structure of the new caster was designed to enable pre-fabrication to the greatest possible extent. Collision checks between new and existing equipment on the basis of detailed 3D CAD (computer-aided design) analyses were also performed (Figure 3).
The exact location of existing foundation bolts—which were to be reused when possible—was surveyed and they were investigated for damage and corrosion. The screws were loosened to determine if the thread was still intact and several different nuts were designed in the case that the thread was damaged during the dismantling of old equipment. The new equipment was designed in such a way that a shift of the equipment by several centimeters would be possible if any bolts were incorrectly positioned. These precautions ensured that all bolts could be used without the necessity of cutting and rewelding the large M80 bolts, which would have taken around 8 hours per bolt.

FABRICATION AND PRE-ASSEMBLY

To minimize onsite construction time, pre-assembly of the entire caster and extensive workshop integration tests were carried out in Linz, Austria, prior to shipment (Figure 4). Even stairways and valve stands were attached to the outer side of the strand-guide support structure, and the complete piping for the cooling, hydraulic and lubrication systems were preinstalled.
The segments, which were manufactured in an adjacent workshop, were inserted into the support structure, followed by the installation of the mold oscillator and bender. Finally, the individual strand guide components were carefully measured and shimmed.
As a customer requirement, the interchangeability of the segments of each section was already demonstrated during these pre-assembly activities. Afterwards, these equipment portions were disassembled in pieces of maximum possible size. In order to assure rapid, smooth and efficient installation of the equipment onsite, the same team of specialists that performed the integration tests in Linz was sent to UGINE & ALZ in Belgium.
The complete ladle operator station with dimensions of 31.2 m by 2.5 m by 5.7 m, containing the upper support structure of the semi-gantry tundish cars, was erected on the casting floor while the existing casting machine was still in operation (Figure 5). Then, during the revamping activities, the complete structure, which already contained all interconnecting piping, was moved into its final position, aligned and welded to the base plates.
The tundish cars were completely prefabricated, including electrics and sub-systems. They were fully tested at the manufacturer's workshop and shipped to the plant site in one piece. During the onsite installation of the various units, complex sequences of moving and turning the tundish cars were necessary. Both the main crane and a mobile crane were used for the lifting of the tundish cars to the casting floor and their installation in the designated positions (Figure 6). A move of one tundish car to its final position took only about 5 hours, compared to a typical erection time of several days, if the tundish installation had been done in a conventional manner.

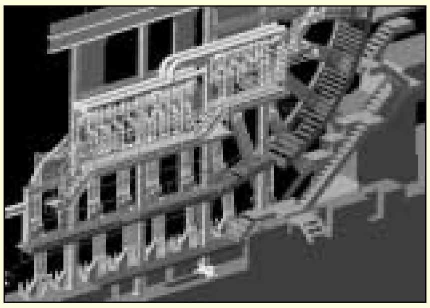


Figure 3: 3D Caster Layout .

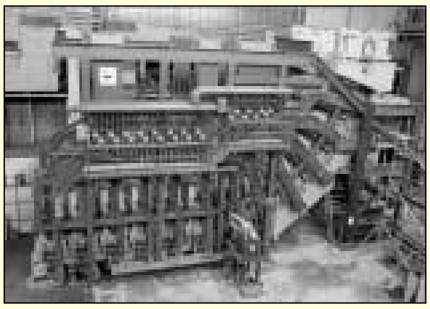


Figure 4: Workshop Integration Testing.

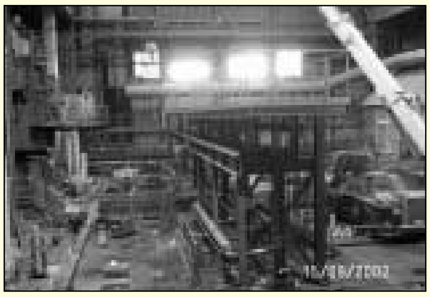


Figure 5: Ladle Operator Station.

Figure 6: Tundish Car Installation.

DISMANTLING AND INSTALLATION OF EQUIPMENT

A very strict organization of the involved project teams was mandatory during the 3-week shutdown period. The working crew was split into small groups of 5 to 10 individuals, each responsible for a specific area or job.
Two short strategic meetings were held each day to supervise the overall progress and to coordinate the necessary changes of priorities and specific actions to be taken in order to cope with delays in individual areas. In this way the key project personnel of UGINE & ALZ, VAI and the companies responsible for mechanical

Figure 7: Quantities of Dismantled, Relocated and Installed Equipment.

	Dismantled	Relocated	Installed
Structure/Equipment	800 t	30 t	1400 t
Piping	10 t	2 t	26 t
Cabling	10 km	3 km	40 km

(Quantities without spare parts and water-treatment facilities)

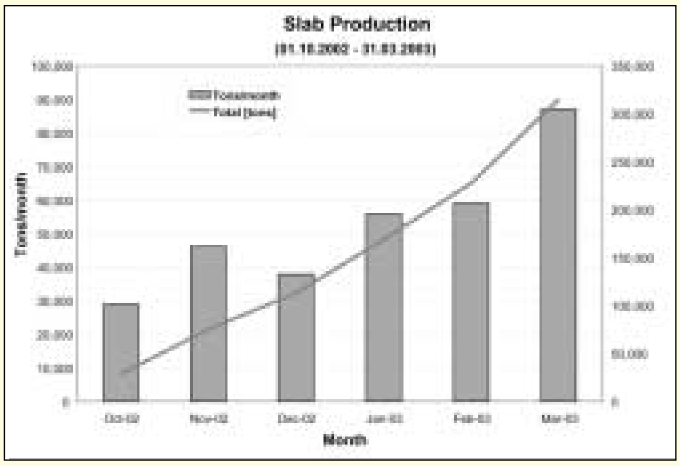


Figure 8: Production Start-up Curve During the 1st Six Months of Operation (Seasonal Outage in December).

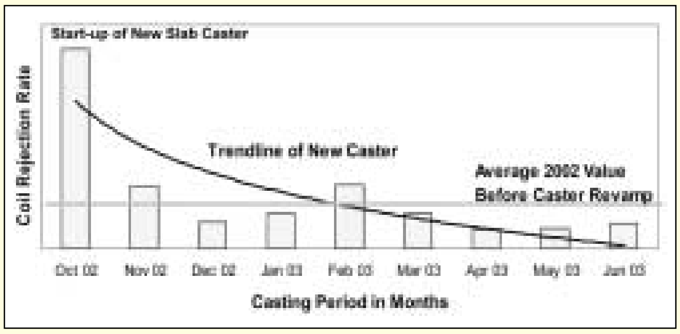


Figure 9: Rejection Rate for Cold-Rolled A304 Steel.

Figure 10: Successful Start-up of the World's Largest Stainless Steel Caster.

work, piping, electrics and automation could clarify the following questions and enact decisions with respect to

- Safety issues and general regulations
- Status of progress within each individual location or system
- Work to be done within the next 12 hours
- Changes in the time schedule according to the actual situation
- Work priorities, in cases where they could not be simultaneously carried out
- Specific actions to be done to improve progress in areas of concern
- Designation of specific people to ensure progress in areas of concern.

Figure 7 provides an overview of the total equipment quantities that had to be dismantled, relocated and newly installed.

TESTING

The testing procedure was an integrated part of the installation activities. Equipment testing already commenced even during the installation of other major equipment items. Specific time windows were designated for integration tests during installation. During these times the caster was operated in the cast-simulation mode to simultaneously test the complete caster equipment.

START-UP AND INITIAL RESULTS

After only 19 days of plant stoppage the caster was declared ready for operation. One additional day was used for more intensive training of the operators. On October 1, 2002, one day ahead of the project time schedule, the machine was successfully started up. Production was quickly ramped up and single slabs were continuously produced in thicknesses of 160 and 200 mm and twin slabs in a thickness of 200 mm (Figure 8).

Casting rates of up to 4.2 t/min (= 250 t/h) were achieved, which is a worldwide novelty for a stainless-steel slab caster. On March 26 2003, the performance test of the entire steelmaking plant was successfully completed after a total of 404 ladles were cast within a period of 14 days.

Parallel with the high caster throughput rate (up to 4.2 t/min) a high level of quality could be maintained. Figure 9 illustrates the continuous quality improvements since the start-up of the stainless-steel slab caster.

CONCLUDING REMARKS

The highly successful start-up of the upgraded and expanded stainless steel slab caster at UGINE & ALZ, Belgium, was the logical result of detailed and all-embracing preparation activities during the preliminary stages of the project, and the result of expertly organized organizational, logistical and installation activities at the plant site itself. Extensive continuous casting experience in combination with expertise in engineering, plant-building, pre-assembly and equipment testing, together with the outstanding cooperation with experienced and highly trained UGINE & ALZ personnel, were the decisive factors for the success of this project.