



# CUSTOMER EMBEDDED MAINTENANCE ORGANIZATION FOR CONTINUOUS IMPROVEMENTS<sup>1</sup>

## BEST PRACTICE EXAMPLES FROM SIEMENS VAI MAINTENANCE SERVICES EXPERIENCE

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### Abstract

Continuous improvement in equipment performance, product quality and total cost of ownership have been achieved by establishing maintenance organizations fully integrated with the customer organization and a “win-win” relationship between steel plant operators and Siemens VAI as a provider of maintenance services, in particular in the area of continuous casting. Based on 25 years of experience in maintenance operations in USA, Brazil, South Africa and China, the key elements of a sustainable partnership between steel plant operators and a world class maintenance service provider are described. Models of cooperation between a steel plant operator and a service provider will be explained, and the success criteria will be discussed.

**Key words:** Maintenance; Continuous casting; Best practice.

### Resumo

A melhoria contínua no desempenho dos equipamentos, qualidade do produto e o custo total de produção foram alcançados estabelecendo organizações de manutenção, que ficam plenamente integradas com as organizações do cliente em uma relação "win-win" entre os operadores das plantas de fabricação Siemens-VAI como prestadora de serviços de manutenção, em especial na área de lingotamento contínuo. Baseado em 25 anos de experiência em operações de manutenção nos EUA, Brasil, África do Sul e China, os principais elementos de uma parceria sustentável entre os operadores da aciaria e um prestador de serviços de manutenção da primeira linha são descritos neste trabalho. Modelos de cooperação entre um operador de usina siderúrgica e um fornecedor de serviço será explicado, e os critérios de sucesso serão discutidos.

**Palavras-chave:** Manutenção; Lingotamento contínuo; Melhores práticas.

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### Success story of Siemens VAI Maintenance Services in the US<sup>i</sup>

In 1985, VOEST-Alpine, the former owner of Siemens VAI, started up 2 slab casters at Bethlehem Steel in Sparrows Point to replace the outdated ingot casting process. Bethlehem Steel asked VOEST-Alpine to provide caster offline maintenance services, because they did not want to go through the learning curve for maintenance of the new technology. In 1985, managers and engineers from VOEST-Alpine steel plant maintenance started up a caster repair workshop adjacent to Bethlehem Steel Sparrows Point.

The scope of caster maintenance services mainly relates to the following topics:

- Selected preventive maintenance activities
- Unit change in the plant (remove & replace)
- Repetitive repair and refurbishing work in workshops focusing on wear parts and assembly-units
- Improvement of the service life of repaired units
- Manufacture of selected spare parts
- Management of all related spare parts

More than 20 years of sustainable development and growth in rendering maintenance services for slab, bloom and billet casters designed by our company as well as by other suppliers demonstrate the competitive advantage of maintenance services by Siemens VAI.

This is mainly based on a unique symbiosis of engineering, providing service and operational experience together with market leadership in design and installation of slab casters and permanent R&D related to increasing the service life of components.<sup>ii</sup>

Our service departments continuously provide maintenance services to more than 20 steel plants in the US.



### Success story of Siemens VAI Maintenance Services in Brazil<sup>iii</sup>

In 1999, Companhia Siderurgica Nacional (CSN), Volta Redonda, RJ, Brazil awarded a Contract for off-line caster maintenance to VAIS do Brasil (now Siemens VAI Metals Services Ltda; SVS). Initially, the contract was based on a price menu combined with performance control (CSN's specific cost based on former budget and a bonus system (if maintenance cost was below CSN's budget)). However, it turned out, that this concept consumed too much management time and attention on both sides. Therefore the contract was renegotiated in 2002, with following main changes:

- Elimination of menu prices and bonus model (consumed too much management capacity on both sides)
- Monthly payments in Brazilian Real per ton → shift maintenance to variable cost
- SVS responsible for spare parts procurement
- Streamlining of all administrative procedures
- Specific caster maintenance cost (BRL / ton) based on realistic caster unit change plans and on caster unit lifetime targets

The scope of services rendered by SVS was extended to cover the following items:

- Mounting & dismantling of molds & segments
- Caster roller refurbishing
- Mold copper refurbishing
- Refurbishing of spare parts (bearings, axles, etc.)
- Spare parts management (SAP)
- Spare parts procurement
- Nickel – plating of mold coppers
- Takeover of existing spare parts stock

CSN's obligations were simplified to performance control (lifetime of molds & segments) and monthly payments (specific cost x production).



The new contract supported the development of a win-win relationship enabling further developments, e.g.

On-line Caster Maintenance (starting 2004)

- Change of segments in the caster machines
- Measurement & adjustment of pass-line, gap and bending
- Lubrication services
- Sporadic jobs e.g. repair of frames, oscillator, etc.

Introduction and / or test of new developments

- Ni – plating: NiFe, NiCo, etc.
- Inner Cooled Rollers (spiral)
- Galvanized Rollers
- DIAFACE (Narrow-face Coppers new design)
- Development of special welding wire for longer “no wear” roller lifetime
- Various small improvements to extend lifetime of components

The contract with CSN has been repeatedly renewed. In addition, SVS started the manufacture of rollers as well as Nickel – plating services for other companies.

Based on the fact, that Siemens VAI Maintenance Services was able to outperform all competitors on the Brazilian market, SVS signed a long-term maintenance contract for the new integrated steel works of ThyssenKrupp in Sebetiba, Rio de Janeiro state in Brazil. The 15 years contract covers central maintenance mechanical and E&A, caster maintenance based on cost per ton as well as on-line maintenance for the complete integrated steel plant. Maintenance workforce will be above 600.

### **Customer’s advantages from Siemens VAI Maintenance Services**

To reduce overall cost of production and to increase the value of the steel produced, our service department deliberately dedicates the maintenance spending to the place where it has the best leverage.



This philosophy is strongly supported by the win-win relationship created e.g. by cost per ton contracts as shown in the example of CSN.

Trying to save money at the wrong place – which may often be associated with conventional concepts to reduce maintenance cost – often has detrimental consequences like:

- Quality downgrades due to cracks occurring as a consequence of high wear
- Loss of yield
- Loss of production due higher share of downtime
- Higher cost for equipment due to earlier replacement needed as a consequence of improper maintenance
- Higher overall maintenance cost due to lower mean time between repairs
- Higher specific overhead cost due to lower production

Therefore, finding and sustaining the optimum amount and place for maintenance spending is of utmost importance to every steel mill operator.

### **Key elements of success for Siemens VAI Maintenance Services**

A win-win relationship, e.g. based on a cost per ton service contract is the driving force for improvements.

This is key to meet plant performance criteria defined by the customers (e.g. tolerances necessary for sustainable production of high quality slabs, low portion of downtime due to maintenance), and to continuously improve component lifetime and lower overall maintenance costs.

Component life improvement is the key to improve overall equipment effectiveness. One target is “no wear” during the target lifetime of a component in order to secure consistent slab quality. The successful implementation of this guiding principle can be demonstrated at the example of the wear pattern of bender zone rolls observed after surpassing the target lifetime of 600.000 tons of slab cast. Virtually no wear (less than 0,2 mm) has been observed before end of target lifetime.



	Wear Outerbow			Wear Innerbow		
1º	0,13	0,09	0,10	0,02	0,05	0,04
2º	0,03	0,20	0,13	0,03	0,02	0,03
3º	0,02	0,13	0,05	0,05	0,04	0,01
4º	0,01	0,10	0,01	0,05	0,08	0,02
5º	0,06	0,09	0,02	0,04	0,05	0,03
6º	0,01	0,12	0,01	0,03	0,06	0,04
7º	0,05	0,15	0,10	0,02	0,07	0,01
8º	0,01	0,08	0,02	0,01	0,04	0,02
9º	0,01	0,06	0,11	0,01	0,04	0,02
10º	0,02	0,05	0,05	0,02	0,03	0,02
11º	0,04	0,08	0,15	0,01	0,07	0,01
12º	0,02	0,05	0,06	0,01	0,13	0,05
13º	0,03	0,12	0,02	0,02	0,08	0,02
14º	0,02	0,05	0,02	0,03	0,05	0,03
15º	0,04	0,01	0,03	0,02	0,02	0,01

Figure 1: "No-wear" component lifetime: Wear on Bending Zone after 609.705 tons (wear in mm).

## Discussion

The continued success of maintenance services operated by Siemens VAI is based on a strong network of maintenance operations in the Europe, USA, Brazil, South Africa and recently also China and Middle East. This network is coordinated and supported by a business development group based in Linz, Austria for development of new maintenance contracts and establishment of new maintenance operations as well as for know how sharing and continuous improvement.

One important element of this success in maintenance outsourcing is the awareness of pitfalls and continued endeavors to avoid them. One of the pitfalls most frequently observed in maintenance outsourcing is that steel operators do not sufficiently acknowledge the value of indirect activities like maintenance engineering, predictive maintenance activities, maintenance planning, supervision, expertise and training for continuous improvement and quality assurance. As a consequence, they are tempted to purchase services at the lowest hourly rate or the lowest unit price. This leads to a degradation of maintenance quality with adverse effects on product quality, equipment performance and equipment lifetime. At the most successful steel operators, a continuous increase of the share of indirect activities in maintenance can be observed. CSN has been rated TOP 1 competitive steel producer in Brazil and TOP 4 in



the world by WSD. We are proud to provide caster maintenance services to CSN since more than 10 years.

While there are certainly merits in using key performance indicators (KPI) for improving maintenance operations, there are a number of pitfalls, which can turn their use into adverse effects. Some examples of adverse effects caused by inappropriate use of KPI's:

- Too many KPI's create bureaucratic burden for measuring analysis and discussion
- Different KPI's between the operator and the service provider immediately create a win – loose / loose – loose situation
- KPI's not exactly measurable create conflicts and frustration
- Combining the wrong KPI's with bonus / penalty payments hinder analysis of root causes for undesired developments and are therefore an obstacle to continuous improvement

The most important step to achieve a win-win partnership is of course a change in the mindset, which is traditionally anchored in purchasing organizations. Fighting for the lowest price and toughest terms by tendering and playing competitors against each others may be effective in projects for delivery of equipment. It is not the basis for long term partnership. This requires first a prequalification of the best suitable partner. Then, the focus needs to be put on the alignment of goals and strategies. This has to cover the joint development of an operation and maintenance philosophy as well as relevant KPI's. Finally, a contract model avoiding pitfalls and aligning the interests of both parties with performance based payments reflecting the structure of cost and setting reasonable incentives in line with the strategy needs to be established – and continuously improved.

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<sup>i</sup> Reiter, Ludwig: "Win-Win Relationship for Plant Performance Improvements". Siemens VAI Metals Symposium Shanghai 2009

<sup>ii</sup> Brower, Jeffrey: "Maintenance for the New Millennium" Presentation to IISI. 2006

<sup>iii</sup> Trnka, Karl; Reichel, Erhard. CCR 2004. Linz Austria