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ROLLING MILL SERVICES: SLITTING SPECIALISTS[1]

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Abstract
Outline given into the structure of Siemens VAI in the UK, and it's recent combination of two previous mill service/spares groups, Ashlow and Morgan. Focus of paper on bar mills and the extra possible tonnages a mill can produce when adopting a good slitting package. Explanation of how slitting works and the changes a mill needs to adapt to its guides and pass design. Previous references and possible cost saving that can be achieved.
Key words: Bar mills; Slitting process; Pass design.

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Resumo
Destaque dado dentro da estrutura da Siemens VAI Reino Unido e sua recente combinação de dois grupos de serviços e sobressalentes para laminador, Ashlow e Morgan. O Foco desse trabalho são laminadores de barras e a possibilidade de tonelagem extra que um laminador pode produzir adotando um bom pacote divisão de veios. Explicação de como funciona a divisão de veios e as alterações necessárias para adaptar-se às suas guias e desenhos de passes. Referências anteriores e possível economia de custos que podem ser alcançados.
Palavras-chave: Laminador de barras; Processo de divisão de veios; Desenho de passes.

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1 INTRODUCTION

Siemens VAI is one of the biggest producers and suppliers of rolling mills and metal making equipment in the world. To date the company has over 9,000 employee's world wide, spread across 40 countries. Each country specializes in a different area of the metals industry, ranging from manufacturing to design, sales to development. Siemens VAI is seen as a world leader and a company that is always moving the industry forward.
Within the UK, on the Sheffield site there has recently been a structure change to the Long Rolling section (formally Ashlow Guides) this section works closely with Siemens VAI –Italy (formally Pomini) to supply Rod and Bar Mills. In 2008 a new member was added to the Siemens VAI group, the 'Morgan' construction group. Morgan is based in the USA, Worcester but also has an office in Sheffield, the Europe office.
This has now made the Sheffield office in the UK stronger as it has now incorporated Morgan Europe into there site and the whole Long Rolling Services group is now stronger with the addition of Morgan.
Together all three sites that make up the Long Rolling group are focused on producing quality steel rolling mill equipment and furthering the development of new techniques, to advance the production of rolled steel long products.
In recent years the biggest development in Rod and Bar mills has been the process of slit rolling. This process is used to increase production within a Rolling mill and to reduce operating costs. Siemens VAI in now considered one of the world leaders in Slit rolling packages, with over xx successful slit packages installed to date.

2 MULTI-SLIT ROLLING

2.1 Introduction to Multi-Slit Rolling

The implementation of the multi-slit rolling processes into bar mills has without doubt revolutionized the production of reinforcing bars (re-bar), for the construction industry. Siemens VAI are honored and proud to have played a key roll in this and also in the ongoing development of slitting, which greatly increases the production capacity of rolling mills.
However, before introducing the latest developments and full benefits gained from multi-slit rolling, it is first beneficial to gain an understanding to the most common process available to-date.
In the conventional rolling mill process of bar products a billet is passed through the rolling mill with mill rolls having various pass grooves and a single strand of bar is produced.
In the multi-slit rolling process however, rolling is performed by using a different mill roll pass design. This design allows for a single strand bar to be rolled in the roughing and intermediate rolling stand sections. The single strand bar then enters the finishing mill rolling stands section, and is divided into 2, 3 or 4 strands, and then conveyed onto the cooling bed.
The method for dividing the single strand bar is achieved by a combination of mill roll pass and roller delivery guide (slitting guide) designs.

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The slitting stand mill roll passes are cut to accept a single strand bar, which has a dog bone shape (Figure 1). The mill rolls are set to a roll gap of approximately 1 mm. The dog bone shape enters 2, 3 or 4 passes within the mill rolls and is almost divided in two separate bars.

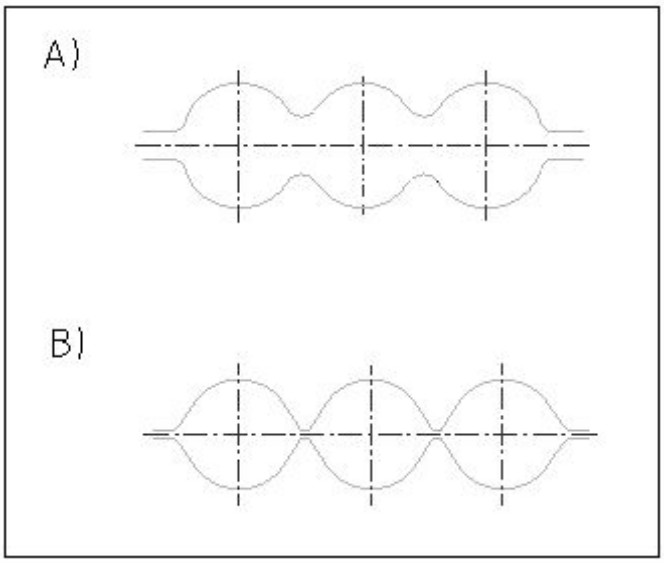

Figure 1. Roll pass design slitting groves: (a) dog-bone; (b) slit pass.

This single strand bar then passes into the slitting delivery guide and the process of dividing it in to separate bars takes place. This is achieved by 2 rollers within the guide, which by means of a wedging effect produce an outward force on the single strand bar deformed sections, and forces the sections to separate by tearing the membrane.
The advantage gained by using this application for multi-slit rolling is that continuous rolling is performed in a stable manner for an extended period of time, resulting in a high working ratio.
High capacity output can be obtained for small finishing sizes at moderate finishing speeds.
Multi-slit rolling is now accepted as an efficient rolling method, its application offers substantial advantages in terms of productivity, equipment, rolling costs and accuracy.
The rolled bar is divided into separate bars by slitting. This means that, in the process, the finishing stand produces a correspondingly greater area than produced by conventional single strand rolling. Therefore the number of rolling stands necessary for multi slit rolling is reduced to a minimum and remains constant.
It follows therefore that the mill building space required is also reduced substantially in the case of multi-slit rolling.
A typical pass design showing all stands, indicating the application of 2, 3 slit rolling to an existing single strand bar mill is shown in Figure 2.

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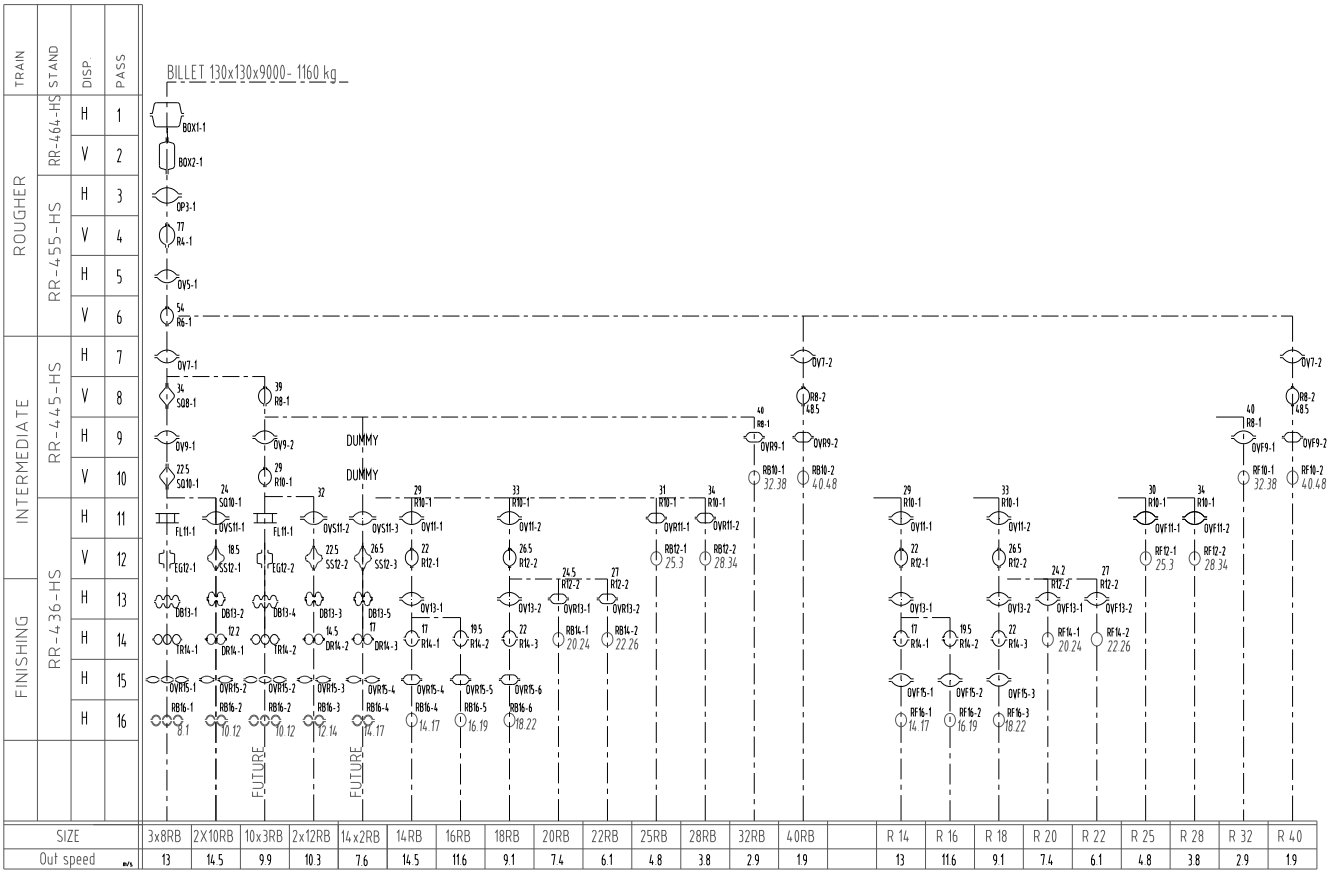

Figure 2. Roll pass design layout.

The pass deign shown in Figure 2 would have been designed for a particular mill that had a 120 tonne per hour furnace with a billet size of 130 mm square x 16 m long and a finishing speed of 14 metres per sec.

It is essential to closely analyze the power and speed requirements when applying multi-slit rolling to an existing mill, since there are often deficiencies in installed power and gearbox ratios. Therefore graphical speed cones for all bar sizes should be produced together with power calculations.

In particular special attention should be paid to the capacity of the mill shears as the bar sections will increase.

Although the pass design will normally only need to be modified in the last eight stands, to correctly implement multi-slit rolling it is also essential to carry out speed and power calculations throughout the mill for all positions. This means first staring in the roughing stand to the last finishing stand.

Following many installations Siemens VAI are able to confirm that the investment in multi-slit rolling is one of the few investments in a rolling mill which will allows a quick repay time to the investment. Results in payback are expected to be as quickly as 6 months, subject to the product mix.

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2.2 Slitting Development

Siemens VAI is considered to be one of the world leaders in slit rolling packages and are seen by many mills as one of the key mill builders that are continuingly developing and improving the slit rolling process. One of the reasons for this is the amount of successful slit project installed, in the last 10 years Siemens VAI - Long Rolling has been involved in over 25 bar mill projects with more than 50 percent being slit projects.
The projects were mostly slit rolling Re-Bar, but Siemens VAI were also involved in some more special slitting packages.
For example Siemens VAI were the first company to successfully install a slitting package where the slitting pass was done on a vertical stand. Most companies and mills believed this was not achievable, but with the correct equipment, and experience it can and has been achieved.
Another example of innovation was slit rolling of mechanical grade profiled. By the nature of the slitting process a slight whiteness is left in the product which for the Re-Bar market is acceptable. This doesn't always have to be the case, as it is possible to slit roll without. Siemens VAI managed to achieve slit rolling to mechanical grade A-36. This applied to 3/8 inch round diameters and 3/8 inch sharp edge square bars. To achieve this grade requires a greater amount of control in the guide shop and in the mills, than single strand rolling. Plus strong design capabilities for guides and pass design.

3 POTENTIAL COST SAVINGS

As stated before the real driving factor behind implementing a slit rolling package is the cost saving benefit that it produces. The amount of saving achieved though depends on each individual mill. The tonnages the mill will be rolling, the product mix rolled and the discipline of the mill.
Siemens VAI believe from previous experience with all there successful slitting package a payback period is normally 12 months, but this can potentially be achieved in as quick as 6 months if the conditions are correct.
A typical example would be a mill that's rolls Ø10 rebar with an annual tonnage of 50,000 tones.
An average will would be capable of rolling Ø10 mm Re-bar at a finishing speed of 12 m/s, assuming the mill was only rolling single strand. This would cap the mills capacity at 22 tonnes per hour.

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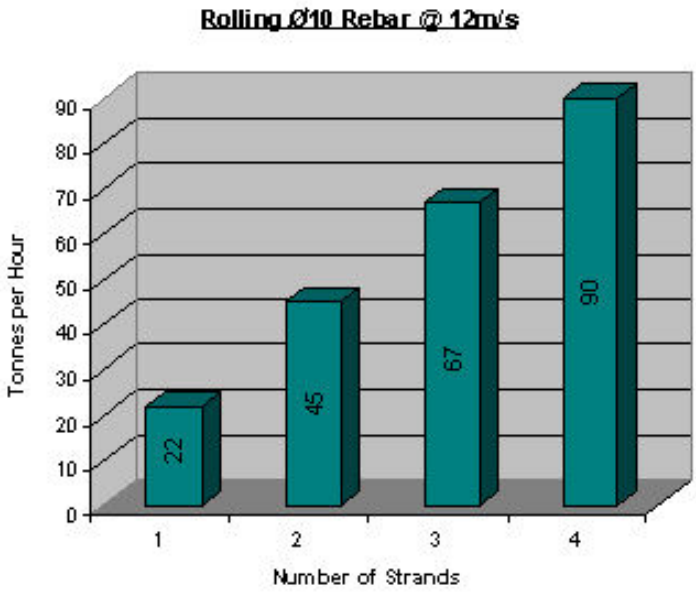

Figure 3. Graph showing tonnages per hour against number of strands.

It is granted then that as a mill increases the number of rolling strands the tonnage per hour would also increase. The values by what they increase is shown in Figure 3.
Back to the example, if a mill had a target of 50,000 tonnes per annum then it can be worked out that for a single strand mill this would take 2272 hours of rolling. We can assume this figure to be 100% of the time.
So with a correctly installed slit package the same 50,000 tonnes would only take 746 hours to produce. This is a time saving of 67%, which equates to 1,526 hours rolling time saved. These figures are summarized in Figure 4.

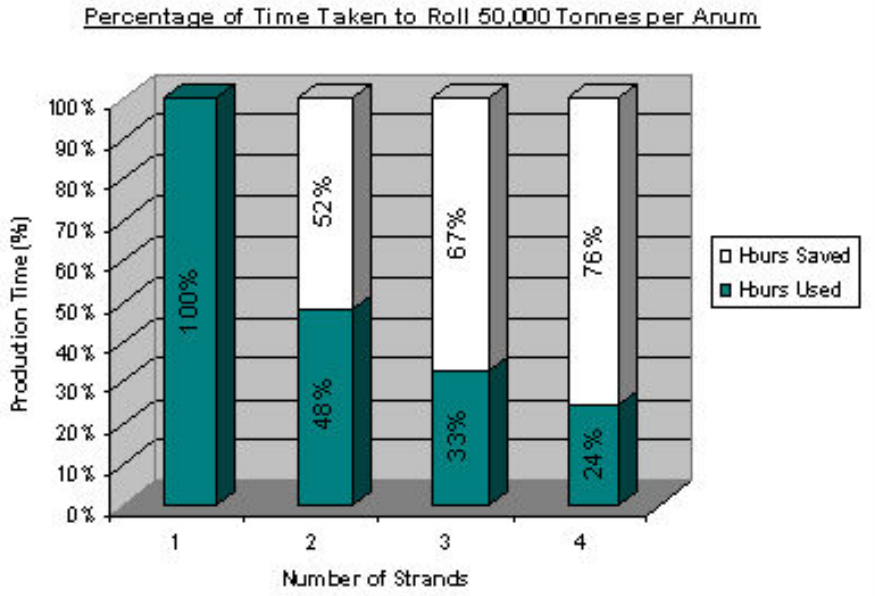

Figure 4. Graph showing tonnages per hour against number of strands.

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4 CONCLUSION

Siemens VAI continue to offer and install slit rolling packages to customers as the outcome for a rolling mill simply is increased rolling tonnages at reduced costs.
A correctly installed slit package along with disciplined mill is able to produce one of the biggest improvements to a mill for one of the smallest setup costs, as well as offering one of the quickest payback periods of any mill service.
Slit rolling also lends itself to a wide verity of rolling profiles, which again further increases potential for mill profit. Products can range from small rounds (previously expensive on single strand mills) to mechanical grade squares.
Slit rolling is a healthy addition to any rolling mill looking to improve their output and lower costs.