SIEMENS VAI MT CONTINUOUS PICKLING LINES COUPLED OR STAND ALONE[1]

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Abstract
Continuous Pickling lines coupled or stand alone supplied by Siemens VAI are characterized by high pickling rates, low-cost pickling operations, flexible production, a wide range of product sizes, qualities, reliable plant operation, and low maintenance requirements, as well as compliance with the highest standards for environmental safety. This paper gives and overview about our pickling technology featuring compact Welder, scale breakers, reliable low-maintenance equipment, Dynamic With Change side trimmer, FAPLAC® (fully automatic pickling liquor analysis and control) and the applied mathematical model for optimum process setup and control.
Keywords: Pickling lines; SIROLL PL.

SIEMENS VAI MT LINHAS DE DECAPAGEM CONTINUAS ACOPLADAS OU STAND ALONE

Resumo
Linhas de decapagem contínuas acopladas ou stand alone fornecidas pela Siemens VAI são caracterizadas por altas taxas de decapagem, baixo custo de operação, produção flexível, vários níveis de tamanhos de produto, qualidade, confiabilidade, baixa manutenção, assim como de acordo com os mais altos níveis exigidos para segurança ambiental. Este trabalho fornece uma visão geral sobre nossa tecnologia com uma compacta máquina de solda, scale breaker, equipamentos com baixo índice de manutenção e confiabilidade, Tesoura de bordas, FAPLAC® (fully automatic pickling liquor analysis and control) e um modelo matemático aplicado para otimizar o set up e controle do processo.
Palavras-Chave: Linhas de decapagem; SIROLL PL.

[1] *Technical contribution to the 46th Rolling Seminar – Processes, Rolled and Coated Products, October, 27th-30th, 2009, Santos, SP, Brazil.*
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1 INTRODUCTION

For a wide range of product applications the required strip thickness, flatness and surface quality can be achieved more economically by linking the pickling and cold-rolling processes. This delivers significant improvements with regard to mill productivity, yield and production cost as a result of the elimination of strip threading and tailing-out operations.
The pickling line technology of a coupled line is very similar to the technology used on a high productivity continuous pickling line.
SIEMENS VAI provides comprehensive process, mechanical, electrical and automation solutions of all key equipment as well as in-house manufacturing of key components such as:

- Welders
- Scale breakers
- Polypropylene pickling tanks
- Side trimmers and scrap choppers
- Drive and automation systems

2 KEY EQUIPMENT

2.1 Welders

Two types of machines with integrated shears are offered for coupled lines. These machines are based on flash butt welding and laser technologies.
However, for new lines dedicated to high strength material the laser technology is highly recommended.

Figure 1: Flash butt welder

The Siemens VAI flash butt welder features DC current technology, weldamatic welding process control and oxygen free and annealing.
The Siemens VAI laser welder is designed for steel grades up to 2000 MPA and comprises as well automatic weld inspection.

Figure 1: Pre-assembled laser welder

At entry of the process section the scale breaker ensuring up to 3% elongation on the strip facilitates the pickling operation and, gives the strip the perfect flatness (6 IU) demanded by the market.

2.2 Scale Breaker

Figure 2: Scale breaker

Three sizes of scale breakers are provided in order to cover the full steel grade spectrum, for strip tensions of 50 tons, 65 tons and 100 tons.
SIEMENS VAI has designed a hybrid scale exhaust system to combine the advantages of dry type, lower maintenance and wet type, higher efficiency.

2.3 Pickling Tanks

The process section uses the Siemens VAI high turbulent tanks. This arrangement has been chosen due to:
High operating flexibility of the process section and adaptation to low speed situations
Low maintenance of the pickling tanks
High surface quality of the finished product
The design guarantees that the strip will not touch fixed parts. This avoids any surface defects when processing HSS products which are not properly flattened.
High efficiency of pickling at low temperature

Main technological features are as follows:
Spray headers maximise the strip length in contact with acid
Side jets maintain high turbulence all along the tanks
Side jets target pickling action on the strip edge area where the scale layer is of highest thickness
Turbulence is independent of strip speed allowing efficient pickling action at any line speed
High quality pickling can be achieved at process speed as low as 15 m/min through our “slow pickling mode”
The pickling tanks are designed to follow the shape of the strip in order to minimize the acid volume in the process tank.

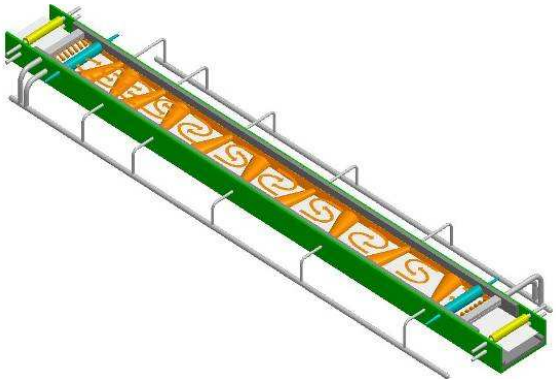

Figure 3: Pickling tank design

Figure 4: Cross section of pickling tank

The water seal design of tanks and covers allow a significant reduction of the acid fume exhaust flow.

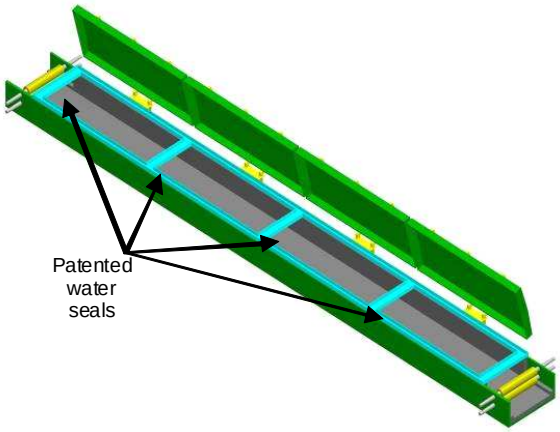

Figure 5: Water seal design of pickling tanks and covers

2.3.1 Pickling tank material

The pickling tanks can be made either of polypropylene or steel with rubber lining and bricks.
In the last 10 years polypropylene tanks have been used on 75% of the pickling lines built by Siemens VAI. According to our experience a minimum life time of 30 years can be expected with polypropylene copolymer tanks.
Polypropylene copolymer tanks feature excellent chemical and corrosion resistance, long life time, light weight, excellent thermal insulating properties, short repair times, when necessary and simple future modifications. The off-site tank construction significantly reduces installation and start up time, in total the polypropylene tanks are a cost effective solution.

2.4 Side Trimming Section

The side trimming section includes the side trimmer and the scrap chopper. The main features are:

- Automatic gap and lap adjustment:
  - Machines without backlash
  - Gap and lap adjustment performed through servo-motors. High accuracy and adjustment speed
- Fast knife change capability
- No gap and lap calibration after knife change
- All drives are electrical to avoid more complicated handling of hoses and leakages.
- Optimized design of scrap chutes:
  - Smooth feeding operation of trimming scrap after line restart
  - Fast opening and easy access to scrap chute in case of cobbles

Figure 6: Side trimmer

Two types of side trimmer are offered:

- The conventional turret type
- The dynamic width adjustment (DWA) type

The DWA side trimmer allows width change without notching and strip stop. Due to the fact that less line stops are necessary the risk of scrap jamming at line restart is reduced.

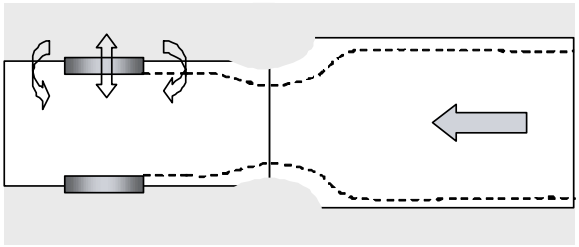

Figure 7: Principle of DWA mode

2.5 Reverse Rinsing Operation

In case of line stop in the pickling area the strip section in the rinsing tank starts to stain. To remove the stain the line can be started in reverse direction to remove this stain in the last pickling tank. To avoid any drag out of acid into the scale breaker, a spraying system is installed between the two sets of squeeze rolls positioned at the head of the first tank.

2.5.1 Strip run and turning equipment

For strip run SVAI installs 2-, 4- or 6-strand accumulators at one or more levels. For tension decoupling bridle units are installed. Steering units and other deflector rolls complete the line run equipment. If it is necessary to change the line direction e.g. by 90° helical turning devices are installed.

2.6 Surface Inspection

Typically a visual inspection of the surface is installed directly after the pickling section. Other costumers prefer this station after the side trimmer; this allows also stoppage of the strip and the inspection of the side trimmed edges. For both inspections SVAI offers also automatic systems. SIROLLCIS Sias for surface and the Vatron edge inspection system.

2.7 Electrostatic Oiler

In PLTCM which also produce pickled and oiled material oilers are installed in front of the tension reel.

3 PROCESS CONTROL SYSTEM

The process section is managed by the Siemens VAI Fully Automatic Pickle Liquor Analysis and Control SIROLLCIS Faplac®.

All main parameters in process sections, such as acid-iron content, rinse water conductivity, etc. are automatically measured and controlled through a mathematical model

The main benefits are operator friendliness, production cost reduction and line productivity.

3.1 Operator Friendly

- All process information is available at operator station
- Minimum process section management decisions required from operators

- Acid and iron concentrations are automatically controlled
- Low dependence on the concentration of incoming acid
- The control system automatically protects heat exchangers during line starts-and stops
- On-line calculation of productivity indicators

3.2 Reduced Production Costs

- Optimized use of acid to reduce operating costs
- Optimized steam consumption
- Pickling quality and media consumptions are not operator dependent
- Minimize the amount of acid in the waste pickle liquor
- Minimize the use of rinse water to reduce waste processing costs
- No overpickling
- Connection with the speed optimization of the cold rolling mill (alert of over or under pickling) for automatic adjustment of mill speed

3.3 Line Productivity

- The model will predict the optimum process speed for each coil considering the process parameters such as strip quality, bath concentration and bath temperature
- The SIROLLCIS Faplac® system can be associated with an automatic surface inspection system (SIROLLCIS Sias) at the line exit, with a closed loop control on the pickling process

Siemens VAI has installed a number of new pickling sections in PLTCMS. Latest reference and currently in the engineering phase is the PLTCM for Boharo in India. POSCO Gwang Yang PLTCM No.1 dedicated to high strength material up to 1380 MPa has been very successful from its start up in 2006.

4 CONCLUSION

Siemens VAI is at the cutting edge of technology for high strength material. Further developments such as on-line silicon filtration in the pickling section are to bring solutions to new problems caused by such products.