SIROLL CIS PL – Solutions for processing lines

Technology, mechanical engineering, automation and electrical engineering from a single source – highest throughput and quality for growing demands
Staying on top in your industry requires further quality improvements as well as higher throughput while lowering operational costs. How can you fulfill these growing demands all at once? What do you need to compete better – today and tomorrow?

You expect...

- Competitive strength in your market – with an innovative partner
- Top results – thanks to the plant and process expertise of your supplier
- Best overall efficiency – through integration of auxiliary facilities
- Optimized processes – with integrated strip processing lines
- One partner who takes complete responsibility – for all process equipment (mechanical, electrical and automation)
- Tailor-made revamps – with modular upgrade packages
- Full-service concepts – that integrate local facilities and cover the entire plant life cycle
- Easy-to-handle mechatronic packages
- Reduced total cost of ownership
Your challenge: Expanded capacity, enhanced quality

Growing demand and ongoing consolidation
Worldwide demand for steel is set to grow 25% by the year 2015, particularly in Asia. Processing lines must respond to this need with expanded capacity, speedier processing, and overall enhanced plant productivity. At the same time, the iron and steel industry is consolidating, while more and more companies are calling for high-quality products.

What does this mean for your processing line? Which aspects do you have to address to stay competitive now and in the future?

New steel grades
Driven by the automotive industry, the worldwide demand for advanced high-strength steel is continuously growing and is soon expected to expand beyond 10 million tons per year.

The push for quality
To satisfy the market demands for quality, you need to ensure that you produce steel with perfect strip surfaces, tight tolerances, uniform mechanical properties, and excellent flatness, combined with good coating adhesion and uniformity.

High plant availability
Ensuring that your processing line runs with maximum availability is the key to your economical viability. This requires quick roll changes and as few planned shutdowns as possible. At the same time, the line has to adapt flexibly to any condition. Production must be consistent even when you’re working with challenging materials and a variety of end products. Technical processing equipment and automation must be highly reliable, day after day.

High production throughput and yield
Facing the growing demand requires reduced strip-to-strip transition times and minimal scrap losses. This calls for fully automatic operations and advanced strip welding technologies with minimized overthicknesses. Safe operations and maintenance procedures are also essential, which rely on safety-compliant equipment design. Moreover, future upgrades must be considered as an integral part of plant design.

Low operational costs
To stay highly competitive and profitable, your line has to work as leanly as possible. This means minimizing the use of coating materials and other consumables, reducing the need for maintenance, lowering energy consumption, and automating operations.
Our solution: SIROLL\textsuperscript{CIS} PL – setting the standards in strip processing technology

Everything to fulfill your most stringent requirements for quality and efficiency

Siemens VAI is dedicated to excellence in the field of strip processing technology. Our experience working with leading steel producers worldwide has led us to create integrated and comprehensive solutions that fulfill the most stringent requirements for quality, and for production and cost-efficiency.

Our continued emphasis on research and development has led to the application of new solutions, such as an efficient pickling process, compact and cost-efficient hot- and cold-strip galvanizing, unique DAK\textsuperscript{®} air knives, light- and heavy-gauge laser welders, SIAS\textsuperscript{®} automatic surface inspection systems, advanced roll coaters and galvannealing for automotive strip qualities.
As a globally active full-liner, we provide you with expertise that is unique in the steel production industry. Backed by our extensive experience, our product solutions ensure that every aspect of your production process is optimized. Not only do we provide cutting-edge technology, we also offer top-notch service. In everything we do, our goal is to improve your plant’s performance.

**Good reasons for SIROLL<sup>CS</sup> PL**

- Completely integrated solutions – from a single-source supplier for mechanical, electrical and automation equipment
- Successful partnership – thanks to our proven experience in new plants and modernizations at leading steel producers
- Maximum plant availability and yield – based on proven low-maintenance designs and intelligent control systems
- Best life-cycle performance – with a life-cycle partner backed by global resources
Integration is more effective than mere interfacing, because it leads to shorter commissioning and installation times, faster start-up, smoother operations, optimized maintenance, and easier modernization. Siemens VAI helps you integrate with turnkey equipment, mechanical and hydraulic equipment, and electrical and automation systems. We offer end-to-end process expertise on everything from iron ore processing to coated-steel production. Moreover, we provide service throughout the entire life cycle of your plant, including assistance with modernization to keep your processing line or cold-rolling mill at the leading edge of technology.
Winning through integration –
whatever your process, whatever your needs

With Siemens VAI, you have a reliable partner for a wide range of applications and technologies:

**Turnkey processing complexes**
Siemens VAI specializes in the construction of turnkey cold-rolling and strip processing complexes, including pickling, cold rolling, galvanizing, annealing and finishing, as well as in the integration of all related automation systems and auxiliary facilities.

**Pickling lines**
Our modular continuous and push/pull-type pickling lines are supplied with compact scale breakers, advanced welders and turbulent pickling systems, all of which draw on our extensive operational experience for their design.

**Linked pickling and cold-rolling lines**
Our technology helps you achieve outstanding product quality with respect to strip thickness, width, flatness, surface cleanliness, mechanical properties and microstructure. It also helps you to significantly improve productivity and yield, and lower production costs.

**Galvanizing lines**
We provide customized solutions for the hot-dip galvanizing of both hot- and cold-rolled strip, which guarantee the production of first-class output that meets the most stringent demands of the market.

**Continuous annealing lines**
As a profitable alternative to batch annealing, Siemens VAI-supplied continuous annealing lines feature a flexible, multizone furnace design for the production of a broad range of steel grades and dimensions.

**Color coating lines**
In addition to ensuring an attractive and decorative strip appearance, our organic coatings also substantially improve corrosion resistance, especially for outside applications.

**Cleaning lines or cleaning sections**
These solutions are designed to help you achieve the kind of high-level strip cleanliness required for the downstream processes in association with technologies involving immersion, spray, brushes, electrolytic, horizontal or vertical design.

**Electrolytic tinning and tin-free lines**
We offer specific tension leveling technology and an optimized metal coating process section which ensure that your products are top-notch.

**Inspection, tension leveling and skin-passing lines**
Our solutions ensure optimal mechanical and flatness performance with high yield on finished strips.

**Stainless-steel annealing and pickling lines**
Our stainless lines combine the traditionally separate processes of rolling, annealing and pickling, skin passing, and leveling into one integrated processing line.

**Mechatronic packages**
Siemens VAI workshops develop, design, manufacture and test key process equipment such as welders, air knives, skin-pass mills, tension levelers, scale breakers, roll coaters and automatic surface inspection systems.

**SIAS**
SIAS stands for “surface inspection automated systems” – our innovative tool that helps you achieve processed steel strip in superb condition.

**Our supplies and services**
- Innovation in processing lines
- Production flow optimization
- Life-cycle management
- Modernization
Turnkey cold-rolling complexes
We draw on our experience to design optimized production routes

With turnkey solutions, you want minimum coordination effort and maximum integration right from the beginning. You also want to work with a supplier who has an outstanding record. With Siemens VAI, you get an experienced partner in process expertise who can help you plan and complete your project according to time, budget, and quality demands.

A track record you can trust
We supply tandem cold mills, reversing mills, skin-pass mills, strip processing lines, heat treatment facilities, layout and logistic planning, as well as all related automation and production control (MES) systems and auxiliary facilities, roll shops, storage, slitting and recoiling finishing lines, and packing and dispatch equipment. We’re also available to provide additional solutions and services according to your needs.

Benefits of partnering with Siemens VAI
- Single point of responsibility
- Optimized layout solutions for key and auxiliary equipment
- Highest throughput rates
- Savings in spare parts and maintenance costs over the entire life cycle

Selected references
Mittal Steel, Sparrows Point, Maryland, USA
Hadeed, Al Jubail, Saudi Arabia
Duferco, Saldanha Bay, South Africa
CSN, Terre Haute, Indiana, USA
Krakatau Steel, Cilegon, Indonesia
voestalpine Stahl, Linz, Austria

Hadeed, Al Jubali, Saudi Arabia

Pickling line

Color coating line
Cold mill complex for 600,000 t/a

Reversing cold mill

Skin-pass mill

Galvanizing line

Slitting line

Packing line

Coil storage
Siemens VAI offers a uniquely designed V-shaped flat pickling tank, which increases the strip stiffness during its passage through the tank. This eliminates strip buckling and flattening, and assures reliable threading.

To prevent strip staining in the rinsing section, Siemens VAI has developed a special antistain system that does not require chemical additives. The energy-efficient design of the fume extraction and sealing system significantly reduces energy costs and acid losses. A dedicated FAPLAC® controls process and especially acid and iron concentration.

**Continuous pickling lines**
Continuous pickling lines supplied by Siemens VAI feature a modular design, high pickling efficiency, economical operation and the application of advanced technologies such as turbulence pickling. Drawing on our extensive operational experience, we help you select and integrate all process equipment and components to best meet the needs of your specific situation. The top of the art process section is automatically controlled by the Siemens VAI Automatic Pickle Liquor Analyzing and Control System (FAPLAC®) giving significant benefits in terms of productivity, quality, operation management and operational cost.

**Push-pull pickling lines**
For the pickling of up to approximately 1,000,000 tons of strip per year, push-pull pickling lines offer significant advantages when it comes to investment costs and operational flexibility. This is the case particularly when you frequently change strip dimensions and steel grades.

Siemens VAI offers a uniquely designed V-shaped flat pickling tank, which increases the strip stiffness during its passage through the tank. This eliminates strip buckling and flattening, and assures reliable threading.

To prevent strip staining in the rinsing section, Siemens VAI has developed a special antistain system that does not require chemical additives. The energy-efficient design of the fume extraction and sealing system significantly reduces energy costs and acid losses. A dedicated FAPLAC® controls process and especially acid and iron concentration.

**Overall line features**
- Comprehensive package and complete in-house design (mechanical, electrical, process)
- Flash-but welder FBS21 or heavy laser welder LW21H
- Compact scale breakers
- Turret-type side trimmer with automatic width adjustment

**Process section features**
- High pickling efficiency with our unique turbulence technology
- Side-jet target pickling action on the edge area where the scale layer is thickest
- FAPLAC® (fully automatic pickling liquor analysis and control)
- Perfectly sealed pickling tanks
- Pickling at low temperature
- New antistain rinse system

**Selected references**
Zaporizhstal JSC, Zaporizhya, Ukraine
Posco I&S, Pohang, Korea
voestalpine, Linz, Austria
Posco I&S, Gwangyang, Korea
Aceria Compacta de Bizkaia, Sestao, Spain
Nucor Steel, USA
Mittal Steel, Galati, Romania
CSN, Terre Haute, Indiana, USA
DunaFerr, Hungary
Corus, Port Talbot, UK
BlueScope Steel, Port Kembla, Australia
Coupled pickling lines and tandem cold-rolling mills
High-capacity production for high-quality products

Enhancing economy by coupling
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 results in significant improvements in mill productivity and yield, and production cost savings as a result of the elimination of strip threading and tailing-out operations. Reduced strip-head and tail-end losses also contribute to better overall yield. Our speed optimization system ensures maximum throughput rates under all operating conditions, and reduces maintenance, roll consumption and manpower. Typical production capacities of such combined facilities are in the range of 1.2 – 2 million t/a.

Coupling devices
Siemens VAI can install turning towers or helical turn devices for coupling existing sections or new and existing sections for a pickling line tandem cold mill configuration. These solutions allow you to change the direction of the strip and build a line, such as a 90° configuration, in line with layout requirements.

Tandem cold mills
Our technological and process automation experience in four-high and six-high technology delivers a solution that offers maximum added value for your production. Advanced mill stand actuators will bring the benefits of improved yield, user-friendly mill operation and high strip quality.

Features
- SmartCrown® roll contour associated with roll axial shifting for enhanced flatness control
- Four-high and six-high mill stands for high mill flexibility for all products
- Physical-based analytical online models supported by neural networks ensure accurate mill setup to achieve tight tolerances right from the start
- Patented compensation systems for correcting periodic roll and coil eccentricities
- Use of last stand in temper mode for smoothing or roughing strip surface
- Fully automatic operation allows operators to concentrate on product quality; actual operator intervention is reduced to an absolute minimum

Selected references
Sollac Atlantique, Mardyck, France
Tangshan I&S Co, Tangshan, China
Benxi I&S Co. Benxi, China
Panzhihua, Panzhihua, China
Wuhan I&S Co. Wuhan, China
voestalpine Stahl, Linz, Austria
Arcelor Mittal, Sparrows Point, Maryland, USA
Arcelor, Liège, Belgium
Corus, Ijmuiden, Netherlands
Ilva spa Riva, Taranto, Italy
Corus, Port Talbot, UK
Angang, Anshan, China
Galvanizing of cold-rolled strip

With the new generation of hot-dip galvanizing lines from Siemens VAI, you can produce a wide range of top-quality products. Our coating lines provide the highest degree of flexibility for continually changing base-strip materials, coating types and sizes for numerous product applications. Siemens VAI galvanizing lines are capable of applying the following coatings:

- Pure zinc
- Galvannealed (ZnFe)
- Galfan® (Zn95 Al)
- Zinc-aluminium (Al55 Zn)
- Aluminium (AlSi and Al)

Features

- Suitable welding solution featuring our welding equipment
- Advanced technology working in closed-loop control with DAK dynamic air knives
- Strip roughness and mechanical properties implemented with our skin-pass mill and tension leveler solution
- Siemens VAI roll coater installed in post treatment section
- SIAS – automatic surface inspection

Selected references

Tata BlueScope, India
Corus, Ijmuiden, Netherlands
Borçelik, Gemlik, Turkey
BlueScope, Cilegon, Indonesia
Kashira Steel, Kashira, Russia
China Steel, Kaohsiung, Taiwan
Benxi I&S, Benxi, China
Galvasid, Monterrey, Mexico

Main benefits

- Coating applications for virtually all strip qualities, including extra-deep-drawing grades with yield strengths down to 160 N/mm²
- Galvanized strip ideal for automotive exposed parts
- Fully automated operation with in-line quality control
- Integrated environmental solutions that reduce energy, chemical and process-water requirements

Galvanizing of hot-rolled strip

Recent advances in hot-strip rolling now allow strip to be rolled to gauges of less than 1 mm. This means that with suitable corrosion protection, thin-gauge hot-rolled strip can substitute cold-rolled galvanized strip for a wide range of applications. Siemens VAI has developed a line type that is suitable for both wide and narrow hot-rolled-strip galvanizing. The first plants are already successfully operating at Wuppermann Bandstahl (Linz, Austria) and at Ornatube in Taiwan.

Substantial cost savings can be achieved when the pickling section is incorporated into lines of this type. Galvanized coils from hot-strip galvanizing lines represent an excellent starting material for the downstream production of a wide range of sections, drawing parts and tubes for the construction, appliance and automotive industries.

Features

- Advanced technology in hot-strip treatment and working with the pickling section
- Suitable solution with our welder
- Dynamic air knives providing more coating accuracy and smooth layer
- SIAS – automatic surface inspection
Main benefits
- No need for annealing and cold rolling
- Highly compact plant layout and design
- Cost savings through in-line pickling option with inherent cost-saving potential
- Low operational and environmental expenditures
- Flexible on-/offline operation with induction heating

Selected references
Tangshan, China
Wuppermann Bandstahl, Austria
Ornatube, Taiwan

Cleaning sections in continuous galvanizing lines
Strip cleanliness is essential in the coating process to allow good layer adhesion onto the strip surface. Oil and iron fines removal is achieved thanks to suitable cleaning definition. Siemens VAI has optimized cleaning section technology according to the incoming strip cleanliness, furnace type and application of the coated product.

Features
- Complete regulation of the coating control system
- Zinc coating full control
- Option of fully automatic mode

Main benefits
- Coating of a wide range of strip gauges and widths
- More coating accuracy and smoother layers
- Low zinc consumption due to exact zinc layer thickness control
- Accommodation of some strip crossbow on the rising pass line above the zinc pot, compensated by the width coating regulation

Dynamic air knives
Our dynamic air knife (DAK) consists of a bottom flat rigid lip and a top flexible lip actuated by servomechanisms. A unique feature of the variable opening lip system permits dynamic control of the constant pressure (or “dart”) blowing area along the nozzles.

Features
- Complete regulation of the coating control system
- Zinc coating full control
- Option of fully automatic mode

Main benefits
- Full “cleaning solution,” not just a cleaning section
- Optimization of utilities consumption
- Waste reduction
Continuous annealing lines

Advanced technology for various grade qualities

Nonstop quality production
As a profitable alternative to batch annealing, Siemens VAI continuous annealing lines lead to high throughput rates, high yields, significant energy savings and the production of high-quality products. We supply annealing lines in cooperation with all major furnace builders, which ensures optimized interfaces and trouble-free operation.

Features
- Welder
- Cleaning section
- Skin-pass mill and tension leveler
- SIAS – automatic surface inspection

Main benefits
- Ideal for strip used in exposed automotive parts
- Lower personnel costs due to full automation
- Exact temperature control and rapid cooling for production of steel qualities not attainable with batch annealing
- Reduced alloy consumption with simultaneous fulfilment of required steel characteristics
- Operational flexibility for changing product mixes
- Proven high plant availability

Selected references
- Maanshan I&S, Maanshan, China
- Rasselstein, Andernach, Germany
- voestalpine, Linz, Austria
- Ugine, Isbergues, France
- Columbus, Middleburg, South Africa
- Mittal Steel, Cleveland, Ohio, USA
- Corus, Trostre, UK,
- Krakatau Steel, Cilegon, Indonesia
- NLMK, Lipetsk, Russia
All the colors of the rainbow

Siemens VAI color coating lines stand for reliable operation, high throughput rates and top product quality. Our lines assure the highest degree of flexibility for changing steel strip grades, coating compositions, and colors, as well as strip dimensions, for a wide range of product applications, particularly in the automotive and household appliance industries. In addition to giving an aesthetically pleasing and decorative appearance to the strip, color coatings also substantially improve corrosion resistance, especially for outside applications.

Features
- Optimized pretreatment
- Application of coater control
- Special furnace design
- Fully automated line presetting and program change
- Integrated quality control system
- Integrated environmental solutions

Main benefits
- Ideal coating adhesion
- Uniform coating thickness with low lacquer consumption
- Fast and homogeneous heat transfer to the strip
- Increased yield and throughput capacity

Selected references
- Tata BlueScope Steel, India
- PT BlueScope, Indonesia
- Mittal Steel, Poland
- Replasa, Spain
- Apliband, Spain
- Galvasid, Mexico
- Magnitogorsk, Russia
- Group Steel, Malaysia
- voestalpine Stahl, Linz, Austria

MMK – Magnitogorsk Iron and Steel Works, Russia
Small processing lines
Big gains in efficiency

Electrolytic cleaning lines
Electrolytic cleaning lines are used before batch annealing furnace to obtain perfect surface cleanliness.
This type of line could also be used as coil buildup line. Modules such as payoff reel, shear, welder, cleaning section, etc. are common with galvanizing lines.

Main benefits
- Improved technology of different cleaning section design (spray, "V" shape and electrolytic, vertical tank and electrolytic)
- A “cleaning solution” is supplied, not just a cleaning section
- Cleaning design for fast and efficient strip cleaning
- Fully automated line presetting and program change for increased yield and throughput capacity
- Integrated environmental solutions
- Optimization of utilities consumption

Siemens VAI has developed and implemented the best technologies of cleaning (immersion, type of brushes, type for electrolysis, rinsing) in terms of:
- Investments costs (civil works included)
- Operating cost (waste treatment included)
- Environmental impact
- Design optimized to suit application

Features
- Welder
- Cleaning section

Selected references
Steel Corp. of Gujarat, India
Borçelik, Gemlik, Turkey
PT Krakatau Steel, Cilegon, Indonesia

Electrotinning lines and tin-free steel
Our electrotinning lines are designed to provide you with high plant performance and product quality. Our tin plating process allows for equal or differential strip coating. The coating performance is drastically improved by our tension leveler, installed upstream of the process tinning section. The thickness of tin layers is monitored and controlled through Siemens’ automation system. Tin-free steel (TFS) is less costly than tin plates, and boasts superior lacquer and paint adhesion, as well as strong resistance against corrosion.

Features
- Optimized precleaning and cleaning design allows for strip cleaning at the fastest line speed possible for the tinning process
- Pickling section meets environmental regulations
- Two separate tinning coating processes:
  - Soluble anodes MSA or PSA
  - Insoluble anodes
Inspection lines and combined lines
In addition to traditional coil-to-coil inspection line solutions, Siemens VAI has developed innovative advanced solutions that let you combine the following strip processing operations into one continuous combined line:

- Skin passing
- Tension leveling
- Side trimming
- Automatic or visual surface inspection
- Oiling

Main benefits
- Strip flatness controlled before tinning process
- Process section designed for fast and efficient strip coating
- Increased yield and throughput capacity
- Optimization of utilities consumption
- Reproducible “in control” process technology
- Consistent product quality
- Environmental friendliness
- Continuous process development

Selected references
Farokhshar Steel Ind. Iran
Aceralia Echevarri, Spain
Ludosider, Portugal
Mittal Steel Termitau, Kazakhstan
Corus, Trostre, UK
Mittal Steel, South Africa

Inspection lines and combined lines
In addition to traditional coil-to-coil inspection line solutions, Siemens VAI has developed innovative advanced solutions that let you combine the following strip processing operations into one continuous combined line:

- Skin passing
- Tension leveling
- Side trimming
- Automatic or visual surface inspection
- Oiling

Main benefits
- Improved production quality (flatness, surface finishing, mechanical properties)
- Better production yield (fewer scraps due to combined continuous operations)
- High production capacity and flexibility to cope with market demand
- Life-cycle partner with global resources
- Completely integrated, single-source solutions

Selected references
Cosipa, Brazil
Usiminas, Brazil
Mycron Steel, Malaysia
Borçelik, Gemlik, Turkey

Features
Continuous combined lines may include:
- Entry section with one or two pay-off reels
- Siemens VAI laser or mash-lap welder with entry and exit four-point centering units and notcher
- Vertical entry and exit accumulators
- Four-high skin-pass mill with wet- and/or dry-rolling modes
- Six-high tension leveler
- Turret-type side trimmer
- SIAS automatic surface inspection system
- Vertical and/or horizontal inspection and an electrostatic oiler
- One- or two-exit tension reels
Stainless lines
A finished product in just two laps

Integrated rolling and processing
Siemens VAI direct-rolling, annealing and pickling lines combine the traditionally separate processes of rolling, annealing and pickling, skin passing, and leveling into one integrated processing line.

Features
- Welders
- Skin-pass mill and tension levelers

Main benefits
- Reduced yield loss due to less coil handling
- No leader strips required for cold rolling; no coil preparation line required
- Welds can be rolled for certain strip grades, further minimizing losses
- Reduced lead time from order to final product
- Less work in progress, lower inventory costs
- Operating cost savings from reduced labor and utility consumption

Cold-rolling section
A key element of the integrated process is the in-line rolling mill. The Siemens VAI solution developed for this application includes a number of unique features. Due to the high work-hardening characteristics of stainless steel, small work rolls are required to achieve the necessary reduction. The technology uses additional lateral support rolls to ensure stable and controllable rolling. Lateral shifting of intermediate rolls and positive and negative bending of the intermediate rolls allows for shape actuation.

Features
- Multistand tandem six-high mill with intermediate roll bending and shifting
- Hydraulic automatic gauge control at all stands
- Siemens VAI patented quick roll change system
- Roll and strip lubrication and cooling via high-capacity mineral oil recirculation

Main benefits
- Accurate shape control
- Work rolls and intermediate rolls can be changed while process section is at full speed
Cleaning section
Strip surface quality is an essential property of stainless flat products. Strip, strip cleanliness prior to the annealing furnace is therefore essential. Siemens VAI has designed an in-line de-greasing section that ensures the highest product quality.

Features
- A combination of spray, immersion and brush technologies
- Full "cleaning solution" not merely a cleaning section

Main benefits
- Maximized operating efficiency
- Flexible and automatic set-up parameters to match product requirements
- Optimization of utility consumption
- Waste reduction

Annealing and pickling section
The work-hardened strip requires annealing and surface scale removal. This is achieved with a tunnel furnace and acid pickling section. For hot band, Siemens VAI also provides shot blast and scale breaker equipment between the furnace and pickle section to help with oxide removal.

Features
- Annealing section with waste gas preheating section
- Air and water cooling
- Electrolytic and mixed acid pickling with double brush scrubber
- High-turbulence line tanks
- Brush and spray rinsing

Main benefits
- High-efficiency and low-NOx burners
- Maintained strip shape
- High maximum process speed of up to 125 mm/min
- Optimum pickling

Selected references
- Lianzhong Stainless Steel Corp. (LISCO), Guangzhou, China
- Outokumpu RAP 5 line (electrics and automation), Finland
- Arcelor Mittal LC2i Line, France
Our solutions combine technology, mechanical engineering and automation expertise. We provide mechatronic packages, which we offer for new lines as well as for modernization projects. Our packages comprise proven mechanical solutions to optimize actuator systems, control systems and sensors and measurement systems.
Our mechatronic packages are manufactured, assembled and tested in our workshops. This ensures the best quality and performance from one single source, and gives you the opportunity to preinspect your equipment or track it in its development from project start to shipment.

Examples for SIROLL CS PL mechatronic packages include:

- Welders
- Scale breakers
- In-line skin-pass mills and tension levelers
- Cleaning sections
- SIAS surface inspection automated systems
- Roll coaters
- Dynamic air knives

### Welders

Siemens VAI has been a major welder supplier for the iron and steel industry since the 1970s. In 1995, we initiated a global improvement program for all welder types to provide customers with equipment featuring high performance, increased reliability and the ability to process future steel grades.

Today, Siemens VAI provides unique worldwide experience in designing and commissioning welders for cold-rolling mills and processing lines. Whatever your individual application, we can answer your needs – with a wide range of solutions ranging from more conventional processes (mashed-lap or flash-butt) to the laser process:

- Light laser welder (LW21L) and mashed-lap welders with three sizes of machine (ML21L, ML21M, ML21H) are dedicated to the application coming after the designed for post-cold rolling mill (galvanizing lines, finishing lines, inspection lines, ...).
- Our heavy laser welder (LW21H) and flash-butt welder (with gauge bar FBW21C or with integrated shear FBW21S) are dedicated to the pickling line, continuous tandem mill or coupled pickling tandem mill.

### Features

- Real-time feedback of the welding quality with welding quality control systems
- Use of the most efficient technology and process from low-carbon steel to actual high-strength steel (DP, TRIP) and future steel (manganese steel and higher-strength steel, ...)

### Main benefits

- Fully automatic welding machines requiring no operator assistance
- Increased welder reliability (over 99%)
- Perfect command of the different welding process for mashed-lap, flash-butt and laser process
- Easy operation thanks to user-friendly HMI
- Easy maintenance with easy access to the components and long service life
**Scale breakers**
This is a time-tested Siemens VAI technology. Its benefits have resulted in the orders for more than 25 machines delivered worldwide over the course of the past ten years. The scale breaker is comprised of a stand (including two sets of two leveling units and an anticrossbow unit), a dust collection system (wet or dry process), as well as and entry and exit tension bridles with their respective drive systems. More than 25 of these time-tested Siemens VAI machines are operating worldwide.

**Skin-pass mills and tension levelers**
With Siemens VAI, you benefit from the experience of the world leader in these technologies.

Our solution range encompasses skin-pass mills and tension levelers that cover all applications. With rolling force capacity ranging from 400 to 1,500 tons, skin-pass mill stands can be of two-high or four-high design – thus providing a best-in-class solution, whatever your application.

**Cleaning sections**
Strip cleanliness is essential in the coating process to allow a good layer adhesion onto the strip surface. Oil and fines are removed thanks to adequate cleaning definition in association with process technology. Siemens VAI has optimized cleaning section technology according to the incoming strip and coated products. Our design is specifically adapted according to the line process and covers the following:
- Electrolytic cleaning
- Galvanizing
- Annealing
- Color coating
- Tinning

**Features**
- Improved technology of different cleaning section designs (spray, “V” shape and electrolytic, vertical tank and electrolytic)
- Supplying of a “cleaning solution,” not only a cleaning section

**Main benefits**
- Optimization of utilities consumption
- Reduction of waste

**SIAS – surface inspection automated systems**
Automatic surface inspection with SIAS — the perfect tool to guarantee you a defect-free surface condition of the processed steel strip. SIAS will detect and identify critical defects, for deep-drawing applications such as fine slivers, holes or scratches, as well as coating defects. The tiniest defects such as arc spots, may be detected even at maximum speed.

This technology can be used in a wide range of processing applications. Examples range from galvanized products for the automotive industry to those for annealed steel, painted steel strip, tin plate and tin-free steel.

**Features**
- Preset detection
- Automatic detection optimizer
- Preloaded defect database from past application experience
Main benefits
- Real-time detection of edge cracks, holes, severe slivers, stains, roll dents, scratches, and laminations
- Operator warning on potentially harmful defects
- Elimination of defect-induced strip breaks
- Faster decision-making due to clear data
- Online coil grading
- Dramatic reduction in the number of coils sent to reinspection
- Increased mill productivity

Dynamic air knives
Our dynamic air knife (DAK) consists of a bottom flat rigid lip and a top flexible lip actuated by servomechanisms. A unique feature of the variable opening lip system permits dynamic control of the constant pressure (or "dart") blowing area along the nozzles.

SIROLL\textsuperscript{CIS} SIFLAT
SIROLL\textsuperscript{CIS} SIFLAT is our advanced solution for contactless measurement of processed steel strip. It completely eliminates weak points of conventional roll-based systems such as time-consuming calibration procedures. Instead, SIROLL\textsuperscript{CIS} SIFLAT drastically reduces the risk of damage to the strip surface, causes no wear to the measurement device, and reduces maintenance costs.

Features
- Periodic excitation of the strip and measurement of the excitation amplitudes across the strip width
- Measurement with contactless eddy-current sensors

Main benefits
- High quality of the measured values since not dependent on the strip speed
- Drastic reduction of the risk of damage to the metal strip
- No wear and tear of the measurement equipment
- Lower maintenance costs
- Reduced costs for calibration equipment and rolls

Roll coaters
Siemens VAI closely follows trends in the market and stays in close touch with clients. That's why our coaters are designed in a "mechatronic package" that includes all technological aspects, including mechanical, fluid, electrical and automation functions. This modular approach offers great benefits, and allows us to provide completely integrated solutions consisting of extensively preconfigured products, solutions and cycle services specifically tailored for galvanizing lines.

Main benefits
- Less vibrations due to short universal joints
- Less applicator covering wear due to load control
- Quick roll change
- Reduction of coating consumption
- Tightest thickness tolerances by dynamic force control
- Quality improvement due to computer-controlled coater presetting.
Automation solutions
Complete process control at every level

As a comprehensive solution for continuous and batch-process strip processing plants, SIROLL CIS PL covers all parts of plant engineering, from the world’s best automation and drive engineering to technological solutions.

These technologies enable you to have perfect command of the process and its complex parameters. Our optimally coordinated services ensure high performance throughout the entire life cycle.

Great investment security in the long term
Based on many years of cooperation with OEMs and plant operators, we have developed the scalable automation solution SIROLL CIS PL. Its modular architecture from the field level to the ERP level also ensures that your solution is efficient, whether you build a new plant or modernize an existing one, even in multivendor environments. Because the strategy is standardized on a common platform with intuitive user interfaces and integrated diagnostic functions, training and maintenance expenditure is reduced permanently.

The process control system
With its standardized components and modular structure, the SIMATIC process control system is open to expansion and conversion – while at the same time incorporating a variety of specific rolling mill requirements.

Features
- Unified functional blocks in the software landscape
- Integrated system information data
- Integrated production monitoring system – fully scalable for all production processes in rolling mills
- Easy-to-understand human-machine interface

Main benefits
- Minimum familiarization time, maintenance time and expenses
- Efficient maintenance and quality assurance
- Best possible support of operating personnel

The plant and information management solution
What was produced in the plant? What quantities and qualities? In which stages and under what conditions? Our plant and information management solution provides answers to all of these questions. When it comes to quality assurance, it delivers informative reports and concrete proposals for immediate modification of target parameters in the subsequent process steps, for reworking or for using the product in other orders.

Features
- Detailed tracking and tracing of production route and conditions
- Reliable information on the current status of production, mapped as readily accessible key performance indicators (KPIs)
- Constant online logging of quality data and other process data – at defined checkpoints throughout the production process

Main benefits
- Boosted knowledge of the production process
- Easy processing of any complaints
- Reliable quality prediction
- Flexibility to make changes when necessary
- Prevention of defects at first sign
Drive systems
Reliable, precise and efficient

In processing lines, interruption-free processes and high-quality end products are important. The crucial demands placed on drive technology are therefore high-dynamic response of the control system and brief-overload capability, smooth running, maximum availability, service friendliness, and seamless integration into higher-level automation systems.

Siemens VAI covers all your drive tasks with coordinated drive systems comprising motors of all voltage and performance classes – from 20 kW to over 50 MW. Our portfolio includes the relevant converters as well.

A new family of drives
As part of the new family, all of the drive systems have the same technical platform and the same “look & feel”. This applies for all power and voltage classes as well as performance levels and applications. All of the versions are engineered, commissioned and controlled in the same standard and straightforward way.

Features
- Sizer and starter software tools for engineering and commissioning of all Siemens drives
- IGBT frequency converters and integrated vector control
- Operator panel with self-explanatory texts
- Upgrading of DC drives to a similar technical level as AC drives – through subsequent digitalization

Main benefits
- Constant strip tension even in the highly critical sections of annealing furnaces
- Smooth strip flow in all operational states with nearly maintenance-free operation even for DC drives – throughout the entire service life
- Quick responses to changes in load – reliable prevention of strip damage
We’ve been working to build your future – for the past 100 years.

- 1989: Dynamic air knives (DAK)
- 1990: Roll coater
- 2000: Digital coil replay; LED
- 2001: Turbulent pickling tanks; welder-internal postannealing
- 2002: Light-gauge laser welder
- 2004: Intelligent CGL; heavy-gauge laser
- 2007: Welder-internal postannealing
Innovation – just a few examples

What new developments in steel processing lie ahead? Where should you focus your own innovations? Siemens VAI serves as your partner to help you find answers and turn new concepts into reality. At Siemens VAI, we understand your technological needs and what your customers are looking for.

High-turbulent pickling – locating and defining side jets
In the pickling process, acid renewal in contact of the strip to be pickled and turbulence in the tank are very important to achieve a high surface quality of the finished product.

By calculation and simulation our solution helps locate and define the acid injections in the pickling tanks: the side jets.

This study shows that:

- New side jets maintain a very high turbulence all along the tanks – turbulence is then independent of strip speed allowing efficient pickling action at any line speed
- New side-jet orientation allows to get a differential speed between strip and acid higher than the strip speed
- New side-jet orientation and definition allow the acid level to stay constant by limiting the acid drag-out by counter-flow side jets. Then the strip length in contact with acid stays constant at all pickling process speeds

SiChemPro – the simulation tool for chemical process analysis and calculation
SiChemPro has been developed from a powerful chemical process flow sheeting and optimization program used in chemical and petrochemical industries. Using this knowledge, the simulation tool allows rigorous mass and energy balances, calculation of process data required for equipment sizing over chemical sections of pickling, cleaning, tinning and TFS lines in steady-state operation.

SiChemPro integrates a user-friendly graphical interface, databases of chemical components – standard database with 1,800 components, private databases can be created – and a library of thermodynamics models (Engels, UNIQUAC, sour water ...).

Also, the software provides a complete set of unit operation as heat exchangers, pickling tanks, tinning tanks ... and a unique convergence approach enabling to perform multivariable control.

SiChemPro can be used in every step of a project, from the preproject phase up to prediction during production.

LED lighting – for surface inspection on processing lines
Surface inspection images are obtained by observing the reflection of a light beam that illuminates the strip. Good lighting is thus essential for accurate defect detection and classification. Traditional lighting requires close monitoring and check of light sources, and implies consumables (lamps) and maintenance operations.

This is why Siemens VAI has developed the LED lighting unit – a light source with a high lifetime of over 100,000 hours, low maintenance and no need of consumables. The solution is based on a series of high-power LED modules. Aligned together, they form a uniform, consistent light beam of high intensity that is fully adapted to surface quality control on processing lines, independent of the speed. Successful implementation in several hot-dip galvanizing, stainless-steel and electrolytic tinning plants shows the future potential of this innovation.

FAPLAC
The FAPLAC® (fully automatic pickling liquor analysis and control) is a mathematical model for acid and iron concentration management and calculation of the optimum process speed.
Life-cycle management
Partnership never ends

Siemens VAI Life-cycle Services
As a plant operator, you have conflicting needs. On the one hand, your performance is measured each quarter against short-term profitability expectations. On the other hand, you have to think on a totally different timescale compared with the capital market. Depending on the lifetime of your plant, you have to take 15 years or more into account. At the very least, that’s 60 full quarters.

But thanks to our comprehensive expertise and integrated approach to solutions, you benefit both short-term and long-term from our life-cycle services.

In the short term: Backed by our extensive experience with many reference plants, we provide you with the certainty of fast, dependable production start-up and shorter amortization periods.

In the long term: Our master plan guarantees competitive performance for your plant in every phase of its life cycle. Whether we’re providing 24/7 technical support, optimizing maintenance, or making permanent plant improvements, we are always working to ensure the cost-effective operation of your plant.
Modernization
Fit for the future

Putting our innovation to work for you
Modernizing can be an effective way to adapt to market requirements and decrease conversion costs. Siemens VAI approaches range from incremental improvements to major revamps in one stage.

Strongly increasing demands on product quality and lower-cost production force strip producers to constantly seek for equipment improvements and more efficient operations. At a certain point, this adaptation cannot be done by the operator himself in the course of normal maintenance and a comprehensive review has to be considered.

Generally, these targets can be subdivided into the following parts:
- Decrease operating costs (energy, maintenance and consumables, operation personnel)
- Improvement of product quality (thickness, flatness, surface)
- Extension of the product mix in terms of steel grades and dimensional range

Siemens VAI has vast experience in upgrading and modernization of processing lines. With a systematic approach, we work closely with our customers to develop a tailored modernization concept based on their individual needs taking all boundary conditions fully into account. The result is a solution that utilizes components of the SIROLL.C6 PL concept.

The solution may be purely electrical, automated, mechanical or a combination. Based on the selected concept, the modernization can be carried out in several steps or during a plant shutdown. Siemens VAI’s experience minimizes downtimes and ensures a fast start-up and top quality.
Excellence from experience
Selected success stories with SIROLL\textsuperscript{CIS} PL

Variety as a success factor
Customer: Posco, Pohang, Korea
Plant type: Coupled pickling line P2C
Our solution: All the process parameters are computer-controlled through a mathematic pickling model.
The result: Perfect strip surface cleanliness
Technical data: Width: 600 – 1,670 mm; thickness: 1.50 – 5.00 mm

Flexibility for high-strength steel
Customer: Maanshan, Maanshan, China
Plant type: Continuous annealing line
Our solution: Whole range of steel grades for proceeds on a fastest line.
The result: Produces automotive grades including DP and TRIP grades (1 million tpa)
Technical data: Width: 900 – 2,000 mm; thickness: 0.25 – 2.50 mm

Precision pays off
Customer: Corus, Ijmuiden, Netherlands
Plant type: Continuous galvanizing line DVL3
Our solution: Our hot-dip galvanizing line incorporates the latest developments in technology and automation for producing a wide range of top-quality products.
The result: Produces various types of high-quality coated steel (550,000 tpa).
Technical data: Width: 900 – 2,050 mm; thickness: 0.60 – 2.50 mm
SIROLL$^{CS}$ PL from Siemens VAI comprises the 35 years of experience in plant construction embodied by global market leader Voestalpine Industrieanlagenbau GmbH until 2005.

The integration into Siemens AG placed our expertise in complete systems on a new basis. The success stories presented below provide just a brief impression of our comprehensive experience.

### Instantaneous quality qualification
- **Customer:** Arcelor Mittal, Vega do Sul, Brazil
- **Plant type:** SIROLL$^{CS}$ PL – SIAS in hot-dip galvanizing line with live display, density analysis and edges-holes features
- **Our solution:** The SIAS at Vega do Sul is equipped with a special density analysis module for real-time reporting of microdross presence as well as standard surface defects detection capabilities.
- **The result:** Elimination of manual reinspection of automotive exposed quality products
- **Technical data:** Inspection of GI/GA products – strip width: up to 1,875 mm; resolution: 0.25 x 0.25 mm; speed: up to 240 m/min

### Better detect than defect
- **Customer:** Mittal Steel, Swietochlowice, Poland
- **Plant type:** Color coating line
- **Our solution:** Siemens VAI roll coater for accurate and smooth paint layer.
- **The result:** High-quality paint strip surface
- **Technical data:** Width: 700 – 1,600 mm; thickness: 0.20 – 1.20 mm

### Quality as a matter of principle
- **Customer:** Borçelik, Gemlik, Turkey
- **Plant type:** Inspection line
- **Our solution:** Laser welder mechatronic package
- **The result:** High-quality welding with coil buildup
- **Technical data:** Width: 600 – 1,530 mm; thickness: 0.3 – 2.00 mm

### Excellence in quality
- **Customer:** Lianzhong Stainless Steel Corp. (LISCO), Guangzhou, China
- **Plant type:** Annealing & pickling line with in-line rolling facility
- **Our solution:** New concept line heralds a new era of high-volume production for stainless steel.
- **The result:** The facility is the first line in the world specifically built to produce 2B finished product from “white-hot band”.
- **Technical data:** Width: 800 – 1,300 mm; thickness: 0.3 – 3.00 mm
Completely Integrated Solutions with Siemens VAI

Integrated offerings for higher plant performance

Optimized processes
We lay the foundation for optimized processes with proven, leading products worldwide, including mechanical and technological engineering for metal production, rolling and strip processing as well as process control engineering, drive engineering and power supply. Integrated online and offline process models reflect decades of practical experience and help to ensure reliable, reproducible quality.

Our process engineering expertise fuses these products into complete plant solutions that also accommodate the upstream and downstream processes. These solutions are the basis for optimal resource use, minimized waiting times and reduced maintenance and spare parts costs, as well as wide flexibility with respect to raw materials and the resulting products.

Efficient production control
A further factor for competitive production is the quality of information processing. Production data must be consolidated and compared with planning data to ensure optimal production flow.

As a leading supplier for the metals industry Siemens VAI offers integrated information technology across all automation levels – from the sensor to the Enterprise Resource Planning system. Patented solutions, such as for smelting reduction plants, electric arc furnaces, hot-strip mills, profile rolling or processing lines, enable systematic quality assurance, efficient logistics, flexible production planning and scheduling, end-to-end tracking and tracing from raw materials to the end product and back, and much more.

Maximized life-cycle returns
Services from Siemens VAI help to ensure high profitability for your plant throughout the entire life cycle. Reliable project implementation by our specialists sets the course for quick start-up and repayment of funds as scheduled.

During the operating phase, preventive maintenance, standardized components and component design that meets the requirements of steel plants help keep maintenance costs low. A reliable spare parts supply – with in-house workshops for key components – ensures high availability. And modernization at the right time guarantees a high level of competitiveness and compliance with environmental regulations in the future.
Perfect integration of every aspect

Completely Integrated Solutions offer a comprehensive range of products and services, tailored and refined to the specific requirements of your plant. The key to this approach is the close interlinking of plant construction, process engineering, electrical and automation engineering, sensors and actuators, as well as information technology and life-cycle services, seamlessly integrated by Siemens VAI.

**Completely Integrated Solutions from Siemens VAI – your benefits from an integrated concept:**

- High process quality, lower energy costs and increased throughput – by taking all process steps into account
- Reproducible high product quality and efficient use of charging materials – thanks to integrated process models
- High enterprise quality, low life-cycle costs and unique investment protection – through flexible production based on metal-specific MES systems, intelligent plant design and integrated planning
For further information contact:

Siemens VAI
Metals Technologies SAS
P.O. Box 154, 51 rue Sibert
42403 Saint-Chamond Cedex, France
Phone: (+33/4) 77298056
Fax: (+33/4) 77298390
E-mail: processingline.metals@siemens.com

Headquarters:
Siemens VAI
Metals Technologies GmbH & Co
P.O. Box 4, Turmstr. 44
A 4031 Linz, Austria
E-mail: contact.metals@siemens.com

The information provided in this brochure contains merely general descriptions or characteristics of performance which in actual case of use do not always apply as described or which may change as a result of further development of the products. An obligation to provide the respective characteristics shall only exist if expressly agreed in the terms of contract.

© Siemens AG 2008.
All rights reserved.
SIROLL is a trademark of Siemens AG.
CIS = Completely Integrated Solutions