Solutions for processing lines

Highest throughput and quality for growing demands



Your challenge expanded capacity, enhanced qualitys.

GROWING DEMAND AND ONGOING CONSOLIDATION

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?



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 quality must remain 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 YIELDY

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

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

setting the standards in strip processing technology.

EVERYTHING TO FULFILL YOUR MOST STRINGENT REQUIRE-MENTS FOR QUALITY AND EFFICIENCY

Clecim is dedicated to excellence in the field of strip processing technology. Our experience combined with the expertise of leading steel producers worldwide has led us to create integrated and comprehensive solutions that fulfill the most stringent requirements for quality, productivity 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 and annealing, unique air knives Dynawipe, light and heavy gauge Laser Welders, SIAS Automated Surface Inspection System, Side Trimmer with automatic width adjustment, advanced roll coaters and galvannealing for automotive strip qualities.

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As a globally active full-liner, we provide you with a unique expertise 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 PROCESSING LINES

- 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 lifecycle performance with a lifecycle partner backed by global resources



WITH CLECIM, YOU HAVE A RELIABLE PARTNER FOR A WIDE RANGE OF APPLICATIONS AND TECHNOLOGIES

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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.

Clecim integrates mechanical and hydraulic equipment, electrical and automation systems within turnkey plants. 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.

TURNKEY PROCESSING COMPLEXES

Clecim can advise you for 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 customers have the choice of different pickling concepts (turbulent tank, shallow bath tank), benefiting of our extensive operational and design experience.

PICKLING AND COLD-ROLLING LINES (LINKED OR BATCH)

Our technology helps you achieve outstanding product quality with respect to strip thickness, width, flatness, surface cleanliness, mechanical properties and microstructure. It also facilitates 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 such as the automotive market.

CONTINUOUS ANNEALING

As a profitable alternative to batch annealing, Clecim supplied continuous annealing lines featuring a flexible, multizone furnace design for the production of a broad range of steel grades and dimensions.

COLOR COATING

In addition to ensuring an attractive and defect-free strip appearance, our organic coatings also substantially improve corrosion resistance, especially for outside applications.

CLEANING LINES OR CLEANING SECTIONS

These solutions are designed to boost the 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 dedicated to tin-plate steel quality and an optimized metal coating process sections which ensure high-ranking products.

INSPECTION, TENSION LEVELING AND SKIN-PASSING LINES

Our solutions ensure optimal mechanical and flatness performance with high yield on finished strips.

STAINLESS-STEEL ANNEALING PICKLING LINES AND 18-HI MILLS

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

MECHATRONIC PACKAGES

Clecim factories develop, design, manufacture and test key process equipment such as welders, air knives dynawipe, Skin-Pass Mills, Tension Levelers, Scale Breakers, Side Trimmers with Scrap Chopper, roll coaters and SIAS (Automated Surface Inspection System).

Our supplies and services.

- Innovation in processing lines
- Production flow optimization
- Lifecycle management
- Modernization

Turnkey Cold-Rolling complexes experience to design optimized production.

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 Clecim, you get an experienced partner in process expertise who can help you plan and advise for your project according to time, budget, and quality demands.

GROWING DEMAND AND ONGOING CONSOLIDATION

We supply Tandem Cold Mills, Reversing Mills, Skin-Pass Mills, Strip Processing Lines, heat treatment facilities, layout and logistic planning, and can partner for related automation and production control systems for auxiliary facilities, roll shops, storage, slitting and recoiling finishing lines, and packing and dispatch equipment, we are also available to provide additional services according to your needs.

BENEFITS OF PARTNERING WITH CLECIM

- Optimized layout solutions for key and auxiliary equipment
- Highest throughput rates
- Savings in spare parts and maintenance costs over the entire lifecycle

- HBIS Group Tangshan Iron & Steel, Tangshan PR China
- Steel Authority of India Ltd, Bokaro, India
- CSN, LLC., Terre Haute, Indiana, USA
- PT Krakatau Steel (Persero) TBK, Cilegon, Indonesia



Batch or Coupled Pickling Lines and Cold-Rolling Mills

high quality and high-capacity production.



5 stands Tandem Cold Mill, HBIS Group Tangshan Iron & Steel

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 coldrolling processes. Stable operation enabled by such concept is also a key driver for high-end applications (automotive) requiring sustained high quality level. 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

Clecim 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.



Continuous Pickling Line, Tata Steel

| FEATURES

- Roll contour associated with roll axial shifting for enhanced flatness control
- Four-high and six-high mill stands for high flexibility for all products
- Physical-based analytical online models ensure accurate mill setup to achieve tight tolerances right from the start
- Use of last stand in temper mode for precise control of strip roughness
- Fully automatic operation allows operators to concentrate on product quality; actual operator intervention is reduced to an absolute minimum adjustment

- HBIS Group Tangshan Iron & Steel, Tangshan, PR China
- Panzhihua Iron and Steel Co. Ltd., Panzhihua, PR China
- Tata Steel, Ijmuiden, Netherlands
- Wuhan Iron & Steel Co. Ltd., Wuhan, PR China
- Ilva S.p.A Riva, Taranto, Italy
- Benxi Iron & Steel Co., Benxi, PR China
- ArcelorMittal, Mardyck, France
- ArcelorMittal, Liège, Belgium

Pickling lines

clean and scale-free for optimized downsteam processes.





Scale Breaker



Side Trimmer



Entry section of a Continuous Pickling Line

To achieve the highest strip cleanliness and high surface quality with a reliable and cost-efficient process Clecim offers modular continuous and Push-Pull Pickling Lines. They are supplied with advanced Laser Welders, compact Scale Breakers and customers have the choice of different pickling concepts (turbulent shallow or flat tanks).

CONTINUOUS PICKLING

Our Continuous Pickling Lines feature a modular design, high pickling efficiency, economical operation and are integrated with the latest advanced technologies. The line can be also combined with a Galvanizing Line (CPGL - Continuous Pickling and Galvanizing Line).

PUSH-PULL PICKLING

For the pickling of up to 1,000,000 tons of strip per year depending on the product mix, Push-Pull Pickling Lines offer significant advantages in terms of investment costs and operational flexibility (frequent change of strip dimensions and steel grades) with uniquely designed V-shape flat pickling tanks.

MAIN Benefits

- Broad range of pickling technology available to cope with customer expectation
- Modular design to optimize operation and maintenance practices and cost
- High efficient pickling rates to achieve a surface clean and free of scale
- Special anti-stain system that does not require chemical additives
- Energy efficient design of the fume extraction and sealing system



Side trimming section on a Continuous Pickling Line

FEATURES

- Heavy laser welding machine (solid state laser cutting and welding)
- High tension Scale Breaker (up to 100 tons)
- Turbulent flat tanks for high process speeds (up to 400 m/min) and production output
- Shallow tanks for lower process speeds
- Skin-Pass Mill, Tension Leveler (more than 400 references worldwide)
- Properties monitoring Inline Mechanical properties
 gauge
- SIAS Automated Surface Inspection System
- Turret-type Side Trimmer with flying width adjustment, Edge Monitoring and Scrap Chopper
- Pickle Liquor Analysis and Control System

- HBIS Laoting Iron & Steel, Laoting, PR China
- Shougang Jingtang Iron & Steel Co. Ltd., Jingtang, PR China
- Chengde Iron & Steel Group, Chengde Co. Ltd., PR
 China



Tank technologies.

DETAILS OF THE PICKLING LINES TECHNOLOGIES

SHALLOW BATH PICKLING TANK

The shallow bath tank reduces running and maintenance costs because of its in-tank heat exchanger that does not require a circulation heating system. The boundary films of acid solution on the strip surfaces are broken by the intermediate weirs and rolls, resulting in improved pickling effect.

FLAT TURBULENT SIDE JET PICKLING TANK

The side jet pickling tank can reduce the pickling time (descaling time) by 35% to 45% of the conventional deepbath pickling tank. The acid solution is filled into the tank area by side jet seal nozzles.



Galvanizing lines accurate and smooth coatings.











3. Zinc coating

1. Entry section





4. Skin Pass Mill/Tension Leveller



5. Side-Trimmer



6. SIAS (Automated Surface Inspection System)

Galvanizing Lines, adding value for a wide range of applications.



Skin-Pass Mill

To meet your expectations and your market (steel grades, gauges, coatings, qualities...), Clecim designs and implements different solutions according to your upstream production facilities and process route. Based on the above considerations and additional customer constraints, the most suitable solution will be proposed.

GALVANIZING OF **COLD-ROLLED STRIP**

With the new generation of Hot-Dip Galvanizing Lines from Clecim, 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. Clecim Galvanizing Lines are capable of applying the following coatings:

- Pure zinc
- Galvannealed (ZnFe)
- Galfan[®] (Zn95 Al)
- Zinc-aluminium (Al55 Zn)
- Aluminium (AISi and AI)

FEATURES

- · Laser welding machine (pioneer in solid state laser cutting and welding)
- Cleaning section
- In-line multi zone annealing furnace
- Robot solutions for dross management

- Air knives Dynawipe, zinc wiping system



Temper Mill - Tension Leveler section

- Electromagnetic strip vibration damper and crossbow corrector
- Strip roughness and mechanical properties controlled with our skin-pass mill and tension leveller
- Properties monitoring
- Roll coater installed in post treatment section
- Single head or turret-type side trimmer
- SIAS Automated Surface Inspection System
- TCO[®]

MAIN BENEFITS

- Coating applications for virtually all strip qualities, including extra-deep drawing grades with yield strengths down to 160 N/mm²
- Galvanized strip surfaces ideal for automotive exposed parts and home appliance applications
- Fully automated operation with in-line quality control
- Integrated environmental solutions that reduce energy, chemicals and process-water used
- Easy maintenance and operation due to ideal equipment design

- HBIS Laoting Iron & Steel, Laoting, PR China
- Talleres y Aceros TYASA (TYASA), Veracruz State, Mexico
- Ternium, Pesqueria, Mexico



Air knives Dynawipe

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. Clecim has developed a solution type that is suitable for both wide and narrow hot-rolledstrip 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.

MAIN Benefits

- No need for annealing and cold rolling
- Highly compact plant layout and design
- Cost savings through in-line pickling as option
- Low operational and environmental expenditures
- Flexible on- and offline operation with induction heating

SELECTED REFERENCES

HBIS Group Tangshan Iron & Steel, Tangshan PR China

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. Clecim has optimized cleaning section technology according to the incoming strip cleanliness, furnace type and application of the coated product.

FEATURES

- Improved technology of cleaning section design
- Spray, "V" shape and electrolytic, vertical tank and electrolytic

MAIN Benefits

- Full "cleaning solution" not just a cleaning section
- Optimization of utilities consumption
- Waste reduction

AIR KNIVES DYNAWIPE

Our zinc wiping solutions are adapted to the end application demand for a cost effective approach. Adjustable nozzle lip opening is a unique feature enabling to precisely control the coating thickness, longitudinally and transversally, for quality and cost efficiency.

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

Continuous Annealing Lines

advanced technology for various grade qualities.





Laser Welder

Vertical furnace

Cleaning section



Entry section at Tiantie Metallurgical Group, Tianjin, PR China

NONSTOP QUALITY PRODUCTION

As a profitable alternative to batch annealing usually selected for high-end application e.g. automotive, Clecim Continuous Annealing Lines lead to high throughput rates, high yields, significant energy savings and the production of high-quality products.

| FEATURES

- Laser welding machine (pioneer in solid state laser cutting and welding)
- Vertical or Horizontal Electrolytic Cleaning section
- Multi zone furnace
- Skin-Pass Mill and Tension Leveler
- Turret-type Side Trimmer and Automatic chopper
- Properties monitoring Inline Mechanical Properties Measurement System
- SIAS Automated Surface Inspection System
- TCO[®] Total Cost Optimizer

MAIN Benefits

- Automatic coil insertion onto pay-off reel
- Automatic coil opening and head end threading to welder
- Exact temperature control and rapid cooling for production of steel qualities not attainable with batch annealing
- 6-high UCM Skin-Pass Mill for strip surface & improve strip shape
- Precision Side Trimmer and scrap baller for reliable line operation and accurate product width adjustment
- Proven high plant availability
- Easy maintenance and operation due to ideal equipment design

SELECTED REFERENCES

- HBIS Laoting Iron & Steel, Laoting, PR China
- Tiantie Metallurgical Group, Tianjing, PR China



Coil charging and pay-off reel section

FURNACE TECHNOLOGIES

For more than 40 years, Clecim has integrated vertical and horizontal furnaces in its solutions to the steel industry, responding to customer requests for production capacity, thermal treatment cycle, greater energy savings, extended equipment lifetime, etc.

TYPE OF FURNACES

- Vertical furnace
- Horizontal furnace
- L-shaped furnace, a combination of vertical and horizontal

MAIN Benefits

- Proven high availability
- High quality products for exposed automotive use
- Fully automated operation to minimize number of operators
- Capability to provide stable strip transfer technologies for vertical continuous furnace up to 1,000 mpm for tin products
- Capability to supply several types of in house cooling technology to satisfy the market demands
- Accurate temperature control by using advanced thermal models
- Solution for AHSS production such as direct flame impingement burners, water / hydrogen quenching strip cooler, etc.

Furnace technologies

higher production capacity, greater energy savings.



Vertical furnace

A LONG-TIME FURNACE SUPPLIER TO THE STEEL INDUSTRY

For more than 40 years, Clecim has integrated vertical and horizontal furnaces for the steel industry, responding to customer requests for higher production capacity, greater energy savings, extended equipment lifetime, etc. Heating and cooling are key technologies for furnace equipment. Also, thanks to the long-term partnership with multiple Furnaces manufacturers, Clecim has accumulated know-how to handle high-temperature steel strip in the furnace. Clecim has integrated:

- Furnaces for Continuous Annealing Line (CAL)
- Furnaces for Continuous Galvanizing Line (CGL)
- Furnaces for other lines, such as Annealing and Pickling Line (APL)

The type of furnaces are:

- Vertical furnace
- Horizontal furnace
- L-shaped furnace, which is a combination of vertical and horizontal

Stainless Annealing & Pickling Lines efficient, reliable and economic.



Lianzhong Stainless Steel Corp., Guangzhou, China

Clecim terminal equipment and mechatronic equipment (such as our solid-state Laser Welder LW21) have been specially designed to process stainless steels, focusing on the highly demanding surface finish. The annealing section is designed based on a tunnel type furnace with unfired pre-heat first stage, fume heat recovery, high-efficiency and low-NOx burners. The chemical section features high-turbulence tanks, electrolytic tanks and brush scrubbers. For hot rolled products (HAPL), shot blasting equipment and a Scale Breaker are installed between the furnace and pickle section to help with oxide removal. For cold rolled products (CAPL), a multistage cleaning section is installed upstream of the furnace.

Direct Rolling Annealing and Pickling Lines (DRAPL) or Hot Rolling Annealing and Pickling Lines (HRAPL) can be supplied with the integration of single or multi-stands **Power X-Hi® mills**.

CLEANING Section

Strip surface quality is an essential property of stainless flat products. Strip cleanliness prior to the annealing furnace is therefore essential. Clecim has designed an in-line degreasing section that ensures the highest product quality.



Entry section equipment in an Annealing and Pickling section

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 type furnace and chemical pickling section. For hot band, Clecim also provides shot blast and Scale Breaker equipment between the furnace and pickle section to help with oxide removal.



Tension reel and associated equipment

| FEATURES

- Annealing section with first stage, unfired pre-heat, for increased efficiency
- Air and water cooling
- Electrolytic and mixed acid pickling with additional brush scrubbers
- High-turbulence line tanks
- Brush and spray rinsing

MAIN Benefits

- High-efficiency
- Maintained strip shape
- High maximum process speed
- Optimum pickling

SELECTED REFERENCES

- TCSS, PR China
- Baosteel Desheng Stainless Steel Co., Ltd., Fujian, PR China
- Jiuquan Iron & SteelCO., Ltd, PR China
- Posco, Korea
- Lianzhong Stainless Steel Corp. (LISCO), Guangzhou, PR China



2-high Skin-Pass Mill

INTEGRATED ROLLING AND PROCESSING

Clecim 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

- Annealing and Pickling Lines
- Laser 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

• ArcelorMittal Ugine, France

Power X-High®

high reduction and excellent finish.



Beihai Chengde Stainless Steel Co., Ltd., PR China

Stainless steel is characterized by high strength and an appealing finish. Various mill designs including KZR mill, Power X-HI[®] mill, HZ mill, and 6-high Universal Crown Control Mill (UC-MILL) with small-diameter work rolls are offered in tandem or single reversing configuration, in order to achieve efficient rolling of hard stainless products. For a smooth and aesthetic finish, Finishing Skin Pass Mills with large diameter work rolls are integrated into annealing and pickling lines (APL) and are also available as standalone reversing machine.

TANDEM POWER X-HI® MILL

As continuous tandem or integrated in Annealing and Pickling Lines our mills allow an average 70% reduction (5 stands) for cost-effective production.

To perform cost-effective reduction on stainless black and white coils Clecim has developed the Power X-High[®] mill which includes numerous unique features, such as patented coolant distribution system.

The technology provides a full mechanical adjustment of the lateral support rolls to ensure stable and controllable rolling. Lateral shifting and bending of the intermediate rolls allow strip shape correction. The automatic roll change car and flying roll change function make the replacement of intermediate and work rolls faster while the process section is operating and without changing the side supporting rolls.



Power X-Hi®

skin-pass Mill

Our 2-high skin pass mills are available with a rolling force of 1000 or 1200 tons and work roll diameters ranging from 710 to 830 mm. The roll surface is permanently maintained in good working condition thanks to a polishing system, with automatic pressure and oscillation control.

Reversible Skin-Pass Mill is available for multi-pass process featuring paper winders/unwinders at both ends and reels with 25 Tons tension.

- Beihai Chengde Stainless Steel Co. Ltd., Chengde, PR China
- Baosteel Desheng Stainless Steel Co., Ltd., Fujian, PR China
- Lianzhong Stainless Steel Corp. (LISCO), Guangzhou, PR China

Electrolytic Cleaning Lines

compact processing for big gains efficiency.



Cleaning section at Tangshan Cold Rolling Mill

The Electrolytic Cleaning Lines (ECL) supplied by Clecim enable the removal of the remaining iron fines and oil residues from the tandem mill.

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
 - Hot alkali dunk tank or spraying tank
 - Vertical electrolytic cleaning tank or "V" shape electrolytic cleaning tank
 - Strip immersion enhanced by turbulent technology
 - Automatic cleaning of the spray bars (no need to dismantle the spray bar)
 - Self-adjustment of the brushes intermesh
 - Easy roll change
- 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

To degrease your strips, Clecim has developed a "cleaning solution" (dipping or spraying, type of brushes, type of electrolysis, type of rinsing, fume exhaust) optimized in terms of:

- Investments costs
- Operating cost
- Environmental impact

| FEATURES

- Laser welding machine (for coil build-up)
- SIAS Automated Surface Inspection System

- Steel Authority of India Ltd, Bokaro, India
- Essar Steel Private Limited, Gujarat, India
- Borcelik Steel Industry Trade Inc., Gemlik, Turkey
- PT Krakatau Steel (Persero) TBK, Cilegon, Indonesia

Recoiling and Leveling Lines

adding the final touch to high-quality products.



Welder Recoiling and Inspection Line

Clecim supplies high performance Recoiling and Leveling Lines which can be coupled with upstream processes and inspection systems. These lines are aimed to process semi-finished products for all type of applications: construction, household appliance or automotive products quality. Frequently positioned after strip processing lines, such as pickling, galvanizing, painting or annealing, these lines will incorporate on demand various processes to bring the required added value to your products.

RECOILING AND

Clecim designs and implements different solutions according to customer market (steel grades, gauges, coatings, throughput, quality grade...), and production upstream facilities. Based on the above considerations and additional customer constraints, the most suitable solution will be proposed.

Various combinations of processes can also be considered to optimize your production:

- Continuous Skin-Passing
- Tension Leveling
- Side Trimming
- Automatic or visual strip surface inspection
- Oiling



Tension Leveling Line

FEATURES

- Laser welding machine (for coil build-up) or Mash-Lap welding machine
- Hot Skin-Pass Mill or cold Skin-Pass Mill
- Tension Leveling machine
- Properties monitoring to allow continuous Inline Mechanical properties measurement
- Turret-type Side Trimmer with flying width adjustment, edge monitoring and Scrap Chopper
- SIAS Automated Surface Inspection System
- Eccentric flying shear as an alternative to a guillotine shear or rotary shear

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

- Kosice, Slovakia
- Mycron Steel Berhad, Selangor, Malaysia

Electrolytic Tinning Lines outstanding corrosion protection.



Tinning Line in Iran (entry section with Side Trimmer)

The Electrolytic Tinning Line (ETL) and Tin-Free Steel (TFS) coating are the efficient solutions to protect packagings from corrosive contents. The electrolytic tinning process suits packaging requirements in term of surface quality & flatness, mechanical properties & formability, weight optimization and corrosion-resistance.

PROTECTION FROM CORROSIVE CONTENTS

Our Electrolytic Tinning Lines (ETL) are designed to provide our customers with high plant performance and product quality. Our Electrotinning solution allows for equal or differential strip coating. When installed upstream of the coating process, our multi-roll Tension Leveler improves drastically the coating performance.

Our coating solutions include:

- Electrotytic plating with MSA electrolyte (Methyl Sulphonic Acid) and soluble anodes
- Tin-Free Steel (TFS) coating using high current density cells. TFS is less costly than tin plating, it offers superior lacquer and paint adhesion, as well as strong resistance against corrosion
- The main processes of the ETL are welding, cleaning, leveling, pickling, tinplating - reflowing - passivating with by-pass to TFS, final control & inspection



Multi-roll Tension Leveler, Miory Steel (MMPZ), Republic of Belarus

FEATURES

- Mash-Lap welding machine
- Muti-roll Tension Leveler
- Side Trimmer
- Properties monitoring Inline Mechanical properties gauge
- Turret-type Side Trimmer with flying width adjustment, edge monitoring and Scrap Chopper
- SIAS Automated Surface Inspection System

MAIN Benefits

- Strip flatness controlled before tinning process
- Process section designed for fast and efficient strip coating
- Optimization of utilities consumption
- Reproducible "in control" process technology

- Farokhshahr Steel Industries, Tehran, Iran
- Aceralia Echevarri, Spain
- Tata Steel Europe Ltd Group, Trostre, The United Kingdom

UNIQUE SOLUTIONS TO IMPROVE THE PERFORMANCE OF YOUR PROCESSING LINES

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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.

Mechatronic packages benefit from our



Laser cutting 8mm with Heavy Laser Welder

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 of Processing Lines mechatronic packages:

- Welders
- Scale Breakers
- In-line Skin-Pass Mills and Tension Levelers
- SIAS Automated Surface Inspection System
- Roll coaters
- Air knives Dynawipe
- Dross removal robot
- Side Trimmers and Scrap Choppers

WELDERS

Clecim has been a major welder supplier for the iron and steel industry since the 1970s. In 2010, we initiated a global development program for all laser welder types to provide customers with equipment featuring high performance, increased reliability and the ability to process future steel grades. Today, Clecim 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 process with the laser process:

 Light Laser Welder (LW21L) suitable for the application up to 1.7 mm. With its compact design and ability to weld all the most advanced grades, its fitted well Electrical Steel ACL & Slitting Line, Thin Gauge Galvanizing Lines, Recoiling and Leveling Lines, Inspection Lines, ...



Medium Laser Welder

bundled experience.

- Medium Laser Welder (LW21M) are dedicated to the application up to medium thickness range like : Thin Gauge Pickling Line, Hot Annealing and Pickling line, Continuous Annealing Lines, Galvanizing Lines, Recoiling and Leveling Lines, Inspection Lines, ...] can benefits from the advantage of this machine
- Heavy Laser Welder (LW21H) are dedicated to the Pickling Line, Continuous Tandem Mill & Coupled Pickling Tandem Mill as well has Hot Annealing and Pickling Line

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, ...)
- Laser use in full safety condition (no beam alinement necessary)

MAIN Benefits

- Fully automatic welding machines requiring no operator assistance
- Increased welder reliability (over 99 %)
- Perfect command of the different welding process for laser process
- Easy operation thanks to user-friendly HMI
- Easy maintenance with easy access to the components and long service life



Scale Breaker on a Pickling Line and Tandem Cold Mill

SCALE Breakers

This is a time-tested Clecim technology. Its benefits have resulted in the orders of plenty of 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 entry and exit tension bridles with their respective drive systems.

SKIN-PASS MILLS AND TENSION LEVELERS

With Clecim, 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, four-high or six-high design - thus providing a best-inclass solution, no matter your applications.

SIAS AUTOMATED SURFACE INSPECTION SYSTEM

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.



SIAS (Automated Surface Inspection System)

FEATURES

- Clear HMI to provide relevant information both online
 and offline
- 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 plant productivity

SIDE TRIMMER AND SCRAP CHOPPER

Our Side Trimmers and our single-stand Scrap Chopper are designed and manufactured to ensure high quality cutting and strong availability. Our turret-type/double heads allows strip cutting and knives change at the same time and a very short head changing cycle time. Close association of Side Trimmer and Scrap Chopper is a guarantee for a best scrap disposal and lowest cobble ratio. Many features can be added, such as the Dynamic Width Adjustment/Flying Width Change that lowers the cobble ratio and improves production yield; or the Edge Monitoring system that inspects trimmed edge to detect knife defects and optimizes machine setup [Gap/Lap]. Condition Monitoring System [CMS] is an optimizing tool for maintenance purposes.



Air knife Dynawipe

AIR KNIVES **DYNAWIPE**

From the initial stage, Dynawipe Air Knives technology has been thought & designed on the basis of fundamental guidelines that insure Quality and Uniformity of coating thickness, opening the path to the achievement of the best Surface Aspect possible white controlling tightly "Zinc, Al, Mg, Si, ..." consumption.

MAIN Benefits

- Reduction of coating consumption (significant savings)
- Coating thickness Uniformity and surface Quality
- Energy consumption
- Strip stability
- Pot rolls equipment
- Control automation system with Feed-back/Feed-forward control loops



Integrated design including a safe environment

DROSS REMOVAL ROBOT

Our dross robot is a perfect addition to our Dynawipe, maintaining an optimum zinc bath in full security for the operation personnel.

MAIN Benefits

- Limit heavy duty handling for operators
- Safer environment for operators
- Design for user friendly operation
- Improve bath surface for higher strip quality
- Minimizes waste of coating material



Vertical chemical coater

ROLL Coaters

Clecim 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 or Color Coating 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.

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

GREAT INVESTMENT SECURITY IN THE LONG TERM

Based on many years of cooperation and in partnership with OEMs and plant operators, we have developed a scalable automation solution. 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 process control system is open to expansion and conversion while at the same time incorporating a variety.

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

YOUR EXPERT

As a comprehensive solution for continuous and batch-process strip processing plants, Clecim solutions cover all parts of plant engineering, from the world's best automation and drive engineering to technological solutions.





What new developments in steel processing lie ahead? Where should you focus your own innovations? Clecim serves as your partner to help you find answers and turn new concepts into reality.

At Clecim, we understand your technological needs and what your customers are looking for.



3

7

Innovation

just a few examples.

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 counterflow 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 & 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, UNI-QUAC, 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.

SIAS DEEPLEARNING – INSPECTION SYSTEMS THAT BREAK THE GLASS CEILING OF PERFORMANCE

SIAS – the Clecim automatic strip surface inspection – as one of the mechatronic packages of Clecim has been realized its revolution in Deep Learning. This domain of Artificial Intelligence is particularly dedicated for image processing.

Clecim has developed a new SIAS that can extract much more information in images provided by its cameras. SIAS DeepLearning is a breakthrough in training as well as in inference (real-time restitution). The main benefit for a user of such systems is an improvement in detection as well as in classification.

In detection, SIAS DeepLearning catches up low contrasted defects and normally contrasted ones drowned out in the noisy surface background (like checkered plate, strip with spangle).

In classification, SIAS DeepLearning determines during training the characteristics of defects to distinguish one class from the others and use them during inference. It is particularly prominent with multi-field inspection.

NEW CLECIM PICKLING CONCEPT

The "New Clecim Pickling Concept" (fully automatic pickling liquor analysis and control) is a mathematical model for acid and iron concentration management and calculation of the optimum process speed.



High-quality turbulent pickling processes: results are applied and improved in each line

Lifecycle management BDA way of working.

As a partner, we support you all along the lifecycle of your equipment through our BDA way of working:



Before: define improvements and optimization solutions through Consulting Services

During: deliver on our commitments with premium quality equipment and services to enable our customers reaching their targets

After: support the operations and maintenance activities with on-site assistance and spare parts

LIFECYCLE 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 longterm from our lifecycle 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 lifecycle. 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.



Heavy Leaser Welder

PUTTING OUR INNOVATION TO WORK FOR YOU

Modernizing can be an effective way to adapt to market requirements and decrease conversion costs. Clecim 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:

- 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

Clecim 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 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. Clecim experience minimizes downtimes and ensures a fast start-up and top quality production.



SELECTED SUCCESS STORIES WITH PROCESSING LINES. CLECIM COMPRISES MORE THAN 40 YEARS OF EXPERIENCE IN PLANT CONSTRUCTION.



HBIS Group Tangshan

Iron & Steel Company,

Tanashan PR China

Line type: Continous Pickling Line

Clecim solution: A high-speed Continuous Pickling Line, the fastest in P.R. China, downstream to an ESP (Endless Strip Processing) line, able to process high quality steel grades like the latest generation of Advanced High-Strength Steels (AHSS) and silicon steels. Our in-house design covered many of the strategic equipment and advanced features of this CPL (Scale Breaker, Turbulent flat tanks, Side Trimmer and Scrap Chopper, 1500 tons Skin-Pass Mill) **Technical data**: Annual capacity: 2,000,000 tons; Thickness: 0.8 - 4.0 mm; Width: 900 - 1600 mm; Processing speed: 400m/min



Clecim solution: This Continuous Annealing Line serves the automotive market (exposed and non-exposed parts up to AHSS) as well as high quality applications in household appliances. With the provided process & quality know-how package, a new market opportunity has been offered to HBIS Group and the CRM2 (PLTCM, CAL, CGL4, CGL5, CGL6 supplied by Clecim) is now the pilot plant of the HBIS Group for automotive market **Technical data**: Annual capacity: 750,000 tons; Thickness: 0.2 - 2.5 mm; Width: 700 - 1,600 mm; Processing speed: 400m/min



Line type: Continuous Galvanizing Line 2

Clecim solution: This turnkey project consists in the delivery of the new galvanizing line 2 to produce 350,000 metric tons per year of IF steel and high-strength cold strip with a focus on automotive exposed parts. A new market opportunity is offered to Erdemir with this modern CGL 2 and a process & quality know-how package from Clecim **Technical data**: Annual capacity: 750,000 tons; Thickness: 0.2 - 2.5 mm; Width: 700 - 1,600 mm; Processing speed: 400m/min



Line type: Direct Rolling Annealing and Pickling Line

Clecim solution: A 4-stand patented Power X-Hi[®] tandem cold mill coupled with an Annealing and Pickling Line including a Skin-Pass Mill. Two lines in one to decrease investment costs, operational costs and to produce top quality products (continuous rolling and skin passing provide tight shape, thickness and surface aspect tolerances; for sensitive materials, no intermediate surface or mechanical alteration, since there is no intermediate storage) **Technical data**: Incoming material: Hot-rolled annealed and pickled stainless steel; Product grades: 200 and 300 series; Entry/Exit thickness: 2.0-5.0 mm / 0.8-2.5 mm; Width: 1,200 mm; Outgoing surface finish: 2B



Line type: Electrolytic strip cleaning line within Cold Rolling Mill Plant **Clecim solution**: This Electrolytic Cleaning Line from Clecim is an efficient solution for strip cleanliness by removing iron fines and oil film from the surface. Our electrolytic solution is a must to achieve optimum performance **Technical data**: Annual capacity: 370,000 tons; Thickness: 0.25 - 1.5 mm; Width: 800 - 1,560 mm; Processing speed: 270m/min



Line type: Recoiling Line and inspection line

Clecim solution: A single line for multiple applications. The line can be used as a reparation line to produce high-quality coils including auto-exposed applications. One coil can be made out of 2 coils thanks to the Laser Welder which produces flat seams **Technical data**: Annual capacity: 200,000 tons; Thickness: 0.30 - 2.20 mm; Width: 800 - 1,850 mm; Processing speed: 300m/min



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