SMS SIEMAG

SMS group

ELECTRICS and AUTOMATION

X-Pact®

SMS SIEMAG | Electrics and Automation

ELECTRICS and AUTOMATION for metallurgical plants and rolling mills

Increasingly, the market demands all-inclusive solutions, with everything from the motor shaft to the production planning system supplied from one source. That reduces the number of interfaces both in engineering and manufacturing. Using X-Pact means you hold the key to meeting this requirement. And, due to thoroughly pre-tested systems, the plants can be commissioned after ever shorter delivery times.

ALL-INCLUSIVE SOLUTIONS based on a modular system

Close cooperation and coordination between our specialists in electrics, automation, technology and mechanics ensure that the plants are exactly tuned to each other. Wherever possible and whenever faced with similar tasks, we use uniform, modular-design components. That makes handling and maintenance easier, facilitates troubleshooting, which in turn creates a convincing cost/benefit ratio.

So, because X-Pact draws on the experience from hundreds of automation packages we have supplied, you can quickly and efficiently achieve all the results you need to succeed.

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CONTENTS

X-Pact®

PLUG and WORK

Making the most of SYNERGIES

The experience of SMS Siemag in constructing plants for the steel, stainless steel and nonferrous metals industry covers plant, technology and process engineering for all stages of production and processing. Added to this experience is automation know-how that leads the world.

This is how mechanics, technology, electrics and automation form an effective unit – clearly structured and geared to your products. Using these perfectly harmonized components, it is possible to optimally implement the latest developments in steel production and processing at any time.

Steep START-UP CURVES for new installations and revamps

Prior to commissioning our automation technology, we carry out plant functioning and operation simulations. Included here is the process of linking the automation system to a simulation model that covers the entire process. This way, we carefully test and optimize routines and technological functions even before commissioning. That ensures steep start-up curves and the production targets you want to achieve – especially for modernizations.

INTERNATIONAL standards for hard and software

X-Pact electric and automation systems use globally available components and are based on recognized standards. This guarantees you the best possible security, service and independence. It also makes upgrades and continuous updates possible in record time. Take advantage of this combination to tap existing and future resources in the long term.

X-Pact simulates your plant's characteristic values before installation.

Practice-proven cooperation and synergy effects lead to high product quality and productivity.

From liquid STEEL to the finished product

Using X-Pact you can coordinate all processing levels in the metallurgical and rolling mill industry – from steel production right through to finished strip. X-Pact offers you a technology and automation package that provides high flexibility in production and final products geared to the market at all times.

Particularly worth mentioning are today's steadily growing demands made on final product quality, and X-Pact meets them all. It ensures performance that is adjustable and expandable throughout the plant's lifetime. That supports you in achieving leading market positions.

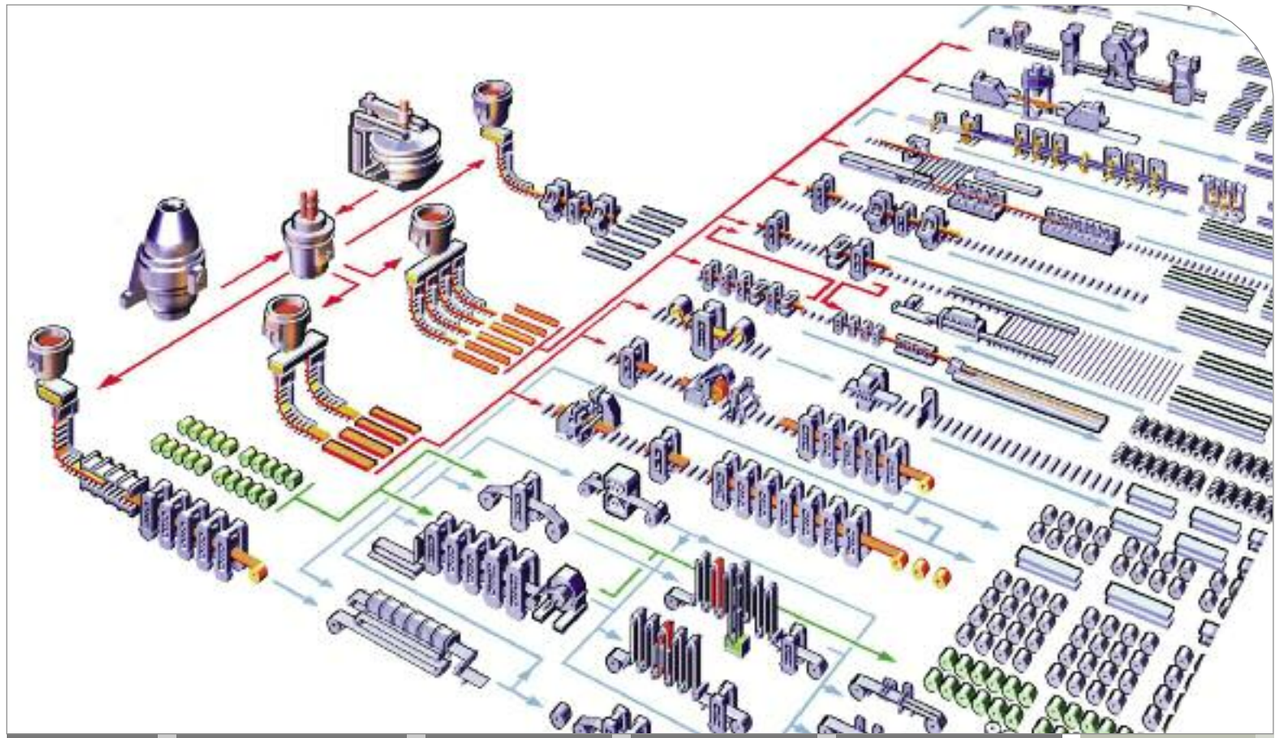
INTEGRATED packages

There are even more extras available with X-Pact because it comprises the entire electrics, sensory systems and all levels of automation up to Level 3. All components match each other and are exactly tuned to the demands of the metallurgical and rolling mill industry. This helps you attain high productivity and plan how to unlock market potentials much more effectively.

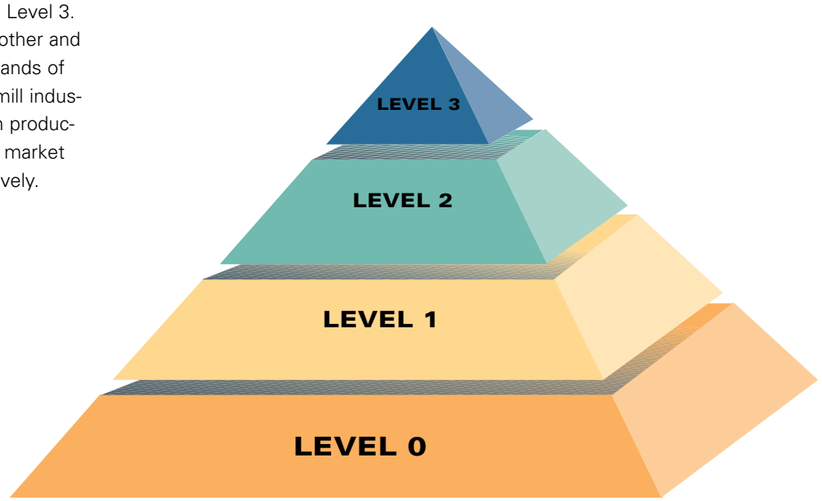
Modular structure for CUSTOM solutions

X-Pact is entirely modular in structure. That ensures short adjustment times and a high availability of your plants.

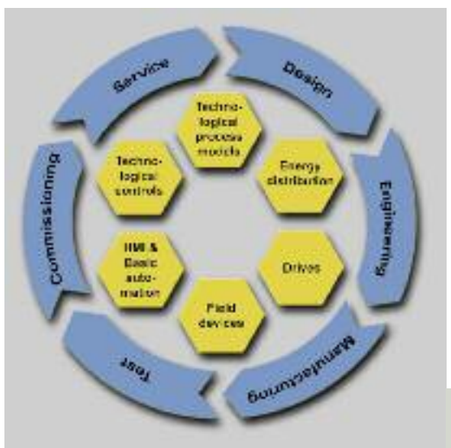
Significant here is that X-Pact combines the current operating experience of our customers with technological developments to create customized systems. The modular design makes it easy to quickly vary the system structure, extend it as required and adequately respond to the requirements of production at all times.



▲ Steelworks | ▲ Continuous casting plants | ▲ Hot flat rolling mills | ▲ Cold rolling mills | ▲ Strip processing lines



Levels of electrics and automation



Range of products and services

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Increased productivity for STEELWORKS

Worldwide acceptance of X-PACT in steel production

The worldwide acceptance of X-Pact in steel production is proven by the large number of steel plants of all types we have automated. Whatever the application – whether BOF, EAF or CONARC® smelting processes, whether secondary metallurgy or stainless steel production – X-Pact automation controls turnkey plants just as perfectly as individual or partial plants.

COMPLETE PACKAGE from SMS Siemag

Our experience is rooted in system integration of the entire range of drive systems, the power distribution up to dynamic compensation, the instrumentation, basic automation and process optimization. This includes the relevant service for both new plants and revamps.

PROCESS MODELS for calculating the power, charge materials and alloys required

Power and material management exactly tuned to the smelting process forms the basis for automation of steel plants with X-Pact.

A whole series of measuring and control units supports the effective application of the process models. Extensive calculations relate to the energy input, the charge materials and the ferroalloys. Working to narrow tolerances by means of analysis as well as exactly achieving the right final temperature, final steel weight and treatment duration are key factors in increasing productivity.

INCREASED PRODUCTIVITY

Using X-Pact minimizes re-blows, reduces ladle cycle times and increases the service life of the refractories. That in turn reduces the amount of maintenance. There are even more benefits as a result of using the X-Pact metallurgical process models, such as systematically optimized production costs, increased productivity and sustainable quality assurance of the final products.

Conventional or INTEGRATED systems

Our automation systems can be designed as conventional or integrated systems, i.e. with separate or common HMI for level 1 and level 2. Typical features of X-Pact are process and data links to pig iron production, continuous casting technology and other metallurgical plants.

Metallurgical process models for steel production and secondary metallurgy are integrated in X-Pact.

Control station of an AOD converter

AOD converter

Metallurgical PROCESS MODELS for steel production and secondary metallurgy are integral parts of X-Pact:

- BOF process
- CONARC® process
- EAF process
- MRP-L process
- AOD process
- LF process
- VD/VOD process
- RH-Top process
- LTS process
- HMD process

Electric arc furnace

Electric and Automation with X-PACT

Level 3

- Production planning and scheduling (PPS)

Level 2

- Steel plant computer system
  - Charge material calculation
  - Alloy calculation
  - Mass and energy balances
  - Process prediction
  - Determination of process set points

Level 1

- Basic automation system
  - Operator stations
  - Sequencing and interlocking
  - Measured value processing
  - Signal and data exchange

Level 0

- Complete systems to equip plants
  - Field instrumentation
  - Drive systems
  - Power distribution
  - Auxiliary equipment

Top values for CONTINUOUS CASTERS

Precise process control with X-PACT

Process control with X-Pact for continuous casting is seamless and precise. To control the casting process and the molds, advanced level 2 and level 1 systems are available. This is an area where we have unparalleled experience with both new plants and revamps. Also contained to complete the range are exactly matched drive control and sensory systems.

PROCESS MODELS for many tasks

Automatic material tracking provides the process models with the data they require. Using the break-out prediction system, the model recognizes possible incidences of sticker break-out at an early stage so that suitable steps can be taken to prevent them. To visualize the heat transition between the strand and the mold, mold temperature mapping is ready to be used. The caster computer system applies casting speed optimization to coordinate the optimized casting speed. Finally, the spray water control and cut length optimization features included in X-Pact complete the level 2 package for the process models.

Technological controls of X-PACT for high quality and flexibility

The technological controls of X-Pact for automatic continuous casting range from tundish level control to mold level control. The high mold level accuracy ensures a very good quality material surface without casting powder inclusion. To allow high flexibility in the range of final products, the width of the narrow side of the mold can be adjusted during casting. Using hydraulic mold oscillation it is possible to vary the stroke frequency, stroke height and curve shape as well as to record and visualize the friction force.

The X-Pact hardware solution requires little maintenance. Specially developed devices with plug-in connections are used to achieve rapid change-overs. X-Pact is the first choice for ideal cycle times and high final product quality in continuous casting.

Temperature distribution across the width of the mold

Data recording and processing

X-PACT for continuous casting lines

Level 3

- Production planning and scheduling (PPS)

Level 2

- Break out prediction system (BPS)
- Mold temperature mapping (MTM)
- Caster computer system (CCC)
  - Material tracking (MT)
  - Casting speed optimization (CSO)
  - Spray water control (SPW)
  - Cut length optimization (CLO)
- Dynamic solidification control/ temperature tracking (DSC/TT)
- Autopilot taper and speed optimization
- Integrated Product Quality system (IPQS)

Level 1

- Hydraulic tundish adjustment (HTA)
- Tundish level control (TLC)
- Remote adjustable mold (RAM)
- Hydraulic mold oscillation (HMO)
- Mold level control (MLC)
- Hydraulic segment adjustment (HSA)
- Liquid core reduction (LCR)
- Basic automation and HMI Step control, drive control, operating stations
- Plant and process monitoring system (PPMS)

Level 0

- Technological measuring systems
- Power distribution, motors, feeders, drive systems
- Field equipment

CyberLink® segments

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Increased performance for HOT FLAT ROLLING

Increased performance with X-PACT

Central to increasing the performance of modern hot rolling mills is automation with X-Pact. It uses physical process models to determine the setup of rolling mills from the furnace to the coiler. Mill Pacing optimizes the plant throughput. To precisely control all details of the process, a complete set of control systems is available.

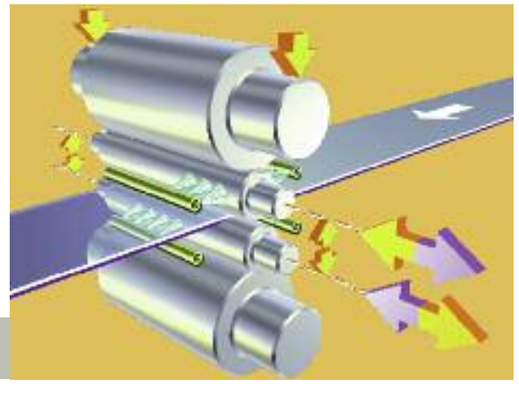
HIGH-PERFORMANCE models

Pass schedule models calculate the reduction strategy. Based on the pass schedules, the PCFC® model (profile, contour and flatness control) calculates the necessary adjustment values for work roll bending and shifting devices using CVC PLUS technology. This is how strip is produced with perfect profile, contour and flatness. Whenever corrections during rolling are necessary, the PCFC® model communicates them directly to the adjusting systems. The grain size model monitors the metallurgical properties of the products. X-Pact for hot rolling mills combines the operating and visualizing functions of level 1 basic automation with those of the level 2 process models and integrates them, also taking ergonomic aspects into account.

X-Pact reliably controls the sequences performed during roll changing, media control, coil transport and material tracking. It also manages the data flow, speed setups and auxiliary functions. Integrating the models and controls guarantees high availability. Added to this are plant and process monitoring systems that effectively support diagnosis and maintenance at any time.

PHYSICAL PROCESS MODELS and control systems of X-Pact ensure:

- Thickness
- Width
- Profile
- Contours
- Flatness
- Temperature
- Speed
- Tension
- Material properties



PCFC® system controls roll bending and shifting

X-PACT for hot rolling mills

Level 3

- Production planning and scheduling (PPS)

Level 2

- Pass schedule calculation (PSC)
- Pacing (PAC)
- Profile, contour and flatness control (PCFC)
- Cooling section control (CSC)
- Accelerated cooling system (ACC)
- Preset model for levelers

Level 1

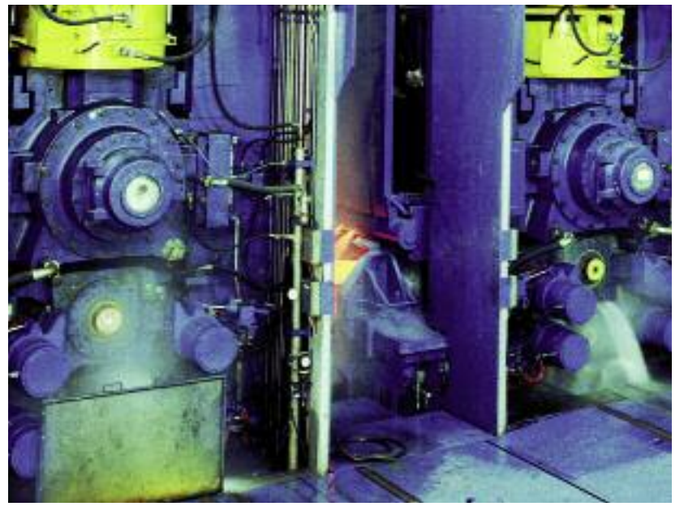
- Hydraulic gap control (HGC)
- Thickness control (AGC)
- Flatness control (AFC)
- Tension control, looper control, strip steering control
- Automatic width control (AWC)
- Automatic step control (ASC)
- Laminar cooling control (LCC)
- Leveler technological control
- Basic automation and HMI sequencing control, mill master, material tracking, roll change, media control
- Plant and process monitoring system (PPMS)

Level 0

- Technological measuring systems (thickness, profile, flatness, width, speed)
- Power distribution, motors, feeders, drive systems
- Field instrumentation

Control station of a hot rolling mill

Looper control



SMS SIEMAG | Electrics and Automation

Trendsetting solutions for COLD ROLLING MILLS

Complete process control with X-PACT

X-Pact supplies a complete automation package for full control of the rolling process. It is above all our roll gap control, with exact adjustment of the roll gap to the stand and the final control elements, that provides groundbreaking solutions for cold rolling mills in the steel, stainless steel and nonferrous metals industries as well as for foil rolling mills.There is also a guide target value control in X-Pact to efficiently control the cold rolling mill. All this is rounded off by plant visualization with error warning systems and pass schedule management as well as statistical process data recording and evaluation.

Production growth due to our PROCESS MODELS

Physical process models take account of the current state of the rolling mill to calculate the right settings for rolling the strip. This is crucial because the ideal settings during rolling the strip head as well as rolling during acceleration and deceleration phases increase productivity. Models calculate the pass schedules. The system coordinates rolling force, torque and rolling speed so that target thickness and flatness are perfectly balanced using the models and technological controls, even with small batch sizes. The flatness control system featured in X-Pact supplies data for the final control elements to influence flatness. The T-Roll® model simulates the rolling process. Cooling and lubrication are preselected to suit the material rolled as well as the current plant condition. This optimizes the rolling process and improves the material surface.

Closest TOLERANCES

Variable contours of the work and intermediate rolls with CVC PLUS, but also the backup rolls (SCR) extend the adjustment range of the flatness regulation and provide sufficient control range under all operating conditions of the rolling mill.

To achieve the close tolerances required, above all in the thin strip area, additional actuators for flatness control are necessary. Especially worth mentioning here is the compensation of thermal effects during aluminum rolling with the SCR roll, which facilitates rapid run-up times of the mills even with cold rolls. That increases both product quality and productivity.

Methods specially developed to compensate for edge effects in thin strip mills are axial work roll shifting with Edge Drop Control (EDC®) for steel rolling mills and hot oil application to the work rolls using Hot Edge Sprays (HES) in aluminum rolling mills. What is being presented here in both systems are active controls that help reliably and effectively compensate for edge effects that inhibit production but are physically unavoidable.

Used together with tried-and-tested strip thickness control concepts, these application-centered developments increase the rolling speed, availability and reliability of our plants.

20-roll stand for stainless steel

X-PACT for cold rolling mills

Level 3

- Production planning and scheduling (PPS)

Level 2

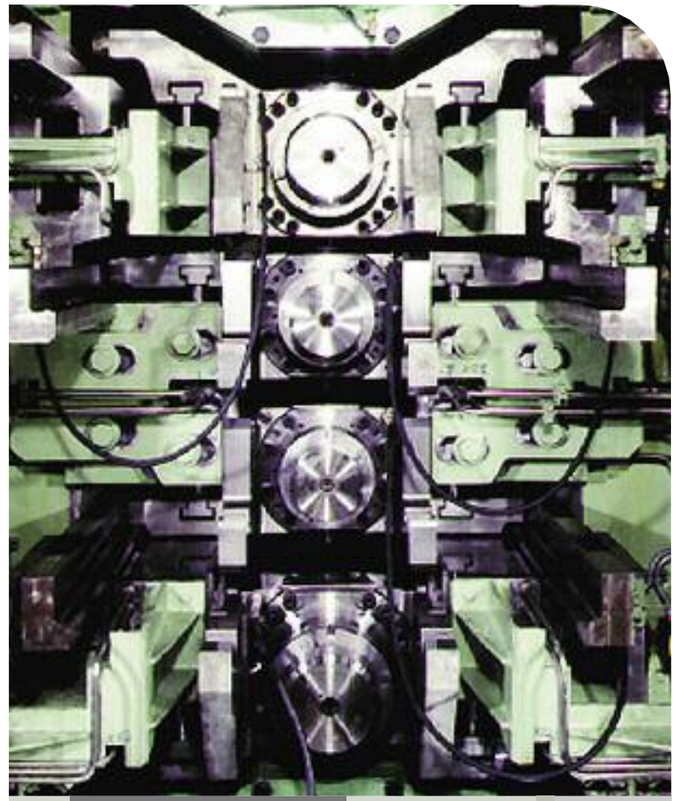
- Pass schedule calculation (PSC)
- Profile and flatness control (PFC)
- Edge drop control (EDC)

Level 1

- Thickness control (GCS, MON, FFC, VFC, STC)
- Flatness control system (FCS) (WR, IR bending, WR, IR shifting, selective WR cooling)
- Elongation control
- EDC control
- Roll eccentricity compensation (REC)
- Horizontal stabilization
- Tension control
- Basic automation and HMI sequencing control, mill master, material tracking, roll change, media
- Plant and process monitoring system monitoring, diagnosis, error warning systems (PPMS)

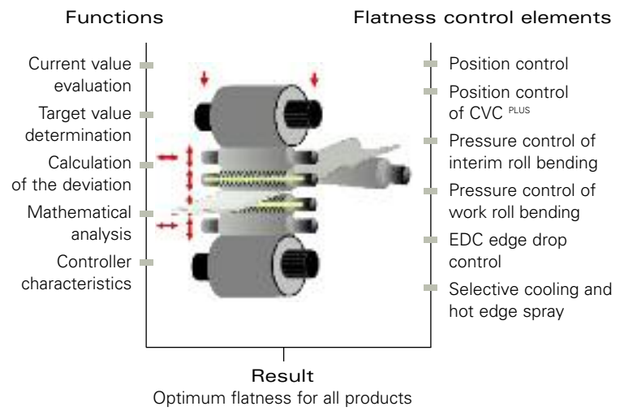
Level 0

- Technological measuring systems (thickness, flatness, speed, tension)
- Power distribution, motors, feeders, drive systems
- Field equipment



6-hi stand

FLATNESS CONTROL IN A SIX-HIGH CVC PLUS STAND



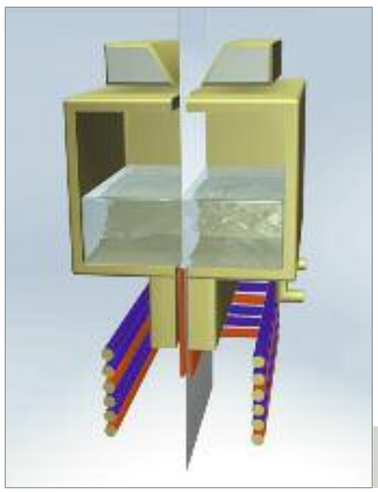
A broad range of functions with powerful flatness control elements ensures optimal flatness of all products.

SMS SIEMAG | Electrics and Automation

Top surface quality in STRIP PROCESSING LINES

Everything from drive technology to the process model with X-PACT

Integrating X-Pact into the process and plant technology of strip processing lines ensures consistently high quality of the surfaces of cold and hot-rolled products as well as energy-saving, eco-friendly process guidance. A perfect understanding of the pickling, cleaning and coating process forms the basis for comprehensive strip treatment plants. Included in our product range are comprehensive electric and automation systems for strip processing lines that are fine-tuned to the mechanics and technology used, as well as all services starting with design through to commissioning. Service modules, whether individual packages or all-in service solutions, round off our product range. Here is a one-stop-shop for everything from production planning systems to field and measuring devices.



The new CVGL® process

No more OVER OR UNDER PICKLING with X-Pact

Level 2 automation that provides the technological process model for turbulence pickling optimizes the temperature and turbulence of the pickling medium. There is much to be said for the pickling model because it calculates the maximum possible strip speed at minimum consumption, prevents under-pickling and reduces over-pickling for a broad product mix. The exact material tracking supplies the target values to the control systems of the various plant sections in good time and depending on the product. Also featured are tools for process visualization and quality data evaluation.

CVGL® – new technology for vertical hot galvanizing

Vertical hot-dip finishing in the form of our CVGL® Continuous Vertical Galvanizing Line is a process developed by SMS Siemag for hot galvanizing strip that offers huge advantages compared to conventional methods. Mechanics, electrics, controls and regulation right up to special process models are part of a total solution from one source.

X-PACT for strip processing lines

Level 3

- Production planning and control (PPS)

Level 2

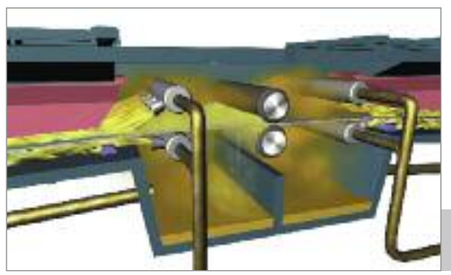
- Pickling model
- CVGL® models
- Process control level for the entire strip processing line
- Material tracking
- Quality data recording
- Quality diagnoses

Level 1

- Technological regulation for skin-passing stands, stretch-levelers, CVGL®, coating and strip course control
- Basis automation and visualization (sequence control and regulation from feed end through process to discharge end)
- Drive regulation of the entire strip processing line
- Material tracking
- Diagnosis and error warning system
- Process data recording

Level 0

- Technological measuring systems (e.g. thickness, layer thickness, speed and tension measuring)
- Field devices
- Energy distribution
- Drive systems



Turbulence pickling section

Control station in a continuous pickling plant

Perfect product quality

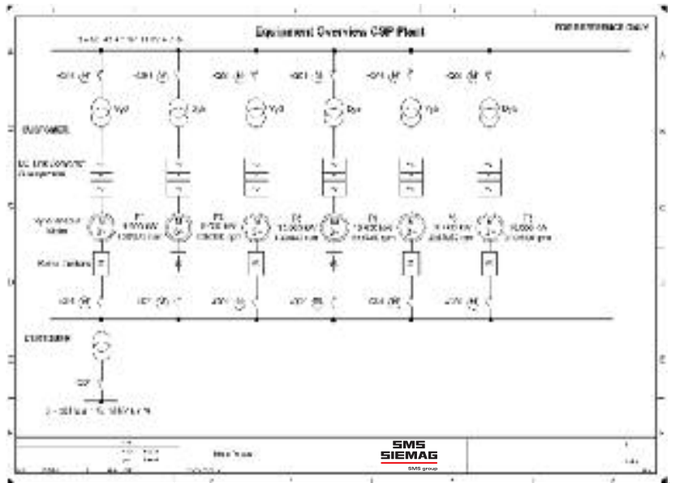
SOLUTIONS for power distribution and drive technology

Integrated SYSTEMS

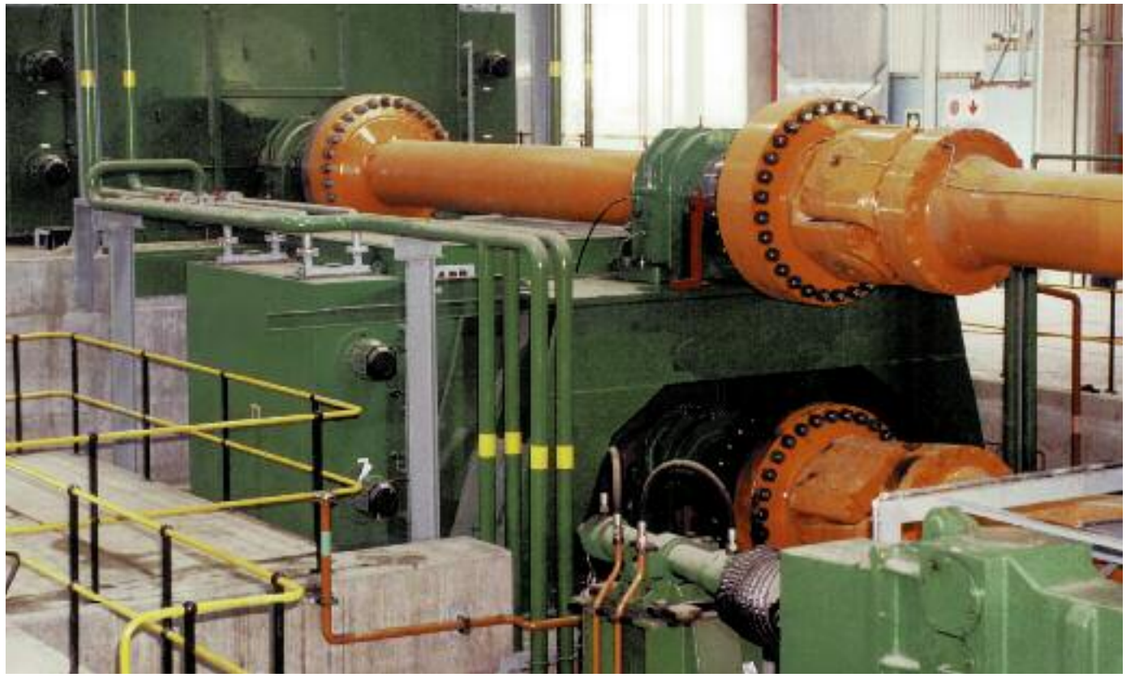
Significant here is our coordinated design of mechanics, electrics and automation so that we can supply complete solutions from one source optimally geared to the demands of your product range. Low investment costs and overheads due to reduced losses, low space requirement and less maintenance are the result of a well-meshed solution.

Our range of products and services for power supply and drive technology:

- Planning from high-voltage to low-voltage distribution
  - Load flow and short circuit calculation
  - Planning of buildings and open-air facilities
  - Design of transformers and switchgears
  - Emergency concepts
- Analysis of network distorsion for the design of the dynamic compensation plant
- Dimensioning and optimization of drive strands with optimal matching of mechanics and drive
- Planning and design of supply lines of constant drives
- Design of electrical rooms and detail planning
- Planning and advice on connection strategies in the interconnected network



Drive solution for a CSP® plant



SERVICE, TRAINING, ACCESSIBILITY

All-inclusive SERVICE

You can choose from both individual services and complete service packages.

Tailor-made service agreements are available to free you from a whole range of tasks. That is how we act as your partner to secure low-cost, reliable operation of your plants.

Here are the service packages on offer:

- Spare parts service
- Hotline
- Tele-service
- On-site fault fixing
- Support by plant and technology experts
- System upgrades and updates
- Plant and process monitoring
- Exchange of technological experience
- Technological upgrades

Immediate ACCESSIBILITY

Always ready to serve you are automation specialists in our Asian, European, North and South American branches who guarantee X-Pact service close at hand whenever you want it. These global locations are controlled from our Düsseldorf and Hilchenbach headquarters to ensure uniform standards.

X-Pact®

Outstanding EXPERIENCE

Three central features are responsible for X-Pact's leading role in the industry – the integration of all automation levels, the application to all processing stages and the coordinated link-up of technologies, mechanics and automation. There are many references already that demonstrate our large scope of experience.

STEELWORKS

162 plants automated, 107 of which were equipped with our process models (since 1990), including various integrated electrical and automation packages:

- Pig iron desulphurization plants
- Electric arc furnaces
- BOF converters
- CONARC® plants
- MRP-L converters
- AOD converters
- Ladle furnaces
- Ladle treatment stands

CONTINUOUS CASTING TECHNOLOGY

More than 208 strands equipped (since 1990),including various integrated electrical and automation packages:

- Mold level controls
- Breakout prediction systems
- Mold narrow side adjusters
- Mold oscillation systems
- Hydraulic segment adjusters
- Dynamic cooling models
- Process control computers
- Quality monitoring systems
- PPMS

HOT ROLLING MILLS

175 automation packages in 87 plants (since 1990), including various integrated electrical and automation packages:

- Thickness controls
- Tension and looping controls
- Models for pass schedule calculation
- Models for profile and flatness control
- Models for width control
- Models for strip and sheet cooling
- Coiler controls with Automatic Step Control
- Systems for straighteners
- PPMS

COLD ROLLING MILLS

102 automation packages in 63 plants (since 1990), including various integrated electrical and automation packages:

- Thickness controls
- Flatness controls
- Degree of skin-passing controls
- Tension controls between the stands
- Models for pass schedule calculation and mill setup
- Models for CVC PLUS setup
- Model for Edge Drop Control
- PPMS

STRIP PROCESSING LINES

33 solutions (since 1990), including various integrated electrical and automation packages:

- Degree of skin-passing controls
- Models for turbulence pickling
- Models for straighteners
- Automation systems for turbulence pickling
- Compete supply of electrics and automation

X-Pact®

Electrics and automation from SMS Siemag control all processes in metallurgical plant and rolling mill technology.

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MEETING your **EXPECTATIONS**

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