Salzgitter Stahl AG & PSI Metals
more than 30 years of mutual history
Salzgitter AG: Subsidiaries

Bad Salzdetfurth
PSImetals Systems at Salzgitter Steel

Iron reduction | Steel Mill | Forming of steel
---|---|---
Blast Furnaces | Making | Casting | Hot Rolling | Cold Rolling | Finishing

**Salzgitter Flat**
- Process control for 3 blast furnaces
- Planning and Sequencing
- New project: Integrated Long-, Mid- and Shortterm Planning for the entire site
- Production & Quality
- Automation of CCM's
- Logistics

**Ilseburg plates**
- PSImetals systems

**Peine Long**
- Planning and Sequencing
- Production & Quality / VM-ADJ (2010)
- WVS (2006)

**Planning & Sequencing**

**Production & Quality**

**Logistics**
PSI metals at Salzgitter Flachstahl GmbH
Salzgitter Flachstahl GmbH:
Production Equipment and Facilities

- 01 2 Coke oven batteries, 108 coke ovens, 46,0 m³ each
- 02 Sintering plant – 180 m²
- 03 3 Blast furnaces, hearth Ø 11,2/10,8 m
- 04 3 x 220 t LD converters
- 05 Continuous casting machines:
  - strand thickness [mm] width [mm]
  - 2 250 1.100 - 1.950
  - 1 250 2.200 - 2.600
  - 1 250 950 - 2.100
  - 1 250-350 1.200 - 2.600
- 06 Hot strip mill
- 07 Continuous pickling line and push-pull pickling line
- 08 Hot strip cutting line
- 09 Cold rolling mill
- 10 Hot-dip galvanizing No. 1 and 2
- 11 Electro-zinc coating line
- 12 Organic coating No. 1 and 2
- 13 Sheet in coils
- 14 Surface-coated sheet in coils
- 15 Sheets
- 16 Narrow strip, rim material
- 17 Hot-rolled strip
PSImetals for Blast Furnaces
### SzFG:
Technical Data from the Blast Furnaces at Salzgitter

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Blast furnace</strong></td>
<td><strong>A</strong></td>
<td><strong>B</strong></td>
<td><strong>C</strong></td>
<td></td>
</tr>
<tr>
<td>Hearthdiameter</td>
<td>10,8 m</td>
<td>11,2 m</td>
<td>8,2 m</td>
<td></td>
</tr>
<tr>
<td>Furnace volume</td>
<td>2,330 m³</td>
<td>2,530 m³</td>
<td>1,164 m³</td>
<td></td>
</tr>
<tr>
<td>Furnace volume</td>
<td>1,8 Mio. t</td>
<td>2,0 Mio. t</td>
<td>0,8 Mio. t</td>
<td></td>
</tr>
<tr>
<td>Wind rate</td>
<td>260,000 Nm³/h</td>
<td>270,000 Nm³/h</td>
<td>90,000 Nm³/h</td>
<td></td>
</tr>
<tr>
<td>Hot blast temperature</td>
<td>1,150 °C</td>
<td>1,200 °C</td>
<td>1,100 °C</td>
<td></td>
</tr>
<tr>
<td>Pressure at furnace top</td>
<td>2,9 bar</td>
<td>3,5 bar</td>
<td>1,5 bar</td>
<td></td>
</tr>
<tr>
<td>Daily Production</td>
<td>5,200 t</td>
<td>5,500 t</td>
<td>1,900 t</td>
<td></td>
</tr>
</tbody>
</table>
PSImetals for Blast Furnaces

The task
- Balancing of the used materials
- Configurable collection and presentation of high speed process data
- Determination of the filling collection and representation of “burden” changes
- Execution of the burden calculation, model calculation

Benefits
- Three different blast furnaces, one software
- Highly configurable
- Improvement of the operation by state-of-the-art HMI
- Simplification of the system structure
- Long term data archives of the process data for a furnace travel (approx. 15 years)
Snapshots / Pattern Recognition

**Snapshots**
preventive maintenance of plant states by pattern recognition

**Long-term data storage**
storage of compressed data for a whole life cycle of the lining
Configurable computing values

- Definition of complex parameters
- Archiving and compressing process values
PSImetals for Blast Furnaces
PSI metals Planning: From Steel Making to Coil Dispatch
Comprehensive Support of End-To-End Processes

**Commercial Processes**

- Sales Order Entry
- Pricing
- Purchasing
- Plant Maintenance
- Costing
- Billing

**Order Dressing**

- Production Configuration
- Sales Order Dressing
- Production Order Elaboration

**Demand & Sales Planning**

- Demand Forecasting
- Sales Plan Optimisation
- Due Date Quoting

**Scheduling**

- Order Scheduling

- Hot Mill Scheduling
- Cold Mill & Finishing Scheduling

**Production & Material Planning**

- Master Planning
- Capacity Plan Management
- Campaign Optimisation

- Inventory Optimisation
- Plate & Coil Combination
- Interactive Material Allocation

**Production Execution & Material Logistic**

- Production Order Life Cycle
- Material & Stock Management
- Schedule Execution Management
- Production Tracking
- Quality Control & Deviation Management
- Warehouse & Transport Management
- Delivery
PSImetals Planning (ALS): From Steel Making to Coil Dispatch

Benefits

- Standard System for sequence planning at all production lines of SMP, HRM, CRM.
- Dynamic pegging and automated material allocation.
- Integrated to SAP planning system and process control systems.
- Characteristic based configuration according to the customer requirements by customizing of
  - the factory model
  - user views and filters
  - rules and restrictions for sequence optimizations
  - algorithm managers
PSImetals Production & Quality for melt shop
Melt Shop: Cross-sectional layout

01.) Hot metal transport
02.) Hot metal mixer
03.) Desulphurization stations
04.) 3 x 220 t BOF
05.) Main control room
06.) LF, ladle treatment station
07.) Vacuum-tank degassers
08.) SMS DEMAG vertical-blend continuous caster - Single strand caster
09.) DEMAG arc-type plant - Twin strand caster
10.) DEMAG arc-type plant - Single strand caster
11.) Slitting lines
Benefits
- Dynamic planning in real-time
- Transparency of production deadlines
- Real-time recognition of aggregate bottle necks
- Generation of process regulations for sub-systems
- Full system support for introduction of new steel grades

Improvement of Product Quality
- more consistent steel analysis, by close management of timing (e.g. of alloy-addition, casting-speed)
- control of metallurgical quality by real-time monitoring
- support dynamic routing

Reduction of Production Costs
- Model based temperature control
- rule-based control systems to avoid reheating
- optimized performance of plant by avoiding bottlenecks and improving the routing and reducing energy consumption per ton
- precise and quick decisions and operator instructions according to the transparent overall system
**PSImetals Production & Quality IT Levels**

- **Level IV**
  - ERP (SAP)
- **Level III**
  - PSImetals Planning (Line Sequencing)
  - PSImetals Production & Quality (SLS)
- **Level II**
  - Desulphurisation
  - Converter (BOF 1-3)
  - Secondary Metallurgy
  - CCM 1 - 3
  - Lab
- **Level I**
  - Plant Control (PLC)

*Image of processes:*
- Desulphurisation
- Converter (BOF 1-3)
- Secondary Metallurgy
- CCM 1 - 3
- Lab
Workflow with PSImetals

- **SAP**
  - Customer Order
  - Orders, Stock, Master Data

- **Planning (ALS)**
  - Scheduling of Heats, Sequences

- **Production & Quality (SLS)**
  - Program Take Over
  - Generate Data (P.O.)
  - Schedule
  - Supply L2 Systems

- **Customer order (ready)**

**Workflow Steps:**
- **Level 2**
  - Manufacturing the heat / sequences
- **Level 3**
  - Orders, Stock, Master Data
  - Material, Heat tracking
  - To be – as is - comparison
  - Material tracking
  - Quality Data
  - Production Order
  - Rework, Reschedule
- **Level 4**
  - Customer order

**Key Processes:**
- Generate to be Data
- Ready Message
PSImetals Production & Quality
Online Heat Scheduler

High information density
- Sequences, Heats to Lines
- Delay times
- Buffer times
- Time lack
- Presentation
- Preparation time
- Aim of the schedule: continuous casting
- State of the heat (ready, in treatment, scheduled)
Company's know-how for high quality steel production

„cooking recipes“ for making of heats

Definition of the working steps with:

- Analytical sub-targets after certain process steps
- Production rules
- Treatment setpoints in order to reach the targets
- Production information
- Additional instructions describing accompanying measures
- Quality specifications for evaluating the actual situation (inspection values, min/max values, characteristic parameters, etc.)
PSImetals Production & Quality (SLS)
Temperature Model

- Interaction with the operational timetable of the used treatment stations
- Correct production timing by speed, time and temperature adjustment
- Aims
  - minimize energy consumption
  - maximize throughput
  - plant lifetime care (e.g. refractories)
- Considers a wide range of operating modes
  e.g. Ladle history, Ladle cover usage etc.
**PSI metals Production & Quality**

**Ladle Management**

- **Tight control of all steel ladles**
- **Availability of ladle and equipment history at any time**
- **Quality compatibility of ladles**
- **Overall goals of the ladle circulation system:**
  - Rapid and smooth circulation
  - Minimise number of ladles in circulation at any time
  - Minimise overall cost of each ladle over its complete life-cycle
  - Achieve close and consistent control of steel quality
- **Minimize amount of ladles needed for production**

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**ladle circulation: BOF plant to casters**

- BOF
- steel ladles
- secondary steelmaking
- ladle store (inspection)
- slab casters

- BOF plant to casters
- alloy refining, vac. degassing, stirring, alloy analysis
- steel ladles
- secondary steelmaking
- ladle store (inspection)
- slab casters
- clinker/slag removal
- position ladle, fill tundish, change over tundishes
- maintenance

---

**PSI AG 2011**

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Calculating the to-be analysis (with the flexible treatment rules)
Comparing to-be and as is analysis
Violations are represented coloured

Nb should be between 0.0150 and 0.0150
Increased Throughput
- 1 extra 220t ladle/day, 1,5 – 2 %

Energy Saving
- product reaches each stage with more precise timing
- reduced need to reheat ladles (cost leadership)

Documented Quality
- full documentation on quality of every piece, to ISO 9000 standards - a key requirement in the automobile-industry

Flexible & Adaptable
- new object-oriented system is very adaptable and easy to re-configure
- Easy integration of new aggregates (4th vacuum degasser, 3rd casting machine)
PSI metals for CCM
(Continuous Casting Machines)
## PSImetals for CCM

![Diagram of PSImetals for CCM](image)

<table>
<thead>
<tr>
<th>Caster</th>
<th>Strands</th>
<th>Dimensions</th>
<th>Capacity</th>
<th>Length of vertical section</th>
<th>Radius</th>
<th>bending Points</th>
<th>Length</th>
<th>Tundish capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caster 1</td>
<td>1</td>
<td>2.200 - 2.600 x 250</td>
<td>120.000</td>
<td>-</td>
<td>10,5</td>
<td>4</td>
<td>34</td>
<td>26</td>
</tr>
<tr>
<td>Caster 2</td>
<td>2</td>
<td>1.100 - 1.950 x 250</td>
<td>150.000</td>
<td>-</td>
<td>10,5</td>
<td>4</td>
<td>34</td>
<td>34</td>
</tr>
<tr>
<td>Caster 3</td>
<td>1</td>
<td>550 - 2.100 x 250</td>
<td>100.000</td>
<td>2,86</td>
<td>9,1</td>
<td>7</td>
<td>31</td>
<td>34</td>
</tr>
<tr>
<td>Caster 4</td>
<td>1</td>
<td>1.200 - 2.600 x 250-350</td>
<td>100.000</td>
<td>-</td>
<td>11,5</td>
<td>7</td>
<td>34</td>
<td>34</td>
</tr>
</tbody>
</table>
PSImetals for CCM

Reached aims
- Integration into the plant schedule
- Complete chain of quality control
- Enclosed Process- und quality data analysis
- Enclosed control of the plant parts (tundish, rolls,...)

Benefits
- Full quality/process documentation (automotive key requirement)
- Cost efficiency (real-time order reallocation)
- Automatic steel grade adaptation
- Very easy to use (clear presentation of the operating condition)
PSImetals for CCM: Casting Events, Strand Control

- Excellent overview
- Graphical presentation of
  - Cutting machine state
  - Casting events
  - Heat / ladle borders
  - Scheduled strand
  - Slitted slabs
- Automatic steel-grade adaptation (rules/events)
- Reactive planning (in case of events)
PSI\textit{metals} Logistics: From Rolling Mill to Dispatch
PSImetals Logistics: Plant Scheme

The Task
- Complete flow of material is controlled between the cold rolling machines and dispatch.
- Automatic crane control within 23 coil shops
- Complete control of the in-plant transport tasks (ground conveyor, automatic cranes, transport wagons)
- Calculation of coordinates and mobile data entry on the crane
- Integration of up to five units of not occupied AGV's
Ilsenburger Grobblech GmbH
Production Equipment and Facilities (side Ilsenburg)

1. Semi Material
2. Pit Furnace
3. Pusher-Type Furnace
4. Bogie Hearth Furnace
5. Descaling Unit
6. Side Shift Table
7. Four-High Rolling Stand
8. ACC Equipment
9. Hot Leveler
10. Hot Shear
11. Thick Plates
12. Cooling Bed
13. Stack Cooling
14. Flame Cutting Facility
15. Normalizing Furnace
16. Cooling Line
17. Cold Leveler
18. US Testing, Stamping and Marking
19. Side Shear
20. Cross Shear
21. Inspection and Loading
Ilsenburger Grobblech GmbH
Production Equipment and Facilities (side Salzgitter)

12 Cooling Bed
14 Flame Cutting Facility
15 Normalizing Furnace
17 Cold Leveler
20 Cross Shear
21 Inspection and Loading

22 Water Quenching Equipment
(Salzgitter site)
23 Shot-Blasting and Coating Line
24 Milling Line
25 Bending Line
Ilsenburger Grobblech GmbH installed systems

- **PSImetals Planning (ALS)**
  The entire scheduling is made with ALS

- **PSImetals Production & Quality (PLS)**
  Tracing and tracking through the complete plant. Process all Level I/II Systems

- **PSImetals Logistics**
  control the whole shipping process
PSImetals Planning(ALS) for Heavy Plate Mills
PSImetals ALS: Example Hot Rolling Mill with two Pusher Type Furnace

- The rules in the mill determine the filling of the furnace
- Higher delivery reliability
**PSImetals ALS for Heavy Plate Mills**

**The task**
- System for sequence planning at all parts in the heavy plate mill, charging the pusher furnaces, the shear lines, annealing lines
- Connected to the SAP of planning systems and process guidance level.
- Adjustment to the customer requirements by customizing
  - Adjustment of the factory model
  - Definition of the user views
  - Production of the planning procedures and constraints by means of algorithm managers

**Benefits**
- Optimization of the throughput and the used resources (tools/energ.) of the
  - rolling mill
  - annealing furnace
  - slitting line
- Adjustment to the customer changing requirements by customizing
- Enabling to produce small lot sizes
PSImetals Production & Quality and Automation for Heavy Plate Mills
**PSImetals Production & Quality / Automation Status Overview (Plant /Hot Part/ Cold Furnace Side)**

**Section overview**
- State of the complete plant at one view
- Coloured presentation of critical situation
- Getting a more finely scope by clicking in the interesting section
Peiner Träger GmbH

ERP / SAP
- Planning
- Quality
- Logistics
- Production
- Energy
- Automation

PSImetals

Cockpit

Base Automation
Peiner Träger GmbH
plant overview

Electric steel plant (Peine)
- Ladle furnace
- Rinsing unit
- Bloom continuous casting machine
- Beam blank continuous casting machine

Blooms
- Universal Medium Section Mill
  - Walking beam furnace
  - Two-high reversing stand
  - Continuous finishing train

Beam blanks
- Heavy beam mill
  - Walking beam furnace
  - Break-down stand
  - Finishing group

Slabs
- Edger stand S
- Universal stand U
PSImetals Planning, Production & Quality at Peiner Träger GmbH

- **SAP R/3**: FI, CO, SD, MM
- **APO**: DP, PP

**Planning (APS)**
- Cross plant material flow optimization

**Planning (ALS)**
- Sequencing Melt Shop
- Rolling Mills

**Production & Quality**
- Materialtracking / Qualitymanagement / Reporting

**PROKONT**
- Prozessdatenanalyse

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