RUEDIGER HOLZ
DANIELI WEAN UNITED

COLD MILLS AND STRIP
PROCESSING LINES
NEW SOLUTIONS
ENHANCING
COMPETITIVENESS

2018 SEAISI
CONFERENCE
& EXHIBITION
25-28 JUNE 2018
JAKARTA
1. DANIELI’S PRIMARY MISSION

2. ENHANCING COMPETITIVENESS OF DISCONTINUOUS COLD MILLS

3. ENHANCING COMPETITIVENESS OF GALVANIZING PROCESS

4. CONCLUSIONS
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2. ENHANCING COMPETITIVENESS OF DISCONTINUOUS COLD MILLS

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4. CONCLUSIONS
Source: vdeh Plantfacts, Cold reduction mills for carbon steels without electrical sheets, TCM Tandem Cold Rolling Mill, RCM Reversing Cold Rolling Mill

DANIELI’S PRIMARY MISSION

DISCONTINUOUS OPERATING COLD ROLLING MILLS (TANDEM MILLS AND REVERSING MILLS)

- Discontinuous CRMs — TMC
- Discontinuous CRMs — RCM
- Continuous CRMs

No of mills |
--- |
NORTH AMERICA: 21, 22, 10 |
SOUTH AMERICA: 8, 5, 4 |
EUROPE: 28, 45, 26 |
Million Metric tons per year: 25.1, 7.5, 15.8, 7.2, 0.9, 3.5, 22.3, 8.6, 33.9

Source:
- vdeh Plantfacts, Cold reduction mills for carbon steels without electrical sheets, TCM Tandem Cold Rolling Mill, RCM Reversing Cold Rolling Mill
Collaboration since 2014

SISSA
International School for Advanced Studies, Trieste, Italy.

MIT
Oxford
Cambridge
TU Berlin
RWTH Aachen
Politecnico di Milano

FIELDS OF COOPERATION
DANIELI/SISSA

Fluid dynamic simulations

SISSA

> Most advanced methods for mathematical modelling and numerical simulation

> Supercomputing facilities
NEW TECHNICAL SOLUTIONS IN COLD ROLLING AND STRIP PROCESSING

DANIELI’S PRIMARY MISSION
1. DANIELI’S PRIMARY MISSION

2. ENHANCING COMPETITIVENESS OF DISCONTINUOUS COLD MILLS

3. ENHANCING COMPETITIVENESS OF GALVANIZING PROCESS

4. CONCLUSIONS
KEYS FOR SUCCESS

> Optimized threading setup
> Strip steering by enhanced automatic bending and tilting adjustment control
> Reduction control

97.6% - 98.9 %
Danieli yield boost technology

96.0% - 98.2 %
Conventional

YIELD BOOST TECHNOLOGY IN 2-STAND REVERSING MILL

ENHANCING COMPETITIVENESS OF DISCONTINUOUS COLD MILLS
## ENHANCING COMPETITIVENESS OF DISCONTINUOUS COLD MILLS

### DANIELI YIELD BOOST TECHNOLOGY

### MATERIAL AND CONVERSION COST

<table>
<thead>
<tr>
<th>Cost Category</th>
<th>Cost</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pickling cost</td>
<td>9,50</td>
<td>USD/ton</td>
</tr>
<tr>
<td>Hot Rolled cost</td>
<td>492,92</td>
<td>USD/ton</td>
</tr>
<tr>
<td>Cold rolling</td>
<td>15,29</td>
<td>USD/ton</td>
</tr>
<tr>
<td>Scrap price (pup coil price)</td>
<td>220,00</td>
<td>USD/ton</td>
</tr>
<tr>
<td>Cold rolled full hard market price</td>
<td>595,00</td>
<td>USD/ton</td>
</tr>
</tbody>
</table>

### Target annual cold rolled capacity

- **380,000 t/y**

### Reference strip size

- **2,35 mm**
- **0.30 x 990 mm**
- **17.12 ton coil weight**

### CONVENTIONAL MILL

- **MATERIAL YIELD**: 98.05 %
- **COST SAVINGS (USD)**: 991,648

### DANIELI YIELD BOOST TECHNOLOGY

- **MATERIAL YIELD**: 98.90 %
- **COST SAVINGS (USD)**: 

Client in South-East Asia, October 2016
## Comparison of Configurations: Yield and Production Output Per Year

<table>
<thead>
<tr>
<th>Configuration</th>
<th>Material Yield</th>
<th>Annual Production (Tons)</th>
<th>Additional Net Income (USD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional Mill</td>
<td>98.05%</td>
<td>380,000</td>
<td></td>
</tr>
<tr>
<td><strong>DANIELI YIELD BOOST TECHNOLOGY</strong></td>
<td>98.90%</td>
<td>380,000</td>
<td>991,648</td>
</tr>
<tr>
<td><strong>DANIELI CRM PLUS TECHNOLOGY</strong></td>
<td>99.35%</td>
<td>431,600</td>
<td>5,451,981</td>
</tr>
</tbody>
</table>

**ROI with DANIELI CRM PLUS TECHNOLOGY within 1 year**
<table>
<thead>
<tr>
<th>Option 1</th>
<th>Option 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conventional plant concept</td>
<td>With Danieli Yield Boost and CRM PLUS technology</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Plant Configuration</th>
<th>Production (t/a)</th>
<th>Plant Configuration</th>
<th>Production (t/a)</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Plant Configuration" /></td>
<td>205,000</td>
<td><img src="image2" alt="Plant Configuration" /></td>
<td>205,000</td>
</tr>
<tr>
<td><img src="image3" alt="Plant Configuration" /></td>
<td>565,000</td>
<td><img src="image4" alt="Plant Configuration" /></td>
<td>565,000</td>
</tr>
<tr>
<td><img src="image5" alt="Plant Configuration" /></td>
<td>860,000</td>
<td><img src="image6" alt="Plant Configuration" /></td>
<td>860,000</td>
</tr>
</tbody>
</table>

| Total Material Yield   | 98,0 %            | Total Material Yield   | 99,6 %            |
| Total Investment Process Equipment | 100,0 %          | Total Investment Process Equipment | 93,0 %          |
| Number of Cold Rolling Mills | 3                | Number of Cold Rolling Mills | 2                |

(Extension in 3 phases)
DANIELI OSRT 6-HI MILL: PERFORMANCE AT THIN GAUGE ROLLING

FINAL THICKNESS DEVIATION (mm)

FINAL FLATNESS DEVIATION (l-Unit)

Strip length (m)

Strip length (m)
PUSH-PULL PICKLING LINE AND COLD REVERSING MILL FOR INDONESIA

Client: PT. Sunrise Mill, Surabaya, Indonesia

SCOPE OF SUPPLY

> Puch-pull pickling line, extendable to 600,000 tpy
> 6-Hi OSRT cold rolling mill with Yield Boost Technology for 200,000 tpy

TARGETS

> Low operating and maintenance costs
> Easy and safe operation
> Best strip flatness performance also at thin gauge rolling
> Reduce material losses at strip head and tail end by more than 60 %
ENHANCING COMPETITIVENESS OF DISCONTINUOUS COLD MILLS

DANIELI LASER WELDER: INNOVATIVE TECHNOLOGICAL SOLUTIONS

> High speed laser cutting of strip ends
> Reduced maintenance due to high equipment reliability and less wear parts
> Minimized consumption of technical gases

REDUCED CAPEX AND OPEX DUE TO REDUCED INSTALLED POWER AND COMPACT DESIGN
DANIELI LASER WELDER: CUTTING AND WELDING BY LASER
1. DANIELI’S PRIMARY MISSION

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ENHANCING COMPETITIVENESS OF GALVANIZING PROCESS

DANIELEI GALVANZING TECHNOLOGY

PLUS

QUALITY SPEED
PRODUCTIVITY
YIELD

LESS

COSTS
COATING WEIGHT
FULLY INTEGRATED TECHNOLOGICAL PACKAGE TO PERFORM WIPING PROCESS WITH HIGH QUALITY

ENHANCING COMPETITIVENESS OF GALVANIZING PROCESS

**Danieli Automation**
- **Q-Zinc CLC**
  - Danieli Automation Q-Zinc Closed Loop Coating weight control
- **Q-Robot Zinc**
  - Danieli Automation Q-Robot Zinc for dross removal
- **DES™**
  - Danieli DES Electromagnetic Strip Stabilizer
- **Kohler X-JET / COMPACT X-JET**
  - Kohler X-JET / COMPACT X-JET

**Danieli**
- **Q-Zinc CLC**
- **Q-Robot Zinc**
- **DES™**
- **Kohler X-JET / COMPACT X-JET**
PERFORMANCE OF DANIELI KOHLER X-JET AIR KNIVES

ENHANCING COMPETITIVENESS OF GALVANIZING PROCESS

**BENEFITS OF SHARPER AIR JET**

- Higher process speed
- Less coating weight
- Less overcoat
- Less flow
- Less cleaning efforts for nozzle lips
- Fewer surface defects
- Less skimming
- Energy savings

Static pressure ($sP$) created by air flow impacting the strip surface

$$\max \left( \frac{dsP}{dx} \right) > \max \left( \frac{dsP}{dx} \right)$$

Perpendicular position to lips gap ($X$)

X-JET

Traditional air knives
The newly developed and modular designed Compact X-JET

> Maintains X-JET high performances
> Maintains X-JET functions and Add-ins
> Requires less space
> Is dedicated for crowded Pot areas
> Easily replaces old Air Knife equipment
> Significantly reduces capital investment
Knife distance reduction can be achieved by the DES Danieli electromagnetic strip stabilizer method:
Non-contact, electromagnetic forces

RESULTS
> Reduced vibration
> Strip flattening optimized
> Constant passline position
ADAPTIVE COATING MODEL SUPPORTS
HIGH ACCURACY ZINC COATING CONTROL
Air knives control set-up by adaptive coating model and control

Enhancing competitiveness of galvanizing process

Up to 5% in significant savings in zinc consumption

Closed loop control
Standard deviation of $<1g/m^2$ can be reached in less than 150 meters

Closed loop control
Overcoating ratio can be significantly reduced, resulting in significant saving in zinc consumption
DANIELI DEVELOPED ROBOTIC SYSTEMS IN THE ZINC POT AREA

OPERATING RESULTS

> Significant zinc savings
> Return of investment within 1 year
> Save operator time while improving health and safety

> Continuous, repetitive and flexible dross skimming
> Automatic adaption to the bath level
> Compact dimensions
> Low maintenance
> Fully integrated in the automation L1 system

LESS OPEX

ENHANCING OPERATOR SAFETY
UPGRADES FOR 2 HOT DIP GALVANIZING LINES
Client: Hoa Sen, Vietnam

SCOPE OF SUPPLY
- New Gas Analyzers system
- New Snout, Heaters and HNx system
- New Roll Rigs for GI and GL
- New X-JET Air Knives
- New Non-Contact Edge Baffles
- New APC ducts, manifolds and fans
- New Automation control with Closed Loop Control

TARGETS
- Reduce average coating weight
- Increase surface quality
- Reduce maintenance and production costs
- Improve coating uniformity
- Reduce edge overcoating
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4. CONCLUSIONS
The market has become highly competitive, forcing producers to reduce costs and improve product quality and productivity.

With the latest technologies, Danieli is providing answers for these ambitious targets.
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