A WORLD MARKET LEADER
WITH FOUR BUSINESS AREAS

PRODUCT OFFERINGS

HYDRO
Electromechanical equipment for hydropower plants (turbines, generators); pumps; turbo generators.

PULP & PAPER
Equipment for production of all types of pulp, paper, tissue, and board; energy boilers.

METALS
Presses/press lines for metal forming (Schuler); systems for production of stainless steel, carbon steel, and non-ferrous metal strip; industrial furnace plants.

SEPARATION
Equipment for solid/liquid separation for municipalities and various industries; equipment for production of animal feed and biomass pellets.

UNIT 2017

<table>
<thead>
<tr>
<th>Order intake MEUR</th>
<th>5,579.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employees</td>
<td>25,566</td>
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</tbody>
</table>

* Share of total Group order intake 2017.
**PRODUCT PORTFOLIO**

Innovative technology – from single parts up to complete lines

<table>
<thead>
<tr>
<th>PRODUCT</th>
<th>Features</th>
</tr>
</thead>
</table>
| **PULP** | - Complete chemical and mechanical pulp, and recycled fiber production lines from woodyard to finished bales  
- Complete recovery island, including recovery boilers, evaporation plants and white liquor plants |
| **PAPER** | - Complete lines for paper, board, and tissue  
- Stock preparation and approach flow systems  
- Sludge and reject handling  
- Finishing |
| **POWER** | - Solid biofuel production applications  
- BFB & CFB boilers and biomass gasifiers, Process off-gas fired and liquor boilers  
- Reject treatment – Waste-to-value systems  
- Wet & multi-stage flue gas cleaning systems |
| **SERVICE & AUTOMATION** | - Engineered services for the pulp & paper industry and others related industries  
- Advanced engineered wear products  
- Complete and specific automation solutions  
- Mill-wide maintenance solutions and full service contracts |
| **OTHERS** | - Nonwoven and textile  
- Air Pollution Control  
- Perforated plates, wedge wires, metal fabrics  
- Panelboard  
- Recycling |
## RECENT MAJOR WOOD PROCESSING REFERENCES

<table>
<thead>
<tr>
<th>Year</th>
<th>Company</th>
<th>Country</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>2018</td>
<td>Ilim Pulp Bratsk</td>
<td>Russia</td>
<td>Woodyard</td>
</tr>
<tr>
<td>2018</td>
<td>Yumn Limited</td>
<td>Rwanda</td>
<td>Peat handling plant, boiler feeding</td>
</tr>
<tr>
<td>2018</td>
<td>Kama Karton LLC</td>
<td>Russia</td>
<td>Woodyard for APMP/FBB plant</td>
</tr>
<tr>
<td>2017</td>
<td>Sappi Skowhegan, Maine</td>
<td>USA</td>
<td>Debarking line</td>
</tr>
<tr>
<td>2017</td>
<td>GP Alabama River Cellulose</td>
<td>USA</td>
<td>Three-length log line</td>
</tr>
<tr>
<td>2017</td>
<td>Ilim Pulp Ustilimsk</td>
<td>Russia</td>
<td>Woodyard</td>
</tr>
<tr>
<td>2017</td>
<td>Fibria Tres Lagoas, Horizonte II</td>
<td>Brazil</td>
<td>Woodyard (EPC)</td>
</tr>
<tr>
<td>2017</td>
<td>Chenming Shouguan Meilun</td>
<td>China</td>
<td>Chip handling with 2 x S/R</td>
</tr>
<tr>
<td>2017</td>
<td>SCA Östrand</td>
<td>Sweden</td>
<td>Woodyard</td>
</tr>
<tr>
<td>2017</td>
<td>MetsäFibre, Äänekoski</td>
<td>Finland</td>
<td>Woodyard</td>
</tr>
<tr>
<td>2016</td>
<td>Mondi, Richards Bay</td>
<td>South-Africa</td>
<td>Chipping line</td>
</tr>
<tr>
<td>2016</td>
<td>StoraEnso, Tiger</td>
<td>China</td>
<td>Woodyard for APMP plant</td>
</tr>
<tr>
<td>2016</td>
<td>Klabin S.A., Origueira Mill</td>
<td>Brazil</td>
<td>Woodyard (EPC)</td>
</tr>
<tr>
<td>2015</td>
<td>Asian Pulp and Paper, OKI</td>
<td>Indonesia</td>
<td>Woodyard equipment</td>
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<tr>
<td>2014</td>
<td>Rock Tenn Florence</td>
<td>USA</td>
<td>Woodyard with Circular Cranes, EPC</td>
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<tr>
<td>2014</td>
<td>XuanYuan Ind. Development Co., Ltd. Dobrush</td>
<td>Belarus</td>
<td>Woodyard</td>
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<td>2014</td>
<td>North Star Pulp Industrial Compl. LCC, Amazar</td>
<td>Russia</td>
<td>Woodyard</td>
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<tr>
<td>2014</td>
<td>China CAMC Engineering Co., Ltd. Svetlogorsk</td>
<td>Belarus</td>
<td>Woodyard</td>
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<tr>
<td>2013</td>
<td>Montes del Plata Co. Ltd.</td>
<td>Uruguay</td>
<td>Woodyard (EPC)</td>
</tr>
<tr>
<td>2013</td>
<td>Phoenix Pulp and Paper Co., Ltd.</td>
<td>Thailand</td>
<td>Woodyard</td>
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<tr>
<td>2012</td>
<td>Iggesund Workington UK</td>
<td>UK</td>
<td>Biomass handling for boiler</td>
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<tr>
<td>2012</td>
<td>StoraEnso Skoghall Mill</td>
<td>Sweden</td>
<td>Woodyard</td>
</tr>
<tr>
<td>2012</td>
<td>Eldorado Celulose e Papel Ltda</td>
<td>Brazil</td>
<td>Woodyard (EPC)</td>
</tr>
<tr>
<td>2012</td>
<td>Metsä-Botnia Joutseno Mill</td>
<td>Finland</td>
<td>Biomass handling for gasification</td>
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<td>2012</td>
<td>EON Värme, Örebro</td>
<td>Sweden</td>
<td>Biomass handling</td>
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<tr>
<td>2011</td>
<td>Domsjö Fabriker AB</td>
<td>Sweden</td>
<td>Debarking line</td>
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<tr>
<td>2011</td>
<td>PT. TEL, Musi</td>
<td>Indonesia</td>
<td>RotaBarker™ debarking line</td>
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<tr>
<td>2011</td>
<td>CMPC Celulosa S.A., Santa Fe Mill</td>
<td>Chile</td>
<td>Debarking lines (2 pcs)</td>
</tr>
<tr>
<td>2011</td>
<td>CMPC Celulosa S.A., Santa Fe &amp; Laja Mills</td>
<td>Chile</td>
<td>Biomass handling (2 pcs)</td>
</tr>
<tr>
<td>2011</td>
<td>Celulosa Arauco y Constitucion S.A., Nueva Aldea &amp; Arauco Mills</td>
<td>Chile</td>
<td>Debarking lines (2 pcs)</td>
</tr>
<tr>
<td>2010</td>
<td>Mondi Syktyvkar</td>
<td>Russia</td>
<td>Woodyard</td>
</tr>
<tr>
<td>2009</td>
<td>Veracel Celulose S.A., Eunapolis</td>
<td>Brazil</td>
<td>Chipping line (EPC)</td>
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MARKET LEADER IN DEBARKING AND CHIPPING
EUCALYPTUS / ACACIA

<table>
<thead>
<tr>
<th>Year</th>
<th>Company</th>
<th>Country</th>
<th>Reference</th>
<th>Capacity (m³ sub/h)</th>
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</thead>
<tbody>
<tr>
<td>2017</td>
<td>Fibria, Tres Lagoas</td>
<td>Brasil</td>
<td>Woodyard (EPC)</td>
<td>4 x 400</td>
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<tr>
<td>2017</td>
<td>Mondi Richards Bay</td>
<td>S-Africa</td>
<td>Chipping line</td>
<td>1 x 400</td>
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<td>2016</td>
<td>Klabin S.A., Ortigueira Mill</td>
<td>Brazil</td>
<td>Woodyard (EPC)</td>
<td>4 x 350/400</td>
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<td>2013</td>
<td>Montes del Plata Co. Ltd.</td>
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<td>2013</td>
<td>Celulosa Arauco y Constitucion S.A., Constitucion</td>
<td>Chile</td>
<td>Chipping line</td>
<td>1 x 230</td>
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<td>2013</td>
<td>Phoenix Pulp and Paper Co., Ltd., Thailand</td>
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<td>Debarking line</td>
<td>1 x 230</td>
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<td>2012</td>
<td>Eldorado Celulose e Papel Ltda.</td>
<td>Brazil</td>
<td>Wood processing plant (EPC)</td>
<td>3 x 400</td>
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<tr>
<td>2011</td>
<td>Celulosa Arauco y Constitucion S.A., Arauco /Nueva Aldea</td>
<td>Chile</td>
<td>Debarking lines (2 pcs)</td>
<td>1 x 230</td>
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<td>2011</td>
<td>CMPC Celulosa S.A., Santa Fe Mill, Nacimiento</td>
<td>Chile</td>
<td>Debarking lines (2 pcs)</td>
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<td>JK Paper Mills</td>
<td>India</td>
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<td>2011</td>
<td>PT Tanjung Enim Lestari Pulp &amp; Paper</td>
<td>Indonesia</td>
<td>Debarking line</td>
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<td>2010</td>
<td>Zhanjiang Chenming Pulp and Paper Co., Ltd.</td>
<td>China</td>
<td>Wood Processing plant</td>
<td>1 x 300</td>
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<td>2009</td>
<td>Veracel Celulose S.A., Eunapolis</td>
<td>Brazil</td>
<td>Chipping line</td>
<td>1 x 400</td>
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<td>2007</td>
<td>Aracruz Celulose S.A., Aracruz</td>
<td>Brazil</td>
<td>Chipping line (EPC)</td>
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<td>2007</td>
<td>Suzano Bahia Sul Papel e Celulose S.A., Mucuri</td>
<td>Brazil</td>
<td>Wood processing plant (EPC)</td>
<td>3 x 280</td>
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<td>2007</td>
<td>Botnia S.A., Frey Bentos</td>
<td>Uruguay</td>
<td>Wood Processing plant</td>
<td>2 x 330</td>
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</table>

+ 32 other installations 1970-2007
FIBRIA TRÊS LAGOAS (MS) - SECOND PULP PRODUCTION LINE, BRAZIL

Wood processing plant

Pulp mill capacity 1,950,000 adt/a
Processed wood 7,540,000 m³ sub/a

Chipping
- 4 x 400 m³ sub/h

Chip storage 191,000 m³
Chip feeding 5,100 m³ l/h
Chip reclaiming 3,100 m³ l/h

Chip screening 5 x 1,000 m³ l/h
Bark handling 2 x 250 m³ l/h
FIBRIA TRÊS LAGOAS (MS) - SECOND PULP PRODUCTION LINE, BRAZIL
WOOD PROCESSING PLANT
KLABIN S.A., ORTIGUEIRA MILL, PUMA-PROJECT

Wood Processing Plant

Biomass storage – 25,000 m³
• Reclaimers 4 x 100…300 m³/h

Debarking: 4 lines
• Euca 350 m³ sob/h
• Pine 400 m³ sob/h

Eucalyptus pulp production:
• 1,100,000 Admt/a
• Wood consumption 3,700,000 m³ sub

Pine pulp production:
• 400,000 Admt/a
• Wood consumption 1,930,000 m³ sub

Eucalyptus chips storage – 89,000 m³
• Stacker 3,200 m³/h, reclaimer 800-2,100 m³/h

Pine chips storage – 47,000 m³
• Stacker 2,200 m³/h, reclaimer 550-1,600 m³/h
KLABIN S.A., ORTIGUEIRA MILL, PUMA-PROJECT WOOD PROCESSING PLANT
Chipping Line

Chipping 400 m³ sub/h
- HHQ-EXL with 18 knives (TK-IV turnknife)

Chip Screening
- 2 x CS1000 gyratory screens
CHIP QUALITY THROUGH R&D

High Capacity Chipping Line for Forest Debarked Logs – Main Functions

Log receiving
• for dosing and equalizing log flow

EucaRoller
• for efficient bark separation
• efficient washing to remove sand and soil

Metal detection
• to protect chipper

Chipper feed conveyor
• for equalizing log flow

Surge bin
• for equalizing chip flow

Chipping with horizontally fed HHQ-Chipper
• for high quality chip formation
HHQ-CHIPPER - THE UNIQUE HORIZONTALLY FED CHIPPER

High capacity without compromises in chip quality

- Highest and most uniform chip quality at the market
- Produces with 33 degree feed angle thinner chips than any other brand at the market;
- Max. Capacity is > 500 m3/h (EXL model)
- Runnability is appreciated – operators love it! - much less blockages in infeed than with drop feed chipper
- Special 4-motor drive saves in running and electrification costs
- Results typically 1-2% -unit yield improvement in cooking

- 128 pcs of horizontally fed HHQ-Chippers sold since 2001; 25 pcs of EXL models since 2009
CHIP QUALITY TROUGH R&D

Homogenous and uniform chip quality results important savings

High chip quality provides savings
- Raw material savings
- Better yield in pulping
- Increased pulp production
- Lower chemical consumption
- Higher pulp strength

Example – One big capacity chipping line (400 m³/h):
- 1% wood savings = 0,9 MUSD annually
  (raw material costs only 2,000,000 m³ sub/a x 1% x 45 USD /m³)
- 1,5% yield improvement in fiberline = 5,2 MUSD more profit annually
  (15.000 tn/a more pulp x 700 USD/tn x 50%)
CHIPPING DEVELOPMENT – FIRST “BIG STEP”
HQ-CHIPPER LAUNCHED 1990

Chip quality improvements through single log layer chipping

**Conventional drop fed chipper**
- V-spout with side angle

**HQ-Chipper**
- Disc tilted for stable behavior of logs during chipping
- Wide spout without side angle
CHIPPING DEVELOPMENT – “REVOLUTION”
HHQ-CHIPPER LAUNCHED 2001
Chip quality improvements through single log layer chipping

**Conventional horizontally fed chipper**
- Small number of logs chipped against bed knife
- Outer portion of knife used heavily

**HHQ-Chipper**
- Simultaneous chipping of several logs against bed knife
- Very stable behavior of logs during chipping
- Total length of knife used evenly
HOW TO MAINTAIN HIGH CHIP QUALITY?

Sustainable chip quality

- Proper knife system with service contract
- Benefit from SmartWoodyard (IoT) systems like
  - Monitor condition of the chipper
  - Detect stones
  - Have remote connection for trouble shooting
  - Measure chip quality “online”
  - Metris “big data” collection to improve operation
- Select gentle chip storage and reclaim system
- Etc.
TURNKNIFE SYSTEM
Technical concept and benefits

Benefits summary
• Improved operator safety due to low weight, easy to handle knives.
• Only one operator needed for knife change.
• Exact hardening and cutting edge for ~2.5x longer knife life and higher uptime and production potential.
• Integrated counter knife – optimum performance for high chip quality.
• No knife grinding – always sharp knives for best chip quality
• Full service contracts available
CHIPPER EKG CONDITION MONITORING SYSTEM

1. Chipper bearing diagnostics
2. Chipper motor diagnostics
3. Foreign object diagnostics
4. Knife damage diagnostics
5. Knife wearing diagnostics
CHIP QUALITY MEASUREMENT
SCANCHIP

Optical chip analysis system

Benefits summary
- On-line and laboratory measurements
- Measures chip dimensions (length, width, thickness)
- Results can be produced based on different standards like SCAN, TAPPI, etc.
- Additional modules available for moisture and brightness measurement
- Feedback to Decision Support System
MARKET LEADER IN WOOD PROCESSING DELIVERIES
For cold climate conditions – high capacity lines for pulpwood

<table>
<thead>
<tr>
<th>Mill</th>
<th>Capacity m³sob/h SW/HW</th>
<th>Delivered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ilim Pulp, Bratsk, Russia</td>
<td>3 x 360/250</td>
<td>2018</td>
</tr>
<tr>
<td>Sappi, Skowhegan, Maine, USA</td>
<td>1 x 405/365</td>
<td>2017</td>
</tr>
<tr>
<td>SCA Östrand, Sweden</td>
<td>2 x 425</td>
<td>2017</td>
</tr>
<tr>
<td>Metsä Fibre, Äänekoski, Finland</td>
<td>3 x 470/350/270</td>
<td>2017</td>
</tr>
<tr>
<td>Ilim Pulp, Ust-Ilimsk, Russia</td>
<td>2 x 350</td>
<td>2016</td>
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<tr>
<td>North Star Pulp, Amazar, Russia</td>
<td>1 x 290/190</td>
<td>2015</td>
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<tr>
<td>Camce, Svetlogorsk, Belarus</td>
<td>2 x 320/240</td>
<td>2015</td>
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<tr>
<td>StoraEnso, Skoghall, Sweden</td>
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<td>2012</td>
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<tr>
<td>Domsjö, Sweden</td>
<td>1 x 350</td>
<td>2011</td>
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<tr>
<td>Mondi Sykyvkar, Russia</td>
<td>2 x 415/300</td>
<td>2009</td>
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<tr>
<td>StoraEnso, Varkaus, Finland</td>
<td>2 x 350/250</td>
<td>2007</td>
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<tr>
<td>Arkhangelsk Pulp and Paper Mill, Russia</td>
<td>370/280</td>
<td>2006</td>
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<td>Metsä- Botnia Oy, Joutseno Mill, Finland</td>
<td>2 x 350/250</td>
<td>2001</td>
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<tr>
<td>AssiDomän, Skärblacka, Sweden</td>
<td>1 x 305</td>
<td>1999</td>
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<tr>
<td>Södra Cell AB, Värö Bruk, Sweden</td>
<td>1 x 350</td>
<td>1998</td>
</tr>
</tbody>
</table>
METSÄ FIBRE OY, ÄÄNEKOSKI BIOPRODUCT MILL

Wood processing plant

**Chip handling:**
- Chips to storage
  - 3 x 3,000 m³ l/h
- Chip storage volume
  - 3 x 120,000 m³
- Chip reclaiming
  - 3 x ...2,800 m³ l/h

**Bark handling:**
- Bark storage 10,000 m³
- Bark reclaiming 2 x ...200 m³ l/h

**Wood amounts / year:**
- Softwood (pine, spruce)
  - 4,650,000 m³ sob/a
- Hardwood (birch)
  - 2,100,000 m³ sob/a

**Debarking lines:**
- 3 x 470/350/270 m³ sob/h
- Drums 5 x 48 m
- Chippers HHQ-EXL 18
METSÄ FIBRE OY, ÄÄNEKOSKI
BIOPRODUCT MILL
Wood processing plant
METSÄ FIBRE OY, ÄÄNEKOSKI
BIOPRODUCT MILL

Wood processing plant
METSÄ FIBRE OY, ÄÄNEKOSKI
BIOPRODUCT MILL

Wood processing plant

ANDRITZ chips after HHQ-Chippers are so high quality that MF Äänekoski don’t have chip screening at all!!
ANDRITZ 360° STACKER RECLAIMER

Homogenous chip supply to digester

- Optimum cooking performance through homogenous and guaranteed continuous chip supply.
- Real FIFO chip pile management: blending feature reduces hourly chip moisture variations up to 30%.
- Minimal chip degradation for overall yield improvement.
- Feasible storage sizes up to 360,000 m³
- 17 chip storage systems with S/R sold since 2012

KEY SUCCESS FACTOR:
Securing continuous and homogenous chip supply to cooking process
GYRATORY CS-CHIP SCREENING - RELIABLE SCREENING RESULT

Excellent service record

- Gyratory type screen with 3-4 screening decks
- Rugged and durable construction
- Effective overs and fines separation
- Self cleaning construction due to amplitude, frequency and screening deck inclination

Totally 236 CS-Screens sold since 1980
ANDRITZ CRUSHER – ENSURES STABLE PARTICLE SIZE FOR BOILER

Robust machine with easy maintenance

**Softwood:**
- 10 pcs delivered since 2011

**Eucalyptus/Acacia:**
- 26 pcs delivered since 2012

**Horizontally fed crusher**
- 2 pcs delivered since 2012

Totally 38 BioCrushers sold
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ANDRITZ IS THE MOST EXPERIENCED PARTNER IN WOOD PROCESSING

THANK YOU – QUESTIONS?
(e-mail: hannu.silventoinen@andritz.com)

HANNU SILVENTOINEN - 2018