Metso power pulp mill products
Boiler design

We provide service for:
- Recovery boilers
- Power and utility boilers
- Evaporators

Services and products are:
- Rebuilds and upgrades
- Replacement in kind
- Spare parts
- Preventive maintenance
- Knowledge based services
- Accessory products
RECOX™ History

- Götaverken
  - 1936
  - 1994 Kvaerner Pulping

- Tampella
  - 1933
  - 1996 Kvaerner Pulping

- Kvaerner Power Recovery Boiler

- Metso Power Recovery Boiler

Over 300 recovery boilers worldwide
Furnace floor design

Benefits:
• Symmetrical air penetration for uniform and symmetric bed
• Floor tubes always covered with frozen smelt
• Floor protected by fluffy char bed
• 2.5° slope avoids accumulation of steam bubbles inside floor tubes
• Even flow of molten smelt

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Important velocities and positive slope

Benefits:
- No smelt flow on the tube surface = no corrosion
- Cooling ensured by 2.5° = no steam blanketing
Lower furnace tubing

**Composite Sanicro 38**
- Carbon steel: 63.5 mm
- Sanicro 38: 1.85 mm
- Composite tubing: 4 mm
- Outer diameter: 76.2 mm

**Composite tube AISI 304**
- Stainless steel: 63.5 mm
- Sanicro 38: 1.65 mm
- Composite tubing: 4 mm
- Outer diameter: 76.2 mm

**Carbon steel tube**
- Carbon steel: 60.3 mm
- Composite tubing: 5 mm
- Outer diameter: 63.5 mm

**Benefits:**
- Composite tubing demonstrates excellent corrosion resistance in furnace walls, resulting in lower maintenance cost
- Gas tight membrane design
- Decanting floor allows non-studded carbon steel tubes
Floor tube material selection

<table>
<thead>
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<th>High Pressure</th>
<th>Medium Pressure</th>
<th>Low Pressure</th>
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<tr>
<td>High Corrosiveness of smelt</td>
<td>Carbon steel</td>
<td>AISI 304L</td>
<td>Sanicro 38</td>
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<tr>
<td>Medium Corrosiveness of smelt</td>
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<tr>
<td>Low Corrosiveness of smelt</td>
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</table>
Furnace floor selection

AISI 304L

Sanicro 38

AISI 304L

Sanicro 38

Carbon steel
Furnace floor selection

AISI 304L

Studding

Carbon steel
Furnace corner design

Benefits:
- Improves heat absorption
- Minimizes salt cake build-up
- Ensures boiler water circulation

Features:
- Separate circulation circuits for corner and floor tubes adjacent to the sidewalls
- One corner designed for safe relief of furnace overpressure
Furnace floor sealing

Benefits:
- Tight seal to side walls and headers
Side wall sealing

Benefits:
- Tight seal to side walls
- Flexible seal minimizes stresses to tubes
Rebuild of furnace floor

Old boiler

Kvaerner Tampella CE Others

Customer preference

Metso Power standard decanting floor

Sloping floor

Kvaerner Götaverken B&W

Customer preference, required additional modifications

Customer preference

Benefits:
- Sloping or decanted floor – we have the experience!
Safety corner design

Features:
- Located between tertiary level and nose arch of boiler in one corner
- Pins designed for safe relief of furnace overpressure

Reduced pin diameter, 16mm (32mm) in safety corner

Weak pin
Requirements on a modern air system

- Good boiler control, allowing a wide range of load and black liquor quality variations
- Good bed control with stable smelt flow
- High reduction rate and low amount of unburned carbon in smelt
- Minimized emissions
- High availability of boiler
- Good and safe working environment
- Flexibility for integration of NCG system
CFD - Temperature profile

Non-optimized air system

Multilevel air system

Temp. °C

0
115
230
350
460
575
690
800
920
1000
1150
1250
1380
1500
1600

Conclusion

• Significantly lower gas temperatures into superheater area with Multilevel air system
Large air ports provide for good mixing

- Low CO
- Low O₂
- Low NOₓ
Multilevel Air System™ combustion zones

- Stable, undisturbed liquor spraying zone with even droplet distribution
- Pyrolysis zone, optimum drying and pyrolysis, heat to char bed reactions
- Final combustion zone, completes combustion and ensures an even flow pattern for optimal superheater performance
- Char bed control zone, reduced atmosphere and smooth smelt removal
Correct Velocity

- High-Secondary air
- Secondary air
- Tertiary air
- Primary air
Allow Room For Bed

Limit Bed Height
Allow Room For Droplet Formation
Room to Prevent Interference
Secondary and High Secondary air level

Benefits
- Non welded sleeve design
- Easy to change sleeve
- Pressure control possibilities
Tertiary, air levels

Valdivia, Chile

Billerud, Gruvön, Sweden

Benefits
• Non welded sleeve design
• Easy to change sleeve
• Pressure control possibilities
Low pressure drop register

4 inwc, large boiler, sec + tert: cost 1 MUSD in 10 years
NCG and Vent Gas

- DNCG, CNCG, vent- and mix tank gas can be integrated optimally with Multilevel Air System to form Multifuel Combustion System.

CNCG at secondary air level

DNCG and vent gas at tertiary air level
New liquor gun station
Easy angle adjustment

- Manual, local or from the control room
- Easy to adjust angle for:
  - Load changes
  - Start-up
  - Changes in liquor distribution, liquor grade and air distribution
- 20° angle range possible
- Easy to adjust from the control room
  - Ensures quick response

Without motor (manual) or with motor (local or from control room)
Opening-centered nozzle – ensured performance

- Nozzle always centred in liquor opening
- Controlled air flow around nozzle
  - Better cooling: extends life
  - Controlled liquor dispersal pattern
Smelt dissolving tank

Benefits:
- Isolated dissolving tank foundation
- Thermal expansion of the tank possible between tank and foundation
  - Thermal movements do not cause stresses to structural steel
  - Safety
- Sound proofing by concrete lining

Boiler rear wall
Smelt spout
Stainless steel lining
Steam
Stainless steel lining
Insulation
Concrete
Overflow level
Normal level
Dissolving tank with big access door

Dissolving tank’s big access door and alternative access door for "bob cat" (small front dump truck).
Smelt spouts and openings

Principle of the sealing
- refractory is pressed against gasket
Smelt spout design
Dual Shatterjets

Advantages:
• Safer
• Stability of shattering
• Powerful
• Low steam usage
• Adapted for different hood design
Micro Hood Design

Steam shatter jet

Collar is seal welded to dissolver

Floating seal plate for expansion
Cleaning robot for smelt spouts
Patended
The operator sees what the robot sees

Actual situation

Operator screen, with robot camera view.
Smelt-X – Smelt removal

- Driven by pressurized air – no mechanical pumps or motors
- Simple design, no moving parts = reliable!
Smelt-X

- Good flow, straight into the dissolving tank
- Can be used in other boiler wall openings

- Smelt spout opening, from the inside
Smelt-X in operation
Savings

• Ideally, almost all of the smelt could be ejected
  - Washing the boiler could be done using hoses with warm water. No high-pressure equipment.
  - Start washing quickly after ejecting smelt, maybe even 5 hours after liquor out. This is possible because there is no bed to cool down.

• Total reduction of outage could be 24 - 48 hours
  - This gives more time to other activities, like inspections.