Variable Capacity Vacuum System and Efficient Nip Dewatering bring Energy Savings

Principles and experiences

Jyrki Uimonen
Speech in Slovenian Paper Association 2014
WHAT IS A GOOD VACUUM SYSTEM?

• Maximizes and stabilizes dewatering rate in various production conditions (grade, speed, felt age, ..)
• Keeps paper web in good control
• Keeps felts in optimal moisture when entering the nip
• Energy efficient
• Water economical
• Operator friendly
• Maintenance friendly
LIMITATIONS OF EXISTING VACUUM SYSTEMS

• Fixed speed or limited range: fixed capacity
• Systems overdimensioned (safety margin): high energy consumption
• No tools for economical use of vacuum (valves for control flows/vacuums)
• High water consumption
• Need for water treatment
• Building and piping set limits for rebuild
Different energy cons in different mills, due to:
- Machine concept
- Furnish
- Paper grade
- Vacuum concept
- Tradition
Lower vacuum can bring higher dewatering

=> Max Dewatering with OPTIMAL vacuum
DIRECT DRIVEN VARIABLE SPEED TURBO SAVES

HIGH SPEED (10000rpm)
⇒ COMPACT DIMENSIONS AND LOW WEIGHT

DIRECT DRIVE
⇒ NO GEARBOX, NO COUPLINGS

MAINTENANCE ACTIONS ONSITE,
NO NEED FOR HEAVY LIFTING

VARIABLE SPEED DRIVE
⇒ ADJUSTS TO REAL NEED OF CAPACITY

⇒ SUPERIOR ENERGY EFFICIENCY
System configuration

- Cooling Air
- Blower Outlet
- Vacuum Breaker Valve
- Turbo Blower
- Power Supply
- Frequency Converter
- DCS
- Drop Separator
- Discharge to Seal Pit Tank or Pump
- Suction Position

Scope of delivery
IMPROVED NIP DEWATERING to handle larger water amount

- Uhle box vacuums lowered, less water in uhle box
- Better functioning nip, more water in the nip
- Air doctor blade to remove the increased nip water from rolls
- Suction press roll saveall pan modified to collect the water removed in the nip

=> Total dewatering was increased due better nip dewatering

UPM Grand Couronne PM3
SCPE OF A REBUILD

- Process survey and rebuild plan
- Turbo including electric drive and lubrication (one or several)
- Separator for each turbo
- Nip improvement package: air blade, high performance saveall
- Pipeline modifications
- Electric and automation installation

Possibly also:
- Heat recovery
REBUILD SCOPE OPTIONS

- Always the whole system to be evaluated to avoid suboptimisation
- Either all or just some of the pumps replaced
- Turbos installed in positions where the positive impact is best

- The best payback comes with partial rebuild
- Stepwise realisation reduces (or eliminates) the need for shutdown
ADAPTIVE DESIGN

EXISTING BUILDINGS AS STARTING POINT

EXISTING PUMP BEDS AS FOUNDATIONS

EXISTING PIPING UTILISED WHEREVER FEASIBLE

⇒ SAVINGS IN MONEY
⇒ SAVINGS IN SHUT DOWN TIME
Press section dewatering control

Flows from nip and uhle box of each felt monitored
Felt, vacuum and dewatering optimisation

![Graph showing water flow over time with labels for Good Felt, UHLE Box, and Save All categories.](image-url)
INSTALLATION IN LIMITED SPACE
UPM Grand Couronne PM3

Turbo Blower T1: forming section

Turbo Blower T2: pick-up and suction press roll
Both mounted on the foundations of the old system
Utilizing old piping, too
# Mondi Ruzomberok PM18

**VACUUM SYSTEM REBUILD WITH TURBO BLOWER**
*(SINGLE SHOE PRESS, FINE PAPER, 1550 M/MIN)*

## Power kW

<table>
<thead>
<tr>
<th>Old system</th>
<th>kW</th>
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<tbody>
<tr>
<td>NASH x 9</td>
<td>2150</td>
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<tr>
<td>Altogether</td>
<td>2150</td>
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<tr>
<td>EP400-700-D1</td>
<td></td>
</tr>
<tr>
<td>EP500-700-S</td>
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</tr>
<tr>
<td>NASH x 4</td>
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<td>1500</td>
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## RESULTS

- Energy savings **650 kW** (30% of the original situation)
- Additional saving potential 100 kW if pump#8 is stopped.
- Specific energy consumption **31 kwh/ton** for vacuum system
Mondi Ruzomberok PM18

VACUUM SYSTEM REBUILD WITH TURBO BLOWER
(SINGLE SHOE PRESS, FINE PAPER, 1550 M/MIN)

PROJECT REALISATION IN STEPS

• Vacuum system and dewatering survey

• (30% of the original situation)

• Additional saving potential
  100 kW if pump#8 is stopped.

• Specific energy consumption
  31 kWh/ton for vacuum system
Mondi Ruzomberok PM16
VACUUM SYSTEM REBUILD WITH TURBO BLOWER (FINE PAPER)

RESULTS
• Energy savings 310 kW (32kWh/ton) (43% of the original situation)
• Improved vacuum control
Stora Enso Ostroleka PM8
GREENFIELD VOITH LINERBOARD MACHINE IN POLAND

KEY TARGETS
• Top energy efficiency
• No water consumption
• Backup process connections
• Savings in building cost
• Savings in piping cost

APPROACH
• Compact/lightweight turbos give more freedom in planning => Totally new type layout
• Concrete separator possible when new building is made
• Cost efficient piping as a part of system and building design
KRPA Hostinne

Starting point:
- 6 water ring pump system with complex piping as a result of various modification during many years
- High specific power consumption
- Problems in water separation

Actions:
- Eliminating leaks and excessive pressure losses
- Redesigning the vacuum system to hybrid system:
  - Couch roll to be served with old water ring pumps
  - All other positions with a single impeller turbo
KRPA HostinnePM6
VACUUM SYSTEM REBUILD WITH TURBO BLOWER (Greaseproof paper 5tph)

RESULTS

- Energy savings **350 kW** (43% of the original situation)
- Savings in seal water
- Improved vacuum control
- Flexible use in different grammages

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www.runtech.fi
STARTING POINT

- Old pumps requiring replacement
- High specific energy consumption
- Need to reduce seal water consumption
- Vacuum capacity to be adapted to future speed increase, as well as for wide product range
Schumacher Grudziaz PM1
VACUUM SYSTEM REBUILD WITH TURBO BLOWER (TESTLINER 10tph)

### RESULTS

- **Energy savings** 350 kW  
  (43% of the original situation)
- **Improved vacuum control**

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FUTURE DEVELOPMENT:

NIP DEWATERING DEVELOPMENT
DEWATERING MEASUREMENT SYSTEM (ECOFLOW)
DOCTORING SOLUTIONS
WATER COLLECTING IMPROVEMENTS
⇒ HIGHER PRESS DRYNESS
⇒ LOWER ENERGY CONSUMPTION

HEAT RECOVERY: UTILISING THE SAME PUMPING ENERGY
ONCE AGAIN => FURTHER SAVINGS

REBUILDS WITHOUT SHUTDOWNS
SUMMARY

Good payback and limited investment can be reached through:
- Energy efficient vacuum sources
- Equipment adaptable in existing equipment and limited space
- Utilising existing foundations and piping

Additional benefit through:
- Installations not requiring shutdowns other than regular mainenance/fabric change shuts
- Utilising heat recovery potential
- Improving both process performance and energy efficiency
Thank you!