Variable Capacity Vacuum System and Efficient Nip Dewatering bring Energy Savings

Principles and experiences

Jyrki Uimonen Speech in Slovenian Paper Association 2014





- 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



BENCMARKING TO BEST PRACTISES



Different energy cons in different mills, due to:

- Machine concept
- Furnish
- Paper grade
- Vacuum concept
- <u>Tradition</u>





Lower vacuum can bring higher higher dewatering





VARIABLE SPEED DRIVE \Rightarrow ADJUSTS TO REAL NEED OF CAPACITY

MAINTENANCE ACTIONS ONSITE, NO NEED FOR HEAVY LIFTING

DIRECT DRIVE \Rightarrow NO GEARBOX, NO COUPLINGS

HIGH SPEED (10000rpm) \Rightarrow COMPACT DIMENSIONS AND LOW WEIGHT





System configuration





IMPROVED NIP DEWATERING to handle larger water amount



= NEW COMPONENTS		
PAPER GRADE:	NEWSPRINT	
ALL COULDE CONTRACTOR	11.00	

QUOTATION DRAWING

The information controlled here is proprietary to Munice Systems List, and the optimized set of the produced set of the produc

UPM Grand Couronne PM3

- 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





- 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





- 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

 $\Rightarrow \mathsf{SAVINGS} \text{ IN MONEY} \\ \Rightarrow \mathsf{SAVINGS} \text{ IN SHUT DOWN TIME}$





Press section dewatering control

Flows from nip and uhle box of each felt monitored





Felt, vacuum and dewatering optimisation





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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)

				and the second
Old system	kW	New system	kW	S
		EP400-700-D1		~
NASH x 9	2150	EP500-700-S		
Altogether	2150	NASH x 4		
	Altogether	1500		

Old system vs. Turbo blowers



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)



Old system vs. Turbo blower





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







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)

1 water ring pumps

kW

Old system	kW	N	ew system
6 water ring pumps running		EP	400-700-D1
-		1 v rur	water ring pum nning
Altogether	800	Alt	together

RESULTS

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



Schumacher Grudziaz PM1 VACUUM SYSTEM REBUILD WITH TURBO BLOWER (TESTLINER 10tph)

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)

Old system	kW	1
6 water ring pumps		E
		1
		r
Altogether	800	A

New system	kW
EP400-700-D1	
1 water ring pumps running	
Altogether	450

RESULTS

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







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

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

REBUILDS WITHOUT SHUTDOWNS





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!

