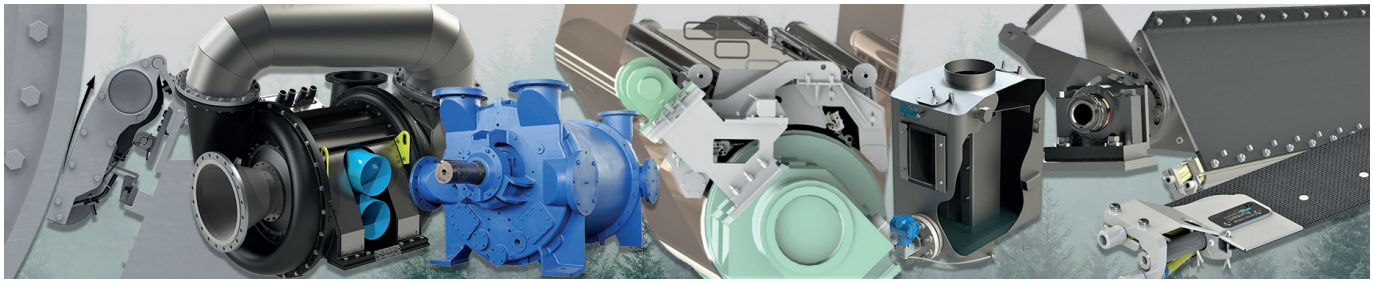
Hybrid vacuum system

Runtech Systems and Nash engineers have completed thousands of vacuum system audits and dewatering studies at paper mills over the last 20 years. Those studies and audits provided our engineers with a wealth of experience in benchmarking the effectiveness of existing vacuum systems, dewatering equipment, suction elements, fabrics and felts. To the benefit of our customers, each audit summarizes its findings in a clear and concise report, often in the form of a step-by-step rebuild or upgrade plan that results in minimized operational expenses coupled with a production increase and/or runnability improvements.

During a basic vacuum system survey, vacuum levels are studied to identify the actual vacuum connections. Vacuum levels are measured both at the paper machine and at the auxiliary vacuum equipment, namely vacuum pumps and blowers. Together with a dewatering and runnability study, the state and efficiency of the current system is analyzed and the need for any upgrades evaluated in order to improve the system's operation.

A typical Runtech RunEco vacuum system consists of several smaller size turbo blowers giving clear design and operational advantages over the competition. In addition, as the only company in the world we also offer liquid ring pump technology to form a combination of both technologies – a hybrid system. This allows us to always find the best fit solution to the customer's needs and budget.

Quite often a situation has been observed where a single, or a few low air flow consumers (devices) are operating at high vacuum levels, such as a high vac box or a press suction roll high vacuum zone, while the rest use a considerably lower vacuum level. This leads to a situation where the most economical option is to continue the use of the existing Liquid Ring Pump (LRP). Fully rebuilding a system with blower technology is not always the most efficient solution, especially if this means that different vacuum levels need to be combined in one blower. It is proven that a well maintained LRP operating at low speed to produce high vacuum level can perform at a good efficiency level outperforming systems where a large single blower experiences considerable expansion losses.



For example (see figure 1), a paper machine often has multiple vacuum consumers and vacuum levels. By combining all these together to a single large unit you inherently introduce losses and lower your system's efficiency. As is evident in this case, only one consumer can operate at the blower vacuum and all the others need throttling control that lead to significant energy losses. In addition, as air is a compressible medium which changes volume significantly with the surrounding pressure, a single large unit will experience expansion losses.

The airflow from a lower vacuum level (higher abs. p) expands over the valve to a higher vacuum level (lower abs. p) at the blower/header and thus the actual airflow seen by the equipment can be doubled or even tripled. An often seen vacuum level difference of e.g. 20 kPa (-60 kPa vs. -40 kPa) between two consumers at the machine can lead to a 100% increase in the air volume through expansion and thus naturally lead to a large increase in the blower's energy consumption.

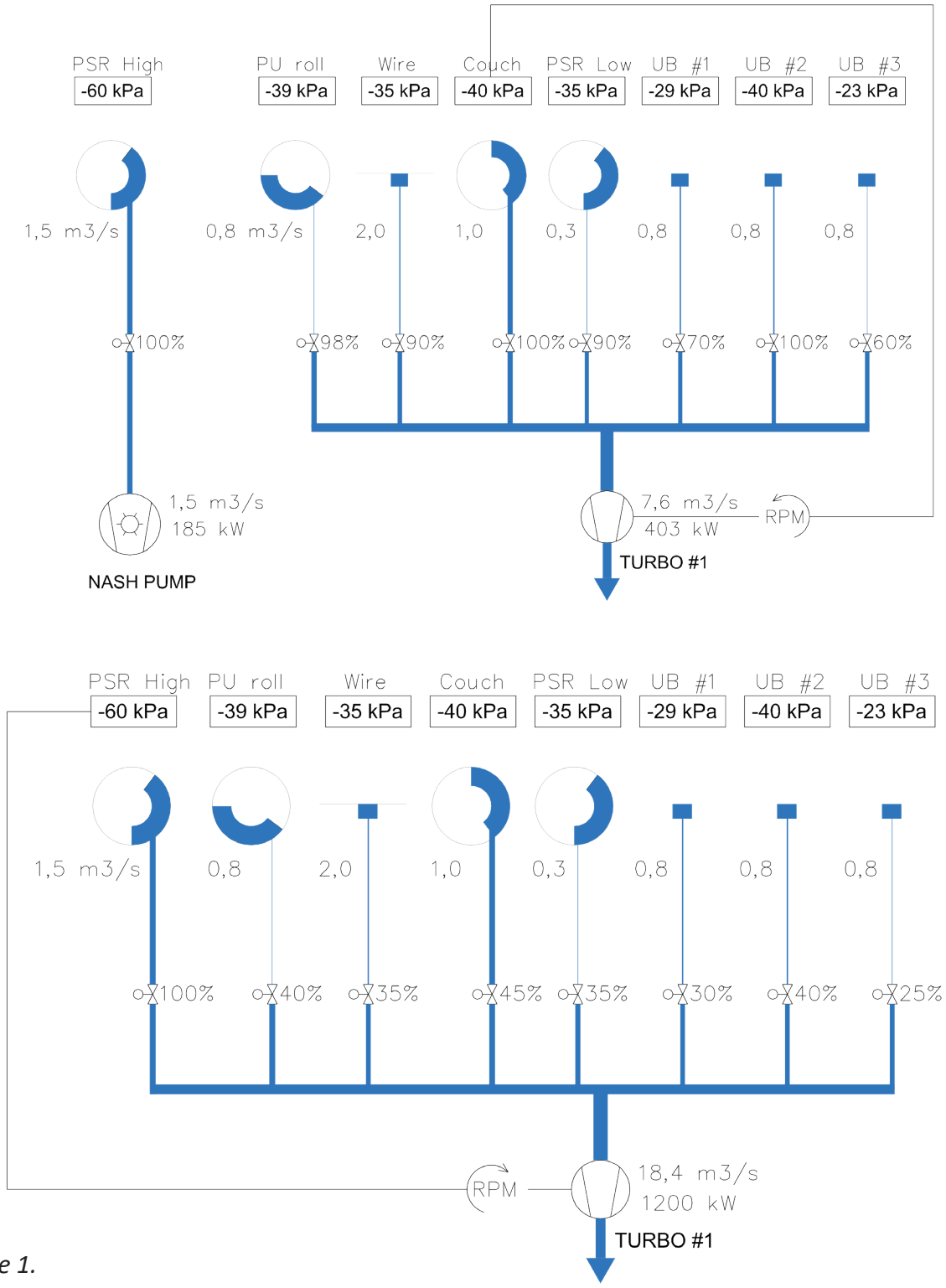


Figure 1.

Vacuum demand varies for different paper grades, felts and machine speeds, therefore, a tailor-made solution with flexible and variable capacity can balance the supply and demand, resulting in both optimized dewatering and minimized power consumption. Paper machine vacuum levels are measured at the vacuum pumps and blowers to identify problem areas. The dewatering elements such as flat boxes, save-all pans and uhle boxes are also reviewed. Specialists study pressure and bleed losses to analyze the energy consumption and evaluate if the vacuum levels are too high.

In the following rebuild cases, existing liquid ring pump or pumps are compared to a hybrid system to find an optimal balance between investment and operating costs.

A containerboard machine achieved even higher energy savings than expected. The start-up was very smooth and provided instant savings with a flexible vacuum system that provided good vacuum control to the mill. In addition, water savings were significant.

Old system	kW	New system	kW	Savings
LRP x 14		EP600-T1		
Blower		EP600-HF1		
		LRP x 1		
Total	2,150	Total	700-800	**≥ 1,350 kW**
				≥ 67%

A board machine achieved electricity savings of over 60% by optimizing its vacuum system. An EP Turbo Blower replaced five of the liquid ring pumps to supply vacuum for the low vacuum consumers. Specific energy consumption improved from 114 kWh/t to 45 kWh/t and seal water savings were significant.

Old system	kW	New system	kW	Savings
LRP x 6		LRP x 1		
		EP600-700S		
Total	900	Total	410	**490 kW**
				54%

A tissue producer gained energy savings of 447 kW which was almost 50% of its previous usage; water usage decreased by 75%. The installed EcoFlow dewatering measurement system provided a better control of the process.

Old system	kW	New system	kW	Savings
LRP x 4		LRP x 1		
LRP x 1	spare	EP500-D1		
Total	950	Total	500	**450 kW**
				47%

A confidential tissue producer kept two liquid ring pumps for the chester box. A RunEco EP550-T1 Turbo Blower was connected to other vacuum consumers to allow for all energy efficiency targets to be reached.

Old system	kW	New system	kW	Savings
LRP x 4		LRP x 2		
		EP550-T1		
Total	3,037	Total	2,087	**950 kW**
				31%

Runtech rebuilt two vacuum systems on board machines in Turkey, operated by the same customer. BM1 specific energy consumption improved from 73kWh/t to 35 kWh/t. Savings in electricity were approx. 50% and there is still potential for process optimization.

Old system	kW	New system	kW	Savings
LRP x 7		LRP x 1		
		EP600-HF		
Total	1,040	Total	500	**540 kW**
				52%

BM2 reached similar results with the SEC improving from 75 kWh/t to 40 kWh/t. All project targets were fulfilled right after the start-up.

Old system	kW	New system	kW	Savings
LRP x 4		LRP x 1		
		EP600-HF		
Total	530	Total	280	**250 kW**
				47%

On a fine paper machine, eight liquid ring pumps were replaced with three EP Turbo Blowers, and an LRP remained to provide vacuum for high vacuum consumers. The rebuild provided energy savings of 1,000 kW, dropping the specific energy consumption to 24 kWh/t, with Turbo Blower exhaust air also saving one ton of steam per hour. In addition, a cooling water tower was stopped, bringing the mill substantial water savings.

Old system	kW	New system	kW	Savings
LRP x 9		LRP x 1		
		EP400-700-D1		
		EP500-700-S x2		
Total	2,150	Total	1,150	**1,000 kW**
				47%

In addition, we offer dewatering measurement systems, doctors and save-alls, making our offering a complete package for paper machine dewatering.

Understanding the dewatering process is key to a well-functioning vacuum system. Combining the dewatering measurement system, press section doctoring and heat recovery with a vacuum system rebuild project can shorten the payback time significantly.

Runtech Systems

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