

Valmet

Technical Paper Series

Upgrading Runnability

Executive Summary

The latest blow box designs include features that improve performance, decrease energy consumption and allow for a simpler means of maintaining the equipment. These technical improvements are also available as upgrade packages. The energy consumed in runnability systems is the electricity needed for the fans. With upgraded blow box designs it is possible to consume as little as half of the energy of the old type blow box design. Maintenance of runnability systems is essential. Dirt, grease, dust build up, alignment and equipment failure are the main reasons for runnability performance issues.

Runnability system rebuilds and upgrades enable higher speed, lower draws and better efficiency. These can combine to yield more productivity with up to 50% less energy. The payback time for a runnability systems upgrade investment can be less than one year due to a combination of savings in electrical energy, draw reduction, chemicals and improved quality. On top of that many other benefits like improved tail threading, increased speed and fewer breaks further shorten the payback time.

This paper presents a background of runnability and blow box operation, the applicable components for different grades and machine sections, suggestions for energy savings, and case studies to support the recommendations made in the paper.

The importance of runnability

Runnability through the press and dryer sections has always been an important issue for papermakers. Air flow and boundary layer disturbances reveal themselves in many different types of runnability problems. Some common problems that are observed are:

- Sheet blowing at the press nip, especially during the startup of new press felt
- Edge drop-off or sheet drop-off as the sheet transfers between the press and the dryer
- Cross-machine and machine direction wrinkles caused by air being trapped between the fabric and the sheet
- Edge flip from cross-machine air flows or boundary layers of air
- Curling or edge flutter caused by strong air currents entering across the machine
- Difficult tail threading caused by undesirable air flows
- Edge flutter in double-felted areas due to unbalanced pocket air flows
- Bad moisture profiles due to uneven pocket humidities
- Low drying rate due to high pocket humidity levels

The solution to poor runnability – full control of the sheet

In most cases these problems can be completely controlled with the use of blow boxes and pocket ventilators. Blow boxes are designed to create an underpressure that supports the sheet from the fabric side of the sheet run. By using a special configuration of air nozzles, Valmet's blow boxes wipe boundary layers of air from fabric and roll surfaces to seal and remove air from between the sheet and the fabric. The air nozzle design takes advantage of Coanda forces to seal and evacuate the air which is detrimental to good runnability.

Having sufficient air flow to the blow boxes is very important for the reliable operation of the blow box system. Depending on the blow box type, different sources can be used for the supply air.

Machine room air is normally used for press blow boxes. For stabilizers located in the dryer section, the air is typically recirculated from the hood, with the addition of dry hood supply air or supplied with heated machine room air. Double-felted blow boxes generally use dry

supply air, mixed with recirculated air from the hood if necessary. All the pocket ventilators are connected to the hood supply air system to deliver dry air to the dryer section.

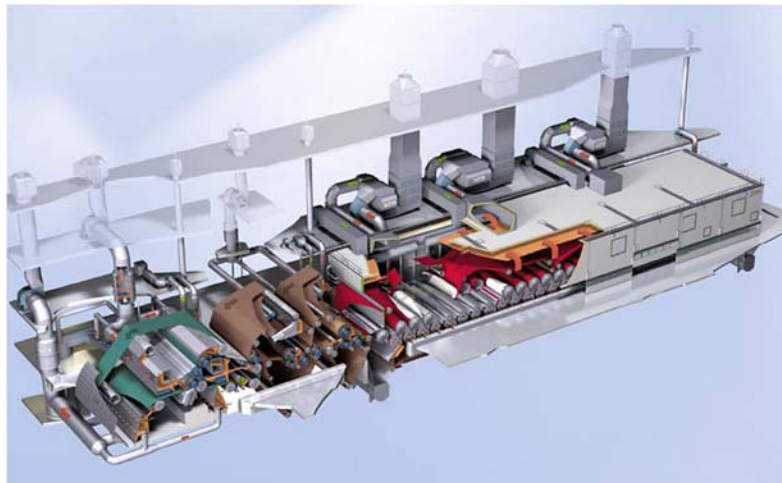


Figure 1. In most cases, runnability problems can be completely controlled with the use of blow boxes and pocket ventilators.

Maintain the components you already have

It's undeniably more cost-effective to adequately maintain and upgrade existing components than to replace them with newer models. A "run until it breaks" approach is detrimental to the long-term performance of existing mill runnability systems. Due to the depressed economy since 2008, but even before that, many mills have not had the personnel in-house to service runnability equipment properly.

This has led to a North American situation of overall neglect of existing runnability systems. As a result, mills call their OEM or service provider more frequently for emergency service due to runnability components being full of grease and oil, misalignment or failed equipment. This presents a big expense for our customers as the equipment needs to be removed from the machine for repair, cleaning or replacement. This results in higher project costs as the equipment needs to be modified, leading to a larger project than it should have been.

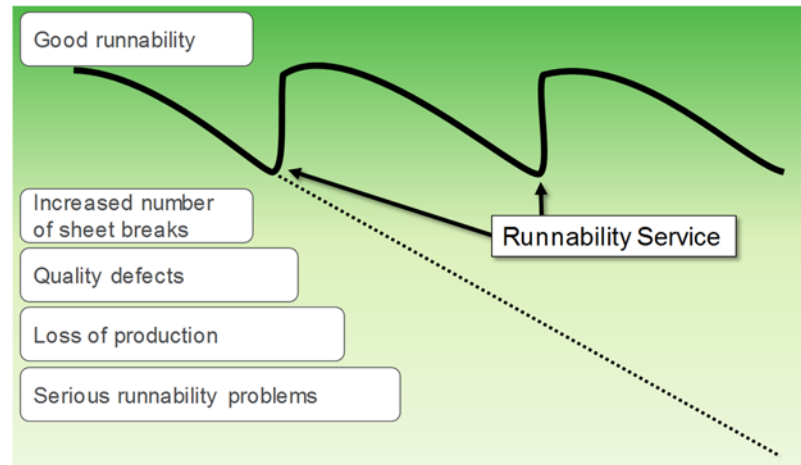


Figure 2. Regular runnability system maintenance ensures continuous top performance of the machine line.

Cleaning plugged nozzles is a critical part of normal maintenance. Typically mills are already overbooked with work to do during a shutdown, and understaffed to complete this rudimentary but very important task. In these cases, maintenance managers have called Valmet to come in and supervise the process, using local labor contracted by the mill. This provides the best expertise and cleaning result for the least cost.

In some cases, a pre-trip by Valmet personnel is needed to troubleshoot and determine what corrective actions are needed before quoting a remedial service package. After a mill orders the runnability service, Valmet experts arrive at the mill for the shutdown and make corrections. Sometimes it's not possible to fix everything during the prescribed shutdown, in which case the Valmet-provided comprehensive report of all findings and yet-to-be-taken actions is invaluable.

When providing service, Valmet will always audit the runnability system performance before taking any actions. This audit will be done again after the service event in order to show the effectiveness of all service actions. These pre- and post-shutdown performance surveys are done during machine runtime.

Upgrading existing components

Since runnability research and development is a never-ending process, every year brings new technology that is incorporated in the latest products being launched into the market. Many of these technology advances are also available as upgrades to existing machinery. While these upgrades are one solution, the best solution is to directly replace the existing equipment.

Direct replacements take longer as the components are replaced one by one during general maintenance outages. In the long run this offers the best solution as the latest technology is in the machine.



Figure 3. A pre- and post-shutdown performance survey are performed while the machine is running, in order to show improvements gained.

When rebuilding existing equipment, for example, some old generation blow boxes can benefit from a flood shower upgrade, wherein a water pipe is installed to allow internal water cleaning

Installing cleaning showers and cleaning existing blow boxes improves maintenance and performance. Typically, the OEM will also set them back up so they run like new. All setup clearances are brought back to original specification, which is in many cases a fix for a problem the mill didn't even know existed.

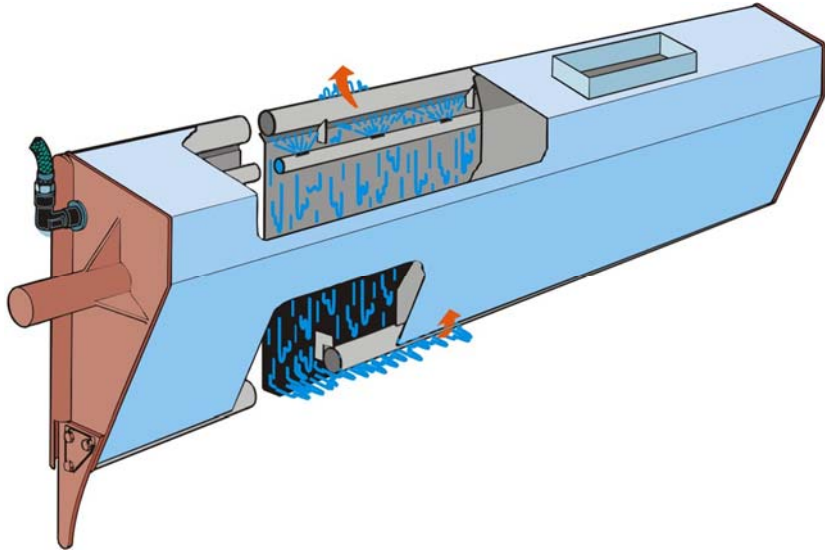


Figure 4. Adding a flood shower upgrade to an existing blow box helps maintain runnability by cleaning plugged nozzles.

Finally, the need to decrease energy usage has resulted in many small improvements in existing blow box design. In the case of Valmet Hirun Web Stabilizer blow boxes, the older type of fixed axial vacuum dividers or air nozzles can now be upgraded to modern adjustable labyrinth seals.

Additionally, the side nozzles can be replaced with PTFE seals for smaller fan input power.

The resultant decrease in electric power consumption is due to the reduced air flow after upgrading. Tail threading is more stable because of the reduced air streams at the edges.

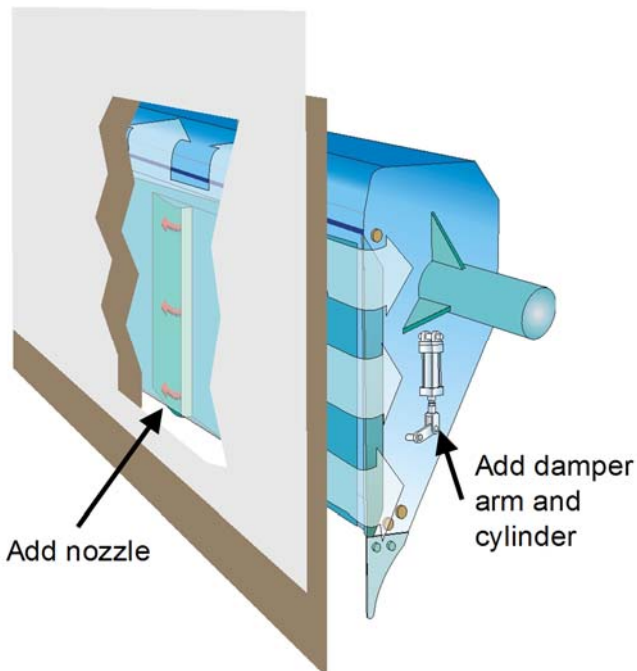


Figure 5. Tail threading assist can be added by modifying the tend side of existing blow boxes.

Adjustments may be made during machine operation for optimum performance.

Blow box principle of operation

At higher speeds the sheet will tend to follow the dryer cylinder surface due to adhesion and vacuum forces. Vacuum in the opening dryer nip exponentially increases with increasing machine speed. Blow boxes are needed to create a sufficient counter-force behind the fabric.

As seen in **Figure 6 (next page)**, Valmet blow boxes operate by blowing high velocity air through air nozzles, using the Coanda effect (no contact with the fabric). No mechanical seals contact the fabric.

Air is supplied into the blow box and exits the box at high velocity through nozzle gaps. This evacuates the air from the area

between the blow box and the fabric, creating negative pressure between the box and the fabric. The negative pressure is transferred through the fabric, resulting in the paper web being pulled tightly to the fabric for maximum sheet stability.

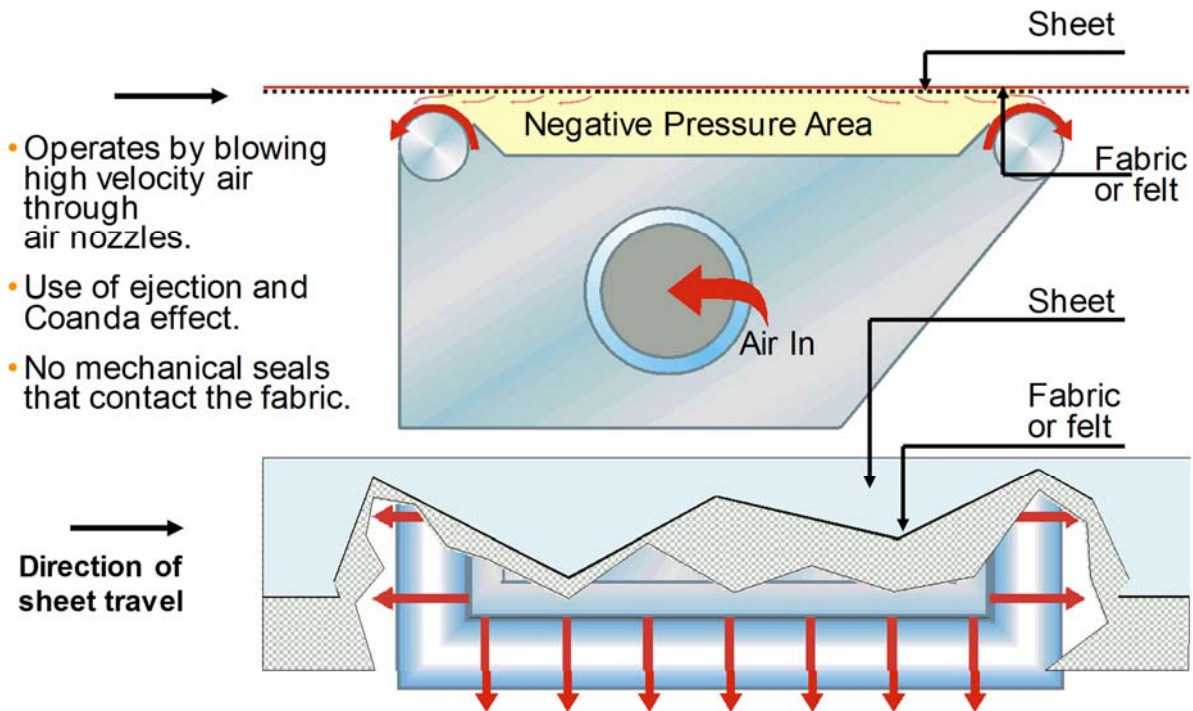


Figure 6. Blow box principle of operation

Fabric permeability is important as the vacuum the blow box creates acts on the web over the open area of the fabric. When fabric closes or fills in, the vacuum effect diminishes on the web. Therefore keeping the fabrics open is very important.

The position of blow boxes, both in the machine direction and the cross direction, is also quite important. If the web edge is too close to the blow box edge nozzle, edge drop off and sheet instability can occur.

Runnability on high speed paper machines

On many paper machines speed cannot be increased, because this would lead to uncontrolled sheet flutter, wrinkles, quality defects, an increased number of sheet breaks and more difficult tail threading after the breaks. Although there are several other aspects of the papermaking process that have an influence on dryer section runnability, the air movements close to the surface of the web play a very important role, especially at higher machine speeds. Air currents at high running speeds cause a significant build-up of pressure in the nip areas, causing the sheet to separate from the fabric or press felt.

Valmet has for many years focused on developing new runnability solutions for faster machine speeds and meeting the very demanding challenges of sheet handling on high speed machines.

Excellent sheet stability at highest speeds

Runnability at the sheet transfer from press to dryer section has become more and more important at high machine speeds. The new closed press section concepts have also brought new demands for sheet handling. Valmet Press Nip Web Stabilizer and Valmet Press Run Web Stabilizer blow boxes provide

excellent sheet support and ensure trouble-free high speed runnability between the press and dryer sections.

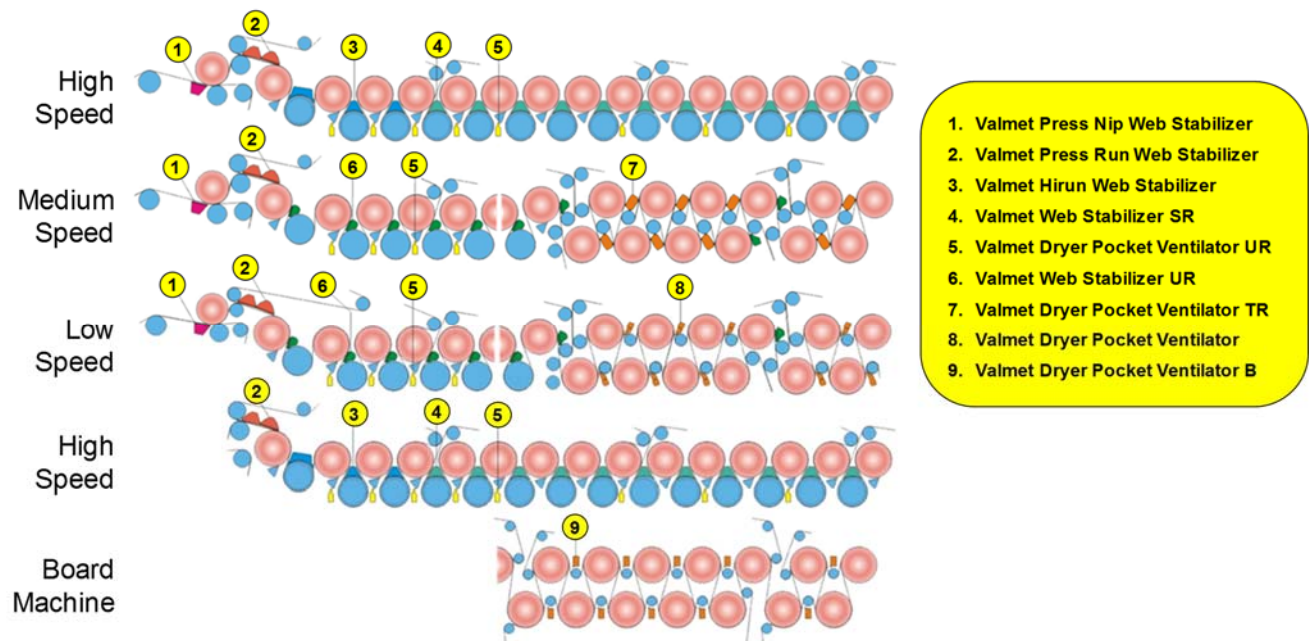


Figure 7. Runnability component combinations for various machine speeds and grades

Modern high speed paper machine concepts utilize longer or total single-felting as the dryer section configuration. Excellent runnability at the beginning of the dryer section is a great challenge at continuously increasing machine speeds. In particular, due to the natural underpressure effect in the opening dryer cylinder nip, the web has a high tendency to try to follow the dryer surface rather than to stay flat on the dryer fabric. Adhesive forces also have a negative influence on web release from the dryer cylinder.

The Valmet Hirun Web Stabilizer concentrates on solving these special runnability problems of first dryer groups. The web release from the dryer cylinder is facilitated by means of a very powerful vacuum area. The Valmet Hirun Web Stabilizer web release zone guarantees that the web and the tail will follow the dryer fabric in all running conditions.

In the other parts of the single-felting dryer section, Valmet Web Stabilizer SR blow boxes are used to provide excellent sheet stability. Valmet Dryer Pocket Ventilator UR takes care of the ventilation in the bottom pockets in single-felting sections.

Runnability on medium speed paper machines

Medium speed paper machines typically have both single- and double-felting dryer groups. Valmet blow box technology helps to achieve better production and efficiency targets in all process stages.

In addition to providing sheet support through the press and dryer sections, the blow box concept provides easier threading, ventilation, and proper hood balance.

Valmet's runnability system for the press section has been adapted to fit many types of presses including standard and inverted shoe presses and separate presses.

In these installations, also the geometry between the press and lead-in felt roll is optimized to work with the Valmet Press Run Web Stabilizer blow box to prevent sheet drop-off and sheet disturbances in the open draw.

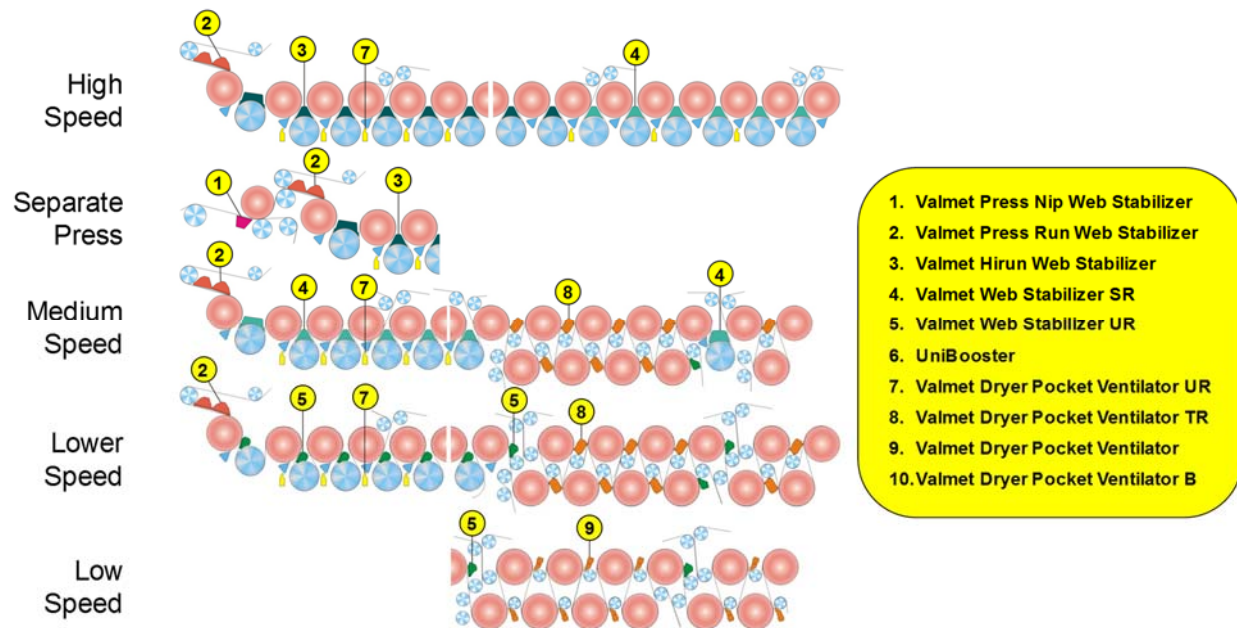


Figure 8. Runnability component combinations for paper machines

In the single-felted section the blow box concept has been installed in many different configurations and geometries and has proven to be very successful. Valmet Web Stabilizer SR blow boxes are typically installed in conjunction with grooved or vacuum rolls. The Valmet Web Stabilizer SR boxes provide complete sheet support from the top dryer release point to the closing nip in the next top dryer. In many machines sheet support only on the down-run side is enough to achieve good runnability. In these cases, Valmet Web Stabilizer UR blow boxes are installed on the down-run to develop underpressure and to stop the boundary layers of air flows that disturb proper sheet runnability.

Improved runnability and uniform ventilation

The single-felted section also requires ventilation air under the dryer group, and this is supported with the use of Valmet Dryer Pocket Ventilator UR units.

The blow box technology can also be carried into the double-felted section. Valmet Dryer Pocket Ventilator TR blow boxes provide extra sheet support and stability for a fragile sheet at high speeds while also providing directed ventilation into the pocket.

Valmet Dryer Pocket Ventilators deliver proper pocket ventilation in the double-felted section. These ventilators are designed to provide a high volume of air at a low velocity to ensure the pockets are ventilated but the sheet is not disturbed by air flows.

Runnability on board machines

As speeds have also been gradually increasing for board grades, it has become apparent that runnability improvements are necessary. The technology of improving sheet stability with the use of controlled air flows has been adapted from paper and lightweight lines to be utilized in board machine configurations.

As on paper machines, the Valmet Press Nip Web Stabilizer blow box is positioned and designed to lock the sheet onto the press felt to prevent sheet lifting before the nip of the separate press.

A Valmet Press Run Web Stabilizer blow box is also used to reduce the open draw between the last press and dryer section.

Sheet stability is also compromised when the sheet passes through the single-felted section. The solution also for board machines is the installation of Valmet Web Stabilizer UR blow boxes at the down-run from top to bottom dryers. Depending on grades run and machine speeds, there is a range of machine configurations which then dictates what runnability components are used.

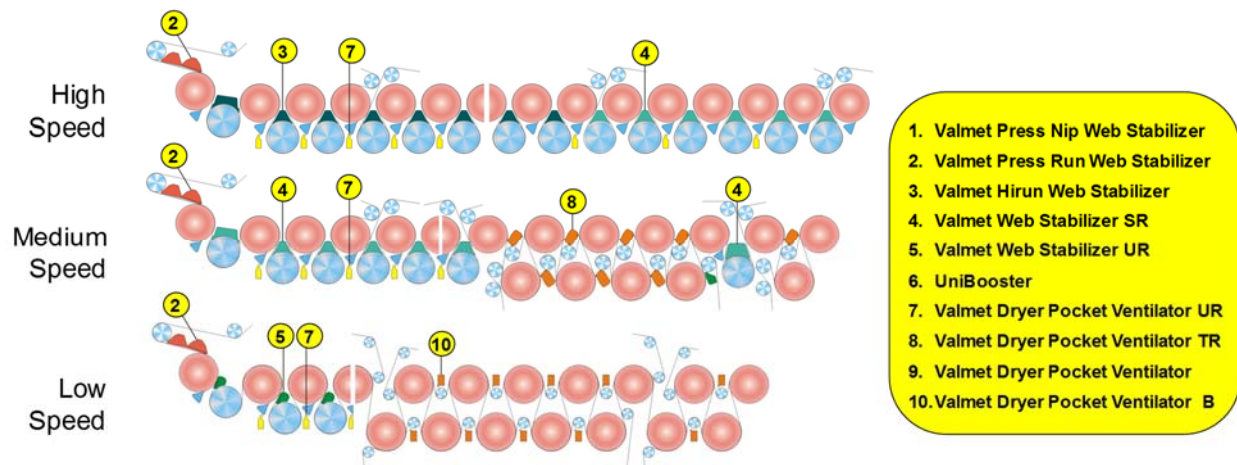


Figure 9. Runnability systems for board machines

Air to increase evaporation in the dryer pockets

Although the sheet has gained much strength through the single-felted section, the sheet stability in the double-felted section cannot be ignored. With problems such as sheet flutter, high pocket humidities, uncontrolled cross machine air flows and bad moisture profiles, the double-felted section also requires runnability devices.

The Valmet Pocket Ventilator Family offers a specially developed ventilator to meet board machine requirements, namely the Valmet Dryer Pocket Ventilator B. The basic idea is to bring hot air into the pockets in a controlled manner. The Valmet Dryer Pocket Ventilator B contributes to increased evaporation by lowering pocket humidity levels and creating a uniform pocket humidity profile.

Modern, fast-running board machines are utilizing the same runnability concepts as machines running lightweight papers.

Runnability systems for press and dryer sections

Valmet press and dryer section runnability systems offer excellent sheet stability and runnability to all web grades and speeds. Runnability components are chosen based on the machine speed and paper grade.

Valmet Press Nip Web Stabilizer

The main feature of the Valmet Press Nip Web Stabilizer blow box is the prevention of an air bubble at the nip. In press sections with separate presses the air pumped through and along the press felt in the nip can cause the web to detach. This "blowing problem" is at its worst with new and open press felts and can

result in felt or roll damage. The underpressure created by the Valmet Press Nip Web Stabilizer prevents web flutter before the nip of the press and keeps the web in good contact with the press felt, preventing a wrinkle from going through the press which might destroy the felt.



Figure 10. The Valmet Press Nip Web Stabilizer prevents an air bubble in the nip.

Main benefits of the Valmet Press Nip Web Stabilizer blow box include:

- Eliminates air blowing in the nip of the separate press
- Particularly necessary with new and open press felts
- No felt contact

Valmet Press Run Web Stabilizer

The main feature of the Valmet Press Run Web Stabilizer blow box is to minimize free draws while supporting the sheet. The runnability between the press and the dryer section can be improved by bringing the fabrics as close to the center roll as possible, minimizing the length of unsupported web. The Valmet Press Run Web Stabilizer creates an effective underpressure which ensures that the web is fully supported against the dryer fabric.

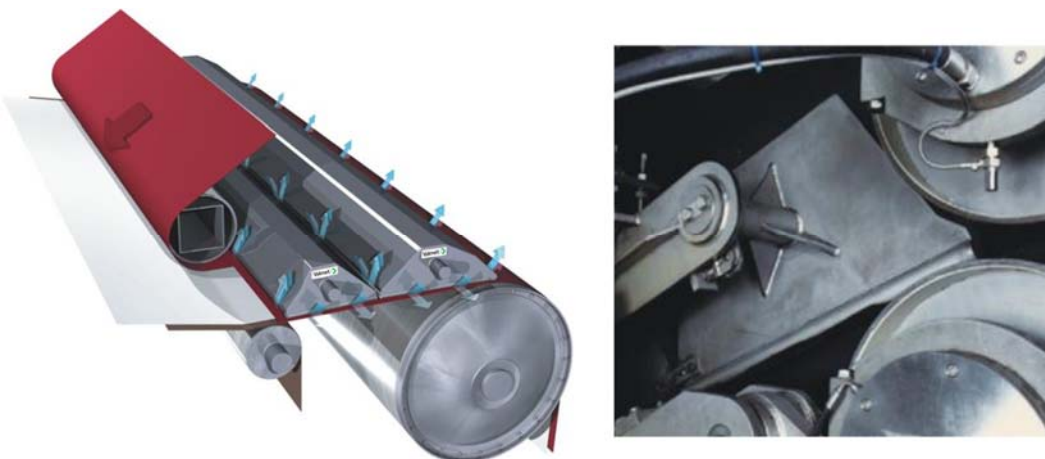


Figure 11. The Valmet Press Run Web Stabilizer minimizes free draws while supporting the sheet.

This is done without any mechanical contact between the blow box and the fabric, thus ensuring that there are no fabric wear problems. Air pumping caused by the dryer fabric is eliminated due to optimal nozzle configuration and the correct location of the rolls.

Use of Valmet Press Run Web Stabilizer blow boxes has resulted in reduced draw, fewer breaks and significantly improved runnability. The concept is compatible with different kinds of press section geometry - 3-nip presses, separate presses, shoe presses, etc. - and excellent results have been achieved with both lightweight and board applications.

The main benefits of the Valmet Press Run Web Stabilizer runnability system are:

- Reduced draw
- Fewer breaks
- Significantly improved runnability
- Improved sheet edge control

Valmet Hirun Web Stabilizer for high speed paper machine runnability

The Valmet Hirun Web Stabilizer runnability concept offers solutions for different requirements depending on the grade and the targeted speed. The system is designed with a separate high vacuum zone where paper is taken off the dryer cylinder. This high vacuum area ensures tail and web transfer from the cylinder to the next vacuum roll and provides excellent runnability.

At the beginning of the dryer section, the web dries rather slowly. This means that with increasing machine speeds it becomes more difficult to maintain web stability. Due to the natural underpressure created when the paper web is separated from the dryer cylinder surface, the paper web is more inclined to follow the smooth cylinder surface than the dryer fabric. This tendency is increased if insufficient draw is applied between the press and the dryer section to create web tension. Usually dryer section runnability is adjusted by changing the draw between the press section and the dryer section, or the pulp refining level, etc. This causes defects in paper quality and limits machine speed and efficiency. This critical bottleneck can be avoided by placing a proper runnability system in the first groups of the dryer section.

The current Valmet Hirun Web Stabilizer system is the result of many years of development by Valmet and includes several key features. Nozzle slot dimensions and distances are optimized. The effective Coanda-type cross direction nozzle with flexible construction allows optimal installation clearances without any risk of fabric damage in wad situations. The adjustable vacuum divider with Teflon seal strips allows easy and optimal high-vacuum zone control.

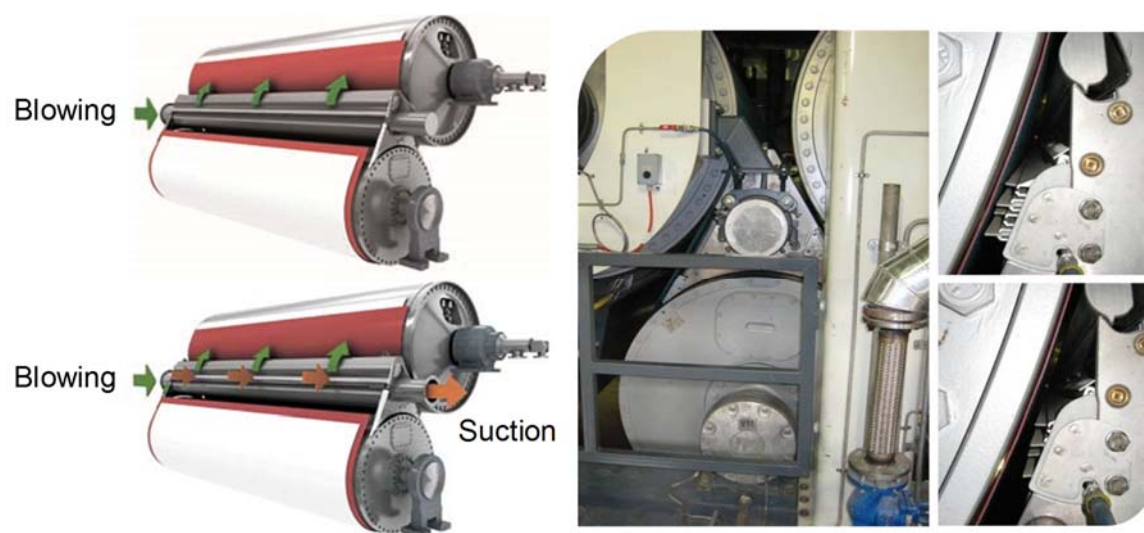


Figure 12. The Valmet Hirun Web Stabilizer system functions with blowing (upper left) or blowing and suction (lower left), depending on machine speed and location of dryer group.

The new design allows easy adjustment and quick movement to the service position. The Teflon seals at the edges are also adjustable. A tail threading zone with booster is an option for certain locations. The removal of the up-run nozzle reduces air flow by up to 30%.

With all the incremental upgrades, it's possible to lower the vacuum roll air flow by up to 50% as compared to the normal situation.

Valmet Hirun Web Stabilizer has many benefits, proven in production situations. It provides the potential to raise speeds and improve /aid tail threading to improve machine productivity. The main benefit of the Valmet Hirun Web Stabilizer system is that it gives the ability to control web draws to optimize paper properties. The excellent web stability provided by Valmet Hirun Web Stabilizer blow boxes makes it possible to adjust the draws, not only in terms of runnability, but also by affecting the paper properties. According to the results from pilot and production machines, wet draw reduction has a considerable effect on, for example, porosity, oil absorption and Scott Bond values. This provides new tools for quality control in cylinder drying.

The latest Valmet Hirun Web Stabilizer includes an exhaust connection option to increase the vacuum to the highest possible levels. The normal Valmet Hirun Web Stabilizer has vacuums in the 1500 - 2000 Pa range, and with the exhaust option this range is increased to 2000 - 4000 Pa.

The dryer section of a modern paper machine is no longer just a "device for drying the paper," but instead also has significant quality effects. The HiRun System gives papermakers more margin to control not only runnability but also quality issues.

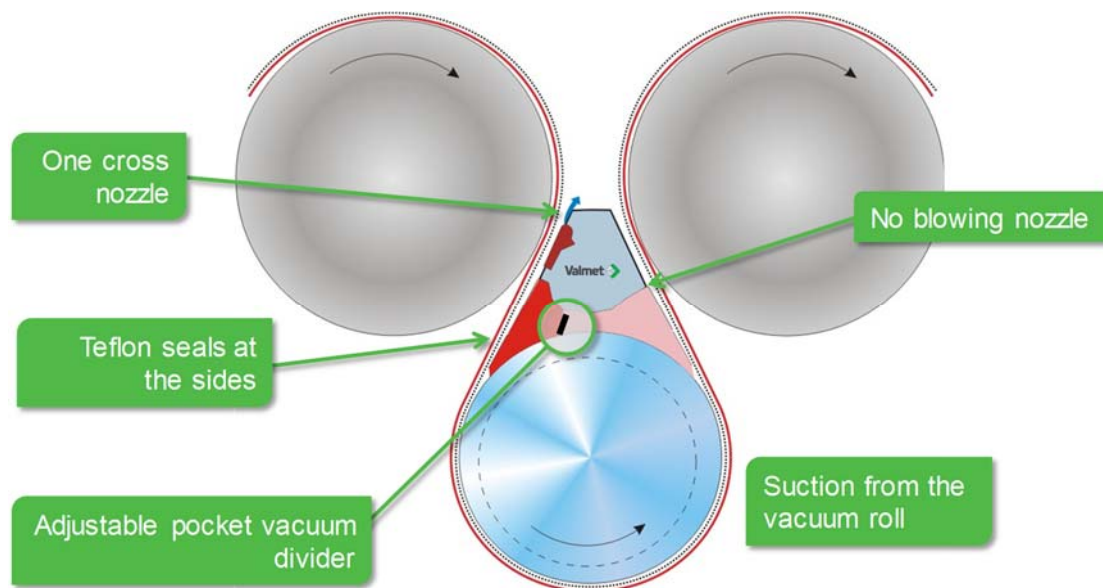


Figure 13. Valmet Hirun Web Stabilizer is being continuously developed; some recent advances are shown here.

The main benefits of the Valmet Hirun Web Stabilizer system, proven in production situations are:

- Control of the web draws to optimize paper properties
- Fewer breaks due to reduced draws
- Improved web stability – higher production speed
- Faster tail threading
- Less sensitivity to changes in dryness
- Improved overall machine productivity

Valmet Web Stabilizer SR runnability concept

Valmet Web Stabilizer SR is an energy efficient runnability solution for medium speed paper machines and at the dry end of high speed single-felted machines. The Valmet Web Stabilizer SR blow box concept provides excellent runnability by generating higher underpressure in the entire pocket area above the unrolls or vacuum rolls. The concept utilizes specially designed blowing nozzles on both sides of the pocket, which create underpressure between the box and the dryer fabric.

The Valmet Web Stabilizer SR blow boxes are typically installed in conjunction with grooved rolls or vacuum rolls and can be applied for both paper and board machine concepts having single-felting.

The well-known and proven blowing principle is used to create an effective underpressure in the entire pocket area to support the sheet and thus excellent

runnability is achieved. The concept utilizes specially designed blowing nozzles on both sides of the pocket, which create underpressure between the box and the dryer fabric. This new blowing nozzle construction has made it possible to reduce the blowing air amount remarkably leading to improved energy economy and smaller ducts and fans.

Recent advances in Valmet Web Stabilizer technology were aimed at reducing the needed fan energy. This was accomplished by modifying the nozzle designs. A flexible Coanda nozzle is used to allow installation closer to the fabric. Improved nozzle design minimizes the air consumption required. The resulting power demand is reduced to roughly 30% of the original. The aluminum and Teflon side seals are adjustable.

The Valmet Web Stabilizer SR blow boxes can also be equipped with an additional tail threading feature. These effective tail threading boosters ensure that the tail is in full contact with the dryer fabric resulting in a more stable and reliable tail threading process.

The main benefits of Valmet Web Stabilizer SR include:

- Entire pocket effectively under-pressurized
- Low energy consumption
- Reduced air amount
- Small supply air system and smaller space requirement
- Fast and reliable tail threading
- Easy maintenance



Figure 14. Valmet Web Stabilizer SR blow boxes are the main alternative for single-felted dryer sections having grooved rolls or VacRolls.

Valmet Dryer Pocket Ventilator UR

Valmet Dryer Pocket Ventilator UR works for ventilation in the bottom pockets in single-felted sections. In the single-felted dryer section, the hood supply air is traditionally blown into the dryer section basement enclosure. By bringing this air into the bottom pockets with Valmet Dryer Pocket Ventilator UR, the ventilation of this area can be improved. Valmet Dryer Pocket Ventilator UR blows hot and dry supply air on the paper side where evaporation takes place, thus also increasing drying capacity. Runnability is also improved due to the more uniform pressure conditions in the pocket.

The importance of Valmet Dryer Pocket Ventilator UR has grown considerably because of the development of totally single-felted dryer section concepts.

Benefits of the Valmet Dryer Pocket Ventilator UR include:

- Improved runnability in single-felting
- Air balance in bottom pockets
- Disturbing air flows minimized
- Uniform ventilation across the machine width



Figure 15. Valmet Dryer Pocket Ventilator UR provides ventilation in the bottom pocket of single-felted sections.

Valmet pocket ventilator family

For dryer pocket ventilation in the double-felted section, Valmet has developed a complete family of pocket ventilators. Depending on the machine speed and paper grade, the appropriate concept can be selected from the following:

- **Valmet Dryer Pocket Ventilator B:** For board grades with conventional double-felting
- **Valmet Dryer Pocket Ventilator:** For medium to higher speed machines with conventional double-felting
- **Valmet Dryer Pocket Ventilator TR:** For high speed machines with special double-felted arrangement

Valmet Dryer Pocket Ventilator B

When running board grades, it is vitally important to have effective ventilation in the dryer pockets in order to achieve high drying capacity. The Valmet Dryer Pocket Ventilator B was developed to meet the requirements of board grades on lower to medium speed machines. This ventilator was designed for large air flows, but at the same time the pressure losses are low. A very uniform air distribution is one of the features of the Valmet Dryer Pocket Ventilator B. In addition, the clearances achieved with this ventilator type are suitably large. The benefits of Valmet Dryer Pocket Ventilator B for board grades include:

- Large air flows
- High drying capacity
- Uniform air distribution
- Low pressure losses
- Large clearances

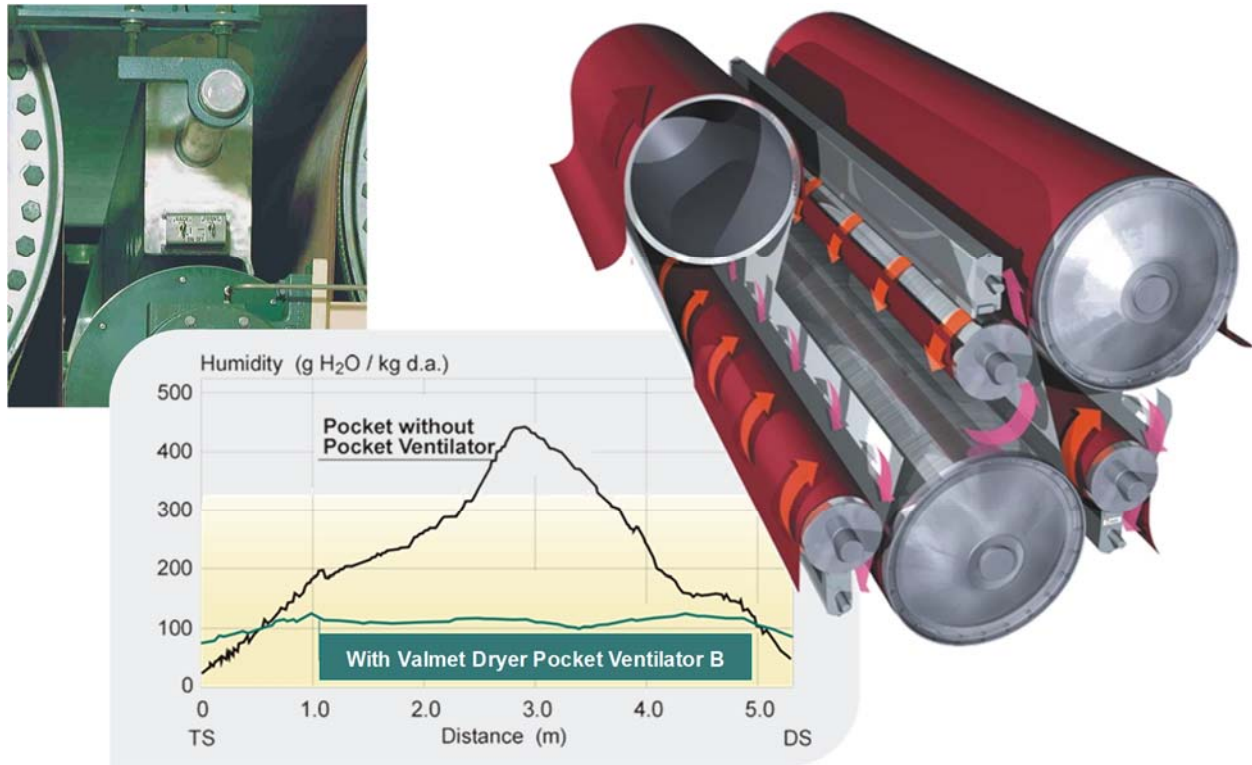


Figure 16. The Valmet Dryer Pocket Ventilator B is for board grades with conventional double-felting.

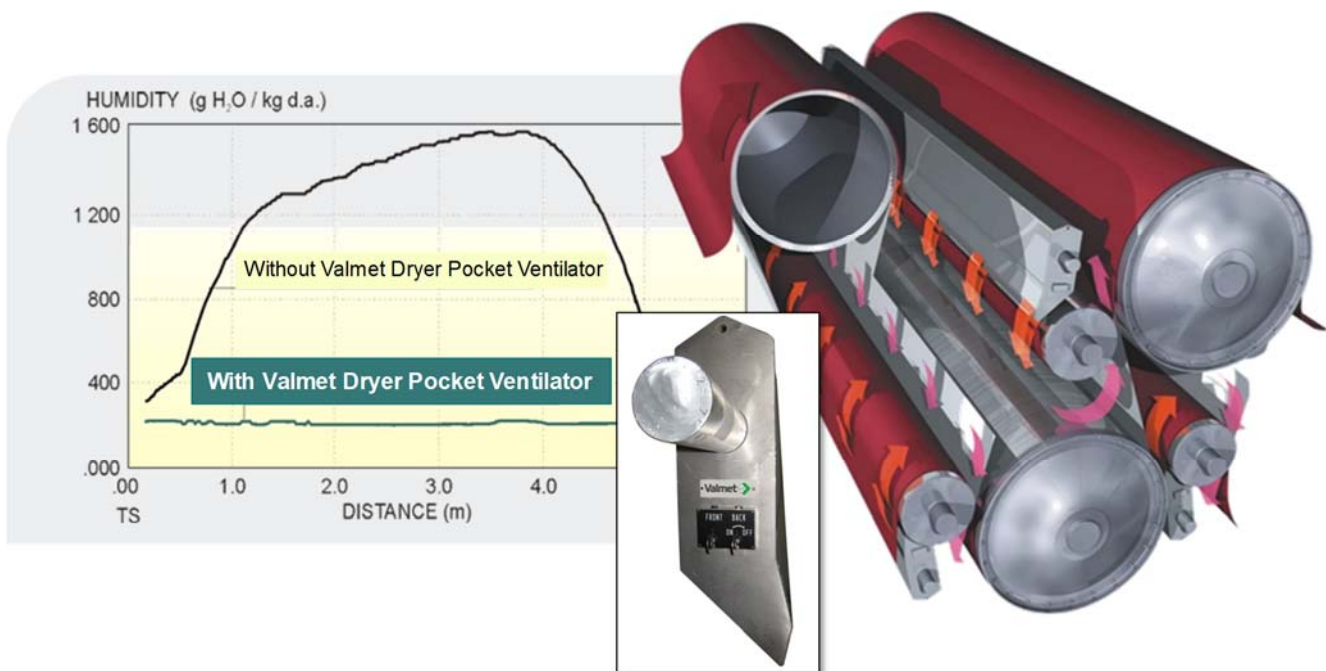


Figure 17. The Valmet Dryer Pocket Ventilator is for medium to higher speed machines with conventional double-felting.

Valmet Dryer Pocket Ventilator

Valmet Dryer Pocket Ventilator blows air into the pockets in a controlled manner, which increases evaporation with minimal sheet flutter. Valmet Dryer Pocket Ventilator may be installed throughout the dryer section on medium to higher speed machines. Excellent pocket ventilation and the control of axial and roll-induced air flows are characteristic features of Valmet Dryer Pocket Ventilators.

Valmet Dryer Pocket Ventilator provides the following benefits:

- Good runnability
- Balanced pocket air flows
- No disturbing sheet edge flutter
- High drying capacity
- Effective for all paper grades and a broad range of fabric permeabilities

Valmet Dryer Pocket Ventilator TR

The Valmet Dryer Pocket Ventilator TR blow box creates an underpressure which keeps the web in good contact with the fabric, while at the same time ventilating the dryer pocket. The main idea of the Valmet Dryer Pocket Ventilator TR is to support the web after the dryer for as long as possible. The felt rolls are installed non-centrally toward the wet end. The free unsupported draw can usually be shortened by 30 - 50%, depending on the machine geometry. The sheet runnability is good due to the sheet stabilizing nozzles of the Valmet Dryer Pocket Ventilator TR blow box.

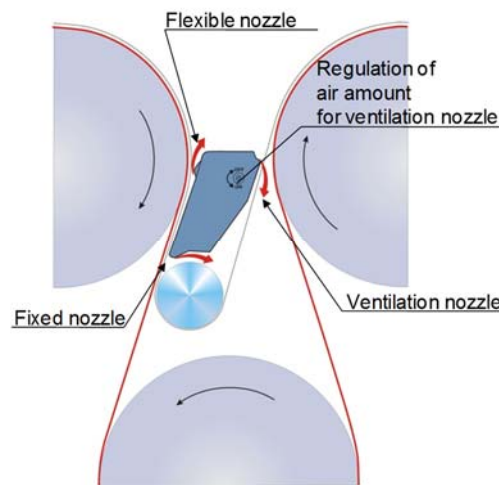


Figure 18. The Valmet Dryer Pocket Ventilator TR concept is for medium to high speed machines with special double-felted arrangement. The geometry for the concept is different compared to normal double-felting. Pocket rolls are placed non-centrally toward the wet end. The sheet is supported onto the fabric by utilizing the blow box principle in combination with the pocket ventilator principle.

This kind of unsymmetrical felt roll installation can lead to undesirable underpressure in the dryer pocket. To prevent this and to ventilate the pocket, the Valmet Dryer Pocket Ventilator TR is also equipped with pocket ventilation nozzles. This ensures the air balance and an even air moisture profile in the pocket.

Not only is runnability improved because of increased web stability, but the evaporation and removal of moist air is also more efficient because of the controlled air flow into the pocket. The air moisture profile in Valmet Dryer Pocket Ventilator TR dryer pockets is uniform, resulting in an even final CD paper moisture profile.

Benefits to be expected with Valmet Dryer Pocket Ventilator TR include:

- Stable sheet run in reduced open draw
- Excellent runnability with pocket ventilation
- Uniform pocket air moisture profile
- No disturbing axial air flows in pockets

Savings via runnability component design, operation and maintenance

Valmet Hirun Web Stabilizer and Valmet Web Stabilizer SR runnability systems are used for improving sheet support for the single-tier dryer groups of high and middle speed paper and board machines. At the moment, there are over 1,500 Valmet Hirun Web Stabilizer and Valmet Web Stabilizer SR blow boxes in over 100 paper and board machines, and runnability systems upgrades have been installed on 150 blow boxes around the world. Sometimes the target has been improved performance, and sometimes energy savings. In the best cases both targets have been gained at the same time.

Savings through design

The latest blow box design includes features that improve performance and decrease energy consumption. These technical improvements are now also available as an easy upgrade package for existing Valmet Hirun Web Stabilizer, Valmet Web Stabilizer SR and older UnoRun model blow boxes. These upgrade services can be carried out at the customer's mill or by purchasing one new component and sending the other blow boxes one at a time to a Valmet manufacturing facility for rebuild. This is the preferred way to complete the rebuilds as the boxes are rebuilt in a controlled environment.

Valmet Hirun Web Stabilizer and Valmet Web Stabilizer SR runnability systems are now available for various kinds of drying section configurations; for example, existing perforated bottom rolls without external air system is an option.

Valmet's runnability system rebuilds and upgrades enable: higher speed, lower draws and better efficiency. These can combine to yield more productivity with up to 50% less energy.

Savings through operations

The energy consumed in runnability systems is the electricity needed for the fans. Upgraded blow box designs consume up to half of the energy of the old type blow box design. The way the system is run and operates also has an effect: adjusting the vacuum level that is needed instead of running maximum vacuums from the wet end to the dry end of the machine can result in remarkable savings.

Savings through maintenance

Maintenance of runnability systems is essential. Dirt, grease, dust build up, blow box misalignment and equipment failures are the main reasons for runnability problems and increased energy consumption. A fan energy-saving of up to 50% has been gained by complete runnability system maintenance and runnability system upgrade carried out at the same shut down. The payback time for such an investment has been less than one year from the savings in improved threading, efficiency, sheet quality and electrical energy. Many of the benefits such as improved tail threading, increased speed and fewer breaks are major areas which shorten payback time.

Savings through quality and efficiency improvements

Utilizing the correct runnability components in the machine has an effect on paper quality properties. When sheet stability is better controlled in the beginning of the dryer section, significant improvements

are achieved. These include higher speed potential, a stronger sheet through the dryers and fewer sheet breaks – all of which combine for very favorable savings and return on investment.

Savings through energy reduction

Development towards more sustainable paper production is a continuous process. An important part of this development is the overall tendency to reduce the drying section energy usage. While the cost of energy in North America is not as high as in other areas of the world, it still represents a further savings area.

Several improvements have recently led to new and more energy-efficient runnability systems at the dryer section. And what is also important is that in spite of the lower energy usage, the performance of the new runnability systems is even better than before, resulting in higher productivity from the papermaking line.

New generation blow boxes for improved runnability and electricity savings

Most of the severe runnability problems at the dryer section are caused by the fact that wet paper has a tendency to stick to the hot dryer cylinder surface. This is due to adhesion forces and aerodynamics in the opening nip. These forces increase with machine speed. By directing the counter forces with blow boxes to just the right zones in the pocket area, it is possible to improve runnability.

Also, energy aspects have been carefully taken into account when improving our runnability systems. One example of this is the development of the Valmet Web Stabilizer SR blow box, which replaced the previous SymRun HS model. This improvement provides as significantly lower electricity consumption due to the smaller air flows and other modifications in the blow box design.

The same type of improvement has recently been carried out on the Valmet Hirun Web Stabilizer runnability system. With certain constructional modifications to Valmet Hirun Web Stabilizer blow boxes, the energy usage of the system can be greatly reduced. In addition to this, an even bigger reduction in the fan energy usage has been possible with our newest Valmet Hirun Web Stabilizer blow box model – without compromising sheet runnability or tail threading efficiency.

These remarkable results in energy savings have been possible by rethinking the equipment construction and carefully researching the paper web behavior, especially in the opening dryer nip.

Additional energy savings with new ways to run the air system

In addition to the above savings given by new energy-friendly equipment, it is also possible to re-think the ways of running the whole air system. By controlling the air systems in a new way, it is possible to achieve savings in the dryer section runnability. This kind of adjustment can be done both for runnability boxes and for vacuum rolls in the dryer section.

For the Valmet Dryer Vac Roll system, for example, this kind of optimizing process means that the ductwork is designed so that the system can be divided into separate vacuum zones in the machine

Energy consumption, %

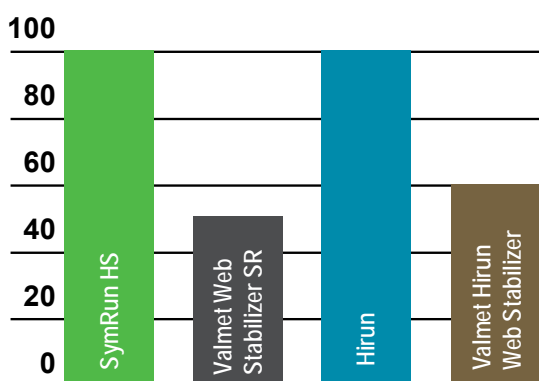


Figure 19. The development projects for Valmet Web Stabilizer SR and Valmet Hirun Web Stabilizer blow boxes show good energy results.

direction. Generally, at least two Valmet Dryer Vac Roll fans with variable speed drives are needed for the system in order to be able to minimize the energy consumption in a proper way.

With such main arrangements in the air system, it is now possible to optimize the vacuum levels in the machine direction so that sheet runnability remains excellent but fan energy usage is lowered dramatically. The highest vacuums are needed at the beginning of the dryer section, where the sheet is weakest. When going toward the dry end of the dryer section, vacuums can be reduced without causing any harm to the sheet. This allows less fan power to be used in the latter part of the dryer section.

Of course, the ability to carry out this kind of adjustment successfully also depends on the paper grade and production speed. But even quite small reductions in air flows are known to be very beneficial in the energy respect if adjustment is made by using variable speed drives for the fan motors. The dimensioned full air flows and fan power are, however, normally needed for successful tail threading.

Figure 20 schematically shows the principle of this new way of operating the runnability air system with optimized air flows in the machine direction. By adjusting the vacuum roll air flows accordingly, it is possible to achieve up to 50% savings in fan power consumption.

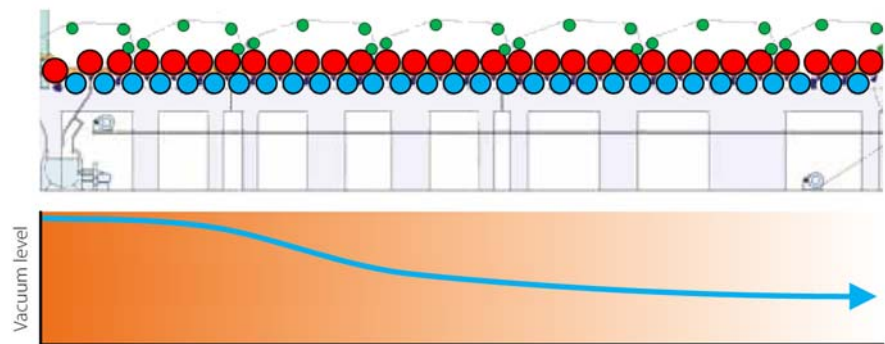


Figure 20. The optimal way to run the dryer section

Case Study – Valmet Press Run Web Stabilizer and Valmet Web Stabilizer UR blow boxes reduce sheet stability problems

Chung Hwa Pulp Corporation PM 1 in Taiwan produced high quality WFC coated woodfree papers. The machine speed was 600 m/min and the wire width 3.6 m.

The target of the rebuild was to get rid of the sheet stability problems in single-felting. The delivery included one Valmet Press Run Web Stabilizer blow box, two Valmet Web Stabilizer UR blow boxes and one centrifugal fan.

Valmet Press Run Web Stabilizer blow boxes were installed between the press section and dryer section to support the web and to minimize the free draws in this critical area. The Valmet Press Run Web Stabilizer created a very effective underpressure between the web and the fabric. This was done without any mechanical contact between the blow box and the fabric.

Valmet Web Stabilizer UR blow boxes were installed between the top and bottom cylinders in the single-felting section. The underpressure created by Valmet Web Stabilizer UR blow boxes eliminated the pressure build-up in the nip between the cylinder and the fabric, thus preventing sheet detachment from the fabric across the machine width.

The results were very good – runnability up, breaks down

Runnability increased and sheet breaks decreased. The mill manager was very pleased with the post-rebuild situation, saying "The runnability has improved a lot, which has made it possible to increase the speed and to reduce the draw from the press. Also the number of sheet breaks has been reduced."

Before the rebuild the machine speed was limited to 540 m/min (design speed 600 m/min). The machine was normally operated at speeds 350 - 540 m/min depending on the basis weight. The draw between the 3rd press and the 1st dryer group was about 3 - 5 m/min.

After the rebuild the machine was speeded-up to 600 m/min, which is the design speed of PM1, since the first day of start-up. The normal running speed is 400 - 600 m/min depending on the basis weight. The draw between the 3rd press and the 1st dryer group of dryer is at a level of only 1.0 - 1.2 m/min. Additionally, the number of sheet breaks has been reduced remarkably.



Figure 21. Runnability improvements with Valmet components at Chung Hwa have allowed the mill to increase machine speed.

Case Study – Valmet Hiron Web Stabilizer Upgrade service saves energy

Valmet Hiron Web Stabilizer blow boxes are used for improving sheet support at the single-tier dryer groups of high speed paper and board machines. The latest Valmet Hiron Web Stabilizer blow box design includes features that improve performance and decrease energy consumption. Now some of these technical improvements are also available as an easy upgrade package for existing Valmet Hiron Web Stabilizer blow boxes. This Valmet Hiron Web Stabilizer Upgrade service can be carried out at the customer's mill concurrently with regular blow box overhaul.

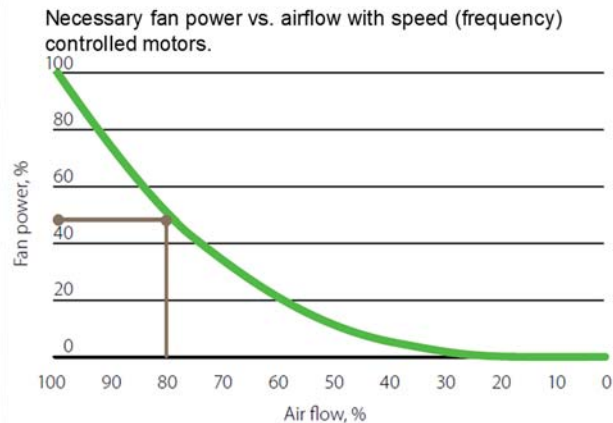


Figure 22. Air flow reduction provided remarkable savings in power need.

Fast upgrade during maintenance shutdown

Stora Enso Sachsen Papier PM 1 in Germany produces newsprint with a wire width of 10 m and a production speed of 1,750 m/min. The mill was among the first in adopting Valmet Hiron Web Stabilizer technology in 2003. A total of seven Valmet Hiron Web Stabilizer blow boxes placed at the start of the dryer section ensure the runnability of the machine's newsprint production.

All Valmet Hiron Web Stabilizer blow boxes were upgraded at the mill's annual maintenance shutdown in December 2009. In addition to general maintenance and upkeep, the target was to save electric energy. The scope of service included an upgrade of the blow box edge areas as well as a complete box overhaul (including replacement of Coanda profiles and labyrinth seals). The end covers were replaced with new

ones in this upgrade, including an improved end sealing arrangement. These new end covers also include a service hatch at the tending side that enables faster and easier vacuum roll cleaning.

50% energy savings

The improved end sealing arrangement reduces air consumption, thus creating savings in air fan electricity use. Fan power consumption was reduced by nearly 50% after final setup while blow box performance remained at the same level as before the HiRun upgrade service.

Mill and Valmet personnel worked well together before, during and after the installation. According to the mill's Mechanical Maintenance Manager, "The performance of Valmet's service team was very professional and the improvement achieved in energy efficiency is of great importance to our mill."

"...the improvement achieved in energy efficiency is of great importance to our mill."

- Uwe Commichau, Mechanical Maintenance Manager



Figure 23. The Valmet Hirun Web Stabilizer service was performed professionally and produced excellent results.

This upgrade service is available for all Valmet Hirun Web Stabilizer blow box models. The redesigned blow box construction is a standard feature for new Valmet Hirun Web Stabilizer blow boxes.

Case Study – Valmet Hirun Web Stabilizer and Valmet Web Stabilizer SR blow boxes assist in speed increase

The main target for the rebuild was to increase the paper machine production speed. Earlier, the speed was limited by edge wrinkles, especially in the area of the first dryer sections.

How to get rid of the edge wrinkles and speed up the machine?

The UPM Schongau mill produces newsprint and uncoated paper with a high filler content for newspapers, newspaper supplements, advertisers, brochures, magazines and catalogues. The mill annually supplies up to 750,000 tonnes of printing paper to publishers and major printers all over the world. PM 7 is a Voith machine producing newsprint grades of 40 - 52 g/m² at a speed level of 1,700 m/min. The machine width is about 8.5 m.

Valmet's excellent blow box references from several paper mills convinced the customer that this technology would be the optimal solution for their machine as well. The high vacuums offered by Valmet Hirun Web Stabilizer boxes would obviously lead to better sheet stability at the beginning of the dryer section, eliminate the edge wrinkles and give more potential speed for the machine.

Installation of the new blow boxes to stabilize the sheet in the dryer section

The dryer section was rebuilt by Valmet in the summer of 2006. At the same time, modifications were made to the press section (nip load increase), resulting in a higher dryness level from the press. In the rebuild the existing original vacuum boxes were replaced by the new Valmet Hirun Web Stabilizer and Valmet Web Stabilizer SR boxes. A total of seven Valmet Hirun Web Stabilizer 2 blow boxes were installed in the two 1st dryer groups and eight Valmet Web Stabilizer SR blow boxes in the 3rd and 4th dryer groups. The new Valmet Web Stabilizer SR boxes were also equipped with Valmet Tail Threading Single Fabric B.

More speed – and no wrinkles

According to Josef Eder, Production Manager, PM 7, the targets of the investment were well achieved, "We have been able to increase the machine speed by 50 m/min, which is a very good result. Our running speed is now 1,730–1,740 m/min. And we don't have edge wrinkles anymore." "When we chose Valmet's runnability system for our machine, the key issue affecting our decision was that it was known to be effective and proven technology with a lot of good references. Now we know that we made a good decision. We are very happy with this Valmet delivery."

According to Josef Eder,
Production Manager:

"We have been able to increase the machine speed... a very good result. And we don't have edge wrinkles anymore."



Figure 24. According to mill management, the Valmet Hirun Web Stabilizer and Valmet Web Stabilizer SR blow box installation was "mission accomplished."

Case Study – Valmet Hirun Web Stabilizer blow boxes improve paper quality

The main target of the runnability system investment at this mill was to positively influence the quality properties of the paper. The idea was to achieve this by improving sheet stability at the beginning of the dryer section, an area that seemed to be a bottleneck in the process.

The Stracel company is part of the UPM Group. Situated in Strasbourg, France, the company enjoys an ideal geographical location in the heart of European economic activity, but close to abundant forests and wood supplies. The Stracel mill produces high quality magazine paper – UPM Satin and UPM Matt – obtained from sawmill chips and round wood from the first thinning. The mill's PM 1 runs at a speed of 1,500 m/min and produces an 8.48 m wide sheet. The annual production capacity is 270,000 tonnes.

Based on experience gained at other UPM mills, and several other mills as well, it was clear for the mill that the Valmet Hirun Web Stabilizer was the tool with the most potential to reach the targets set for this kind of dryer section modification. The high vacuums offered by the Valmet Hirun Web Stabilizer boxes would make it possible to lower the press-to-dryer draw and thus affect paper quality properties. Additionally, the better sheet stability at the beginning of the dryer section would obviously lead to higher speed potential and fewer sheet breaks at the dryer section.

Valmet Hirun Web Stabilizer 2 boxes chosen as the runnability tool

Valmet Hirun Web Stabilizer 2 blow boxes were chosen as the solution to meet the targets set for this rebuild. The delivery included five Valmet Hirun Web Stabilizer 2 blow boxes for the two first dryer groups.

According to Pascal Bernard, Mill Process Development Manager, the project with Valmet went well and in a spirit of good co-operation. He was very pleased with the progress; the documentation and training were well carried out and the schedules were kept exactly. Nothing unexpected came up during the whole rebuild project.

Lower draw gives many benefits

According to Pascal Bernard all the targets were achieved and even exceeded: "Our process has really changed in a very positive way. The machine is running well and the number of sheet breaks in the dryer section has decreased by as much as 75 %. This is due to the fact that we can now run the machine with a significantly lower press-to-dryer draw. Actually, the draw has come down from 2.5 % to 2.0 %, which is a very big change. The influence of the lower draw is clearly reflected in the strength properties of the paper."

"The targets of the investment were reached and we are really pleased with this Hirun delivery. Hirun is a tool not only for improved runnability, but also for improved paper quality!"

- Pascal Bernard, Mill Process Development Manager



Figure 25. Stracel based their decision on experiences at other mills, and were not let down by the results of their Valmet Hirun Web Stabilizer 2 installation.

"The targets of the investment were reached and we are really pleased with this [Valmet Hirun Web Stabilizer 2] delivery and the co-operation with Valmet," says Bernard. "Hirun is a tool not only for improved runnability, but also for improved paper quality!"

Summary

As a leader in developing technology for the pulp, paper and board industries, Valmet continuously improves the performance of every part of the process. Valmet is comprised of many experts in diverse fields, focused on developing, delivering and supporting technology solutions for the pulp and paper industry.

We are continuously developing ventilation and drying systems to improve paper and board machine runnability and energy economy. An essential part of this work is maintaining and increasing our knowledge of the papermaking process, so as to better understand and anticipate the real needs of papermakers.

In our runnability and drying research we use modern pilot machines and runnability simulators. This gives us great potential, not only to solve the runnability problems of our customers, but also to demonstrate our solutions and give training, cost-effectively and at minimum risk.

This white paper combines technical information obtained from Valmet personnel and published Valmet articles and papers.

Valmet provides competitive technologies and services to the pulp, energy and paper industries. Valmet's pulp, paper and power professionals specialize in processes, machinery, equipment, services, paper machine clothing and filter fabrics. Our offering and experience cover the entire process life cycle including new production lines, rebuilds and services.

We are committed to moving our customers' performance forward.