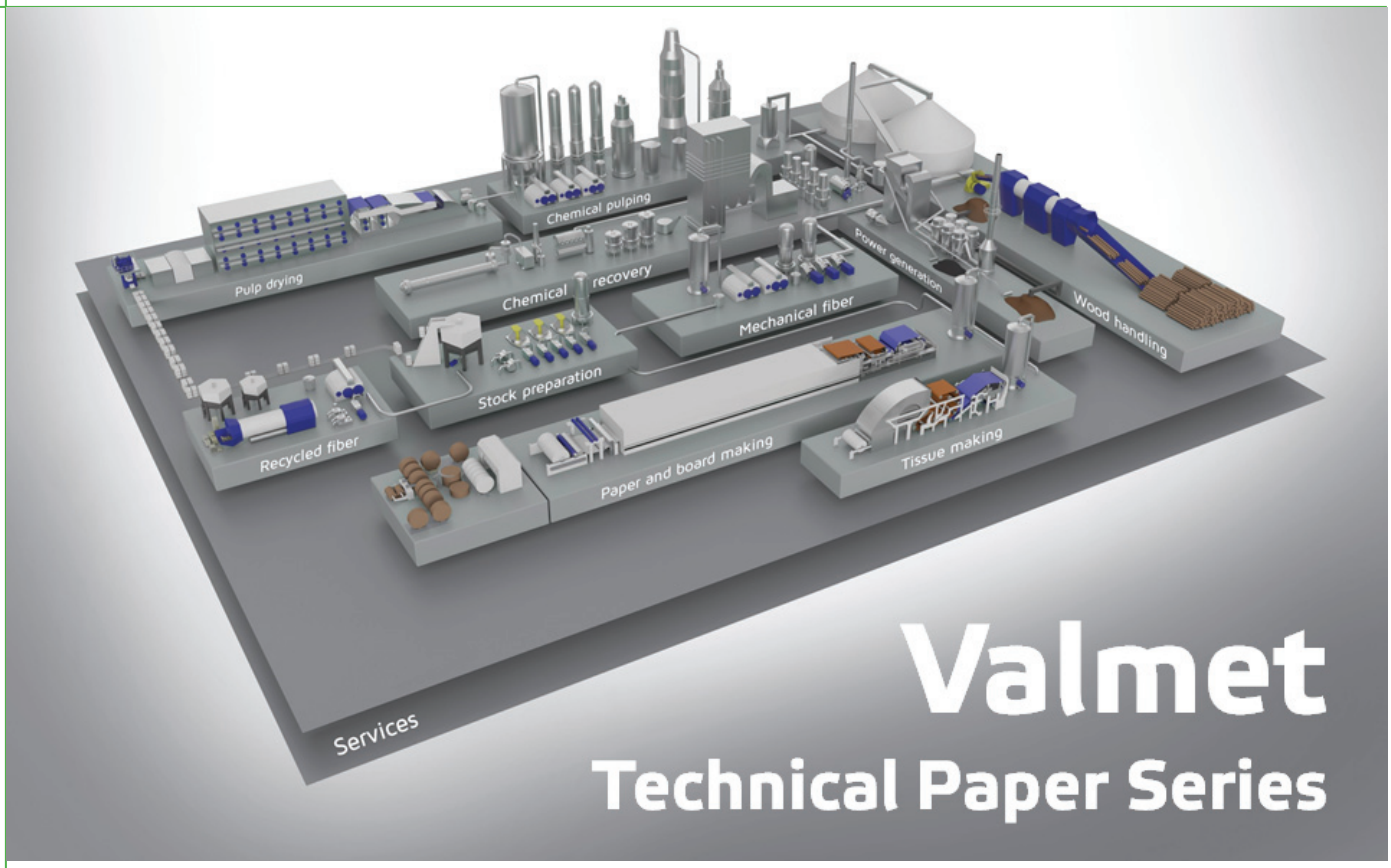

Slitter Management

Executive Summary

Valmet pioneered Slitter Management to bring slitting best practices to your winder. The overall objective of this service has always been to extend the duration between blade changes. While that objective remains a focus, Valmet has also developed a portfolio that includes comprehensive training and other resources designed to achieve increased operator safety, lower operating costs and improved customer roll quality.

This service manages the factors affecting slitting performance, including; equipment condition and setup, blade and band quality and sharpness, and operational skill level. Operator training continues to be a critical element. Slitter Management training concentrates on the fundamentals of the slitting process; slitter blade care and handling, slitter section troubleshooting, and how to set-up the slitting equipment. All training focuses on operator safety, a large part of which is minimizing the need to handle blades.

This white paper provides a background of Valmet's Slitter Management service, as well as helpful slitter safety, setup and maintenance tips. Case studies of effective use of Slitter Management are reviewed.

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Slitter management at the winder

Winding processes worldwide face the same problems: poor slitting equipment condition, poor quality blades and bands, dull blades and bands, and insufficient operator slitting process knowledge. The Slitter Management service was developed by Valmet to help winder operators and finishing superintendents overcome these plaguing winder issues.

For the best possible roll quality, all of the factors in the slitting process have to function properly. As a winder manufacturer, Valmet fully understands the entire slitting process.

Dusting and ragged roll edges can be caused by poor condition of the slitting equipment. Predictive maintenance and continuous development through Valmet's Slitter Management service helps improve and maintain customer roll quality.

Figure 1. Valmet has manufactured winders for over 100 years, and has slitting expertise from hundreds of winder installations.

Use of the Slitter Management service considerably reduces maintenance costs of the winder, extending slitter blade life and blade change intervals, thus improving slitting performance. More effective winder operation improves productivity of the entire line.

Blade and band handling

Always remember, changing a blade is a one person job. Our natural tendency is to reach for falling objects, which is a dangerous reaction when it comes to slitter blades. Do not prop slitter blades on a ledge or hang them on a hook where they could fall.

- Always wear cut-resistant gloves (**Figure 2**).
- Always move the top blade out of the way before changing the bottom band.

Figure 2. Always wear appropriate safety gear when working with sharp slitter blades and bands.

History of Slitter Management

In 1990, Valmet started the Slitter Management service after listening to winder operators and finishing superintendents. They told us they needed a consistent grinding solution combined with winding process expertise. They felt this would help them improve their shipping roll quality, slitter setup time, and overall productivity. As a result, Valmet and Valley Grinding combined capabilities to provide Slitter Management to a few mills in North America with great success.

During the 1990s, Valmet added simplified billing, by charging a flat fee for unlimited blade sharpening and polishing (superfinishing) and replacement. In the late 1990s a new WR6 material was developed by Valmet. This material provided significantly longer life and greater tip strength resulting in longer runtimes on the winder.

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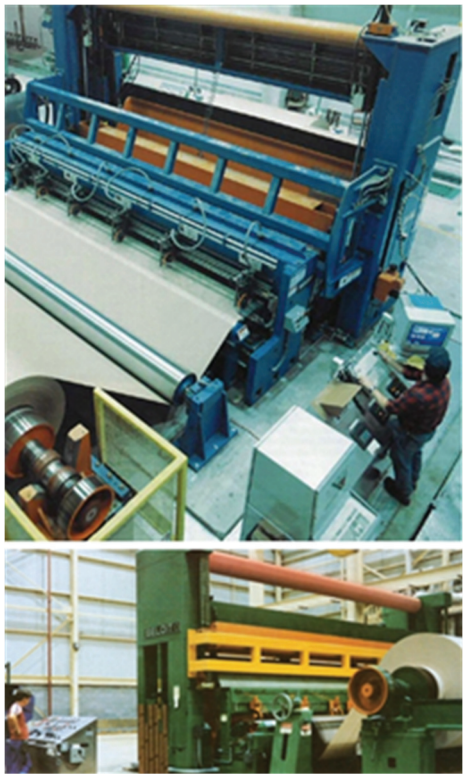

Figure 3. Valmet has offered slitter assembly exchange services and slitter section rebuilds for several decades, for Valmet, Metso, Beloit, Valmet, Voith and Jagenberg winders.

Valmet introduced Valmet Slitter Services Blade Pool as a new Slitter Management offering. Valmet Slitter Services Blade Pool provides a constant inventory of blades at each mill location, so there is no concern about running out of sharp blades. Valmet also offers a spare part service where essential parts are kept at your winder. This means simple issues such as air leaks can be resolved easily either by mill personnel or a Valmet representative. Holder and carriage exchanges can be included as an essential spare part.

Since the early 1990s, other vendors have sought to emulate Slitter Management. Today, Valmet is proud that we are still the only slitter solution provider using experienced winding process personnel backed by a field service team and engineering team second to none. Valmet has been making and servicing winders for over 100 years.

What is Slitter Management?

Slitter Management is an advanced single-source offering from Valmet for maintenance and service of your winder slitting section. Slitter Management covers all factors in slitting to achieve continuous improvement in the slitting process. Each program is tailored for a specific mill's needs, taking advantage of the best blade and band materials.

At the most basic level, Slitter Management is unlimited sharpening and blade replacement through the Valmet Slitter Services Blade Pool service. Blade sharpening includes superfinishing, a proven method of achieving the highest cut quality and blade life. Mill inventory control is simplified with Valmet Slitter Services Blade Pool.

Operator training, either classroom or on-machine, is a fundamental element of Slitter Management. Operators learn to setup slitters correctly, keep them running efficiently, identify slitting process problems and solve them.

Additionally, Slitter Management may include spare parts service to stock essential parts onsite for Valmet winders. This enables operators, mill maintenance personnel or Valmet Slitter Management representatives to perform basic on-the-spot repairs of common slitter section issues.

Whether you are operating under a Slitter Management agreement or not, Valmet can supply exchange units or rebuild your existing equipment. This service is available for all Valmet slitting equipment.

Figure 4. Building top quality rolls requires comprehensive operator training.

It is recommended that a full mechanical winder audit be performed annually. The audit helps identify winder issues beyond the slitter section, catching winding process problems before they snowball into larger issues. This service can be included in a Slitter Management agreement.

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Training and resources

In order to be effective, efficient and safe, your winder operators must have the best training available. Skilled Valmet personnel supported by decades of winder process expertise provide comprehensive training programs that make mill winder operators able to handle process issues on their own (**Figure 5**).

Slitter Management can include complete slitting process training, either in classroom or on-the-job. Training includes a comprehensive printed manual detailing all aspects of safe slitter operation. Training always starts with safety, and covers all slitting variables that will enhance the slitting operation, including:

- Fundamentals of the slitting process
- Slitter blade care and handling
- Basic slitter section troubleshooting
- How to setup the slitting equipment
- ... and much more!

Slitter Management can also include a checkup of your slitter section. A Valmet slitting expert investigates the slitting operation, and then passes on information and training to help ensure that operators and maintenance personnel work with peak efficiency and safety.

Figure 5. Valmet slitting and winding experts come to your mill to assist and train operators.

Finally, Slitter Management offers a mill visit by winding experts to perform a complete audit of your winding operation. These audits look upstream and downstream for any problems that impinge on winding success and help you to find winding problems - beyond the slitter section. At **www.valmet.com/slittermanagement**, you will find a wealth of valuable slitting information and many other resources.

Figure 6. Regular cleaning improves slitting safety and roll quality.

Housekeeping

Housekeeping is important in keeping the slitter section operating properly and thus reducing the chances of mechanical breakdown. The condition of the slitting equipment also affects cut quality and thereby customer roll quality.

It is important to keep the slitter section as free of dust and debris as possible at all times. Vacuum the slitter section and wipe the ways clean at least once per shift (**Figure 6**).

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Blade and band storage

Blades and bands should be stored in proper containers (**Figure 7**), in a way that protects the cutting edge of the knives. Blades and bands storage must also protect operators from possible injury.

Figure 7. A custom storage facility near the winder is the safe and convenient way to provide ready access to sharp slitter blades and bands

Never place a blade where it could fall from a surface. Your natural reaction is to attempt to catch it with your hand and, even while wearing the required protective gloves, this can be very dangerous.

Safety Note: Always wear cut-resistant gloves when handling blades and bands.

Because blades and bands are very sharp, always use extreme caution. Dull blades should be handled with as much care as sharp blades to prevent nicks and chips. Always store and ship the blades and bands in a container specially designed to protect the blades and bands from damage.

Valmet Slitter Services Quick Check– keeping slitters setup and operating properly

A convenient listing of important slitter information is available in the Quick Checks booklet. You can see a copy at **www.valmet.com/slittermanagement** or ask a Valmet representative to send one.

Valmet has developed an operator methodology designed to positively affect blade change frequency. Monitoring, setting up and maintaining the slitter section safely, accurately and at regular intervals are key factors for extending blade change intervals.

Performing these simple checks, or Quick Checks, at each slitter position between sets or during a shutdown is recommended. This is a standard part of the Valmet Slitter Management operator training program. Doing these Quick Checks regularly and consistently across shifts will guarantee a smoothly running slitter section. It also provides the finishing superintendent and operators a way to grade their performance with respect to slitting. With Quick Checks, your product quality is protected.

Figure 8. Roll quality will maintain at optimal levels when Quick Checks are performed regularly.

Quick Checks inspection report

Valmet developed additional copyrighted tools to further help operators maintain a consistent slitter setup. The first tool, the Quick Checks Inspection Report (or scorecard) was designed with operations management and operators in mind. It allows you to inspect five positions against the most important 8 parameters to see how operators are setting up the

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slitter section from shift to shift. Using the report regularly will help you track slitter maintenance and operability, as well as determine where to focus your training efforts. Your Valmet representative will be happy to explain the use of the Quick Checks scorecard (**Figure 9, left**) at your convenience.

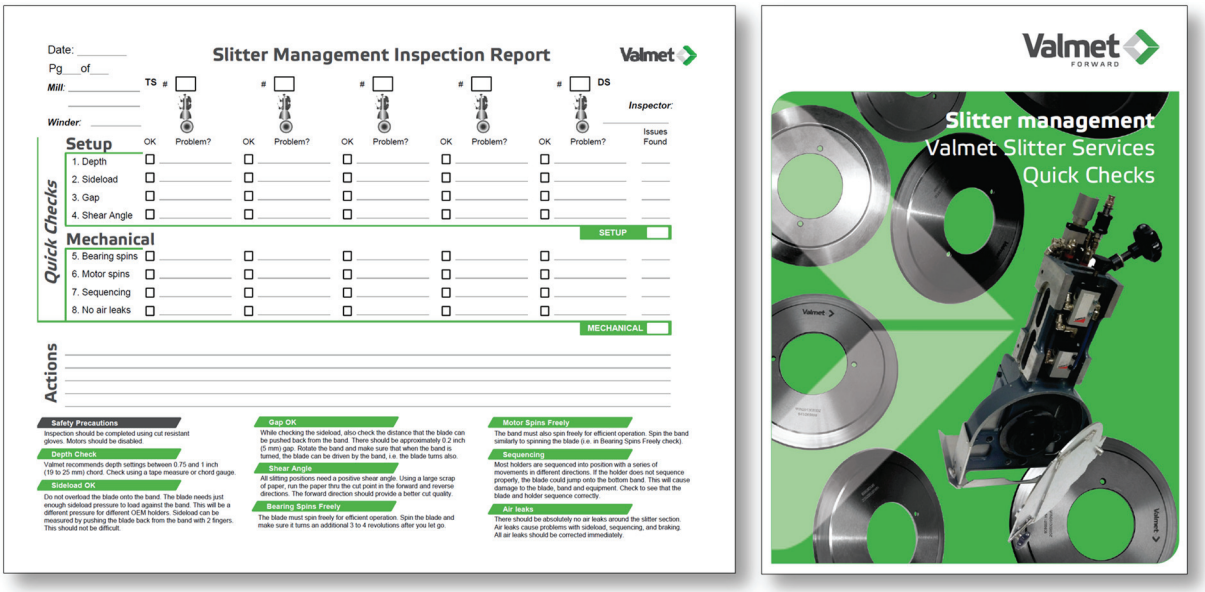

Figure 9. The Quick Checks inspection report (left) and booklet (right) are tools used by operators to guarantee slitter setup quality and consistency.

The second printed tool, the Quick Checks booklet (**Figure 9, right**), is a handy pocket-sized reference guide that covers the Quick Checks slitter setup and adjustment key areas that are also described at the Slitter Management website (***www.valmet.com/slittermanagement***).

Your Valmet Slitter Management expert is ready to provide you with printed versions of these helpful guides upon request. The printed version of the Quick Checks Inspection Report has the instructions for use conveniently printed on the back of each page.

The Quick Checks process

There are several steps in the Quick Checks process for setting up and maintaining your slitter section.

Setting slitter blade depth

Valmet recommends depth settings between .625 and 1 inch. For consistent setup, check using a tape measure or chord gauge (**Figure 10**). Valmet provides a handy chord gauge for quick and reliable slitter setup.

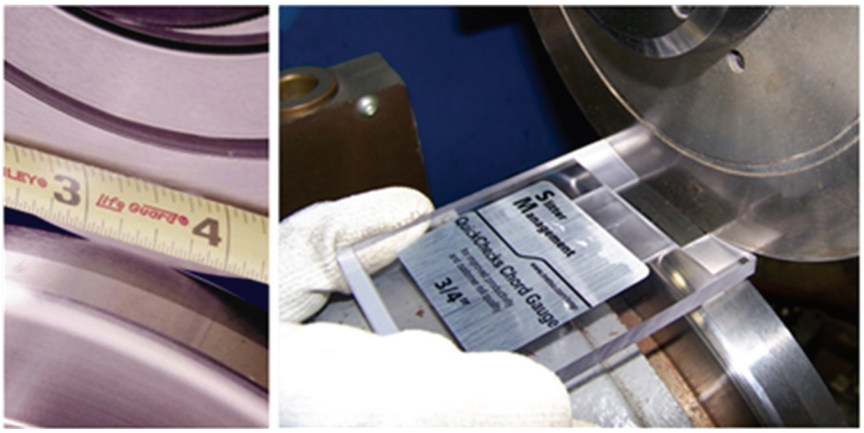

Figure 10. Blade depth may be checked with a tape measure or chord gauge.

Setting slitter blade side load against the band

Side loading has a big impact on blade life and cut quality. The pressure needed to keep the top blade in contact with the bottom band varies depending on the material being slit. It is important that the side loading always be set as light as the process will allow (**Figure 11**).

- The side loading pressure must be heavy enough to enable the bottom band to drive the top blade. Yet excessive side loading causes faster blade wear.
- The heavier the basis weight, the more side loading needed. Heavier papers create more lateral force on the blade.

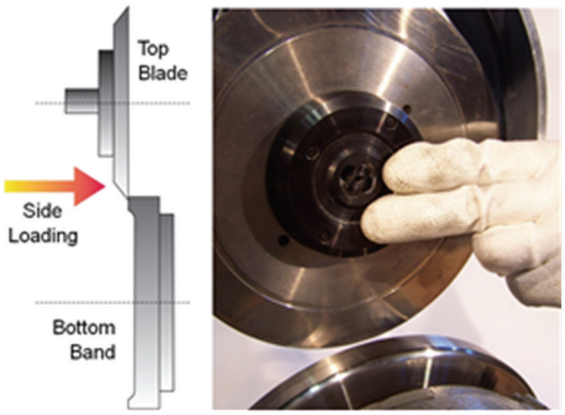

Figure 11. Use just enough side loading pressure to laterally engage the blade against the bottom band. Generally, pushing with two fingers should easily move the blade from the band.

Setting the gap between the slitter blade and band

While checking the side load, also check the distance that the blade can be pushed back from the band (**Figure 12**). There should be approximately 0.25-inch gap. Rotate the band and make sure that when the band is turned, the blade can be driven by the band, i.e. the blade turns also.

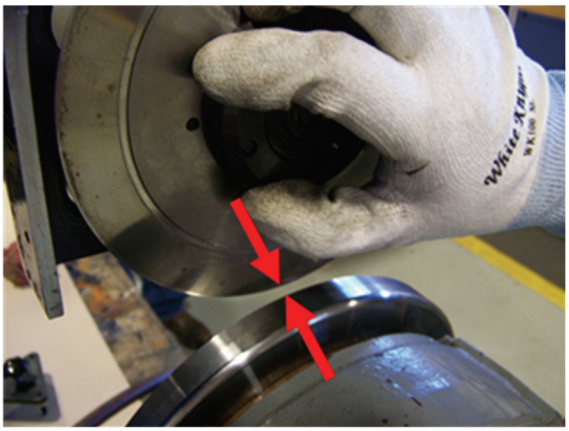

Figure 12. There should be a ¼" gap between blade and band when the blade is pushed away from the band.

Seating the slitter blade against the band

Blade seating is a critical step in blade setup that is commonly overlooked. Before installing the top blade, check that the mounting surfaces are clean. After the installation, the top blade should be seated against the bottom band to increase cut quality and extend blade life. In the first few revolutions of the top blade and bottom band, a wear pattern is established that determines how effectively the pair will run.

For proper seating perform the following three steps for each blade/band combination:

1. Hold back on the bearing assembly to soften the initial contact between the top blade and bottom band when the blade is side loading. This will prevent chipping the tip of the top blade.
2. Turn the blade in the opposite direction from that which it turns during normal operation (**Figure 13**). Continue spinning for 3 - 4 revolutions. This will properly seat the fine superfinished tip.

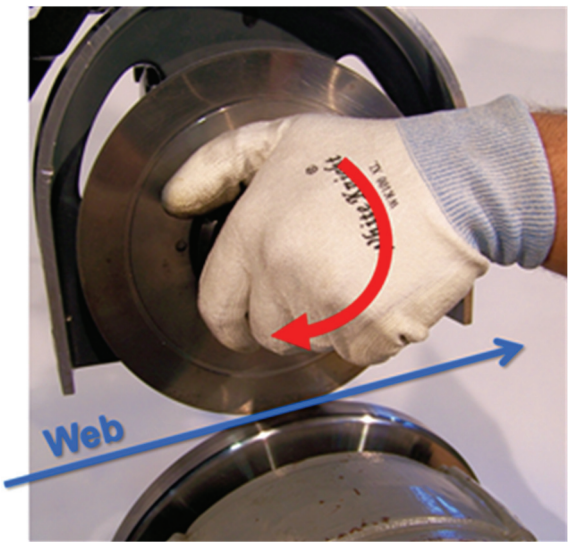

Figure 13. Rotate the blade opposite web flow to seat it against the band.

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3. Turn the blade in the direction of normal operation. While turning the blade forward, work the blade back and forth causing it to slip against the bottom band. Continue until the top blade runs quietly and feels smooth as it runs against the bottom band.

Checking the shear angle

Shear (cant) angle is the angular relationship between the lower band and the upper blade. The best shear angle for a specific product is the minimum angle required to reliably slit the web. The steeper the shear angle, the faster the blade will wear. All slitting positions need a positive shear angle.

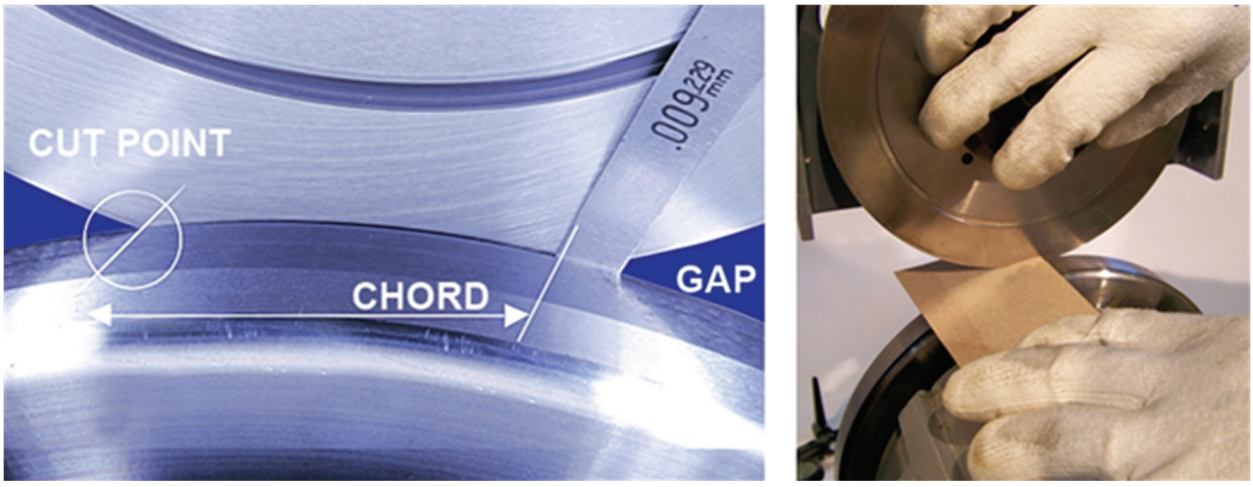

Figure 14. A feeler gauge (left) is used to measure the shear angle, and positive angle is verified by running paper scrap (right) through cut point.

The shear angle can be measured by inserting a feeler gauge between the top blade and bottom band behind the cut point (**Figure 14, left**). The greater the chord (a straight line joining two points on a curve), the larger the measured gap will be.

Using a large scrap of paper, run the paper through the cut point in the forward and reverse directions (**Figure 14, right**). The forward direction should provide better cut quality, verifying there is a positive shear angle.

Checking carbide bands

Always check the bottom band for carbide separation from the carrier (**Figure 15**).

- If there is any visible separation, the band should be removed immediately.
- Dispose of a damaged band so that it will no longer be used.

Checking the bearing and band motor

The blade and band must spin freely for efficient operation. Independently spin each to make sure that the blade and band continue to turn an additional 3 to 4 revolutions after you let go.

NOTE: Wear cut resistant gloves whenever handling blades and bands.

Figure 15. Check bands regularly for carbide separation.

Run-Out

It is critical to minimize the wobble in the cross-machine direction (axial run-out), as well as in the machine direction (radial run-out) (**Figure 16**). Run-out of the bottom band and top blade will substantially decrease cut quality and blade life. The axial run-out on the hub should be kept to .002" or less, while the radial runout on the hub should be kept to .004" or less.

If the run-out exceeds these tolerances, make sure all the mounting surfaces are clear of paper and other debris. If the run-out is still excessive, replace the top slitter blade. If run-out still occurs, check the slitting equipment.

Check to see that the holder sequences correctly

Most holders make two movements when positioning for slitting. First it moves down (1) before it makes a lateral movement (2) against the bottom band (**Figure 17**). If the holder does not sequence properly, the blade may jump onto the bottom band. This will cause damage to the blade, band and equipment.

Check for air leaks and missing parts

There should be absolutely no air leaks around the slitter section. Air leaks cause problems with sideload, sequencing, and braking. All air leaks should be corrected immediately.

Compare each slitter position to its neighboring position. List any parts that are missing, and replace them at your earliest opportunity.

Valmet Slitter Services Blade Pool service

The best winding operation can be brought to a screeching halt when you run out of sharp blades. Either you make poor shipping rolls - or stop production. Not a pleasant choice.

Most mills, at some point, experience shortages of sharp blades and the possibility of unacceptable cut quality. These concerns and many more can be addressed by outsourcing your blade grinding, polishing and inventory control.

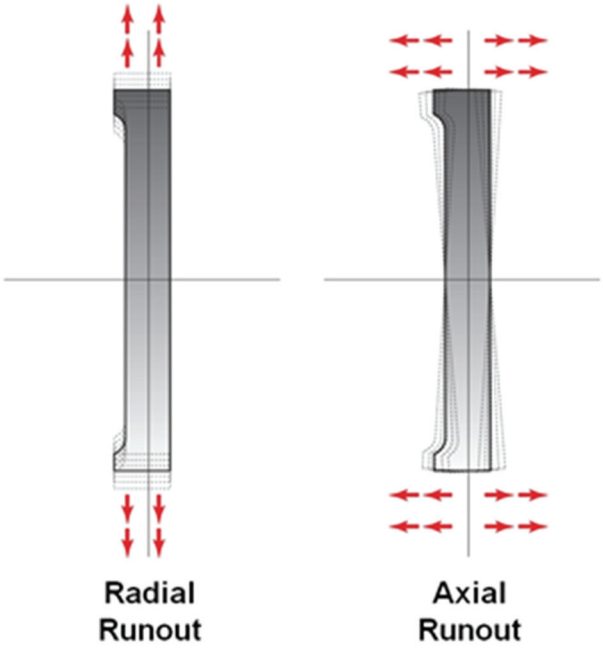

Figure 16. Axial and radial run-out decrease blade life and cut quality.

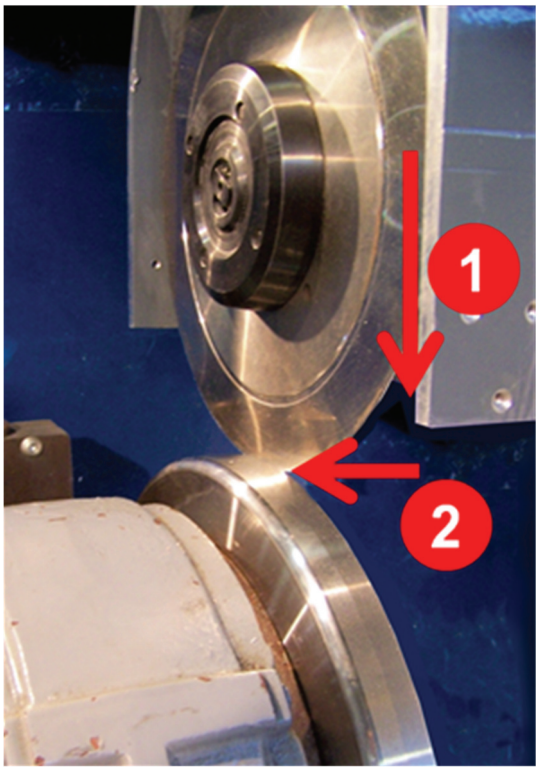

Figure 17. The blade must move down first (1) before moving sideways (2).

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Valmet Slitter Services Blade Pool, from Valmet Slitter Management, is the best way to ensure you always have a supply of sharp, high quality blades ready to use when a change is needed (**Figure 18**). Utilizing the Valmet Slitter Services Blade Pool service, you will increase winder productivity, lower inventory costs and, most importantly, produce a quality end product.

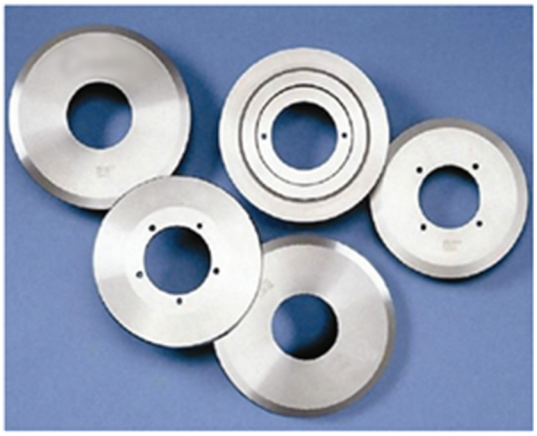
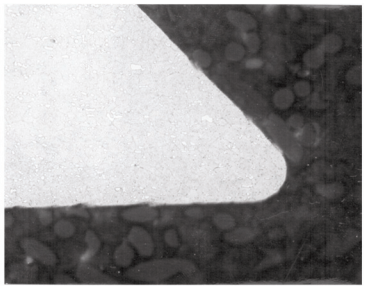


Figure 18. Valmet Slitter Services Blade Pool keeps you supplied with no-stress sharp blades at all times.

Superfinishing – for the best cutting edge

The process used to grind blades heavily influences blade life and cut quality. In most grinding applications, a tub-type plunge grinder is used to remove stock from the dull blade. When the blade is ground to the correct diameter, a substantial burr still remains and the grinder operator hand hones the burr off the edge of the blade. Because the grinder operator must chase the burr from side to side around the circumference of the blade to remove it, frequently the tip is rounded off before the blade is even run on the machine.



The tip of a hand-honed slitter blade (.001 radius at the tip, 400x magnification)

The tip of a SUPERFINISHED slitter blade (.0001 radius at the tip, 400x magnification)

Figure 19. Superfinishing (right) provides the sharpest blade edge, as compared to conventional grinding (left).

Slitter Management uses the superfinishing process for sharpening and polishing slitter blades and bands (**Figure 19**). This produces the cleanest, sharpest cutting edge possible. First, worn stock is removed with a traverse-type grinder for a better finish. The blade then goes to the superfinisher where the burr is mechanically removed and the edge is polished. The result is a highly polished cutting surface and razor-sharp blade edge.

Valmet stocks the latest technology top slitter blades and bottom bands for Valmet, Valmet and Wärtsilä winders plus the most common models for Jagenberg, Beloit and Lennox winders.

Safer, environmentally friendly packaging

Valmet continues to enhance the benefits of Valmet Slitter Services Blade Pool membership. Your fresh blades are now delivered in a safer and more environmentally friendly manner (**Figure 20**). The toxic petroleum based coating on the blade edge is gone, replaced by a new, reusable package made from paperboard. This

Figure 20. Valmet Slitter Services Blade Pool ships blades in environmental packaging that is safer than traditional shipping methods (magnetic blade cover shown in lower left).

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packaging eliminates one more need to handle a blade. By also using Valmet's Slitter Management magnetic blade cover, you'll never actually have to touch a blade again. Remember to always be safe and wear your protective gloves.

Exchange and repair services

The mechanical condition of the slitter section is critical for effective, dust free and safe slitting. Valmet stocks entire holders and carriages, slitter setup and adjustment tools and all parts. The Valmet holders and carriages available for exchange (**Figure 21**) and tools are further described at the Slitter Management website (***www.valmet.com/slittermanagement***), along with their critical subassemblies.

When a part goes bad on your slitter assembly, it must be taken out of service. Instead of tracking separate parts and pieces you can easily replace the entire assembly. Valmet offers exchange units from stock for the current version Valmet slitter holder and carriage. Valmet also rebuilds older version KL1000 carriages as well as Valmet KL200, Beloit and Beloit-Lenox slitter holders. Valmet offers replacement parts for all Valmet, Valmet and Wärtsilä slitting equipment.

Figure 21. Upon receiving a slitter assembly (left) with an exchange tag and RGA#, Valmet immediately return ships a rebuilt assembly (right) from stock.

Valmet's Quick Change slitter holders were designed to be a safer method for blade change. But ease and speed of blade change with the new design became very valuable added benefits. Other safety features include a lock ring release button that only operates when the slitter is in the OFF position and a braking system that stops the rotation of the slitter blade when the slitter holder is placed in the DISENGAGED (blade change-out) position. The blade is only free to rotate after the slitter blade holder is placed back into the ENGAGED (operating/slitting) position.

Valmet offers an exchange service for the top slitter holder and slitter carriage. Valmet will ship you a fully rebuilt assembly from our stock that meets all OEM specifications (**Figure 21**).

Repair and Certification Process

All rebuilt holders are completely assembled with their new replacement parts. Critical tolerances as well as specific operational aspects are thoroughly checked at a slitter station test stand. Each unit is then accepted for service as an exchange unit, receiving its Slitter Management certification and full mechanical guarantee.

Critical tolerance and operational checks include:

- Blade sequence testing
- Sideload pressure testing
- Shear angle verification to acceptable tolerances

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Case Studies

Sometimes it's easier to make a decision when your peers in the industry have already walked that path. Here are a couple of examples of what the Slitter Management service has done for two different mills to enhance the safety, efficiency and quality of their process.

Board mill improves product quality

At a USA board mill, personnel were tired of changing blades frequently and still ending up with less than acceptable roll edge quality. After learning that Valmet's Slitter Management service would address these and other issues, they decided to give Slitter Management a try. Valmet was called in to help improve the product quality being delivered to their customers.

The problem - frequent changeouts

Before the Valmet slitting expert arrived, the mill had been changing out a set of blades each week and slitter bands every other week. It was very important to this mill to provide the highest quality to their customers, thus the frequent changeouts.

The mill was also using an outside supplier for grinding, but the blades were not being superfinished. At that time, the blades were industry standard powdered metal blades with 10% vanadium, paired with carbide bottom bands.

The solution - new materials, training and regular checkups

Upon arrival, the Valmet Slitter Management technician discussed which aspects of the Slitter Management service would most help mill operations and personnel. For this particular mill, the greatest benefits would occur with a comprehensive review of blade and band material and usage, as well as operator procedural changes.

After reviewing the relative merits of different blade materials, the mill chose to upgrade to Valmet's newly developed material containing 15% vanadium. This combined extreme edge strength with an improved ability to polish the blade edge.

In addition to improving the blade materials, Valmet Slitter Management personnel provided on-site hands-on training demonstrating the optimal way to setup and operate blades and bands. As is always the case with the Slitter Management service, improving operational safety was an integral element of the training.

Excellent results

The most obvious result is higher roll quality being shipped. And this quality is being sustained with blades that now operate for 8 weeks and bands that last 16 weeks.

Additionally, operator safety and blade/band organization have also improved. There is measurably safer slitter handling taking place after Slitter Management training. Winder equipment is also less likely to be damaged by poorly maintained and maladjusted slitters.

The absolute safest way to handle a slitter blade is to NOT handle a slitter blade. Since the new blade material and properly setup blades and bands combine to greatly extend slitter lifetime between grindings - there is much less frequent blade handling needed. Therefore operator exposure to slitters has reduced considerably, thereby increasing safety.

As operations continue, Valmet Slitter Management personnel will be visiting the mill to exchange the dull slitter blades for sharp slitter blades. This further guarantees roll quality by making sure there is no need to run unnecessarily dull blades.

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This mill has seen the value of expert slitter management, and continues to partner with Valmet to further improve their slitting and winding processes.

Slitter Management service sharpens up winding processes at newsprint mill

Superior sharpness and cut quality are what the world's top chefs value most in their knives. Even the best raw material can be ruined with dull equipment. The same applies to a Scandinavian newsprint mill, where the winder slitters are kept in top-notch condition through Valmet's Slitter Management service. One of the success factors is clearly divided responsibilities.

The mill, located in central Norway, is one of the largest newsprint mills in Europe, serving demanding customers worldwide. It produces newsprint in the basis weight range of 42.5–48.8 g/m^2 on three paper machines PM 1, PM 2 and PM 3, with a total capacity of 600,000 tons per year. The trimmed width of the newsprint varies between 6,600 and 8,470 mm.

Paper is cut into customer rolls on five production winders: four Valmet KL1000 winders and one DuoRoller II winder by Voith. Their speeds range from 2,300 to 2,500 m/min, and they have 11-14 pairs in the slitter units.

Everybody knows what to do

Like most paper mills, this mill used to regrind the winder slitters in its own facilities with its own tools. However, in 2007, the mill entered into a tailored Slitter Management service with Valmet concerning Winders 1 and 2. At the beginning of 2008, Winder 4 was included in the program. Since September 2008, the remaining two winders have also been covered by a long-term agreement.

Both parties know their responsibilities, since they are clearly stated in the agreement (**Figure 22**). For example, while Valmet owns the blades and bands, the mill is responsible for changing and maintaining them. Maintenance planning and development support are carried out together. Superfinishing is Valmet's responsibility.

The mill set clear targets for the agreement. First, it wanted to reduce dust in the customer rolls and thus reduce customer complaints. Second, it aimed to achieve a visually neat slitting result. Third, it wanted to extend the change interval of blades and bands, and improve maintenance efficiency.

Mill	Valmet	Responsibility
X		Changing blades and bands
X		Maintenance
	X	Ownership of the blades and bands
	X	Sharpening services
	X	Inventory control for the blades and bands
	X	Onsite maintenance support every year
X	X	Maintenance planning and development support
	X	Onsite and classroom training, including: - Safe handling of slitters - Slitter adjustment, alignment and setup - Process and maintenance
	X	Latest technology updates

Figure 22. The Slitter Management service helped to define the partnership between the mill and Valmet.

"With the Slitter Management service, we don't need to focus on slitting quality. We can concentrate on other roll finishing matters and improve general roll quality," says the mill's Winder Production Engineer.

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Higher roll quality, happier customers

The decision about entering the Slitter Management service and extending it to cover all five winders has brought good results. The process improvements are visible through less dust, better customer roll quality and less dishing. Printing houses have been very satisfied with the shipping roll quality.

"Dust was earlier a big problem for us and for our customers' printing processes. Now it is at an acceptable level, and we can focus on the winders' continuous development program. We have bought the best slitter material for high-quality slitting," the Production Engineer explains.

The targets set for maintenance improvement have also been reached. The knives now run longer than earlier and less maintenance is needed on the slitter section.

Summary

Valmet's Slitter Management service brings slitting best practices to your winder and provides the training and resources you need to improve customer roll quality and productivity at your winder.

Slitter Management addresses the factors affecting slitting performance, including: equipment condition and setup, blade and band quality and sharpness, and operator skill level. Operator training is comprehensive.

To get more information contact your Valmet representative.

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.

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