AMERICAN CUTTING EDGE
Industrial Blades & Knives

A division of CB Manufacturing

The Ultimate Guide to Slitting and Converting Knives

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The Ultimate Guide to Slitting and Converting Knives

Optimizing your slitting and converting process to achieve maximum uptime starts with selecting the best blade for your operation.

Converting and slitting blades come in a wide variety of configurations.

Selecting the ideal blade for your application ensures that you achieve maximum blade life, minimize maintenance-induced downtime, and achieve your ideal cuts.

THREE COMMON TYPES OF SLITTING

Razor slitting, shear slitting, and scoring/crush slitting are three common processes for converting materials. Each of these processes is used on a variety of materials and can be optimized, through proper blade selection, to achieve production, waste, and efficiency goals.

RAZOR SLITTING

Razor slitting is easy and inexpensive to set up and is often used to convert films, plastics, tapes, ribbons, and vinyl.

Using razor slitting, materials can be converted into very narrow slit widths while still producing very little dust, making it one of the cleanest methods of slitting. However, this type of slitting does have some limitations when cutting heavy materials and woven products.

> **“ The blades used for razor slitting are inexpensive and require more frequent changes than with other types of slitting.**

The blades used for razor slitting are inexpensive and require more frequent changes than with other types of slitting. Also referred to as “in-air slitting,” razor slitting blades are mounted to a bar and remain stationary during the slitting process.

The material is conveyed across 1 to 120 blades on a single bar, depending on the width of the material to be cut.

During blade replacement, it is best if all blades on the bar are changed at the same time; however, it is not necessary on some set-ups.

> **To achieve the longest life, female knives should have a larger outer diameter than male knives and be manufactured from a material that has a higher hardness level.**

SHEAR SLITTING

Shear slitting is used in applications that require precision cuts. It is more expensive and difficult to setup than other slitting methods and is commonly used to convert heavy films, foils, paper, layered materials, and composites.

Shear slitting requires two blades, a top blade known as the “male knife” and the bottom blade, known as the “female knife” or “anvil.” The male knife is adjusted at the cant angle so that the two blades to come into contact at the nip point, similar to a pair of hand scissors, which separates the material. To achieve the longest life, female knives should have a larger outer diameter than male knives and be manufactured from a material that has a higher hardness level.

Achieving the longest blade life in shear slitting operations requires appropriately setting the nip point. If the nip point is not set correctly, the blades will wear very quickly. Adequate and on-going training is required to ensure that all operators fully understand how to set up their operations correctly.

Since shear slitting generates the least amount of heat, it is often used in environments that demand long runtimes.

SCORING/CRUSH CUT SLITTING

Crush cut slitting or scoring is used to separate thick, tough, non-woven materials, fabrics, laminates, and paper. The ragged edge created by this slitting process results in rolls that are thicker on the inside and more narrow (where the cut material lays flat) on the outside of the roll.

While this type of slitting produces the poorest edge quality and is less precise than other methods, it is easy to setup and requires relatively inexpensive parts.

In a crush cut slitter, the knife is held in place by a pneumatic holder and activated by air pressure. During the scoring process, a knife presses into the material and runs against a hardened anvil to separate (by scoring or crushing) the web of the material. The cutting edge of the knife has a radius tip and is not sharp.

OPTIMUM KNIVES PRODUCE OPTIMUM RESULTS

Maintaining high-quality, sharp, slitter knives improves both the production output and quality of your slitting processes and is essential to optimized shear slitting processes. A sharp blade ensures the highest-quality cuts and lowest dust production. Precision-fit, sharp knives also enable optimum nip point setting to provide the longest blade life.

Selecting the best blade for your cutting application begins with determining the optimum geometry for the top knife. Top knives may be flat, dish, single bevel, compound bevel, or hollow ground. To determine the best geometry for your application, work with a precision knife manufacturer.

> **“ Selecting the best blade for your cutting application begins with determining the optimum geometry for the top knife.**

The best blade material for each type of slitting process is dependent on runtime needs and the material to be slit. When the optimum blade material is utilized, production is increased by decreasing maintenance-induced downtime.

SELECTING THE BEST BLADE MATERIAL FOR YOUR SHEAR SLITTING APPLICATION

When shear slitting blades dull, the slitting operation stops while the entire bar set up is removed and the blades are replaced. Downtime for this type of maintenance can be several hours. Production losses are compounded when the blades dull in the middle of the roll resulting in scrapping the remainder of the material. Selecting an ideal blade material for the application and runtime requirements prevents costly downtime and material losses.

Both the top and bottom blades of the shear slitter can be sharpened to increase the life of the blades. D2 steel is the most common material used for shear slitting. In applications where the material to be slit increases blade wear, M2 steel, carbide inlaid steel, and CPM 10V steel can be used to increase blade life.

52100 STEEL

52100 steel has the lowest wear life and as such, is rarely recommended for shear slitting applications. Shear slitting machines that employ 52100 steel blades must undergo frequent maintenance to replace dull blades.

Knives manufactured from this material are low-cost and are not usually sharpened. Instead, the dull blades are discarded and replaced with new blades.

However, this blade material is required in shear slitting of specific plastic materials since it generates low amounts of heat during the cutting process.

> **“ Shear slitting machines that employ 52100 steel blades must undergo frequent maintenance to replace dull blades.**

D2 STEEL

D2 steel is the most commonly used material for both top and bottom blades. It has a good combination of both cost and associated wear life, and is easy to sharpen. It is also a versatile material and can be used in shear slitting applications involving both plastics and paper. It is typically the most cost-effective option for both wear and low budget applications.

M2 STEEL

This steel is also used for both top and bottom blades and provides increased wear life since it is harder and tougher than D2 steel. M2 is often recommended in shear slitting applications involving nonwoven materials and paper since each is very abrasive and cause

blades to wear quickly. Switching from D2 to M2 allows operators to increase runtimes between blade changes resulting in less maintenance-induced downtime.

CPM 10V

Prized for its wear resistance, this steel type is ideal for applications that demand long runtimes and varying materials (multilayer plastics, papers, and nonwoven materials). Blades crafted of CPM 10V steel are easily sharpened which helps to offset the higher costs associated with procuring blades from this material.

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> **Carbide maintains sharpness through slitting long rolls of abrasive materials.**

CARBIDE INLAY BLADES

In environments that demand 24 x 7 runtimes, carbide inlay blades are an ideal choice for the bottom blade.

Carbide maintains sharpness through slitting long rolls of abrasive materials. The inlaid blade is manufactured of D2 steel and carbide is inlaid only at the nip point to provide maximum benefit while minimizing cost.

It is important to note that carbide inlay blades have very little shock resistance so accurate setting of the cant angle is very important when using this material.

SPLIT BOTTOM KNIVES

Most shear slitting blades are solid in construction, making it impossible to change a single blade on a bar without removing every blade. As a result, every blade is replaced (or at minimum removed and placed back onto the line) when a single blade dulls, chips, or breaks. Changing out all blades on a bar can can take hours depending on the number of blade set ups on the line.

Split bottom knives allow operators to replace a single blade without removing all of the blades on the bar. Instead of a solid circular blade, a split bottom knife splits into two pieces allowing it to be pulled off and re-installed anywhere on the bar with only the use of an torque wrench.

When manufactured with a double cutting edge, a dulled split bottom knife can be removed and flipped to provide a fresh cutting surface in a fraction of the time required to change solid, circular shear slitting blades.

> **Selecting the right blade material for your shear slitting application is critical to maximizing uptime and decreasing material losses and maintenance costs.**

Selecting the right blade material for your shear slitting application is critical to maximizing uptime and decreasing material losses and maintenance costs. Expert industrial knife manufacturers analyze your specific budgetary, material, and runtime needs to recommend an ideal shear slitting blade material and configuration.

SELECTING THE BEST BLADE MATERIAL FOR YOUR RAZOR SLITTING APPLICATION

The ideal blade material is dependent on the type of material being cut and the needs of the business. For short runs and easy to slit materials, lower grade blade metals, such as carbon steel and stainless steel, may be utilized. To decrease maintenance-induced downtime and best meet the needs of long-runs, use a high-grade blade material, like tungsten carbide or zirconia ceramic.

ADVANTAGES OF TUNGSTEN CARBIDE AND ZIRCONIA CERAMIC BLADES IN RAZOR SLITTING

Razor slitting is a versatile cutting method commonly used for creating slit widths of light gauge films, tapes, ribbons, plastics, and nonwoven

materials. Choosing the right blade material for your razor slitting application ensures that you achieve maximize runtime and blade life while creating ideal cuts.

While many razor slitting operations employ steel blades, there are distinct advantages to upgrading to a tungsten carbide or zirconia ceramic blade.

→ Dramatically Increase Wear Life

Slitting operations halt during blade changes, decreasing overall production. Razor slitting blades are extremely sharp and require precise installation to enable maximum wear life and highest-quality cuts.

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> **Every blade replacement is an opportunity for operator-induced error and injury.**

Every blade replacement is an opportunity for operator-induced error and injury. While the material being cut, cutting speed, and angle all influence wear life, the cost savings over long material runs as a result of improved wear life is substantial.

Both tungsten carbide and zirconia ceramic blades provide significantly improved wear life over carbon steel blades. In fact, operators switching from carbon steel to tungsten carbide or zirconia ceramic can expect wear life to increase by 50 to 500 times.

Some companies have found that simply upgrading the blade material in their razor slitting application negated the need to switch from razor slitting to shear slitting.

If your razor slitting operation is experiencing failures, consider upgrading your blades to tungsten carbide or zirconia ceramic before replacing your razor slitting set up.

Create Precise Cuts

In addition to a long wear life, the high hardness levels of tungsten carbide and zirconia ceramic hold rigidity in the application to create precise, pristine cuts.

Both tungsten carbide and zirconia ceramic are powdered metals that have very similar properties. Each time the blade is sharpened the binders in the material are stressed.

Blades crafted from these materials can be sharpened up to three times. With each sharpening, the blade life will decrease. After three sharpenings, the lifetime of the blade is typically decreased beyond the cost savings associated with sharpening process.

> **“After three sharpenings, the lifetime of the blade is typically decreased beyond the cost savings associated with sharpening process.**

It is best to accurately mark your blades to account for each time they have gone through sharpening so as not to over-extend their use and ultimately cause issues in your slitting application.

Extremely High Hardness, Zero Flexibility

The high hardness levels of tungsten carbide and zirconia ceramic that provide long wear life and precision cuts also make the blade extremely fragile. Mishandling can cause the blades to chip, shatter, or crack.

If a cracked blade is installed into the machine, the blade will shatter as soon as it makes contact with the material to be cut. In fact, any impact from a side load (apart from the material to be cut) can cause the blade to shatter.

Precise setup is required to avoid any blade breakage when using these materials in configurations that have groove inserts below the material.

Switching from Carbon Steel to Tungsten Carbide or Zirconia Ceramic Blades

When switching from carbon steel to tungsten carbide or zirconia ceramic blades, the most critical investment will be in training operators on the different material characteristics between the powdered metal (tungsten carbide or zirconia ceramic) and the previously used steel blades.

> **Operators must also be trained on the handling of these extremely sharp and fragile blades.**

In many cases, carbon steel blades used in razor slitting applications are not sharpened due to their low cost to manufacture from a coil form. However, both tungsten carbide and zirconia ceramic blades are more costly raw materials and plant supervisors often elect to have these blades sharpened to extend their life.

Operators must also be trained on the handling of these extremely sharp and fragile blades. When tightening the set screw against a carbon steel blade, operators can apply significant torque without damaging the blade. However, if the set screw is over-tightened against a tungsten carbide or zirconia ceramic blade, the blade will crack and then shatter when the machine is started or once the line is fully up to speed.

It is also important to note that neither tungsten carbide nor zirconia ceramic blades are magnetic, which means that magnetic knife holders cannot be used.

Do You Need Tungsten Carbide or Zirconia Ceramic Blades?

Both tungsten carbide and zirconia ceramic blades can be used in a wide variety of razor slitting applications, including plastics, paper-backed labels, tapes, and paper.

However, since zirconia ceramic generates less heat during the cutting process than tungsten carbide, zirconia ceramic blades are recommended for some plastics applications or any application which generates high amounts of heat.

Tungsten carbide and zirconia ceramic blades provide better cut quality, more efficient runs, and longer wear life than carbon steel blades. Incorporating these high-quality blades into your razor slitting operation can dramatically increase production while decreasing downtime and improving quality.

IMPORTANCE OF THE RIGHT SLITTER KNIFE MANUFACTURER

> **The right blade material provides a perfect mix of toughness, hardness, cost, and flexibility.**

When selecting a slitter knife manufacturer, look for one with the experience to evaluate your entire slitting process operation, make recommendations to improve blade lifetime and cut quality, and supply you with slitting knives that meet the unique needs of your business.

Expert knife manufacturers analyze the material to be cut, current blade selections, runtime requirements, and budgetary needs before recommending the best blade material for a specific shear slitting application. The right blade material provides a perfect mix of toughness, hardness, cost, and flexibility.

SLITTER BLADE SHARPENING

Shear male and female knives, core cutting blades, scoring knives, tungsten carbide and zirconium ceramic razor blades, and inlaid femalid knives can all be sharpened to maintain optimum slitting performance while decreasing replacement knife costs.

Some blades can be ground as many as two to three times before the minimum outer diameter grind for cutting effectiveness is reached, translating into significant savings. For example, sharpening carbide razor blades is often half the cost of purchasing replacement blades.

Sharpening your slitter blades allows you to extend the life of your current blades and decrease knife replacement costs. When sharpened by a professional, precision sharpening knife manufacturer, slitting

blades are returned to like-new condition at a fraction of the cost of purchasing new knives. All that is required to sharpen slitting blades is to establish a relationship with a precision sharpener, collect the blades, and ship them out for sharpening. Any minimum outer diameter grinds or specific cutting angle requirements will need to be discussed before your first sharpening service.

To ensure maximum utilization of your slitting knives, establish slitter knife maintenance processes and procedures within your organization. For those with a consistent flow of slitting operations, a maintenance schedule founded on operation time may be the easiest and most effective to implement.

To determine optimal maintenance frequency, collect data on slitting volume, material, and knife condition for a set period. Then create a schedule that ensures slitting blade condition is routinely assessed and that blades are sent for sharpening.

Creating a maintenance schedule ensures that you always have the best possible performance from your slitting knives. It also provides you with the data you need to maintain an adequate inventory of production-ready slitting knives.

Some slitting configurations require knives to be sharpened as a matched set to maintain the balance and efficiency of the slitting operation. Additionally, machines may require minimum outer diameter grinds to ensure fit within the machine. High-quality, experienced slitter knife manufacturers, guarantee that your knives are sharpened to the precise tolerances of your slitting machine without removing excess material.

> **Preventive Maintenance: Don't start today by doing what you should have done yesterday.**
> DENIECE SCHOFIELD

KNIFE HOLDER REPAIRS AND REBUILDS

Shear knife holders require proper maintenance to ensure high-quality cuts and to optimize the life of shear slitting blades. Industrial knife suppliers with knife holder repair and rebuild capabilities test, inspect, repair, rebuild, and certify shear slitting knife holders.

> **Quality is never an accident. It is the result of intelligent effort.**
>
> JOHN RUSKIN

This ensures the best performance from your shear slitting machine and blades without requiring you to source a separate vendor for knife holder maintenance, repairs, and rebuilds. Utilizing your slitter knife supplier also eliminates the need to maintain these capabilities in-house.

To determine if your knife holder requires maintenance, work with an industrial knife supplier to troubleshoot your machine.

When a knife holder needs maintenance, the most common symptom presented is poor quality cuts. Since poor cuts can be a caused by inadequate blades, not running at the right line speed, or problems with the knife holder, troubleshooting with an expert in both industrial knives and knife holders ensures identification of the true root cause.

WIDE INVENTORY OF CUSTOM AND STOCK SOLUTIONS

The wide variety of stock knife sourcing options makes it imperative to understand material certification processes, inspection criteria, and best-fit products. High-quality industrial knife suppliers offer only blades that are crafted from certified materials to meet exacting standards of quality, performance, and durability.

Industrial cutting applications require materials that adhere to the strict tolerances of slitting and converting machinery to guarantee optimal life,

production, and safety. When your cutting needs change as a result of new materials, changes in production requirements, or new machinery, an experienced blade supplier discusses your unique needs and makes recommendations that best fit your business goals.

In some cases, this means employing a customized solution. For example, converters that utilize a bottom knife with a single cutting edge on a shear setup can significantly decrease maintenance-driven downtime by switching to a split knife bottom with a double cutting edge. This upgrade enables blade changes without requiring the removal of every blade from the shaft.

“Industrial knife suppliers with large stock and customized options provide converters with the ability to find the solution that best fits both production and budgetary needs.

Other custom requirement situations include manufacturing blades for OEM’s who are no longer in business. Reverse engineering capabilities in this instance will become very important to keeping your operations running smoothly.

Industrial knife suppliers with large stock and customized options provide converters with the ability to find the solution that best fits both production and budgetary needs.

Partner with a vendor that offers a wide variety of in-house solutions, including blade sharpening, knife holder maintenance, and certification, and both customized and stock blade options. Doing so decreases reliance on multiple vendors and provides simplified, one-stop access to expert consultants, recommendations, services, and products.

THREE WAYS TO GET BETTER PERFORMANCE FROM YOUR CONVERTING KNIVES

> **If you are experiencing low runtime, low lifetime, or machine inefficiencies, changing to a new blade material may be the solution you need.**

Optimizing the performance of your converting blades allows you to obtain the longest life, highest quality cuts, and maintain cutting efficiency. Blades that meet the ideal specifications for your converting machine and cutting material provide optimum performance and contribute to increased uptime to ensure the highest outputs.

Changing your current knife selection is not the only way to increase your converting knife performance.

Often, the best choice is to upgrade your existing knife to provide better performance, lifetime, and efficiency.

1. UPGRADE BLADE MATERIAL

Evaluating and adjusting the blade material of your converting knife can dramatically increase the efficiency of your converting machine. If you are experiencing low runtime, low lifetime, or machine inefficiencies, changing to a new blade material may be the solution you need.

For example, many operators who are experiencing very low blade lifetime are using carbon steel converting knives. In this situation, simply changing to a new blade material, without changing the blade style, can increase lifetime, runtime, and production efficiency by days or months.

In razor slitting applications, converting knives manufactured of carbon and stainless steel often display the lowest production efficiency and lifetime. Upgrading the same blade style to tungsten carbide or Zirconia Ceramic can significantly increase knife performance.

In sheer slitting operations, 52100 and D2 are the most common, low-cost knife materials. To increase lifetime, runtime, and production efficiency, consider upgrading to M2, CPM10V or carbide inlaid bottom knives to dramatically improve non-woven material converting.

2. ADD A COATING TO CURRENT BLADE

The addition of a coating to your current blade is a simple way of improving lifetime and production efficiency. Selecting the best coating starts with understanding the cutting application. Experienced blade manufacturers can evaluate your unique converting needs and recommend knife coatings that will increase performance.

“Experienced blade manufacturers can evaluate your unique converting needs and recommend knife coatings that will increase performance.

PVD or Physical Vapor Deposition coating increases resistance to wear and corrosion. During the coating process, the coating material is vaporized, at a high temperature or in a vacuum chamber. The vaporized coating material is combined with a reactive gas and deposited onto the blade through the process of condensation.

The result is a hard, thin, chemically inert coating. PVD coatings are ideal for decreasing both abrasion and adhesion issues. Boron carbide, titanium carbide, and titanium nitride are commonly applied to converting knives using a PVD process.

CVD or Chemical Vapor Deposition increases lifetime and production efficiency. To apply a CVD coating, blades are placed in a chamber and

heated to a precise temperature to avoid material warping. A gas is then pumped into the chamber where a reaction with the blade material occurs to create a thin layer of coating material.

> **Coatings can also be applied to specific areas of the knife to relieve adhesion, abrasion, and wear issues that do not affect the entire knife surface.**

The process changes the chemical properties of the blade and results in a wear resistant coating that has excellent adhesion properties.

Titanium carbide is a hard ceramic material that is commonly applied using a CVD process to improve production and wear.

Coatings can be applied to the entire blade surface or limited to the cutting edge. When the converting knife only penetrates a portion of the material, the coating may only need be applied to the cutting edge.

Coatings can also be applied to specific areas of the knife to relieve adhesion, abrasion, and wear issues that do not affect the entire knife surface.

3. IMPROVE KNIFE HOLDER MAINTENANCE

Inadequate knife performance could be the result of improper knife holder maintenance. If the knife is not securely installed in the holder, it will display inconsistent wear patterns, will wear more quickly, and produce low-quality cuts.

To maintain the highest quality cuts and increase the lifetime of your blades, ensure that knife holders are rebuilt, cleaned, certified, and when necessary, replaced on a consistent schedule. If you are unsure about the condition of your knife holder, request an evaluation from your blade

supplier. Converting knife manufacturers can determine the health of your knife holder using pictures, videos, and even plant visits to ensure the maximum life of your converting blade.

Finding the best way to optimize your converting knives and cuts requires assessing all aspects of your converting operation, including cutting material, maintenance procedures, cutting volume, budget, and machinery. Work with a knowledgeable, experienced converting knife supplier that can recommend an ideal combination of solutions to meet your converting needs.

ABOUT US

Since 1965, American Cutting Edge has been a market leader in the design and manufacturing of industrial machine knives and razors. Our extensive product selection provides same-day shipping of a wide array of granulating, pelletizing, food and meat processing, wood chipping, converting, textile and fiber processing, flooring, and steel cutting knives and razors.

When an off-the-shelf solution won't work for your specific application, American Cutting Edge has the experience and resources to quickly engineer and manufacture custom machine knives and industrial razors. If you can imagine it (and provide us a sketch and dimensions), we can build it.

Need a steel or carbide wear part that is not a blade? Many customers rely on us to build steel wear parts that aren't knives or razors. As specialists in grinding and machining of large steel parts to precise tolerances, American Cutting Edge is more than just a knife and razor company. We're partners to our customer who help solve problems.

Contact us today and let American Cutting Edge help you solve your industrial machine knife, industrial razor, and tool steel wear part challenge.

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