The cutting edge.

SLITTING REFERENCE GUIDE
2ND EDITION

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Shear Slitting Theory Introduction

We are proud to present our second edition of this slitting guide with more pertinent information for your slitting process.

Added is information on knife side-load, set-up methods, and slitting dust. Slitting dust is the single most common problem converting and paper mill operations must deal with. We have therefore tried to identify what factors cause slitting dust, and what steps can be taken to reduce this problem.

The intent of this slitting guide is to be informative and educational. Because we offer the highest quality slitting, knives, holders, systems and service, we welcome your inquiries in support of your production process or machinery sales.

This guide is the result of the collective efforts of many people here at Dienes Corporation, USA and Dienes Werke. Germany. We hope the information presented helps your operation in a positive way.

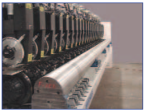
Dave Rumson, Editor
National Sales Manager

Bill Shea, Publisher
President

Contents

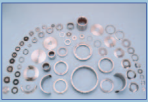
The Dienes Group: Locations

DIENES WERKE
Overath, Germany
Founded 1913
Knives, holders and positioning systems.
Phone: (+49) 2206 605-0

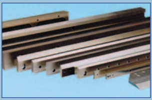


DIENES CORPORATION
Spencer, MA USA
Founded 1977
Knives, holders, systems, straight knives and roll shear.
Phone: (800) 345-4038 • (508)885-6301

NEUENKAMP
Remscheid, Germany
Founded 1926
Metal roll shearing (slitting) components and systems.
Phone: (+49) 2191 9351-0



EUROKNIFE
Piliscsaba, Hungary
Founded 1995
Slitting knives and holder components.
Phone: (+36) 26 575 520



KRUMM MFG.
Remscheid, Germany
Founded 1794
Straight knives for the sheeting and printing industries.
Phone: (+49) 2191-74058

DIENES ASIA
Petaling/Jaya
Phone: 011-603-78034036

DIENES POLSKA
Inowroclaw, Poland
Phone: 480-523-577033

Shear Slitting Web Paths

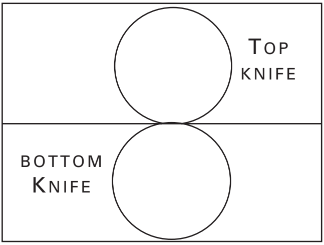
The two web path options for shear slitting are "wrap" and "tangential".

Advantages/Disadvantages

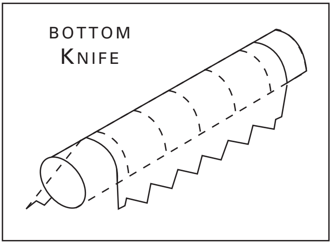
With either option it is **extremely important** to set and maintain the proper web tension for quality shear slitting.

A wrap web path offers better web stability for the slitters and generally produces less dust. The main drawbacks are the difficulty of changing bottom knives for different slit widths, and moving the required spacers

TANGENTIAL



WRAP



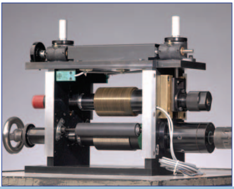
between knives to support the web. Certain films and pressure sensitive materials may be damaged in a wrapped web configuration.

A tangential web path allows *web-in* knife position changes and is better suited for operations that have numerous slit changes. Typically a 0.010" to 0.030" wrap is designed into a web path. Tangential webs allow for quick set-up changes but wrapped webs produce a higher quality cut.

Shaft Mounted Dished Blades

Shear slitting operations continually producing the same slit widths can benefit economically with two shafted arrangements. Two shafted systems are mostly seen on packaging, plastic film and sheet lines. Shear knives are located between precision spacers. The important factor is that long production runs with dedicated slit widths can be maintained.

Typically both shafts are connected with a gear or belt arrangement. Overspeed of the bottom knives is not required because both knives are now driven. Wide webs with many cuts require higher set-up and manufacturing precision on the bottom knives. Top knives usually have collars and springs



SHAFT MOUNTED BLADES

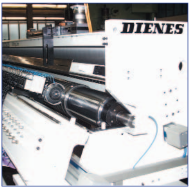
that provide a side load force and set-up flexibility when engaging the knife sets. Manufacturing and assembly tolerance can be broader this way.

The springs behind the top knives are stretched over the collar and sit in a groove, pressed against the knife blade. When the top knives are moved to contact the bottom knives, the springs flex to lessen the engagement contact forces. They also provide individual side load forces for each knife set…otherwise…setting the correct side load for each knife along the shaft, or even maintaining knife contact, would be difficult.

Pneumatic Top Knife Holders (Male)

Pneumatic knife holders are designed to make changing slit widths and knife blades easier. Different sized holders offer specific options for various materials and speeds of operation. In general, higher speed slitting operations benefit from large top and bottom knife diameters.

Most knife holders utilize air pressure to activate a vertical stroke, for web penetration, and a horizontal stroke, for moving the top knife against a bottom knife cutting edge, to establish slitting. It is important that these movements function properly. Damage to the top (male) knife from a too early, or too late, horizontal stroke is possible. Too early and the top blade edge is destroyed by



PNEUMATIC TOP KNIFE HOLDER

crashing onto the top of the bottom knife. This can also happen if the top knife is not initially set properly to the bottom (female) knife, in the downward stroke.

If the horizontal stroke function is too late during retraction of the vertical stroke, the top knife will slide off the bottom knife with the side load force still applied, causing the knife edge to be under excessive load, and then the blade will knick, or chip.

The bottom knife must be driven with a tangential web and the top knife follows by friction. Occasionally a wrapped web under high tension can drive a bottom knife, but this is a rarity in this day and age. Various mounting arrangements can make knife holders versatile for manual and automatic positioning systems.

Bottom Knives (Female/Anvil)

The most common bottom knife mounting arrangement is on a shaft, either inflating to capture the bottom knife I.D., or, a solid body with a mechanical locking method.

The bottom knife of a shear slitting system is typically designed to outlast the top knife by a factor of 10:1, if top and bottom knives are made from the same material, and because most often there is a longer down time associated with changing bottom knives than top knives. It should be larger in diameter and is usually harder by 1 to 3 Rockwell "C" points. Larger diameter means less rotating cycles of the cutting edge. A higher hardness

BOTTOM KNIVES (FEMALE)

assures that the "easier to change" top knife will wear down quicker. Bottom knives mounted on motors reduce the possibility of excessive axial and radial run out of the knife cutting edge.

- Shaft or motor mounted
- Designed with a higher hardness to outlast male knives
- Important to have a larger diameter than top knife
- Fewer cycles
- Reduced run-out

Bottom Knives (Female/Anvil)

Bottom (female) knives come in various mounting configurations. Most typical is the set screw locking design for non-expanding shafts. Attached to the set screw tip is a bronze, or brass, piece to prevent scarring of the shaft when the screw is tightened. If the shaft becomes damaged and raised edges occur, the bottom knives become difficult or impossible to relocate smoothly over time.

Eccentric locking knives are equipped with an eccentric inner ring and ball bearings that, when rotated, force the inner ring against the shaft. Usually some type of spanner wrench is required to loosen these knives.

Bottom knives on expanding airshafts do not require any tools or use of manual force to engage to the shaft. These shafts usually have air bladders that, when inflated, push a series of rubber retaining bands against the bottom knife I.D.

Over-speed is the practice of running the bottom knife slightly faster than the web speed. This is easily accomplished with modern digital drive systems. With a tangential web path, 3% to 5% bottom knife over-speed is sufficient for most applications. The bottom knife is over sped because the top knife is friction driven by the bottom knife.

Bottom Knives (Female/Anvil)

The top knife will lag the bottom knife in speed because of the material's resistance to being cut and mechanical friction losses of the contact point. If the top knife rotates too slowly, the material may fracture and tear instead of being sliced.

All the technical advantage is in using motors for driving bottom knives. Bottom knives mounted on motors reduce the possibility of excessive axial and radial run out of the knife cutting edge. But, the cost advantage is clearly with shaft mounted bottom knife systems, in most, but not all cases.

Dienes offers high torque bottom knife motors in slit widths less than 2".

BOTTOM KNIVES (FEMALE)

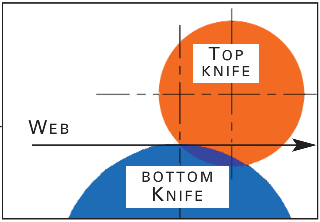
Typically a bottom knife is manufactured with a groove set deeper than the cutting edge. Contrary to the the idea that this is a dust collecting groove, it is a planned relief for future regrind operations. The grinding wheel must have clearance as it can not bottom out against a stop.

- Set screw locking
- Eccentric locking
- Inflating shafts
- Motor driven
- 3% to 5% faster than web speed
- Motor technical advantage vs. shaft cost advantage

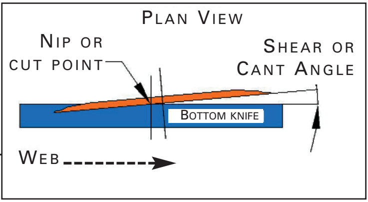
Tangential Shear Slitting

Below are four important geometrical relationships that can greatly affect slit quality, knife blade life and dust generation.

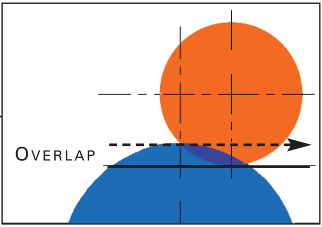
1. Cut Point



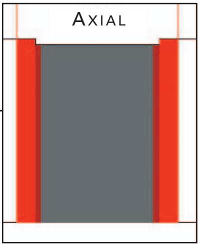
2. Shear Angle (cant angle or toe-in)



3. Knife Overlap



4. Dimensional Runout

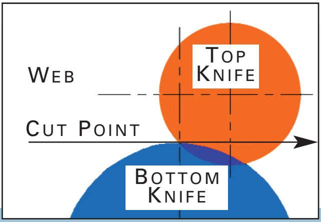


Cut Point (Nip Point)

Definition

The location where the web meets the contact point of the two knife blades. With a tangential web path, the top knife must be offset away from the on-coming web. There is a very narrow window for this contact point and initial design layout is important.

A wrapped web offers contact area everywhere the web touches the bottom knife. This area is much larger than with a tangential cut point.



APPLICABLE WITH TANGENTIAL WEB PATH

Web tension control is extremely important to the cut point. Low web tension leads to web flutter. Web flutter causes material sawing on the top knife blade resulting in increased dust. Excessive web tension can lead to web breaking or tearing.

It is similar to a pair of scissors sliding through wrapping paper with the blades stationary. If the wrapping paper is held in the proper tension, the scissors can be pushed through without opening and closing. If the paper tension changes, the paper will tear.

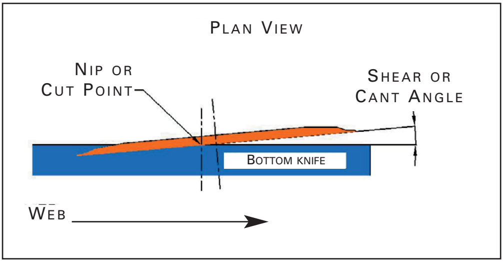
Maintaining a stable cut point is the single most important geometry to preserve.

This is where Dienes knife holders offer the best long term knife stability and performance. Rigid control of the cut point is essential.

Shear Angle Geometry

The "shear angle" creates the cut point by angling the top knife blade into the bottom knife. One side of the slit material must travel across and around the angle. The angle is set by the knife holder and should be consistent and set for the minimum required for any given material. Typically 1/2 degrees is sufficient for most materials. 1/4 degree or 3/4 degrees are sometimes used for certain other materials.

Because the top knife is thin and very sharp, the shear angle contact point on the bottom knife edge is very small. Depending on side load force applied by air pressure through the holder, the very sharp new top



knife edge quickly wears until enough surface area is formed that can support the side force load. Blade dulling begins immediately.

Loss of shear angle can lead to an open cut or nip point.

Shear Angle Geometry

RECOMMENDED ANGLE

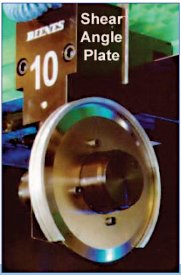
1/4 to 1/2 degree

Lower is better for longer knife life.

HEAVIER MATERIALS

3/4 degree

Precision shear angle plates, and rigid holders offer long term shear angle stability.



PNEUMATIC TOP
KNIFE HOLDER

In general, the lower the shear angle set-up, the better the slit quality with less dust generated. A higher shear angle will shorten blade life and increase dust potential.

To be effective, the shear angle must be precisely set and reliable. Machined angle plates accomplish this best when used with solidly designed and manufactured knife holders.

Vibration is the single most damaging operating effect to a knife holder. Holders with clearance guides are more susceptible to vibration damage, which reduces or eliminates the shear angle. Decreased shear angle causes an open nip. Over time, slitting performance decreases and dust levels increase.

Knife Overlap Geometry

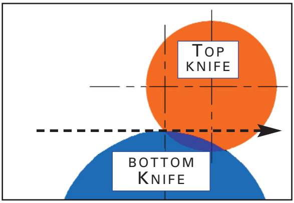
For shear slitting to occur, there needs to be a "Cut Point". This requires some overlap of the two knife blades.

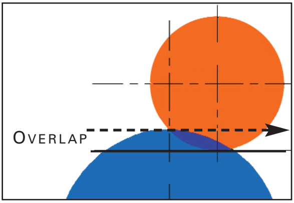
Overlap is defined as the distance the top knife is set below the tangential surface of the bottom knife.

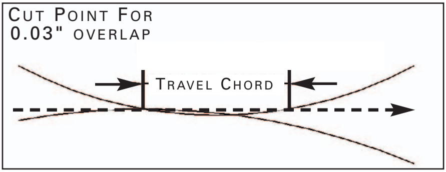
Overlap must resist dynamic operating forces while minimizing web material contact by reducing the "travel chord" between both slitting tools. The "travel chord" is defined as the distance the slit web must move, in contact with the beveled knife edge.

Dienes recommends 0.030" to 0.040" of overlap for most applications.

KNIFE OVERLAP GEOMETRY







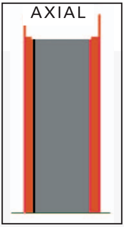
Challenges

- Dimensional Runout
- Machine Vibration
- Material Pressure
- Operator Set-Ups

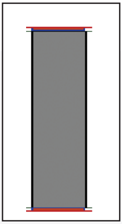
Dimensional Run-Out

Axial Run-Out

Dienes manufactures bottom knives to very tight tolerances to reduce the chance for negative run-out effects. Very high speed slitting applications require precise control of all run-out factors because knife wear is accelerated. This is one reason why motor driven bottom knives are used in paper mills. Another reason is that web widths can be 4 to 10 meters wide which makes using a shaft nearly impossible, and certainly not as cost effective.



Recommended
T.I.R. 0.002″ to 4,000 fpm
T.I.R. 0.001″ to 8,000 fpm
T.I.R. 0.0005″ to 12,000 fpm



Recommended
T.I.R. 0.004″ to 4,000 fpm
T.I.R. 0.002″ to 8,000 fpm
T.I.R. 0.001″ to 12,000 fpm

A simple axial run-out check is to mount and lock your bottom knives to the driven shaft. Then place a 0 to 0.010" dial indicator against the bottom knife edge and slowly rotate the shaft while noting the maximum dimension change. The dial indicator can also be placed on the bottom knife O.D. to measure radial run-out.

- The faster the web speed, the more negative the effect.
- Knife blade and knife holder life will deteriorate quicker.
- Holder response time may not keep up with impact frequency.
- Runout on shaft mounted bottom knives is even more difficult and critical to control.
- Shaft to knife clearance, shaft OD variations, knife OD variations and shaft deflection are added factors.

Slitting Knives

There is a lot of competition in the knife blade business. And like any other product, there is a difference from one manufacturer to another. Alloy content, alloy quality, heat treatment process control and manufacturing control are important factors to consider. Unfortunately, in the final analysis, price and operational performance are usually the governing factors for purchasing decisions in deference to knife life and performance.

Dienes manufactures slitting knives for shear and crush holders. Replacement blades for competitor holders are readily available.

Perf and heated knives are also available.

Knives

- Crush Cut
- Score Cut
- Shear Cut
- Perf Cut
- Scallop, Zip, etc.
- Heat Cut
- Split Bottom
- Grooved Sleeve
- Competitors
- Multiple Groove Knife Blocks

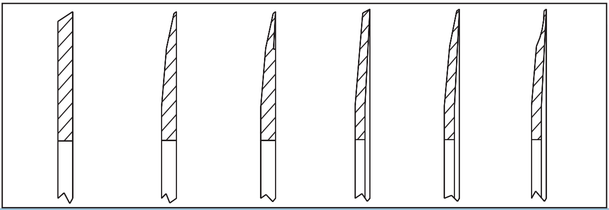
In addition to carrying a large inventory of knife blades, Dienes can manufacture special blades to fit most any application.

Knife Geometry: Shear Blades

There are many different top knife blade bevel options available. Factors for consideration are the material being slit, speed of operation, and side load force required.

Flat blades are machined from raw stock and generally used for higher speed operations, or high density material slitting. Paper mills and their finishing departments always use high quality steel flat blades. In general, depending on the blade material selected, flat blades cost two to four times more than dished blades.

FLAT BLADES DISHED BLADES



SINGLE DOUBLE DOUBLE W/RELIEF SINGLE DOUBLE DOUBLE HOLLOW

Dish blades are usually thinner than flat blades and can be stamped in high volume production runs and therefore less expensive. They are well suited for lighter materials, such as films, foils, nonwovens, etc.

Dish blades, with collar/spring supports lessen excessive side load force across driven, dual shaft arrangements.

Thicker blades create more web disruption and dust. Bevels are intended to reduce dust generation.

Dished blades were designed for dual shaft systems as well as knife holders without cant angle adjustment. Typically a coiled spring behind the blade creates a side load force for the top knife.

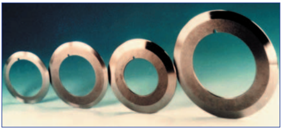
Considerations

- Material being slit
- Speed of web
- Side load force needed to slit material

Knife Geometry: Shear Blades

DIFFERENT MATERIALS, DIFFERENT BEVELS

A blade's circumferential edge will be machined with either 1 bevel, 2 bevels or 2 bevels with relief. The correct angles of these bevels are crucial for some applications.



-Cutting Edge Geometry- top knife		
shape of bevel	bevel design	application areas
	normal bevel S = 0,6 - 3 mm	strong materials like cardboard and others (robust cutting edge)
	double bevel S = 0,5	paper, light cardboard, textiles
	double hollow bevel S = 0,3 mm-0,5 mm	light paper, thin plastic materials

-Cutting Edge Geometry- top knife		
cutting bevel	angel of bevel - α -	application areas
	0 - 10 °	metals, laminates plastic materials, low edge distortion
	30°	paper, foils, laminates, fleece, cardboard
	45°	
	60°	special cases, film industry, sensitive cutting edges

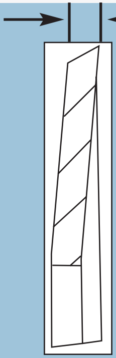
The purpose of a bevel is:

1. To allow the blade to present a sharp thin edge to the material.
2. To minimize the amount of material deformation caused by blade penetration.
3. To offer a strong, durable and reliable cutting edge.

Top Knives (Male)

Blade Bevel

Single bevel blades are better suited for heavier materials and web speeds up to 4,000 - 5,000 fpm. They will produce more dust compared to multiple beveled blades.



Guidelines

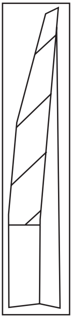
Single Bevel

- Tough materials
- .6mm - 3.0mm primary bevel width

Top Knives (Male)

Blade Bevel

Double bevel blades are better suited for medium to lighter materials running at speeds up to and above 8,000 fpm. Double bevel blades are the most common blade in use today for almost all industrial slitting markets.



Guidelines

Double Bevel

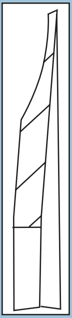
- Most applications
- Reduces dust
- Higher speeds of operation
- .5mm primary bevel width

Top Knives (Male)

Blade Bevel

Double hollow ground bevel blades are good for slitting light materials and adhesives. They offer less area for sticky substances to adhere. They are somewhat speed limited but produce much less dust because of the lessened path the slit edge must travel in contact with the blade.

Edge cut profile is typically very clean.



Guidelines

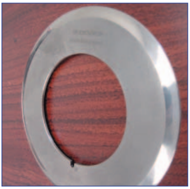
Double Hollow Bevels

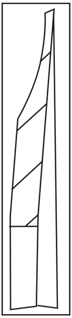
- Light paper, tissue, plastics, foil
- Adhesive slitting
- .3mm to .5mm primary bevel width

Shear Knives Surface Finish

There is no question that top (male) knife blade surface finish is an important factor for quality slitting. The rougher the blade surface the more potential for web edge damage. For this reason standard Dienes blades have a minimum 8 RMS finish.

Highly polished, or super finished, less than 1 rms, double hollow dished blades, provide the absolute best slitting presentation for any material, in this regard.





Guidelines

Double Hollow Bevel

- Reduced travel chord
- =<1 rms finish
- Best performance

Knife Metallurgy

Top Knives

52100

Typically 60 to 70% of the knives are made of 52100. It's a very high volume seller and is used in the ball bearing industry.

52100 is a very nice knife material because you can heat treat it up into the mid Rockwell 60's and it is very economical. 52100 is readily available in the market, which helps to keep the price of the knife down.

It has decent wear resistance similar to A2 tool steel, even though 52100 is not typically a tool steel. It has OK corrosive properties with a machinability rate of 40%. Machinability is a measure used in the metals working industry as compared to 11L7 Alloy which is 100%, 52100 being 40% machinable as compared to 11L7. It shows good shock resistance and is not expensive. It has high ultimate yield strength, the same as tool steels.

- Low chromium, high carbon alloy steel
- Easily hardened to 65Rc, tempered to 60-62.5Rc
- Fair resistance to wear
- Corrosive resistant properties
- Machining rate of 40
  (ease of stock removal compared to 11L17,@100%.)
- Better resistance to shock than tool steels
- Less expensive than tool steels
- Can heat treat to tool steel mechanical properties
- High ultimate strength (minimum standard for knives)

D2

The first level of tool steel that you see in the market is a D2. D2, out of all the tool steels, has the best wear resistance. However it doesn't have the best shock resistance.

With deep hardening, it's capable of going up to 64 Rockwell C. Every knife material we present can be hardened to 65 RC.

D2 is not applied to slitting at 65 RC because it is very brittle. It is to be drawn back to 60 to 62 Rc. And a knife, whether it be 52100 or D2 or any other knife (material) is always hardened to 60 to 62 RC. Some people say D2 is harder than 52100. It's not. They are all made to the same hardness.

Knife Metallurgy

But D2 has high wear resistance because they've added 12.5% chrome to the material as opposed to 1.2% on 52100.

Machines to 45% as opposed to 11L7. Not good in shock resistance where 52100 will take a hit better than D2 will, and it's expensive. It's much more expensive than 52100. You have to heat treat to around 2100 degrees F, where 52100 is around 1700 degrees F. So the heat treat is more expensive and the raw material is more expensive. They have similar mechanical properties with high ultimate yield strength.

Top knives

M2

A third material you see quite often is M2. M2 has better wear resistance than D2. Another reason you would use M2 over the others is high temperature slitting, because it has a high annealing temperature. Each time you pick up an attribute in a material your going to give something up. It can be hardened to 65RC but again the knife is drawn to 60-62.5 RC.

M2 has good wear resistance and good corrosive resistance. It can be machined easier than some of the other materials, but has poor shock resistance.

Higher cost. Raw material cost of an M2 is twice as much as D2.

CPM-10V

CPM10V is the top of the line in slitting blade material. Because it is a mixed particle metal with excellent alloy distribution it offers the best in wear resistance and is mostly used by paper mills and paper converters with high speed slitters. CPM10V offers long run capability and minimum down time.

Most converting slitter applications do not require the use of CPM10V material because the slitting speeds are moderate and adequate blade material, like 52100 and D2, are much less expensive. Also, with proper holder designs, material like D2 can have knife slitting lives that span the time between scheduled downs.

Knife Metallurgy Top/Male Knives

All top knives hardened to 60 –62.5 RC

52100
- Low chromium, high carbon alloy steel; 1.2%
- Fair resistance to wear
- Better resistance to shock than tool steels
- Less expensive than tool steels

D2
- High chromium, high carbon cold work steel; 12%
- Best wear resistance of tool steels
- Poor resistance to shock
- Higher cost than 52100, less than high speed steels

M2
- Medium carbon, high molybdenum tool steel
- Very good wear resistance
- Poor resistance to shock
- Higher material costs than D2

CPM10V
- Particle metal
- Life close to carbide
- Excellent wear capability
- Higher cost than D2; less expensive than carbide
- Top knives only\ paper mill choice

Note:

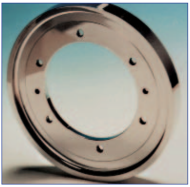
It is extremely important that when CPM-10V runs against D2, CPM-10V's hardness should be in the 58-60 RC range.

Knife Metallurgy Bottom/Female Knives

Cemented Carbide

Sometimes anvil/bottom knife cutting edges are made out of cemented carbide. Cemented carbide by far is more wear resistant than any tool steel. Typically Dienes uses C13. C13 has 13% cobalt, which is the cement.

Carbide can be hardened to 71-73 RC. Blades will not cut into a carbide anvil roll, but it's very, very expensive. A high speed steel or 52100 hardened anvil sleeve might cost in the neighborhood of $300. One of these would easily cost $3,000. They have very poor shock



CEMENTED CARBIDE (C13)
BOTTOM KNIVES ONLY

resistance. If you drop or mishandle the knife, there's a good chance your going to ruin it. Withstands high compressive strengths too.

Most applications for cemented carbide are bottom knives on high speed paper slitting lines that also use CPM10V for the holder top knives. These two materials are about the best you can get for long life slitting.

- Fine grain structure, cobalt bonded
- Hardening to 71-73Rc
- Excellent wear resistance
- High cost
- High machining rate, 5
- Very poor shock resistance
- Low tensile strength

Female knives are more commonly made from 52100 or D2 steels.

Knife Metallurgy

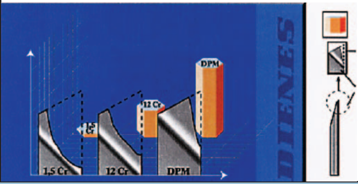
Superior blade material has a higher cost. Companies must weigh increased blade performance and longer life with the up front costs.

If better quality blade material matches time between scheduled downs, the higher cost might be justified.

Typically, within highly productive and well controlled slitting operations having high quality standards, the higher up front costs translate into longer, more efficient production runs.

Knife Quality

Service its components



Material quality

particularly new cutting edge

cutting edge aggrandized 100 times

Better metal insures lower operational cost over time

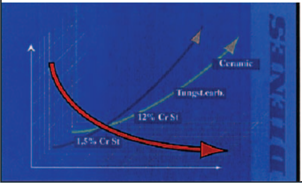
KNIFE QUALITY

Knife Quality

Knife operation costs a shift operation considering.

Material quality
Knife costs
Increased service intervals

reduced regrinding costs
reduced stock keeping
reduced knife demand
reduced machine downtime



Knife costs

Service life expectancy

Knife operation costs

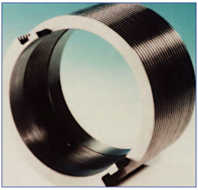
Better metal means longer life with a higher up front cost

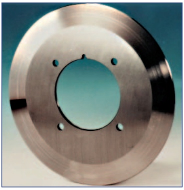
Knife Metallurgy

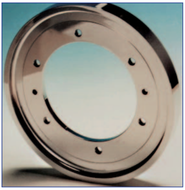
GOAL

Build a good Martensitic structure within a well straightened blade.

Temper twice, straighten three times, that's what makes one blade better than another.







Key Elements

- Heat treatments
- Tempering
- Straightening

Concerns

- Retained austenite
- Brittle knife; chipping
- Runout

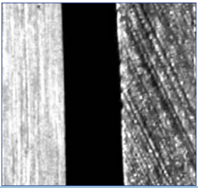
Knife Regrinding

Purpose

Restore original geometry and finish. Minimum surface finish should be 12 rms. Dienes regrinds typically to 8 rms. Photo paper, 35 mm film and other sensitive materials require a 3-4 rms finish. A super finish is less than 1 rms.

Caution

A regrind depth less than 0.010" to 0.015" may retain subsurface fractured material which sharply lessens knife life and may cause blade chipping or breakdown. Over-heating during regrind may cause material annealing (softening). Look for a straw color.



KNIFE REGRINDING

Improper burr removal may cause blade chipping and breaking. Poor concentric grinding can affect slit edge quality.

Poor regrinding may lessen optimum knife performance.

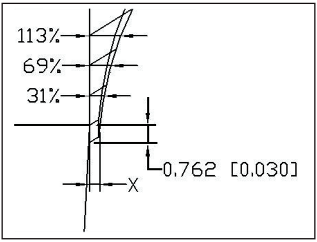
The blade on the right has grinding marks running to the outer edge of the blade diameter. When the web material traverses this regrind, the hills and valleys will rub against the material to damage the slit edge and generate more dust than necessary.

The concentric regrind on the left is with the web path. The rubbing effect is reduced significantly to produce a better slit edge with less dust.

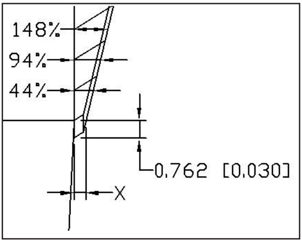
Knife Regrinding

Knife regrinding increases the blade area the slit web must traverse after being slit.

Shown here is the comparison of increased traverse area between double bevel and double hollow bevel with subsequent regrind operations.



Double Bevel



Double Hollow Bevel

KNIFE BEVEL SHAPE
REGRIND EFFECTS

1st	0.030" regrind	44% and 31% increase
2nd	0.030" regrind	94% and 69% increase
3rd	0.030" regrind	148% and 113% increase

Dienes GR-1 automatic precision knife grinder

It is recommended that top knife blades be reground in sets.

To conclude our knife regrind section, a poorly manufactured, misapplied knife or a bad regrind can lessen slitter performance, cause operational down-time and create customer dissatisfaction.

Shear Knife Holders

The purpose of a shear knife holder is to maintain all the geometry arrangements to properly shear slit.

It must be sized properly for any given material. In the long run, a holder must be reliable and maintain its structural integrity by resisting vibration and the normal wear and tear of vertical and horizontal operation.

The ease of set-up for web width changes and dull blade exchange are also important. There are many different designs available, but there should be careful consideration when selecting a particular holder. Bronze on steel

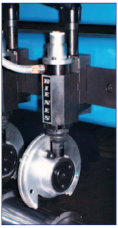
MAINTAINING SHEAR GEOMETRY: THE PNEUMATIC SHEAR KNIFE HOLDER

sliding members will wear significantly over time. Excessive wear generated holder looseness changes the shear angle and cut point with detrimental effects to slit quality.

Shear Knife Holders: Operation

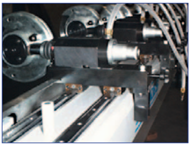
MOUNTING METHODS AND SET-UP RATING

The most common and least expensive method of mounting pneumatic holders is using a dovetail arrangement. Dovetail mounting is used for manual positioning applications. Setting the proper holder location for horizontal knife travel relative to the bottom knife is somewhat time consuming and tricky. It would be best suited for long run, dedicated set-ups.



Dovetail

- Somewhat difficult set-up
- Most economical



Dual Linear Bearing

- Smoother set-up and higher speeds.

Center Linear Bearing (CLB)

- Cost effective and smooth set-up

Linear bearings offer very smooth and easy holder positioning. They are more expensive than dovetail mounting but well suited for those applications requiring frequent change.

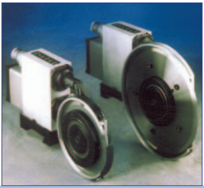
A third alternative is a Center Linear Bearing design which offers a single linear bearing and a double brake assembly spanning the holder length. The "CLB" offers the smoothness of linear bearings and a cost closer to dovetail for manual systems.

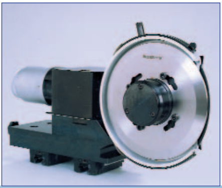
Shear Knife Holders: Operation

Vertical stroke is defined as the pneumatically actuated approach of the top blade towards the bottom blade.

Vertical stroke must be smooth and consistent. Holders must fully retract for thread up and travel full stroke to set the proper overlap depth. Holders with vertical stroke micrometer adjustment offer the best position control.

There must be enough air pressure to maintain the overlap depth. It should be regulated and reliable. Loss of air pressure can cause the blade to jump onto the bottom knife outside diameter with instant destruction and danger of blade fragmentation.





VERTICAL STROKE

Because there is a set shear angle, the horizontal side load contact force wants to twist the holder away from the cut point. Holders with vertical support clearance can loosen under vibration, load, and wear to twist and decrease the blade shear angle.

A decrease in shear angle helps reduce dust generation. But, at some point, as steel continually wears away the typical bronze bushing, and holder looseness increases, the loss of shear angle will cause an "open nip" situation. Then the web material will be "pinched" and dust levels will increase dramatically.

Dienes' Elite DF holder family, with dual shafts, offers zero vertical stroke clearance with preloaded ball cage bearings. There is no change of the set shear angle.

Shear Knife Holders: Operation

Side load is defined as the horizontal force exerted by the top blade against the bottom blade.

Side load must accomplish the following:

1. Keep the two blades in contact. Blades that disengage stop cutting and impact unnecessarily when re-engaged.
2. Overcome vibration. Excessive machine vibration may shorten knife life.
3. Resist dimensional runout and material pressure to not be cut.

SIDE LOAD
HORIZONTAL STROKE

4. Be repeatable. Apply the same force for a repeated air pressure. 1/2 lb. to 9 lbs. typically. Larger forces reduce knife life.

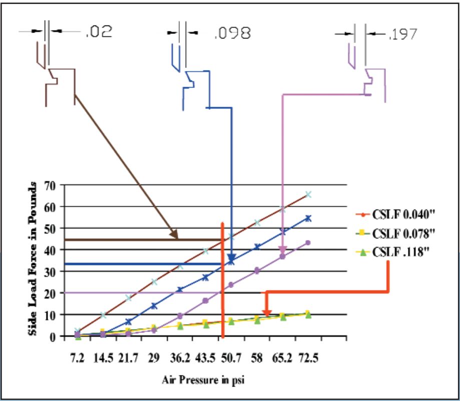
Dienes' Elite DF Series holders have a separate air supply for the horizontal stroke operation. High pressure to secure the vertical and a lower side stoke pressure to reduce wear.

Note: When manually rotating the top knife blade to gage relative knife force, **never** rotate the blade in the same direction as the web travels. By rotating the blade into the stationary harder bottom knife, the effect is to be shearing the softer top knife.

Shear Knife Holders

Side load affects (4lbs. to 9lbs.)

All knife holders utilize air pressure to activate both a vertical and horizontal stroke. The air pressure must overcome a mechanical return spring that is used to return the slitting blade to the vertical activating position once air pressure is removed. This return spring affects the amount of side load force, to varying levels, based upon how far away the horizontal stroke must travel to contact the bottom knife anvil from its set-up location. Working friction also affects side load.



The above graph shows the side load differences for one model top knife holder when the horizontal stroke starting location varies. As can be seen, the closer the blade is to bottom knife, the higher the side load force will be. This is a major factor relative to knife cutting life inconsistencies.

The reality is that the needed side load force for almost all materials is less than 10 pounds, and closer to the 4 pound level.

Dienes offers patented knife holders that, when activated, remove all the return spring effects, and provide for setting the minimal side load force needed to cut a given material. This greatly extends blade life.

Shear Knife Holders: Operation

Both blades need to rotate. Typically, the bottom blade will be driven by a motor, a belt or a shaft. The top blade will be driven by friction.

It is recommended to calibrate the bottom blade surface speed at 3-5% over that of the web. In some cases 10% may be acceptable.

This over-speed enables the top blade to keep up with the web pressure and yield smooth, break free slitting.

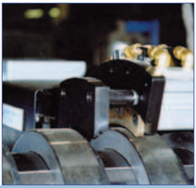
BOTTOM KNIFE
OVER-SPEED

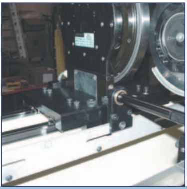
The over-speed factor is dictated by web material and the mean operational speed. Generally, lower speed operations gain little with over-speeding.

Positioning Methods

With dovetail mounted slitting holders, setting slit width is accomplished with a tape measure or a frame mounted scale. The mechanical reality may affect accuracy and cause excessive time with repeated tries.

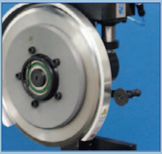
With linear bearings, small, quick holder adjustments can be made easily. Because they move smoothly they lend themselves to digital strip, or laser locating devices with digital readout. Automatic positioning systems require the linear bearing advantage. Significant set-up change time gains and slit width accuracy are always seen.





Rack and pinion designs are flexible but offer the abuse of easily increasing blade side load force to get longer runs at the cost of process quality and dust generation.

- Tape measure females & trial and error males
- Laser females & mechanical link males
- Magneto-strictive location and linked female and male
- Automatic females and males



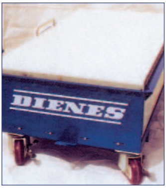
Holder and Knife Care

In the long run, knife holder and knife blade maintenance are as important as any set-up made to slit product. Careless handling of blades and holders can result in unnecessary injury and compromising of the slit quality caused by nicked blades. There are many products on the market to lessen damage to hardware and personnel.

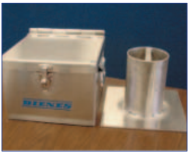
Dienes offers safety gloves, special knife shipping containers, storage shelving, and wax protection for reground knives.

WHAT NOT TO DO!

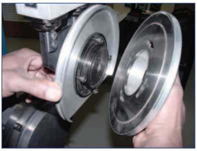
PERMANENT STORAGE CABINET



MOBILE KNIFE BOX



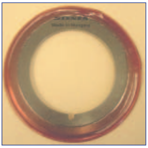
SHIPPING CONTAINER



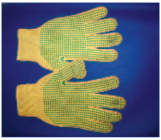
MAGNETIC BLADE REMOVAL TOOL

Maintenance Program

- Knife handling
- Safety gloves
- Edge protection - wood surfaces
- Peg mounting - in queue
- Packaging for regrind
- Knife and holder storage cabinets
- Magnetic blade removal tool



WAX PROTECTED KNIFE EDGE



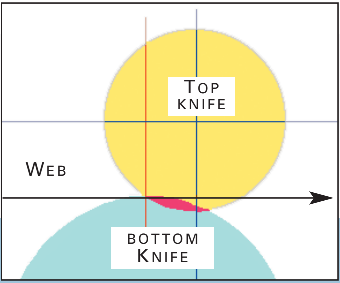
SAFETY GLOVES

DF Technology

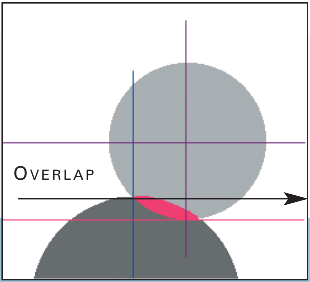
What is DF Technology?

Shear slitting knife holders should be manufactured to maintain the four basic geometric design principles of shear Slitting:

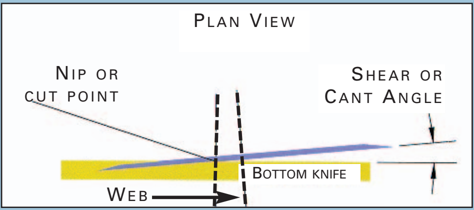
DF Technology is the use of three (3) pre-loaded, anti-friction, zero clearance linear bearings, to support and prevent the lower knife head from compromising any of these four geometric design principles.



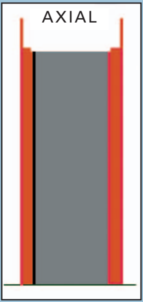
• Cut Point



• Knife Overlap



• Shear Angle



• Knife Run-out

DF-Technology

Advantages

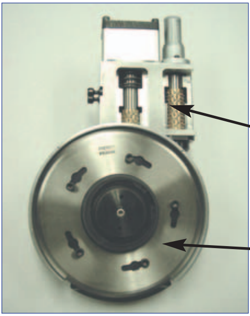
- Dual shaft support
- Anti-friction preloaded ball cage bearings
- High precision manufacturing
- Maximum rigidity
- Superior vibration resistance
- Far exceeds bronze yoke supported shafts
- Independent side load air pressure

Benefits

- Better slit quality
- Improved dust control
- Longer knife life

Dienes DF Holders

The DF-50, DF-70, DF-150-200 & the Driven Top Knife holders have preloaded, zero-clearance, caged linear ball bearings, supporting horizontal and vertical stroke travel.



VERTICAL STROKE
Preloaded ball cage bearings

HORIZONTAL STROKE
Preloaded ball cage bearing

Slitting Dust

The first thing to note is that when slitting, there will always be slitting dust. No matter the web material, no matter the slitting method.

That's why it's important to know what causes dust…and what can be done to lessen its impact on your operation. Film and foil may produce less dust, but over time it will accumulate.

There are many contributing factors for dust. Blade set-up errors, poor design, mechanical characteristics, and the web material itself, can lead to excessive dust generation. Beware of those professing "dust free" slitting.

To understand slitting dust we must be aware of slitting geometries. Various angles, shapes and blade holder clearances can, and do, effect when and how much dust will occur.

Basic geometry is the relationship of the web to be cut, to many factors. They are the exact location of the knife holders/blades for the best possible cut, the ability to maintain the proper holder/knife/blade/web location(s) and the knife shape itself.

Knife geometry is the shape of the knife cutting edge. The materials the knife is made from can effect slitting performance.

How effective the knife holder is in maintaining the proper geometry of the cutting tools relates to the design and ruggedness of the holder. Accuracy and consistency of set up, forces applied and safety are effected by the set up procedures and tooling themselves.

Always slitting dust, all slitting methods, know why...

Contributing Factors

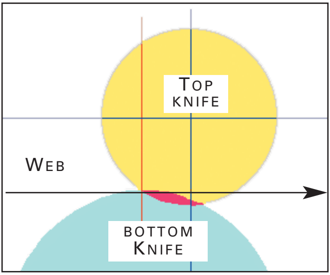
- Geometric relationships; blades, angles
- Blade set-up errors
- Poor design; web path
- Holder factors; looseness
- Web materials

Slitting Dust

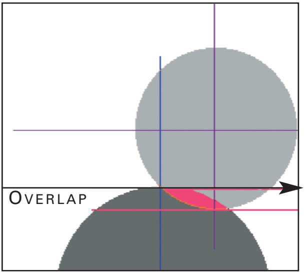
Tangential Shear

The starting point regarding slitting dust is to adhere to the geometric fundamentals discussed earlier in this book. Cut Point, Overlap, Shear (cant) Angle, and Run-out.

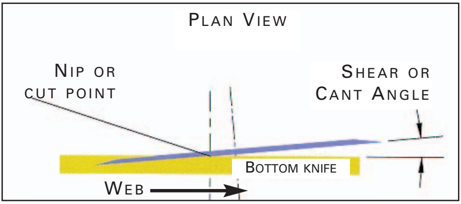
As we have discussed the function of these slitting geometries, we will now see how they affect dust generation.



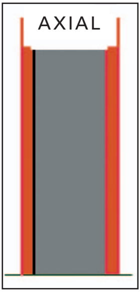
Cut Point



Overlap Geometry



Shear Angle Geometry



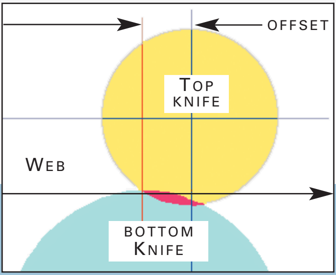
Run-out Geometry

Slitting Dust

Cut Point:

The Cut Point is designed into all shear slitting systems. Based upon the knife diameters and the web path, mounting locations are set in the manufacturing and assembly drawings. Operators have no control over offset. This is a critical element of controlling dust generation.

The amount of web tension plays a key role in limiting dust. If a web is loose, or floats into the slitters the material will contact the top (male) knife before the Cut Point. The web is then sawed as the blade "bursts" through it. Just as tension control is important to winding a roll, it is as important for web slitting, controlling a clean roll edge, and limiting dust generation.



Cut Point

Cut Point

- Most Important: the objective
- Minimal web tension: flutter and sawing
- Excessive web tension: stretching and breaks

Slitting Dust

The shear angle contributes to slitting dust generation by the amount of planned angle, the unplanned decreasing angle and as a cause of blade dulling.

One side of the slit material must travel across and around the angled blade. This by itself will cause damage to the web edge and contribute to dust. The angle is set by the knife holder and should be kept to a minimum; 1/4, 1/2 or 3/4 degrees, depending on the material to be cut. The steeper the angle, the more the web is disrupted after it is cut.

If a knife holder is manufactured with internal clearances, it can not maintain the planned shear angle because, as side load is applied when contacting the bottom knife, the loose components shift until the clearance is taken up. A 0.0065" looseness can remove a full 1/4 degree of unplanned shear angle from some holders.

After approximately six to twelve months of 24/7 operation, knife holders made with bronze and hardened steel sliding components, will affect a change in the amount of shear angle. With increased looseness, the side load forces will push the knife blade closer to an open nip, or Cut Point, situation. This will severely increase the amount of dust generated as the web becomes pinched, rather than being sliced.

Knife holder looseness can be checked for by wearing safety gloves and twisting the knife holder lower head arrangement side-to-side. There should be zero movement. Dienes holder designs offer two shafts to hold the knife lower head assembly. Unlike other dual shaft designs, the Dienes DF family of holders utilize pre-loaded, caged, linear ball bearings to prevent any change in the basic geometric requirements.

As a knife blade edge becomes dull with operation, a less clean cut of the material causes more dust. Blade nicks compound the dust situation.

Not much can be done about this except for maintaining the minimal shear angle, by not using loose blade head holders, and possibly looking at high chromium knife blade materials to keep the sharp edge as long as possible.

Shear Angle (cant angle, toe-in)

- Web travels across the blade
- Planned shear angle 1/4,1/2 or 3/4 degrees
- Unplanned angle side load force;edge support
- Open nip, holder integrity
- Blade dulling, high chromium blades

Slitting Dust

Too much top knife overlap depth is the single worst set up error to make. There are three significant ways too much overlap contributes to dust when slitting with a tangential web path. They are:

1. Increased web travel chord distance.
2. Change of the Cut Point.
3. Wider blade width.

With a wrapped web path only 1 and 3 contribute to slitting dust. The cut point can be anywhere the web is in contact with the bottom knife. It is still very important that the blade be held rigidly in place.

Excessive Overlap

The most common problem and single worst error

Slitting Dust

1. Increased web travel chord distance.

The deeper the blade, the longer the travel chord distance the web rubs against the blade, after slitting.

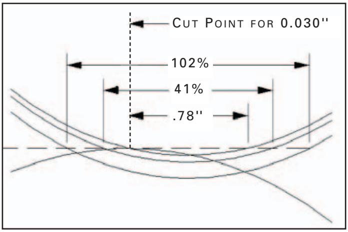
When a knife set cuts the web, one side of the slit travels straight through, over the bottom knife O.D.

The other side is directed by the top knife blade shape (bevel), on an angle away from, but in contact with the top knife itself.

The distance traveled is the "Travel Chord". Generally there is minimum bottom knife web support.

Because the web is, as it should be, in tension through the slitters, the web is pulled against the knife blade as it rubs across the Travel Chord.

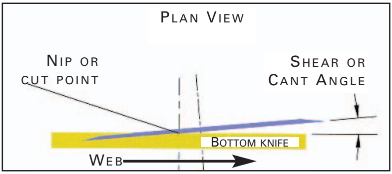
The exception is made when a totally flat top knife blade is used. The flat knife has a near square O.D. that, after slitting actually mirrors the opposite cut that travels over the bottom knife O.D., except upside down under the top knife.



Chord for a 6" O.D. blade

Excessive Overlap

- 0.030"-0.040" depth recommended
- At 0.060" depth, chord length increases by 41%
- At 0.125" depth, chord length increases by 102%

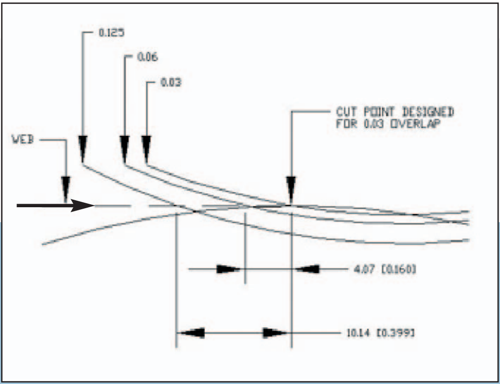


Shear Angle Geometry

Slitting Dust

2. Changing the Cut Point.

Excessive overlap moves the front of the top blade away from the cut point towards the oncoming web. With the web in proper tension control it is no longer in contact with the bottom knife O.D. The top knife pushes the web downward, penetrates and is sawed before it reaches the Cut Point.



Excessive Overlap

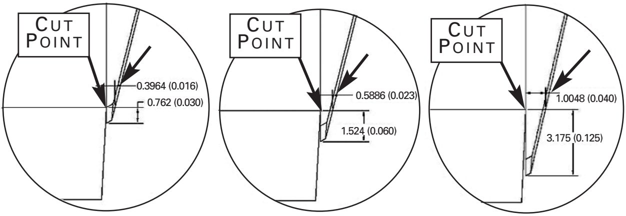
Note: With a wrapped web the cut point would follow the curvature of the bottom knife, therefore eliminating "web sawing" effects. But, the deeper the overlap, the larger the travel chord distance.

Slitting Dust

3. Increased Blade Thickness.

Because the top knife has one side with a bevel, the further up the tapered blade the web is cut, the wider the area the web must traverse as it starts across the Travel Chord.

A 6" diameter standard double beveled blade set to 0.030" overlap presents a blade thickness of 0.016" at the cut point. This minimum blade width will produce some dust.



PNEUMATIC TOP KNIFE HOLDER

If the overlap is increased to 0.060", the blade thickness increases by 44% to 0.023".

If the overlap is increased to 0.125", 1/8th inch, the blade thickness increases by 148% to 0.040".

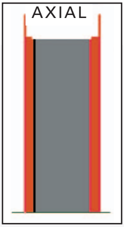
Although you may not consider these large areas, web speed, amount of material to be slit, and material fragility compound the problem of dust generation.

Slitting Dust

There are two types of run-outs affecting slitting and indirectly, dust: Excessive axial run-out and radial run-out cause cyclic changes in overlap depth and blade thickness. Both will increase knife blade wear, or dulling.

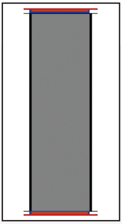
These run-out conditions can be the result of poorly designed, improperly manufactured, inadequately mounted, or improperly reground tools.

Inadequate or worn-out holder bearings, worn-out vertical or horizontal pneumatic piston rods (guides) and poorly designed or worn-out knife mounting surfaces can cause run-out.



Axial Run-Out

Recommended T.I.R. 0.002"



Radial Run-Out

Recommended T.I.R. 0.004"

Shaft driven bottom knives are susceptible to run-out based on knife O.D., width, and shaft mounting clearance. Cocking should always be avoided.

A simple axial run-out check is to mount and lock your bottom knives to the driven shaft. Then place a 0 to 0.010" dial indicator against the bottom knife edge and slowly rotate the shaft while noting the maximum dimension change. The dial indicator can also be placed on the bottom knife O.D. to measure radial run-out.

Worn out holders or poor mounting

Axial Run-Out Effects

- Cyclic side load: blade dulling
- Knife holder life: bearing wear
- Holder response time: blade impact

Radial Run-Out Effects

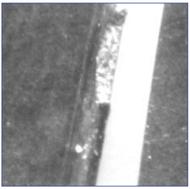
- Overlap change: travel chord, blade width, web sawing
- Dial indicator checking

Slitting Dust

Obviously, the sharper the blade, the cleaner the cut with less dust.

Because of the shear angle required to cut, the blade edge immediately begins to lose sharpness when set in operation. Maintaining sharpness is dependent on: 1) the amount of shear angle, 2) the amount of holder side load force applied, 3) the knife blade material itself, 4) the web material being slit, and, 5) the speed of blade rotation.

There is no clear standard to quantify blade sharpness. Often a lessening cut quality, or increased dust generation establish knife change over time. Dienes recommends standard blade changes during planned P.M. shut downs.



How to gauge sharpness
What not to do!

One important note: when first setting the top knife holder manually to gauge side load force, only rotate the blade by hand in the opposite direction of normal operation. By rotating the blade in the opposite direction of normal operation you ensure that the stationary bottom knife sharp edge will not "cut" the top knife.

Dull Blades

- Sharper the better
- Immediate loss; shear angle
- Holder response time: blade impact

Maintaining sharpness depends on:

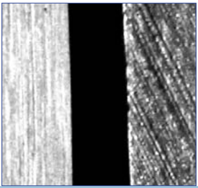
- Amount of shear angle
- Amount of side load force
- Knife blade material
- Web material
- Speed of operation

Slitting Dust

Regrind Surface Finish

Knife blade surface finish also plays a role in dust generation. Basically, rough blades can fray slit edges as they traverse along the blade surface. Typically a minimum 8 rms (root mean square) finish, measured with a profilometer, is required. Some high speed paper slitters running at 6,000 to 9,000 fpm have a "super finish"; less than 1 rms.

Regrind direction can also effect dust generation.The blade on the right has grinding marks running to the outer edge of the blade diameter. When the web material traverses this regrind, the hills and valleys will grate against the material to damage the slit edge and generate more dust than necessary.



Regrind Quality is Important

The regrind on the left is "with" the web path. The grating affect is reduced significantly to produce a better edge with less dust. Interestingly, both of these blade grinds can measure the same rms finish.

Knife Thickness Regrind Effects

Regrind Purpose

- Restore original geometry and finish
- Remove fatigued metal
- Poor regrinding may lessen knife performance
- Rough surface frays slit edges
- Grind direction with the web path

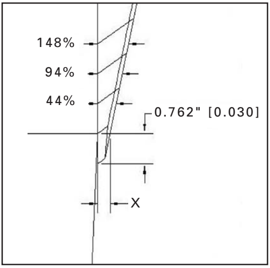
Slitting Dust

Knife Thickness Regrind Effects

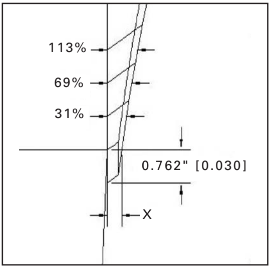
Knife regrinding can increase slitting dust generation in the same way as excessive blade depth. When a blade becomes dull and is reground to return the sharp edge, usually the second bevel is not touched by the grinding operation. Typically a minimum of 0.015" to 0.030" of the blade must be removed to eliminate sub-surface, fractured material. This in effect increases the blade width when a 0.030" depth is made during the next set-up.

Shown here is the comparison of increased thickness between a double bevel and a double hollow bevel after regrind operations, each removing 0.030'' of material.

Double Bevel



Double Hollow Bevel



With each regrind, and subsequent new depth adjustment, a thicker blade area becomes exposed to the slit web, causing greater and greater web deformation during slitting. The change of blade width is shown as a percentage of increase from the original width. It is less damaging with the double hollow bevel blade because it is thinner.

It is possible to regrind both bevels, but it is not usually done.

Remove 0.015'' to 0.030''; sub surface fractures

1st 0.030" regrind results in a 44% & 31% width increase
2nd 0.030" regrind results in a 94% & 69% width increase
3rd 0.030" regrind results in a 148% & 113% width increase

Double Hollow Bevel can be fully reground

Slitting Dust

Most all pneumatic top blade knife holders have both vertical and horizontal strokes. Vertical stroke moves the knife blade to a point through and below the web path. The horizontal stroke moves the top knife blade into contact with the bottom knife.

Operators control the amount of overlap of the top knife to the bottom knife. We have already seen the numerous ways too much overlap can contribute to dust. Too little overlap can lead to "knife jump". This is when run-out, or a lessening of air pressure, causes the top knife blade to lift over and onto the top of the bottom knife blade.

Immediately the top knife will be destroyed. In addition, because of the continuing horizontal stroke, when the top knife jumps a carbide inserted bottom knife, it can slide into the carbide/tool steel adhesive joint and slice the carbide ring off.

Operator Set-Up

Blade Depth

- Too much overlap; increased dust
- Too little overlap; knife jump
- Too much run out; knife jump

Horizontal location

- Knife side load

Slitting Dust

It is extremely important to maintain a flat, taut web through the slitter section. In-feed and exit rolls create a tension zone of sorts, and the proper web path. Unwind brakes and pull rolls, nip and wrap designs, can greatly improve the slitting operation as well as contribute to good finish roll formation.

Some materials, like paper and board, run at very high web tension…usually measured in P.L.I., (pounds per linear inch of width). Two to sixteen P.L.I. for paper grades are common.

High web tension by itself does not create dust. But, dust creating factors such as excessive overlap and run-out, dull blades, and loose holders accentuate dust creation at the higher web speeds paper products are typically run; 4,000 fpm to 9,000 fpm.

Thin, delicate materials, such as nonwovens and tissue, may run at web tensions below 1 P.L.I.. Some even to 1/4 P.L.I. on webs in excess of 100" wide. Web bounce at the slitter section is a major concern. Not only does the bounce cause dust, it also lifts the web off the cut point into a sawing effect.

With low web tension materials, consideration should be given to use low inertia, "tendency-driven" idler rolls or "wrap pull rolls" to help control web tension.

Gauge bands across the web width, possible in both high and low tension materials, may cause a taut web in one location and floppy looseness in another spot. An entry bow roll should be considered to help keep the web flat to the slitters.

Another concern can be a wind effect from drive blowers and/or poor air flow that lifts the web and contributes to dust creation.

Web tension: PLI

- Tension zone; in-feed & exit rolls
  Flat, taut web; no web bounce
- Tension zone; brakes, pull rolls, load cells
- High tension materials; 2 to 16 pli
  Typical high speeds; 4,000-9,000fpm
- Low tension materials; 1/4 to 1 pli
  Web bounce
- Gauge bands
- Wind effects

Trouble Shooting

POOR BLADE REGRIND

1. Fuzzy slit edge
2. Increased dust
3. Web fold over
4. Poor knife life
5. Top knife chipping

EXCESSIVE VIBRATION

1. Increased dust
2. Poor knife life
3. Fuzzy edges
4. Knife holder looseness

EXCESSIVE OVERLAP

1. Poor knife life
2. Fuzzy edges
3. Roll rings
4. Cracked web edge
5. Top knife chipping
6. Web breaks
7. Increased dust

EXCESSIVE SIDE LOAD FORCE

1. Fuzzy slit edge
2. Poor knife life
3. Top knife chipping

EXCESSIVE CANT ANGLE

1. Fuzzy slit edge
2. Increased dust
3. Poor knife life
4. Top knife chipping

EXCESSIVE RUNOUT

1. Fuzzy slit edge
2. Increased dust
3. Erratic slit
4. Web fold over
5. Web break
6. Poor knife life
7. Top knife chipping

NEGATIVE CANT ANGLE

1. Web breaks
2. Web fold over
3. Won't cut

INADEQUATE SIDE LOAD FORCE

1. Erratic slit
2. Web fold over
3. Web breaks

WEB TENSION PROBLEMS

1. Cracked web edges
2. Web breaks
3. Increased dust

INCORRECT BOTTOM KNIFE SPEED

1. Poor knife life
2. Increased dust
3. Cracked edges

Conversion Factors

To convert	Into	Multiply By
Bars	pounds sq./in.	14.50
Grams	ounces	0.03527
Horsepower	kilowatts	0.7457
Kilograms	pounds	2.205
Kilowatts	horsepower	1.341
Meters	feet	3.281
Millimeters	inches	0.03937
Pounds	kilograms	0.4536

PAPER EXAMPLE: 40 POUND PAPER PER 1000 SQ.FT. = 193 GSM/19 = 10 MIL THICKNESS

1 pound of paper x 1.48 = 1 gsm
gsm divided by 19 = 1 point or 1 mil (approx)
1 point = 25.4 microns
1 pound per 1000 sq.ft. = 4.882 gsm
1 pound per 3000 sq.ft. = 1.63 gsm
1 gsm - 0.0295 oz./yd. sq.

104# paper x 1.48 = 154 gsm divided by 19 = 8 mils

1 mil = 25.4 mm or .001"
1 micron = 0.04 mils or 0.00004"
50 microns = 2 mils

Web speed in feet per minute

$$\text{FPM} = \frac{3.14 \text{ x bottom blade diameter}}{12} \text{ x shaft rpm}$$

Glossary of Terms

Austenite: A non-magnetic solid solution of ferric carbide or carbon in iron, used in making corrosion-resistant steel.

Axial run out: A condition describing side-to-side (horizontal) motion of a bottom knife cutting edge.

Bevel: Angle(s) machined into the back side of a top knife.

Bottom knife/anvil/female: The driven, fixed axis shear knife that supports the web during slitting.

Cant angle: Slight angle (normally 30') from parallel with the plane of the bottom knife as seen in the plan view. Also known as shear angle or toe-in.

Crush/score cut: A blade is pushed through the web... backed up by a hardened roll.

Cut point: The intersection of the top and bottom knives at top dead center of the bottom knife. Also known as nip point.

DF-Technology: Dienes patented method to prevent unwanted top (Male)blade movement.

Downstream web travel: Standing in front of the slitting section looking at the web moving away from the slitting section.

Exit rolls: Idler rolls that support the web in the proper position after the slitting function.

Gauge bands: Thickness variations in the web that can create web bounce and roll telescoping after slitting.

In-feed rolls: Idler rolls that support the web in the proper position prior to entry to the slitter section.

Martensite: A solid solution of iron and up to one percent carbon, the chief constituent of hardened carbon tool steels.

Motor driven anvils: Bottom/female knives mounted and driven directly by an AC or DC motor.

Nip point: See Cut point.

Overlap: The distance of the top knife below the tangential surface of the bottom knife.

Overspeed: Bottom knives running faster than web speed.

Pull rolls: Driven rolls that drive the web through the slitters either through a nipping action or a severe S-wrapping web path.

Radial run out: A condition describing the up-and-down (vertical) movement of the bottom knife cutting edge.

Shear angle: See Cant angle.

Shear cut: Top knife overlaps and mates with the bottom knife.

Side load: The horizontal force exerted on the bottom knife by the top knife.

Slitting dust: Particles from the web material that develop as a result of the shear knife action.

System dust: Particles from the web material that develop as a result of the material being stretched and bent around various idler and pull roll arrangements.

Tangential slitting: The web path is tangential to the bottom knife.

Toe-in: See Cant angle.

Top knife/blade/male: The traction driven knife (via the female knife), with a moving axis that plunges through the web prior to the slitting operation.

Torsion: Twisting force around the centerline of a knife holder shaft.

Travel chord: The distance the slit edge moves while in contact with the back side of the top knife.

Upstream web travel: Standing in front of the slitting section looking at the web coming towards the slitting section.

Web: The material being cut.

Web tension: A controlled pulling of the material against a braking action that creates a taut, flat web needed for the best slitting results.

Wrap slit: The web is wrapped around the bottom knives (shear cut) or hardened shaft (crush/score cut). Depending on material being slit, spacers or extra bottom knives will be needed for web support when shear cutting.

DIENES
The cutting edge.

CIRCULAR KNIVES

STRAIGHT KNIVES

HEATED KNIVES

SCORE/CRUSH CUT HOLDERS

SHEAR CUT HOLDERS

MANUAL POSITIONING SYSTEMS

AUTOMATIC POSITIONING SYSTEMS

KNIFE GRINDING MACHINES

MICROSLIT SYSTEMS

Your Local Representative

$3.75