POLAR

...CLOSER TO YOU.

Hints and conditions for a good cut

CUTTING IN PRACTICE

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Times have changed ...

In the past there have been hardly any questions about cutting problems. People usually processed paper, sometimes thin cardboard or glassine paper, but there has never been the variety of materials that we have today.

Nowadays the question is rather: What kind of material cannot be cut on a POLAR?

In fact, all kinds of material can be cut, whether thin stencil duplicator paper or plastic sheet and plates, floor covering materials, metal foils or plywood.

Thick wooden veneers which previously had to be cut by saws can now also be cut on highspeed cutting machines, with an amazing accuracy and without waste.

The demands on state-of-theart high-speed cutters vary as much as the materials to be cut. They should perform cutting with hairline accuracy, quickly cutting big and small jobs alike and above all it should be capable of cutting every kind of material.

Your customers pay more and more attention to the printing and cutting quality of even a small printed job. They notice whether the cut is straight or uneven.

Your customers do not only demand good printing.

A high-speed cutter is expected to perform a precise and clean cut and to be constructed very sturdily in order to cut even the hardest materials accurately. POLAR comes up to fulfill these expectations.

Cutting problems which arise all the same are usually caused by a poorly adjusted clamping pressure, a wrong knife angle, improper knife quality or blunt knives.

The experience gained on POLAR high-speed cutters over many years has been compiled in this brochure. Even if some materials have not been considered we trust that our tables will give you the necessary information for performing well with your POLAR cutter.

If you should have any problems, please let us have a cutting sample. In urgent cases give us a call.

We are quite sure that we or our nearest agency can quickly help you ...

Knife angle
The physical changes of the products to be cut cause the knife's angular geometries to change.

1960:
21°

1975:
22°

1980:
23°

1990 until 2005:
24°

Cutting problems and their frequency of occurrence

When the high-speed cutter is working perfectly and operated correctly most cutting problems arise in connection with the knife.

The most common knives (HSS, carbide-tipped knives and finest grain), and the relevant grinding angles allow to deal with most of the available cutting materials.

Cutting results which are all the same beyond the desired tolerances require special knife angles and the matching knife qualities.

A correctly adjusted clamping pressure and the proper cutting stick also have a highly positive influence on the cutting quality.

Share	Subject	Explanation
70 %	Knife	Wrong knife angle, or knife quality does not fit the material to be cut
14 %	Paper and other materials to be cut	Continuous advancement of papers (paper coating) for improved printability. This requires experience with constantly changing applications (knife angle, knife qualities, height compensation when clamping the paper). Special cutting materials.
6 %	Climate	Climate-related faults in finishing, such as stress within the material to be cut which have uncontrollable consequences for the measurements (humidity/temperature; as a rule of thumb, a 10 % change in humidity results in a 0.1 % deformation of the material to be cut)
4 %	Modified production conditions	Shortest job cycle times. Poorly dried run. This makes finishing much more difficult.
3 %	Lay guide from printing Lay guide of paper	Development of machine features for production management and support
2 %	Instruction and training	Cutting training courses where operators learn to understand the practice
	of machine staff	oriented application of machine functions, such as the proper clamping pressure adjustment, backgauge compensation, cut correction, difference of positions etc. for improving both product and production
2 %	Professional service	Proper installation of the machine (angled position, general machine geometry), production supporting service with advice for application

Continuous rise in hard fillers

Cutting problems also arise frequently in connection with the materials to be cut some of the reasons being that the paper contains a higher amount of fillers that make cutting more difficult.

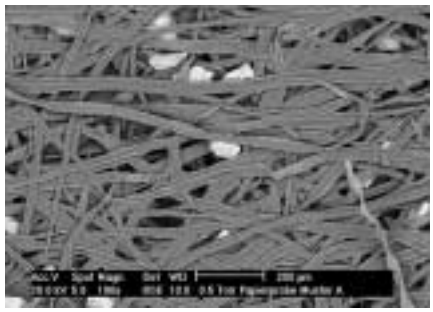
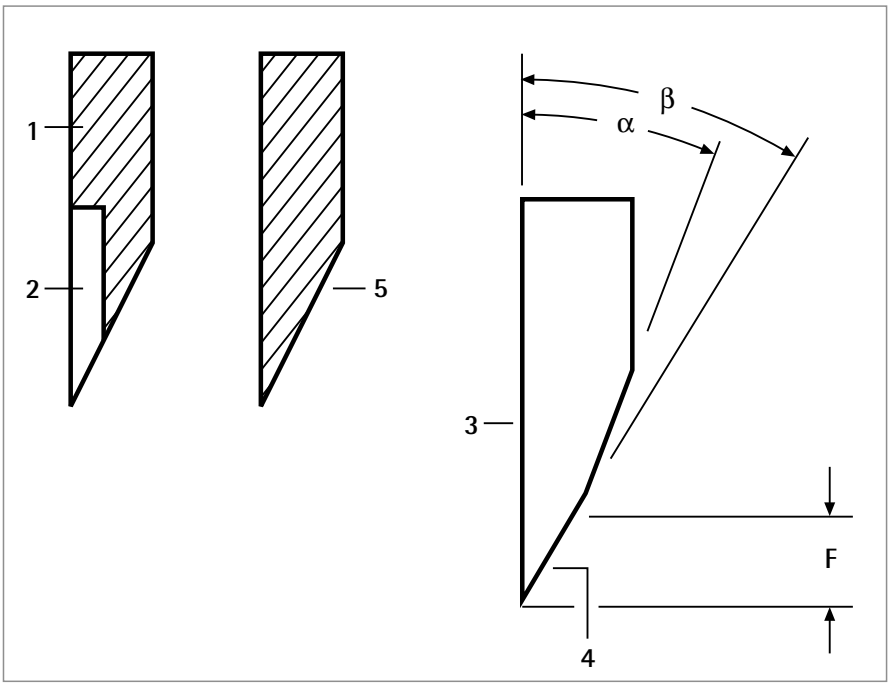


Fig:
Paper with a 42 % share of corundum (48.5 g/m²)

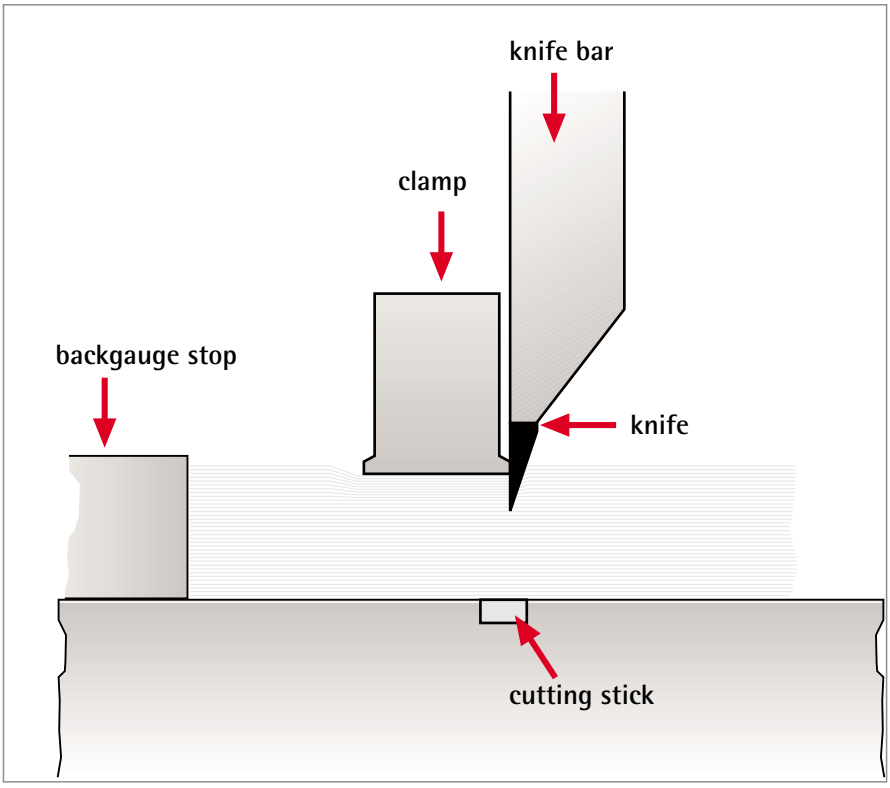
Main characteristics of the knife according to DIN 8869:

1	Knife body - body
2	Cutting coating – steeling – hard-metal coating
3	Cutting surface = flank – cutting side
4	First face – bevel – first facet
5	Cutting surface = pressure surface – facet - face
b	Faces – angle of the bevel – first facet
a	Wedge angle – angle of facet
F	Width of bevel



Sequence of cutting operation

1. Positioning
2. Clamping
3. Cutting (swing cut)



Choosing a correct knife angle

In the operation of modern high-speed cutters it is unavoidable that cutting differences are encountered occasionally, in spite of accurate achine adjustment and most careful alignment of the material to be cut by the operator.

The reason is to be found in the varying characteristics of the material to be cut. It would, therefore, be ideal if only one particular material were processed on one particular machine.

Different materials require different knife angles and it is difficult to determine the correct knife angle if all sorts of material are to be cut successively at short intervals of time.

In such cases a mean knife angle of 24° is recommended. If the customer does not explicitly order another knife angle the Polar HSS knives are delivered with an angle of 24°. This also applies to the standard equipment of new POLAR highspeed cutters.

The correct cutting angle and suitable knife quality determine to a large extent the cutting quality and economical operation of the high-speed cutter.

Servicing and maintenance of the knife

The knife should always be carefully kept in its special box

1. for reasons of safety and

2. for protecting the knife, so that the cutting edge will not be damaged.

When a knife is to be replaced it must never be put on the machine table without underlaying a cardboard or wooden support. The surfaces of both the knife and the knife bar must be completely free from burrs and dirt.

The threaded fixing holes in the knife and the knife screws which ensure the firm and precise seating of the knife should be kept in perfect condition.

At first, all knife screws are only tightened slightly to avoid damage during their final firm tightening.

As soon as the knife has been screwed down tightly and all tools have been removed from the machine table the knife can be adjusted.

At its lowest position the knife must be adjusted in such a way that it is in parallel with the machine table, slightly touching the cutting stick.

The cutting stick must have been reversed or replaced before this is done.

Please observe the information given in the corresponding operating instructions of the high-speed cutter.

Dressing the knife (Standard/HSS qualities)

After the knife has been ground it must be carefully dressed, because this is decisive for the quality of the cut and the service life of the knife.

Rectangular grindstones are used for dressing, which must not be too small in order to avoid canting.

For removing the grinding burr we recommend a stone with a fine and soft graining, for finishing use an Arkansas oil stone.

For dressing the knife should be placed on a flat surface to ensure that the dressing stone can be moved along the cutting edge securely and precisely.

Uneven and insecure placing can lead to imperfect dressing and cause serious injury, because you can easily get hurt by the sharp knife edge.

Prior to dressing it is of utmost importance to clean the knife thoroughly. The same applies to the dressing stone. By storing the stone immersed in a kerosene-oil mix the stone is always kept clean.

Care must be taken that there are no indentations or grooves in the stone which might damage the cutting edge and cause imperfect dressing.

Defective stones can be used again after they have been newly ground.

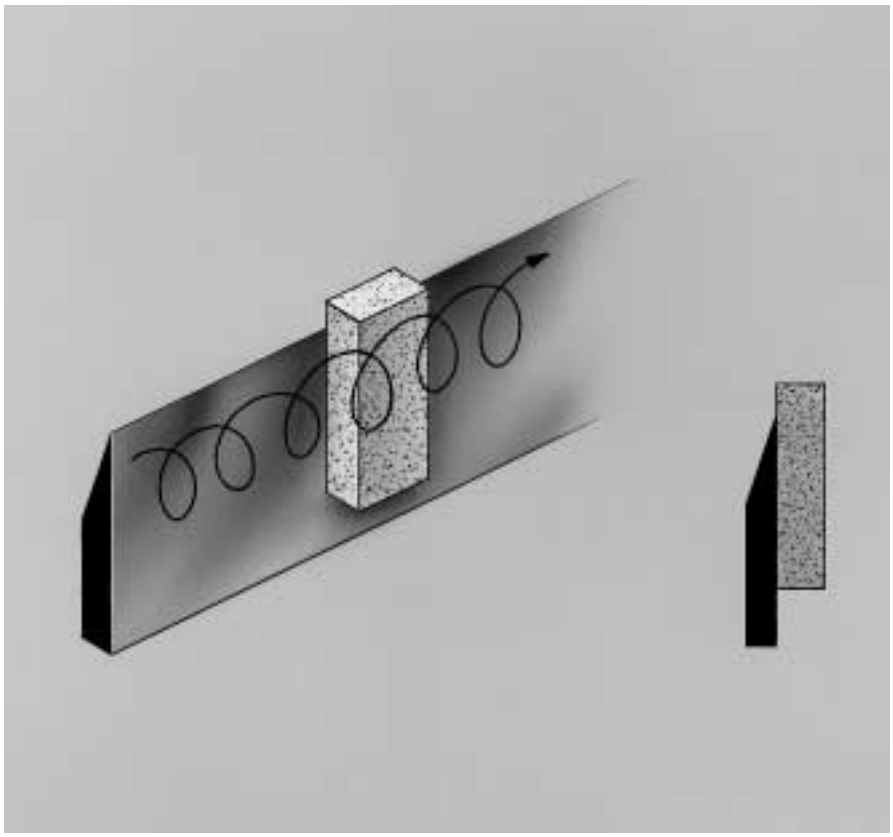
Manual Dressing

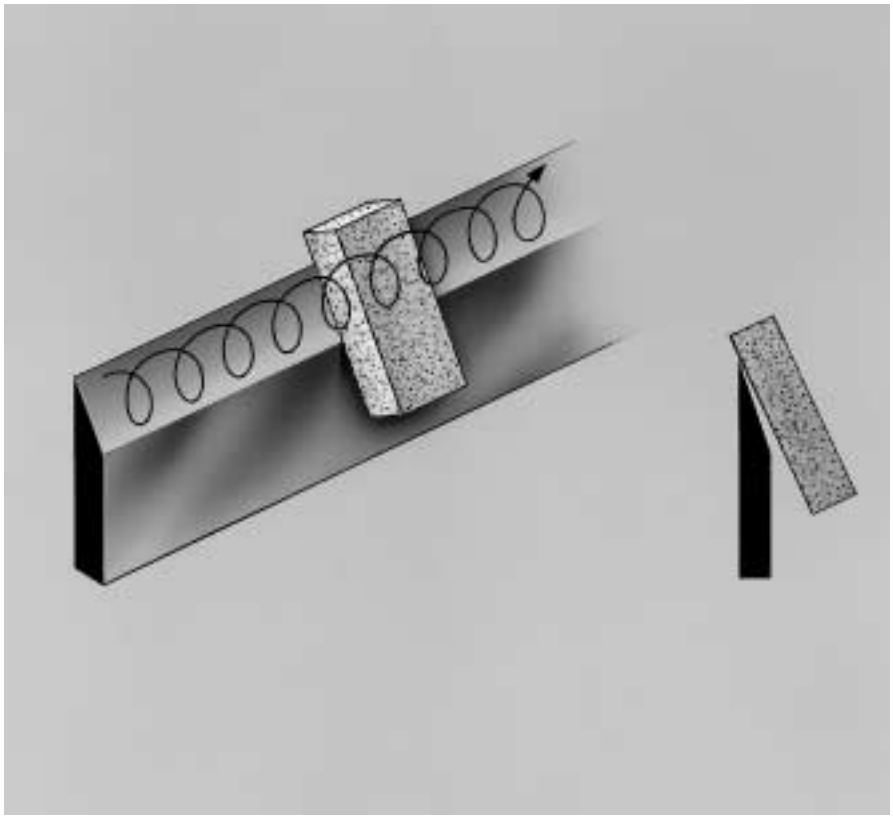
On dressing, care must be taken that the grindstone is laid flat against the back of the knife. If the stone is not placed flat against the back of the knife, the cutting edge will break away from the back causing the knife to divert from the cutting line which is extremely undesirable. A so-called "sagging edge" will be formed – with the consequence of a resulting **overcut**.

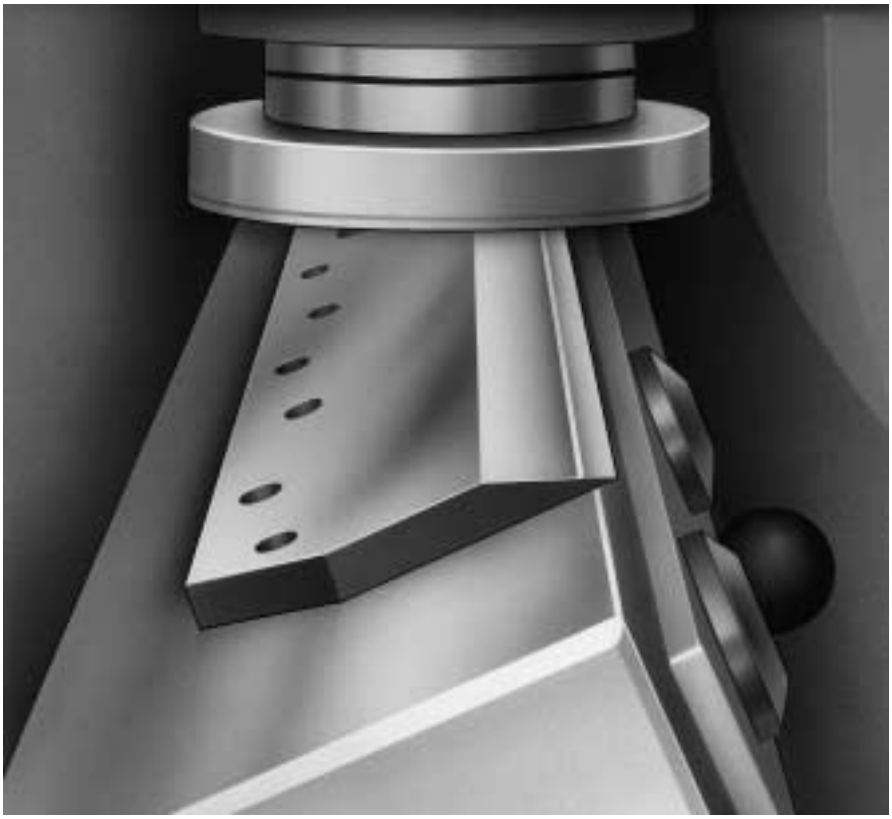
In circular motions and with somewhat light pressure the burr is upended.

On the face of the knife the stone is **slightly tilted** and the burrs are removed with circular motions (against the cutting edge). Too much tilting would blunt the knife.

As soon as the burr has been completely removed and the knife edge perfectly smoothed both sides of the knife are subsequently treated with the Arkansas oilstone as described above.







Mechanical dressing
(Not for carbide tipped knives HM)

When knives are handled inexpertly mistakes are often made in manual dressing and this leads to cutting problems. We therefore recommend to use a mechanical knife dresser.

When using this device a continuously compressed cutting edge is achieved over the complete length of the knife after the first dressing (removal of burr).

For mechanical dressing use standard machine oil to obtain an improved dressing result.

Please make absolutely sure that the Arkansas stones at the mechanical knife dresser are without any notches and run absolutely parallel to the back of the knife, because otherwise a sagging edge may be formed.

Hints for the knife grinder

1| Grinding machine
The first requirement is a grinding machine heavy and solid enough to absorb unavoidable vibrations. The clamping beam for the knife must be absolutely plane, parallel to the grinding level and free of flexing.

The quality of a grinding machine can be quickly checked by the following method:
Accumulated shavings when compressed by hand, should spring back (like steelwool) to indicate that the machine is of good quality. Shavings which stay compressed point to vibration within the machine or to the use of unsuitable grinding media. Both these factors support burning on the grinding surface.

2| The feed of the grinding sledge must be performed easily without canting and jerking when switched over (constant speed).

3| A large clear scale at the clamping beam should allow direct reading of the bevel. The knife clamping device must securely hold the knife parallel to the grinding level. The knife must be clamped with its bevel facing upward.
With standard/HSS knives the direction of rotation of the grinding wheel is selected in such a way that grinding is performed away from the knife.

Grinding against the knife edge might cause nicks resulting from the abrasive grains breaking out.
Such fine nicks are only noticed during dressing.

For carbide tipped knives the opposite direction of rotation is selected (i.e. against the edge).

Upon grinding special attention must be paid that plenty of **cooling water** is supplied. The best way is a supply through the motor shaft or carefully directed from outside onto the grinding spot.

4| The grinding spindle should be equipped with bearings which are either self-adjusting or automatically secured against axial thrust, because axial play reduces the quality when grinding cups or rings are used. The grinding cups or rings must be perfectly concentric and should be well balanced in order to prevent wobble or avoidable shaking.

5| The feed should be performed by the grinding head, not by the machine table, unless its adjustment is done with parallel faces by one single element. The feed must be automatically limitable and variable.

6| Operating controls should be arranged together at a central position within convenient reach of the operator and at a point from which the operator has a close control over the actual working area.

7| The cooling pump must at all times supply a strong, full coolant flow directly onto the grinding spot. A sufficiently large coolant tank equipped with a filtering device which allows removal of the grinding sludge is essential.
An integrated wheel dressing tool should be part of the machine, because it is indispensable for sharpening the wheels in case of glazing and for dressing the working area of the wheel.
Well selected grinding wheels ensure that the wheels do not load during the grinding process and therefore do not require dressing.

8| Grinding wheels
The enormous variety of wheels with different grain, hardness and bonding seems confusing at first sight. The following information will assist in choosing suitable wheels:

a) Grains are graduated from 8 to 800 according to DIN standard 69100, i.e. from coarse to very fine.
For machine knives only medium sizes from approx. 36 to 60 apply, with "60" almost resulting in polishing.

b) Hardness graduations according to DIN standard 69100 are distinguished by letters from A to Z. Only the soft grades for guillotines, i.e. H to K are used for this purpose.

c) In accordance with international standards the grain is marked by a number. The smaller this number the less distance is there between one grain and the other. Consequently, small numbers are unsuitable. "Open" structures are preferred, because they do not have a tendency to sticking.

d) Bondings according to DIN 69100 are marked by abbreviations. The most common bondings are:

Artificial resin	Ba
Rubber	Gu
Magnesite	Mg
Natural resin	Nh
The artificial resin bonding	(Ba)

is best suited for guillotine knives.

e) Frequently used **abrasives** according to DIN 69100:

Normal corundum	NK
Semi-refinded corundum	HK
Refined corundum	EK
Silicon carbide, dark	SiCg

The only suitable abrasives for guillotine knives are corundums (NK, HK, EK).

Improperly selected grinding wheels may damage the knives. The grain bonding must release grains before these become completely blunt.

Otherwise they have a polishing effect creating excessive heat. The distance between grains is of importance. High local temperatures as encountered on grinding have harmful consequences, increasing in severity with the alloy quality of knives.

The porosity of the grinding wheel controls "glazing" (loading). Fine steel particles – or even worse – iron particles clog the pores when these are too small. This has the same effect as wheels with too hard a bonding, i.e. **generation of excessive heat!**

Consequently, the first requirement is to use wheels which keep "open" and clean. The higher wheel consumption possibly resulting is offset by the avoidance of major consequential difficulties.

9| Coolant.
It is not recommendable to use clear water as a coolant, since the ground object as well as the machine would corrode very quickly. The main purpose of the coolant is not only to cool the point of working contact, but also to wash the grinding wheel and prevent the formation of rust. These fundamental functions are further facilitated if a special cooling media is added to the water. Knife and machine are protected against corrosion without being greasy or sticky. High quality cooling oils mix into a milky or waterclear emulsion and their specific properties bind dirt and prevent loading of the stone. The full coolant flow should be directed onto the grinding wheel, just in front of the grinding contact. Drip cooling is ineffective.

10| Cleanliness.
The best combination of grinding machine, grinding wheel and coolant becomes ineffective if dirt is allowed to accumulate. Dirt and steel shavings delivered with the coolant will adversely affect the grinding result, despite the fact that a first-class grinding wheel is employed.

11| Straightening the knives
Before grinding, check if the knife is straight. Knives which are bent by more than 1 mm have to be straightened first. Roller flattening machines are perfectly suitable for this. Dressing by hammer should only be made with knives made of solid chromium steel.

12| Attention must be paid at all times during **machine operation,** even after well performed setting. If an interruption of the coolant supply or blunting of the grinding wheel is not detected at once, the knife will be burned and rendered useless. A similar danger exists if a knife is excessively ground, i.e. if there is no infeed and the wheel is repeatedly led along the knife edge without bite.

Burning defects of the knives are not always, nor immediately, recognizable. It may take one or two more resharpenings before the damage becomes evident by breaking (chipping) of the cutting edge.

When starting the sharpening operation the grinding wheel must carefully be brought into contact with the knife and the reverse movement of the machine table must take place outside the grinding zone.

Care must be taken that the stone does not stop anywhere on the grinding zone, i.e. grinding must be done speedily. Sharpening is completed when all notches have been removed from the knife edge, the grinding surface shows a silvery shine and a fine burr is formed on the back of the cutting edge. Any additional grinding is unnecessary and shortens the life span of the knife. For these reasons, the entire grinding operation must be watched very closely in order to avoid the faults described.

The infeed of the grinding wheel (for standard/HSS knives) should never be performed outside the grinding zone, because the grindstone will be damaged and the first segment of the grinding zone become coarse. For HM knives, infeed is generally done outside the grinding zone.

13| **Sparking out** means a feed movement without infeed.
If sparking out is done correctly it results in a smooth surface of the knife bevel. For a larger area or harder stone use a shorter sparking out period. If striations show after the procedure sparking out has been done improperly or an inadequate stone has been used.

Typical symptoms resulting from grinding errors

a) Uneven grinding sound and varying spark density indicate that the knife is out of parallel with the grinding level.

b) If the ends of the knife edge are protruding when fixing it into the grinding machine this indicates a flexing of the clamp beam in the centre part or worn machine table guidings. As a consequence, the middle of the cutting edge will be concave ground which means that the knife cannot be positioned evenly over the complete length of the cutting stick and hence its centre part will not cut through.

c) **Brown or blue colouring** of the knife near the cutting edge results from overheating caused by

- excessive infeed,
- excessive feed,
- insufficient cooling,
- unsuitable abrasives,
- loaded or blunt grinding wheels.

To recover burned knives, the blushed areas must be completely removed with a coarse, open stone and the knife subsequently finished in the normal manner.

d) More dangerous, because very hard to trace, are the "notorious" brownish yellow grinding spots on the knife bevel. They indicate that excessive heat was generated when the knife was ground. This is mostly caused by:

- too hard grinding wheels,
- blunt grinding wheels,
- loaded grinding wheels,
- contaminated coolant

or,

- improper sparking out.

The colour of these spots indicates a temperature of 200° to 300° C (or above). Strange is their round or oval shape the size of a small pea or bean. Although one single grinding stroke with an "open" stone is sufficient to erase the colour the fault remains in the knife.

To avoid subsequent chipping of such a knife during cutting operations, the knife must be drastically re-machined with an open, soft stone, until all tension flaws have completely disappeared.

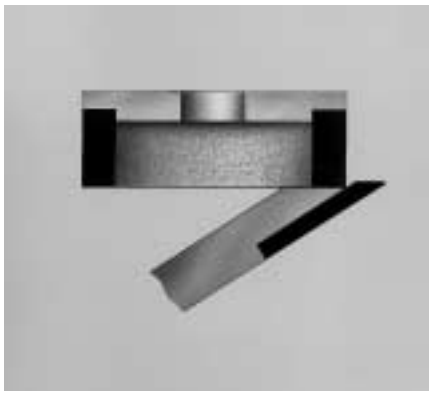
Summary of Grinding Data

Grinding cups or wheels

	Normal steel/knives Swedish steel knives HSS-knives	Steel knives
Abrasive	NK, EK	NK, EK
Grain	40 - 60	40 - 46
Hardness	Jot – L	G
Structure	8 – 14	14
Bonding	Ba	Ba
Circumferential speed m/sec	18 – 26	18 – 26
Transfer or table speed m/min.	15 – 25	15 – 25
Infeed in mm	0.01 – 0.03	0.01 – 0.03

Instructions for grinding carbide tipped knives (HM)

The grinding of carbide tipped (hard metal) knives requires up to 3 passes (using different grindstones).



1st Pass

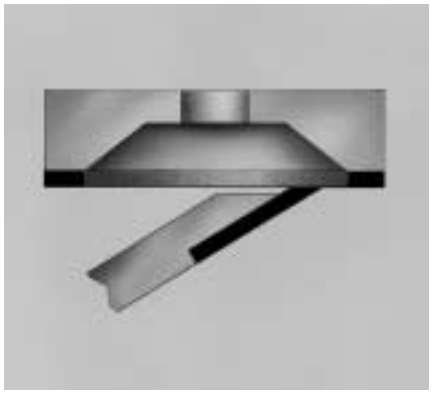
Reliefgrinding of the steel carrier body.

Grindstone diametre: 100 mm
(grain 60, hardness M, Ba)

(If 0.5–1.0 mm is ground at a time, this is sufficient for regrinding the hard metal insert 3 to 4 times)

Transfer or table speed: 14 m/min.

Infeed: 0.01 mm
(Proceed similar to normal steel, Swedish steel and HSS knives).



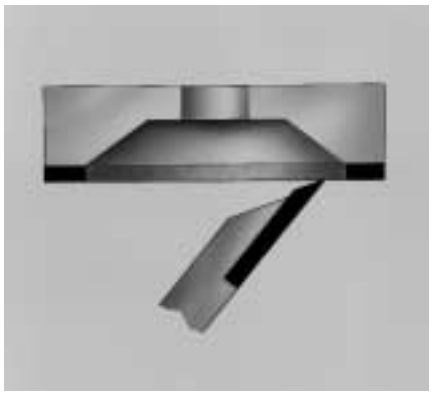
2nd Pass

Grinding the carbide tipped insert (rough grinding/finish grinding)

Grindstone diametre 200 mm
(D 91, C75, Ba).

Transfer or table speed: 14 m/min.
(for sparking out: 1 m/min.)

Infeed: 0.01 mm
(outside grinding zone!)



3rd Pass

Grinding the bevel
(HM, 0.5 to max. 1 mm)

Grindstone diametre: 200 mm
(D 15, C50, Ba)

Transfer or table speed:
250 mm/min.
(for deep grinding;
otherwise: 5m/min.)

Infeed: The grinding of the bevel is done in one pass (deep grinding, one double stroke approx. 0.1 mm).

Dressing carbide tipped (hard metal) knives (HM)

The decision to dress carbide-tipped knives at all depends upon the material to be cut.
Dressing stone:
round, approx. 30 mm in diametre (special manual lap D 7).

Relation of steel quality and service life of the knife

Knives are available in various qualities:

1. Low-alloy steels (Swedish steel)
2. High-alloy steels (HSS)
3. Carbide tipped knives (standard grain)
4. Finest-grain hard metal
5. Ultra-finest grain hard metal = UFK hard metal

The above listed qualities are composite materials. Alloys of varying qualities are applied onto non-hardened bodies. Available are low-alloy tool steels for standard knives, super-speed steels with a tungsten content of 18 % (HSS 18 knives) and sintered hard metals (carbide tipped knives).

Standard and HSS 18 knives are basically suitable for any material to be cut. Both qualities allow variations of the cutting angles and the use of narrow angles if suitable for the corresponding material.

Due to their high proportion of alloy elements HSS-18 knives provide the advantage of a considerably longer service life and a higher stability of the cutting edge.

Carbide-tipped knives even exceed the service lifetimes of HSS-W 18 knives, but their edges are more sensitive.

Ultra-finest grain hard metal of the most recent generations even provide longer service lifetimes than hard metal. Their high elasticity make them suitable for almost any material to be cut.

Guidelines for selecting the proper cutting angle

The knife angle depends upon the characteristics of the material to be cut. Basic rule:

- soft material = narrow angle
- hard material = wide angle

The cutting angles are usually selected between 17° and 30°.

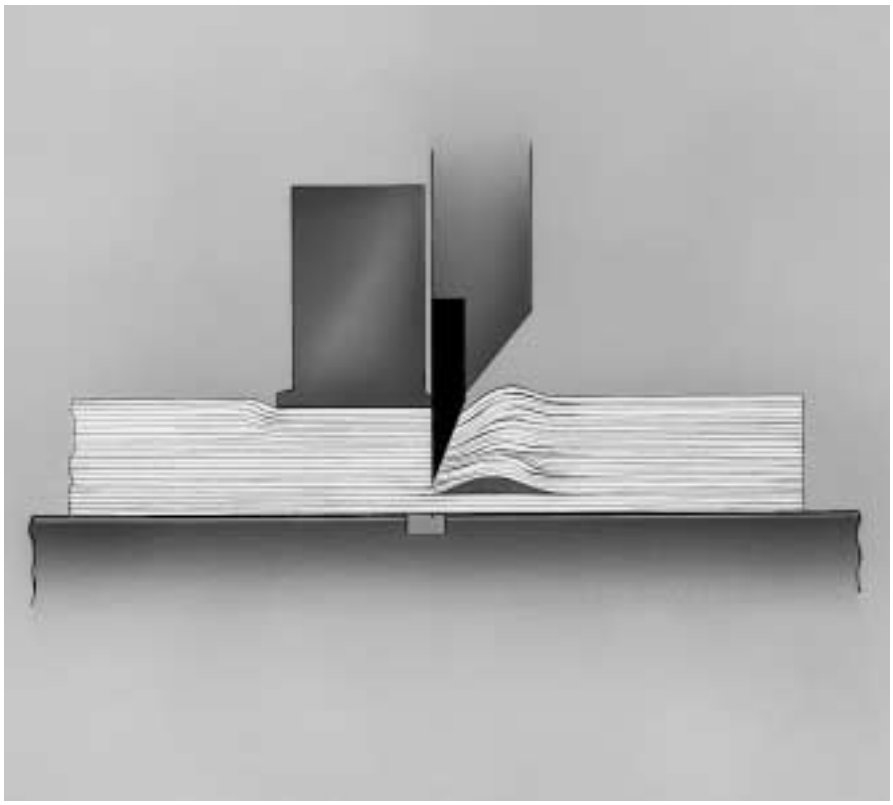
Knife qualities

Quality	Service lifetime	Hardness	Composite
Standard (Swedish steel)	1	59-61 HRC	rolled
18 % HSS Stahl (superspeed steel)	> 3	62-64 HRC	rolled/ soldered
Hard metal (standard)	> 10	1100 HV 10	soldered
Finest-grain hard metal	> 15	1330 HV 10	soldered
Ultra finest-grain hard metal	> 20	1500 HV 10	soldered/ bonded

Soft cutting materials

Soft materials, such as e.g. flimsy, stencil duplicator paper, tissue and blotting paper show characteristics which can be very troublesome when cutting the material:

1. Bad sliding properties
2. High air volume in pile
3. The material softness itself.

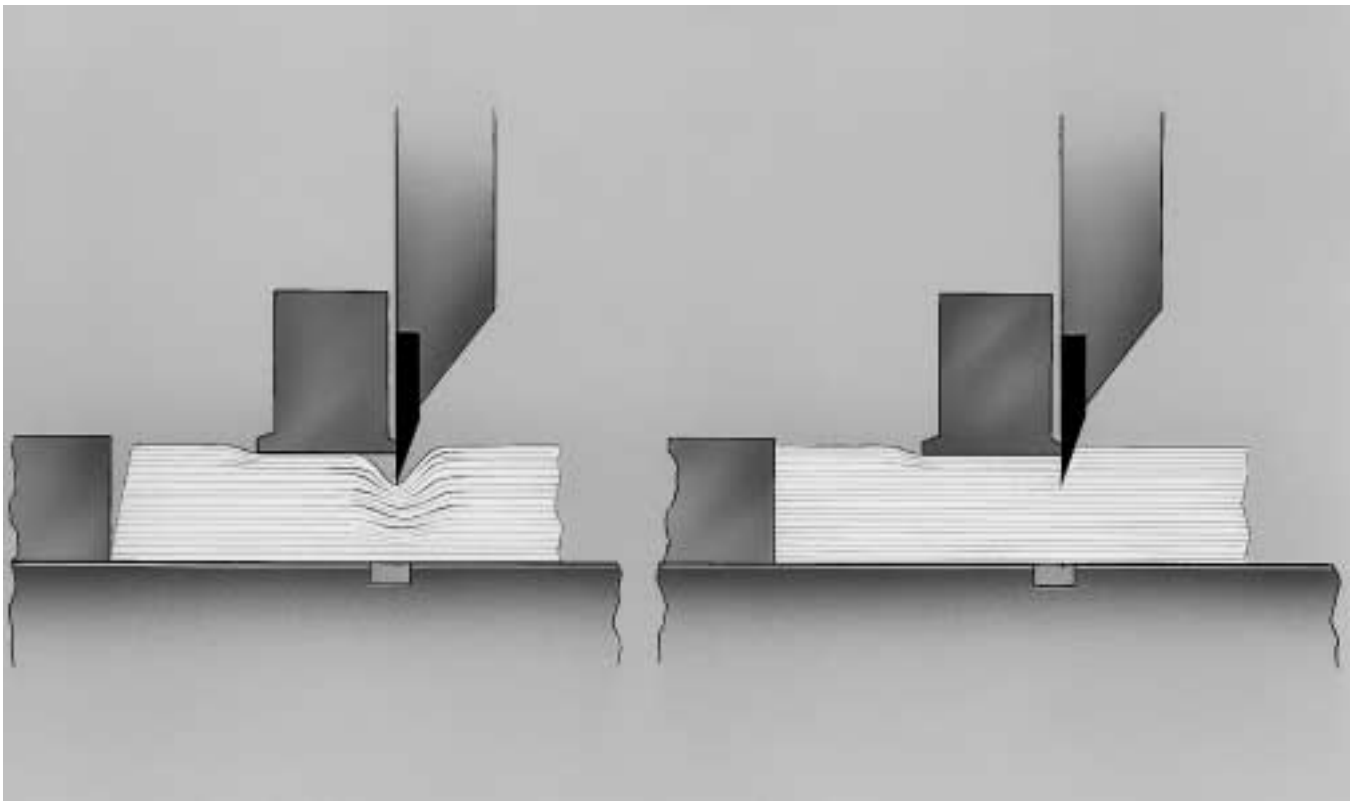


Concerning 1:

Owing to its bad sliding properties the material is jammed in front of the knife, blocking it and creating excessive cutting pressure.

It should be observed that such materials should always be placed on the left-hand side of the machine-table when the knife moves from left to right.

Otherwise, i.e. when placing the material on the right-hand side, the jam will be increased, because the right-hand side gauge would impair the material flow even more.



Concerning 2 and 3:

Owing to the high air volume and the material softness the knife tends to pull the material from beneath the clamp during the cutting cycle.

This occurrence leads to an "over-cut". In other words the upper layers of the ream are cut shorter than the lower ones. To prevent this a narrow cutting angle and/or increased pressure time is required.

Further improvement can be achieved by giving the knife bevel a particularly smooth surface finish.

As shown in the sketches a blunt knife exerts a much higher pulling force than a sharp one.

However, it is not only the knife that influences cutting quality.
The clamp as well as the clamping pressure also play an important part.

Basic rule:

soft material =
high clamping pressure

hard material =
low clamping pressure

The clamping pressure is infinitely variable between 150 and 7000daN. If high pressure is exerted on soft material the clamp rake will cause deformation of the material tobe cut.

This disadvantage can be overcome to a great extent by applying a false clamp plate. In particularly difficult cases a cardboard strip, 4 to 5 mm thick, can be glued under the false clamp plate. This strip should be smoothly tapered towards the rear.

Regular cutting materials

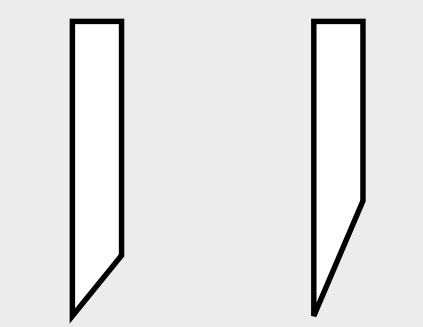
"Regular materials" comprise such stock which can be properly processed with a knife angle of 24° and a mean clamping pressure. Such materials are e. g. writing paper and common printing paper.

Why use a "mean clamping pressure"?

You could assume that the highest pressure could be selected for such common materials. However, this is wrong, because excessive pressure may cause an "overcut".

As a general rule, the clamping pressure selected should not be higher than absolutely necessary in order to avoid dislocation or dragging of sheets.

Geometry of angles



hard cutting material = obtuse knife angle

soft cutting material = slender knife angle

Hard cutting materials

When processing hard materials, such as art papers, gummed papers, cardboard or plastic foils the knife may deflect during the actual cut. In most cases this is caused by an excessively narrow cutting angle. The knife needs regrinding. To avoid a considerable loss of knife "material" a bevel with a wider angle is applied.

This offers the advantage that a good material flow in front of the knife is retained despite a wider cutting angle.

One difficulty often encountered when cutting hard materials is an overcut, resulting from the fact that at the dressing stage the cutting edge had been broken from the rear.

Overcuts are also caused by burrs or dirt on the surface of the knife or knife beam due to which the knife is out of its true vertical position.

The same thing happens with knives which are wider at the top than at the bottom (fault of the knife manufacturer or grinding shop). This is indicated by smooth, shiny pressure spots on the cutting surface of the material cut.

Cutting differences caused by thickness variations of the materialto be cut

Convex or concave cuts result from the fact that the material is always cut shorter in areas where the clamping pressure is weak. A convex (bowed) cut appears on materials building up higher in the centre, because both ends are pulled out by the knife during the cut.

Stitched materials become shorter on their open side, since the clamping pressure is insufficient there.

Height differences of reams, amounting to less than 4 mm can be levelled with the flexible false clamp which obtains a steady pressure.

Differences exceeding 4 mm require additional compensation, e.g. by applying cardboardstrips.

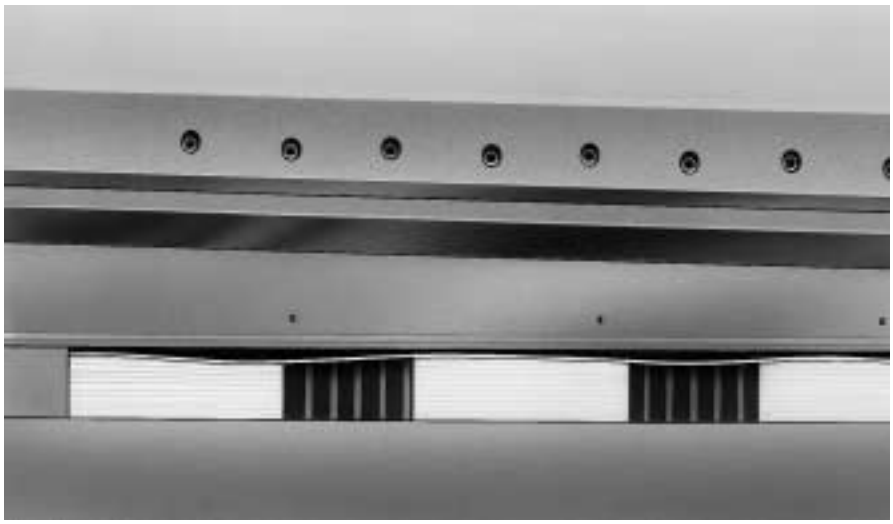
Concave (hollow) cuts appear when the material is wavy on all sides. The clamp pushes these waves backwards and after completion of the cut they go back to their original position.

To diminish a concave cut the clamping pressure should be kept to the minimum value possible. Another means is to cut the ream up from thecentre, i.e. the dividing cuts are started from the centre whereas the finishing or trim cuts of the outer edges are made last.

Working with false clamp plate

Marks of the clamping bar contour on the material to be cut can be avoided by using a false clamp plate when dealing with sensitive cutting material.

Height differences in cutting layers can be compensated by using a flexible false clamp, a felt or foam rubber pad. Only in this way can the full-surface clamping for a precise cut be obtained.



When is a knife blunt?

Never use a blunt knife for cutting. The cutting machine will be strained and the cuts are inaccurate and untidy.

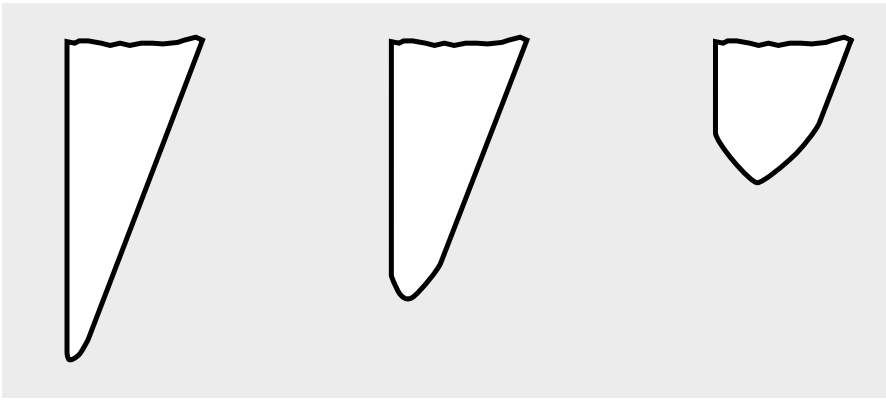
Paper edges which are sticking together, becoming darker in colour or resulting coarse are indications of a blunt knife.

When cutting hard materials the lowest sheet is cut with a sharp bang.

These indications call for changing the knife, because

1. re-sharpening costs are lower if the knife has not been worn too much
2. cutting quality is improved
3. knife consumption is reduced if only little material is removed by grinding
4. less strain to the cutting machine.

extremely sharp (after grinding) **sharp (best condition of the knife)** **blunt**



The cutting stick

The cutting stick is the counter cutting tool of the machine knife and should be made of a material which is tough, but not too hard. If the material is too soft, the knife will cut too deep. The lower sheets will not be correctly cut through. With an excessively hard material the knife will soon get dull or notches.
The POLAR cutting stick meets these requirements perfectly.

Replacement or reversal of the cutting stick becomes necessary when the knife has dug into it up to a depth that the lowest sheets of a ream are actually torn instead of being cut.

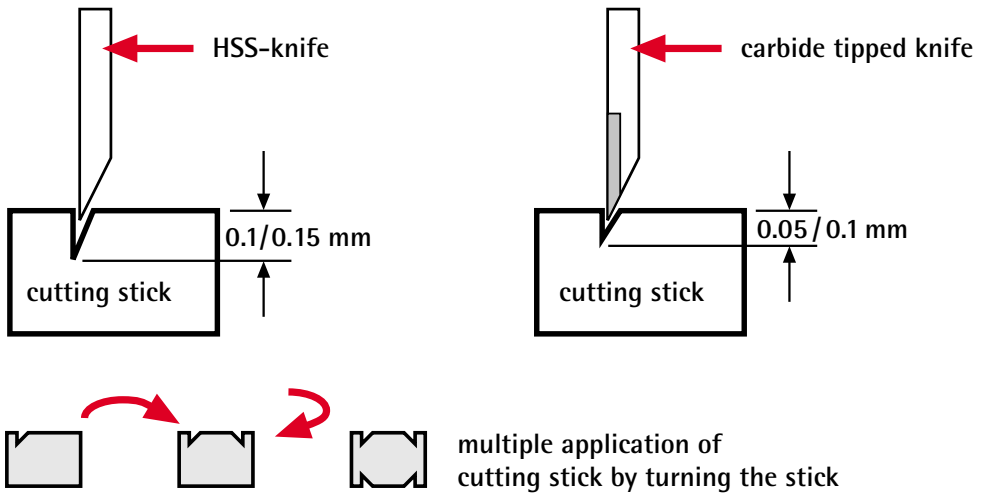
Every time the knife is changed the stick should be reversed or replaced.

The consumption of cutting sticks depends completely on the materials processed.
"The harder the materials cut the more sticks will be consumed".

Recommended value: The cutting stick should be turned or replaced every 800 cuts. This increases the service life of the knives and prevents the edge from notching.

At the factory, POLAR installs cutting sticks that can be fully recycled and used with every type of knife. Especially for ultra fine grain hard metal knives we also use cutting sticks made of nylon. Due to the special properties of this material, only a very minor notch effect is caused during cutting.

Cutting stick
Immersion depths for different knife qualities



Cutting data on various materials

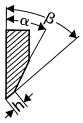
In the tables below we compiled the most common cutting materials in alphabetic order. The lists are divided into various groups to facilitate their use. The values indicated are based on our practical experience gained with POLAR high-speed cutters. The clamping pressure data refer to piles of paper of medium height and more than two thirds of the cutting width.

Higher or wider piles of paper require a higher clamping pressure.
Lower or narrower piles need less pressure.

For delicate materials (thin, soft) use a standard false clamp.

Materialwhich is unequal in height or wavy (cardboard, stitched brochures) should be cut with flexible false clamp plate (special device).

You can as well use a standard false clamp fitted with a felt strip instead of a flexible false clamp. In this case the indicated clamping pressure in the table should be increased by 600 to 1000 daN!

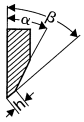


Paper:

Material to be cut	Knife	α	β	h (mm)	Pressure daN/kg	Remarks
Bible paper	HSS, HM, UFK *	24°			1500-2000	false clamp plate
Double waxed papers	HSS, HM, UFK	24°			3200	**
Printing papers, regular	HSS, HM, UFK	24°			2500	false clamp plate
Duplex papers	HSS, UFK	24°	26°	2,0	3000-3500	**
Flimsy	HSS, HM, UFK	19°			3000-4000	false clamp plate
Label papers	HSS, HM, UFK	24°			3500-4000	**
Felt-cardboard	HSS, HM, UFK	24°			2000-2500	false clamp plate
Photographic papers	HSS, HM, UFK	24°			2500-3000	**
Gummed papers	HSS, HM, UFK	24°			2500-3500	**
Carbonizing papers	HSS, HM, UFK	19°			400	false clamp plate
Carbon paper	HSS, HM, UFK	22°			800-1000	**
Art papers	HSS, HM, UFK	23°	25°	3,5	3000-4000	**
Plastic fiber paper	HSS, UFK	26°			2500-3000	
Blotting paper	HSS, HM, UFK	19°			2000-2500	**
Metallic papers	HSS, HM, UFK	24°			3000-3500	**
Parchment paper	HSS	24°			2500-3000	**
Glassine paper	HSS	24°	26°	3,0	4000-4500	
Stencil duplicator paper	HSS, HM, UFK	19°			3000	false clamp plate
Writing papers	HSS, HM, UFK	24°			2500-3000	
Tissue paper	HSS, HM, UFK	19°			2000	false clamp plate
Autocopying paper (NCR-Reacto or similar)	HSS, HM , UFK	24°			800-1000	**
Transparent papers	HSS, UFK	24°			3000-3800	**
Velours papers	HSS, HM, UFK	19°			2500	**
Wertpapiere (Geldscheine, Aktienvordrucke, usw.)	HSS, (HM), UFK	19°	22°		2500-3700	**

* HSS = high-speed steel knives
HM = carbide-tipped knives (normal: 23/25°)
UFK = ultra-finest grain hard metal (normal 22/25)

** Compensation of differences in height is necessary

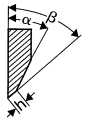


Cardboards:

Material to be cut	Knife	α	β	h (mm)	Pressure daN/kg	Remarks
Bristol board	HSS, UFK	24°			2000-2500	**
Chromolux	HSS, HM, UFK	24°	26°	2,0	3000-3500	**
Duplex board, two-layer board	HSS, UFK	24°			2500	
Finnboard, sheet-lined	HSS, UFK	19°	22°	3,5	2000-3000	**
Felt cardboard	HSS, HM, UFK	24°			2000-2500	false clamp plate
Gray board	HSS, UFK	24°			3000-3500	**
Handmade cardboard	HSS, UFK	24°			3000	**
Hard board	HSS, UFK	24°	26°	2,0	3000-3800	**
Wood pulp board, soft	HSS, UFK	21°	24°	2,0	3000	false clamp plate
Index cardboard	HSS, HM, UFK	22°	24°	2,0	3000-3500	**
Box board	HSS, UFK	22°	24°	2,0	3000-3500	**
Container board	HSS, UFK	22°	24°	2,0	3000-3500	**
Leather cardboard	HSS, HM, UFK	22°	24°	2,0	3000-3500	**
Manilla cardboard	HSS, UFK	22°	24°	2,0	3000-3500	
Multiplex board	HSS, UFK	22°	24°	2,0	2500	
Postcard board	HSS, HM, UFK	22°	24°	2,0	2500-3500	**
Triplexpappe, -karton	HSS , UFK	22°	24°	2,0	3000	

Plastic Materials
(please observe that the materials specified are processed at room temperature)
Due to the versatility of many plastic materials and the type of composition it is recommendable to have cutting testsperformed at POLAR.

Material to be cut	Knife	α	β	h (mm)	Pressure daN/kg	Remarks
Astralon transparent sheet	HSS	23°	26°	2,0	3000	**
Acetate films	HSS	25°			3000-3500	** slightly blunt new knives
Cellophane	HSS	23°	25°	2,0	3000-4000	**
Cellulose foils	HSS	24°			3000-4000	**
Cellulose acetate foils	HSS	23°	25°	2,0	3000-4000	**
Cellulose hydrate films	HSS	24°			3000-4000	**
Polyethylene foils	HSS, HM, UFK	23°	26°	2,0	3000-4000	**
PVC, hard	HSS	23°	28°	2,0	3000-4000	**
PVC, soft	HSS, HM, UFK	23°			3000-4000	**
PVC floor covering	HSS, HM, UFK	19°	22°	3,5	3000-4000	**
Cellophane	HSS	26°			3000-3500	**
Celluloid	HSS	23°			2500-3000	**



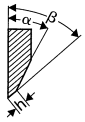
Rubber, textiles, wood, metal:

Material to be cut	Knife	α	β	h (mm)	Pressure daN/kg	Remarks
Rubber tubes	HSS	17°			from 150	option
Hart rubber	HSS	24°			from 1500	**
Raw rubber	HSS	17°			from 150	false clamp plate
Soft rubber	HSS	17°			from 150	false clamp plate
Emery cloth	HSS	24°			2500-3000	false clamp plate
Textiles	HSS, UFK	19°			from 150	false clamp plate
Veneers	HSS	19°	22°	3,5	1000-2000	**
Pressboard	HSS	24°			2500-3000	**
Transformer pressboard	HSS	24°			2500-3000	**
Aluminium foils	HSS, HM, UFK	24°			3000-3500	**
Aluminium foils, laminated	HSS, HM, UFK	24°			3000-3500	**
Lead foils	HSS, HM, UFK	24°			500-1500	false clamp plate
Offset plates	HM, UFK	26°	30°	1	4500	false clamp plate
Tin foils	HSS	19°			from 200	
Zinc foils	HSS	19°			from 200	false clamp plate

Other materials:

Material to be cut	Knife	α	β	h (mm)	Pressure daN/kg	Remarks
Packing materials	HSS, UFK	24°			2500-3000	false clamp plate
Felt	HSS, HM, UFK	19°			1000	false clamp plate
Glass papers	HSS	24°			2000	**
Cork	HSS, HM, UFK	19°			1000-2000	**
Leather	HSS, HM, UFK	24°			2000-3000	**
Linoleum	HSS, UFK	24°			1800-2500	**
Cellulose wadding	HSS, HM, UFK	19°			1500	false clamp plate

** Compensation of differences in height is necessary



Values gathered by your own practical experience:

Material to be cut	Knife	α	β	h (mm)	Pressure daN/kg	Remarks

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1906 2006
100 YEARS

The Adolf Mohr Maschinenfabrik was established in 1906 and now sells its entire product range under the POLAR brand name. An independent family-owned business, POLAR has developed into the world leader for high-speed cutters and cutting systems. POLAR began positioning itself as a global sales and service organization back in 1949 by a partnership with Heidelberger Druckmaschinen AG

Today, POLAR maintains close contact with its customers via a network of 200 agencies and branches in 170 countries.
POLAR has made a decisive contribution to shaping technical developments, thinking and language in the finishing sector, e. g. by defining processes used in the finishing of cut goods (loading, jogging, cutting, unloading ...)
and by configuring process-oriented cutting and jogging systems. The aim is to rationalize work processes using various component parts, thereby taking the pressure off operators and increasing productivity.

Aiming to remain the global market leader, POLAR is keenly aware of the importance of understanding every facet of the market, pinpointing trends and offering new products: LabelSystems for square-cut and die-cut labels, POLAR PACE for fully automatic cutting, POLAR Autojog for no-operator jogging and peripheral equipment for the print room or logistics.
POLAR's P-Net network component links up the finishing area with networked print shops via ethernet.
More detailed information on POLAR products is available at
www.polar-mohr.com