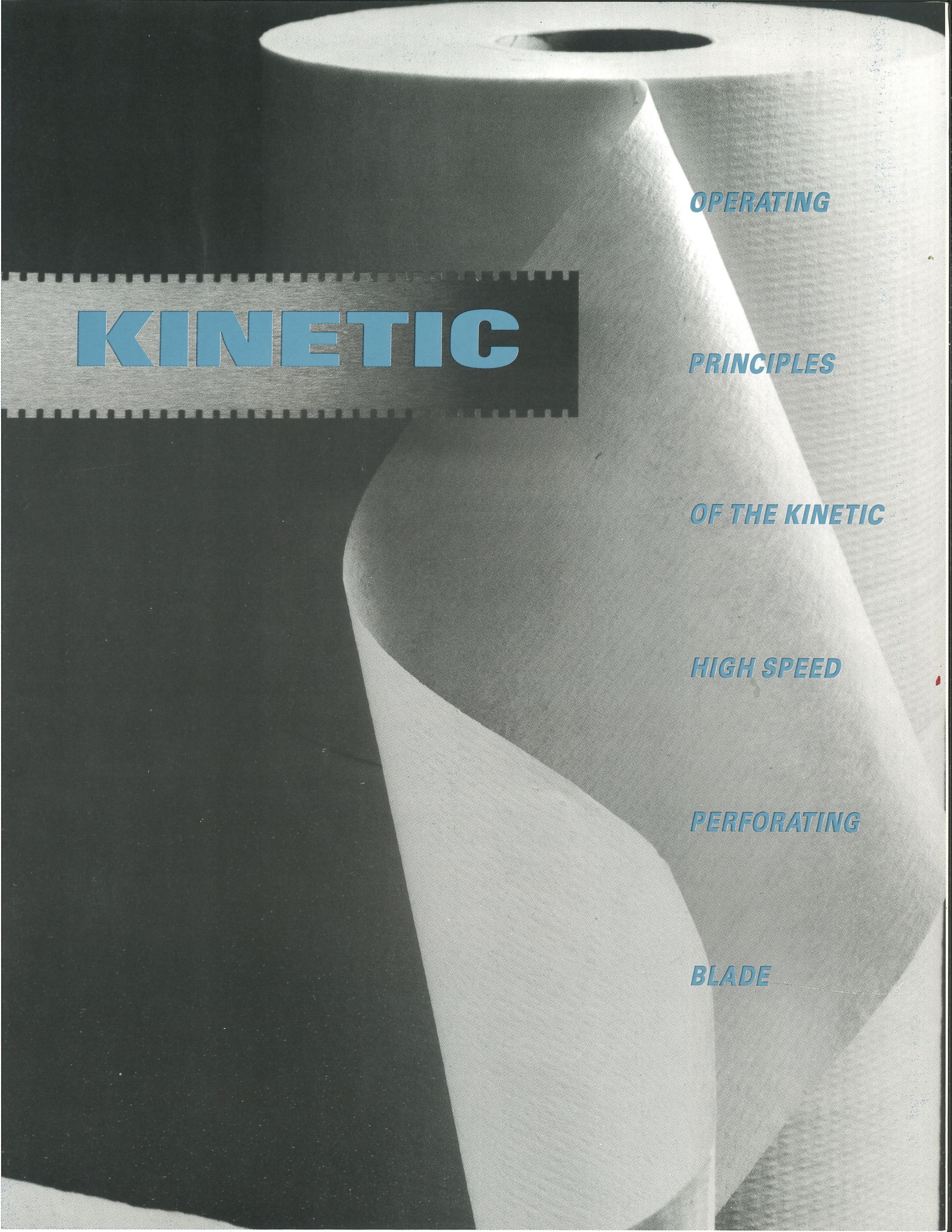

KINETIC
OPERATING
PRINCIPLES
OF THE KINETIC
HIGH SPEED
PERFORATING
BLADE

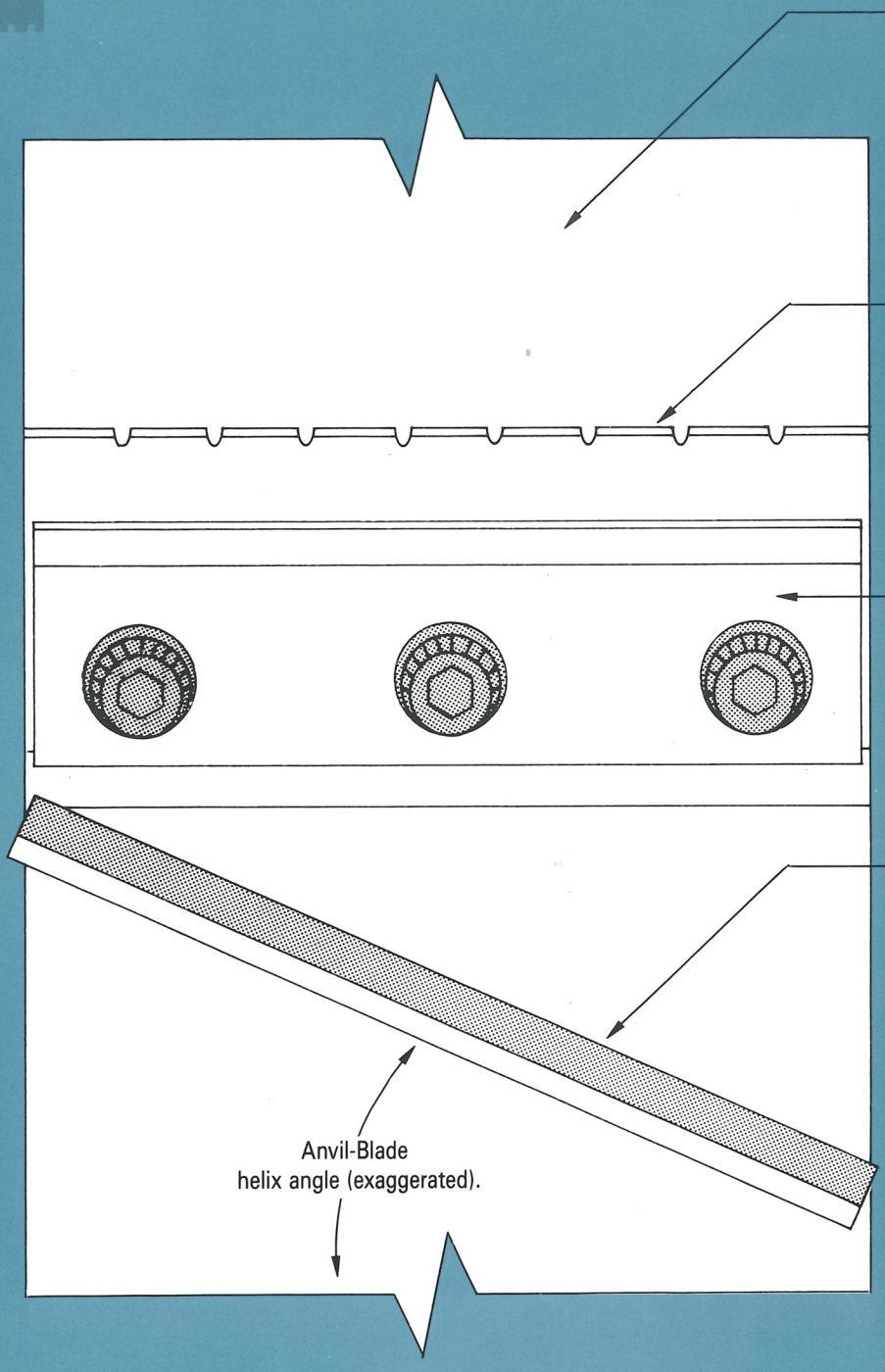

Anvil-Blade
helix angle (exaggerated).

Illustration A

Knife Roll
Paper (not shown) is wrapped around knife roll and travels at same speed as knife roll.

Perforating Blade
Blade flexes on striking anvil.

Blade Clamp

Carbide Anvil
Anvil (Kinetic Part No. 117332-001) does not flex when blade strikes it. Anvil holder is not shown.

Anvil-Blade helix angle is typically 2.5° and is not adjustable.

Schematic showing relationship between perforating blade and carbide anvil in high speed perforating head.

Please read this booklet. It contains a description of how your Kinetic high speed perforating blades operate. We are providing this information to help you use these blades to peak efficiency.

KINETIC®

THEORETICAL OPERATION
KINETIC HIGH SPEED PERFORATING BLADE

The Paper Converting Machine Company's perforating process uses a moving blade to perforate a traveling web of paper. The paper passes between the moving blade and a stationary anvil. The blade is positioned perpendicular to the traveling paper. As the paper moves, the blade rubs against the anvil and perforates the paper.

The web of paper may be quite wide — widths of 8 feet (2438mm) are common — and the web can travel at speeds up to 2500 surface feet (762m) per minute. The web passes over a rotating knife roll as wide as the web and traveling at the same speed as the web.

Typically, the knife roll is 12″ (304.8mm) in diameter and contains machined grooves. A perforating blade is mounted in each groove, as shown in Illustration B. The perforating blades, approximately 4-½″ long (114.3mm), are mounted in rows around the entire circumference of the roll. The distance between the rows of blades corresponds to the distance between the perforations on the web.

''Bonds'' refer to the slots in the perforating blade. As the blade rubs against the paper lying on the stationary carbide anvil, the blade cuts the paper everywhere the blade touches. That means that the ''bonds,'' the slots in the blade, prevent certain areas from being cut. These uncut areas *bond* the paper — preventing the paper from tearing entirely.

Perforating blades can be bonded in any pattern, but usually the pattern maintains an equal distance between each bond. Two reasons support this uniform spacing. First, regularly spaced bonds produce a visually appealing perforation. And second, regular blade patterns are less expensive to manufacture.

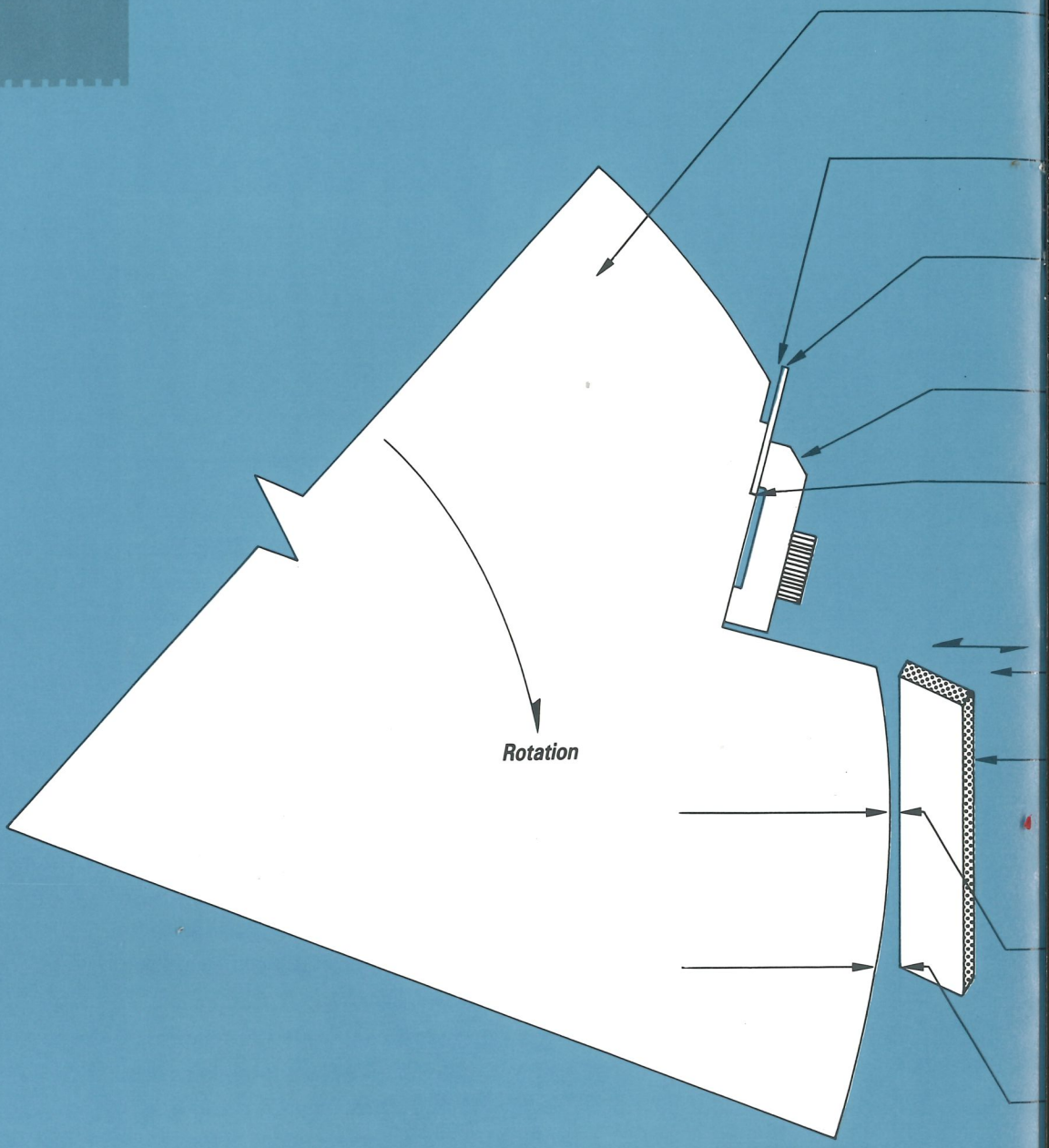

Rotation

Illustration B

Knife Roll
Paper (not shown) wraps around knife roll and travels at same speed as knife roll.

Relief Area
Allows blade to flex.

Perforating Blade
Blade flexes on striking anvil.

Blade Clamp

Blade Bearing Surface
Blade must be accurately positioned against this surface. Inaccurate positioning is the leading cause of blade breakage.

Carbide anvil adjustable in this direction only.

Carbide Anvil
Anvil (Kinetic Part No. 117332-001) does not flex when blade strikes it. Anvil holder is not shown.

Anvil center to roll distance .055″ (1.4mm).

Anvil edge to roll distance .059″ (1.5mm). Distance is not to scale because of exaggerated anvil-blade helix angle.

Schematic showing relationship between perforating blade and carbide anvil in high speed perforating head.

The properties of the paper determine the best bonding pattern. The perforations must tear easily enough to satisfy the consumer. Yet the perforations cannot tear so easily that the paper web breaks while it travels through the rewinder.

Each time the blade cuts, the blade meets the anvil at a 90° angle. To be productive, the cutting edge must remain sharp. You can prolong the life of the blade by rotating the blade in its knife roll position. Each blade has a total of four cutting edges that can be used before its life is exhausted.

The blade flexes when it strikes the anvil. The amount of flexing, or ''interference,'' must be critically controlled. (See Illustration C.) While the operator cannot change the angle of the anvil, he can adjust the distance between the anvil and the face of the knife roll.

The tungsten carbide anvil is rigidly mounted in its holder, and the holder is mounted on the machine head. Note that the anvil is not parallel to the centerline of the knife roll. (See Illustration A.) Rather, each anvil is mounted at an angle to the roll. The typical angle is 2.5°, and when all the anvils are mounted on the machine, they form a helical pattern.

The angle, which allows the blade to contact the anvil a section at a time, is important to the perforation process for two reasons. First, the strength of the web weakens gradually as it travels over the anvils and under the blades. If all of the perforations are cut simultaneously, this instantaneous weakening of the web would probably cause it to break as it travels through the rewinder. Second, because the anvils are set at an angle, the impact of the blade edge meeting the anvil is lessened. If the entire blade strikes the anvil at the same time, the impact puts stress on the knife. A knife so flexed is more likely to break.

A radius of approximately .004″ (0.1mm) should be placed on the anvil's edge. Without this radius, the anvil will damage the perforating blade. A sharp anvil positioned incorrectly will shear away the edge of a perforating blade in a very short time. (See Illustration C.)

As mentioned earlier, operators can adjust the distance between the anvils and the face of the knife roll. After replacing a blade or an anvil, many operators first position the anvil so that the blade cannot strike it as the blade passes. Gradually, the operator adjusts the distance between the anvil and the knife roll until he finds the position that produces the best quality perforations. *Note:* Operators should initially adjust anvil positions every few hours during operation. The edges of new perforating blades break down quite fast.

About blade breakage... The primary reason that the blades break is that they are improperly placed in the knife roll. To prevent breakage, the operator must accurately position the blades against the bearing surface. This means the operator must clean the bearing surface before installing the blades. Debris may interfere with the blade's position, and if the blade is off as little as .004″ (0.1mm), it may break.

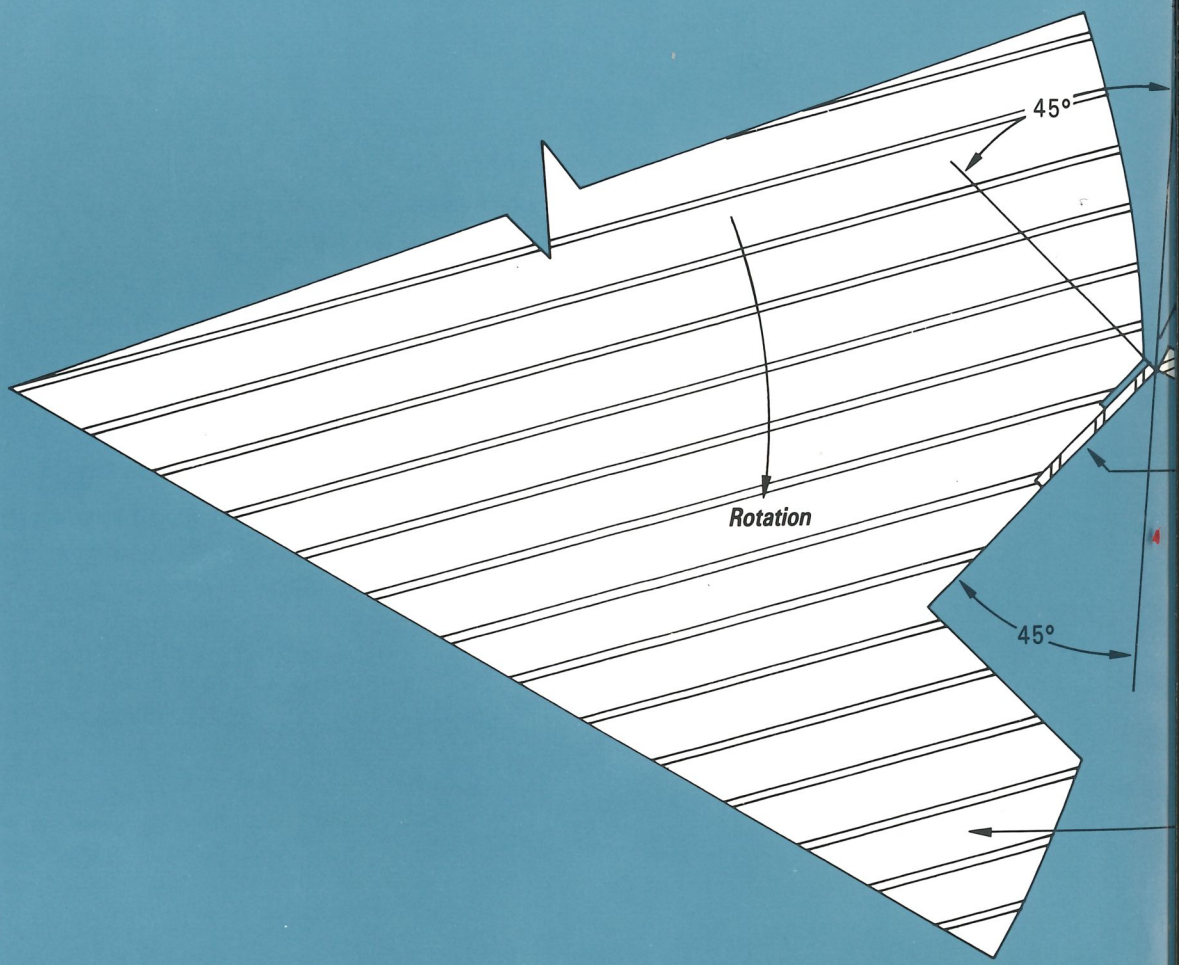

45°
Rotation
45°

Illustration C

Carbide Anvil
Edges cannot be sharp. They must have a radius of .004″ (0.1mm) on them.

Perforating Blade
Edges form a 90° angle and must remain as sharp as possible under repeated impact for good life.

Knife Roll

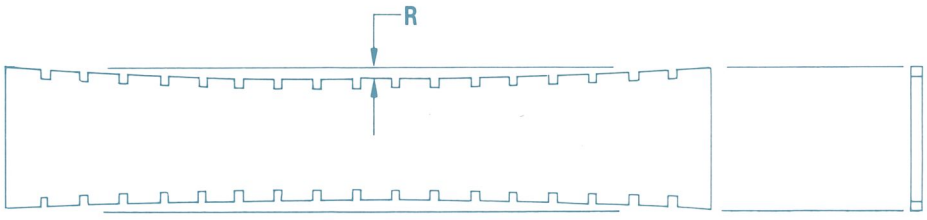
Interference between blade and anvil at contact varies from a maximum of .008″ (0.2mm) at blade center to a minimum of .004″ (0.1mm) at blade edge. These numbers refer to a straight edge (non-hollow ground) blade only.

Schematic showing relationship between perforating blade and carbide anvil at instant of contact.

Blades may also break because they are flexed twice as much at their center as they are at their edge. This stress is caused by the anvil's angle at impact. To solve this problem, Kinetic can hollow grind perforating blades as the sketch below illustrates:

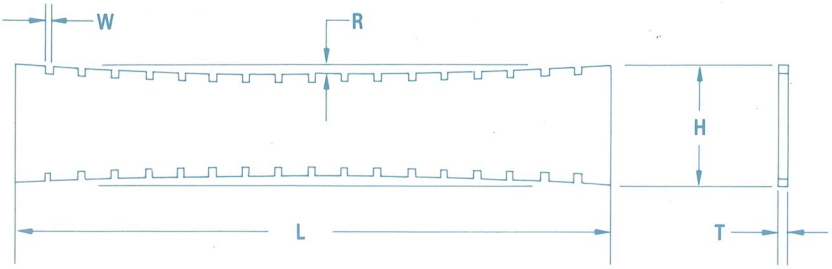
The depth of the hollow grind radius, dimension ''R'', is typically .004″ (0.1mm). We suggest this radius to customers if breakage has been a problem. Customers also find it helpful in reducing skipped perforations.

About web breakage... The perforated paper web sometimes breaks shortly after it has been perforated. When the web breaks, it wraps itself around the knife roll. After several revolutions, the thickness of the paper around the roll builds up so that the perforating blade cannot flex properly. The perforating blades simply break off when they hit the anvils. The only cure is to quickly remove the anvils and stop the knife roll. Newer Paper Converting Machine Company rewinders automatically detect web breakage, remove the anvils, and stop the knife roll.



KINETIC®

HOW TO ORDER PERFORATING BLADES FROM KINETIC



The first time you order a particular blade, please give us the information below. KINETIC will then assign the blade a part number you can use on future orders.

1. ***The number of bonds per side***
   This is one half the total number of bonds on a blade. The bonds are uniformly spaced along each blade side.
   KINETIC can supply any number of bonds on a side, as well as bonds on the ends of each side, if desired.
2. ***The bond width "W"***
   Any bond width from .010" (.25mm) upwards can be manufactured by KINETIC. Bond width tolerance is ± .001" (.025mm).
3. ***The blade height "H"***
   KINETIC manufactures blades in the popular industry heights: .875" (22.22mm) and 1.000" (25.40mm).
4. ***The blade thickness "T"***
   Perforating blades are supplied in thicknesses of .032" (0.8mm) and .040" (1.0mm).
5. ***The blade radius "R"***
   For the ultimate in contact uniformity, KINETIC can hollow grind each side to a maximum of .010" (.25mm).
6. ***The blade length "L"***
   The standard length is approximately 4-$^{15}/_{32}$" (113.2mm), but please specify the exact length.
   If you want help in a particular application, please contact us directly.

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