DIECUTTING

Solutions

Sosform® SANDVIK

Issue No. 8

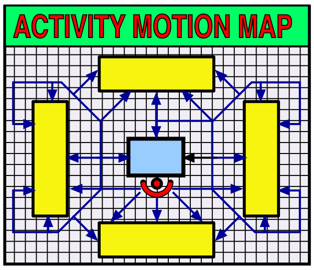
The Diemaker's Workstation

***"Simplicity is the Ultimate Sophistication."** Leonardo DaVinci*

> *"Waste can be defined as anything other than the minimum amount of equipment, material, parts, tools, space, and the worker's time, which are absolutely essential to add value to the product."* Fujio Cho - Toyota

Diemaking ruling is a production application in which materials, tools, equipment, technology, and the diemaker, are combined to fabricate a steel rule die. Cost and time are critical factors in this process and it is vital to create an efficient work area, where movement is minimized, where non-value-added activity/time is progressively eliminated, and where everything needed to complete the ruling task is in the right place, it is in the right quantity and it is in the right condition.

The closest analogy is the hospital emergency room, however, in our example the surgeon is the diemaker! The mission of the diemaker is clear. To stabilize, to standardize, to benchmark, and to streamline the ruling process to produce tools in the shortest possible time, at the lowest cost; to minimize the consumption of all resources, particularly time; and to continuously refine the work area and the layout of tools, materials, and equipment, so the activity is refined, and all non-essential moves, actions, and activities are eliminated.



The diemaker is our engine room in this process and it is vital to develop a work station approach to ruling, which is as compact and well designed as possible, to maximize the production efficiency and output of each diemaker. When you stand in the diemaking workstation, is every tool, every material, every part, every component, every piece of equipment, every supply, every piece of technology, and every piece of information consistently organized and positioned in the most compact and efficient layout, in single source, color-coded storage locations?

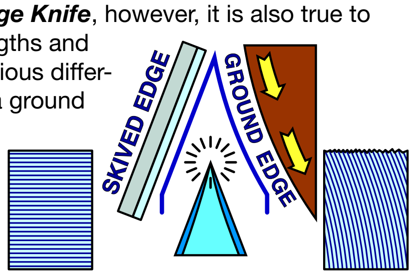
7 Waste Sources
Time
Motion
Processing
Defects
Over-Production
Inventory
Transportation

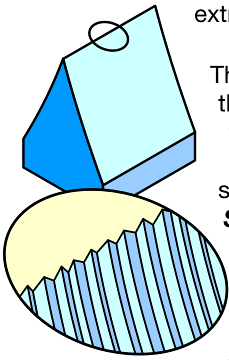
In manufacturing or diemaking there are seven sources of waste that we must recognize, we must understand, and we must address, if we are to becomes the fastest & the most efficient toolmaking organization. Standardization of procedures, benchmarking of procedures, uniform implementation of approved procedures, followed by a repeated focus on streamlining and simplification, ***will eliminate waste.***

Remember, every non-value added move, step or action by the diemaker consumes valuable time, increases fatigue, reduces throughput, and increases cost. It is essential to move from a craft based, artisan driven diemaking process, to a fast, efficient, and a meticulously organized system of toolmaking manufacturing.

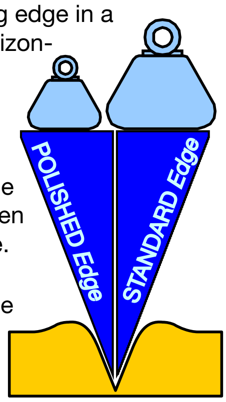
G12 - 42: Sharpness with an Edge!

It is a common understanding that a ***Ground Edge Knife*** is sharper than a ***Skived Edge Knife***, however, it is also true to state that both have strengths and weaknesses. The first obvious difference is when comparing a ground edge blade, to a skived edge blade, the concave face of the ground edge blade provides a sharper cutting edge and it results in lower pressure penetration into a material, and less plucking as the knife is extracted from the diecut material. ***See right***.





This attribute of a ground edge knife is further enhanced by the almost vertical direction of the machining striations or grooves in the bevel surfaces of the blade, and the slightly serrated profile of the cutting edge. ***See left***. These microscopic machining marks are the grooves generated by machining the bevel profile at the top of the steel strip, vertical and at right angles to the cutting edge in a ground knife, and horizontal or parallel to the cutting edge in the skived knife. The potential Achilles Heel of a ground edge knife is the sharper the cutting edge, the greater the chance the serrated tips will be compressed, and the edge loses much of its technical advantages when cutting against a steel anvil or cutting plate.



The obvious question, is how can this blade not only be improved, but could the precision of the cutting edge be further enhanced. ***The answer was Yes, and Yes!***

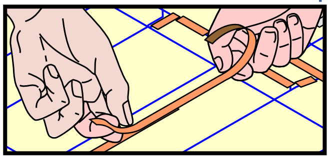
The solution is to polish the ground edge to further refine the tip of the blade. Polishing is simply another word for grinding, however, in this case, the grinding is far finer and the resulting edge is very sharp, it penetrates even difficult material with ease, and it combines both the strengths of the Ground Knife with the strengths of the Skived Knife.

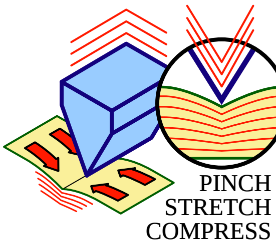
Summary

As the name suggests G12 - 42 is a 42 degree angle blade. It has excellent machining characteristics and bendability and it is one more important addition to the most comprehensive toolbox of cutting knife options available to the industry. G12 - 42 is designed for tough materials, where penetration pressure needs to be controlled and the cleanliness of the diecut edges is critical. However, as with many of the blades in the Sandvik Applications Spider, G12 - 42 knife is used successfully for a diverse range of materials and substrates and diecutting applications.

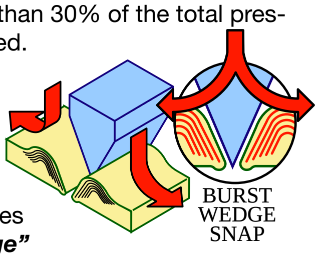
The Relationship Between the Cutting Knife & Diecutting Pressure?

When materials are diecut the majority of professionals discuss ***"adding pressure"***, when in reality the adjustments made, ***see below***, are simply designed to reduce the gap between the steel rule die and the cutting anvil. The ***"pressure"*** registered is simply a measurement of the ***"resistance"*** of each specific material to the splitting and separation of the material by a cutting blade. But what is the primary source of the pressure or the resistance generated?



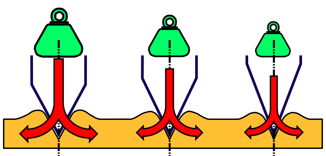


In platen diecutting when the knife strikes the upper surface of a material, it begins to compress the material and create a valley or a depression in the surface of the material. ***See above***. Eventually, because of the compression of the material and the severe stretching of the surface, the material splits apart, to allow the knife to enter the material. The degree of pressure or force generated by this ***"explosive penetration"*** is less than 30% of the total pressure expended.

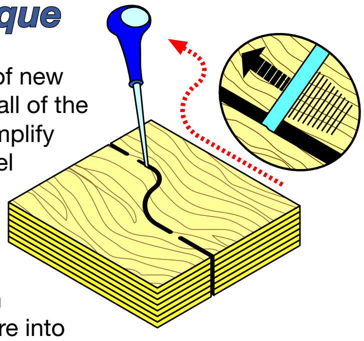


Once the knife has penetrated the surface, the bevel faces of the ***"wedge"*** begin to displace and push the material away from the centerline of the cutting edge, ***see above***, until the material splits. The degree of force generated by this ***"explosive separation"*** uses more than 70% of the pressure expended.

Therefore, when designing and specifying a steel rule die the bevel angle of the knife selected is of critical importance in diecutting! The higher the bevel angle, the greater the pressure to diecut, and the lower the angle the lower the pressure to diecut!



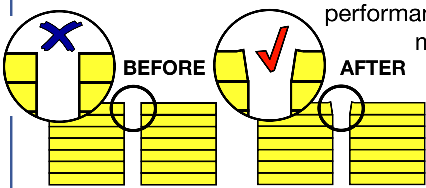
The Kerf "Open" Ruling Technique



One of the disadvantages of the rapid introduction of new technology into diemaking, is we often fail to retain all of the techniques which experience has demonstrated, simplify toolmaking and improve the performance of the steel rule die. One of these old tricks of the trade is called the ***Kerf Open Technique.***

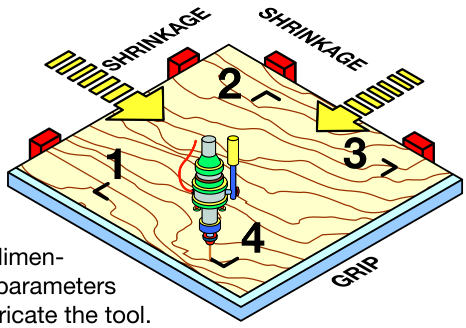
Before the lasercut or routed dieboard is ruled, the top of each kerf channel is traced using a marlin spine which is pushed downward with slight pressure into each channel, ***see right***, as the profile of all of the kerf is followed. This slight downward pressure pushes the edges of the upper veneer slightly to one side, to make the opening of the kerf slightly wider than the rule to be inserted. ***See below***.

What are the advantages of this technique? This modification of the kerf makes it faster, easier and safer to insert rules into the dieboard; there is far less damage to the upper veneer layers; the rule does less damage to the kerf walls and the rule is seated more precisely and with less debris; there is less flexing and distortion of the rule, particularly around bridge points; there is less pressure required to drive each rule into the dieboard; cleaning the back of the dieboard is easier, and better kiss-cut performance and a longer die life, make this a worthwhile modification to standard operating procedures.



Now we have eliminated the square peg in the square hole challenge of ruling, the process is faster, safer, simpler, and more effective.

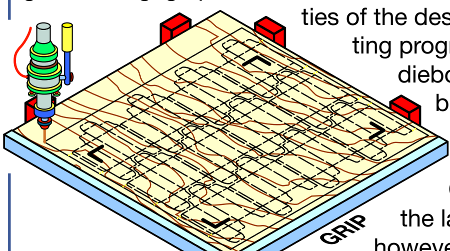
The Dieboard Shrinkage Gage



One of the key specification criteria for steel rule dies is the dimensional accuracy from the center or the cutting edge of one knife, to the center or the cutting edge of a second knife. This claim of a specific dimensional precision is clearly a function of the parameters and the stability of the material used to fabricate the tool.

One of the critical dynamics of fabricating a steel rule dieboard from a plywood panel, is the progressive shrinkage of the cellulose fibers in each exposed surface as the drier air in the manufacturing environment leaches moisture into the surrounding atmosphere. The intense heat of lasercutting and the exposure of the end grain in each kerf channel wall accelerate this moisture loss. This fiber shrinkage, and gradual change in the dimensional size of the dieboard, is actually happening as the plywood panel is lasercut!

To measure actual machining shrinkage the professional toolmaker often integrates a ***"Shrinkage Gage"*** into the CAD program, which will control the laser-cutting program. The gage pattern consists of burning four ***"L"*** shapes at the furthest extremities of the design layout at the beginning of the laser-cutting program. ***See above***. At the conclusion of the dieboard burning cycle, the laser is directed to burn the same four ***"L"*** shapes a second time. ***See below***.



Clearly as the slots are already in existence, the laser will theoretically have nothing to burn, however, if the plywood has shrunk and the relative positions of each ***"L"*** shape has moved, the laser will cut a wider slot than originally specified. By testing each of the four ***"shrinkage gage"*** shapes with thickness shims, the toolmaker can precisely define how much the dieboard has shrunk during the laser cutting process.