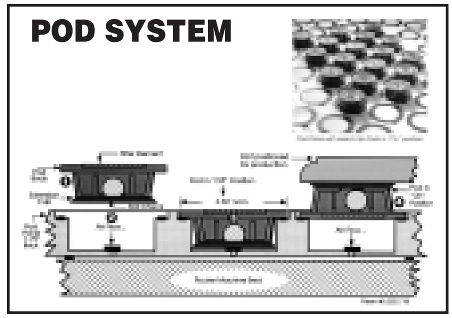
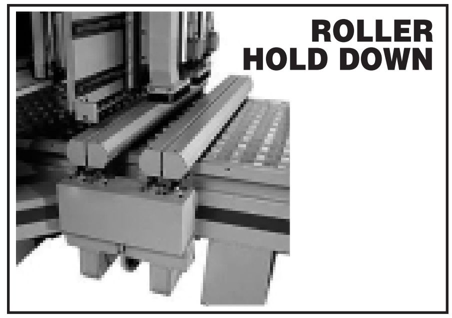
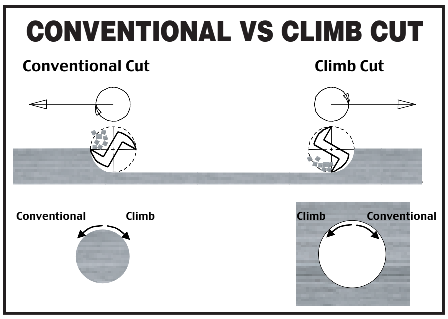
## OTHER TYPES OF HOLDDOWN SYSTEMS

Within the realm of vacuum systems a fixturing process that is sometimes seen is the Pod System which utilizes a raised approach to alleviate the aforementioned problems with off-fall. Also, this system allows the operator to change the configuration of the part setup by flipping pods on top or underneath the work area to accommodate the travel of the cutter and duplicate the desired pattern. The system is somewhat limited in terms of vacuum area and almost always necessitates the use of downcut or neutral effect tools to avoid pushing parts off the pod. These systems are commercially available, but some firms have manufactured homemade versions to accommodate individual needs and save cost. The Pod System is extremely prevalent in Point-to-Point machines.




In the area of mechanical holddown, the Roller Holddown is probably the most predominately utilized in conjunction with CNC routing. This mechanism has rollers, which travel the length of the work area holding down specific areas as the individual part is machined. It may be assisted with flow through vacuum, but most times the roller holddown is the sole agent to eliminate part movement. This type of machine and holddown procedure is very prevalent in the manufacturing of upholstered furniture and boat parts.




# PROGRAMMING TECHNIQUES

## CLIMB AND CONVENTIONAL CUTTING

In most cases, conventional cutting provides the best edge provided the right tool geometry to cut a specific material has been selected. This applies mainly to man-made board products. If you are cutting solid wood where multidirectional grain patterns have to be considered, it is often necessary to employ climb cutting thereby limiting the chip the tool can remove at one time and reducing splintering. In CNC routing with right hand rotation tooling, climb cutting occurs as the perimeter of the workpiece is routed in a clockwise direction. Routing the same workpiece in a counter clockwise direction represents conventional cutting. The whole process is reversed when making internal cuts on the part. When workpiece finish is substandard, check the scrap as a comparison. If the scrap finish is better, change the direction of feed.

## OSCILLATING TO IMPROVE TOOL LIFE

When cutting laminated materials such as plywood, laminated MDF or particleboard with a decorative surface such as melamine, glue lines represent the biggest threat to tool life. These glue lines are more abrasive than the surrounding material and tend to cause focused wear at a single point on the tool thereby prematurely degrading one or more of the areas of the edge. The remedy for this situation, provided a dedicated spoilboards or a pod system is in use, is to ramp the tool up and down through each tangent of the part insuring the glue line is never focused on one spot of the tool for any length of time. This will increase the life of the tool substantially while not actually reducing cycle times. The method of dropping the "Z" axis when the tool starts to get dull is highly ineffective. By the time you realize the edge is chipped, it is already too late to recalibrate the "Z" axis and the tool will leave lines in subsequent parts. Note that some software manufacturers offer the preferred approach in the form of "automatic tool oscillation".

## SKIN CUTTING PARTS

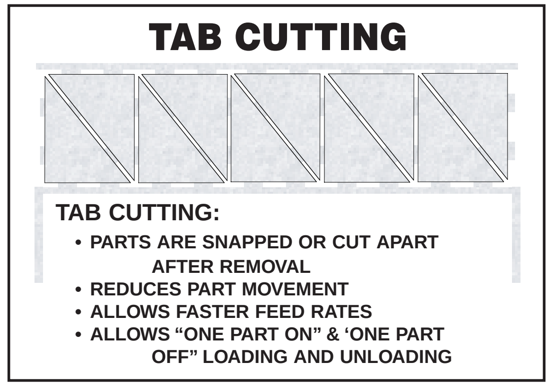
Skin cutting is a method of cutting parts where the tool cuts most of the way through the part leaving a thin "skin" attached to the larger sheet. Typically skin thickness is .020 - .030" requiring that the spoilboard must be surfaced flat before machining parts. This method is commonly employed in small parts that cannot adequately be held individually by vacuum. Such is the case with lettering or narrow parts where gasketing is impossible. This method also allows for faster loading and unloading of the machine as parts come off in the same quantity as went on the machine. This method is often employed in solid wood where after the parts come off the router they are passed through a wide belt sander to remove the "skin" and sand the parts free. Sometimes the parts are just broken apart and then routed on a table router with a flush trim bit or sanded to eliminate the skin. On some high accuracy routers routing plastic sheet on properly surfaced spoilboards, the skin may be limited to only the masking.

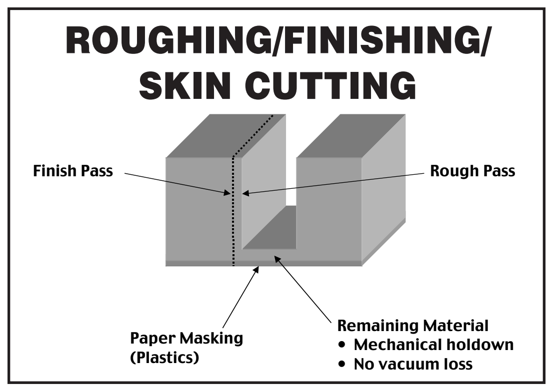
## TAB CUTTING PARTS

Tab or bridge cutting is another method similar to skin cutting. The material is cut through; however, tabbing leaves a skeletal framing behind to hold the parts together. This is commonly used where many parts are cut from the same sheet of material while almost the entire table is opened up on a flow through vacuum system thereby minimizing holding power. The tabbing allows the skeleton to hold everything together until the cutting is completed. Tabbing usually leaves behind a 1/4 – 1/2" long x .020" thick tab, which can either be routed away in a final pass or sanded or trimmed away in a secondary operation.

## ROUGHING AND FINISHING

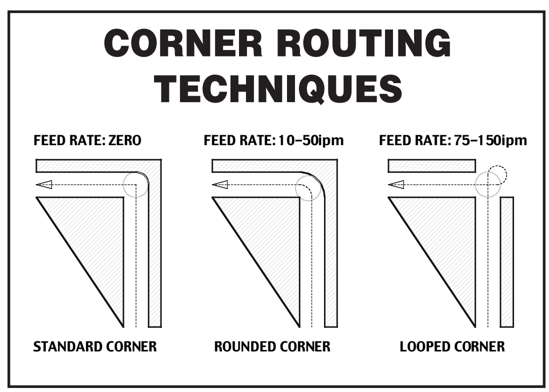
The propensity of tool changers on CNC routers has made the concept of roughing and finishing passes a productive technique to improve edge finish and part quality without sacrificing productivity. In this process, a rougher is used to remove the bulk of the material leaving and a finisher or profile tool is employed to achieve the finished edge. The material remaining for the execution of the finish pass should be approximately 20% of the diameter of the tool used in the roughing portion of the application. In both roughing and finishing, the feed and speed should be appropriate to enhance productivity without adversely effecting the part.




## MIRRORED OR NESTED PARTS

If possible, always attempt to make the tool run the edges of both parts in one pass. This is a shared cut, which means one edge is climb cut and the other is conventional cut. This works extremely well for parts not requiring a high quality edge finish such as plywood panels for upholstered furniture industry. However, users should be careful not to utilize mirroring techniques when cutting circles. The climb cutting of one part followed by the conventional cut of the next part requiring a high quality finish will result in two different edge finishes. This happens frequently with point-to-point machines where parts are repeatedly run on either end of the machine. It is much more practical to "copy" the program in order to achieve similar part finish. Failure to maintain proper direction of cut will result in not only reduced edge quality but diminished feed rates and tool life as well.




## AVOID DEAD STOPS

A router bit in a CNC environment was designed to run at high performance feeds and speeds. Unfortunately, parts many times have corners, which necessitates the router bit to slow down or stop to change direction. Understanding the concept of chipload, it is easy to comprehend the devastating effect this has on the cutting edge of the tool. In other words, nothing good happens when the tool stops. Consequently, it is important to establish corner-rounding techniques that minimize the adverse condition created by stopping in the cut. There are two ways to alleviate or lessen the severity of corner rounding. First, a very small radius of .001 applied on the corners will prevent dead stops, but at a very reduced feed rate. The most effective method is to do a looped corner where the tool travels beyond the corner and loops back and intersects the original path. This provides a cooling effect on the tool as it momentarily leaves the workpiece and assures a square corner.