

# TOOL SELECTION

Tool selection involves an evaluation of the circumstances regarding the application and asking questions or making a needs assessment. The needs assessment is the logical order to follow in making a valid tool selection.

## WHAT TYPE OF MATERIAL IS BEING MACHINED?

This is the first and most basic question because it defines the type of tool material and geometry needed to perform the job. In terms of wood, some are natural woods; others are man-made composites or combinations of both. Plastic and aluminum have characteristics of hardness and softness, which dictates tool material and geometry. Consequently, the foremost question becomes how is the part material going to effect the tool material and the life of the tool?

## WHAT TYPE OF ROUTER IS BEING UTILIZED?

The use of a hand router or pin router dictates different tool choices than a CNC machine. The obvious difference is feed and speed capabilities and how various tool materials react in the cutting environment. Hand fed operations tend to be best suited to steel bodied router tools, which can better tolerate inconsistent feeds, while CNC machines enhance the toughness of solid carbide.

## WHAT IS THE MATERIAL THICKNESS?

Quite simply, this question leads to the selection of tool diameter and cutting edge length. Always choose the tool with the shortest possible cutting edge to cover the thickness of the part with a slight overlap. Since diameter of tool increases rigidity, it is best to select the largest diameter possible, but the cutting edge length should be as short as possible and not more than three times the diameter in a perfect world.

## WHAT IS THE PART CONFIGURATION?

The size, contour and detail in a part play a huge role in tool selection and tool life. For instance, large parts can be machined extremely fast and may react very well with multi-flute tools. Conversely, a smaller part with tight radii would operate ineffectively with multi-flute tools by decreasing tool life because of slower feed and speed.

## HOW IS THE PART BEING HELD?

In the section regarding vacuum systems and holddowns, the emphasis was on rigidity of part during the routing process. Tool selection is almost a mute issue if the part is not held solidly.

## WHAT INFLUENCE SHOULD THE TOOL HAVE ON THE PART?

Router tools come in straight, shear, spiral upcut, spiral downcut, and a combination of up and down cut. They come in single flute through multi-flute in a wide range of diameters. All these characteristics have an influence on the part. For example, in a thermoformed part which is set up on a formed fixture, it is important to have no or neutral influence on the part to alleviate problems of pulling the part off the fixture. The larger diameter tools exert more lateral pressure on a part; smaller diameters do the opposite but provide less chip removal because of smaller flute area. Spirals move chips up or down and influence the part in the same direction. Influencing the part by tool selection is important and must be considered when selecting the right tool.

## WHAT IS THE MOST IMPORTANT CONSIDERATION, SPEED OR FINISH?

The selection on feeds and speeds specifically details the theory behind chiploads and tool life. Once the right tool for a job is chosen, the tool life is really a function of how the end-user fixtures the part and the speed and feed rate applied to the part. If chips are produced a significant thickness to dissipate heat, then tool life will be extended.

In summary, following these basic principles will aid in the tool selection process:

- Match the tool with material and the application
- Select a tool with the shortest cutting edge length to cut through the part
- Select the largest diameter possible to achieve rigidity
- Keep cutting and shank diameter the same whenever possible
- Select tools that accomplish goal i.e. finish or speed
- Select tools on the way the part needs to be influenced
- Select multi-function tools i.e. compression spiral with mortise point
- Select tools based on productivity rather than cost (The final bullet point is best illustrated by the Value Analysis Report on the next page)

## ROUTER SELECTION RESOURCES

- Onsrud Cutter Production Catalog
- Internet at [www.onsrud.com](http://www.onsrud.com) and [www.plasticrouting.com](http://www.plasticrouting.com)