O Flutes for Mechanical Plastics

Mechanical plastics are steadily becoming the material of choice for the job shops and machine shops throughout the country. These plastics have proven to demonstrate excellent performance in gears, bearings, material-handling parts, and other machine components such as spacers and positioning mounts where reduction of vibration is essential. A few common mechanical plastics include: (ABS), Acetal, Delrin, Hydex, UHMW, nylon, polycarbonate, polyurethane, and polyethylene terephtalate (PTE). These plastics have consistently demonstrated predictable performance because of durability, machinability, and exceptional mechanical and electrical properties and are replacing metal for parts manufactured to resist wear.

In terms of machining mechanicals, they can be classified as a soft plastic. Soft plastic utilizes "O" flute router type tooling that tends to curl a chip during the machining process. **(Figure 1-"O" Flute Chip Action)** This tooling has been designed to attack soft plastics with a high rake and low clearance geometry that actually carves the material. This tooling, when properly applied within a narrow range of chipload, typically 0.004 to 0.012, will provide an excellent finish in mechanical plastics. The consequence of improperly curled chips is visible knife marks that adversely affect the finish, which remains the most important consideration in plastic fabrication. **(Figure 2-Formation of Edge Finish)**

Figure 1

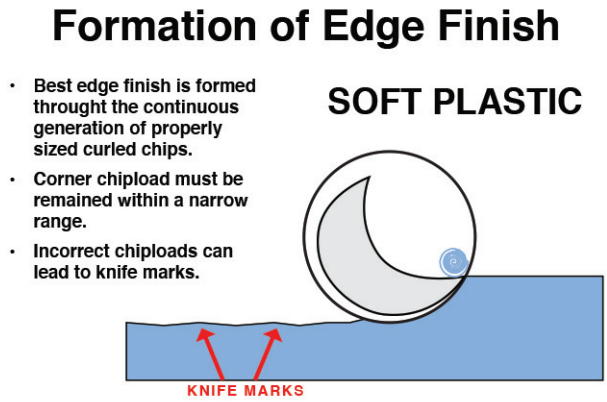

Figure 2

"O" flute tools are manufactured from micro grain solid carbide tool material in straight and spiral configuration. The upcut, or right hand spiral is most readily utilized because of the need to evacuate chip in an upward direction in flat sheet or block applications. Upward movement of chips avoids welding, which is a common problem in the machining of plastic. The tools are available in either single or double edge cutting diameters. A single edge tool is an excellent choice for most machining applications and can accommodate those situations requiring smaller diameters. The only caution with single edge tooling is to avoid using diameters over 3/8's because of balance issues associated with the tooling. If larger diameters are needed, the double edge alleviates the balance problem while providing a much improved bottom finish for slotting application, which are prevalent in the machining of mechanical plastics. The double edge tools additionally provide longer cutting edges for deeper cuts of two to four times the cutting edge diameter at aggressive feedrates.

In shops with high feed and speed CNC routers the use of router bits is common practice. The benefits of the tooling are understood, but this is not always the case in shops with CNC mills. In these environments, the tool of choice has traditionally been the endmill. These tools are intended for metal removal and do not possess the proper geometry to effectively machine mechanical plastics. Endmills have minimal rake and low clearance and were designed as robust cutting tools for heavy loads. Also, minimal flute area on these multi-edged tools interfere with the process of clearing chips, and this along with inappropriate geometry, can easily aggravate melting and rewelding problems common in mechanical plastic applications. Besides the endmill dilemma, machining methodology in many shops remains constant because of past practices associated with milling metal. The feedrates and spindle speeds tend to be slow relative to the capability of today's CNC machining centers and climb cutting with multiple passes are commonly utilized to enhance finish. These practices adversely affect productivity, profitability, and are the antithesis of the meaning of high speed machining.

The use of "O" flute router tooling represents a whole new concept in high speed machining of mechanical plastics. By selecting a tool properly designed for cutting soft plastics, and a few basic changes in machining methods, the task of producing parts from mechanical plastics can be greatly reduced, and the potential of the CNC milling machine can be fully realized.

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