



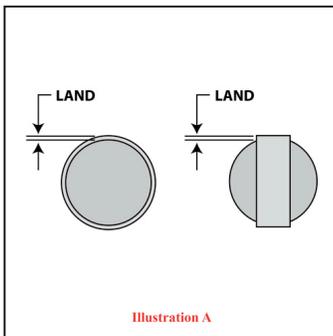
Tablet Compression Tooling – Land or No Land?

By: Bill Turner

The topic of land on a tablet design is a much-debated one.

Tablet land is the narrow, horizontal surface perpendicular to the tablet's periphery, which creates a junction between the tablet's periphery and cup (see Illustration A). The three primary reasons for incorporating a land into a tablet's design are to (1) increase the strength of the punch edges, (2) increase the wear characteristics of the inner edge of the punch cup, and (3) reduce the severity of nicks on punch edges.

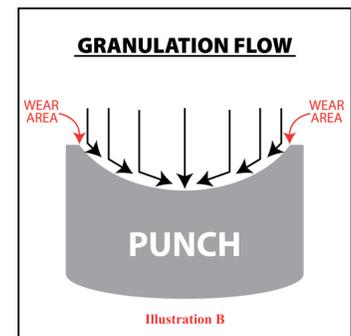
On one hand, the land is beneficial to add strength and durability to the punch tip. On the other hand land may be perceived as making it more difficult to coat the tablet.



The width of the land is dependent upon the tip diameter, cup depth, cup configuration, punch steel selection, required compression force and abrasiveness of the granulation.

Round punch tips deeper than standard concave are normally designed with 0.002" to 0.008" (0.05mm to 0.20mm) land and special shaped punch tips are normally designed with 0.002" to 0.012" (0.05mm to 0.30mm) land. In extreme cases, land widths in excess of 0.020" (0.51mm) will be used to add strength and longevity to the punch tip.

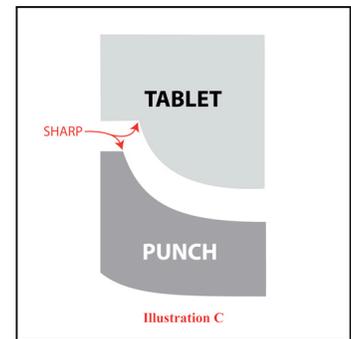
As the cup depth increases, so does the slope of the cup at the periphery of the tip. This will lead to the distinct possibility of deformed tip edges, or tip fractures, under heavy compression loads when the tip has little or no land. When a punch begins compressing a tablet, the stress is initially higher at the tip edge. The compression stress is distributed across the cup's surface as the granulation is forced towards the middle of the cup (see Illustration B). This also describes the wear issue at the outer edges of the cup face as the granulation flows across this area of the cup. Adding land to the tablet design will reduce the likelihood of punch tip deflection, as it increases the strength and durability of the tip edges. With deeper cup designs, wider lands should be utilized to strengthen the tip.



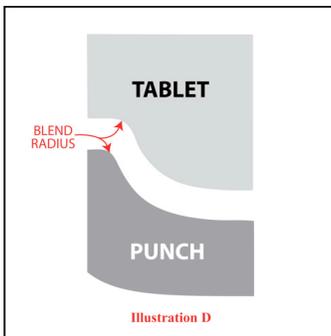
Punches made of premium steel normally used for compressing nutritional supplements will require wider land in the tablet design. This is due primarily to the reduced shock resistance of these steels compared to standard steels and the typical requirement of heavy forces necessary to compress nutritional supplement tablets.

Although tablet compression punches are made from high quality tool steels and are heat treated for optimal wear resistance the punch still requires extreme care while handling, during set up, and during press operation. Incidental contact between punch tips, or contact between a punch tip and another hard surface, will most likely cause damage to the tip edge. A punch tip designed with an appropriate land will reduce the severity of the damage due to the added strength in this area of the punch.

The presence of punch tip land results in a small “lip” or “ridge” around the periphery of the tablet at the junction of the tablet face and the bellyband, or tablet side wall. This edge is more prone to erosion during the tumbling action in the coating pan. The junction of the land to the cup face will result in a sharp inside corner on the tablet (see Illustration C). To avoid difficulties during the coating process, it is suggested that the land have a generous blend radius at this junction. This will eliminate the sharp corner by adding a curved transition between the two surfaces (see Illustration D). If this is desired, it must be stated on the tablet drawing that the land is “BLENDED”. Generally, the tablet design drawing will indicate the land width *before* the sharp corner is blended.



Additional dimensions can be added to the tablet drawing to indicate the desired land width after blending (known as “MEASUREABLE LAND”), and the blend radius may also be dimensioned. Blending the inner edge of the land can be achieved by either (1) incorporating this requirement into the design of the hob, so it is formed on the onset of the punch manufacturing process, or (2) by blending the punch cup during the final polishing at the end of the manufacturing process.



The slope of the cup adjacent to the inner edge of the land on punches that have a compound cup incorporated into their design is greater than that of single radius cups. This results in a reduction of allowable tip force. Therefore, land becomes even more critical, replenishing much of the strength lost due to the steeper slope. It is common that a wider land is suggested by the tooling manufacturer when a compound cup design is required.

It should be noted that the land is the area of most concentrated wear on the punch cup and should be inspected on a regular basis. Reworking the punch cup to re-establish the land is critical to extend the life expectancy of the tools and to

maintain tablet quality.

Many tablet designs have evolved to incorporate a heavy land for punch tip strength and longevity while without effecting overall tablet quality. High volume nutritional supplement manufacturers commonly implement a .020” (0.51mm) wide land into tablet designs that are coated successfully. This popular design is often duplicated by generic manufactures as well.

Generally, an increase in land width will strengthen the punch and reduce the likelihood of tip deflection or breakage, while allowing for higher compression forces and extended tool life. Let your experienced tooling manufacturer guide you through the design process to assure a successful tableting project.



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