A Decade of Drilling Dilemmas

Ten years of troubleshooting techniques.

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Several months ago, we received a phone call in reference to an article we wrote for PC FAB *in 1984. Shortly thereafter, a colleague traveling in Southeast Asia telephoned on behalf of a board shop supervisor in that region who had a specific production problem. This supervisor also referred to an article, which appeared in PC* FAB *at around the same time. These contacts confirmed the theory that, despite its rapid advancement, drilling technology* is *still being called upon to address some of the problems that were prominent a decade ago.*

The following review of troubleshooting developments is presented for today's fabricator, who must simultaneously grapple with both basic and sophisticated challenges in the drilling room.

The PCB industry is facing tremendous pressure to deliver world-class-quality boards at globally competitive prices. This has created a need for individualized yet universally applicable manufacturing techniques. Some such options for drilling applications are detailed below.

Deep-Hole Drilling

Since the effective maximum flute length of standard common-shank (1/8") drills is 0.500", a drill with the ability to penetrate beyond this limit is needed for special applications (Figure 1). This drill is based on the concept of relieved or undercut-neck drilling. Using the existing flute length, the depth of penetration can be increased to 0.750", depending on the drill diameter and the material to be processed. Standard drills modified to user requirements have been used in a variety of projects.

Tooling Plate Drills

Most PCB drills with a diameter exceeding 1/8" have an overall length of 1 1/2%" and a common-sized shank. The drill shown in Figure 2 was developed for the special requirements of tooling-hole drilling. With an overall length of 2" to 2 1/2", this design allows for true position accuracy without the need for adjustment of the machine spindle.

Drilling plastic tooling plugs with consistent diameter and straightness has been problematic in the past. The drill shown in Figure 3, which incorporates a pilot for centering accuracy, controls the major diameter to very close tolerances. This, in turn, ensures a snug fit for the tooling pins.

Countersinking and Counterboring

From a historical standpoint, producing countersink or counterbored configurations to printed circuit board manufacturers' requirements has been a time-consuming and costly process. The following

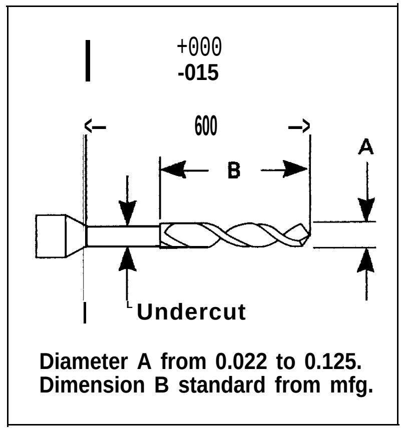

Figure 1. Extended-flute PCB *drill.*

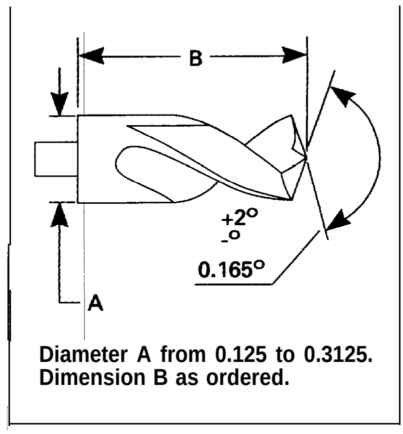

Figure 2. *Tooling-plate* drill.

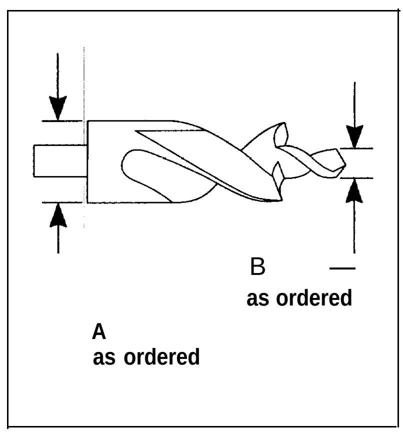

Figure 3. *Piloted* tooling-plate *drill.*

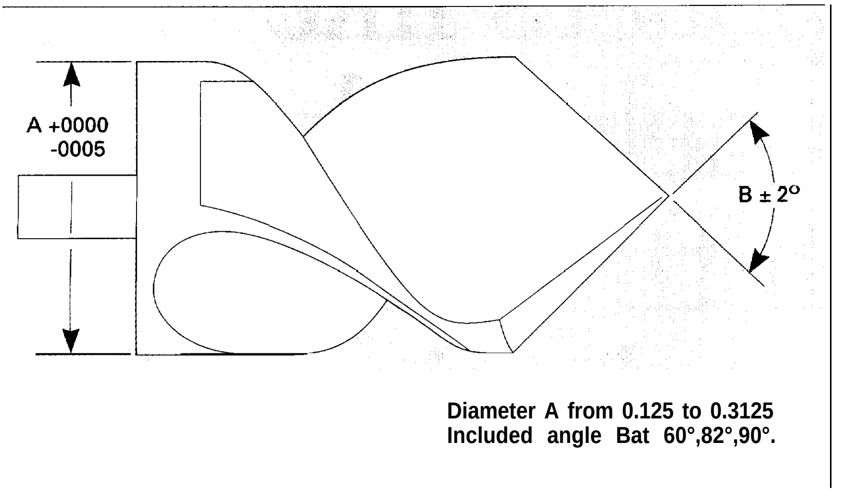

Figure 4. Drill designed for specified-angle countersinking.

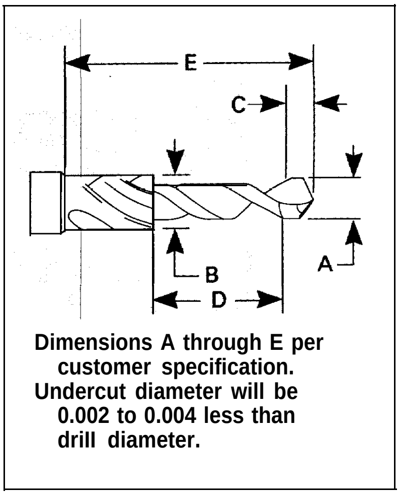

Figure 5. Combined drill and counterbore.

tools can be used on conventional machines.

Specified-angle countersinking can be done on a drilling machine (Figure 4). The multiple-fluted tool yields countersink holes with high-quality surface finishes. Since the tool can be resharpened and the angle maintained, tool life is extended.

The need to drill and counterbore simultaneously while improving productivity in a specialized application resulted in the tool shown in Figure 5. This design carries the relieved-neck theory a step further by adding a counterbore or countersink diameter. A variety of diameters can be accommodated using this configuration. If necessary, the counterbore can be adapted to a countersink with a specific angle.

The need to counterbore holes over 1/8” in diameter led to an adaptation. Using an existing hole as a starting coordinate and a pilot to ensure true position with no tool wander, a high degree of accuracy can be achieved. Application for long runs on automatic equipment can be accommodated with the common-shank tool; short runs can be processed on a single-spindle drill press.

Conclusion

Although there have been many advancements in drilling technology over the past 10 years, PCB manufacturers continue to require additional solutions to both old and new problems. The proliferation of high-aspect-ratio holes will accentuate this trend. Whether it means dusting off a time-tested technique or converting to an emerging one, board fabricators will *carry on the* quest for drilling proficiency. FAB

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