Aging Plating Lines: To Replace or Reconfigure

Processing today's PCBs on yesterday's automated plating lines.

Neil Baker

An interesting phenomenon can be seen at today's all-too-frequent equipment auctions: Automated plating machines arc selling at outrageously low prices—often as low as $.05 on the dollar!

Granted, the older, larger lines with deeper tanks can be intimidating because of their size, the uncertainty surrounding upgrading costs, and the possible liability of transporting a chemically contaminated system. But these old behemoths have a potential that's being recognized by only a handful of users and savvy used-equipment dealers.

Origins

Many of the old machines were built between 1975 and 1985, when board shops were vying for large-lot contracts with major computer companies. For maximum cost-effectiveness, plating line manufacturers designed their products with the largest possible payload. They sometimes carried two workbars at a time. For a typical 48" rack height, which held two 18" X 24" panels, and to allow for freeboard and agitation, 62" deep tanks were the norm. In modern terms, this would be considered a very deep tank, but some systems in those days handled rack heights of 6' and more!

The wider lines, larger hole sizes, and lower-aspect-ratio holes of that generation of PCBs resulted in plating machines with face to face anode-cathode distances of not more than 6". When floor space limitations were a factor, an equipment manufacturer might even violate the nominal 6" dimension by basing the cathode-anode distance on a center-to-center measurement, resulting in as little as 4" face to face. This spacing is wholly incompatible with today's typical minimal face-to-face spacing of 9" to 1 0".

Another shortcoming of older equipment was that racks were usually made of solid copper, with hooking arrangements that tended to stress and eventually bend. The stress was partly due to the early programmable hoists' two-speed drive systems, which turned the racks into pendulums as the hoists abruptly changed speed. We recently measured the bottom of a 54" effective deep rack on an 1 l-year-old line, and found the anode-cathode spacing, which had been designed *to* be 6", was 2" out of plumb. This displacement caused the boards to be 4" from the anodes on one side of the rack: and 8" on the other, which accounted for substantial variations in plating thickness and distribution.

In defense of the equipment suppliers, the simple, mass-produced boards of the day were extremely forgiving, and rarely needed enhancements such as side-to-side rectification or workbar vibration. Back then, however, a major concern was the rapid depletion of anodes. As a result, one sometimes finds a common row of anodes between adjacent workbars in multicell plating tanks.

Reconfiguration

Minimal anode-cathode spacing and common rows of anodes clearly indicate why older systems must be reconfigured to plate to day's high-tech panels. Hopefully, the system to be reconfigured will have sufficient space for additional plating stations, Otherwise, throughput will decrease because of the reduction in the number of plating cells and the likelihood of shallower racking arrangements.

For companies that have been operating older lines at lower capacities to handle PCBs requiring longer plating times lower throughput is not a problem. When plating today's smaller, more sophisticated lots, most firms will sacrifice speed in favor of increased yields.

A reduction in rack depth isn't always needed. Recognizing that many of their customers cannot afford to purchase new "one-Up" electroplating lines, specialty chemical manufacturers in recent years have significantly enhanced plating distribution in deeper tanks (usually not exceeding a 36" effective rack height).

Some firms with older automated lines are using manual methods for plating their more complicated panels. This trend, which seems to make little sense, is due to the basically inflexible control systems of these lines. Some difficult-to-process boards, such as backpanels, are not well suited for the older lines in their as-built state. Most of these systems were built with a single-cycle, timeway-based control system and designed for a 48- to 60-minute plating time. Plating backpanels that require two or more hours of copper plating essentially grinds the older line to a halt.

Equipment Advancements

With the development of the programmable logic controller (PLC) and the PC, plating automation has taken a big leap. The ease of creating a parts database and the ability to use the computing power of a low-cost PC to run a complex optimizing algorithm enables today's board manufacturer to run a wide variety of panel types concurrently. A typical mix might include double-sided panels needing only 55 minutes of copper, combined with a highly complex 0.125" thick, 14-layer backpanel requiring four hours of plating at a low-current density. Once the operator has defined the mix, in seconds the computer can provide an optimizing loading order to maximize throughput.

The flexibility afforded by the newer control systems allows firms to simultaneously run products requiring widely varying plating times and tank sequences. (It is not uncommon to have copper-solder, copper-tin, and panel plating on the same line.) These systems also have the flexibility to run one-up boards and multitiered racks because the computer, through a reservation-based program, ensures correct immersion sequences.

Automated plating machines are selling at outrageously low prices— often as low as $.05 on the dollar?

Since the parts database defines all relevant parameters, larger power supplies are not necessarily needed for every plating cell. The computer totals the surface areas of the boards and adjusts the amperage accordingly. These systems also total ampere hours, signal chemical additions as required, control rinse water based on the number and configuration of holes, provide fault diagnostics and process engineering prompts, and provide SPC and other reports,

How Proceed With Your Dollars

Assuming that existing tanks and progammable hoists are in reasonably good condition, the rebuild steps consist of reconfiguring and rebussing the plating tanks, and replacing the control system.

Unfortunately, many firms look at this procedure as "throwing good money at old equipment. " Instead of investing in their existing equipment, they either consider a new line or manual equipment. The end result is often a protracted deferral of all efforts or, more commonly, a large expenditure for new, manual plating capacity and a spruce-up of the old line. These misdirected dollars can often be better spent on a new control system and a reconfiguration of the existing line.

The new control system and power supplies can, of course, be used on a new line in the future. It should also be kept in mind that stopgap manual equipment solutions are very labor-intensive, and the monies for this equipment and its installation may never be recovered.

Another advantage of reconfiguring existing equipment is the ability to learn through operating, a process that enables more intelligent decisions in evaluating new equipment at a later date.

Conclusion

Old plating lines are often condemned to the scrap pile based on the assumption that the equipment is limited to its original capabilities: therefore, its potential for plating sophisticated printed circuit boards is not recognized. We do not advise fabricators to shun new, enhanced systems, but wc do encourage them to thoroughly evaluate the potential of existing workhorses. FAB

Neil Baker is president *of Baker* Technology Associates, Los Angeles, CA.