



The electronics industry uses many liquids in the various processes required to manufacture printed circuit boards or other electronic components. "Good" water is most essential since it is used to make up most of the solutions, in addition to being used for rinsing and cooling. Various water treatments may be required, including softening, deionizing, and/or purifying with carbon, all of which may employ prefiltration for solids removal to prevent surface loading of the resin or carbon. This may be followed by several stages of trap filtration down to and including sub-micron sizes.

One solution requiring continuous filtration is photoresist. It is a must to have this solution free of contaminants; otherwise, when using roller-coating or dip methods, small particles of dirt or dust are deposited on the copper laminate, thus leaving a light impervious barrier. After exposure, this speck leaves a spot of unexposed photoresist on the circuit pattern. Since the ultraviolet rays are unable to penetrate the particle of dirt, the resist does not completely harden and would then dissolve around and under the foreign particle in the developing stage. The result is a small area of exposed copper which, after etching, produces a pinhole on the circuitry or a nodule in the land area of the printed circuit board.

Finally, all of the electroplating solutions such as copper, tin-lead solder, nickel and precious metal baths such as gold, plus all autocatalytic deposits such as electroless nickel and copper, black oxide, Shadow®, Crimson®, or Black Hole® require filtration for removal of solids. Some of the above require removal of organic impurities with activated carbon, which is a purification process sometimes handled with filtration equipment.

The need for filtration cannot be emphasized enough, especially when plating in through-holes. Any void in the plating in the hole caused by small pieces of contaminant causes a reduction in the area available to carry the electric current. Rejects would also be caused when tin or tin-lead are used as a resist in the etching process, since any voids would allow etching in unwanted areas. Nickel and gold plating baths are also critical.

If activated carbon powder is used to adsorb organic impurities, it may be added to a pre-coated surface or mixed with the solution in a treatment tank. Adsorption is quick, but the powdered carbon is messy to recover from the solution. Therefore granular

carbon is generally preferred; it is held in a separate chamber for removal of organic impurities. Prefiltration to remove solids will increase the adsorption efficiency of the porous carbon granules. It is advantageous to run 10% of the process solution into a granular carbon chamber on a continuous basis to keep organics at a steady level.

Perhaps the most critical plating is done on memory discs or drums which require the ultimate in freedom from solids in the solution. This can only be accomplished by using filter media dense enough to remove the undesirable particles at flow rates high enough to have all of the liquid pass through the filter at sufficiently frequent intervals so that they will be picked up. The filter must also have sufficient solids holding capacity to maintain a high flow rate. Using two filtration chambers in series provides the best results and maximizes cartridge life.

Flow rates are the only means of carrying solids to a filter or bringing fresh solution into contact with the carbon. The rate of flow is referred to as the turnover — total gallons pumped per hour in relation to the size of the tank (for example, 200 gal/h on a 100 gal tank is two turnovers per hour). Dirt holding capacity is essential and can be attained with throw-away paper, or cartridges of different porosities, or filter surfaces coated with filter aid. Porosities of 100 micron down to less than 1 micron are typical.

In practice, the average plating solution is turned over once per hour. We are presently recommending at least twice per hour tank turnover; however, to achieve the ultimate in clarity, turnovers of up to ten times per hour may be necessary. Keep in mind that the initial flow rate is not the average flow rate. In other words, if we started at 1000 gal/h, and cleaned the filter when the flow was reduced to 200 gal/h, the actual average flow would probably be about 600 gal/h, depending upon the type of filter media used. This is just over once per hour on a 500 gal tank. Electroless nickel in memory disk work requires 20 turns per hour, minimum.

The most common type of filter media used in the electronics industry is a depth type cartridge which is available in different porosities to achieve the desired particle retention, from 100 microns down to ½ micron on a nominal basis. These cartridges are wound from cotton fibers, or various synthetic fibers such as polypropylene to achieve compatibility with the chemicals in the solution.

Important factors which must be considered before purchasing filtration and purification equipment include: 1) The degree of clarity necessary to achieve the quality of plating required; 2) Amount of liquid (total amount of plating solution); 3) Impurities to be removed; 4) Flow rate; 5) Continuous or batch carbon treatment; 6) Pump installation requirements (including in-tank or out-of-tank placement); 7) Filter media material and porosity.

Other considerations are the materials of construction, which must be compatible with the solutions, the location of the filtration system, and whether or not carbon is to be used as part of the filtering process or as a separate function in another chamber. The amount of solids or organics present will dictate the size of the filter chamber itself, which must provide a sufficient amount of dirt holding capacity.

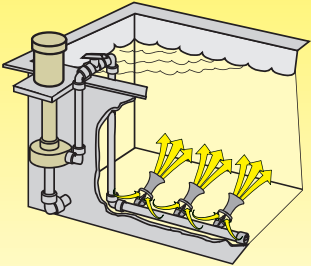
Finally, the best type of pump, capable of delivering the required flow and pressure, must be selected. Centrifugal pumps of all plastic construction are quite popular for electronics manufacturing applications. Direct drive single or double seal pumps, magnetic coupled pumps and vertical centrifugal pumps are available.

Vertical pumps can be used out-of-tank, or in-tank as long as there is room in the tank or reservoir. They are also used for the transfer of liquids used in the waste treatment system or any other recirculatory rinse or spray tanks. On certain solutions, they can also be used for tank agitation without filtration. They can be run dry without damage.

Gear pumps of stainless steel construction are usually limited to use on photoresist solvent solutions. Care must be taken to operate them at very low RPM's to prevent aeration and heating of the solution. Some resists are sensitive to even a few degrees rise in temperature. Gear pumps are self-priming and are equipped with packed stuffing boxes or mechanical seals.

Once selected, the components can then be assembled into a functional package. Valves can be added to control or direct flow. A chamber for priming the pump or for mixing slurries to precoat the filter can also be added. A pressure gauge to indicate condition of the filter is also desirable. And last, but not least, adequate space is needed to place the unit where it can be serviced.

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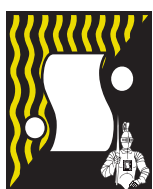
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