Technical Brief

## KEY ELEMENTS OF RINSING

A chemical common to nearly all aqueous cleaning processes is water (H<sub>2</sub>O). It is used to prepare most aqueous cleaning solutions, but most importantly, it is used as a rinse medium to remove soils that will leave residue on a precision-cleaned surface.

The quality of water in precision rinsing applications is critical since its primary function is to remove residue from a cleaned surface and not leave any impurities on the surface that may be contained in the water itself. There are many quality levels of water available. The purity level will depend on the needs of the application and how clean the surface must be for the next processing step.

## Water Purity Levels

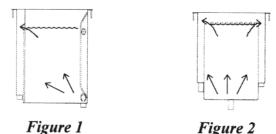
Hard water contains inorganic ions that can form water insoluble salts which react with cleaning agents. Soft water is produced by passing water through an ion exchange process. This may form insoluble salts with the softening medium sodium chloride (NaCl), which is water-soluble. As a result, it will leave a residue when the water evaporates in the drying cycle. Soft water is relatively free of ions, but can contain organic and biological agents.

Ultrapure or semiconductor-grade water has virtually all of the contaminants removed from it. It has extremely low levels of impurities to reduce the deposit of residues on a clean surface. Removal of organic contamination is accomplished by passing water through activated carbon prior to the resin exchange beds. Ion exchange resin columns are employed to remove ions (impurities) from the water by polar exchange. These resins are replaced periodically as they become loaded with impurities. Ultrapure water is commonly called deionized (DI) water.

The quality of deionized water is measured by electrical conductivity or resistivity. These electrical measurements of the purity of the water do not however measure the organic content, biological or particulate contamination. Therefore, carbon filtration, ultraviolet light and specialized particle filtration should be considered when evaluating the overall use of water in rinse applications.

Another important consideration in rinsing is the equipment that is used to manage the water in a

method that will enhance rinse effectiveness. Equipment design is a key element. There are numerous equipment designs used in rinsing. Most commonly used is a single-sided overflow rinse. In this design water enters from the bottom of the tank and rises to a single overflow weir located on one side at the top of the tank where the water overflows (some actually top feed and top exit!). The effluent water can then be diverted to another rinse tank forming a cascade arrangement or simply diverted to drain or recovery (Figure 1).

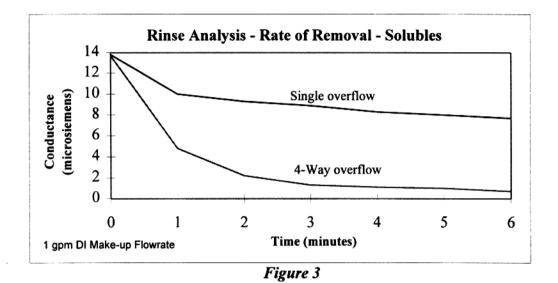


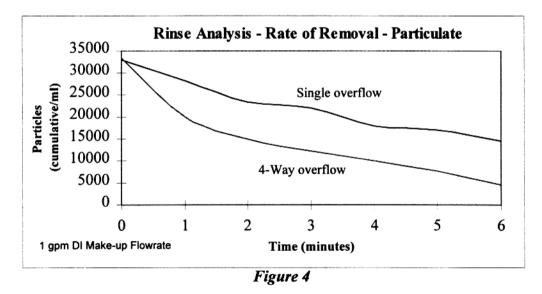
**Equipment Considerations** 

Another more uncompromising design commonly used in precision rinsing applications is the 4-way overflow rinse design (Figure 2). In this design water enters from the bottom center of the tank and is diffused in laminar flow throughout the entire area of the tank where it overflows on all four sides. A separate pump and filter capture a portion of the overflow, filter it and reintroduce the water back into the tank bottom. Fresh water is injected into the recirculation loop to ensure that water quality is maintained at the appropriate resistivity level. If the water quality falls below a pre-set resistivity level, additional fresh water is injected to maintain higher purity levels and application requirements. The 4way design guarantees even water distribution on all four sides of the tank and eliminates any dead spots commonly found in single sided rinse tanks. Additionally, the pump and filter loop increases the liquid flow and force exerted on the components being rinsed to flush out solubles and dislodge particles on the components surface. In unison, a very effective, consistent and repeatable rinse is attained.

The graphs in Figures 3 and 4 depict the effectiveness of contaminant removal comparing the two rinse equipment designs as described above. The rate of soluble contaminant removal from the 4-way design is approximately 60% more effective than the single overflow design. This is directly related to the

effectiveness of the design that allow solubles to quickly go into solution and particles quickly sweptaway for removal. Once dissolved and displaced from the components' surface a rapid purge of the water away from the process area of the rinse tank is provided by the high-flow pumping system.





## Summary

Proper water quality selection is critical to the cleanliness needs of the application. However, water quality is only one significant element to consider for effective rinsing. Specific equipment design, as

documented by this brief and evidenced by the fact that 4-way overflow rinse tanks offer a combined benefit of effective contamination removal and reduced operating costs, is equally critical.

