Qualifying a Cleaning System for Space Flight Printed Wiring Assemblies

by

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ABSTRACT

During the last decade, the challenges of printed wiring assemblies (PWAs) have grown tremendously. Today printed wiring boards have grown more complex to meet the continuing challenges posed by the increasing uses of microdevices such as ball grid arrays and microball grid arrays. Multilayer boards with a large layer count and narrow trace widths and spaces are commonplace. The ball grid arrays, microball grid arrays, and other small devices generally have a large number of I/Os, small standoffs, and small pitches. The small standoff and small pitch, coupled with the complex circuitry needed to route such components, makes cleaning an ever more critical operation. High reliability PWAs cannot tolerate contaminants since their presence can potentially degrade the board, thus compromising the intended mission. Cleaning for high performance PWAs is normally performed as a minimum at the following stages:

(1) At the bare PWB stage prior to the application of solder mask;
(2) Immediately after the application of flux or paste;
(3) Immediately prior to the application of conformal coating.

If the PWAs are properly stored, the second and third operation are sometimes combined. In addition to cleaning, some sort of cleanliness verification method is employed to ascertain that a certain level of cleanliness has been achieved. The most common cleanliness verification method has been ionic contamination testing using an industry-recognized device such as an Ionograph® or Omega-Meter®. Today, however, determining the amount of residual rosin (assuming that a rosin-based flux or paste was used) is often done. Another useful technique is to remove some of the components and examine for flux residues both visually and by use of a microscope.

In addition to all this, the last decade has also seen the dramatic decrease and continuing disuse of ozone-depleting solvents. The common chlorofluorocarbon solvents, such as Freon® TMS, have been discontinued, and many PWA assemblers have switched to more environmentally friendly cleaning agents, such as a wide variety of semi-aqueous and aqueous-based materials. To enhance the performance of such materials, the proper equipment selection plays a critical role.

This paper addresses a centrifugal cleaning system used in conjunction with a water-based cleaning medium to achieve optimally low levels of contaminants on PWAs. Ionograph data, ion chromatography profiling, residual rosin determination, and outgassing data are presented demonstrating the effectiveness of the centrifugal cleaning system and the cleaning agent for space flight printed wiring assemblies.