For production part manufacturers, cleaning specifications are a major concern when setting up a line. Cleaning specifications have numerous effects on production, planning, and the ultimate success of a job. They set the parameters for the type of washer that will be used, they determine what chemicals and steps will be necessary within the washing process, and keeping the customer pleased depends on meeting or exceeding the guidelines. The specifications can be rigid, difficult to understand, and tough to meet for many manufacturers. That is why it is imperative to seek the help of a qualified lab to conduct proper testing, prior to the purchase of cleaning equipment.

Testing helps manufacturers gain a clear understanding of how clean their parts need to be, and lays the groundwork for determining how to get there. A reputable cleanliness testing lab will have a variety of methods encompassing many types of testing. These will encompass qualitative, quantitative, subjective, and objective methods of testing, allowing for a comprehensive study of the part. The more information, the better a washing process can be designed to meet the needs of the manufacturer.

First, there is visual analysis alone. Human visual analysis, using no instruments, is entirely subjective and unreliable. Since many parts have specifications in the microns, the human eye is virtually worthless. A human hair is 70-100 micros in width, and many parts have to be free of particles that are slightly larger than that. When dealing with that small of contamination, it is difficult to trust the eyes of an observer.

Black light/UV Testing exposes clean and dirty samples to a 254nm and 365nm light. They are observed for fluorescence, which determines the contaminant level of the part. With this method there is a visual identification of the contamination present on the part. It is also inexpensive, and can even be implemented into the manufacturing process as a part of the line. However, it is a subjective test. The individual determines cleanliness; there is no objective analysis performed by a machine or data received.

Millipore testing is a commonly used objective measurement standard for cleanliness specifications. The part is first washed in an aqueous or sealed solvent system and passes a cursory subjective cleanliness review like those listed above. The part is then rinsed with a solvent to remove all the contaminant that had remained on the part after cleaning, is collected and filtered through a pre-weighed membrane that has a specified micron rating. The membrane with the contaminant, which is greater than the size of the specified micron rating, is dried and weighed. The net weight equals the overall amount of contaminant left on the part. Millipore testing is common, inexpensive, objective and provides semi-quantitative information. However, regimented, standardized testing techniques must be repeated and followed throughout the process in order for this testing to be valid.

Another testing method is particle counting. The part is washed as it is with the Millipore testing and then rinsed or cleaned with an ultrasonic bath. The solution is then introduced to laser by way of an automated pressure-sampling device. Light scattering receiving optics or extinction detectors gather the redirected or diffracted energy and create a raw sensor output for each particle. The results are expressed in particles per fluid volume or particles per part. This method can quantify large quantities of particulates quickly and indicate particles within certain ranges. The equipment is costly- $10,000 to $30,000. Also, bubbles in the sample are occasionally counted as particles.

A CCD camera compares clean and dirty parts using photographs. The parts are photographed using the same photographic variables, i.e. f-stop and time. Computer

software is then used to produce a histogram of pixel intensities, with higher intensities indicating a higher level of contamination. This is a quantitative methodology that few companies are in possession of. Like the particle counter, it is expensive technology. Another drawback is that only contaminants that exhibit fluorescence in the UV range of the camera are documented.

Microscopy is used to examine minute particles. It can be used for particle counting, but the process is subjective and tedious. Cost is an issue with this test as well, ranging up to a $100,000.00.

OSEE is the Optically Stimulated Election Emission test. The surface of the part is subjected to high energy UN light, which causes electrons to be emitted. The reflected electrons are then measured. Clean surfaces emit more electrons than unclean surfaces in this test. OSEE has excellent repeatability, is able to accurately quantify minute levels of contamination and is founded upon solid scientific principles. It is another expensive test, though. OSEE is also unable to identify specific contaminants; it simply can tell if there is contamination.

After the testing has been conducted, the manufacturer should receive a laboratory report. This report should detail the specifics of the contamination found in the testing, and ideally will offer a process by which to reduce contamination. These reports are vital for distilling the information found in testing into a more digestible form.

With proper testing, a wash process can be designed to meet any reasonable cleanliness specification.