



## PARTICLE TESTING FOR CLEANROOM FORMS AND LABELS

HIGH TECH GRAPHICS

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**W**hether your company is in the semiconductor, disk drive, pharmaceutical, or biotechnology industry, you have invested considerable time and money to ensure the yields and efficiency of your production processes. Every day, you face the substantial challenge of protecting the product you are manufacturing by choosing the correct materials to be used within your manufacturing environment, as well as the materials used to identify and track your product and process during and after its conversion. Many of these latter materials are forms, labels, and tags.

The cleanroom form, label, and tags industry draws most of its materials specifications from Federal or Military standards. Cleanliness testing procedures are drawn from yet another array of specifications ranging from NASA KSC-C-123H to IEST-RP-CC020.2.

Traditionally, these items are tested for sub-visible particle levels using wet method testing, followed by particle enumeration using filtration, electronic laser, or microscopy. Wet method testing is the most accurate and detailed method of testing for particle counts on materials. Most, however, would argue that these methods do not represent the overall average particulate cleanliness of the items upon delivery and do not offer a cost effective means to accurately monitor particle counts over a broad statistical sampling for a specific production run. Most manufacturers, and their customers, will use this worst case data, derived from either wet or dry method testing, and will presume that the product will consistently meet this criterion. Put another way, the data sheet says it is a Class 10 cleanroom product, so it must be a Class 10 product. Unfortunately, Federal Standard 209 E deals with a cubic foot of air, not a surface of a label or its liner. Therefore, there is no such thing as a Class 10 or Class 100 labels. To make matters worse, the majority of label and tag vendors do not know what they are producing and will make the subject even cloudier.

How do we deal with this issue?

Make no mistake: producing precision surface cleaned products is difficult. Precision surface cleaning of forms, labels and tags (down to 0.3  $\mu$ m particles) requires a combination of different processes to achieve the cleanliness

levels needed in today's critical cleanroom environments.

Precision surface cleaning combines electrostatic ionization to neutralize the triboelectric surface charge that develops during the manufacturing process, air knife and contact cleaning of the material during and after the manufacturing process. Pre-cleaning (with an air knife) of the materials will focus on the 1  $\mu$ m and larger particles and precision surface cleaning (contact) of the materials will break the boundary layer where 0.3  $\mu$ m particles lay. In addition, they must deal with ionic contamination and nonvolatile residue (NVR) contamination from not only the materials themselves but also the processes they use to manufacture and convert the products. Finally they must be able to monitor particle counts on two surfaces (top and bottom) of the material and keep their cleaning process within specification. To accomplish this some manufacturers have turned to a laser based surface particle measuring instrument (example: Pentagons QIII) to ensure statistical process and material particle cleanliness. The measurement device, and its probe, are stationary and the material surface is drawn under the probe at a constant rate of speed in a Class 10 mini-environment. Particles on that surface are disturbed and fluidized by high pressure UHPA air discharged through openings in the bottom of the probe head. These particles are then pulled through the vacuum port in the probe head to the QIII detector, which counts and analyzes the particles. The machine will then display the particle counts in 0.3  $\mu$ m to 5  $\mu$ m readings. In today's critical environments, it is mandatory to be able to clean and measure surface particles at 0.3  $\mu$ m levels. It is essential that techniques and standards be developed to aid in the detection and measurement of these surface particles in a cost effective and repeatable method. Although no current industry standard exists for this method, it does offer statistical and repeatable measuring for both the manufacturer and the user.