

## Testing Wipe Cleanliness Considerations and Limitations

By David P. Nobile  
Contec, Inc.

Users of wipes searching for alternative or new wipe options often look to manufacturers' Technical Data Sheets (TDS) to compare wipes for their critical cleaning applications. Unfortunately, while simple and relatively quick to do, this approach cannot provide accurate insight into how various wipes compare to each other, nor how suitable an alternative wipe might be for a specific application.

Most recognized test laboratories that are contracted to test cleanroom wipes for cleanliness follow test methods detailed in published versions of the Institute of Environmental Sciences and Technology (IEST) Recommended Practice 4 (IEST RP-CC-004.X). Currently, the IEST has an active Working Group (WG-004) that is revising and improving the current version of these wipe test methods. For the first time ever, it is expected that the revised RP004 will include wipe selection guidance for end users in most major critical environment markets.

While the test methods detailed in the IEST Recommended Practice are sometimes used to evaluate wipes for various cleanliness and performance characteristics (particle, residue, extractable ions, sorbency, etc.) in comparison to established specifications or requirements, they are often used to compare wipes from different manufacturers relative to a wipe currently used in a facility. Often this comparison is made in the absence of an established specification, but rather the incumbent wipe is delineated as the acceptable benchmark for wipe cleanliness and performance, against which other wipes are compared.

While there is typically a strong desire to compare wipes using manufacturers' published wipe cleanliness data, or to compare data from some previous wipe testing to more recent testing of the same or different wipes, this is plainly not possible, especially for the characteristic of particles. The particle cleanliness of all cleanroom wipes falls within a certain range for any given wipe. Indeed, the goal of wipe manufacturers is to make that range as narrow and consistent as possible through control of all the contributors to wipe quality – fabric, construction, processing, converting, laundering, and packaging. While these components are all regulated, an inherent and natural range of variation still exists to lesser or greater extent depending upon many factors, including manufacturer.

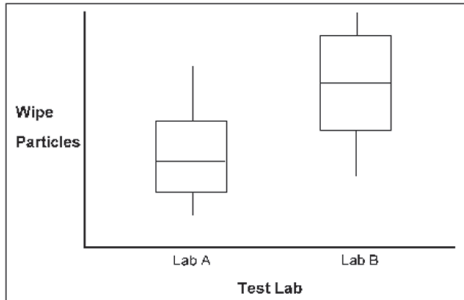


Compounded with this range of wipe variation are the very real variations and variables that exist in the testing of wipes, and specifically the sampling and enumeration of particles released from wipes. Sample preparation, equipment condition and calibration, and technician skill and diligence all affect wipe particle test results within a given test lab.

Importantly, it is the differences between test labs that provide the greatest disparities in particle data for a given cleanroom wipe. Even when two test labs are following the same published test methods, differences between labs have significant influence on the test results finally reported. These differences include, but are not limited to:

- Particle sampling equipment
- Particle enumeration equipment; brand, type, sensor, calibration, condition, etc.
- Sampling volume and rate
- Laboratory practices
- Test solutions
- Interpretation of test methods
- Specific sampling and enumeration techniques
- Data interpretation, calculations, and reporting
- Test environment
- All of the above at a specific moment in time

The following graphic can be used to illustrate a given cleanroom wipe tested by two different test labs. The combination of wipe variation and lab variables can be represented by a common Box-and-Whisker plot for either Lab A or Lab B as shown.



These plots can be thought of as representing a given manufactured population of wipes, a very small sampling of which is tested by test Lab A and Lab B. In this illustration though, the boxes and whiskers represent the potential range of the data due to the compounded variations of wipe and test lab. In fact, unless a very large data base of a wipe characteristic is created over an extended period of time, any wipe test data represent merely a snapshot of that characteristic at the time the wipes were tested. The data as reported by either test lab may fall anywhere on these plots – the mean line (in the box), at the extremes of the boxes, or as outliers at the ends of the whiskers.

What is critical to understand is that the only practical way in which a valid and meaningful comparison of wipes can be made is through testing samples of the wipes in the same lab, using the same methods and equipment, within the shortest timeframe practical, and ideally, by the same technician.

So in order to evaluate wipes relative to an incumbent wipe, all of the wipes being compared must be tested together. While it is possible to compare candidate wipes to a known wipe with a large enough database, and enough time to enable trend analyses of the known wipe, this is very rarely the situation in which wipes are considered.

Once all wipes under consideration have been tested together, valid and meaningful comparisons can then be made to the benchmarked wipe. It is most common for wipes to have areas of strengths and weaknesses relative to other wipes (e.g. one may be lower in particles, but higher in residue relative to another wipe).

As a result, it is both important and practically useful to understand and clearly identify those wipe characteristics that are critical to the needs of the operations and applications in a given facility or process, and those characteristics that are less critical. Awareness of the critical wipe characteristics, combined with valid comparative test data will then enable selection of the wipe most likely to provide the required and desired performance for any specific application.

