

Understanding Your Particle Counter Calibration

by Jason Kelly

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We recommend this paper is read in conjunction with ISO/IEC 17025 Calibration Explained.

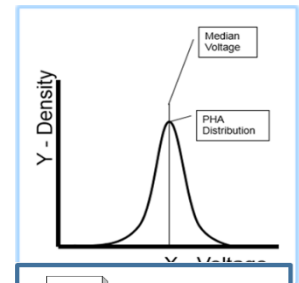
Particle Counter calibrations since 2007 are mostly based on ISO 21501 which is the most complete particle counter calibration. Parameters in ISO 21501-4 for airborne particle counter calibration challenge the particle counter sensor functionality and accuracy to standard references.

There are TEN particle counter test and calibration parameters that are required under ISO 21501-4: 2018;

- **Size Setting Error**
 - Target Limit: $\pm 5\%$
- **Counting Efficiency**
 - First Channel: $50\% \pm 20\%$
 - Particle Sizes 1.5 to 2 times
 - Second Channel: $100\% \pm 10\%$
- **Size Resolution**
 - $\leq 15\%$
- **False Count Rate**
- **Maximum Particle Number Concentration**
 - Specified by Manufacturer
- **Sampling Flow Rate Error**
 - $\pm 5\%$
- **Sampling Time Error**
 - $\pm 1\%$
- **Response Rate**
 - $\pm 0.5\%$
- **Calibration Interval**
 - ≤ 1 year
- **Reporting Results from Test and Calibration**
 - Date of Calibration
 - Calibration Particle Sizes
 - Flow Rate
 - Size Resolution
 - Counting Efficiency (50% & 100%)
 - False Count Rate
 - Voltage Limit or Channel of Internal Pulse Height Analyzer (PHA)

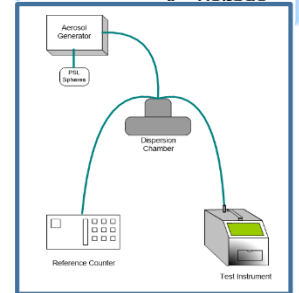
What is Size Setting Error?

Particles are sized based on the amount of light scattered inside the sensor as the . The signal amplitude (peak height) determines the size of the particle. The PHA determines the peak height of each pulse and over the sample time and builds a distribution of peak height voltages for further analysis.



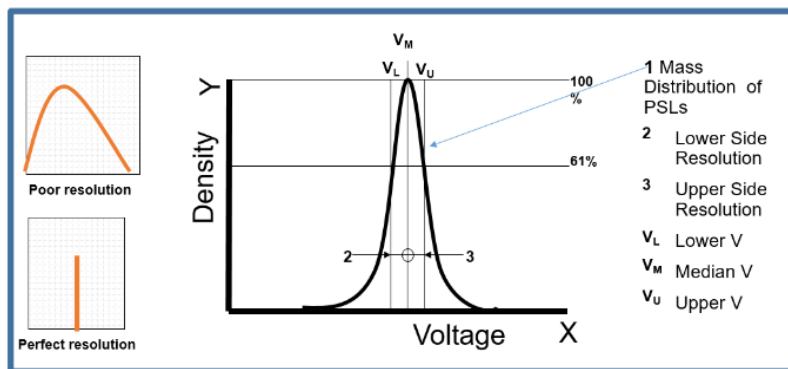
What is Counting Efficiency?

Ratio of the measured result of APC to that of a reference instrument using the same sample. A Golden Standard is required to compare to the instrument being calibrated. Efficiency is described as $(50 \pm 20)\%$ for the minimum detectable size and $(100 \pm 10)\%$ with a size from 1.5 to 2 times larger than the smallest particle channel size.



What is Size Resolution?

The size resolution shall be $\leq 10\%$ for calibration particles of a size specified by the manufacturer. Size Resolution is the



What is Sampling Flow Rate Error?

What is Sampling Time Error?

What is Response Rate?

What is Calibration Interval?

What your calibration certificate should provide?