REX DYNAMICS

EMPOWERING CONTROLLED ENVIRONMENTS

The Science Behind Particle Counting

Part 2 of 3

Understanding Calibration of Optical Particle Counters

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ISO 21501-4:2018 outlines the requirements for the calibration of Optical Particle Counters (OPCs) used in cleanroom environments. This standard ensures consistency, reliability, and accuracy in particle measurement, which is critical for maintaining the integrity of controlled environments.

Key Components in Calibration

1. Latex Spheres

Latex spheres are used as calibration standards because they are uniform in size and composition. These spheres help in verifying the size sensitivity and counting efficiency of particle counters.

2. Optical Particle Counters

Optical Particle Counters (OPCs) operate by detecting and measuring particles in air using laser light. The particle size is determined based on the intensity of light scattered by each particle.

3. Pulse Height Analysis

Pulse height analysis is critical for calibrating OPCs. It involves analyzing the electrical pulses generated by scattered light to determine particle size accurately.

Calibration Process

Calibration involves verifying the performance of an OPC against defined standards. The process includes:

1. Verification of particle size accuracy using latex spheres.
2. Ensuring counting efficiency within the specified range.
3. Generating a calibration certificate detailing the results.

Pass and Fail Criteria According to ISO 21501-4:2018

ISO 21501-4:2018 specifies strict criteria for the performance evaluation of Optical Particle Counters (OPCs). These criteria are designed to ensure that OPCs provide reliable and consistent measurements. The pass and fail criteria include the following:

1. Counting Efficiency

Counting efficiency determines the ability of an OPC to detect particles of a specific size. According to ISO 21501-4:2018, the counting efficiency must be within the following limits:
- For particles at 1.5 times the minimum calibration size, the efficiency should be at least 90%.
- For particles of the minimum calibration size, the efficiency should not exceed 110%.
A failure to meet these thresholds results in a failed calibration.

2. Particle Size Accuracy

Particle size accuracy is assessed by measuring the response of the OPC to calibration particles of known sizes. The measured size must align with the nominal size of the calibration particles within a specified tolerance.

3. Flow Rate Accuracy

The flow rate of the OPC must remain within ±5% of the specified rate during operation. A deviation beyond this range indicates a calibration failure.

4. Resolution of Pulse Height Distribution

Resolution is evaluated to ensure the OPC can distinguish between particles of different sizes. The resolution must meet or exceed the minimum specified value for the instrument type.

5. False Count Rate

The false count rate refers to the number of spurious counts recorded by the OPC in the absence of particles. ISO 21501-4:2018 specifies a maximum allowable false count rate, which, if exceeded, results in failure.

Adherence to these criteria is critical for maintaining the accuracy and reliability of particle measurements. A calibration report will detail the results for each criterion, indicating whether the OPC passes or fails.

Conclusion

Calibration of Optical Particle Counters according to ISO 21501-4:2018 ensures precise and reliable particle measurement. This process is essential for maintaining compliance with cleanroom standards and ensuring the integrity of controlled environments.

This article is written by REX Dynamics. We empower controlled environments when it comes to consultation, design, installation, validation & servicing of environmental monitoring solutions. For further information please visit our webpage www.rexdynamics.se or contact us at info@rexdynamics.se