

**INSTITUTE OF  
ENVIRONMENTAL  
SCIENCES AND  
TECHNOLOGY**

---

---

**Contamination Control Division  
Technical Guide 1001**

**IEST-G-CC1001**

---

**Counting Airborne Particles for  
Classification and Monitoring of  
Cleanrooms and Clean Zones**

---

---

**INSTITUTE OF ENVIRONMENTAL SCIENCES AND TECHNOLOGY**

---

Arlington Place One  
2340 S. Arlington Heights Road, Suite 620  
Arlington Heights, IL 60005-4510  
Phone: (847) 981-0100 • Fax: (847) 981-4130  
E-mail: [iest@iest.org](mailto:iest@iest.org) • Web: [www.iest.org](http://www.iest.org)





This Guide is published by the INSTITUTE OF ENVIRONMENTAL SCIENCES AND TECHNOLOGY to advance contamination control technology and the technical and engineering sciences. Its use is entirely voluntary, and determination of its applicability and suitability for any particular use is solely the responsibility of the user.

Copyright © 1999 by the **INSTITUTE OF ENVIRONMENTAL SCIENCES AND TECHNOLOGY**

ISBN 978-1-877862-74-8

No part of this publication may be copied or reproduced in any form, or by any means, including electronic, mechanical, photocopying, or otherwise, without the prior written permission of the Institute of Environmental Sciences and Technology, 2340 S. Arlington Heights Road, Arlington Heights, IL 60005-4516.

**INSTITUTE OF ENVIRONMENTAL SCIENCES AND TECHNOLOGY**

Arlington Place One

2340 S. Arlington Heights Road, Suite 620

Arlington Heights, IL 60005-4510

Phone: (847) 981-0100 • Fax: (847) 981-4130

E-mail: [iest@iest.org](mailto:iest@iest.org) • Web: [www.iest.org](http://www.iest.org)



---

# Counting Airborne Particles for Classification and Monitoring of Cleanrooms and Clean Zones

## IEST-G-CC1001

### CONTENTS

#### SECTION

|   |   |
|---|---|
| 1 Application .....                               | 7 |
| 2 Scope .....                                     | 7 |
| 3 Definitions .....                               | 7 |
| 4 Apparatus for counting airborne particles ..... | 8 |
| 5 Measurement test procedures .....               | 8 |
| 6 References .....                                | 9 |

#### APPENDIX

|                                       |    |
|---------------------------------------|----|
| APPENDIX A; Data Report Example ..... | 10 |
|---------------------------------------|----|



# **Counting Airborne Particles for Classification and Monitoring of Cleanrooms and Clean Zones**

## **IEST-G-CC1001**

### **1 Application**

This guide describes standard protocols for measurement of concentrations of airborne particles that are characterized by distributions having threshold sizes (lower size limits) ranging from 0.1  $\mu\text{m}$  to 5  $\mu\text{m}$ . Measurements are made in any of three occupancy states (as-built, at-rest, or operational) as defined in ISO 14644-1. These measurements are made to determine or verify the classification of the air in cleanrooms and clean zones in accordance with ISO 14644-1, or for monitoring or testing for continuing compliance with ISO 14644-1, in accordance with ISO 14644-2.

### **2 Scope**

Air sampling procedures are provided for both unidirectional and nonunidirectional airflow environments. The methods presented herein are reference methods; other appropriate methods of equivalent accuracy may be used by agreement between the customer and the supplier. If no alternative method has been agreed upon, or in case of dispute, the reference method shall be used.

### **3 Definitions**

#### **3.1 cleanroom**

A room in which the concentration of airborne particles is controlled and which contains one or more clean zones.

##### **3.1.1 cleanroom, as-built**

A cleanroom that is complete and ready for operation, with all services connected and functional, but without production equipment or personnel within the room.

##### **3.1.2 cleanroom, at-rest**

A cleanroom that is complete and has the production equipment installed and operating, but without personnel within the room.

##### **3.1.3 cleanroom, operational**

A cleanroom in normal operation with all services functioning and with production equipment and personnel, if applicable, present and performing their normal work functions in the room.

#### **3.2 clean zone**

A defined space in which the concentration of airborne particles is controlled to specified limits.

#### **3.3 discrete-particle counter (DPC)**

An instrument, such as an optical particle counter, that is capable of resolving responses from individual particles. The optical particle counter reports particle size as the equivalent diameter of a known reference sphere.

#### **3.4 isoaxial**

A condition of sampling in which the direction of the airflow into the sampling probe inlet is the same as that of the unidirectional airflow being sampled.

#### **3.5 isokinetic sampling**

The condition of isoaxial sampling in which the mean velocity of the air entering the sampling probe inlet is the same as the mean velocity of the unidirectional airflow at that location.

#### **3.6 nonunidirectional airflow**

Airflow that does not qualify as unidirectional because it has a multiplicity of flow directions or multiple-pass circulation (eddies), or both.