

**INSTITUTE OF  
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**Contamination Control Division  
Standard 1246D**

**IEST-STD-CC1246D**

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**Product Cleanliness Levels and  
Contamination Control Program**

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**INSTITUTE OF ENVIRONMENTAL SCIENCES AND TECHNOLOGY**

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Please note that in regard to references herein to *Federal Standard 209 (FED-STD-209), Airborne Particulate Cleanliness Classes in Cleanrooms and Clean Zones*, the U.S. General Services Administration issued the following NOTICE OF CANCELLATION of FED-STD-209 on November 29, 2001: "Federal Standard 209E dated September 11, 1992 is hereby canceled and superseded by International Organization for Standardization (ISO) Standards. International Standards for Cleanrooms and associated controlled environments, ISO 14644-1 Part 1: Classification of air cleanliness; and ISO 14644-2 Part 2: Specifications for testing and monitoring to prove continued compliance with ISO 14644-1."

Copies of ISO Standards 14644-1 Part 1, and 14644-2 Part 2, may be obtained from the Institute of Environmental Sciences and Technology (IEST), 5005 Newport Drive, Suite 506, Rolling Meadows, IL 60008-3841. Phone: 1-847-255-1561, Fax: 1-847-255-1699, Website: [www.iest.org](http://www.iest.org), E-mail: [publicationsales@iest.org](mailto:publicationsales@iest.org).

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# Product Cleanliness Levels and Contamination Control Program

## IEST-STD-CC1246D

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## HISTORY

The establishment of contamination control practices became a necessity with the advent of World War II and the ensuing mechanical wartime innovations. Two of the wartime inventions requiring high levels of cleanliness were the Norden bombsight and the first navigational gyroscopes. Particles in the range of 20  $\mu\text{m}$  to 50  $\mu\text{m}$  would cause the bombsight and the gyroscope to malfunction. Further degrees of refinement in equipment created the need for greater control of product cleanliness and ambient conditions. In 1956, the government acquired an inertial guidance system containing two floating gyros. The suspension system was highly dependent on contaminant-free fluid. It was observed that contamination one-half the size of cigarette smoke particles could compromise the system, indicating the degree of cleanliness control necessary in the development of that system.

Major improvements in the area of industrial contamination control and air filtration occurred during the late 1950s and early 1960s. The development of improved techniques occurred as a result of manufacturing advances and the introduction of extremely sophisticated electronic, electromechanical, electro-optical, and hydraulic equipment. These devices required major improvements in cleanliness levels, because the presence of microscopic particles could result in the malfunction of a device, an entire system, or even the mission.

With the technological advancements that have followed, requirements for higher degrees of cleanliness have forced contamination control efforts to keep pace through new developments and applications. The greatest impetus for stricter requirements for contamination control has come from the microelectronics industry. The advent of solid-state electronics and integrated circuits made it possible to produce "chips" containing hundreds of thousands of discrete devices, each consisting of multiple component parts with specific functions totaling perhaps millions of such components per chip. Without the innovations in contamination control, the advances in low-cost computers, communications, and a myriad of other uses of microelectronics would not have been possible.

The development of cleanliness standards for critical components was the direct result of satisfying the need for common terminology and standardization. In 1962, a military standard was created to establish guidelines and requirements for the specification of cleanliness levels essential to product reliability and quality. This document, known as MIL-STD-1246, has been updated periodically in order to keep current with technological advances. Its history is summarized below:

MIL-STD-1246 (MI)	19 DECEMBER 1962
MIL-STD-1246A	18 AUGUST 1967
MIL-STD-1246B	4 SEPTEMBER 1981
MIL-STD-1246C	11 APRIL 1994

The 1246C version was prepared for the U.S. Army Missile Command by the Contamination Control Division of the Institute of Environmental Sciences and Technology.

In 1997, the U.S. Army commissioned the Institute of Environmental Sciences and Technology to revise and adapt this military standard as an industry standard, since its usefulness today extends far beyond military applications. This document is the resulting industry standard.

# Product Cleanliness Levels and Contamination Control Program

## 1 SCOPE AND LIMITATIONS

### 1.1 Scope

This standard provides a basis and a uniform method for specifying product cleanliness levels and contamination control program requirements. The emphasis is on contaminants that can impact product performance.

### 1.2 Use

These requirements are not required for all products but are intended for use in procurement and design contracts for those items where contamination control limits for parts, components, or fluids are necessary to ensure reliability and performance.

### 1.3 Safety

This standard does not purport to address the safety problems associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

## 2 REFERENCES AND APPLICABLE DOCUMENTS

Unless otherwise specified, the latest revision shall apply. In the event of a conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless specific exemption has been obtained.

### 2.1 International Organization for Standardization (ISO)

*ISO 14644-1 Cleanrooms and associated controlled environments—part 1: Classification of air cleanliness*  
(Available from IEST and other sources)

### 2.2 American Society for Testing and Materials (ASTM)

*E595: Standard Test Method for Total Mass Loss and Collected Volatile Condensable Materials from Outgassing in a Vacuum Environment*

*E1216: Standard Practice for Sampling for Surface Particulate Contamination by Tape Lift*

*E1234: Standard Practice for Handling, Transporting, and Installing Nonvolatile Residue (NVR) Sample Plates Used in Environmentally Controlled Areas for Spacecraft*

*E1235: Standard Test Method for Gravimetric Determination of Nonvolatile Residue (NVR) in Environmentally Controlled Areas for Spacecraft*

*E1548: Standard Practice for Preparation of Aerospace Contamination Control Plans*

*E1559: Standard Test Method for Contamination Outgassing Characteristics of Spacecraft Materials*

*F25: Standard Test Method for Sizing and Counting Airborne Particulate Contamination in Clean Rooms and Other Dust-Controlled Areas Designed for Electronic and Similar Applications*

*F50: Standard Practice for Continuous Sizing and Counting of Airborne Particles in Dust-Controlled Areas and Clean Rooms Using Instruments Capable of Detecting Single Sub-Micrometre and Larger Particles*