

*Institute of Environmental Sciences and Technology*

IEST-STD-CC1246E

Contamination Control Division  
Standard 1246E

**Product Cleanliness Levels –  
Applications, Requirements, and  
Determination**



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## HISTORICAL BACKGROUND

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 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 US 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 as follows:

MIL-STD-1246 (MI)	19 December 1962
MIL-STD-1246A 18	23 August 1967
MIL-STD-1246B 4	1 September 1987
MIL-STD-1246 11	April 1994
IEST-STD-CC-1246D	January 2002

The 1246C version was prepared for the US Army Missile Command by the Contamination Control Division of the Institute of Environmental Sciences and Technology (IEST).

In 1997, the U.S. Army commissioned IEST to revise and adapt this military standard as an industry standard. Its usefulness today extends far beyond military applications. This document is the resulting industry standard.

# Product Cleanliness Levels – Applications, Requirements, and Determination

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### 1 SCOPE AND LIMITATIONS

#### 1.1 Scope

This standard provides methods for specifying and determining product cleanliness levels for contamination-critical products. The emphasis is on contaminants that can impact product performance.

#### 1.2 Use

The requirements set forth in this standard 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 that may be 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.

#### 1.4 Contamination Control Program

This standard no longer provides information concerning the creation of a contamination control program. Refer to ASTM E1548, Standard Practice for Preparation of Aerospace Contamination Control Plans, for this information.

### 2 REFERENCES AND APPLICABLE DOCUMENTS

The following documents are incorporated into this Standard to the extent specified herein. 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. No content in this document, however, supersedes applicable laws and regulations unless specific exemption has been obtained.

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

*E1216: Standard Practice for Sampling for 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*

*F25: Standard Test Method for Sizing and Counting Airborne Particulate Contamination in Cleanrooms and Other Dust-Controlled Areas*