



# PARAGON

*Mission Critical Environment Specialists*

## Overview

Paragon Mission Critical Environment Specialists practice proper procedures to decontaminate your clean-room and data center environment. To accomplish this we need to meet and exceed the cleanliness standards for your class of cleanroom.

As you are aware the ISO standards replaced the federal standards for cleanroom environments. This document is a snapshot of how the ISO standards have been categorized. This document also contains a list of documents that are found on the ISO website. These documents can be used to perform additional research for your particular cleanroom classification and needs.

For Paragon MCES, the most common standard we work with is the ISO standard for data center cleanrooms. Below are the old Federal Standard and the subsequent ISO standard. Although the cleanliness levels haven't change, the ways they are figured have.

---

## Data Center Standards

### **Federal Standard 209e for Data Centers:**

The benchmark for optimum and safe operating levels is compared to Federal Standard 209e for Data Centers at 100,000 microns at .5 particles per cubic foot of air space. Optimum levels for temperature should normally be 70 to 72 degrees Fahrenheit, with humidity levels at 50%.

Please note: equipment manufacturers have varying optimum operating levels.

---

## Cleanrooms

### **ISO-14644-1 Classification of Air Cleanliness**

Cleanliness class designations and quantity has changed from FS209E (see Table 1). Along with the obvious change to metric measure of air volume, ISO 14644-1 adds three additional classes.

(Table 1) ISO 14644-1.

Class	Number of Particles per Cubic Meter by Micrometer Size					
	0.1 um	0.2 um	0.3 um	0.5 um	1 um	5 um
ISO 1	10	2				
ISO 2	100	24	10	4		
ISO 3	1,000	237	102	35	8	
ISO 4	10,000	2,370	1,020	352	83	
ISO 5	100,000	23,700	10,200	3,520	832	29
ISO 6	1,000,000	237,000	102,000	35,200	8,320	293
ISO 7				352,000	83,200	2,930
ISO 8				3,520,000	832,000	29,300
ISO 9				35,200,000	8,320,000	293,000

Data Centers

(Table 2) Comparing FED STD 209E to the new ISO 14644-1.

Airborne Particulate Cleanliness Class Comparison	ISO 14644-1	FED STD 209E	
	1		
	2		
	3		1 M1.5
	4		10 M2.5
	5		100 M3.5
	6		1,000 M4.5
	7		10,000 M5.5
	8		100,000 M6.5

Data Centers

### ISO-14644-2 Cleanroom Testing for Compliance

This document determines the type and frequency of testing required to conform to the standard.

**Strategic Testing: (Table 1) Schedule of Tests to Demonstrate Continuing Compliance.**

Test Parameter	Class	Maximum Time Interval	Test Procedure
Particle Count Test	< or = ISO 5	6 Months	ISO 14644-1 Annex A
	> ISO 5	12 Months	
Air Pressure Difference	All Classes	12 Months	ISO 14644-1 Annex B5
Airflow	All Classes	12 Months	ISO 14644-1 Annex B4

**Strategic Testing: (Table 2) Schedule of Additional Optional Tests.**

Test Parameter	Class	Maximum Time Interval	Test Procedure
Installed Filter Leakage	All Classes	24 Months	ISO 14644-3 Annex B6
Containment Leakage	All Classes	24 Months	ISO 14644-3 Annex B4
Recovery	All Classes	24 Months	ISO 14644-3 Annex B13
Airflow Visualization	All Classes	24 Months	ISO 14644-3 Annex B7

**ISO-14644-4 Cleanroom Design & Construction**

Outlines the design and construction of cleanrooms. It covers all aspects of the process from design development to startup and commissioning.

**ISO-14644-5 Cleanroom Operations**

An introduction on cleanroom operation. It covers all aspects of the operation of a cleanroom including entry and exit procedures for equipment and personnel, education and training, cleanroom apparel, and facility issues such as maintenance, housekeeping, monitoring, system failure, etc.

**ISO-14644-6 Terms, Definitions & Units**

Provides a consistent reference for all terms, definitions and units discussed across all ISO cleanroom standards.

**ISO-14644-7 Mini-environments & Isolators**

Highlights stand-alone clean spaces including their design, construction, and operations.

*For additional information please contact:*

*Paragon International  
2885 N Berkeley Lake Road NW  
Suite 17  
Duluth, GA 30096  
800/526-1095*