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FED-STD-209D
CHANGE NOTICE 1
January 28, 1991

FEDERAL STANDARD

CLEAN ROOM AND WORK STATION
REQUIREMENTS, CONTROLLED ENVIRONMENT

The following changes, which form a part of FED-STD-209D,
dated June 15, 1988, are approved by the Commissioner,
Federal Supply Service, General Services Administration,
for use by all Federal agencies.

REMOVE: Page 8 of June 15, 1988

ADD: Page 8 of January 28, 1991

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Note: Locations of changes, additions, and deletions resulting
from this change notice are marked with vertical bars in
the left margins.

RETAIN THIS CHANGE NOTICE AND PLACE IT BEFORE THE FIRST PAGE OF
THE STANDARD

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FSC 3694

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area within the clean zone. The minimum number of sample locations required for classification of a clean zone shall be the lesser of (a) the area of the entrance plane (in square feet) divided by 25, or (b) the area of the entrance plane (in square feet) divided by the square root of the airborne particulate cleanliness class designation.

5.1.3.2 Sample locations and number - nonunidirectional airflow. For nonunidirectional airflow, the number of sample locations shall be uniformly spaced horizontally, and as specified¹ vertically, throughout the clean zone, except as limited by equipment within the clean zone. The minimum number of sample locations shall be equal to the square feet of floor area of the clean zone divided by the square root of the airborne particulate cleanliness class designation.

5.1.3.3 Sample location restrictions. No fewer than two locations shall be sampled for any clean zone. The number of sample locations shall be uniformly spaced throughout the clean zone except as limited by equipment within the clean zone. At least one sample shall be taken at each of the sampling locations specified in Paragraph 5.1.3.1 or 5.1.3.2. A total of at least five samples shall be taken. More than one sample may be taken at each location and different numbers of samples may be taken at different locations.

5.1.3.4 Sample volume and sampling time. Table II lists the minimum volume per sample for various airborne particulate cleanliness classes and measured particle sizes. The sample time is calculated by dividing the sample volume by the sample flow rate. A larger sample volume will improve the precision of the concentration measurements, decreasing the amount of variation between samples, but the volume should not be so large as to render the sample time impractical. Sample volumes need not be identical at all locations; however, the particle concentration shall be reported in terms of particles per cubic foot of air regardless of the sample volume size. The sample volume size shall also be reported.

¹When the terms "as specified" or "shall be specified" are used without further reference, the degree of control needed to meet requirements will be specified by the user or contracting agency.

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TABLE II

Minimum volume per sample in cubic feet for the air cleanliness class and measured particle size shown

Class	Measured Particle Size (Micrometers)				
	0.1	0.2	0.3	0.5	5.0
1	0.6	3.0	7.0	20.0	NA.
10	0.1	0.3	0.7	2.0	NA.
100	NA.	0.1	0.1	0.2	NA.
1,000	NA.	NA.	NA.	0.1	3.0
10,000	NA.	NA.	NA.	0.1	0.3
100,000	NA.	NA.	NA.	0.1	0.3

(NA. - not applicable)

5.1.3.5 Sample volume at other classes or particle sizes. The minimum sample volume for other classes or particle sizes not specified herein shall be the same as that specified for the next lower class or next larger particle size.

5.1.4 Interpretation of the data. A statistical evaluation of particle concentration measurement data shall be performed according to Paragraph 5.4 to verify the airborne particulate cleanliness class level.

5.2 Monitoring of airborne particulate cleanliness. After verification, if specified¹, the airborne particulate cleanliness shall be monitored during operations. Monitoring shall consist of particle concentration measurements. Other environmental parameters as suggested in Paragraph 5.1.2.2 may also be monitored as specified¹ to indicate trends in airborne particulate cleanliness.

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5.2.1 Monitoring plan. A monitoring plan shall be established based on the airborne particulate cleanliness class and the degree of cleanliness control necessary for work activity or product protection. The monitoring plan shall specify frequency, operating conditions, the method of counting particles, the locations, number, and volume of samples, and some method for interpretation of the sample data.

5.2.2 Particle counting. Particle counting shall be performed using one of the test methods in Paragraph 5.3, as specified¹. Particle concentration measurements shall be taken at locations throughout the clean zone or where the cleanliness level is particularly critical or where the higher particle concentration levels are found during verification testing.

5.3 Methods and equipment for measuring airborne particle concentration. The method and equipment to be used for measuring the airborne particle concentration shall be selected on the basis of the particle size of interest. The following methods are suitable for class verification and monitoring of air cleanliness unless otherwise specified¹. Other particle counting methods and equipment may be used if demonstrated to have accuracy and repeatability equal to or better than the methods listed below^{2,3}.

¹When the terms "as specified" or "shall be specified" are used without further reference, the degree of control needed to meet requirements will be specified by the user or contracting agency.

²For example, for particle size approximately 0.01 micrometer in diameter and larger, a condensation nucleus counter, which optically detects particles which have been grown by condensation of a supersaturated vapor, may be used. The counter must detect single particles.

³For monitoring purposes only, evaluation of particles by sedimentation methods may be carried out by allowing the particles to deposit on the surface of an appropriate medium and then counting them using optical microscopy.

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D30.13	Document No. Title Abstract	IES-RP-CC-013 Source IES Recommended Practice for Equipment Calibration or Validation Procedures This Recommended Practice covers definitions and procedures for calibrating instruments used for testing cleanrooms and clean air devices, and for determining intervals of calibration.
D30.14	Document No. Title Abstract	NHB 5340.2 Source MSFC NASA Standards for Clean Rooms and Work Stations for the Microbially Controlled Environment Establishes standard classes of air conditions (both total particles and viable particles) within cleanrooms and clean work stations for the microbially controlled environment.
D30.15	Document No. Title Abstract	IES-CC-009 Source IES Compendium of Standards, Practices, Methods and Similar Documents Relating to Contamination Control Listing of documents.
D30.16	Document No. Title Abstract	MIL-STD-45662 Source NPFC Calibration Systems Requirements Prescribes requirements for establishment and maintenance of a calibration system used to control the accuracy of measuring and test equipment.
D30.17	Document No. Title Abstract	MIL-F-51068 Source NPFC Military Specification: Filter, Particulate, High-Efficiency, Fire Resistant Covers design, construction, and performance of HEPA filters in six sizes and seven types.
D30.18	Document No. Title	MIL-F-51079 Source NPFC Military Specification: Filter Medium, Fire-Resistant, High-Efficiency