



CLEAN ROOMS

A DIVISION OF CLEAN ENVIRONMENT

Clean Rooms

A cleanroom is a controlled environment where products are manufactured. It is a room in which the concentration of airborne particles is controlled to specified limits. Eliminating sub-micron airborne contamination is really a process of control. These contaminants are generated by people, process, facilities and equipment. They must be continually removed from the air. The level to which these particles need to be removed depends upon the standards required. The most frequently used standard is the Federal Standard 209E. The 209E is a document that establishes standard classes of air cleanliness for airborne particulate levels in cleanrooms and clean zones. Strict rules and procedures are followed to prevent contamination of the product.

What is Contamination?

Contamination is a process or act that causes materials or surfaces to be soiled with contaminating substances. There are two broad categories of surface contaminants: film type and particulates. These contaminants can produce a “killer defect” in a miniature circuit. Film contaminants of only 10 nm (nanometers) can drastically reduce coating adhesion on a wafer or chip. It is widely accepted that particles of 0.5 microns or larger are the target. However, some industries are now targeting smaller particles.

Sources of Contamination

This is a partial list of some of the commonly known contaminants that can cause problems in some cleanroom environments. It has been found that many of these contaminants are generated from five basic sources. The facilities, people, tools, fluids and the product being manufactured can all contribute to contamination. Review this list to gain a better understanding of where contamination originates.

- **Facilities**

Walls, Floors and Ceilings, Paint and Coatings, Construction Material (Sheet Rock, Saw Dust etc.) Air Conditioning Debris, Room Air and Vapors, Spills and Leaks

- **People**

Skin Flakes and Oil Cosmetics and Perfume, Spittle, Clothing Debris (Lint, Fibers etc.), Hair

- **Tool Generated**

Friction and Wear Particles, Lubricants and Emissions, Vibrations, Brooms, Mops and Dusters

- **Fluids**

Particulates Floating in Air, Bacteria, Organics and Moisture, Floor Finishes or Coatings, Cleaning Chemicals, Plasticizers (Outgases), Deionizer Water

- **Product generated**

Silicon chips, Quartz Flakes, Cleanroom Debris, Aluminum Particles





Cleaning Procedures for Clean Rooms

What follows are some recommended procedures for cleaning cleanrooms. It is important to emphasize that these procedures are guidelines and not standards or rules. The procedures listed here are routine cleaning tasks. Local cleanroom cleaning procedures may supercede the ones listed here. It is important for cleaning managers to review all cleaning procedures to be used in a cleanroom with the cleanroom management. A detailed cleaning schedule should be prepared for every cleanroom. Here are some procedures to be completed when cleaning a Class 10,000 cleanroom:

Key Elements of Contamination Control

We will look at several areas of concern to get a better idea of the overall picture of contamination control. These are the things that need to be considered when providing an effective contamination control program.

HEPA (HighEfficiency Particulate Air Filter) - These filters are extremely important formaintaining contamination control. They filter particles as small as 0.3 microns with a99.97% minimum particle-collective efficiency.

CLEANROOM ARCHITECTURE - Cleanrooms are designed to achieve and maintain a airflow in which essentially the entire body of air within a confined area moves with uniform velocity along parellel flow lines. This air flow is called laminar flow. The more restriction of air flow the more turbulence. Turbulence can cause particle movement.

FILTRATION - In addition to the HEPA filters commonly used in cleanrooms, there are a number of other filtration mechanisms used to remove particles from gases and liquids. These filters are essential for providing effective contamination control.

CLEANING - Cleaning is an essential element of contamination control. Decisions need to made about the details of cleanroom maintenance and cleaning. Applications and procederes need to be written and agreed upon by cleanroom management and contractors (if used). There are many problems associated with cleaning. Managers need to answer the following questions before proceeding with any cleanroom cleaning program.

CLEANROOM GARMENTS - The requirements for cleanroom garments will vary from location to location. It is important to know the local garment requirements of the cleanroom management. Gloves, face masks and head covers are standard in nearly every cleanroom environment. Smocks are being used more and more. Jump suits are required in very clean environments.

HUMANS IN CLEANROOMS - There are both physical and psychological concerns when humans are present in cleanrooms. Physical behavior like fast motion and horseplay can increase contamination. Psychological concerns like room temperature, humidity, claustrophobia, odors and workplace attitude are important. Below are several ways people produce contamination

COMMODITIES - Care is taken when selecting and using commodity items in clean rooms. Wipers, cleanroom paper and pencils and other supplies that service the clean room should be carefully screened and selected. Review of the local clean room requirements for approving and taking these items into the clean room are essential. In fact, many clean room managers will have approval lists of these types of items.

COSMETICS - Many cosmetics contain sodium, magnesium, silicon, calcium, potassium or iron. These chemicals can create damaging particles. Cleanroom managers may ban or restrict cosmetics in the cleanroom. This is usually dependent upon the threat to the product being made in the cleanroom. A recent mirror on a space telescope was fogged up from the cologne that was present in the cleanroom.

MEASUREMENT AND INSTRUMENTATION - Some important measurements related to contamination control are particle count, air flow & velocity, humidity, temperature and surface cleanliness. Cleanroom managers usually have specific standards and/or instruments to measure these factors.

ELECTROSTATIC DISCHARGE (ESD) - When two surfaces rub together an electrical charge can be created. Moving air creates a charge. People touching surfaces or walking across the floor can create a triboelectric charge. Special care is taken to use ESD protective materials to prevent damage from ESD. Cleaning managers should work with their personnel to understand where these conditions may be present and how to prevent them.



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