



## ***The clean room***

The purpose of every clean room is to control an environment by limiting the presence of sub-micron particles and modifying inadequate environmental conditions. The level to which the environment is controlled is what separates one clean room from another.

For instance, a Class 10 clean room has 10 particles of size 0.5 microns per cubic foot of air, where as a Class 100,000 clean room has 100,000 particles of size 0.5 micron per cubic foot of air.

## ***The need for clean rooms***

The electronic, high-tech, semiconductor, pharmaceutical, aerospace, medical and many other industries depend on clean room technology. As products such as cell phone circuit boards become smaller, the chance of contamination in manufacturing becomes higher.

For pharmaceutical companies, clean, safe and contaminant-free products are imperative to manufacturing and distributing a viable product.

## ***Personnel: the greatest threat!***

The largest cause of contamination in a clean room is personnel.

The following statistics have been taken from "The Austin Index" to illustrate personnel contamination.

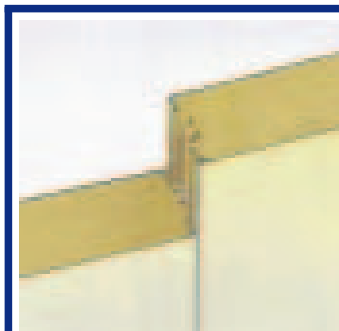
Personnel sampled were fully clothed in clean room garments and engaged in one of the following:

1. Standing or sitting with no movement resulted in 100,000 particles/minute 0.3 microns or larger.
2. Sitting or standing, light head, hand and forearm movement resulted in 500,000 particles/minute, 0.3 microns and larger.
3. Sitting or standing, average body and arm movement, toe tapping, resulted in 1,000,000 particles/minute, 0.3 microns and larger.
4. Changing positions, sitting to standing, resulted in 2,500,000 particles/minute, 0.3 microns
- 5a. Slow walking (2 mph), 5,000,000 particles/minute, 0.3 microns and larger.
- 5b. Average walking (3.57 mph), 7,500,000 particles/minute, 0.3 microns and larger.
- 5c. Fast walking (5 mph) 10,000,000 particles/minute, 0.3 microns and larger.
6. Climbing stairs, 10,000,000 particles/minute, 0.3 microns and larger.

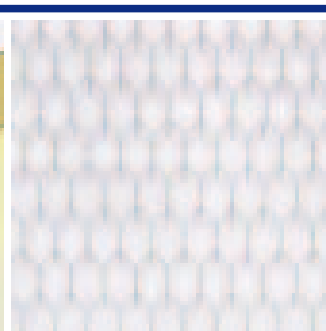
## ***Cleanliness level is classified under specific conditions***

The cleanliness of a clean room is measured by the size and number of dust particles in a given volume of air. The rating of classification by the number of particles in a given volume of air under specific conditions is called cleanliness level class. Regulations vary from country to country, but in most places, the national rule is established by referring to US Federal standard 209E.

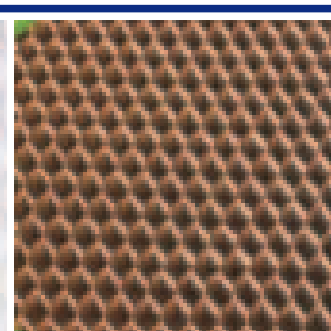
***Polyurethane sandwich panel***

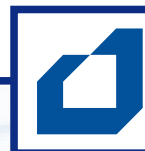


***Aluminium honeycomb panel***



***Ceramic paper honeycomb panel***





### Biological clean rooms (BCR)

There are three standards for industrial clean rooms (ICR)

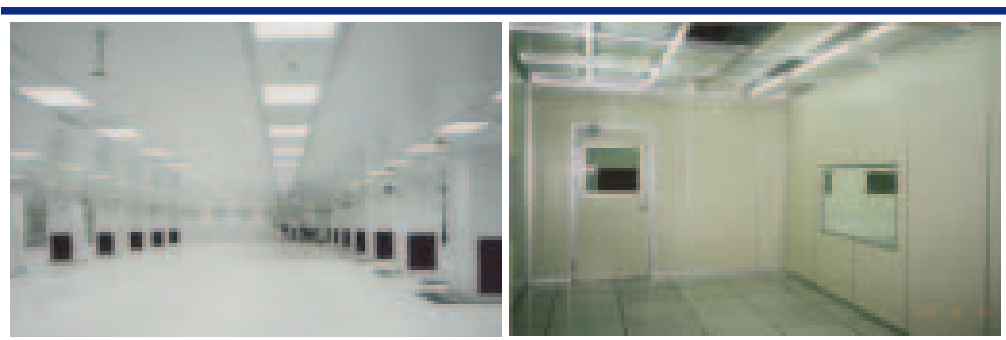
Class - ISO 14644	US Federal Standard 209e	Japanese Standard JIS B9920
ISO 8	(Class 100,000)	(Class 100,000)
ISO 7	(Class 10,000)	(Class 10,000)
ISO 6	(Class 1,000)	(Class 1,000)
ISO 5	(Class 100)	(Class 100)
ISO 4	(Class 10)	(Class 10)
ISO 3	(Class 1)*	(Class 1)
ISO 2 and cleaner		

\*ULPA filters required in Class 10-1 and cleaner applications. HEPA filters used in all others.

In Japan, JIS B9920 and Federal Standard 209E are generally adopted as the standards for industrial clean rooms. The cleanliness level classes are defined in JIS B9920 by the number of dust and particles with a diameter 0.1 micron meter or larger contained in one cubic meter of air. In Federal Standard 209E, the number of particles of 0.5 micron meter or larger contained in one cubic foot is used. An industrial clean room controls non-biological particles such as airborne dust particles. ICRs are mainly utilized in the production lines for the semiconductor, electronic equipment and precision machine industries.

ISO Class. Number	Class Limits (Particles/m <sup>3</sup> )					
	0.1 micron	0.2 micron	0.3 micron	0.5 micron	1 micron	5 micron
ISO Class 1	10	2				
ISO Class 2	100	24	10	4		
ISO Class 3	1,000	237	102	35	8	
ISO Class 4	10,000	2,370	1,020	352	83	
ISO Class 5	100,000	23,700	10,200	3,520	832	29
ISO Class 6		237,000	102,000	35,200	8,320	293
ISO Class 7				352,000	83,200	2,930
ISO Class 8					832,000	29,300
ISO Class 9						293,000

Biological clean rooms control the biological particles in the room. The US National Space Aviation Bureau (NASA) Standard NHB-5340-2 specifies the cleanliness level classes. The number of biological particles floating in a given volume of air in the room (particles/ft<sup>3</sup>) is counted, irrespective of their size, as well as the number of biological particles falling on a given area of the floor of the room, in a given time period (particles/ft<sup>3</sup> x week). However, biological particles may propagate, perish, or behave otherwise depending on environmental conditions other than cleanliness, and hence no clear-cut specification have been established. In Japan, various institutions and organic cleanliness level corresponding to application and purpose. BCRs respond to the increasing needs of the food processing and distribution industries. A biological clean room controls biological particles such as bacteria and microbes (fungi spores). BCRs are extensively used in fields where a controlled aseptic state is required, such as food related industries, medicine and pharmaceuticals.



# Clean Room Panels

## Fire extinguish Test between Polyurethane & Polystyrene

Right Side: Rigid Polyurethane foam. Density = 38 kg/m<sup>3</sup>

Left Side: Polystyrene foam

Step 1

after 3 seconds **Step 2**

after 5 seconds.

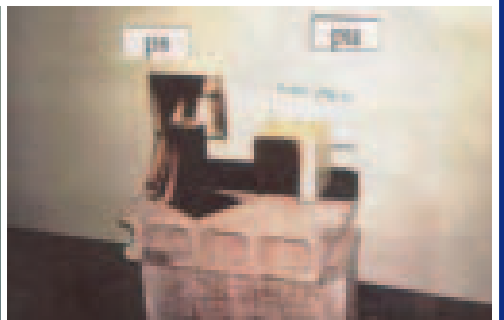
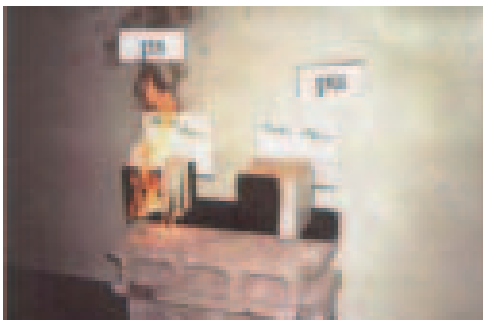
Only rigid polyurethane foam extinguish **Step 3**



Step 4

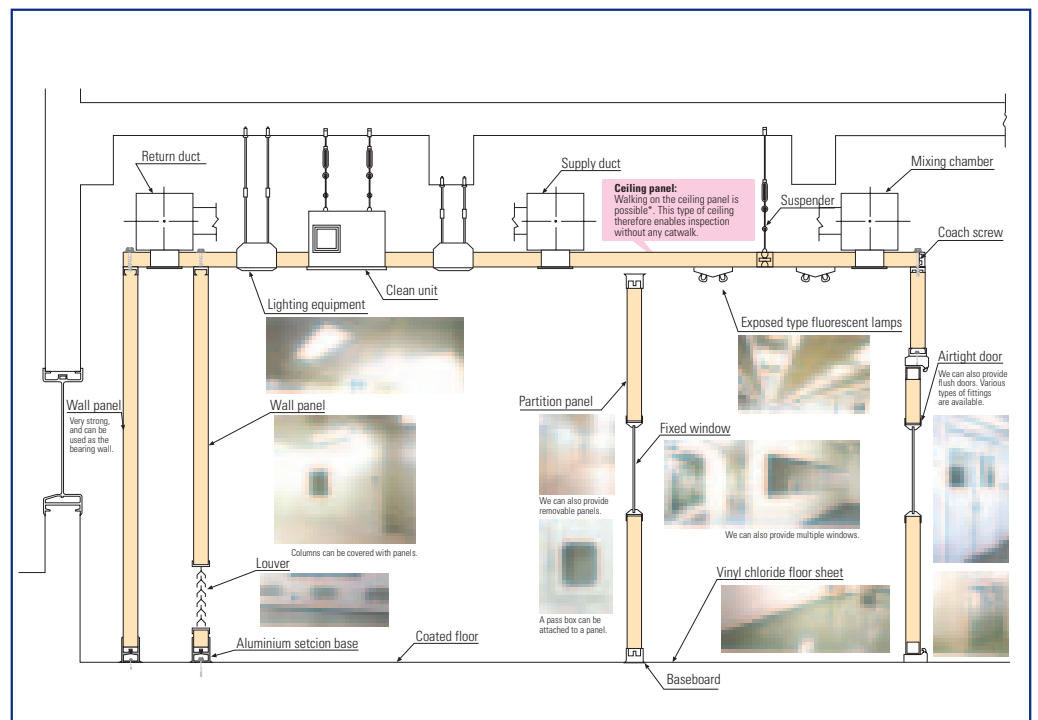
after 3 minutes **Step 5**

fire extinguish **Step 6**



## Typical Clean Room

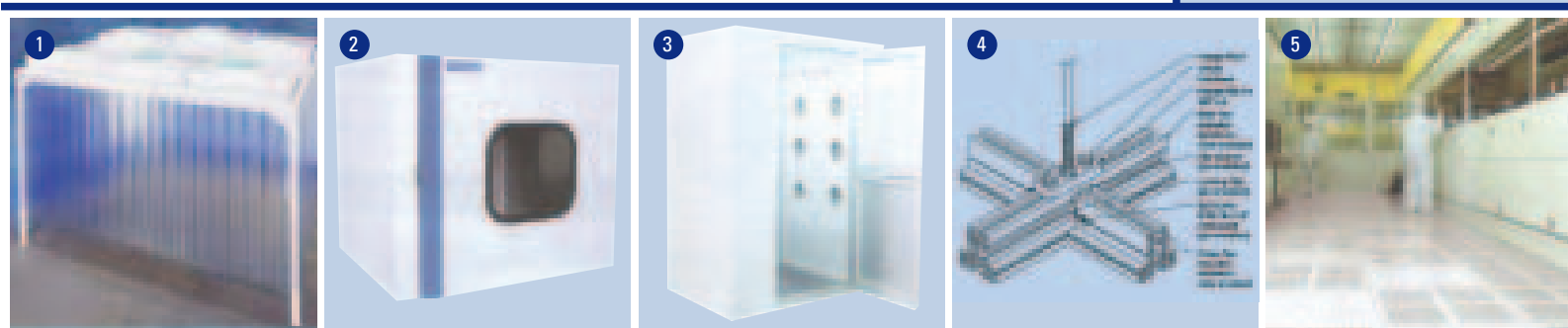
Walking on the ceiling panel is possible. This type of ceiling enables inspection without any catwalk. We can also manufacture return ducts from panels.





### ***The clean room equipments supplied by others***

1. **Soft walls/Portable Clean Rooms**
2. **Pass thru** are small airtight enclosures in the wall used to pass sensitive material from one room to another without being contaminated.
3. **Air showers** are used to gain entry into cleanrooms blowing filtered air on and around the person to remove any surface contaminants before entering the clean space.
4. **Ceiling grids** may be PVC or anodized aluminium, range from 1", 1.5" or 2" wide.
5. **Access Floor option** include solid heat seam-welded vinyl, self-leveling epoxy, tile floors and conductive raised access flooring.



### ***Clean room basics terms***

**Clean room:** An enclosed area that's controlled environmentally over atmospheric contamination, temperature, pressure and, often, humidity.

**Air Lock:** A room attached to the Clean room. This room has interlocking doors and its function is to act as a buffer zone between the clean room and the outside atmosphere, during the transfer of material or personnel. It helps keep the clean room pressurized and free from infiltrating dirt.

**Air Shower:** An enclosed chamber designed to clean personnel and their garments of contamination, prior to entering the clean room, by means of high velocity of air jets.

**Garments:** These are garments made of synthetic fabrics such as Nylon, Dacron, and Tyvek and others. They are lint free and limit contamination from personnel.

**HEPA filter:** High Efficiency Particulate Air filter, capable of filtering out 0.3 micron particles or larger with 99.99% efficiency.

**Laminar Flow:** of air in parallel planes (unidirectional).

**Micron:** A unit of measurement equal to one-millionth of a meter: 0.00003937 inches.

**Particle Size:** Particle size in the maximum dimension of the particle. Linear measure used for fibrous particles and diameter used for spherical particles.

**Pass Thru:** A small enclosure that mounted through the clean room wall and allows product to be passed through efficiently. Pass thru's cut down on personnel traffic, hence reducing contamination.

**Sticky Mat:** Located at the clean room or airshower entrance, sticky mats are multiple layers of treated film with adhesive to clean shoe bottoms and sides before entering the room.

**ULPA filter:** Ultra Lower Particulate Air filter, capable of filtering out 0.12 micron particles or larger. ULPA's operate with 99.9999% efficiency.