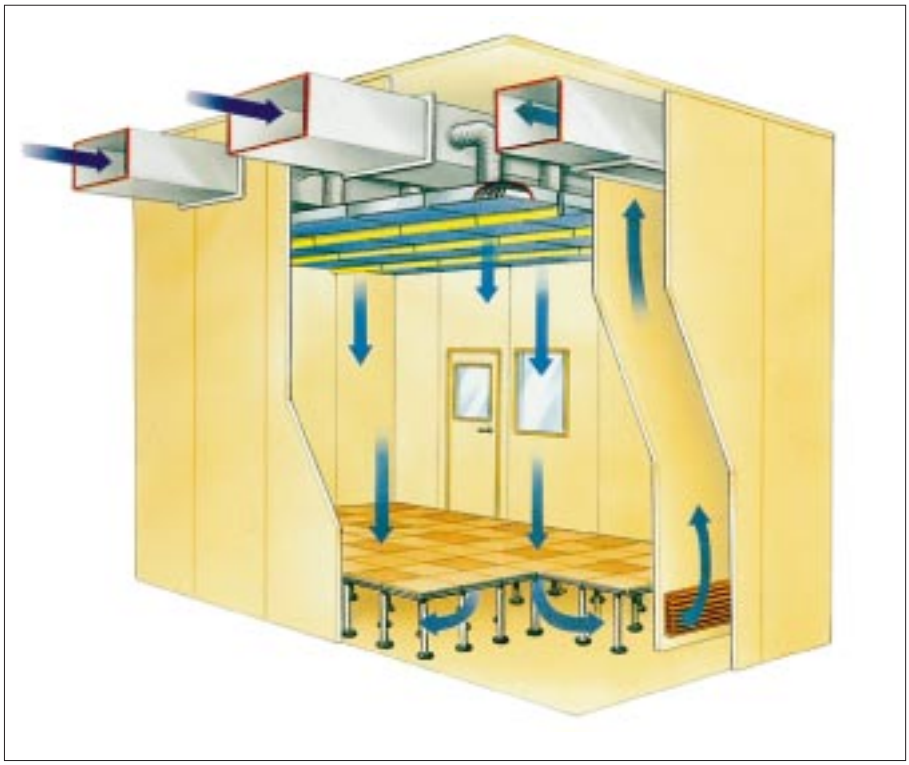
Laminar Flow Cleanrooms

Basic Design and Operating Considerations



The principle of laminar airflow or, to be more precise, unidirectional airflow cleanrooms is based on air moving along parallel streamlines at a uniform velocity of 0.3 to 0.45 m/s with as little turbulence as possible between the place where the air enters and exits the room. The principle is based on expelling any dust in the airflow by the shortest route.

Basically, there are two types of laminar airflow cleanroom:
a) Vertical downflow
b) Horizontal crossflow

Vertical Downflow

In a vertical downflow cleanroom, air enters the room via filters in the ceiling surface and is exhausted via a perforated floor. This downward aiflow flushes contaminated air particles out of the room via the floor, thus preventing a build-up of contaminated particles. Particles generated at one work station are therefore removed before they have the chance to migrate. The air velocity in this type of cleanroom is usually 0.3 to 0.45 m/s.

Horizontal Crossflow

In a horizontal crossflow cleanroom, the direction of airflow is from left to right or right to left across the room. Air enters the room via filters in one wall and is exhausted and/or recirculated via a bank of filters and perforated panels in the opposite wall. The air velocity has to be established at a sufficiently high level, usually 0.45 m/s, to counter the effects of upward thermal movement of particles. In work stations close to the high efficiency filter wall, Class 100 or better is possible.

Since the flow of particles in this type of cleanroom is in the horizontal direction, the particle contamination generated at one work station can be transported to work stations further downstream of the filters. This, however, is dependent on the type of work or the process(es) being carried out in the cleanroom. Horizontal crossflow is nevertheless a very practical and cost effective system, particularly in cleanrooms which have to be built in existing spaces with limited ceiling height.

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Achievable Class*	**1 and 10 (M1.5 and M2.5)**	**100 (M3.5)**
Area per occupant **Occupants properly attired** **Occupant activity** **Equipment in room** **Housekeeping**	40 m² Full gowns Minimum Minimum Meticulous	30 m² Full gowns Minimum Minimum Meticulous
Room pressurized **Air changes per hour** **Air lock**	15 Pa 500-600 Yes	15 Pa 500 Yes
Clean air inlets as % of ceiling area **Clean air inlet locations** **Terminal velocity at clean air inlet** **Return air location**	90-100% Ceiling 0.3 - 0.45 m/s Perforated floor	90% Ceiling (wall) 0.3 - 0.45 m/s Low level or floor (opposite wall, 0.45 m/s)
Prefilters: **- First stage**** **- Second stage**** **Prefilter maintenance and inspection** **Final filters****	 30% dust spot efficiency F5 95% @ 0.3 µm H10 Monthly Min. 99.9995% on 0.12 µm (for Class 10) U15 Min. 99.99995% on 0.12 µm (for Class 1) U16	 50% dust spot efficiency F5 90% dust spot efficiency F9 Monthly Min. 99.999% @ 0.3 um H14
Routine particle count interval	Daily	Weekly

* Class according to US Federal Standard 209E (between brackets in SI)
** G and F classification in accordance with EN779. H and U classification in accordance with draft EN1822.

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