Non-Laminar Flow Cleanrooms

Basic Design and Operating Considerations

In a non-laminar cleanroom or, to use its official name, non-unidirectional airflow cleanroom, air enters the room via filters in the ceiling, and is exhausted via grilles in the wall close to the floor.
The principle of this technique is based on allowing air to flow along irregular, random paths in a turbulent way.

The success of this technique hinges on optimizing the mixing of clean incoming air with dust laden air in the room and thereby diluting the contamination level in the cleanroom and lowering the number of particles per m^3. The supply of clean air is therefore the factor which determines the success of this technique. In general, the greater the frequency with which the air is renewed the lower the contamination build-up in the room and the greater the rate with which impurities are diluted. On an hourly basis, the number of air changes in a room can vary between 10 and 50, depending on the type of work and the achievable Class of the room.

Although more unpredictable than laminar airflow cleanrooms, in many applications a non-laminar flow room can be a cost effective solution, especially when local laminar flow work stations are operational in the room.

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Achievable Class*	1,000 (M4.5)	10,000 (M5.5)	100,000 (M6.5)	Avoid
Room size (m^2)	100	300	500	
Room aspect ratio	Narrow	3:1	2:1	Large square room
Room height (m)	min. 3	min. 2.75	min 2.25	
Area per occupant (m^2)	20	10	5	
Equipment in room	Minimum	30% Floor	50% Floor	
Occupant activity	Sedentary	Occasional movement	Constant activity	Frivolous activities
Traffic in/out per hour	1-2	2-6	More than 6	
Occupants properly attired	Full gowns	Smocks	Smocks	Street clothes
Particle generation in room	Miniature	Slight	Considerable	
Thermal updrafts	None	Slight	Considerable	
Housekeeping	Meticulous	Good	Mediocre	
Room Pressure (Pa)	10-15	10-15	5-10	None
Air changes per hour	40-120	20-40	10-20	
Airlock	Adequate	Small	None	
Clean air inlets as % of ceiling area	20-50	10-20	5-10	
Clean air inlet locations	Ceiling	Ceiling	Ceiling or high sidewall	Floor
Terminal velocity at clean air inlet (m/s)	0.15-0.45	0.15-0.45	0.15-0.45	
Return locations	Low level or floor	Low sidewall	Sidewall	Ceiling
Wall return spacing	Continuous on all 4 walls	Intermittent on long walls	Non-uniform	Single
Max. horizontal distance to return (m)	3	6	9	
Return face velocity (m/s)	0.5-1	1-2.5	2.5	
Prefilters				
- First Stage**	50% dust spot eff. F5	90% arrestance G4	80% arrestance G4	Doors open
- Second Stage**	90% dust spot eff. F8	80-90% dust spot eff. F7	80-90% dust spot eff. F7	
Prefilter maintenance and inspection	Quarterly	Semi-annual	Annual	No schedule
Final Filters**	min.99.999% @ 0.3 µm H14	min. 99.99% @ 0.3 µm H13	min. 95% @ 0.3 µm H10	
Routine particle count interval	Monthly	Monthly	Quarterly	

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

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