



AirClean System Design - Clean Rooms

The **AirClean** system must be designed according to the final condition to be achieved in the controlled environment, usually a clean room.

In order to obtain the AirClean effect the correct air distribution for allowing ionization has to be met.

The following steps are required:

1. Identification of the room classification needed
2. Filtering efficiency required
3. Calculation of filtering modules necessary for the efficiency required
4. Negative ion emitters' calculation

| Table 1 Classification per food sector | Filter efficiency | | Type of plant |
|--|-------------------|------|----------------------------|
| | Min. | Max. | |
| Dairy | | | |
| Cheese ripening/maturing (semi hard and hard) | 90 | 95 | High efficiency filtration |
| Milk and Yoghurt filling | 90 | 95 | Contamination control |
| Rooms in which product is not in direct contact with the environment | 90 | 95 | High efficiency filtration |
| Soft cheese cooling | 99 | 99.5 | Contamination control |
| Drying | 99 | 99.5 | Contamination control |
| Cheese packing | 99 | 99.5 | Contamination control |
| Yoghurt production (open cups) | 99 | 99.5 | |
| Meat | 99 | 99.5 | |
| Processing | 99 | 99.5 | Contamination control |
| Packing/Canning | 99 | 99.5 | Contamination control |
| Sausages | | | |
| Raw Meat cold storage | 90 | 95 | High efficiency filtration |
| Drying | 99 | 99.5 | Contamination control |
| Seasoning and maturing | 99 | 99.5 | Contamination control |
| Storage | 90 | 95 | High efficiency filtration |
| Prosciutto (ham) drying | 99 | | Contamination control |
| Prosciutto (ham) ripening and seasoning | 99 | 99.5 | Contamination control |
| Packaging | 99 | 99.5 | Contamination control |
| Poulties | 99 | 99.5 | |
| Processing | 99 | 99.5 | Contamination control |
| Packaging | 99 | 99.5 | Contamination control |
| Fruit and vegetables | | | |
| Storage | 90 | 95 | High efficiency filtration |
| Packaging | 99 | 99.5 | Contamination control |
| Classified environment ISO 5 & ISO 6 | See table 2 | | Pre-filtration |



| Clean Area Classification (0.5 µm particles/ft ³) | ISO Designation ^b | > 0.5 mm particles/m ³ | Microbiological Active Air Action Levels ^c (cfu/m ³) | Microbiological Settling Plates Action Levels ^{c,d} (diam. 90mm; cfu/4 hours) |
|---|------------------------------|-----------------------------------|---|--|
| 100 | 5 | 3,520 | 1 ^e | 1 ^e |
| 1000 | 6 | 35,200 | 7 | 3 |
| 10,000 | 7 | 352,000 | 10 | 5 |
| 100,000 | 8 | 3,520,000 | 100 | 50 |

- a. All classifications based on data measured in the vicinity of exposed materials/particles during periods of activity.
- b. ISO 14644 -1 designations provide uniform particle concentration values for cleanrooms in multiple industries. An ISO 5 particle concentration is equal to Class 100 and approximately equals EU Grade A.
- c. Values represent recommended levels of environmental quality. You may find it appropriate to establish alternate microbiological action levels due to the nature of the operation or method of analysis.
- d. The additional use of settling plates is optional.
- e. Samples from Class 100 (ISO 5) environments should normally yield no microbiological contaminants.

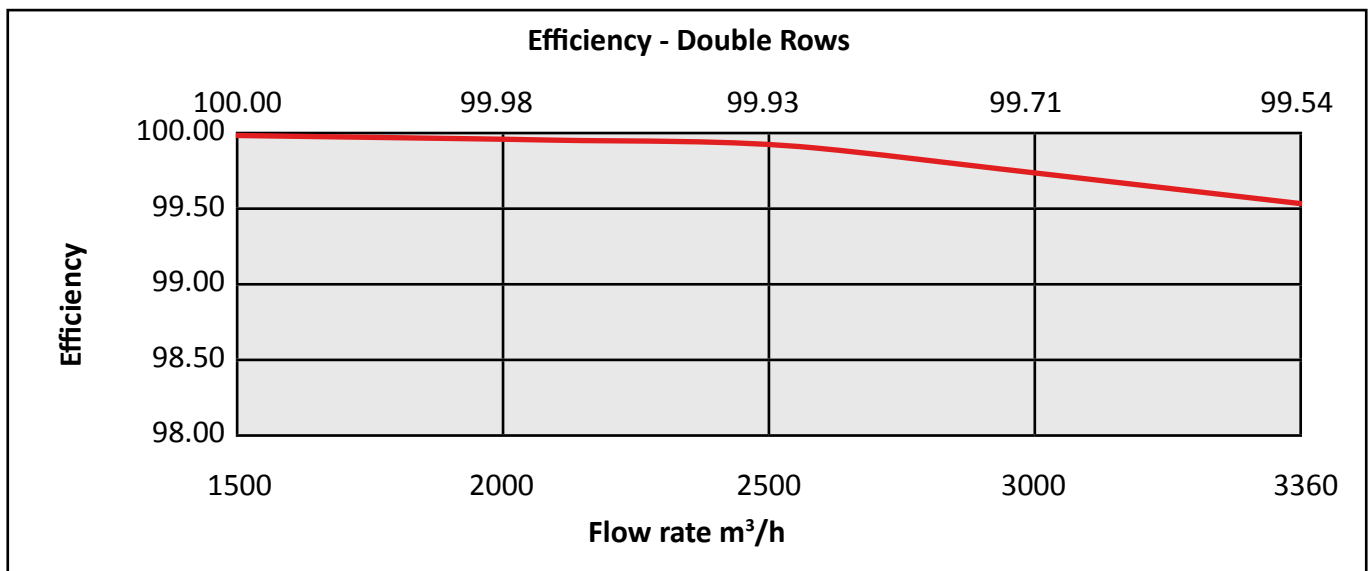
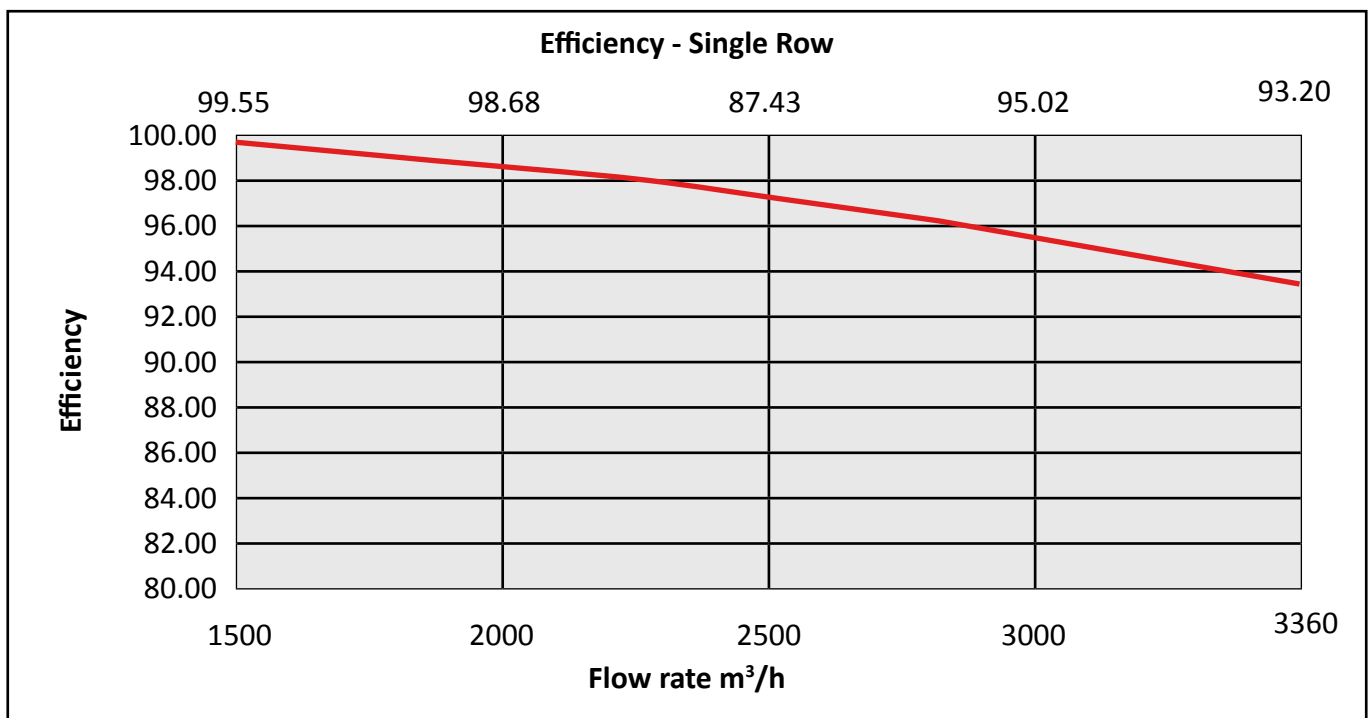


Example:

Let's assume we have room of 1000m³ that needs to maintain proper thermo-hygrometric conditions at an air flow rate of 7500m³/h. The room is designed for food packaging and must consequently be under Contamination Control.

Table 3 shows that recirculation must increase by a factor of 10 and the minimum air flow rate should therefore be 10000m³/h. Thermo-hygrometric calculation must be revised accordingly.

The efficiency required has to be above 99%.





| Table 3 Selection | Pre-filter | Electrostatic filter | Efficiency average % | Final | Efficiency % mpps | Recirculation |
|------------------------------|-------------------|---------------------------------|---------------------------------|--------------|------------------------------|----------------------|
| Class A Room (ISO5) | G4 | ES1* | 95 | U15 | 99.99995 | 250 - 500 |
| Class B Room (ISO6) | G4 | ES1* | 95 | H15 | 99.9995 | 50 - 150 |
| Class C Room (ISO7) | G4 | ES2* | 99 | | 99.995 | 25 - 50 |
| Class D Room (ISO8) | G4 | ES2* | 99 | | 99.95 | 10 - 25 |
| Contamination Control | G4 | ES2* | 99 | | | 10 - 25 |
| High efficiency filtration | G4 | ES1* | 90 | | | 7 - 15 |
| Pre-filtration | G4 | ES1* | 80 | | | - |

* ES1 (Electrostatic 1 row)

* ES2 (Electrostatic 2 rows)

| Air velocity m/s | | | | | | | |
|------------------------------|------|------|------|------|------|------|------|
| Section m² | 2 | 3 | 4 | 5 | 6 | 7 | > 8 |
| Emitter steps | | | | | | | |
| | 2 | 3 | 4 | 5 | 6 | 7 | 7 |
| > 0.25 | 0.50 | 0.33 | 0.25 | 0.20 | 0.17 | 0.14 | 0.14 |
| 0.5 | 1.00 | 0.67 | 0.50 | 0.40 | 0.33 | 0.29 | 0.29 |
| 1 | 2.00 | 1.33 | 1.00 | 0.80 | 0.67 | 0.57 | 0.57 |
| 2 | 4.00 | 2.67 | 2.00 | 1.60 | 1.33 | 1.14 | 1.14 |
| > 4 | 8.00 | 5.33 | 4.00 | 3.20 | 2-67 | 2.29 | 2.29 |