

In This Section

The Eagleson Institute
Industry Links
Library
Intro to Biological Safety Cabinets
Intro to Clean Benches
Vapor Testing
Glossary
Bibliography

[Education and Resources > Intro to Clean Benches](#)
Intro to Clean Benches

The laminar flow clean bench is a work bench or similar enclosure which has its own filtered air supply. The clean bench was developed as an adjunct to clean room technology (the need to protect the work from contamination). In recent years, the use of the clean bench has spread from research and manufacturing to other fields such as aerospace, bioscience, pharmaceutical production and food processing.

Today, laminar flow clean benches are used in a variety of applications throughout medical research laboratories, hospitals, manufacturing facilities and other research and production environments.

Clean Bench Function

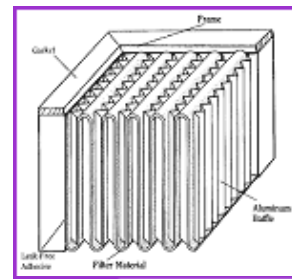
The clean bench provides product protection by ensuring that the work in the bench is exposed only to HEPA-filtered air.

- The clean bench is recommended for work with non-hazardous materials where clean, particle-free air quality is required.
- It does not provide protection to personnel or to the ambient environment.
- It is not designed to contain aerosols generated by the procedure; the user is exposed to these aerosols.

The HEPA Filter

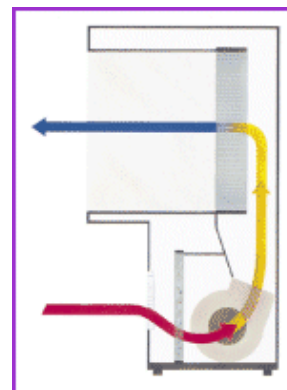
A common component in any clean bench is the HEPA filter. The HEPA filter (High Efficiency Particulate Air) removes particulates, generally called aerosols, such as micro-organisms, from the air. The HEPA filter does not remove vapors or gases.

- HEPA filters are made of boron silicate microfibers formed into a flat sheet by a process similar to making paper.
- Flat filter sheets are pleated to increase the overall surface area.
- Pleats are separated by aluminum baffles which direct the airflow through the filter.



[Cross section of HEPA filter. Click to enlarge.](#)

Depending on its quality, a HEPA filter can trap from 9,997 to 9,999 of every 10,000 particulates of a diameter greater than and less than 0.3 micron. For most industrial uses, the 99.97% performance is acceptable. Pharmacy and laboratory applications, however, require a 99.99% filtration performance level. To satisfy performance standards established by The Baker Company, HEPA filters used in all Baker products are leak-free and rated at the 99.99% level.



Conventional horizontal clean bench.

[▲ Back To Top](#)

Laminar Airflow

Another common attribute in clean bench technology is laminar airflow. The following general definition applies to the application of laminar airflow in this literature.

[Click to enlarge.](#)

- Generally defined, laminar airflow is airflow in which the entire body of air within a confined area moves in a unidirectional velocity along parallel flow lines.
- Technically defined, laminar airflow is the fluid flow in which air velocities are free of macroscopic fluctuations which occur when the Reynolds Number is less than 2000. (The Reynolds Number is the ratio of inertial to viscous forces in a pipe or duct.)

Horizontal Laminar Airflow

The clean bench or "hood" is a work area with its own HEPA-filtered air supply. Protection is provided by capturing room air, passing the air through a HEPA filter, and directing the filtered air horizontally across the work surface at a constant speed toward the user.

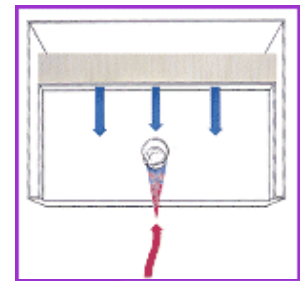
- In a horizontal laminar flow clean bench (the Baker EdgeGARD®), room air is drawn into the base of the hood by the blower/motor, through a washable, reusable pre-filter.
- The air pushed up the rear plenum of the hood passes through the HEPA filter.
- Filtered air is directed horizontally across the work surface at a constant velocity of 100 FPM toward the user.

Turbulence

Creates Backwash

Particle-free air quality in the laminar flow clean bench is accomplished with precise control of airflow volumes and velocities. Any obstruction will have a significant impact on laminar flow performance. Obstructions include work in process or materials placed inside the hood or on the hood surface. Federal Standard No. 209E does not account for obstructions.

- Obstructions cause interruptions in airflow which allow particulates to enter the work area, sharply increasing particle counts inside the hood.
- Backwash is the general term applied to the entry of unfiltered room air into the work area.
- Backwash may be created when the user inserts a hand or materials into the work area.

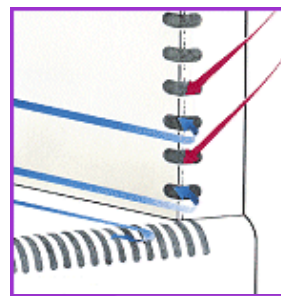


In a conventional laminar flow clean bench, particulates may contaminate the work area when hands or materials (such as a beaker, illustrated) are placed inside the hood. The resulting turbulence creates backwash which allows dirty room air to enter the zone. [Click to enlarge.](#)

Baker High Velocity Return Air Slots Reduce Backwash

All Baker clean benches employ a patented cabinet design with high velocity return air slots which are proven effective in significantly reducing the effects of backwash.

- High velocity slots are located along the front edge of the work surface and along the side walls of the work area.
- Air is drawn into these slots at 1,000 FPM ensuring that no unfiltered air enters the work



The Baker EdgeGARD® clean bench design includes patented high velocity

- area.
 - Slots radically reduce particle counts from backwash created by the introduction of work pieces or operator's hands into the work stream.
 - Slots recover air at all leading edges of the work space, and recirculate the air through the HEPA filter to reduce the particle count.
 - Slots help extend filter life by reducing the proliferation of dirty air into the filter intake.
- return air slots which minimize particulate contamination created by backwash common in conventional clean bench construction.
- [Click to enlarge.](#)

 [Back To Top](#)

Air Cleanliness Classification

In Federal Standard No. 209E (last revised Sept.11,1992) the United States Government provides requirements for three classes of air cleanliness. Classifications are based on particle counts taken at a location within the clean bench which will yield a particle count of air as it approaches the work location. It is important to note that government classifications reflect performance when the bench is "at rest", or free of materials or work activity within the hood.

Air Cleanliness Classes, Federal Standard No. 209E	
Class 100	Particle count not to exceed a total of 100 particles per cubic foot of a size 0.5 micron and larger.
Class 10,000	Particle count not to exceed a total of 10,000 particles per cubic foot of a size 0.5 micron and larger, or 65 particles per cubic foot of a size 5.0 micron and larger.
Class 100,000	Particle count not to exceed a total of 100,000 particles per cubic foot of a size 0.5 micron and larger, or 700 particles per cubic foot of a size 5.0 micron and larger.

Baker Performance Exceeds Federal Minimum Standards

In tests conducted by The Baker Company, the Baker EdgeGARD® clean bench, with patented high velocity return air slots, has been proven to reduce backwash. Tests were conducted under conditions at and beyond minimum standards established in Federal Standard 209E.

- Tests on the EdgeGARD® (Model EG3220) were conducted with the high velocity return air slots uncovered (normal), and covered (to simulate a conventional laminar flow clean bench).
- Comparative tests were conducted with the EdgeGARD® in three modes:
 - empty and operating (federal minimum standard).
 - operating with a commonly used piece of equipment in the air stream (Baker standard).
 - and operating while work was being performed in the work area (Baker standard).

Baker EdgeGARD® Clean Bench	With High Velocity Return Air Slots Covered To Simulate Conventional Clean Bench	With High Velocity Air Slots Uncovered To Deliver Maximum Protection
Operating, Empty (Federal Minimum Standard)	particle count within Class 100 limits	particle count within Class 100 limits

Operating, With Common Equipment In Hood (Baker Standard)	particle count exceeds limits of Class 100 and Class 10,000 air quality performance	particle count within Class 100 limits due to performance of high velocity return air slots
Operating, Work Being Performed In Work Area (Baker Standard)	particle count exceeds limits of Class 100 air quality performance	particle count within Class 100 limits due to performance of high velocity return air slots

Test Summary

Baker Company tests suggest that neither Class 100 nor Class 10,000 federal standards can be routinely maintained in a conventional laminar flow clean bench when a backwash effect is induced by normal placement of any object within the work area.

Smoke Tests Prove Unique Performance of Baker Clean Bench

Results of extensive testing by The Baker Company are illustrated by smoke tests conducted at the front of the hood.

- When a beaker is placed in the air stream of a conventional laminar flow clean bench (shown, EdgeGARD® with return air slots covered), the resulting airflow interruption creates a backwash of smoke into the work area.
- With high velocity return air slots uncovered, introduction of smoke into the work area is prevented.
- Only Baker offers patented high velocity return air slots for maximum protection.

Baker EdgeGARD® with high velocity return air slots covered to simulate conventional clean bench. Turbulence created by normal placement of beaker on work surface allows smoke (particulates) to migrate into the work area.



When high velocity return air slots are uncovered, smoke (particulates) are prevented from contaminating the work area.



▲ [Back To Top](#)

Copyright 2003-2005, The Baker Company | [Terms of Use](#) | [Privacy Policy](#) | [Site Map](#)
Site Development: OffWhite