

Animal Transfer Stations Vs. Animal Handling Biosafety Cabinets

Important Distinctions in Airflow Fundamentals, Design, Operational Techniques, and Intended Uses



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Ensuring Safety in the Vivarium

In the vivarium, protecting both personnel and animals must always remain top priority. To ensure their protection, technicians should only handle animals within proper equipment designed specifically for handling animals to avoid cross-contamination. Animals may be immunocompromised or have specific pathogen free (SPF) status making them susceptible to microorganisms and infections.

Since elimination and/or substitution of risk is rarely achievable in the vivarium, engineering controls, administrative controls, and personal protective equipment (PPE) provide the primary means of protection. Typically, Animal Transfer Stations (ATs) and Animal Handling Biological Safety Cabinets (AH BSCs) serve the role of engineering controls in this context. Understanding the capabilities and differences between these two controls will help eliminate unnecessary costs and loss of resources due to compromised animals and research.

Key Operation and Design Fundamentals

Both ATs and BSCs utilize vertical laminar downflow of HEPA-filtered air inside the work zone where the animals are being handled. HEPA stands for high efficiency particulate air (filter). In accordance with the National Sanitation Foundation's (NSF) standards, Class II biosafety cabinets must utilize HEPA filters that are at least 99.99% efficient at 0.3 microns for the supply and exhausted airflow. The constant downflow of air pulls dander and microorganisms down into the air intake grills located on the

work surface. To extend the lifespan of HEPA filters, washable mesh pre-filters are often employed to remove larger particles, such as hair, dander, and dust, before reaching the HEPA filters.

On a Class II Type A2 biosafety cabinet, ambient air will also be pulled into the inflow air grill at the front edge of the cabinet. These airflow dynamics are often referred to as a dynamic air barrier, separating personnel from the product(s) inside the work zone.

Although both devices utilize similar airflow fundamentals, notable differences in construction, operational technique, and intended uses still exist between ATs and AH BSCs.



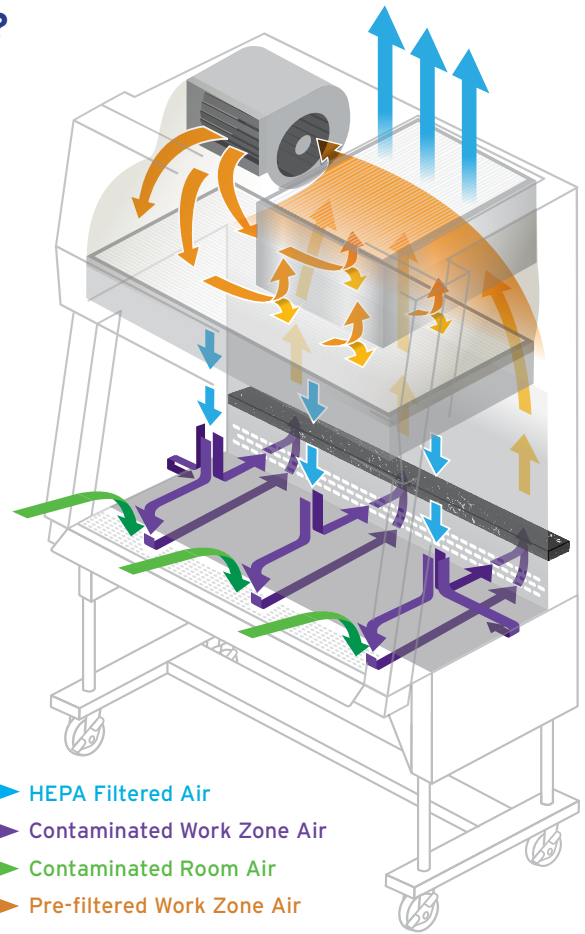
Class II Type A2 Animal Handling Biosafety Cabinet

What is an Animal Handling Biosafety Cabinet?

An Animal Handling Biosafety Cabinet (AH BSC) is an enclosed clean air workspace for safely handling potentially contaminated or otherwise hazardous materials requiring a predefined level of biosafety. Because of the increased protection granted by a BSC, personnel can practice procedural tasks in the work zone, such as injecting, manipulating, or examining the product.

Three different classes (I, II, or III) of biosafety cabinets currently exist, defined by the varying degrees of biocontainment required. Class I biosafety cabinets are designed to only provide personnel and environmental protection by pulling in ambient air past the user and through the work zone. Class II biosafety cabinets provide mid-range product, personnel, and environment protection while Class III devices offer the highest containment with products in the work zone only accessible via physical barriers.

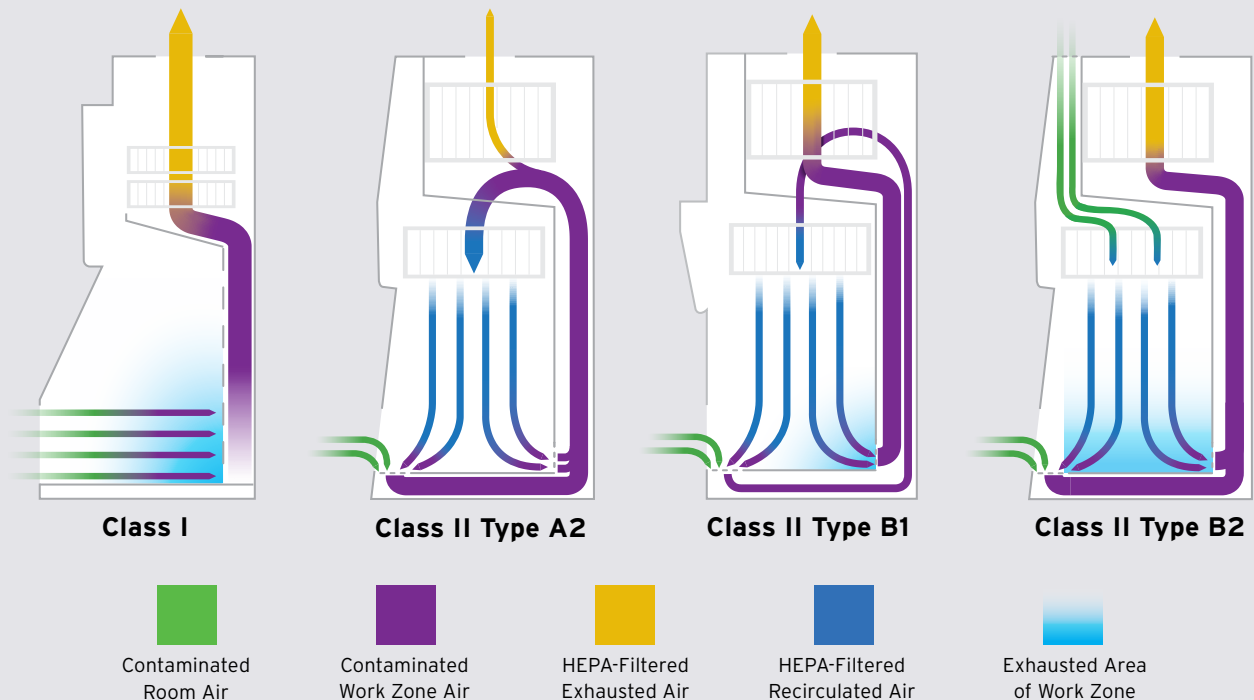
Multiple types also exist within class II biosafety cabinets, dictated by what proportion of the air passing through the work zone gets exhausted versus recirculated. Unlike traditional BSCs designed for microbiology research, animal handling models accommodate the specific needs of animal researchers with unique modifications, such as pre-filters, built-in waste chutes, and/or cage pass-through chambers. The higher level of containment provided by Class II units protect animals that may be immunocompromised, biohazardous, or designated as unknown infection status.



- ▶ HEPA Filtered Air
- ▶ Contaminated Work Zone Air
- ▶ Contaminated Room Air
- ▶ Pre-filtered Work Zone Air

Class II Type A2 Biosafety Cabinet Airflow Dynamics

Biosafety Cabinet Work Zone Airflow Dynamics by Class & Type





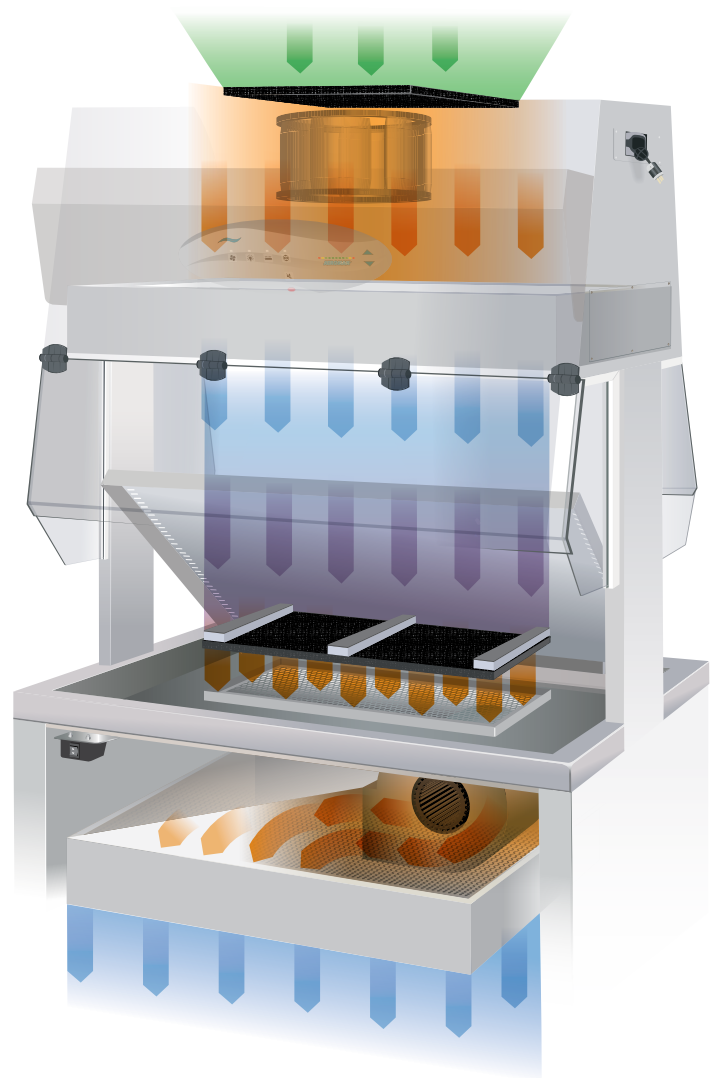
What is an Animal Transfer Station (ATS)?

Animal Transfer Stations (ATSs) are clean air workstations designed to accommodate changing of cages for non-infected animals only. ATS units are designed for transferring animals between dirty and clean cages and are not typically intended for procedural work, such as injecting, handling, examining, etc. They do provide protection against most allergens but do not ensure protection against exposure to infectious agents. Though no current performance standards and/or certifications currently exist, ATSs must still be certified to operate according to manufacturer specifications.

Many ATSs utilize a “push-pull” downward airflow pattern. An air supply impeller at the top of the cabinet creates the “push” action by directing air straight down through the work zone while a second motor beneath the work surface “pulls” the air through the air slots located on the edges of the work surface. Due to the lack of regulatory agencies, ATSs can vary widely in design and functionality. However, as mentioned, one must still regularly certify the ATS functions according to manufacturer specifications.

The ATS workspace can be accessible from one or two sides, depending on the intended usage. Typically, one-sided stations create a stronger air barrier than their dual-sided counterparts. Two-sided ATSs offer greater convenience, but the additional access opening increases the surface area of the air barrier, making it markedly less stable.

The opening sash levels can be higher than biosafety cabinets, allowing for large cages to be moved in and out of the work zone with ease. ATS units typically occupy a smaller footprint and can be conveniently moved between animal IVC racks and handling rooms. The versatility of these devices makes them suitable for widespread, low-risk workflows throughout the vivarium.



- ➔ HEPA Filtered Air
- ➔ Contaminated Work Zone Air
- ➔ Contaminated Room Air
- ➔ Pre-filtered Work Zone Air

Dual-Sided Animal Transfer Station Airflow Dynamics

What are the Performance Standards for Biosafety Cabinets?

Design features of biosafety cabinets are largely dictated by performance standards such as NSF/ANSI 49 or EN 12469.

These standards involve multiple aspects of BSC operation and include: downflow and inflow velocities (dynamic air barrier), allowable sash heights, biological containment restrictions, and exhaust system parameters. Although not a strict requirement, animal handling models typically utilize a pre-filter to catch hair and dander in line with HEPA filtration.

Additional considerations include recertification requirements upon moving the BSC unit and/or operating the unit in different locations throughout the vivarium. Proper cabinet operation should be confirmed by airflow smoke pattern tests at each site of use. If the cabinet is relocated to another facility or subjected to excessive shock/vibration, the cabinet should be re-certified to ensure proper containment.

Biosafety cabinets must be routinely re-calibrated and certified to regulatory agencies' specifications. This includes ensuring the standard inflow and downflow velocities dictated by the NSF are being constantly sustained by the cabinet:

- For Class II BSCs, the inflow velocity should be a minimum of 100 fpm (0.51 m/s)
- Downflow velocity requirements vary by model, most range from 50 to 80 fpm (0.25 to 0.40 m/s) for both types
- Class II, Type A2 BSC models exhaust approximately 30% of the air passing through the work zone, while recirculating the other 70%
- Class II, Type B1 cabinets are the inverse of A2 models by exhausting 70% and recirculating 30% of the air passing through the work zone
- Class II, Type B2 and Class III biosafety cabinets exhaust 100% of all air passing through the work zone

What are the Performance Standards for Animal Transfer Stations?



Single-Sided Animal Transfer Station

Due to the absence of ATS regulatory agencies, each device manufacturer sets their own performance standards of their animal transfer stations. Single-sided ATS units offer allergen protection through an air barrier at the front access opening of the workstation. Double-sided ATS models rely on the “piston” of air principle in their airflow dynamics. In both cases, HEPA-filtered air gets pulled from the top of the device and flushes the work zone, then exhausts through an additional HEPA filter before finally recirculating back into the vivarium.

Overall, ATS units are intended for low-risk procedures, which allows them to produce noticeably lower airflow velocities when compared to BSC units; this will also vary greatly between ATS manufacturers. It is absolutely imperative to communicate with your desired ATS manufacturer before choosing a specific model to meet the needs of your workflow.

Summary

Animal Transfer Stations are generally suited for lower-risk duties such as cage changing, while Animal Handling Biosafety Cabinets provide much higher levels of security for procedural applications, such as blood sampling, biopsies, examinations, and other invasive procedures. The infection status and whether or not the animal is immunocompromised will influence the type of containment system required. Although they may appear similar, each type of clean air workstation requires very specific training, routine certifications, and due diligence during the purchasing process. Use of safe practices and strict adherence to Standard Operating Procedures (SOPs) should be always maintained to mitigate potential risks.

About NuAire

For over half a century, NuAire has consistently led the industry in safety standards and customer satisfaction. We obsess over our customers' needs and tailor unique solutions to meet those needs. With invaluable input from customers like you, we now offer a wide range of biological safety cabinets, CO₂ incubators, laminar airflow workstations, restricted access barrier systems, animal handling stations, -86°C ultralow temperature freezers, and custom solutions. With our cutting-edge robotic sheet metal facility, we are able to deliver you custom, innovative solutions in addition to the standard laboratory equipment that we sell.

Choose NuAire as the Safer Choice.



References:

1. CDC/NIH Biosafety in Microbiological and Biomedical Laboratories (BMBL) 6th Edition:
<https://www.cdc.gov/labs/BMBL.html>
2. National Institute for Occupational Safety and Health (NIOSH) Hierarchy of Controls:
<https://www.cdc.gov/niosh/topics/hierarchy/default.html>
3. NSF/ANSI 49 -2020 Biosafety Cabinetry: Design, Construction, Performance, and Field Certification Informative Annex 1:
<https://webstore.ansi.org/Standards/NSF/NSFANSI492020Annex>



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