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SEFA 12 - Laminar Flow Workstation - Acid & Corrosive Resistant Polypropylene, PVC, PVDF (Reg./Flame Retardant), Painted & Stainless Steel

1.0 Purpose

The purpose of these Recommended Practices is to provide architects, engineers, planners, specifiers, manufacturers and end users with the Industry Standard Practices for the various types of Laminar Flow Workstation – Metal & Plastic.

- ***The RP will detail the types of Laminar Flow Workstation, the types of construction with the advantages for each type of construction, include chemical resistance / acid resistance data, and highlight the applications.***

SEFA 12 Recommended Practices will also include the design, construction, installation, testing, maintenance and safe use of Laminar Flow Clean Air Workstations. Acid resistance and flame retardancy will be highlighted for each type.

2.0 Scope

The Recommended Practices provide a comprehensive single source of knowledge pertaining to the various types and construction of Laminar Flow Workstations. Laminar flow is UNIDIRECTIONAL air flow; Clean Class 100 /ISO 5 or better environments with HEPA /ULPA filter, at a velocity of 60 to 100 feet per minute. Both the force to create laminar flow **and** the filtration are required to keep the interior of the workstation clean. A laminar flow work station can become turbulent and non-compliant if it has obstructions in it. Since the Laminar Flow Workstation is integral to the Laboratory Ventilation System, these practices will address the entire system.

Definition - **Laminar Flow** takes place in layers without interaction between them, so that all parts move in one direction. **Laminar Flow** is uninterrupted flow in a fluid near a solid boundary in which the direction of flow at every point remains constant. Laminar flow is smooth, orderly movement of a fluid, in which there is o turbulence, and any given subcurrent moves more or less in parallel with any other nearby subcurrent.

Clean Class is a critical element of Laminar Flow Clean Workstations. The air in the interior of these work stations has no more particles larger than 0.l, 0.3,0.5, 1 and 5 microns in size than the amount allowed by each ISO class shown in the table below, per cubic meter of air, according to the ISO – 14644 standards.

Particles are filtered out of supply air or recirculating air by pressurized **HEPA** Filters - ***High Efficiency Particle Filters*** **-** can remove 99.97% of dust particles that are 0.3 microns in diameter (micron is one millionth of a meter).

ULPA Filters - "***Ultra Low Particulate Air (filter)"*** - can remove from the air at least 99.999% of dust, pollen, mold, bacteria and any airborne particles with a size of 100 nanometres (0.1 µm) or larger.

3.0 Laminar Flow Workstation Defined – [P = Plastic, M = Metal] -Removed WOOD

An Exhausting Laminar Flow Workstation is a safety device specifically designed to carry undesirable effluents (generated within the Hood during a laboratory procedure) away from laboratory personnel and out of the building, when connected to a properly designed laboratory ventilation system. A Laminar Flow Workstation shall include the top, three fixed sides & a single face opening. Face opening may be equipped with a sash or protective shield. Face opening may have a profiled entry and an airfoil designed to sweep & reduce reverse airflows at the lower surface; Benchtop or Free-standing.

Non-Exhausting Laminar Flow Clean Air Workstation – Room or ducted supply air is pressurized using a local or remote fan and forced through a HEPA or ULPA air filter with the bottom face of the filter directed horizontally or vertically. The Particle free Clean, pressurized air, flowing at 60 to 100 feet per minute will be Laminar until it reaches an obstruction, creating a clean (Class 100 / ISO 5) or better work zone - **protecting the product ONLY**. A non-exhausted Laminar Flow Clean Air Work station should only be used where **User Protection is not Required**. The Laboratory Ventilation System serving a Non-Exhausting Laminar Flow Clean Air Workstation includes a sufficient Supply Air System for fresh air ventilation and any recirculating air fans. An Exhaust Air System must be present. Multiple Non-Exhausting Laminar Flow Clean Air workstations may have side containment elements OR be connected together with no side barriers to provide a continuous long work station, if there is no risk of cross contamination between stations. Note that a non-exhausting Laminar Flow Clean Air Workstation will filter out most particles as the air is recirculated through the HEPA / ULPA Filter, but will not filter out all hazards such as chemicals in gaseous, liquid or submicron particulate format. The specific type of hazard being used in the Workstation will determine if a Non-Exhausting Laminar Flow Clean Air workstation can be used; as specified by the engineer of record.

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Exhausting Laminar Flow Clean Air Workstations provide Clean / Filtered air in the work chamber, using HEPA / ULPA filters AND Exhaust from the workstation to capture hazardous materials. An Exhausted Laminar Flow Clean Air Workstation has the attributes of a "Hood" or enclosure.

- **HEPA / ULPA Filtered Supply Air**, creates a clean work chamber & provides - ***Product Protection***
- **Hazard contaminated Air is Exhausted** via the Workstation to the building exhaust system & provides - ***User Protection***

An Exhausting Laminar Flow Clean Air Workstation has all the attributes of a non-Exhausting Laminar Flow Clean Air workstation as listed above, but in addition, is a safety device specifically designed to carry undesirable effluents (generated within the work chamber during a laboratory procedure) away from laboratory personnel and out of the building. The Workstation MUST be connected to a properly designed laboratory exhaust ventilation system capable of exhausting the air brought into that station. An Exhausted Laminar Flow Clean Air Workstation shall include the top, three fixed sides and a single face opening. Face opening may be equipped with a sash or protective shield, with or without built-in gloves (glove box). Face opening may have a profiled entry and an airfoil designed to sweep & reduce reverse airflows at the lower surface;

Other widely used terms include – [Laminar Flow Hood = Laminar Flow Workstation Hood]:

- **Vertical Laminar Flow Workstation** Exhausting & **Vertical Laminar Flow Workstation** Non-Exhausting – *Air Flows downward from the (above) top of the work chamber, towards the work surface.*
- **Horizontal Laminar Flow Workstation** Exhausting & **Horizontal Laminar Flow Workstation** Non-Exhausting – *Air Flows across the work surface from back to front or from side to side.*
- **ISO** Standards for Laminar Flow Workstation = **HEPA / ULPA Filtration**
- **ASHRAE 110** Standards

Laminar Flow Workstation are perhaps the most widely used and misused safety devices and are available in many shapes, sizes, materials, and finishes. Their flexible design enables them to be configured to accommodate a variety of chemical procedures. However, the flexibility offered by different designs, construction and operating configurations can result in varying levels of performance and operator protection. Great care must be employed by the user when selecting and using a Laminar Flow Clean Air Workstation. Consult the manufacturers' Recommended Practices for Specific Operation, Safety & Maintenance Guidelines.

3.10 Applications & Advantages

- When & Where to use various Hood & Construction types – Including Advantages

3.2 Testing Protocol

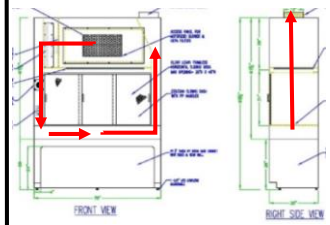
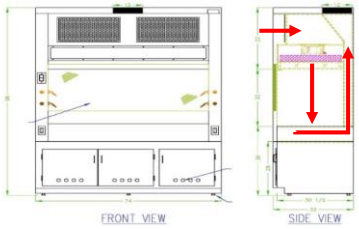
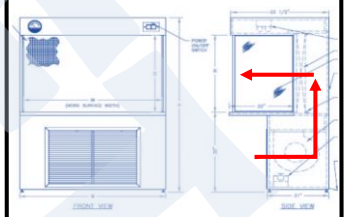
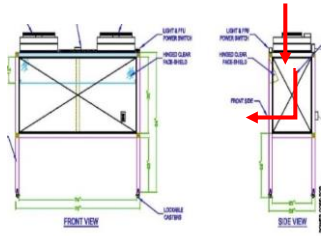
1. **Laminar Flow Clean Air Workstations - Non-Exhausting**
    a. ASHRAE110 testing will NOT apply
    b. ISO 5 - Clean class or Better Particulate testing will apply.
    c. **Laminarity testing will apply**
    d. **If connected to a supply air duct, Testing and balancing will be needed to insure the Workstation is positively pressured with respect to the surrounding room as specified.**
2. **Laminar Flow Clean Air Workstations - Exhausting**
    a. ASHRAE 110 testing will apply. Operator safety is provided by the exhaust from the Workstation connected directly and sealed to the buildings exhaust system. A filter may be provided in the exhaust air stream of the work station, if needed.
    b. Testing and Balancing of supply & exhaust air will be needed to insure the Workstation is Positively or negatively pressured with respect to the surrounding room, as required by regulations and as specified by the engineer of record.
    c. ISO 5 - Clean Class or better Particulate testing will apply.
    d. **Laminarity testing will apply.**

SEFA 12 - CLEAN AIR WORKSTATIONS
Pete Daniele - LM Air
Jan. 2019

SEFA 12

Laminar Flow WORKSTATIONS

HEPA / ULPA FILTERED

EXHAUSTING	***EXHAUSTING***		***NON-EXHAUSTING***	***NON-EXHAUSTING***
HORIZONTAL	**VERTICAL**		**HORIZONTAL**	**VERTICAL**
L Side to R Side to Exhaust	**Top to Bottom to Exhaust**	**AIR FLOW DIRECTION**	**Back to Front**	**Top to Bottom to Exhaust**
ASHRAE110 ***technology***	*ASHRAE110* ***technology***	**ASHRAE 110**	*N/A*	*N/A*
YES	***YES***	**Product Protection - ISO = Filtered Air to Work Chamber**	***YES***	***YES***
YES	***YES***	**Operator Protection - ASHRAE 110 Exhausting the Work Chamber**	***NO***	***NO***
		*red arrows represent air flow direction*		

Laminar Flow (uninterrupted air flow) includes Unidirectional Air Flow - Class 100 / ISO 5 or better - as per **ISO Standard utilizing HEPA / ULPA Filtration - keeping the work chamber clean**
Product Protection = ISO - HEPA/ULPA Filtered Air provides a clean environment within the work chamber
Personnel Protection = ASHRAE - provided by Exhausting the Work Chamber to the Building Exhaust

Highlighted items were updated based on SEFA conference presentation