

**Construction Industry
Master Format
Vertical Laminar Air Flow (VLAf)
Type HA Polypropylene Fume Hoods
(High Acid Use)**

Part 1 - General

1.1 Description of Work

All benchtop polypropylene vertical laminar flow total exhaust fume hoods shall be furnished, installed, and shall be demonstrated to properly perform in accordance with the specifications set forth herein.

1.2 Products Included

- A VLAf Type HA (High Acid Use)
Complete one-piece bench top polypropylene hood with minimum use of metal parts. All metal parts are Teflon coated (blower), HEPA filter is separatorless and the adjustable window is Lexan to access the nonmetal work zone.
- B Fume Hood Base
Matching acid storage fume hood bases to accommodate the width, depth and desired work surface height.

1.3 Related Sections

- A. Division 9: Metal Backing in Walls – Seismic Restraints
- B. Division 11: Equipment (11600)
- C. Division 12: Furnishings (12350)
- D. Division 15: Mechanical (15200, 15800, 15900)
- E. Division 16: Electrical

1.4 Delivery, Storage and Handling

- A. Do not deliver or install equipment until the following conditions have been met:
 - 1. Windows and doors are installed and the building is secure and weather tight. Space heated to at least 40°F.
 - 2. Ceiling, overhead ductwork, and lighting are installed.
 - 3. All painting is completed and floor finish is installed.
 - 4. Polypropylene fume hoods and related materials require the interior building temperature not to exceed 90°F to avoid undue structural fatigue and damage.

- B. Protect finished surfaces from soiling or damage during handling and installation. The equipment comes with a protective film that should be left in place while handling, and then removed ONLY where pieces are mated during installation.
- C. When ambient temperatures are below -20°F, careful handling is required to prevent polypropylene from cracking at the seams.

1.5 Submittals

- A. Product Data: Submit manufacturer's data for each item of fume hood being furnished. Include component dimensions, configurations, and construction details. Indicate location, size and service requirement for each utility connection. See Specification Division 1 for additional general requirements.
- B. Shop Drawings: Provide scalable drawing(s) of each hood, illustrating front, side and top views. Drawings shall include all options, special features, component dimensions, construction details and tolerances. Particular attention shall be given to installation interfaces as required by other trades (plumbing fixtures, exhaust connections, electrical requirements, etc.). Drawings shall be available on electronic format for viewing using AUTOCAD, 2000.
- C. Submit 3-inch by 3-inch samples of all construction materials where required, including hinges, door pulls, fastening devices, etc.
- D. Submit detailed seismic anchorage and attachment drawings and calculations complying with all Uniform Building Code requirements and regulations for seismic restraint (where applicable).
- E. Certifications: Submit certification stating that items in this section are installed per applicable referenced codes, standards, specifications and are complete and ready for intended function. Copies of all hood certification test reports shall be included.
- F. Operations and Maintenance Manuals: Submit complete operating and maintenance manuals for each type of hood and size that describe proper operating procedures, maintenance and replacement schedules, components parts list, and nearest local factory representative for components and emergency repairs.

1.6 Quality Assurance

- A. Single Source Responsibility: Fume Hoods and accessories included in this section shall be manufactured or furnished by the same manufacturer or laboratory furniture supplier for single responsibility.
- B. The supplier for work in this section shall use manufacturers with production facilities including all tools, equipment and special machinery necessary for specializing in the fabrication and installation of the type of fume hoods specified, with skilled personnel, factory trained workmen and an experienced engineering department. Each shall have the demonstrated knowledge, ability and the proven capability to complete an installation of the size and type within the required time limits:

1. Ten years or more experience in the manufacture of polypropylene fume hoods.
 2. Ten installations of equal or larger size and requirements within the last five years.
- C. Factory Testing: Prior to delivery to the job site, every hood shall be tested to manufacturer's specifications for performance and safety and a copy of the "Inspection Report" report shall accompany each hood. One representative sample hood of each type shall have been tested according to the test procedures outlined below to verify that subsequent production models meet the "Personnel Protection Factor" and "Product Protection" criteria. The test facility (emulating actual operating conditions), samples, apparatus and instruments to be supplied by the manufacturer.
1. ANSI/ASHRAE 110-1995: A tracer gas is introduced 6 -inches behind the sash at a rate of 4 liters per minute. A sensor located outside the work zone monitors for gas leakage from the hood face. The "Personnel Protection Factor" shall be less than 4.0 AM at less than 0.1 PPM, in the center, right and left sides of the work access opening.
 2. NSF STD 49: Uses an aerosolized spore solution aimed at the sash from both inside (personnel) and outside (product) to determine the containment properties of the cabinet. Air samplers or agar plates monitor for leakage to/from hood face. Three tests are performed: Personnel Protection Test, Product Protection Test, and Cross Contamination Test. The "Personnel Protection Factor" shall be less than 15 spores recovered for a thirty-minute test. Total of three tests are performed.
- D. Field Testing: Each cabinet shall be subjected to field certification per manufacturers procedures and performance criteria, after the cabinets are completely installed and all exhaust/supply systems fully operational and balanced as intended. The field tests shall be conducted by an independent certifying agency, selected by the manufacturer and approved by the Owner, at no expense to the Owner. The Owner or his representative may witness the tests. In the event that cabinets cannot be certified, a detailed report shall be prepared outlining deficiencies.
- E. Training: After the equipment has been accepted and is fully operational as intended, the manufacturer shall coordinate with the Owner for training on the proper operation, adjustment and maintenance of the equipment at no expense to the Owner. A maximum of two, four-hour training sessions shall be required.

1.7 Warranty

- A. Provide a written warranty that work shall be free from defects in materials (structural failure, warping and finish integrity) and workmanship for a period of 1 year from the date of acceptance or Substantial Completion whichever is later. Stipulate that defects that develop within the warranty period shall be removed, repaired and replaced at no additional cost to the Owner.

1.8 References

- A. ISO 14644 Class 4
NSF/ANSI 49:2002
- C. American National Standards Institute (ANSI)
 - 1. ANSI/ASHRAE Standard 110-1995 – Method of Testing Performance of Laboratory Fume Hoods
 - 2. ANSI/ISO/ASQC Q9001-1994 – Quality Systems
- D. National Fire Protection Association (NFPA)
 - 1. NFPA 45 – Fire Protection for Laboratories Using Chemicals
 - 2. National Electrical Code
- E. ASTM D-4101 Group 1, Class I, Grade II
- F. ASTM E 162-76
- G. CPSC Standard 16 CF R1201 – Safety Glazing Materials Building Materials
- H. Institute of Environmental Sciences (IES) - IES-RP-CC001.3
- I. Underwriters Laboratories - UL 61010A-1
- J. ANSI/AIHA 29.5

1.9 Materials

- A. Appendix 1: Properties of Standard and Flame Retardant Polypropylene Materials.
- B. Appendix 2: Typical Chemical Resistance Properties for Polypropylene Materials.
- C. Appendix 3: Properties of Polycarbonate (Lexan™) Material
- D. Appendix 4: Properties of Halar® 901, Clear 453 Material
- E. Appendix 5: Properties of DuPont Teflon™ PFA Coatings
- F. Appendix 6: Properties of RIE 1000 Series PTFE Coatings
- G. Appendix 7: Properties of Corzan™ CPVC

Part 2 - Products

2.1 Vertical Laminar Flow Polypropylene Fume Hoods – High Acid Use

A. Manufacturer:

1. The design of vertical laminar flow total exhaust polypropylene fume hoods is based on products manufactured by NuAire, Inc. All fume hoods shall be the product of one manufacturer.

Each fume hood shall have a completely welded shell assembly (case), which shall be rigid and self-supporting, requiring little or no field assembly.

2. Products of other polypropylene fume hood manufacturers may be used as an approved equal, provided they meet the product specifications and performance characteristics specified herein.
3. For manufacturers and/or suppliers not listed, submittal for approval must be received by the Architect 10 calendar days prior to bid. No exceptions.

B. General Design Requirements:

1. Fume hoods required under this specification will be referenced as: Vertical Laminar Air Flow (VLAF), Type HA – High Acid use
2. Fume Hood Configurations: Provide in sizes and configurations with fume hood bases as shown on the drawings.

C. Performance Characteristics

1. All cabinets of size and type as indicated on the hood schedule shall be a bench style, single pass flow-through design in which all HEPA filtered work zone (downflow) and work access inflow air, is drawn through the cabinet's internal exhaust plenums to a single exit point at the top.
2. Air shall be drawn into the HEPA filter by the internal supply blower from a prefilter at the top of the cabinet. The air shall exit the HEPA filter through a diffuser into the work zone in a laminar manner. The air shall split at the removable work surface with ½ being drawn into a rear inlet grill and ½ drawn into the front inlet grill along with the work access inflow. The combination of the downflow and inflow into the front inlet grill forms an “air barrier” that creates the “personnel protection factor”.
3. The area beneath the removable work surface shall form a leak-tight exhaust plenum that shall drain to a single, polypropylene, 3/8-inch, ball-type drain valve. The drain valve shall be plumbed to a polypropylene “p-trap” where a sink/cup sink has been specified or dead ended into a ball valve. 1½-inch vent holes shall be provided through the bottom of the plenum/cabinet to provide venting for the base cabinets below. One vent hole shall be provided for each base cabinet door and they shall be protected from plenum spills by 3-inch high “mushroom capped” stand pipes.

4. The supply HEPA filter shall be the full cabinets' work surface width and depth and removable from the front of the cabinet. The work zone shall be the same fixed cross sectional area as the HEPA filter.
5. The positive pressure supply plenum shall be surrounded by negative pressure, even down to the interface of the supply HEPA filter and the filter frame in order to absolutely preclude any gasket leaks from contaminating the HEPA filtered work zone air.
6. The downflow air velocity from a clean HEPA filter shall average from 55 to 65 LFPM with no single point more than 20% above or below the average velocity measured in a horizontal plane defined by the bottom of edge of the sash at nominal working height (10-inches).
7. Minimum average inflow velocity through the work access opening shall be 105 LFPM with a 10-inch nominal sash opening. Working sash heights shall vary between 8 and 12-inches without a loss of the "personnel protection factor". The maximum non-working height shall be 20-inches [heights up to 30-inches may be specified].
8. The exhaust volumes and negative static pressures required per cabinet size shall not exceed the following based on an average inflow velocity of 105 FPM at an work access opening height of 10-inches and an average internal downflow velocity of 65 LFPM.

Cabinet width	24-inch depth	30-inch depth
4-foot cabinet	690CFM @ 0.7"w.g.	790CFM @ 0.7"w.g.
5-foot cabinet	910CFM @ 0.8"w.g.	1040CFM @ 0.9"w.g.
6-foot cabinet	1120CFM @ 1.0"w.g.	1280CFM @ 1.1"w.g.
8-foot cabinet	1550CFM @ 1.2"w.g.	1770CFM @ 1.3"w.g.

9. The supply HEPA filter shall be wood board framed and constructed from non-woven pleated fiberglass media with separatorless media. [Filter can be specified to use a non-boron, woven Gore-Tex™ media]. All media shall be a minimum of 99.99% efficient on 0.3-micron particles with greater efficiency on smaller and/or larger particles. [Efficiencies of 99.999% and 99.9999% on 0.12-micron particles may be specified].
10. The internal downflow blower shall be a non-overloading, backward inclined, dynamically balanced, motorized impeller with the impeller and all hardware (i.e. nuts, bolts, screws, etc) TFE coated by a licensed coating manufacturer, for maximum corrosion resistance. The coating shall be a minimum thickness of 1.5 mil.
11. All motors shall be permanent split capacitor type and sized to automatically compensate for airflow as the filter loads with particulate to achieve a fan delivery fall off of no more than 10% for an 80% increase in pressure drop across the filter. The Class B insulated motor shall be thermally protected, rated for 24-hour continuous operation, lubricated for life and speed controlled by a solid state, voltage regulated solid-state speed controller.
12. Vibration, due to the motor, shall be minimized through the use of vibration isolators when mounting the motor/blower assembly to the internal frame.

13. The work zone shall be illuminated by an externally mounted, polypropylene, fluorescent lamp fixture and shall provide an average of 100 foot-candles, as measured at the work surface. The lamp shall use two T8 bulbs and use a thermally protected, Listed electronic ballast with automatic reset. The fluorescent fixture shall be gas-tight and constructed from 1/2-inch polypropylene with a clear Lexan™ lens. All lamps shall be easily replaceable using simple tools.
14. All electronic controls shall be housed in a separate gastight polypropylene enclosure and shall be accessible from the top of the cabinet.
15. The polypropylene workspace shall be enclosed on both sidewalls by a 4-inch wide plumbing chase. The chase shall extend the full height and width of the cabinet's exterior sidewall. Access panels shall be provided on both the exterior and interior sides of the chase. All panels shall mount flush to the surrounding material, be fastened by #8-32 flat head polypropylene screws and provide sufficient access for maintenance and repair of plumbing, electrical and sash components.

D. Fume Hood Construction:

1. The cabinets work space, plumbing chase, structural support members and bottom shall be constructed from 1/2-inch fully stress relieved, refrigerator white, polypropylene sheet stock. All sections are to be reinforced where necessary and continuously heat seam welded to form a rigid structure with all exterior welds finished flush with the surrounding surfaces. All access panels, rear exhaust duct, and the perforated reinforced and removable work surface shall use 1/4-inch material.
2. The upper structure of the cabinet containing the HEPA filter, blower, supply plenum and electronics shall use 1/2-inch thick polypropylene material and shall be an integral extension of the work space sides and back walls (i.e. one-piece construction). Access panels shall be provided at the top of plumbing chase section for maintenance of sash pulleys, counterweight and polypropylene attachment rope.
3. Access to the HEPA filters and motor blower assembly for maintenance and repair shall be through a flush mounted access panel in the upper portion of the hood face. Access to internal components shall NOT require disassembly of the window sash and glide system.
4. Prefilter(s) shall be mounted on top of the motor/blower module and easily replaceable. Prefilter(s) shall be 1-inch thick non-woven fiberglass and shall be 40 percent efficient per the Atmospheric Dust Test.
5. Closure panels, where specified, shall be constructed from materials to match VLAH hood AND shall use 1/4-inch polypropylene. The panels shall enclose the top of the cabinet to the ceiling and/or the plumbing chase to the wall in the rear. Panels shall be finished to match hood type. For ceiling enclosures, the panels shall be louvered (or slotted) to obtain supply air for the downflow, unless otherwise stipulated. The side panels shall fasten to the top of cabinet and the rear wall. The front panel shall fasten only to the side panels and easily removable to provide access to the top for maintenance purposes.

6. The glazing material shall be ¼-inch Lexan™ with Margard™, unframed, unless otherwise specified. The glazing is suspended within polypropylene glide channels by a 3/16-inch polypropylene cable routed over front and rear pulleys connected to a totally PVC enclosed counter balanced weight located in the plumbing chase. The counter balance weight shall ride within a close-tolerance outer PVC tube to control vertical motion.
7. The diffuser below the HEPA filter shall fit snugly full width and length of the work zone and constructed from 1/16-inch thick, 22 percent open, perforated PVC and held in place with polypro screws. A vinyl wiper shall be installed between the sash and the interface of the diffuser and the upper workspace to provide a seal against the glazing material. The area above the wiper, but under the sash, shall be maintained under a negative pressure.
8. All internal electrical wiring shall be enclosed in flexible, UL Listed or Recognized, non-metal corrosive-resistant, liquid-tight conduit with Listed fittings. All internal junction boxes and enclosures shall be constructed from polypropylene and shall be liquid-tight construction and gasketed where required. All exposed controls and visual indicators shall be constructed from non-metal corrosive-resistant materials or protected by non-metal, gas-tight enclosures with a clear viewing lens, where required.
9. The work surface shall be removable and constructed from ¼-inch thick polypropylene material, reinforced with polypropylene ribbing to maintain surface flatness. The perforated front and rear sections shall be 3/16-inch diameter holes on 1/4-inch alternate centers, whose width is suitable to provide both personnel and product protection per the testing methods of NSF STD 49. Where sinks are called out, the work surface shall be segmented such that the sink section is fixed and separate from the rest of the removable work surface.
10. Supply mains to the cabinet shall be connected to a UL Listed junction box of suitable size to accommodate required circuits as indicated on the hood schedule. The junction box shall be non-metallic and require non-metallic liquid-tight connections.
11. Where required, all cabinets shall be provided with a separate support base constructed from ½-inch polypropylene. Fume hood bases shall be constructed per the requirements for polypropylene base cabinets, section 12350, except as specified herein.
 - a. Fume hood bases shall have 1½-inch diameter adjustable levelers that are accessible from inside the base cabinet and protected from spills with a ½-inch high rim, covered with a removable cap. A minimum of two (front and rear) levelers shall be provided for each 2-foot section of fume hood. The levelers shall thread through a minimum of 1½-inches of material for stability and permit an adjustment of 2-inches.
 - b. The top of the base cabinet shall have a 3-inch wide, full interior perimeter stretcher to facilitate assembly to the hood.

- c. Hood bases shall have at least one sealed compartment where sinks/cup sinks are scheduled. The remaining space shall contain a fixed shelf. Where sinks are scheduled on both sides of the workspace, each shall have a sealed compartment. Each sealed compartment shall have an access panel for connection to building utilities. Depending on hood size, any remaining space shall contain a fixed shelf.
- d. Each segmented compartment shall be vented to the exhaust duct via a stand pipe, plumbed through the base of the VLAf cabinet to the exhaust duct.
- e. All base cabinet doors shall have four 1½- inch diameter vent holes, centered 4-inches above the bottom of the door and evenly spaced. An adjustable slide shall be located on the inside of the door, with an identical offset hole-pattern to control airflow through the compartment(s). For compartments with shelves, shelves shall permit air to pass through the front ½ -inch of the shelf.

E. Hood Services

- 1. Services shall be provided in each hood as per the hood schedule. Hood shall not have any pre-punched holes on the hood post except for services per the schedule. Where multiple services are scheduled, provide one each side.
- 2. Service fixtures and fittings mounted inside of hood shall consist of labeled hose nozzle outlets remotely controlled from the hood post with color-coded index handles. The fixtures (valves and nozzles) shall be constructed from polypropylene unless otherwise noted. The valve body shall be easily removed from the front for repair.
- 3. Service fixtures shall be provided with piping, from the outlet/valve to the exterior. Where services are scheduled on both sides of the hood, piping shall be connected for a coordinated single point connection to the building services.
- 4. Exhaust duct washdowns, where specified, shall consist of three, ¾-inch, schedule 80, polypropylene pipes (spray bars) extending horizontally across the rear exhaust duct, evenly spaced vertically and sealed on one end. Each spray bar shall consist of replaceable, 1/8-inch NPT, polypropylene spray heads, with a 110-degree spray angle and 0.28 GPM at 10 PSI, on evenly spaced centers (minimum of three), orientated down toward the floor. The spray bars shall be manifolded to a common point through a ball valve mounted on the hood post as shown on the drawings for operator control (on/off and flow rate). The valve shall be plumbed out the rear of the cabinet for connection to building utilities. A 1½-inch, NPT threaded drain hole shall be installed in the center of the floor of the exhaust duct to remove washdown water. The floor shall insure complete drainage of wash water. The rear divider panel shall be removable for inspection and maintenance of the spray bar system. The panel shall be gasketed via inlaid 1/8-inch thick EPDM gasket material, around the entire periphery of the panel and fastened to the back via ¼-inch-20 flat head screws on 4-inch centers to form a leak-tight seal.

5. Sinks of size per the hood schedule and/or cup sinks (nominal 6" by 3") shall be flush with the work surface and be complete with strainer, tail piece and p-trap, plumbed to the rear of the hood base. Sinks and accessories shall be constructed from ¼-inch polypropylene unless otherwise specified and shall have a slanted bottom to the drain. Cold/hot/DI water goosenecks where scheduled shall be positioned so that they discharge into the sink(s).
6. Service for flammable gas shall be installed per local codes using approved piping methods. Where metallic (black pipe) is required, the pipe shall be epoxy coated, including the remote valve and all internal piping. Any external color-coded handles/rods shall be coated with a clear acid and solvent resistant plastic coating.
7. Electrical services shall be three wire grounding type receptacles rated for 120 volt or 220 volt supply per the schedule. Outlets shall be provided on the hood post where noted. Each outlet shall have a non-metallic, corrosive resistant, vapor-tight gasketed cover capable of being sealed in place with a gasketed thumbscrew and shall have removable inserts of plastic to seal outlet contacts when not in use. Receptacles shall conform to NEMA standards.

Part 3 - Execution

3.1 Installation

- A. Fume Hood Base Installation:
Temporarily set fume hood bases plumb, square, and straight with no distortion using the leg levelers adjustable from with the hood base. Use polypropylene shims as required for added support. (bases can be "tacked" in place via nails through the toe kick backer.
- B. Fume Hood Installation:
Set fume hood on base cabinet and using base cabinet leg levelers plumb, square and straight with no distortion. Fasten fume hood to bases from inside the base cabinet, through perimeter base cabinet strips, using TFE coated screws, recessed and plugged. Once the work surface is level and true, the bases shall be fastened to the floor via a treated wood backer installed behind the toe kick. Adjust levelers/shims. All screws shall be TFE coated, recessed and covered with a polypropylene plug.
- C. Accessory Installation:
Install sinks, cup sinks and accessories in accordance with manufacturer's recommendations.

3.2 Adjusting

- A. Repair or remove and replace defective work, as directed by Owner's Representative upon completion of installation.
- B. Adjust sash, doors, hardware, fixtures and other moving or operating parts to function smoothly.

3.3 Cleaning

- A. Remove all remaining protective masking from the cabinet.
- B. Clean finished fume hood, work surfaces, and accessories. Touch up as required, wipe down and vacuum the interior of the equipment. Note: Polypropylene will carry a static charge and, as such, attract dirt and dust. Alcohol or Acetone is an effective cleaning agent to remove dust and dirt from the surface. Consult MSDS for precautions.

3.4 Protection of Finished Work

- A. Provide all necessary protective measures to prevent exposure of the vertical laminar flow fume hood to other construction activity during operational test and balancing. In Particular high concentrations of aerosols caused by spray painting or plaster dust can seriously shorten the lifetime of the HEPA filter.
- B. Advise contractor of procedures and precautions for protection of material, installed fume hood and fixtures from damage by work of other trades.

-- END OF SECTION --