

Construction Industry Master Format Polypropylene By-Pass Fume Hoods

Part 1 - General

1.01 Description of Work

All benchtop polypropylene by-pass fume hoods shall be furnished, installed, and demonstrated to properly perform in accordance with the specifications set forth herein.

1.02 Products Included

- A. Fume Hood Type BP
Complete one-piece benchtop polypropylene (NO metal) constant volume by-pass fume hood with adjustable window.
- B. Fume Hood Base
Matching acid storage or standard fume hood base to accommodate the width, depth, plumbing chase depth and specified work surface height.

1.03 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

1.04 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. The space should be 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.

1.05 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.
- 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.

1.06 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" criteria. The test facility (emulating actual operating conditions), samples, apparatus and instruments to be supplied by the manufacturer.
1. **ASHRAE 110-1995:** Consists of the following individual tests, "as manufactured".
 - **Tracer Gas:**
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.
 - **Face Velocity:** Measured velocity shall fall within design.
 - **Smoke Patterns:** A smoke source is passed around the periphery of the access opening. No reverse flow or refluxing shall occur.
 - **Saturation Smoke Test:** Release of a large volume of smoke shall result in total containment.
 2. **SEFA 1-1992:** Consists of the following tests, usually conducted in the field to verify "as installed" performance.
 - **Face Velocity (sash fully open):**
Using a suitable velocimeter, determine that face velocity meets the design requirements.
 - **Airflow Smoke Patterns (sash fully open):**
A source of smoke is passed around the exterior/interior of the work access-opening periphery along with an interior smoke candle. No reverse flow, refluxing or escape shall be observed.
- 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.

1.07 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.

1.08 References

- A. 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
- B. National Fire Protection Association (NFPA)
 - 1. NFPA 45 – Fire Protection for Laboratories Using Chemicals
 - 2. National Electrical Code
- C. American Society for Testing and Materials (ASTM)
 - 1. D - 4101 Group 1, Class I, Grade II
 - 2. E162 - 76
 - 3. D 570 – Water Absorption of Plastics
 - 4. E 84 – Test method for Surface Burning Characteristics of Building Materials.
 - 5. D 695 – Compressive Properties of Rigid Plastics
 - 6. D 790 – Flexural Properties of Unreinforced/Reinforced Plastics
 - 7. D 638 – Tensile Strength and Elongation of Plastics
- D. CPSC Standard 16 CF R1201 – Safety Glazing Materials Building Materials
- E. Scientific Equipment Furniture Association - SEFA 1-1992
- F. Underwriters Laboratories - UL 61010A-1
- G. ANSI/AIHA 29.5

1.09 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

2.01 Polypropylene Fume Hoods

A. Manufacturer:

1. The design of 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 assembly.

2. Products of other polypropylene fume hood manufacturers may be used as an approved equal, providing they meet the product 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: Constant Volume Bypass Fume Hood (FH), Type BP - By-Pass
2. Fume Hood Configurations: Provide in sizes and configurations with fume hood bases as shown on the drawings.

C. Performance Requirements

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 work access inflow air, is drawn through the cabinet's internal exhaust plenums to a single exit point at the top.
2. For purposes of defining a performance point, the average inflow velocity through the work access opening shall be 100 LFPM with an 18-inch nominal sash opening. Working sash heights shall vary between 8 and 18-inches without a loss of the "personnel protection factor". The maximum travel of the sash shall be from fully closed to 18-inches open. [Sash heights up to 28-inches may be specified].
3. The exhaust volumes and negative static pressures required per cabinet size shall not exceed the following based on an average inflow velocity of 100 FPM with a sash opening of 18-inches.
 - 4-foot cabinet - 460CFM @ 0.3" w.g.
 - 5-foot cabinet - 620CFM @ 0.4" w.g.
 - 6-foot cabinet - 775CFM @ 0.5" w.g.
 - 8-foot cabinet - 1075CFM @ 0.8" w.g.

4. Air shall be drawn into the work zone by an external exhaust blower located remotely from the hood. The airflow into the hood face shall be smooth with no reverse flow or refluxing along the cabinet's sides, forming the "air barrier" that creates the "personnel protection factor".
5. The hood shall have a by-pass feature that allows inflow air that would otherwise go through the work access opening, to by-pass directly into the exhaust duct through a canopy, thereby increasing/decreasing the average volume through the work access opening to produce a constant inflow velocity as the sash is raised or lowered, respectively. The canopy shall have sufficient louvers for the bypass air to maintain inflow velocity within 25 percent around 50 percent of the working sash height.
6. The solid polypropylene work surface shall form an integral part of the work space, be leak-tight and recessed 1/2-inch below the front spill lip/airfoil to contain liquid from spilling to the floor. The area beneath the work surface (dead air space) shall be maintained under a negative pressure.
7. The work zone shall be illuminated by an internally/externally mounted, gas-tight, polypropylene, fluorescent lamp fixture that shall be constructed from 1/4-inch material, including the clear plastic lens. The fixture shall provide an average of 100 foot-candles, measured at the work surface. The lamp shall use two T8 bulbs and a thermally protected, Listed electronic ballast with automatic reset. All lamps shall be easily replaceable using simple tools.
8. All electronic controls shall be housed in a separate gastight polypropylene enclosure and shall be accessible by removing the control panel. The control panel shall be constructed from polypropylene, recessed flush in the hood post and shall expose only the plastic bezels of rocker switches and lamps, etc.

D. Fume Hood Construction:

1. The cabinet workspace, 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 cabinet surfaces shall be square within 1/8-inch in all dimensions.
2. All seams shall be welded using a minimum of 5/32-inch diameter round/oval welding rod. The non-exposed interior welds of all panels (i.e. sides, back, bottom, etc.) that are exposed to the exterior shall be double welded for added strength. All interior welds shall be water/air-tight and need not be finished flush to adjoining surfaces.
3. The polypropylene workspace shall be enclosed on both sidewalls by a clear 4-inch wide plumbing chase. The chase shall extend the full height and width of the work zone. Access panels shall be provided on both the exterior and interior (workspace) walls of the chase. All panels shall be 1/4-inch material and mount flush to the surrounding material. They shall be sized to provide sufficient access for maintenance and installation of services and controls. All 1/4-inch access panels shall be fastened with #8-32 x 1/2-inch polypropylene flathead screws.

4. Where specified, the workspace interior and exhaust plenum shall be constructed from flame retardant polypropylene, or lined with PVDF or TFE. The lining shall use 1/8-inch virgin sheet stock material and shall overlay the polypropylene surface such that the interior dimensions are identical. The liner shall be heat-welded together to form a ridged structure and fastened to the polypropylene by 1/4-inch by 20 flathead screws of like material, where required.
5. The interior access panel must be of sufficient size to permit the ONLY access for maintenance of the electrical, plumbing fixtures and/or window sash components or counterbalance when installed. The access panel(s) shall be recessed flush with the interior sidewall to prevent eddy currents and back flow of air along the wall. The panel shall be removable using simple tools and need not be gasketed.
6. The work surface shall be an integral part of the fume hood, supplied by the fume hood manufacturer and constructed from 1/2-inch solid polypropylene and supported from below with 1/2-inch by 1-1/2-inch front to back ribs on 12-inch centers. The front spill lip/airfoil shall be a minimum of 1/2-inch above the work surface.
7. Where specified, the work surface may be constructed of alternative materials (i.e. modified epoxy resin, composition stone, phenolic, etc.). In all cases a minimum of a 1/4-inch polypropylene reinforced sub-layer shall be installed under the alternative material to provide a leak-tight seal. The alternate material with an integral spill lip/airfoil shall fit within a maximum tolerance of 1/8-inch within the workspace walls.
8. An airfoil shall be installed 1-inch above the spill lip for all work surfaces. The airfoil shall be constructed from 1/4-inch polypropylene and be fastened by polypropylene screws with 1-inch standoffs on 12-inch centers. The airfoil shall provide an aerodynamic entrance that will eliminate eddies that would otherwise form on the work surface due to the "vena contracta" phenomenon.
9. The by-pass shall consist of a canopy, 4-inches in depth, covering the portion of the hood face from just below the top of the sash to the top of the cabinet and a corresponding opening behind the canopy that permits air to enter the work zone based on the window height, bypassing the normal work access opening. The canopy shall be constructed from 1/4-inch polypropylene, reinforced and fastened to the top by molded polypropylene hinges, on three-foot centers. The canopy shall provide access to the window glides and fluorescent lighting. Louvers shall be provided along the top and in the front for bypass air.
10. The sash shall be constructed from 1/4-inch Lexan XL™ with Margard™. The sash shall not be framed and slide within a polypropylene track, counterbalanced with a PVC encased weight, attached to the window with polypropylene 3/16-inch diameter rope over front and rear polypropylene pulleys. The PVC enclosed counterweight shall travel within a larger diameter PVC pipe to control vertical motion within the sidewall.
 - The bottom edge of the sash shall have an aerodynamically curved lip, that redirects the induced "workspace roll" toward the rear baffle.
 - A 1-inch by 2-inch sash stiffener shall be installed even with the top of the curved lip and extend the full length of the sash, for plastic sashes only. The stiffener shall be fastened using 1/4 x 20, PVC hex-head bolts, from the interior of the workspace.

11. The rear exhaust duct (area behind the rear baffle) shall be formed, as an integral extension of the workspace sidewall structure, from 1/2-inch material. A support structure for the removable vertical suction slotted baffle shall be welded 4-inches from the rear wall around the periphery of the workspace, forming the exhaust plenum. The slotted baffle shall be removable, constructed from 1/4-inch material and be fastened to the support structure by 1/4 x 20 x 1/2-inch polypropylene flat-head screws on 6-inch centers. For cabinets specified to have washdowns, the suction slots shall be designed to prevent the egress of water into the workspace while operating and the baffle shall be gasketed with a 1/4-inch wide inset EPDM gasket around the periphery. Extending from the top of the vertical baffle shall be a short permanently welded baffle that is slanted forward to cover the exhaust exit.
12. Vent pipes shall be installed through the hood bottom to the rear exhaust duct internally within the dead air space under the work surface. The vent pipes shall be 1 1/2-inches in diameter and constructed from polypropylene. There shall be one vent pipe for each base cabinet door. Where washdowns are specified, the vent pipes shall be extended 12-inches above the floor and bent 180 degrees down to prevent the egress of washdown water.
13. Closure panels, where specified, shall be constructed from 1/4-inch polypropylene and shall enclose the top of the cabinet to the ceiling and/or the plumbing chase to the wall in the rear. For ceiling enclosures, the side panels shall fasten to the top of cabinet and the rear wall. The front panel shall fasten only to the side panels, easily removable to provide access to the top for maintenance purposes.
14. All internal electrical wiring shall be, as much as possible, 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 PVC 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.
15. 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.
16. Where required, all cabinets shall be provided with a separate support base constructed from 1/2-inch polypropylene. Fume hood bases shall be constructed per the requirements for polypropylene base cabinets, section 12350, except as specified herein.
 - Fume hood bases shall have 1 1/2-inch diameter adjustable levelers that are accessible from inside the base cabinet and protected from spills with a 1/2-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 1 1/2-inches of material for stability and permit an adjustment of 2-inches.
 - The top of the base cabinet shall have a 3-inch wide, full interior perimeter stretcher to facilitate assembly to the hood.

- 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.
 - 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.
17. There must be no use of nylon materials including nylon filled/mixed or any other combination of nylon with other plastics. Miscellaneous tubing, valves, caps, etc. may be of other acceptable (PVC, TFE, PVDF, vinyl, etc.) non-metallic, non-corrosive materials. Unless otherwise specified, all screws shall be flathead, installed flush to surrounding material and be ¼ x 20.

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 color-coded hose nozzle outlets remotely controlled from the hood post with labeled 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 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 12-inch centers, 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.
5. Where specified in junction with duct washdowns, a drain trough shall be installed all along the back edge of the work surface at the rear baffle. The drain trough shall start 2-inches away from the rear baffle and drop down 2-inches the entire width of the work surface, to the baffle. The trough shall drain into the rear plenum via a series of ¼-inch drain holes spaced every 6-inches.

6. 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).
7. 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 corrosive resistant 2-mil coat.
8. 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. Note: 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, exhaust transitions and other custom 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 doors, sash, hardware, fixtures and other moving or operating parts to function smoothly.

3.3 Cleaning

- A. 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.
- B. Remove all protective masking for cabinet surfaces.

3.4 Protection of Finished Work

- A. Provide all necessary protective measures to prevent exposure of the fume hood to other construction activity during installation.
- 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 --