

**DIVISION 11 - EQUIPMENT****LABORATORY EQUIPMENT****11 53 00****FUME HOOD****A. General Fume Hood Requirements**

1. Quality Assurance - Published specifications, standards, tests or recommended methods of trade, industry or governmental organizations apply to work in this section.
  - a. NFPA 45 - Standard on fire protection for laboratories using chemicals. Chapter 6: Ventilating System, Chapter 9-2.8: Laboratory Hoods.
  - b. NFPA 56C - Safety standard for laboratories in health-related institutions, chapter 3-3.5: Fume hoods.
2. Requirements of Regulatory Agencies
  - a. Prior approval from University of California Davis Environmental Health & Safety (UCDEH&S) for any substitution is required.
  - b. Flammable liquid storage cabinets shall conform to Fire Department's certification requirements and NFPA Pamphlet #30.
3. Fume Hood Design Standards
  - a. SAMA Fume Hood Standards - LF-10, latest edition.
  - b. ASHRAE Current Applications: Chapter 14 - Laboratories: Part VIII: Laboratory Fume Hoods - American Society of Heating, Refrigerating, and Air Conditioning Engineers.
  - c. Guidelines for Construction and Equipment of Hospital and Medical Facilities - U.S. Department of Health and Human Services; Chapter 7.29 Mechanical Standards - Sections D(1)(n): Laboratory Hood Special Standards.
  - d. USDA: Science and Educational Administration Manual for Laboratory Chemical Fume Hoods - Standards - United States Department of Agriculture.
4. Submittals
  - a. Only those fume hoods on the University's approved list may be used. Fume hood submittals must be reviewed and approved by UCD EH&S prior to selection.
  - b. Fume hoods not on the University's approved list may be added to the approved list only after UCD EH&S review and approval of manufacturer's specifications.
  - c. Manufacturer's product literature and data sheets, including ASHRAE 110 test results. As-manufactured, under the ASHRAE 110 test method, fume hoods must meet 4/OAMO.01 (4.0 liters/minute release rate of tracer gas, as-manufactured, less than 0.01 ppm of tracer gas detected by the mannequin) criteria.
  - d. Plastic laminate for color selection.
  - e. Submit specifications for size of fume hood, showing dimensions, required clearances, and finishes; and where necessary, size (especially height above floor), and capacity and location of all mechanical and electrical services required.
  - f. Certificates: Certify compliance with UCDFPB requirements for under hood flammable liquid storage cabinets.

5. Testing (refer to Division 23 09 00 for additional testing details).
  - a. Balance, test, and certify each fume hood in accordance with the latest edition of ASHRAE 110 Testing Requirements. Fume hood field tests shall be performed by a qualified independent testing company on each hood to determine face velocity, containment, response time (for hoods installed on a VAV lab airflow control system), cross drafts, and air flow patterns.
  - b. Fume hood face velocity to be maintained at between 100-120 fpm at all times during normal operation.
  - c. As installed, under the ASHRAE 110 test method, fume hoods must meet the testing criteria 4.0A10.05 as specified in the Industrial Ventilation Handbook (4.0 liters/minute release rate of tracer gas, as-installed, less than 0.05 ppm of tracer gas detected by the mannequin).
  - d. There shall be no visible smoke flow out of the fume hood during the flow visualization test.
  - e. Response time shall be less than 10 seconds for face velocity re-stabilization.
  - f. Cross drafts measured at the fume hood face in the horizontal and vertical direction should be less than 20% of the face velocity. This is not pass/fail criteria but is used to inform proper fume hood operation in the laboratory environment.
  - g. Balance, test, and certify each glove box in accordance with the latest edition of NSF 49 Testing Requirements. Glove box field tests shall be performed by a qualified independent testing company on each glove box to determine proper containment. Glove boxes to be maintained at a negative air pressure of at least 0.50 inches w.g.
6. General Design Issues
  - 1) Fume hoods are to be operated 24 hours a day. No user controlled shut-off switch is allowed.
  - 2) Fume hoods may be ganged together if materials used are compatible in all hoods and meet National Fire Protection Association (NFPA) and other regulatory requirements.
  - 3) Perchloric acid and other hot acid digestion hoods must be on a dedicated system and have an automatic wash down system. High use solvent extraction and solvent use hoods (ether, other flammable solvents, etc.) must be on dedicated system.
  - 4) Full by-pass fume hoods must be used for constant volume applications (no variable air volume system exists). Variable air volume (VAV) hoods (partial by-pass) must be used in conjunction with a VAV general ventilation system (i.e., Phoenix Controls, or equal). Refer to Section 23 09 00 Lab VAV Controls.

## B. Chemical Fume Hoods

1. General Product Requirements
  - a. All chemical fume hoods must meet the Campus' review team for approval. The review team is composed of University of California Davis Architects & Engineers (UCD A&E), UCD EH&S and University of California Davis Operations & Maintenance (UCD O&M). The following chemical fume hood manufacturers currently approved for campus are: ThermoFisher/Hamilton, Kewaunee, Jamestown, Mott Manufacturing,

LabConco and H.H. Hawkins Ltd. Manufacturer's specifications for specific model types shall be submitted to University Representative for approval.

- b. Must be in commercial production and usage for a minimum of 5 years.
- c. Must be tested using most current American National Standards Institute (ANSI)/ASHRAE 110 method.
- d. Ductless or auxiliary air hoods are not acceptable.
- e. No operator adjustable baffles, removable fixed slot or perforated baffles only. Slots are to be continuous across the back of the fume hood.
- f. Noise generated by the functioning hood within 6 inches of the plane of the sash and by-pass opening in any position shall not exceed 60 dBA.
- g. Full by-pass constant volume hood or partial by-pass variable air volume (VAV) hood. VAV fume hoods must meet the criteria of this section and Section 15900 Laboratory VAV (Variable Air Volume) Control Systems.
- h. Under fume hood storage cabinets:
  - (1) Flammable liquid storage cabinets may be ventilated. Cabinets used for flammable liquid storage must not be vented directly into the fume hood, through the fume hood work surface. Ventilated cabinets may be exhausted into fume hood exhaust above the fume hood damper or exhausted separately.
  - (2) Acid/corrosive storage cabinets do not require venting. If acid/corrosive storage cabinet is vented, it must be separate from the fume hood exhaust. The vent may be connected at the point where the fume hood exhaust duct enters the general fume hood exhaust manifold. Cabinets must not be vented directly into the fume hood, through the fume hood work surface.

## 2. Materials

- a. Fume Hood Construction
  - (1) Fume hood shall be constructed of materials compatible with intended usage, e.g. type 316 stainless steel, polyresin, etc.
    - a) Removable baffles with three fixed slots or engineered perforations.
    - b) Air Foil that provides an air sweep across the work surface with the sash in the fully lowered position. Air foils installed over the work surface edge, allowing for air flow under the air foil are preferred.
    - c) Interior end panels require an access panel with gas tight gasket.
- b. Sash
  - (1) Vertical type: 1/4-inch thick laminated safety glass complete with 1/4- inch deep stainless steel metal channels on sides, top and bottom; or frameless.
    - a) Combination sashes must be pre-approved by UCD EH&S.
  - (2) Mechanical stops (not friction) to ensure that sash work opening is 18 inches, as measured from the bottom of the fume hood work surface to the bottom of the sash.
  - (3) A manual override to allow the vertical sash to be raised above the maximum opening to allow lab apparatus to be installed or removed.
  - (4) Operating face velocity at 18 inches shall be set between 100-120 fpm.

- c. Fume hood Air Flow Indicator/Alarm
 

Provide an airflow alarm. The hood shall be prepared at the factory to receive the specified alarm/monitor. As a minimum, the alarm shall accommodate the following:

  - (1) The Safety Monitor/Alarm System shall monitor face velocity and provide audible and visual alarm if face velocity drops below 90 fpm or rises above 125 fpm. Audible alarm shall pulse at 80 dbA.
  - (2) The monitor shall be UL listed, with all alarm circuit electric components, external tubing, restrictors and manifolds furnished complete. Monitor shall have light emitting diode display, which provides clear indication of airflow conditions. Safety monitor shall be tamperproof.
  - (3) Alarm Signal. Audible pulsating signal and a visual, large flashing red light emitting diode.
    - a) Silence push button, which temporarily overrides the audible alarm for a period no longer than 5 minutes, shall be accessible on the front of the Safety Monitor. Note: Teaching laboratory hood alarm override shall not exceed a one-minute period. Once the "unsafe" operating condition has been corrected, the audio alarm shall automatically reset.
    - b) During temporary silence of audible alarm the visual alarm remains activated until the alarm condition is corrected.
    - c) It shall not be possible to routinely disable the alarm signal. Locate electrical outlet on top of hood.
    - d) When alarm condition is corrected and face velocity and volume is return to specified levels, the safety monitor will automatically reset and begin routine monitoring.
  - (4) Test circuit will be provided to verify proper safety monitor operation.
  - (5) Electrical Rating: Maximum 15 VDC and maximum current rating of 200 MA.
  - (6) An air monitor or alarm, comparable to ALNOR Airgard 335, or equal is acceptable.
  - (7) Connect between fume hood and the filter or damper.
  - (8) Flow tube device (floating indicators) or ribbons hanging in the air stream are not acceptable airflow indicators.
- d. Electrical Items
  - (1) Receptacles per National Electrical Manufacturers Association (NEMA) 5-15R: 15A-125V AC three-wire duplex polarized receptacles. Same as Harvey Hubbel- Inc.'s No. 5252, Arrow-Hart, Leviton or equal. Receptacles shall be GFI.
  - (2) Plate Covers: Meet usage, Campus Standard is Bell or equal.
  - (3) Switch for lighting: Campus Standard is Hubbel #1221 or equal.
  - (4) Flexible Conduit: 1/2-inch complete with wiring as required.
  - (5) Light Fixture: Heavy-duty fluorescent strip light with 430 Ma rapid- start lamps and 120-volt HPF ballasts. Provide three-foot length for four-foot hoods, and four-foot for six-foot hoods. Same as Garco #RN 9942- 36H; Columbia Lighting, Inc.; Smoot-Holman Company; Benjamin Products of Thomas Industries, Inc.; or equal (all units must be vapor proof lighting).
  - (6) Shall be accessible for service from outside the hood.

- (7) No fan switch at the fume hood.
- e. Work Surface
  - (1) The work surface shall have a raised lip on all four sides, and be constructed of materials compatible with usage. Union between work surface and counter shall be covered at a 3/4-inch radius and sealed watertight.
- f. Cup Sink
  - (1) Flush with work surface and conforming to usage requirements, complete with stainless steel tailpiece as required.
- g. Duct Work
  - (1) Materials shall be compatible with intended usage.
  - (2) Include trim damper in duct above ceiling.
  - (3) Outlet shall be 12 inch round or square-to-round transition provided.
- h. Utilities (gas, air, water, steam, and vacuum)
  - (1) Make provisions for cold water only for each hood, in accordance with utility service symbols. Provide vacuum breaker, required at each fume hood outlet, in addition to main backflow preventer.
  - (2) Run internal electric wiring in conduit. Do not run conduit through hood interior or across hood front.
  - (3) Utilities controls shall be located outside of hood interior for convenient access and use.
  - (4) Fixtures shall be Water Saver Faucet Company, Chicago Faucet, T & S, or equal. The following specifications refer to Water Saver Faucet Company to establish quality, utility, and appearances.
    - a) Gas, air, water, steam, and vacuum fixtures shall be made up of remote control valves L-3185 (1/2 inch IPS inlet pipe thread, 3/8 inch NNPT outlet pipe threads) with guide bushing "B" with 4-arm handle and color plastic index disc, for service specified.
    - b) For gas, air, and vacuum, the remote control valve shall be connected to a Water Saver L-14 (or equal) serrated nozzle with 3/8 inch male threads, 10 serrations, and of dimensions as shown on drawing. Valve shall have stainless steel seat and stainless steel renewable floating cone unit.
    - c) For water, the remote control valve shall be connected to a Water Saver L171-WSA with vacuum breaker (or equal) serrated nozzle with a 1/2 inch pipe and elbow. Valves shall have "Water Saver: standardized renewable operating unit."
    - d) Access panel to service utilities shall be gasketed with approved gasket material.
    - e) Do not run plumbing through hood interior or across front of hood.
    - f) Water faucet shall have vacuum breaker.
    - g) Pre-plumb all utilities.
- i. Exterior Construction
  - (1) Chemical resistant finish.
  - (2) End panels fastened to frame with screws.
  - (3) Unused holes (interior or exterior) shall be plugged or blanked.

### C. Acid Fume Hoods

1. General Product Requirements for Acid Fume hoods (Perchloric, other hot inorganic acid digestions, etc.). Shall conform to NFPA 45. Note: refer to general requirements section for chemical fume hoods in previous section.
  - a. Pre-approved by UCD EH&S.
  - b. Must be in commercial production and usage for a minimum of five years.
  - c. Noise generated by the functioning hood within 6 inches of the plane of the sash in any position shall not exceed 60 dBA.
  - d. Constant volume hood with by-pass feature.
  - e. Under fume hood storage cabinets:
    - (1) Flammable liquid storage cabinets are not approved for installation under acid fume hoods.
    - (2) Acid storage cabinets are approved for under fume hood storage. Do not vent cabinets through the fume hood work surface or into acid fume hood exhaust system. Cabinets may be vented into the general lab exhaust.
2. Materials
  - a. Fume hood Construction
    - (1) Fume hood shall be constructed of material suitable with chemical to be used. Consult with University to identify acceptable material to be specified for perchloric acid and hot acid fume hoods.
      - a) Removable baffles with three fixed slots, no adjustable baffles.
      - b) Wash Down System - shall thoroughly wash in sequence from the exhaust stack, fan, exhaust duct and behind fume hood baffles. Wash down will not include the interior fume "cupboard."
      - c) Air foil that provides an air sweep across the work surface with the sash in the fully lowered position. Air foils installed over the work surface edge, allowing for air flow under the air foil are optimum.
    - (2) Pre-wire all items.
  - b. Sash
    - (1) Vertical type: 1/4-inch thick laminated safety glass complete with 1/4- inch deep stainless steel metal channels on sides, top and bottom. Some speciality acid hoods (i.e., hydrofluoric acid) may require a lexan or similar sash. Contact EH&S and User Group for more information.
      - a) No combination sash allowed.
      - b) Bypass.
    - (2) Mechanical stops to ensure that sash work opening is 18 inches, as measured from the bottom of the fume hood work surface to the bottom of the sash.
    - (3) A manual override to allow the vertical sash to be raised above the maximum opening to allow lab apparatus to be installed or removed.
    - (4) Operating face velocity at 18 inches shall be between 100-120 fpm.
  - c. Glass
    - (1) Panels: 1/4-inch thick laminated safety glass complete with 1/4-inch deep metal channels on sides and bottom compatible with usage.

- (2) Light Opening: 1/4-inch thick safety glass in rubber channels within metal frame.
- d. Fume hood Air Flow Indicator/Alarm
 

Provide an air flow alarm. The hood shall be prepared at the factory to receive the specified alarm/monitor. As a minimum, the alarm shall accommodate the following:

  - (1) The Safety Monitor/Alarm System shall monitor face velocity and provide audible and visual alarm if face velocity drops below 90 fpm or rises above 125 fpm. Audible alarm shall pulse at 80 dbA.
  - (2) The monitor shall be UL listed, with all alarm circuit electric components, external tubing, restrictors, and manifolds furnished complete. Monitor shall have light emitting diode display, which provides clear indication of airflow conditions. Safety monitor shall be tamperproof.
  - (3) Alarm Signal. Audible pulsating signal and a visual, flashing red large light emitting diode.
    - a) Silence push button, which temporarily overrides the audible alarm for a period no longer than 5 minutes, shall be accessible on the front of the Safety Monitor. Note: Teaching laboratory hood alarm override shall not exceed a one-minute period. Once the "unsafe" operating condition has been corrected, the audio alarm shall automatically reset.
    - b) During temporary silence of audible alarm the visual alarm remains activated until the alarm condition is corrected.
    - c) It shall not be possible to routinely disable the alarm signal. Locate electrical outlet on top of hood.
    - d) When alarm condition is corrected and face velocity and volume return to specified levels, the safety monitor will automatically reset and begin routine monitoring.
  - (4) Test circuit will be provided to verify proper safety monitor operation.
  - (5) Electrical Rating: Maximum 15 VDC and maximum current rating of 200 MA.
  - (6) An air monitor or alarm, comparable to ALNOR Airgard 335, or equal is acceptable.
  - (7) Connect between fume hood and the filter or damper.
  - (8) Flow tube device (floating indicators) or ribbons hanging in the air stream are not acceptable air flow indicators.
- e. Electrical Items
  - (1) Receptacles per NEMA 5-15R: 15A-125V AC three-wire duplex polarized receptacles. Same as Harvey Hubbel-Inc.'s No. 5252, Arrow-Hart, Leviton, or equal. Receptacles shall be GFI.
  - (2) Plate Covers: Meet usage, Campus Standard is Bell or equal.
  - (3) Switch for lighting: Campus Standard is Hubbel #1221 or equal.
  - (4) Flexible Conduit: 1/2-inch complete with wiring as required.
  - (5) Light Fixture: Heavy-duty fluorescent strip light with 430 Ma rapid- start lamps and 120-volt HPF ballasts. Provide three-foot length for four-foot hoods, and four-foot for six-foot hoods. Same as Garcy #RN 9942- 36H; Columbia Lighting,

- Inc.; Smoot-Holman Company; Benjamin Products of Thomas Industries, Inc.; or equal (all units must be vapor proof lighting).
- (6) Shall be accessible for service from outside the hood.
- (7) No fan switch at the fume hood.
- f. Work Surface
  - (1) The work surface shall have a raised lip on all 4 sides, and be constructed of materials to meet usage. Union between work surface and counter shall be covered at a 3/4-inch radius and watertight.
- g. Duct Work
  - (1) Materials shall be non-reactive, acid resistant and compatible with intended usage.
- h. Use only acid-resistant metallic fan protected by an inorganic coating.
- i. Cup Sink
  - (1) Flush with work surface and conforming to usage requirements, complete with stainless steel tailpiece as required.
- 3. Fabrication
  - a. Shop fabricates and assembly complete units insofar as dimensions permit shipment and installations.
  - b. Fume hood Assembly
    - (1) Assemble hood with continuous welding of all metal-to-metal joints.
    - (2) Grind joints round so that all surfaces are smooth (3/4 inch radius), or glass fiber reinforced fire retardant polyester resin one-piece molded hood chamber completely seamless and crevice free. Basin is to be an integral part of the chamber.
  - c. Utilities
    - (1) Make provisions for cold water only for each hood, in accordance with utility service symbols. Fixture must be provided with a vacuum breaker.
    - (2) Run internal electric wiring in conduit. Do not run conduit through hood interior or across hood front.
    - (3) Utilities controls shall be located outside of hood interior for convenient access and use.
    - (4) Fixtures shall be Water Saver Faucet Company, Chicago Faucet, T & S, or equal. The following specifications refer to Water Saver Faucet Company to establish quality, utility, and appearances.
      - a) Gas, air, water, steam, and vacuum fixtures shall be made up of remote control valves L-3185 (1/2 inch IPS inlet pipe thread, 3/8 inch NNPT outlet pipe threads) with guide bushing "B" with 4-arm handle and color plastic index disc, for service specified.
      - b) For gas, air, and vacuum, the remote control valve shall be connected to a Water Saver L-14 (or equal) serrated nozzle with 3/8 inch male threads, 10 serrations, and of dimensions as shown on drawing. Valve shall have stainless steel seat and stainless steel renewable floating cone unit.
      - c) For water, the remote control valve shall be connected to a Water Saver L171-WSA with vacuum breaker (or equal) serrated nozzle with a 1/2 inch



pipe and elbow. Valves shall have "Water Saver: standardized renewable operating unit."

- d) Access panel to service utilities shall be gasketed with approved gasket material.
- e) Do not run plumbing through hood interior or across front of hood.
- f) Pre-plumb all utilities.
- g) Water faucet shall have vacuum breaker.

4. Testing

- a. Balance, test, and certify each fume hood in accordance with the latest edition of ASHRAE 110 Testing Requirements. A qualified independent testing company shall perform fume hood field tests on each hood.

BIOLOGICAL SAFETY CABINETS (also see information on biological safety cabinets available in Appendix D Biosafety Laboratories)

1. All biological safety cabinets shall meet the specifications within the most recent edition of the National Sanitation Standard 49 – Class II (Laminar Flow) Biohazard Cabinetry.
2. All biological safety cabinets must meet the Campus' review team approval. The following biological safety cabinet manufacturers are currently approved for the Campus: Baker, Nu-Aire, LabConco, and ThermoFisher-Forma. Manufacturer's specifications for specific model types shall be submitted to UCD EH&S for pre-approval.
3. Do not provide any class/type of biological safety cabinet other than Class II Type A2 without prior authorization from the Biological Safety Officer.
  - a. Biosafety cabinet face velocity shall be maintained at no less than 100 fpm at all times during operation.
  - b. Each cabinet shall be equipped with one front mounted Magnehelic gauge indicating the differential pressure across the filter (except Class II Type B2 cabinets, which "alarm" if the air flow drops 20% or more from specification).
  - c. The noise level as measured 12 inches in front of the cabinet and 15 inches above the work surface shall not exceed 67 dBA.
  - d. All biosafety cabinets must be tested per National Sanitation Foundation (NSF) Standard 49 or manufacturer's specifications after installation. The University's Representative should forward the testing results to UCD EH&S for review.
4. Classes and types of Biological Safety Cabinets are listed below:
  - a. Class II Type A1 cabinets (formerly designated Type A, now obsolete)
    - (1) Do not provide a new Class II Type A1 biological safety cabinet. The following rules apply to existing Class II Type A1 biological safety cabinets.
    - (2) Maintain minimum average inflow velocity of 75 fpm through the work access opening (note: the average inflow velocity of some Class II Type A1 biological safety cabinets can be increased to 100 fpm by internal modification. This is not recommended because of other design deficiencies in this type of biological safety cabinet--a Class II Type A2 cabinet is recommended as a replacement).
    - (3) Have HEPA filtered downflow air that is a portion of the mixed downflow and inflow air from a common plenum (i.e., a plenum from which a portion of the air

- is exhausted from the cabinet and the remainder supplied to the work area).  
(Typical 70% of the inflow air is recirculated and 30% is exhausted.)
- (4) May exhaust HEPA filtered air back into the laboratory or to the environment through an exhaust canopy.
  - (5) Have positive pressure contaminated ducts and plenums that are not surrounded by negative pressure plenums.
  - (6) Type A1 cabinets are not suitable for work with volatile toxic chemicals and volatile radionuclides.
- b. Class II, Type A2 Cabinets (formerly designated Type B3)
- (1) Maintain a minimum average inflow velocity of 100 fpm (0.5 m/s) through the work access opening.
  - (2) Have HEPA filtered downflow air that is a portion of the mixed downflow and inflow air from a common exhaust plenum. (Typically 70% of the inflow air is recirculated and 30% is exhausted.)
  - (3) May exhaust HEPA filtered air back into the laboratory or to the environment through an exhaust canopy.
  - (4) Have all biologically contaminated ducts and plenums under negative pressure or surrounded by negative pressure ducts and plenums.
  - (5) Type A2 cabinets used for work with minute quantities of volatile toxic chemicals and tracer amounts of radionuclides required as an adjunct to microbiological studies must be exhausted through properly functioning exhaust canopies.
- c. Class II, Type B1 Cabinets
- (1) Maintain a minimum average inflow velocity of 100 fpm (0.5 m/s) through the work access opening.
  - (2) Have HEPA filtered downflow air composed largely of uncontaminated recirculated inflow air. (Typically 30% of the inflow air is recirculated and 70% is exhausted.)
  - (3) Exhaust most of the contaminated downflow air through a dedicated duct exhausted to the atmosphere after passing through a HEPA filter.
  - (4) Have all biologically contaminated ducts and plenums under negative pressure or surrounded by negative pressure ducts and plenums.
  - (5) Type B1 cabinets may be used for work treated with minute quantities of volatile toxic chemicals and tracer amounts of radionuclides required as an adjunct to microbiological studies if work is done in the direct exhausted portion of the cabinet, or if the chemicals or radionuclides will not interfere with the work when recirculated in the downflow air.
  - (6) Exhaust in-place HEPA filters must be of the bag-in/bag-out type.
- d. Class II, Type B2 Cabinets (sometimes referred to as "total exhaust")
- (1) Maintain a minimum average inflow velocity of 100 fpm (0.5 m/s) through the work access opening.
  - (2) Have HEPA filtered downflow air drawn from the laboratory or the outside air (i.e., downflow air is not recirculated from the cabinet exhaust air).
  - (3) Exhaust all inflow and downflow air into the atmosphere after filtration through a HEPA filter without recirculation in the cabinet or return to the laboratory.

- (4) Have all contaminated ducts and plenums under negative pressure or surrounded by directly exhausted (nonrecirculated through the work area) negative pressure ducts and plenums.
  - (5) Type B2 cabinets may be used for work with volatile toxic chemicals and radionuclides required as adjuncts to microbiological studies.
  - (6) Exhaust in-place HEPA filters must be of the bag-in/bag-out type.
- e. Class III Cabinets
- (1) A totally enclosed, ventilated cabinet of leak-tight construction. Operations in the cabinet are conducted through attached rubber gloves. The cabinet is maintained under negative air pressure of at least 0.50 in. w.g. (120 Pa). Downflow air is drawn into the cabinet through HEPA filters. The exhaust air is treated by double HEPA filtration or by HEPA filtration and incineration.
  - (2) Exhaust in-place HEPA filters must be of the bag-in/bag-out type.

#### GLOVE BOXES

Glove hood (box) may be required for special applications using highly toxic, extremely reactive or California Occupational Safety and Health Act (COSHA) regulated chemical carcinogens. Glove boxes shall meet ANSI standard Z9.5, "Standard on Lab Ventilation" and the American Glove Box Society Standard, "Guidelines for Glove Boxes."

#### OTHER SPECIALTY HOODS & LOCAL EXHAUST

Histology hoods, specimen hoods, and other local exhaust specialty hoods require a minimum operating face velocity of 100 fpm with a range of 100-120 fpm. An audible/visual flow alarm may be required depending on use.

#### FLAMMABLE AND CORROSIVE STORAGE CABINETS

1. Flammable storage cabinets must be UL listed and/or NFPA approved.
2. Flammable liquid storage cabinets may be ventilated. Cabinets used for flammable liquid storage must not be vented directly into the fume hood, through the fume hood work surface. Ventilated cabinets may be exhausted into fume hood exhaust above the fume hood damper or exhausted separately.
3. Acid/corrosive storage cabinets do not require venting. If acid/corrosive storage cabinet is vented, it must be separate from the fume hood exhaust. The vent may be connected at the point where the fume hood exhaust duct enters the general fume hood exhaust manifold. Cabinets must not be vented directly into the fume hood, through the fume hood work surface.
4. Ventilated cabinets need EH&S and Fire Department approval. Flammable liquid storage cabinets must be vented in accordance with Fire Net: Venting Flammable Liquid Storage Cabinets.