

SECTION 11600- LABORATORY EQUIPMENT CONSTRUCTION STANDARD

PART 1: GENERAL

1.01 Scope of Standard

- A. This standard provides general guidance concerning the specific preferences of the University of Texas at Austin for safety equipment used in or in support of laboratories.
- B. UT recognizes that project conditions and requirements vary, thus precluding the absolute adherence to the items identified herein in all cases. However, unless there is adequate written justification, it is expected that these guidelines will govern the design and specifications for UT projects.

1.02 Related Standards

- A. 11700 – Fumehoods
- B. 11500 – Laboratory Renovations

1.03 Reference Standards

- A. ANSI Z358.1-1998
- B. NFPA 45, 2000C. NFPA 30, 2000
- C. OSHA 29 CFR 1910.106
- D. OSHA 29 CFR 1910.1450
- E. Centers for Disease Control (CDC)/ National Institutes of Health (NIH) Biosafety in Microbiological and Biomedical Laboratories, 4th edition
- F. NSF 49 (most current version)
- G. CRC Handbook of Laboratory Safety, 5th edition
- H. Prudent Practices in the Laboratory, National Research Council

1.04 General Requirements For All Labs (chemical and biological)

- A. Each laboratory shall contain a sink for hand washing.
- B. The laboratory shall be designed so that it can be easily cleaned.
- C. Laboratory furniture shall be capable of supporting anticipated loading and uses. Spaces between benches, cabinets, and equipment are accessible for cleaning.

General Ventilation

- A. The general ventilation shall: be used for input to local ventilation devices; not be relied on for protection from toxic substances released into the lab; ensure that lab air is continually replaced, preventing increase of air concentrations of toxic substances during the working day; direct air flow into the lab from non-lab areas and out to the exterior of the building

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- B. When local exhaust systems such as hoods are used as the primary method of control, six to twelve room air changes per hour is adequate. (Ten – twelve room air changes per hour for moderate – high risk laboratories.)

Ventilation Devices

- A. Fume hoods: Located 10 feet (minimum) from exit doors.
- B. Exhaust air from glove boxes and isolation rooms shall be passed through scrubbers or other treatment before release into the regular exhaust system.
- C. Biological Safety Cabinets must be constructed, installed, and tested in accordance with the current version of the National Sanitation Foundation (NSF) Standard 49.

Lab Benches

- A. Provide for at least 40 – 48 inches of clearance between lab benches and everything else in the lab, e.g., other lab benches, walls, and fumehoods.
- B. Epoxy resin counter tops – typical.
- C. Provide Stainless Steel counters at locations with radioactive materials.
- D. Bench tops shall be impervious to water and are resistant to moderate heat and the organic solvents, acids, alkalis, and chemicals used to decontaminate the work surface and equipment.

Emergency Showers and Eyewashes

The following requirements apply to both emergency showers and eyewashes:

- A. The valve shall be designed so that the water flow remains "on" without requiring the use of the operator's hands (hands-free) and shall remain activated until intentionally shut off.
- B. Valve shall be simple to operate and go from "off" to "on" in 1 second or less.
- C. Equipment shall be in accessible locations that require no more than 10 seconds to reach from any laboratory work area.
- D. Each location shall be identified with a highly visible sign.
- E. Water shall be tepid, moderately warm.

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- F. Only potable water shall be used for eyewashes and showers.

Emergency Showers

- A. The shower shall be located so that a water column is provided that is not less than 82 inches nor more than 96 inches in height from the surface on which the user stands.
- B. Often, the best location for a shower is in the main corridor.
- C. The center of the spray pattern shall be located at least 16 inches from any obstruction.
- D. The shower shall be capable of delivering a minimum of 20 gallons of water per minute.

Eyewashes

- A. An eyewash facility shall be readily available to all labs.
- B. Eyewashes shall be installed close to the showers (in addition to other laboratory locations) so that, if necessary, the eyes can be washed while the body is showered.
- C. The eyewash shall be positioned with the water nozzles 33 inches to 45 inches from the surface on which the user stands and 6 inches minimum from the wall or nearest obstruction.
- D. There shall be no sharp projections anywhere in the operating area of the unit.
- E. Eyewashes shall be designed to provide water to both eyes simultaneously, be a continuous flow design, and operate hands-free (although they can be actuated by hand).
- F. Eyewashes shall be capable of delivering to the eyes not less than 0.4 gallons of water per minute.
- G. Eyewash nozzles shall be protected from airborne contaminants and the protector cap's removal shall not require a separate motion by the operator.
- H. Eyewashes shall be drained or be of the swivel type that allows the water to run directly into the sink. (Eyewashes shall be activated weekly to purge bacteria and debris from the water.)

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Storage Units

Flammable Storage Cabinets

- A. Flammable cabinets shall be specified for all labs that may use flammable chemicals in quantities greater than ten gallons.
- B. Flammable cabinets shall meet NFPA 30 and OSHA 29 CFR 1910.106 standards.
- C. Flammable cabinets are not required to be vented. Vent openings shall be sealed with the bungs supplied with the cabinet or with bungs specified by the manufacturer of the cabinet.
- D. If vented, the cabinets shall be vented directly to the outdoors in a manner that will not compromise the specified performance of the cabinet and in a manner that is acceptable to The University Fire Marshall.
- E. Flammable cabinets shall be marked in conspicuous lettering: "Flammable - Keep Fire Away."

Corrosive Cabinets

Corrosive cabinets shall be provided for labs that need to store corrosive material.

Base Cabinets for Fumehoods

- A. Wherever possible, flammable storage cabinets shall be used as the base cabinets for fumehoods. If flammable storage cabinets are not used as the base cabinet, then the cabinet shall be constructed to withstand fire conditions so that the hood remains supported.
- B. If vented storage cabinets are provided under the hood, they shall be vented in the following manner:
 - do not cut the work surface for venting the base cabinets
 - vent through the side wall of the hood with 1.5 to 2 inch national pipe thread (npt) galvanized pipe
 - the tap into the exhaust shall be done above the hood
 - the tap from the back of the cabinet shall be at the lower part of the cabinet and as supplied by the cabinet manufacturer

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C. See attached Specification Sheet

Compressed Gas Cylinder Cabinets

- A. Ventilated compressed gas cylinder cabinets shall be specified for labs which will use certain hazardous gases that are identified by The University, in larger than lecture bottle quantities (or where there are no fumehoods in which to store small cylinders). Refer to, www.utexas.edu/safety/ehs Environmental Health & Safety website, or EH&S at 471-3511 for a list of gases requiring ventilation.
- B. Ventilated cabinets shall comply with International NFPA Standards Fire Code.

Lab Safe Refrigerators

- A. If refrigerators are provided as part of the project, they will be Lab safe for labs that will utilize cold storage of flammable chemicals.
- B. Refrigerators shall be manufactured as "lab safe," but need not be "explosion-proof."

Special Work Areas

Cold rooms and warm rooms shall have provisions for rapid escape in the event of electrical failure.

Biological Laboratories (only)

In addition to the equipment and design requirements described above, the following requirements are specifically for biological labs. (Refer to EH&S at 471-3511 to determine the appropriate biosafety level.)

Laboratory Facilities for Labs at a Biosafety Level 1

- A. Each laboratory shall contain a sink for hand washing.
- B. The laboratory shall be designed so that it can be easily cleaned.
- C. Bench tops shall be impervious to water and are resistant to moderate heat and the organic solvents, acids, alkalis, and chemicals used to decontaminate the work surface and equipment.
- D. Laboratory furniture shall be capable of supporting anticipated loading and uses. Spaces between benches, cabinets, and equipment are accessible for cleaning.
- E. If the laboratory has windows that open to the exterior, they shall be fitted with fly screens.

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Laboratory Facilities for Labs at a Biosafety Level 2

These are in addition to all of the requirements for Biosafety Level 1.

- A. Chairs and other furniture used in laboratory work shall be covered with a non-fabric material that can be easily decontaminated.
- B. Class II biological cabinets may be required (contact EH&S for assistance). If biological cabinets are used, install them in such a manner that fluctuations of the room supply and exhaust air do not cause the biological safety cabinets to operate outside their parameters for containment. Locate biological safety cabinets away from doors, from windows that can be opened, from heavily traveled laboratory areas, and from other potentially disruptive equipment so as to maintain the biological safety cabinets' air flow parameters for containment.
- C. An eyewash facility shall be readily available.
- D. Illumination shall be adequate for all activities, avoiding reflections and glare that could impede vision.
- E. There shall be an inward flow of air without recirculation to spaces outside the laboratory.

Laboratory Facilities for Labs at a Biosafety Level 3

These are in addition to all of the requirements for Biosafety Level 1 and Biosafety Level 2.

- A. The laboratory shall be separated from areas that are open to unrestricted traffic flow within the building, and access to the laboratory is restricted. Passage through a series of two self-closing doors in the basic requirement for entry into the laboratory from access corridors. A clothes change room (shower optional) may be included in the passageway.
- B. Each laboratory room shall contain a sink for handwashing. The sink is hands-free or automatically operated and is located near the room exit door.
- C. The interior surfaces of walls, floors, and ceilings of areas where BSL-3 agents are handled shall be constructed for easy cleaning and decontamination. Seams, if present, shall be sealed. Walls, ceilings, and floors shall be smooth, impermeable to liquids and resistant to the chemicals and disinfectants normally used in the laboratory. Floors shall be monolithic and slip-resistant. Use coved floor coverings. Penetrations in floors, walls, and ceiling surfaces shall be sealed. Openings such as around ducts and the spaces between doors and frames shall be capable of being sealed to facilitate decontamination.

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- D. Windows in the laboratory shall be closed and sealed.
- E. A method for decontaminating all laboratory wastes shall be available in the facility and utilized, preferably within the laboratory (i.e., autoclave, chemical disinfection, incineration, or other approved decontamination methods).
- F. Biological safety cabinets are required and are located away from doors, from room supply louvers, and from heavily-traveled laboratory areas.
- G. A ducted exhaust air ventilation system shall be provided. This system shall create directional airflow which draws air into the laboratory from “clean” areas and toward "contaminated" areas. The exhaust air shall not be recirculated to any other area of the building. Filtration and other treatments of the exhaust air are not required, but may be considered based on site requirements, and specific agent manipulations and use conditions. The outside exhaust shall be dispersed away from occupied areas and air intakes, or the exhaust shall be HEPA-filtered. A visual monitoring device that indicates and confirms directional inward airflow shall be provided at the lab entry. Consideration shall be given to installing an HVAC control system to prevent sustained positive pressurization of the lab. Audible alarms shall be considered to notify personnel of HVAC system failure.
- H. HEPA-filtered exhaust air from a Class II biological safety cabinet can be recirculated into the laboratory if the cabinet is tested and certified at least annually. When exhaust air from Class II safety cabinets is to be discharged to the outside through the building exhaust air system, the cabinets shall be connected in a manner that avoids any interference with the air balance of the cabinets or the building exhaust system (e.g., an air gap between the cabinet exhaust and the exhaust duct). When Class III biological safety cabinets are used they shall be directly connected to the exhaust system. If the Class III cabinets are connected to the supply system, it is done in a manner that prevents positive pressurization of the cabinets.
- I. Continuous flow centrifuges or other equipment that may produce aerosols are contained in devices that exhaust air through HEPA filters before discharge into the laboratory. These HEPA systems are tested at least annually. Alternatively, the exhaust from such equipment may be vented to the outside if it is dispersed away from occupied areas and air intakes.
- J. The Biosafety Level 3 facility design and operational procedures shall be documented. The facility shall be tested for verification that the design and operational parameters have been met prior to operation.

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Facilities shall be re-verified, at least annually, against these procedures as modified by operational experience.

- K. Additional environmental protection (e.g., personnel showers, HEPA filtration of exhaust air, containment of other piped services and the provision of effluent decontamination) shall be considered if recommend by the agent summary statement, as determined by risk assessment, the site conditions, or other applicable federal, state, or local regulations.

PART 2: PRODUCTS – NOT USED

PART 3: EXECUTION

Emergency Showers - Testing

When the shower is installed, test it in accordance with the following procedures:

- A. With the unit correctly connected to the water source and the valve(s) closed, visually check the piping for leaks.
- B. Open the valve to the full open position. The valve shall remain open without requiring further use of the operator's hands.
- C. Measure the shower. The face of the showerhead shall be not less than 82 inches nor more than 96 inches from the surface on which the user stands.
- D. With the valve in the "full on" position, measure the diameter of the spray pattern. It shall be a minimum of 20 inches at 60 inches above the standing surface. The center of the spray shall be at least 16 inches from any obstructions.
- E. Delivered water temperature shall be tepid.

Eyewashes – Testing

- A. When the eyewash is installed, the valve shall be operated to determine that both eyes would be washed simultaneously at a velocity low enough to be non-injurious to the user.
- B. Delivered water temperature shall be tepid.

END OF STANDARD 11600