DIVISION 11 – EQUIPMENT

11 40 00 FOODSERVICE EQUIPMENT

A. Design Considerations

1. The A/E shall use the services of a foodservice equipment specialist in preparation of kitchen areas and other food preparation areas when required in the building. Such areas shall be designed in close coordination with the University foodservice personnel.

2. In non-residential areas such as break room areas, the A/E should note the following:

   a. Consider size of room and number of users when specifying refrigerator sizes and quantities. Exact manufacturer model and size shall be coordinated and confirmed with Owner's Project Manager.

   b. Microwaves provided shall be medium duty commercial grade.

   c. Toasters provided shall be medium duty commercial grade.

   d. Consider under counter water filtration system or in-line water cooler instead of traditional bottled water cooler for labor and space conservation.

B. Special Documentation Requirements

RESERVED

C. Materials and Methods of Construction

RESERVED

11 53 13 LABORATORY FUME HOODS

A. Design Considerations

1. Fume hood manufacturers shall be limited to Mott, Kewaunee, or Labconco. Alternate manufacturers proposed by the A/E may be considered subject to conformance with the requirements of this standard and approval by REHS.

2. All significant laboratory projects (new & renovation) shall be reviewed in the early stages by a team comprised of representatives from REHS, University Facilities, Project Services and Institutional Planning and Operations. Proposed program requirements shall be reviewed to determine whether existing infrastructure (i.e. utilities, existing building MEP systems, building area/configuration, etc.) are adequate to support proposed program goals (i.e. number/type of proposed fume hoods, face velocity, diversity, etc.) as developed by the A/E. The A/E shall include a "Fume Hood Schedule" with basis of design on mechanical drawings. The schedule shall clearly indicate hood air flow (CFM) and face velocity (FPM) at both working height and full open sash along with hood manufacturer, model, type (i.e. constant volume, VAV), static pressure drop and whether the hood is new or existing.

3. All laboratory renovation projects shall meet the following requirements:

   - In all lab renovations and HVAC upgrades (i.e. supply, exhaust, added hoods, etc.), every opportunity should be taken to replace the existing fume hoods with 'high performance' hoods.
   - When replacing multiple 4' or 6' hoods the option should be reviewed with the researchers to replace two 4' hoods or two 6' hoods with a single 8' hood, since an 8' hood typically requires less air flow.

4. All new laboratory projects shall meet the following requirements:

   - VAV HVAC systems for new laboratories shall include a 10-20% safety factor to facilitate future installation of additional hoods.

5. Fume hood diversity should be considered for variable air volume systems. The engineer of record shall propose a diversity factor based upon the lab design parameters (capacity and performance of outdoor air make-up and exhaust systems), programming needs for the space, the ability to support future growth or needs, and the impact on HVAC systems performance and maintenance. The diversity factor and supporting documentation must be submitted to Rutgers. Fume hood diversity factor for each laboratory HVAC system shall be noted on design drawings for use by the Testing, Adjusting & Balancing contractor.

6. New fume hoods may be constant volume or VAV as required to suit the application, and shall be "high performance" type, certified by the manufacturer to conform to the requirements of the latest adopted issue of ANSI\ASHRAE Standard 110 "as manufactured" at a nominal face velocity of 60 FPM at both full open sash and operating height (18"). Fume hoods that rely on integral "moving baffles" or other moving components and associated control devices incorporated by the hood manufacturer to achieve specified performance are not acceptable unless approved for a specific project. All new fume hoods that are equipped with

occupied/unoccupied control functionality shall be equipped with face velocity alarm monitor and "high sash" face velocity setpoint override capability. Sashes for all new fume hoods shall automatically drop by gravity to the operating height (18" for vertically tracked sashes and fully closed for combination sashes) unless manually locked in the full open position for set-up purposes. Refer to paragraph 'C' of this standard for additional information pertaining to required fume hood construction and features.

7. Operating face velocity of hoods shall be as follows:
    - High Performance Hoods: 80-100 fpm at full open sash height. Final flow rate determination shall be based on anticipated hazards.
    - Conventional Fume Hood Systems:
    - 100 fpm at full open sash height for bypass hoods
    - 80 fpm at full open sash height for hoods without bypass.
    - All Hoods: Minimum of 60 fpm at any point in unoccupied mode. Higher air flow (i.e. 150 -375 cfm) and corresponding face velocity may be required to maintain required hood air change rate in keeping with ANSI/ASSP Standard Z9.5 'Laboratory Ventilation' and hazard assessment determined by REHS.

8. Minimum laboratory air change rates shall be as follows:
    - 8-12 ACH (occupied) and 6 ACH (unoccupied) for a typical laboratory with hazardous chemicals.
    - Lower air change rates based on system operations, activities performed, lab design, etc. and in ancillary laboratory support spaces (i.e. instrument rooms, etc.) may be acceptable subject to approval by REHS.
    - 6-10 ACH (occupied) for clinical laboratories.
    - 10-15 ACH for animal rooms (must consult Comparative Medicine Resources).

9. All fume hoods must meet testing criteria established by the latest adopted issue of ASHRAE Standard 110. In addition, the following conditions shall be met:
    - Must pass ANSI/ASHRAE 110 test criterion of 4.0 AI 0.05 (as installed)
    - Must be tested at full open and operating sash heights
    - Cross draft velocities must be less than 30% of the average face velocity
    - Measured deviation across the face may vary 10 fpm for hoods operating at 80 fpm and 20 fpm for hoods operating at 100 fpm

10. All new fume hoods shall be an integral part of the laboratory design and all laboratory renovations shall also-rectify improper hood locations. Fume hoods shall be located in a room so that air currents generated in the room will not interfere with the hood's ability to capture and eliminate vapors, mists, and airborne particles. Therefore, hoods shall be located as far away as possible from:

    - Doors

- Supply air diffusers
- Windows which can be opened
- Heavy traffic areas
- Other local exhaust ventilation devices

a. Room air current velocities at the face of the hood should not exceed twenty linear feet per minute (LFM) from any source and should be as close to zero as practicable.

11. See Section 23 08 00 'Commissioning of HVAC' and Section 23 05 93 'Testing, Adjusting, and Balancing for HVAC' of these Standards for commissioning/testing/certification requirements for laboratory fume hoods and biological safety cabinets.

12. Design requirements for occupied/unoccupied control of fume hoods and laboratories shall be in accordance with Section 23 09 00 'HVAC Instrumentation and Controls' of the Rutgers Design Standards.

B. Special Documentation Requirements

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C. Materials and Methods of Construction

1. Hood Design and Construction: In general, all fume hoods should be constructed and contain materials that will permit their planned use to be carried out safely; therefore, their intended use must be known.

   a. Sides: Hood sidewalls shall be 3 1/2 - 6 1/2 inches wide and shall be properly formed to present a smooth airfoil to the inflowing air. The hood interior lining shall be flush with the sides. These features shall, over the range of the hood's designed air face velocity, prevent significant eddy currents from circulating air from inside the hood through the plane of the face of the hood.

   b. Sill: A radiused painted sill is required unless otherwise required to suit application. It shall be installed at the bottom of the hood opening and extend back under the sash. An open area of approximately one inch shall be present under the sill to direct air across the work surface at all sash positions.

   c. Sash: Vertically tracked sashes are preferred. Combination sashes (vertically and horizontally tracked) are acceptable when requested by the user and approved by REHS. Combination sashes shall drop to the fully closed position unless manually locked in the fully open position for set-up purposes. Removal of the sash only is possible with special tools or keys. Glass used in the sash shall be at least 7/32" thick combination sheet. The sash shall be securely enclosed in a complete frame, welded and ground smooth at the corners. Stainless steel or a baked-on epoxy coat is to be used for the sash frame. Vertical sashes shall be counter-balanced with sash weights, suspended from

each side of the sash and shall be easily operated. Vertical sashes shall drop to the University standard 18 inch operating height unless manually locked in the full open position for set-up purposes. The sash frame must be held in a stainless steel track and have plastic guides. Sashes shall be anti-guillotine.

d. Interior: The interior lining of the hood must be resistant to the materials and chemicals to which it will be exposed. The selection of resistant materials must be made through consultation with REHS.

   1) Use of perchloric acid, hydrofluoric acid, and radioisotopes require special consideration as detailed in those sections.

e. Exterior: Cold rolled steel shall be used for the hood exterior. All parts shall be joined together as required to allow for dismantling and access for service. After fabrication and before final assembly, all component parts shall be given an acid, alkali and solvent resistant finish on both exterior and interior surfaces.

f. Frame: The exterior and interior walls of the hood shall be rigidly supported by a full frame.

g. Working Surface: The hood working surface shall be molded epoxy or stainless steel. It shall be recessed not less than 1/4" deep and have a raised area on all sides. The raised area across the front of the hood shall be at least three inches wide.

h. Hood Fixtures and Services: All hood services shall be specified by the user. All electric service shall be located on the exterior of the hood. Plumbing services shall be brass, chrome-plated, or acid and organic vapor resistant plastic. All fixtures shall have color coded end caps. All controls for plumbing services shall be located on the hood exterior.

i. Lighting: Sufficient lighting shall be provided by either fluorescent, LED, or incandescent light fixtures at the top exterior of the hoods. The light fixture shall be easily accessible from the outside of the hood, shall be shielded from the hood interior by a laminated or tempered glass panel, and shall be vapor sealed.

j. Air By-Pass Mechanism: All constant volume hoods shall be factory equipped with an air by-pass mechanism located above the hood face opening. It shall provide an effective sight-tight barrier between the user and the hood interior. By-pass louvers shall be directed upward away from the front of the hood and provide an effective barrier and deflector for flying debris from inside the hood. The by-pass shall control the face velocity as the sash is lowered. The velocity of the air at any sash position shall never exceed 1.5 (one and one half) times the open face velocity. The air by-pass shall begin to operate when the sash is one-third to one-half closed.

k. Plenum and Slot Arrangement: A plenum shall be located in the rear of all fume hoods. It must have at least two but no more than three slots. The lower slot shall be furnished at the working surface level and be locked at 2 to 2 1/2 inches or have the baffle removed entirely. The upper slot shall be located in

the upper section of the hood. The opening shall be set at 3/8 to 1/2 inch maximum. A middle slot, if furnished, shall is to be fixed and have an opening no greater than 2 inches.

l. Exhaust Fans and Ductwork: See Division 23

m. Face Velocity Alarm Monitor: Each fume hood shall be equipped with a face velocity alarm monitor compatible with specified laboratory HVAC control system. At a minimum, the monitor shall have a digital display of the hood face velocity and adjustable low flow/caution alarm points with audible alarm. Low flow alarm must have dual setpoint capability to avoid nuisance alarms where reduced face velocities are maintained during the unoccupied mode of operation. It is also required that new fume hoods equipped with occupied/unoccupied control functionality shall be equipped with a local high sash alarm activated when the sash height exceeds 19 inches. High sash alarm shall be equipped with a silence button with an adjustable timing device that resets when the sash is lowered.

n. "High Sash" Face Velocity Setpoint Override: New hoods equipped with occupied/unoccupied control functionality shall be equipped with a limit switch or sash sensor to index face velocity to occupied setpoint whenever sash is raised above 18" whether the hood is attended or not.

o. Laboratory Controls & Commissioning: Provision of control components (i.e. field versus factory furnishing, mounting and wiring) shall be coordinated with Section 23 09 00. All alarms and controls shall be calibrated and commissioned in accordance with Section 23 08 00 'Commissioning of HVAC' of these Standards.

2. Special Hoods:

a. **Perchloric Acid Hood:** To safely contain perchloric acid, work requirements in addition to the standard design for fume hoods are specified under this section.

1) Construction: Materials of construction for the hood shall be nonreactive, acid resistant and relatively impervious. Type 316 stainless steel, with welded joints, is preferred. Unplasticized polyvinyl chloride or an inorganic ceramic coating such as porcelain are acceptable. All interior surfaces of the hood and ductwork shall be smooth and seamless, and constructed for easy cleaning. The work surface shall be smooth and watertight with a minimum of 1/2" dished front and sides and an integral trough at the rear to collect wash-down water. The hood shall be designed to allow easy visual inspection of all interior surfaces.

See Division 23 for ductwork and exhaust fans.

b. **Hydrofluoric Acid Hoods:** Hydrofluoric acid is a highly corrosive agent. Consequently, materials resistant to hydrofluoric acid attack shall be substituted for standard laboratory fume hood construction materials. For hydrofluoric

acid, use the standard design specified for fume hoods, supplemented by the following specifications on construction and materials:

1) Construction: The hood shall be constructed of nonreactive materials that are resistant to hydrofluoric acid attack and are relatively impervious. A Portland cement hood interior or other suitable material is recommended. The hood shall be constructed to allow easy visual inspection of all interior surfaces. A transparent plastic sash is required.

2) See division 23 for ductwork and exhaust fans.

c. **Radioisotope Hoods:** In addition to meeting the standard design specifications for fume hoods, the interior of all radioisotope hoods shall be stainless steel or molded epoxy resin and must form a smooth integral unit. All interior screws shall be countersunk and joints sealed and smooth for ease of decontamination.

11 53 53 BIOLOGICAL SAFETY CABINETS

A. Design Considerations

1. All Biological Safety Cabinets (BSC) must be able to achieve adequate containment for the expected hazards being controlled and be selected in consultation with REHS and the end user.

2. Any location identified for a BSC must comply with the most current NSF/ANSI 49 Standard.

   a. Cabinets should be placed away from doors, windows, vents, high traffic areas, and supply diffusers, to reduce turbulence and maintain containment.

   b. The cabinet exhaust should have a twelve to fourteen-inch clearance from the ceiling for proper air flow.

   c. For maintenance purposes, a twelve to fourteen-inch clearance is recommended on both sides of the cabinet.

   d. The A/E shall review the BSC with the end user to confirm required options such as vacuum turret(s), UV lamps, BSC width, etc.

3. The default BSC selected shall be a non-ducted, Class II, Type A2 cabinet.

   a. Any ducted Class II, Type A2 cabinet will require a thimble connection and an airflow monitor, in accordance with NSF/ANSI 49 Standard.

4. Any BSC selected to control potential chemical hazards will be a hard-ducted, Class II, Type B2 Cabinet, and be selected in consultation with REHS.

a. All ducts must meet the same specifications as found in Section 23 31 13 of this Design Standard for fume hoods and hazardous exhaust systems.

b. Any air volume valve and/or damper must support certification testing and gaseous decontamination in accordance with NSF/ANSI 49 Standard.

c. Where applicable, B2 Cabinets shall be connected to a lab exhaust system. A dedicated exhaust should be used, or a manifold system with approved VAV controls may be considered, in consultation with REHS.

5. Any Class III or Specialty Cabinet with HEPA filtration identified to control hazards will require an assessment by REHS prior to selection.

6. Any HEPA filtering system designed for exhausting high biological containment laboratories will require pressure gauges (pre and post-filter) and a means of leak testing in compliance NSF/ANSI 49 and ASSP/ANSI Z9.14.

7. All Biological Safety Cabinets installed or relocated will be designed without a natural gas connection.

   a. If a specific researcher requires natural gas, a natural gas line connection may be considered in consultation with REHS and the end user for specific processes.

8. All Biological Safety Cabinets installed, relocated, and/or repaired will require field certification performed by an accredited vendor meeting NSF/ANSI 49.

   a. All testing and balancing affecting the lab must be completed prior to performing any BSC NSF/ANSI 49 certification.

   b. All completed NSF/ANSI 49 certification reports will be reviewed by REHS prior to commissioning, to verify BSC performance as installed (AI), to ensure user protection.

   c. See Section 23 08 00 ‘Commissioning of HVAC’ and Section 23 05 93 ‘Testing, Adjusting, and Balancing for HVAC’ of these Standards for commissioning/testing/certification requirements for laboratory fume hoods and biological safety cabinets.

B. Special Documentation Requirements

RESERVED

C. Materials and Methods of Construction

RESERVED