

SECTION 11 53 53
BIOLOGICAL SAFETY CABINETS AND LAMINAR AIRFLOW WORK STATIONS

SPEC WRITER NOTES:

1. Delete between // ____ // if not applicable to project.
2. Delete other items or paragraphs in the section that are not applicable and renumber the paragraphs.

PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies Biological Safety Cabinets: // Class I // Class II, Type A1 // Class II, Type A2 // Class II, Type B1 // Class II, Type B2 // and Laminar Airflow Work Stations (LAFW): // Vertical // Horizontal //.

1.2 DEFINITIONS

- A. Class I Biological Safety Cabinet: A ventilated cabinet for exposure protection of personnel and the environment, suitable for work involving low to moderate risk agents (BSL 1,2, and 3). Cabinet air is exhausted through a HEPA filter, either into the laboratory or to the outside.
- B. Class II Biological Safety Cabinet: A ventilated cabinet for exposure protection of personnel, product and the environment, suitable for work involving low to moderate risk agents (BSL 1,2, and 3). Cabinet air is exhausted through a HEPA filter either into the laboratory or to the outside. Class II cabinets are available as two types (A and B) based on construction, air flow velocities and patterns, and exhaust systems. Refer to Table 1.
- C. Laminar Airflow Work Station(LAFW): A self-contained, positive pressure cabinet that provides an ISO 5/Class 100 clean air environment, designed to provide product protection when handling non-hazardous products. Streams of unidirectional air move in parallel lines through the cabinet, then through a HEPA filter, and into the laboratory. Both horizontal and vertical laminar flow work stations are available.

1.3 RELATED WORK

- A. Section 22 15 00, GENERAL SERVICE COMPRESSED-AIR SYSTEMS: Connections to Compressed Air System.
- B. Section 22 11 00, FACILITY WATER DISTRIBUTION: Plumbing Connections.
- C. Section 22 13 00, FACILITY SANITARY SEWERAGE: Plumbing Connections.

- D. Section 22 62 00, VACUUM SYSTEMS FOR LABORATORY and HEALTHCARE FACILITIES: Connections to Gas and Vacuum Systems.
- E. Section 22 63 00, GAS SYSTEMS FOR LABORATORY and HEALTHCARE FACILITIES: Connections to Gas and Vacuum Systems.
- F. Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC: Pressure Switches.
- G. Section 23 31 00, HVAC DUCTS and CASINGS: Ductwork.
- H. Section 23 36 00, AIR TERMINAL UNITS: Airflow Control Valves.
- I. Section 23 40 00, HVAC AIR CLEANING DEVICES: HEPA Filters.
- J. Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS and CABLES (600 VOLTS AND BELOW): Electrical Connections.
- K. Section 26 27 26, WIRING DEVICES: Electrical Devices.

1.4 QUALITY CONTROL

- A. Mechanical, electrical and associated systems shall be safe, reliable, efficient, durable, easily and safely operable, maintainable, and accessible.
- B. Standard Products: Material and equipment shall be the standard products of the selected manufacturer, and they should be regularly engaged in the manufacture of such products for at least 3 years.
- C. All items furnished shall be free from defects that would adversely affect the performance, maintainability and appearance of individual components and overall assembly.
- D. NSF Compliance: Equipment bears NSF (National Sanitation Foundation) Certification Mark indicating compliance with NSF 49. This certification applies only to Class 1 and 2 Biological Safety Cabinets, not LAFW.
- E. Electrical Components and Devices: UL listed and labeled for intended use.

1.5 SUBMITTALS

- A. Submit in accordance with specification Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data: Include the following:
 1. Illustrations and descriptions of the unit and factory-installed devices associated with it.
 2. Catalog or model numbers for each item incorporated into the work.
 3. Utility requirements.

- C. Shop Drawings: Show details of fabrication, installation, adjoining construction, coordination with mechanical and electrical work, anchorage, and other work required for complete installation.
- D. Factory Testing: Provide manufacturer's QC checklist or other reports that indicate comprehensive factory testing has been performed, and the results of these tests.
- E. Field Test Reports: Provide certification reports from accredited service technicians or installers.
- F. Operating Instructions: Comply with requirements in specification Section 01 00 00, GENERAL REQUIREMENTS.

SPEC WRITER NOTE: Edit the following requirements to coordinate with project sustainability goals.

- G. LEED Information:
 - 1. LEED (v 3.0) MR Credit 4, Recycled Content: Product data indicating percentages, by weight of post-consumer and post-industrial recycled content for products having recycled content:
 - a. Include statement indicating costs for each product having recycled content.
 - 2. LEED (V 3.0) MR Credit 5, Regional Materials: Manufacturer's data identifying point of origin for products procured within 500 mile radius of the project:
 - a. Include statement indicating costs for each product submitted.

1.6 APPLICABLE PUBLICATIONS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American National Standards Institute / National Electrical Manufacturers Association (ANSI/NEMA):
 - WD 6-2002 (R2008).....Wiring Devices--Dimensional Specifications
- C. National Sanitation Foundation International / American National Standards Institute (NSF/ANSI):
 - 49-2009.....Biosafety Cabinetry: Design, Construction, Performance and Field Certification
- D. Scientific Equipment and Furniture Association (SEFA):
 - 2-1999.....Recommended Practices for Installation
 - 7-2007.....Recommended Practices for Fixtures
- E. National Fire Protection Association (NFPA):

45-2011.....Standard on Fire Protection for Laboratories
using Chemicals

PART 2 - PRODUCTS

2.1 BIOLOGICAL SAFETY CABINETS

SPEC WRITER NOTE: Edit the following requirements to coordinate with the equipment shown on drawings.

A. General Specification for Biological Safety Cabinets

SPEC WRITER NOTE: The following specifications apply to both Class I and Class II Biological Safety Cabinets.

Furnish and install biological safety cabinets that have the following characteristics:

1. Cabinet Exterior:
 - a. Class I: // Epoxy-coated aluminum // polycarbonate and steel // steel //.
 - b. Class II: // Reinforced cold-rolled steel with acid-resistant painted finish // stainless steel //.
2. Cabinet Interior:
 - a. Class I: // Epoxy-coated aluminum // polycarbonate and steel // steel //.
 - b. Class II: // Reinforced cold-rolled steel with acid-resistant painted finish // stainless steel //.
3. View Screen: Hinged, 6-mm- (1/4-inch-) minimum thick, laminated safety glass.
4. Motor/Blower System: To circulate filtered air into and/or through cabinet.
5. Duct: Stainless-steel duct to direct air from the recirculation blower cabinet to the exterior. Refer to Section 23 31 00, HVAC DUCTS and CASINGS.
6. HEPA Filtering: 99.99 percent effective on 0.3 microns for both recirculated and exhausted air. Refer to Section 23 40 00, HVAC AIR CLEANING DEVICES.
7. Lighting: Fluorescent lights producing a minimum of 1076 lux (100 fc) of non-glare illumination in the work area, and ultraviolet lamp electrically interlocked to be inoperable while fluorescent lighting is "on."
8. Magnehelic Gauge: Located on the front of the cabinet to indicate cabinet interior pressure. Provide DDC sensor with remote indicator. Refer to Section 23 09 23, DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC.

SPEC WRITER NOTE: Show types, quantities, and locations of wiring devices and service fixtures on the drawings.

9. Equip with listed hospital-grade duplex receptacles having drip proof covers, and control switch. Refer to Section 26 27 26, WIRING DEVICES for additional requirements
10. Equip with gas, vacuum, water, and air valves, as needed.
11. Equip with the following controls:
 - a. On/off switch and circuit breaker with pilot "on" light for blowers.
 - b. On/off switch for // fluorescent // and ultraviolet lamps //.
 - c. Circuit breaker and on/off switch for duplex outlets.
 - d. Removable stainless steel exhaust duct transition unit with airtight damper // On type A2 cabinets, provide an indirect canopy ("thimble") connection by the cabinet manufacturer //.
12. Locate HEPA filters and blower so that they are removable from the front without entry into workspace.
13. Equip with drain spillage trough in each unit. Provide ball valve and cap on trough drain outlet.
14. Equip with optional Intravenous (IV) bar, suspended across the top of the work area.
15. Equip with a supportive work surface or base stand.

SPEC WRITER NOTE: Edit the following requirements to coordinate with the equipment shown on drawings.

- B. Class II Biological Safety Cabinet Types: Furnish and install Class II biological safety cabinets, according to the following table:

Table 1

TYPE	AIRFLOW	MAXIMUM FACE VELOCITY	Biosafety Level	COMMENTS
A1	30 percent indirect exhaust / 70 percent recirculated	0.38 m/s (75 fpm)	1,2,3	Contaminated positive-pressure plenums permitted
A2	30 percent indirect exhaust / 70 percent recirculated	0.51 m/s (100 fpm)	1,2,3	Contaminated plenums must be surrounded by negative pressure.
B1	70 percent direct exhaust / 30 percent recirculated	0.51 m/s (100 fpm)	1,2,3	Contaminated plenums must be surrounded by negative pressure.
B2	100 percent direct exhaust	0.51 m/s (100 fpm)	1,2,3	All ducts and plenums must be under negative pressure.

2.2 LAMINAR AIRFLOW WORK STATIONS (LAFW)

A. Specifications for Laminar Airflow Work Stations (LAFW)

1. Cabinet Exterior: // Reinforced cold-rolled steel with acid-resistant painted finish // stainless steel //.
2. Cabinet Interior: // Reinforced cold-rolled steel with acid resistant painted finish // stainless steel //.
3. Motor/Blower System: To circulate filtered air into and/or through cabinet.
4. HEPA filtering: 99.99 percent effective on 0.3 microns for exhausted air.
5. Duct: Self-contained unit; no ducting required.
6. Lighting: A minimum of 1076 lux (100 fc).
7. Magnehelic Gauge: +/- 2% accuracy of full scale with a 0.35 bar (15 psi) pressure rating.
8. Equip with hospital-grade duplex receptacles having drip proof covers, and control switch. Refer to Section 26 27 26, WIRING DEVICES for additional requirements.
9. Equip with gas, vacuum, water and air valves as indicated on drawings.
10. Equip with the following controls:
 - a. On/off switch and circuit breaker with pilot "on" light for blowers.
 - b. On/off switch for // fluorescent // and ultraviolet lamps //.
 - c. Circuit breaker and on/off switch for duplex outlets.
11. Locate HEPA filters and blower so that they are removable from the front without entry into workspace (Vertical Laminar Airflow Work Stations only).
12. Equip with drain spillage trough in each unit. Provide ball valve and cap on trough drain outlet.
13. Equip with optional Intravenous (IV) bar, suspended across the top of the work area.
14. Equip with a supportive work surface or base stand.

2.3 MECHANICAL SERVICE FIXTURES

A. Valves, General Requirements:

1. Comply with requirements in SEFA 7.
2. Cast red brass alloy bodies with copper content not less than 81 percent, or drop forged brass alloy with high density and no porosity.

3. Locate valves so that they are accessible for maintenance and repair of internal working parts.
 4. Equip valves with four-arm handles.
 5. Design valves to withstand 689 kPa (100 psig) without leakage.
- B. Gas, Air, and Vacuum Valves:
1. Provide floating needle valves with a replaceable cone and a replaceable valve seat.
 2. Provide bonnet with exterior packing nut and packing gland designed for valve to be repacked while under pressure.
- C. Outlet Fittings: Fit each outlet with a 10 serrated hose connector.
- D. Electrical System: 115 V, 1 phase, 60 Hz.
- E. Identification: Code valves with full-view plastic index buttons as follows:

Table 3

SERVICE	BUTTON COLOR	CODE	LETTER COLORS
Air	Orange	AIR	Black
Gas	Dark Blue	GAS	White
Vacuum	Yellow	VAC	Black

- F. Finish:
1. Fixtures, Handles, and Escutcheons: Polished chrome plate.
 2. Fixtures Inside Hoods: Acid- and solvent-resistant coating applied by fixture manufacturer.
- G. Electrical Receptacles: Hospital-grade; ANSI/NEMA WD 6 Configuration 5-20R; duplex; with chrome-plated brass or stainless-steel cover plates; minimum 120 V, 20 A.

PART 3 - EXECUTION

3.1 PREPARATION

Install equipment after installation of finish flooring in rooms to receive cabinets has been completed.

3.2 INSTALLATION

- A. General:
1. Install biohazard safety cabinets and LAFWs according to manufacturer's written instructions
 2. Coordinate installation with related mechanical and electrical work. Provide cutouts and openings for plumbing and electrical work as indicated or as required by trades involved.
 3. Install level, plumb, true, and straight without distortion.

- a. Shim cabinets using concealed shims.
4. Adjust hardware so that doors and drawers operate smoothly without warp or bind. Lubricate operating hardware as recommended in writing by manufacturer.
5. Locate unit away from fans, heating and air conditioning registers, laboratory hoods, high traffic areas and doors that could interfere with airflow patterns.

3.3 TESTING

- A. Biological Safety Cabinets: After installation, an independent accredited service technician must test the biological safety cabinet according to NSF 49 and permanently attach certificate of compliance to equipment.
- B. Laminar Airflow Work Stations: After installation, an independent accredited service technician must test the laminar flow work station and provide a written report certifying that it provides an ISO 5/Class 100 clean air environment.

3.4 PROTECTING AND CLEANING

- A. Protect equipment from dirt, water, and chemical or mechanical injury during the remainder of the construction period.
- B. At the completion of work, clean equipment as required to produce ready-for-use condition.

3.5 INSTRUCTIONS

Instruct personnel and transmit operating instructions in accordance with requirements in specification.

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