UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2021
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SECTION 11 53 00

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05/11, CHG 1: 11/17

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USACE / NAVFAC / AFCEC / NASA	**UFGS-11 53 00 (May 2011)** **Change 1 - 11/17**
Preparing Activity: NAVFAC	**Superseding** **UFGS-11 53 00 (November 2008)**

UNIFIED FACILITIES GUIDE SPECIFICATIONS

References are in agreement with UMRL dated January 2021

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SECTION 11 53 00

LABORATORY EQUIPMENT AND FUMEHOODS
05/11, CHG 1: 11/17

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NOTE: This guide specification covers the requirements for laboratory equipment and fume hoods.

Adhere to UFC 1-300-02 Unified Facilities Guide Specifications (UFGS) Format Standard when editing this guide specification or preparing new project specification sections. Edit this guide specification for project specific requirements by adding, deleting, or revising text. For bracketed items, choose applicable item(s) or insert appropriate information.

Remove information and requirements not required in respective project, whether or not brackets are present.

Comments, suggestions and recommended changes for this guide specification are welcome and should be submitted as a Criteria Change Request (CCR).

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NOTE: Types of equipment normally specified in this section include fumehoods, furniture not specified in casework section, and related laboratory products. Laboratory fumehoods included by the guide specification are not to be utilized for perchloric acid handling operations. Perchloric acid is extremely dangerous because it is a very strong oxidizer. When this acid reacts with organic material, an explosive product may form.

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NOTE: On the drawings, show:

1. Location of equipment, utility connections and relation to other work.

2. Remotely located blower and ductwork, to create

negative pressure at hood. Require weatherproof caution labels attached to outlet end of exhaust systems where warning of dangerous chemical fumes will be necessary.

3. Fans and ductwork needed to create negative pressure. Laboratory fume hoods are ventilated enclosures designed to provide safe working area for laboratory activities involving hazardous materials, generated fumes, aerosols, gases, and particulate matter. To operate satisfactorily, air is removed from enclosure at optimum face velocity. Require velocities measurable at maximum face area of hood, with maximum allowances for hood, filter, and appurtenance static pressure losses within specified limits.

****

PART 1 GENERAL

1.1 REFERENCES

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NOTE: This paragraph is used to list the publications cited in the text of the guide specification. The publications are referred to in the text by basic designation only and listed in this paragraph by organization, designation, date, and title.

Use the Reference Wizard's Check Reference feature when you add a Reference Identifier (RID) outside of the Section's Reference Article to automatically place the reference in the Reference Article. Also use the Reference Wizard's Check Reference feature to update the issue dates.

References not used in the text will automatically be deleted from this section of the project specification when you choose to reconcile references in the publish print process.

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The publications listed below form a part of this specification to the extent referenced. The publications are referred to within the text by the basic designation only.

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS (ACGIH)

ACGIH-2097	(2013) Industrial Ventilation: A Manual of Recommended Practice (Metric)

ASTM INTERNATIONAL (ASTM)

ASTM A1008/A1008M	(2020) Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable

ASTM B221	(2014) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
ASTM B221M	(2013) Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric)
ASTM C1048	(2018) Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass

CENTERS FOR DISEASE CONTROL AND PREVENTION (CDC)

CDC 21-1112	(2009) Biosafety in Microbiological and Biomedical Laboratories, 5th Edition

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

NFPA 45	(2019) Standard on Fire Protection for Laboratories Using Chemicals
NFPA 70	(2020; ERTA 20-1 2020; ERTA 20-2 2020; TIA 20-1; TIA 20-2; TIA 20-3; TIA 20-4) National Electrical Code

UNDERWRITERS LABORATORIES (UL)

UL 586	(2009; Reprint Dec 2017) UL Standard for Safety High-Efficiency Particulate, Air Filter Units

1.2 RELATED WORK SPECIFIED IN OTHER SECTIONS

Conform to provisions of Section 11 70 00 GENERAL REQUIREMENTS FOR MEDICAL AND DENTAL EQUIPMENT and Section 12 35 70 HEALTHCARE CASEWORK. Provide final utility connections and utility service to equipment including waste, under Sections 23 03 00.00 20 BASIC MECHANICAL MATERIALS AND METHODS; 22 00 00 PLUMBING SYSTEMS; 22 60 70 GAS AND VACUUM SYSTEMS FOR HEALTHCARE FACILITIES; and 26 20 00 INTERIOR DISTRIBUTION SYSTEM.

1.3 SUBMITTALS

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NOTE: Review Submittal Description (SD) definitions in Section 01 33 00 SUBMITTAL PROCEDURES and edit the following list, and corresponding submittal items in the text, to reflect only the submittals required for the project. The Guide Specification technical editors have classified those items that require Government approval, due to their complexity or criticality, with a "G". Generally, other submittal items can be reviewed by the Contractor's Quality Control System. Only add a "G" to an item if the submittal is sufficiently important or complex in context of the project.

For Army projects, fill in the empty brackets

following the "G" classification, with a code of up to three characters to indicate the approving authority. Codes for Army projects using the Resident Management System (RMS) are: "AE" for Architect-Engineer; "DO" for District Office (Engineering Division or other organization in the District Office); "AO" for Area Office; "RO" for Resident Office; and "PO" for Project Office. Codes following the "G" typically are not used for Navy, Air Force, and NASA projects.

The "S" classification indicates submittals required as proof of compliance for sustainability Guiding Principles Validation or Third Party Certification and as described in Section 01 33 00 SUBMITTAL PROCEDURES.

Choose the first bracketed item for Navy, Air Force, and NASA projects, or choose the second bracketed item for Army projects.

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Government approval is required for submittals with a "G" or "S" classification. Submittals not having a "G" or "S" classification are [for Contractor Quality Control approval.][for information only. When used, a code following the "G" classification identifies the office that will review the submittal for the Government.] Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

SD-02 Shop Drawings

Laboratory equipment and fume hood layout; G[, [_____]]

Laboratory equipment and hood schedules

SD-03 Product Data

Fumehood assembly; G[, [_____]]

Radio isotope fumehood; G[, [_____]]

Biological safety cabinet; G[, [_____]]

Include descriptive literature, technical data sheets, and diagrams.

SD-04 Samples

Exterior hood paint; G[, [_____]]

SD-06 Test Reports

Fumehood test; G[, [_____]]

Base cabinet test; G[, [_____]]

SD-08 Manufacturer's Instructions

Fumehood assembly

Radio isotope fumehood

Biological safety cabinet

SD-10 Operation and Maintenance Data

Fumehood assembly, Data Package 2; G[, [_____]]

Radio isotope fumehood, Data Package 2; G[, [_____]]

Biological safety cabinet, Data Package 2; G[, [_____]]

Submit in accordance with Section 01 78 23 OPERATION AND MAINTENANCE DATA.

1.4 SUBMITTAL REQUIREMENTS

1.4.1 Hood Paint

Submit color chips of exterior hood paint. Submit [at least five] colors which are standard with the manufacturer.

1.4.2 Drawing Requirements

Show pertinent installation layout. Indicate details of construction and rough-in requirements.

1.4.3 Schedule

Include each type of equipment and hood and submit in accordance with Section 11 70 00 GENERAL REQUIREMENTS FOR MEDICAL AND DENTAL EQUIPMENT.

1.4.4 Tests

Submit fumehood test [and] cabinet test reports required by ACGIH-2097.

PART 2 PRODUCTS

2.1 MATERIALS, COMPONENTS, AND SPECIAL DESIGN REQUIREMENTS

****

NOTE: Use of certain chemicals such as hydrochloric and hydrofluoric acids may react with specified materials. Epoxy, mineral, or synthetic materials for hood interior working area, acid wastes, and drains may be required depending on chemicals to be used. If other materials are required, add text.

****

2.1.1 Aluminum Alloy

ASTM B221M ASTM B221 equivalent in ultimate tensile, yield, and shear strengths to Alloy 6063-T5 or 6063-T6.

2.1.2 Carbon Steel

ASTM A1008/A1008M, cold rolled sheets, commercial bright finish.

2.1.3 Stainless Steel

No 4 satin finish including welds and fabricated surfaces. Provide Type 302, 304, or 316 alloy unless otherwise specified. Provide minimum thickness of 1.5 mm U.S. Standard 16 gage, except 1.8 mm thick 14 gage for working surface.

2.1.4 Safety Glass

ASTM C1048, fully tempered "FT," clear.

2.1.5 Casework Components

Conform with Section 12 35 70 HEALTHCARE CASEWORK for base cabinets, counter tops, service fittings and finishes.

2.1.6 High Efficiency Particulate Air (HEPA) Filter

Meet requirements of UL 586.

2.1.7 Fumehood Design

Design, calculate face velocities, and test fume hoods in accordance with ACGIH-2097, Laboratory fume hoods, auxiliary systems, and associated equipment shall meet the requirements of NFPA 70 and NFPA 45.

2.1.8 Hood Static Pressure Loss

****

NOTE: For determining the system total static pressure loss for sizing blowers, use the hood maximum static pressure loss when operating at 46 mpm 150 fpm face velocity; allow 50 mm 2 inch water gage loss for dirty HEPA filter and 25 mm one inch water gage additional loss for a downstream charcoal filter or a prefilter (or the filter manufacturer's recommended resistance at the rated cfm of exhaust air).

****

With the sash in full-open position the static pressure loss through the fumehood shall not exceed 13 mm 1/2 inch water gage when operating at 23 mpm 75 feet per minute (fpm), 22 mm 7/8 inch water gage at 30 mpm 100 fpm, 29 mm 1.125 inch water gage at 38 mpm 125 fpm. For hoods equipped with bypass, the static pressure loss and exhaust volume shall remain relatively constant (within 5 percent) regardless of sash position.

2.1.9 Electrical Devices

Prewired at the factory to a common, integral junction box to provide easy exterior connection and disconnection.

2.2 UNITS

2.2.1 Unit [_____], [_____]

2.2.1.1 Base Cabinet Portion of Assembly

[_____].

2.2.1.2 Hood Interior

[_____].

2.2.1.3 Sash

[_____].

2.2.2 Fumehood Assembly, Constant Volume

****
NOTE: Provide packaged heater assembly for tempering cold outside air when auxiliary air type hoods are specified.
****

Constant volume, [auxiliary air] [bypass/airfoil] configuration, enclosed unit mounted on base cabinet; exterior dimensions maximum 1245 mm wide (across face) by 750 mm deep (front to back by 2400 mm high 49 inches wide (across face) by 30 inches deep (front to back) by 96 inches high; interior working area at least 900 mm wide by 600 mm deep by 1195 mm high 36 inches wide 24 inches deep by 47 inches high.

2.2.2.1 Base Cabinet Portion of Assembly

Carbon steel, modified to have recessed apron to contain electrical convenience outlets.

2.2.2.2 Hood Interior, Including Working Surface

Type 304 stainless steel, with interior vertical joints and intersections of vertical surface with working surface having an approximate 20 mm 3/4 inch radius. Provide working surface with a raised rim around all sides to prevent spillage from running out face of hood.

2.2.2.3 Sash

Safety glass, 5.6 mm 7/32 inch minimum thickness, counterbalanced, vertical sliding type, Type 304 stainless steel frame.

2.2.2.4 Baffle

Adjustable, with moving parts resistant to corrosion, removable for cleaning.

2.2.2.5 Lighting Fixtures

[Explosion proof] [Vapor proof], fluorescent, with cool white lamps and switch, providing 800 lux 75 foot candles on working area. Locate switch for fixture on exterior of hood frame, or in recess of base cabinet. Provide sealed safety glass window barrier between interior working and fixture spaces, and access for tube replacement exterior to hood interior working area.

2.2.2.6 Service Fixtures

Provide remote controls for piped services and locate on hood exterior frame. Provide serrated supply ends with nozzles arranged close to sash,

precluding the need of reaching to interior back of hood to make connections to outlets. Base metal of fixtures shall be brass. Protect metal fixtures inside hood with chemical resistant coating of [clear plastic over polished chrome plate] [or] [_____].

a. Cold water: Remote controlled valve, with vacuum breaker; hood wall mounted gooseneck faucet with serrated nozzle. Arrange faucet parallel to hood wall and over cup sink.

b. Gas, air and vacuum: Provide fixtures for each service, each fitting with remote controlled valve and supply end (inside hood) consisting of a serrated hose nozzle and escutcheon trim. Provide natural gas, air at 685 kPa 85 psig, and vacuum at 750 mm 30 inches of HG.

c. Acid waste: Recessed cup sink, 75 by 150 mm 3 by 6 inches or 75 by 225 mm 3 by 9 inches, fabricated of Type 316 stainless steel, 2 liter capacity. Furnish with acid waste p-trap and locate under water faucet, integral with countertop. Provide acid vent.

d. Electrical convenience outlets: Two duplex, grounded, three-wire, 125 volt, 60 Hz, single phase [and one 240 volt single phase], 20 ampere. Locate in recessed area of base cabinet or on side posts of hood. Provide stainless steel or chrome-plated cover plate. [Provide 15 ampere circuit breaker protection.]

2.2.2.7 Blower Switch

****

NOTE: Coordinate switch requirements with specifications for the blowers for fume hoods. Fans requiring switches not discussed in the paragraph cited above (e.g., greater than one horsepower or 208-volt) shall have a single pole switch with an indicator light.

****

[Single-pole, 115-volt] [Double-pole, 208-volt], 60-Hz, with pilot light. Locate switch in hood frame or in recess of base cabinet.

2.2.2.8 Duct Stub

****

NOTE: Verify that ductwork to hoods is discussed in the appropriate documents and that blowers for the hoods are located at exhaust end. Avoid positive pressure in ducts.

****

Collar size suitable for ductwork indicated. Finish of areas that may come in direct contact with fumes shall be same material and finish as hood interior.

2.2.3 Radio Isotope Fumehood With Vent

Enclosed, isotope-type hood mounted on base cabinet of [auxiliary air] [bypass/airfoil] configuration. Maximum exterior dimensions: 900 mm wide (across face) by 750 mm deep (front to back) by 2400 mm high (including base) 36 inches wide (across face) by 30 inches deep (front to back) by 96 inches high (including base). Minimum interior working area: 750 by 600

mm deep by 1170 mm high 30 by 24 inches deep by 46 inches high.

2.2.3.1 Base Cabinet Portion of Assembly

Carbon steel comparable to a sink cupboard section, modified to have recessed apron to contain electrical convenience outlets.

2.2.3.2 Hood Interior, Including Working Surface

Type 304 stainless steel, with interior vertical joints and intersections of vertical surface with working surface having an approximate 20 mm 3/4 inch radius. Working surface shall have a raised rim all around to prevent spillage from running out face of hood.

2.2.3.3 Sash

****

NOTE: Several materials are available for sash. Clear safety glass is acceptable where minimum storage of materials allows use of lead bricks as a front barrier. Leaded safety glass provides excellent protection but scratches easily. Bulletproof glass and various plastics have good resistance to certain levels of radiation.

****

[Safety glass] [Leaded (equivalent to [_____] mm inch lead protection) safety glass] [_____], vertical sliding type, counterbalanced.

2.2.3.4 Lead Lining

Concealed, [_____] mm inch[es] thick. Provide with lapped seams, protecting areas adjacent to the three enclosed vertical sides of the hood [and the area below working surface of hood]. Lap sash area and intersections with adjacent surfaces at least 10 mm 3/8 inch.

2.2.3.5 Baffle

Adjustable with moving parts resistant to corrosion, removable for cleaning.

2.2.3.6 Lighting Fixture

Vapor proof, fluorescent, with cool white lamps and switch, providing 800 lux 75 foot candles on working area. Locate switch for fixture on exterior front of hood, or in recess of base cabinet.

2.2.3.7 Mirror

****

NOTE: Mirror is for view behind lead brick barrier. Clear safety glass is acceptable where minimum storage of materials allows use of lead bricks as a front barrier. Leaded safety glass provides excellent protection but scratches easily. Bulletproof glass and various plastics have good resistance to certain levels of radiation. It may be desirable for any sash finish. Delete if special equipment must be attached to back interior.

****

Fully framed, fully adjustable, and suitably backed to prevent fume damage to silvering.

2.2.3.8 Service Fixtures

Locate remote controls for piped services on hood exterior and provide serrated supply ends with nozzles arranged close to sash, precluding the need of reaching to interior back of hood to make connections to outlets. Base metal of fixtures shall be brass. Protect metal fittings inside hood with chemical resistant coating of [clear plastic over polished chrome plate] [or] [_____].

a. Cold water: Remote controlled valve with vacuum breaker; hood wall mounted gooseneck faucet with serrated nozzle. Arrange faucet parallel to hood wall.

b. Natural gas and vacuum: Provide fixtures for each service, each fitting with remote controlled valve. Supply end (inside hood) consisting of a serrated hose nozzle and escutcheon trim. Provide natural gas and vacuum 750 mm HG 30 inches HG.

c. Acid waste: Recessed cup sink, 750 by 150 or 75 by 225 mm 3 by 6 or 3 by 9 inches, fabricated of Type 316 stainless steel, 2 liter capacity. Furnish with acid waste p-trap and locate under water faucet, integral with countertop. Provide acid vent.

d. Electrical convenience outlet: Two polarized duplex, grounded, three-wire, 125 volt, 60 Hz, single phase [and one 240 volt single phase], 20 ampere. Locate in recessed area of base cabinet or on side posts of hood. Provide stainless steel or chrome-plated cover plate. [Provide 15 ampere circuit breaker protection.]

2.2.3.9 Blower Switch

****

NOTE: Coordinate switch requirements with specifications for the blowers for fume hoods. Fans requiring switches not discussed in the paragraphs cited above (e.g., greater than one horsepower or 208-volt) shall have a single pole switch with an indicator light.

****

[Single-pole, 115-volt] [Double-pole, 208-volt], 60-Hz, with pilot light. Locate switch in hood frame or in recess of base cabinet.

2.2.3.10 Duct Stub

****

NOTE: Verify that ductwork to hoods is discussed in the appropriate documents and that blowers for the hoods are located at exhaust end. Avoid positive pressure in ducts.

****

Collar size suitable for ductwork indicated. Material of collar same as hood interior or metal coated with epoxy having corrosion resistance

comparable to finish on fittings in hood.

2.2.3.11 Replaceable Filter

[HEPA, efficiency [_____] percent] [and] [prefilter] [activated charcoal filter]; with stainless steel filter housing. HEPA filter static pressure loss shall not exceed 249 pascals one inch water gage when clean and operated at the rated airflow capacity.

2.2.3.12 Warning System

Ensure detection and alarm for insufficient air velocities caused by failure of supply or exhaust system or by dirty filter. [Provide static pressure sensing switch in exhaust duct to shut off auxiliary air blower when failure occurs].

2.2.4 Biological Safety Cabinet

Suitable for biological work and protecting the user from airborne infectious agents and similar hazardous particulate matter by providing an inward flow of air while preventing hazardous discharge into ambient atmosphere. Hood must meet the requirements for CDC 21-1112, and have overall approximate dimensions of 1800 mm wide (across front) by 790 mm deep (front to back) by 2160 high 72 inches wide (across front) by 31 inches deep (front to back) by 85 inches high.

2.2.4.1 Glove Panel

Removable, with two pairs of combination gloves, hand sections of surgical rubber, detachable from neoprene sleeves. Provide with built-in tubes connectable to air supply and appropriate "O" rings and clamps. Glove assembly removable, providing access into hood for bare-hand work. Hood shall meet the requirements for general purpose fume hoods of ACGIH-2097, when operated with glove panel removed.

2.2.4.2 Light Fixture[s]

Fluorescent, prewired, with cool white bulbs, with switch hood-mounted exterior to working area. [Ultraviolet, germicidal, prewired, single tube, with separate switch hood-mounted exterior to working area].

2.2.4.3 Service Fittings

Locate remote controls for piped services on hood exterior; provide serrated supply end. Base metal of fixtures shall be brass. Protect metal fixtures inside hood with [chemical resistant coating of clear plastic over polished chrome plate] [or] [_____].

a. Natural gas, air at 685 kPa 85 psig minimum, and vacuum at 750 mm 30 inches HG.

b. Cold water: Remote controlled valve with vacuum breaker; hood-wall mounted gooseneck faucet with serrated nozzle. Arrange faucet parallel to hood wall.

c. Sink and drain: 300 mm long by 150 mm wide by 50 mm deep 12 inches long by 6 inches wide by 2 inches deep; minimum of 1.25 mm 0.050 inch thick stainless steel, welded into surface of cabinet, corners coved to not less than 6 mm 1/4 inchradius. Provide with stainless steel

strainer; drain plug; and 38 mm 1 1/2 inch borosilicate glass non-syphon P-Trap, with compression joints and bottom clean-out fitting.

d. Electrical convenience outlets: Two polarized duplex, grounded, three-wire, 125 volt, 60-Hz., single phase [and one 240 volt single phase], 20 ampere. Locate on exterior of hood front or on hood side walls near hood front. Include stainless steel or chrome-plated cover plate. [Provide 15 ampere circuit breaker.]

2.2.4.4 Viewing Panel

Safety glass, 5.56 mm 7/32 inch minimum thickness.

2.2.4.5 Blower Switch

****
NOTE: Coordinate switch requirements with specifications for the blowers for fume hoods. Fans requiring switches not discussed in the paragraphs cited above (e.g., greater than 750 watt one horsepower or 208 volt) shall have a single pole switch with an indicator light.
****

[Single-pole, 115 volt] [Double-pole, 208 volt], 60 Hz, with pilot light. Include galvanized switch box and chrome-plated metal switch cover plate. Locate switch on hood exterior.

2.2.4.6 Duct Stub

****
NOTE: Verify that ductwork to hoods is discussed in the appropriate documents and that blowers for the hoods are located at exhaust end. Avoid positive pressure in ducts.
****

Collar size suitable for ductwork indicated. Finish of areas that may come in direct contact with fumes to be same as to hood interior.

2.2.4.7 Intake and Exhaust Filters

Replaceable HEPA filters having a minimum efficiency rating of 99.97 percent, including stainless steel housing. HEPA filter static pressure loss shall not exceed one inch water gage when clean and operated at the rated airflow capacity.

2.2.4.8 Warning System

Ensure detection and alarm for insufficient air velocities caused by failure of exhaust system or by dirty filters.

PART 3 EXECUTION

3.1 INSTALLATION

Install units at locations indicated. Conform to installation provisions of Section 11 70 00 GENERAL REQUIREMENTS FOR MEDICAL AND DENTAL EQUIPMENT

[and utility installation provisions of] [Section 23 11 20 FACILITY GAS PIPING;] [Section 33 51 15 NATURAL-GAS / LIQUID PETROLEUM GAS DISTRIBUTION PIPELINES;] [Section 22 00 00 PLUMBING SYSTEMS;] [Section 22 60 70 GAS AND VACUUM SYSTEMS FOR HEALTHCARE FACILITIES] [and] the ACGIH-2097 including provision for an adequate supply of tempered make-up air to meet the air flow requirements of fume hood(s). Provide interlocks for controls and alarms to maintain the required air balance between hood interiors and the room.

3.2 POSTED OPERATING INSTRUCTIONS

Provide in accordance with the requirements in Section 23 03 00.00 20 BASIC MECHANICAL MATERIALS AND METHODS.

3.3 FIELD QUALITY CONTROL

3.3.1 Inspection

Examine each unit for visual defects, operation and conformance to specifications.

3.3.2 Tests

Test each unit to ensure that the equipment is operational and conforms to specification requirements. Field tests for fume hood operation and performance shall meet the requirements of ACGIH-2097.

-- End of Section --