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SPECIFICATION DIVISION 11

NUMBER SECTION DESCRIPTION

DIVISION 11 EQUIPMENT

SECTION 115313 - LABORATORY FUME HOODS

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SUBSTANTIAL REVISIONS INCORPORATED INTO THIS SECTION - MAY 9, 2011, BY LAB SUSTAINABILITY TEAM AND A&E ARCHITECTURAL DEPARTMENT.

REVISED NOV. 8, 2013 TO REFLECT NEW ANSI Z9.5 2012 VERSION AND TO SPECIFY THE MINIMUM HOOD AIR FLOW RATE TO BE 375 ACH. D. KARLE, PER LAB SUSTAINABILITY TEAM.

DIVISION 11 EQUIPMENT
SECTION 115313 - LABORATORY FUME HOODS

CONSULT WITH MECHANICAL ENGINEER TO DETERMINE APPROPRIATE TYPE OF FUME HOOD AND VENTILATION REQUIREMENTS. SECTION 115313 "LABORATORY FUME HOODS" AND SECTION 230920 LABORATORY TERMINAL AIRFLOW UNITS AND CONTROLS MUST BE COORDINATED WITH EACH OTHER. SEE U-M DESIGN GUIDELINE 230920 FOR ADDITIONAL INFORMATION REGARDING HOODS AND LAB DESIGN. INVOLVE OSEH EARLY IN THE PLANNING OF PROJECTS WHICH WILL UTILIZE FUME HOODS.

THIS SPECIFICATION COVERS BENCH TOP STYLE HOODS. FLOOR MOUNTED (SOMETIMES REFERRED TO AS "WALK-IN" HOODS) REQUIRE SPECIAL CONSIDERATIONS AND ARE NOT SPECIFIED BELOW. SEE THE U-M LAB VENTILATION DESIGN GUIDELINE FOR REQUIREMENTS FOR FLOOR MOUNTED WALK IN HOODS.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including Standard General Conditions, Supplemental General Conditions, Division 01 Specification Sections, and other applicable Specification Sections, apply to this Section.
- B. Related Sections:
 - 1. Division 01 Sections "Project Commissioning for Small Projects" and "Full Project Commissioning".
 - 2. Division 12 Section: "Laboratory Casework".
 - 3. Division 22 Section: Basic Piping Materials and Methods
 - 4. Division 22 Section: Mechanical Identification
 - 5. Division 23 Section: Laboratory Terminal Airflow Units and Controls
 - 6. Division 23 Section: Laboratory Airflow Controls-DDC
 - 7. Division 26 Section: Electrical

1.2 SUMMARY

- A. Section Includes

ADD FULL BYPASS CONSTANT VOLUME TYPE IF INCLUDED ON YOUR PROJECT. FULL BYPASS CONSTANT VOLUME HOODS ARE NOT TYPICALLY USED AT U-M AND ARE THUS NOT SPECIFIED IN THIS SPECIFICATION (ALTHOUGH THEY ARE DEFINED IN THE "DEFINITIONS" SECTION, FURTHER BELOW).

- 1. Chemical Fume Hoods of the following types:
 - a. Partial Bypass Constant Volume
 - b. Restricted Bypass Variable Volume
 - c. Reduced Face Velocity (RFV)
- 2. Fume Hood Understructures (base units, flammable and acid storage cabinets)
- 3. Fume Hood Plumbing Accessories
- 4. Fume Hood Electrical Accessories

1.3 SUBMITTALS

- A. Samples: Submit samples of exterior finish colors and interior liner material for Architect's initial selection.
- B. Shop Drawings: Submit shop drawings for fume hoods showing plans, elevations, ends, cross-sections, service run spaces, location and type of service fixtures; details and location of anchorages and fitting to floors, walls, and base; layout of units with relation to surrounding walls, doors, windows, and other building components; connection to hood exhaust system; location of access doors.
 - 1. Coordinate shop drawings with other work involved.
 - 2. Provide roughing-in drawings for mechanical and electrical services, including location of cut-off valves and junction boxes, where pre-plumbed or pre-wired units are required.
 - 3. Quantify net free area of fume hood opening with Sash Height in fully open position and at sash stop height.
 - 4. Provide static pressure drop at 100 fpm face velocity with fume hood sash in full open position.
- C. Certification of Performance As Manufactured: Provide for each hood type and size indicating hood meets or exceeds the ASHRAE 110 As Manufactured (AM) requirements specified in Part 2.
- D. Certification of Performance, Field: Provide certification of performance signed by Installer, verifying that each unit has been field tested in accordance with the provisions of Part 3 "Field Quality Control" article, and is operating in compliance with specified requirements.
- E. Shipping, handling, and storage instructions.
- F. Installation and start-up instructions.
- G. Project specific maintenance and operating data, and recommended spare parts list.

1.4 QUALITY ASSURANCE

- A. Manufacturers and Products: The products and manufacturers specified in this Section establish the standard of quality for the Work. Subject to compliance with all requirements, provide specified products from the manufacturers named in Part 2.

USUALLY RETAIN BELOW - DELETE/REVISE ONLY IF FUME HOOD BASE CABINETS DO NOT NEED TO MATCH ADJACENT LAB BENCH BASE CABINETS, OR FOR OTHER CIRCUMSTANCES.

- B. Laboratory fume hoods, casework, tops, sinks, service fixtures, and related furniture shall be provided by the same distributor who shall be fully responsible for coordinating all such components. All fume hoods shall be supplied from the same hood manufacturer.
 - 1. For projects using both RFV and standard fume hoods, fume hoods from a maximum of two manufacturers may be provided.
- C. Reference Standards: Products in this section shall be built, tested, and installed in compliance with the following quality assurance standards; latest editions, unless noted otherwise:

1. Comply with provisions of Michigan Building Code .
2. Scientific Equipment and Furniture Association, SEFA 1 Laboratory Fume Hoods.
3. Scientific Equipment and Furniture Association, SEFA 8 Laboratory Furniture, Casework, Shelving and Tables.
4. Scientific Equipment and Furniture Association, SEFA 2.3 Installation of Scientific Laboratory Furniture and Equipment.
5. Underwriters Laboratories, UL 1805 Laboratory Hoods and Cabinets.
6. American Society of Heating, Refrigeration and Air-conditioning Engineers, ANSI/ASHRAE 110-1995 Method of Testing Performance of Laboratory Fume Hoods.
7. ANSI/AIHA Z9.5-2012 Laboratory Ventilation.
8. National Fire Protection Association NFPA 45 Flammable and Combustible Liquids Code 2004.

1.5 DEFINITIONS

A. Hood- Full Bypass Constant Volume Type

1. With the sash at sash stop height, the air flowing through the bypass and the air flowing through the Working Area are essentially equal in volume (the free area of the bypass and the free area of the Working Area are essentially the same).
2. With the sash at any other position, including fully opened or fully closed, the total air volume (bypass + Working Area) entering the hood remains essentially unchanged. The face velocity through the Working Area remains constant, regardless of sash position.

B. Hood-Partial Bypass Constant Volume Hood

1. With the sash at sash stop height, the air flowing through the bypass is essentially zero.
2. With the sash at any position between sash stop height and fully closed, the bypass opens in proportion to the sash closing, such that the face velocity through the Working Area remains essentially constant.
3. With the sash at any position between sash stop height and fully open, the air volume exiting the hood remains unchanged, therefore as the sash is opened the face velocity through the Working Area decreases proportionally with the sash position. When the sash is fully open, the face velocity through the Working Area is approximately half what it was when the sash was at sash stop height (assuming a typical maximum Sash Height of approximately 28").

C. Hood- Restricted Bypass Variable Volume Hood

1. Regardless of sash position, the face velocity through the Working Area remains constant. The air flowing through the bypass is only enough such that the hood maintains the minimum air change rate when the sash is fully closed. Thus "restricted bypass" means there is nearly zero bypass.

- D. **Sash Height:** The distance from the bottom of the sash to the working surface of the hood. Not from the bottom of the sash to the top of the airfoil vane(unless the top of the air foil vane and the top of the working surface are at the same height).
- E. **Working Area:** The area bounded by the Sash Height and the net width of the hood opening.

1.6 DELIVERY, STORAGE, AND HANDLING

ADD BELOW IF LABORATORY CASEWORK SECTION INCLUDED

- A. Coordinate delivery of fume hood with delivery of other laboratory casework components.
- B. Protect finished surfaces from soiling and damage during handling and installation. Keep covered with polyethylene film or other protective covering.

1.7 WARRANTY

- A. Provide a complete parts and labor warranty for a minimum of 1 year from the date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Chemical fume hoods, all types except Reduced Face Velocity type:
 - 1. Air Master; Air master Systems Corp.
 - 2. BMC
 - 3. Hamilton Scientific
 - 4. Kewaunee Scientific Corp.
 - 5. Mott Manufacturing, Ltd.
 - 6. Labconco Corp.
- B. Reduced Face Velocity type chemical fume hoods (bench top models only):
 - 1. Labconco Protector Xstream
 - 2. Kewaunee Supreme Air LV

2.2 FUME HOODS, GENERAL

- A. Provide UL 1805 labeled fume hoods that provide proper exhaust volume and operate in a safe, efficient manner, within the tolerances for face velocities specified. Dead air pockets and reverse air currents shall not occur along the surface of hood interiors.
- B. Static Pressure Drop: Maximum of 0.35" (WG) at 100 FPM face velocity with fume hood sash in full open position.

THE MINIMUM 375 AIR CHANGE RATE PER HOUR SPECIFIED BELOW MAY NOT BE ADEQUATE TO PREVENT A HAZARD IF FLAMMABLE LIQUIDS, VAPORS, OR GASES WILL EXIST ALONG WITH AN IGNITION SOURCE, OR

BECAUSE OF OTHER CONCERNS OUTLINED IN Z9.5. WHEN IN DOUBT EVALUATE THE HAZARD WITH U-M OSEH, AND ADJUST ACCORDINGLY.

- C. Hood minimum air flow rate (any sash position): Sufficient to prevent hazardous concentrations of contaminants within the hood and in compliance with ANSI Z9.5-2012, no less than 375 hood air changes per hour.
- D. Splay or radius the top and sides of the face opening with configuration proven to provide an aerodynamic section to ensure smooth, even flow of air into hood.
- E. Provide air foil vane at work surface. Air foil vane shall not be mounted more than 3" above the hood working surface. Air foil vane shall prevent backflow of air and shall direct positive flow of air across work surface.
- F. Control System Components: Coordinate with Related Section "Laboratory Terminal Airflow Units and Controls" and "Laboratory Airflow Controls-DDC". Provide cutout in side of sash opening for the fume hood monitor to allow it to be flush or surface mounted, as required for the project. Also make provisions to allow mounting of sash sensors, sash alarm, and other devices provided by Related Section.

ALWAYS INCLUDE THE REQUIRED HOOD PERFORMANCE CRITERIA. THE PERFORMANCE CRITERIA BELOW IS TYPICALLY ADEQUATE FOR U-M LABS. HOODS INVOLVING HIGHLY TOXIC CHEMICALS, HIGH PRODUCTION VOLUMES, HIGH-HAZARD RADIOACTIVE MATERIALS, OR OTHER UNIQUE CIRCUMSTANCES MAY REQUIRE MORE STRINGENT CRITERIA. U-M OSEH SHOULD BE CONSULTED IN SUCH CASES.

FIELD "AS INSTALLED" (AI) TESTING MAY BE APPROPRIATE IN SOME CASES. IF REQUIRED, REVISE BELOW IF NECESSARY AND CORRESPONDING PART 3 PARAGRAPH.

2.3 HOOD PERFORMANCE CRITERIA

- A. Chemical fume hoods shall meet or exceed the following ASHRAE 110 As Manufactured (AM) performance criteria. Performance criteria shall be met with the sash raised to the height of the sash stop (unless noted otherwise), and at any face velocity within +/- 10 FPM of the average face velocity indicated.
 - 1. All Hood Types shall pass the Local Flow Visualization and Large Volume Visualization challenges.
 - 2. Chemical fume hoods except Reduced Face Velocity (RFV) type shall be tested at 100 FPM average face velocity. Tracer gas concentrations, including Sash Movement Effect, shall not exceed 0.01 PPM at 4 LPM tracer gas release rate (4AM0.01 and 4SME-AM0.01). VAV Hoods shall also achieve this performance at the full open sash position.

3. Chemical fume hoods RFV type shall be tested at 60 FPM average face velocity. Tracer gas concentrations, including Sash Movement Effect, shall not exceed 0.01 PPM at 6 LPM tracer gas release rate (6AM0.01 and 6SME-AM0.01). The vertical position of the detector port shall be located 12" above the hood working surface during testing. All other detector positions (horizontal positions, distance from sash) shall match ASHRAE 110 requirements.
- B. The above performance criteria shall also be met when field ASHRAE 110 testing is specified.

SELECT ONE OR MORE OF THE FOLLOWING STANDARD HOOD TYPES, OR REVISE TO SUIT PROJECT. IF YOU HAVE A VARIETY OF LINING OR TOP TYPES IN YOUR PROJECT, BE SURE TO CAREFULLY INDICATE ON DRAWINGS WHAT MATERIALS BELONG IN WHICH HOODS

ALWAYS CONSULT WITH THE MECHANICAL ENGINEER AND U-M OSEH REGARDING THE APPROPRIATE HOOD TYPE TO SPECIFY. CLEARLY DELINEATE THE HOOD TYPES REQUIRED FOR THE PROJECT EITHER IN THIS SPECIFICATION OR ON THE DRAWINGS (PREFERRED).

CONSTANT VOLUME HOODS OF ANY TYPE ARE NOT SAFE WITH COMBINATION SASH ARRANGEMENTS BECAUSE CORRECT FACE VELOCITY CAN'T BE ASSURED AS THE HORIZONTAL SASH IS ADJUSTED. IF COMBINATION SASHES ARE REQUIRED, SPECIFY RESTRICTED BYPASS VAV HOODS, AND ASSURE THE MECHANICAL ENGINEER SPECIFIES A CORRESPONDING VAV TYPE LAB TERMINAL AIR FLOW UNIT.

FULL BYPASS CONSTANT VOLUME HOODS ARE NOT SPECIFIED BELOW AS THEY ARE NOT TYPICALLY USED AT U-M. IF YOUR PROJECT REQUIRES A HOOD OF THIS TYPE, ADD BELOW.

2.4 PARTIAL BY-PASS CONSTANT VOLUME CHEMICAL FUME HOOD

- A. Equip units with compensating by-pass above the sash which functions automatically as the vertical sash is operated, to provide air flow control as described in the Definitions article.
1. Provide vertical rising sashes only.

DEPENDING ON ROOM MINIMUM AIR CHANGE RATES, VAV HOODS MAY SAVE ENERGY. THEY SHOULD NOT BE INDISCRIMINATELY SPECIFIED UNLESS THE MECHANICAL ENGINEER HAS DONE AN ANALYSIS DETERMINING ENERGY SAVINGS WILL ACTUALLY OCCUR. AN EXCEPTION IS COMBINATION SASHES; IF THESE ARE REQUIRED, ALWAYS SPECIFY A VAV HOOD AND ASSURE THE MECHANICAL ENGINEER SPECIFIES A CORRESPONDING VAV TYPE LAB TERMINAL AIR FLOW UNIT.

IF YOUR PROJECT REQUIRES VAV HOODS, EDIT BELOW OR INDICATE ON A DRAWING SCHEDULE (PREFERRED) WHICH TYPE SASH IS REQUIRED: VERTICAL RISING OR COMBINATION.

2.5 RESTRICTED BYPASS, VARIABLE AIR VOLUME (VAV) CHEMICAL FUME HOOD

- A. Provide hoods specifically designed for VAV application which provide air flow control as described in the Definitions article.
 - 1. Provide vertical rising or combination sashes, as indicated.

RFV HOODS ARE RESTRICTED TO ONLY THE MODEL AND MFR. LISTED UNDER THE ARTICLE "APPROVED MANUFACTURERS". BY U-M OSEH RULING, RFV HOODS:

ARE LIMITED TO 6' MAXIMUM WIDTH. NOTE THE FOLLOWING FOR SPACE PLANNING. SEE FUME HOOD CUT SHEETS FOR MORE DETAILED INFORMATION:

8'-6" MINIMUM CEILING HEIGHT

OVERALL HOOD DEPTH IS GREATER THAN STANDARD.

ARE TO BE BALANCED TO PROVIDE 70 +/- 5 FPM AVERAGE FACE VELOCITY AND SHALL ALARM AT 60 FPM FACE VELOCITY. THIS AIR BALANCE INFORMATION MUST APPEAR IN THE MECHANICAL DOCUMENTS-COORDINATE WITH MECHANICAL ENGINEER.

IF YOUR PROJECT REQUIRES RFV HOODS, EDIT BELOW OR INDICATE ON A DRAWING SCHEDULE (PREFERRED):

WHICH TYPE SASH IS REQUIRED: VERTICAL RISING OR COMBINATION.

IF THE RFV HOODS ARE PARTIAL BYPASS CONSTANT VOLUME OR VAV TYPE.

2.6 REDUCED FACE VELOCITY CHEMICAL FUME HOOD

- A. Provide bench top type hoods specifically designed for reduced face velocity (RFV) operation of model and manufacturer listed under Acceptable Manufacturers, and which provide air flow control as described in the Definitions article.
 - 1. RFV hoods shall be partial bypass constant volume or VAV type, as indicated.
 - a. Provide vertical rising sash on constant volume type.
 - b. Provide vertical rising or combination sashes, as indicated, on VAV type.
 - 2. Maximum over-all hood depth: 36".

2.7 HOOD SUPERSTRUCTURE CONSTRUCTION

USUALLY RETAIN ALL FOLLOWING REQUIREMENTS

- A. General: Design hoods to be chemical and flame resistant, for collection, retention and disposal of hazardous fumes with complete safety, minimum expenditure of purging air from room supply, and minimum turbulence within chamber.
- B. Framework: Heavy-gage steel members, reinforced, braced and assembled to insure strength and rigidity.

- C. Body Construction: Superstructure shall have double wall construction. Exterior shall be of minimum 18 gage cold-rolled steel with component parts screwed together to allow removal of end panels, front end fascia pieces, top fascia and air foil strips, and to allow access to plumbing lines and service fixtures. Apply manufacturer's standard acid and alkali resistant baked-on or powder-coated finish to interior and exterior surface of component parts prior to final assembly.

SELECT COLOR

1. Color: Selected by Architect from manufacturer's standard range.
- D. Ends: Double-wall end panels (enclosing sash counter-balance weights and all utilities) without projecting corner posts or other obstructions to interfere with smooth, even flow of air.
- E. Rear Baffle: Provide non-adjustable baffle at rear of hood with openings located to purge the upper and lower area of the hood. Baffle is to be fabricated of the same material as the hood liner.

USUALLY SELECT ABOVE AND DELETE BELOW FOR TEACHING LABS (WHERE USERS ARE LESS LIKELY TO BE KNOWLEDGEABLE ABOUT FUME HOODS AND TO HAVE NEED FOR THE FLEXIBILITY OF ADJUSTABLE BAFFLES). FOR RESEARCH LABS AND LABS USED FOR CHEMICAL DISPENSING, SELECT BELOW AND DELETE ABOVE IN CONSULTATION WITH MECHANICAL ENGINEER AND OSEH.

- F. Rear Baffle: Provide baffle at rear of hood with manually adjustable openings at top and bottom to allow adjusted flow of air through hood to compensate for type of gas, apparatus, or heat source used. Fabricate unit to be easily removable for cleaning behind baffle, and of same material as hood lining.
- G. Plenum Chamber: Adequate volume for hood dimensions, extending full width of hoods to equalize incoming air flow, of same material as hood lining. Provide corrosion resistant duct stub of proper dimension for connection to exhaust duct assembly.
- H. By-Pass Grilles: When air is required to be taken from room other than through hood sash opening, provide suitable by-pass grilles having required free opening but concealing plenum behind.
- I. Sash: Provide an operable sash fabricated with minimum 18 gage steel four-sided frame with corners welded and ground smooth. Glaze with laminated safety glass set into chemical resistant rubber glazing channels, held in place with removable stops. Sash lifting system (cable or chain) shall hold sash at any position without creep and prevent sash drop in the event of a cable failure. Sash and counter balance mechanism design shall be life cycle tested to withstand a minimum of 100,000 full travel cycles without signs of fatigue.

14" IS THE STANDARD SASH HEIGHT AT U-M AND RARELY IF EVER SHOULD BE CHANGED. SEE U-M DESIGN GUIDELINE 230920 FOR ADDITIONAL INFORMATION. THE DESCRIPTION BELOW FOR SASH STOP LOCATION WHEN VANES ARE LOCATED MORE THAN 2" ABOVE THE HOOD WORKING SURFACE IS NECESSARY TO ACCOMMODATE CERTAIN HOOD MFR.S.

1. Sash Stops: Install integral sash stops on fume hoods 14 inches above the hood working surface. For hoods with air foil vanes located more than 2" above the hood working surface, locate sash stop 12" above top of vane.
 - a. Example- The vane is located 3" above the working surface: sash stop to be 12" above vane, 15" above working surface.
 - b. The stops shall be of the type that can be temporarily bypassed to allow the sash to be raised to the full open position for equipment/experiment set-up and removal.
2. Vertical Rising Sash: Provide sliding single-hung, full-view sash.

SELECT ABOVE OR BELOW OR BOTH IF BOTH TYPES OF SASH ARE REQUIRED. IF BOTH, INDICATE THE SASH TYPE REQUIRED AT EACH SPECIFIC HOOD LOCATION. CAREFULLY REVIEW ADDITIONAL SPEC EDITORS NOTES AT ARTICLES 2.3, 2.4 AND 2.5 BEFORE SELECTING SASH TYPES. VERTICAL SASH HAS LESS EXPENSIVE FIRST COST AND ARE PREFERRED BY U-M OSEH AND PLANT. COMBINATION SASH PROVIDES ADDITIONAL FLEXIBILITY FOR USERS BUT REQUIRES THAT MORE EXPENSIVE VAV FUME HOODS AND VAV CONTROLS BE SPECIFIED AS WELL.

3. Combination Sash: Provide sliding single-hung sash with dual-track system at top and bottom of glazing opening for individual, horizontally sliding safety glass panes.

MODIFY PARAGRAPH BELOW IF DIFFERENT CONFIGURATION IS DESIRED.

- a. Panel Arrangement: Provide sash with 4 individual sliding glass panes.
4. Counterbalance vertical sliding sash with sash weight and cable/chain system. Provide stainless steel or monel metal cable/chain, ball-bearing sheaves/sprockets, plastic glides in stainless steel guides, and stainless steel lift handles. Provide rubber bumpers at top and bottom of each sash unit.
5. Safety Glazing: Two sheets of double strength "B" quality, clear sheet glass permanently laminated with a sheet of clear, plasticized polyvinyl butyl.

- J. Closure Strips: Wood or metal, as required to matching adjoining materials and finishes. Provide where required to close openings between fume hood base cabinet and superstructure and adjacent building wall construction.

INCLUDE BELOW FOR IMPROVED APPEARANCE WITH SUSPENDED CEILINGS. USUALLY NOT APPROPRIATE FOR USE IN ROOMS WITHOUT SUSPENDED CEILINGS

- K. Enclosure Panels: Provide removable metal panels matching hood superstructure. Enclose area from top of hood to underside of suspended ceiling unless indicated otherwise.
- L. Holes: Provide holes for passage of piping and conduit and for fixtures furnished in this Section or under Related Sections.
- M. Fasteners: Provide stainless steel fasteners wherever exposed to fumes in hood.

2.8 INTERIOR LINER PANELS AND WORKING SURFACE

USUALLY RETAIN BELOW LINER PANEL PARAGRAPH; MODIFY IN THE RARE CASE WHERE ONLY STAINLESS STEEL INTERIORS ARE REQUIRED, OR IF EPOXY RESIN LINER IS REQUIRED. AT THIS TIME ONLY KEWAUNEE AND MOTT OFFER EPOXY RESIN LINER AS AN OPTION.

- A. Liner Panels: Interior lining shall be flush, cut to fit size of hood interior and securely held in place with fasteners. Provide back baffles of the same material as liner panels. Fabricate liner panels with cut-outs in hood side panels to provide access to plumbing lines and to receive service fixtures at side of hood, as indicated. Furnish removable plug buttons for holes not used for indicated fixtures. Liner material shall be as follows:

EPOXY RESIN ALSO AVAILABLE FROM SOME MANUFACTURERS. PROVIDES INCREASED HEAT AND CHEMICAL RESISTANCE. USE CAUTION WHEN SPECIFYING. TYPICAL THICKNESS IS 1/4" - EPOXY RESIN AT THIS THICKNESS IS SUSCEPTIBLE TO DAMAGE DURING SHIPPING.

GLASS FIBER REINFORCED EPOXY RESIN AND CELLULOSE FIBER REINFORCED PHENOLIC RESIN IS ALSO AVAILABLE FROM SOME MANUFACTURERS WHICH ALSO PROVIDES INCREASED CHEMICAL RESISTANCE WITHOUT THE ISSUES OF BREAKAGE FOR EPOXY RESIN. VERIFY AVAILABILITY PRIOR TO SPECIFYING.

1. Glass Reinforced Polyester: 1/4-inch thick, press-molded, heat-converted, catalyzed glass reinforced polyester sheet. Color: Manufacturer's standard white.

ALWAYS INCLUDE BELOW.

2. Liner shall have a flame spread rating of 25 or less when tested in accordance with ASTM E-84.

INCLUDE BELOW FOR STANDARD BLACK EPOXY RESIN WORKING SURFACE IN HOOD.

- B. Epoxy Resin Working Surface: 1-1/4-inch thick, dished to retain spillage.

1. Conform to specifications for epoxy resin top material properties outlined in Division 12 Section "Laboratory Casework".

IF RESIN TOPS ARE NOT SPECIFIED IN LAB CASEWORK SECTION: DELETE PARAGRAPH ABOVE AND RETAIN TWO PARAGRAPHS BELOW

2. Color: Black.

IF RESIN TOPS ARE SPECIFIED IN LAB CASEWORK SECTION: RETAIN TWO PARAGRAPHS ABOVE AND DELETE PARAGRAPH BELOW.

3. Physical Properties: Flexural strength - 4000 psi; compressive strength - 14,000 psi; hardness, Rockwell M-197; water absorption in 24 hours - 0.05%; heat distortion point - 400 deg. F; resistant to thermal shock.
 - a. Workmanship: Cast surfaces very smooth, with factory cut-outs for sinks, drip grooves, and service fixtures. Plain butt type joints assembled with epoxy adhesive.

RETAIN BELOW FOR ISOTOPE-TYPE STAINLESS STEEL INTERIORS AND PERCHLORIC ACID HOODS. NOTE THAT MOST LOW-LEVEL RADIOISOTOPE WORK CAN BE CARRIED OUT IN REGULAR FUME HOODS. THEREFORE, IF RADIOISOTOPES ARE TO BE USED, CONSULT WITH OSEH TO DETERMINE WHICH TYPE OF HOOD TO SPECIFY.

PERCHLORIC ACID HOODS ALSO REQUIRE A WASH-DOWN SYSTEM FOR THE HOOD, EXHAUST DUCTWORK, AND EXHAUST FAN.

MODIFY LANGUAGE IN PARAGRAPH BELOW (I.E., CHANGE "RADIOISOTOPE" TO "PERCHLORIC" OR DELETE REFERENCE TO RADIOISOTOPE FOR NON-ISOTOPE HOODS).

- C. Radioisotope (RI) Type Stainless Steel Liner and Work Surface: For applications where highly radioactive materials will be used with lead brick shielding, furnish seamless welded construction of the work surface with intersecting rear and interior end panels, and as follows:
 - 1. Stainless Steel Lining: Radius corners, weld, grind smooth and polish to eliminate cracks and crevices.
 - a. Punch hood side panels to receive remote controls and service fixtures at side of hood, as indicated. Furnish removable plug buttons for holes not used for indicated fixtures.
 - b. Interior corners: 1/2 inch radius, seamless, coved.
 - c. Stainless steel: 16 gage, AISI Type 302/304, with no. 4 finish.
 - 2. Stainless Steel Working Surface: 14 gage, AISI Type 302/304, with no. 4 finish and 1/2 inch high raised "marine edge" around perimeter to retain spillage.

RETAIN THE FOLLOWING IF CUPSINK WILL BE INCLUDED IN STAINLESS STEEL TOP.

- a. Integrally weld stainless steel cupsinks to stainless steel work surfaces. Also see Plumbing Accessories article, below.

FOLLOWING REQUIREMENT PROVIDES SUFFICIENT LOAD CAPACITY FOR MOST LEAD BRICK SHIELDING ARRANGEMENTS - USUALLY RETAIN

- b. Reinforce to provide min. 200 lbs. per sq. ft. load capacity.

SELECT EITHER METAL OR WOOD UNDERSTRUCTURES FROM BELOW

2.9 FUME HOOD UNDERSTRUCTURES

- A. Products: Subject to compliance with indicated requirements, provide products manufactured by one of the following:
 - 1. Metal Units:
 - a. Airmaster; Airmaster Systems Corp.
 - b. BMC
 - c. Kewaunee Scientific Equipment Corp.
 - d. Mott Manufacturing
 - e. Thermo Scientific: Hamilton Laboratory Furniture and Fume Hoods
 - 2. Wood Units:

- a. Kewaunee Scientific Equipment Corp.
- b. Mott Manufacturing
- c. Thermo Scientific Hamilton Laboratory

B. In general, provide metal base units complying with the following:

1. Toe Space: Approximately 4 inches high by 3 inches deep, closed metal with no open pockets. Open channel formations are not permitted.

DELETE BELOW IF NO METAL CABINETS

2. Exterior Metal: Mfr's standard with acid and alkali resistant baked-on finish. Match fume hood color.

DELETE BELOW IF NO WOOD CABINETS

C. In general, provide wood base units complying with the following:

1. Finish: Mfr's standard with acid and alkali resistant finish. Color to be selected by Architect from mfr's standard range of finishes.

DELETE THE FOLLOWING TWO REQUIREMENTS FOR FLAMMABLE STORAGE UNITS

2. Provide base cabinets with removable backs in cupboard areas to provide openings for access to plumbing lines and shut-off valves.
3. Provide space, cut-outs, and holes for pipes, conduits and fittings and cabinet bodies to accommodate services and their support-strut assemblies.

TYPICALLY PROVIDE BOTH FLAMMABLE STORAGE CABINET AND ACID STORAGE CABINET BELOW FUME HOOD.

NOTE THAT FLAMMABLE STORAGE CABINETS ARE NOT REQUIRED TO BE VENTED. IF THEY ARE VENTED, DO NOT VENT THROUGH HOOD, BUT USE A SEPARATE NON-FLAMMABLE VENT PIPE FROM THE CABINET DIRECTLY CONNECTED TO THE EXHAUST DUCT. INCLUDE A DETAIL ON THE DRAWINGS TO SHOW THE VENTING.

D. Flammable Liquid Storage Cabinets: Provide flammable liquid storage type constructed in compliance with NFPA 30 and UL or FM labeled. Requirements of NFPA 30 supersede other indicated requirements.

1. Label door exterior: "FLAMMABLE - KEEP FIRE AWAY".

ACID STORAGE CABINETS ARE REQUIRED TO BE VENTED. COORDINATE WITH MECHANICAL ENGINEER TO ENSURE THAT VENTING DETAIL IS INCLUDED ON DRAWINGS. DELETE REFERENCE TO METAL OR WOOD AS APPROPRIATE.

E. Vented Metal and Wood Acid Storage Cabinets: Provide vented acid storage cabinets as indicated. Do not vent acid storage cabinets through hood. Provide all required vent piping and connections for direct connection to fume hood exhaust duct.

1. Minimum cabinet ventilation: 10 air changes per hour.

2. Line interior of acid storage cabinets with manufacturer's standard chemical-resistant polyethylene lining.
3. Label door exterior: "ACIDS"

2.10 PLUMBING ACCESSORIES

EDIT THIS ARTICLE BASED ON WHETHER RELATED SECTION "LABORATORY CASEWORK AND ACCESSORIES" IS INCLUDED.

ALWAYS RETAIN PARAGRAPH BELOW. IN THE UNUSUAL CIRCUMSTANCE THAT THERE IS MEDICAL GAS PIPING IN THE HOOD IT WILL REQUIRE A SPECIAL PIPING SPECIFICATION.

A. Plumbing, General: Refer to Related Sections and as follows:

1. Provide complete factory plumbing for hoods. Use materials as specified in Related Section. All natural gas piping shall be threaded black steel, Schedule 40.
2. Plumbing Fixtures: Remote controlled from face of hood.

IF CUPSINKS ARE REQUIRED, SELECT EPOXY RESIN TYPE UNLESS A RADIOISOTOPE HOOD WITH WELDED STAINLESS STEEL INTERIOR IS REQUIRED.

3. Cup Sinks: Cast epoxy resin, 3 inch by 6 inch with raised rim. Rim height to match the fume hood's working surface indented (dished edge) height. Coordinate cup sink location to avoid interference with dished edge of work surface.
4. Cup Sinks: Integrally welded 3 inch by 9 inch, Type 304 stainless steel, raised rim. Rim height to match the fume hood's working surface indented (dished edge) height. Coordinate cup sink location to avoid interference with dished edge of work surface.

INFORMATION BELOW MAY BE REDUNDANT WITH INFORMATION IN THE U-M LAB CASEWORK SECTION. EDIT PARAGRAPHS BELOW UP TO "ELECTRICAL ACCESSORIES" IF A LAB CASEWORK SECTION WILL BE INCLUDED IN THE PROJECT'S SPECIFICATIONS AND THAT SECTION COVERS HOOD PLUMBING FIXTURES.

B. Plumbing Service Fixtures: Provide pre-piped units complete with washers, locknuts, unions, nipples and other accessories for positive mounting to hood superstructures. Include wall flanges, escutcheons, handle extension rods, remote valves, and similar items required. Fabricate units to withstand test pressure of 100 psig.

1. Service fixtures are indicated on drawings by symbols, with design type of each fixture indicated by letter and number reference marks.
2. Material and Finish: Cast or forged red brass containing a minimum of 81 percent copper.
3. Exposed surfaces (including fittings and escutcheons): Acid and solvent resistant baked-on plastic coating of mfr's standard color. Fixtures fabricated of plastic are not acceptable except for use as high purity water faucets.

4. Service Outlets Identification: Provide colored plastic index disks with embossed identification letters at each service fixture handle or knob. Secure disks to fixture handles to be tamperproof.
5. Handles: Provide 3 arm or 4 arm forged brass handles for remote controls.
6. Valves and Faucets: Provide indicated fixtures with renewable barrel locked in valve body. Barrel shall contain all wearing parts, with renewable disks.
 - a. Remote Control Valves: Provide valves controlled from face of hood. Use angle valves where required.

SELECT ONE OF THE OPTIONS BELOW

- b. Faucets: Wall-mounted, gooseneck style faucets.
- c. Faucets: Wall-mounted, hose cock water outlets.

ALWAYS INCLUDE BELOW

- d. Vacuum breaker: Provide in-line vacuum breaker complying with codes, installed on front face of hood.

2.11 ELECTRICAL ACCESSORIES

COORDINATE THIS ARTICLE WITH RELATED SECTION "LABORATORY CASEWORK AND ACCESSORIES". INFORMATION BELOW MAY BE REDUNDANT WITH INFORMATION IN THE U-M LAB CASEWORK SECTION. EDIT PARAGRAPHS BELOW IF A LAB CASEWORK SECTION WILL BE INCLUDED IN THE PROJECT'S SPECIFICATIONS AND THAT SECTION COVERS HOOD ELECTRICAL FIXTURES.

- A. Electrical Fixtures, General: Refer to Related Sections and as follows:
 1. Electrical Receptacles: Provide each hood with two duplex receptacles.
 2. Lights: Provide each hood with a two-lamp light fixture of longest practicable length. Equip each fixture with two T-8, 32 watt, straight tube, rapid-start, multi-phosphor fluorescent lamps with a medium bi-pin base, color temperature of 3500 deg K, and a CRI of not less than 82.
 - a. Shield light from hood interior by 1/4 inch thick safety glass or 1/8 inch thick tempered glass panel, sealed air tight into hood body with chemical resistant rubber channels. Set units so that lamps are easily replaceable from outside hood.
 - b. Provide switch marked "Fume Hood Light" on face of hood.
 - c. Provide only fixtures which carry the Underwriter's Laboratory (UL) label.
- B. Internal Electrical Wiring: Provide complete factory wiring for hoods. Comply with requirements of the National Electrical Code.
 1. Wire duplex receptacles and light to a single gang junction box for connection to Owner's 120V, single phase, 20 amp, AC supply.
 2. Where fume hood is supplied with an air flow monitor or similar controls, wire monitor components together and to a second single gang junction box for connection to Owner's second 120V, single phase, 20 amp AC supply.

3. Provide wiring with a green ground conductor. Conduit shall not be used for ground.
4. Install all wiring in metallic conduit.

INFORMATION BELOW MAY BE REDUNDANT WITH INFORMATION IN THE U-M LAB CASEWORK SECTION. EDIT PARAGRAPHS BELOW IF A LAB CASEWORK SECTION WILL BE INCLUDED IN THE PROJECT'S SPECIFICATIONS AND THAT SECTION COVERS HOOD ELECTRICAL FIXTURES.

C. Electrical Service Fixtures: Provide units complete with box; necessary receptacles, terminals, switches, device plates, and fittings and gaskets required for mounting on casework. Provide only fixtures with UL label.

1. Service fixtures are indicated on drawings by symbols, with design type of each fixture indicated by letter and number reference marks.
2. Cover Plates: Provide stainless steel cover plates for AC receptacles and devices.
 - a. Cover Plate Material: Stainless steel, Type 302, satin finish, with formed beveled edges.
3. Mark the following devices whether shown on drawings or not.
 - a. AC receptacles, other than standard 120 volt duplex, grounding type. Indicate voltage and phase.
 - b. Switches: Indicate equipment being controlled (e.g., "Fume Hood Light").
4. Finishes for Service Fixture Components: Furnish boxes with mfr's standard finish. Provide galvanized finish on ferrous fittings.

MODIFY BELOW IF USER REQUIRES 208 V. RECEPTACLES OR SPECIAL TYPE OF OUTLETS.

5. Receptacles: 125 volt, 20 amp, 2 pole, 3 wire, NEMA Type 5-20R, ground fault circuit interrupter type (at all locations), UL extra heavy duty grounding type with nylon or Lexan bodies.
 - a. Ground fault circuit interrupter receptacles shall be rated for 2000 amps interrupting capacity and trip in 25 milliseconds or less when ground currents exceed 5 milliamps.

SELECT ONE OF THE FOLLOWING

- b. Color: Dark brown.
- c. Color: Ivory.
- d. Products: Subject to compliance with requirements, provide products of one of the following:
Arrow Hart.
Bryant.
Hubbell.
Leviton.
Pass and Seymour.

USUALLY RETAIN BELOW FOR LIGHT SWITCH

6. Switches: Rated 120-277 volts AC and 20 amps, unless otherwise indicated, UL extra heavy duty.
 - a. Furnish pilot light adjacent to toggle switch, where noted as "PL" adjacent to switch identification.

SELECT ONE OF THE FOLLOWING

- b. Color: Dark brown.
- c. Color: Ivory.
- d. Products: Subject to compliance with requirements, provide products of one of the following:
Arrow Hart.
Bryant.
Hubbell.
Leviton.
Pass and Seymour.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install fume hoods plumb level, rigid, securely anchored to building and adjacent furniture in proper location, in accordance with manufacturer's instructions. Install closures neatly. Securely attach access panels, but provide for easy removal and secure re-attachment.
 - 1. Coordinate sequence of work with Mechanical and Electrical trades and with laboratory casework and fixtures specified in Related Sections.

ALWAYS INCLUDE THE COMMISSIONING ARTICLE BELOW.

3.2 COMMISSIONING

- A. Perform the commissioning activities as outlined in Division 01 Section "Full Project Commissioning" or "Project Commissioning for Small Projects" and other requirements of the Contract Documents.

3.3 FIELD QUALITY CONTROL

- A. Field test each fume hood after completion of installation to verify proper operation of hoods in accordance with SEFA 1 Guidelines

USUALLY DELETE BELOW. CONSIDER AS INSTALLED TESTING ONLY FOR LARGE PROJECTS, AND AFTER CONSULTATION WITH U-M OSEH AND MECHANICAL ENGINEER. ADJUST PERCENTAGE OF FUME HOODS TO BE TESTED IF APPROPRIATE, AND INDICATE TYPES TO BE TESTED IF MULTIPLE TYPES ARE USED ON THE PROJECT.

- B. Perform As Installed Containment Testing per ASHRAE 110 on 10% of installed fume hoods. Hoods shall be selected by the Commissioning Agent in consultation with U-M OSEH.
 - 1. Demonstrate that hoods meet the performance criteria specified in Part 2. Remedy failing hoods and retest until hoods meet the performance criteria.
 - 2. Provide a complete test report to the Commissioner immediately after each test.

3.4 ADJUST AND CLEAN

- A. Moving Parts: Carefully check to insure: smooth, near-silent, and accurate operation; sash operation with one hand with uniform contact of rubber bumpers; counterbalance operation without interference.
- B. Clean surfaces, including both sides of glass.
- C. Damaged Work: Repair equal to new undamaged work, or replace with new units, as directed by Architect.

END OF SECTION 115313