

SECTION 11610 – LABORATORY FUME HOODS AND RELATED PRODUCTS

PART 1: DESCRIPTION OF WORK

1.00 SUMMARY AND SCOPE

- A. Section Includes:
Based on **Kewaunee Scientific Corporation's Supreme Air Series** fume hood design, furnish and install all fume hoods, work tops, and understructures. Furnishing and installing all filler panels, knee space panels and scribes as shown on drawings.
- B. Accessorization (Choose one):
1. Furnishing and delivering all service outlets, accessory fittings, electrical receptacles and switches, as listed in these specifications, equipment schedules or as shown on drawings. Fittings attached to the fume hood superstructure shall be mounted at the factory.
- Or**
2. Furnishing and delivering all service outlets, accessory fittings, electrical receptacles and switches, as listed in these specifications, equipment schedules or as shown on drawings. Plumbing fixtures mounted on the fume hood superstructures shall be preplumbed per section 2.01.I. Electrical fixtures shall be prewired per section 2.01.J. The fume hood superstructure shall be listed to UL Standards for Safety by Underwriters Laboratories Inc. (UL). Final plumbing and electrical connections are the responsibility of those contractors fulfilling requirements of Divisions 15 and 16.
- C. Removal of all debris, dirt and rubbish accumulated as a result of the installation of the fume hoods to an on-site container provided by others, leaving the premises clean and orderly.
- D. Related Divisions:
1. Division 12: Laboratory Casework
 2. Division 15: Plumbing and Exhaust Ducting
 3. Division 16: Electrical Fittings and Connections
- E. Related Publications:
1. ASHRAE Standard 110.1995 - Method of Testing Performance of Laboratory Fume Hoods
 2. NSF STD#49 – Photometric Method of Testing
 3. NIH03-112C - National Institute of Health Specification
 4. UL – Underwriters Laboratories
 5. ASTM D552 – Bending Test
 6. NFPA-45 – National Fire Protection Association

1.01 BASIS OF WORK

- A. It is the intent of this specification to use **Kewaunee Scientific Corporation, Statesville, North Carolina**, as the standard of construction for laboratory fume hoods. The construction standards of the **Kewaunee Supreme Air** product line shall provide the basis for quality and functional installation.
- B. Supply all equipment in accordance with this specification. The offering of a product differing in materials and construction from this specification requires written approval. This approval must be obtained seven (7) days before the proposal deadline. Procedures for obtaining

approval for an alternate manufacturer are defined in section 2.00 C. in this specification.

- C. General Contractors should secure a list of approved fume hood manufacturers from the architect as a protection against non-conformance to these specifications.
- D. The owner/architect reserves the right to reject qualified or alternate proposals and to award based on product value where such action assures the owner greater integrity of product.
- E. Submittals:
 - 1. Manufacturer's Data: Submit manufacturer's data and installation instructions for each type of fume hood. Provide data indicating compliance with ASHRAE Standard 110.1995.
 - 2. Samples: Samples if called for will be reviewed for color, texture, and pattern only. Submit the following:
 - a. Hood interior lining, 6 by 6 inches.
 - b. Hood enclosure, 6 by 6 inches, of color selected.
 - c. Operation sign(s).
 - d. Shop Drawings:
 - Submit shop drawings for fume hoods showing plans, elevations, ends, cross-sections, service run spaces, location and type of service fittings:
 - 1) Coordinate shop drawings with other work involved.
 - 2) Provide roughing-in drawings for mechanical and electrical services when required.
 - 3) Provide face opening, air volume, and static pressure drop data.
 - 3. Non-Specified Manufacturer's Samples:

A sample from each non-specified manufacturer will be required and reviewed per specification. This sample shall be delivered, at no cost to the architect or owner to a destination set forth by the architect or owner. The sample must then be tested per section 1.02.C by an independent test agency hired by the submitting company and approved by the owner/architect. A passing test and owner/architect approval of the prototype must be written and approved seven (7) days before quotation deadline as a condition of acceptance for any quotation participant.

1.02 STANDARD FUME HOOD PERFORMANCE REQUIREMENTS

- A. Fume hoods shall be of complete airfoil design to insure maximum operating efficiency. Foil sections at the front facias of the hood shall minimize eddying of air currents at the hood face and the rear baffle system shall minimize turbulence in the upper portion of the hood interior.
- B. Standard Fume Hood Types (Choose One):
 - 1. Open Bypass:

The hoods shall be of the bypass type. The fume hood design shall allow for automatic air bypass above the sash opening. The bypass shall limit the maximum air velocity through the face of the hood and provide for a constant volume of air through the hood regardless of sash position. The bypass shall control the increase in face velocity as the sash is lowered to limit the maximum velocity to not more than three and one-half, times the velocity with the sash full open.

Or
 - 2. Auxiliary Air Chamber (Optional):

Auxiliary air chamber may be mounted on bypass type hood only. The design of the auxiliary air attachment shall be such that the auxiliary air shall enter through the hood face when the sash is in the open position, and through the bypass with the sash closed.

An auxiliary air chamber when specified shall be located forward of and above the sash opening. The chamber shall be of modular design such that it may be added to an existing hood without dismantling the exhaust duct or other potentially contaminated parts. The chamber, when connected to a supply air system, shall direct a flow of auxiliary air down the exterior front of the hood to be drawn through the face opening (with sash open), and through the bypass (with sash closed) by the exhaust system. Hoods shall provide efficient fume removal when operating with 70% of the exhaust air requirement being auxiliary air and 30% room air. Auxiliary air should be supplied at temperatures ranging from 70 degrees F. to 95 degrees F. The flow of auxiliary air shall be confined to the area immediately in front of the hood, and shall be entrained in the flow of air entering the hood with a capture efficiency of at least 95%. The interior, potentially contaminated back side of the sash shall never enter the clean, auxiliary air stream

Or

3. Variable Air Volume:
The fume hoods shall be of the variable air volume type in which the exhaust air volume varies proportionally to the hood opening when used with a hood face velocity controller system (provided by others). The air bypass shall be RESTRICTED PER THE VAV Manufacturer's recommendation.
- C. Containment
1. Purpose:
The purpose of this specification is to prequalify the performance of the bidder's laboratory fume hood before award of contract. At his option, the owner or his representative may require the same tests to be performed and the same performance be achieved before acceptance of the hood after award of contract. The owner or his representative shall witness the tests. Failure to meet the performance specified shall be cause for rejection of the bidder.
 2. Test Method:
The hood shall be tested per the American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE) Standard 110-1995 and by the Auxiliary Air Capture Test (Auxiliary Air hoods only).
 3. Location of Tests and Test Facility:
All tests referenced herein shall be performed in the bidder's fume hood test facility. Field testing is described in Section 3.01.F.

The test facility shall meet the following requirements:
 - a. The test facility shall have sufficient area so that a minimum of 5 feet of clear space is available in front of and on both sides of the hood for viewing tests.
 - b. The facility's ventilation system shall have adequate heating and air conditioning so that room air temperatures can be maintained within the desired ranges.
 - c. Room air currents in the test area shall be less than 20 FPM.
 - d. The hood exhaust system shall be properly calibrated so that the desired exhaust air volumes can be easily attained.
 4. Instrumentation, Equipment and Test Personnel:
Qualified personnel to perform the tests shall be supplied by the bidder.

Instrumentation and equipment required shall be supplied by the bidder at his expense. Required instrumentation shall include but not be limited to the following items:

- a. Thermal anemometer capable of measuring air velocities from 10 to 600 ft./minute
 - b. Three dozen one-half minute smoke candles
 - c. Four ounces of Titanium Tetrachloride
 - d. Supply of cotton throat swabs
 - e. ITI Leakmeter 120 calibrated to indicate concentration of sulfur hexafluoride or equivalent
 - f. Flowmeter – 150 ml/minute capacity
 - g. Flowmeter – 15 L/minute capacity
 - h. Four gas sampling bags – 8 liter capacity
 - i. Two vacuum pumps – 1 CFM capacity
 - j. Two flow regulating valves
 - k. Two size 3 tanks of sulfur hexafluoride with a two-stage regulator or other tracer gas suitable for detector to be used
 - l. Three-way gas valve
 - m. Mannequin, 5'7" in height, or reasonable human proportions with arms hanging at its side
 - n. ASHRAE 110-1995 tracer gas ejector
5. ASHRAE Standard 110-1995 Test:
Hood shall be tested with a face velocity of 100 FPM full open vertically and at 100 FPM right, left and center 100% open horizontally. If horizontal openings are present, additional sash configurations and face velocities may be specified. The hood shall have a performance rating of 4.0 AM 0.01 or better wherein:
- | | |
|------|--|
| 4.0 | = tracer gas release in liters/minute |
| AM | = as manufactured |
| 0.01 | = level of control of tracer gas in parts per million (ppm). |

1.03 QUALITY ASSURANCE

- A. The laboratory fume hood manufacturer shall provide fume hood work tops and casework all **manufactured or shipped from the same geographic location** to assure proper staging, shipment and single source responsibility.
- B. General Performance: Provide certification that fume hoods meet the performance requirements described in section 1.02.C.

PART 2 – PRODUCTS

2.00 MANUFACTURERS

- A. The basis of this specification is the **Supreme Air** fume hood as manufactured by **Kewaunee Scientific Corporation**, 2700 West Front Street, Statesville, North Carolina.
- B. All laboratory equipment covered by the specification **shall be the product of one manufacturer and be fabricated at one geographic location** to assure shipping continuity and single-source responsibility. All quotations from a manufacturer other than Kewaunee Scientific shall contain a review of the following capabilities:
 - 1. List of shop facilities
 - 2. List of engineering and manufacturing personnel
 - 3. Proof of financial ability to fulfill the contract
 - 4. List of a minimum of ten installations over the last five years of comparable scope
 - 5. Proof of project management and installation capabilities
- C. The selected manufacturer must warrant for a period of one-year starting (date of acceptance or occupancy, whichever comes first) that all products sold under the contract referenced above shall be free from defects in material and workmanship. Purchaser shall notify the manufacturer's representative immediately of any defective product. The manufacturer shall have a reasonable opportunity to inspect the goods. The purchaser shall return no product until receipt by purchaser of written shipping instructions from the manufacturer.

2.01 MATERIALS AND CONSTRUCTION

- A. Fume Hood Superstructure Frame:

A free-standing rigid frame structure of steel angle shall be provided to support exterior panels and interior liner and baffle panels. To allow for maintenance and replacements, the interior liner panels shall be removable without disassembly of the frame structure and outer steel panels. Likewise, the exterior steel panels shall be removable without disassembly of the frame structure and inner liner panels. Fume hoods that require disassembly of the superstructure for liner replacement are not acceptable.
- B. Fume Hood Interior Walls:

Double wall ends, not more than 4" wide, shall be provided to maximize interior working area. The area between the double wall ends shall be closed to house the remote control valves. The front vertical fascia section shall have a full 135 degree 1" radius at the front leading edge to provide a streamlined section and insure smooth even flow of air into the hood. The vertical facias shall contain the required service controls, electrical switches and receptacles. The hood interior end panels and sash track shall be flush with the fascia to prevent eddy currents and back flow of air.
- C. Fume Hood Airfoil:

A streamlined airfoil shall be integral at the bottom of the hood opening on bench and distillation hoods. This foil shall provide a nominal 1" open space between the foil and the top front edge of the work surface to direct an air stream across the work surface to prevent back flow of air. The airfoil shall extend back under the sash, so that the sash does not close the 1" opening. The foil shall be removable to allow large equipment into the hood. The foil shall be of 12-gauge steel to resist denting and flexing. Walk-in hoods shall have a stop located at the bottom of the sash track that will ensure a nominal 1" opening between the bottom of the sash and the floor.
- D. Fume Hood Top Panel (select one):
 - 1. Standard Grille Bypass Configuration:

The top front panel shall be of the same material as the exterior fascia. It shall have an integral grille stamped into the upper portion.

(Recommended option) The top front panel of the hood shall have an integral vision

panel. It shall be located directly above the sash opening and in such a manner that it allows viewing into the top portion of the hood without the operator having to stoop or place their face inside the hood

Or

2. Chevron Grille:

The top front panel shall be of the same material as the exterior facia. It shall contain a chevron shaped grille that is sight-tight to create an effective barrier against flying debris from inside the hood.

(Recommended option) The top front panel of the hood shall have an integral vision panel. It shall be located directly above the sash opening and in such a manner that it allows viewing into the top portion of the hood without the operator having to stoop or place their face inside the hood.

E. Fume Hood Baffles (select one):

1. A stable, non-adjustable baffle with three fixed horizontal slots shall be provided to aid in distributing the flow of air into and through the hood. The baffle shall be spaced out 2-1/4" from the back liner. The baffle shall be removable for cleaning

Or

2. The upper and lower horizontal slots shall be provided with adjustable baffles that allow the slots to be opened or closed

Or

3. A single-point baffle adjustment shall allow the operator to make adjustments without placing their hand further than six inches into the hood.

F. Fume Hood Duct Collar (select one):

1. **(Recommended)** A 12" diameter polyethylene bell-mouthed duct collar shall be located in the top of the hood plenum chamber. Coated common steel duct collars are not acceptable

Or

2. A 12" diameter stainless steel bell-mouthed duct collar shall be located in the top of the hood plenum chamber.

G. Fume Hood Lighting:

A two-tube T-12 (T-87) fluorescent light fixture (bulbs not included) of the size given below shall be provided at the top of the hood to give maximum light in the hood working area.

Hood Size, Ft.	Nominal Fixture Length, Ft.
4	3
5	4
6	4
8	3 (2 Fixtures)

The light fixtures shall be isolated from the hood interior by a 1/4" thick tempered glass panel sealed from the hood cavity. Fixture shall be UL labeled.

H. Fume Hood Sash (Choose one):

1. Vertical Rising Sash:

A vertical rising sash of 1/4" laminated safety float glass shall be provided. The sash shall have a neutral colored polyvinyl chloride horizontal member at the top and a full

length metal handle at the bottom. The sash shall be counterbalanced with a single weight to prevent tilting and binding during operation. The sash track shall be a neutral colored polyvinyl chloride set flush with the interior liner panels to minimize turbulence. Bench hoods shall have one sash in a single slotted sash track. Walk-in hoods shall have two sashes in a double slotted sash track

Or

2. Horizontal Sliding Sash:
 - a. Bench Hoods:

Horizontal sliding sash shall be provided. The sashes shall be mounted on metal rollers on an aluminum track. The glass shall be 1/4" laminated safety float glass.
 - b. Walk-in Hoods:

Horizontal sliding sashes shall be provided. The sashes shall be suspended from a metal track with stainless steel hangers and nylon rollers. The glass shall be 1/4" laminated safety float glass

Or

3. Combination Sash:

A combination sash shall be provided. The sash shall have horizontal sliding glass panels in a vertical rising steel frame. The bottom of the sash frame shall have a full length metal handle. The sash track shall be a neutral colored polyvinyl chloride set flush with the interior liner panels to minimize turbulence. The sash shall be counterbalanced with a single weight to prevent tilting and binding during operation. The glass panels shall be 1/4" laminated safety float glass mounted on metal rollers in an aluminum track.
- I. Fume Hood Plumbing Services (Choose one):
 1. **(Recommended)** Plumbing services shall consist of remote control valves as selected located within the end panels, controlled by extension rods projecting through the control panels of the hood, with color coded plastic handles. Interior fitting for gases and water shall be nylon panel flanges and angle serrated hose connectors, color coded. Interior fittings for distilled water shall consist of a bronze tin lined, white color-coded, panel flange and angle serrated hose connector. Interior fittings for steam shall consist of a cast bronze flange and angle serrated hose connector with a chemical resistant metallic bronze finish. Water goosenecks shall be cast bronze with a chemical resistant metallic bronze finish. All plumbing fittings shall be factory installed and piped between the valve and the outlet. Inlet piping shall have a single-point connection for each valve provided and carried to a point 1" above the fume hood roof or 1" above the worktop rear corner depending on the rough-in locations shown in the drawings. Points of final service connection by other trades shall be at the stub provided by the fume hood manufacturer.

Or

2. Plumbing services shall consist of remote control valves as selected located within the end panels, controlled by extension rods projecting through the control panels of the hood, with color coded plastic handles. Interior fitting for gases and water shall be nylon panel flanges and angle serrated hose connectors, color coded. Interior fittings for distilled water shall consist of a bronze tin lined, white color-coded, panel flange and angle serrated hose connector. Interior fittings for steam shall consist of a cast bronze flange and angle serrated hose connector with a chemical resistant metallic bronze finish. Water goosenecks shall be cast bronze with a chemical resistant metallic bronze finish. Plumbing shall be attached to the fume hood interior for shipping purposes only to be field plumbed by others at the jobsite.

J. Fume Hood Electrical Services (Choose one):

1. **(Recommended)** The hood superstructure shall be pre-wired and contain a UL label certifying acceptable wire gauge, connections, fixtures and wire color coding. Wiring electrical services shall consist of two duplex receptacles and a light switch. The duplex receptacles shall be 20 Amp., 125 volt AC, and 3-wire polarized grounded with ground fault interruption. The receptacles shall be of specification grade, side wired only, to insure a positive connection. The light switch shall be 20 Amp., 125 volt AC, and 3-wire polarized grounded. Wiring shall terminate in one 6" x 6" x 4" service junction box located on the fume hood roof. Final wiring and circuit dedication shall be by others.

Or

2. Electrical components shall be shipped loose with the hood and shall be attached to the fume hood and wired by others at the jobsite. Wiring electrical services shall consist of two GFI duplex receptacles and a light switch. The duplex receptacles shall be 20 Amp., 125 volt AC. Component mounting, furnishing of wire, provision of appropriate junction box, final wiring, circuit dedication, and final electrical connections shall be done by others.

K. Hood Work Surface (Choose one):

1. Epoxy Resin:

Hood worksurface shall be 1-1/4" thick molded epoxy resin made in the form of a watertight pan, not less than 3/8" deep to contain spillage with a 6" wide safety ledge across the front edge. Top shall be manufactured at the same manufacturing location as the fume hood to assure proper cutout alignment and coordinated shipping. A cup drain flush with the recessed worksurface shall be provided. The worksurface and cup drain shall be available in either black or grey.

Or

2. Stainless Steel:

Hood worksurface shall be 14-gauge, Type 304 stainless steel with a No. 4 finish made in the form of a watertight pan, 1/2" deep to contain spillage, with a 6" wide safety ledge across the front edge. A cup drain mounted flush with the recessed top shall be provided.

L. Access Opening:

The interior end liner panels shall be furnished with an opening that provides access to the service piping and valves to facilitate installation and maintenance. The openings shall be covered with a removable panel with rounded corners. Panels that require tools to remove are not acceptable. The panel shall provide an overlapping seal on all edges.

M. Fume Hood Finish:

After the component parts have been completely welded together and before finishing, they shall be given a pre-paint treatment to provide excellent adhesion of the finish system to the steel and to aid in the prevention of corrosion. Physical and chemical cleaning of the steel shall be accomplished by washing with an alkaline cleaner, followed by a spray treatment with a complex metallic phosphate solution to provide a uniform fine grained crystalline phosphate surface that shall provide both an excellent bond for the finish and enhance the protection provided by the finish against humidity and corrosive chemicals.

After the phosphate treatment, the steel shall be dried and all steel surfaces shall be coated with a chemical and corrosion-resistant, environmentally friendly, electrostatically applied powder coat finish. All components shall be individually painted, insuring that no area be vulnerable to corrosion due to lack of paint coverage. The coating shall then be cured by baking at elevated temperatures to provide maximum properties of corrosion and wear

resistance.

The completed finish system in standard colors shall meet the performance test requirements specified under PERFORMANCE TEST RESULTS.

N. Performance Test Results (Chemical Spot Tests):

a. Testing Procedure:

Chemical spot tests for non-volatile chemicals shall be made by applying 5 drops of each reagent to the surface to be tested and covering with a 1-1/4" dia. watch glass, convex side down to confine the reagent. Spot tests of volatile chemicals shall be tested by placing a cotton ball saturated with reagent on the surface to be tested and covering with an inverted 2-ounce wide mouth bottle to retard evaporation. All spot tests shall be conducted in such a manner that the test surface is kept wet throughout the entire test period, and at a temperature of 77° ±3° F. For both methods, leave the reagents on the panel for a period of one hour. At the end of the test period, the reagents shall be flushed from the surface with water, and the surface scrubbed with a soft bristle brush under running water, rinsed and dried. Volatile solvent test areas shall be cleaned with a cotton swab soaked in the solvent used on the test area. Immediately prior to evaluation, 16 to 24 hours after the reagents are removed, the test surface shall be scrubbed with a damp paper towel and dried with paper towels.

b. Test Evaluation:

Evaluation shall be based on the following rating system.

Level 0 – No detectable change.

Level 1 – Slight change in color or gloss.

Level 2 – Slight surface etching or severe staining.

Level 3 – Pitting, cratering, swelling, or erosion of coating. Obvious and significant deterioration.

After testing, panel shall show no more than three (3) Level 3 conditions.

c. Test Reagents

Test No.	Chemical Reagent	Test Method
1.	Acetate, Amyl	Cotton ball & bottle
2.	Acetate, Ethyl	Cotton ball & bottle
3.	Acetic Acid, 98%	Watch glass
4.	Acetone	Cotton ball & bottle
5.	Acid Dichromate, 5%	Watch glass
6.	Alcohol, Butyl	Cotton ball & bottle
7.	Alcohol, Ethyl	Cotton ball & bottle
8.	Alcohol, Methyl	Cotton ball & bottle
9.	Ammonium Hydroxide, 28%	Watch glass
10.	Benzene	Cotton ball & bottle
11.	Carbon Tetrachloride	Cotton ball & bottle
12.	Chloroform	Cotton ball & bottle
13.	Chromic Acid, 60%	Watch glass
14.	Cresol	Cotton ball & bottle
15.	Dichlor Acetic Acid	Cotton ball & bottle
16.	Dimethylformamide	Cotton ball & bottle
17.	Dioxane	Cotton ball & bottle
18.	Ethyl Ether	Cotton ball & bottle
19.	Formaldehyde, 37%	Cotton ball & bottle
20.	Formic Acid, 90%	Watch glass

21.	Furfural	Cotton ball & bottle
22.	Gasoline	Cotton ball & bottle
23.	Hydrochloric Acid, 37%	Watch glass
24.	Hydrofluoric Acid, 48%	Watch glass
25.	Hydrogen Peroxide, 3%	Watch glass
26.	Iodine, Tincture of	Watch glass
27.	Methyl Ethyl Ketone	Cotton ball & bottle
28.	Methylene Chloride	Cotton ball & bottle
29.	Mono Chlorobenzene	Cotton ball & bottle
30.	Naphthalene	Cotton ball & bottle
31.	Nitric Acid, 20%	Watch glass
32.	Nitric Acid, 30%	Watch glass
33.	Nitric Acid, 70%	Watch glass
34.	Phenol, 90%	Cotton ball & bottle
35.	Phosphoric Acid, 85%	Watch glass
36.	Silver Nitrate, Saturated	Watch glass
37.	Sodium Hydroxide, 10%	Watch glass
38.	Sodium Hydroxide, 20%	Watch glass
39.	Sodium Hydroxide, 40%	Watch glass
40.	Sodium Hydroxide, Flake	Watch glass
41.	Sodium Sulfide, Saturated	Watch glass
42.	Sulfuric Acid, 33%	Watch glass
43.	Sulfuric Acid, 77%	Watch glass
44.	Sulfuric Acid, 96%	Watch glass
45.	Sulfuric Acid, 77% and Nitric Acid, 70%, equal parts	Watch glass
46.	Toluene	Cotton ball & bottle
47.	Trichloroethylene	Cotton ball & bottle
48.	Xylene	Cotton ball & bottle
49.	Zinc Chloride, Saturated	Watch glass

* Where concentrations are indicated, percentages are by weight.

O. Performance Test Results (Heat Resistance):

Hot water (190° F - 205° F) shall be allowed to trickle (with a steady stream at a rate not less than 6 ounces per minute) on the finished surface, which shall be set at an angle of 45° from horizontal, for a period of five minutes. After cooling and wiping dry, the finish shall show no visible effect from the hot water treatment.

P. Performance Test Results (Impact Resistance):

A one-pound ball (approximately 2" diameter) shall be dropped from a distance of 12 inches onto the finished surface of steel panel supported underneath by a solid surface. There shall be no evidence of cracks or checks in the finish due to impact upon close eye-ball examination.

Q. Performance Test Results (Bending Test):

An 18 gauge steel strip, finished as specified, when bent 180° over a 1/2" diameter mandrel, shall show no peeling or flaking off of the finish.

R. Performance Test Results (Adhesion):

Ninety or more squares of the test sample shall remain coated after the scratch adhesion test. Two sets of eleven parallel lines 1/16" apart shall be cut with a razor blade to intersect at right angle thus forming a grid of 100 squares. The cuts shall be made just deep enough to go through the coating, but not into the substrate. They shall then be brushed lightly with a soft brush. Examine under 100 foot-candles of illumination. Note: This test is based on ASTM D2197-68, "Standard Method of Test for Adhesion of Organic Coatings".

S. Performance Test Results (Hardness):

The test sample shall have a hardness of 4-H using the pencil hardness test. Pencils, regardless of their brand are valued in this way: 8-H is the hardest, and next in order of diminishing hardness are 7-H, 6-H, 5-H, 4-H, 3-H, 2-H, F, HB, B (soft), 2-B, 3-B, 4-B, 5-B (which is the softest).

The pencils shall be sharpened on emery paper to a wide sharp edge. Pencils of increasing hardness shall be pushed across the paint film in a chisel-like manner until one is found that will cut or scratch the film. The pencil used before that one-that is, the hardest pencil that will not rupture the film-is then used to express or designate the hardness.

T. Fume Hood Dimensions

Double wall end panel thickness shall not exceed 4". Interior clear working height shall be not less than 41-3/4" at any location in the interior of the hood on bench hoods and 76" on walk-in and distillation hoods. Interior depth from the back of the sash to the front of the rear baffle shall not be less than 25-1/4". The sash opening shall be not less than 28" in height above the worksurface on bench hoods and 60" on walk-in and distillation hoods.

U. Fume Hood Liners (Choose one):

1. KMER Epoxy Resin Lining:

KMER epoxy resin liner shall be the manufacturing standard for liners in this specification. To assure proper punching and coordination with remaining pieces of assembled fume hood superstructure, this liner material must be manufactured at the same geographic location and the fume hood superstructure. Interior liner panels shall be 1/4" thick epoxy resin sheets of a neutral color. Interior liner panels shall be fastened using stainless steel screws with plastic covered heads.

Flame spread of material as measured by ASTM E84 shall be 6.2 or less.

Fiberglass reinforced plastics or polyesters shall not be acceptable substitute liner materials for epoxy resin.

2. KEMGLASS Reinforced Polyester Lining:

Interior liner panels shall be 1/4" thick fiberglass reinforced polyester sheet. Interior liner panels shall be fastened using stainless steel screws with plastic covered heads.

3. Reinforced Phenolic Resin Lining:

Interior liner panels shall be 1/4" thick made from a compression molded cellulose fiber reinforced phenolic resin core with integrally cured white melamine surfaces. Interior liner panels shall be fastened using stainless steel screws with plastic covered heads.

4. Stainless Steel Lining:

Interior liner panels shall be 16 gauge Type 304 stainless steel with a No. 4 finish. Interior liner panels shall be fastened using stainless steel screws.

Q. Liner Tests – Chemical Spot Tests – 24 Hours

1. Chemical spot test shall be made by applying 10 drops (approximately 1/2 cc) of each reagent to the surface to be tested. Each reagent (except those marked **) shall be covered with a 1-1/2" diameter watch glass, convex side down to confine the reagent. Spot tests of volatile solvents marked ** shall be tested as follows: A 1" or larger ball of cotton shall be saturated with the solvent and placed on the surfaces to be tested. The cotton ball shall then be covered by an inverted 2-ounce, wide mouth bottle to retard evaporation. All spot tests shall be conducted in such a manner that the test surface is kept wet throughout the entire 24-hour test period and at a temperature of 77 degrees F.

± 3 degrees F.

2. At the end of the test period, the reagents shall be flushed from the surfaces with water and the surface scrubbed with a soft bristle brush under running water, rinsed, and dried. Volatile solvent test areas shall be cleaned with a cotton swab soaked in the solvent used on the test area. Spots where dyes have dried shall be cleaned with a cotton swab soaked in alcohol to remove the surface dye. The test panel shall then be evaluated immediately after drying.

3. Ratings/Legend:

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|--|--|
| 1 – KMER (Kewaunee Modified Epoxy Resin) | A = No effect or slight change in gloss |
| 2 – Glass Reinforced Polyester | B = Slight change in gloss or color |
| 3 – Stainless Steel 304 | C = Slight etching or severe staining |
| 4 – Stainless Steel 316 | D = Swelling, pitting, or severe etching |
| 5 – Reinforced Phenolic Resin | |

RESULTS:	1	2	3	4	5
1. Acetic Acid 98%	A	B	B	B	A
2. Acetone **	A	D	A	A	A
3. Acid Dichromate	A	A	A	A	A
4. Ammonium Hydroxide ** 28%	A	A	B	B	A
5. Amyl Acetate **	A	A	A	A	A
6. Benzene **	A	A	A	A	A
7. Butyl Alcohol **	A	A	A	A	A
8. Carbon Tetrachloride **	A	A	A	A	A
9. Chloroform **	A	D	A	A	A
10. Chromic Acid 60%	B	B	C	C	A
11. Cresol	A	A	A	A	A
12. Dichloroacetic Acid	A	D	B	A	A
13. Dimethylformamide	A	A	A	A	A
14. Dioxane **	A	A	A	A	A
15. Ethyl Acetate **	A	A	A	A	A
16. Ethyl Ether **	A	A	A	A	A
17. Ethyl Alcohol **	A	A	A	A	A
18. Formaldehyde	A	A	A	A	A
19. Formic Acid 90%	A	A	A	A	A
20. Furfural **	B	B	A	A	C
21. Gasoline **	A	A	A	A	A
22. Hydrochloric Acid 37%	A	A	B	B	A
23. Hydrofluoric Acid 48%	B	D	D	D	A
24. Hydrogen Peroxide 30%	A	A	A	A	A
25. Methyl Ethyl Ketone **	A	A	A	A	A
26. Methyl Alcohol **	A	A	A	A	A
27. Methylene Chloride **	A	D	A	A	A
28. Monochlorobenzene **	A	A	A	A	A
29. Naphthalene **	A	A	A	A	A
30. Nitric Acid 20%	B	A	B	A	A
31. Nitric Acid 30%	B	A	B	A	A
32. Nitric Acid 70%	B	D	B	A	A
33. Phenol ** 85%	A	C	A	A	A
34. Phosphoric Acid 85%	A	A	B	A	A
35. Silver Nitrate	B	C	A	A	C
36. Sodium Hydroxide 40%	A	D	A	A	A
37. Sodium Hydroxide 20%	A	D	A	A	A
38. Sodium Hydroxide 10%	A	D	A	A	A
39. Sodium Hydroxide Flake	A	B	A	A	A

40. Sodium Sulfide	A	B	A	A	A
41. Sulfuric Acid 77%	A	A	C	A	A
42. Sulfuric Acid 96%	C	D	C	A	C
43. Sulfuric Acid 33%	A	A	C	A	A
44. Tincture of Iodine	A	C	B	B	A
45. Toluene **	A	A	A	A	A
46. Trichlorethylene **	A	A	A	A	A
47. Xylene **	A	A	A	A	A
48. Zinc Chloride	A	A	B	A	A
49. Nitric 70%/Sulfuric Acid 77%*	B	B	B	A	A

* Equal parts of Nitric Acid 70% and Sulfuric Acid 77%.

** Indicates these solvents tested with cotton and jar method

S. Fume Hood Base Cabinets

1. Standard Steel

- Unless otherwise indicated base units under hoods shall be fabricated of cold rolled prime grade roller leveled furniture steel. Gauges of steel used in construction shall be 18 gauge except as follows:
- Corner gussets for leveling bolts and apron corner braces, 12 gauge.
- Hinge reinforcements, 14 gauge.
- Top and intermediate front horizontal rails, apron rails and reinforcement gussets, 16 gauge.
- Door assemblies and adjustable shelves, 20 gauge.
- Performance of the painted surfaces shall match that of the fume hood outer panels.

2. Special Purpose Cabinets for Use Under Fume Hoods:

a. Acid Storage Cabinets:

Where indicated acid storage cabinets shall use the same gauges of steel and construction features as other base cabinets. In addition, they shall have a one-piece liner insert made of linear low-density polyethylene. The liner insert shall form a one-inch pan at the bottom to retain spillage. Each door will have a set of louvers at the top and bottom. The door shall be lined with a polyethylene sheet. Each cabinet shall be vented into the fume hood with a 1-1/2" vent pipe. Providing a positive airflow directly into the fume hood exhaust system.

b. Solvent Storage Cabinets:

Solvent storage cabinets shall be UL labeled and specifically designed for the storage of flammable and combustible liquids. Construction shall be based upon the requirements listed by UL, UFC, OSHA, and NFPA No. 30 – 1993. The bottoms, top, sides and doors shall be fabricated of 18" gauge steel and shall be all double panel construction with a 1-1/2" air space between panels. All joints shall be welded, or screwed, to provide a rigid enclosure. The doors shall swing on full-length stainless steel piano hinges and shall be fully insulated. The right hand door shall be equipped with a three point latching device and the left-hand door shall have a full height astragal. The doors are self-closing and synchronized so that both doors will always fully close. The right hand door is equipped with a three-point latching system that automatically engages when the doors close. Each door is equipped with a fusible-link hold-open feature that will ensure the door closes should the temperature outside the cabinet exceed 165 degrees Fahrenheit. Units 24" long have only one door, self-closing, and equipped with a three-point latching system and hold-open feature. A 2" deep liquid tight pan that covers the entire bottom of the cabinet shall be furnished to contain liquid leaks and spills. A full-depth adjustable shelf is also provided. The shelf is perforated to allow air circulation within the cabinet. Two diametrically opposed vents with spark screens are provided in the back of the cabinet as well as a grounding screw. The cabinet shall have interior finish same as exterior.

The cabinet shall be labeled: "FLAMMABLE – KEEP FIRE AWAY".

T. Accessories:

1. Filters and Housings:

Where called for, a filter housing shall be provided above the hoods. The housing shall contain an absolute filter (99.97% efficient for 0.3 micron particles) and a furnace type prefilter. The housing shall form a rigid, self-supporting assembly and have a gasketed front cover to allow replacement of the filters without disturbing the ductwork. The filter housing shall be fabricated of cold rolled steel with a chemical resistant finish.

2. Alarms (Optional – Choose One):

a. Low Face Velocity Alarm:

Fume hoods shall be provided with an electronic alarm system to detect low hood face velocities. The alarm system shall sense the actual face velocity of the hood regardless of sash position. The system shall have air velocity sensing thermistor located in the monitor on the face of the hood. The monitor shall have a green light activated when the face velocity is above the set point and a red light and audible alarm which are activated when the face velocity is below the set point. The audible alarm can be acknowledged and silenced with mute switch on panel. When the mute is activated, it automatically resets itself when face velocity again rises above calibrated set point. The set point is to be factory set and calibrated at approximately 70 FPM. Field calibration is possible with adjustment of recessed zero potentiometer on front of unit.

b. Low Static Pressure Alarm:

Fume hoods shall be provided with an alarm system to detect low hood face velocities. The alarm system shall sense the static pressure in the exhaust duct above the hood using a differential pressure switch. The switch shall incorporate a gauge and switch set point indicators for continuous indication of hood static pressure and alarm settings. The switch shall be diaphragm operated with switching accomplished by photocell controlled relays. The alarm shall have both high and low set points which can be set from the front of the unit. The alarm shall have both visible (red light) and audible (buzzer) signals to alert the fume hood operator of an unsafe condition. The buzzer shall have a momentary contact silencing switch to allow the buzzer to be silenced. The red light shall remain on as long as the alarm condition exists.

c. Digital Face Velocity Alarm System:

Fume hoods shall be provided with an alarm system to detect low and high hood face velocities. The alarm system shall indicate the actual face velocity of the hood regardless of sash position. The system shall have an air velocity sensor mounted on the interior side liner of the hood where it is easily accessible for cleaning. The velocity monitor shall have a digital display of the air velocity through the hood face in feet per minute. The alarm signals shall activate any time the face velocity falls below the low velocity alarm set point or rises above the high velocity alarm set point. There shall be both visual and audible alarm signals. The audible alarm shall have a mute. Low and high alarm contacts shall be provided for remote monitoring.

2.02 SPECIFIC PURPOSE FUME HOODS

A. Perchloric Acid Hood:

1. Hood Interior Lining including end panel and back panel, shall be 14 gauge, Type 316 stainless steel with a No. 4 finish. Baffles and top panel shall be 16 gauge, Type 316 stainless steel with a No. 4 finish. The duct collar shall be Type 316 stainless steel with a drip edge. The baffle shall be held in place with stainless steel screws and shall be removable to allow cleaning of the area behind the baffle. The inside back and end

panels shall be made in a one-piece wrap around which is welded to the worksurface, forming smooth 1/2" radius corners. All interior corners shall be 1/2" radius, except for top liner, which is spot welded to the wrap-around. The entire stainless steel hood interior shall be reinforced with angles and plug hats to provide a completely rigid assembly and shall be welded together to form a self-supporting assembly. The hood end liners shall not have access openings.

2. Hood Service Fittings shall include a remote controlled perforated spray pipe to wash down surface of hood in rear of baffle and a remote controlled water fitting. The spray pipe shall run the full length of the hood interior and shall be located above and behind the baffle. Valves for the wash down and water fitting shall be front loaded type, mounted in the vertical fascia panel. The water fitting shall include a panel flange and angle serrated hose connector with a chemical resistant metallic bronze finish.
3. Hood Light Fixture (bulbs not included) shall be the vapor proof incandescent type, 150 watt capacity. Fixture shall be UL approved and labeled.

Hood Size, Ft.	No. of Fixtures
4	1
5	1
6	1
8	2

4. Hood Worksurface shall be 14 gauge, Type 316 stainless steel with a No. 4 satin finish made in the form of a watertight pan 12" deep to contain spillage, with a 6" wide safety ledge at the front edge and an integral trough sink at the rear. The trough sink shall contain two 1-1/2" I.P.S. outlets located 11" from each outside end panel to facilitate the removal of water from the washdown system.

B. Isotope Hood:

1. Hood Interior Lining including end panels and back panel – shall be 14-gauge, Type 304 stainless steel with a No. 4 finish. Baffle and top panels shall be 16-gauge, Type 304 stainless steel with a No. 4 finish. The duct collar shall be Type 304 stainless steel. The rear baffle shall be held in place with stainless steel screws and shall be removable to allow cleaning and decontamination of the area behind the baffle. The inside back and end panels shall be made in a one-piece wrap-around which is welded to the work top, forming smooth 1/2" radius corners. All interior corners shall be 1/2" radius, except for top liner, which is spot welded to the wrap-around. The entire stainless steel hood interior shall be reinforced with angles and plug hats and shall be welded together to form a self-supporting assembly. The hood end liners shall not have access openings and the front fascia panel shall be punched to accept front loaded service fittings.
2. Hood Worksurface shall be 14-gauge, Type 304 stainless steel with a No. 4 satin finish made in the form of a watertight pan, 1/2" deep to contain spillage, with a 6" wide safety ledge across the front edge. A round cup drain mounted flush with the recessed top, shall be provided. The worksurface shall be reinforced to support a uniform maximum loading of 200 pounds per square foot.

PART 3 – EXECUTION – SUPREME AIR SERIES FUME HOOD AND RELATED PRODUCTS

3.00 SITE EXAMINATION

The owner and/or his representative shall certify building conditions conducive to the installation of a finished goods product, including all critical dimensions.

3.01 INSTALLATION

- A. Preparation:
Prior to beginning installation of fume hood, check and verify that no irregularities exist that would affect quality of execution of work specified.
- B. Coordination:
Coordinate the work of the Section with the schedule and other requirements of other work being performed in the area at the same time both with regard to mechanical and electrical connections to and in the fume hoods and the general construction work.
- C. Performance:
Install fume hoods, plumb, level, rigid, securely anchored to building and adjacent furniture in proper location, in accordance with manufacturer's instructions and the approved shop drawings. Provide filler panels between top of hood and ceiling. Securely attach access panels but provide for easy removal and secure reattachment. Do not install any damaged units.
- D. Adjust and Clean:
 - 1. After installations are complete, adjust all moving parts for smooth operation.
 - 2. Remove all packing materials and debris resulting from this work, and turn over the fume hoods to the Owner clean and polished both inside and out.
 - 3. Repair or remove and replace defective work, as directed by owner and/or his representative upon completion of installation.
- E. Protection:
 - 1. Provide reasonable protective measures to prevent casework and equipment from being exposed to other construction activity.
 - 2. Advise owner and/or his representative of procedures and precautions for protection of material, installed laboratory casework and fixtures from damage by work of other trades.
- F. Certification:
 - 1. Fume Hood Manufacturer shall field test a random sample of 20% of the installed units using ANSI/ASHRAE 110-1995 to a control level of AI 0.01 ppm or better.
 - 2. Project substantial completion shall be withheld until all required fume hood certification letters, tests, and reports have been submitted to and approved by the Architect.