SECTION 11610 –LABORATORY FUME HOODS AND RELATED PRODUCTS

PART 2 – PRODUCTS

2.03 FANS

1. General
   a. Fans shall be clockwise rotation, single width, single inlet, centrifugal type, with Vertical upblast discharge.

   b. The centrifugal fan assembly shall consist of fan impeller wheel, housing, electric motor, bearings, V-belt driven shaft, stainless steel weather cover and accessories. All components shall be attached to a common base which shall include provisions for fastening it to a foundation. The assembly shall be completely assembled, ready for mounting and wiring to power source.

2. Fan Materials and Construction
   a. Fan Wheels:
   Fan wheels shall be one of two (2) types and shall be dynamically balanced. Plastic or fiberglass wheels are not acceptable. Types are as follows:

      1) Forward Inclined Blade Wheels - The wheel shall consist of die formed identical blades, machine riveted to a die punched rim and back plate to form a rigid wheel assembly.

      2) Backward Inclined Blade Wheels - The wheel shall consist of flat, die formed identical blades, machine riveted to the die punched back plate and arc welded to the front rim to form a rigid wheel assembly.

   b. Fan Shaft:
   Shafts shall be turned, ground and polished carbon steel alloy and shall be sized to provide maximum horsepower for the size of fan involved.

   c. Fan Housings:
   Housings shall be constructed of carbon steel or aluminum sheet and have a nominal 16 gauge thickness. Housings shall be welded construction and shall be reinforced to minimize vibration. The discharge direction shall be reinforced to minimize vibration. The discharge direction shall be up-blast with clockwise rotation as designated by the AMCA standard method of designation for rotation and discharge.

   d. Weather Covers:
   Weather covers shall be constructed of #24 gauge stainless steel No. 2B finish.

   e. Fan Bearings:
   Fans shall be equipped with precision anti-friction bearings, pre-lubricated and sealed. Bearings shall be the self-aligning type and shall be mounted in suitable pillow blocks with provision for attachment to the fan frame assembly.

   f. Fan Sheaves:
   Fans shall be equipped with high quality cast iron adjustable pitch type motor sheaves and shall be sized to provide the CFM and static pressure range a shown in the manufacturer's catalog ratings. Fan shaft sheaves shall be similar, non-adjustable.

   g. Fan Motors:
   Fan motors shall conform to NEMA MG-1 and shall be capable of continuous operation when driving the fan at rated conditions. Motors shall be UL listed.

1) Motors shall be in one of the following electrical voltages as standard:
   - 115/230 Volt, 60 H_z, Single Phase
   - 230/460 Volt, 60 H_z, Three Phase

2) Motors shall be one of the three (3) types:
   - ODP (open, drip proof)
   - TEFC (totally enclosed, fan cooled)
   - EP (explosion proof)

   with the following characteristics:

Motor Type	Insulation	Base *	Bearing *
ODP	Class A	Resilient-Rigid	Sleeve-Ball
TEFC	Class A or B	Resilient-Rigid	Sleeve-Ball
EP**	Class A or B	Resilient-Rigid	Sleeve-Ball

* - Depending on horsepower requirements

** - Class 1, Group D, E, F and G; and Class 2, Group E, F and G

3. Fan Finish
   a. Fan Housing and Motor Support Frame Finish:
      1) 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 metal and to aid in the prevention of corrosion. Physical and chemical cleaning of the metal 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.

      2) After the phosphate treatment, the metal shall be dried and all metal surfaces shall be coated with a corrosion-resistant paint finish. The coating shall then be cured by baking at elevated temperatures to provide maximum properties of corrosion and wear resistance. The finish shall meet the Performance Requirements specified in Section 5.02 d. 2. d.

      3) KEM-FP Corrosion Resistant Finish (Optional):
      Fan housing and other components within the exhaust air stream shall, after the units have been completely welded together and before finishing, be given a pre-paint treatment to provide excellent adhesion of the finish system to the metal and to aid in the prevention of corrosion. Immediately following the pre-finish treatment, the surfaces shall be pre-heated to required pre-heat temperature and then all surfaces shall be given a single coating (5-6 mil thick) of fluoropolymer resin coating and post baked at 550 degrees F. temperature for 12 minutes. The completed finish shall meet the performance test requirements specified under Performance Test Results in Section 5.01 D. 3. e.

   b. Impeller Wheel Finish:
      1) Standard:
      Special KEM-FP Corrosion Resistant - After the wheels have been completely assembled and before finishing, they shall be given a pre-paint treatment to provide excellent adhesion of the finish system to the metal and to aid in the prevention of corrosion. Immediately following the pre-finish treatment, the surfaces shall be pre-heated to the required pre-heat temperature and then all surfaces shall be given a single coating (5-6 mil thick) of fluoropolymer resin coating and post baked at 550 degrees F. temperature for 12 minutes. The completed finish shall meet the performance test requirements specified under Performance Requirements in Section 5.02 D. 2. e.

2) Perchloric:
For perchloric acid use, all parts within the air stream shall be coated with a special corrosion resistant fluoropolymer finish.

4. Fan Performance Requirements
   a. Airflow AMCA Certification:
   Fan performance shall be in accordance with test codes adopted by AMCA.

   b. Conditions:
   The fan ratings shall be based on 70 degrees F. inlet air at a barometric pressure of 29.92 inches. The fans shall provide the rated CFM and static pressure shown in the fan chart ratings contained in the manufacturer's catalog.

   c. Performance Test - Finish:
      1) Terms and Equipment:
      Terms and equipment defined as required for the paint system finish and performance specification evaluation.

      Specified Chemicals - This list is composed of reagents commonly used in the laboratories that purchase laboratory furniture.

      Watch Glass - Round, convex glass pieces designed for laboratory reagent testing. One size per panel is recommended for uniformity.

      Convex - Curved or rounded like the exterior of a sphere or circle, the curved side of a watch glass.

      Saturate - To load to capacity or fill completely.

      Cotton Balls - Approximately one cubic inch balls of cotton fiber, not sterilized, each weighing approximately 0.32 grams.

      2) Performance Test Ratings:
      The terms referred to in Performance Test Results follows:

      "Excellent" - indicates that the test leaves no visible effect on the finish film other than an increase in gloss.

      "Good" - indicates that the testing leaves no effect other than slight discoloration, slight decrease in gloss or * temporary slight softening of the finish film with no loss of adhesion and film protection.

      "Failures" - are indicated as objectionable discoloration or decrease in gloss, swelling, blistering, softening, or bared metal.

      * Temporary slight softening may exist upon reagent removal, but should be termed as failure only if the softened condition exists at the end of the one hour recovery period.

      3) Performance Test (Chemical Spot Test):
         a) The test panel should be a suitable sized production piece.

         b) Prepare the test panel with labeled spaces for each of the specified chemicals. Two by two inch test spaces should be used.

         c) Chemical spot tests should be made by applying ten (10) drops (approximately 1/2 cc) of each reagent to the test surface. Each reagent should be covered with a watch glass, convex side down, in the center of the puddle to hold the reagent in place. Volatile solvents should be applied by

using saturated one inch cotton balls, which are in turn, covered by inverted two ounce wide mouth bottles to retard evaporation.

d) All spot tests should be performed in such a manner that the tested surfaces remain wet throughout the entire test period, at a temperature of 77^{o} F. plus or minus 3^{o} F. At the end of the test period, the test surface should be flushed with cold water and lightly scrubbed with a soft bristle brush and soapy water, then rinsed and dried before examination and evaluation. Test results are to be determined at the end of a one hour recovery period. Performance test ratings are to be determined as indicated in D.2.b. (The test approximates the actual condition of a reagent bottle setting in a puddle of the reagent on a surface).

4) Resistivity of Housing and Motor Support Frame Finish Shall Equal:

Reagents*	Time in Minutes	Test Ratings
Acetic Acid, 98%	60	Good
Sulfuric Acid, 25%	60	Excellent
Sulfuric Acid, 85%	60	Good
Hydrochloric Acid, 37%	60	Excellent
Nitric Acid, 25%	60	Excellent
Phosphoric Acid, 75%	60	Excellent
Perchloric Acid, 70	60	Excellent
Methylene Chloride	60	Excellent
Sodium Hydroxide, 25%	60	Excellent
Sodium Hydroxide, 10%	60	Excellent
Ammonium Hydroxide, 28%	60	Excellent
Hydrogen Peroxide, 5%	60	Excellent
Ether	60	Excellent
Ethyl Alcohol **	60	Excellent
Ethyl Acetate **	60	Excellent
Xylene **	60	Excellent
Acetone **	60	Excellent
Formaldehyde, 37%	60	Excellent
Carbon Tetrachloride **	60	Excellent
Methyl Ethyl Ketone **	60	Excellent

* Where concentrations are indicated, percentages are by weight.
** Volatile solvents, applied by saturated cotton ball method.

5) Results Impeller Wheel Finish Should Equal or Exceed:

Reagents*	Time in Hours	Test Ratings
Acetone **	168	Excellent
Ammonium Hydroxide, 28%	168	Excellent
Benzene **	168	Excellent
Butyl Alcohol **	168	Excellent
Carbon Tetrachloride **	168	Excellent
Chloroform **	168	Excellent
Chromic Acid, 60%	168	Excellent
Cresol	168	Excellent
Dioxane **	168	Excellent
Ethyl Acetate **	168	Excellent

Ethyl Alcohol **	168	Excellent
Ethyl Ether **	168	Excellent
Formaldehyde	168	Excellent
Formic Acid, 90%	168	Excellent
Furfural	168	Excellent
Gasoline **	168	Excellent
Gentian Violet, 1% Aq.	168	Excellent
Glacial Acetic Acid, 99%	168	Excellent
Hydrochloric Acid, 37%	168	Excellent
Hydrochloric Acid, 20%	168	Excellent
Hydrofluoric Acid, 48%	168	Excellent
Methanol **	168	Excellent
Mono-Chlorobenzene **	168	Excellent
Nitric Acid, 70%	168	Excellent
Nitric Acid, 30%	168	Excellent
Nitric Acid, 20%	168	Excellent
Perchloric Acid, 60%	168	Excellent
Perchloric Acid, 70%	168	Excellent
Phenol, 85%	168	Excellent
Phosphoric Acid, 85%	168	Excellent
Silver Nitrate, 10%	168	Excellent
Sodium Hydroxide, 40%	168	Excellent
Sodium Hydroxide, 10%	168	Excellent
Sodium Hydroxide, Flake	168	Excellent
Sodium Hypochlorite, 5%	168	Excellent
Sulfuric Acid, 96%	168	Excellent
Sulfuric Acid, 77%	168	Excellent
Sulfuric Acid, 33%	168	Excellent
Tincture of Iodine	168	Excellent
Trichlorethylene **	168	Excellent
Toluene **	168	Excellent
Wright's Blood Stain	168	Excellent
Xylene **	168	Excellent
Zinc Chloride, Saturated	168	Excellent

* Where concentrations are indicated, percentages are by weight.

** See spot test for volatile solvents on previous page.