The following are requirements for testing of fume hoods at the source (factory) which the specifier may wish to insert into Part 2 of the fume hood specifications.

**1. SOURCE QUALITY CONTROL TESTING OF FUME HOODS**

At Owner's option, Owner may verify data with his instruments providing instrument suitability and calibration are mutually acceptable.

A. Evaluation of manufacturer's standard product shall take place in manufacturer's own test facility, with testing personnel, samples, apparatus, instruments, and test materials supplied by the manufacturer at no cost to the Owner.

B. Submit test report consisting of the following test parameters and equipment for each hood width and configuration specified.

C. Hood shall achieve a rating of 4.0 AM 0.1 P.P.M. or better. Tested to ASHRAE-110-R.

D. Test facility: Sufficient size to provide unobstructed clearance of five feet each side and ten feet in front of fume hood. Provide make-up air to replace room air exhausted through fume hood and to obtain a negative 0.2" w.g. room pressure. Introduce make-up air in a manner that minimizes drafts in front of hood to less than 20% of the face velocity. Connect 100 feet per minute air velocity through face of fume hood. Adjustment in blower shall vary face velocity down to 75 feet per minute.

1. Examine facility to verify conformance to the requirements of this Section.

2. Test room shall be isolated from all personnel during test procedure.

*Provide following for testing of auxiliary air fume hood.*

3. Control room temperature and maintain quantity of auxiliary air sufficient to meet the manufacturer's stated ratio of auxiliary air to exhaust air.

Provide following for testing of Vectrol fume hoods.

4. Maintain temperature of auxiliary air 10 degrees F. above room temperature.

E. Testing equipment:

1. Properly calibrated hot wire thermal anemometer probes equal to Sierra Model 600-02; correlate with computer data acquisition format to provide simultaneous readings at all points.

2. Pitot tube and inclined manometer with graduations no greater than 0.2 inch of water, equal to F.W. Dwyer Model 400. Calibration curves based on 20. Pitot traverse readings and correlated to a digital readout indicator to provide quick and accurate adjustment of air flows.

3. Tracer gas: Sulfur hexa-fluoride supplied from a cylinder at a test flow rate of four liters per minute.

4. Ejector system: Tracer gas ejector equal to IHE No. 525-014. Submit sufficient proof of ejector system calibration.

5. Critical orifice: Sized to provide tracer gas at four liters per minute at an upstream pressure of 30 PSIG.

6. Detection instruments: Ion Track Model 61 Leak Meter II sulfur hexafluoride detector instrument.

7. Recorder with accuracy better than plus or minus 0.5% of full scale.

8. Three-dimensional manikin, overall height 67", clothed in a smock.

9. Titanium tetrachloride glass modules. CAUTION: Titanium tetrachloride is corrosive and irritating; skin contact or inhalation shall be avoided.

10. One dozen 30-second smoke bombs.

F. Preliminary Test and Data:

1. Provide sketch of room indicating room layout, location of significant equipment, including test hood and other hoods. Provide sketch of air supply system indicating type of supply fixtures.

2. Reverse air flows and dead space:

a. Swab strip of titanium tetrachloride along both walls and floor of hood in a line 6" behind and parallel to the hood face, and along the top of the face opening. Swab an 8" diameter circle on the back of the hood. All smoke should be carried to the back of the hood and exhausted.

b. Test the operation of the bottom air bypass air foil by running the cotton swab under the air foil.

c. If visible fumes flow out of the front of the hood, the hood fails the test and receives no rating.

3. Face velocity measurements: Face velocity shall be determined by averaging minimum of four and maximum of eight readings at the hood face. Take readings at center of a grid made up of sections of equal area across the top half of the face and sections of equal area across the bottom half of the face. Take simultaneous readings at each point with a series of calibrated hot wire anemometers over a one minute period of time. Probes shall be correlated to a computer data acquisition package, which will provide an average of each reading over that one minute period and also an overall average. During the one minute monitoring period, all velocities must automatically update average at a maximum of four second intervals.

G. Test Procedure:

1. Check sash operation by moving sash through its full travel. Verify that sash operation is smooth and easy, and that vertical rising sash shall hold at any height without creeping up or down. Position sash in the full open position.

2. Measure exhaust air flow with the baffles' position to give maximum air flow. Measure exhaust air volume with baffles' position to give minimum air flow. Verify that the air volume at minimum air flow is not less than 95% of the exhaust air volume at maximum air flow. Hoods exceeding this fail the test and receive no rating.

3. Take a static pressure reading, using methods assuring an accurate reading, in an area of the ductwork no more than three feet nor less than one foot above the exhaust collar. Static pressure loss shall not exceed values given under Design Requirements in Part 1 of this Section.

4. Install ejector in test positions. For a typical bench-type hood, three positions are required: left, center and right as seen looking into the hood. In the left position the ejector center line is 12" from the left inside wall of the hood; center position is equal distance from the inside sidewalls; and the right position is 12" from the right inside wall. The ejector body is 6" in from the hood face in all positions. Location of ejector may require modification for hoods of unusual dimensions.

5. Install manikin positioned in front of the hood, centered on the ejector.

6. Fix detector probe in the region of the nose and mouth of the manikin. Take care that method of attachment of the probe does not interfere with the flow patterns around the manikin. Locate nose of manikin 9" in front of ejector (3" in front of sash).

7. Open tracer gas block valve. Correlate readings with a computer data acquisition package, which is capable of monitoring and visually recording a minimum of one reading per second for a minimal three minute time period at each of the three positions.

8. The control level rating of the hood shall be the maximum of the three average values for the three test positions.

9. Record performance rating of the fume hood as XXAMyyy, where XX equals the release rate in liters per minute (4.0) and AM represents the as manufactured test sequence and yyy equals the control level in parts per million.

10. All data on the above test conditions including instrumentation and equipment, test conditions, preliminary test and data information shall be provided on a one page report, including a printout of the average face velocities, and a separate graph-type performance curve on all three tracer gas positions.

H. Constant Volume/Bypass and VAV/Conventional Fume Hoods:

1. Conduct test as outlined above with the sash open.

2. Ignite a smoke bomb within the fume hood work area to verify that the fumes are quickly and efficiently carried away. Move the lighted bomb about the fume hood work area, checking near fume hood ends and work surface to verify that there is no reverse flow of air at these locations.

I. Air flow in fume hoods with auxiliary air:

1. When the specified velocity has been determined, the volume of exhaust air should be verified by multiplying the average face velocity by the square foot area of the fume hood opening. The volume of exhaust air may be determined by other recognized procedures. In accordance with industry standards, the auxiliary air blower shall be turned off during face velocity grid readings.

2. Following grid readings, turn on the auxiliary air blower, adjust to give the proper quantity of auxiliary air, and continue with other steps outlined in Test Procedures above. The quantity of auxiliary air should be determined by the use of a 20 point Pitot tube traverse of the duct and be correlated to an indicator to provide easy adjustment for varying volumes. The quantity of auxiliary air may be determined by other recognized procedures. The temperature of the auxiliary air shall be adjusted to 10 degrees F. above the room temperature.

3. When the proper air volumes and temperatures have been obtained and with the sash in the full open position except as indicated, conduct the following tests:

a. Ignite a smoke bomb within the fume hood work area to verify that the fumes are quickly and efficiently carried away. Move the lighted bomb about the fume hood work area, checking near fume hood ends and work surface to verify that there is no reverse flow of air at these locations.

b. Discharge smoke bomb into the auxiliary air duct ahead of the blower to insure that the smoke is thoroughly mixed with the auxiliary air. Observe the flow of air down and into the fume hood face to verify that capture efficiency is 95% minimum.

4. With the sash in a closed position, discharge a smoke bomb in auxiliary air duct and verify that all smoke and air is captured and drawn through the fume hood work area.

END OF SECTION