Fume Hood Performance Certification

Standard Operating Procedure (SOP)
Version 1. 10/20/2023

PURPOSE:

This SOP aims to establish the standard workflow for conducting EH&S performance certifications of fume hoods. The following procedure has been adapted from the American National Standards Institute (ANSI) 110-2016: Methods of Testing Performance of Laboratory Fume Hoods. This SOP details the certification frequency, testing criteria, documentation/labeling, along with outlining steps for addressing concerns.

RESPONSIBILITIES:

- ☐ EH&S is responsible for completing and documenting performance checks. Alternatively, designated departmental safety personnel may conduct fume hood certifications in full accordance with this SOP.
- ☐ Fume Hood performance certifications are minimally performed on a yearly basis.
- ☐ In addition to routine annual testing, fume hood performance testing must be performed following any replacement/repair to the unit, airflow controllers, or HVAC components that may influence performance (i.e., exhaust fan(s), dampers, actuators, etc.).
- ☐ Results of the performance checks must be posted on the unit. If issues are noted during the performance checks, EH&S is responsible for posting appropriate notifications.
- ☐ EH&S is accountable for submitting safety work orders to address any noted concerns that necessitate repairs.

PERFORMANCE TESTING:

I. General Test Conditions:

1. Building/room ventilation systems shall be in standard operation during these tests.
2. Any standard procedures for the laboratory shall be observed during these tests (e.g. limitations on the number of hoods in operation at one time, etc.).
3. The sash or sashes shall be staged in the design position(s).
4. If the hood has an auxiliary supply, the supply shall be in operation during the tests. If the supply is capable of convenient adjustment by laboratory personnel, the adjustments shall be as specified.
5. General activity in the laboratory shall be maintained in as normal a state as possible.
6. The tests shall be conducted with normal hood apparatus in place and in operation.

II. Visual Check:

1. Unit Integrity:
   a. Visually inspect the sash to verify it is intact and free of cracks or other potentially compromising damage.
   b. Confirm the side panels are in place.

c. Verify the unit is free of any signs of notable incidents (such as fire damage, excessive corrosion, etc.).
d. Ensure the position of the sash can be readily adjusted. Upon adjustment, verify vertical sashes remain in place.

2. Display Monitor.
   a. Verify the local display monitor is operational and not in alarm.
   b. Ensure the unit is operating under normal conditions and not set to non-standard (i.e. emergency exhaust) settings.

III. Face Velocity Measurement:

1. Anemometer:
   a. Face velocity measurements shall be made with a calibrated thermal anemometer. The unit shall be minimally calibrated on a yearly basis.
   b. The probe must be fully extended prior to acquiring data. Be mindful of environmental factors that may disrupt airflow dynamics and disrupt face velocity measurements.

2. Fume hood preparation:
   a. If the unit was not on, allow at least 1 minute of operation prior to measuring face velocity.
   b. If the sash has been adjusted, allow at least 30 seconds prior to measuring face velocity.
   c. Divide the open face of the fume hood into imaginary grids. Each grid section shall be less than 1 ft^2 (0.09 m^2), and the larger side of the grid rectangle shall not exceed 13 in. (330 mm).

3. Vertical sash configurations:
   a. Ensure the sash is raised to maximum operating height of 18”. If testing a variable air volume unit, repeat the test with the sash staged midway (9”).
   b. To accommodate for maximal sash height, it is recommended for grid rectangles to be 9”x12”; thus, 4 foot hoods should have a minimum of 8 measurements, and 6 foot hoods should have a minimum of 12 measurements.
   c. Determine the average face velocity based upon the acquired readings. Record the total average face velocity.

4. Horizontal sash configurations:
   a. Measurements must be acquired for every potential maximal operating position (which may include left, center, and right sash openings).
   b. Determine the average face velocity based upon the acquired readings. Record the total average face velocity.

5. Vertical/horizontal combination sashes:
   a. Test according to all applicable operating positions as previously detailed.

6. Average face velocity parameters:
   a. Average face velocity measurements are optimally 100 lfm, with a lower limit of 70 lfm and an upper threshold of 130 lfm. Units that meet this criterion are considered to “Pass” face velocity measurement certification.
   b. Units with an average face velocity measurement >130 are considered to be “Marginal”. Smoke tests need to be performed on any unit that meets marginal criteria. If turbulent eddies are noted that disrupt appropriate laminar flow, staging and use of the unit may need to be modified. Alternatively, if the eddies cannot be resolved, the unit will be listed as “Fail”.
   c. Units with an average face velocity measurement <70 are considered to “Fail”.

IV. Smoke Visualization Testing:

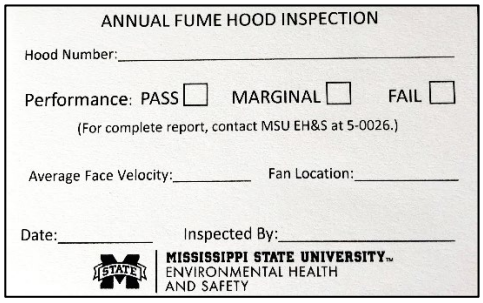
a. Smoke visualization testing should be performed on all units, and must be documented for all units that are graded as "Marginal" per face velocity measurements.
b. Smoke visualization testing "smoke" shall be produced by smoke bottles, smoke tubes, smoke sticks, or other means. This smoke shall be able to show airflow patterns within the hood without generating such volume or momentum that it affects the ability to make observations.
c. Local smoke visualization challenge consists of the following when the unit is sash is staged in the operational position:
    i. Release smoke immediately outside the hood. Observe the airflow into the hood and determine whether the room air currents appear to affect the airflow at the hood. If smoke is not readily drawn into the unit, which is typically associate with low velocity airflow, the external smoke test results in a "Fail".
    ii. Release smoke along the active (>6" behind the sash) work surface. All of the smoke generated within the hood shall be carried to the back of the hood and exhausted. If the smoke moves forward toward the front of the hood, the airflow is described as "reverse flow." A minimal amount of reverse flow will nearly always occur at the marginal edge of the work surface (<6" behind the sash) and is considered normal. Any uncorrected turbulent "reverse flow" is noted, which is primarily potentially affiliated with high velocity airflow, the internal smoke test results in a "Fail".

DOCUMENTATION

☐ Document results in the linked Smartsheet log.

☐ Complete the written inspection log that is prominently posted on the unit. When certifying performance, heed the following standards:

- If both the face velocity measurements and smoke tests pass, the unit performance is rated as "Pass".
- If the face velocity is measured as "Marginal", yet the smoke test does not indicate turbulent "reverse flow" and is rated as "Pass", the overall performance is rated as "Marginal".
- If the face velocity is measured as "Marginal", yet the smoke test is rated as "Fail", the overall performance is rated as "Fail".
- If the face velocity measurement is rated as "Fail", the overall performance is rated as "Fail".


ANNUAL FUME HOOD INSPECTION

Hood Number:_____

Performance: PASS ☐ MARGINAL ☐ FAIL ☐

(For complete report, contact MSU EH&S at 5-0026.)

Average Face Velocity:_____ Fan Location:_____

Date:_____ Inspected By:_____

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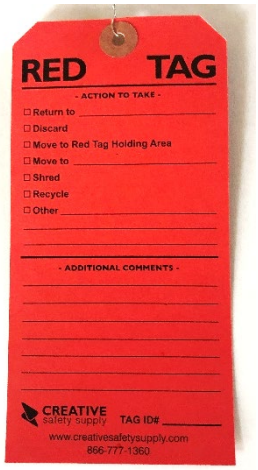
ISSUES:

- ☐ If face velocity limitations are noted that can be addressed through reduced sash opening, "Appropriate Working Height" labels must be posted.

- ☐ Units that are inoperable, have a non-functional display monitor, have a display monitor reading that exceeds 25% variance from the measured face velocity, or "Fail" to achieve acceptable face velocity parameters are inherently unsafe and must be clearly labeled as "Do Not USE". EH&S must submit Safety Work Orders on a regular basis to the EH&S Facilities Management coordinator(s). When submitting urgent work orders, please consider the following:

- ☐ Units that are damaged or have "Marginal" face velocity measurements require a "Red Tag" to indicate repairs are needed. The investigator or building manager must be notified of the concern, and it is their responsibility to submit applicable Facilities Management work order(s).



WORK ORDER FOLLOW-UP

- ☐ Upon completion of a work orders that may influence airflow dynamics (e.g., adjusted controllers, replaced dampers, exhaust fan repairs, etc.), the fume hood must be re-certified.
    - If optimal parameters are met, update the Smartsheet log, update the posted inspection notice, and remove the applicable warning label.
    - If optimal parameters are not achieved, please adhere to previously-detailed issue resolution workflow.