

Laboratory and Factory Exhaust

When do the Standards Apply?

The 2019 Building Energy Efficiency Standards (Energy Code) has requirements for laboratory and factory exhaust systems with any of the following:

- Laboratory exhaust systems with a minimum air circulation rate of 10 air changes per hour (ACH) or less.
- Laboratories and factories with mechanical exhaust in conditioned space.
- Laboratories and factories with new fan exhaust system greater than 10,000 cubic feet per minute (cfm).
- Laboratories with variable air volume fume hoods with vertical only sashes located in fume hood intensive laboratories as described in Table 1.

The minimum requirements for laboratory and factory exhaust systems are found in California Code of Regulations, Title 24, Part 6, §140.9(c).

Additional information can be found in the Nonresidential Compliance Manual (NCM), Chapter 10. The NCM has discussions about the requirements with insightful diagrams and compliance examples.

What are the Requirements?

Airflow Reduction Requirements

Laboratory exhaust systems with a minimum air

circulation rate of 10 ACH or less have exhaust and makeup airflow rate requirements. The system must reduce exhaust and makeup airflow rates to the larger of:

- The regulated minimum circulation rate.
- The minimum required to maintain pressurization requirements.

Variable exhaust and makeup airflow must be coordinated to achieve the required space pressurization at varied levels of demand and fan system capacity.

There are two exceptions to these requirements:

1. Systems serving zones where constant volume is required by the authority having jurisdiction, the environmental health and safety department for the facility, or other code.
2. New zones on an existing constant volume exhaust system.

Exhaust System Transfer Air

Conditioned supply air delivered to any space with mechanical exhaust must comply with the exhaust system transfer air requirements of Section 140.4(o).

Fan System Power Consumption

All new fan exhaust systems greater than 10,000 cfm serving a laboratory or factory, must meet A and either B, C, or D:

Table 1: Fume Hood Intensive Laboratories

Occupied Minimum Ventilation ACH	≤ 4	> 4 and ≤ 6	> 6 and ≤ 8	> 8 and ≤ 10	> 10 and ≤ 12	> 12 and ≤ 14
Hood Density (linear feet per 10,000 ft³ of laboratory space)	≥ 6	≥ 8	≥ 10	≥ 12	≥ 14	≥ 16

- A. System must meet all discharge requirements in ANSI Z9.5-2012.
- B. The exhaust fan system power must not exceed the following:
 - I. Systems with air filtration, scrubbers, or other air treatment devices must not exceed 0.85 watts/cfm of exhaust air.
 - II. All other the system power must not exceed 0.65 watts/cfm of exhaust air.

There is an exception to B for systems where code requires air treatment devices causing a water pressure drop > 1 in.

- C. The volume flow rate at the stack must vary based on the measured 5-minute averaged wind speed and wind direction obtained from at least two calibrated anemometers and the following:
 - I. The exhaust volume flow rate must be based on the 2018 American Conference of Governmental Industrial Hygienists Threshold Limit Values and Biological Exposure Indices, or other codes if more stringent.
 - II. Wind speed/direction sensors must be calibrated and certified by the manufacturer.
- D. The stack volume flow rate must vary based on the contaminant concentration measured by calibrated sensors installed within each exhaust plenum and the following:
 - I. A contaminant-event threshold based on maintaining downwind concentrations

below health and odor limits for all detectable chemicals at worst-case wind conditions.

- II. At least two Photo Ionization Detectors (PID) sensors certified and calibrated by the manufacturer must be used.

In the event of an anemometer or sensor failure, the system must reset the exhaust volume flow rate to maintain downwind concentrations below health and odor limits at worst-case wind conditions. The system must automatically report the fault to a remote system provider.

The equipment and system must be tested and meet the acceptance test requirements in Reference Nonresidential Appendix NA7.16.

Fume Hood Automatic Sash Closure

Sash closure systems in fume hood intensive laboratories as described in Table 1 that have variable air volume fume hoods with vertical only sashes must have the following:

- A. A dedicated zone presence sensor that automatically closes the sash within 5 minutes of no detection.
- B. Controls to prevent the sash from automatic closing when a force of no more than 10 lbs. is detected.
- C. Obstruction sensor capable of sensing transparent materials such as laboratory glassware.
- D. Capability to be configured in a manual open mode that prevents the sash from opening when people are nearby.



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