Allegheny County Health Department

FOOD FACILITY PLAN REVIEW VENTILATION GUIDE

GENERAL

All rooms shall have sufficient ventilation to keep them free of excessive heat, steam, condensation, vapors, obnoxious odors, smoke and fumes. Ventilation systems shall be designed and installed according to law and, when vented to the outside, shall not create a nuisance nor an unsightly, harmful or unlawful discharge.

All hoods should be tested prior to use, to ensure the hoods exhaust adequately.

Lighting within the hood shall be at least 20 foot candles and shielded to protect against broken glass falling into food.

COOKING

Cooking ventilation hoods and devices shall be designed and installed to prevent grease or condensation from collecting on walls, ceilings, and fire suppression supply piping and from dripping into food or onto food contact surfaces. See figure #15-1.

All hoods shall comply with the standards of an ANSI accredited certification program and be designed, constructed and installed in conformance with the National Fire Protection Association Bulletin #96 (The Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations), and other applicable fire safety codes.

Make-up air intakes must be screened (bird screen) and filtered to prevent the entrance of dust, dirt, insects and other contaminating material. Where the introduction of make-up air will cause condensation, drafting or interfere with the exhaust or vapor capture efficiency of the hood, the make-up air must be tempered. Tempering of makeup air may be necessary in certain climates.

The installation of fire suppression system piping in the unfiltered air space in exhaust hoods should be limited to vertical runs as much as physically possible to minimize grease collection. Exposed piping must be cleanable.

Wood burning appliances must be properly exhausted with air quality equipment that adequately prevents smoke fumes, and obnoxious odors that can create a nuisance. Such devices can include charcoal activated filters, electrostatic precipitators, and catalytic converters.

HOT WATER SANITIZING DISHMACHINES

Hot water sanitizing dishwashing machines must be provided with adequate ventilation sized according to the dishwashing machine manufacturer's specifications.

GENERAL GUIDELINES

The following information is provided to offer guidance in meeting the requirement for ventilating cooking equipment. There are several methods used in calculating the volume of air movement, measured in Cubic Feet per Minute (CFM), necessary to effectively and efficiently ventilate cooking equipment. While these methods are used in general applications, it must be noted that engineered exhaust systems which are customized for specific equipment under specific use conditions may also be approved by the building code official or fire marshal.

PRINCIPLES OF EXHAUST

The purpose of an exhaust hood is to provide a method of collecting, as nearly as possible, all of the grease produced from the cooking process, while furnishing a means of removing heat, smoke, and odors from the cooking area.

For the hood to fulfill its purpose there must be a sufficient volume of air movement (capture velocity) to draw grease particles and cooking vapors directly from the cooking surface to the grease extractors. This air flow removes cooking odors and keeps grease particles from settling onto nearby surfaces.

An effective capture velocity shall be sufficient to overcome opposing air currents, capture the grease and cooking vapors, and transport them directly to the grease extractors.

Grease extractors are ineffective in removing grease vapors. Only when grease vapors cool and condense can an extractor remove grease particles by directed air flow, contraction, and expansion (drop out). It is essential to have a sufficient volume of air flowing to cool and condense the grease vapors into grease particles prior to reaching the grease extractors.

In the case of heat and steam producing equipment, the purpose of the hood or ventilation system (such as a pants-leg duct system) is to control humidity, heat, and unwanted condensation.

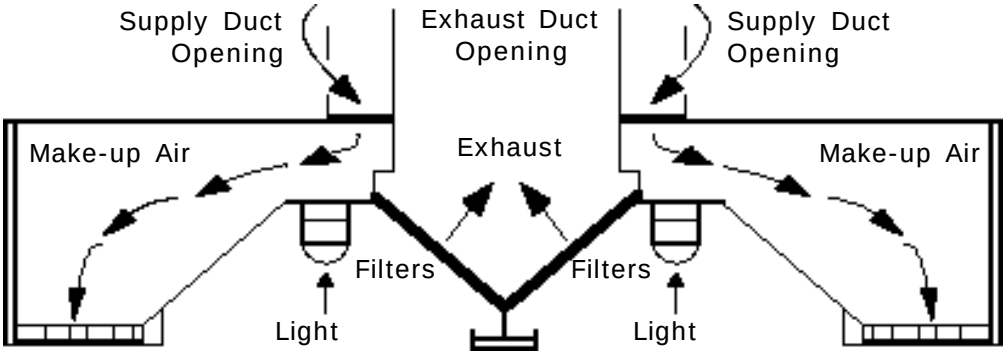
A major cause of unacceptable hood performance is a lack of coordination between the Heating, Ventilation, and Air Conditioning (HVAC) system and the exhaust hood system. These systems should be coordinated prior to installation, and balanced when installation is completed, to ensure the proper performance of both.

FIRE PROTECTION

Exhaust ventilation systems for all grease producing cooking equipment is under the jurisdiction of the State Fire Marshal's Office and local fire and building officials. System designers and/or owners should contact these officials regarding fire safety plan review and inspection.

HOOD SIZE

1. Canopy hoods and island hoods shall have a minimum depth of two feet and shall extend at least six inches beyond any equipment being ventilated, except that no overhang will be required on sides where aprons are installed. The dimensions of the hood are, in all cases, larger than the cooking surface to be covered by the hood. The amount of overhang of the hood depends upon the clearance or distance between the base of the hood and the top of the cooking equipment.



BACK **Figure #15-1 illustrates a canopy hood.**

2. Ventilator, or "backshelf", hoods are designed to mount to the wall directly behind the cooking equipment. This type of hood is often used where ceiling height is a factor. It is normally placed closer to the cooking surfaces than a canopy hood, and works well in light to medium duty cooking applications. The ventilator hood is not recommended for charbroilers or similar high heat and grease producing cooking equipment. It does not have the capture area of a canopy hood and is not able to effectively handle large surges of cooking emissions (steam, heat, vapors, etc.)

   Several dimensions are essential in the proper installation of a ventilator hood. Ventilator hoods shall extend from the wall a minimum of 16 inches, and shall be installed so that the distance from the top of the cooking equipment to the bottom of the ventilator hood is no more than 24 inches. Equipment placed under a ventilator hood shall not extend beyond the sides of the hood or more than 36 inches from the back of the hood. These restrictions are necessary to ensure maximum capture and removal of cooking emissions.

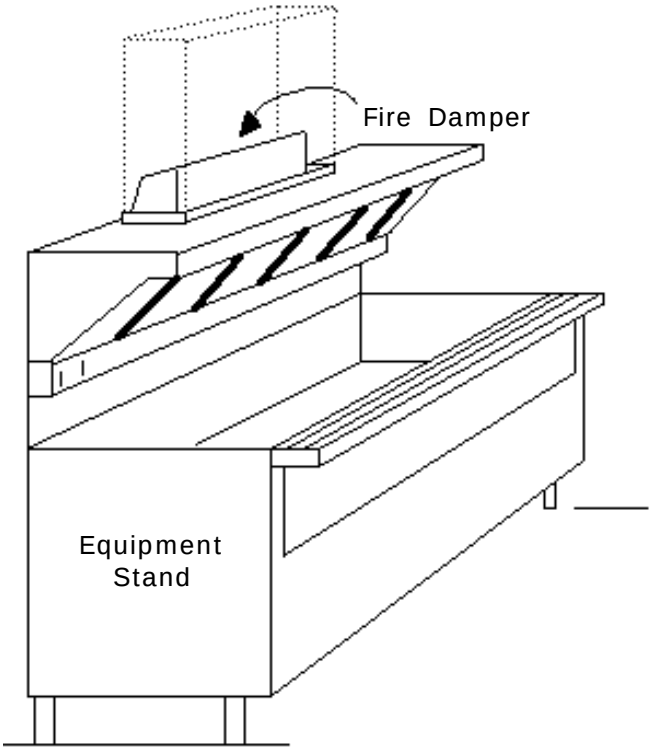


Figure #15-2 illustrates a ventilator hood.

3. Pants-leg exhaust systems are designed to remove the heat or steam close to the point of discharge from warewashers or conveyor cooking equipment. These systems must be sized to effectively ventilate the equipment served.

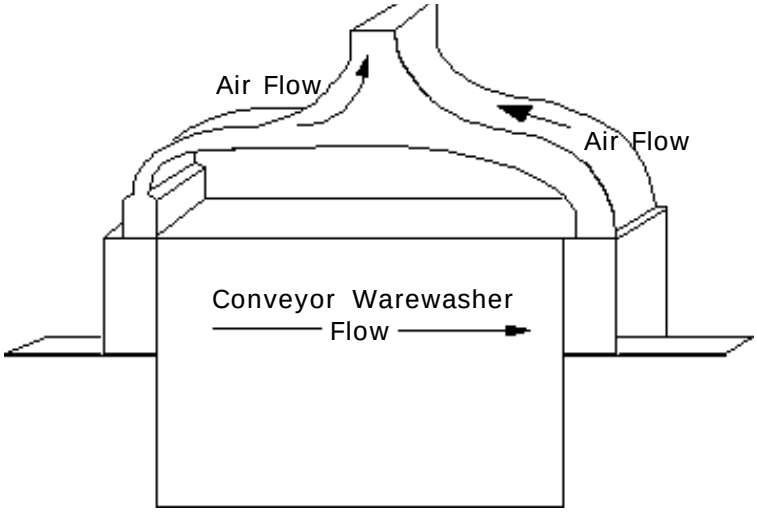


Figure #15-3 illustrates a pants-leg duct system.

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4. Eyebrow hoods are designed to immediately remove heat from an oven at the point of emission or as the door is opened. These hoods must effectively ventilate the door openings of the equipment served.

Figure #15-4 illustrates an eyebrow hood.

EXHAUSTED AIR PERFORMANCE STANDARD

The amount of air exhausted through a hood exhaust system is dependent upon the size of the hood, its particular installation, and its use. There are several methods available for determining the amount of air to be exhausted. With the exception of systems engineered for specific equipment and specific applications that are approved by the health authority, the following criteria shall be used to calculate the amount of air exhausted:

1. Canopy hoods:

A. Standard square foot method.

This method of calculating exhaust air volume is based on the size of the opening in the hood (length x width) and the capture velocity relative to the installation of the hood (see Table I).

Hood length x hood width = square feet ($ft.^2$) of hood opening.

$Ft.^2$ of hood opening x factor from Table I = CFM of air exhausted.

Table I

Exposed sides	Factor (CFM/ft.^{2})
4 (central island hood)	125
3 (wall hung hood)	100
2 (corner hung hood, or with aprons)	85
Steam or heat exhaust only	70

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Example*:*

8 ft. (length) x 4 ft. (width) = 32 ft.^{2}

32 ft.^{2} X 100 CFM/ft.^{2} (wall hung hood) = 3200 CFM

B. Exposed linear foot method.

This method of calculating the exhaust air volume is based on the total exposed linear footage of the hood and the capture velocity relative to its application (see Table II).

Exposed linear footage of hood x factor from Table II = CFM of air exhausted.

Table II

Application	Factor (CFM/in ft.)
Light duty (no grease, light grease)	150-250
Medium duty (fryers and griddles)	250-350
Heavy duty (heavy grease, charbroiler)	350+

Example:

4 ft. x 8 ft. hood (light grease), 3 exposed sides

4 ft. + 8 ft. + 4 ft. = 16 exposed linear ft.

16 exposed linear ft. x 250 CFM/linear ft. = 4000 CFM

C. Square feet of cooking surface method.

This calculation of the volume of exhausted air depends on the size, temperature, and design of the cooking equipment and the minimal capture velocity required to keep smoke, vapors, and fumes under the hood. The amount of air to be removed is calculated by multiplying the surface area of the equipment (ft.2) by the appropriate updraft velocity factor (see Table III); total air exhausted is the sum of exhaust air volumes of all the equipment added to the minimal capture velocity.

Ft.^{2} of cooking surface of each piece of equipment (length x width) x the updraft velocity factor from Table III = CFM of exhaust required for each piece of equipment.

Table III

Application	Updraft velocity factor
Steam kettles, ranges, ovens, non-grease producing equipment	50 fpm
Fryers/griddles, grease produci equipment	85 fpm
Charbroilers, high heat and grease producing equipment	150 fpm

Example:

Equipment	Square feet
oven	30"x36" = 7.5ft.^{2}
fryer	18"x24" = 3.0ft.^{2}
charbroiler	32"x54" = 7.6ft.^{2}
range	42"x34" = 9.6ft.^{2}

Ft.	Factor	Exhaust
7.5 X	50 fpm	375 CFM
3.0 X	85 fpm	255 CFM
7.6 X	150 fpm	1140 CFM
9.6 X	85 fpm	816 CFM

Total equipment exhaust volume = 2586 CFM
The minimal capture velocity = hood opening area (ft.^{2}) - cooking equipment surface area (ft.2) x 50 fpm]

Example:
4 ft. x 15 ft. hood = 4 ft. x 15 ft. = 60 ft.^{2} hood opening

Cooking equipment surface area (from above) = 7.5 ft.^{2} + 3 ft.^{2} + 7.6 ft.^{2} + 9.9 ft.^{2} = 28 ft.^{2}

Minimal capture velocity = (60 ft.^{2} - 28 ft.^{2}) x 50 fpm = 32 ft.^{2} x 50 fpm = 1600 CFM

Total system exhaust volume = equipment exhaust volume + minimal capture velocity
Example:

Total system exhaust volume = 2586 CFM (from above) + 1600 CFM (from above) = 4186 CFM

2. Ventilator and backshelf hoods.

Linear footage of hood x ventilator exhaust factor from Table IV = CFM of air exhausted.

Table IV

Application	Exhaust Factor
Light duty (no grease, light grease)	200 CFM/ft.
Medium duty (light grease producing)	275 CFM/ft.
Heavy duty (heavy grease producing)	350 CFM/ft.

Example:

12 ft. ventilator hood, medium duty (light grease producing)

12 ft. x 275 CFM/ft. = 3300 CFM air exhausted

FACTORS THAT EFFECT CUBIC FOOT INSTALLATION

FAN SIZE

The exhaust fan shall be sized to remove the amount of air to be exhausted at the required static pressure.

MAKE-UP AIR

The term “make-up air” is used to identify the supply of outdoor air to a room or building to replace the air removed by an exhaust system. For a consistent and regulated flow, make-up air should be mechanically introduced by a fan, swamp cooler, etc. Mechanically introduced make-up air shall be supplied as part of the exhaust system when the amount of air to be exhausted exceeds 1500 CFM.

Make-up air is critical to the design of a ventilation system. It is generally recognized that all systems exhausting more than 1500 CFM need mechanically introduced make-up air to ensure a balanced system. Mechanical engineers recommend that make-up air be supplied at 85 to 90 percent of the exhausted air. Make-up air controls should be interlocked with exhaust controls to ensure that the units operate simultaneously. Replacement air shall be filtered and may also be tempered by a separate control. The air velocity through the make-up air system should be low enough to avoid the possibility of drafts. It is desirable to have the kitchen under a very slight negative pressure to prevent any filtration of cooking odors from the kitchen into the dining room. The supply of make-up air is frequently introduced at some point within the hood, or in close proximity to the hood, to avoid the removal of conditioned air that has been heated or cooled.

The make-up air inlet should be located at least 10 feet from the exhaust fan to comply with National Fire Protection Association requirements.

Based on information from the U.S. Food and Drug Administration and Conference for Food Protection Food Facility Plan Review Guide, 2000.

Grease Filters:

There are general types of grease filters: wire mesh and extractor filters. The extractor filter removes grease in the exhaust process by centrifugal motion or by impingement on a series of baffles. Standard size filters should be used to avoid additional cost and to allow ease of replacement. Any space in the filter bank not covered by filters/extractors shall be fitted with sheet metal blanks. Filters must be banked at a 45-60 degree angle.

Reference:

South Carolina Department of Health And Environmental Control, 2600 Bull Street, Columbia, South Carolina 29201, "Food Equipment Installation Manual"

Other references are available for additional formulas and information. Such references include:

North American Association of Food Equipment Manufacturers. An Introduction to the Food Service Industry. First Edition 1995.

National Environmental Health Association. Manual of Recommended Practice for Ventilation in Food Service Establishments, by James D. Barnes.