# MINNESOTA COMMERCIAL KITCHEN

# Ventilation Guidelines

Inter-Agency

Ventilation Committee

Review Council

*Ventilation Committee of the Inter-Agency Review Council*

This document was produced by persons representing the State of Minnesota Departments of Agriculture, Health, Public Safety (Fire Marshal), and Administration (Building Codes), as well as local building, city and county health regulatory agencies (metro), local county health regulatory agencies (greater Minnesota) and food service and retail industries.


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# PREFACE

These guidelines were developed by the Ventilation Committee of the Inter-Agency Review Council (IARC). This committee was formed by the IARC to review technical issues relating to commercial kitchen ventilation (CKV) and to make recommendations to the IARC for their consideration and action. The committee consists of people with technical expertise in CKV issues from state health and agriculture agencies, local environmental health agencies, building and fire code regulatory agencies, academia, and industry.

## MISSION STATEMENT OF THE IARC VENTILATION COMMITTEE

*To promote and encourage uniformity in regulation of ventilation standards and assure public health and safety through:*

1. *Review of proposed equipment and its application;*
2. *Recommendation of appropriate ventilation controls;*
3. *Interpretation of codes and standards; and*
4. *Recommendation of code changes to appropriate regulatory authorities.*

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# VENTILATION TERMS & DEFINITIONS

**Anemometer (rotating vane or digital):**
A device for measuring air velocity. A heated wire anemometer measures the resistance changes of a heated wire with temperature changes as air velocity varies. A rotating vane anemometer is used more commonly in large openings.

**Back-Drafting:**
A flow of combustion products in any direction opposite to normal flow in a vent stack.

**Balance:**
Distributing the airflow throughout the exhaust ventilation system so that the static pressure in each duct meeting at a common junction is equal.

**BTUs:**
British Thermal Units. A British thermal unit is a unit of heat energy equal to the heat needed to raise the temperature of 1 pound of air-free water from 60 to 61° F at a constant pressure of 1 standard atmosphere.

**Canopy Hood:**
A receiving type of hood that is positioned above the equipment it serves to capture contaminants that rise or are thrown at it and which overhangs the cooking bank on all open sides.

**Cap or Eyebrow Hood:**
A type of hood normally located on or above a pizza oven or rotisserie baking oven that overhangs the door opening.

**Capture:**
The containment of the thermal plume containing contaminants that rise from heated processes in a kitchen such as cooking or dishwashing.

**CFM:**
The volumetric flow rate expressed in terms of cubic feet per minute.

**Compensating Hood:**
Hood which utilizes make-up air as part of its design.

**Contaminated Air:**
Air that contains unwanted by-products from commercial kitchen operation such as heat, grease, odor, smoke, water vapor, and combustion products.

**Diffuser:**
A ceiling make-up air supply grille which is louvered to avoid drafts being directed onto workers.

**Direct Fire MUA Unit:**
A type of make-up air heater unit in which fuel is burned directly in the air stream and the products of combustion are released in the air supply.

**Duct:**
A conduit used for conveying air at low pressures.

**EPA Test Method 202:**
Determination of condensable particulate emissions for stationary sources. It is intended to represent condensible particulate matter as material that condenses after passing through a filter.

**FPM:**
The velocity of air expressed in terms of feet per minute.

**Exhausted Vestibule:**
A stainless steel vent cowl located over a warewashing machine entrance or exit opening.

**Filter Resistance:**
The pressure loss contributed by grease filters that must be overcome by the exhaust fan.

**Food Zone:**
Surfaces that normally come into contact with food, and those surfaces from which food may drain, drip, or splash back onto surfaces that normally come into contact with food.

**Friction Loss:**
The total static pressure loss in a ventilation system due to friction.

**Fume:**
Consists of solid particles formed by the condensation of vapors of solid materials.

**Grease:**
A by-product of the cooking process of foods containing animal fat that escape as particles into the air and that can congeal on surfaces to provide a flammable substance.

**Grease Extractor:**
A proprietary device or system designed to remove grease particles from the air stream by centrifugal force and direct impingement, electronic precipitation, continuous water spray, or other approved means.

**Grease Filter:**
A filter that is designed to protect the exhaust ventilation system by collecting combustible grease contaminants from air exhausting from the hood cavity into the discharge duct.

**HVAC:**
Heating, Ventilation, Air-Conditioning system.

**Hood:**
A device designed to contain grease, vapors, mists, particulate matter, fumes, smoke, steam, or heat before entering an exhaust duct.

**Inches Water Gauge (w.g.):**
A measurement of resistance used to express velocity pressure, static pressure, or total pressure. One inch w.g. is equal to 0.04 pounds per square inch (p.s.i).

**Indirect Fired MUA Unit:**
A make-up air unit that incorporates a heat exchanger which effectively separates the incoming air stream from the products of combustion.

**Island Hood:**
A type of canopy hood with 4 sides exposed.

**Listed Hood:**
A hood tested and listed by a nationally recognized testing laboratory as meeting UL Standard 710.

### Make-Up Air (MUA).

Air introduced to replace 100% of the volume of exhausted air in a room or building. (MUA must be introduced in a controlled manner in such quantity that a negative pressure (greater than 0.02 inches w.g) is not created).

### Manometer:

A device for measuring pressure.

### Minimal Face Capture Velocity:

The velocity of air in feet per minute (FPM) required across the face of the hood to contain smoke, grease, vapors, steam or heat to prevent spillage.

### MUFC:

Minnesota Uniform Fire Code.

### Negative Pressure:

A condition where the air pressure within a room or building is less than the pressure in an adjacent room or outside air. Negative pressure is created by exhausting air without sufficient make-up air. At a negative pressure of 0.02 inches w.g. or greater, back-drafting of exhaust gases from combustion appliances may begin to occur.

### NFPA 96:

Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations, as published by the National Fire Protection Association.

### Non Food Zone:

All exposed surfaces other than food and splash zones.

### Overhang:

The area of a hood along an open face which projects horizontally beyond the kitchen equipment as measured from the internal perimeter of the hood.

### Plenum:

The internal exhaust collection chamber of the hood which is not directly exposed to the cooking equipment.

### Plume:

See Updraft.

### Positive Pressure:

A condition where the air pressure within a room or building is greater than the air pressure in an adjacent room or outside air. Positive pressure is created by providing more make-up air into a room or building than is exhausted.

### Replacement Air:

See Make-Up Air.

### Spillage:

The escape of contaminated air from a hood.

### Splash Zone:

Surfaces, other than food zone, subject to routine splash, spillage, or other food soiling during normal use.

### Standard:

A model level of acceptability for measuring or evaluating materials, design, construction, testing and/or performance.

### Static Pressure:

A measurement of resistance expressed in inches of water or inches of water gauge. It represents the potential energy in a ventilation system that acts equally in all directions. It acts to collapse the walls on the suction side (inlet) of the fan and burst the ducts on the discharge side.

### Transport Velocity:

The velocity range measured in FPM required to move particulates in an air stream. The 1991 Uniform Mechanical Code requires a transport velocity in Type I (grease) ducts of 1500-2500 FPM.

### Type I Hood:

A kitchen exhaust hood, either canopy or non-canopy, designed for collecting and removing grease-laden vapors and smoke.

### Type II Hood:

A general kitchen hood for collecting and removing steam, vapor, excess heat, or odors, but not grease-laden vapor or smoke.

### UL 710:

Standard for Commercial Electric Cooking Appliances, as published by Underwriters Laboratories, Inc.

### UMC:

1991 Uniform Mechanical Code, a joint publication of the International Conference of Building Officials (ICBO) and the International Association of Plumbing and Mechanical Officials (IAPMO). It is designed to provide complete requirements for the installation and use of heating, ventilating, cooling, and refrigeration systems.

### Updraft:

The upward movement of air due to a change in thermal density.

### Velometer (deflecting vane type):

A device for measuring air velocity.

# INTRODUCTION

The purpose of these guidelines is to provide some general information about commercial kitchen ventilation (CKV) systems to food inspectors, environmental health specialists (sanitarians), food service equipment retailers and designers, architects, contractors, and others in the food service industry.

This document is not a regulation, rule, or ordinance. It is intended to serve as a guide for the design, review, sizing, testing, and inspection of CKV systems. It is also intended to provide more uniformity in the application of CKV requirements by assisting in the decision process for the proper type of exhaust ventilation systems in food establishments. The reader is encouraged to consult with design, installation, and inspection specialists to ensure compliance with applicable building, mechanical, fire, and health codes.

The General Ventilation Criteria flow chart (page 49) was developed by the Ventilation Committee of the Minnesota Inter-Agency Review Council which oversees various Food Code and related interpretation and enforcement issues for the Minnesota Departments of Health and Agriculture. It is intended to be used by both design professionals and regulatory authorities as a guide for determining the type of exhaust system required for various cooking or heating applications. Instructions on the use of the flow chart begin on page 51.

# GENERAL PRINCIPLES OF VENTILATION FOR FOOD ESTABLISHMENTS

The heating, ventilation and air conditioning (HVAC) system in a commercial kitchen represents a major energy expense to a typical food establishment. The purpose of this section is to describe the major components of a properly designed commercial kitchen ventilation (CKV) system. For more information, you should consult your local mechanical inspector or building official.

A commercial kitchen is a complicated environment for proper air distribution. There are many factors that can affect the capture performance of an exhaust system. Because kitchens vary widely in both their design and usage, it is not possible to present a single set of guidelines that will always guarantee complete contaminant capture in every situation.

The purpose of a CKV system is to safely capture and remove contaminants (such as grease, smoke, vapor, fumes, objectionable odors, etc.) in a method that prevents or reduces problems affecting the health, safety, and comfort of employees and customers. Improper ventilation can cause many problems such as excessive temperature or humidity levels, conditions which promote the growth of micro-organisms. (See "Ventilation Related Illnesses and Conditions" on page 31).

Ventilation requirements are driven by many different variables ranging from types of commercial kitchen equipment, menu, loading, capacities, floor area, ceiling height, air changes per hour, fresh air percentages, mechanical systems sizing, controls, distribution, installation, preventive maintenance, occupancy, etc. Design decisions and regulatory approval for different ventilation approaches must accommodate all variables relating to HVAC effectiveness and safety in order to minimize hazards to people and property.

General ventilation (also known as dilution ventilation) refers to the removal and supply of air from a general area, room, or building for the control of the ambient environment through the use of HVAC equipment. General ventilation may be used under certain circumstances for health hazard or comfort control, or in conjunction with the CKV system.

The theory of any ventilation system is quite simple: exhaust enough air to remove pollutants and replace it with sufficient clean make-up air (MUA) to prevent negative pressure in the building. The exhaust fan creates a low pressure through the duct to the hood above the kitchen equipment. The hood fills with hot, contaminated air created by cooking, heating, or dishwashing (warewashing) equipment. Negative pressure complicates the capture and containment of heat and contaminants, and results in back-drafting of gas or solid fuel appliances. Back-drafting causes combustion by-products, such as carbon monoxide, to enter the space.

The capture of contaminants is dependent upon air flowing past the cooking surface at an adequate velocity to capture the particles in the air stream and draw contaminated air into the hood. The cooking or warewashing equipment can be thought of as a generator of contaminated air. The quantity of such air developed by each piece of kitchen equipment is mainly dependent upon the temperature and size of the cooking surface. The heated surfaces affect a density change in the surrounding air. This density change causes the air to rise, developing a thermal updraft. As the air rises from the heated surface, it is replaced by air in the immediate vicinity of the cooking equipment.

A local exhaust system should effectively contain airborne particulate contamination at its source with a minimum of airflow. An exhaust hood is utilized for this purpose. The more complete the hood enclosure, the more economical and effective the exhaust system will be to operate.

Beyond the actual ventilation needs from different food processing applications, there are different kinds of hoods, ventilators, extractors, filters and/or other methods for the capture and containment of heat, smoke, moisture and grease-laden vapors. Hoods are categorized by fire hazard. Type I hoods are used where grease deposition from cooking fatty foods or cooking with oil creates a fire hazard by leaving a film of grease on surfaces throughout the space. Type II hoods are used for collecting and removing steam, vapor, heat, or odors, but not grease or smoke. Generally speaking, a filter or grease extractor serves two purposes: to collect and contain grease, and to serve as a mechanical fire barrier to inhibit flame penetration. Type II hoods typically do not have filters as required for Type I hoods.

EPA testing method 202 references and other test methods that quantify volatile organic compounds (VOCs) and condensable particulates establish standards for acceptable levels of grease specific to a particular piece of equipment and menu item(s) in a laboratory setting. When a recirculating system (ventless hood) is listed to the UL Standard 197 reference, a Type I hood is not needed; however, depending on the amount of heat generated, a Type II hood, or other supplemental mechanical ventilation, may be required. In addition other criteria must be met, such as adequate room size and general ventilation in order to safely allow installation without any exhaust (to the outside) or make-up air.

## DESIGN CRITERIA

Proper operation of a CKV system begins with good design. The most common problems in CKV are 1) too much or too little exhaust; 2) too much or too little make-up air (MUA); and 3) turbulence from entry of MUA into the kitchen resulting in poor capture and containment of the thermal plume above cooking equipment.

In designing kitchen ventilation, the following design concepts should be observed:

1. Hoods should be located where there will be a minimum of traffic and cross-drafts past the hood and face.
2. Island-type cooking arrangements ventilated by canopy hoods open on all four sides require considerably higher exhaust volumes than wall hoods.
3. To prevent grease from accumulating in the ductwork, filters or other grease extraction equipment must be incorporated into the hood. This reduces the danger of fire and makes the job of cleaning ducts and fans easier.
4. On unlisted hoods, grease filters should be sized according to the manufacturer's recommendations for velocity to maximize grease removal.
5. Grease filters should be mounted at an angle at least 45 degrees from horizontal with a grease gutter and grease collection container installed below the filters.

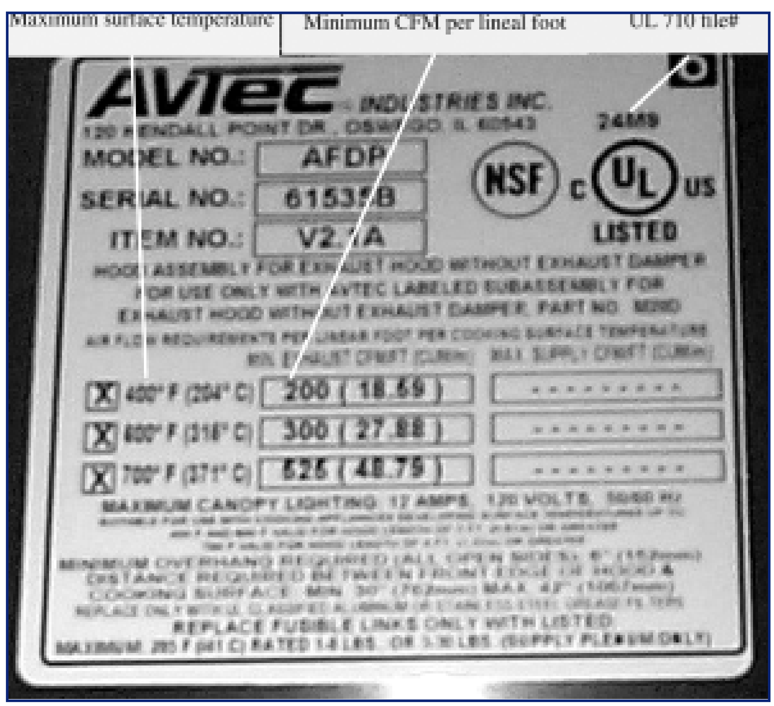
6. Exhaust ducts should be as straight and as short as possible with a minimum of elbows or other fittings. Horizontal exhaust ducts should slope toward the hood so that grease residues can drain back to the grease collection system.
7. Fans should be provided with hinged bases to make maintenance and cleaning easier and safer.
8. A fan should be selected which will exhaust the required volume of air against the calculated static pressure (resistance).
9. The MUA system should be designed to be capable of heating outside air to at least 55°F at the discharge point.
10. Diffusers should be distributed and sized to minimize cross drafts at the hood and to distribute air throughout the kitchen area for comfort during all seasons.
11. The kitchen area should be under a slightly negative pressure (less than 0.02 inches w.g.) in relation to the dining area. This will minimize grease and odors from escaping the kitchen area. The kitchen should be at equilibrium with outdoor conditions, which means the rest of the building is positively pressurized in comparison.

## HOODS

By using the thermal updraft concept that hot air rises, the purpose of the hood is to receive, capture, and hold the contaminated air until it can be exhausted. There are several types of hoods commonly used in CKV.

### UL Standard 710 Listed Hood

The Uniform Mechanical Code requires exhaust hoods to meet certain design and construction standards, but it also permits exceptions for products which have been designed, manufactured, and tested to meet or exceed the performance standard. Underwriter's Laboratory (UL) has established its Standard 710 for proprietary CKV systems. Those systems which have been listed by a nationally recognized testing laboratory as meeting UL Standard 710 are exempt from the specific requirements of the Mechanical Code. It is important to note that the engineering values for each listing are established in a controlled, laboratory setting, and as such, should be considered as minimum values. They should be used as a base line from which additional exhaust rates should be added to overcome turbulence and cross-drafts in a commercial kitchen.



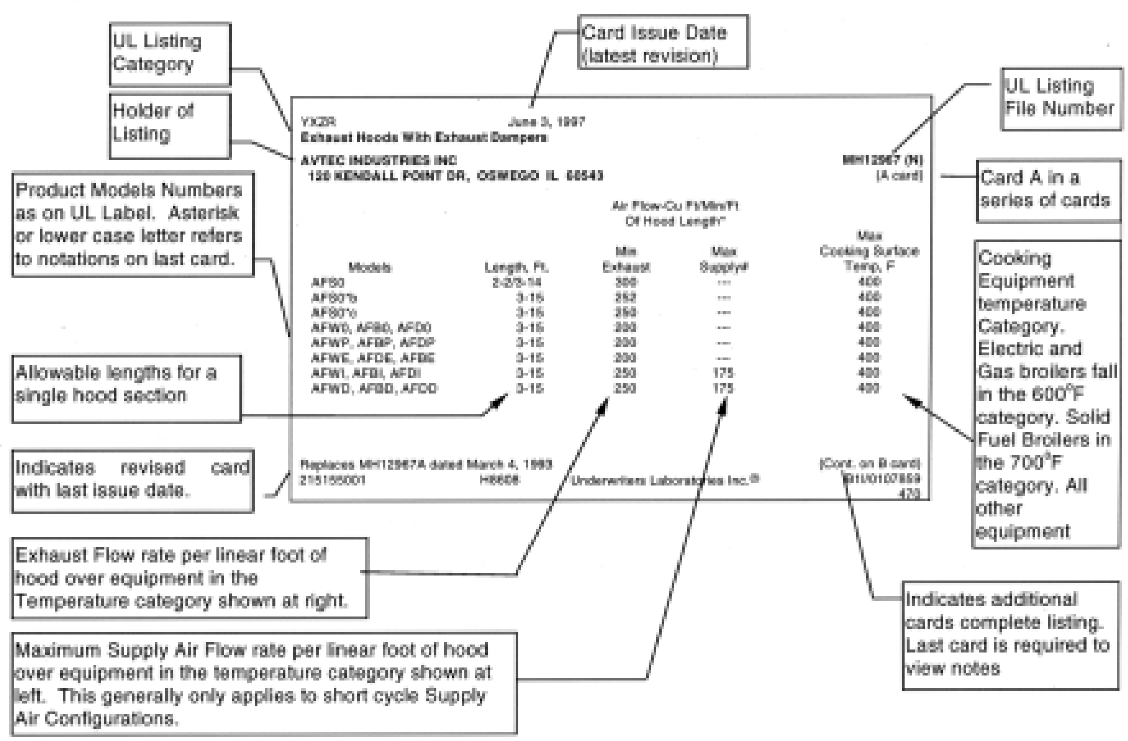
The volume of air that must be exhausted with a Type I hood depends upon the temperature and area of the cooking surface beneath it. There are two approaches to determining the correct ventilation rates within the Mechanical Code. Many of today's hoods are pre-engineered products that are manufactured to nationally recognized standards. UL Standard 710 is referred to in the Mechanical Code as the exception to the prescriptive formula in the Code.

Listed hoods must be installed in accordance with their listing, which includes such things as recommended exhaust volumes for different applications. Applications are classified into 4 categories:

- Low temperature – includes standard and convection ovens;
- Medium temperature – includes open burner ranges, braising pans, salamander broilers, griddles, and fryers;
- High temperature – includes broilers, and Chinese or Gadong style ranges;
- Solid fuel – equipment that uses solid fuel (e.g. wood) and is located under a dedicated hood, duct, and fan.

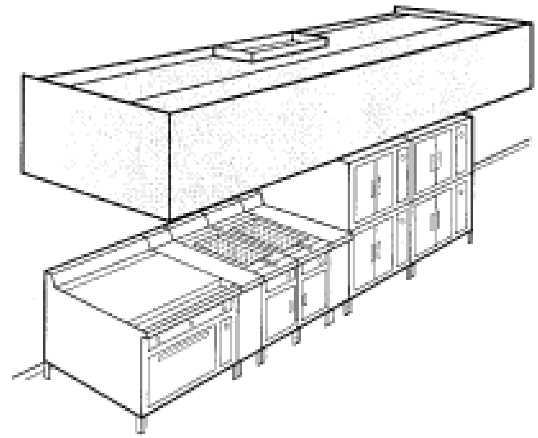
Most of the prescriptive criteria to follow in the section pertain to hoods that are not listed to UL Standard 710.

## UL 710 Listing Card Explanation



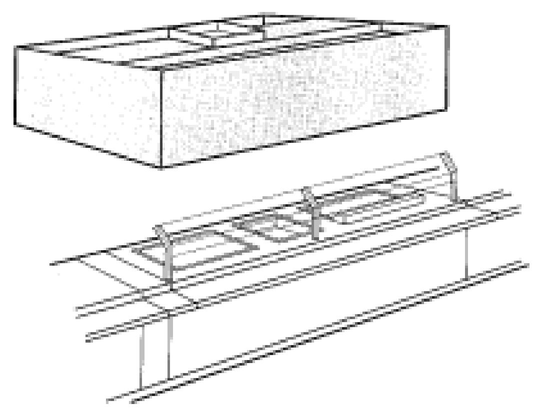
## Canopy Type Hood

Drawing 1 — Wall Hung Hood



This is the most common type of CKV exhaust hood. It can be used over most of the familiar types of food service cooking equipment, such as ranges, fryers, griddles and ovens. Due to its relatively large size and volume, a canopy type hood is the most effective method for control of contaminants over cooking and dishwashing processes where sudden releases of hot vapors or gases are encountered. A canopy is not typically placed over rotary rack ovens, some smoker ovens (direct vent), hearth type ovens, and deck pizza and bakery ovens (eyebrow).

Drawing 2 — Island Canopy Hood



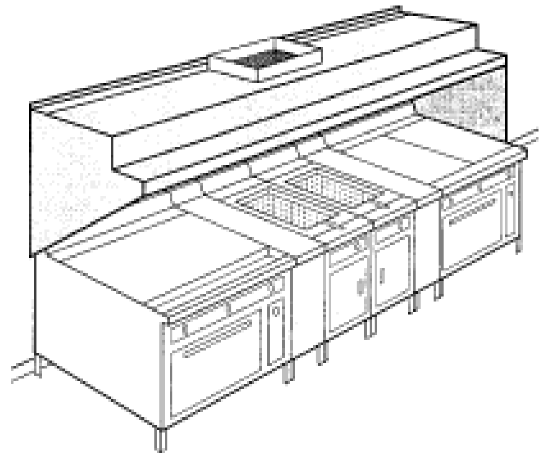
The wall-hung hood is attached to a wall and the cooking equipment is placed under the hood with a minimum 6 inch overhang on all sides. This overhang can be disregarded on the ends of the hood if full side curtains are provided. If used, side curtains should extend from the bottom edge of the hood to the top edge of the cooking equipment and along the full width of the hood. The back wall on which the hood is attached acts as a barrier so that no air is drawn along at this edge, thus reducing the air quantities. This arrangement dictates that there be a front-to-back airflow. Thus, all the air flowing into the hood must come from the front and go up and back to the filters to be exhausted. (see drawing 1.)

The island canopy hood is suspended from the ceiling and has all sides exposed (see drawing 2), thus providing 4 different directions from which the replacement air will flow into the hood. This design is more susceptible to cross-drafts and spillage which necessitates increasing the air quantity substantially to ensure that the proper capture velocity is maintained across the face of the cooking equipment. Side curtains can be installed, but the front and back must be considered in the airflow calculations.

## Non-Canopy Type Hoods

The non-canopy type hood is used in applications where low ceiling height is a factor or for special types of hoods that are intended for light to medium duty cooking (see drawing 3). Unlike the canopy hood, which overhangs all open sides of the cooking appliances to capture the rising thermal plume, the non-canopy hood is set back or in front of the appliances and may have full or partial side panels. The non-canopy hood requires a higher inlet velocity to catch and contain the thermal plume, and it is usually placed closer to the cooking surface or opening than a canopy hood. A non-canopy hood is available as a Type I or Type II hood, depending on the specific application. Non-canopy hoods are generally classified in three categories: 1) backshelf (or proximity), 2) low sidewall (or plateshelf, pass-over), and 3) eyebrow (or cap) hoods.

Drawing 3 — Non-Canopy Hood (low hood sidewall)



The Mechanical Code requires a minimum of 24 inches between the lowest edge of the grease filter and the cooking surface. Hoods listed to UL Standard 710 may be less than 24 inches when listed as such. Backshelf and low sidewall hoods are also designed so that the front of the hood has a 12 inch maximum underhang (i.e. the distance that the cooking equipment extends beyond the face of the hood). At this distance the air flowing into the hood will maintain adequate velocity to capture grease-contaminated air and convey it to the filters. These hoods are not recommended for use with high heat or grease producing equipment because the small hood volume does not capture large surges of contaminated air. Also, filter temperatures above 200° F may permit grease accumulations to bake onto the filters, making them difficult to clean. Excessive temperatures will also cause grease accumulations on the filters to vaporize and pass through the filters. This vaporized grease will collect on duct walls, fan blades, or other system components, increasing cleaning and maintenance costs.

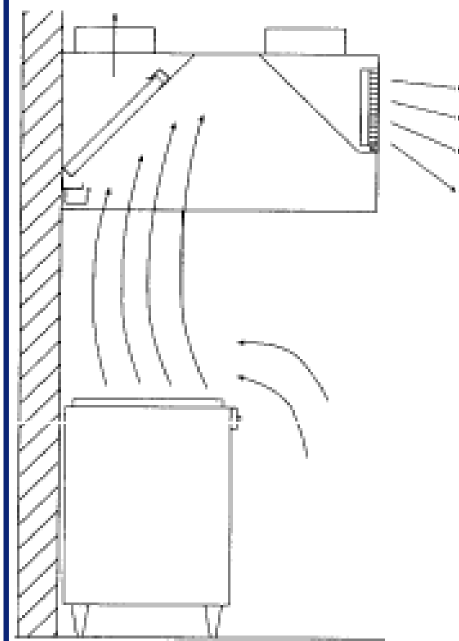
The main difference between the backshelf hood and the low sidewall hood is that the backshelf hood is designed to be mounted directly on the wall behind the cooking equipment, while the low sidewall hood (also known as a plateshelf or pass-over hood) is designed so that it can be free standing or mounted on the wall. This allows the area above the hood to be a "plate shelf" or "pass-over" between the cooking area and the serving area. The sides of the low sidewall hood extend from the top of the cooking surface to the bottom of the hood so that grease-laden vapors are captured effectively.

The eyebrow (cap, vent cowl) is a hood that is intended for use above a door or opening such as a pizza or bakery oven, broiler, steamer or similar equipment that projects a thermal plume upward within a relatively narrow space along the entire width of the opening. These hoods may or may not contain a filter, depending on the specific application, and are usually mounted directly to the cooking appliance. They do not have to be completely contained under the hood. The maximum underhang of the equipment (i.e., the distance that the cooking equipment can extend beyond the face of the hood) is 12 inches. At this distance the air flowing into the hood will still maintain adequate velocity to capture grease-contaminated air and transport it to the filters.

## Compensating Hood

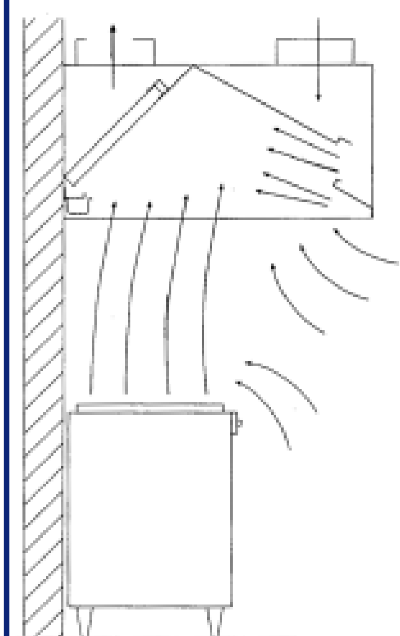
Another concept is the compensating hood (see drawing 4a). This hood is designed like any other canopy hood (wall or island) except there is an additional plenum chamber built into the front leading edge (and at times the rear equipment level). When untempered air is introduced directly into the cavity of the hood, it becomes a short-circuit hood (see drawing 4b). This alleviates the need for providing 100% tempered (heated or air-conditioned) supply air, thus reducing operating costs.

Drawing 4a — Compensating Hood



There are different manufacturers of compensating hoods and the levels of compensation vary from manufacturer to manufacturer (see drawing 4b). The maximum amount of untempered make-up air permitted in Minnesota for a compensating hood is 20%. This is due to the extreme cold temperatures that cause problems with grease congealing and employee discomfort. The remaining 80% must be supplied through a separate, tempered make-up air unit or provided by the HVAC system. This ratio is known as a “20/80 split.”

Drawing 4b — Short Circuit Compensating Hood



Review and evaluation of the compensating hood is very critical to its proper performance. One method for determining the performance of a compensating hood is with the use of a smoke pencil. If any of the smoke escapes from under the hood, it is easily seen indicating the system is not operating properly.

## SIDE CURTAINS

Side curtains are used to serve as physical barriers to reduce the amount of heat radiated into the kitchen and the amount of contaminated air spilled from under the hood. They improve the capture characteristics of a hood, reduce the air quantities exhausted, and increase the velocity of the incoming air at the front of the hood. This increased velocity helps to force the contaminated air back farther under the hood and reduce the amount of spillage. Side curtains are recommended in areas where strong cross-drafts from traffic or ventilation patterns exist which would disperse contaminated air into the kitchen.

## GREASE FILTERS AND GREASE EXTRACTORS

Grease filters are required to prevent large amounts of grease from collecting on the sides of the ductwork, fan blades, walls or rooftops. Efficient removal of grease from the exhaust airflow depends upon proper filter selection and placement.

For optimum grease removal, the velocity through the filters should be that which is specified by the filter manufacturer. This velocity is usually between 200 to 300 feet per minute (FPM) for the low velocity baffle type grease filters. This may require the installation of smaller filters, or sheet metal spacers, to achieve the optimum velocity through the filters. When spacers are necessary, they should be installed in areas where low updrafts are expected and distributed throughout the hood. Grease filters should always be placed at the ends of the hood to prevent spillage.

## DUCTWORK

Ducts are the conduit through which the exhaust fan creates a negative pressure. They also serve as the transport mechanism to remove contaminants from the kitchen which are not removed by the grease filters.

Ducts should be designed and installed to be as short and as straight as possible to reduce static pressure (resistance). Cleanouts should be installed at each turn in the ductwork and at sufficient intervals to facilitate cleaning. Ducts should be constructed of steel and without screws, rivets, or other obstructions penetrating duct walls.

Type I ducts should be continuously welded and liquid-tight to prevent grease leakage, and to prevent water leakage during cleaning.

The cross-section area of a duct affects the velocity of air removed. As the cross-section area of a duct increases, the velocity of air within the duct decreases. A smaller duct increases the air velocity. Common engineering practice requires ducts to be sized so that grease-laden air is transported at 1500-2500 FPM to prevent grease accumulation within the ducts.

Canopy hoods should be equipped with one (1) duct for every 12 feet of hood length. Ducts should be located to provide equal draw across the face of the filters.

## CAPTURE VELOCITY

Proper capture and removal of contaminants is dependent upon air flowing past the cooking surface at an adequate velocity to capture the particles in the air stream and draw contaminated air into the hood. This is known as capture velocity.

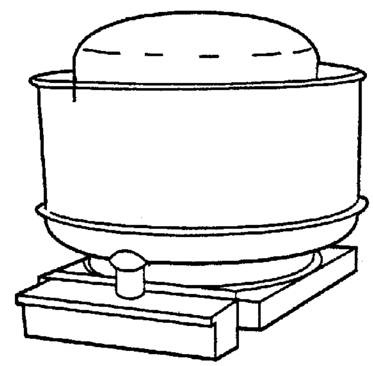
The capture velocity must be great enough to collect the grease-laden air and pull it along in the air stream. If the velocity is too slow to overcome the heat currents and capture the grease, the grease-laden air will escape from the hood causing cleaning problems for the operator.

The capture velocity for effective control of grease-laden air from cooking processes is accomplished by maintaining the air velocity of 50 feet FPM for non-grease producing equipment, 100 FPM for grease producing equipment, and 150 FPM for high-heat, grease-producing equipment, such as broilers.

## EXHAUST FANS

The fan should be selected based upon its ability to overcome system resistance and move the appropriate amount of air desired. Since high pressure losses are associated with the systems, the fan selected should be of the centrifugal type. Belt drive fans are preferred because the speed can be adjusted for final system balancing. The high temperatures encountered in CKV applications require a fan with the motor located out of the airstream to prevent grease build-up or excessive temperatures which will cause motor burn out.

Drawing 5 — Upblast fan



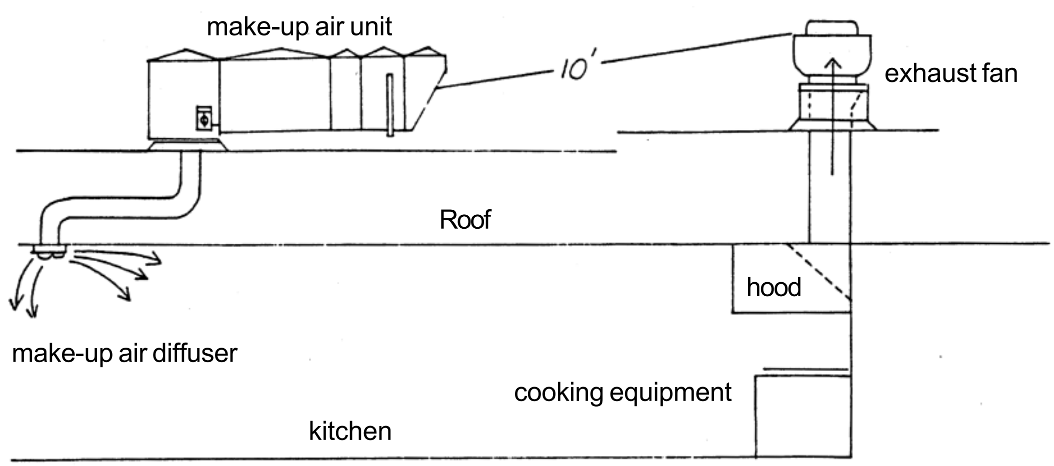
Although various types of fans are available for CKV systems, the most common fan design is the upblast ventilator type (see drawing 5). This fan is designed to direct hot and contaminated air away from the rooftop to prevent roof damage.

Drains or other methods should be employed to catch and contain any grease which may collect and drip from the fan. The exhaust fan discharge should not be protected with some type of birdscreen or guard to prevent accumulation of grease.

## MAKE-UP AIR

Make-up air is a ventilation term used to describe the controlled supply of outside air to a building. An adequate supply of outside air is essential for proper ventilation. An exhaust system without sufficient make-up air will create a negative pressure situation in the building which will decrease the performance of the ventilation system (see 16 Signs That an Area is Starving For MUA). When the exhaust volume is small in relation to the size of the building, minimal negative pressure will be encountered. Older buildings may be less airtight, allowing large amounts of infiltration; therefore, a greater amount of air may be exhausted without encountering excessive negative pressure. Newer, more energy-efficient buildings may be

Drawing 6 — Kitchen Make-Up Air System



relatively airtight and problems with negative air pressure may be encountered even when the exhaust volume is small.

When 0.02 inches w.g. or greater negative pressure exists, back-drafting of gas-fired equipment may occur. Building balance must be maintained for the following reasons:

1. To prevent a negative pressure condition which increases the static pressure the exhaust fan must overcome, resulting in reduced exhaust volume;
2. To eliminate high velocity cross-drafts through the doors and windows;
3. To ensure operation of natural draft stacks, i.e., combustion flues; and
4. To permit the safe opening and closing of building exterior doors.

The make-up air system must be designed to provide replacement of 100% of the total exhaust volume. Twenty (20) percent of the total may be supplied through HVAC equipment because the majority of HVAC units are designed to provide 20% fresh air (the remaining 80% is recirculated).

Once the decision is made to provide make-up air, the next step is to determine where and how to introduce the supply air into the kitchen. Two major problems encountered are:

1. High velocity drafts short-circuit the hood or disrupt the airflow pattern to the extent that capture effectiveness is reduced, and
2. High velocity drafts lower the effective temperature and cause worker discomfort.

The method of introducing make-up air into a kitchen is important for the effective operation of the exhaust ventilation system (see drawing 6). Ceiling diffusers should be located at a greater distance from the canopy than the throw radius of the diffuser to prevent disruption of capture velocities under the hood. An alternative is to size the diffuser to ensure a terminal velocity of 50 FPM or less at 6 feet above the floor (i.e., an increase in diffuser size decreases face velocity).

When wall diffusers are used, they are usually introduced near the ceiling to keep the air flow near the ceiling until it mixes with the ambient air before circulating into the occupied zone. These diffusers usually have high face velocities to obtain sufficient air flow. However, care must be taken to ensure the resulting circulation pattern does not interfere with the capture characteristics of the exhaust hood or create worker discomfort

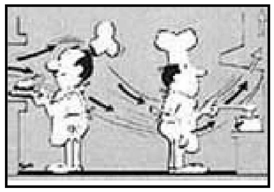
The most common way to introduce make-up air is with a 4-way diffuser suspended from the ceiling with the louvers directing the airflow away from the hood cavity.

Return air grills for recirculating systems should not be located in the area of food preparation or dishwashing because the air currents created can interfere with the capture characteristics of exhaust systems.

# 16 SIGNS THAT AN AREA IS STARVING FOR MAKE-UP AIR

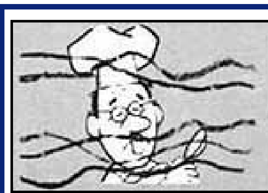

### Doors Are Hard to Open

Are outward-opening doors hard to open? Do they slam shut? Are inward-opening doors hard to close? If so, you need make-up air.



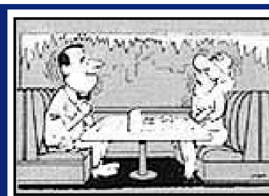
### Draft Flow Toward Exhaust

Cold air flows in and rushes directly toward the exhaust, creating a serious draft problem. Make-up air eliminates drafts!



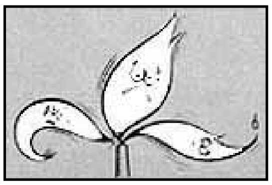
### Smoke in the Kitchen

If your kitchen exhaust system isn't getting enough air to carry away smoke and food odors, it's starved! Feed it make-up air.



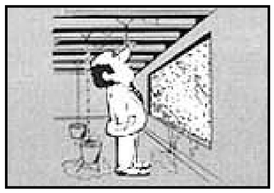
### Frigid Walls and Windows

Starved exhaust systems suck icy outdoor air through cracks in walls and windows. The result: employees and customers suffer.



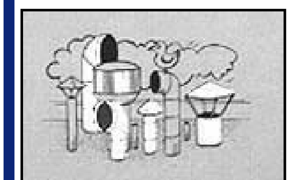
### Fickle Flames and Pilots

Do downdrafts blow pilots out or cause heater flames to keep changing? They do if your exhaust system isn't getting enough air.



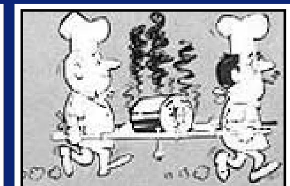
### Leaky Walls and Roofs

Is rain "sucked" through cracks in walls and windows? Do mysterious leaks appear in roofs? This could be a negative pressure problem.



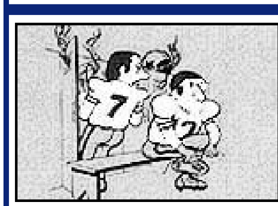
### A Forest of Chimneys

A chimney can not work without air. A forest of chimneys is a sure sign they're fighting each other for a supply of make-up air.



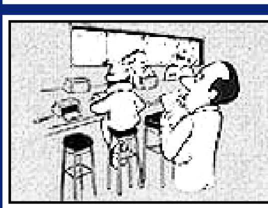
### Burned-out Exhaust Motors

Exhaust motors should last ten years. If your have to fight for make-up air, you'll have to replace them much more often.



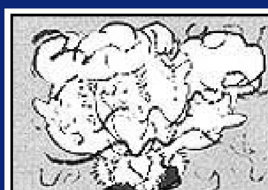
### Stale Locker Rooms

Are your locker rooms stale and odorous? Ventilation is essential, but also impossible without make-up air.



### Employees Out Sick

Cold air infiltration makes work stations near doors and outer walls hard to heat. Absenteeism rises when temperature drops!

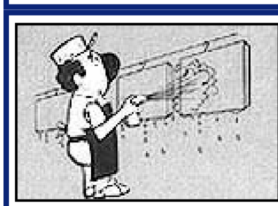


### Fumes and Odors

Odors can't always be avoided, but a healthy exhaust system can get rid of them...providing it is fed an adequate supply of make-up air.

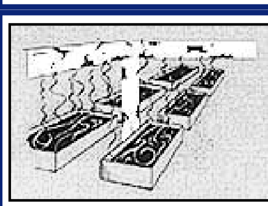
### Flies Can't Stay Out

Flies collect at doorways near warmth and food odors. They're sucked inside by the "negative pressure" when doors are opened.



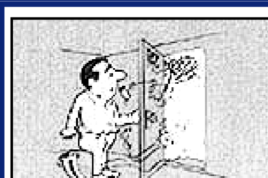
### Poor Paint Jobs

Uniform paint coverage requires a steady flow of clean air. Backdrafts and fluctuating air flow cause varied coverage and waste.



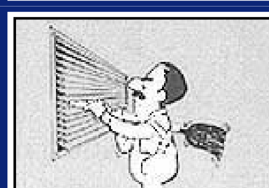
### Corrosion of Steelwork

If structural steel or metal roofing is gradually being consumed by corrosive vapors, the exhaust isn't working properly.



### Dust and Debris

Housekeeping is an endless problem! Dust and dirt are drawn in continuously through every opening when the exhaust isn't working properly.



### Lazy Outlet Shutters

Outlet shutters stay half closed when they should be wide open, flutter with the slightest breeze or indoor air pressure change.

*Reproduced with permission of Mars Air Products, Co.*

## DETERMINING EXHAUST QUANTITIES

The amount of air which must be removed from the kitchen hood is dependent upon the following two quantities: 1) The amount of exhaust airflow which will remove all of the contaminated air being generated by the cooking or warewashing equipment and entering the hood, and 2) The amount of air required to establish a minimal capture velocity under the hood in areas outside the updrafts.

The generation of contaminated air from each piece of equipment is mainly a function of its size, temperature, and design. To calculate the volume of air which must be exhausted, the surface of the equipment area (in square feet) must be determined. This area is then multiplied by the appropriate updraft velocity.

Thus, it is important to understand the relationship between the quantity of airflow and the velocity in the basic ventilation formula:

$$Q = VA$$

Q = quantity (volumetric flow rate), measured in cubic feet per minute (CFM)
V = velocity, measured in feet per minute (FPM)
A = area (cross sectional) through which air flows, measured in square feet

This basic relationship describes airflow under all conditions. Accordingly, the equation can be transposed to solve for velocity or area when the other two factors are known, such as calculating both duct velocities and duct cross-sectional areas.

$$V = \frac{Q}{A} \quad \text{or} \quad A = \frac{Q}{V}$$

The 1991 Uniform Mechanical Code, Section 2003(g) specifies various capacities for different types of commercial kitchen equipment. Following are typical airflow capacities of wall-mounted canopy hoods with 3 exposed sides.

1. Type I Hood for use over charcoal and solid fuel charbroilers:
   Q=200 CFM per square foot (of horizontal surface area of hood)
2. Type I Hood for high-temperature appliances:
   Q=100 CFM per square foot
3. Type I Hood for medium-temperature appliances:
   Q=75 CFM per square foot
4. Type I or Type II Hood for low-temperature appliances:
   Q=50 CFM per square foot

## AIRFLOW RESISTANCE

Static pressure is the resistance to flow that must be overcome by air passing through a duct. There are two types of resistance: 1) friction losses, and 2) dynamic losses (turbulence). Friction losses are due to rubbing of air against the interior surfaces of the duct, while the dynamic losses are caused by air turbulence due to changes in direction and/or velocity.

It is necessary to overcome the resistance to flow or static pressure which builds up in the duct system to maintain the desired exhaust quantity passing through the duct. The velocity pressure represents the pressure necessary to move the air at a specific velocity within the ducts. The hood entry loss represents the energy necessary to overcome loss as the air enters the duct. Hood static pressure is equal to the velocity pressure in the duct plus the hood entry loss. Calculations of these pressures are necessary to accurately size a fan for a specific exhaust system.

Filter resistance is the amount of energy required to move air through the filter, and is also expressed as static pressure. The resistance for grease filters varies from manufacturer to manufacturer, and from type to type. Data for filter resistance calculations can be obtained from the manufacturer's specification sheets.

## METHODS OF THE AIRFLOW MEASUREMENT

Airflow must be measured to ensure that exhaust and make-up air systems are functioning as designed. Most instruments used in testing ventilation systems measure velocity, even those that provide direct reading of total quantity. They are able to do this because they automatically convert the measured velocity to volume (Q=VA) utilizing the known open face area of the instrument. Therefore, velocity measurement is the most important aspect in testing a new or repaired ventilation system.

## TESTING AND BALANCING

A final performance test of the completed CKV system is necessary to verify the velocity and quantity of air flow for both exhaust and make-up air systems. This test often takes many adjustments of the fan speeds to obtain the proper exhaust and make-up balance. Such testing should only be done by trained and qualified personnel.

# TYPE I vs. TYPE II HOOD SYSTEMS

| | TYPE I | TYPE II |
|---|---|---|
| Description: | A kitchen hood for collecting and removing grease and smoke. | A general kitchen hood for collecting and removing steam, vapor, heat or odors. |
| Ducts and plenums: | Must be constructed of not less than 0.055 inch (16 gage) steel or stainless steel at least 0.044 inch (18 gage) in thickness. | Must be constructed of rigid metallic materials complying with HVAC air distribution duct requirements. |
| Joints & seams of ducts: | Must be made with a continuous liquid-tight weld or braze made on the external surface of the duct system. | Must be made substantially airtight by using tapes, gasketing or other means. |
| Grease duct penetration: | A grease duct which penetrates a ceiling, wall or floor must be enclosed in a duct enclosure from the point of penetration to the outside. | No requirement. |
| Duct velocity: | Must not be less than 1,500 feet per minute and not more than 2,500 feet per minute. | No requirement. |
| Exhaust fan outlet: | Centrifugal exhaust fan outlet (bottom) must be a minimum of 2 feet above the roof.<br><br>Vertical discharge (upblast) exhaust fan must have its grease outlet 2 feet above the roof. | In-line fans are allowed. |
| Exhaust fan termination: | Exhaust outlet must be at least 10 feet horizontally from parts of the same or contiguous building, adjacent property line, or air intake opening into any building (may be reduced to 5 feet if the discharge is directed away from such location) and must be located at least 10 feet above the adjoining grade level. | No requirement. |
| Exhaust fan: | Any type of fan which is UL listed for use in grease exhaust systems and is installed in accordance with the terms of its listing and the manufacturer's installation instructions. | No requirement. |
| Hood materials: | Stainless steel not less than 0.030 inch (22 gage) per NSF Standard 2 in the Minnesota Food Code. | Stainless steel not less than 0.030 inch (22 gage) (NSF Standard No. 2, Minnesota Food Code) |
| Ceilings: | Ceilings within 18 inches measured from the top of the hood must be constructed with materials conforming to 1-hour fire-resistive construction on the hood side.<br><br>Hoods less than 12 inches from the ceiling or wall must be flashed solidly with materials required for hoods above or materials conforming to one-hour fire-resistive construction.<br><br>Hoods recessed into the ceiling must be enclosed in a rated enclosure. Ceiling must be constructed with materials conforming to one-hour fire-resistive construction, on the hood side, to a distance of 18 inches measured from the hood at the ceiling line. | No requirement.<br><br>No requirement.<br><br>No requirement. |
| Grease filters or extractors: | Must be installed and of design for the specific purpose. | No requirement. |
| Fire-extinguishing: | System is generally required. | No requirement. |

# SUMMARY OF UNIFORM MECHANICAL CODE

The following are some key points for CKV requirements contained in the 1991 Uniform Mechanical Code, Chapter 20. They are NOT intended to be a comprehensive listing of all CKV requirements. For more specific information about these requirements, consult your local mechanical inspector or building official.

Note: The UMC, Chapter 20, provides for exceptions for UL Standard 710 listed hoods.

## DUCTS

- Grease ducts and plenums serving a Type I hood must be constructed of at least 0.055 inch (16 gage) steel or at least 0.044 inch (18 gage) stainless steel. Joints and seams must be made with a continuous liquid tight weld or a braze on the external surface of the duct. Ducts must be constructed and installed to prevent grease from pocketing. Ducts must slope at least ¼ inch per lineal foot toward the hood or toward an approved grease reservoir. Horizontal ducts longer than 75 feet must slope at least 1 inch per lineal foot toward the hood.
- Ducts and plenums serving a Type II hood must be constructed of rigid metallic materials.
- Ducts subject to positive pressure (makeup or supply air) must be adequately sealed.
- Grease ducts must not have any openings other than those required for proper operation and maintenance. Any portion of a duct that is not accessible must be provided with adequate cleanout openings.
- Grease ducts serving a Type I hood which penetrate a ceiling, wall or floor must be enclosed in a duct enclosure as specified within the mechanical code.
- Grease ducts serving a Type I hood must be designed and installed to provide an air velocity within the duct between 1500 to 2500 feet per minute (FPM).
- Exhaust outlets for grease ducts must extend through the roof unless otherwise approved by the building official. Such extension must be at least 2 feet above the roof surface, at least 10 feet from any part of the same or adjacent building, adjacent property line, or air intake opening into any building.

## HOODS

- Type I and Type II hoods must be constructed of at least 0.030 inch (22 gage) steel.
- Joints and seams must be substantially tight. Solder must not be used except for sealing a joint or seam.
- Hoods must be designed to provide for thorough cleaning of the entire hood when installed.
- Type I hoods must be equipped with approved grease filters or grease extractors. The lowest edge of a grease filter located above a cooking surface must comply with minimum height requirements contained in the Mechanical Code.
- An overhang of at least 6 inches beyond the edge of the cooking surface must be provided on all open sides of canopy hoods.
- The maximum distance between the cooking surface and the bottom of the hood is 4 feet.
- Exhaust outlets must be provided so that each outlet serves not more than a 12 foot section of hood.

## FILTERS

- Grease filters and grease extractors must be designed and installed to permit the required quantity of air to pass through the unit at a rate not exceeding that for which the unit was designed or approved.
- Grease filters must be sized to permit cleaning in a dishmachine or pot sink.
- Grease filters must be installed and removed without the use of tools.
- Grease filters must be installed at a minimum angle of 45 degrees from horizontal.
- A receptacle must be installed below the lowest edge of the filters.

## MAKE-UP AIR

- Each room equipped with an exhaust system must have air supplied to the room in an amount equal to that being exhausted.
- Windows and doors may not be used for the purpose of providing make-up air.
- Exhaust and make-up air systems must be electrically interlocked.
- Make-up air must be tempered to a minimum temperature of 55° F (Minnesota amendment to UMC).
- Compensating hoods must extract at least 80% of their required exhaust air flow from the kitchen area. (Minnesota amendment to UMC).

## PERFORMANCE TEST

- A performance test may be required by the building official to verify proper operation of the CKV system.

# ANSI/NSF STANDARD NO. 2
# REQUIREMENTS FOR EXHAUST HOODS

| | | |
|---|---|---|
| **Interior surfaces** | Shall meet the *food zone material* requirements and shall comply with the *splash zone design* and *construction* requirements. | |
| | ***Food zone materials*** | Shall not impart toxic substances, odor, color or taste.<br><br>Shall be smooth, easily cleanable, and corrosion resistant.<br><br>Solder shall be nontoxic and corrosion resistant.<br>Lead based solder is not permitted.<br><br>Copper and copper-nickel alloys are not acceptable. |
| | ***Splash zone design and construction*** | Fabricated to minimize retention of moisture, dust, or dirt. Designed to facilitate inspection, servicing, maintenance, and cleaning.<br><br>Joints and seams shall be sealed and smooth. Joints shall be fabricated to eliminate horizontal ledges.<br><br>Exposed threads, projecting screws, and studs are not acceptable. |
| **Interior reinforcing** | Shall be smooth, easily cleanable, and not act as a dam or create a surface on which grease or condensate will collect and drip. | |
| **Gutters** | When provided, shall be smooth, easily cleanable, and fitted with a drain or clean-out opening. | |
| **Exterior surfaces** | Shall be classified as ***nonfood zones*** except joints and seams shall be sealed and exposed threads are not acceptable. | |
| | ***Nonfood zones*** | Materials shall be smooth and corrosion resistant or rendered corrosion resistant. Coatings, if used, shall be noncracking and nonchipping.<br><br>Fabricated to minimize retention of moisture, dust, or dirt. Designed to facilitate inspection, servicing, maintenance, and cleaning.<br><br>Joints and seams shall be closed.<br><br>Exposed threads, projecting screws, and studs are limited to no more than 2.5 threads or 6.5 mm (0.25 in.). |
| **Filters** | Shall be readily removable and installed to prevent drippage into food.<br><br>Metal mesh filters are not acceptable.<br><br>Shall be designed to be pressure cleaned and self-draining. | |
| **Plenum-type hoods without filters** | Baffles, turning vanes, and sliding dampers used to control air volume shall be readily accessible or readily removable and easily cleanable. | |

*Comment: Food zone requirements (hood interior) require stainless steel with a #3 finish on stainless steel. Coatings used on the hood exterior (for decorative purposes) must meet requirements for splash zone. Paint would not be acceptable.*

# CKV PLAN REVIEW CHECKLIST

- ❑ Equipment requiring exhaust ventilation is placed under the appropriate type of exhaust system. Refer to the flow chart and other criteria in these guidelines.

- ❑ Equipment requiring exhaust ventilation is fully contained within the capture zone of the exhaust system. Hoods without a 6 inch overhang would need to have end curtains for containment.

- ❑ The exhaust hood complies with ANSI/NSF Standard No. 2, and listed by an approved third party testing laboratory.

- ❑ Sufficient lighting provides a minimum of 540 lux (50 foot candles) as required by the Minnesota Food Code, M.R. 4626.1470 (C).

- ❑ The floor, walls, and ceiling materials are durable and easily cleanable.

- ❑ Automatic fire suppression is provided for grease-producing cooking equipment in accordance with the Minnesota Uniform Fire Code.

- ❑ Exhaust fan is sized to provide minimum exhaust quantity, including static pressure.

- ❑ Type I grease ducts are sized to provide a velocity of 1500-2500 FPM.

- ❑ Exhaust discharge location must be a minimum of 10 feet from the air intake openings and adjacent buildings and property lines so that it does not create a nuisance condition.

- ❑ Make-up air (when required) is tempered and electronically interlocked with the exhaust system.

- ❑ Total filter area provides a velocity that meets the filters manufacturer's specifications (V=Q/A)

# VENTILATION RELATED ILLNESSES AND CONDITIONS

| SYMPTOMS AND CONDITIONS | AGENT | CAUSE |
|---|---|---|
| Headache, tracheobronchitis, nausea, weakness, dizziness, confusion, death | Carbon monoxide (CO) | Backdrafting of combustion gases from cooking equipment, furnaces, water heaters; frequently caused by lack of make-up air (MUA). |
| Headache, dizziness, restlessness | Carbon dioxide ($CO_2$) | Inadequate exhaust of combustion gases from cooking equipment, furnaces, water heaters; frequently caused by lack of MUA. |
| Irritation of eyes, skin and mucous membrane, delayed pulmonary edema, chronic respiratory disease | Acrolein (smoke) | Inadequate exhaust or lack of MUA during broiling or frying of meat containing animal fat. |
| Irritation of nose, pneumonitis | Sodium hydeozide (lye) | Inadequate exhaust or lack of MUA during cleaning. |
| Light headache, drowsiness, death | Liquid petroleum gas (LPG or bottled gas) | Inadequate exhaust, lack of MUA, or improper design of MUA causing interruption of gas combustion. |
| Mold growth | Excessive humidity, heat or mold spores | Inadequate exhaust or lack of filtered MUA source. |
| Condensation on walls or windows | Excessive humidity | Inadequate exhaust or lack of MUA. |
| Rapid spoilage of food | Excessive heat | Inadequate exhaust or lack of MUA. |
| Long refrigeration compressor run time | (1) Excessive heat<br>(2) Radiant heat | (1) Inadequate exhaust or lack of MUA.<br>(2) Location of refrigeration equipment near cooking equipment. |

# UNIQUE CONSIDERATIONS FOR RECIRCULATING SYSTEMS

## INTRODUCTION

Some commercial electric cooking appliances are provided with (either integral or non-integral) recirculating hood systems with fire suppression. These types of recirculating systems are also known as ductless or ventless hoods. Recirculating systems are specifically designed to safely remove grease, smoke, and odor. Most of these systems do not vent to the outdoors, though there are some hybrid systems that provide gas-fired cooking equipment with direct venting of flue gases. Recirculating systems do nothing to remove excess heat, so depending upon other criteria, a Type II hood with make-up air may still be required.

The primary benefit of recirculating systems is that they do not require grease ducts with discharge to the outdoors. They are ideal for installations in building designs where it is impractical or too expensive to exhaust to the outdoors. Examples include some indoor food carts, stadiums, arenas, and operations where there is limited food preparation or where there are physical limitations with access to the outdoors. The standard components of a recirculating system could include: 1) a UL listed grease filter, 2) a high efficiency particulate arresting (HEPA) filter and/or an electrostatic precipitator (ESP) or water system, 3) an activated charcoal or other odor control device, 4) a recirculating fan, and 5) a safety interlock system that disables the system if any of the components are missing or loaded with grease.

Requirements for recirculating systems are found in the following two references:

1. National Fire Protection Association (NFPA) Standard 96 (reference only-not adopted in MN)
2. UL Standard 197, Supplement SB. (latest edition)

NFPA 96 addresses the design, fire suppression, maintenance, inspection and testing of recirculating systems. As part of the maintenance, the filters, ESP, hood and fan must be cleaned on a specific schedule, including testing of the total operation and interlocks. NFPA 96 also requires that all recirculating systems be listed with a nationally recognized testing laboratory.

The recognized test is UL Standard 197, Supplement SB, which incorporates the EPA Standard 202 test methodology for grease-laden effluent and compliance with components of NFPA Standard 96. Once listed, the system is listed by a nationally recognized testing laboratory and the listing will denote that the system conforms to UL Standard 197. It is also important to take into consideration the ventilation flow rate (CFM) of exhausted air used in EPA Standard 202. Since test results can very based on this flow rate, a low CFM is preferable.

## APPROVAL PROCESS

The Minnesota Building Code states that the building official has the ultimate authority to approve a recirculating system, as follows:

> [Chapter 20, Section 2002 (i), of the 1991 Uniform Mechanical Code (UMC) states, in part,] *"Exhaust outlets for grease ducts serving commercial food heat-processing equipment shall extend through the roof unless otherwise approved by the building official…" Under EXCEPTIONS: 2. "Upon approval of the building official, the exhaust from any hood serving commercial food heat-processing equipment may terminate in a properly engineered air recovery system for recirculation to the room in which the hood is located."*
>
> [Chapter 1, Section 105, of the UMC states, in part] *"…The building official may authorize any alternate, provided he finds the proposed design is satisfactory for the intended use and complies with the provisions of this code and that the material, method or work offered is, for the purpose intended, at least equivalent to that prescribed by this code in suitability, strength, effectiveness, fire resistance, durability and safety. The building official shall require sufficient evidence or proof be submitted to substantiate any claims made regarding the use of alternates…"*

Therefore, in the past, the Minnesota Departments of Health (MDH) and Agriculture (MDA) worked with the Minnesota Department of Administration, Building Codes & Standards Division, which would review the submitted data. Today, the IARC Ventilation Committee serves as a technical resource and will review, upon request, technical documentation and testing data for compliance with UL Standard 197, and provide recommendations to MDH, MDA, local health departments, and building officials for installation in foodservice facilities and retail food stores. Included in the committee's recommendations is a reference to the local building official's authority to approve or deny use of any recirculating system.

If a company is interested in requesting review and comment on a recirculating system, the following technical data and testing documentation, as a minimum, need to be submitted to the IARC:

- Completed IARC Submittal form (see page 82);
- Name of the nationally recognized testing laboratory, including credentials and certifications;
- Documentation of the UL Standard 197 Listing, including the UL Edition date;
- Listing of all Sections from UL 197 for which the recirculating system was tested and is in conformance;
- Actual test results of the average captured condensible particulate matter from the EPA Test Method 202 for determination of Condensible Particulate Emissions From Stationary Sources, covering an 8-hour period; and

# UNIQUE CONSIDERATIONS FOR SOLID FUEL EQUIPMENT

Solid fuel appliances must have their own duct. The Mechanical Code does not allow solid fuel and gas-fired appliances to share the same vent. Contact the authority having jurisdiction for Fire Code requirements to determine application of the Minnesota Uniform Fire Code (MUFC) to solid fuel equipment. The State Fire Marshal has in the past ruled (FMCAP 00-007-I) that a fire suppression system was not required for a solid fuel fired wood oven when directly connected to a class A chimney. Additional protection, however, was required (such as a hose station). It is necessary to obtain approval from the Fire Marshal before installing this type of oven without suppression.

All such equipment must be installed pursuant to the manufacturer's installation instructions. Eyebrow hoods are not required since the oven is designed to be at a negative pressure compared to the kitchen area. The local code official may also accept Class A (NFPA 211) chimneys. Hearth ovens with heavy usage do produce grease-laden vapors and effluent, and their ducts are subject to deposition of grease. An aggressive cleaning schedule may be needed, and it is recommended that an inspection be made after 30 days of use to better determine the required cleaning schedule for safe operation. This cleaning requirement must be routine, and available for review by the authority having jurisdiction upon inspection. The MUFC requires inspection of such systems and safeguards every 6 months.

# MINNESOTA UNIFORM FIRE CODE

## BACKGROUND

The current edition of the Minnesota Uniform Fire Code (MUFC) was adopted on June 29, 1998, and contains provisions for both new and existing buildings. Since it is adopted statewide, the MUFC applies in all areas of Minnesota and does not require local adoption for enforcement.

The MUFC sets the minimum level of safety, although local jurisdictions can adopt ordinances that increase (but not decrease) the level of safety by exceeding the Code. In addition, the local fire official legally enforces the Fire Code. So, it is always necessary to contact the local fire marshal, fire department or fire chief with questions before beginning any construction or installation.

Since it is a copyrighted document, the MUFC is not available for download on the internet. It is available for purchase from the Minnesota State Bookstore at (651) 297-3000 or (800) 657-3757. The MUFC consists of three parts:

1. Volume I contains the overall Code requirements and is the document that tells you when something must be done. For example, when smoke detectors or sprinklers are necessary. Anyone involved in fire protection issues should have access to Volume I.
2. Volume II contains installation and testing standards. Examples are standards for installing sprinkler systems or instruction for wiring fire alarms. Usually contractors or those actually installing or specifying fire protection equipment order Volume II.
3. A number of state amendments are made to the 1997 Uniform Fire Code to make it the 1998 Minnesota Uniform Fire Code (MUFC). You can order the state amendments from the Bookstore, or you can download them at: http://www.dps.state.mn.us/fmarshal.html. Since many sections of the Code are modified by amendments, it is absolutely necessary to have a copy of the state amendments.

Fire safety inspections may be conducted by a local fire or building official or local fire chief. In some cases, State Fire Marshal Division inspectors conduct inspections of buildings (such as hotels and schools) or other fire safety concerns such as above-ground tanks. For questions about Fire Code requirements, first contact the local fire marshal or fire chief, since this is the person with the legal authority to enforce the MUFC in that jurisdiction. If you are still unable to resolve an issue or obtain an answer to your question, contact the State Fire Marshal Division at firecode@state.mn.us or (651) 215-0500.

## COMMERCIAL KITCHEN VENTILATION

The installation of commercial kitchen ventilation and hoods, including chimneys, flues and associated equipment, is addressed in the State Mechanical Code. For questions relating to this topic, contact the State Building Codes and Standards Division at (651) 296-4639.

The MUFC contains only minimal requirements relating to commercial kitchen ventilation. Basically, Section 1006.1 of the MUFC requires that a ventilating hood and duct system be provided in accordance with the Mechanical Code for commercial kitchen equipment that produces grease-laden vapors.

# SUPPRESSION SYSTEMS

Although the MUFC sends the user to the Mechanical Code for guidance on ventilation and hoods, the Fire Code is the document that identifies when and how suppression systems for commercial cooking are to be provided. Because the exact wording of code language is important, the requirements for commercial cooking found in the MUFC have been copied here in its entirety. Commentary to assist with interpretation has been added in a text box after each section. Thus, the commentary in each text box is simply guidance for enforcement and is not to be considered Code language.

The State Fire Marshal Division is currently working on adopting the International Fire Code (IFC) with a proposed effective date in the middle of 2002. The code language given below is based on the 1998 MUFC and will possibly change dramatically with the adoption of the IFC. Contact your local fire marshal for complete details.

## Section 1006 — Protection of Commerical Cooking Operations

### 1006.1 — Ventilating Hood and Duct Systems

A ventilating hood and duct system shall be provided in accordance with the Mechanical Code for commercial-type food heat-processing equipment that produces grease-laden vapors.

### 1006.2 — Fire-Extinguishing System.

**1006.2.1 Where required.** Approved automatic fire-extinguishing systems shall be provided for the protection of commercial-type cooking equipment.

*Exception: The requirement for protection does not include steam kettles and steam tables or equipment which as used does not create grease-laden vapors.*

> Comment: This section of the MUFC is one of the more difficult issues to enforce since only very general guidance is provided. Basically, all commercial cooking installations require a suppression system, unless they meet the exception and do not produce grease-laden vapors and thus require a suppression system. Enclosure of a cooking process does not remove the requirement for a suppression system. Thus, ovens would still require a suppression system when producing grease-laden vapors.

**1006.2.2 Type of system.** The system used for the protection of commercial-type cooking equipment shall be either a system listed for application with such equipment or an automatic fire-extinguishing system that is specifically designed for such application.

Systems shall be installed in accordance with the Mechanical Code, their listing and the manufacturer's instruction. Other systems shall be of an approved design and shall be of one of the following types:

1. Automatic sprinkler system.
2. Dry-chemical extinguishing system.
3. Carbon dioxide extinguishing system.
4. Wet-chemical extinguishing system.

## 1006.2.3 — Extent of protection.

**1006.2.3.1 General.** The automatic fire-extinguishing system used to protect ventilating hoods, ducts and cooking appliances shall be installed to include cooking surfaces, deep fat fryers, griddles, upright broilers, charbroilers, range tops and grills. Protection shall also be provided for the enclosed plenum space within the hood above filters and exhaust ducts serving the hood.

> Comment: When suppression is required, it needs to be provided throughout the hazardous cooking areas.
>
> In some cases, the MUFC also requires that a building be sprinklered throughout. In buildings with large hoods (greater than 4 feet wide), the hood may become an obstruction to sprinkler discharge. If a kitchen suppression system is provided under the entire hood, then additional sprinkler protection is not necessary. When all areas under a hood do not have a kitchen suppression system and the building is required to be sprinklered throughout, then gap coverage exists. Either the kitchen suppression system or the sprinkler system will need to be extended to provide full coverage of all areas of the kitchen including the complete area under the hood.

**1006.2.3.2 Carbon dioxide systems.** When carbon dioxide systems are used, there shall be a nozzle at the top of the ventilating duct. Additional nozzles that are symmetrically arranged to give uniform distribution shall be installed within vertical ducts exceeding 20 feet (6096 mm) and horizontal ducts exceeding 50 feet (15 240 mm). Dampers shall be installed at either the top or the bottom of the duct and shall be arranged to operate automatically upon activation of the fire-extinguishing system. When the damper is installed at the top of the duct, the top nozzle shall be immediately below the damper. Carbon dioxide automatic fire-extinguishing systems shall be sufficiently sized to protect all hazards from venting through a common duct simultaneously.

## 1006.2.4 — Automatic power, fuel and ventilation shutoff.

**1006.2.4.1 General.** Automatic fire-extinguishing systems shall be interconnected to the fuel or current supply for cooking equipment. The interconnection shall be arranged to automatically shut off all cooking equipment and electrical receptacles which are located under the hood when the system is activated. Shutoff valves or switches shall be of a type that require manual operation to reset.

**1006.2.4.2 Carbon dioxide systems.** Commercial-type cooking equipment protected by an automatic carbon dioxide extinguishing system shall be arranged to shut off the ventilation system upon activation.

**1006.2.5 Special provisions for automatic sprinkler systems.** Commercial-type cooking equipment protected by automatic sprinkler systems shall be supplied from a separate, readily accessible indicating-type control valve that is identified. Sprinklers used for the protection of fryers shall be listed for that application and installed in accordance with their listing.

**1006.2.6 Manual system operation.** A readily accessible manual activation device installed at an approved location shall be provided for dry chemical, wet chemical and carbon dioxide systems. The activation device is allowed to be mechanically or electrically operated. If electrical power is used, the system shall be connected to a standby power system and a visual means shall be provided to show that the extinguishing system is energized. Instructions for operating the fire-extinguishing system shall be posted adjacent to manual activation devices.

**1006.2.7 Portable fire extinguishers.** A sodium bicarbonate or potassium bicarbonate dry-chemical-type portable fire extinguisher having a minimum rating of 40-B shall be installed within 30 feet (9144 mm) of commercial food heat-processing equipment, as measured along an unobstructed path of travel, in accordance with UFC Standard 10-1.

> Comment: National Fire Protection Association (NFPA) Standard 10 provides guidance on the selection, location and maintenance of portable fire extinguishers. The latest edition of NFPA 10 requires the installation of a new type of extinguisher called a Type K extinguisher for commerical cooking. Since this standard is not yet adopted in Minnesota, a Type K extinguisher is not required. The current type of extinguisher to be provided is a dry chemical one as outlined above in Section 1006.2.7

**1006.2.8 Operations and maintenance.** The ventilation system in connection with hoods shall be operated at the required rate of air movement, and classified grease filters shall be in place when equipment under a kitchen grease hood is used. If grease extractors are installed, they shall be operated when the commercial-type cooking equipment is used.

Hoods, grease-removal devices, fans, ducts and other appurtenances shall be cleaned at intervals necessary to prevent the accumulation of grease. Cleanings shall be recorded, and records shall state the extent, time and date of cleaning. Such records shall be maintained on the premises. Extinguishing systems shall be serviced at least every six months or after activation of the system. Inspection shall be by qualified individuals, and a Certificate of Inspection shall be forwarded to the chief upon completion.

Fusible links and automatic sprinkler heads shall be replaced at least annually, and other protection devices shall be serviced or replaced in accordance with the manufacturer's instructions. *Exception: Frangible bulbs need not be replaced annually.*

## A TEMPORARY COOKING OPERATION, SUCH AS A MOBILE TRAILER OR A BOOTH AT A FAIR

The requirements found in the MUFC for a hood suppression system for commercial cooking equipment are not directly applicable to temporary cooking operations such as a mini donut stand at a carnival or a mobile operation. In these cases, the MUFC has more flexible requirements that apply to all outdoor carnivals and fairs. Complete requirements can be found in Section 2504 of the MUFC, but for purposes of commercial cooking, here are the major points:

- Concession stands utilized for cooking shall have a minimum of 10 feet of clearance on two sides and shall not be located within 10 feet of amusement rides or devices [MUFC (1998) Section 2504.3.2].
- A 40 B:C rated dry chemical fire extinguisher shall be provided where deep-fat fryers are used [MUFC (1998) Section 2504.3.3]. There are additional requirements for fire extinguishers throughout the carnival midway, as required by the fire chief. All booths, even ones not using deep-fat fryers, should have immediate access to fire extinguishers.

- When propane (LP-gas) is used to fuel cooking equipment, the use shall be in accordance with National Fire Protection Association Standard 58 (1995 edition). There are too many requirements relating to propane to detail here, questions on the use of propane should be directed to the local fire marshal. Some of the more common problems include cylinders that are not secured, use of hoses instead of piping with high temperature materials (copper or steel), and use of LP-gas cylinders inside buildings (which is prohibited in all but a very few cases).
- When conducted inside a tent, canopy, or temporary membrane structure, cooking and heating equipment shall be vented to the outside. Where vents or flues are used, all portions of the temporary membrane structure, tent or canopy shall be no less than 12 inches from the flue or vent. Solid-fuel burning equipment shall be equipped with spark arrestors. Cooking and heating shall not be located within 10 feet of exits or combustible materials. Tents where cooking is performed shall be separated from temporary membrane structures, other tents and canopies by a minimum of 20 feet. Outdoor cooking that produces sparks or grease-laden vapors shall not be performed within 20 feet from a temporary membrane structure, tent or canopy. LP gas containers must be located outside tents. Flammable liquid fueled equipment is not permitted in temporary membrane structures, tents or canopies.
- LP-gas cylinders larger than 10 oz shall not be used for any type of food preparation inside buildings. There may be a few exception in NFPA Standard 58 for larger cylinders in buildings not frequented by the public or during disasters or states of emergency, but in general, any LP-gas cylinder larger than 10 oz used for cooking inside a building should be investigated.
- Hoses should not be used to provide fuel from a cylinder located outside, to a cooking appliance located inside.

## TABLESIDE COOKING INSIDE A RESTAURANT

The Minnesota Uniform Fire Code has requirements to limit the possibility of open flames from igniting other materials, especially in buildings frequented by the public. The important requirements are summarized as follows:

- If candles and other open flame decorative devices are used, there are requirements for the size of flame and enclosure of the burning fuel. For complete details, see the fact sheet on open flame devices available from the State Fire Marshal web site at http://www.dps.state.mn.us/fmarshal/mufcweb
- Portable fueled open flame devices must be enclosed in such a manner as to prevent the flame from contacting any combustible materials.
- Many portable cooking devices are fueled by LP-gas, usually in small nonrefillable (disposable) type fuel gas cylinder assemblies, with a maximum size of 10 oz and complying with UL Standard 147B. Usually the fuel is butane and the 10 oz or smaller cylinder is connected directly to a self-contained portable cooking appliance (single burner). At no time should cylinders larger than 10 oz be permitted to be used for cooking and no more than two containers may be connected to an appliance at one time. Containers shall not be manifolded. The fuel

container must be an integral part of the listed commercial food service device and shall not be connected through the use of any hose. See Section 3-4.8.4 of the 1995 edition of NFPA 58 for more information.

- LP-gas cylinders larger than 10 oz shall not be used for any type of food preparation inside buildings. There may be a few exceptions in NFPA 58 for larger cylinders in buildings not frequented by the public or during disasters or states of emergency, but in general, any LP-gas cylinder larger than 10 oz used for cooking inside a building should be investigated.
- Hoses should not be used to provide fuel from a cylinder located outside, to a cooking appliance located inside.

# FREQUENTLY ASKED QUESTIONS AND ANSWERS

The answers for the FAQ's on the following pages are based upon Minnesota's revision to the 1991 Uniform Mechanical Code (UMC). The State is presently reviewing this Code and a change will be made in 2002. At that time new or updated FAQ's will be provided.

### 1. When is an exhaust system required in a commercial kitchen?

A ***Type I hood*** system is needed anytime a food heating process produces grease-laden vapors or smoke. Currently a process is said to produce grease-laden vapors if it emits more than 0.01 pounds of condensable grease per hour, which is equivalent to 5 mg/m$^3$ at 500 CFM exhaust. A ***Type II hood*** system is needed based upon two criteria: first, if the equipment/ process emits "comparable amounts" of heat/moisture compared to a dishmachine, and second, if this emitted heat and moisture is "excessive." "Excessive" is to say that the design strategy for the mechanical load is insufficient and the process/equipment will make the space unsafe due to potential mold growth, or non-compliance with ASHRAE Standards 55 and 62.

### 2. What is the difference between a Type I and a Type II hood?

A ***Type I*** hood is required for collecting and removing grease and smoke produced by cooking processes. A Type I hood must have approved grease filters or UL listed grease removal devices. The Mechanical Code provides prescriptive details on Type I hood construction materials and methods. Type I hoods are formed of steel. Type I hoods are intended to withstand a fire without allowing flame penetration. ***Type II*** hoods are used for collecting and removing steam, vapor, heat or odors. They do not require filters. Since there is no grease deposition associated with the process, the hood material can be thinner and composed of less durable material.

### 3. What is the difference between a Type I duct and a Type II duct?

Although the Mechanical Code does not specifically define a Type I or Type II duct, it is common to refer to a Type I duct as required for a Type I hood and a Type II duct as required for a Type II hood. A Type I duct must have a minimum thickness of 16 gage black steel iron or 18 gage stainless steel. All joints and seams must be made with a continuous liquid-tight weld. Type I ducts must slope toward the hood a minimum of ¼ inch per foot to prevent grease accumulation. Factory built prefabricated grease duct systems listed to UL Standard 1978 may also be used in lieu of the traditional field welded duct if prior approval is obtained from the building official. The Code requires Type II ducts to meet the minimum requirements of a metal air distribution duct. They are generally divided into two categories: condensate or heat and odor. Condensate ducts are usually made of a non-corrosive material such as aluminum or stainless steel, and the joints and seams are caulked or welded to allow moisture to drain to a collection point. Heat and odor ducts are constructed similar to a typical HVAC air distribution duct.

## 4. What is the difference between a grease filter and a grease extractor?

A grease filter is a removable baffle filter listed to UL Standard 1046 (grease filters for exhaust ducts) that is designed to capture grease and drain it into a container. UL 1046 also requires a grease filter to limit the projection of flames into the grease duct. Grease filters are designed to easily insert into a channel or bracket in the rear of the hood, which allows for easy removal and cleaning.

A removable grease extractor is usually designed as a cartridge that is an integral component of a listed exhaust hood. A stationary grease extractor, also known as a water-wash hood, contains an integral slot or baffle that runs the entire length of the hood. The water wash system can be either a continuous cold water mist or a periodic hot, detergent-injected water spray that is typically activated at the end of the day. The Mechanical Code does not specifically address grease extractors.

## 5. What are examples of exhaust hoods used over cooking equipment?

Canopies are the most common form of exhaust hood. They can be used over most of the familiar types of food service cooking equipment, such as ranges, fryers, griddles and ovens. A canopy is not typically placed over rotary rack ovens, some smoker ovens (direct vent), hearth type ovens, and deck pizza and bakery ovens (eyebrow). Another style of exhaust hoods is known as the plate shelf type of exhaust hood. Also known as the back shelf ventilator, they are non-canopy type hoods and are generally limited to use over fryers, griddles, ranges, under-fired broilers, and other conduction or induction cooking methods. Eyebrow hoods with or without listed filters (similar to vent cowls) are limited to above a door or opening for an oven, broiler, steamer or other equipment that projects effluent forward and up.

## 6. Are ventilation requirements different for gas equipment vs. electric?

Yes, for the time being. Sect. 2003(g) of the 1991 UMC states electric equipment exhaust rates can be 80% of the prescriptive values determined by a perimeter calculation. This issue will need to be revisited in the next Mechanical Code.

## 7. What venting requirements are there for wood hearth oven?

The ovens must have all separate, welded Type I ducts and rated fans at the outlet. If the ovens use only wood as a fuel, then fire suppression is not required. It is extremely important that the manufacturer's installation instructions are followed (eyebrow hood would most likely not be required). Solid-fuel appliances are usually vented with a class A chimney (and are not permitted to share a vent with a gas-fired appliance), and discussed on page 35 of these guidelines. For further information, contact the Fire Marshal and building official having jurisdiction for the building

## 8. What are the distance requirements from the cooking surface to the bottom edge of the hood.

The distance from the cooking surface to the bottom edge of the hood must not exceed 4 feet. An OSHA requirement states that overhead obstructions adjacent to an egress shall not be less than 6'8" above finished floor. Otherwise, hood elevation requirements are a function of the distance from the lowest edge of the filter rack and the cooking surface as listed in Table No. 20-A, in the UMC.

| | |
|---|---|
| No exposed flame grills, fryers, etc | 2 feet |
| Exposed flame and burners | 2 feet |
| Exposed charcoal and charbroiler type fires | 3.5 feet |

Note: A 3½ foot separation distance is recommended for woks and other high temperature equipment. Solid fuel requires a separate hood section, duct and dedicated exhaust fan.

### 9. How do I calculate the exhaust rate of an existing system in the field?

To determine the design exhaust volume of a system, measure the area of the duct collar. Take the total square feet of duct collar area and multiply by 1800. The result is the original design exhaust volume (CFM) of that hood section. The Mechanical Code requires exhaust duct velocities of 1500-2500 FPM, with 1800 as a common design velocity.

### 10. What are the general requirements for make-up air (MUA)?

According to the Uniform Mechanical Code, each room equipped with an exhaust hood must have air supplied to the room equal to the amount of air being exhausted. In addition, an electrical interlock must connect the exhaust and make-up air systems, and exhaust systems must be provided with tempered make-up air. Windows and doors must not be used for the purpose of providing MUA. Tempered make-up air must be at least 55° F from the discharge diffuser into the room.

### 11. What is a compensating hood?

A compensating hood is one that includes a MUA plenum within it to accomodate all, or a portion, of the total MUA requirement. There are two types of compensating hoods. A short-circuit compensating hood is one that discharges MUA directly into the capture area of the hood. The Minnesota amendments to UMC state that 20% of the total MUA requirement can be short-circuited. The other type of compensating hood is a front discharge compensating hood, where some percentage of MUA is discharged on the front vertical face of the hood. MUA systems must be capable of discharging MUA at a minimum temperature of 55° F.

### 12. When can transfer air be used in lieu of dedicated MUA?

There are two important differences between fresh air and transfer air. Fresh air comes from outside, so when it is introduced by powered means, it pressurizes the indoor space. Transfer air comes from within the same building and as a consequence, cannot help compensate for the air exhausted from the building. Fresh air is presumed to have fewer contaminants than indoor air. Transfer air can sometimes be used for a portion of the total replacement air requirement. When air is being exhausted, outdoor air must be introduced in order to stabilize room pressure. The current UMC does not specify the percentage of fresh air to transfer air for MUA purposes. As a rule, engineers design buildings to be slightly pressurized (.01-.02 inch w.g.) compared to atmospheric conditions. The kitchen should always be at equilibrium with average outdoor pressure, which will place it in a slightly negative pressure compared to the rest of the building. This condition prevents migration of cooking odors into other areas.

## 13.What does "listed hood" mean and when is it required?

A listed hood is a particular model of hood that a manufacturer has designed and developed to withstand the UL Standard 710 performance test. This worst case test takes the materials as specified by the manufacturer, and their specific forming techniques, and tests the assembly with very high temperature grease fires to assure the system does its job of capturing and containing. When a particular design of hood has passed the UL 710 test, it is said to be "listed", and is exempt from many of the requirements of the Mechanical Code. A listed hood is not required; however, the primary advantage to an owner for utilizing a listed hood over an unlisted hood is that the required exhaust air volumes may be less. This is often a significant cost savings over the life of the overall system.

Listed hoods are the exceptions referred to in the Mechanical Code as it relates to calculating exhaust air volumes and resulting MUA needs. Look for the data plates affixed to UL 710 hoods with information about the listed cooking equipment temperature rating for that specific hood.

## 14.What is an approved grease filter?

An approved baffle grease filter will comply with UL Standard 1046. It should also be approved (and stamped as such) to the ANSI NSF Standard 2 to meet the Minnesota Food Code requirements. Mesh filters cannot be used in a Type I hood. There are both aluminum and stainless steel baffle filters available with UL classification for use over cooking equipment. Though the Code does not prescribe the use of one over the other, aluminum filters are dangerous in high temperature applications, such as over a solid fuel broiler, or above an under-fired gas broiler enclosed on three sides, because of their lower melting point in comparison to stainless steel.

Some listed hoods may have grease removal devices that appear to removable, and have an integral slot running the length of the cooking equipment. These are part of the listing and are approved in lieu of baffle filters. Individual filters are classified based upon their average face velocity. It is important that the exhaust rate enables the filters to be within their classified range of air velocity (FPM).

## 15. How much lighting is required at the cooking surface?

The Minnesota Food Code, 4626.1470 6-303.11, states, in part: "The light intensity shall be: (C) At least 540 lux (50 foot candles) at a surface where a food employee is working with food …." Deeper hoods (over 48 inches front to rear) may need flush mounted flourescent lamps in order to meet this requirement. The standard marine incandescent lamps typically provided by the hood manufacturers with 48 inches on center spacing will probably not provide the required illumination at the cooking surface.

## 16. What cleaning frequency is required for Type I hoods and ducts?

The Minnesota Uniform Fire Code requires hoods, grease-removal devices, fan ducts and other appurtenances to be cleaned at intervals necessary to prevent the accumulation of grease. This can range from monthly cleaning for high volume commercial kitchens to annual cleaning for other kitchens, subject to the approval of the local fire official.

## 17. Are dry chemical fire suppression systems allowed in Type I hoods?

Yes, provided that they are serviced every 6 months and a Certificate of Inspection is provided by the fire official. Dry chemical extinguishing systems that have been installed in the past are unable to comply with the test standard required for new installations. However, as long as the extinguising system complies with the terms of the original listing and the system and/or cooking appliances are not modified, dry chemical extinguishing systems can remain if they are in compliance with the servicing requirements. Recent changes in the listing requirements in UL Standard 300 have resulted in the majority of chemical suppression systems using a wet agent as opposed to the dry agent as used in the past. In any case, a newer installation requires the use of a listed system agent; therefore, the older dry agents would not pass the current tests.

### 18. What are the fire suppression requirements for a Type I Hood?

The MUFC requires approved automatic fire-extinguishing systems shall be provided for the protection of commerical type cooking equipment. Exception: The requirement for protection does not include steam kettles and steam tables or equipment that does not create grease-laden vapors. If a convection oven, for example, produces grease-laden vapors, then it would require a fire-extinguishing system.

### 19. What considerations should be taken into account when discharging make-up air into the kitchen?

The distribution of MUA into the kitchen must meet the following principles:

a. Distribute air into the kitchen area without disturbance to the hot and cold food holding equipment,
b. Distribute air into the kitchen without air turbulence or contamination to food products or discomfort to personnel, and
c. Distribute air into the kitchen in a manner that does not disturb the function of the capture air velocity at the hood perimeter.

### 20. Does all gas-fired cooking equipment need to be located under a hood?

No. The Mechanical Code does not require gas-fired equipment to be placed under a hood, unless it produces comparable amounts of heat, steam, grease, or smoke, but it must be installed in accordance with the manufacturer's listing installation instructions.

### 21. Are there any changes in code requirements when a NSF fabricator is called in to make some modification to the existing hood, e.g. Mechanical Code, Food Code, UL Standard 710?

If the NSF fabricator does anything to change the duct collar or the original filter rack and plenum of the hood, the UL 710 listing is no longer valid. Prior to such work, the fabricator should contact the listing holder (manufacturer) and describe the work to be performed to determine what impact, if any, it will have on the listing. In addition, if an NSF fabricator makes any modifications to the hood, the hood should be appropriately evaluated and relabelled.

### 22. When do older ventilation systems need to be updated?

The Minnesota Food Code, Section 4626.0690, requires the ventilation system to have sufficient capacity to prevent the accumulation of grease or condensation on walls and ceilings. If a special fire hazard exists, a fire official can order changes in accordance with the State Fire Code. The Mechanical Code allows existing ventilation systems to remain if the use is in accordance with the original design and location and no hazard to life, health or property has been created.

### 23. What are the ventilation requirements for a low temperature dishmachine that is used once every other week?

Common sense would lead one to say no specific hazard exists. A mechanical exhaust canopy may not be required. Professional judgement should be used when applying the "Other Criteria" referenced in these guidelines and the flow chart should be utilized when making that determination.

### 24. The Food Code, section 4626.1335(A), states, in part "...walls, wall coverings, shall be designed, constructed, and installed so they are smooth and easily cleanable...." What are the specific requirements for the wall surface beneath the hood?

There are no other requirements beyond those in the Food Code. The Mechanical Code and Building Code are silent on this issue. The specific equipment and its use must be thoroughly evaluated when interpreting this provision in the Food Code. A wall finish consisting of paint or fiberglass reinforced panels would not be appropriate for food equipment that generates grease-laden vapors or excessive heat. Food service equipment must be installed in accordance to the manufactuerer's instructions.

### 25. How does the regulatory authority quantify odors for determining inadequate ventilation and then convert this into objective data, so that he/she can write an order to repair the ventilation system?

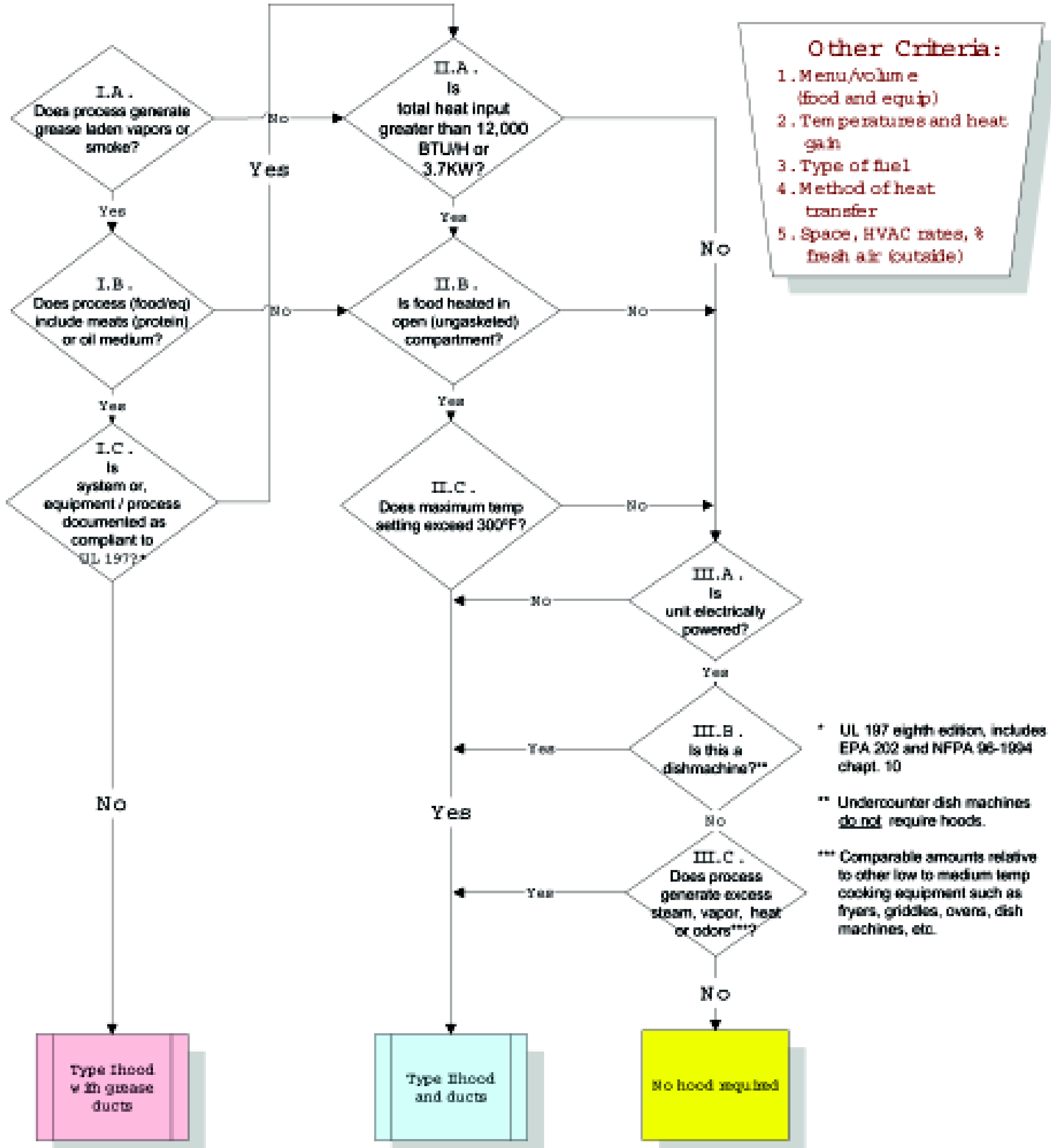
It is generally not necessary for the regulatory authority to quantify these odors when referring to the various sections of the Food Code. The Food Code requires a ventilation system be adequate to prevent grease accumulation or excessive heat, smoke or fumes. If inadequate ventilation is suspected based on subjective criteria, a performance test (or testing and balancing report) may be requested to verify the required rate of air movement as specified in the Mechanical Code and Fire Code.

### 26. How do you promote partnering with trades and mechanical inspectors on the all-important pre-opening inspection?

Since last minute delays due to a lack of coordination are a major inconvenience for all entities involved, it is of utmost importance to avoid potential problems well before the pre-opening inspection. Usually this can be accomplished by explaining the inspection procedures and frequency to the owner or owner's representative to ensure that necessary inspections are requested in an appropriate and timely manner.

# General Ventilation Criteria Flow Chart

TJ



## HOW TO USE THE FLOW CHART

When using a flow chart, only ONE question can be asked at a time. Furthermore, the "flow" of the chart must be followed. For example, if you answer **I. A.** (the first question) with a YES (it does produce grease-laden vapors), then you never get around to asking the questions relating to input levels (**II.A.**), unless the answer to **I. C.** is YES. The only way you get to question **II. C.** which relates to 3.7KW input for example, is if you answered NO to **I. A.** or, the unit complies with UL Standard 197 eighth edition (**I. C.**). Thus, if you answer YES to the first two questions and NO to the third question in column one, you get a Type I hood. You cannot then answer subsequent questions, as they do not follow logic line (or flow) of the chart. However, if in the inspector's opinion, the amount of grease-laden vapors produced is insignificant or not visible, then, you can use the "other criteria" to justify installing the equipment either with a Type II hood, or no hood at all. The flow chart is a good guideline, but it is useless if the flow chart discipline is not applied.

### Type I

#### A. Does process generate grease-laden vapors or smoke?

This is the most important of all of the questions, and requires the most diligence to answer. Grease deposition is a fire hazard as grease will spontaneously combust at about 680°F. EPA test method 202 documents a concentration of particulates given a specific ventilation rate for a UL 197 listed recirculating hood systems using UL Standard 300 fire suppression systems. Concentrations of less then 5mg/$m^3$ at specific exhaust rates are considered to be negligible. Future test methods will provide documentation relating to total volume of grease-laden effluent irrespective of exhaust rates. Subjective evaluation criteria is also valid. Because a toaster can make toast "smoke" does not mean a hood is required. Because a steam table produces some vapors does not mean a Type II hood is required. Soup or sandwich warmers, though they may have inputs beyond the limits referred to in this guide do not necessarily need to be vented, as they are not "cooking", and the temperatures to which they bring food products are not high enough to generate significant effluent.

#### B. Does process (food/eq) include meats (protein) or oil medium?

This is a further qualifier to the first question. If there is no oil medium, and the product does not include animal protein items, then there will not be grease-laden effluent. There may be "excess" heat and condensate, but not volatile organic compounds that can condense and build up in sufficient volume to fuel a fire.

#### C. Is the system or, equipment/process documented as compliant to UL Standard 197?

This is the objective documentation referred to in the **I.A.** At this time, UL 197, eighth edition (April 10th, 2000) is the best critical limit we have. Submittals for recirculating hood systems listed to this standard do not require Type I hoods.

### Type II

#### A. Is total heat input greater than 12,000 BTU/H or 3.7 KW?

The logic behind this question deals with heat equivalents into the space. This is where the "other criteria" referred to in the flow chart becomes important. The amount of excess heat generated by a piece of equipment that is warming or holding a food item consists of two variables: latent heat and sensible heat. Latent heat is the amount of heat released when steam makes a phase change to become vapor, or when vapors precipitate. Sensible heat is the heat value represented by a thermometer and it reads the same regardless of relative humidity. If the installation is in a large space, such as a stadium, auditorium, arena or other facility with very high ceilings and large volumes of indoor air, there is no need to vent as there is no hazard of elevating temperature and humidity levels. However, if the space is small, or lacking mechanical ventilation, and or has low ceilings, then a Type II hood may be needed to assure that the heat from the process does not cause the space to become uncomfortable or humidity levels to rise to such as point as to encourage mold growth or ceiling panels to discolor or sag. The critical limits associated with this question are based upon empirical evidence and best guesses from informed industry experts.

### B. Is food heated in open (ungasketed) compartments?

Foods that are cooked in cabinets or oven compartments that are sealed with gaskets are designed to prevent the atmosphere in the heating chamber with mixing with atmosphere in the kitchen. This does not include convection ovens as their doors are not gasketed. The idea is that as the foods warm, they give off moisture and volatile organic compounds (VOCs). Once the atmosphere inside the heating chamber is saturated, no more moisture will be evaporated. The result is a moister product. Since the piece of equipment has sealed gasketed doors, there are no emissions of VOCs or moisture while it is heating. When a batch is completed, the door is opened, and the total volume of condensable particulate is a function of exit temperature of the "air", and its dew point. Prime rib cookers and similarly designed pieces that are electrically powered do not require a hood. When "other criteria" are not met, such as inadequate general ventilation, excessive loading, continuous cooking or the space is confined or has low ceilings. If other criteria lead you to recommend a hood, a Type II will most likely be suitable. Using "other criteria", there may be instances where a hood may not be needed for an electric conventional oven as they do not have fans (like convection ovens), and they cook/bake slow in comparison. These too may not need to have a hood, as they will not and cannot be used as a broiler.

### C. Does the maximum temp setting exceed 300°F?

The intent behind the question is this: if the piece of equipment is not capable of heating air to 300°F, then it is not capable of heating a food items to the point that they will emit grease-laden vapors significant enough to comprise a hazard. Since there may not be a good way to determine what temperature a piece is capable of attaining at its maximum, there is a reference made to the temperatures on the thermostatic dial. Ideally the inspector can ascertain by other means the heating capacity of a piece of equipment and then, applying "other criteria", make a sensible decision relating to ventilation needs.

## "No hood required" qualifiers

### A. Is unit electrically powered?

Gas fired units produce by-products of combustion and may need to be vented.

### B. Is this a dishmachine?

Undercounter type dishwashers do not require a hood. All others do.

### C. Does process generate excess steam, vapor, heat or odors?

"Excess" is defined as *comparable amounts* relative to other low to medium temperature types of cooking equipment, such as fryers, griddles, ovens or dishmachines.

In every example it is necessary to consider all of the variables that relate to safety. Make-up air is critical to capture and contain heat and grease-laden vapors. From a mechanical perspective, simply verifying that the MUA system exists, is electrically interlocked with the exhaust, and is of sufficient volume to prevent creating a negative pressure in the space is adequate. The testing, adjusting and balancing of an exhaust system is critical, as the motors that drive the fans for both exhaust and supply are typically shipped from the manufacturer ready for full speed performance. Engineers specifying equipment always select fans with greater horsepower than is necessary to obtain their design air volumes, thus, every system MUST be balanced.

From an environmental health perspective, taking care of the mechanical and fire needs is only the beginning. Make-up air diffusers that impinge air onto refrigerated prep tables and potentially hazardous foods that are being held hot or cold presents a hazard. Turbulence is to be avoided in the kitchen prep area, though it is desirable in the dish room, especially over the clean dish table and over drying racks to promote drying.

A conflict between mechanical codes and health codes relates to materials used. The Mechanical Code allows the use of regular steel to form a hood. Health codes require that surfaces be durable and easy to clean, with coving where two planes meet (ANSI/NSF Std 2). Thus, stainless steel hoods must be listed to NSF Standard 2. In every case, common sense must be used to gain the best perspective on the potential hazard that the menu, process and the equipment may present in each specific situation. Similarly, the code official needs to check the data plates provided on UL Standard 710 hoods. All hoods that are pre-engineered and listed to UL 710 are required to have data plates that indicate the minimum exhaust and make-up air values to which the assembly was built. Unlisted Type I hoods must follow the prescriptive formulas of the Mechanical Code for exhaust volumes. The 3 inch air barrier requirement where wall mounted hoods abut combustible wall material is a component of their UL 710 listing. Unlisted hoods must be checked to verify that they maintain appropriate distance to combustible requirements, and adequate distances from the bottom edge of their UL listed filters (unlisted filters are not allowed in any Type I application) to cooking surfaces or open flame.

# EQUIPMENT CATEGORIES

The purpose of listing these examples is to provide a basic description of various kinds of food equipment, applications for their use, and information on ventilation. This information does not consider the type of fuel used (electric, gas, solid), which may be included in some of the equipment examples. Ventilation considerations for different types of fuel are specifically addressed in other sections of these guidelines. The listing of equipment is not an endorsement of any company, manufacturer or model number.

## COMMERCIAL KITCHEN FOODSERVICE EQUIPMENT

A

Gas Broiler with Cabinet
TYPE: Overfired

B

Radiglo Gas Broiler with Modular Stand
TYPE: Overfired

C

Char-Broiler Gas Radiant Type
TYPE: Underfired

D

Gas Infrared Salamander
TYPE: Countertop Broiler

## USE OF EQUIPMENT

*Overfired* means the burners are located at the top and radiate their heat downward.

*Underfired* has a heat source that is located beneath the food being cooked.

*Salamander* is for reheating finished product.

## TYPICAL APPLICATION

Imparts flame broiled taste and aroma to meats and poultry. Other uses include broiling, toasting, browning and finishing of:

vegetables    raw meats    chicken without skin

## HOOD AND EXHAUST SYSTEM

Type I system. Type II may be used for salamander based upon heat removal only.

High grease production based upon menu.

A

Countertop Fryer

B

Fryer

TYPE: Floor Model

Pressure Fryer

## USE OF EQUIPMENT

Fast cooking to order, cooks rapidly & uniformly.

## TYPICAL APPLICATION

This is generally used for all types of fried foods with a high grease output, except for closed pressure types.

## HOOD AND EXHAUST SYSTEM

Grease producing. Type I system.

A

Small, Counter Griddle
TYPE: Countertop

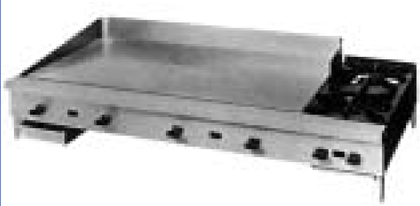
B

Standard Griddle
TYPE: Countertop

C

Electric Bistro Grill
TYPE: Clam-shell style

D



Standard and Combination Griddles
TYPE: Countertop

## USE OF EQUIPMENT

Fast cooking. Griddle size and type is determined by menu and production.

## TYPICAL APPLICATION

Typically used for:

| | | | |
|---|---|---|---|
| eggs | bacon | pancakes | tortilla shells |
| meat | potatoes | fish | |

## HOOD AND EXHAUST SYSTEM

Type I System with high to medium grease production based upon the menu. Ideal for meat, fish or chicken.

Type II for non-grease foods such as grilled sandwiches and tortilla shells.

A

Hotplate
TYPE: Single Burner

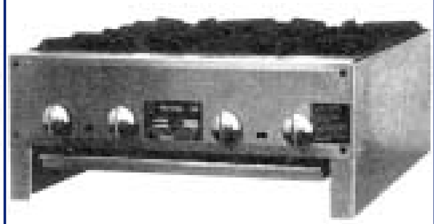
B

Hotplate
TYPE: Two Burner

C

Heavy Duty Electric Induction Cooktop

D



Step-Up Hotplate
TYPE: Four Burner

## USE OF EQUIPMENT

General cooking, small space equipment capable of producing a wide range of menu items.

## TYPICAL APPLICATION

Typically used for:

| | |
|---|---|
| sauteing | pan broiling |
| stewing | frying |

## HOOD AND EXHAUST SYSTEM

Type I or Type II, or no hood required based on menu. Example, no hood required for a single unit use, with no grease production, such as reheating or boiling with adequate room exhaust ventilation.

Low to no grease when located in a limited food service facility.

A



Stainless Steel Steam Jacketed Kettle
TYPE: Countertop Tilting

B

Stainless Steel 2/3 Steam Jacketed Cooker/Mixer
TYPE: Floor Model Tilting

C

Self Contained Steam Kettle
TYPE:Floor Model

D

Steam Jacketed Tilting Braising Unit
TYPE: Floor Model

## USE OF EQUIPMENT

Kettles offer the advantage of one pot cooking for speed and consistency. Low temps allow for simmering foods while high heat settings braise meats and quickly bring foods to a rapid boil.

## TYPICAL APPLICATION

Typically used for:

| | | |
|---|---|---|
| soups | stews | vegetables |
| puddings | sauces | pasta |
| braising meats | | |

## HOOD AND EXHAUST SYSTEM

Type II System, typically. Low to no grease production based upon the menu.

Type I System based on foods cooked.

A

Countertop Convection Gas Oven

B

Single Convection Oven

C

Double Deck Convection Oven

D

Combination Oven/ Steamer

## USE OF EQUIPMENT

*Convection ovens* provide multi-purpose cooking capabilities, cook foods faster at lower temperatures, and heat foods uniformly.

*Combitherm ovens* provide fast, uniform and moist cooking with low product shrinkage.

## TYPICAL APPLICATION

*Convection ovens* and combination ovens typically used for:

| | |
|---|---|
| vegetables | baked goods |
| lasagna | roasting meat |
| rolls | baking potatoes |
| cakes | pastries |
| seafood | |

## HOOD AND EXHAUST SYSTEM

Type I or Type II System, based upon the menu.

Low to no grease production.

A

## Small Countertop
TYPE: Radiant Electric Heat

B

## Convect-a-Ray Oven
TYPE: Electric

C

## Rotary Rack Oven
TYPE: Mobile Rack

D

## Revolving Deck Oven
TYPE: Deck

### USE OF EQUIPMENT

*Convect-A-Ray ovens* provide multi-purpose cooking capabilities, cook foods faster at lower temperatures, and heat foods uniformly.

*Rack ovens* provide a central food cooking facility for roasting and baking since they are cooked and cooled on the same rack.

### TYPICAL APPLICATION

*Ovens* are typically used for fresh or reheating products such as pizzas, frozen baked goods, cookies, muffins, and meats.

*Rack ovens* are typically used for baking in a high volume facility.

### HOOD AND EXHAUST SYSTEM

*Convect-a-Ray ovens,* when not used for grease-producing food items, have no hood and local exhaust for single units only. Multiple units require a Type II hood based on the menu.

*Revolving rack ovens* are vented in accordance with manufacturer's instructions and Mechanical Code. A vent eyebrow hood design must be installed.

A

Bake and Roast Gas Deck Oven

B

Countertop Pizza Oven

C

Electric Pizza Oven
TYPE: Countertop

## USE OF EQUIPMENT

Used for a large variety of items to be cooked or baked. Models include standard, full size, and countertop.

## TYPICAL APPLICATION

Typically used for:

| | | |
|---|---|---|
| pizza | casseroles | baked potatotes |
| seafood | poultry | cookies |

## HOOD AND EXHAUST SYSTEM

Type I or Type II System based upon the menu and the size of the oven installed.

Please refer to flow chart on pages 49 and 51.

A

Conveyor Oven
Electric Series
(Large)

B

Conveyor Oven
Electric Series
(Triplestack)

C

Conveyor Oven
Electric Series
(Single Unit)

## USE OF EQUIPMENT

Used mainly for retail, fast food, and specialty food service establishments for baking, roasting, and cooking.

## TYPICAL APPLICATION

Typically used for:

| | |
|---|---|
| pizza | frozen entrees |
| casseroles | meats |
| breads | pastries |

## HOOD AND EXHAUST SYSTEM

A & B are Type I (large size)

C is Type II (smaller), when menu permits and no grease is produced.

A


Electric Counter Top Oven
All Purpose Mini Oven
(Low volume)

B

Counter Top Oven
Single Shelf Pretzel Oven

C

Counter Top Oven

## USE OF EQUIPMENT

Allows for cooking in small volume in a compact work area.

## TYPICAL APPLICATION

Typically used for:

pizza baked goods

## HOOD AND EXHAUST SYSTEM

A & B single ovens require area exhaust.

C requires a Type I or II System based upon the menu relating to grease production.

A

Medium Duty Counter Range
TYPE: Countertop

B

Counter Range and Add-A-Unit
TYPE: Countertop (with hot plate)

C

Gas Light Duty Range
TYPE: Floor Model

D

Gas High Performance Range
TYPE: Floor Model

## USE OF EQUIPMENT

*Countertop* and *floor models* are multi-purpose cooking devices.

## TYPICAL APPLICATION

*Countertop models* are typically used for:

| | |
|---|---|
| sauteeing | panbroiling |
| stewing | stock pot work |

*Floor models* are typically used for:

| | |
|---|---|
| sauteeing | panbroiling |
| stewing | stock pot work |

The steamer and base on *floor models* provide conventional and convection oven cooking.

## HOOD AND EXHAUST SYSTEM

*Countertop and floor models* are Type I Systems, with low to medium grease production based upon the menu.

A

## Graduated Hot Top
TYPE: Floor Model
(with hot plate)

B

## Combination Char Broiler/Range
TYPE: Floor Model

## USE OF EQUIPMENT

*Hot plates* are designed to cook and heat foods through a total heat range. The hot center is for fast boiling, the outer edge is for simmering. They provide even heating with high performance. *Combination cooking units* provide char/broiler hot tops and open burner use with ovens below concentrate on a high heat output when all units are in use.

## TYPICAL APPLICATION

*Hot plates* are typically used for:

- candies
- heating or cooking at a rapid boil
- soups

## HOOD AND EXHAUST SYSTEM

*Hot plates* are a Type I or II System based upon the menu. *Combination cooking units* are a Type I hood with an exhaust rate that is based on the combined BTU's and grease output considerations.

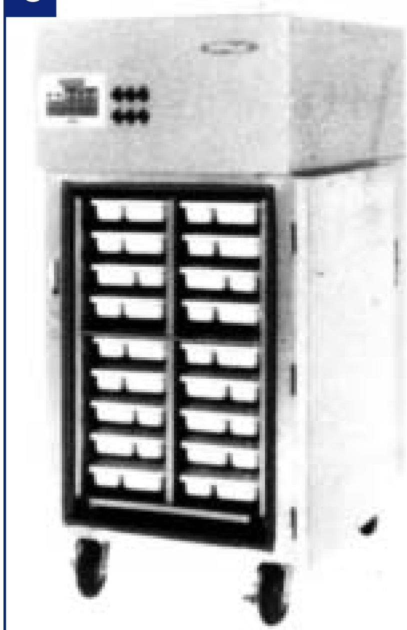
A

Pasta Rethermailzer
TYPE: Countertop

B

Gas Pasta Units
TYPE: Floor Model

C



Rethermalization Cabinet

## USE OF EQUIPMENT

Reheating of previously prepared or cooked foods.

## TYPICAL APPLICATION

Typically used for a variety of items including:

soups meats entrees

## HOOD AND EXHAUST SYSTEM

Type II System for steam and odor.

Cabinet rethermalizer is heated by 9 & 15 KW heaters.

Very low to no grease production based upon the food items heated.

A

Barbecue/Roaster Oven

B

Electric Rotisserie Roasters

C

Bird Rotisserie

## USE OF EQUIPMENT

Countertop and display cooking in restaurant, grocery or deli operations.

## TYPICAL APPLICATION

Typically used for home meals ready to eat and sit down meals such as roasting and pastries or baked goods.

## HOOD AND EXHAUST SYSTEM

Type I System.

Medium grease production based upon the menu.

A

Cooking and Holding Ovens

B

Two Ovens Stacked

## USE OF EQUIPMENT

Cooks slowly, retaining moisture and holds food hot until served. Cook and hold use.

## TYPICAL APPLICATION

Typically used for cooking whole roasts of:

beef turkey pork

## HOOD AND EXHAUST SYSTEM

Area room exhaust with single unit installation to Type II for installation of multiple units, based upon the menu and style of use.

Refer to the flow chart and use of flow chart on pages 49 and 52 (B) for gasketed and non-gasketed types.

Very low to no grease production.

A

Smoke Chef Vortex Convection Smoker Oven

B

Smoke Chef Vortex Convection Smoker Oven

C

Rotisserie

TYPE: Solid fuels

## USE OF EQUIPMENT

Specialty cooking, smoking and glazing imparts flavor.

## TYPICAL APPLICATION

Typically used for:

| | | |
|---|---|---|
| prime rib | ham | whole chickens |
| sausage | pork | duck products |

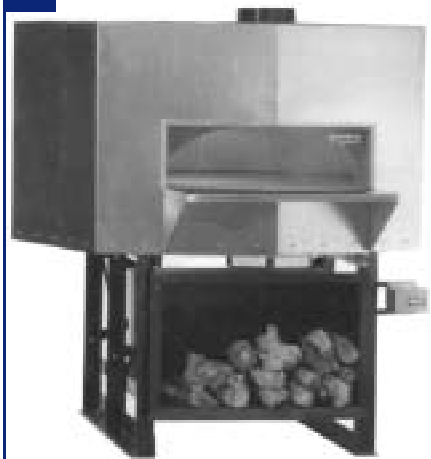
## HOOD AND EXHAUST SYSTEM

Vented in accordance with manufacturer instructions and Mechanical Code (stack vent).

A

Charbroiler
TYPE: Solid fuels

B



Wood-Fired,
Stone-Hearth Oven
TYPE: Wood-Fired

C

Charcoal Type Broiler

## USE OF EQUIPMENT

Baking and roasting.

## TYPICAL APPLICATION

Typically used for roasting and basting of:

chicken beef pork

## HOOD AND EXHAUST SYSTEM

Dedicated Type I System. Refer to solid fuels on page 35 of this guideline.

High heat and grease production based upon the menu.

Separate exhaust hood and duct from other cooking appliances according to the Mechanical Code.

A

3 Pan Capacity Stainless Steel Pressureless Steamer
TYPE: Convection Steamer

B

6 Pan Capacity Stainless Steel Pressureless Steamer
TYPE: Double Door

C

Steam Cooker
TYPE: Gas Fired

## USE OF EQUIPMENT

High moisture retention, fast cooking without any flavor transfer.

## TYPICAL APPLICATION

Typically used for reheating and cooling where no browning occurs.

## HOOD AND EXHAUST SYSTEM

Type II System.

Low to no grease production based upon the menu.

A

Ventless Fryer

B

Ventless Preesure Fryer
(Recirculating)

## USE OF EQUIPMENT

Uniform, fast cooking with high moisture retention.

## TYPICAL APPLICATION

Typically used for fried foods.

## HOOD AND EXHAUST SYSTEM

Type I System.

Ventless style, with fire protection and area exhaust required. Must be approved for installation by local building officials.

A

Freestanding Drawer Warmers

B

Gas Food Hot Table

C


Heated Display Cabinet

D

Food Warmer

E

Soup Cookers/Warmers

## USE OF EQUIPMENT

Holding cooked food at the required temperature.

## TYPICAL APPLICATION

Typically used for a large variety of foods.

## HOOD AND EXHAUST SYSTEM

None required.

Normal room ventilation unless multiple units are used, then additional room air exhaust is required.

A

Stir-Frying Wok Range

B

Chinese Cooking Range
TYPE: Gadong Range

## USE OF EQUIPMENT

Fast cooking, high moisture food products.

## TYPICAL APPLICATION

Typically used for:
stir fry   saute

## HOOD AND EXHAUST SYSTEM

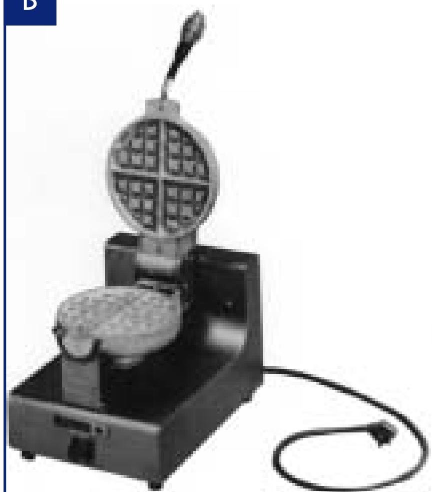
Type I System.

High heat and grease production based upon the menu.

A

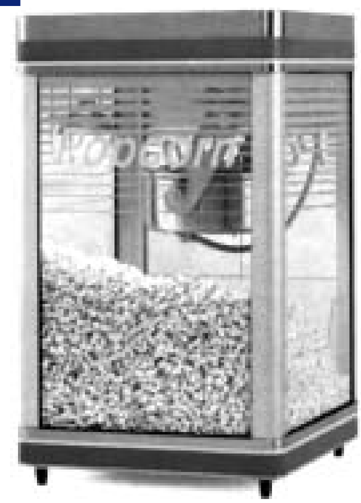
Grill -Max Roller Grill

B



Belgian Waffle Baker

C



Galaxy Popcorn Machine

TYPE: Popcorn Popper (small)

D

Dual Server

TYPE: Popcorn Warmer/Server

## USE OF EQUIPMENT

Low temperature and low volume cooking.

## TYPICAL APPLICATION

The food produced is based upon the design of the equipment.

## HOOD AND EXHAUST SYSTEM

None required.

Normal room ventilator unless multiple units are used, then additional room air exhaust may be required.

Large popcorn popper (e.g theater style) using oil typically requires Type I system based upon the volume.

Popcorn kettles using oil require Type I, (see Flow Chart).

Air type popcorn poppers require room exhaust for heat removal.

A

Counter Electric Oven
TYPE: Lightwave Oven

B

Electric Rice Cooker

## USE OF EQUIPMENT

*Lightwave oven:* Fast baking.
*Rice cooker:* Cooking and holding.

## TYPICAL APPLICATION

*Lightwave oven* typically used for pan baking, pizzas, cookies and muffins.
*Rice cooker* typically used for rice cooking.

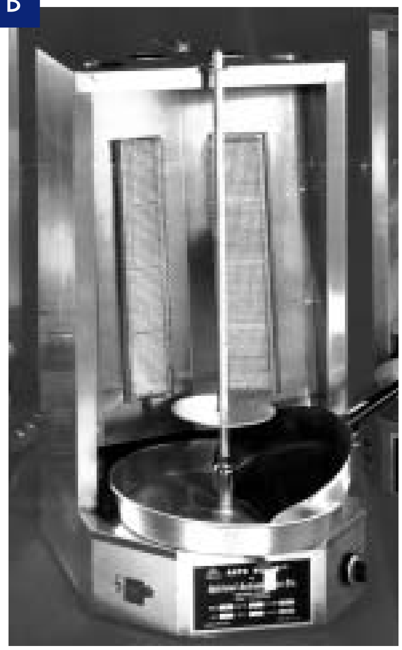
## HOOD AND EXHAUST SYSTEM

*Lightwave oven:* Normal room ventilation unless multiple units are used, then additional room air exhaust may be required. For grease producing food products, Type I required.
*Rice cooker:* Requires normal room ventilation.

A

Electric Vertical Broiler

B



Gas Vertical Broiler

C

Broiler
TYPE: Low Volume

## USE OF EQUIPMENT

Allows for fast countertop cooking in restaurants, convenience stores, grocery stores and office shops.

## TYPICAL APPLICATION

Specialty selection of beef, lamb, pork, gyros or combinations of.

## HOOD AND EXHAUST SYSTEM

Type I system for raw or partially pre-cooked meat.

Type II depends upon volume and menu.

A


Glasswasher
TYPE: Rotary

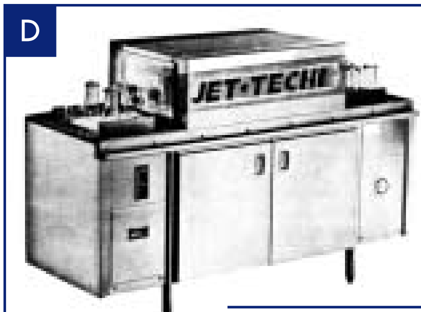
B

Cup and Glasswasher
TYPE: Undercounter

C

Dishmachine
TYPE: Frontload

D




Dishmachine
TYPE: Pass through glass washer

E

Dishmachine
TYPE: Conveyor

## USE OF EQUIPMENT

Cleaning of equipment and utensils.

## TYPICAL APPLICATION

Typically used for glassware in a bar or cups in food service, or in a full-service operation that uses reusable dishware.

## HOOD AND EXHAUST SYSTEM

A & B, no hood required. Additional general ventilation may be required (see "other criteria").

Side or front load dishmachine requires a Type II hood system.

Conveyor machines require a hood or pant leg hood type.

Chemical dishwashing machines may operate at an air exhaust rate lower than 180°F for final rinse machines. This is due to the low volume of heat and moisture generated.

A double rack chemical dishwasher requires a hood and normal air exhaust as indicated in the Mechanical Code for any dishmachine.

# Inter-Agency Review Council (IARC)
# Issue Submittal Form

*(Please submit 12 copies of this form and accompanying documentation)*

**Subject of Request:**

Type of Equipment, Product or Process_____________________________________________

Brand and Model No.______________________________________________________________

Other:_____________________________________________________________________

| | |
|---|---|
| ***For Office Use Only*** | Issue No.__________________ |
| Council Decision:________________________ | Date of Decision:___________ |

Acceptance    Denial with Justification    No Action with Explanation    Pilot Study

***Please provide the following information. Use additional sheets if necessary.***

**What is the issue you would like the IARC to consider?** Briefly explain the issue that concerns you.

**How will this issue impact the foodservice, retail or other industry?**

**What do you feel is the recommended solution?** State as precisely as possible the action you would like the IARC to take to address this issue.

**Please complete the reverse side of the application.**

Date Submitted: ______ Name of Person Submitting Information:______________________

Agency/Company: ___________________________________________________________

Mailing Address:_____________________________________________________________

City ______________________________________ State ________ Zip _______________

Phone (___)____________________________ Fax (___)

E-mail address:

***************************************************************************

***If this is a ventilation issue, please provide the following information:***

1. What menu items are to be prepared with the type of appliance you are submitting?

2. What volume of menu items will be processed in the appliance on a daily basis?

3. How many hours /day will this piece of equipment be operated?

4. What type of fuel will this equipment use?

5. What is the area of the room into which this piece of equipment will be placed?

6. Is room served by HVAC?

7. What is the ventilation rate (air exchange rate) of this space?

# REFERENCES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ACGIH—*American Council of Government alIndustrial Hygenists*
ASHRAE—*American Society of Heating, Refrigeration, and Air-Conditioning Engineers*
EPA—*United States Environmental Protection Agency*
NEHA—*National Environmental Health Association*
NFPA—*National Fire Protection Association*
UL—*Underwriters Laboratories*
ANSI/NSF—*American National Standards lnstitute/National Sanitation Foundation*