

WhitePaper | **SPECIFYING AND INSPECTING
COMMERCIAL KITCHEN HOODS**



STRIVING FOR EXCELLENCE



Objectives

To provide information and increase awareness of the standard and code requirements for Commercial Kitchen Hoods and Hood Systems with an emphasis on the life and fire safety and grease removal attributes of Hoods and Hood Systems.

To clarify some of the Hood and Hood system components and features that may be misunderstood or unclear, and

To provide information on the Hood and Hood system installation and operation requirements, and their relationship to each other together in one place (in this document) for reference, all of which are included in various standards and codes in different places.

It is not the objective of this document to provide specific or extensive information on Hood and/or Hood system accessories, such as, grease removal devices, exhaust and supply fans, lighting fixtures and fire suppression systems, or hood performance requirements such as exhaust and/or supply airflows which were left to be addressed in future documents.

A Statement of Disclaimer

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Jeff Lambertson (Author)

Founder- Streivor Inc.-1989. Streivor Inc. provides design, engineering, manufacturing & installation, services & products for the Commercial Kitchen Ventilation Industry.
California C-43 Licensed Contractor-1991
Active Member ASHRAE Technical Committee 5.10, Kitchen Ventilation
Voting Member UL 710 Standards Technical Panel
Voting Member UL 1046 Standards Technical Panel



Garrett Tom (Peer Reviewer)

Founder- Product Certification Consultants LLC (PCC)-2004. PCC provides consulting services for companies navigating the complex process of product certification.
Underwriters Laboratories Inc. Santa Clara, CA 23 years, Associate Managing Engineer exhaust hoods for restaurant cooking appliances.
B.S. Civil Engineering University of the Pacific
Voting Member UL 710 Standards Technical Panel
Voting Member UL 1046 Standards Technical Panel



Jayendra Parikh (Peer Reviewer)

Founder- Compliance Solutions International Inc. (CSI)-2004. CSI provides global management consulting services to companies for product development, testing & certification, inspections, codes & standards, and regulatory compliance.
Underwriters Laboratories Inc. Northbrook, IL 26 years, Managing Engineer commercial kitchen ventilation equipment - exhaust hoods, grease filters, grease ducts, and exhaust fans, international business development and operations
M.B.A. Roosevelt University, Chicago, IL
M.S. Mechanical Engineering Illinois Institute of Technology Chicago, IL
Member NFPA-96 Technical Committee
Voting Member ASHRAE Technical Committee 5.10, Kitchen Ventilation
Voting Member UL 710 Standards Technical Panel
Voting Member UL 1046 Standards Technical Panel

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INTRODUCTION

“A Hood is not just a box.”

“The primary function of a Commercial Kitchen Hood System is to serve as a fire control and safety device!”

Restaurant fires risk lives and result in millions of dollars in losses every year.

In 2002 (the latest year for which fire-related statistics are available), there were an estimated 7,100 commercial restaurant fires in the USA that were responsible for 108 civilian fire injuries and approximately 116 million dollars in property loss.*

Many restaurant fires occur in or in close proximity to the Commercial Kitchen Hood (Hood) and often are the result of a Hood or Hood System that has not been manufactured or installed in accordance with the prevailing standards and/or codes.

A Hood is not just a box. A Hood should be a thoroughly engineered and meticulously manufactured piece of equipment.

There are many factors to be considered before choosing which Hood is the best choice for an installation. The decision will require input and communication from several different constituents, such as the Owner, Architect, Engineer, Consultant, Designer and Purchaser (Specifiers) as well as the Authority Having Jurisdiction.

A Hood and Hood System will usually need to be inspected and approved by several different local jurisdictional departments. Departments such as, building, fire, health and mechanical, to name a few, play an active role in approving and inspecting Hoods and Hood Systems. Hoods and Hood Systems will be inspected for compliance to the prevailing standards and/or codes.

The prevailing codes may include local building, fire, health and mechanical codes in addition to the national standards and codes.

There are several national, and state organizations that write and publish standards and codes that govern the manufacturing, construction and installation of Hoods and Hood Systems such as:

- California Mechanical Code, 2007 (CMC)
- Uniform Mechanical Code, 2009 (UMC)
- International Mechanical Code, 2009 (IMC)
- National Fire Protection Association Standard 96, 2011 (NFPA 96)
- Underwriters Laboratories Inc Standard 710, 1995 (UL 710)

The standards and codes include the minimum requirements for the design, construction, and installation, as well as the testing and listing for Hoods and Hood Systems. The standards and codes dictate what attributes must be present to insure that a Hood fulfills its primary functions, which are **to serve as a fire and safety device, and to capture, contain, and remove effluents produced from the cooking process and the cooking equipment to outside the kitchen.**

This document includes pertinent information from CMC, UMC, IMC, NFPA 96, and UL 710 that Streivor Air Systems (Streivor) has found to be the most often misunderstood, misinterpreted and/or misrepresented requirements in these standards and codes in regard to the design, manufacturing, construction, and/or installation of Hoods and Hood Systems.

This misinformation can lead to undermining the integrity of the Hood and/or Hood System. It is important to note that all standard and code requirements are equally important if the Hood and Hood System is to fulfill its primary functions.

Specifiers should not specify or install a Hood until they are sure that the Hood meets all of the prevailing standards and codes and have the documentation to guarantee it. If the Specifier determines that a Hood does not comply or cannot determine if a Hood complies with the prevailing standards and codes, they should not specify or install that Hood.

*Restaurant Fires: Topical Fire Research Series. (2004). U.S. Fire Administration/National Fire Data Center, FEMA, 4(3).

What is a Hood?

A device provided for a cooking appliance to direct and capture grease-laden vapors and exhaust gases.

What Types of Hoods are there?

There are two Types of Hoods:

- 1. Type I:** A Type I Hood shall be used in a commercial kitchen to capture, contain and exhaust heat, steam and/or other effluents including grease laden particulates produced by cooking and cooking equipment.

Note that all Type I Hoods shall have a liquidtight Hood Enclosure, Grease Removal Devices and a fire suppression system.

- Example of a Type I Hood -

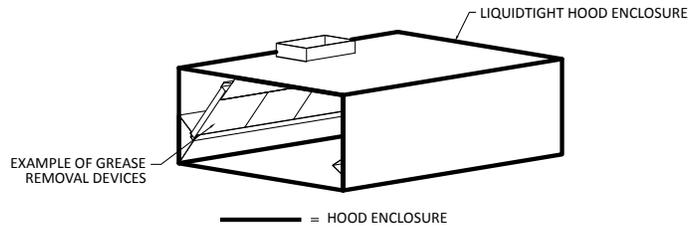


Figure #1

- 2. Type II:** A Type II Hood shall only be used in a commercial kitchen to capture, contain and exhaust heat and/or steam produced by cooking equipment.

Note that Type II Hoods do not require a liquidtight Hood Enclosure, Grease Removal Devices, or a fire suppression system.

- Example of a Type II Hood -

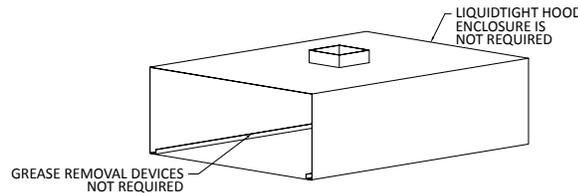


Figure #2

In this paper, only Type I Hoods and Hood Systems will be discussed. Wherever the reference to Hood(s), or Hood System(s) is made, the reader is to understand that the author is referring to a Type I Hood or Hood System.

What is a Hood Enclosure?

The Hood Enclosure consists of the portion of the Hood that:

1. Directs, captures, and contains the cooking effluents, and/or gases, and
2. Houses the Grease Removal Devices, the Grease Drip Tray and the enclosed metal grease collection container.

What are the construction requirements of a Hood Enclosure?

A Hood Enclosure shall be constructed of a minimum of 20 gauge stainless steel or 18 gauge steel:

1. With a continuous liquidtight external weld to the Hood's lower outermost perimeter, or
2. Be fabricated in accordance with the Hood's listing for acceptable alternate construction.

- Examples of a Hood Enclosure -

- Acceptable -

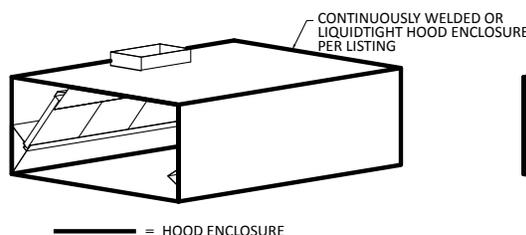


Figure #3A

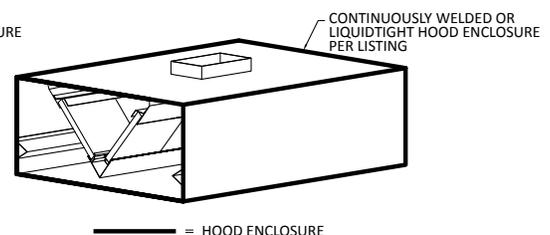


Figure #3B

“A Hood shall have a Hood Enclosure...with a continuous liquidtight external weld to the Hood’s lower outermost perimeter.”

What is liquidtight construction?

Constructed and performing in such a manner as not to permit the passage of any liquid at any temperature.

- Example of Liquidtight Construction -
- Acceptable -

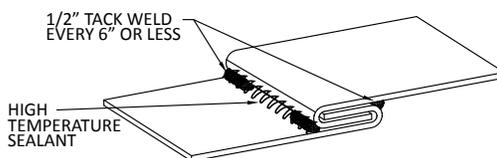


Figure #4

The UL 710 Standard allows for a Hood to be listed with seams and joints made with a fastening means other than a liquidtight continuous weld as long as those seams and/or joints have been tested in accordance with the UL 710 Standard and have no evidence of the passage of smoke, flame, or grease vapor through the seam and/or joint.

What is the difference between a Low and High Proximity Hood?

Hoods are designed and manufactured in an infinite amount of sizes, shapes and configurations, however, they are often categorized as either a Low Proximity (passover, back shelf, or shelf ventilator) or High Proximity (canopy) Hoods. The determining factor as to the categorization of a Hood is usually the distance that the Hood is installed above its associated cooking equipment.

Hoods that are installed less than 36 inches above the cooking equipment are generally referred to as Low Proximity and Hoods that are installed more than 36 inches above the cooking equipment are generally referred to as High Proximity. Although the Low and High Proximity categorization of Hoods are often used in the discussion of Hoods, very little value if any should be given to the subject.

For instance, a Hood generally categorized as a Low Proximity Hood could be installed more than 36 inches, and a Hood generally categorized as a High Proximity Hood could be installed less than 36 inches above the cooking equipment and still be standard and code compliant. All Hood standard and code requirements for fire containment, safety, capture, containment and grease removal apply equally to all Hoods regardless of their proximity to the cooking equipment.

What are the primary functions of a Hood?

The primary functions of a Hood are:

1. To serve as a fire containment and safety device, and
2. To capture, contain, and remove effluents produced by cooking and the cooking equipment to outside the kitchen.

The most important questions to consider when choosing a Hood, in order to mitigate the possibility of fire, loss of life and/or property damage are:

1. Does the Hood meet all of the fire and safety requirements for the specific application and installation?
2. Does the Hood comply with all of the applicable codes and standards?

All too often Specifiers place other considerations such as, air movement, aesthetics, or costs ahead of fire and safety requirements, and/or code compliance when choosing a Hood, sometimes leading to a tragic ending.

What is a Hood System?

For the purpose of this paper, a Hood System may include all or some of the following: Hood with its enclosure, Hood accessories such as stand offs, ceiling or wall enclosures, clearance reducing system, make up air plenum, grease removal device, enclosed metal container, lighting fixtures, exhaust and/or supply dampers, exhaust and supply duct, exhaust and supply fan, internal hood fan, temperature monitors, control panels, electrical interlock and shunt trip breakers, water wash system, and fire suppression system. A Hood System may also be referred to as an exhaust system or kitchen ventilation system.

“The minimum clearance from the Hood Enclosure to combustible material is 18 inches.”

What is the minimum clearance requirement from a Hood Enclosure to a combustible surface?

There is a consensus between NFPA 96, CMC, IMC and UMC that there must be a minimum clearance of 18 inches (457.2 mm) from the Hood Enclosure to any combustible material.

Some codes offer options for reducing the minimum clearance to combustible material. Examples of such options are provided on page #11.

- Example of an Acceptable Hood Enclosure Clearance From Combustible Material -

- Acceptable -

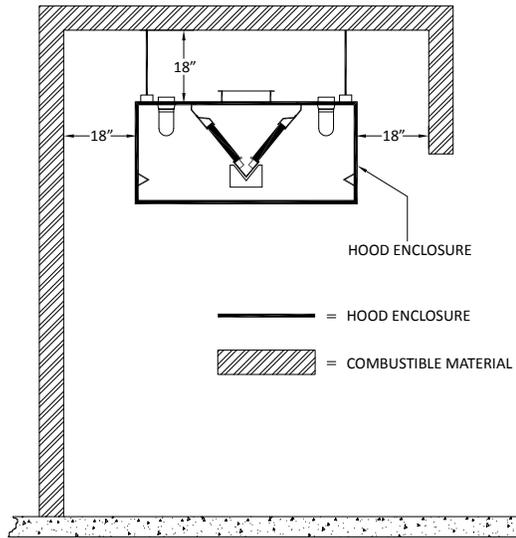


Figure #5

- Example of a Not Acceptable Hood Enclosure Clearance From Combustible Material -

- Not Acceptable -

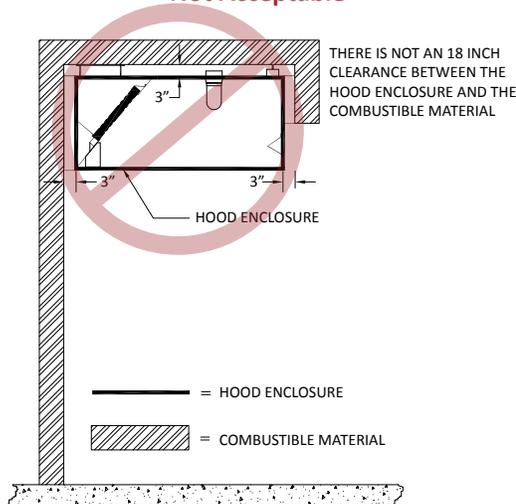


Figure #6

“Some standards and codes offer or allow exceptions to reduce the Hood Enclosure clearance from combustible material”

What is a combustible material?*

Any material that will burn regardless of its auto ignition temperature.

SUMMARY: There is an 18 inch minimum clearance requirement from the Hood Enclosure to all combustible materials.

*Definition of a combustible material as per NFPA 96, 2011.

“The minimum clearance from the Hood Enclosure to limited-combustible material is 3 inches.”

What is the minimum clearance requirement from a Hood Enclosure to a limited-combustible surface?

There is a consensus between NFPA 96, CMC, and UMC that there must be a minimum clearance of 3 inches (76.2 mm) from the Hood Enclosure to any limited-combustible material. The IMC does not specifically address this issue.

Some codes may offer options for reducing the minimum clearances to combustibles. Examples of such options are provided on page #12.

- Example of an Acceptable Hood Enclosure Clearance From Limited-Combustible Material -
- Acceptable -

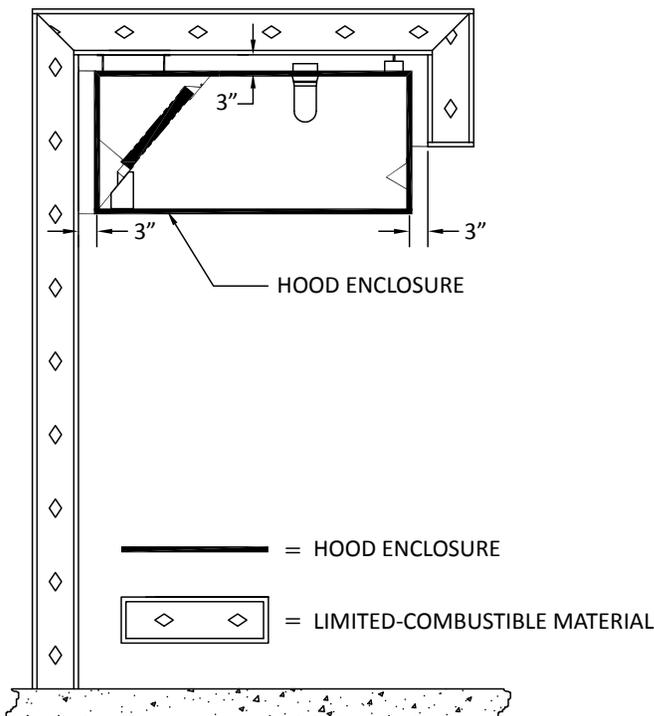


Figure #7

What is a limited-combustible material?*

A building construction material that does not comply with the definition of noncombustible material, that, in the form in which it is used, has a potential heat value not exceeding 3,500 Btu/lb. (8141 kJ/kg), when tested in accordance with NFPA 259, *Standard Test Method for Potential Heat of Building Materials*, and includes either of the following:

- A. Materials having a structural base of noncombustible material, with a surface not exceeding a thickness of 1/8 inch (3.2 mm), and with a flame spread index not greater than 50, and
- B. Materials in the form and thickness used, having neither a flame spread index greater than 25 nor evidence of continued progressive combustion, and of such composition that surfaces that would be exposed by cutting through the material on any plane would have neither a flame spread index greater than 25 nor evidence of continued progressive combustion, when tested in accordance with ASTM E 84, or UL 723.

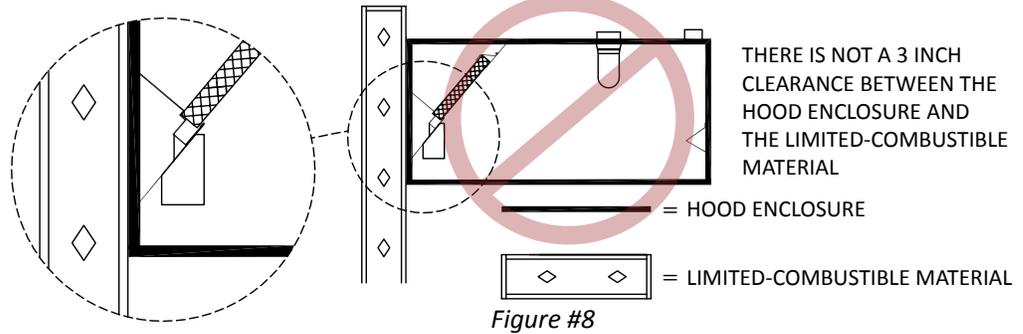
Materials subject to an increase in combustibility or flame-spread rating beyond the limits herein established through the effects of age, moisture, or other atmospheric conditions shall be considered combustible.

*Definition of a limited-combustible material as per NFPA 96, 2011.

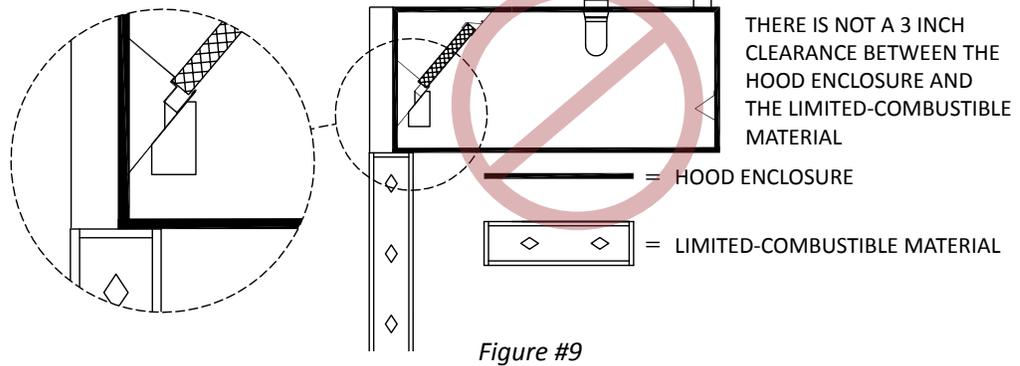
“Some standards and codes offer or allow exceptions to reduce Hood Enclosure clearance from limited-combustible materials.”

- Examples of Not Acceptable Hood Enclosure Clearance From Limited-Combustible Material -

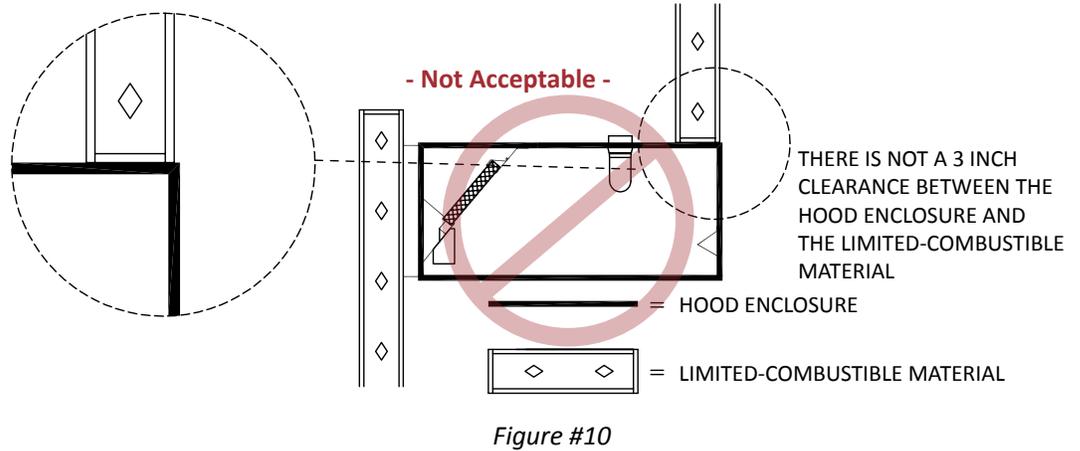
- Not Acceptable -



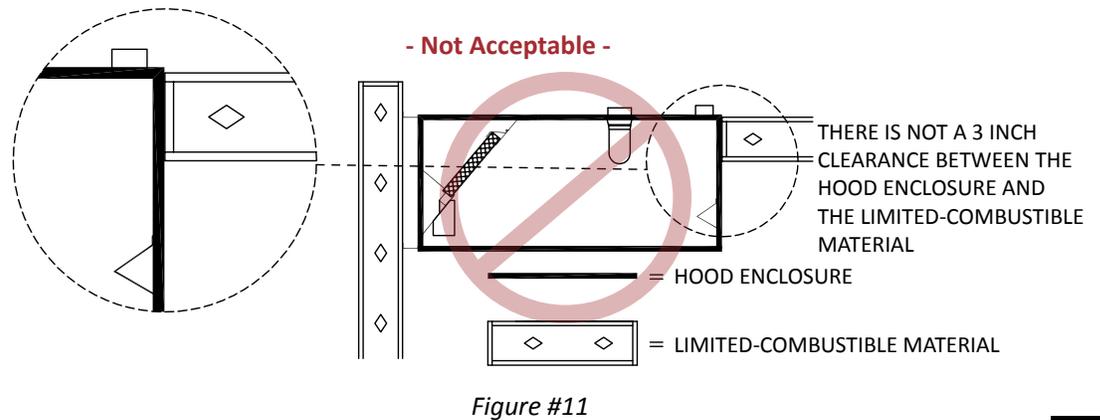
- Not Acceptable -



- Not Acceptable -



- Not Acceptable -



“There is no clearance required from the Hood Enclosure to a noncombustible surface.”

What is the minimum clearance requirement from a Hood Enclosure to noncombustible surface?

There is a consensus between NFPA 96, CMC, IMC, and UMC that there can be a minimum clearance of 0 inches (0 mm) from the Hood Enclosure to any noncombustible material.

What is a noncombustible material?*

A substance that will not ignite and burn when subjected to a fire.

- Examples of Acceptable Hood Enclosure Clearance From Noncombustible Material -

- Acceptable -

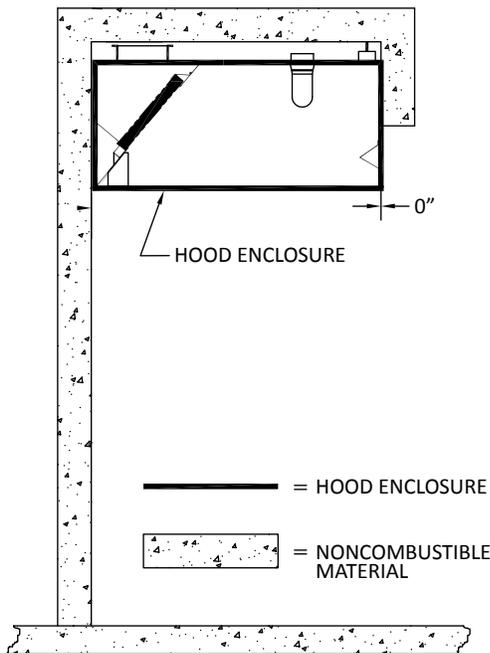


Figure #12

- Acceptable -

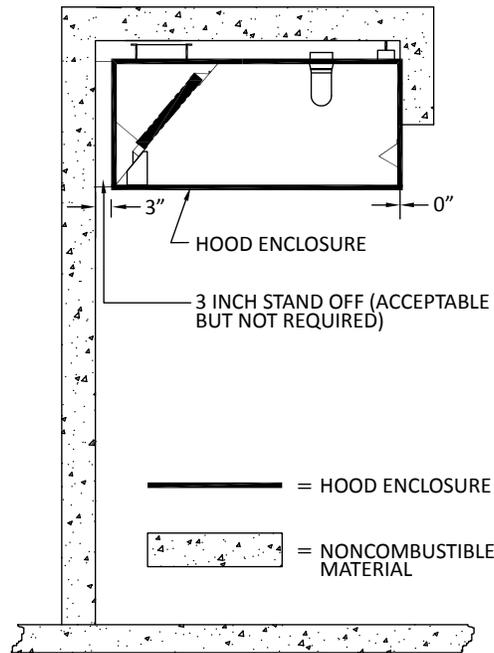


Figure #13

- Acceptable -

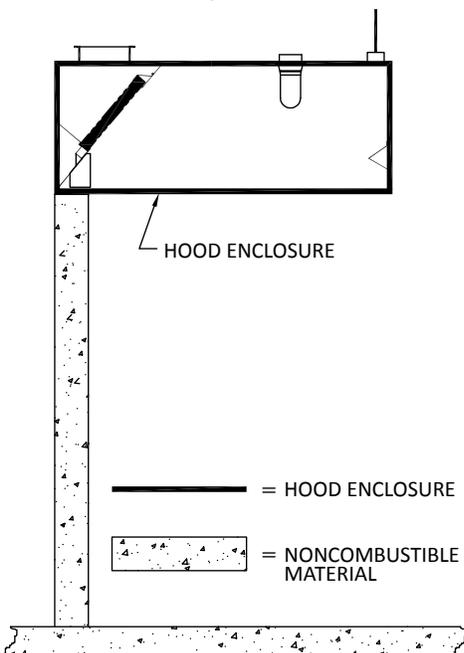


Figure #14

- Acceptable -

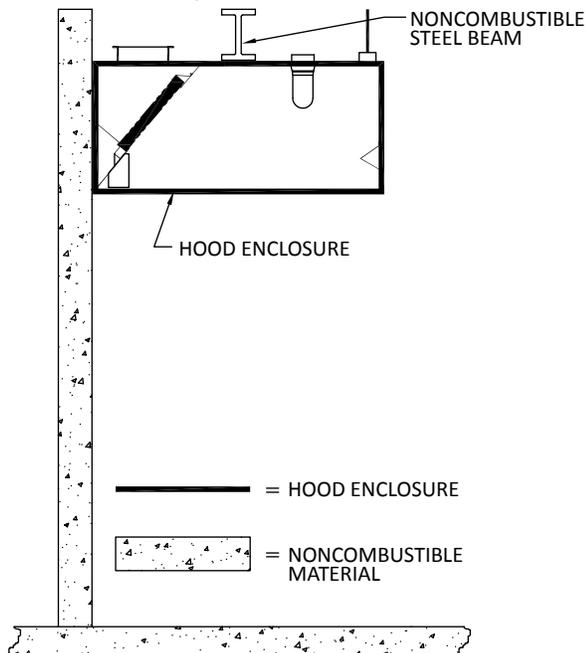


Figure #15

There is no clearance required from the Hood Enclosure to a noncombustible surface.

*Definition of a noncombustible material as per NFPA 96, 2011.

Are there exceptions, in the standards and codes, for reducing the minimum clearance requirement from a Hood Enclosure to a combustable surface?

“The Specifier should not rely on marketing materials or generic company information to make a determination as to if the Hood can be installed with a reduced clearance.”

Some standards and codes offer or allow exceptions to reduce the Hood Enclosure clearance from combustable materials. They describe and/or detail manufacturing and/or construction techniques and/or alternate materials for reduced clearances, however, these exceptions are not uniform throughout all of the codes.

Thus it is the responsibility of the Specifier to research if an exception is applicable for their specific application and installation. If the Specifier determines that an exception is applicable for their application and installation and elects to proceed with the Hood installation using that exception the Specifier should:

1. Note the cited exception on the construction documents submitted for permitting.
2. Consult and obtain approval for the exception from the Authority Having Jurisdiction prior to installing the Hood.

- Example of a Clearance Reducing Option -

- Acceptable -

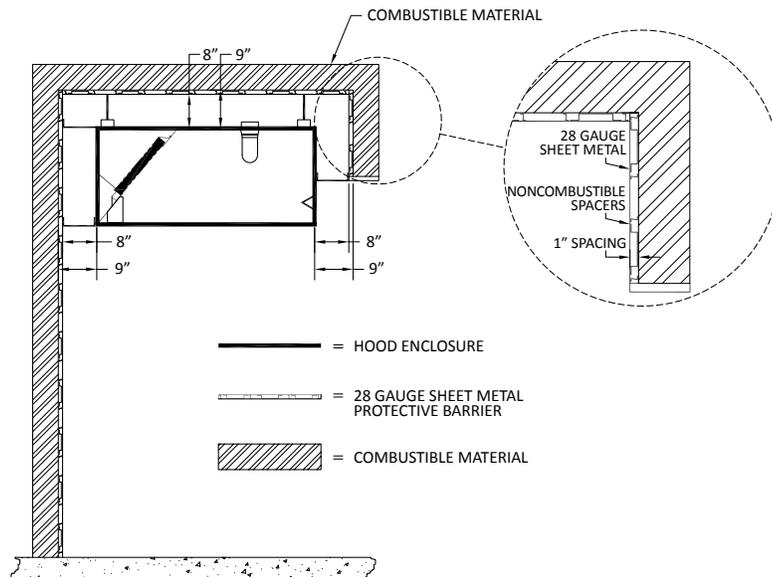


Figure #16

- Example of a Clearance Reducing Option -

- Acceptable -

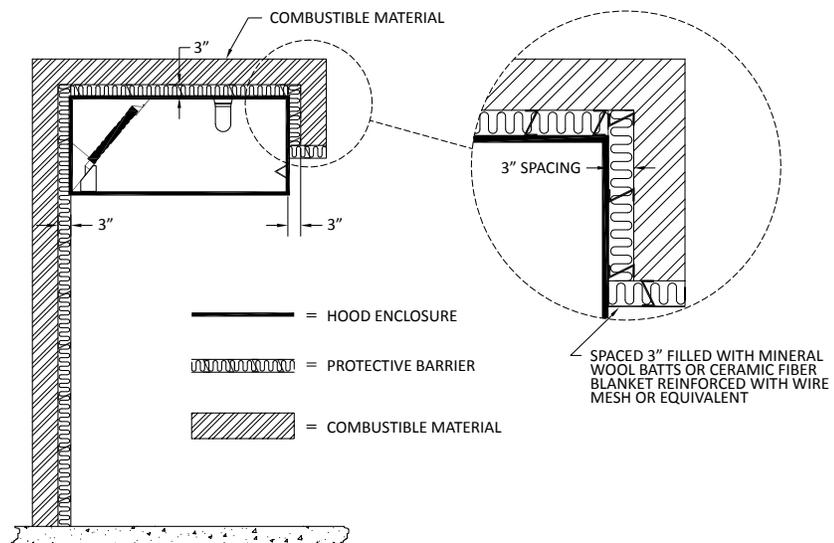


Figure #17

Are there exceptions, in the standards and codes, for reducing the minimum clearance requirement from a Hood Enclosure to a limited-combustible surface?

Some standards and codes offer or allow exceptions to reduce Hood Enclosure clearance from limited-combustible materials. They describe and/or detail manufacturing and/or construction techniques and/or alternate materials for reduced clearances, however, these exceptions are not uniform throughout all the codes.

Thus it is the responsibility of the Specifier to research if an exception is applicable for their specific application and installation. If the Specifier determines that an exception is applicable for their application and installation and elects to proceed with the Hood installation using that exception the Specifier should:

1. Note the cited code exception on the construction documents submitted for permitting.
2. Consult with and obtain approval from the Authority Having Jurisdiction prior to installation of the Hood.

Can Hoods be listed for reduced clearances to combustibles and/or limited-combustibles?

Some codes allow for a Hood to be installed with reduced clearances as long as the Hood is installed in accordance with its listing.

A manufacturer may have a Hood tested for reduced clearances to combustible and/or limited-combustible material. Upon completion of the reduced clearance testing, the listing agency will document the Hood Enclosure construction requirements and the minimum clearance allowed from the Hood Enclosure to combustible or limited-combustible materials.

If the Specifier determines that a reduced clearance exception for a listed Hood Enclosure is applicable to his building conditions and elects to proceed with the installation based on the exception in the code the Specifier should:

1. Note the cited code exception on the construction documents submitted for permitting.
2. Provide a copy of the manufacturer’s listing information, drawings and/or installation instructions.
3. Consult with and obtain approval from the Authority Having Jurisdiction prior to installation of the Hood.

If the Hood has not been tested for reduced clearances to combustible or limited-combustible materials, the Specifier should consult the prevailing standard and codes for the Hood Enclosure clearance requirements.

**- Example of a Hood Enclosure Clearance Reducing Option -
- Acceptable -**

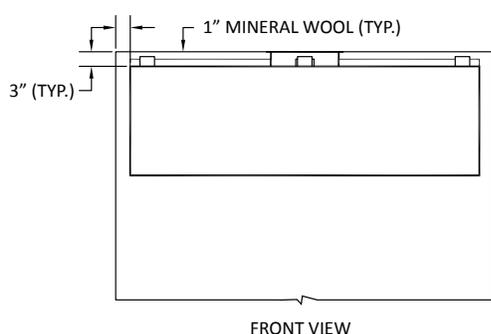


Figure #18A

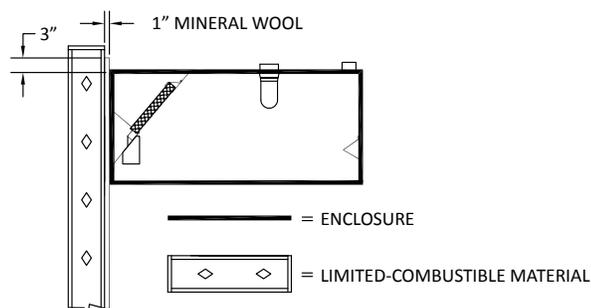


Figure #18B

SUMMARY: Some standards and codes allow for reduced clearances from Hood Enclosures to combustibles and/or limited-combustibles. Clearance reducing options can be materials or systems that are added to or placed between the Hood Enclosure and the combustible or limited-combustible materials and/or a Hood can be manufactured, tested and listed with Hood Enclosure clearance reducing systems as part of the Hood assembly.

“It is the responsibility of the Specifier to research if an exception is applicable for their specific application and installation.”

Are volume dampers permitted in an exhaust duct?

There is a consensus between NFPA 96, CMC, and UMC that volume dampers shall not be installed in exhaust Hood or duct, unless specifically listed for such use. Such volume dampers are evaluated for fire safety, and are typically installed directly in the Hood or in the duct collar between the Hood and grease duct per its listing.

IMC does not specifically address this issue.

- Examples of Listed and Non-Listed Volume Dampers -

- Acceptable -

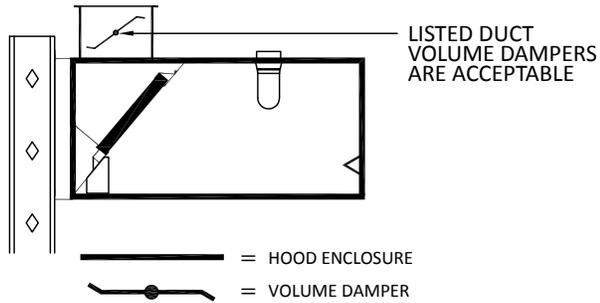


Figure #19

- Acceptable-

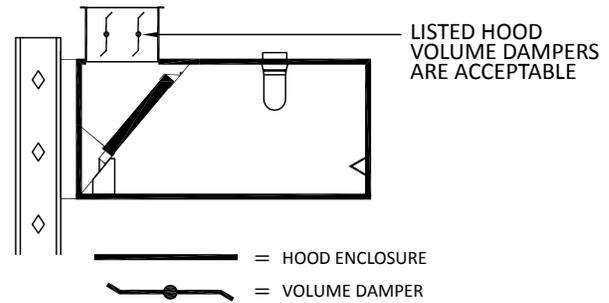


Figure #20

- Not Acceptable -

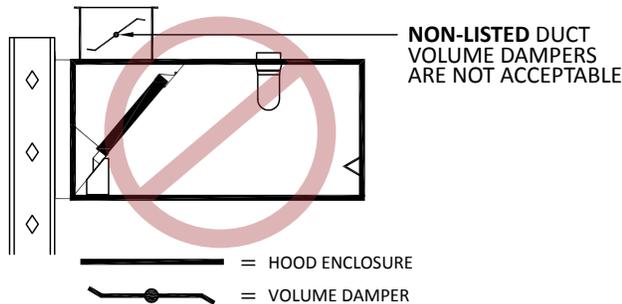


Figure #21

- Not Acceptable-

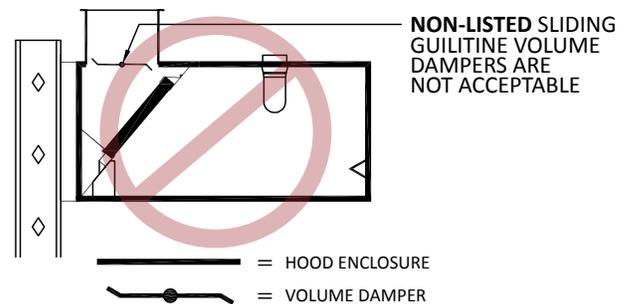


Figure #22

UL 710 allows for Hood accessories such as exhaust volume dampers to be listed.

It is the responsibility of the Specifier to obtain the manufacturer's listing information, drawings and installation instructions for a volume damper prior to specifying it.

Thus it is the responsibility of the Specifier to research if the exception for a volume damper is applicable for their specific application and installation, and to obtain the manufacturer's listing information, drawings and/or installation instructions. If the Specifier determines that an exception is applicable and elects to proceed with the volume damper installation, using that exception, the Specifier should:

1. Note the cited exception on the construction documents submitted for permitting.
2. Attach the manufacturer's listing information, drawings, and/or installation instructions for the volume damper.
3. Consult and obtain approval from the Authority Having Jurisdiction prior to installing the volume damper in the Hood.

SUMMARY: An improperly designed volume damper can add to the potential for grease accumulation and create a fire hazard in the exhaust duct. A properly designed and listed volume damper can be a valuable air-balancing tool.

“A properly designed and listed volume damper can be a valuable air balancing tool.”

“...fire-actuated dampers shall be installed in the Hood Enclosure at each point where a supply air inlet or a supply air outlet penetrates the Hood Enclosure.”

When are listed fire dampers required in a Hood make up air plenum?

There is a consensus between NFPA 96, CMC, and UMC that fire-actuated dampers shall be installed in the Hood Enclosure at each point where a supply air inlet or a supply air outlet penetrates the Hood Enclosure. IMC does not specifically address this issue.

UL 710 requires that a fire-actuated damper shall be installed in the Hood Enclosure at each point where a supply air inlet or a supply air outlet penetrates the Hood Enclosure and offers no exceptions to this requirement.

Thus all Hoods shall have listed fire-actuated dampers installed in the Hood Enclosure at each point where a supply air inlet or a supply air outlet penetrates the Hood Enclosure.

Makeup air inlets or outlets that penetrate the Hood outside of the Hood Enclosure may have, but do not require, fire-actuated dampers.

- Examples of Exhaust Hood Assemblies with Integrated Supply Air Plenums -

- Acceptable -

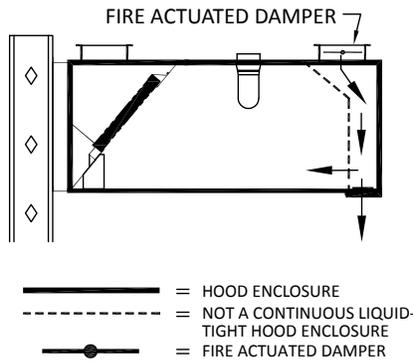


Figure #23

- Not Acceptable -

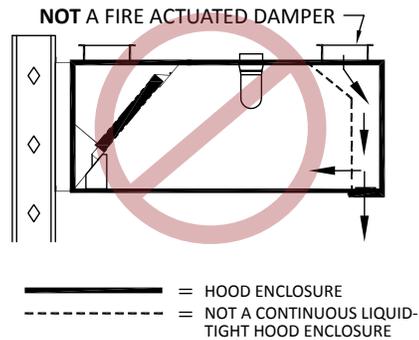


Figure #24

- Acceptable -

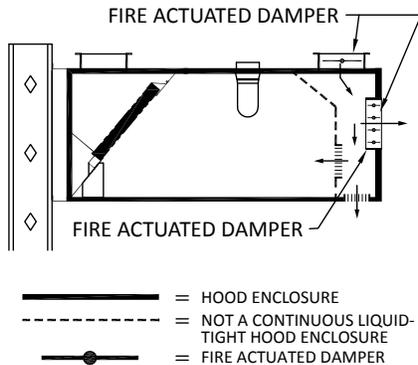


Figure #25

- Not Acceptable -

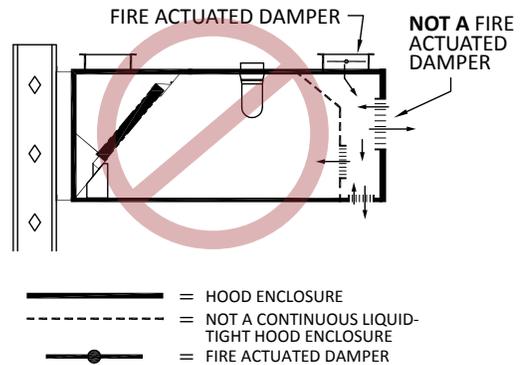


Figure #26

- Acceptable -

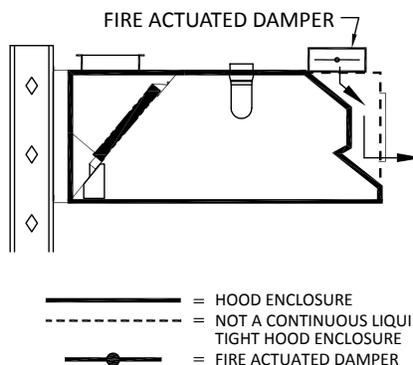


Figure #27

- Acceptable -

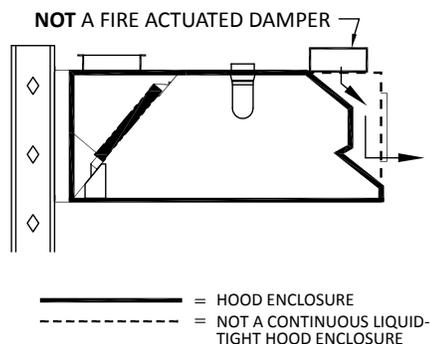


Figure #28

- Acceptable -

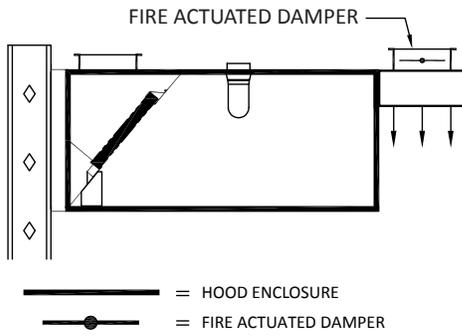


Figure #29

- Acceptable -

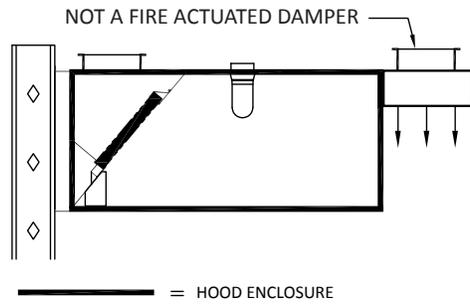


Figure #30

- Examples of Hood's with Internal Hood Fans (IHF) -
- Acceptable -

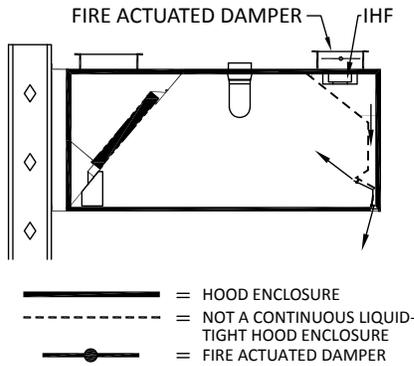


Figure #31

- Not Acceptable -

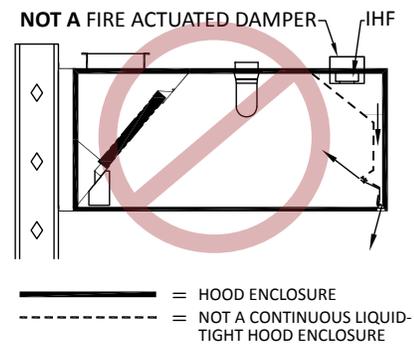


Figure #32

- Acceptable -

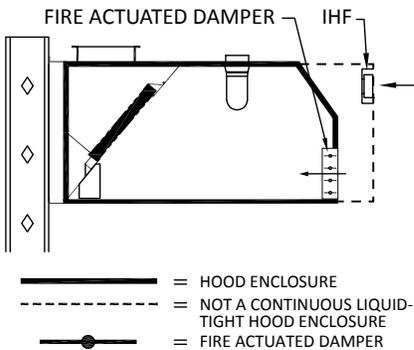


Figure #33

- Not Acceptable -

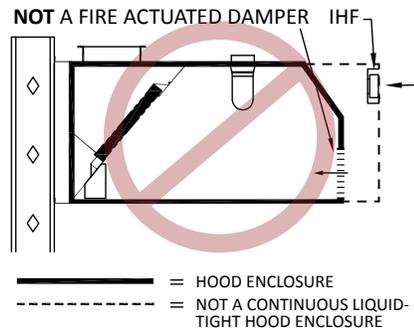


Figure #34

“Hoods with Internal Hood Fans shall have listed fire dampers installed at the point where the make up air inlet or outlet penetrates the Hood Enclosure.”

Hoods with Internal Hood Fans shall have listed fire dampers installed at the point where the make up air inlet or outlet penetrates the Hood Enclosure.

SUMMARY: Make up air ducts are not designed to withstand grease fires. It is mandatory that make up air ducts that penetrate a Hood Enclosure have a fire-actuated damper installed at the point where the make up air duct penetrates the Hood Enclosure to prevent spread of a fire into the make up air duct.

“The standards and codes require that Grease Removal Devices shall be provided with all Hoods.”

Are Grease Removal Devices or Grease Filters required in Hoods?

There is a consensus between NFPA 96, CMC, IMC, UMC, and UL 710 that integral Grease Removal Devices or UL 1046 Listed Grease Filters shall be used with all Hoods.

What is the difference between an integral Grease Removal Device and a UL 1046 Listed Grease Filter?

Integral Grease Removal Devices are usually made up of a series of baffles that are permanently affixed in the Hood Enclosure. Integral Grease Removal Devices are typically found in water wash type Hoods. The baffles shall be designed in such a way:

1. To restrict a fire on the cooking equipment from entering the Hood Enclosure and exhaust duct, and
2. To remove grease from the exhaust airflow.

- Examples of Hoods with Integral Grease Removal Devices -
- Acceptable -



Figure #35A

- Not Acceptable -



Figure #35B

Hoods with integral Grease Removal Devices must be tested per UL 710. Upon successful completion of the testing, the Hood can be listed as an assembly that includes integral Grease Removal Devices, which does not require UL 1046 Listed Grease Filters.

UL 1046 Listed Grease Filters are devices that can be installed and removed from the Hood Enclosures. These filters shall be designed in such a way:

1. To provide a flame barrier for a fire on the cooking equipment from entering the Hood Enclosure and exhaust duct, and
2. To remove grease from the exhaust airflow.

Grease Filters must be tested per UL 1046 Standard. Upon the successful completion of the testing, the filters can be listed and used in any Hood Enclosure that they fit into.

If a Grease Filter is not UL 1046 Listed, it shall not be used in a Hood as a primary filter. Non-listed Grease Filters, if used in a Hood, shall be considered a secondary filter, and shall be evaluated as part of the Hood per UL 710.

What are the most common types of UL 1046 Grease Filters?

1. **Baffle:** Typically made of a frame with a series of baffles, installed in a vertical orientation. The exhaust air with the grease particles enters into the upstream section of the filter. As the exhaust air moves through the baffles, the grease particles impact with the baffles. The grease particles collect on the baffles and drain out of the bottom of the filter.
2. **Cartridge:** Typically made of an enclosure with an opening in the upstream and the downstream sections of the enclosure. The exhaust air with the grease effluents enter through the front of the cartridge and make a series of changes of direction as it travels through the interior of the cartridge. The changes in direction separate the grease particulates from the exhaust air and the grease drains out through the bottom of the cartridge.
3. **Multi-Stage:** Typically a combination of a 1046 listed primary baffle or cartridge filter with a single or series of secondary filtering media. Secondary filters can be installed upstream and/or downstream of the primary filter.

It is the responsibility of the Specifier to make sure that Grease Filters or Grease Removal Devices are provided with the Hood. The Hood can either be:

1. Provided with Grease Removal Devices manufactured as an integral part of the Listed Hood in accordance with UL 710, or
2. Fitted with UL 1046 Listed Grease Filters.

It is the responsibility of the Specifier to either obtain:

1. The manufacturer's Hood listing information, drawings and/or installation instructions documenting that the Grease Removal Devices are an integral part of the Hood assembly and meet the requirements of UL 710, or
2. The manufacturer's information, drawings and/or installation instructions for the UL 1046 Listed Grease Filters that will be supplied with the Hood.

- Examples of Baffle and Cartridge Filters -

- Acceptable -

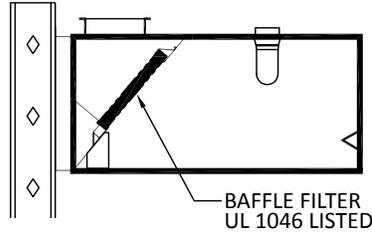


Figure #36A

- Not Acceptable -

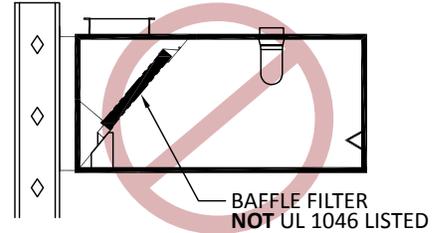


Figure #36B

- Acceptable -

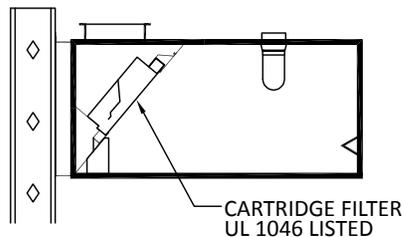


Figure #37A

- Not Acceptable -

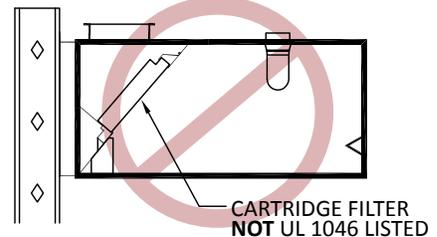


Figure #37B

- Acceptable -

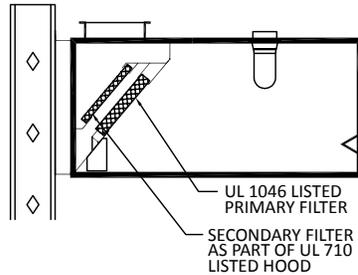


Figure #38A

- Not Acceptable -

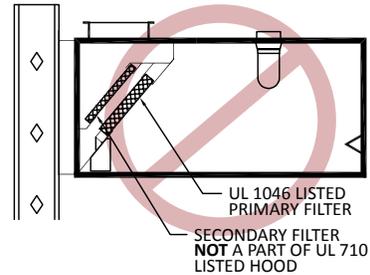


Figure #38B

- Acceptable -

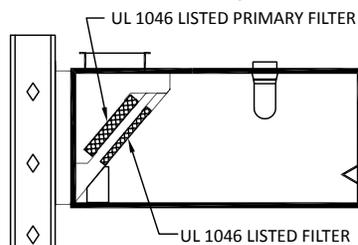


Figure #39A

- Not Acceptable -

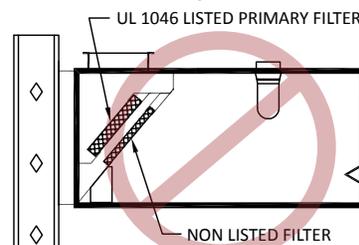


Figure #39B

“If a Grease Filter is not UL 1046 Listed it shall not be used in a listed Hood as a primary filter.”

What are the requirements for installation of Grease Filters in a Hood?

There is a consensus between NFPA 96, CMC, and UMC that all Grease Filters are to be tightly fitted and firmly held in place so that all exhaust air flows through the filters. IMC does not specifically address the issue.

- Examples of Filter Installation in a Hood -

- Acceptable -

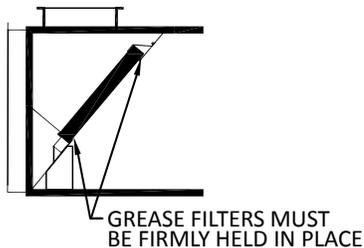


Figure #40A

- Acceptable -

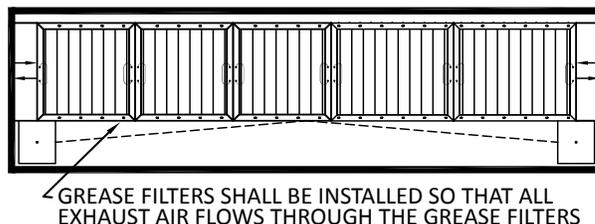


Figure #40B

- Not Acceptable -



Figure #41A

- Not Acceptable -

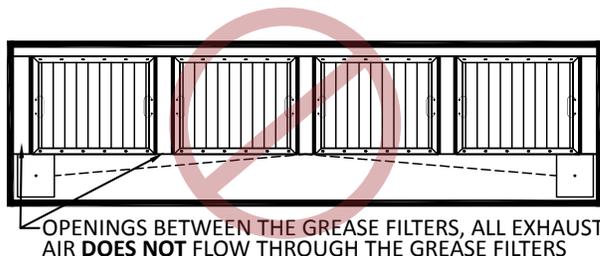


Figure #41B

What is the minimum angle of installation of Grease Filters in a Hood?

There is a consensus between NFPA 96, CMC, IMC, and UMC that Grease Filters shall be installed at an angle not less than 45 degrees (0.79 rad) from horizontal.

UL 710 also requires that Grease Filters shall be installed at an angle not less than 45 degrees (0.79 rad) from horizontal, and offers no exceptions to this requirement.

- Examples of Filter Installation in a Hood -

- Acceptable -

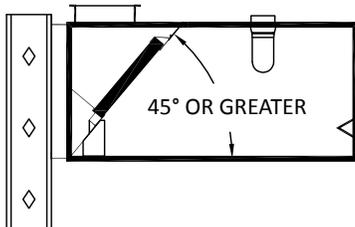


Figure #42A

- Not Acceptable -

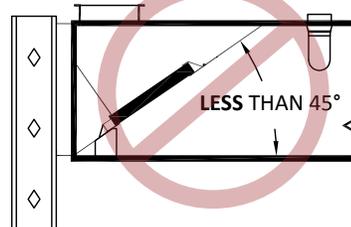


Figure #42B

The minimum angle of installation of Grease Filters is 45 degrees from horizontal.

SUMMARY: Hoods must be fitted with Grease Filters or Grease Removal Devices. Primary Grease Filters installed in the Hood Enclosure must be UL 1046 Listed, with a tight fit in the Hood Enclosure necessitating all of the exhaust air flows through the filters. The filters must be installed at an angle of 45 degrees or greater to the horizontal to ensure no grease drips from the filters.

“The minimum angle of installation of Grease Filters is 45 degrees from horizontal.”

Are Grease Drip Trays and Grease Collectors (enclosed metal containers) required as part of the Hood Enclosure?

“Grease Drip Trays shall be kept to the minimum size needed to collect grease.”

There is a consensus between NFPA 96, CMC, and UMC that:

1. Hoods shall be equipped with a Drip Tray beneath the lower edges of the Grease Filters.
2. Grease Drip Trays shall be kept to the minimum size needed to collect grease.
3. Grease Drip Trays shall be pitched to drain into an enclosed metal container having a capacity not exceeding 3.8 L. (1 gal).

- Examples of Hood Filter Drip Trays -
- Acceptable -

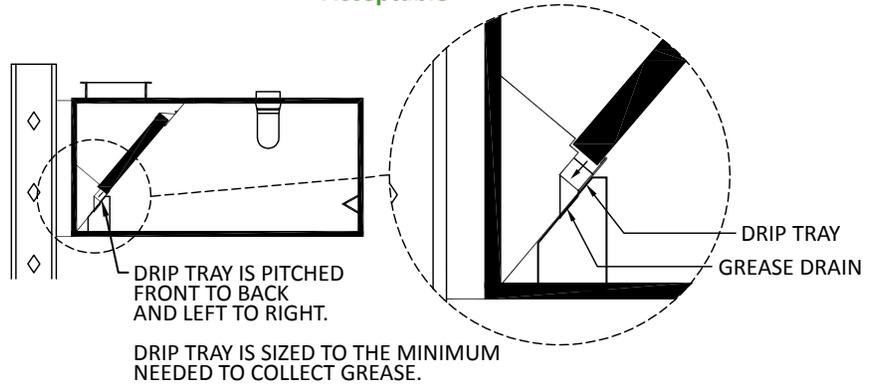


Figure #43

- Not Acceptable -

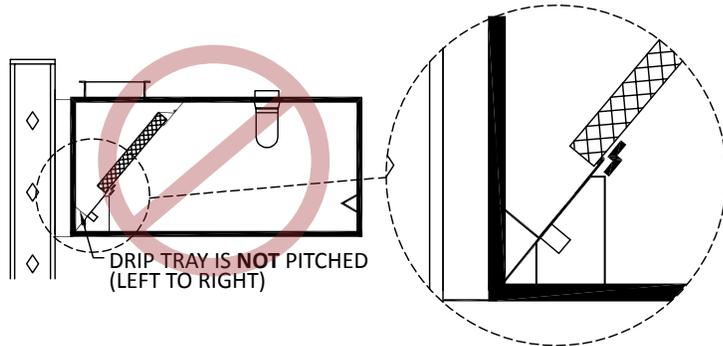


Figure #44

- Not Acceptable -

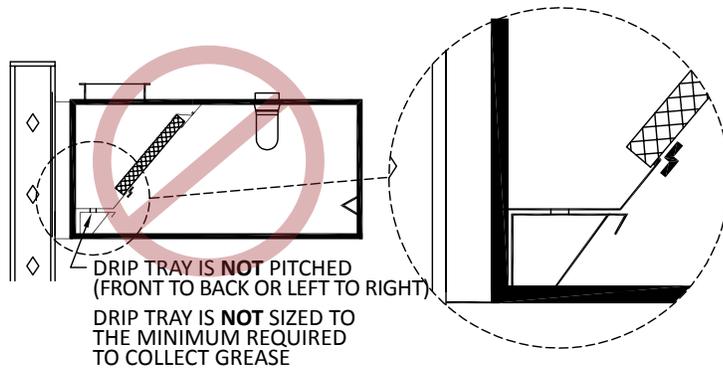


Figure #45

“Grease Drip Trays shall be pitched to drain into an enclosed metal container...”

UL 710 also requires that the Hood be equipped with a Drip Tray beneath the lower edges of the filters, that is kept to the minimum size needed to collect grease and pitched to drain into an enclosed metal container having a capacity not exceeding 3.8 L. (1 gal). UL 710 offers no exceptions to this requirement.

“The Grease Drip Tray shall be pitched to drain into an enclosed metal container.”

It is the responsibility of the Specifier to confirm with the Hood manufacturer that the Hood shall be equipped with a Drip Tray beneath lower edges of the filters. The Drip Tray is to be kept to the minimum size needed to collect grease and pitched to drain into an enclosed metal container having a capacity not exceeding 3.8 L. (1 gal).

- Example of Hood Filter Grease Drip Trays -

- Acceptable -

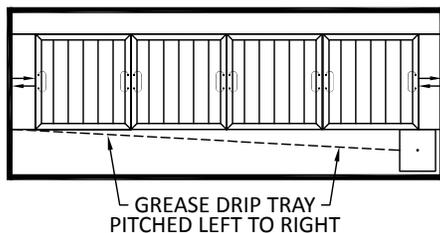


Figure #46A

- Not Acceptable -



Figure #47

- Example of Enclosed Metal Container -

- Acceptable -

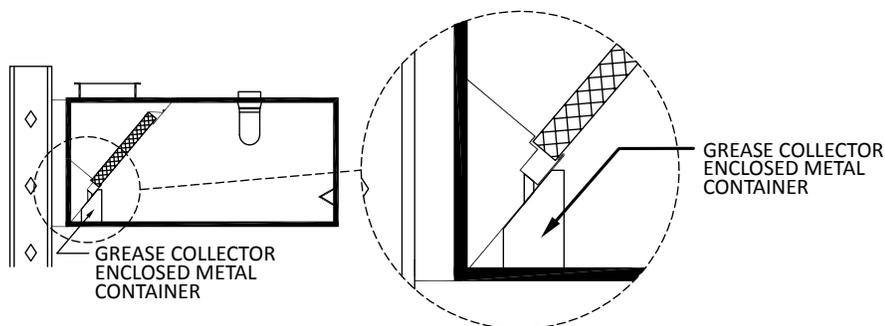


Figure #48

- Example of Non Enclosed Metal Container -

- Not Acceptable -

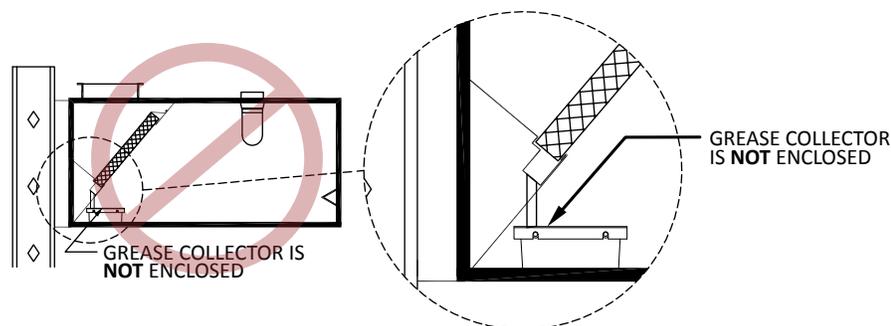


Figure #49

SUMMARY: Hoods shall be designed so that as little grease as possible is allowed to collect in the Hood and/or the filters. Grease that collects in the Hood or on filters becomes an ignition source or added fuel in the event of a fire in the Hood.

“..the exhaust fan must be operated whenever cooking equipment is in use.”

Is there a requirement to have a Hood exhaust fan automatically turn on/off?

There is a consensus between NFPA 96, CMC, IMC, and UMC that the exhaust fan must be operated whenever cooking equipment is in use. Some examples of an automatic fan activation are an electrical interlock between the fan(s) and the cooking equipment, or a heat sensor in the Hood or duct that can initiate a fan start up. However, other means also may be acceptable. The codes do not state a time that a Hood exhaust fan must be automatically turned off.

It is the responsibility of the Specifier to provide an approved means of automatically turning on the Hood exhaust fan when the Hood’s associated cooking equipment is in use. The Specifier should obtain the manufacturer’s listing information, drawings and/or installation instructions for an automatic fan activation system and include them as part of the construction documents for permitting.

- Example of Fan(s) Status -

- Acceptable -

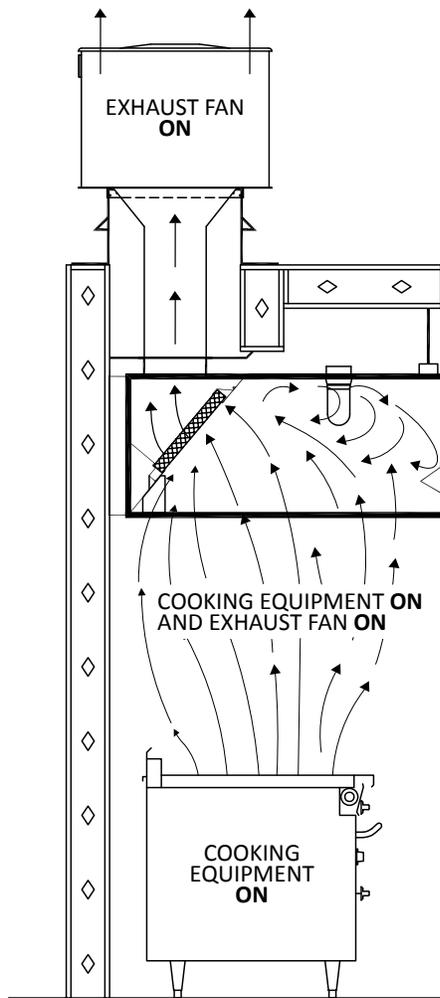


Figure #50A

- Not Acceptable -

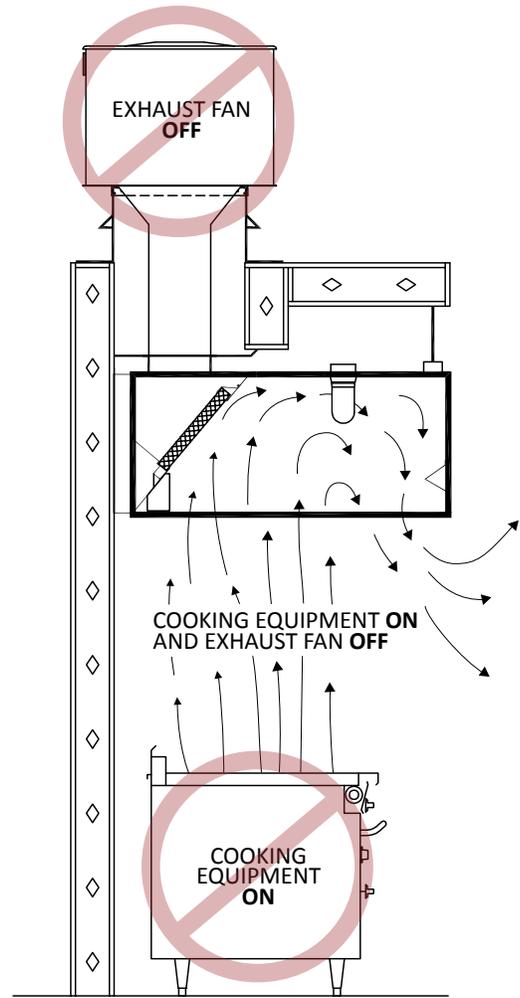


Figure #50B

SUMMARY: The Hood provides a means to capture, contain and exhaust grease-laden air and exhaust gases. If the exhaust fan is not operated when the cooking equipment is in use, an unsafe condition can be created where the gases and effluents are not exhausted from the Hood and/or kitchen. As a result, high temperature effluents and gases can build up inside the Hood and spill out into the kitchen.

“The make up air system is usually electrically interlocked with the exhaust system.”

Is there a requirement to have a Hood make up air fan automatically turn on/off?

There is a consensus between NFPA 96, CMC, IMC, and UMC that the make up air fan system must be operated so the Hood System does not create more than .02 inch water column negative pressure in the kitchen. The make up air system is usually electrically interlocked with the exhaust system and automatically starts up and shuts down as a single system.

It is the responsibility of the Specifier to provide a make up air system that maintains a kitchen environment with no more than a .02 inch negative pressure.

- Example of Fan(s) Status -

- Acceptable -

- Not Acceptable -

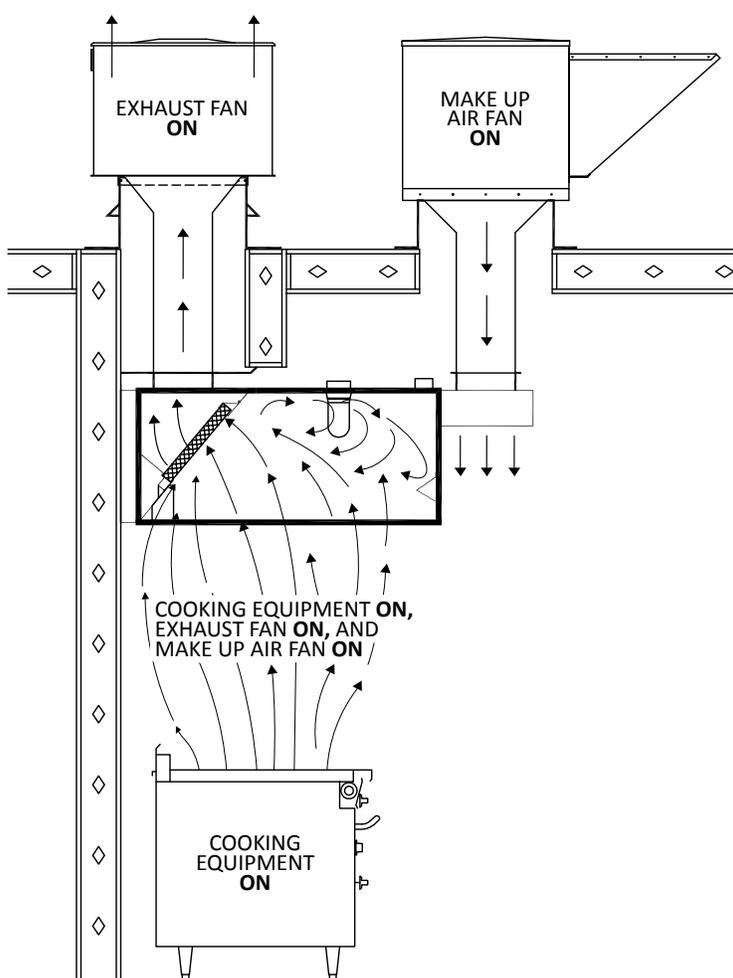


Figure #51A

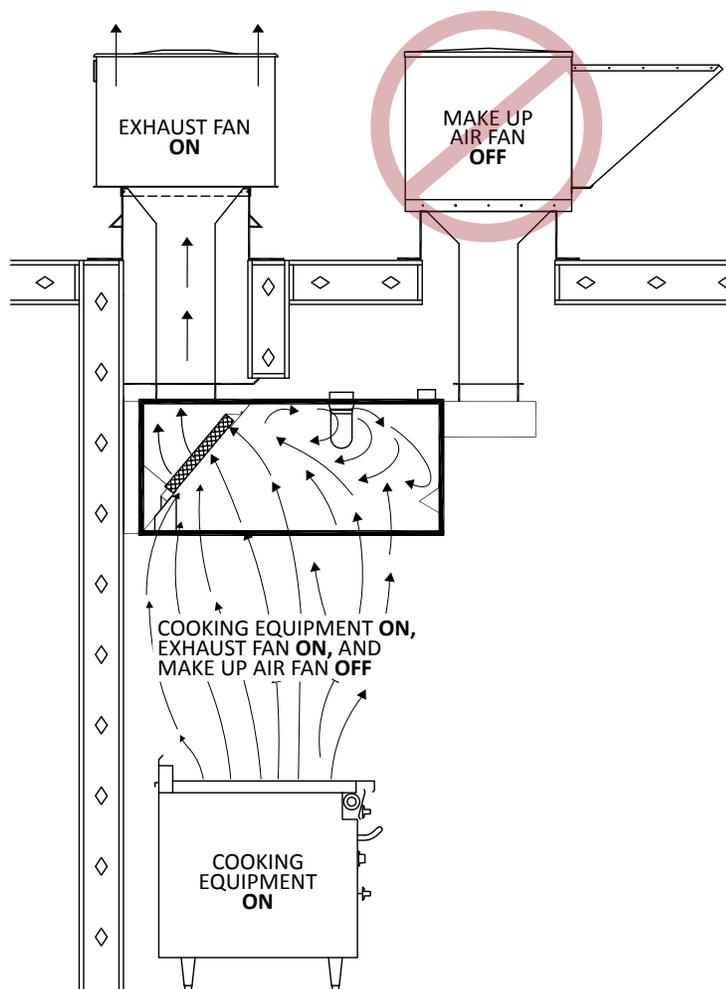


Figure #51B

SUMMARY: A properly designed Hood System is one that has a make up air system that is electrically interlocked with the exhaust fan so as not to create a negative pressure in the kitchen of more than .02 inch water column.

Is there a requirement to have a Hood make up air fan automatically turn off when the fire suppression system is activated?

“Make up air that is supplied internally to the Hood must shut off when a Hood’s fire suppression system activates.”

There is a consensus between NFPA 96, CMC, IMC, and UMC that when a Hood’s fire suppression system discharges, all make up air that is supplied internally to the Hood Enclosure (i.e. a compensating Hood or a short circuit Hood) shall be shut off.

It is the responsibility of the Specifier to determine if the Hood is manufactured in such a way that make up air is supplied internally to the Hood Enclosure. If make up air is supplied internally to the Hood Enclosure, the Specifier must provide an approved means of shutting off the source of that make up air when the Hood’s fire suppression system activates.

- Example of Fan(s) Status -

- Acceptable -

- Not Acceptable -

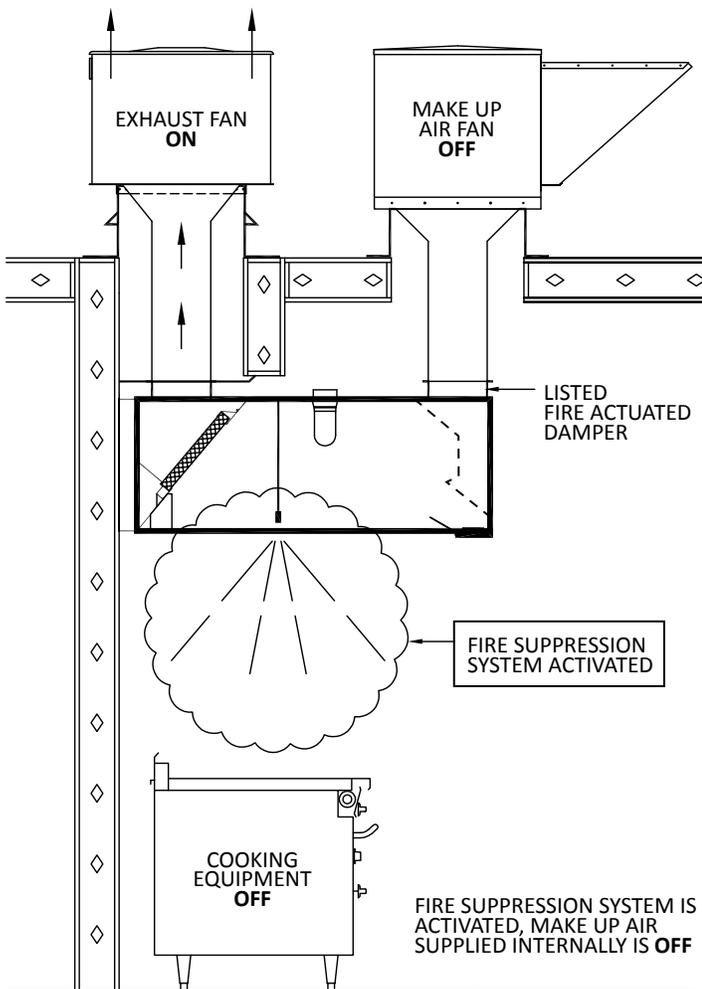


Figure #52A

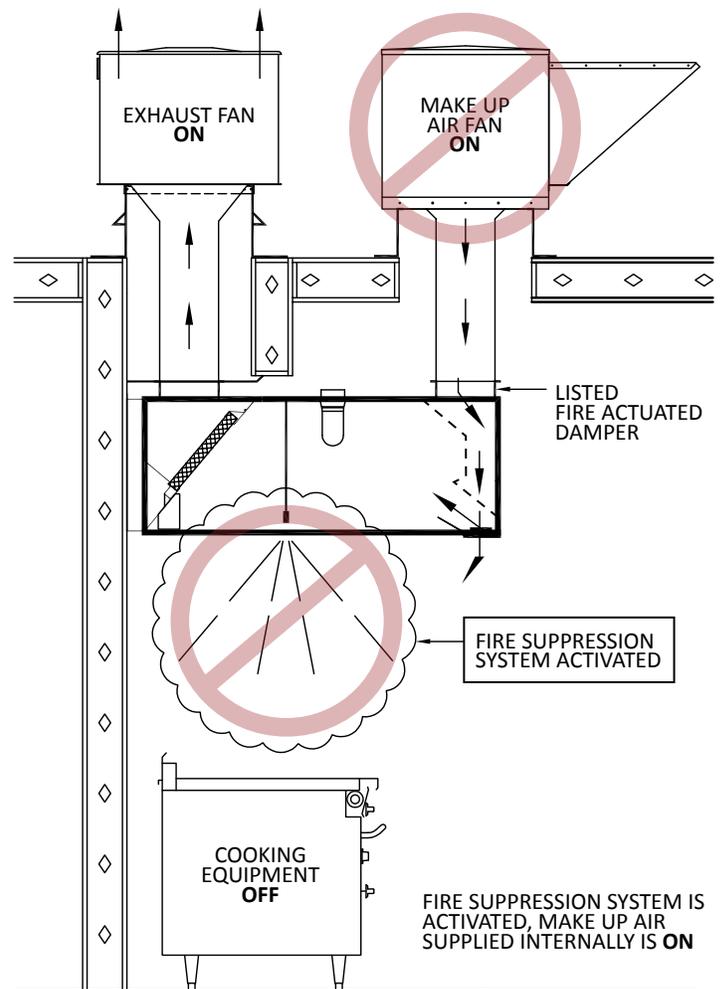


Figure #52B

SUMMARY: Make up air that is supplied to the internal portion of the Hood Enclosure will provide oxygen that can feed a fire inside of the Hood Enclosure, thus any and all make up air supplied to the internal portion of the Hood Enclosure shall be shut off when a Hood’s fire suppression system is activated.

Who are the listing agencies that list Hoods?

In the Hood industry, in the USA and Canada, there are two primary listing agencies that list Hoods:

1. Underwriters Laboratories Inc. (with UL Mark)
2. Intertek (with ETL Mark)

What are the benefits of a Listed Hood?

A listed Hood is a Hood that has been evaluated to the applicable standard by a third party listing agency. The standard contains minimum construction and material requirements as well as performance tests. If the product is in compliance with the standard, it is determined to be eligible to bear the mark of the listing agency.

If the Specifier chooses a listed Hood, is it necessary to verify that the Hood is manufactured and installed in compliance with the prevailing standards and codes?

Yes, it is absolutely mandatory that the Hood Specifier research and conclude that the Hood will meet the prevailing standards and codes prior to specifying the Hood, even if the Hood is listed.

The Specifier should perform due diligence and determine if a listed Hood can be installed in accordance with the prevailing standard or code. It is critical that the Specifier makes no assumptions or accept someone's verbal assurance in regard to the Hood's compliance to standards and/or codes.

As a Specifier or user, why should I not rely solely on a listed Hood for code compliance?

Often Authorities Having Jurisdiction will make amendments to existing codes to address their local needs related to building, fire and/or safety issues. The Hood's listing may not comply with such amended codes. Therefore, a listed Hood cannot assure compliance with such prevailing and amended codes. Specifiers should know that the Hood's listing does not generally cover the Hood's fire safety related installation requirements, which are addressed by the codes. Hood's fire safety related installation requirements include such things as the Hood's clearance to combustibles and limited-combustible materials and building components, installation of a listed fire suppression system in the Hood, and connection of the Hood to an appropriate grease duct, to name a few.

Prior to specifying a Hood the Specifier should:

1. Consult with the Authority Having Jurisdiction to determine which codes are prevailing and will be enforced in regard to the Hood and Hood System.
2. Obtain a copy of the entire code to be enforced.
3. Review and understand the entire code, consult with an Architect, Engineer or Hood specialist, if necessary.
4. Provide a copy of the prevailing code to the Hood manufacturer.
5. Have the Hood manufacturer provide a written guarantee that they have reviewed the prevailing codes and that their Hood will meet all of the requirements of prevailing codes.

It is extremely important to note that:

1. The Specifier should perform just as thorough due diligence process for a listed Hood as a non-listed Hood.
2. A Hood's Listing does not generally cover the Hood's installation requirements, which are addressed by the codes.
3. The Specifier should obtain and review a copy of the Hood manufacturer's installation instructions to assure that when the Hood is installed it will be in compliance with the prevailing codes.
4. The integrity of a listed Hood is only as good as the integrity of the company that manufactures that listed Hood.

Listing agencies often include statements in their published listings such as:

“Authorities Having Jurisdiction should be consulted in all cases as to the particular requirements covering the installation and use of Listed or Classified products, equipment, systems, devices, and materials.”

The preceding text accentuates the point that use of a listed Hood is not an approval. As a specifier or user, know that a listed Hood is not an approved Hood. The only entity that approves a Hood is the Authority Having Jurisdiction.

“A listed Hood provides no assurance as to compliance with any standard or code other than the standard that it was listed in accordance with.”

“Listing Agencies do not make any guarantees as to a Hood being in compliance with all national, state or local codes.”

If the Hood manufacturer provides a drawing that has the name, mark, or logo of a national standard or code on it such as UL, ETL, NFPA, CMC, UMC or IMC, is it necessary to verify that the Hood will be manufactured and installed in compliance with the prevailing standards and codes?

Yes, it is absolutely mandatory that the Hood Specifier research and conclude that the Hood will meet all of the prevailing standards and codes prior to specifying the Hood, even if the Hood manufacturer provides a Hood drawing with the name, mark, or logo of national standards and code agencies on it.

The national standard and code writing organizations such as NFPA, IAPMO and ICC are not listing agencies, and thus provide no testing or listing of products. As a result, the Specifier should make no assumptions in regard to a Hood being in compliance to standard or code due to the presence of the names or logos of these national organizations on the manufacturer’s Hood drawings or literature. All too often, manufacturers place these organization’s names and logos on their Hood drawings and literature without even first determining and/or verifying that their Hoods actually meet all of the requirements of the standards and codes and without receiving permission from the organizations to use their name or logo.

Listing agencies such as UL and Intertek do test and certify products. However, the Specifier should make no assumptions as far as the Hood’s compliance with the prevailing standards and/or codes because of the presence of the names or marks of these listing agencies included on the manufacturer’s Hood drawings or literature. The listing agencies do test and list Hoods and do make unannounced factory inspections to verify that the Hoods are being manufactured in accordance with the manufacturer’s listing, however, these agencies do not:

1. Make any guarantees as to a Hood being in compliance with all prevailing codes.
2. Make any guarantees that the Hood will be installed in accordance with the Hood’s installation instructions.
3. Inspect every Hood that leaves the manufacturing facility. Hood manufacturer’s are typically inspected by the listing agency by means of unannounced quarterly visits.
4. Review Hood manufacturer’s drawings and marketing literature that are project specific.

What does a Hood listing per UL 710 mean?

It means that:

1. The Hood materials and its construction, and its components such as Grease Filters or Grease Removal Devices, dampers, lighting fixtures, and electrical components (if provided) are in compliance with the requirements of UL 710.
2. The Hood has passed the applicable tests in UL 710.
3. The Hood is eligible for the listing agency’s mark and label.

The label on the Hood also contains key engineering data and installation requirements necessary for a Hood’s proper use per the terms of its listing. A Hood listing does not assure its compliance with the codes with respect to installation or other requirements. UL 710 requires Hoods to be manufactured and installed in accordance with the NFPA 96 and other prevailing codes.

“UL 710 requires Hoods to be manufactured and installed in accordance with the NFPA 96 and other prevailing codes.”

RECAP

This paper provides the Specifier a guide to some of the minimum fire and safety requirements that they must research, understand and integrate into a Hood and Hood System prior to specifying it in order to provide maximum fire and safety protection while mitigating the potential for loss of life and/or property, such as:

1. The most important attribute of a Hood is that it serves as a fire containment and safety device.
2. All Hoods shall have a liquidtight Hood Enclosure and Grease Removal Devices.
3. The Hood Enclosure shall be constructed of a minimum 20 gauge stainless steel or 18 gauge steel.
4. The clearance from the Hood assembly to combustible and limited-combustible materials that must be maintained is measured from the outer most portion of the Hood Enclosure that is in the closest proximity to the materials.
5. Listed exhaust volume dampers can be a valuable air balancing tool.
6. A Hood Enclosure does not provide adequate fire protection if that enclosure does not have fire actuated dampers where make up air inlets or outlets penetrate the Hood Enclosure.
7. A Hood Enclosure shall be equipped with Grease Removal Devices that are an integral part of the Hood or fitted with Grease Filters that are UL 1046 Listed.
8. Grease Filters shall be installed in a Hood Enclosure so that all of the exhaust air flows through the filters.
9. Grease Filters shall be installed at no less than a 45 degree angle to the horizontal.
10. Grease Filters shall be equipped with a Drip Tray below the lower edge of the filter.
11. The Grease Filter Drip Tray shall be kept to the minimum size that is required to collect the grease.
12. The Grease Filter Drip Tray shall be pitched to drain into an enclosed metal container.
13. The Grease Filter Drip Tray enclosed metal container shall have a capacity not exceeding 1 gallon (3.875 L.).
14. The Hood exhaust fan(s) shall be operated whenever the associated cooking equipment is in use.
15. The Hood make up air system shall be designed so as not to allow more than .02 inch water column negative pressure in the kitchen.
16. Make up air that is supplied internally to the Hood Enclosure shall be shut down when the fire suppression system is activated.
17. Listed Hoods are not a guarantee that the Hood is in compliance with the prevailing standards and codes.
18. The UL 710 Standard dictates that Hoods must be installed in accordance with its installation manual and the prevailing codes.
19. The presence of names, marks, or logos of national standard or code organizations on manufacturer's drawings and/or literature are not a guarantee of a Hood's compliance with the prevailing standard or code.
20. No single Hood manufacturing technique, component, integrated system, or accessory is more or less important than another (a Hood will only be as strong as its weakest link).

“A Hood is not just a box.”

“The most important attribute of a Hood is that it serves as a fire containment and safety device.”

CONCLUSION

Commercial Kitchen Hoods and Hood Systems fulfill a critical role in the design, building, safety and the overall working environment of a commercial kitchen. The primary functions of a Hood is to serve as a fire safety, life safety, and grease removal device.

A Hood is not just a box.

A Hood is unlike any other piece of equipment that is specified in a commercial kitchen. A Hood is an engineered piece of equipment that must be manufactured and installed in strict compliance with the prevailing codes and standards. An individual that refers to a Hood as just a box is uninformed and/or uneducated in regard to Hoods and Hood Systems and should not be included in the design, engineering, specification, installation, and/or purchasing decisions for Hoods or Hood Systems in any way.

All Hoods are not engineered and/or manufactured equally.

As with all manufactured products, each manufacture develops their own unique designs and manufacturing techniques. Hoods are no different. Some manufacturers focus on building products that exceed the minimum requirements of the codes and standards in effort to provide added safety, longevity, and/or value for the product while others sell at the lowest price.

The Hood Enclosure is the foundation of a Hood.

In the design and manufacturing of Hoods, the Hood Enclosure is the foundation of the Hood assembly. The main code and standard requirements for Hoods pertain to the manufacturing of the Hood Enclosure and its installation. A soundly manufactured Hood Enclosure will support all of the Hood accessories needed to customize each installation. It is paramount that a Specifier specifies a Hood with a Hood Enclosure that is manufactured to meet or exceed all of the code and standard requirements above all other accessory options.

The Hood is a component of a Hood System.

A Hood is integrated and engineered into a Hood System that shall be installed as part of the building structure. The Hood will be inspected by the Authority Having Jurisdiction and has to comply with all prevailing codes and standards. In most commercial kitchens, the Hood System will be the system that requires the most detailed amount of engineering and coordination between systems and trades. A properly designed and installed Hood and/or Hood system should withstand the most extreme conditions in a commercial kitchen for the life expectancy of the building.

Hoods and Hood Systems should be specified, engineered, purchased and installed by trained professionals with years of experience in the field.

Specifying, engineering, purchasing, and installing of Hoods and Hood Systems should only be performed by professionals trained in the field with years of experience.

A Hood should not be considered for specification until the specifier has researched and obtained all pertinent product documentation along with a guarantee from the manufacturer that the Hood meets all of the prevailing codes and standards. The decision for what type of Hood to be specified in a commercial kitchen should not be made by an uninformed specifier.

A Hood System must be engineered into the building structure. Typically a significant amount of coordination and integration will need to take place with the other trades in order to install a code compliant Hood System into a building. All engineering of Hoods and Hood Systems should be performed by licensed engineers and/or trained Hood specialists with years of experience.

Only contractors licensed, trained and with years of experience in the profession of installing Hoods and Hood Systems should be contracted with to install such systems.

The decision on which Hood to purchase should not be made by an uninformed buyer. The cost of a Hood should not be a consideration until the buyer has informed himself and been assured by the manufacturer, in writing, that the Hood meets all of the prevailing codes and standards, and also by the engineer that the Hood can be installed to comply with the code as part of a Hood System. A Hood makes up only a small percentage of the overall Hood System cost, yet it is the most critical component of the Hood System. Other Hood System components, such as the exhaust and supply fans and the exhaust and supply ducts, to name a few, that make up a Hood System will be dictated and engineered based on the engineering requirements of the Hood. An uninformed buyer attempting to save money on the purchase of a Hood will quite often be proven to be penny wise and pound foolish when all of the costs of the Hood System are added. A Hood that is designed, engineered, manufactured, and installed correctly is worth its weight in gold and should provide years of protection and insurance. A Hood that is not designed, engineered, manufactured and installed correctly maybe an accident waiting to happen that could have tragic consequences.

Hood manufacturers such as Streivor Air Systems can be a very good source of information on Hoods, however, all of the information provided by a manufacturer should be in writing and verified, prior to specifying, purchasing, or installing the Hood.

EXAMPLE OF A NFPA STANDARD 96 COMPLIANT HOOD

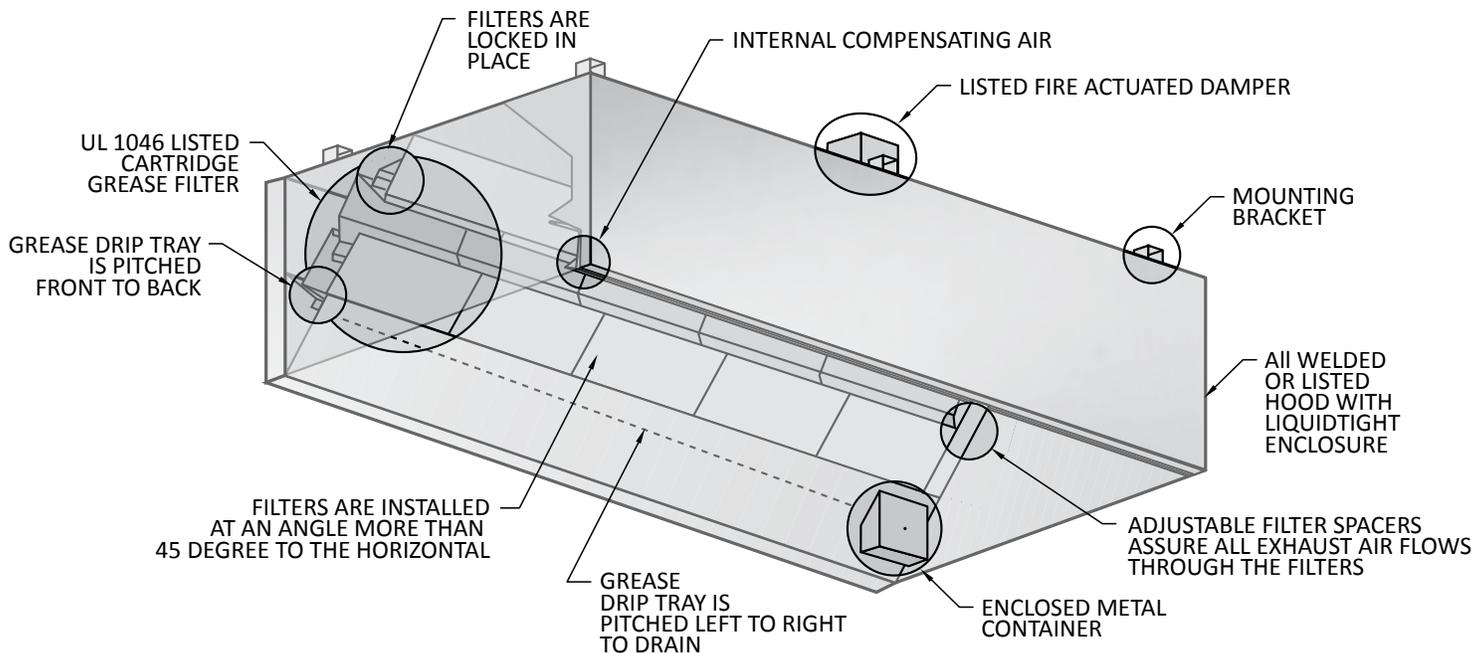


Figure #53

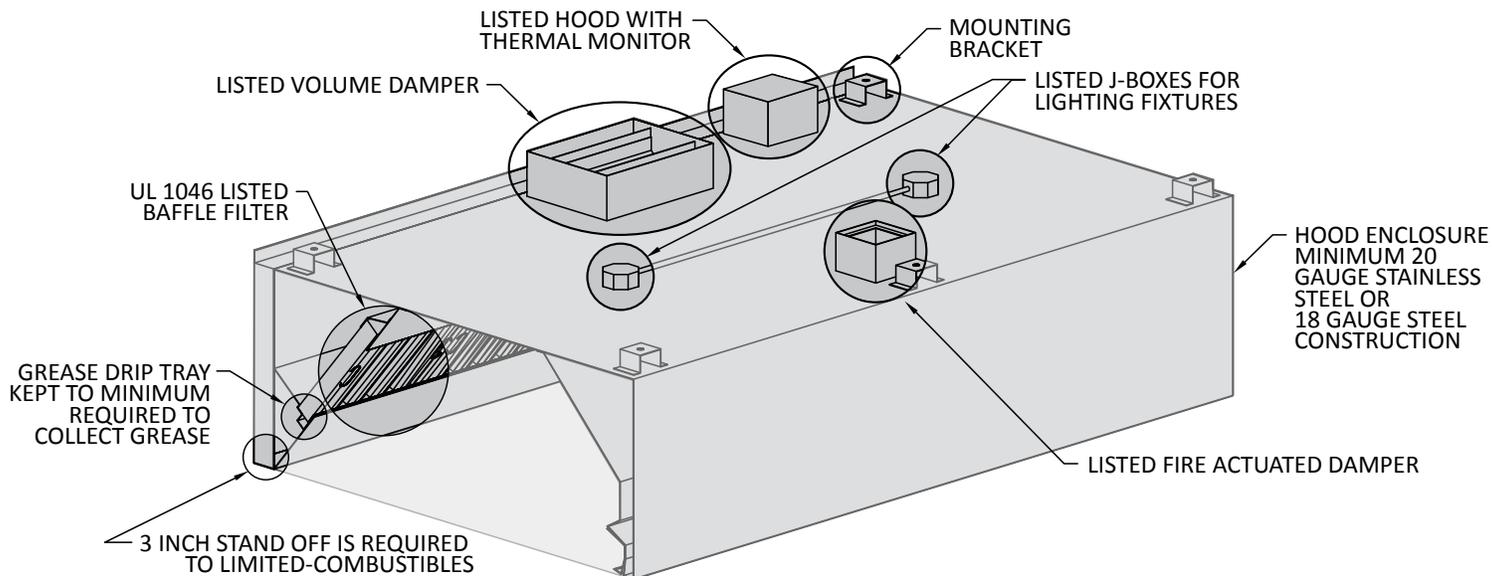


Figure #54

STREIVOR'S HOOD SPECIFICATION AND INSPECTION CHECKLIST FOR TYPE I COMMERCIAL KITCHEN HOODS

Project: _____ Date: _____

Address: _____

	YES	NO	N/A
1. Listed Hood	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. All welded Hood Enclosure. If no see #3	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Alternate construction: Liquidtight Hood Enclosure as part of listed Hood. If yes see #3.1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.1. Listing documents and drawings for the alternate construction are attached	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Stainless Steel: 20 gauge minimum thickness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. Steel: 18 gauge minimum thickness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Hood Enclosure clearance to combustible materials = 18 inches or greater. If no see #6.1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6.1. Listing documents and drawings for reduced clearance system or listed Hood are attached	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Hood Enclosure clearance to limited-combustible materials = 3 inches or greater. If no see #7.1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7.1. Listing documents and drawings for reduced clearance system or listed Hood are attached	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Is there a volume damper installed in the exhaust duct collar? If yes see #8.1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8.1. Listing documents and drawings for the volume damper are attached	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Make up air inlets and/or outlets penetrate the Hood Enclosure. If yes see #10	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Listed fire damper installed where the make up air inlets and/or outlets penetrate the enclosure	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. Grease Removal Devices are integral to the Hood. If yes see #11.1	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11.1 Listing documents and drawings for Hood with integral Grease Removal Devices are attached	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. Includes removable Grease Removal Devices (Grease Filters). If yes see #13	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. Grease Filters are UL 1046 Listed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14. All of the exhaust air flows through the Grease Removal Devices	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. Grease Filters are installed at a 45 degree angle to the horizontal or greater	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. Drip Tray beneath the lower edge of the filters	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. Grease Filter Drip Tray is kept to the minimum size required to collect grease	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18. Grease Filter Drip Tray is pitched to drain into an enclosed metal container	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19. Enclosed metal container has a capacity of 1 gallon or less	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20. The exhaust fan turns on when the cooking equipment is turned on	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21. The make up air system turns on when the exhaust fan is turned on	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22. Does the Hood have make up air supplied into the Hood Enclosure? If yes see #23	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
23. Make up air supplied into the Hood Enclosure shuts off upon fire system activation	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
24. Does the Hood and its installation comply with the prevailing codes?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Hood System: Approved Not Approved

Comments: _____

Inspector/Specifier

“Do not specify a Hood that does not comply with all the requirements of the prevailing codes and the NFPA 96 Standard.”

What should you do if you are in the process of specifying a Hood that does comply with all of the requirements of the prevailing codes and the NFPA 96 Standard?

It is recommended that you:

1. Do not specify a Hood that does not comply with all the requirements of the prevailing codes and the NFPA 96 Standard.
2. Specify a Hood that does comply with all of the prevailing code and standard requirements.

What should you do if you have specified a Hood (that has not yet been installed) that does not comply with all of the requirements of the prevailing codes and the NFPA 96 Standard?

It is recommended that you:

1. Notify the owner that the specified Hood does not comply with the requirements of the prevailing codes and/or standards.
2. Substitute a Hood that does comply with all of the requirements of the prevailing codes and NFPA 96 Standard.

What should you do if you have installed a Hood that does not comply with the prevailing codes and the NFPA 96 Standard?

It is recommended that you:

1. Notify the owner that the installed Hood does not comply with the prevailing codes and/or standards.
2. Notify the Hood manufacturer that the installed Hood does not comply with the prevailing codes and/or standards.
3. Put in place a process to correct the deficiency.

What should you do if you are unsure a Hood that has been advertised and/or labeled as a UL 710 compliant Hood is a UL 710 compliant Hood?

It is recommended that you:

1. Contact the manufacturer of the Hood and request that they address and satisfy your concerns in writing prior to specifying, purchasing, or installing the Hood.
2. Contact the certification agency with your concerns.

Who can you contact if you have questions in regard to Hood or Hood Systems?

You can contact Commercial Kitchen Ventilation Specialists at www.CKVSspecialists.com.

CKVSspecialists is an organization of Architects, Engineers, Consultants, Specialists and Educators that can provide the most current and accurate information available in regard to Hoods and Hood Systems for the Commercial Kitchen Ventilation Industry.

For additional information on references:**Underwriters Laboratories Inc. (UL)****www.UL.com**

333 Pfingsten Road
Northbrook, IL 60062
Tel: 1.877.UL.HELPS (1.877.854.3577)
Fax: 1.360.817.6278

Intertek**www.intertek.com**

801 Travis Street, Suite 1500
Houston, TX 77002
Tel: 1.800.967.5352

National Fire Protection Association (NFPA)**www.nfpa.org**

1 Batterymarch Park
Quincy, MA 02169
Tel: 1.617.770.3000
Fax: 1.617.770.0700

International Association of Plumbing and Mechanical Officials (IAPMO)**www.iapmo.org**

4755 E. Philadelphia St.
Ontario, CA 91761
Tel: 1.909.472.4100
Fax: 1.909.472.4150

California Building Standards Commission**www.bsc.ca.gov**

2525 Natomas Park Drive, Suite 130
Sacramento, CA 95833
Tel: 1.916.263.0916
Fax: 1.916.263.0959

International Code Council (ICC)**www.iccsafe.org**

500 New Jersey Avenue, NW, 6th Floor
Washington, DC 20001
Tel: 1.888.ICC.SAFE (1.888.422.7233)
Fax: 1.202.783.2348

Streivor, Inc. (Streivor Air Systems)**www.streivor.com**

1742 Sabre Street
Hayward, CA 94545
Tel: 1.888.343.6464
Fax: 1.510.670.9055

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EXTRACTAIRE

The Ultimate Adjustable High Velocity Cartridge Filter
US Patent No. 6,394,083



BALANCEAIRE

The Ultimate Hood Balancing Damper
Patented



DEMANDAIRE

The Ultimate in Demand Ventilation Systems



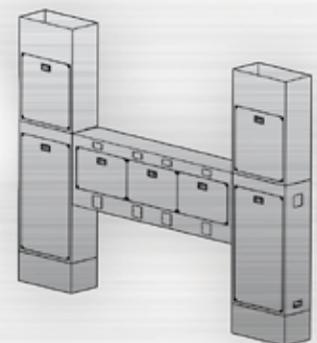
ENCLOSURES

The Ultimate Enclosures for the Protection of Hood and Duct Monitoring Equipment
Patent Pending



MONITORS

The Ultimate in Hood and Duct Monitoring Controls



UTILITY CABINET SYSTEMS

The Ultimate in Modular Utility Cabinets

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