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NFPA® 96 Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations Handbook 2017

NFPA®, 1 Batterymarch Park, Quincy, MA 02169-7471, USA
An International Codes and Standards Organization

NFPA® 96 Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations Handbook 2017

Second Edition

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NFPA, 1 Batterymarch Park, Quincy, MA 02169-7471
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This PDF contains the complete 2017 edition of NFPA 96, *Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations*, annotated to assist the reader's understanding of the standard's language and the intent behind it. The annotations are not part of the NFPA Standard but provide a valuable commentary reflecting the views, explanations, and insights of authors and contributors selected by the NFPA based on their knowledge of and experience with the standard.

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ISBN: 978-14559-1540-8

NFPA ®96

Standard for

Ventilation Control and Fire Protection of Commercial Cooking Operations

2017 Edition

This edition of NFPA 96, *Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations*, was prepared by the Technical Committee on Venting Systems for Cooking Appliances. It was issued by the Standards Council on November 11, 2016, with an effective date of December 1, 2016, and supersedes all previous editions.

This edition of NFPA 96 was approved as an American National Standard on December 1, 2016.

Origin and Development of NFPA 96

The subject of the ventilation of restaurant-type cooking equipment was first considered by the NFPA Committee on Blower and Exhaust Systems, which developed material on ventilation of restaurant-type cooking equipment to be included in NFPA 91, *Standard for the Installation of Blower and Exhaust Systems for Dust, Stock, and Vapor Removal or Conveying*. That standard was adopted by the Association in 1946, and revisions were adopted in 1947 and 1949.

When the NFPA Committee on Chimneys and Heating Equipment was organized in 1955, the material on ventilation of restaurant cooking equipment in NFPA 91 was assigned to the new committee with the suggestion that it be revised and published as a separate standard. Since then, the standard has been published as NFPA 96. Editions prepared by the Committee on Chimneys and Heating Equipment were adopted by the Association in 1961, 1964, 1969, 1970, 1971, 1973, 1976, 1978, 1980, and 1984.

The Correlating Committee on Chimneys and Other Heat and Vapor Removal Equipment was discharged by the Standards Council in 1986. The Technical Committee that prepared the 1987 edition of NFPA 96 became known as the Technical Committee on Venting Systems for Cooking Appliances.

In the 1991 edition, clearance requirements to combustible material were revised and expanded, including appendix figures that illustrated examples. A new definition for *limited-combustible* was added to the standard, and an appendix table was included to show typical construction assemblies. Chapters 3 and 4 were totally revised.

In the 1994 edition, the Committee changed the name of the standard from *Standard for the Installation of Equipment for the Removal of Smoke and Grease-Laden Vapors from Commercial Cooking Equipment* to *Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations*. The title change reflected other changes in the standard: two new chapters, one on recirculating systems and the other on solid fuel cooking operations, were added. A change to clearance and enclosure requirements in the 1994 edition allowed, for the first time, materials or products to be directly applied to a duct.

The Committee prepared a revision to the standard reporting to the 1996 Fall Meeting, which was returned to the Committee at the Technical Committee Reports Session.

The 1998 edition contained new definitions, minor revisions throughout, and a completely revised Chapter 7 on fire-extinguishing equipment.

The 2001 edition revised the document scope to clarify the application of the standard regarding residential-type cooking equipment. Further technical changes clarified requirements for duct installation, rooftop terminations, and fire protection equipment. The 2001 edition also contained a significant organizational and editorial revision based on the *Manual of Style for NFPA Technical Committee Documents*.

The 2004 edition added a chapter that addressed the requirements for downdraft appliance ventilation as well as clarifications of the requirements for cleaning and maintaining exhaust systems and diagrams detailing new arrangements for hoods with integrated supply air.

The 2008 edition clarified the requirements for field-applied and factory-built grease duct enclosures. It also recognized new technologies for venting, such as ultraviolet hoods and ventilating ceilings. New requirements were also added for documentation of exhaust system cleaning and maintenance.

The 2011 edition added additional requirements for equipment installed in hoods and ducts. It also required persons conducting inspection and testing of listed hoods to be certified. The maximum permitted distance between a fire extinguisher and an appliance was clarified, and notification of the impairment of the fire-extinguishing system was required to be given in writing.

The 2014 edition introduced new requirements for the use of solid fuel as a flavor enhancer. It also added a listing requirement for fans used in exhaust systems, a diagram of a wall-mounted fan, and a requirement for exhaust fan activation when any appliance under a hood is turned on. Criteria that affected existing dry or wet chemical systems not in compliance with ANSI/UL 300, *Standard for Fire Testing of Fire Extinguishing Systems for Protection of Commercial Cooking Equipment*, when significant changes are made to a system and that established a deadline for fire protection systems to meet the minimum requirements also were added.

The 2017 edition adds a new normative annex on mobile and temporary cooking operations. The normative annex is written in mandatory language but is not intended to be enforced unless specifically adopted by a jurisdiction or is applied on a voluntary basis. This annex includes requirements not limited to clearance, hoods, ducts, terminations, fire extinguishing systems, carbon monoxide detectors, location, training, generators, LP-gas, as well as procedures for the use, inspection, testing, and maintenance of equipment. The language in the body of the standard clarifies that fixed and mobile cooking equipment is covered by NFPA 96. The term *solid fuel* is used in lieu of charcoal to cover the different types of solid fuel, not just one type. A device installed in a duct, such as a pollution control device, now must be protected by its own fire extinguishing system.

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NOTE: Membership on a committee shall not in and of itself constitute an endorsement of the Association or any document developed by the committee on which the member serves.

Committee Scope: This Committee shall have primary responsibility for documents on fire safety in the design, installation, and use of exhaust systems (including hoods, grease removal devices, exhaust ducts, dampers, air-moving devices; and auxiliary equipment) for the removal of products of combustion, heat, grease, and vapors from cooking equipment, including the application of associated fire extinguishing systems.

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NFPA 96

Standard for

Ventilation Control and Fire Protection of Commercial Cooking Operations

▲ 2017 Edition

NOTICE: An asterisk (*) following the number or letter designating a paragraph indicates that explanatory material on the paragraph can be found in Annex A.

This edition includes the following usability features as aids to the user Technical changes are indicated by gray shading of the sections. An entire figure caption or table title with gray shading indicates a change to an existing figure or table. New sections, figures, and tables are indicated by a bold, italic ***N*** in a gray box to the left of the new material. Where one or more sections have been deleted, the deletion is indicated by a bullet (•) between the sections that remain.

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Information on referenced publications can be found in Chapter 2 and Annex C.

▲ Chapter 1 Administration

1.1 Scope.

▲ **1.1.1*** This standard shall provide the minimum fire safety requirements (preventative and operative) related to the design, installation, operation, inspection, and maintenance of all public and private cooking operations.

▲ **1.1.2** This standard shall apply to residential cooking equipment used for commercial cooking operations.

▲ **1.1.3** This standard shall not apply to cooking equipment located in a single dwelling unit.

1.1.4* This standard shall not apply to facilities where all of the following are met:

(1) Only residential equipment is being used.
(2) Fire extinguishers are located in all kitchen areas in accordance with NFPA 10.
▲ (3) The facility is not an assembly occupancy.
▲ (4) The authority having jurisdiction has approved the installation.

▲ **1.2 Purpose.** The purpose of this standard shall be to reduce the potential fire hazard of cooking operations, irrespective of the type of cooking equipment used and whether it is used in public or private facilities.

1.3 Application.

▲ **1.3.1*** This standard shall be applied as a united whole.

▲ **1.3.2** The authority having jurisdiction shall determine compliance with this standard and authorize equivalent deviations from it in all applications.

▲ **1.4 Retroactivity.** The provisions of this standard reflect a consensus of what is necessary to provide an acceptable degree of protection from the hazards addressed in this standard at the time the standard was issued.

▲ **1.4.1** Unless otherwise specified, the provisions of this standard shall not apply to facilities, equipment, structures, or installations that existed or were approved for construction or installation prior to the effective date of the standard. Where specified, the provisions of this standard shall be retroactive.

1.4.2 In those cases where the authority having jurisdiction determines that the existing situation presents an unacceptable degree of risk, the authority having jurisdiction shall be permitted to apply retroactively any portions of this standard deemed appropriate.

1.4.3 The retroactive requirements of this standard shall be permitted to be modified if their application clearly would be impractical in the judgment of the authority having jurisdiction and only where it is clearly evident that a reasonable degree of safety is provided.

▲ **1.5 Equivalency.** Nothing in this standard is intended to prevent the use of systems, methods, or devices of equivalent or superior quality, strength, fire resistance, effectiveness, durability, and safety over those prescribed by this standard.

1.5.1 Technical documentation shall be submitted to the authority having jurisdiction to demonstrate equivalency.

▲ **1.5.2** The system, method, or device shall be approved for the intended purpose by the authority having jurisdiction.

▲ Chapter 2 Referenced Publications

2.1 General. The documents or portions thereof listed in this chapter are referenced within this standard and shall be considered part of the requirements of this document.

▲ **2.2 NFPA Publications.** National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 10, *Standard for Portable Fire Extinguishers,* 2013 edition.

NFPA 12, *Standard on Carbon Dioxide Extinguishing Systems,* 2015 edition.

NFPA 13, *Standard for the Installation of Sprinkler Systems,* 2016 edition.

NFPA 17, *Standard for Dry Chemical Extinguishing Systems,* 2017 edition.

NFPA 17A, *Standard for Wet Chemical Extinguishing Systems,* 2017 edition.

NFPA 54, *National Fuel Gas Code,* 2015 edition.

NFPA 58, *Liquefied Petroleum Gas Code,* 2017 edition.

NFPA 70®, *National Electrical Code®,* 2017 edition.

NFPA 80, *Standard for Fire Doors and Other Opening Protectives,* 2016 edition.

NFPA 211, *Standard for Chimneys, Fireplaces, Vents, and Solid Fuel–Burning Appliances,* 2016 edition.

NFPA 259, *Standard Test Method for Potential Heat of Building Materials,* 2013 edition.

NFPA 750, *Standard on Water Mist Fire Protection Systems,* 2015 edition.

2.3 Other Publications.

2.3.1 ASTM Publications. ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials,* 2015b.

ASTM E119, *Standard Test Methods for Fire Tests of Building Const uction and Materials,* 2016.

ASTM E136, *Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C,* 2016.

ASTM E814, *Standard Test Method for Fire Tests of Through-Penetration Fire Stops,* 2013a.

ASTM E2336, *Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems,* 2014.

ASTM E2652, *Standard Test Method for Behavior of Materials in a Tube Furnace with a Cone-shaped Airflow Stabilizer, at 750°C,* 2016.

2.3.2 EPA Publications. Environmental Protection Agency, William Jefferson Clinton East Building, 1200 Pennsylvania Avenue, NW, Washington, DC 20460.

EPA Test Method 202, *Determination of Condensable Particulate Emissions for Stationary Sources,* 2010.

2.3.3 UL Publications. Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.

ANSI/UL 197, *Standard for Commercial Electric Cooking Appliances,* 2010, revised 2014.

ANSI/UL 263, *Standard for Fire Tests of Building Construction and Materials,* 2015.

ANSI/UL 300, *Standard for Fire Testing of Fire Extinguishing Systems for Protection of Commercial Cooking Equipment,* 2005, revised 2014.

UL 710, *Standard for Exhaust Hoods for Commercial Cooking Equipment,* 2012, revised 2013.

ANSI/UL 710B, *Standard for Recirculating Systems,* 2011, revised 2014.

UL 710C, *Outline of Investigation for Ultraviolet Radiation Systems for Use in the Ventilation Control of Commercial Cooking Operations,* 2006.

ANSI/UL 723, *Standard for Test for Surface Burning Characteristics of Building Materials,* 2008, revised 2013.

UL 762, *Outline of Investigation for Power Roof Ventilators for Restaurant Exhaust Appliances,* 2013.

ANSI/UL 1046, *Standard for Grease Filters for Exhaust Ducts,* 2010, revised 2012.

ANSI/UL 1479, *Standard for Fire Tests of Through-Penetration Firestops,* 2003, revised 2015.

ANSI/UL 1978, *Standard for Grease Ducts,* 2005, revised 2013.

UL 2221, *Standard for Tests of Fire Resistive Grease Duct Enclosure Assemblies,* 2010.

2.3.4 Other Publications.

Merriam-Webster's Collegiate Dictionary, 11th edition, Merriam-Webster, Inc., Springfield, MA, 2003.

▲ **2.4 References for Extracts in Mandatory Sections.**

NFPA 80, *Standard for Fire Doors and Other Opening Protectives,* 2016 edition.

NFPA *101®*, *Life Safety Code Code®,* 2015 edition.

NFPA 5000®, *Building Construction and Safety Code®,* 2015 edition.

▲ Chapter 3 Definitions

3.1 General. The definitions contained in this chapter shall apply to the terms used in this standard. Where terms are not defined in this chapter or within another chapter, they shall be defined using their ordinarily accepted meanings within the context in which they are used. *Merriam-Webster's Collegiate Dictionary,* 11th edition, shall be the source for the ordinarily accepted meaning.

3.2 NFPA Official Definitions.

▲ **3.2.1* Approved.** Acceptable to the authority having jurisdiction.

▲ **3.2.2* Authority Having Jurisdiction (AHJ).** An organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving equipment, materials, an installation, or a procedure.

3.2.3 Labeled. Equipment or materials to which has been attached a label, symbol, or other identifying mark of an organization that is acceptable to the authority having jurisdiction and concerned with product evaluation, that maintains periodic inspection of production of labeled equipment or materials, and by whose labeling the manufacturer indicates compliance with appropriate standards or performance in a specified manner.

▲ **3.2.4* Listed.** Equipment, materials, or services included in a list published by an organization that is acceptable to the

authority having jurisdiction and concerned with evaluation of products or services, that maintains periodic inspection of production of listed equipment or materials or periodic evaluation of services, and whose listing states that either the equipment, material, or service meets appropriate designated standards or has been tested and found suitable for a specified purpose.

▲ **3.2.5 Shall.** Indicates a mandatory requirement.

▲ **3.2.6 Should.** Indicates a recommendation or that which is advised but not required.

3.2.7 Standard. An NFPA Standard, the main text of which contains only mandatory provisions using the word "shall" to indicate requirements and that is in a form generally suitable for mandatory reference by another standard or code or for adoption into law. Nonmandatory provisions are not to be considered a part of the requirements of a standard and shall be located in an appendix, annex, footnote, informational note, or other means as permitted in the NFPA Manuals of Style. When used in a generic sense, such as in the phrase "standards development process" or "standards development activities," the term "standards" includes all NFPA Standards, including Codes, Standards, Recommended Practices, and Guides.

3.3 General Definitions.

▲ **3.3.1 Access Panel.** A closure device used to cover an opening into a duct, an enclosure, equipment, or an appurtenance.

3.3.2 Air Intakes. An opening in a building's envelope whose purpose is to allow outside air to be drawn into the structure to replace inside air that is removed by exhaust systems or to improve the quality of the inside air by providing a source of air having a lower concentration of odors, suspended particles, or heating content.

3.3.3 Air Pollution Control Devices. Equipment and devices used for the purpose of cleaning air passing through them or by them in such a manner as to reduce or remove the impurities contained therein.

3.3.4* Appliance Flue Outlet. The opening or openings in a cooking device where vapors, combustion gases, or both leave the cooking device.

3.3.5 Appurtenance. An accessory or a subordinate part that enables the primary device to perform or improves its intended function.

▲ **3.3.6 Assembly Occupancy.** An occupancy (1) used for a gathering of 50 or more persons for deliberation, worship, entertainment, eating, drinking, amusement, awaiting transportation, or similar uses; or (2) used as a special amusement building, regardless of occupant load. [***101,*** 2015]

3.3.7 Automatic. Performing a function without the necessity of human intervention.

▲ **3.3.8 Baffle Plate.** An object placed in or near an appliance to change the direction of or to retard the flow of air, air-fuel mixtures, or flue gases.

3.3.9 Broiler.

3.3.9.1 ***High Broiler.*** See 3.3.9.3, Upright Broiler.

3.3.9.2 ***Salamander Broiler.*** See 3.3.9.3, Upright Broiler.

▲ **3.3.9.3** ***Upright Broiler.*** An appliance used in the preparation of food whereby foods are exposed to intense radiant heat, and perhaps to convective heat, with the food or the food and the radiant source not limited to a horizontal mode.

▲ **3.3.10* Certified.** A formally stated recognition and approval of an acceptable level of competency, acceptable to the AHJ.

3.3.11 Classified. Products or materials of a specific group category that are constructed, inspected, tested, and subsequently reinspected in accordance with an established set of requirements. The classification process is performed by an organization acceptable to the authority having jurisdiction. [**80,** 2016]

▲ **3.3.12 Clean(ing).** For kitchen exhaust systems and cooking equipment, the act of removing grease, oil deposits, and other residue.

3.3.13 Clearly Identified. Capable of being recognized by a person of normal vision without causing uncertainty and indecisiveness about the location or operating process of the identified item.

3.3.14* Construction.

3.3.14.1 ***Closed Combustible Construction.*** Combustible building construction, including walls, structural framing, roofs, roof ceilings, floors, and floor–ceiling assemblies, continuously enclosing a grease duct on four sides where one or more sides are protected.

3.3.14.2 ***Open Combustible Construction.*** Combustible building construction, including wall, structural framing, roof, roof ceiling, floor, and floor–ceiling assemblies, adjacent to a grease duct on three or fewer sides where one or more sides are protected.

▲ **3.3.15* Continuous Weld.** A metal-joining method that produces a product without visible interruption or variation in quality.

3.3.16 Damper. A valve or plate for controlling draft or flow of gases, including air.

3.3.17 Detection Devices. Electrical, pneumatic, thermal, mechanical, or optical sensing instruments, or subcomponents of such instruments, whose purpose is to cause an automatic action upon the occurrence of some preselected event.

3.3.18 Discharge. The final portion of a duct or pipe where the product being conveyed is emptied or released from confinement; the termination point of the pipe or duct.

▲ **3.3.19 Duct Termination.** The final or intended end-portion of a duct system that is designed and functions to fulfill the obligations of the system in a satisfactory manner.

3.3.20 Ducts (or Duct System). A continuous passageway for the transmission of air and vapors that, in addition to the containment components themselves, might include duct fittings, dampers, plenums, and/or other items or air-handling equipment.

3.3.20.1 ***Bleed Air Duct.*** An intake duct in a manifold duct system, designed to input air to maintain system balance.

▲ **3.3.20.2** ***Grease Ducts.*** A containment system for the transportation of air and grease vapors that is designed and installed to reduce the possibility of the accumulation of

combustible condensation and the occurrence of damage if a fire occurs within the system.

3.3.21 Easily Accessible. Within comfortable reach, with limited dependence on mechanical devices, extensions, or assistance.

3.3.22 Enclosure.

3.3.22.1 ***Continuous Enclosure.*** A recognized architectural or mechanical component of a building having a fire resistance rating as required for the structure and whose purpose is to enclose the vapor removal duct for its full length to its termination point outside the structure without any portion of the enclosure having a fire resistance rating less than the required value.

3.3.22.2 ***Grease Duct Enclosure.***

3.3.22.2.1 ***Factory-Built Grease Duct Enclosure.*** A listed factory-built grease duct system evaluated as an enclosure system for reduced clearances to combustibles and as an alternative to a duct with its fire-rated enclosure.

▲ **3.3.22.2.2** ***Field-Applied Grease Duct Enclosure.*** A listed system evaluated for reduced clearances to combustibles and as an alternative to a duct with its fire-rated enclosure.

3.3.23 Equipment.

▲ **3.3.23.1** ***Fire-Extinguishing Equipment.*** Automatic fire-extinguishing systems and portable fire extinguishers provided for the protection of grease removal devices, hoods, duct systems, and cooking equipment, and listed for such use.

▲ **3.3.23.2*** ***Solid Fuel Cooking Equipment.*** Cooking equipment that utilizes solid fuel.

3.3.24 Filter.

3.3.24.1* ***Grease Filter.*** A removable component of the grease removal system designed to capture grease and direct it to a safe collection point.

▲ **3.3.24.2** ***Mesh Filter.*** A filter construction consisting of a net made from intersecting strands with a space between each strand.

3.3.25 Fire Resistance Rating. The time, in minutes or hours, that materials or assemblies have withstood a fire exposure as established in accordance with the test procedures of ASTM E119 or ANSI/UL 263.

3.3.26 Fire Wall. A wall separating buildings or subdividing a building to prevent the spread of the fire and having a fire resistance rating and structural stability.

3.3.27 Fume Incinerators. Devices utilizing intense heat or fire to break down and/or oxidize vapors and odors contained in gases or air being exhausted into the atmosphere.

▲ **3.3.28 Fusible Link.** A form of fixed temperature heat-detecting device sometimes employed to restrain the operation of an electrical or mechanical control until its designed temperature is reached.

▲ **3.3.29* Grease.** Rendered animal fat, vegetable shortening, and other such oily matter used for the purposes of and resulting from cooking and/or preparing foods.

3.3.30 Grease Removal Devices. A system of components designed and intended to process vapors, gases, and/or air as it is drawn through such devices by collecting the airborne grease particles and concentrating them for further action at some future time, leaving the exiting air with a lower amount of combustible matter.

3.3.31 Greasetight. Constructed and performing in such a manner as not to permit the passage of any grease under normal cooking conditions.

▲ **3.3.32 High Limit Control Device.** An operating device installed and serving as an integral component of a deep fat fryer that provides secondary limitation of the grease temperature by automatically disconnecting the thermal energy input when the temperature limit is exceeded.

▲ **3.3.33* Hood.** A device provided for a cooking appliance(s) to direct and capture grease-laden vapors and exhaust gases.

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3.3.34 Interconnected. Mutually assembled to another component in such a manner that the operation of one directly affects the other or that the contents of one specific duct system are allowed to encounter or contact the products being moved by another duct system.

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

3.3.36 Maintenance. Work including, but not limited to, repair, replacement, and service, performed to ensure that equipment operates properly.

▲ **3.3.37* Material.**

3.3 37 1 ***Combustible Material.*** Any material that will burn regardless of its au oignition tempera ure

3.3.37.2 ***Limited-Combustible (Material).*** Refers to a building construction material with limited burning characteristics that, when in the form in which it is used, does not comply with the definition of *noncombustible material. (See 4.8.2.)*

3.3.37.3* ***Noncombustible Material.*** A substance that will not ignite and burn under the conditions anticipated when subjected to a fire. *(See 4.8.1.)*

▲ **3.3.38 Noncompliant.** Not meeting all applicable requirements of this standard.

3.3.39 Pitched. To be fixed or set at a desired angle or inclination.

▲ **3.3.40 Qualified.** A competent and capable person who has met the requirements and training for a given field acceptable to the AHJ.

▲ **3.3.41 Recirculating Systems.** Systems for control of smoke or grease-laden vapors from commercial cooking equipment that do not exhaust to the outside.

3.3.42 Removable. Capable of being transferred to another location with a limited application of effort and tools.

3.3.43 Replacement Air. Air deliberately brought into the structure, then specifically to the vicinity of either a combustion process or a mechanically or thermally forced exhausting device, to compensate for the vapor and/or gases being consumed or expelled.

▲ **3.3.44 Single Hazard Area.** Where two or more hazards can be simultaneously involved in fire by reason of their proximity, as determined by the authority having jurisdiction.

3.3.45 Solid Cooking Fuel. Any solid, organic, consumable fuel such as briquettes, mesquite, hardwood, or charcoal.

3.3.46 Solvent. A substance (usually liquid) capable of dissolving or dispersing another substance; a chemical compound designed and used to convert solidified grease into a liquid or semiliquid state in order to facilitate a cleaning operation.

3.3.47 Space.

3.3.47.1 ***Concealed Spaces.*** That portion(s) of a building behind walls, over suspended ceilings, in pipe chases, and in attics whose size might normally range from 44.45 mm (1¾ in.) stud spaces to 2.44 m (8 ft) interstitial truss spaces and that might contain combustible materials such as building structural members, thermal and/or electrical insulation, and ducting.

3.3.47.2 ***Confined Space.*** A space whose volume is less than 1.42 m^3/293 W (50 ft^3/1000 Btu/hr) of the aggregate input rating of all appliances installed in that space.

▲ **3.3.48 Spark Arrester.** A device or method that minimizes the passage of airborne sparks and embers into a plenum, duct, and flue.

3.3.49 Thermal Recovery Unit. A device or series of devices whose purpose is to reclaim only the heat content of air, vapors, gases, or fluids that are being expelled through the exhaust system and to transfer the thermal energy so reclaimed to a location whereby a useful purpose can be served.

▲ **3.3.50* Trained** A person who has become proficient in performing a skill reliably and safely through instruc ion and practice/field experience acceptable to the AHJ.

3.3.51 Trap. A cuplike or U-shaped configuration located on the inside of a duct system component where liquids can accumulate.

N **3.3.52 Water-Wash Fire-Extinguishing System.** A water-wash system that is listed as a fire-extinguishing system.

▲ *N* **3.3.53 Water-Wash System.** A system that employs a water spray to clean grease from the plenum of an exhaust hood and portions of the ductwork on an intermittent or continuous basis.

▲ Chapter 4 General Requirements

4.1 General.

▲ **4.1.1** Cooking equipment used in processes producing smoke or grease-laden vapors shall be equipped with an exhaust system that complies with all the equipment and performance requirements of this standard.

▲ **4.1.1.1*** Cooking equipment that has been listed in accordance with ANSI/UL 197 or an equivalent standard for reduced emissions shall not be required to be provided with an exhaust system.

4.1.1.2 The listing evaluation of cooking equipment covered by 4.1.1.1 shall demonstrate that the grease discharge at the exhaust duct of a test hood placed over the appliance shall not exceed 5 mg/m^3 (0.00018 oz/ft^3) when operated with a total airflow of 0.236 m^3/s (500 cfm).

4.1.2 All such equipment and its performance shall be maintained in accordance with the requirements of this standard during all periods of operation of the cooking equipment.

▲ **4.1.3** The following equipment shall be kept in working condition:

(1) Cooking equipment
(2) Hoods
(3) Ducts (if applicable)
(4) Fans
(5) Fire-extinguishing equipment
(6) Special effluent or energy control equipment

▲ **4.1.3.1** Maintenance and repairs shall be performed on all components at intervals necessary to maintain good working condition.

▲ **4.1.4** All airflows shall be maintained.

▲ **4.1.5** The responsibility for inspection, testing, maintenance, and cleanliness of the ventilation control and fire protection of the commercial cooking operations, including cooking appliances, shall ultimately be that of the owner of the system, provided that this responsibility has not been transferred in written form to a management company, tenant, or other party.

4.1.6* All solid fuel cooking equipment shall comply with the requirements of Chapter 14.

4.1.7 Multitenant applications shall require the concerted cooperation of design, installation, operation, and maintenance responsibilities by tenants and by the building owner.

▲ **4.1 8** All in erior surfaces of the exhaust system shall be accessible for cleaning and inspection purposes.

▲ **4.1.9*** Cooking equipment used in fixed, mobile, or temporary concessions, such as trucks, buses, trailers, pavilions, tents, or any form of roofed enclosure, shall comply with this standard.

▲ **4.2* Clearance.**

▲ **4.2.1*** Where enclosures are not required, hoods, grease removal devices, exhaust fans, and ducts shall have a clearance of at least 457 mm (18 in.) to combustible material, 76 mm (3 in.) to limited-combustible material, and 0 mm (0 in.) to noncombustible material.

4.2.2 Where a hood, duct, or grease removal device is listed for clearances less than those required in 4.2.1, the listing requirements shall be permitted.

▲ **4.2.3 Clearance Reduction.**

4.2.3.1 Where a clearance reduction system consisting of 0.33 mm (0.013 in.) (28 gauge) sheet metal spaced out 25 mm (1 in.) on noncombustible spacers is provided, there shall be a minimum of 229 mm (9 in.) clearance to combustible material.

4.2.3.2 Where a clearance reduction system consisting of 0.69 mm (0.027 in.) (22 gauge) sheet metal on 25 mm (1 in.) mineral wool batts or ceramic fiber blanket reinforced with wire mesh or equivalent spaced 25 mm (1 in.) on noncombustible spacers is provided, there shall be a minimum of 76 mm (3 in.) clearance to combustible material.

▲ **4.2.3.3** Where a clearance reduction system consisting of a listed and labeled field-applied grease duct enclosure material, system, product, or method of construction specifically evaluated for such purpose in accordance with ASTM E2336, the required clearance shall be in accordance with the listing.

▲ **4.2.3.4** Zero clearance to limited-combustible materials shall be permitted where protected by one of the following:

(1) Metal lath and plaster
(2) Ceramic tile
(3) Quarry tile
(4) Other noncombustible materials or assembly of noncombustible materials that are listed for the purpose of reducing clearance
(5) Other materials and products that are listed for the purpose of reducing clearance

4.2.4 Clearance Integrity.

4.2.4.1 In the event of damage, the material or product shall be repaired and restored to meet its intended listing or clearance requirements and shall be acceptable to the AHJ.

4.2.4.2* In the event of a fire within a kitchen exhaust system, the duct and its enclosure (rated shaft, factory-built grease duct enclosure, or field-applied grease duct enclosure) shall be inspected by qualified personnel to determine whether the duct and protection method are structurally sound, capable of maintaining their fire protection function, and in compliance with this standard for continued operation.

▲ **4.2.4.3** Protection shall be provided on the wall from the bottom of the hood to the floor, or to the top of the noncombustible material extending to the floor, to the same level as required in 4.2.1.

▲ **4 2.4.4** The protection methods for ducts to reduce clearance shall be applied to the combustible or limited-combustible construction, not to the duct itself.

▲ **4.3 Field-Applied and Factory-Built Grease Duct Enclosures.**

4.3.1 Field-applied grease duct enclosures shall be protected with a through-penetration firestop system classified in accordance with ASTM E814 or ANSI/UL 1479 having an "F" and a "T" rating equal to the fire resistance rating of the assembly being penetrated.

4.3.1.1 The surface of the field-fabricated grease duct shall be continuously covered on all sides from the point at which the duct enclosure penetrates a ceiling, wall, or floor to the outlet terminal.

4.3.1.2 The field-applied grease duct shall be listed in accordance with ASTM E2336 and installed in accordance with the manufacturer's instructions and the listing requirements.

▲ **4.3.2*** Where subject to physical damage, field-applied grease duct enclosures shall be protected as deemed necessary by the authority having jurisdiction.

4.3.3 Factory-built grease duct enclosures shall be protected with a through-penetration firestop system classified in accordance with ASTM E814 or ANSI/UL 1479 having an "F" and a "T" rating equal to the fire resistance rating of the assembly being penetrated from the point at which the duct penetrates a ceiling, wall, or floor to the outlet terminal.

4.3.3.1 The factory-built grease duct protection system shall be listed in accordance with UL 2221.

▲ *N* **4.3.3.2** Listed single wall factory-built grease ducts shall be permitted to be enclosed with field-applied grease duct enclosure material where the material and the assembly of duct and material are listed for that application and installed in accordance with the grease duct manufacturer's listing and their installation instructions.

4.3.3.3 The factory-built grease duct protection system shall be installed in accordance with the manufacturer's instructions and the listing requirements.

4.3.4 Field-applied grease duct enclosures and factory-built grease duct enclosures shall demonstrate that they provide mechanical and structural integrity, resiliency, and stability when subjected to expected building environmental conditions, duct movement under general operating conditions, and duct movement due to fire conditions.

▲ **4.3.5** The specifications of material, gauge, and construction of the duct used in the testing and listing of field-applied grease duct enclosures and factory-built grease duct enclosures shall be included as minimum requirements in their listing and installation documentation.

▲ **4.3.6 Clearance Options for Field-Applied and Factory-Built Grease Duct Enclosures.** The following clearance options for which field-applied grease duct enclosures and factory-built grease duct enclosures have been successfully evaluated shall be clearly identified in their listing and installation documentation and on their labels:

(1) Open combustible construction clearance at manufacturer's requested dimensions
(2) Closed combustible construction clearance at manufacturer's requested dimensions, with or without specified ventilation
(3) Rated shaft clearance at manufacturer's requested dimensions, with or without specified ventilation

4.4 Building and Structural Duct Contact.

▲ **4.4.1** A duct shall be permitted to contact noncombustible floors, interior walls, and other noncombustible structures or supports, but it shall not be in contact for more than 50 percent of its surface area for each linear foot of contact length.

4.4.2 Where duct contact must exceed the requirements of 4.4.1, the duct shall be protected from corrosion.

4.4.3 Where the duct is listed for zero clearance to combustibles or is otherwise protected with a material or product listed for the purpose of reducing clearance to zero, the duct shall be permitted to exceed the contact limits of 4.4.1 without additional corrosion protection.

4.4.4 Where the duct is listed for zero clearance to combustibles, the duct shall be permitted to exceed the contact limits of 4.4.1 without additional corrosion protection.

▲ **4.5 Duct Clearances to Enclosures.** Clearances between the duct and interior surfaces of enclosures shall meet the requirements of Section 4.2.

4.6 Drawings. A drawing(s) of the exhaust system installation along with copies of operating instructions for subassemblies

and components used in the exhaust system, including electrical schematics, shall be kept on the premises.

4.7 Authority Having Jurisdiction Notification. If required by the authority having jurisdiction, notification in writing shall be given of any alteration, replacement, or relocation of any exhaust or extinguishing system or part thereof or cooking equipment.

▲ **4.8 Materials.**

4.8.1 Noncombustible Material.

4.8.1.1* A material that complies with any of the following shall be considered a noncombustible material:

(1)* The material, in the form in which it is used, and under the conditions anticipated, will not ignite, burn, support combustion, or release flammable vapors when subjected to fire or heat.
(2) The material is reported as passing ASTM E136, *Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 Degrees C.*
(3) The material is reported as complying with the pass/fail criteria of ASTM E136 when tested in accordance with the test method and procedure in ASTM E2652, *Standard Test Method for Behavior of Materials in a Tube Furnace with a Cone-shaped Airflow Stabilizer, at 750 Degrees C.*

[**5000:**7.1.4.1.1]

4.8.1.2 Where the term *limited-combustible* is used in this [standard], it shall also include the term *noncombustible.* [**5000:**7.1.4.1.2]

4.8.2 Limited-Combustible Material. A material shall be considered a limited-combustible material where both of the conditions of 4.8.2.1, and 4.8 2.2, and the conditions of either 4.8.2.3 or 4.8.2.4 are met. [**5000:**7.1.4.2]

4.8.2.1 The material does not comply with the requirements for a noncombustible material, in accordance with 4.8.1.1. [**5000:**7.1.4.2(1)]

4.8.2.2 The material, in the form in which it is used, exhibits a potential heat value not exceeding 3500 Btu/lb (8141 kJ/kg), when tested in accordance with NFPA 259. [**5000:**7.1.4.2(2)]

4.8.2.3 The material shall have a structural base of a noncombustible material with a surfacing not exceeding a thickness of ⅛ in. (3.2 mm) where the surfacing exhibits a flame spread index not greater than 50 when tested in accordance with ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or ANSI/UL 723, *Standard for Test for Surface Burning Characteristics of Building Materials.* [**5000:**7.1.4.2.1]

4.8.2.4 The material shall be composed of materials that, in the form and thickness used, neither exhibit a flame spread index greater than 25 nor evidence of continued progressive combustion when tested in accordance with ASTM E84 or ANSI/UL 723 and are of such composition that all surfaces that would be exposed by cutting through the material on any plane would neither exhibit a flame spread index greater than 25 nor exhibit evidence of continued progressive combustion when tested in accordance with ASTM E84 or ANSI/UL 723. [**5000:**7.1.4.2.2]

4.8.2.5 Where the term *limited-combustible* is used in this [standard], it shall also include the term *noncombustible.* [**5000:**7.1.4.2.3]

▲ Chapter 5 Hoods

5.1 Construction.

5.1.1 The hood or that portion of a primary collection means designed for collecting cooking vapors and residues shall be constructed of and be supported by steel not less than 1.21 mm (0.048 in.) (No. 18 MSG) in thickness, stainless steel not less than 0.91 mm (0.036 in.) (No. 20 MSG) in thickness, or other approved material of equivalent strength and fire and corrosion resistance.

▲ **5.1.2** All seams, joints, and penetrations of the hood enclosure that direct and capture grease-laden vapors and exhaust gases shall have a liquidtight continuous external weld to the hood's lower outermost perimeter.

▲ **5.1.3** Seams, joints, and penetrations of the hood shall be permitted to be internally welded, provided that the weld is formed smooth or ground smooth, so as to not trap grease, and is cleanable.

▲ **5.1.4*** Internal hood joints, seams, filter support frames, and appurtenances attached inside the hood shall be sealed or otherwise made greasetight.

▲ **5.1.5** Penetrations shall be permitted to be sealed by devices that are listed for such use and whose presence does not detract from the hood's or duct's structural integrity.

5.1.6 Listed exhaust hoods with or without exhaust dampers shall be permitted to be constructed of materials required by the listing.

▲ **5.1.7** Listed exhaust hoods with or without exhaust dampers shall be permitted to be assembled in accordance with the listing requirements.

▲ **5.1.8 Eyebrow-Type Hoods.**

5.1.8.1 Eyebrow-type hoods over gas or electric ovens shall be permitted to have a duct constructed as required in Chapter 7 from the oven flue(s) connected to the hood canopy upstream of the exhaust plenum, as shown in Figure 5.1.8.1.

5.1.8.2 The duct connecting the oven flue(s) to the hood canopy shall be connected with a continuous weld or have a duct-to-duct connection. *[See Figure 8.1.3.2(b) through Figure 8.1.3.2(d).]*

5.1.9 Insulation materials other than electrical insulation shall have a flame spread index of 25 or less, when tested in accordance with ASTM E84 or ANSI/UL 723.

5.1.10 Adhesives or cements used in the installation of insulating materials shall comply with the requirements of 5.1.9 when tested with the specific insulating material.

5.1.11 Penetrations shall be sealed with listed devices in accordance with the requirements of 5.1.12.

▲ **5.1.12** Devices that require penetration of the hood, such as pipe and conduit penetration fittings and fasteners, shall be listed in accordance with ANSI/UL 1978.

5.1.13 Wall-mounted exhaust hood assemblies shall be tight fitting against the back wall so as to not permit passage of grease vapor behind the hood or between the back wall and the hood assembly.

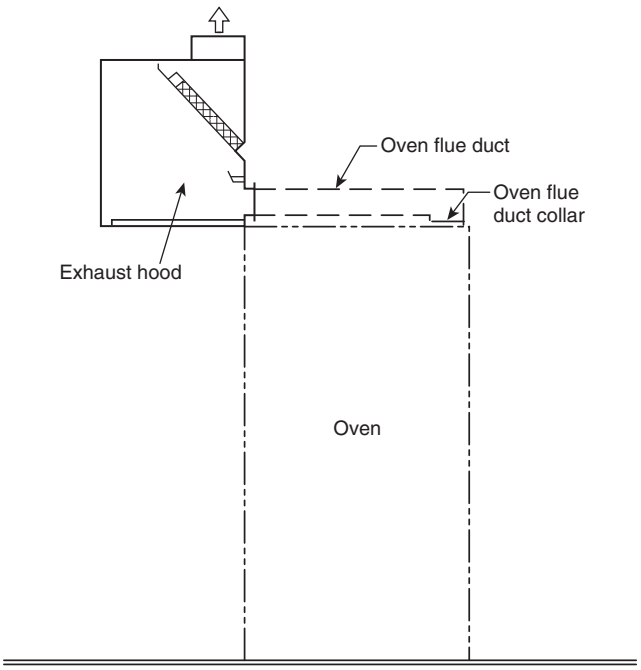


FIGURE 5.1.8.1 Typical Section of Eyebrow-Type Hood.

▲ **5.2 Hood Size.** Hoods shall be sized and configured to provide for the capture and removal of grease-laden vapors. *(See 8.2.2.)*

▲ **5.3 Exhaust Hood Assemblies with Integrated Supply Air Plenums.**

5.3.1 The construction and size of exhaust hood assemblies with integrated supply air plenums shall comply with the requirements of Sections 5.1 and 5.2.

5.3.2 The construction of the outer shell or the inner exhaust shell shall comply with Section 5.1.

5.3.3 Where the outer shell is welded, the inner shell shall be of greasetight construction.

5.3.4* Fire Dampers.

▲ **5.3.4.1** A fire-actuated damper shall be installed in the supply air plenum at each point where a supply air duct inlet or a supply air outlet penetrates the continuously welded shell of the assembly.

5.3.4.2 The fire damper shall be listed for such use or be part of a listed exhaust hood with or without exhaust damper.

▲ **5.3.4.3** The actuation device shall have a maximum temperature rating of 141°C (286°F).

5.3.4.4 Supply air plenums that discharge air from the face rather than from the bottom or into the exhaust hood and that are isolated from the exhaust hood by the continuously welded shell extending to the lower outermost perimeter of the entire hood assembly shall not require a fire-actuated damper. *(See diagram A in Figure A.5.3.4.)*

5.4* Listed Hood Assemblies.

5.4.1 Listed hood assemblies shall be installed in accordance with the terms of their listing and the manufacturer's instructions.

5.4.2 Listed hood assemblies shall be tested in accordance with UL 710 or equivalent.

5.5 Listed Ultraviolet Hoods. Listed ultraviolet hoods shall be installed and maintained in accordance with the terms of their listing and the manufacturer's instructions.

5.5.1 Duct systems connected to ultraviolet hoods shall comply with Chapter 7.

▲ **5.5.2** Ultraviolet hoods shall be tested and listed in accordance with UL 710 and UL 710C.

5.6 Listed Ventilated Ceiling Technology. Listed ventilated ceiling technology shall be installed and maintained in accordance with the terms of its listing and the manufacturer's instructions.

▲ Chapter 6 Grease Removal Devices in Hoods

6.1 Grease Removal Devices.

6.1.1 Listed grease filters or other listed grease removal devices intended for use with commercial cooking operations shall be provided.

▲ **6.1.2** Listed grease filters and grease removal devices that are removable but not an integral component of a specific listed exhaust hood shall be listed in accordance with ANSI/UL 1046 and shall be designated on the filter.

▲ **6.1.3** Mesh filters shall not be used unless evalua ed as an integral part of a listed exhaust hood or listed in conjunction with a primary filter in accordance with ANSI/UL 1046.

6.2 Installation.

6.2.1 Separation Distance.

▲ **6.2.1.1** The distance between the grease removal device and the cooking surface shall be as great as possible but not less than 457 mm (18 in.).

▲ **6.2.1.2** Where grease removal devices are used in conjunction with solid fuel or solid fuel-type broilers, including gas or electrically heated charbroilers, a minimum vertical distance of 1.22 m (4 ft) shall be maintained between the lower edge of the grease removal device and the cooking surface.

6.2.1.3 For cooking equipment without exposed flame and where flue gases bypass grease removal devices, the minimum vertical distance shall be permitted to be reduced to not less than 152 mm (6 in.).

6.2.1.4 Where a grease removal device is listed for separation distances less than those required in 6.2.1.1 and 6.2.1.2, the listing requirements shall be permitted.

6.2.1.5 Grease removal devices supplied as part of listed hood assemblies shall be installed in accordance with the terms of the listing and the manufacturer's instructions.

6.2.2 Grease Removal Device Protection.

6.2.2.1* Where the distance between the grease removal device and the appliance flue outlet (heat source) is less than 457 mm (18 in.), grease removal devices shall be protected from combustion gas outlets and from direct flame impingement occurring during normal operation of cooking appliances producing high flue gas temperatures.

▲ **6.2.2.2*** This protection shall be permitted to be accomplished by the installation of a steel or stainless steel baffle plate between the heat source and the grease removal device.

6.2.2.3 The baffle plate shall be sized and located so that flames or combustion gases travel a distance not less than 457 mm (18 in.) from the heat source to the grease removal device.

6.2.2.4 The baffle shall be located not less than 152 mm (6 in.) from the grease removal device.

6.2.3 Grease Filters.

6.2.3.1 Grease filters shall be listed.

▲ **6.2.3.2** Grease filters shall be constructed of noncombustible material.

6.2.3.3 Grease filters shall be of rigid construction that will not distort or crush under normal operation, handling, and cleaning conditions.

6.2.3.4 Grease filters shall be arranged so that all exhaust air passes through the grease filters.

▲ **6.2.3.5** Grease filters shall be easily accessible for removal.

6.2.3.6 Grease filters shall be installed at an angle not less than 45 degrees from the horizontal

6.2.4 Grease Drip Trays.

6.2.4.1 Grease filters shall be equipped with a grease drip tray beneath their lower edges.

6.2.4.2 Grease drip trays shall be kept to the minimum size needed to collect grease.

▲ **6.2.4.3** Grease drip trays shall be pitched to drain into an enclosed metal container having a capacity not exceeding 3.8 L (1 gal).

▲ **6.2.5 Grease Filter Orientation.** Grease filters that require a specific orientation to drain grease shall be clearly so designated on the face of the filter as to be visible with the filter installed, or the hood or filter shall be constructed so that filters cannot be installed in the wrong orientation.

▲ Chapter 7 Exhaust Duct Systems

7.1 General.

▲ **7.1.1** Ducts shall not pass through fire walls.

▲ **7.1.2*** All ducts shall lead directly to the exterior of the building, so as not to unduly increase any fire hazard.

▲ **7.1.3** Duct systems shall not be interconnected with any other building ventilation or exhaust system.

▲ **7.1.4** All ducts shall be installed with a minimum 2 percent slope on horizontal runs up to 22.86 m (75 ft) and a minimum 8 percent slope on horizontal runs greater than 22.86 m (75 ft).

7.1.4.1 Factory-built grease ducts shall be permitted to be installed at a lesser slope in accordance with the listing and the manufacturer's instructions.

7.1.4.2 All horizontal ducts shall be provided with access in accordance with 7.4.1.

7.1.4.3* Drains shall be provided at low points in horizontal ducts.

7.1.4.3.1 Where provided, drains shall be continuously welded to the exhaust duct in accordance with the terms of the listing and the manufacturer's installation manual.

▲ **7.1.4.4** All ducts shall be installed without forming dips or traps.

7.1.4.5 In manifold (common duct) systems, the lowest end of the main duct shall be connected flush on the bottom with the branch duct.

▲ **7.1.4.6** Exhaust ducts used in downdraft appliance ventilation systems shall be allowed to include an upturn in the duct provided the trapped area contains a low point drain to an approved grease reservoir not exceeding 3.8 L (1 gal) in capacity and the entire length of the duct is easily accessible for cleaning.

7.1.5 Openings required for accessibility shall comply with Section 7.3.

▲ **7.1.6** A sign stating the following shall be placed on all access panels:

ACCESS PANEL — DO NOT OBSTRUCT

▲ **7 1 7** Listed grease ducts shall be installed in accordance with the terms of the listing and the manufacturer's instructions.

7.2 Clearance. Clearance between ducts and combustible materials shall be provided in accordance with the requirements of Section 4.2.

▲ **7.2.1** Where single-wall ductwork penetrates a non-fire-rated roof assembly, the penetration point shall be of limited-combustible or noncombustible construction unless a field-applied grease duct enclosure is installed to the top of the roof curb or the clearances of Section 4.2 are maintained.

▲ **7.3 Openings.**

▲ **7.3.1** Openings shall be provided at the sides or at the top of the duct, whichever is more accessible, and at changes of direction.

▲ **7.3.2** Openings shall be protected by approved access constructed and installed in accordance with the requirements of 7.4.4.

▲ **7.3.3** Openings shall not be required in portions of the duct that are accessible from the duct entry or discharge.

▲ **7.3.4** For hoods with dampers in the exhaust or supply collar, an access panel for cleaning and inspection shall be provided in the duct or the hood within 457 mm (18 in.) of the damper.

7.3.5 For common exhaust duct systems, access panel openings shall be provided for installation and servicing of the fire-extinguishing system.

7.3.6 Access panel openings shall not be required in portions of the common exhaust duct or branch duct that are accessible from the branch duct connection to the exhaust hood.

▲ **7.3.7** Exhaust fans with ductwork connected to both sides shall have access for cleaning and inspection within 0.92 m (3 ft) of each side of the fan.

7.3.8 Wall-mounted exhaust fans shall have access for cleaning and inspection within 0.92 m (3 ft) of the exhaust fan.

7.4 Openings in Ducts. All openings shall comply with the requirements of this section.

7.4.1 Horizontal Ducts.

▲ **7.4.1.1** On horizontal ducts, at least one 508 mm × 508 mm (20 in. × 20 in.) opening shall be provided for personnel entry.

▲ **7.4.1.2** Where an opening of the size specified in 7.4.1.1 is not possible, openings large enough to permit thorough cleaning shall be provided at 3.7 m (12 ft) intervals.

7.4.1.3 If not easily accessible from a 3 m (10 ft) stepladder, openings on horizontal grease duct systems shall be provided with safe access and a work platform.

▲ **7.4.1.4** Support systems for horizontal grease duct systems 609 mm (24 in.) and larger in any cross-sectional dimension shall be designed for the weight of the ductwork plus 363 kg (800 lb) at any point in the duct systems.

▲ **7.4.1.5** On nonlisted ductwork, the edge of the opening shall be not less than 38.1 mm (1½ in.) from all outside edges of the duct or welded seams.

7.4.2 Vertical Ducts.

▲ **7 4.2.1** On vertical ductwork where personnel en ry is possible, access shall be provided at the top of the vertical riser to accommodate descent.

▲ **7.4.2.2** Where personnel entry is not possible, adequate access for cleaning shall be provided on each floor.

7.4.2.3 If not easily accessible from the floor or a 3 m (10 ft) stepladder, openings on vertical grease ducts shall be provided with safe access and a work platform.

▲ **7.4.2.4** On nonlisted ductwork, the edge of the opening shall be not less than 38.1 mm (1½ in.) from all outside edges of the duct or welded seams.

7.4.3 Access Panels.

▲ **7.4.3.1** Access panels shall be of the same material and thickness as the duct.

7.4.3.2 Access panels shall have a gasket or sealant that is rated for 815.6°C (1500°F) and shall be greasetight.

7.4.3.3 Fasteners, such as bolts, weld studs, latches, or wing nuts, used to secure the access panels shall be carbon steel or stainless steel and shall not penetrate duct walls.

▲ **7.4.3.4** Listed grease duct access door assemblies (access panels) shall be installed in accordance with the terms of the listing and the manufacturer's instructions.

7.4.4 Protection of Openings.

7.4.4.1 Openings for installation, servicing, and inspection of listed fire protection system devices and for duct cleaning shall be provided in ducts and enclosures and shall conform to the requirements of Section 7.3 and 7.7.4.

7.4.4.2 Enclosure openings required to reach access panels in the ductwork shall be large enough for removal of the access panel through the enclosure opening.

7.5 Other Grease Ducts. Other grease ducts shall comply with the requirements of this section.

7.5.1* Materials.

▲ **7.5.1.1** Ducts shall be constructed of and supported by carbon steel not less than 1.52 mm (0.060 in.) (No. 16 MSG) in thickness or stainless steel not less than 1.21 mm (0.048 in.) (No. 18 MSG) in thickness.

7.5.1.2 Factory-built grease ducts listed in accordance with ANSI/UL 1978 shall be permitted to use materials in accordance with their listing.

7.5.2 Installation.

7.5.2.1 All seams, joints, penetrations, and duct-to-hood collar connections shall have a liquidtight continuous external weld.

7.5.2.1.1 Factory-built grease ducts listed in accordance with ANSI/UL 1978 shall be permitted to incorporate nonwelded joint construction in accordance with their listings.

▲ **7.5.2.1.2*** Prior to the use of or concealment of any portion of a grease duct system, a leakage test shall be performed to determine that all welded joints and seams are liquidtight.

▲ **7.5.2.2** Duct-to-hood collar connections as shown in Figure 7.5.2.2 shall not require a liquidtight continuous external weld.

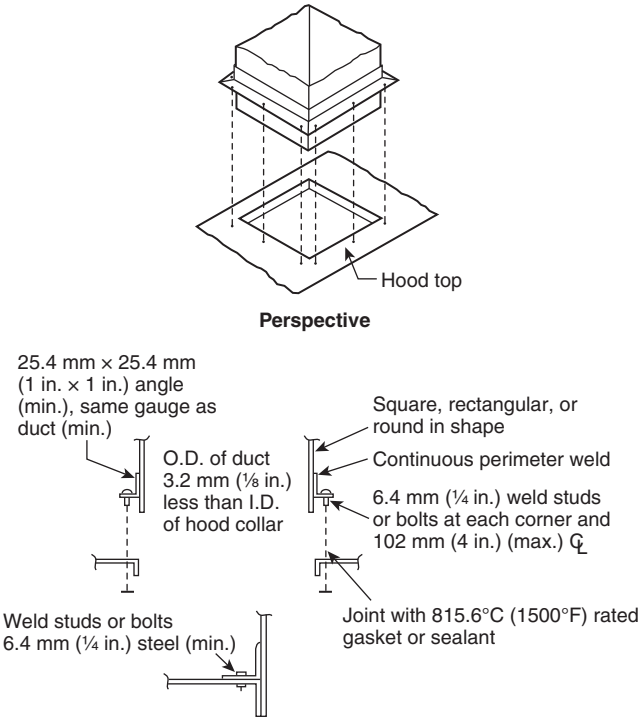


FIGURE 7.5.2.2 Permitted Duct-to-Hood Collar Connection.

▲ **7.5.2.3** Penetrations shall be permitted to be sealed by other listed devices that are tested to be greasetight and are evaluated under the same conditions of fire severity as the hood or enclosure of listed grease extractors and whose presence does not detract from the hood's or duct's structural integrity.

▲ **7.5.2.4** Internal welding shall be permitted, provided the joint is formed or ground smooth and is readily accessible for inspection.

▲ **7.5.3** Penetrations shall be sealed with listed devices in accordance with the requirements of 7.5.4.

7.5.4 Devices that require penetration of the ductwork, such as pipe and conduit penetration fittings and fasteners, shall be listed in accordance with ANSI/UL 1978.

7.5.5 Welded Duct Connections.

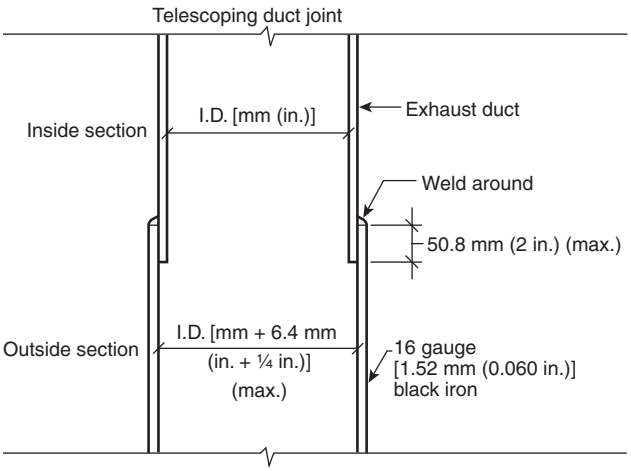
7.5.5.1 Acceptable duct-to-duct connection shall be as follows:

(1) Telescoping joint, as shown in Figure 7.5.5.1(a)
(2) Bell-type joint, as shown in Figure 7.5.5.1(b)
(3) Flange with edge weld, as shown in Figure 7.5.5.1(c)
(4) Flange with filled weld, as shown in Figure 7.5.5.1(d)

▲ **7.5.5.2** Butt-welded connections shall not be permitted.

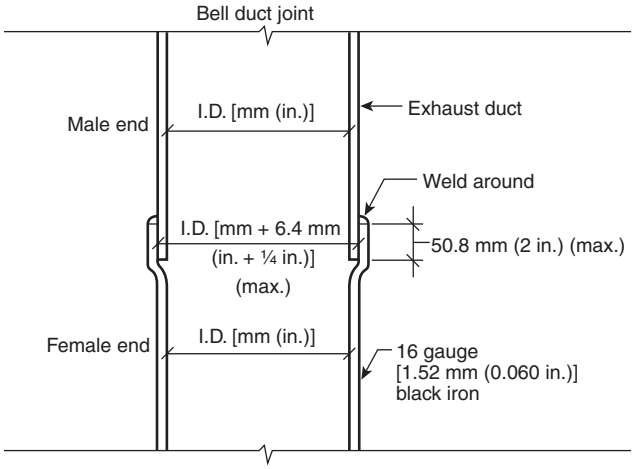
▲ **7.5.5.3** For telescoping and bell-type connections, the inside duct section shall always be uphill of the outside duct section.

7.5.5.4 For telescoping and bell-type connections, the difference between the inside dimensions of overlapping sections shall not exceed 6.4 mm (¼ in.).



Notes:
1. Duct size decreases (going upward) with each telescope.
2. Smaller (inside) duct section is always above or uphill (on sloped duct), to be self-draining into larger (outside) duct.

FIGURE 7.5.5.1(a) Telescoping-Type Duct Connection.



Notes:
1. Duct size stays the same throughout the duct system.
2. Smaller (inside) male duct end is always above or uphill (on sloped duct), to be self-draining into larger (outside) female duct end.

FIGURE 7.5.5.1(b) Bell-Type Duct Connection.

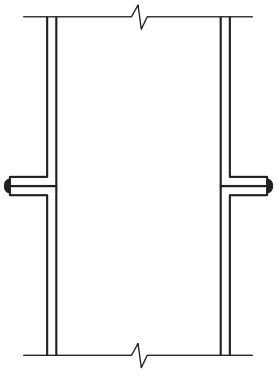


FIGURE 7.5.5.1(c) Flange with Edge Weld.

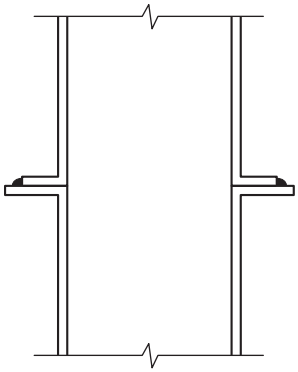


FIGURE 7.5.5.1(d) Flange with Filled Weld.

7.5.5.5 For telescoping and bell-type connections, the overlap shall not exceed 50.8 mm (2 in.).

▲ **7.6 Exterior Installations.**

7.6.1 The exterior portion of the ductwork shall be vertical wherever possible and shall be installed and supported on the exterior of a building.

7.6.2 Bolts, screws, rivets, and other mechanical fasteners shall not penetrate duct walls.

▲ **7.6.3** Clearance of ducts shall comply with Section 4.2.

7.6.4 All ducts shall be protected on the exterior by paint or other suitable weather-protective coating.

7.6.5 Ducts constructed of stainless steel shall not be required to have additional paint or weather-protective coatings.

7.6.6 Ductwork subject to corrosion shall have minimal contact with the building surface.

7.7 Interior Installations.

7.7.1 Duct Enclosures.

▲ **7.7.1.1** In all buildings where vertical fire barriers are penetrated, the ducts shall be enclosed in a continuous enclosure extending from the first penetrated fire barrier and any subsequent fire barriers or concealed spaces to or through the exterior, to maintain the fire resistance rating of the highest fire barrier penetrated.

7.7.1.2 In all buildings more than one story in height and in one-story buildings where the roof-ceiling assembly is required to have a fire resistance rating, the ducts shall be enclosed in a continuous enclosure extending from the lowest fire-rated ceiling or floor above the hood, through any concealed spaces, to or through the roof, to maintain the integrity of the fire separations required by the applicable building code provisions.

7.7.1.3 The enclosure shall be sealed around the duct at the point of penetration of the first fire-rated barrier after the hood, to maintain the fire resistance rating of the enclosure.

▲ **7.7.1.4** The enclosure shall be vented to the exterior of the building through weather-protected openings.

7.7.1.5 The continuous enclosure provisions shall not be required where a field-applied grease duct enclosure or a factory-built grease duct enclosure *(see Section 4.3)* is protected with a listed duct-through-penetration protection system equivalent to the fire resistance rating of the assembly being penetrated and where the materials are installed in accordance with the conditions of the listing and the manufacturer's instructions and are acceptable to the authority having jurisdiction.

7.7.2 Enclosure Fire Resistance Rating and Enclosure Clearance.

7.7.2.1 Fire Resistance Rating.

7.7.2.1.1 Buildings less than four stories in height shall have an enclosure with a fire resistance rating of not less than 1 hour.

7.7.2.1.2 Buildings four stories or more in height shall have an enclosure with a fire resistance rating of not less than 2 hours.

7.7.2.2* Enclosure Clearance.

7.7.2.2.1 Clearance from the duct or the exhaust fan to the interior surface of enclosures of combustible construction shall be not less than 457 mm (18 in.).

7.7.2.2.2 Clearance from the duct to the interior surface of enclosures of noncombustible or limited-combustible construction shall be not less than 152 mm (6 in.).

▲ **7.7.2.2.3** Provisions for reducing clearances as described in Section 4.2 shall not be applicable to enclosures.

7.7.2.2.4 Clearance from the outer surfaces of field-applied grease duct enclosures and factory-built grease duct enclosures to the interior surfaces of construction installed around them shall be permitted to be reduced where the field-applied grease duct enclosure materials and factory-built grease duct enclosures are installed in accordance with the conditions of the listing and the manufacturer's instructions and are acceptable to the authority having jurisdiction.

7.7.2.2.5 Field-applied grease duct enclosures and factory-built grease duct enclosures shall provide mechanical and structural integrity, resiliency, and stability when subjected to expected building environmental conditions, duct movement under general operating conditions, and duct movement as a result of interior and exterior fire conditions.

7.7.3 Protection of Coverings and Enclosure Materials.

▲ **7.7.3.1** Measures shall be taken to prevent physical damage to any covering or enclosure material.

7.7.3.2 Any damage to the covering or enclosure shall be repaired, and the covering or enclosure shall be restored to meet its intended listing and fire resistance rating and to be acceptable to he authority having jurisdiction.

7.7.3.3 In the event of a fire within a kitchen exhaust system, the duct, the enclosure, and the covering directly applied to the duct shall be inspected by qualified personnel to determine whether the duct, the enclosure, and the covering directly applied to the duct are structurally sound, capable of maintaining their fire protection functions, suitable for continued operation, and acceptable to the authority having jurisdiction.

7.7.3.4 Listed grease ducts shall be installed in accordance with the terms of the listing and the manufacturer's instructions.

7.7.4 Enclosure Openings.

7.7.4.1 Where openings in the enclosure walls are provided, they shall be protected by listed fire doors of proper rating.

7.7.4.2 Fire doors shall be installed in accordance with NFPA 80.

7.7.4.3 Openings on other listed materials or products shall be clearly identified and labeled according to the terms of the listing and the manufacturer's instructions and shall be acceptable to the authority having jurisdiction.

7.7.4.3.1 The markings specified in 7.7.4.3 shall be visible on the exterior of the enclosure and shall state the following:

ACCESS PANEL —
DO NOT OBSTRUCT

▲ **7.7.4.4** The fire door shall be readily accessible, aligned, and of sufficient size to allow access to the rated access panels on the ductwork.

7.7.5 Ducts with Enclosure(s).

7.7.5.1 Each duct system shall constitute an individual system serving only exhaust hoods in one fire zone on one floor.

▲ **7.7.5.2** Multiple ducts shall not be permitted in a single enclosure unless acceptable to the authority having jurisdiction.

7.8* Termination of Exhaust System.

▲ **7.8.1** The exhaust system shall terminate as follows:

(1)* Outside the building with a fan or duct
(2) Through the roof or to the roof from outside, as in 7.8.2, or through a wall, as in 7.8.3

7.8.2 Rooftop Terminations.

7.8.2.1 Rooftop terminations shall be arranged with or provided with the following:

▲ (1) A minimum of 3 m (10 ft) of horizontal clearance from the outlet to adjacent buildings, property lines, and air intakes
▲ (2) A minimum of 1.5 m (5 ft) of horizontal clearance from the outlet (fan housing) to any combustible structure
(3) A vertical separation of 0.92 m (3 ft) above any air intakes within 3 m (10 ft) of the exhaust outlet
▲ (4) The ability to drain grease out of any traps or low points formed in the fan or duct near the termination of the system into a collection container that is noncombustible, closed, rainproof, and structurally sound for the service to which it is applied and that will not sustain combustion
(5) A grease collection device that is applied to exhaust systems that does not inhibit the performance of any fan
(6) Listed grease collection systems that meet the requirements of 7.8.2.1(4) and 7.8.2.1(5)
(7) A listed grease duct complying with Section 4.4 or ductwork complying with Section 4.5
▲ (8) A hinged upblast fan supplied with flexible weatherproof electrical cable and service hold-open retainer to permit inspection and cleaning that is listed for commercial cooking equipment with the following conditions:
  (a) Where the fan attaches to the ductwork, the ductwork is a minimum of 0.46 m (18 in.) away from any roof surface, as shown in Figure 7.8.2.1.
  (b) The fan discharges a minimum of 1.02 m (40 in.) away from any roof surface, as shown in Figure 7.8.2.1.
(9) Other approved fan, provided it meets all of the following criteria:
  (a) The fan meets the requirements of 7.8.2.1(3) and 8.1.4.
  (b) Its discharge or its extended duct discharge meets the requirements of 7.8.2.1(2). *(See 8.1.4.)*
  (c) Exhaust fan discharge is directed up and away from the roof surface.

▲ **7.8.2.2*** Fans shall be provided with safe access and a work surface for inspection and cleaning.

7.8.3 Wall Terminations. Wall terminations shall be arranged with or provided with the following properties:

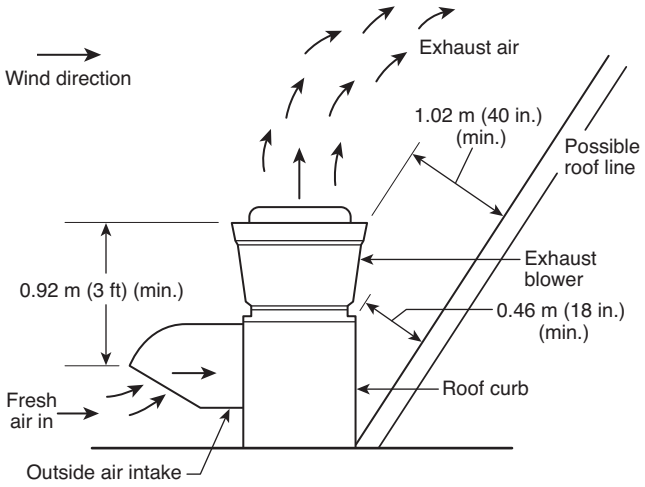


FIGURE 7.8.2.1 Upblast Fan Clearances.

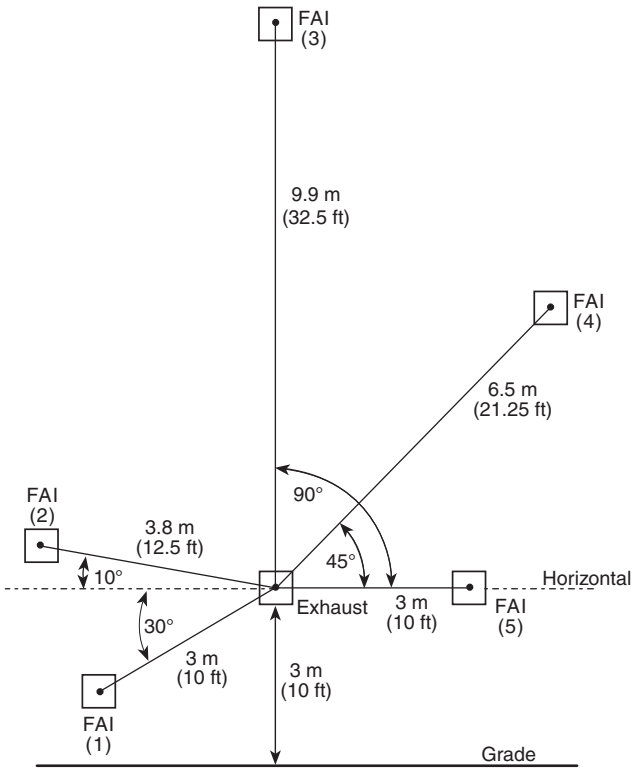
▲ (1) The termination shall be through a noncombustible wall with a minimum of 3 m (10 ft) of clearance from the outlet to adjacent buildings, property lines, grade level, combustible construction, electrical equipment or lines, and with the closest point of any air intake or operable door or window at or below the plane of the exhaust termination.
(2) The closest point of any air intake or operable door or window above the plane of the exhaust termination shall be a minimum of 3 m (10 ft) in distance, plus 76 mm (3 in.) for each 1 degree from horizontal, the angle of degree being measured from the center of the exhaust termination to the center of the air intake or operable door or window, as indicated in Figure 7.8.3.
▲ (3) A wall termination in a secured area shall be permitted to be at a lower height above grade if acceptable to the authority having jurisdiction.
(4) The exhaust flow shall be directed perpendicularly outward from the wall face or upward.
▲ (5) All the ductwork shall be pitched to drain the grease back into the hood(s) or with a drain provided to bring the grease back into a container within the building or into a remote grease trap.
(6) A listed grease duct shall comply with Section 7.4; other ducts shall comply with Section 7.5.
(7) An approved fan shall meet the requirements of 7.8.3(5) and of 8.1.2 or 8.1.4.

7.8.4* Rooftop Terminations Through Combustible or Limited-Combustible Walls.

7.8.4.1 Ductwork that exits a building through a combustible or limited-combustible wall to terminate above the roof line shall have wall protection provided in accordance with Section 4.2.

▲ **7.8.4.2** Where the ductwork exits the building, the opening shall be sealed and shall include a weather-protected vented opening.

▲ **7.8.4.3** Where the ductwork exits through a rated wall, the penetration shall be protected in accordance with 4.4.1.



Notes:
1. Fresh air intake (FAI) applies to any air intake, including an operable door or window.
2. Examples:
   (a) FAIs 1 and 5 are on the same plane of exhaust fan or lower: 3 m (10 f) min. between closest edges.
   (b) FAIs 2, 3, and 4 are above the plane of exhaust fan: 3 m + 76 mm (10 ft + 0.25 ft) per degree between closest edges.

FIGURE 7.8.3 Exhaust Termination Distance from Fresh Air Intake (FAI) or Operable Door or Window.

Chapter 8 Air Movement

8.1 Exhaust Fans for Commercial Cooking Operations.

▲ **8.1.1** Fans used in exhaust systems for commercial cooking shall be listed in accordance with UL 762.

8.1.2* Upblast Exhaust Fans.

▲ **8.1.2.1** Upblast fans with motors surrounded by the airstream shall be hinged and supplied with flexible weatherproof electrical cable and service hold-open retainers.

8.1.2.2 Installation shall conform to the requirements of Section 7.8.

▲ **8.1.2.3** Upblast fans shall have a drain directed to a readily accessible and visible grease receptacle not to exceed 3.8 L (1 gal).

8.1.3* In-Line Exhaust Fans.

▲ **8.1.3.1** In-line fans shall be of the type with the motor located outside the airstream and with belts and pulleys protected from the airstream by a greasetight housing.

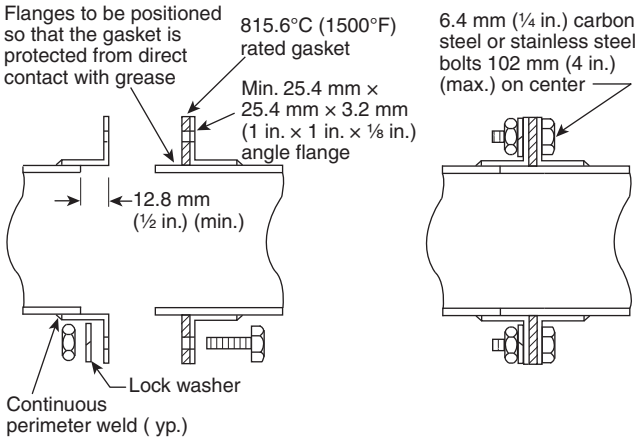
8.1.3.2 In-line fans shall be connected to the exhaust duct by flanges securely bolted as shown in Figure 8.1.3.2(a) through Figure 8.1.3.2(d) or by a system specifically listed for such use.

8.1.3.3 Flexible connectors shall not be used.

8.1.3.4 If the design or positioning of the fan allows grease to be trapped, a drain directed to a readily accessible and visible grease receptacle not exceeding 3.8 L (1 gal) shall be provided.

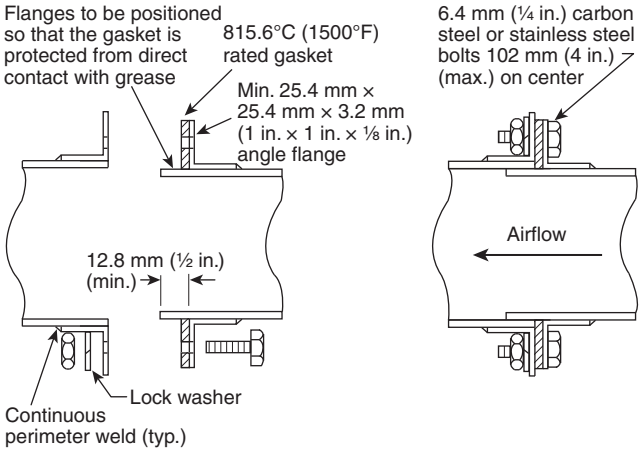
▲ **8.1.3.5** In-line exhaust fans shall be located in easily accessible areas of adequate size to allow for service or removal.

8.1.3.6 Where the duct system connected to the fan is in an enclosure, the space or room in which the exhaust fan is located shall have the same fire resistance rating as the enclosure.



(a) Unassembled Position **(b) Assembled Position**

FIGURE 8.1.3.2(a) Typical Section of Duct-to-Fan Connection — Butt Joint Method.



(a) Unassembled Position **(b) Assembled Position**

FIGURE 8.1.3.2(b) Typical Section of Duct-to-Fan Connection — Overlapping Method.

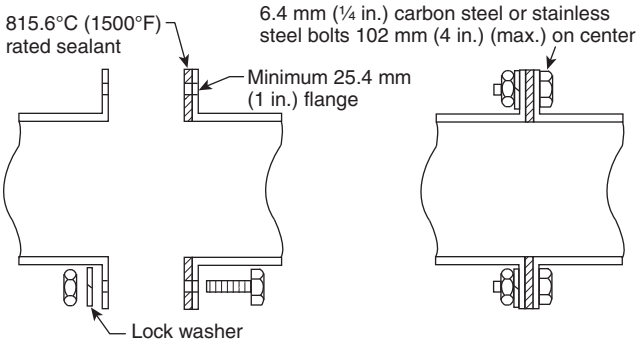


FIGURE 8.1.3.2(c) Typical Section of Duct-to-Fan Connection — Sealant Method.

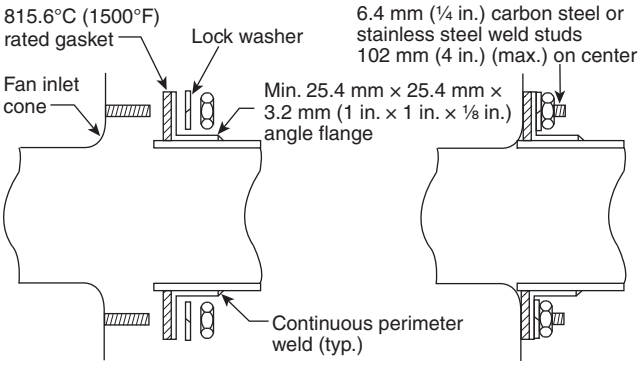


FIGURE 8.1.3.2(d) Typical Section of Duct-to-Fan Connection — Direct to Fan Inlet Cone Method.

8.1.4* Utility Set Exhaust Fans.

▲ **8.1.4.1** Utility set exhaust fans, if installed at the rooftop termination point, shall meet the requirements of 7.8.2.1(1) through 7.8.2.1(3) and 7.8.2.2.

8.1.4.2 Fans installed within the building shall be located in an accessible area of adequate size to allow for service or removal.

8.1.4.3 Where the duct system connected to the fan is in an enclosure, the space or room in which the exhaust fan is located shall have the same fire resistance rating as the enclosure.

8.1.4.4 The fan shall be connected to the exhaust duct by flanges securely bolted as shown in Figure 8.1.3.2(a) through Figure 8.1.3.2(d) or by a system specifically listed for such use.

8.1.4.5 Flexible connectors shall not be used.

8.1.4.6 Exhaust fans shall have a drain directed to a readily accessible and visible grease receptacle not to exceed 3.8 L (1 gal).

8.1.5 Exhaust Fan Housings. Exhaust fan housings shall be constructed of carbon steel not less than 1.52 mm (0.060 in.) (No. 16 MSG) in thickness, of stainless steel not less than 1.21 mm (0.048 in.) (No. 18 MSG) in thickness, or, if listed, in accordance with the terms of the listing.

8.1.6 Openings for Cleaning, Servicing, and Inspection.

8.1.6.1 Openings for cleaning, servicing, and inspection shall conform to the requirements of 7.3.7.

8.1.6.2 Clearances shall conform to the requirements of Section 4.2 or, if installed within an enclosure, to the requirements of 7.7.2.2.

8.1.6.3 Upblast Fans.

8.1.6.3.1 Upblast fans shall be supplied with an access opening of a minimum 76 mm by 127 mm (3 in. by 5 in.) or a circular diameter of 101 mm (4 in.) on the curvature of the outer fan housing to allow for cleaning and inspection of the fan blades.

▲ **8.1.6.3.2** On existing upblast fans where sufficient access is not available to allow for the removal of grease contamination, an approved hinge mechanism or access panel shall be installed.

8.1.7 Wiring and Electrical Equipment. All wiring and electrical equipment shall comply with *NFPA 70 (see also Chapter 9)*.

8.2 Airflow.

8.2.1 Air Velocity.

▲ **8.2.1.1*** The air velocity through any duct shall be not less than 152.4 m/min (500 ft/min).

8.2.1.2 Transition duct sections that do not exceed 0.92 m (3 ft) in length and do not contain grease traps shall be permitted to be connected to hoods and exhaust fans that do not meet this velocity.

8 2.2 Air Volume.

▲ **8.2.2.1** Exhaust air volumes for hoods shall be of a sufficient level to provide for capture and removal of grease-laden cooking vapors.

8.2.2.2* Test data, performance tests acceptable to the authority having jurisdiction, or both shall be displayed, provided on request, or both.

▲ **8.2.2.3** Lower exhaust air volumes shall be permitted during no-load cooking conditions, provided they are sufficient to capture and remove flue gases and residual vapors from cooking equipment.

8.2.3 Exhaust Fan Operation.

▲ **8.2.3.1** A hood exhaust fan(s) shall continue to operate after the extinguishing system has been activated unless fan shutdown is required by a listed component of the ventilation system or by the design of the extinguishing system.

▲ **8.2.3.2** The hood exhaust fan shall start upon activation of the extinguishing system if the exhaust fan and all cooking equipment served by the fan have been shut down, unless fan shutdown is required by a listed component of the ventilation system or by the listing of the extinguishing system.

▲ **8.2.3.3** The exhaust fan shall be provided with a means so that the fan is activated when any heat-producing cooking appliance under the hood is turned on.

8.3* Replacement Air.

▲ **8.3.1** Replacement air quantity shall be adequate to prevent negative pressures in the commercial cooking area(s) from exceeding 4.98 Pa (0.02 in. water column).

▲ **8.3.2** When the fire-extinguishing system activates, makeup air supplied internally to a hood shall be shut off.

8.4 Common Duct (Manifold) Systems.

▲ **8.4.1*** Master kitchen exhaust ducts that serve multiple tenants shall include provision to bleed air from outdoors or from adjacent spaces into the master exhaust duct where required to maintain the necessary minimum air velocity in the master exhaust duct.

8.4.2 Bleed air ducts shall connect to the top or side of the master exhaust duct.

8.4.3 The bleed air duct shall have a fire damper at least 304.8 mm (12 in.) from the exhaust duct connection.

▲ **8.4.4** The bleed air duct shall have the same construction and clearance requirements as the main exhaust duct from the connection to the exhaust duct to at least 304.8 mm (12 in.) on both sides of the fire damper.

8.4.5 Each bleed air duct shall have a means of adjusting (e.g., by using volume dampers) the bleed air quantity.

8.4.6 Means to adjust the bleed air quantity shall be installed between the fire damper and the source of bleed air.

8.4.7 A bleed air duct shall not be used for the exhaust of grease-laden vapors and shall be so labeled.

8.4.8 Unused tenant exhaust connections to the master exhaust duct that are not used as bleed air connec ions shall be disconnected and sealed at the main duct.

Chapter 9 Auxiliary Equipment

9.1 Dampers.

9.1.1 Dampers shall not be installed in exhaust ducts or exhaust duct systems.

9.1.2 Where specifically listed for such use or where required as part of a listed device or system, dampers in exhaust ducts or exhaust duct systems shall be permitted.

9.2 Electrical Equipment.

9.2.1 Wiring systems of any type shall not be installed in ducts.

9.2.2 Motors, lights, and other electrical devices shall be permitted to be installed in ducts or hoods or to be located in the path of travel of exhaust products only where specifically listed for such use.

9.2.3 Lighting Units.

▲ **9.2.3.1** Lighting units in hoods shall be listed for use over commercial cooking appliances and installed in accordance with the terms of their listing.

9.2.3.2 Lighting units on hoods shall not be located in concealed spaces except as permitted by 9.2.3.3 and 9.2.3.4.

9.2.3.3 Lighting units shall be permitted in concealed spaces where such units are part of a listed exhaust hood.

9.2.3.4 Listed lighting units specifically listed for such use and installed in accordance with the terms of the listing shall be permitted to be installed in concealed spaces.

9.2.4* All electrical equipment shall be installed in accordance with *NFPA 70*.

▲ **9.3 Other Equipment.**

9.3.1 Fume incinerators, thermal recovery units, air pollution control devices, or other devices shall be permitted to be installed in ducts or hoods or to be located in the path of travel of exhaust products where specifically listed for such use.

9.3.1.1 Fume incinerators, thermal recovery units, air pollution control devices, and/or other devices installed in ducts or hoods shall comply with the following:

(1) The clearance requirements of Section 4.2.
(2) Hood construction requirements in Section 5.1.
(3) Exhaust duct construction complying with Chapter 7.
(4) Other equipment installed in a hood shall meet the simultaneous operation requirements in 10.3.1.
(5) Other equipment installed in a duct complying with 10.1.3.
(6) Access panels or doors complying with Chapter 7.
(7) In-line fans complying with 8.1.3.1.

9.3.1.2 Equipment listed for reduced clearances shall be listed in accordance with ANSI/UL 1978.

9.3.1.3 Equipment shall have space provided to all access panels or doors for the safe removal and servicing of control devices, such as filters, electrostatic precipitator cells, and odor control media beds, and for cleaning of the equipment housing.

▲ **9.3.2** Downgrading other parts of the exhaust system due to the installation of approved devices, whether listed or not, shall not be allowed.

9.3.3 Any equipment installed in the path of exhaust products that provides secondary filtration or air pollution control shall be provided with an approved automatic fire-extinguishing system, installed in accordance with the fire-extinguishing system manufacturer's instructions.

9.3.3.1 The fire-extinguishing system required by 9.3.3 shall provide protection for the component sections of the equipment, and ductwork downstream of the equipment.

9.3.3.2 Filter media used in secondary filtration or air pollution control units and not complying with 6.2.3 shall have fire protection that is adequate for the filter media being used in accordance with the fire-extinguishing system manufacturer's instructions.

9.3.4 If the equipment provides a source of ignition, it shall be provided with detection to operate the fire-extinguishing system protecting the equipment.

9.3.5 Where a cooking exhaust system employs an air pollution control device that recirculates air into the building, the requirements of Chapter 13 shall apply.

9.3.6 Equipment commissioning report(s) shall be provided for other equipment installed.

▲ *N* **9.3.7** If the heat source is non-electric and open flames are used, a carbon monoxide detector shall be installed in both the kitchen and dining areas.

Chapter 10 Fire-Extinguishing Equipment

10.1 General Requirements.

▲ **10.1.1** Fire-extinguishing equipment for the protection of grease removal devices, hood exhaust plenums, and exhaust duct systems shall be provided.

▲ **10.1.2*** Cooking equipment that produces grease-laden vapors and that might be a source of ignition of grease in the hood, grease removal device, or duct shall be protected by fire-extinguishing equipment.

10.1.3 Fume incinerators, thermal recovery units, air pollution control devices, or other devices installed in the exhaust duct, shall be protected by an automatic fire-extinguishing system.

10.2 Types of Equipment.

▲ **10.2.1** Fire-extinguishing equipment shall include both automatic fire-extinguishing systems as primary protection and portable fire extinguishers as secondary backup.

▲ **10.2.2*** A placard shall be conspicuously placed near each Class K extinguisher that states that the fire protection system shall be activated prior to using the fire extinguisher.

▲ **10.2.2.1** The language and wording for the placard shall be approved by the authority having jurisdiction.

▲ **10.2.3*** Automatic fire-extinguishing systems shall comply with ANSI/UL 300 or other equivalent standards and shall be installed in accordance with the requirements of the listing.

▲ **10.2.3.1*** In existing dry or wet chemical systems not in compliance with ANSI/UL 300, the fire-extinguishing system shall be made to comply with 10.2.3 when any of the following occurs:

(1) The cooking medium is changed from animal oils and fats to vegetable oils.
(2) The positioning of the cooking equipment is changed.
(3) Cooking equipment is replaced.
(4) The equipment is no longer supported by the manufacturer.

▲ **10.2.3.2*** All existing fire-extinguishing systems shall meet the requirements of 10.2.3.

10.2.4 Grease removal devices, hood exhaust plenums, exhaust ducts, and cooking equipment that are not addressed in ANSI/UL 300 or other equivalent test standards shall be protected with an automatic fire-extinguishing system(s) in accordance with the applicable NFPA standard(s), all local building and fire codes, and the fire-extinguishing system's manufacturer's recommendations and shall be approved by the authority having jurisdiction.

10.2.5 Automatic fire-extinguishing equipment provided as part of listed recirculating systems shall comply with ANSI/UL 710B.

▲ **10.2.6** Automatic fire-extinguishing systems shall be installed in accordance with the terms of their listing, the manufacturer's instructions, and the following standards where applicable:

(1) NFPA 12, *Standard on Carbon Dioxide Extinguishing Systems*
(2) NFPA 13, *Standard for the Installation of Sprinkler Systems*
(3) NFPA 17, *Standard for Dry Chemical Extinguishing Systems*
(4) NFPA 17A, *Standard for Wet Chemical Extinguishing Systems*
(5) NFPA 750, *Standard on Water Mist Fire Protection Systems*

▲ **10.2.7 Modifications to Existing Hood Systems.**

▲ **10.2.7.1** Any abandoned pipe or conduit from a previous installation shall be removed from within the hood, plenum, and exhaust duct.

▲ **10.2.7.2** Penetrations and holes resulting from the removal of conduit or piping shall be sealed with listed or equivalent liquidtight sealing devices.

▲ **10.2.7.3** The addition of obstructions to spray patterns from the cooking appliance nozzle(s) such as baffle plates, shelves, or any modification shall not be permitted.

10.2.7.4 Changes or modifications to the hazard after installation of the fire-extinguishing systems shall result in re-evaluation of the system design by a properly trained, qualified, and certified person(s).

▲ **10.2.8 Hoods with Water Wash.**

10.2.8.1 Areas requiring protection in accordance with 10.1.1 shall be permitted to be protected by a water-wash system that is listed as a fire-extinguishing system in compliance with ANSI/UL 300 or other equivalent standards and installed in accordance with the requirements of its listing.

10.2.8.2 Each such area not provided with a listed water-wash fire-extinguishing system shall be provided with a fire-extinguishing system listed for the purpose.

10.2.8.3 The water supply for water-wash fire-extinguishing systems shall be permitted to be supplied from the domestic water supply when the minimum water pressure and flow are provided in accordance with the terms of the listing.

▲ **10.2.8.4** The water supply for water-wash fire-extinguishing systems shall be contro led by a listed indica ing valve.

10.2.8.5 Where a separate fire-extinguishing system is used for protection of cooking equipment only, a water-wash fire-extinguishing system listed for protection of the grease removal device(s), hood exhaust plenum(s), exhaust duct(s), or combination thereof shall be provided with instructions and appropriate means for electrical interface for simultaneous activation.

10.2.8.6 A water-wash system approved to be used for protection of the grease removal device(s), hood exhaust plenum(s), exhaust duct(s), or combination thereof shall include instructions and appropriate electrical interface for simultaneous activation of the water-wash system from an automatic fire-extinguishing system, where the automatic fire-extinguishing system is used for cooking equipment protection only.

▲ **10.2.8.7** Where the automatic fire-extinguishing system in accordance with NFPA 17A provides protection for the hood and duct in a fixed baffle hood containing a water-wash system, the water-wash system shall be made inoperable or delayed for a minimum of 60 seconds upon operation of the automatic fire-extinguishing system.

10.2.8.8 Grease removal devices, hood exhaust plenums, and exhaust ducts on hoods with water wash shall be permitted to be protected by a sprinkler system with an individual control valve if the design of the hood prevents the water from reaching the cooking appliances.

10.2.9 Water-Based Fire-Extinguishing System.

10.2.9.1 The water required for listed automatic fire-extinguishing systems shall be permitted to be supplied from the domestic water supply where the minimum water pressure and flow are provided in accordance with the terms of the listing. The water supply shall be controlled by a supervised water supply control valve.

10.2.9.2 Where the water supply is from a dedicated fire protection water supply in a building with one or more fire sprinkler systems, separate indicating control valves and drains shall be provided and arranged so that the hood system and sprinkler systems can be controlled individually.

10.2.10 Water Valve Supervision. Valves controlling the water supply to listed water-wash fire-extinguishing systems, automatic fire-extinguishing systems, or both shall be listed indicating type of valve and shall be supervised open by one of the following methods:

(1) Central station, proprietary, or remote station alarm service
(2) Local alarm service that will cause the sounding of an audible signal at a constantly attended point
(3) Locking valves open
(4)* Sealing of valves and approved weekly recorded inspection

10.3 Simultaneous Operation.

▲ **10.3.1** Fixed pipe extinguishing systems in a single hazard area *(see 3.3.44 for the definition of single hazard area)* shall be arranged for simultaneous automatic operation upon actuation of any one of the systems.

▲ **10.3.1.1** Hoods installed end to end, back to back, or both or sharing a common ductwork, not exceeding 22.9 m (75 ft) in distance from the farthest hood, and having a grease-producing appliance(s) located under one or more of the hoods, shall be considered a single hazard area requiring simultaneous automatic fire protection in all hoods and ducts.

10.3.1.1.1 In hoods that are installed end to end, back to back, or both, and that share a common ductwork, the ductwork beyond 22.9 m (75 ft) from the farthest hood shall be protected by an independent fire-extinguishing system with its own detection system or by a fire-extinguishing system that activates simultaneously with the fire-extinguishing system(s) protecting the hoods.

10.3.1.2 Hoods installed end to end, back to back, or both that do not share a common exhaust duct and are separated by a wall(s) or other means to ensure that grease-laden vapors exhausted under one hood cannot propagate to the other hoods, the hoods' fire-extinguishing system(s) shall be independent and shall not be required to simultaneously discharge.

10.3.1.3 Fume incinerators, thermal recovery units, air pollution control devices, or other devices installed in the exhaust duct shall not be required to comply with 10.3.1.1.

▲ **10.3.2** Simultaneous operation shall not be required where the one fixed pipe extinguishing system is an automatic sprinkler system.

10.3.2.1 Where an automatic sprinkler system is used in conjunction with a water-based fire-extinguishing system served by the same water supply, hydraulic calculations shall consider both systems operating simultaneously.

10.3.3 Simultaneous operation shall be required where a dry or wet chemical system is used to protect common exhaust ductwork by one of the methods specified in NFPA 17 or NFPA 17A.

10.4 Fuel and Electric Power Shutoff.

▲ **10.4.1** Upon activation of any fire-extinguishing system for a cooking operation, all sources of fuel and electrical power that produce heat to all equipment requiring protection by that system shall automatically shut off.

▲ **10.4.2** Steam supplied from an external source shall not be required to automatically shut off.

▲ **10.4.3** Any gas appliance not requiring protection but located under ventilating equipment where protected appliances are located shall be automatically shut off upon activation of the extinguishing system.

▲ **10.4.4** Shutoff devices shall require manual reset.

N **10.4.5** Solid fuel cooking operations shall not be required to be shut down.

▲ **10.5 Manual Activation.**

10.5.1 All systems shall have both automatic and manual methods of actuation.

▲ **10.5.1.1** At least one manual actuation device shall be located in a means of egress or at a location acceptable to the AHJ.

10.5.1.2 The manual actuation device shall clearly identify the hazard protected.

10.5.2 An automatic sprinkler system shall not require a method of manual actuation.

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▲ **10 5 3** Instruction regarding the proper use of portable fire extinguishers and the manual activation of fire-extinguishing equipment shall be documented and shall be provided by the management to new employees on hiring and to all employees annually.

10.6 System Annunciation.

▲ **10.6.1** Upon activation of an automatic fire-extinguishing system, an audible alarm or visual indicator shall be provided to show that the system has activated.

▲ **10.6.2** Where a fire alarm signaling system is serving the occupancy where the extinguishing system is located, the activation of the automatic fire-extinguishing system shall activate the fire alarm signaling system.

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10.7 Special Design and Application.

▲ **10.7.1** Hoods containing automatic fire-extinguishing systems are protected areas; therefore, these hoods shall not be considered obstructions to overhead sprinkler systems and shall not require additional sprinkler coverage underneath.

10.8 Review and Certification.

10.8.1 Where required, complete drawings of the system installation, including the hood(s), exhaust duct(s), and appliances, along with the interface of the fire-extinguishing system detectors, piping, nozzles, fuel and electric power shutoff devices, agent storage container(s), and manual actuation device(s), shall be submitted to the authority having jurisdiction.

10.8.2* Installation Requirements.

▲ **10.8.2.1** Installation of systems shall be performed only by persons properly trained and qualified to install the specific system being provided.

10.8.2.2 The installer shall provide certification to the authority having jurisdiction that the installation is in agreement with the terms of the listing and the manufacturer's instructions and/or approved design.

10.9 Portable Fire Extinguishers.

▲ **10.9.1*** Portable fire extinguishers shall be selected and installed in kitchen cooking areas in accordance with NFPA 10 and shall be specifically listed for such use.

▲ **10.9.2** Class K fire extinguishers shall be provided for cooking appliance hazards that involve combustible cooking media (vegetable oils and animal oils and fats).

▲ **10.9.3** Portable fire extinguishers shall be provided for other hazards in kitchen areas and shall be selected and installed in accordance with NFPA 10.

10.9.4 Carbon dioxide-type extinguishers shall not be permitted.

▲ **10.9.5** Portable fire extinguishers shall be maintained in accordance with NFPA 10.

Chapter 11 Procedures for the Use, Inspection, Testing, and Maintenance of Equipment

11.1 Operating Procedures.

▲ **11.1.1** Exhaust systems shall be operated whenever cooking equipment is turned on

▲ **11.1.2** Filter-equipped exhaust systems shall not be operated with filters removed.

▲ **11.1.3** Openings provided for replacing air exhausted through ventilating equipment shall not be restricted by covers, dampers, or any other means that would reduce the operating efficiency of the exhaust system.

▲ **11.1.4*** Instructions shall be provided to new employees on hiring and to all employees semiannually on the use of portable fire extinguishers and the manual actuation of the fire-extinguishing system.

N **11.1.4.1** Responsibility for compliance with 11.1.4 shall be that of management of the commercial cooking operation.

N **11.1.4.2** Records of compliance with 11.1.4 shall be maintained and shall be available to the authority having jurisdiction.

▲ **11.1.4.3** Instructions for manually operating the fire-extinguishing system shall be posted conspicuously in the kitchen and shall be reviewed with employees by the management.

11.1.5 Listed exhaust hoods shall be operated in accordance with the terms of their listings and the manufacturer's instructions.

▲ **11.1.6** Cooking equipment shall not be operated while its fire-extinguishing system or exhaust system is nonoperational or impaired.

▲ **11.1.6.1** Where the fire-extinguishing system or exhaust system is nonoperational or impaired, the system shall be tagged as noncompliant, the system owner or the owner's representative shall be notified in writing of the impairment, and, where required, the authority having jurisdiction shall be notified.

▲ **11.1.7** Secondary filtration and pollution control equipment shall be operated in accordance with the terms of its listing and the manufacturer's recommendations.

▲ **11.1.8** Inspection and maintenance of "other equipment" as allowed in 9.3.1 shall be conducted by properly trained and qualified persons at a frequency determined by the manufacturer's instructions or the equipment listing.

11.2 Inspection, Testing, and Maintenance of Fire-Extinguishing Systems.

▲ **11.2.1*** Maintenance of the fire-extinguishing systems and listed exhaust hoods containing a constant or fire-activated water system that is listed to extinguish a fire in the grease removal devices, hood exhaust plenums, and exhaust ducts shall be made by properly trained, qualified, and certified person(s) acceptable to the authority having jurisdiction at least every 6 months.

▲ **11.2.2*** All actuation and control components, including remote manual pull stations, mechanical and electrical devices, detectors, and actuators, shall be tested for proper operation during the inspection in accordance with the manufacturer's procedures.

▲ **11.2.3** The specific inspection and maintenance requirements of the extinguishing system standards as well as the applicable installation and maintenance manuals for the listed system and service bulletins shall be followed

▲ **11.2.4*** Fusible links of the metal alloy type and automatic sprinklers of the metal alloy type shall be replaced at least semi-annually.

▲ **11.2.5** The year of manufacture and the date of installation of the fusible links shall be marked on the system inspection tag.

▲ **11.2.5.1** The tag shall be signed or initialed by the installer.

▲ **11.2.5.2** The fusible links shall be destroyed when removed.

▲ **11.2.6** Detection devices that are bulb-type automatic sprinklers and fusible links other than the metal alloy type shall be examined and cleaned or replaced annually.

11.2.7 Fixed temperature-sensing elements other than the fusible metal alloy type shall be permitted to remain continuously in service, provided they are inspected and cleaned or replaced if necessary in accordance with the manufacturer's instructions, every 12 months or more frequently to ensure proper operation of the system.

▲ **11.2.8** Where required, certificates of inspection and maintenance shall be forwarded to the authority having jurisdiction.

▲ *N* **11.2.8.1** Records, including certificates of inspection and maintenance, shall be permitted to be forwarded to or shared with the authority having jurisdiction either by hard copy or electronically.

▲ **11.3 Inspection of Fire Dampers.**

11.3.1 Actuation components for fire dampers shall be inspected for proper operation in accordance with the manufacturer's listed procedures.

11.3.2 Replacement of Fusible Links.

11.3.2.1 Fusible links on fire damper assemblies shall be replaced at least semiannually or more frequently as necessary.

11.3.2.2 Replacement shall be made by a certified person acceptable to the authority having jurisdiction.

11.3.3* Documentation Tag.

11.3.3.1 The year of manufacture and the date of installation of the fusible links shall be documented.

11.3.3.2 The tag shall be signed or initialed by the installer.

▲ **11.4* Inspection for Grease Buildup.** The entire exhaust system shall be inspected for grease buildup by a properly trained, qualified, and certified person(s) acceptable to the authority having jurisdiction and in accordance with Table 11.4.

11.5 Inspection, Testing, and Maintenance of Listed Hoods Containing Mechanical, Water Spray, or Ultraviolet Devices. Listed hoods containing mechanical or fire-actuated dampers, internal washing components, or other mechanically operated devices shall be inspected and tested by properly trained, qualified, and certified persons every 6 months or at frequencies recommended by the manufacturer in accordance with their listings.

11.6 Cleaning of Exhaust Systems.

▲ **11.6.1*** If, upon inspection, the exhaust system is found to be contaminated with deposits from grease-laden vapors, the contaminated portions of the exhaust system shall be cleaned by a properly trained, qualified, and certified person(s) acceptable to the authority having jurisdiction.

N **11.6.1.1** A measurement system of deposition shall be established to trigger a need to clean when the exhaust system is inspected at the frequencies in Table 11.4.

11.6.1.1.1 Hoods, grease removal devices, fans, ducts, and other appurtenances shall be cleaned to remove combustible contaminants to a minimum of 50 μm (0.002 in.).

Table 11.4 Schedule of Inspection for Grease Buildup

Type or Volume of Cooking	Inspection Frequency
Systems serving solid fuel cooking operations	Monthly
*Systems serving high-volume cooking operations	Quarterly
Systems serving moderate-volume cooking operations	Semiannually
†Systems serving low-volume cooking operations	Annually

*High-volume cooking operations include 24-hour cooking, charbroiling, and wok cooking.
†Low-volume cooking operations include churches, day camps, seasonal businesses, and senior centers.

11.6.1.1.2 A grease depth gauge comb as shown in Figure 11.6.1.1.2 shall be placed upon the surface to measure grease depth.

11.6.1.1.3 Where a measured depth of 2000 μm (0.078 in.) is observed, the surfaces shall be cleaned in accordance with 11.6.1.

11.6.1.1.4 Where a measured depth of 3175 μm (0.125 in.) is observed in a fan housing, the surfaces shall be cleaned in accordance with 11.6.1.

11.6.2 Hoods, grease removal devices, fans, ducts, and other appurtenances shall be cleaned to remove combustible contaminants prior to surfaces becoming heavily contaminated with grease or oily sludge.

▲ **11.6.3** At the start of the cleaning process, electrical switches that could be activated accidentally shall be locked out.

11.6.4 Components of the fire suppression system shall not be rendered inoperable during the cleaning process.

▲ **11.6.5** Fire-extinguishing systems shall be permitted to be rendered inoperable during the cleaning process where serviced by properly trained and qualified persons.

▲ **11.6.6** Flammable solvents or other flammable cleaning aids shall not be used.

▲ **11.6.7** Cleaning chemicals shall not be applied on fusible links or other detection devices of the automatic extinguishing system.

▲ **11.6.8** After the exhaust system is cleaned, it shall not be coated with powder or other substance.

▲ **11.6 9** When cleaning procedures are completed, all access panels (doors) and cover plates shall be restored to their normal operational condition.

▲ **11.6.10** When an access panel is removed, a service company label or tag preprinted with the name of the company and giving the date of inspection or cleaning shall be affixed near the affected access panels.

▲ **11.6.11** Dampers and diffusers shall be positioned for proper airflow.

11.6.12 When cleaning procedures are completed, all electrical switches and system components shall be returned to an operable state.

▲ **11.6.13** When an exhaust system is inspected or cleaned, a certificate showing the name of the servicing company, the name of the person performing the work, and the date of inspection or cleaning shall be maintained on the premises.

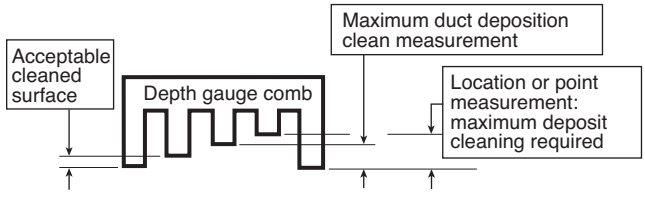


FIGURE 11.6.1.1.2 Depth Gauge Comb.

▲ **11.6.14** After cleaning or inspection is completed, the exhaust cleaning company and the person performing the work at the location shall provide the owner of the system with a written report that also specifies areas that were inaccessible or not cleaned.

▲ **11.6.15** Where required, certificates of inspection and cleaning and reports of areas not cleaned shall be submitted to the authority having jurisdiction.

▲ *N* **11.6.16** Metal containers used to collect grease drippings shall be inspected or emptied at least weekly.

11.7 Cooking Equipment Maintenance.

11.7.1 Inspection and servicing of the cooking equipment shall be made at least annually by properly trained and qualified persons.

▲ **11.7.2*** Cooking equipment that collects grease below the surface, behind the equipment, or in cooking equipment flue gas exhaust, such as griddles or charbroilers, shall be inspected and, if found with grease accumulation, cleaned by a properly trained, qualified, and certified person(s) acceptable to the authority having jurisdiction.

Chapter 12 Minimum Safety Requirements for Cooking Equipment

12.1 Cooking Equipment.

12.1.1* Cooking equipment shall be approved based on one of the following criteria:

▲ (1) Listings by a testing laboratory
▲ (2) Test data acceptable to the authority having jurisdiction

12.1.2 Installation

▲ **12.1.2.1*** All listed appliances shall be installed in accordance with the terms of their listings and the manufacturer's instructions.

12.1.2.1.1 Solid fuel used for flavoring within a gas-operated appliance shall be in a solid fuel holder (smoker box) that is listed with the equipment.

12.1.2.2* Cooking appliances requiring protection shall not be moved, modified, or rearranged without prior re-evaluation of the fire-extinguishing system by the system installer or servicing agent, unless otherwise allowed by the design of the fire-extinguishing system.

12.1.2.2.1 A solid fuel holder shall not be added to an existing appliance until the fire-extinguishing system has been evaluated by the fire-extinguishing system service provider.

▲ **12.1.2.3** The fire-extinguishing system shall not require re-evaluation where the cooking appliances are moved for the purposes of maintenance and cleaning, provided the appliances are returned to approved design location prior to cooking operations, and any disconnected fire-extinguishing system nozzles attached to the appliances are reconnected in accordance with the manufacturer's listed design manual.

12.1.2.3.1 An approved method shall be provided that will ensure that the appliance is returned to an approved design location.

▲ **12.1.2.4** All deep-fat fryers shall be installed with at least a 406 mm (16 in.) space between the fryer and surface flames from adjacent cooking equipment.

▲ **12.1.2.5** Where a steel or tempered glass baffle plate is installed at a minimum 203 mm (8 in.) in height between the fryer and surface flames of the adjacent appliance, the requirement for a 406 mm (16 in.) space shall not apply.

12.1.2.5.1 If the fryer and the surface flames are at different horizontal planes, the minimum height of 203 mm (8 in.) shall be measured from the higher of the two.

▲ **12.2 Operating Controls.** Deep-fat fryers shall be equipped with a separate high-limit control in addition to the adjustable operating control (thermostat) to shut off fuel or energy when the fat temperature reaches 246°C (475°F) at 25.4 mm (1 in.) below the surface.

▲ Chapter 13 Recirculating Systems

13.1 General Requirements. Recirculating systems containing or for use with appliances used in processes producing smoke or grease-laden vapors shall be equipped with components complying with the following:

(1) The clearance requirements of Section 4.2
(2) A hood complying with the requirements of Chapter 5
(3) Grease removal devices complying with Chapter 6
(4) The air movement requirements of 8.2.1.2 and 8.2.2.3
(5) Auxiliary equipment (such as particulate and odor removal devices) complying with Chapter 9
(6) Fire-extinguishing equipment complying with the requirements of Chapter 10 with the exception of 10.1.1 and 10 5 1, which shall not apply
(7) The use and maintenance requirements of Chapter 1
(8) The minimum safety requirements of Chapter 12
(9) All the requirements of Chapter 13

13.2 Design Restrictions. All recirculating systems shall comply with the requirements of Section 13.2.

13.2.1 Only gas-fueled or electrically fueled cooking appliances shall be used.

13.2.2 Listed gas-fueled equipment designed for use with specific recirculating systems shall have the flue outlets connected in the intended manner.

13.2.3 Gas-fueled appliances shall have a minimum 457 mm (18 in.) clearance from the flue outlet to the filter inlet in accordance with 6.2.2 and shall meet the installation requirements of NFPA 54 or NFPA 58.

▲ **13.2.4** Recirculating systems shall be listed with a testing laboratory in accordance with ANSI/UL 710B or equivalent.

13.2.4.1 The recirculating system listing shall include integral fire protection for recirculating hoods, including canopy type.

13.2.4.2 Cooking appliances that require protection and that are under a recirculating hood shall be protected by either the integral fire protection system in accordance with ANSI/UL 710B, or a system in accordance with Chapter 10.

13.2.5 There shall be no substitution or exchange of cooking appliances, filter components, blower components, or fire-extinguishing system components that would violate the listing of the appliance.

13.2.6 A recirculating system shall not use cooking equipment that exceeds the recirculating system's labeled maximum limits for that type of equipment, stated in maximum energy input, maximum cooking temperature, and maximum square area of cooking surface or cubic volume of cooking cavity.

13.2.7 The listing label shall show the type(s) of cooking equipment tested and the maximum limits specified in 13.2.6.

13.2.8 A fire-actuated damper shall be installed at the exhaust outlet of the system.

13.2.9 The fire damper shall be constructed of at least the same gauge as the shell.

13.2.10 The actuation device for the fire damper shall have a maximum temperature rating of 190°C (375°F).

13.2.11 The power supply of any electrostatic precipitator (ESP) shall be of the "cold spark," ferroresonant type in which the voltage falls off as the current draw of a short increases.

13.2.12 Listing evaluation shall include the following:

(1) Capture and containment of vapors at published and labeled airflows
▲(2) Grease discharge at the exhaust outlet of the system not to exceed an average of 5 mg/m^3 (0.00018 oz/ft^3) of exhausted air sampled from that equipment at maximum amount of product that is capable of being processed over a continuous 8-hour test per EPA Test Method 202, with the system operating at its minimum listed airflow
(3) Listing and labeling of clearance to combustibles from all sides, top, and bottom
(4) Electrical connection in the field in accordance with *NFPA 70*
(5) Interlocks on all removable components that lie in the path of airflow within the unit to ensure that they are in place during operation of the cooking appliance

13.3 Interlocks.

13.3.1 The recirculating system shall be provided with interlocks of all critical components and operations as indicated in 13.3.2 through 13.3.4 such that, if any of these interlocks are interrupted, the cooking appliance will not be able to operate.

13.3.2 All closure panels encompassing airflow sections shall have interlocks to ensure that the panels are in place and fully sealed.

13.3.3 Each filter component (grease and odor) shall have an interlock to prove the component is in place.

13.3.4 ESP Interlocks.

13.3.4.1 Each ESP shall have a sensor to prove its performance is as designed, with no interruption of the power to exceed 2 minutes.

13.3.4.2 The sensor shall be a manual reset device or circuit.

13.3.5 Airflow Switch or Transducer.

13.3.5.1 An airflow switch or transducer shall be provided after the last filter component to ensure that a minimum airflow is maintained.

13.3.5.2 The airflow switch or transducer shall open the interlock circuit when the airflow falls 25 percent below the system's normal operating flow or 10 percent below its listed minimum rating, whichever is lower.

13.3.5.3 The airflow switch or transducer shall be a manual reset device or circuit.

13.4 Location and Application Restrictions.

▲**13.4.1** The location of recirculating systems shall be approved by the authority having jurisdiction.

13.4.2 Items to be reviewed in the fire risk assessment shall include, but not be limited to, life safety, combustibility of surroundings, proximity to air vents, and total fuel load.

13.5 Additional Fire Safety Requirements.

▲**13.5.1** In addition to the appliance nozzle(s), a recirculating system shall be listed with the appropriate fire protection for grease filters, grease filtration, odor filtration units, and ductwork, where applicable.

13.5.2 In addition to any other fire-extinguishing system activation device, there shall be a fire-extinguishing system activation device installed downstream of any ESP.

▲**13.5.3** The requirements of Section 10.6 shall also apply to recirculating system locations.

13.5.4 A means of manual activation of the fire-extinguishing system shall be provided in an area where it is safely accessible in the event of a fire in the appliance.

13.5.5 The manual activation device for the fire-extinguishing system shall be clearly identified.

▲**13.6 Use and Maintenance.**

▲**13.6.1** Automatic or manual covers on cooking appliances, especially fryers, shall not interfere with the application of the fire suppression system.

13 6 2 All filters shall be cleaned or replaced in accordance with the manufacturer's instructions.

13.6.3 All ESPs shall be cleaned a minimum of once per week and according to the manufacturer's cleaning instructions.

13.6.4 The entire hood plenum and the blower section shall be cleaned a minimum of once every 3 months.

13.6.5 Inspection and testing of the total operation and all safety interlocks in accordance with the manufacturer's instructions shall be performed by qualified service personnel a minimum of once every 6 months or more frequently if required.

13.6.6 Fire-extinguishing equipment shall be inspected in accordance with Section 11.2.

13.6.7 A signed and dated log of maintenance as performed in accordance with 13.6.4 and 13.6.5 shall be available on the premises for use by the authority having jurisdiction.

▲ Chapter 14 Solid Fuel Cooking Operations

▲**14.1 Venting Application.** Venting requirements of solid fuel cooking operations shall be determined in accordance with 14.1.1 through 14.1.7.

14.1.1 Where solid fuel cooking equipment is required by the manufacturer to have a natural draft, the vent shall comply with Section 14.4.

▲ **14.1.2** Where the solid fuel cooking equipment has a self-contained top, is the only appliance to be vented in an isolated space (except for a single water heater with its own separate vent), has a separate makeup air system, and is provided with supply and return air (not supplied or returned from other spaces), the system shall comply with Sections 14.4 and 14.6.

▲ **14.1.3** Where the solid fuel cooking equipment is located in a space with other vented equipment, all vented equipment shall have an exhaust system interlocked with a makeup air system for the space per Section 14.6.

▲ **14.1.4** Natural draft ventilation systems and power-exhausted ventilation systems shall comply with Sections 14.3, 14.4, and 14.6.

▲ **14.1.5** Where a solid fuel cooking appliance allows effluent to escape from the appliance opening, this opening shall be covered by a hood and an exhaust system that meets the requirements of Sections 14.3, 14.4, and 14.6.

▲ **14.1.6** Solid fuel cooking operations shall have spark arresters to minimize the passage of airborne sparks and embers into plenums and ducts.

14.1.7 Where the solid fuel cooking operation is not located under a hood, a spark arrester shall be provided to minimize the passage of sparks and embers into flues and chimneys.

14.2 Location of Appliances.

▲ **14.2.1** Every appliance shall be located with respect to building construction and other equipment so as to permit access to the appliance.

▲ **14.2.2*** Solid fuel cooking appliances shall not be installed in confined spaces

▲ **14.2.3** Solid fuel cooking appliances listed for installation in confined spaces such as alcoves shall be installed in accordance with the terms of the listing and the manufacturer's instructions.

▲ **14.2.4** Solid fuel cooking appliances shall not be installed in any location where gasoline or any other flammable vapors or gases are present.

14.3 Hoods for Solid Fuel Cooking.

▲ **14.3.1** Hoods shall be sized and located in a manner capable of capturing and containing all the effluent discharging from the appliances.

14.3.2 The hood and its exhaust system shall comply with the requirements of Chapters 5 through 10.

▲ **14.3.3** Except as permitted in 14.3.4, exhaust systems serving solid fuel cooking equipment, including gas or electrically operated equipment, shall be separate from all other exhaust systems.

▲ **14.3.4*** Gas-operated equipment utilizing solid fuel for flavoring that meets all the following conditions shall not be required to have a separate exhaust system:

(1)* The solid fuel holder (smoker box) shall be listed with the gas-operated equipment.
(2) The solid fuel holder shall be located underneath the gas burners.
(3) Spark arresters conforming with 14.1.6 shall be provided.
(4)* The maximum quantity of solid fuel consumed shall not exceed 0.45 kg (1 lb) per hour per 29.3 kW (100,000 Btu/hr) of gas burner capacity.
(5) The gas-operated equipment shall be protected by a fire suppression system listed for the equipment, including the solid fuel holder.
(6) Gas-operated equipment with integral solid fuel holder(s) intended for flavoring, such as radiant charbroiler(s), shall comply simultaneously with the requirements of ANSI/UL 300 that address the gas radiant charbroiler(s) and mesquite wood charbroiler(s).
(7) A fire suppression system nozzle(s) shall be installed to protect the solid fuel holder.
(8) The fire suppression system shall be designed and installed to protect the entire cooking operation.
(9) Each solid fuel holder shall be limited to a size of 2.5 L (150 in.^{3}), with no dimension to exceed 51 cm (20 in.).
(10) A maximum of one solid fuel holder for each 29.3 kW (100,000 Btu/hr), or portion thereof, of burner capacity shall be permitted.
(11) Solid fuel shall be immersed in water for a continuous period of at least 24 hours immediately prior to being placed in the cooking equipment.
(12) The inspection frequency shall be the same as for solid fuel cooking operations in Table 11.4.

14.3.4.1 Gas-operated equipment utilizing solid fuel for flavoring that meets 14.3.4 shall be inspected, cleaned, and maintained in accordance with Section 14.8.

14.3.5 Cooking equipment not requiring automatic fire-extinguishing equipment (per Chapter 10) shall be permitted to be installed under a common hood with solid fuel cooking equipment that is served by a duct system separate from all other exhaust systems.

14.4 Exhaust for Solid Fuel Cooking. Where a hood is not required, in buildings where the duct system is three stories or less in height, a duct complying with Chapter 7 shall be provided.

14.4.1 If a hood is used in buildings where the duct system is three stories or less in height, the duct system shall comply with Chapter 7.

▲ **14.4.2** A listed or approved grease duct system that is four stories in height or greater shall be provided for solid fuel cooking exhaust systems.

▲ **14.4.3** Where a hood is used, the duct system shall conform with the requirements of Chapter 7.

▲ **14.4.4** Wall terminations of solid fuel exhaust systems shall be prohibited.

14.5 Grease Removal Devices for Solid Fuel Cooking.

14.5.1 Grease removal devices shall be constructed of steel or stainless steel or be approved for solid fuel cooking.

14.5.2 If airborne sparks and embers can be generated by the solid fuel cooking operation, spark arrester devices shall be used prior to using the grease removal device, to minimize the entrance of these sparks and embers into the grease removal device and into the hood and the duct system.

14.5.3 Filters shall be a minimum of 1.2 m (4 ft) above the appliance cooking surface.

14.6 Air Movement for Solid Fuel Cooking.

14.6.1 Exhaust system requirements shall comply with Chapter 8 for hooded operation or shall be installed in accordance with the manufacturer's recommendations for unhooded applications.

▲ **14.6.2** A replacement or makeup air system shall be provided to ensure a positive supply of replacement air at all times during cooking operations.

14.6.3 Makeup air systems serving solid fuel cooking operations shall be interlocked with the exhaust air system and powered, if necessary, to prevent the space from attaining a negative pressure while the solid fuel appliance is in operation.

14.7 Fire-Extinguishing Equipment for Solid Fuel Cooking.

▲ **14.7.1** Solid fuel cooking appliances that produce grease-laden vapors shall be protected by listed fire-extinguishing equipment.

14.7.2 Where acceptable to the authority having jurisdiction, solid fuel cooking appliances constructed of solid masonry or reinforced portland or refractory cement concrete and vented in accordance with NFPA 211 shall not require fixed automatic fire-extinguishing equipment.

14.7.3 Listed fire-extinguishing equipment shall be provided for the protection of grease removal devices, hoods, and duct systems.

14.7.4 Where acceptable to the authority having jurisdiction, solid fuel cooking appliances constructed of solid masonry or reinforced portland or refractory cement concrete and vented in accordance with NFPA 211 shall not require automatic fire-extinguishing equipment for the protection of grease removal devices, hoods, and duct systems.

▲ **14.7.5** Listed fire-extinguishing equipment for solid fuel–burning cooking appliances, where required, shall comply with Chapter 10 and shall use water-based agents.

14.7.6 Fire-extinguishing equipment shall be rated and designed to extinguish solid fuel cooking fires.

14.7.7 The fire-extinguishing equipment shall be of sufficient size to totally extinguish fire in the entire hazard area and prevent reignition of the fuel.

14.7.8* All solid fuel appliances (whether under a hood or not) with fire boxes of 0.14 m^3 (5 ft^3) volume or less shall have at least a listed 2-A rated water spray fire extinguisher or a 6 L (1.6 gal) wet chemical fire extinguisher listed for Class K fires in accordance with NFPA 10, with a maximum travel distance of 6 m (20 ft) to the appliance.

▲ **14.7.9 Hose Protection.**

14.7.9.1 Solid fuel appliances with fireboxes exceeding 0.14 m^3 (5 ft^3) shall be provided with a fixed water pipe system with a hose in the kitchen capable of reaching the firebox.

14.7.9.1.1 The hose shall be equipped with an adjustable nozzle capable of producing a fine to medium spray or mist.

▲ **14.7.9.1.2** The nozzle shall be of the type that cannot produce a straight stream.

14.7.9.2 The system shall have a minimum operating pressure of 275.8 kPa (40 psi) and shall provide a minimum of 19 L/min (5 gpm).

14.7.10 Fire suppression for fuel storage areas shall comply with Section 14.9 of this standard.

14.7.11 In addition to the requirements of 14.7.8 through 14.7.10, where any solid fuel cooking appliance is also provided with auxiliary electric, gas, oil, or other fuel for ignition or supplemental heat and the appliance is also served by any portion of a fire-extinguishing system complying with Chapter 10, such auxiliary fuel shall be shut off on actuation of the fire-extinguishing system.

▲ **14.8 Procedures for Inspection, Cleaning, and Maintenance for Solid Fuel Cooking.** Solid fuel cooking appliances shall be inspected, cleaned, and maintained in accordance with the procedures outlined in Chapter 11 and with 14.8.1 through 14.8.5.

▲ **14.8.1** The combustion chamber shall be scraped clean to its original surface once each week and shall be inspected for deterioration or defects.

14.8.2 Any significant deterioration or defect that might weaken the chamber or reduce its insulation capability shall be immediately repaired.

14.8.3 The flue or chimney shall be inspected weekly for the following conditions:

(1) Residue that might begin to restrict the vent or create an additional fuel source
(2) Corrosion or physical damage that might reduce the flue's capability to contain the effluent

14.8 3.1 The flue or chimney shall be cleaned before these conditions exist.

14.8.3.2 The flue or chimney shall be repaired or replaced if any unsafe condition is evident.

14.8.4 Spark arrester screens located at the entrance of the flue or in the hood assembly shall be cleaned prior to their becoming heavily contaminated and restricted.

14.8.5 Filters and filtration devices installed in a hood shall be cleaned per 14.8.4.

14.9 Minimum Safety Requirements: Fuel Storage, Handling, and Ash Removal for Solid Fuel Cooking.

▲ **14.9.1 Installation Clearances.**

14.9.1.1 Solid fuel cooking appliances shall be installed on floors of noncombustible construction that extend 0.92 m (3 ft) in all directions from the appliance.

▲ **14.9.1.2** Floors with noncombustible surfaces shall be permitted to be used where they have been approved for such use by the authority having jurisdiction.

14.9.1.3 Floor assemblies that have been listed for solid fuel appliance applications shall be permitted to be used.

14.9.1.4 Solid fuel cooking appliances that have been listed for zero clearance to combustibles on the bottom and sides and have an approved hearth extending 0.92 m (3 ft) in all directions from the service door(s) shall be permitted to be used on combustible floors.

▲ **14.9.1.5** Combustible and limited-combustible surfaces or construction within 0.92 m (3 ft) of the sides or 1.8 m (6 ft) above a solid fuel cooking appliance shall be protected in a manner acceptable to the authority having jurisdiction.

14.9.1.6 Solid fuel cooking appliances that are specifically listed for less clearance to combustibles shall be permitted to be installed in accordance with the requirements of the listing and the manufacturer's instructions.

▲ **14.9.2 Solid Fuel Storage.**

▲ **14.9.2.1** Where storage is in the same room as the solid fuel appliance or in the same room as the fuel-loading or clean-out doors, fuel storage shall not exceed a 1-day supply.

14.9.2.2 Fuel shall not be stored above any heat-producing appliance or vent or closer than 0.92 m (3 ft) to any portion of a solid fuel appliance constructed of metal or to any other cooking appliance that could ignite the fuel.

14.9.2.3 Fuel shall be permitted to be stored closer than the requirements of 14.9.2.2 where a solid fuel appliance or other cooking appliance is listed or approved for less clearance to combustibles.

▲ **14.9.2.4** Fuel shall not be stored in the path of the ash removal.

14.9.2.5 Where stored in the same building as the solid fuel appliance, fuel shall be stored only in an area with walls, floor, and ceiling of noncombustible construction extending at least 0.92 m (3 ft) past the outside dimensions of the storage pile.

▲ **14.9.2.6** Fuel shall be permitted to be stored in an area with walls, floor, and ceiling of combustible or limited-combustible construction where protected in accordance with 4.2.3.

▲ **14.9.2.7** Fuel shall be separated from all flammable liquids, all ignition sources, all chemicals, and all food supplies and packaging goods.

▲ **14.9.2.8** All fuel storage areas shall be provided with a sprinkler system meeting the requirements of NFPA 13 except as permitted by 14.9.2.8.1 and 14.9.2.8.2.

14.9.2.8.1 Where acceptable to the authority having jurisdiction, fuel storage areas shall be permitted to be protected with a fixed water pipe system with a hose capable of reaching all parts of the area.

14.9.2.8.2 In lieu of the sprinkler system outlined in 14.9.2.8, a listed 2-A rated water spray fire extinguisher or a 6 L (1.6 gal) wet chemical fire extinguisher listed for Class K fires with a maximum travel distance of 6 m (20 ft) to the solid fuel piles shall be permitted to be used for a solid fuel pile, provided that the fuel pile does not exceed 0.14 m^3 (5 ft^3) volume.

14.9.3 Solid Fuel Handling and Ash Removal.

▲ **14.9.3.1** Solid fuel shall be ignited with a match, an approved built-in gas flame, or other approved ignition source.

▲ **14.9.3.2** Combustible or flammable liquids shall not be used to assist ignition.

▲ **14.9.3.3** Matches and other portable ignition sources shall not be stored in the vicinity of the solid fuel appliance.

▲ **14.9.3.4** Solid fuel shall be added to the fire as required in a safe manner and in quantities and ways not creating a higher flame than is required.

▲ **14.9.3.5** Long-handled tongs, hooks, and other required devices shall be provided and used to safely add fuel, adjust the fuel position, and control the fire without the user having to reach into the firebox.

14.9.3.6 Ash Protection.

▲ **14.9.3.6.1** Ash, cinders, and other fire debris shall be removed from the firebox at regular intervals to prevent interference with the draft to the fire and to minimize the length of time the access door is open.

▲ **14.9.3.6.2** All ash shall be removed from the chamber a minimum of once a day.

▲ **14.9.3.6.3** The ash shall be sprayed with water before removal to extinguish any hot ash or cinders and to control the dust when the ash is moved.

14.9.3.7 Hose Protection.

14.9.3.7.1 For the purposes described in 14.9.3.6.3, to cool a fire that has become too hot and to stop all fire before the premises are vacated, a water supply with a flexible hose shall be provided at the solid fuel appliance.

14.9.3.7.2 For appliances with fireboxes not exceeding 0.14 m^3 (5 ft^3), the water source shall be permitted to be a 37.9 L (10 gal) container with a gravity arrangement or a hand pump for pressure.

14.9.3.7.3 For appliances with fireboxes over 0.14 m^3 (5 ft^3), the water source shall be a fixed pipe water system with a hose of adequate leng h to reach the combustion and cooking chambers of the appliance.

14.9.3.7.4 For either application, the nozzle shall be fitted with a manual shutoff device and shall be of the type to provide a fine to medium spray capable of reaching all areas of the combustion and cooking chambers.

▲ **14.9.3.7.4.1** The nozzle shall be of the type that cannot produce a straight stream.

14.9.3.8 Ash Removal Container or Cart.

▲ **14.9.3.8.1** A heavy metal container or cart (minimum 16 gauge) with a cover shall be provided for the removal of ash.

14.9.3.8.2 The ash removal container or cart shall not exceed a maximum of 75.7 L (20 gal) capacity, shall be assigned for this one purpose, shall be able to be handled easily by any employee assigned the task, and shall pass easily through any passageway to the outside of the building.

14.9.3.8.3 The container or cart shall always be covered when it is being moved through the premises.

14.9.3.8.4 When any hole occurs in a container from corrosion or damage, the container shall be repaired or replaced immediately.

14.9.3.9 Ash Removal Process.

14.9.3.9.1 Tools shall be provided so that ash removal can be accomplished without having to reach into the chamber.

14.9.3.9.2 The ash shall be spread out gently in small lots on the chamber floor or on a shovel, to be sprayed before it is removed to the metal container or cart.

14.9.3.9.3 If the floor of the chamber is of a metal that is subject to rapid corrosion from water, then a noncombustible, corrosion-resistant pan shall be placed just outside the clean-out door for this purpose.

14.9.3.9.4 The ash shall be carried to a separate heavy metal container (or dumpster) used exclusively for the purpose.

14.9.4 Other Safety Requirements.

14.9.4.1 Metal-fabricated solid fuel cooking appliances shall be listed for the application where produced in practical quantities or shall be approved by the authority having jurisdiction.

14.9.4.2 Where listed, metal-fabricated solid fuel cooking appliances shall be installed in accordance with the terms of their listings and with the applicable requirements of this standard.

14.9.4.3 Site-Built Solid Fuel Cooking Appliances.

14.9.4.3.1 Site-built solid fuel cooking appliances shall be submitted for approval to the authority having jurisdiction before being considered for installation.

14.9.4.3.2 All units submitted to the authority having jurisdiction shall be installed, operated, and maintained in accordance with the approved terms of the manufacturer's instructions and any additional requirements set forth by the authority having jurisdiction.

14.9.4.4 Except for the spark arresters required in 14.1.6, there shall be no additional devices of any type in any portion of the appliance, flue pipe, and chimney of a natural draft solid fuel operation.

14.9.4.5 No solid fuel cooking device of any type shall be permitted for deep fat frying involving more than 0.95 L (1 qt) of liquid shortening, nor shall any solid fuel cooking device be permitted within 0.92 m (3 ft) of any deep fat frying unit.

▲ Chapter 15 Downdraft Appliance Ventilation Systems

15.1* General Requirements.

▲ **15.1.1** Downdraft appliance ventilation systems containing or for use with appliances used in processes producing smoke or grease-laden vapors shall be equipped with components complying with the following:

(1) The clearance requirements of Section 4.2
(2) The primary collection means designed for collecting cooking vapors and residues complying with the requirements of Chapter 5
(3) Grease removal devices complying with Chapter 6
(4) Special-purpose filters as listed in accordance with ANSI/UL 1046
(5) Exhaust ducts complying with Chapter 7
(6) The air movement requirements of 8.2.1.2 and 8.2.2.3
(7) Auxiliary equipment (such as particulate and odor removal devices) complying with Chapter 9
(8) Fire-extinguishing equipment complying with the requirements of Chapter 10 and as specified in Section 15.2
(9) The use and maintenance requirements of Chapter 11
(10) The minimum safety requirements of Chapter 12

▲ **15.1.2** The downdraft appliance ventilation system shall be capable of capturing and containing all the effluent discharging from the appliance(s) it is serving.

▲ **15.2 Fire-Extinguishing Equipment.** For fire-extinguishing equipment on downdraft appliance ventilation systems, the following shall apply:

(1) Cooking surface, duct, and plenum protection shall be provided.
(2) At least one fusible link or heat detector shall be installed within each exhaust duct opening in accordance with the manufacturer's listing.
(3) A fusible link or heat detector shall be provided for each protected cooking appliance located in the plenum area of that appliance or in accordance with the extinguishing system manufacturer's listing.
(4) A manual activation device shall be provided as part of each appliance at a height acceptable to the authority having jurisdiction.
(5) Portable fire extinguishers shall be provided in accordance with Section 10.9.

15.2.1 A listed downdraft appliance ventilation system employing an integral fire-extinguishing system, including detection systems, that has been evaluated for grease and smoke capture, fire extinguishing, and detection shall be considered as complying with Section 15.2.

▲ **15.2.2** The downdraft appliance ventilation system shall be provided with interlocks such that the cooking fuel supply will not be activated unless the exhaust and supply air systems have been activated

15.3 Airflow Switch or Transducer.

▲ **15.3.1** An airflow switch or transducer shall be provided after the last filter component to ensure that a minimum airflow is maintained.

15.3.2 The airflow switch or transducer shall open the interlock circuit when the airflow falls 25 percent below the system's normal operating flow or 10 percent below its listed minimum rating, whichever is lower.

▲ **15.3.3** The airflow switch or transducer shall be a manual reset device or circuit.

15.4 Surface Materials. Any surface located directly above the cooking appliance shall be of noncombustible or limited-combustible materials.

Annex A Explanatory Material

Annex A is not a part of the requirements of this NFPA document but is included for informational purposes only. This annex contains explanatory material, numbered to correspond with the applicable text paragraphs.

A.1.1.1 These requirements include, but are not limited to, all manner of cooking equipment, exhaust hoods, grease removal devices, exhaust ductwork, exhaust fans, dampers, fire-extinguishing equipment, and all other auxiliary or ancillary components or systems that are involved in the capture, containment, and control of grease-laden cooking effluent.

A.1.1.4 This judgment should take into account the type of cooking being performed, the items being cooked, and the frequency of cooking operations. Examples of operations that might not require compliance with this standard include the following:

(1) Day care centers warming bottles and lunches
(2) Therapy cooking facilities in health care occupancies
(3) Churches and meeting operations that are not cooking meals that produce grease-laden vapors
(4) Employee break rooms where food is warmed

In non-assembly occupancies where residential equipment is utilized, the AHJ may consider requiring protection of the cooking surface with a listed residential range top extinguishing unit as an alternative to no protection or requiring full protection in accordance with this standard.

A.1.3.1 This standard cannot provide safe design and operation if parts of it are not enforced or are arbitrarily deleted in any application.

A.3.2.1 Approved. The National Fire Protection Association does not approve, inspect, or certify any installations, procedures, equipment, or materials; nor does it approve or evaluate testing laboratories. In determining the acceptability of installations, procedures, equipment, or materials, the authority having jurisdiction may base acceptance on compliance with NFPA or other appropriate standards. In the absence of such standards, said authority may require evidence of proper installation, procedure, or use. The authority having jurisdiction may also refer to the listings or labeling practices of an organization that is concerned with product evaluations and is thus in a position to determine compliance with appropriate standards for the current production of listed items.

A.3 2.2 Authority Having Jurisdiction (AHJ) The phrase "authority having jurisdiction," or its acronym AHJ, is used in NFPA documents in a broad manner, since jurisdictions and approval agencies vary, as do their responsibilities. Where public safety is primary, the authority having jurisdiction may be a federal, state, local, or other regional department or individual such as a fire chief; fire marshal; chief of a fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance inspection department, rating bureau, or other insurance company representative may be the authority having jurisdiction. In many circumstances, the property owner or his or her designated agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official may be the authority having jurisdiction.

A.3.2.4 Listed. The means for identifying listed equipment may vary for each organization concerned with product evaluation; some organizations do not recognize equipment as listed unless it is also labeled. The authority having jurisdiction should utilize the system employed by the listing organization to identify a listed product.

A.3.3.4 Appliance Flue Outlet. There might or might not be ductwork attached to the opening(s).

A.3.3.10 Certified. Certification can be provided by the manufacturer of the listed equipment being serviced or an independent third party.

A.3.3.14 Construction. See Figure A.3.3.14.

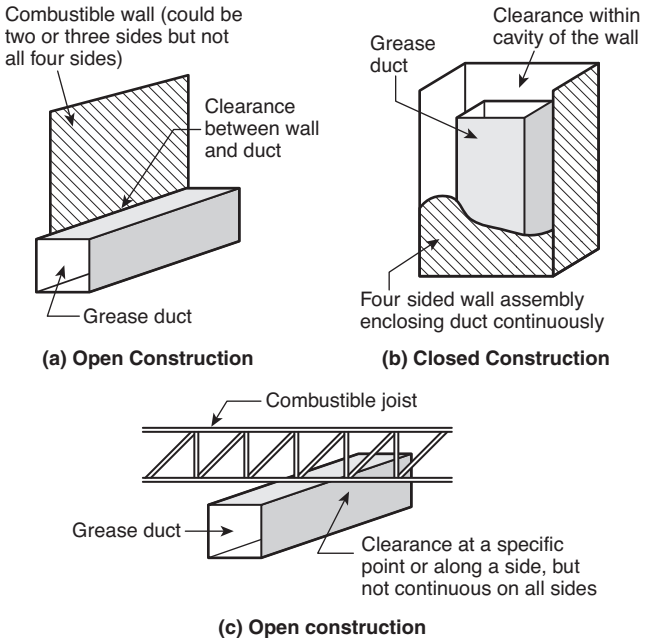


FIGURE A.3.3.14 Examples of Open and Closed Combustible Construction.

A.3.3.15 Continuous Weld. Welding is a fabrication technique for joining metals by heating the materials to the point that they melt and flow together to form an uninterrupted surface of no less strength than the original materials

For the purpose of the definition, it specifically includes the exhaust compartment of hoods and welded joints of exhaust ducts yet specifically does not include filter support frames or appendages inside hoods.

A.3.3.23.2 Solid Fuel Cooking Equipment. This equipment includes ovens, tandoori charcoal pots, grills, broilers, rotisseries, barbecue pits, and any other type of cooking equipment that derives all or part of its heat source from the burning of solid cooking fuel.

A.3.3.24.1 Grease Filter. Filters should limit the projection of flames after grease loading, in accordance with ANSI/UL 1046, *Standard for Grease Filters for Exhaust Ducts*, to a maximum of 457 mm (18 in.) downstream when attacked by flame on the upstream side. They are expected to maintain their strength, shape, and integrity when exposed to the anticipated rough handling, cleaning, and service found in the field.

A.3.3.29 Grease. Grease might be liberated and entrained with exhaust air or might be visible as a liquid or solid.

A.3.3.33 Hood. The term *hoods* as used in this document often refers to Type I hoods, meaning those applied to grease exhaust applications. They are built in various styles, for example, single- or double-island canopy, wall-mounted canopy, noncanopy, backshelf, high sidewall, eyebrow, and pass-over style. All such type and style hoods are applicable to this document, provided they meet all the material and performance requirements of this document. *(See Figure A.3.3.33.)*

The following are types of hoods:

(1) *Type I.* Hoods designed for grease exhaust applications.
(2) *Type II.* Hoods designed for heat and steam removal and other nongrease applications. These hoods are not applicable to the standard.

A.3.3.37 Material. Materials subject to increase in combustibility or flame spread index beyond the limits herein established through the effects of age, moisture, or other atmospheric condition should be considered combustible. See Table A.3.3.37.

A.3.3.37.3 Noncombustible Material. Materials that are reported as passing ASTM E136, *Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C,* should be considered noncombustible materials.

A.3.3.50 Trained. Formal and/or technical training can be administered by the employer or a recognized training program.

A.4.1.1.1 As referenced in ANSI/UL 197, some products evaluated using the emission test procedure EPA 202, as described in ANSI/UL 710B, are listed in the UL directory under the category KNLZ, Commercial, with Integral Systems for Limiting the Emission of Grease-laden Air.

A.4.1.6 When solid fuel is burned in cooking operations, increased quantities of carbon, creosote, and grease-laden vapors are produced that rapidly contaminate surfaces, produce airborne sparks and embers, and are subject to significant flare-ups. Also, solid fuel cooking requires fuel storage and handling and produces ash that requires disposal. For these reasons, solid fuel cooking operations are required to comply with Chapter 14.

A.4.1.9 The authority having jurisdiction can exempt temporary facilities, such as a tent, upon evaluation for compliance to the applicable portions of this standard.

Although it might not be practical to enforce all requirements of this standard in temporary facilities, the authority having jurisdiction should determine that all necessary provisions that affect the personal safety of the occupants are considered.

A.4.2 See Figure A.4.2(a) through Figure A.4.2(h) for clarification of the appropriate clearances required in Section 4.2.

A.4.2.1 The measurement of clearance to combustible or limited-combustible material is intended to be measured from the closest point of the exhaust system component to that material. Example: The clearance where ceramic tile is installed over gypsum board that extends behind the hood should be measured from the hood to the gypsum board. Placing a noncombustible material over a combustible or limited-combustible material does not permit a zero clearance installation.

A.4.2.4.2 The intent of this paragraph is to maintain the systems and their function in accordance with the requirements of the edition of NFPA 96 under which the systems were designed and installed.

A.4.3.2 Protection should be steel outer casing [minimum 0.46 mm (0.018 in.) thick] or equivalent.

A.4.8.1.1 The provisions of 4.8.1.1 do not require inherently noncombustible materials to be tested in order to be classified as noncombustible materials. [**5000:** A.7.1.4.1]

A.4.8.1.1(1) Examples of such materials include steel, concrete, masonry and glass. [**5000:** A.7 1.4 1.1(1)]

A.5.1.4 Welding is one acceptable method.

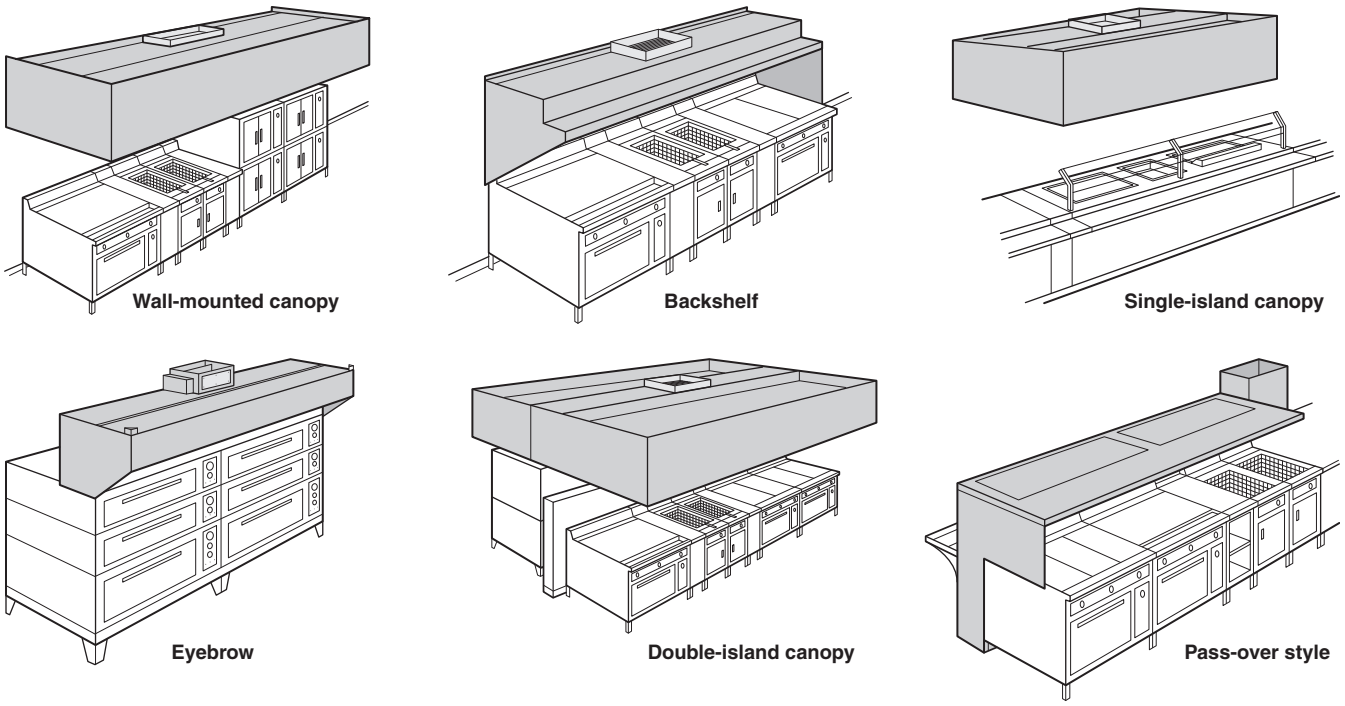


FIGURE A.3.3.33 Styles of Hoods.

Table A.3.3.37 Types of Construction Assemblies Containing Noncombustible, Limited-Combustible, and Combustible Materials

Type of Assembly	Classifications for Determining Hood and Grease Duct Clearance*		
	Non-combustible	Limited-Combustible	Combustible
Wall assemblies			
Brick, clay tile, or concrete masonry products	X		
Plaster, ceramic, or quarry tile on brick, clay tile, or concrete masonry products	X		
Plaster on metal lath on metal studs	X		
Gypsum board on metal studs		X	
Solid gypsum board†		X	
Plaster on wood or metal lath on wood studs			X
Gypsum board on wood studs			X
Plywood or other wood sheathing on wood or metal studs			X
Floor-ceiling or roof-ceiling assemblies			
Plaster applied directly to underside of concrete slab	X		
Suspended membrane ceiling With noncombustible mineral wool acoustical material	X		
With combustible fibrous tile			X
Gypsum board on steel joists beneath concrete slab		X	
Gypsum board on wood joists			X

Notes:
(1) Wall assembly descriptions assume same facing material on both sides of studs.
(2) Categories are not changed by use of fire retardant–treated wood products.
(3) Categories are not changed by use of Type X gypsum board.
(4) See definitions in 3.3.37 of *combustible material*, *limited-combustible material*, and *noncombustible material*.
*See clearance requirements in Section 4.2.
†Solid gypsum walls and partitions, 50.8 mm (2 in.) or 57.15 mm (2¼ in.) thickness, are described in the Gypsum Association publication *Fire Resistance Design Manual*.

A.5.3.4 Figure A.5.3.4 provides examples of exhaust hood assemblies with integrated supply air plenums.

A.5.4 Examples of acceptable materials for hoods include steel and stainless steel.

Additionally, many health officials prohibit galvanized steel in hoods, as does NSF/ANSI 2.

A.6.2.2.1 Appliances that produce high flue gas temperatures include deep-fat fryers, upright or high broilers, and salamander broilers.

A.6.2.2.2 For a typical arrangement of a baffle protecting filters at an appliance vent, see Figure A.6.2.2.2.

A.7.1.2 Vertical or substantially pitched ducts are preferred over horizontal ducts because of their capacity to drain grease and to transfer heated vapors more rapidly to the exterior of a building.

A.7.1.4.3 Typically, ducts that are sloped in accordance with 7.1.4 prevent collection points for residue and eliminate the need for drains. For horizontal ducts greater than 22.86 m (75 ft), low points are difficult to avoid. Where the low points cannot be avoided, access and drains should be considered.

A.7.5.1 Examples of acceptable materials for ducts include the following:

(1) Steel
(2) Galvanized steel
(3) Stainless steel

A.7.5.2.1.2 The leakage test should consist of a light test, a water pressure test, or an approved equivalent test. The permit holder should be responsible for providing the necessary equipment and for performing the test. Refer to ANSI/ASHRAE 154, *Ventilation for Commercial Cooking Operations*, for specific information on such tests.

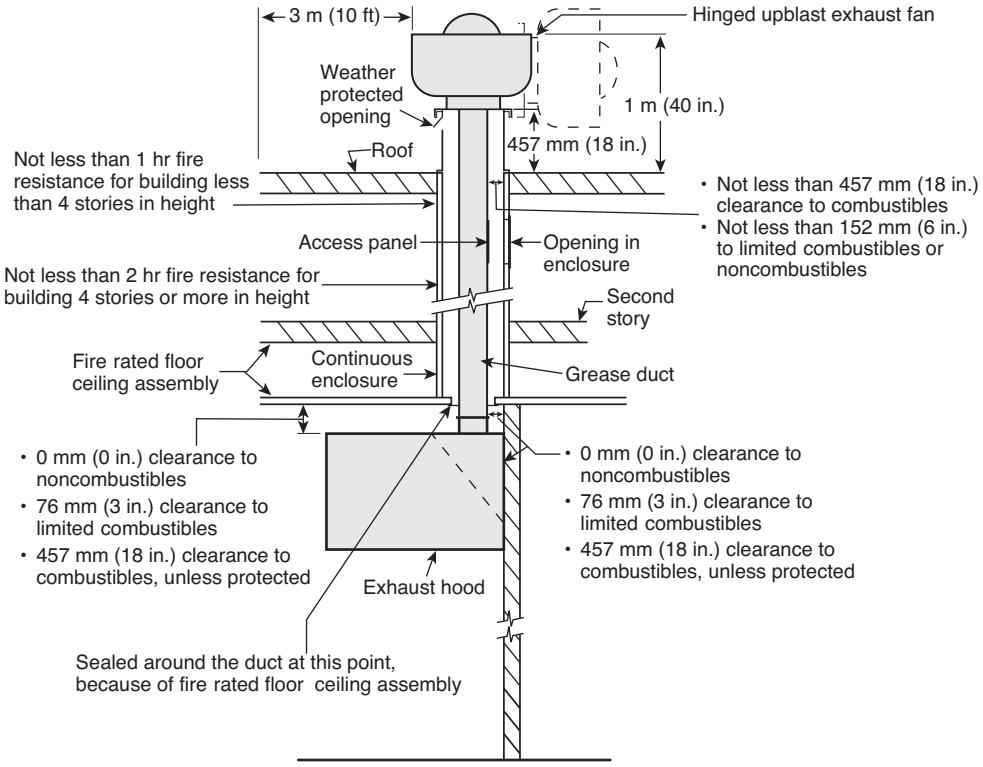


FIGURE A.4.2(a) Typical Section View for Building with Two Stories or More with Fire-Rated Floor-Ceiling Assembly.

A.7.7 2.2 Noncombustible materials such as reinforced concrete floors or protected steel beams, which might pro rude into an enclosure and cause reduced clearance, can be permitted by the authority having jurisdiction if the installation and accessibility of the duct system are considered adequate.

A.7.8 It is preferable for the fan to be at or as close as possible to the end of the duct to minimize the number of pressurized duct joints and clean-outs through which grease might leak more easily.

Wherever possible and practicable, the termination of an exhaust system should be above a roof. Fans on walls should be used only where absolutely necessary, because of the many problems encountered, such as contaminated air recirculating through air intakes, thus lowering environmental quality in traveled or public areas; operable windows' accessibility to vandalism and accidental damage; and strong wind currents restricting airflow.

A.7.8.1(1) It is preferable for the fan to be at or as close to the end of the duct as possible to minimize the number of pressurized duct joints and clean-outs through which grease might leak more easily.

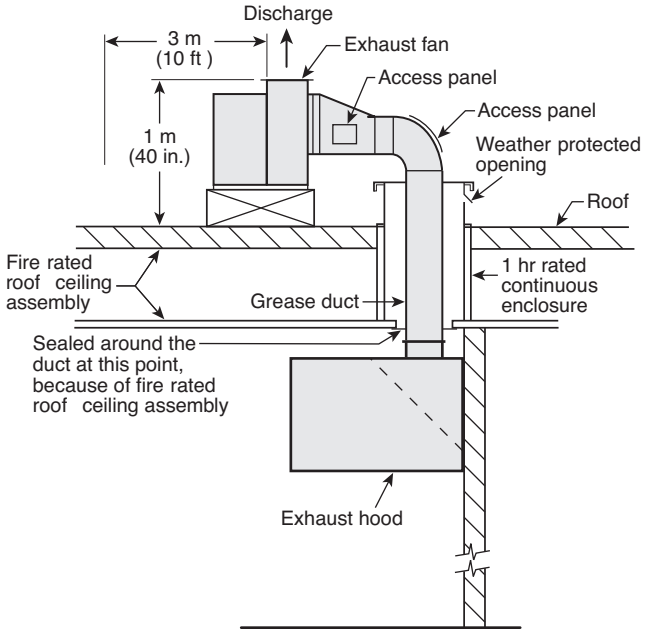


FIGURE A.4.2(b) Typical Section View for One-Story Building with Fire-Rated Roof-Ceiling Assembly. (Clearances given in Figure A.4.2(a) apply also to this drawing.)

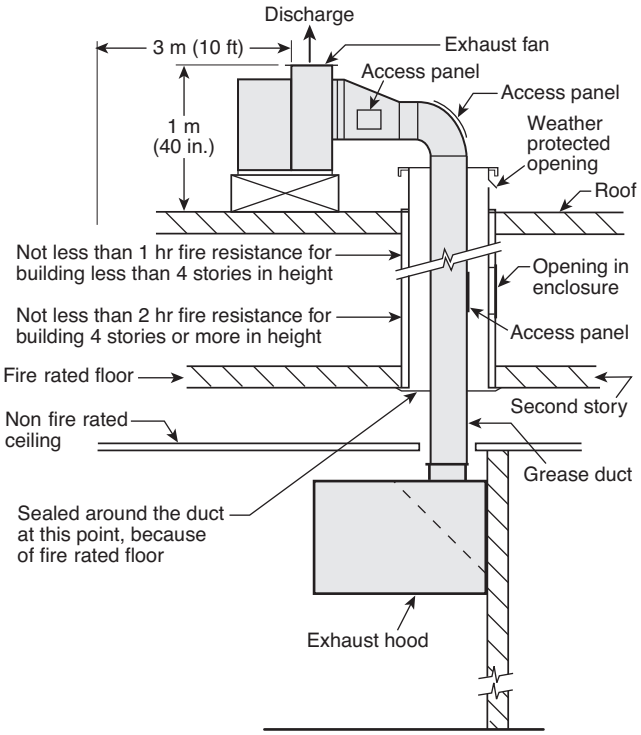
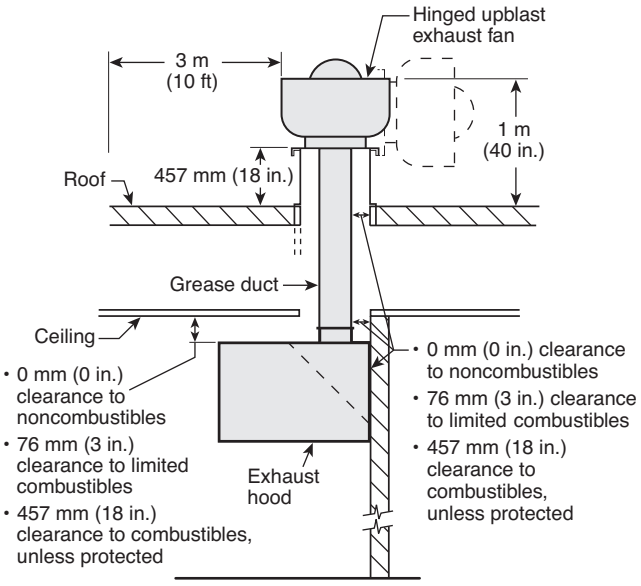
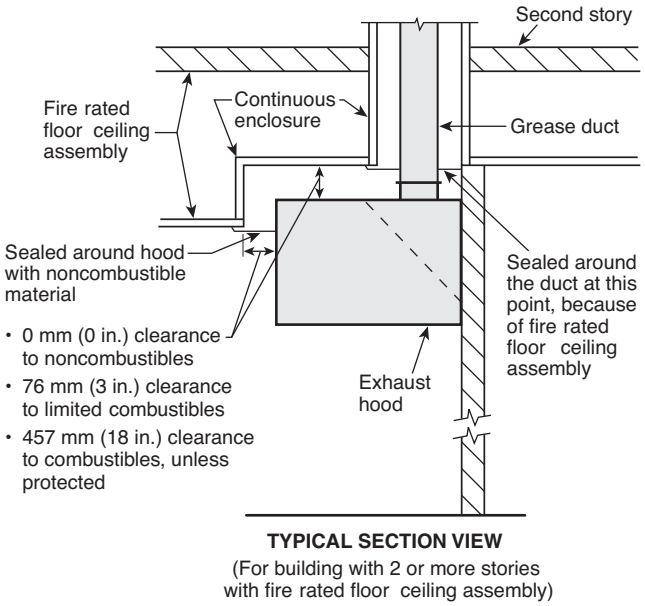


FIGURE A.4.2(c) Typical Section View for Building with Two Stories or More with Non-Fire-Rated Ceiling and Fire-Rated Floor. (Clearances given in Figure A.4.2(a) apply also to this drawing.)



Note: Enclosure is not required in 1 story building where roof ceiling assembly does not have a fire resistance rating.

FIGURE A.4.2(d) Typical Section View for One-Story Building Without Fire-Rated Roof-Ceiling Assembly.



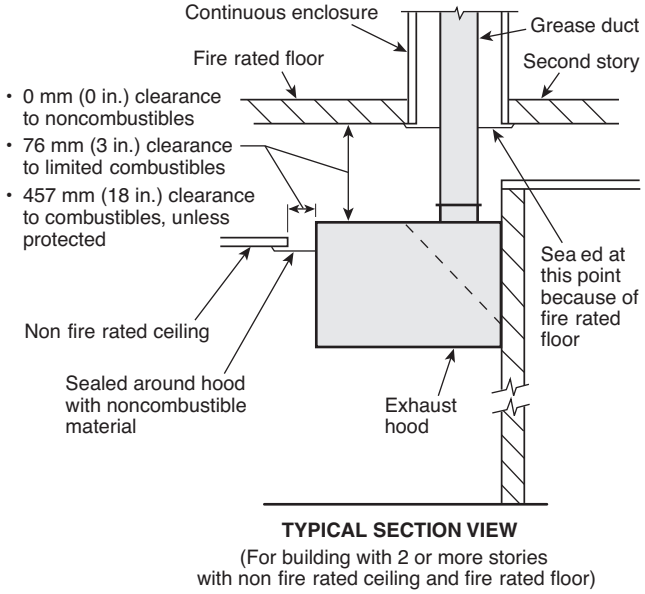


FIGURE A.4.2(e) Detail Drawings Showing Hoods Penetrating Ceilings.

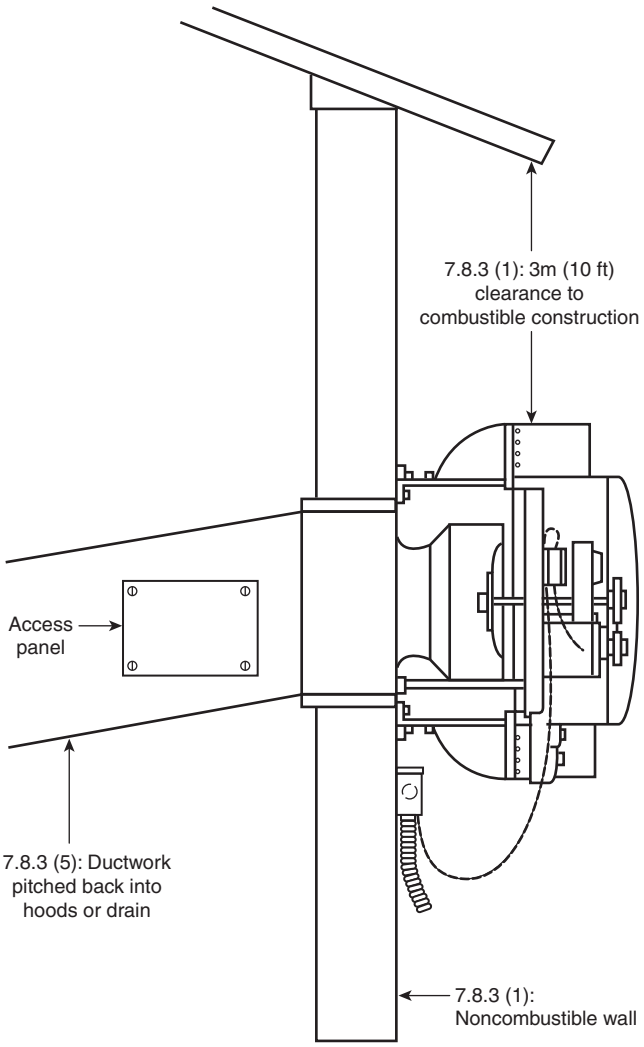


FIGURE A.4.2(f) Wall-Mounted Fan.

A.7.8.2.2 Both types of fan terminations should be accessible as follows:

(1) *Rooftop Terminations.* All roof exhaust fans (whether through the roof or to the roof from outside) should have ready access to all sides from a flat roof surface without a ladder, or they should be provided with safe access via built-in stairs, a walkway, or a portable ladder to a flat work surface on all sides of the fan. *(See 7.8.2.)*

(2) *Wall Terminations.* All through-the-wall exhaust fans should have ready access from the ground from no more than a 2 m (6 ft) stepladder or should be provided with a flat work surface under the fan that allows for access to all sides of the fan from no more than a 6 m (20 ft) extension ladder. *(See 7.8.3.)*

A.7.8.4 Figure A.7.8.4 is an example of a rooftop termination for a duct traveling up the exterior of the building after penetrating a wall.

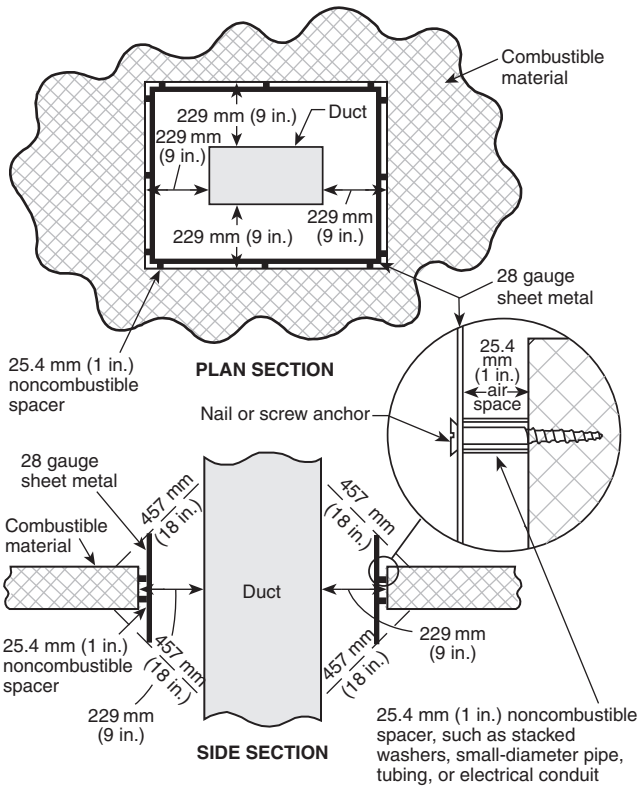


FIGURE A.4.2(g) Example of Clearance Reduction System: 229 mm (9 in.) Clearance to Combustible Material.

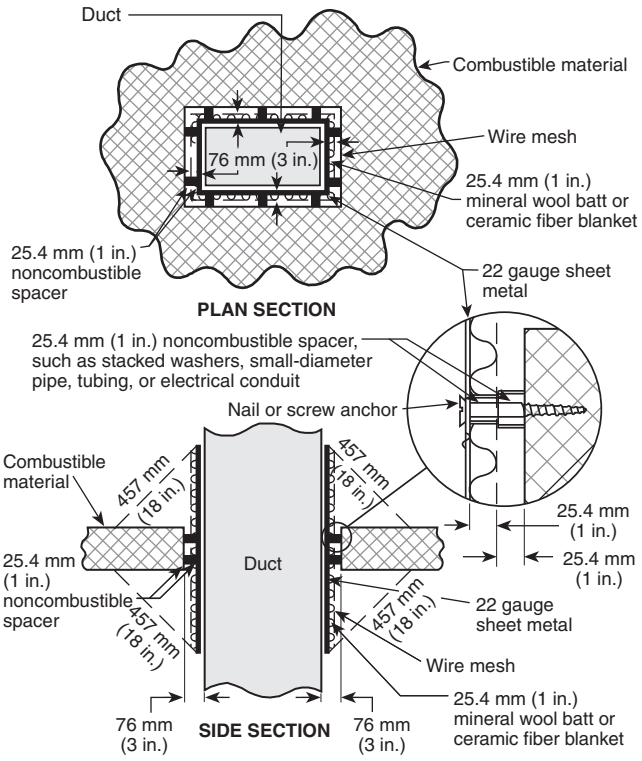


FIGURE A.4.2(h) Example of Clearance Reduction System: 76 mm (3 in.) Clearance to Combustible Material.

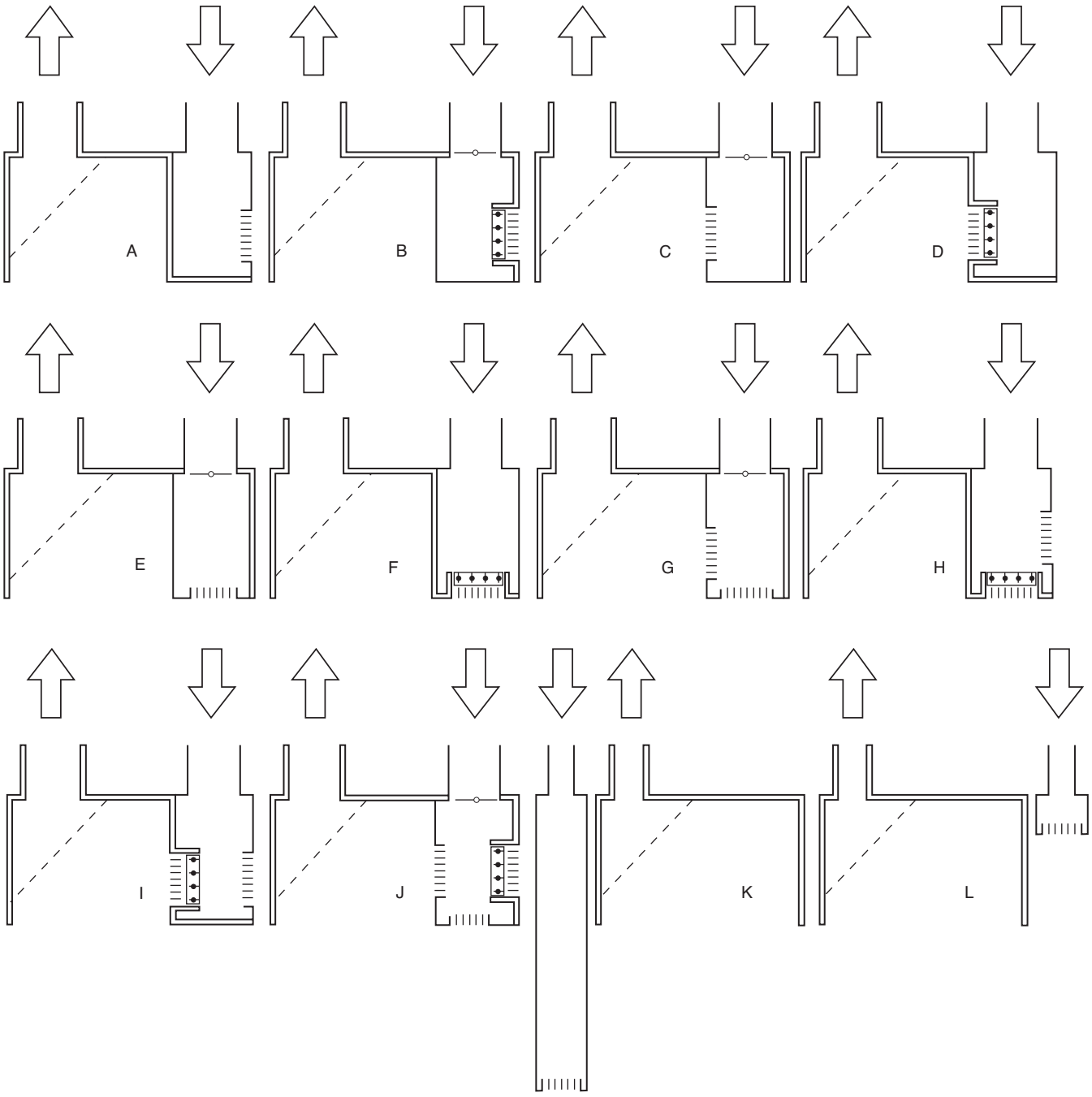


FIGURE A.5.3.4 Examples of Exhaust Hood Assemblies with Integrated Supply Air Plenums.

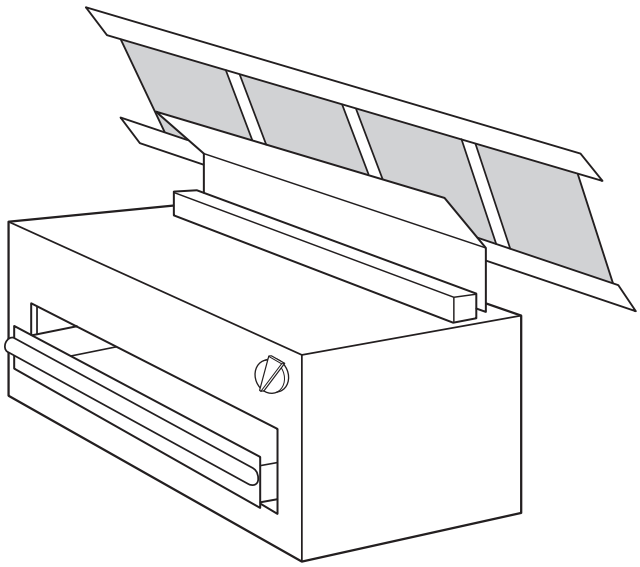


FIGURE A.6.2.2.2 Typical Arrangement of Baffle Protecting Filters at Appliance Vent.

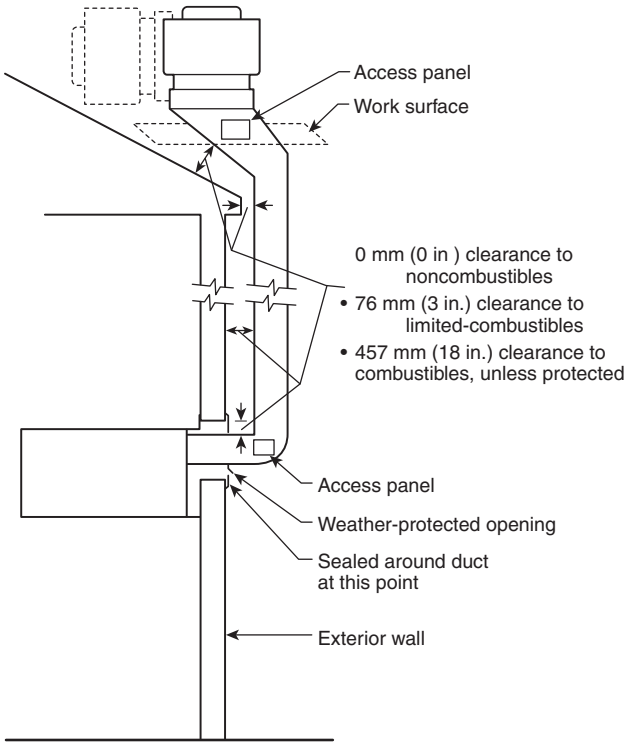


FIGURE A.7.8.4 Rooftop Terminations Through Combustible or Limited-Combustible Walls.

A.8.1.2 An upblast exhaust fan is popular due to its low cost and ease of installation and is common in one- or two-story freestanding restaurants. The fan housing typically is made of spun aluminum. The motor and the belt drive are outside the airstream. See Figure A.8.1.2 for an example.

A.8.1.3 Figure A.8.1.3 shows an in-line fan, which normally is used where space is not available for a utility set fan. It typically is located in a horizontal duct run in the false ceiling (interstitial) space.

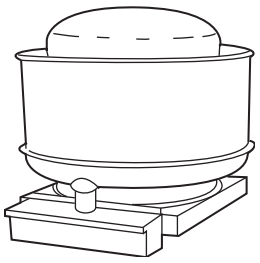


FIGURE A.8.1.2 Typical Upblast Fan.

A.8.1.4 See Figure A.8.1.4 for an example of a utility set fan. This type of fan generally is used for large exhaust systems such as found in hotels, hospitals, and prisons or in restaurants located in high-rise buildings. It typically is mounted on the roof but sometimes is located in a mechanical room.

A.8.2.1.1 In ASHRAE Research Project 1033-RP Final Report, Kuehn et al. documented that grease deposition is reduced as air velocity is reduced, primarily due to less turbulence at the duct surface. Tests were performed at velocities of 2.54 m/s, 5.08 m/s, 7.62 m/s, and 10.16 m/s (500 fpm, 1000 fpm, 1500 fpm, and 2000 fpm). The 2.54 m/s (500 fpm) velocity maintains or improves the safety aspect of minimizing grease buildup, while allowing engineers more flexibility in both retrofit and new kitchen design that include variable flow kitchen exhaust systems. According to the report, grease deposition in uninsulated ducts exposed to cold outdoor climates can increase with lower duct velocities, and insulation of R10 or greater is recommended.

A.8.2.2.2 Performance tests can include a field test conducted with all appliances under the hood at operating temperatures and with all sources of outside air providing makeup air. Capture and containment should be verified visually by observing smoke or steam by actual or simulated full-load cooking.

A.8.3 It is not advisable to discontinue the use of replacement air systems during cooking operations. Exhaust function, indoor pollution, indoor comfort, and grease removal, for example, will be adversely affected.

A.8.4.1 See Figure A.8.4.1.

A.9.2.4 All wiring should be designed, specified, and installed with due regard to the effects of heat, vapor, and grease on the equipment.

A.10.1.2 Examples of cooking equipment that produce grease-laden vapors include, but are not limited to, deep fat fryers, ranges, griddles, broilers, woks, tilting skillets, and braising pans.

A.10.2.2 NFPA 10, Annex A, provides recommendations for placards.

A.10.2.3 ANSI/UL 300 primarily addresses the method of fire testing for self-contained chemical extinguishing systems commonly referred to as pre-engineered systems. ANSI/UL 300 has been identified as a baseline for testing fire-extinguishing systems intended for the protection of commercial cooking–related hazards. Additional equivalent testing standards can and have been written for other types of fire-

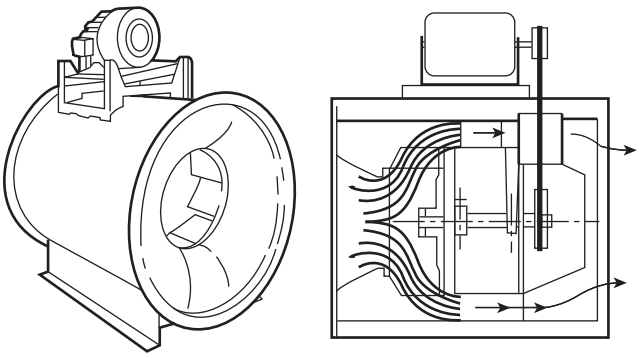


FIGURE A.8.1.3 In-Line Fan.

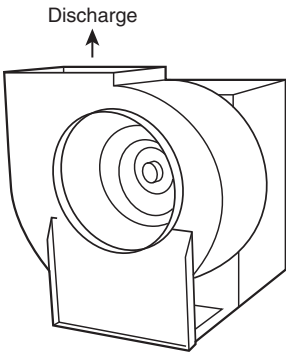


FIGURE A.8.1.4 Typical Utility Set Fan.

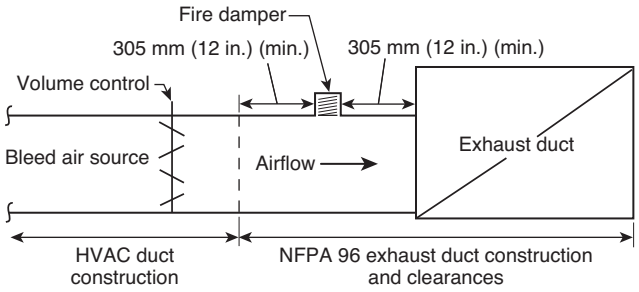


FIGURE A.8.4.1 System for Introducing Bleed Air into a Master Exhaust Duct.

extinguishing systems not considered pre-engineered that demonstrate equivalent fire testing severity to the ANSI/UL 300 test standard. Current examples include, but are not limited to, ANSI/UL 199, UL Subject 199B, UL Subject 199E, and ANSI/UL 710B.

A.10.2.3.1 A change from rendered animal fat to cooking oil likely will increase auto-ignition temperatures, and a change to insulated energy-efficient cooking equipment that does not allow ease of cooling likely will result in difficulties sustaining extinguishment with systems not complying with ANSI/UL 300 or equivalent standards.

N **A.10.2.3.2** The provision became a requirement for all systems effective January 1, 2014.

A.10.2.10(4) An approved weekly recorded inspection could consist of a log of entries that would display the date and time of each inspection and the initials of the person(s) conducting the visual inspection. Attaching the log to a clipboard and mounting it near the valve in question serves as a convenient reminder of the need to conduct the inspection.

A.10.8.2 Although training and qualification might be available elsewhere, the manufacturer of the equipment being installed should be considered an appropriate source of training and qualification.

A.10.9.1 The system used to rate extinguishers for Class B fires (flammable liquids in depth) does not take into consideration the special nature of heated grease fires. Cooking-grease fires are a special hazard requiring agents that saponify (make a soap foam layer to seal the top surface of the grease) for this application.

N **A.11.1.4** It is important that all kitchen employees be instructed that the fire-extinguishing system is the primary protection and how to respond appropriately to a fire. If the fire cannot be extinguished by shutting off the fuel source to a pan of burning grease and covering the pan, then employees should perform the following:

(1) Operate the manual actuation device for the fire-extinguishing system to suppress the fire and automatically shut off fuel to the appliances.
(2) Call the fire department and report the fire.
(3) Evacuate personnel and guests, as needed.
(4) Stand by with a Class K fire extinguisher to be used if the fire is not fully extinguished by the fire-extinguishing system.

A 11.2 1 It is recommended that such training and qualification be performed by the manufacturer of the equipment being inspected and serviced. The various electrical, mechanical, and filtration components of the systems should be inspected and tested as required to ensure that they continue to function according to original design.

A.11.2.2 It is not intended that actual discharge of agent occur to test all components, but where pressure from the discharging agent or from compressed gas actuators is needed to activate control components, an alternate means for testing those components should be provided and used.

A.11.2.4 The date of manufacture marked on fusible metal alloy sensing elements does not limit when they can be used. These devices have unlimited shelf life. The intent of 11.2.4 is to require semiannual replacement of fusible metal alloy sensing elements that have been installed in environments that subject them to contaminant loading, such as grease in restaurant hoods and ducts, that could adversely affect their proper operation.

A.11.3.3 See A.11.2.4.

A.11.4 The primary focus of an inspection for cleanliness is to establish whether the volume of grease buildup within the exhaust system warrants cleaning and to determine whether adequate access is available throughout the exhaust system to remove the grease buildup.

A.11.6.1 ANSI/IKECA Standard C-10 provides guidance for cleaning the exhaust system.

A good operating practice is for cleaning personnel of commercial kitchen exhaust systems to have personal protective equipment (PPE) and height access equipment. The following items should be considered as a minimum:

(1) Eye protection
(2) Hand protection
(3) Head protection
(4) Foot protection
(5) Respiratory protection
(6) Fall protection
(7) Ladders
(8) Lock-out/tag-out kit

Preparation. The fan should be turned off, locked out, and tagged out. Open flames should be extinguished, and switches/breakers serving the appliance and cooking area outlets should be locked out. If the switches/breakers are not capable of being locked out and tagged out, any solid-fuel cooking appliances should be extinguished and the solid fuel removed.

Removal or Covering of Equipment. Food products, cookware, and cooking support equipment that can be removed should be removed from the cleaning area. Equipment that cannot be removed should be covered.

Cleaning Methods. The following methods for cleaning surfaces covered with grease and contaminants have been proved to be effective:

(1) Manual cleaning by scraping, grinding, or scrubbing
(2) Chemical cleaning with agents and water
(3) Pressure washing with pressurized water or pressurized water and agents
(4) Steam cleaning with pressurized steam

Waste Water and Solid Waste. Wa er and agents used in the cleaning process and solid waste should be collected for disposal.

A.11.7.2 Once the agent has fully discharged and if the fire has not been extinguished, the fire can continue to burn and spread. This can occur if the fire starts in or before system discharge and spreads to an area outside the protected area. Examples of areas outside the zone of protection include the flue of a gas-fired fryer, the area below the cooking surface of a griddle, inside the grease drip collectors, and any area behind or below an appliance. To minimize the probability of a fire spreading out of control, it is important that these areas outside the zone of protection be kept clean of grease and other combustible cooking residues.

A.12.1.1 Cooking appliances that are designed for permanent installation, including, but not limited to, ranges, ovens, stoves, broilers, grills, fryers, griddles, and barbecues, should be installed in accordance with the manufacturer's installation instructions.

(1) Commercial electric cooking appliances should be listed and labeled in accordance with ANSI/UL 197.
(2) Microwave cooking appliances should be listed and labeled in accordance with ANSI/UL 923.
(3) Oil-burning stoves should be listed and labeled in accordance with ANSI/UL 896.
(4) Wood-fired cooking appliances should be listed and labeled in accordance with ANSI/UL 737 or UL Subject 2162, depending on exact appliance type.
(5) Gas-fired cooking appliances should be listed and labeled in accordance with ANSI Z83.11.
(6) Gas-wood-fired cooking appliances should be listed and labeled in accordance with ANSI Z83.11, ANSI/UL 737, and/or UL Subject 2162, depending on exact appliance type.

A.12.1.2.1 Gas-fueled appliances should be installed to the requirements of NFPA 54 or NFPA 58.

A.12.1.2.2 The effectiveness of an automatic extinguishing system is affected by the placement of the nozzles. For this reason, it is essential that cooking appliances be situated in the area in which they were when the extinguishing equipment was designed and installed. If an appliance is moved from under the equipment for cleaning or any other reason, it should be returned to its original position prior to initiation of a cooking operation.

When appliances are on wheels or casters for ease of cleaning, it is important that the appliance be placed in its design position to ensure that the fire-extinguishing system will be effective. An approved method should ensure that the appliance is returned to its appropriate position before cooking takes place. Channels, markings, or other approved methods assist in ensuring proper placement.

A.14.2.2 The space or room should be of ample size to permit adequate circulation of heated air.

A.14.3.4 This section is intended to apply when heat for cooking is provided by gas burners when a limited quantity [see 14.3.4(4)] of solid fuel is used for flavoring.

A.14.3.4(1) Verify conformance with 12.1.2 prior to adding a solid fuel holder (smoker box) to existing cooking equipment.

A 14 3.4(4) The limit of 2 kg (4.5 lb) of solid fuel consumed per hour per 29.3 kW (100,000 Btu/hr) of burner capacity is used to provide a measurable and enforceable limitation. It is anticipated that documented cooking procedures can be established to limit solid fuel consumption to 2 kg (4.5 lb) per hour per 29.3 kW (100,000 Btu/hr) of burner capacity. The cooking procedures should clearly identify how the solid fuel is used (i.e., size and quantity of wood strips used, the number of wood strips that can be in the solid fuel holder at any given time, approximately how long the strips are expected to last, and at what point new strips can be added). Acceptable cooking procedures can be used by both the cook and the authority having jurisdiction to verify compliance with this requirement. It is not anticipated that solid fuel consumption will be continuously monitored, but rather that the fuel consumption will be limited by following acceptable documented cooking procedures. The gas burner capacity (in kW or Btu/hr) should be based on the manufacturer's rating.

A.14.7.8 Water-type extinguishers are not allowed in the kitchen cooking area because they do not saponify upon contact with grease. However, 2-A rated water spray extinguishers are allowed to be used for solid fuel cooking in appliances with fireboxes of 0.14 m^3 (5 ft^3) volume or less. The 2-A rated water spray fire extinguisher is equipped with a nozzle that does not produce a straight stream.

A.15.1 See Figure A.15.1, which shows a typical nonrecirculating downdraft system arrangement.

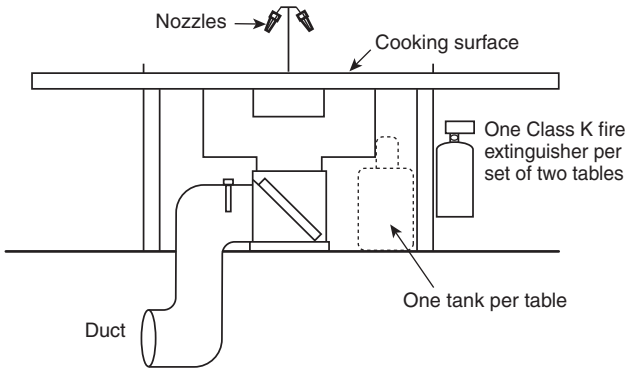


FIGURE A.15.1 Typical Downdraft System Arrangement.

N ▲ Annex B Mobile and Temporary Cooking Operations

This annex is not a part of the requirements of this NFPA document unless specifically adopted by the jurisdiction at the discretion of the adopting jurisdiction. Additionally, information in this annex is intended to be incorporated on a voluntary basis. Although this annex is written in mandatory language, it is not intended to be enforced or applied unless specifically adopted by the jurisdiction or it is applied on a voluntary basis.

B.1 General.

B.1.1 Mobile and temporary cooking operations shall comply with the requirements of this chapter.

B.1.1.1 Cooking equipment that is powered on during transit shall be listed as installed for such use.

B.1.2 Cooking equipment used in processes producing smoke or grease laden vapors shall be equipped with an exhaust system that complies with all the equipment and performance requirements of this standard.

B.1.2.1 Cooking equipment that has been listed in accordance with ANSI/UL 197 or an equivalent standard for reduced emissions shall not be required to be provided with an exhaust system.

B.1.2.2 The listing evaluation of cooking equipment covered by B.1.2.1 shall demonstrate that the grease discharge at the exhaust duct of a test hood placed over the appliance shall not exceed 5 mg/m^3 (0.00018 oz/ft^3) when operated with a total airflow of 0.236 m^3/s (500 cfm).

B.1.3 All such equipment and its performance shall be maintained in accordance with the requirements of this standard during all periods of operation of the cooking equipment.

B.1.4 The following equipment shall be kept in working condition:

(1) Cooking equipment
(2) Hoods
(3) Ducts (if applicable)
(4) Fans
(5) Fire-extinguishing equipment
(6) Special effluent or energy control equipment

B.1.4.1 Maintenance and repairs shall be performed on all components at intervals necessary to maintain good working condition.

B.1.5 All airflows shall be maintained.

B.1.6 The responsibility for inspection, testing, maintenance, and cleanliness of the ventilation control and fire protection of the commercial cooking operations, including cooking appliances, shall ultimately be that of the owner of the system, provided that this responsibility has not been transferred in written form to a management company, tenant, or other party.

B.1.7 All interior surfaces of the exhaust system shall be accessible for cleaning and inspection purposes.

B.2 Clearance. Note: See Figure A.4.2(a) through Figure A.4.2(h) for clarification of the appropriate clearances required in Section B.2.

B.2.1 Where enclosures are not required, hoods, grease removal devices, exhaust fans, and ducts shall have a clearance of at least 457 mm (18 in.) to combustible material, 76 mm (3 in.) to limited-combustible material, and 0 mm (0 in.) to noncombustible material.

B.2.2 Where a hood, duct, or grease removal device is listed for clearances less than those required in B.2.1, the listing requirements shall be permitted.

B.2.3 Clearance Reduction.

B.2.3.1 Where a clearance reduction system consisting of 0.33 mm (0.013 in.) (28 gauge) sheet metal spaced out 25 mm (1 in.) on noncombustible spacers is provided, there shall be a minimum of 229 mm (9 in.) clearance to combustible material.

B.2.3.2 Where a clearance reduction system consisting of 0.69 mm (0.027 in.) (22 gauge) sheet metal on 25 mm (1 in.) mineral wool batts or ceramic fiber blanket reinforced with wire mesh or equivalent spaced 25 mm (1 in.) on noncombustible spacers is provided, there shall be a minimum of 76 mm (3 in.) clearance to combustible material.

B.2.3.3 Where a clearance reduction system consisting of a listed and labeled field-applied grease duct enclosure material, system, product, or method of construction specifically evaluated for such purpose in accordance with ASTM E2336, the required clearance shall be in accordance with the listing.

B.2.3.4 Zero clearance to limited-combustible materials shall be permitted where protected by one of the following:

(1) Metal lath and plaster
(2) Ceramic tile
(3) Quarry tile
(4) Other noncombustible materials or assembly of noncombustible materials that are listed for the purpose of reducing clearance
(5) Other materials and products that are listed for the purpose of reducing clearance

B.2.4 Clearance Integrity.

B.2.4.1 In the event of damage, the material or product shall be repaired and restored to meet its intended listing or clearance requirements and shall be acceptable to the AHJ.

B.2.4.2 In the event of a fire within a kitchen exhaust system, the duct and its enclosure (rated shaft, factory-built grease duct enclosure, or field-applied grease duct enclosure) shall be inspected by qualified personnel to determine whether the duct and protection method are structurally sound, capable of maintaining their fire protection function, and in compliance with this standard for continued operation.

Note: The intent of this paragraph is to maintain the systems and their function in accordance with the requirements of the edition of NFPA 96 under which the systems were designed and installed.

B.2.4.3 Protection shall be provided on the wall from the bottom of the hood to the floor, or to the top of the noncombustible material extending to the floor, to the same level as required in B.2.1.

B.2.4.4 The protection methods for ducts to reduce clearance shall be applied to the combustible or limited-combustible construction, not to the duct itself.

B.3 Duct Contact.

B.3.1 A duct shall be permitted to contact noncombustible floors, interior walls, and other noncombustible structures or supports, but it shall not be in contact for more than 50 percent of its surface area for each linear foot of contact length.

B.3.2 Where duct contact must exceed the requirements of B.3.1, the duct shall be protected from corrosion.

B.3.3 Where the duct is listed for zero clearance to combustibles or is otherwise protected with a material or product listed for the purpose of reducing clearance to zero, the duct shall be permitted to exceed the contact limits of B.3.1 without additional corrosion protection.

B.3.4 Where the duct is listed for zero clearance to combustibles, the duct shall be permitted to exceed the contact limits of B.3.1 without additional corrosion protection.

B.3.5 Duct Clearances to Enclosures. Clearances between the duct and interior surfaces of enclosures shall meet the requirements of Section B.2.

B.3.6 Drawings. A drawing(s) of the exhaust system installation along with copies of operating schematics shall be kept in the mobile unit or temporary cooking operation unit.

B.3.7 Authority Having Jurisdiction Notification. If required by the authority having jurisdiction, notification in writing shall be given of any alteration, replacement, or relocation of any exhaust or extinguishing system or part thereof or cooking equipment.

B.3.8 Materiels.

B.3.8.1 Noncombustible Material.

B.3.8.1.1 A material that complies with any of the following shall be considered a noncombustible material:

(1) The material, in the form in which it is used, and under the conditions anticipated, will not ignite, burn, support combustion, or release flammable vapors when subjected to fire or heat.
(2) The material is reported as passing ASTM E136, *Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 Degrees C.*
(3) The material is reported as complying with the pass/fail criteria of ASTM E136 when tested in accordance with the test method and procedure in ASTM E2652, *Standard Test Method for Behavior of Materials in a Tube Furnace with a Cone-shaped Airflow Stabilizer, at 750 Degrees C.*

[**5000:**7.1.4.1.1]

Note: The provisions of B.3.8.1.1 do not require inherently noncombustible materials to be tested in order to be classified as noncombustible materials. Examples of such materials include steel, concrete, masonry, and glass.

B.3.8.1.2 Where the term *limited-combustible* is used in this [standard], it shall also include the term *noncombustible*. [**5000:**7.1.4.1.2]

B.3.8.2 Limited-Combustible Material. A material shall be considered a limited-combustible material where both of the conditions of B.3.8.2.1, and B.3.8.2.2, and the conditions of either B.3.8.2.3 or B.3.8.2.4 are met. **[5000:**7.1.4.2]

B.3.8.2.1 The material does not comply with the requirements for a noncombustible material, in accordance with B.3.8.1.1. [**5000:**7.1.4.2(1)]

B.3.8.2.2 The material, in the form in which it is used, exhibits a potential heat value not exceeding 3500 Btu/lb (8141 kJ/kg), when tested in accordance with NFPA 259. [**5000:**7.1.4.2(2)]

B.3.8.2.3 The material shall have a structural base of a noncombustible material with a surfacing not exceeding a thickness of 1⁄8 in. (3.2 mm) where the surfacing exhibits a flame spread index not greater than 50 when tested in accordance with ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or ANSI/UL 723, *Standard for Test for Surface Burning Characteristics of Building Materials*. [**5000:**7.1.4.2.1]

B.3.8.2.4 The material shall be composed of materials that, in the form and thickness used, neither exhibit a flame spread index greater than 25 nor evidence of continued progressive combustion when tested in accordance with ASTM E84 or ANSI/UL 723 and are of such composition that all surfaces that would be exposed by cutting through the material on any plane would neither exhibit a flame spread index greater than 25 nor exhibit evidence of continued progressive combustion when tested in accordance with ASTM E84 or ANSI/UL 723. [**5000:**7.1.4.2.2]

B.3.8.2.5 Where the term limited-combustible is used in this [standard], it shall also include the term noncombustible. [**5000:**7.1.4.2.3]

B.4 Hoods.

B.4.1 Construction.

B.4.1.1 The hood or that portion of a primary collection means designed for collecting cooking vapors and residues shall be constructed of and be supported by steel not less than 1.21 mm (0.048 in.) (No. 18 MSG) in thickness, stainless steel not less than 0.91 mm (0.036 in.) (No. 20 MSG) in thickness, or other approved material of equivalent strength and fire and corrosion resistance.

B.4.1.2 All seams, joints, and penetrations of the hood enclosure that direct and capture grease-laden vapors and exhaust gases shall have a liquidtight continuous external weld to the hood's lower outermost perimeter.

B.4.1.3 Seams, joints, and penetrations of the hood shall be permitted to be internally welded, provided that the weld is formed smooth or ground smooth, so as to not trap grease, and is cleanable.

B.4.1.4 Internal hood joints, seams, filter support frames, and appurtenances attached inside the hood shall be sealed or otherwise made greasetight.

Note: Welding is one acceptable method.

B.4.1.5 Penetrations shall be permitted to be sealed by devices that are listed for such use and whose presence does not detract from the hood's or duct's structural integrity.

B.4.1.6 Listed exhaust hoods with or without exhaust dampers shall be permitted to be constructed of materials required by the listing.

B.4.1.7 Listed exhaust hoods with or without exhaust dampers shall be permitted to be assembled in accordance with the listing requirements.

B.4.1.8 Eyebrow-Type Hoods.

B.4.1.8.1 Eyebrow-type hoods over gas or electric ovens shall be permitted to have a duct constructed as required in B.6 from the oven flue(s) connected to the hood canopy upstream of the exhaust plenum, as shown in Figure 5.1.8.1.

B.4.1.8.2 The duct connecting the oven flue(s) to the hood canopy shall be connected with a continuous weld or have a duct-to-duct connection. *[See Figure 8.1.3.2(b) through Figure 8.1.3.2(d).]*

B.4.1.9 Insulation materials other than electrical insulation shall have a flame spread index of 25 or less, when tested in accordance with ASTM E84 or ANSI/UL 723.

B.4.1.10 Adhesives or cements used in the installation of insulating materials shall comply with the requirements of B.4.1.9 when tested with the specific insulating material.

B.4.1.11 Penetrations shall be sealed with listed devices in accordance with the requirements of B.4.1.12.

B.4.1.12 Devices that require penetration of the hood, such as pipe and conduit penetration fittings and fasteners, shall be listed in accordance with ANSI/UL 1978.

B.4.1.13 Wall-mounted exhaust hood assemblies shall be tight fitting against the back wall so as to not permit passage of grease vapor behind the hood or between the back wall and the hood assembly.

B.4.2 Hood Size. Hoods shall be sized and configured to provide for the capture and removal of grease-laden vapors. *(See B.7.2.2.)*

B.4.3 Exhaust Hood Assemblies with Integrated Supply Air Plenums.

B.4.3.1 The construction and size of exhaust hood assemblies with integrated supply air plenums shall comply with the requirements of B.4.1 and B.4.2.

B.4.3.2 The construction of the outer shell or the inner exhaust shell shall comply with B.4.1.

B.4.3.3 Where the outer shell is welded, the inner shell shall be of greasetight construction.

B.4.4 Listed Hood Assemblies. Note: Examples of acceptable materials for hoods include steel and stainless steel. Additionally, many health officials prohibit galvanized steel in hoods, as does NSF/ANSI 2.

B.4.4.1 Listed hood assemblies shall be installed in accordance with the terms of their listing and the manufacturer's instructions.

B.4.4.2 Listed hood assemblies shall be tested in accordance with ANSI/UL 710 or equivalent.

B.5 Grease Removal Devices in Hoods.

B.5.1 Grease Removal Devices.

B.5.1.1 Listed grease filters or other listed grease removal devices intended for use with commercial cooking operations shall be provided.

B.5.1.2 Listed grease filters and grease removal devices that are removable but not an integral component of a specific listed exhaust hood shall be listed in accordance with ANSI/UL 1046 and shall be designated on the filter.

B.5.1.3 Mesh filters shall not be used unless evaluated as an integral part of a listed exhaust hood or listed in conjunction with a primary filter in accordance with ANSI/UL 1046.

B.5.2 Installation.

B.5.2.1 Separation Distance.

B.5.2.1.1 The distance between the grease removal device and the cooking surface shall be as great as possible but not less than 457 mm (18 in.).

B.5.2.1.2 Where grease removal devices are used in conjunction with solid fuel or solid fuel-type broilers, including gas or electrically heated charbroilers, a minimum vertical distance of 1.22 m (4 ft) shall be maintained between the lower edge of the grease removal device and the cooking surface.

B 5 2.1.3 For cooking equipment without exposed flame and where flue gases bypass grease removal devices, the minimum vertical distance shall be permitted to be reduced to not less than 152 mm (6 in.).

B.5.2.1.4 Where a grease removal device is listed for separation distances less than those required in B.5.2.1.1 and B.5.2.1.2, the listing requirements shall be permitted.

B.5.2.1.5 Grease removal devices supplied as part of listed hood assemblies shall be installed in accordance with the terms of the listing and the manufacturer's instructions.

B.5.2.2 Grease Removal Device Protection.

B.5.2.2.1 Where the distance between the grease removal device and the appliance flue outlet (heat source) is less than 457 mm (18 in.), grease removal devices shall be protected from combustion gas outlets and from direct flame impingement occurring during normal operation of cooking appliances producing high flue gas temperatures.

Note: Appliances that produce high flue gas temperatures include deep-fat fryers, upright or high broilers, and salamander broilers.

B.5.2.2.2 This protection shall be permitted to be accomplished by the installation of a steel or stainless steel baffle plate between the heat source and the grease removal device.

Note: For a typical arrangement of a baffle protecting filters at an appliance vent, see Figure A.6.2.2.2.

B.5.2.2.3 The baffle plate shall be sized and located so that flames or combustion gases travel a distance not less than 457 mm (18 in.) from the heat source to the grease removal device.

B.5.2.2.4 The baffle shall be located not less than 152 mm (6 in.) from the grease removal device.

B.5.2.3 Grease Filters.

B.5.2.3.1 Grease filters shall be listed.

B.5.2.3.2 Grease filters shall be constructed of noncombustible material.

B.5.2.3.3 Grease filters shall be of rigid construction that will not distort or crush under normal operation, handling, and cleaning conditions.

B.5.2.3.4 Grease filters shall be arranged so that all exhaust air passes through the grease filters.

B.5.2.3.5 Grease filters shall be easily accessible for removal.

B.5.2.3.6 Grease filters shall be installed at an angle not less than 45 degrees from the horizontal.

B.5.2.4 Grease Drip Trays.

B.5.2.4.1 Grease filters shall be equipped with a grease drip tray beneath their lower edges.

B.5.2.4.2 Grease drip trays shall be kept to the minimum size needed to collect grease.

B.5.2.4.3 Grease drip trays shall be pitched to drain into an enclosed metal container having a capacity not exceeding 3.8 L (1 gal).

B.5.2 5 Grease Filter Orientation Grease filters that require a specific orientation to drain grease shall be clearly so designated on the face of the filter as to be visible with the filter installed, or the hood or filter shall be constructed so that filters cannot be installed in the wrong orientation.

B.6 Exhaust Duct Systems.

B.6.1 All ducts shall lead directly to the exterior of the mobile unit or temporary cooking operation, so as not to unduly increase any fire hazard.

Note: Vertical or substantially pitched ducts are preferred over horizontal ducts because of their capacity to drain grease and to transfer heated vapors more rapidly to the exterior of a mobile unit or temporary cooking operation.

B.6.2 All ducts shall be installed with a minimum 2 percent slope on horizontal runs up to 22.86 m (75 ft) and a minimum 8 percent slope on horizontal runs greater than 22.86 m (75 ft).

B.6.2.1 Factory-built grease ducts shall be permitted to be installed at a lesser slope in accordance with the listing and the manufacturer's instructions.

B.6.2.2 All horizontal ducts shall be provided with access in accordance with B.6.5.1.

B.6.2.3 Drains shall be provided at low points in horizontal ducts.

Note: Typically, ducts that are sloped in accordance with B.6.2 prevent collection points for residue and eliminate the need for drains. For horizontal ducts greater than 22.86 m (75 ft), low points are difficult to avoid. Where the low points cannot be avoided, access and drains should be considered.

B.6.2.3.1 Where provided, drains shall be continuously welded to the exhaust duct in accordance with the terms of the listing and the manufacturer's installation manual.

B.6.2.4 All ducts shall be installed without forming dips or traps.

B.6.2.5 Openings required for accessibility shall comply with B.6.4.

B.6.2.6 A sign stating the following shall be placed on all access panels:

ACCESS PANEL — DO NOT OBSTRUCT

B.6.2.7 Listed grease ducts shall be installed in accordance with the terms of the listing and the manufacturer's instructions.

B.6.3 Clearance. Clearance between ducts and combustible materials shall be provided in accordance with the requirements of Section B.2.

B.6.3.1 Where single-wall ductwork penetrates a non-fire-rated roof assembly, the penetration point shall be of limited combustible or noncombustible construction unless a field applied grease duct enclosure is installed to the top of the roof curb or the clearances of Section B.2 are maintained.

B.6.4 Openings.

B.6.4.1 Openings shall be provided at the sides or at the top of the duct, whichever is more accessible, and at changes of direction.

B.6.4.2 Openings shall be protected by approved access constructed and installed in accordance with the requirements of B.6.5.4.

B.6.4.3 Openings shall not be required in portions of the duct that are accessible from the duct entry or discharge.

B.6.4.4 Access panel openings shall not be required in portions of the common exhaust duct or branch duct that are accessible from the branch duct connection to the exhaust hood.

B.6.4.5 Exhaust fans with ductwork connected to both sides shall have access for cleaning and inspection within 0.92 m (3 ft) of each side of the fan.

B.6.4.6 Wall-mounted exhaust fans shall have access for cleaning and inspection within 0.92 m (3 ft) of the exhaust fan.

B.6.5 Openings in Ducts. All openings shall comply with the requirements of this section.

B.6.5.1 Horizontal Ducts.

B.6.5.1.1 On horizontal ducts, at least one 508 mm × 508 mm (20 in. × 20 in.) opening shall be provided for personnel entry.

B.6.5.1.2 Where an opening of the size specified in B.6.5.1.1 is not possible, openings large enough to permit thorough cleaning shall be provided at 3.7 m (12 ft) intervals.

B.6.5.1.3 Support systems for horizontal grease duct systems 609 mm (24 in.) and larger in any cross-sectional dimension shall be designed for the weight of the ductwork plus 363 kg (800 lb) at any point in the duct systems.

B.6.5.1.4 On nonlisted ductwork, the edge of the opening shall be not less than 38.1 mm (1 ½ in.) from all outside edges of duct or welded seams.

B.6.5.2 Vertical Ducts.

B.6.5.2.1 On vertical ductwork where personnel entry is possible, access shall be provided at the top of the vertical riser to accommodate descent.

B.6.5.2.2 Where personnel entry is not possible, adequate access for cleaning shall be provided on each floor.

B.6.5.2.3 On nonlisted ductwork, the edge of the opening shall be not less than 38.1 mm (1 ½ in.) from all outside edges of the duct or welded seams.

B.6.5.3 Access Panels.

B.6.5.3.1 Access panels shall be of the same material and thickness as the duct.

B.6.5.3.2 Access panels shall have a gasket or sealant that is rated for 815.6°C (1500°F) and shall be greasetight.

B.6.5.3.3 Fasteners, such as bolts, weld studs, latches, or wing nuts, used to secure the access panels shall be carbon steel or stainless steel and shall not penetrate duct walls.

B.6.5.3.4 Listed grease duct access door assemblies (access panels) shall be installed in accordance with the terms of the listing and the manufacturer's instructions.

B.6 5.4 Protection of Openings.

B.6.5.4.1 Openings for installation, servicing, and inspection of listed fire protection system devices and for duct cleaning shall be provided in ducts and enclosures and shall conform to the requirements of B.6.4.

B.6.5.4.2 Enclosure openings required to reach access panels in the ductwork shall be large enough for removal of the access panel through the enclosure opening.

B.6.6 Other Grease Ducts. Other grease ducts shall comply with the requirements of this section.

B.6.6.1 Materials. Note: Examples of acceptable materials for ducts include the following:

(1) Steel
(2) Galvanized steel
(3) Stainless steel

B.6.6.1.1 Ducts shall be constructed of and supported by carbon steel not less than 1.52 mm (0.060 in.) (No. 16 MSG) in thickness or stainless steel not less than 1.21 mm (0.048 in.) (No. 18 MSG) in thickness.

B.6.6.1.2 Factory-built grease ducts listed in accordance with ANSI/UL 1978 shall be permitted to use materials in accordance with their listing.

B.6.6.2 Installation.

B.6.6.2.1 All seams, joints, penetrations, and duct-to-hood collar connections shall have a liquidtight continuous external weld.

B.6.6.2.1.1 Factory-built grease ducts listed in accordance with ANSI/UL 1978 shall be permitted to incorporate nonwelded joint construction in accordance with their listings.

B.6.6.2.1.2 Prior to the use of or concealment of any portion of a grease duct system, a leakage test shall be performed to determine that all welded joints and seams are liquidtight.

Note: The leakage test should consist of a light test, a water pressure test, or an approved equivalent test. The permit holder should be responsible for providing the necessary equipment and for performing the test. Refer to ANSI/ASHRAE 154, *Ventilation for Commercial Cooking Operations*, for specific information on such tests.

B.6.6.2.2 Duct-to-hood collar connections as shown in Figure 7.5.2.2 shall not require a liquidtight continuous external weld.

B.6.6.2.3 Penetrations shall be permitted to be sealed by other listed devices that are tested to be greasetight and are evaluated under the same conditions of fire severity as the hood or enclosure of listed grease extractors and whose presence does not detract from the hood's or duct's structural integrity.

B.6.6.2.4 Internal welding shall be permitted, provided the joint is formed or ground smooth and is readily accessible for inspection.

B.6.6.3 Penetrations shall be sealed with listed devices in accordance with the requirements of 7.5.4.

B.6.6.4 Devices that require penetration of the ductwork, such as pipe and conduit penetration fittings and fasteners, shall be listed in accordance with ANSI/UL 1978.

B.6.6.5 Welded Duct Connections.

B.6 6.5.1 Acceptable duct-to-duct connection shall be as follows:

(1) Telescoping joint, as shown in Figure 7.5.5.1(a)
(2) Bell-type joint, as shown in Figure 7.5.5.1(b)
(3) Flange with edge weld, as shown in Figure 7.5.5.1(c)
(4) Flange with filled weld, as shown in Figure 7.5.5.1(d)

B.6.6.5.2 Butt-welded connections shall not be permitted.

B.6.6.5.3 For telescoping and bell-type connections, the inside duct section shall always be uphill of the outside duct section.

B.6.6.5.4 For telescoping and bell-type connections, the difference between the inside dimensions of overlapping sections shall not exceed 6.4 mm (¼ in.).

B.6.6.5.5 For telescoping and bell-type connections, the overlap shall not exceed 50.8 mm (2 in.).

B.6.7 Exterior Installation.

B.6.7.1 The exterior portion of the ductwork shall be vertical wherever possible and shall be installed and supported on the exterior of a mobile unit or temporary cooking operation.

B.6.7.2 Bolts, screws, rivets, and other mechanical fasteners shall not penetrate duct walls.

B.6.7.3 Clearance of ducts shall comply with Section B.2.

B.6.7.4 All ducts shall be protected on the exterior by paint or other suitable weather-protective coating.

B.6.7.5 Ducts constructed of stainless steel shall not be required to have additional paint or weather-protective coatings.

B.6.7.6 Ductwork subject to corrosion shall have minimal contact with the mobile unit or temporary cooking operation surface.

B.6.8 Rooftop Terminations.

B.6.8.1 Rooftop terminations shall be arranged with or provided with the following:

(1) The ability to drain grease out of any traps or low points formed in the fan or duct near the termination of the system into a collection container that is noncombustible, closed, rainproof, and structurally sound for the service to which it is applied and that will not sustain combustion
(2) A grease collection device that is applied to exhaust systems that does not inhibit the performance of any fan
(3) Listed grease collection systems that meet the requirements of B.6.8.1(1) and B.6.8.1(2)
(4) A listed grease duct complying with Section B.3 or ductwork complying with B.3.5
(5) A hinged upblast fan supplied with flexible weatherproof electrical cable and service hold-open retainer to permit inspection and cleaning that is listed for commercial cooking equipment with the following conditions:
    (a) Where the fan attaches to the ductwork, the ductwork is a minimum of 0.46 m (18 in.) away from any roof surface, as shown in Figure 7.8.2.1.
    (b) The fan discharges a minimum of 1.02 m (40 in.) away from any roof surface, as shown in Figure 7.8.2.1.
(6) Other approved fan, provided it meets all of the following criteria
    (a) The fan meets the requirements of B.7.1.4.
    (b) Exhaust fan discharge is directed up and away from the roof surface.

B.6.8.2 Fans shall be provided with safe access and a work surface for inspection and cleaning.

B.6.9 Wall Terminations. Wall terminations shall be arranged with or provided with the following properties:

(1) The exhaust flow shall be directed perpendicularly outward from the wall face or upward.
(2) All the ductwork shall be pitched to drain the grease back into the hood(s) or with a drain provided to bring the grease back into a container within the mobile unit or temporary cooking operation or into a remote grease trap.
(3) A listed grease duct shall comply with B.6.5; other ducts shall comply with B.6.6.
(4) An approved fan shall meet the requirements of B.6.9(2) and B.7.1.2 or B.7.1.4.

B.7 Air Movement.

B.7.1 Exhaust Fans for Commercial Cooking Operations.

B.7.1.1 Fans used in exhaust systems for commercial cooking shall be listed in accordance with UL 762.

B.7.1.2 Upblast Exhaust Fans. Note: An upblast exhaust fan is popular due to its low cost and ease of installation and is common in one- or two-story freestanding restaurants. The fan housing typically is made of spun aluminum. The motor and the belt drive are outside the airstream. See Figure A.8.1.2 for an example.

B.7.1.2.1 Upblast fans with motors surrounded by the airstream shall be hinged and supplied with flexible weatherproof electrical cable and service hold-open retainers.

B.7.1.2.2 Installation shall conform to the requirements of B.6.8 and B.6.9.

B.7.1.2.3 Upblast fans shall have a drain directed to a readily accessible and visible grease receptacle not to exceed 3.8 L (1 gal).

B.7.1.3 In-Line Exhaust Fans.

B.7.1.3.1 In-line fans shall be of the type with the motor located outside the airstream and with belts and pulleys protected from the airstream by a greasetight housing.

B.7.1.3.2 In-line fans shall be connected to the exhaust duct by flanges securely bolted as shown in Figure 8.1.3.2(a) through Figure 8.1.3.2(d) or by a system specifically listed for such use.

B.7.1.3.3 Flexible connectors shall not be used.

B.7.1.3.4 If the design or positioning of the fan allows grease to be trapped, a drain directed to a readily accessible and visible grease receptacle not exceeding 3.8 L (1 gal) shall be provided.

B.7.1.3.5 In-line exhaust fans shall be located in easily accessible areas of adequate size to allow for service or removal.

B.7.1.3.6 Where the duct system connected to the fan is in an enclosure, the space or room in which the exhaust fan is located shall have the same fire resistance rating as the enclosure.

B.7.1.4 Utility Set Exhaust Fans. Note: See Figure A.8.1.4 for an example of a utility set fan. This type of fan generally is used for large exhaust systems such as found in hotels, hospitals, and prisons or in restaurants located in high-rise buildings. It typically is mounted on the roof but sometimes is located in a mechanical space or room.

B.7.1.4.1 Utility set exhaust fans, if installed at the rooftop termination point, shall meet the requirements of B.6.8.2.

B.7.1.4.2 The fan shall be connected to the exhaust duct by flanges securely bolted as shown in Figure 8.1.3.2(a) through Figure 8.1.3.2(d) or by a system specifically listed for such use.

B.7.1.4.3 Flexible connectors shall not be used.

B.7.1.4.4 Exhaust fans shall have a drain directed to a readily accessible and visible grease receptacle not to exceed 3.8 L (1 gal).

B.7.1.5 Exhaust Fan Housings Exhaust fan housings shall be constructed of carbon steel not less than 1.52 mm (0.060 in.) (No. 16 MSG) in thickness, of stainless steel not less than 1.21 mm (0.048 in.) (No. 18 MSG) in thickness, or, if listed, in accordance with the terms of the listing.

B.7.1.6 Openings for Cleaning, Servicing, and Inspection.

B.7.1.6.1 Openings for cleaning, servicing, and inspection shall conform to the requirements of 7.3.7.

B.7.1.6.2 Clearances shall conform to the requirements of Section B.2.

B.7.1.6.3 Upblast Fans.

B.7.1.6.3.1 Upblast fans shall be supplied with an access opening of a minimum 76 mm by 127 mm (3 in. by 5 in.) or a circular diameter of 101 mm (4 in.) on the curvature of the outer fan housing to allow for cleaning and inspection of the fan blades.

B.7.1.6.3.2 On existing upblast fans where sufficient access is not available to allow for the removal of grease contamination, an approved hinge mechanism or access panel shall be installed.

B.7.1.7 Wiring and Electrical Equipment. All wiring and electrical equipment shall comply with *NFPA 70 (see also Section B.8).*

B.7.2 Airflow

B.7.2.1 Air Velocity.

B.7.2.1.1 The air velocity through any duct shall be not less than 152.4 m/min (500 ft/min).

B.7.2.1.2 Transition duct sections that do not exceed 0.92 m (3 ft) in length and do not contain grease traps shall be permitted to be connected to hoods and exhaust fans that do not meet this velocity.

B.7.2.2 Air Volume.

B.7.2.2.1 Exhaust air volumes for hoods shall be of a sufficient level to provide for capture and removal of grease-laden cooking vapors.

B.7.2.2.2 Test data, performance tests acceptable to the authority having jurisdiction, or both shall be displayed, provided on request, or both.

No e: Performance tests can include a field test conducted with all appliances under the hood at operating temperatures and with all sources of outside air providing makeup air. Capture and containment should be verified visually by observing smoke or steam by actual or simulated full-load cooking.

B.7.2.2.3 Lower exhaust air volumes shall be permitted during no-load cooking conditions, provided they are sufficient to capture and remove flue gases and residual vapors from cooking equipment.

B.7.2.3 Exhaust Fan Operation.

B.7.2.3.1 A hood exhaust fan(s) shall continue to operate after the extinguishing system has been activated unless fan shutdown is required by a listed component of the ventilation system or by the design of the extinguishing system.

B.7.2.3.2 The hood exhaust fan shall start upon activation of the extinguishing system if the exhaust fan and all cooking equipment served by the fan have been shut down, unless fan shutdown is required by a listed component of the ventilation system or by the listing of the extinguishing system.

B.7.2.3.3 The exhaust fan shall be provided with a means so that the fan is activated when any heat-producing cooking appliance under the hood is turned on.

B.7.3 Replacement Air. Note: It is not advisable to discontinue the use of replacement air systems during cooking operations. Exhaust function, indoor pollution, indoor comfort, and grease removal, for example, will be adversely affected.

B.7.3.1 Replacement air quantity shall be adequate to prevent negative pressures in the commercial cooking area(s) from exceeding 4.98 Pa (0.02 in. water column).

B.7.3.2 When the fire-extinguishing system activates, makeup air supplied internally to a hood shall be shut off.

B.8 Auxiliary Equipment.

B.8.1 Dampers.

B.8.1.1 Dampers shall not be installed in exhaust ducts or exhaust duct systems.

B.8.1.2 Where specifically listed for such use or where required as part of a listed device or system, dampers in exhaust ducts or exhaust duct systems shall be permitted.

B.8.2 Electrical Equipment.

B.8.2.1 Wiring systems of any type shall not be installed in ducts.

B.8.2.2 Motors, lights, and other electrical devices shall be permitted to be installed in ducts or hoods or to be located in the path of travel of exhaust products only where specifically listed for such use.

B.8.3 Lighting Units.

B.8.3.1 Lighting units in hoods shall be listed for use over commercial cooking appliances and installed in accordance with the terms of their listing.

B.8.3.2 Lighting units on hoods shall not be located in concealed spaces except as permitted by B.8.3.3 and B.8.3.4.

B.8.3.3 Lighting units shall be permitted in concealed spaces where such units are part of a listed exhaust hood.

B.8.3.4 Listed lighting units specifically listed for such use and installed in accordance with the terms of the listing shall be permitted to be installed in concealed spaces.

B.8.4 All electrical equipment shall be installed in accordance with *NFPA 70.*

Note: All wiring should be designed, specified, and installed with due regard to the effects of heat, vapor, and grease on the equipment.

B.9 Fire-Extinguishing Equipment.

B.9.1 General Requirements.

B.9.1.1 Fire-extinguishing equipment for the protection of grease removal devices, hood exhaust plenums, and exhaust duct systems shall be provided.

B.9.1.2 Cooking equipment that produces grease-laden vapors shall be protected by a fire-extinguishing system for the protection of grease removal devices, hood exhaust plenums, and exhaust duct systems.

B.9.1.3 A placard shall be conspicuously placed near each Class K extinguisher that states that the fire protection system shall be activated prior to using the fire extinguisher.

Note: NFPA 10, Annex A, provides recommendations for placards.

B.9.1.3.1 The language and wording for the placard shall be approved by the authority having jurisdiction.

B.9.1.4 Automatic fire-extinguishing systems shall comply with ANSI/UL 300 or other equivalent standards and shall be installed in accordance with the terms of their listing and NFPA 17A.

Note: ANSI/UL 300 primarily addresses the method of fire testing for self-contained chemical extinguishing systems commonly referred to as pre-engineered systems. ANSI/UL 300 has been identified as a baseline for testing fire-extinguishing systems intended for the protection of commercial cooking–related hazards. Additional equivalent testing standards can and have been written for other types of fire-extinguishing systems not considered pre-engineered that demonstrate equivalent fire testing severity to the ANSI/UL 300 test standard. Current examples include, but are not limited to, ANSI/UL 199, UL Subject 199B, UL Subject 199E, and ANSI/UL 710B.

B.9.1.5 Where required, complete drawings of the system installation, including the hood(s), exhaust duct(s), and appliances, along with the interface of the fire-extinguishing system detectors, piping, nozzles, fuel and electric power shutoff devices, agent storage container(s), and manual actuation device(s), shall be submitted to the authority having jurisdiction and located within the mobile cooking operation.

B.9.2 Modifications to Existing Hood Systems.

B.9.2.1 Any abandoned pipe or conduit from a previous installation shall be removed from within the hood, plenum, and exhaust duct.

B.9.2.2 Penetrations and holes resulting from the removal of conduit or piping shall be sealed with listed or equivalent liquidtight sealing devices.

B.9.2.3 The addition of obstructions to spray patterns from the cooking appliance nozzle(s) such as baffle plates, shelves, or any modification shall not be permitted.

B.9.2.4 Changes or modifications to the hazard after installation of the fire-extinguishing systems shall result in reevaluation of the system design by a properly trained, qualified, and certified person(s).

B.9.3 Fuel and Electric Power Shutoff.

B.9.3.1 Upon activation of any fire-extinguishing system for a cooking operation, all sources of fuel and electrical power that produce heat to all equipment requiring protection by that system shall automatically shut off.

B.9.3.2 Any gas appliance not requiring protection but located under ventilating equipment where protected appliances are located shall be automatically shut off upon activation of the extinguishing system.

B.9.3.3 Shutoff devices shall require manual reset.

B.9.4 Manual Activation.

B.9.4.1 All systems shall have both automatic and manual methods of actuation.

B.9.4.1.1 At least one manual actuation device shall be located in a means of egress or at a location acceptable to the AHJ.

B.9.4.1.2 Manual activation using a cable-operated pull station shall not require more than 178 N (40 lb) of force, with a pull movement not to exceed 356 mm (14 in.) to activate the automatic fire-extinguishing equipment.

B.9.4.2 The automatic and manual means of system activation external to the control head or releasing device shall be separate and independent of each other so that failure of one will not impair the operation of the other except as permitted by B.9.4.3.

B.9.4.3 The manual means of system activation shall be permitted to be common with the automatic means if the manual activation device is located between the control head or releasing device and the first fusible link.

B.9.4.4 The means for manual activation shall be mechanical or rely on electrical power for activation in accordance with B.9.4.5.

B.9.4.5 Electrical power shall be permitted to be used for manual activation if a standby power supply is provided or if supervision is provided in accordance with Section 10.7.

B.9.4.6 Instruction regarding the proper use of portable fire extinguishers and the manual activation of fire extinguishing equipment shall be provided to employees regarding the proper use of portable fire extinguishers and the manual activation of fire-extinguishing equipment.

B.9.5 System Annunciation.

B.9.5.1 Upon activation of an automatic fire-extinguishing system, an audible alarm or visual indicator shall be provided to show that the system has activated.

B.9.5.2 At least one listed audible and visual notification appliance shall be installed on the exterior surface of the vehicle readily audible and visible to the public.

B.9.6 Installation Requirements. Note: Although training and qualification might be available elsewhere, the manufacturer of the equipment being installed should be considered an appropriate source of training and qualification.

B.9.6.1 Installation of systems shall be performed only by persons properly trained and qualified to install the specific system being provided.

B.9.6.2 The installer shall provide certification to the authority having jurisdiction that the installation is in agreement with the terms of the listing and the manufacturer's instructions and/or approved design.

B.9.7 Portable Fire Extinguishers.

B.9.7.1 General.

B.9.7.1.1 Portable fire extinguishers shall be selected and installed in kitchen cooking areas in accordance with NFPA 10 and shall be specifically listed for such use.

Note: The system used to rate extinguishers for Class B fires (flammable liquids in depth) does not take into consideration the special nature of heated grease fires. Cooking-grease fires are a special hazard requiring agents that saponify (make a soap foam layer to seal the top surface of the grease) for this application.

B.9.7.2 Class K fire extinguishers shall be provided for cooking appliance hazards that involve combustible cooking media (vegetable oils and animal oils and fats).

B.9.7.3 Portable fire extinguishers shall be provided for solid fuel cooking operations in accordance with B.10.6.3.

B.9.7.4 Portable fire extinguishers shall be provided for other hazards in kitchen areas and shall be selected and installed in accordance with NFPA 10.

B.9.7.5 Where internal combustion engine power sources are provided, at least one portable fire extinguisher rated 20-B:C shall be provided.

B.9.7.6 Portable fire extinguishers shall be maintained in accordance with NFPA 10.

B.10 Solid Fuel Cooking Operations.

B.10.1 Venting Application. Venting requirements of solid fuel cooking operations shall be determined in accordance with B.10.1.1 through B.10.1.4.

B.10.1.1 Where the solid fuel cooking equipment is located in a space with other vented equipment, all vented equipment shall have an exhaust system interlocked with a makeup air system for the space per B.10.5.

B.10.1.2 Natural draft ventilation systems and power-exhausted ventilation systems shall comply with B.10.3 and B.10.5.

B.10.1.3 Where a solid fuel cooking appliance allows effluent to escape from the appliance opening, this opening shall be covered by a hood and an exhaust system that meets the requirements of B.10.3 and B.10.5.

B.10.1.4 Solid fuel cooking operations shall have spark arresters to minimize the passage of airborne sparks and embers into plenums and ducts.

B.10.2 Location of Appliances.

B.10.2.1 Every appliance shall be located with respect to equipment so as to permit access to he appliance.

B.10.2.2 Solid fuel cooking appliances shall not be installed in confined spaces.

Note: The space should be of ample size to permit adequate circulation of heated air.

B.10.2.3 Solid fuel cooking appliances listed for installation in confined spaces such as alcoves shall be installed in accordance with the terms of the listing and the manufacturer's instructions.

B.10.2.4 Solid fuel cooking appliances shall not be installed in any location where gasoline or any other flammable vapors or gases are present.

B.10.3 Hoods for Solid Fuel Cooking.

B.10.3.1 Hoods shall be sized and located in a manner capable of capturing and containing all the effluent discharging from the appliances.

B.10.3.2 The hood and its exhaust system shall comply with the requirements of Sections B.4 through B.9.

B.10.3.3 Exhaust systems serving solid fuel cooking equipment, including gas or electrically operated equipment, shall be separate from all other exhaust systems.

B.10.3.4 Cooking equipment not requiring automatic fire-extinguishing equipment shall be permitted to be installed under a common hood with solid fuel cooking equipment that is served by a duct system separate from all other exhaust systems.

B.10.4 Grease Removal Devices for Solid Fuel Cooking.

B.10.4.1 Grease removal devices shall be constructed of steel or stainless steel or be approved for solid fuel cooking.

B.10.4.2 If airborne sparks and embers can be generated by the solid fuel cooking operation, spark arrester devices shall be used prior to using the grease removal device, to minimize the entrance of these sparks and embers into the grease removal device and into the hood and the duct system.

B.10.4.3 Filters shall be a minimum of 1.2 m (4 ft) above the appliance cooking surface.

B.10.5 Air Movement for Solid Fuel Cooking.

B.10.5.1 Exhaust system requirements shall comply with Section B.7 for hooded operation.

B.10.5.2 A replacement or makeup air system shall be provided to ensure a positive supply of replacement air at all times during cooking operations.

B.10.5.3 Makeup air systems serving solid fuel cooking operations shall be interlocked with the exhaust air system and powered, if necessary, to prevent the space from attaining a negative pressure while the solid fuel appliance is in operation.

B.10.6 Fire-Extinguishing Equipment for Solid Fuel Cooking.

B.10.6.1 Solid fuel cooking appliances that produce grease-laden vapors shall be protected by listed fire-extinguishing equipment.

B.10.6.2 Listed fire-extinguishing equipment shall be provided for he protection of grease removal devices, hoods, and duct systems.

B.10.6.3 Listed fire-extinguishing equipment for solid fuel–burning cooking appliances, where required, shall comply with Section B.9 and shall use water-based agents.

B.10.6.4 Fire-extinguishing equipment shall be rated and designed to extinguish solid fuel cooking fires.

B.10.6.5 The fire-extinguishing equipment shall be of sufficient size to totally extinguish fire in the entire hazard area and prevent reignition of the fuel.

B.10.6.6 All solid fuel cooking appliances (whether under a hood or not) with fire boxes of 0.14 m^3 (5 ft^3) volume or less shall have at least one listed 2-A rated water mist fire extinguisher or at least one 6 L (1.6 gal) wet chemical fire extinguisher listed for Class K fires in accordance with NFPA 10, with a maximum travel distance of 3 m (10 ft) to each solid fuel cooking appliance.

Note: Water-type extinguishers are not allowed in the kitchen cooking area because they do not saponify upon contact with grease. However, water mist fire extinguishers that are rated 2-A are allowed to be used for solid fuel cooking in appliances. The 2-A rated water mist fire extinguisher is equipped with a nozzle that does not produce a straight stream.

B.10.6.7 Hose Protection.

B.10.6.7.1 Solid fuel appliances with fireboxes exceeding 0.14 m^3 (5 ft^3) shall be provided with a fixed water pipe system with a hose in the kitchen capable of reaching the firebox.

B.10.6.7.1.1 The hose shall be equipped with an adjustable nozzle capable of producing a fine to medium spray or mist.

B.10.6.7.1.2 The nozzle shall be of the type that cannot produce a straight stream.

B.10.6.7.2 The system shall have a minimum operating pressure of 275.8 kPa (40 psi) and shall provide a minimum of 19 L/min (5 gpm).

B.10.6.7.2.1 The system shall have a minimum water supply of 94.6 L (25 gal) for each firebox exceeding 0.14 m^3 (5 ft^3).

B.10.6.8 Fire suppression for fuel storage areas shall comply with B.10.8 of this standard.

B.10.6.9 In addition to the requirements of B.10.6.6 through B.10.6.8, where any solid fuel cooking appliance is also provided with auxiliary electric, gas, oil, or other fuel for ignition or supplemental heat and the appliance is also served by any portion of a fire-extinguishing system complying with Section B.9, such auxiliary fuel shall be shut off on actuation of the fire-extinguishing system.

B.10.7 Procedures for Inspection, Cleaning, and Maintenance for Solid Fuel Cooking. The combustion chamber shall be scraped clean to its original surface once each week and shall be inspected for deterioration or defects.

B.10.7.1 The combustion chamber shall be scraped clean to its original surface once each week and shall be inspected for deterioration or defects.

B.10.7.2 Any significant deterioration or defect that might weaken the chamber or reduce its insulation capability shall be immediately repaired.

B 10.7 3 The flue or chimney shall be inspected weekly for the following conditions:

(1) Residue that might begin to restrict the vent or create an additional fuel source
(2) Corrosion or physical damage that might reduce the flue's capability to contain the effluent

B.10.7.3.1 The flue or chimney shall be cleaned before these conditions exist.

B.10.7.3.2 The flue or chimney shall be repaired or replaced if any unsafe condition is evident.

B.10.7.4 Spark arrester screens located at the entrance of the flue or in the hood assembly shall be cleaned prior to their becoming heavily contaminated and restricted.

B.10.7.5 Filters and filtration devices installed in a hood shall be cleaned per B.10.7.4.

B.10.8 Minimum Safety Requirements: Fuel Storage, Handling, and Ash Removal for Solid Fuel Cooking.

B.10.8.1 Installation Clearances.

B.10.8.1.1 Solid fuel cooking appliances shall be installed on floors of noncombustible construction that extend 0.92 m (3 ft) in all directions from the appliance.

B.10.8.1.2 Floors with noncombustible surfaces shall be permitted to be used where they have been approved for such use by the authority having jurisdiction.

B.10.8.1.3 Floor assemblies that have been listed for solid fuel appliance applications shall be permitted to be used.

B.10.8.1.4 Solid fuel cooking appliances that have been listed for zero clearance to combustibles on the bottom and sides and have an approved hearth extending 0.92 m (3 ft) in all directions from the service door(s) shall be permitted to be used on combustible floors.

B.10.8.1.5 Combustible and limited-combustible surfaces or construction with 0.92 m (3 ft) of the sides or 1.8 m (6 ft) above a solid fuel cooking appliance shall be protected in a manner acceptable to the authority having jurisdiction.

B.10.8.1.6 Solid fuel cooking appliances that are specifically listed for less clearance to combustibles shall be permitted to be installed in accordance with the requirements of the listing and the manufacturer's instructions.

B.10.8.2 Solid Fuel Storage.

B.10.8.2.1 Where storage is in the same space as the solid fuel appliance or in the same space as the fuel-loading or clean-out doors, fuel storage shall not exceed a 1-day supply.

B.10.8.2.2 Fuel shall not be stored above any heat-producing appliance or vent or closer than 0.92 m (3 ft) to any portion of a solid fuel appliance constructed of metal or to any other cooking appliance that could ignite the fuel.

B.10.8.2.3 Fuel shall be permitted to be stored closer than the requirements of B.10.8.2.2 where a solid fuel appliance or other cooking appliance is listed or approved for less clearance to combustibles.

B.10.8.2.4 Fuel shall not be stored in the path of the ash removal

B.10.8.2.5 Where stored in the same space as the solid fuel appliance, fuel shall be stored only in an area with walls, floor, and ceiling of noncombustible construction extending at least 0.92 m (3 ft) past the outside dimensions of the storage pile.

B.10.8.2.6 Fuel shall be permitted to be stored in an area with walls, floor, and ceiling of combustible or limited-combustible construction where protected in accordance with B.2.3.

B.10.8.2.7 Fuel shall be separated from all flammable liquids, all ignition sources, all chemicals, and all food supplies and packaging goods.

B.10.8.2.8 All fuel storage areas larger than 5 ft^3 shall be provided hose protection as required by B.10.6.7.

B.10.8.2.8.1 Where acceptable to the authority having jurisdiction, fuel storage areas shall be permitted to be protected with a fixed water pipe system with a hose capable of reaching all parts of the area.

B.10.8.3 Solid Fuel Handling and Ash Removal.

B.10.8.3.1 Solid fuel shall be ignited with a match, an approved built-in gas flame, or other approved ignition source.

B.10.8.3.2 Combustible or flammable liquids shall not be used to assist ignition.

B.10.8.3.3 Matches and other portable ignition sources shall not be stored in the vicinity of the solid fuel appliance.

B.10.8.3.4 Solid fuel shall be added to the fire as required in a safe manner and in quantities and ways not creating a higher flame than is required.

B.10.8.3.5 Long-handled tongs, hooks, and other required devices shall be provided and used to safely add fuel, adjust the fuel position, and control the fire without the user having to reach into the firebox.

B.10.8.3.6 Ash Protection.

B.10.8.3.6.1 Ash, cinders, and other fire debris shall be removed from the firebox at regular intervals to prevent interference with the draft to the fire and to minimize the length of time the access door is open.

B.10.8.3.6.2 All ash shall be removed from the chamber a minimum of once a day.

B.10.8.3.6.3 The ash shall be sprayed with water before removal to extinguish any hot ash or cinders and to control the dust when the ash is moved.

B.10.8.3.7 Hose Protection.

B.10.8.3.7.1 For the purposes described in B.10.8.3.6.3, to cool a fire that has become too hot and to stop all fire before the premises are vacated, a water supply with a flexible hose shall be provided at the solid fuel appliance.

B.10.8.3.7.2 For appliances with fireboxes not exceeding 0.14 m^3 (5 ft^3), the water source shall be permitted to be a 37.9 L (10 gal) container with a gravity arrangement or a hand pump for pressure.

B.10.8.3.7.3 For appliances with fireboxes over 0.14 m^3 (5 ft^3), the water source shall be a fixed pipe water system with a hose of adequate length to reach the combustion and cooking chambers of the appliance.

B.10.8.3.7.4 For either application, the nozzle shall be fitted with a manual shutoff device and shall be of the type to provide a fine to medium spray capable of reaching all areas of the combustion and cooking chambers.

B.10.8.3.7.5 The nozzle shall be of the type that cannot produce a straight stream.

B.10.8.3.8 Ash Removal Container or Cart.

B.10.8.3.8.1 A heavy metal container or cart (minimum 16 gauge) with a cover shall be provided for the removal of ash.

B.10.8.3.8.2 The ash removal container or cart shall not exceed a maximum of 75.7 L (20 gal) capacity, shall be assigned for this one purpose, shall be able to be handled easily by any employee assigned the task, and shall pass easily through any passageway to the outside of the vehicle or cooking operation.

B.10.8.3.8.3 The container or cart shall always be covered when it is being moved through the vehicle.

B.10.8.3.8.4 When any hole occurs in a container from corrosion or damage, the container shall be repaired or replaced immediately.

B.10.8.3.9 Ash Removal Process.

B.10.8.3.9.1 Tools shall be provided so that ash removal can be accomplished without having to reach into the chamber.

B.10.8.3.9.2 The ash shall be spread out gently in small lots on the chamber floor or on a shovel, to be sprayed before it is removed to the metal container or cart.

B.10.8.3.9.3 If the floor of the chamber is of a metal that is subject to rapid corrosion from water, then a noncombustible, corrosion-resistant pan shall be placed just outside the cleanout door for this purpose.

B.10.8.3.9.4 The ash shall be carried to a separate heavy metal container (or dumpster) used exclusively for the purpose.

B.10.9 Other Safety Requirements.

B.10.9.1 Metal-fabricated solid fuel cooking appliances shall be listed for the application where produced in practical quantities or shall be approved by the authority having jurisdiction.

B.10.9.2 Where listed, metal-fabricated solid fuel cooking appliances shall be installed in accordance with the terms of their listings and with the applicable requirements of this standard.

B.10.9.3 Site-Built Solid Fuel Cooking Appliances.

B.10.9.3.1 Site-built solid fuel cooking appliances shall be submitted for approval to the authority having jurisdiction before being considered for installation.

B.10.9.3.2 All units submitted to the authority having jurisdiction shall be installed, operated, and maintained in accordance with the approved terms of the manufacturer's instructions and any additional requirements set forth by the authority having jurisdiction.

B.10.9.3.3 Except for the spark arresters required in B.10.1.4, there shall be no additional devices of any type in any portion of the appliance, flue pipe and chimney of a natural draft so id fuel operation.

B.10.9.3.4 No solid fuel cooking device of any type shall be permitted for deep fat frying involving more than 0.95 L (1 qt) of liquid shortening, nor shall any solid fuel cooking device be permitted within 0.92 m (3 ft) of any deep fat frying unit.

B.11 Procedures for the Use, Inspection, Testing, and Maintenance of Equipment.

B.11.1 Operating Procedures.

B.11.1.1 Exhaust systems shall be operated whenever cooking equipment is turned on.

B.11.1.2 Filter-equipped exhaust systems shall not be operated with filters removed.

B.11.1.3 Openings provided for replacing air exhausted through ventilating equipment shall not be restricted by covers, dampers, or any other means that would reduce the operating efficiency of the exhaust system.

B.11.1.4 Instructions for manually operating the fire extinguishing system shall be posted conspicuously in the kitchen and shall be reviewed with employees by the management.

B.11.1.5 Listed exhaust hoods shall be operated in accordance with the terms of their listings and the manufacturer's instructions.

B.11.1.6 Cooking equipment shall not be operated while its fire-extinguishing system or exhaust system is nonoperational or impaired.

B.11.1.6.1 Where the fire-extinguishing system or exhaust system is nonoperational or impaired, the system shall be tagged as noncompliant, the system owner or the owner's representative shall be notified in writing of the impairment, and, where required, the authority having jurisdiction shall be notified.

B.11.1.7 Inspection and maintenance of "other equipment" as allowed in 9.3.1 shall be conducted by properly trained and qualified persons at a frequency determined by the manufacturer's instructions or the equipment listing.

B.11.2 Inspection, Testing, and Maintenance of Fire-Extinguishing Systems.

B.11.2.1 All actuation and control components, including remote manual pull stations, mechanical and electrical devices, detectors, and actuators, shall be tested for proper operation during the inspection in accordance with the manufacturer's procedures.

Note: It is not intended that actual discharge of agent occur to test all components, but where pressure from the discharging agent or from compressed gas actuators is needed to activate control components, an alternate means for testing those components should be provided and used.

B.11.2.2 The specific inspection and maintenance requirements of the extinguishing system standards as well as the applicable installation and maintenance manuals for the listed system and service bulletins shall be followed.

B.11.2.3 Fusible links of the metal alloy type and automatic sprinklers of the metal alloy type shall be replaced at least semiannually.

Note: The date of manufacture marked on fusible metal alloy sensing elements does not limit when they can be used. These devices have unlimited shelf life. The intent of B.11.2.3 is to require semiannual replacement of fusible metal alloy sensing elements that have been installed in environments that subject them to contaminant loading, such as grease in restaurant hoods and ducts, that could adversely affect their proper operation.

B.11.2.4 The year of manufacture and the date of installation of the fusible links shall be marked on the system inspection tag.

B.11.2.4.1 The tag shall be signed or initialed by the installer.

B.11.2.4.2 The fusible links shall be destroyed when removed.

B.11.2.5 Fusible links other than the metal alloy type shall be examined and cleaned or replaced annually.

B.11.2.6 Fixed temperature-sensing elements other than the fusible metal alloy type shall be permitted to remain continuously in service, provided they are inspected and cleaned or replaced if necessary in accordance with the manufacturer's instructions, every 12 months or more frequently to ensure proper operation of the system.

B.11.2.7 Where required, certificates of inspection and maintenance shall be forwarded to the authority having jurisdiction.

B.11.3 Inspection for Grease Buildup. The entire exhaust system shall be inspected for grease buildup by a properly trained, qualified, and certified person(s) acceptable to the authority having jurisdiction and in accordance with Table B.11.3.

Note: The primary focus of an inspection for cleanliness is to establish whether the volume of grease buildup within the exhaust system warrants cleaning and to determine whether adequate access is available throughout the exhaust system to remove the grease buildup.

B.11.4 Cleaning of Exhaust Systems.

B.11.4.1 If, upon inspection, the exhaust system is found to be contaminated with deposits from grease-laden vapors, the contaminated portions of the exhaust system shall be cleaned by a properly trained, qualified, and certified person(s) acceptable to the authority having jurisdiction.

Note: A good operating practice is for cleaning personnel of commercial kitchen exhaust systems to have personal protective equipment (PPE) and height access equipment. The following items should be considered as a minimum:

(1) Eye protection
(2) Hand protection
(3) Head protection
(4) Foot protection
(5) Respiratory protection
(6) Fall protection
(7) Ladders
(8) Lock-out/tag-out kit

Preparation. The fan should be turned off, locked out, and tagged out. Open flames should be extinguished, and switches/breakers serving the appliance and cooking area outlets should be locked out. If the switches/breakers are not capable of being locked out and tagged out, any solid-fuel cooking appliances should be extinguished and the solid fuel removed.

Removal or Covering of Equipment. Food products, cookware, and cooking support equipment that can be removed should be removed from the cleaning area. Equipment that cannot be removed should be covered.

Table B.11.3 Schedule of Inspection for Grease Buildup

Type or Volume of Cooking	Inspection Frequency
Systems serving solid fuel cooking operations	Monthly
*Systems serving high-volume cooking operations	Quarterly
Systems serving moderate-volume cooking operations	Semiannually
†Systems serving low-volume cooking operations	Annually

*High-volume cooking operations include 24-hour cooking, charbroiling, and wok cooking.
†Low-volume cooking operations include churches, day camps, seasonal businesses, and senior centers.

Cleaning Methods. The following methods for cleaning surfaces covered with grease and contaminants have proved to be effective:

(1) Manual cleaning by scraping, grinding, or scrubbing
(2) Chemical cleaning with agents and water
(3) Pressure washing with pressurized water or pressurized water and agents
(4) Steam cleaning with pressurized steam

Waste Water and Solid Waste. Water and agents used in the cleaning process and solid waste should be collected for disposal.

B.11.4.2 Hoods, grease removal devices, fans, ducts, and other appurtenances shall be cleaned to remove combustible contaminants to a minimum of 50 μm (0.002 in.).

B.11.4.2.1 A measurement system of deposition shall be established to trigger a need to clean when the exhaust system is inspected at the frequencies in Table B.11.3.

B.11.4.2.2 A grease depth gauge comb as shown in Figure 11.6.1.1.2 shall be placed upon the duct surface to measure grease depth.

B.11.4.2.3 Where a measured depth of 2000 μm (0.078 in.) is observed, the surfaces shall be cleaned in accordance with B.11.4.1.

B.11.4.3 Hoods, grease removal devices, fans, ducts, and other appurtenances shall be cleaned to remove combustible contaminants prior to surfaces becoming heavily contaminated with grease or oily sludge.

B.11.4.4 At the start of the cleaning process, electrical switches that could be activated accidentally shall be locked out.

B.11.4.5 Components of the fire suppression system shall not be rendered inoperable during the cleaning process.

B.11.4.6 Fire-extinguishing systems shall be permitted to be rendered inoperable during the cleaning process where serviced by properly trained and qualified persons.

B.11.4.7 Flammable solvents or other flammable cleaning aids shall not be used.

B.11.4.8 Cleaning chemicals shall not be applied on fusible links or other detection devices of the automatic extinguishing system.

B.11.4.9 After the exhaust system is cleaned, it shall not be coated with powder or other substance.

B.11.4.10 When cleaning procedures are completed, all access panels (doors) and cover plates shall be restored to their normal operational condition

B.11.4.11 When an access panel is removed, a service company label or tag preprinted with the name of the company and giving the date of inspection or cleaning shall be affixed near the affected access panels.

B.11.4.12 Dampers and diffusers shall be positioned for proper airflow.

B.11.4.13 When cleaning procedures are completed, all electrical switches and system components shall be returned to an operable state.

B.11.4.14 When an exhaust system is inspected or cleaned, a certificate showing the name of the servicing company, the name of the person performing the work, and the date of inspection or cleaning shall be maintained on the premises.

B.11.4.15 After cleaning or inspection is completed, the exhaust cleaning company and the person performing the work at the location shall provide the owner of the system with a written report that also specifies areas that were inaccessible or not cleaned.

B.11.4.16 Where required, certificates of inspection and cleaning and reports of areas not cleaned shall be submitted to the authority having jurisdiction.

B.11.5 Cooking Equipment Maintenance.

B.11.5.1 Inspection and servicing of the cooking equipment shall be made at least annually by properly trained and qualified persons.

B.11.5.2 Cooking equipment that collects grease below the surface, behind the equipment, or in cooking equipment flue gas exhaust, such as griddles or charbroilers, shall be inspected and, if found with grease accumulation, cleaned by a properly trained, qualified, and certified person(s) acceptable to the authority having jurisdiction.

B.12 Carbon Monoxide Detectors.

B.12.1 If the heat source is nonelectric and open flames are used, at least one listed carbon monoxide detector shall be installed.

B.13 Location of Mobile and Temporary Cooking Operations.

B.13.1 Relative to Buildings. Mobile or temporary cooking operations shall be separated from the entrances and other exits of buildings or structures, combustible materials, vehicles and other cooking operations by a clear space distance of 3 m (10 ft).

B.13.2 Relative to Other Mobile or Temporary Cooking. Mobile or temporary cooking operations shall be separated from other mobile or temporary cooking operations by a clear distance of 3 m (10 ft).

B.13.3 When the mobile unit is parked, the vehicle shall be stabilized so that it will not move, either by jacking the vehicle or placing wheel chocks around the wheels.

B.14 Tents.

B.14.1 Temporary cooking operations conducted in tents shall comply with NFPA 102.

B.15 Training.

B.15.1 Prior to performing cooking operations, one worker shall be provided with initial training in emergency response procedures including the following:

(1) Using portable fire extinguishers and extinguishing systems
(2) Shutting off fuel sources
(3) Notifying the local fire department
(4) Refueling internal combustion engine power sources and LP-Gas container change-out
(5) Performing leak detection of LP-Gas
(6) Understanding fuel properties

B.15.2 During the time of cooking operation at least one person in the vehicle shall be trained to provide the functions listed in B.15.1.

B.15.3 The provision of training shall be the responsibility of the owner, and the training program and materials shall be acceptable to the AHJ.

B.15.4 Refresher training shall be provided annually.

B.15.5 Initial and refresher training shall be documented, and the documentation shall be held in the mobile unit and made available to the AHJ upon request.

B.15.6 The address of the current operational location shall be posted and accessible to all employees.

B.16 16 Internal Combustion Engine Power Sources.

B.16.1 An internal combustion engine shall be permitted to be used to operate an electric power generator.

B.16.2 Generator units that are not vehicle-mounted while in use shall meet the requirement of B.16.2.1 through B.16.2.3.

B.16.2.1 Internal combustion engine power sources shall be located at least 4 m (12 ft) from mobile or temporary cooking operations.

B.16.2.2 Internal combustion engine power sources shall be isolated from physical contact by the installation of physical guards, fencing, or an enclosure.

B.16.2.3 Internal combustion engine power sources shall be positioned so that the exhaust complies with the following:

(1) Located at least 4 m (12 ft) from openings, air intakes, and means of egress
(2) In a position pointed away from any building
(3) In a position pointed away from any mobile or temporary cooking operations

B.17 Vehicle-Mounted Generators.

B.17.1 Vehicle-mounted generators shall meet the requirements of B.17.2 through B.17.5.

B.17.2 Internal combustion engine–driven generator units (subject to the provisions of NFPA 1192) shall be listed and installed in accordance with the manufacturer's instructions and shall be vapor resistant to the interior of the vehicle. [**1192:**6.4.5.1]

B.17.3 Where a generator compartment is used to isolate the installed generator from the vehicle's interior, or a compartment is provided for the future installation of a generator and is intended to isolate the future generator from the vehicle interior, the generator compartment shall be lined with galvanized steel not less than 26 MSG thick. [**1192:**6.4.5.2]

B.17.3.1 Seams and joints shall be lapped, mechanically secured, and made vapor resistant to the interior of the vehicle. [**1192:**6.4.5.2.1]

B.17.3.2 Alternative materials and methods of construction shall be permitted in accordance with Section 1.5. [**1192:**6.4.5.2.2]

B.17.4 Liquid fuel lines and exhaust systems shall not penetrate into the area. [**1192:**6.4.5.2.3]

B.17.5 Holes into the living area shall be sealed. [**1192:**6.4.5.2.4]

B.18 Electrical Wiring.

B.18.1 Vehicle-mounted generators shall comply with the provisions of *NFPA 70* , Article 551, Part III.

B.18.2 The manufacturer of an engine generator unit intended for installation in a recreational vehicle shall provide instructions for the safe and effective installation, operation, and servicing of the generator.

B.18.3 Refueling of internal combustion engine power sources shall be permitted only when the electric generators and internal combustion power sources are not in use.

B.18.3.1 Refueling of internal combustion engines shall not be allowed during mobile or temporary cooking operations.

B.18.3.2 Refueling of internal combustion engine power sources from a container shall be permitted when the engine is shut down and the surface temperature of the engine and fuel tank is below the autoignition temperature of the fuel.

B.19 LP-Gas Systems.

B.19.1 LP-Gas systems for mobile cooking operations shall comply with NFPA 58.

B.19.1.1 LP-Gas cylinders shall be secured in an upright position.

B.19.2 LP-Gas System Leak Detection.

B.19.2.1 All recreational vehicles equipped with a propane appliance and an electrical system shall be equipped with a propane detector listed and marked on the device as being suitable for use in the vehicles under the requirements of ANSI/UL 1484, *Standard for Residential Gas Detectors*, and installed according to the terms of its listing. [**1192:**6.3.3.1]

B.19.2.2 The LP-Gas leak detection system shall be tested monthly.

B.19.2.3 LP-Gas systems shall be inspected prior to each use.

B.19.2.4 LP-Gas leak detection testing shall be performed every time a new LP-Gas connection is made or an LP-Gas cylinder is changed out.

B.19.2.5 LP-Gas leak detection testing shall be documented and the documentation be held in the mobile or temporary unit and made available to the AHJ upon request.

B.19.3 LP-Gas Systems on Vehicles Other Than Engine Fuel Systems.

B.19.3.1 LP-Gas Container Installation Requirements.

B.19.3.1.1 Only ASME mobile LP-Gas containers in compliance with the following shall be used:

(1) A maximum allowable working pressure (MAWP) of 312 psi (2.2 MPag) or higher for LP-Gas containers installed in the enclosed spaces of a vehicle
(2) A maximum allowable working pressure (MAWP) of 250 psi (1.7 MPag) or higher for LP-Gas containers installed on the exterior of a vehicle

B.19.3.1.2 LP-Gas containers installed on vehicles shall not exceed 0.8 m^3 (200 gal) aggregate water capacity.

B.19.3.2 Disconnected LP-Gas containers and LP-Gas cylinders for purposes other than engine fuel systems shall not be transported or stored inside the vehicle.

B.19.3.3 All other LP-Gas containers and LP-Gas cylinders in storage shall comply with B.9.5 of this standard.

B.19.3.4 The LP-Gas supply system, including the containers, shall be installed either on the outside of the vehicle or in a recess or cabinet that is vaportight to the inside of the vehicle but accessible from and vented to the outside, with the vents located near the top and bottom of the enclosure and 1 m (3 ft) horizontally away from any opening into the vehicle and below the level of the vents.

B.19.3.5 LP-Gas containers shall be mounted securely on the vehicle or within the enclosing recess or cabinet and shall comply with the following:

(1) LP-Gas containers shall be installed above the height of the rear bumper and forward of the rear bumper.
(2) LP-Gas containers shall not be installed on the roof of the vehicle.
(3) LP-Gas containers shall be mounted to prevent jarring loose and slipping or rotating, and the fastenings shall be designed and constructed to withstand, without permanent visible deformation, static loading in any direction equal to four times the weight of the container filled with fuel.
(4) Where LP-Gas containers are mounted within the vehicle housing, the housing shall be secured to the vehicle and any removable portions of the housing shall be secured to the housing while in transit.
(5) Field welding on LP-Gas containers shall be limited to attachments to nonpressure parts such as saddle plates, wear plates, or brackets applied by the container manufacturer.
(6) All LP-Gas container valves, appurtenances, and connections shall be protected to prevent damage from accidental contact with stationary objects, loose objects, stones, mud, or ice thrown up from the ground or floor, and damage due to overturn or similar vehicular accident.
(7) LP-Gas cylinders shall have permanent protection for cylinder valves and connections.
(8) Where LP-Gas cylinders are located on the outside of a vehicle, weather protection shall be provided.

B.19.3.6 Where equipment such as a cargo heater or cooler is designed to be in operation while the vehicle is in transit, means such as an excess-flow valve to stop the flow of gas in the event of a line break shall be installed.

B.19.3.7 Cylinders shall be retested every 5 to 12 years in accordance with the manufacturer's recommendations and 49 CFR 180.205:

(1) No letter after the requalification date means the cylinder must be retested within 12 years.
(2) "S" means the cylinder must be retested within 7 years.
(3) "E" means the cylinder must be retested within 5 years.

B.19.4 Installation of LP-Gas Container Appurtenances.

B.19.4.1 LP-Gas container appurtenances shall be installed in accordance with the following:

(1) Pressure relief valve installation on ASME LP-Gas containers installed in the interior of vehicles complying with Section 11.9 of NFPA 58 shall comply with 11.8.5 of NFPA 58.
(2) Pressure relief valve installations on ASME LP-Gas containers installed on the outside of vehicles shall comply with 11.8.5 of NFPA 58 and B.19.3.4 of this standard.
(3) Main shutoff valves on LP-Gas containers for liquid and vapor shall be readily accessible.
(4) There shall be a quarter-turn manual gas ball valve installed within the LP-Gas piping for emergency shutoff use and shall be installed on the exterior of the vehicle and readily accessible.
(5) LP-Gas cylinders shall be designed to be filled in either the vertical or horizontal position, or if they are universal-type cylinders, they shall be permitted to be filled in either position.
(6) All LP-Gas container inlets, outlets, or valves installed in container inlets or outlets, except pressure relief devices and gauging devices, shall be labeled to designate whether they communicate with the vapor or liquid space.
(7) LP-Gas containers from which only vapor is to be withdrawn shall be installed and equipped with connections to minimize the possibility of the accidental withdrawal of liquid.

B.19.4.2 Propane containers shall be so located that the discharge from their pressure relief valves shall be not less than 0.9 m (3 ft) measured horizontally along the surface of the vehicle from any of the following located below the level of such discharge:

(1) Openings into the vehicle
(2) Propane-burning appliance intake and exhaust vents
(3) All combustion engine and hydronic heating appliance exhaust terminations

B.19.5 Regulators shall be installed in accordance with 6.8.2 of NFPA 58 and the following:

(1) Regulators shall be installed with the pressure relief vent opening pointing vertically downward to allow for drainage of moisture collected on the diaphragm of the regulator.
(2) Regulators not installed in compartments shall be equipped with a durable cover designed to protect the regulator vent opening from sleet, snow, freezing rain, ice, mud, and wheel spray.
(3) If vehicle-mounted regulators are installed at or below the floor level, they shall be installed in a compartment that provides protection against the weather and wheel spray.
(4) Regulator compartments shall comply with the following:
    (1) The compartment shall be of sufficient size to allow tool operation for connection to and replacement of the regulator(s).
    (2) The compartment shall be vaportight to the interior of the vehicle.
    (3) The compartment shall have a 650 mm^2 (1 $in.^2$) minimum vent opening to the exterior located within 25 mm (1 in.) of the bottom of the compartment.
    (4) The compartment shall not contain flame- or spark-producing equipment.
(5) A regulator vent outlet shall be at least 51 mm (2 in.) above the compartment vent opening.

B.19.6 Gas Piping.

B.19.6.1 Piping shall be installed in accordance with 6.9.3 of NFPA 58 and the following provisions:

(1) Steel tubing shall have a minimum wall thickness of 1.2 mm (0.049 in.).
(2) A flexible connector shall be installed between the regulator outlet and the fixed piping system to protect against expansion, contraction, jarring, and vibration strains.
(3) Flexibility shall be provided in the piping between a cylinder and the gas piping system or regulator.
(4) Flexible connectors shall be installed in accordance with 6.9.6 of NFPA 58.
(5) Flexible connectors longer than the length allowed in the code, or fuel lines that incorporate hose, shall be used only where approved.
(6) The fixed piping system shall be designed, installed, supported, and secured to minimize the possibility of damage due to vibration, strains, or wear and to preclude any loosening while in transit.
(7) Piping shall be installed in a protected location.
    (a) Where piping is installed outside the vehicle, piping shall be under the vehicle and below any insulation or false bottom.
    (b) Fastening or other protection shall be installed to prevent damage due to vibration or abrasion.
    (c) At each point where piping passes through sheet metal or a structural member, a rubber grommet or equivalent protection shall be installed to prevent chafing.
(8) Gas piping shall be installed to enter the vehicle through the floor directly beneath or adjacent to the appliance served.
(9) If a branch line is installed, the tee connection shall be located in the main gas line under the floor and outside the vehicle.
(10) Exposed parts of the fixed piping system shall be of corrosion-resistant material or shall be coated or protected to minimize exterior corrosion.
(11) Hydrostatic relief valves shall be installed in isolated sections of liquid piping in accordance with Section 6.13 of NFPA 58.
(12) Piping systems, including hose, shall be pressure tested and proven free of leaks in accordance with Section 6.14 of NFPA 58.

B.19.6.2 There shall be no fuel connection between a powered vehicle and trailer or other vehicle units.

B.19.6.3 Protection of Valves on LP-Gas Cylinders in Storage.

B.19.6.3.1 LP-Gas cylinder valves shall be protected as required by 5.2.6.1 and 7.2.2.5 of NFPA 58.

B.19.6.3.2 Screw-on-type caps or collars shall be in place on all cylinders stored, regardless of whether they are full, partially full, or empty, and cylinder outlet valves shall be closed.

B.19.6.3.3 Valve outlets on LP-Gas cylinders less than 49 kg (108 lb) water capacity [nominal 20 kg (45 lb) propane capacity] shall be plugged, capped, or sealed in accordance with 7.2.2.5 of NFPA 58.

B.20 Cooking Appliance Installation on Vehicles.

B.20.1 All cooking appliances installed on vehicles shall be approved.

B.20.2 Gas-fired cooking appliances shall be equipped with shutoffs in accordance with 5.20.7(A) of NFPA 58.

B.20.3 Cooking appliances installed on vehicles shall be readily accessible under all conditions.

B.20.4 To minimize possible damage and impaired operation due to items shifting in transit, cooking appliances shall be constructed and secured in place or otherwise protected.

B.20.5 Cooking appliances shall be located so that a fire at any cooking appliance will not block egress of persons from the vehicle.

B.20.6 A permanent caution plate shall be provided, affixed to either the appliance or the vehicle outside of any enclosure and adjacent to the container(s), and shall include the following items:


CAUTION

(1) Be sure all appliance valves are closed before opening container valve.

(2) Connections at the appliances, regulators, and containers shall be checked periodically for leaks with soapy water or its equivalent.

(3) Never use a match or flame to check for leaks.

(4) Container valves shall be closed when equipment is not in use.

B.20.7 Gas-fired cooking appliances shall be equipped with automa ic devices designed to shut off the flow of gas to the main burner and the pilot in the event the pilot flame is extinguished.

B.21 Parking, Servicing, and Repair.

B.21.1 Where vehicles with LP-Gas fuel systems used for purposes other than propulsion are parked, serviced, or repaired inside buildings, paragraphs B.21.2 through B.21.5 shall apply.

B.21.2 The LP-Gas system shall be leak-free, and the LP-Gas container(s) shall not be filled beyond the limits specified in Chapter 7 of NFPA 58.

B.21.3 LP-Gas container shutoff valves shall be closed, except that the container shutoff valve shall not be required to be closed when fuel is required for test or repair.

B.21.4 The vehicle shall not be parked near sources of heat, open flames, or similar sources of ignition, or near unventilated pits.

B.21.5 Wheel chocks shall be provided to prevent mobile and temporary cooking units from moving.

B.22 Records. All record-keeping documents shall be combined in one location on the mobile cooking operation and made available to the AHJ upon request.

Annex C Informational References

C.1 Referenced Publications. The documents or portions thereof listed in this annex are referenced within the informational sections of this standard and are not part of the requirements of this document unless also listed in Chapter 2 for other reasons.

C.1.1 NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 10, *Standard for Portable Fire Extinguishers*, 2013 edition.

NFPA 17A, *Standard for Wet Chemical Extinguishing Systems*, 2017 edition.

NFPA 54, *National Fuel Gas Code*, 2015 edition.

NFPA 58, *Liquefied Petroleum Gas Code*, 2017 edition.

NFPA 70®, *National Electrical Code®*, 2017 edition.

NFPA 102, *Standard for Grandstands, Folding and Telescopic Seating, Tents, and Membrane Structures*, 2016 edition.

NFPA 259, *Standard Test Method for Potential Heat of Building Materials*, 2013 edition.

C.1.2 Other Publications.

C.1.2.1 ANSI Publications. American National Standards Institute, Inc., 25 West 43rd Street, 4th Floor, New York, NY, 10036.

ANSI Z83.11, *Gas Food Service Equipment*, 2006 (reaffirmed 2011).

C.1.2.2 ASHRAE Publications. ASHRAE, Inc., 1791 Tullie Circle N.E., Atlanta, GA 30329 2305

Kuehn, T. H., et al., "Effects of air velocity on grease deposition in exhaust ductwork," ASHRAE Research Project 1033-RP Final Report. Minneapolis: University of Minnesota, 2006.

ANSI/ASHRAE 154, *Ventilation for Commercial Cooking Operations*, 2011.

C.1.2.3 ASTM Publications. ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, 2015b.

ASTM E136, *Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C*, 2016.

ASTM E2336, *Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems*, 2016.

ASTM E2652, *Standard Test Method for Behavior of Materials in a Tube Furnace with a Cone-shaped Airflow Stabilizer, at 750°C*, 2016.

N **C.1.2.4 EPA Publications.** Environmental Protection Agency, William Jefferson Clinton East Building, 1200 Pennsylvania Avenue, NW, Washington, DC 20460.

EPA Test Method 202, *Determination of Condensable Particulate Emissions for Stationary Sources*, 2010.

C.1.2.5 GA Publications. GA, 6525 Belcrest Road, Suite 480, Hyattsville, MD 20782.

Fire Resistance Design Manual, 2012.

C.1.2.6 IKECA Publications. IKECA, 100 North 20th Street, Suite 400, Philadelphia, PA 19103.

ANSI/IKECA C-10, *Standard for the Methodology for Cleaning Commercial Kitchen Exhaust Systems*, 2016.

C.1.2.7 NSF International Publications. NSF International, P.O. Box 130140, 789 N. Dixboro Road, Ann Arbor, MI 48113-0140.

NSF/ANSI 2, *Food Equipment*, 2014.

C.1.2.8 UL Publications. Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.

ANSI/UL 197, *Standard for Commercial Electric Cooking Appliances*, 2010, revised 2014.

ANSI/UL 199, *Standard for Automatic Sprinklers for Fire-Protection Service*, 2005, revised 2014.

ANSI/UL 300, *Standard for Fire Testing of Fire Extinguishing Systems for Protection of Commercial Cooking Equipment*, 2005, revised 2014.

ANSI/UL 710, *Standard for Exhaust Hoods for Commercial Cooking Equipment*, 2006.

ANSI/UL 710B, *Standard for Recirculating Systems*, 2011, revised 2014.

ANSI/UL 723, *Standard for Test for Surface Burning Characteristics of Building Materials*, 2010.

ANSI/UL 737, *Standard for F replace Stoves*, 2011, revised 2015.

ANSI/UL 896, *Standard for Oil-Burning Stoves*, 1993, revised 2012.

ANSI/UL 923, *Standard for Microwave Cooking Appliances*, 2013, revised 2015.

ANSI/UL 1046, *Standard for Grease Filters for Exhaust Ducts*, 2010, revised 2012.

ANSI/UL 1484, *Standard for Residential Gas Detectors*, 2005.

ANSI/UL 1978, *Standard for Grease Ducts*, 2004.

UL Subject 199B, *Outline of Investigation for Control Cabinets for Automatic Sprinkler Systems Used for Protection of Commercial Cooking Equipment*, 2015.

UL Subject 199E, *Outline of Investigation for Fire Testing of Sprinklers and Water Spray Nozzles for Protection of Deep Fat Fryers*, 2004.

UL Subject 2162, *Outline of Investigation for Commercial Wood-Fired Baking Ovens — Refractory Type*, 2014.

N **C.1.2.9 U.S. Government Publications.** U.S. Government Publishing Office, 732 North Capitol Street, NW, Washington, DC 20401-0001.

Title 49, Code of Federal Regulations, Part 180.205, "General Requirements for Requalification of Specification Cylinders."

C.2 Informational References. The following documents or portions thereof are listed here as informational resources only. They are not a part of the requirements of this document.

Ackland, P., *Inspection Manual for Commercial Kitchen Exhaust Systems*, 2001. ISBN 0-968160-4-6. Phil Ackland, P.O. Box 856, Summerland, BC V0H 1Z0.

Ackland, P., *Kitchen Exhaust Cleaning and Certification Manual*, 2003. ISBN 0-9681760-70. Phil Ackland, P.O. Box 856, Summerland, BC V0H 1Z0.

American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), "Kitchen Ventilation," Chapter 33 in *Heating, Ventilating, and Air-Conditioning Applications*, Atlanta: ASHRAE, 2011.

ANSI/UL 263, *Standard for Fire Tests of Building Construction and Materials*, 2015.

ASTM E119, *Standard Test Methods for Fire Tests of Building Construction and Materials*, 2016.

Carson, W. G., and R. L. Klinker, *Fire Protection Systems: Inspection, Test and Maintenance Manual*, 4th edition, Quincy, MA: NFPA, 2012.

Cote, A. E., ed., "Ventilation of Commercial Cooking Operations," Chapter 12.9 in *Fire Protection Handbook*, 19th edition, Quincy, MA: NFPA, 2003.

Gerstler, W. D., "New Rules for Kitchen Exhaust," *ASHRAE Journal*, November 2002: 26–33.

Solomon, R. E., ed., "Protection of Commercial Cooking Equipment," Chapter 55 in *Fire and Life Safety Inspection Manual*, 8th edition, Quincy, MA: NFPA, 2002.

"Using Extinguishers in Commercial Kitchens." National Fire Protection Association video, VC72VH, Quincy, MA: NFPA, 2002.

C.3 References for Extracts in Informational Sections.

NFPA 1192, *Standard on Recreational Vehicles*, 2015 edition.

NFPA 5000®, *Building Construction and Safety Code®*, 2015 edition.

Index

Sequence of Events for the Standards Development Process

Once the current edition is published, a Standard is opened for Public Input.

Step 1 – Input Stage

- Input accepted from the public or other committees for consideration to develop the First Draft
- Technical Committee holds First Draft Meeting to revise Standard (23 weeks); Technical Committee(s) with Correlating Committee (10 weeks)
- Technical Committee ballots on First Draft (12 weeks); Technical Committee(s) with Correlating Committee (11 weeks)
- Correlating Committee First Draft Meeting (9 weeks)
- Correlating Committee ballots on First Draft (5 weeks)
- First Draft Report posted on the document information page

Step 2 – Comment Stage

- Public Comments accepted on First Draft (10 weeks) following posting of First Draft Report
- If Standard does not receive Public Comments and the Technical Committee chooses not to hold a Second Draft meeting, the Standard becomes a Consent Standard and is sent directly to the Standards Council for issuance (see Step 4) or
- Technical Committee holds Second Draft Meeting (21 weeks); Technical Committee(s) with Correlating Committee (7 weeks)
- Technical Committee ballots on Second Draft (11 weeks); Technical Committee(s) with Correlating Committee (10 weeks)
- Correlating Committee Second Draft Meeting (9 weeks)
- Correlating Committee ballots on Second Draft (8 weeks)
- Second Draft Report posted on the document information page

Step 3 – NFPA Technical Meeting

- Notice of Intent to Make a Motion (NITMAM) accepted (5 weeks) following the posting of Second Draft Report
- NITMAMs are reviewed and valid motions are certified by the Motions Committee for presentation at the NFPA Technical Meeting
- NFPA membership meets each June at the NFPA Technical Meeting to act on Standards with "Certified Amending Motions" (certified NITMAMs)
- Committee(s) vote on any successful amendments to the Technical Committee Reports made by the NFPA membership at the NFPA Technical Meeting

Step 4 – Council Appeals and Issuance of Standard

- Notification of intent to file an appeal to the Standards Council on Technical Meeting action must be filed within 20 days of the NFPA Technical Meeting
- Standards Council decides, based on all evidence, whether to issue the standard or to take other action

Notes:

1. Time periods are approximate; refer to published schedules for actual dates.
2. Annual revision cycle documents with certified amending motions take approximately 101 weeks to complete.
3. Fall revision cycle documents receiving certified amending motions take approximately 141 weeks to complete.

Committee Membership Classifications[1,2,3,4]

The following classifications apply to Committee members and represent their principal interest in the activity of the Committee.

1. M *Manufacturer:* A representative of a maker or marketer of a product, assembly, or system, or portion thereof, that is affected by the standard.
2. U *User:* A representative of an entity that is subject to the provisions of the standard or that voluntarily uses the standard.
3. IM *Installer/Maintainer:* A representative of an entity that is in the business of installing or maintaining a product, assembly, or system affected by the standard.
4. L *Labor:* A labor representative or employee concerned with safety in the workplace.
5. RT *Applied Research/Testing Laboratory:* A representative of an independent testing laboratory or independent applied research organization that promulgates and/or enforces standards.
6. E *Enforcing Authority:* A representative of an agency or an organization that promulgates and/or enforces standards.
7. I *Insurance:* A representative of an insurance company, broker, agent, bureau, or inspection agency.
8. C *Consumer:* A person who is or represents the ultimate purchaser of a product, system, or service affected by the standard, but who is not included in (2).
9. SE *Special Expert:* A person not representing (1) through (8) and who has special expertise in the scope of the standard or portion thereof.

NOTE 1: "Standard" connotes code, standard, recommended practice, or guide.

NOTE 2: A representative includes an employee.

NOTE 3: While these classifications will be used by the Standards Council to achieve a balance for Technical Committees, the Standards Council may determine that new classifications of member or unique interests need representation in order to foster the best possible Committee deliberations on any project. In this connection, the Standards Council may make such appointments as it deems appropriate in the public interest, such as the classification of "Utilities" in the National Electrical Code Committee.

NOTE 4: Representatives of subsidiaries of any group are generally considered to have the same classification as the parent organization.

Submitting Public Input / Public Comment Through the Online Submission System

Soon after the current edition is published, a Standard is open for Public Input.

Before accessing the Online Submission System, you must first sign in at www.nfpa.org. *Note: You will be asked to sign-in or create a free online account with NFPA before using this system:*

a. Click on Sign In at the upper right side of the page.
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OR

a. Go directly to your specific document information page by typing the convenient shortcut link of www.nfpa.org/document# (Example: NFPA 921 would be www.nfpa.org/921). Sign in at the upper right side of the page.

To begin your Public Input, select the link "The next edition of this standard is now open for Public Input" located on the About tab, Current & Prior Editions tab, and the Next Edition tab. Alternatively, the Next Edition tab includes a link to Submit Public Input online.

At this point, the NFPA Standards Development Site will open showing details for the document you have selected. This "Document Home" page site includes an explanatory introduction, information on the current document phase and closing date, a left-hand navigation panel that includes useful links, a document Table of Contents, and icons at the top you can click for Help when using the site. The Help icons and navigation panel will be visible except when you are actually in the process of creating a Public Input.

Once the First Draft Report becomes available there is a Public Comment period during which anyone may submit a Public Comment on the First Draft. Any objections or further related changes to the content of the First Draft must be submitted at the Comment stage.

To submit a Public Comment you may access the online submission system utilizing the same steps as previously explained for the submission of Public Input.

For further information on submitting public input and public comments, go to: http://www.nfpa.org/publicinput.

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Technical Committee tab: View current committee member rosters or apply to a committee.

Technical Questions tab: For members and Public Sector Officials/AHJs to submit questions about codes and standards to NFPA staff. Our Technical Questions Service provides a convenient way to receive timely and consistent technical assistance when you need to know more about NFPA codes and standards relevant to your work. Responses are provided by NFPA staff on an informal basis.

Products & Training tab: List of NFPA's publications and training available for purchase.

Information on the NFPA Standards Development Process

I. Applicable Regulations. The primary rules governing the processing of NFPA standards (codes, standards, recommended practices, and guides) are the NFPA *Regulations Governing the Development of NFPA Standards (Regs)*. Other applicable rules include NFPA *Bylaws*, NFPA *Technical Meeting Convention Rules*, NFPA *Guide for the Conduct of Participants in the NFPA Standards Development Process*, and the NFPA *Regulations Governing Petitions to the Board of Directors from Decisions of the Standards Council*. Most of these rules and regulations are contained in the *NFPA Standards Directory*. For copies of the *Directory*, contact Codes and Standards Administration at NFPA Headquarters; all these documents are also available on the NFPA website at "www.nfpa.org."

The following is general information on the NFPA process. All participants, however, should refer to the actual rules and regulations for a full understanding of this process and for the criteria that govern participation.

II. Technical Committee Report. The Technical Committee Report is defined as "the Report of the responsible Committee(s), in accordance with the Regulations, in preparation of a new or revised NFPA Standard." The Technical Committee Report is in two parts and consists of the First Draft Report and the Second Draft Report. (See *Regs* at Section 1.4.)

III. Step 1: First Draft Report. The First Draft Report is defined as "Part one of the Technical Committee Report, which documents the Input Stage." The First Draft Report consists of the First Draft, Public Input, Committee Input, Committee and Correlating Committee Statements, Correlating Notes, and Ballot Statements. (See *Regs* at 4.2.5.2 and Section 4.3.) Any objection to an action in the First Draft Report must be raised through the filing of an appropriate Comment for consideration in the Second Draft Report or the objection will be considered resolved. [See *Regs* at 4.3.1(b).]

IV. Step 2: Second Draft Report. The Second Draft Report is defined as "Part two of the Technical Committee Report, which documents the Comment Stage." The Second Draft Report consists of the Second Draft, Public Comments with corresponding Committee Actions and Committee Statements, Correlating Notes and their respective Committee Statements, Committee Comments, Correlating Revisions, and Ballot Statements. (See *Regs* at 4.2.5.2 and Section 4.4.) The First Draft Report and the Second Draft Report together constitute the Technical Committee Report. Any outstanding objection following the Second Draft Report must be raised through an appropriate Amending Motion at the NFPA Technical Meeting or the objection will be considered resolved. [See *Regs* at 4.4.1(b).]

V. Step 3a: Action at NFPA Technical Meeting. Following the publication of the Second Draft Report, there is a period during which those wishing to make proper Amending Motions on the Technical Committee Reports must signal their intention by submitting a Notice of Intent to Make a Motion (NITMAM). (See *Regs* at 4.5.2.) Standards that receive notice of proper Amending Motions (Certified Amending Motions) will be presented for action at the annual June NFPA Technical Meeting. At the meeting, the NFPA membership can consider and act on these Certified Amending Motions as well as Follow-up Amending Motions, that is, motions that become necessary as a result of a previous successful Amending Motion (See 4 5 3 2 through 4.5 3 6 and Table 1, Columns 1-3 of *Regs* for a summary of the available Amending Motions and who may make them.) Any outstanding objection following action at an NFPA Technical Meeting (and any further Technical Committee consideration following successful Amending Motions, see *Regs* at 4.5.3.7 through 4.6.5.3) must be raised through an appeal to the Standards Council or it will be considered to be resolved.

VI. Step 3b: Documents Forwarded Directly to the Council. Where no NITMAM is received and certified in accordance with the Technical Meeting Convention Rules, the standard is forwarded directly to the Standards Council for action on issuance. Objections are deemed to be resolved for these documents. (See *Regs* at 4.5.2.5.)

VII. Step 4a: Council Appeals. Anyone can appeal to the Standards Council concerning procedural or substantive matters related to the development, content, or issuance of any document of the NFPA or on matters within the purview of the authority of the Council, as established by the Bylaws and as determined by the Board of Directors. Such appeals must be in written form and filed with the Secretary of the Standards Council (see *Regs* at Section 1.6). Time constraints for filing an appeal must be in accordance with 1.6.2 of the *Regs*. Objections are deemed to be resolved if not pursued at this level.

VIII. Step 4b: Document Issuance. The Standards Council is the issuer of all documents (see Article 8 of *Bylaws*). The Council acts on the issuance of a document presented for action at an NFPA Technical Meeting within 75 days from the date of the recommendation from the NFPA Technical Meeting, unless this period is extended by the Council (see *Regs* at 4.7.2). For documents forwarded directly to the Standards Council, the Council acts on the issuance of the document at its next scheduled meeting, or at such other meeting as the Council may determine (see *Regs* at 4.5.2.5 and 4.7.4).

IX. Petitions to the Board of Directors. The Standards Council has been delegated the responsibility for the administration of the codes and standards development process and the issuance of documents. However, where extraordinary circumstances requiring the intervention of the Board of Directors exist, the Board of Directors may take any action necessary to fulfill its obligations to preserve the integrity of the codes and standards development process and to protect the interests of the NFPA. The rules for petitioning the Board of Directors can be found in the *Regulations Governing Petitions to the Board of Directors from Decisions of the Standards Council* and in Section 1.7 of the *Regs*.

X. For More Information. The program for the NFPA Technical Meeting (as well as the NFPA website as information becomes available) should be consulted for the date on which each report scheduled for consideration at the meeting will be presented. To view the First Draft Report and Second Draft Report as well as information on NFPA rules and for up-to-date information on schedules and deadlines for processing NFPA documents, check the NFPA website (www.nfpa.org/docinfo) or contact NFPA Codes & Standards Administration at (617) 984-7246.

2017 Edition

NFPA 96 TECHNICAL CHANGES

This table provides an overview of major code changes from the 2014 edition to the 2017 edition of NFPA 96, *Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations*. Purely editorial and formatting changes are not included. For more information about the reason(s) for each change, visit www.nfpa.org/96. The first revision (FR) and second revision (SR) numbers are given in the third column of this table for reference to the official documentation of the technical committee's actions.

Section Number	Comments	FR/SR Number
3.3.33.1	Removed term *fixed baffle hood* and its definition from the standard.	FR-44
3.3.52, 3.3.53	Added new definitions for the terms *water-wash fire-extinguishing system* and *water-wash system*, which are used in the standard.	FR-5
A.4.1.1.1	Revised language to provide a clearer explanation of ANSI/UL 197 and ANSI/UL 710B for appliances with limited grease emissions.	FR-12
A.4.2.1	Added new language to provide clarification for measurements for clearance requirements.	FR-8
4.1.5	Revised language to emphasize the responsibility for assuring that compliance with the standard is that of the owner.	FR-6
4.1.9	Revised language to eliminate redundancy. Subsections 1.3.2 and 1.3.5 allow the AHJ to determine equivalency.	FR-7
4.3.3.2	Added new language to address listed single-wall factory-built grease duct systems that are available in the industry.	FR-41
6.1.2	Revised language to require grease removal devices to be clearly marked to allow inspecting authorities and end users to easily identify that the employed grease removal devices comply with the requirements of the standard.	FR-9
6 2 5	Revised language to give users an opt on to have a clear indication of the required orientation of the grease removal devices.	FR- 1
7.1.4.3.1	Modified language to clarify grease duct drains are not listed. If the drains are provided with a listed grease duct, they are components of that grease duct.	FR-15
8.2.3.2	Revised language to clarify the requirements for the activation of exhaust fans when the fire-extinguishing system is activated.	FR-56
8.2.3.3	Modified language to provide clear guidance for the AHJ.	FR-18
9.3.1.1	Revised language to clarify that other devices installed in a duct are required to have a fire-extinguishing system.	FR-20
9.3.7	Added new requirement for the installation of carbon monoxide detectors.	FR-19
10.1.3	Revised language to clarify that other devices installed in a duct are required to have a fire-extinguishing system.	FR-21, SR-7
10.2.2	Revised language to specify that Class K–type extinguishers need a placard.	SR-15
10.2.3.2	Revised language to eliminate the date since the effective date has passed. Now, all existing fire-extinguishing systems need to comply.	SR-8
10.2.8	Modified section to eliminate redundancy and to use new terminology for clarification.	FR-42
10.3.1.1	Modified 10.3.1.2 to require independent fire protection systems for multiple hoods on a single duct. Revised 10.3.1.3 to comply with new 10.1.3.	FR-45, SR-9

Section Number	Comments	FR/SR Number
10.4.5	Moved new language regarding solid fuel from NFPA 17A to NFPA 96 to improve correlation between the two standards.	FR-23
10.5.1, 10.5.2, 10.5.3, 10.5.4, 10.5.5, and 10.5.6	Revised language to improve correlation between NFPA 17A and NFPA 96 and to clarify that the requirements are applicable to all types of extinguishing systems.	FR-46, SR-10
10.5.3	Added new requirement to specify when employees of commercial cooking operations need to be trained to use portable fire extinguishers.	FR-26, SR-10
10.7.1	Revised language to clarify intent of requirement with regard to additional sprinklers and hood systems.	FR-28
10.9.4	Added new language to clarify that carbon dioxide–type extinguishers are not permitted.	FR-29
11.1.4	Revised language to emphasize employees of commercial cooking operations are required to be provided with portable fire extinguisher training at regular intervals.	FR-48
11.2.9	Added new language to permit inspection and maintenance records to be stored and accessed electronically.	FR-31
11.6.1	Revised section to include language originally in the annex to establish a requirement for a measurement system for cleanliness.	FR-34
11.6.16	Added new requirement to specify when metal containers that are used to collect grease drippings need to be inspected or emptied.	FR-36
A.11.7.2	Added new annex language to describe the hazard created by not complying with 11.7.2.	FR-22
Annex B	Added new annex chapter, which was developed to provide the minimum fire safety requirements for mobile and temporary cooking operations.	SR-12

Chapter 1

Chapter 1 of NFPA 96, *Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations*, covers the administration requirements relating to the design, installation, operation, inspection, and maintenance of all public and private cooking operations. This chapter provides the requirements for administering the provisions of this document. The requirements in Chapter 1 are essential for establishing a framework for enforcing the standard, where adopted by the authority having jurisdiction (AHJ). These provisions are necessary to achieve uniformity in enforcement between jurisdictions by avoiding conflicts and overlaps. This chapter lays the ground rules by which the provisions of this standard are enforced.

1.1.1

As with all NFPA codes and standards, NFPA 96 requirements are intended to provide a minimum level of safety that must be achieved. There are designs and approaches that go above and beyond what is required by this standard that can provide higher levels of protection, but it might be impractical to provide such a level of protection in all instances.

Guidance on the design, installation, and operation of commercial cooking equipment, ventilation components, and extinguishing systems is developed by the manufacturer of the particular equipment and should be strictly adhered to. The manufacturer might have specific maintenance and inspection requirements above and beyond the requirements of this standard. Not following these additional requirements specific to that equipment can potentially void the warranty or decrease the overall safety of the equipment, or both.

1.1.2

NFPA 96 applies to public and private commercial cooking operations. Private commercial cooking operations are kitchens located in nursing homes, college dormitories, and any other

private commercial facilities that have cooking procedures that produce grease-laden vapors. Operations involving residential cooking equipment have been the source of considerable discussion. There has been debate in regard to whether or not NFPA 96 should apply to residential equipment at all, in all instances, or in limited circumstances, since the majority of the requirements are based on operations using commercial appliances. NFPA 96 states that residential equipment used in commercial cooking operations is within its scope. An example of equipment that would be covered is a residential range located in a church fellowship hall that does not meet the exemption allowed in 1.1.4.

1.1.3

It is not the intent of this standard to apply the requirements in this standard to residential or commercial cooking equipment located in a residence that is a single dwelling unit.

1.1.4(3)

See 3.3.6 for the definition of an assembly occupancy.

1.1.4(4)

The requirement in 1.1.4 provides an exception to the application of this standard to residential equipment being used for commercial cooking operations, provided other safety considerations are met. Examples of such situations are listed in A.1.1.4.

1.2

Fires in commercial cooking establishments are a serious concern because many commercial cooking operations are part of assembly, educational, and health care occupancies where a fire could create a significant risk to life safety. The proper design, installation, and maintenance of a commercial cooking system are essential to the proper function of a building and the safety of its occupants.

1.3.1

It is vital that all the applicable requirements of this standard be applied to the cooking operation. Simply providing a suppression system but not following any of the other requirements of this standard could defeat the ability of the system to extinguish a fire.

1.3.2

Most commercial cooking equipment produces smoke and grease-laden vapors, with very few exceptions. Equipment that is being considered for qualification as an exception must be carefully evaluated by both the designer and the AHJ before modifying any of the requirements for ventilation and protection.

1.4

The retroactivity section appears in many NFPA codes and standards. The purpose of this section is to reinforce the premise that any hood and duct installation and fire suppression installation installed in accordance with the applicable edition of NFPA 96 is considered to be compliant with the standard for its lifetime, as long as the associated hazards remain unchanged and the system is properly cleaned, inspected, and maintained per the requirements of this standard. Therefore, an existing installation is not required to be reviewed for compliance with every new edition.

1.4.1

While the majority of the requirements of this standard are not intended to be retroactive, where it is specifically stated, those sections should be applied to systems that are already in existence and approved. One such instance is the requirement in 10.2.3.2, which requires all existing fire-extinguishing systems to be compliant with ANSI/UL 300, *Standard for Fire Testing of Fire Extinguishing Systems for Protection of Commercial Cooking Equipment*, or other equivalent standards.

1.5

An equivalency statement is included in many NFPA documents to allow products and system arrangements to be used that are not specifically covered by this standard. However, if they are used, the products or arrangements must demonstrate that they do not lower the level of safety provided by this standard or alter the standard's intent.

1.5.2

The authority having jurisdiction is responsible for determining whether equivalency has been demonstrated based on the technical documentation that has been submitted.

Chapter 2

This chapter lists the mandatory publications referenced in Chapter 3 through Chapter 15 of NFPA 96, while Annex C lists nonmandatory publications referenced in the annexes. Because the reference information is located immediately after Chapter 1, Administration, the user has the complete list of publications needed for effective use of the standard before reading the specific requirements.

2.2

It is NFPA policy that the editions of the NFPA publications referenced be the most current at the time the standard is issued.

2.4

The documents listed in Section 2.4 provide reference information, including title and edition, for extracts throughout the mandatory sections of this standard as indicated by a reference in brackets [ ] following a section or paragraph.

The provisions of the publications that are mandated by NFPA 96 are also requirements. The provisions of the documents listed in Chapter 2 are mandatory requirements only to the extent called for in NFPA 96.

Where specific equipment and systems are required, their proper installation and maintenance are important. Rather than develop its own installation criteria, NFPA 96 mandates the use of expert documents. The referenced documents become an enforceable part of NFPA 96.

NFPA 96 like other NFPA codes and standards can mandate the use of a referenced document only if that document is an American National Standards Institute, Inc. (ANSI) consensus code or standard, provided that such an ANSI-accredited document exists. NFPA policy does not permit mandating the use of a referenced document that has not been developed under consensus procedures, nor does it permit reference to those documents developed by committees whose membership is not balanced with respect to user interests.

REFERENCES CITED IN COMMENTARY

NFPA Publications. National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

NFPA 1, *Fire Code*, 2015 edition.

NFPA 10, *Standard for Portable Fire Extinguishers*, 2013 edition.

NFPA 13, *Standard for the Installation of Sprinkler Systems*, 2016 edition.

NFPA 17, *Standard for Dry Chemical Extinguishing Systems*, 2017 edition.

NFPA 17A, *Standard for Wet Chemical Extinguishing Systems*, 2017 edition.

NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*, 2017 edition.

NFPA 54, *National Fuel Gas Code*, 2015 edition.

NFPA 58, *Liquefied Petroleum Gas Code*, 2017 edition.

NFPA 70®, *National Electrical Code®*, 2017 edition.

NFPA 72®, *National Fire Alarm and Signaling Code*, 2016 edition.

NFPA 80, *Standard for Fire Doors and Other Opening Protectives*, 2016 edition.

NFPA 731, *Standard for the Installation of Electronic Premises Security Systems*, 2017 edition.

NFPA 5000®, *Building Construction and Safety Code®*, 2015 edition.

Other Publications.

Merriam-Webster's Collegiate Dictionary, 11th edition, Merriam-Webster, Inc., Springfield, MA, 2003.

ASHRAE Publications. ASHRAE, 1791 Tullie Circle, NE, Atlanta, GA 30329-2305.

Kuehn, T. H., et al., "Effects of air velocity on grease deposition in exhaust ductwork," ASHRAE Research Project 1033-RP Final Report. Minneapolis: University of Minnesota, 2006.

ASTM Publications. ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959.

ASTM E814, *Standard Test Method for Fire Tests of Penetration Firestop Systems*, 2013a.

ASTM E2336, *Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems*, 2014.

UL Publications. Underwriters Laboratories Inc., 333 Pfingsten Road, Northbrook, IL 60062-2096.

ANSI/UL 197, *Standard for Commercial Electric Cooking Appliances*, 2010, revised 2014.

ANSI/UL 300, *Standard for Fire Testing of Fire Extinguishing Systems for Protection of Commercial Cooking Equipment*, 2005, revised 2014.

ANSI/UL 710, *Standard for Exhaust Hoods for Commercial Cooking Equipment*, 2012, revised 2013.

ANSI/UL 710B, *Standard for Recirculating Systems*, 2011, revised 2014.

UL 762, *Outline of Investigation for Power Roof Ventilators for Restaurant Exhaust Appliances*, 2013.

ANSI/UL 1046, *Standard for Grease Filters for Exhaust Ducts*, 2010, revised 2012.

ANSI/UL 1479, *Standard for Fire Tests of Through-Penetration Firestops*, 2003, revised 2015.

ANSI/UL 1978, *Standard for Grease Ducts*, 2005, revised 2013.

UL 2221, *Standard for Tests of Fire Resistive Grease Duct Enclosure Assemblies*, 2010.

Chapter 3

This chapter provides definitions for terms used in this standard. Where terms are not defined in this chapter or within another chapter, they are to be defined using their ordinarily accepted meanings in the context in which they are used. *Merriam-Webster's Collegiate Dictionary*, 11th edition, serves as the source for the ordinarily accepted meaning. The definitions in this chapter are grouped into two different sections:

- NFPA official definitions are listed in Section 3.2. These definitions are under the purview of the NFPA Standards Council, not the NFPA 96 Technical Committee, and are the same in all NFPA documents.
- General definitions are listed in Section 3.3. These definitions are technical terms that are considered crucial to the proper understanding of this document. Chapter 3 is limited to only terms used within this document. Even if a term might be of benefit to the user, if it is not used in the document, it will not be included in Chapter 3.

A reference in brackets [ ] following a section or paragraph indicates material that has been extracted from another NFPA document. As an aid to the user, the complete title and edition of the source documents for extracts in mandatory sections of the document are given in Chapter 2, and those for extracts in informational sections are given in Annex C.

3.2.1

The term *approved*, defined in 3.2.1, differs from the term *listed*, which is defined in 3 2.4. An item that is approved is not necessarily listed. Where "approved" products are permitted, the authority having jurisdiction is allowed to accept any product that they believe is appropriate for the situation, even if that product is not listed.

3.2.2

The term *authority having jurisdiction*, or *AHJ*, is that person or office enforcing the standard. Where public safety is primary, the *authority having jurisdiction* might be a federal, state, local, or other regional department; individual such as a fire chief; fire marshal; chief of fire prevention bureau, labor department, or health department; building official; electrical inspector; or others having statutory authority. For insurance purposes, an insurance bureau, inspection department, rating bureau, or other insurance company representative might be the authority having jurisdiction. In many circumstances, the property owner or his/her designated agent assumes the role of the authority having jurisdiction; at government installations, the commanding officer or departmental official might be the authority having jurisdiction.

3.2.4

Components that are critical to system operation and performance are required to be listed. At least one listing agency uses the designation "classified" to indicate that a specific product complies with testing and evaluation requirements. Products with this designation meet the intent of the term "listed."

3.2.5

The term *shall* indicates a requirement of this standard and mandates that a specific provision of NFPA 96 be followed. When the term *shall* is attached to a specific provision of this standard, compliance with that provision is not optional.

3.2.6

The term *should* indicates a recommendation, not a requirement, of this standard. A provision of this standard associated with the term *should* is advisory, and its use is limited to the annexes. The term *should* identifies a good idea or a better practice. If the recommendation is not followed, the hood suppression system is still expected to perform satisfactorily. Any paragraph number preceded by a letter is an annex item. The terms *should* and *recommend* are prevalent in the annexes of the document.

3.3.1

Approved access panels, which allow for access to the inside of ductwork for cleaning and inspection, are required to be provided by Section 7.3. Exhibit 3.1 shows examples of an access panel that might be found on an exhaust duct.

EXHIBIT 3.1 *Examples of a typical access panel.*

3.3.6

The requirement in 1.1.4 allows residential cooking equipment to be exempted from this standard if the equipment is located in a building that is not an assembly occupancy and if the other three criteria are met. However, if residential cooking equipment is used in an assembly occupancy, the requirements of NFPA 96 must be applied.

3.3.8

Baffle plates are commonly used to protect grease removal devices from the heat and flame of the cooking source where proper clearance between the two, which is required by 6 2.2.1, cannot be achieved. See Figure A.6.2.2.2 for a typical arrangement of a baffle protecting filters.

3.3.9.3

Upright broilers are common cooking equipment found in commercial kitchens that require ventilation and fire suppression in accordance with this standard.

3.3.10

This definition for the term *certified* does not specifically define what makes someone certified but does identify that the AHJ determines which accreditations will be acceptable.

3.3.12

It is important to emphasize that the definition of the term *cleaning* applies to both the kitchen exhaust systems and to cooking equipment that could collect grease below the surface or behind the equipment.

3.3.15

A continuous weld ensures a liquidtight seam that will not allow grease to escape. Continuous welds, as shown in Exhibit 3.2, are required for seams, joints, and penetrations in the hood and exhaust duct, except where other methods are specifically identified.

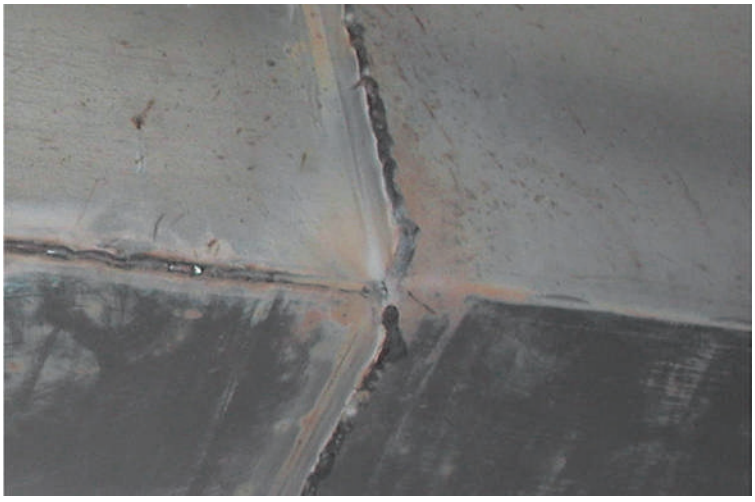


EXHIBIT 3.2 *Example of a continuous weld.*

3.3.19

Section 7.8 addresses both rooftop and wall terminations.

3.3.20.2

Chapter 7 provides detailed requirements for the design and installation of grease ducts.

3.3.22.2.2

Exhibit 3.3 shows a factory-built grease duct enclosure and Exhibit 3.4 shows a field-built grease duct enclosure. Both types of enclosures allow for reduced clearances to combustible material and are used in installations where the required clearances will otherwise be difficult, if not impossible, to achieve. Field-applied enclosures are often called "duct-wrap" and can be put onto a duct in the field in accordance with the listing and manufacturer's instructions. Factory-built enclosures come already assembled from the manufacturer in accordance with the listing requirements.

EXHIBIT 3.3 *Example of a factory-built grease duct enclosure. (Courtesy of Phillip Ackland Holdings Ltd.)*

EXHIBIT 3.4 *Example of a field-built grease duct enclosure. (Courtesy of Phillip Ackland Holdings Ltd.)*

3.3.23.1

Fire-extinguishing equipment, including both automatic systems and portable fire extinguishers, is required by Chapter 10 of this standard.

3.3.23.2

The use of solid fuel, as opposed to electricity or gas, presents unique challenges and issues. Burning wood creates creosote, which is a dark brown or black flammable tar deposited from especially wood smoke on the walls of a chimney. When creosote is mixed with grease-laden vapors, a highly flammable vapor is created that is heavier than air. The requirements for solid fuel cooking equipment are found in Chapter 14 of this standard.

3.3.24.2

Exhibit 3.5 shows a mesh filter and a grease filter side by side. Mesh filters are not permitted to be used by NFPA 96 because the mesh design captures and holds grease within it, and the filter itself can then add to the fire load. Nonmesh filters capture the grease but do not hold the grease within the path of exhaust travel.

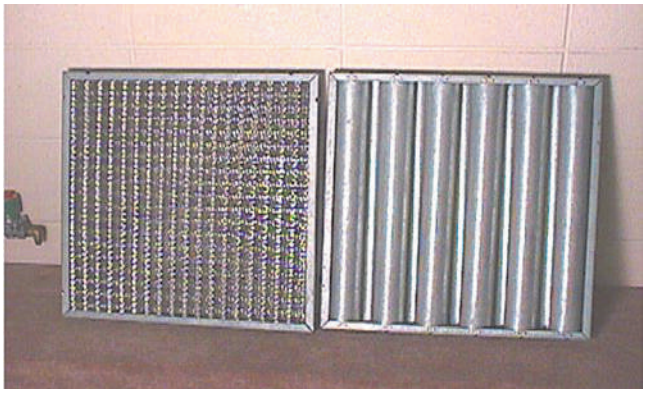


EXHIBIT 3.5 *Examples of two types of filters: (left) a mesh filter and (right) a grease filter.*

3.3.28

Fusible links are often used as the automatic detection required of the fire-extinguishing systems. Requirements exist for the installation and cleaning of these links because they are vital in the proper operation of the fire-extinguishing system. A fusible link in a duct for a fire-extinguishing system can be seen in Exhibit 3.6.

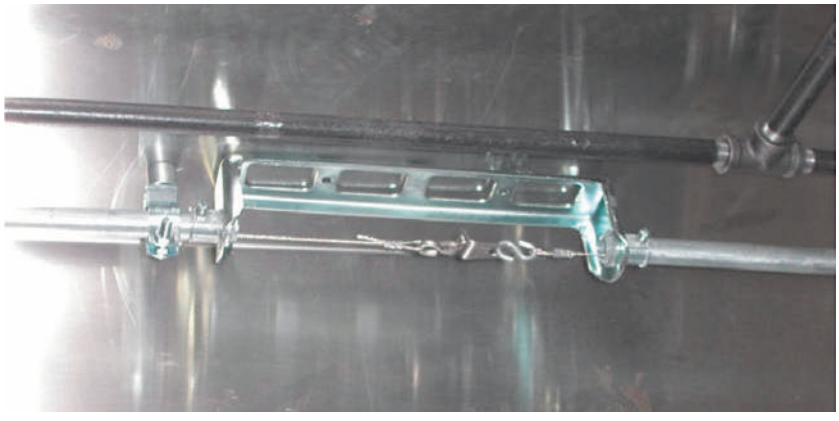


EXHIBIT 3.6 *Example of a fusible link.*

3.3.29

The purpose of NFPA 96 is to protect cooking equipment that produces grease-laden vapors. The grease that is emitted during cooking operations can act as a fuel load for a fire once it has ignited. While much of the danger of cooking operations is right at the equipment, grease that has accumulated in the ductwork can ignite and cause intense fires to burn, which often go undetected for much longer periods of time.

3.3.32

High limit control devices keep deep fat fryers from reaching the autoignition temperature of the cooking medium by shutting off the heat at a set temperature somewhere below that point. Exhibit 3.7 shows the controls for a deep fat fryer, which must include a high limit control device.

EXHIBIT 3.7 *Deep fat fryer controls.*

3.3.33

See the annex material on this section for more information.

3.3.37

The clearance from the components of the exhaust system to the building structure is based on the combustibility of the building material. As shown in Table A.3.3.37, the building material must be considered as an assembly, not just as the facing material. See Table A.3.3.37 for addit onal information on the types of construct on assemblies containing noncombustible, limited-combustible, and combustible materials.

3.3.38

Systems that do not meet the requirements of this standard are required to be tagged as "noncompliant," as shown in Exhibit 3.8. See 11.1.6.1.

EXHIBIT 3.8 *Example of a noncompliance tag.*

3.3.40

Similar to the discussion following the definition for *certified*, this definition does not define specifically what makes someone qualified but does specify that it is a decision of the AHJ as to what will be acceptable requirements and training.

3.3.41

Chapter 13 addresses these types of cooking equipment and systems that are unique in comparison to the traditionally exhausted ducted systems. See Exhibit 3.9.

EXHIBIT 3.9 *Example of a recirculating system.*

3.3.44

The term *single hazard area* is used in Section 10.3 regarding simultaneous operation of fixed pipe extinguishing systems.

3.3.48

Spark arresters are required only in solid fuel cooking operations due to the nature of the fuel and its tendency to produce embers and sparks.

3.3.50

Similar to the discussions following the definitions of *certified* and *qualified*, the definition of the term *trained* does not identify specific training, but rather states that the AHJ will determine acceptable training.

3.3.53

Definitions for the terms *water-wash fire-extinguishing system* and *water-wash system* are new for the 2017 edition. This new terminology, used in 10.2.8, clarifies each type of system.

Chapter 4

Chapter 4 includes general requirements that are applicable to all commercial cooking operations and to all portions of the ventilation system. While later chapters apply specifically to hoods, ducts, fans, and other components, Chapter 4 applies to all components. The most important issue addressed by Chapter 4 is that of the clearance provided from the exhaust system to the building structure, which is based on the combustibility of the building material.

4.1.1

While Chapter 1 lays the groundwork for the types of cooking equipment and operations covered by NFPA 96, 4.1.1 provides additional considerations to the application of this standard. This requirement specifies that cooking equipment "used in processes producing smoke or grease-laden vapors" must be provided with an exhaust system meeting all the requirements of this standard.

The NFPA Advisory Service Program receives numerous questions on the types of food and cooking appliances that are required to comply with 4.1.1. Conveyor pizza ovens are often the most common appliance in question concerning this requirement. It is important to recognize that in addition to being used to cook pizza, these appliances are used to warm food and melt cheese as a final preparation step in which food items pass through the oven before the food is served. Regardless of the name of the appliance, if the cooking operation or type of food being cooked produces smoke or grease-laden vapors, an exhaust system that complies with this standard is required.

That being said, it is possible to have a piece of equipment and a location that fall under the applicability of NFPA 96 but are not required to be provided with an exhaust system as the standard specifies. This will be a rare occurrence, because most cooking operations produce smoke or grease-laden vapors. The possibility still exists, for example, for a piece of equipment to be installed without the exhaust system, provided policy is set that limits its use to only operations that do not produce smoke or grease-laden vapors. That is a policy that would be difficult to ensure, and final approval would need to come from the AHJ.

4.1.1.1

Although this provision applies to any cooking equipment that has been listed to ANSI/UL 197, *Standard for Commercial Electric Cooking Appliances*, it applies specifically to equipment served by recirculation systems, which are covered in Chapter 13 and are known as ventless-type cooking equipment. New annex material is provided in the 2017 edition to clarify ANSI/UL 197 and ANSI/UL 710B, *Standard for Recirculating Systems*, for appliances with limited grease emissions.

4.1.3

As indicated in 1.3.1, where it states that the standard needs to be applied as a united whole, 4 1 3 also emphasizes the importance of maintain ng all components of the system to ensure the entire system works properly and provides the appropriate level of protection.

4.1.3.1

Manufacturer's instructions will likely include a recommended maintenance schedule.

4.1.4

Proper ventilation is a major factor in the safe operation of commercial cooking equipment. It is therefore imperative that exhaust ventilation and powered replacement air ventilation systems, where applicable, are operating whenever cooking appliances are powered or fired up.

4.1.5

The phrase "including cooking appliances" was added to the 2017 edition to emphasize that, in addition to the owner taking responsibility for the inspection, testing, maintenance, and cleanliness of exhaust systems and fire protection systems, the owner is responsible for maintaining the cooking appliances to comply with the standard.

> **Operational Compliance Tip:** This requirement states that the responsibility for the systems is that of the system owner. This responsibility can only be transferred in written form to other parties, including a tenant or management company. It is important for building owners and tenants to understand who will have this responsibility where a space with an existing kitchen exhaust system is leased.

4.1.8

Both Section 7.2 and Section 7.3 provide more specific requirements on how this access is to be provided on the ducted system.

4.1.9

Many AHJs have developed specific guidelines to address temporary arrangements within their jurisdictions, such as temporary venues, including carnivals or mobile street vendors. The standard provides the AHJ with some latitude as to which provisions they require to be enforced and to what degree, based on the circumstances in each individual instance or as jurisdictional policy for all temporary cooking arrangements. See Annex B for more information on mobile and temporary cooking operations.

4.2

The issue of clearance from cooking equipment to combustible material is particularly important to prevent fires from spreading. Fires that burn in ducts can reach very high temperatures. Extremely hot temperatures in a duct can create a large amount of radiant heat on the outside of the duct even where the duct is not compromised. In this case, the radiant heat has the potential to ignite combustible materials and start fires in the combustible concealed spaces of a building. Maintaining a clearance from the duct to combustible and limited-combustible materials is intended to reduce this risk. Exhibit 4.1 shows an example of a hood with near zero clearance to noncombustible construction.

Operational Compliance Tip: While the clearances specified in Section 4.2 are directly related to construction requirements, the clearances should still be observed in the ongoing operational life of the system. Placing combustible boxes on top of a hood or directly against the side of it, for instance, can present the very same hazards discussed above.

EXHIBIT 4.1 *Example of near zero clearance to noncombustible construction.*

4.2.1

For the 2017 edition, new annex material clarifies how to measure the distances given in 4.2.1. In addition, it is important to recognize that the distance specified in this requirement is intended to apply in every direction from the hoods, grease removal devices, exhaust fans, and ducts to the combustible, limited-combustible, and noncombustible materials.

4.2.3

The requirements in 4.2.3 provide specific techniques for reducing the clearance required in 4.2.2, where combustible material might already exist and the clearance will be difficult, if not impossible, to achieve. Figure A.4.2(a) through Figure A.4.2(h) provide typical section views for various buildings/fire-rated assemblies and illustrate the order in which the components of the clearance reduction system are to be installed.

4.2.3.3

ASTM E2336, *Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems*, is applicable to exhaust ducts and access doors, and it specifies the requirements of the clearance reduction.

4.2.3.4

The requirement in 4.2.3.4 permits the materials listed to be laid over the limited-combustible materials to allow for reduced clearance. The clearance reduction systems covered in 4.2.3.1 through 4.2.3.3 provide clearance reduction to combustible material.

4.2.4.3

The requirement in 4.2.4.3 is included to prevent the design from precluding the clearance requirements from the bottom of the hood. The clearance required in 4.2.1 must be maintained even below the bottom of the hood.

4.2.4.4

This provision does not apply to listed grease ducts (other than single-wall grease ducts) or listed enclosure systems since the listing criteria contain protection methods for the proximity to or contact with combustible or limited-combustible construction.

4.3

Section 4.3 provides construction requirements for field-applied and factory-built grease duct enclosures. These are characteristics that the enclosure must have and are typically assured through the manufacturing and listing process. None of the requirements of this section require the use of these enclosures but must be applied wherever these enclosures are used. Section 7.7 of this standard provides more requirements on where enclosures must be provided and what other factors must be considered in the design process. Exhibit 4.2 shows details of field-applied and factory-built duct enclosures.

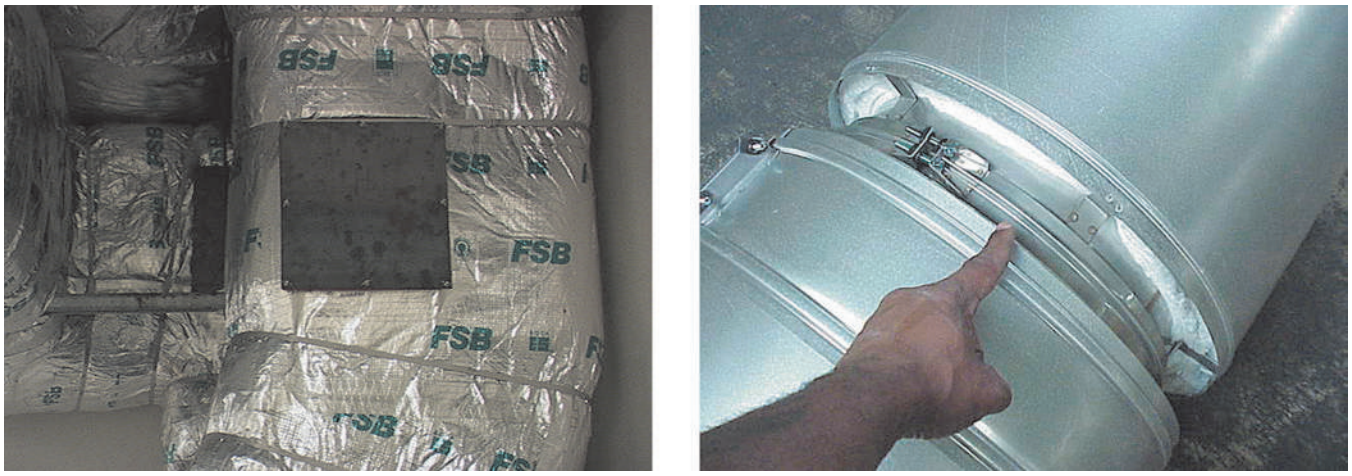


EXHIBIT 4.2 *Example of field-applied (left) and factory-built (right) grease duct enclosures. (Courtesy of Phillip Ackland Holdings Ltd.)*

4.3.2

If enclosure systems are subject to access by personnel, physical damage can result. In some cases, damage occurs when concealed spaces are accessed for maintenance or if they are being used for storage. In an effort to reduce the possibility of damage, additional protective measures, such as bollards, walls, barriers, fencing, or other rigid material, must be used as a safeguard where the AHJ deems it necessary.

4.3.3.2

This requirement is new to the 2017 edition and was included to address listed single-wall factory-built grease duct systems that are available in the industry.

4.3.5

As an example of the requirement in 4 3.5, the listing requirements in ANSI/UL 1978, *Standard for Grease Ducts*, for listed grease ducts mandate that stainless steel be used and not carbon steel or galvanized steel. The rigidity and added strength of stainless steel allow the listing requirements to also permit material less than 1.37 mm (0.054 in.) (No. 16 MSG) in thickness.

4.3.6

UL 2221, *Standard for Tests of Fire Resistive Grease Duct Enclosure Assemblies*, has provisions for evaluating enclosure systems when installed within fully enclosed combustible construction. UL 2221 allows for clearance to combustibles ranging down to zero inches.

4.4.1

The main concern that is being addressed in 4.4.1 is the potential for corrosion that exists where the duct is in contact with the structure over extended lengths. As the other requirements in Section 4.4 show, this limitation can be exceeded provided the duct is listed for zero clearance or is protected from corrosion by a material or product listed for zero clearance.

4.5

This requirement refers to *continuous enclosures* as defined in 3.3.22.1. The requirements for c earance to grease duct enclosures are contained in 4 3.6

4.8

The requirements in Section 4.8 supplement the definitions of noncombustible and limited-combustible material by providing the specific criteria that material must meet to fall under such a classification. The language is extracted from *NFPA 5000, Building Construction and Safety Code*. The specific sections of *NFPA 5000* are indicated in brackets at the end of the requirements in Section 4.8.

Chapter 5

While Chapter 4 addresses general requirements and some requirements for the cooking equipment itself, Chapter 5 specifically addresses the requirements for hoods, which are the first component of ventilation systems

5.1.2

The requirement in 5.1.2 applies to all hoods that are not listed. For listed hoods, refer to 5.1.7. The red line shown in Exhibit 5.1 represents an example of a hood enclosure. The purpose of the continuous welds is to prevent grease and, in the event of a fire, the flame from extending into the overhead of the building. The top of the hood must be continuously welded to the front, back, and both ends. Penetrations in the hood are typically for fire-extinguishing system piping. Instead of welding, listed hood penetration fittings (HPF), as shown in Exhibit 5.2, are typically used

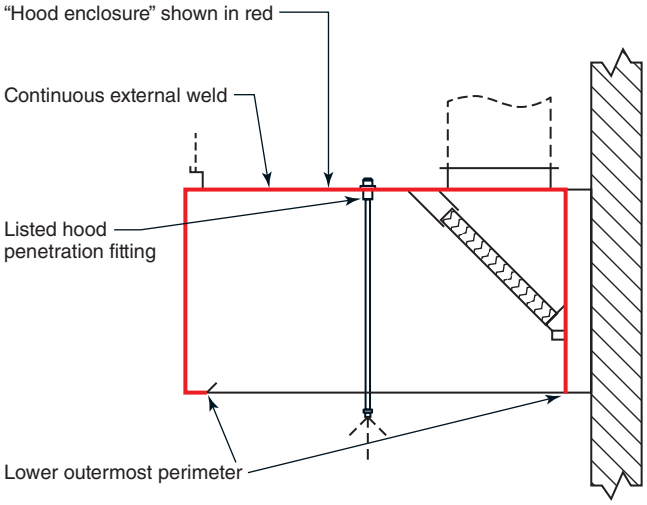


EXHIBIT 5.1 *Typical section of canopy hood. (Courtesy of Phil Morton)*

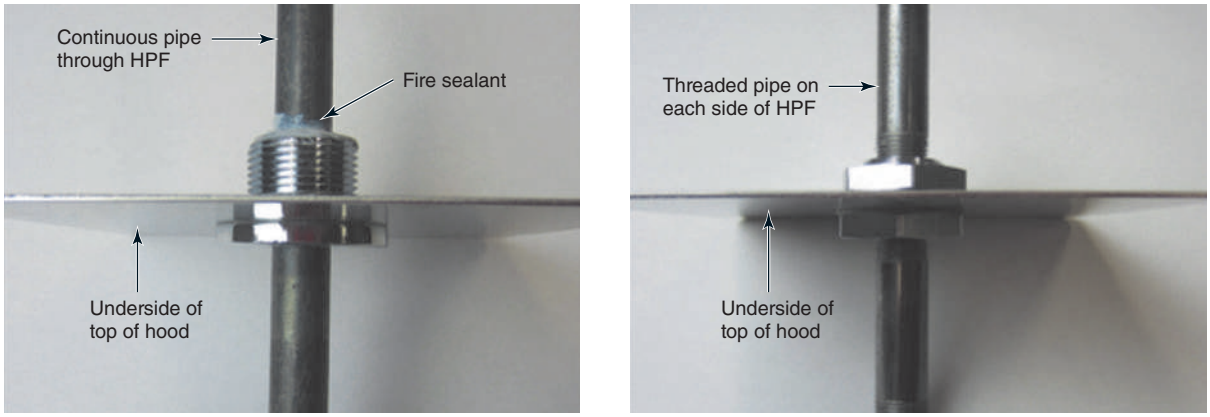


EXHIBIT 5.2 *Fire-extinguishing system piping hood penetration fittings. (Courtesy of Phil Morton)*

5.1.3

If the seams, joints, and penetrations, as described in 5.1.2, are welded from the interior side of the hood, they must be ground smooth so they can be easily cleanable. See Exhibit 5.3.

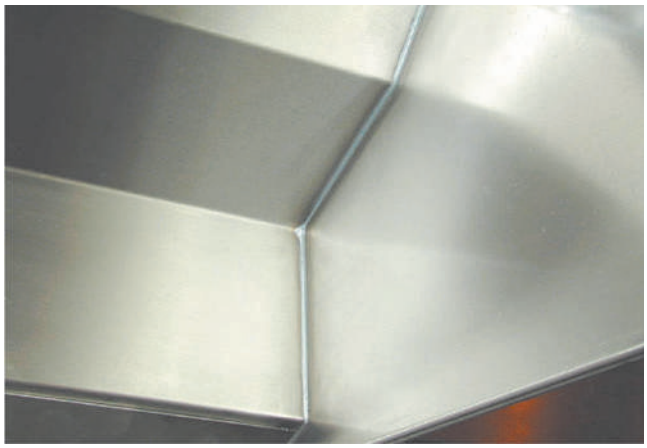


EXHIBIT 5.3 *Example of a smooth welded seam inside a hood.*

5.1.4

Joints, seams, filter supports, or fixtures within the hood enclosure do not need to be continuously welded but must be smooth and easily cleanable. See Exhibit 5.4.

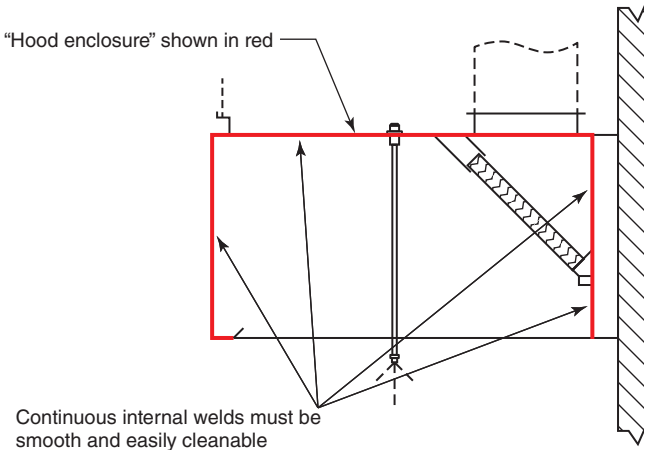


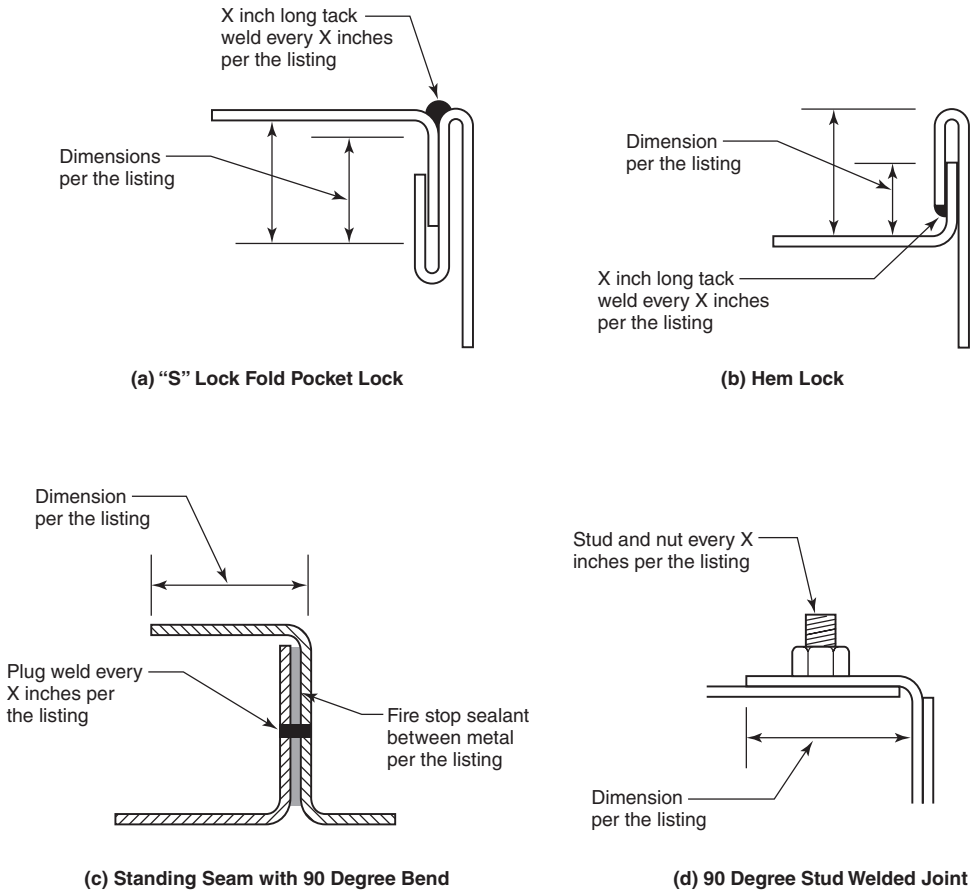
EXHIBIT 5.4 *Typical section of canopy hood showing location of internal welds. (Courtesy of Phil Morton)*

5.1.5

Refer to Exhibit 5.2 for examples of permitted penetrations.

5.1.7

Listed exhaust hoods, with or without exhaust dampers, are tested in accordance with ANSI/ UL 710, *Standard for Exhaust Hoods for Commercial Cooking Equipment*, or equivalent. ANSI/UL 710 includes several fire tests to test the integrity of various joints and seams of the hood's enclosure that are not welded. The purpose of the fire tests is to prove that specific designs of unwelded joints or the seams are equivalent to a welded joint or seam. See Exhibit 5.5 for a few typical examples of what manufacturers of listed hoods use.



(a) "S" Lock Fold Pocket Lock

(b) Hem Lock

(c) Standing Seam with 90 Degree Bend

(d) 90 Degree Stud Welded Joint

EXHIBIT 5.5 *Section view of connections for a listed hood that are not continuously welded. (Courtesy of Phil Morton)*

5.1.8

Eyebrow hoods are typically used to vent the effluent from broilers, convection ovens, and other taller pieces of cooking equipment. See Exhibit 5.6 for an example of an eyebrow hood.

5.1.12

Operational Compliance Tip: When a hood is penetrated for items, such as fire-extinguishing system piping, the penetrations must be sealed with listed devices that can provide the same integrity as the hood. During the initial design and installation process, this can easily be identified and provided. Sealing penetrations that are made later on in the life of the system cannot be overlooked. Penetrations compromise the ability of the hood to capture grease-laden vapors and to contain a fire, and whenever a penetration is needed it must be properly sealed.

EXHIBIT 5.6 *Eyebrow hood.*

5.2

The hood size is determined by the front and side overhang requirements from the hood to the cooking appliance, which are dimensions "F" and "S" as shown in Exhibit 5 7(a) and Exhibit 5.7(b).

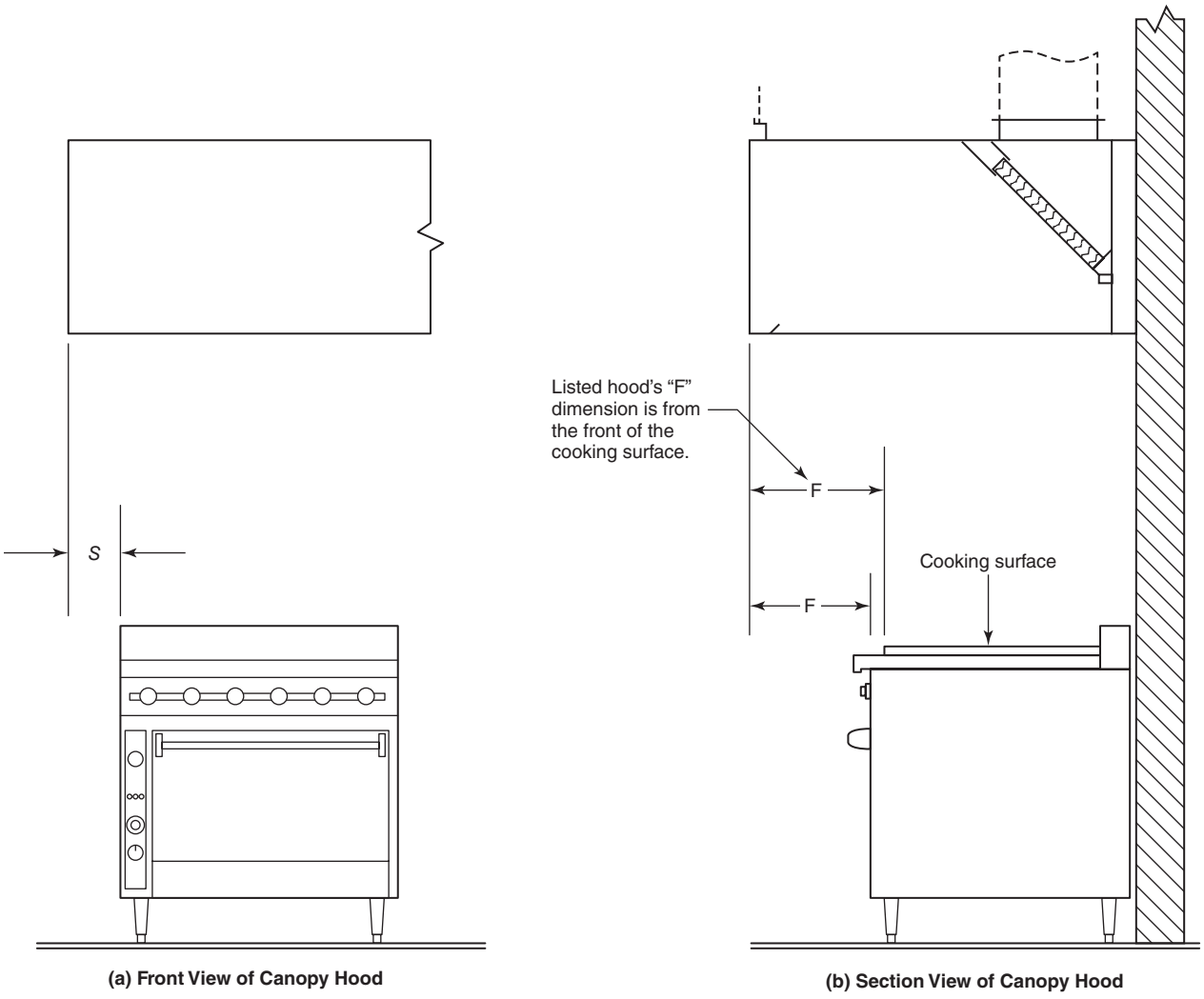


EXHIBIT 5.7 *Hood sizing dimensions. (Courtesy of Phil Morton)*

Listed exhaust hoods, with or without exhaust dampers, are tested in accordance with ANSI/UL 710, *Standard for Exhaust Hoods for Commercial Cooking Equipment*, or equivalent. ANSI/UL 710 includes many cooking smoke and grease capture tests to confirm proper exhaust volumes and overhang requirements for a particular hood over various types of cooking appliances. Once the hood successfully passes the tests, the overhang dimensions become part of the hood's listing. Most listed hoods have many different listed overhang dimensions based on the type of cooking appliance under the hood. For example, the hood listing might call for 304.8 mm (12 in.) for dimension "F" when the hood is over a charbroiler, 229 mm (9 in) when over a griddle, and only 152 mm (6 in.) when over a convection oven. One important difference between the nonlisted and the listed hood is that the listed hood "F" dimension is measured from the front of the cooking surface, not the front of the cooking appliance.

While overhang dimensions will typically be provided for listed hoods, based on the wording of Section 5.2, no overhang is actually specified or even necessarily required. Exhibit 5.8 shows a hood with no overhang of the equipment provided. Based on the cooking equipment, air volume, and air velocity, it is possible that this hood has the potential to capture and remove grease-laden vapors as required. However, it will be up to the owner, designer, or other responsible party to provide proof to the AHJ that this is possible. If the hood is listed, and it requires an overhang, then the hood would not be used to its listing and this would not be in compliance.

Operational Compliance Tip: The sizing of the hood will be a task that is specific to the equipment being protected and mostly the hood itself and its overhang dimensions. While the hood can be sized perfectly at the initial installation, installing new cooking equipment underneath the hood or, as is more often the case, moving the equipment for cleaning and not returning it to the proper location, can immediately defeat the proper hood sizing. See 12.1.2.2 and 12.1.2.3 for further discussion on ensuring that precautions are taken for returning the equipment to the proper location.

EXHIBIT 5.8 *Hood over equipment with no overhang.*

5.3

The exhaust system removes air from the kitchen, so makeup air must be provided per Section 8.3 to prevent excessive negative pressures. (See the commentary following 8.3.1 for more detail on replacement air.) One way this is accomplished is through hood assemblies that have built-in supply air plenums that directly provide the replacement air that is needed. These supply air plenums need to have the same construction as the hood itself and are required to be provided with fire dampers to contain the fire to the duct in designs where fire could likely burn in that plenum.

5.3.4.1

In case of fire, the damper will close and cut off the supply of air to the exhaust and contain the fire to the exhaust duct. See Figure A.5.3.4. The fire damper needs to be checked frequently for grease buildup, which can cause the damper to move sluggishly or to close slowly and not allow the damper to be effective.

5.3.4.3

Typically provided by a fusible link, actuation devices must follow the same inspection schedule as that for the extinguishing system because they can become coated with grease.

5.5.2

Exhibit 5.9 shows an example of an ultraviolet hood. Note the ultraviolet bulbs are located directly in the airflow prior to entering the duct.

EXHIBIT 5.9 *Ultraviolet hood. (Courtesy of Halton Company)*

Chapter 6

The intent of the requirements for providing a hood as specified in Chapter 5 is to capture all the smoke and grease-laden vapors and prevent them from escaping elsewhere. Once the smoke and grease laden vapors are captured by the hood, grease removal devices in the hood are intended to take the grease out of the airstream flowing up through the system and capture it so that it can be dealt with at a later time. The requirements for complying with this process are covered in Chapter 6.

6.1.2

Although the standard requires all grease removal devices to be listed to ANSI/UL1046, *Standard for Grease Filters for Exhaust Ducts*, many nonlisted filters are found in the field. The new requirement in 6.1.2 requires filters to be clearly marked to allow inspecting authorities and end users to easily identify that the employed grease removal devices align with the requirements of this standard.

Grease filters and grease removal devices that are provided as an integral component of a specifically listed exhaust hood are not evaluated and listed in accordance with ANSI/UL 1046, but they are evaluated as a component of that hood in accordance with ANSI/UL 710, *Standard for Exhaust Hoods for Commercial Cooking Equipment*. Such grease filters and grease removal devices are to be used only with those specifically listed exhaust hoods.

6.1.3

Commonly available mesh filters listed as "air filters" and not "grease filters" have always been prohibited in cooking exhaust systems, as they have never been tested to capture grease particulates and divert them to a safe area for collection. The captured particulates would be held within the mesh medium, causing an unsafe condition. Mesh filters used in a listed exhaust hood as an integral part of that hood are evaluated as a component of that hood in accordance with ANSI/UL 710, *Standard for Exhaust Hoods for Commercial Cooking Equipment*, and, as such, are only to be used with those specifically listed exhaust hoods. Mesh filters used with grease filters in front of an exhaust hood, such as prefilters installed on the upstream side of the grease

filters, are listed when used in conjunction with grease filters listed in accordance with ANSI/UL 1046, *Standard for Grease Filters for Exhaust Ducts*. The grease filters used with the mesh filters are also listed in accordance with ANSI/UL 1046; they act as primary filters because they provide a flame barrier during a fire, which the mesh filters might not provide.

6.2.1.1

Ideally, there should be more than 457 mm (18 in.) between the grease filters or other grease removal devices and the cooking surface. Unless otherwise specified in 6.2.1, the device cannot be located within 457 mm (18 in.) from its lower edge and the cooking surface. This device will be collecting the grease, which is a potential fuel for a fire, and locating it within 457 mm (18 in.) would expose it to high temperatures that could potentially ignite it.

6.2.1.2

For the 2017 edition, the term *solid fuel* replaces *charcoal* in order to include charcoal, wood, or any other solid fuels that would require a 1.22 m (4 ft) clearance.

6.2.2.2

The baffle plate permitted to be used in 6.2.2.2 to meet the requirement of 6.2.2.1 is shown in Figure A.6.2.2.2.

6.2.3.2

Grease filters are typically made of noncombustible metal, such as steel or aluminum. When grease filters are constructed of a nonmetallic material, that material is also required to be noncombustible.

6.2.3.5

Grease filters, such as the one shown in Exhibit 6.1, should be manufactured for ease of removal for inspection of grease accumulation or integrity and for ease of cleaning and replacement.

EXHIBIT 6.1 *Example of a grease filter removed for inspection.*

6.2.4.3

The grease that is captured by the filters must be contained and stored. This is accomplished with the use of grease drip trays. The trays are collecting a potential fire fuel, so their size is required to be limited as much as possible. Exhibit 6.2 shows examples of a typical grease drip tray.

EXHIBIT 6.2 *Examples of a grease drip tray.*

6.2.5

The language in 6.2.5 has been modified in the 2017 edition to give end users a clear indication of the required orientation of grease removal devices without having to remove the grease removal devices from the exhaust hood.

> **Operational Compliance Tip:** A standard baffle filter would be unable to drain to the drip tray if the filters were installed incorrectly with the baffles running horizontally. Sometimes manufacturers will construct filters and hoods with a built-in "notch and key" fo ease of orientation, but users of these baff e filters should be aware of thei proper orientation for this reason.

Chapter 7

Chapter 7 addresses the exhaust duct systems used for commercial cooking ventilation. Once the smoke and grease-laden vapors have been captured by the hood and the majority of the grease removed from the air by the grease removal devices, the air is carried through the exhaust duct to be expelled at the system termination either at the rooftop or through an exterior wall. The main objective of the duct system design is to provide enough access so that it can be cleaned and inspected, ensure that it is constructed with materials and connections that will not compromise its integrity should a fire occur in the duct, and ensure that the termination is at a location so as to not exhaust any contaminated air in a location where that air could be recirculated back into the building or any adjacent building.

7.1.1

Like any other material or equipment, grease ducts are not permitted to violate the fire rating of walls or partitions. When a duct must pass through a fire-rated assembly, specific criteria for the through-penetration would be required to meet the integrity of the rated wall or partition.

7.1.2

While many buildings might contain architectural features that make it difficult to design the duct to lead directly to the exterior of the building, it should be done as directly as possible. This will ensure that if a fire does occur in the duct, it travels through as little of the building as possible.

7.1.3

Commercial cooking ventilation systems pose a much greater fire risk than other ventilation systems typically found in buildings. While it might be obvious not to interconnect the kitchen exhaust with the building's HVAC system, it also cannot be connected to other ventilation systems, such as those provided for dishwashers or other equipment.

7.1.4

The 2 percent slope requirement for horizontal ducts not exceeding 22.86 m (75 ft) is more simply stated as a ¼ inch rise per 1 linear foot of run. For horizontal ducts 22.86 m (75 ft) or longer, 8 percent slope translates into a 1 inch rise per 1 linear foot of run. These slopes ensure proper drainage back to an acceptable collection point during duct cleaning.

The manufacturer's installation instructions for listed factory-built grease ducts could provide different slope values. These values are confirmed as appropriate as part of their listing.

7.1.4.4

When ductwork forms dips or traps, it provides a place for grease and residue to accumulate. Therefore, all ducts should be installed as straight as possible to avoid dips and traps.

7.1.4.6

Downdraft appliances will inherently have an upturn in their exhaust duct system. This section provides the requirement for how to safely provide for this by using a low point drain.

7.1.6

> **Operational Compliance Tip:** The purpose of providing this sign on the access panel is so that, if the building that houses the system undergoes a renovation or similar work, the person(s) performing the construction will know that access to the panel needs to be maintained, and it cannot be obstructed by the construction. The owner/operator of the system should be aware of these locations for this reason.

7.1.7

The recognized test standard for listed grease ducts is ANSI/UL 1978, *Standard for Grease Ducts* (see 2.3.3).

7.2.1

It is not uncommon to encounter a single-wall duct that extends through a roof curb and could or could not support the exhaust fan. Many times the duct has been surrounded by a field-applied duct enclosure up to the level of the roof but not all the way up to the top of the roof curb. Combustible items can be found at the roof curb level, including wood nailers and other materials for the attachment of the exhaust fans. It is necessary to ensure either the single-wall grease duct is insulated within the roof curb, or the 457 mm (18 in.) minimum clearance to combustible construction is maintained.

7.3

The purpose of openings is for cleaning. Section 7.4 provides specific requirements for openings in horizontal and vertical ducts.

7.3.1

Grease film from normal operating conditions will naturally seal openings closed from the inside. Therefore, they should not be located on the bottom side of the exhaust duct.

7.3.2

While openings are important to allow for access to the inside of the duct, they also represent potential weak points in the integrity of the duct under fire conditions. This paragraph refers the user to 7.4.4, which provides requirements to ensure that the protection of any openings maintains the same level of safety as the rest of the duct. See Exhibit 3.1 for an example of an access panel.

7.3.3

Most exhaust fans are hinge-mounted on a roof curb and can be flipped open to allow access for duct maintenance and inspection. This provision allows portions of the duct accessible from the hinged fan to omit openings.

7.3.4

Some fire-extinguishing methods can require a damper in the exhaust to reduce oxygen in the event of a grease fire within the duct. These dampers must be allowed to operate as designed; therefore, inspection and maintenance are required. Close access is necessary to accomplish this task.

7.3.7

This provision specifically requires access to in-line fans for cleaning and inspection.

7.4.1.1

Although the dimension is rectangular, the opening is not required to be a rectangle. For instance, a round duct might provide access at a tee located at the end of the horizontal duct. A 508 mm × 508 mm (20 in. by 20 in.) rectangle, however, must be able to fit into the opening.

7.4.1.2

The basis for providing the openings at 3.7 m (12 ft) intervals on a horizontal duct estimates that a person cleaning an exhaust duct holding an extended cleaning device can reach approximately 1.8 m (6 ft). Therefore, if someone is reaching from two adjacent openings, the intervening 3.7 m (12 ft) can be properly cleaned.

7.4.1.4

For support systems of horizontal ducts enclosed with field-applied duct-wrap materials, the total weight of the duct and wrap materials are considered the weight of the ductwork.

7.4.1.5

Listed grease ducts can provide openings that are flush to the outer edges of the duct, as long as the attachment method meets the leakage restrictions of ANSI/UL 1978, *Standard for Grease Ducts*.

7.4.2.1

The hinged exhaust fan located at the top of the vertical ductwork usually meets this requirement.

7 4.2 2

As previously stated, the purpose of openings is for cleaning. As long as access is available for the cleaning to be done correctly and completely, it should not matter if personnel entry can be made. However, in multistory buildings, correct and complete cleaning might be difficult to achieve without access for personnel, and adequate access for cleaning is required to be provided on each floor.

7.4.2.4

Listed grease ducts can provide openings that are flush to the outer edges of the duct, as long as the attachment method meets the leakage requirements of ANSI/UL 1978, *Standard for Grease Ducts*.

7.4.3.1

Access panels constructed of steel or galvanized steel must be a minimum 1.52 mm (0.060 in.) thick. Access panels constructed of stainless steel must be a minimum 1 22 mm (0.048 in.) thick. Stainless steel access panels for listed grease ducts are allowed to be less than 1.22 mm (0.048 in.) thick, if they are listed for such use.

7.4.3.4

Listed access panels have been proven to withstand an actual test grease fire and still remain liquidtight. However, gaskets might or might not be rated for use at 815°C (1500°F) continuous exposure. Therefore, a listed grease duct access panel is an exception to 7.4.3.2 when installed per the listing and manufacturer's installation instructions.

7.5.1.1

Although from a fire safety standpoint, 1.52 mm (0.060 in.) thick galvanized steel is considered an acceptable material, some health officials prohibit galvanized materials in food preparation areas.

7.5.2.1.2

Leakage tests must be performed while the duct interior is still accessible. A light test — illuminating a standard light bulb within the duct — can be an effective means to identify pinholes in welded seams and joints. This test is most useful when the building can be made dark. Another effective test to verify liquidtightness is to employ a high-pressure water-wash spray that is typically used for duct cleaning. Other test methods besides a light or water test can be used to determine liquidtight construction. However, an air pressure test would be inappropriate, as some duct components are not airtight.

7.5.2.2

Duct-to-hood collar connections can be accomplished with a listed, well-constructed, factory-built connection that includes an 815.6°C (1500°F) rated gasket. These connections are not required to be welded like other duct joints.

7.5.2.3

In this context, penetrations refer to breaches into the exhaust duct, such as a pipe nipple that is welded into the duct to provide a drain. This term is not referring to through-penetrations where ducts pass through fire-rated walls or through fire-rated ceiling assemblies.

7.5.2.4

Where internal welding is used, it must be available for inspection so that the smoothness of the joint can be verified. If it is not ground smooth, this could be an area that would not only allow grease to accumulate but would also be difficult to clean.

7.5.3

Exhibit 7.1 shows a listed penetration device used for sealing a penetration in a duct.

EXHIBIT 7.1 *Example of a listed device used for sealing penetrations.*

7.5.5.2

Butt-welded connections are not permitted because they have been shown to be unreliable, and they do not demonstrate adequate structural integrity over the long duration of normal use. It is also unlikely that this type of connection will be able to endure a grease fire inside the duct.

7.5.5.3

The ledge caused by arranging this connection in the opposite orientation would create a place for grease to accumulate, thereby increasing the potential fire load.

7.6

In some instances, often where new systems are placed in existing buildings, the exhaust system will need to be designed in such a way that the exhaust leaves the building immediately through an exterior wall near the cooking equipment and is then ducted up to the roof level along the exterior of the building. The requirements of Section 7.6 are intended to provide an adequate level of fire safety where such installations are found. Exhibit 7.2 shows an exterior through-wall duct installation.

EXHIBIT 7.2 *Exterior through-wall duct installation.*

7.6.3

The same concerns about adequate clearance and radiant heat apply to exterior duct installations as well as the interior portions of a system. See the annotations to Section 4 2 for more information. Exhibit 7.3 shows an exterior duct installation with what appears to be nadequate clearance.

EXHIBIT 7.3 *Exterior duct installation with questionable clearance.*

7.7.1.1

A continuous enclosure can be a traditional design of rated gypsum board and metal studs or other methods, such as listed flexible wrap systems (covered in ASTM E2336, *Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems*) and factory-built grease duct enclosure systems (covered in UL 2221, *Standard for Tests of Fire Resistive Grease Duct Enclosure Assemblies*).

7.7.1.4

Further provisions, outlined in the listing criteria, are often applicable to listed factory-built or field-applied-type enclosure systems.

7.7.2.2.3

The required clearances in 7.7.2 2 from the duct to the enclosure differ from the clearances that are required in Chapter 4, which apply to the other components of the ventilation system. There must be at least 152 mm (6 in.) clearance provided between the duct and the enclosure, even when the enclosure is made of noncombustible construction.

7.7.3.1

Operational Compliance Tip: The primary objective is to maintain the protection afforded by the covering and/or enclosure by using whatever safeguards are necessary to minimize damage to enclosure materials. Where daily operations or another occurrence do cause damage to the covering, 7.7.3.2 requires that it be repaired or restored so as to meet its initial listing and fire resistance rating.

7.7.4.4

The reason these openings are required is to allow access for maintenance and inspection of the duct, and to do so, the door protecting the opening must be in a location that allows someone to easily reach and use the access panel on the duct.

7.7.5.2

The requirement in 7 7.5.2 applies to cooking exhaust ducts and any other ducted system.

7 8.1

This permits three different arrangements for the termination of the exhaust system.

7.8.2.1(1)

The intent of the 3 m (10 ft) clearance is to enhance fire prevention and life safety, and to reduce the potential nuisance and hazard to neighbors. Terminations within 3 m (10 ft) of adjacent neighbors create an increased chance for concealed fires.

7.8.2.1(2)

This minimum clearance requirement should not be considered a contradiction to 7.8.2.1(8)(b). The 1.5 m (5 ft) clearance is for combustibles located horizontally from the discharge. Even if a roof surface is combustible, pitches upward at an angle, and meets the minimum 1.02 m (40 in.) distance from the exhaust, the fan outlet is still required to maintain a 1.5 m (5 ft) horizontal clearance to the combustible surface.

7.8.2.1(4)

Exhibit 7.4 shows an example of an appropriate grease collection container.

EXHIBIT 7.4 *Grease collection container located near fan.*

7.8.2.1(8)

The term hold-open is intended to allow the hinged upblast fan to stay in the open position in such a way that it is kept from falling back to closed during inspections and cleaning.

7.8.2.2

Operational Compliance Tip: Fans can become contaminated with grease, so they must be able to be inspected and cleaned. The hinged fan also allows for access to the final portion of ductwork for inspection and cleaning. Providing safe access allows this work to be performed as well as any other maintenance that might need to be performed on the fan. See A.7.8.2.2 for guidance on what might be considered safe access for different terminations. This access needs to be maintained for the life of the system.

7.8.3(1)

Exhibit 7.5 shows an example of a wall termination.

EXHIBIT 7.5 *Wall termination provided with proper clearances.*

7.8.3(3)

Locating the termination below 3 m (10 ft) above grade can allow access to the fan to those without a ladder, and this could lead to trouble if the area is not secured.

7.8.3(5)

Pitching the ductwork to drain toward the exhaust fan or directing the exhaust flow downward could result in large amounts of grease dripping on the ground below the wall termination.

7.8.4.2

For duct enclosure systems listed for through-penetrations of combustible and limited-combustible walls, venting the opening might not be required by the listing. Exhibit 7.6 shows such a penetration properly sealed.

EXHIBIT 7.6 *Example of a properly sealed penetration.*

7.8.4.3

A fire-rated through-penetration for walls (tested to ASTM E814, *Standard Test Method for Fire Tests of Penetration Firestop Systems*, or ANSI/UL 1479, *Standard for Fire Tests of Through-Penetration Firestops*) might not take into account external environmental conditions. Means to protect the penet at on from the elements are required, and minimum clearances to the rated wall need to be maintained.

8.1.1

Before the 2014 edition of this standard, fans were required to be listed, but no specific listing was provided. UL 762, *Outline of Investigation for Power Roof Ventilators for Restaurant Exhaust Appliances*, is the industry-accepted listing standard for these fans.

8.1.2.1

The intent of this requirement is to allow for the cleaning and servicing of the fan. The fan in Exhibit 8.1 is hinged to allow for this.

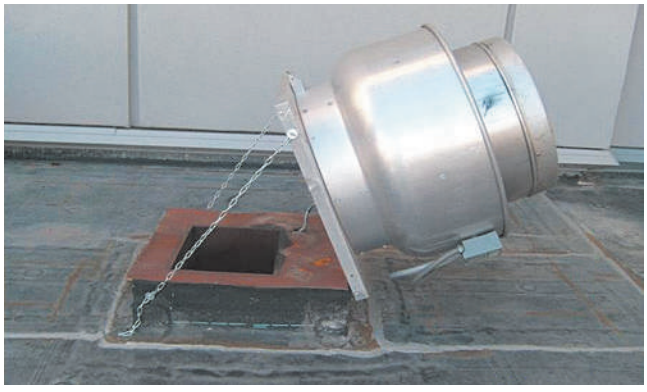


EXHIBIT 8.1 *Hinged upblast fan. (Courtesy of the Delta Company, LLC)*

8.1.2.3

Operational Compliance Tip: Providing this receptacle and maintaining it over time will prevent the possibility of large amounts of grease from accumulating and contaminating the rooftop.

8.1.3.1

In-line exhaust fans, such as the one shown in Exhibit 8.2, are located within the ductwork.

EXHIBIT 8.2 *Example of an in-line exhaust fan.*

8.1.3.5

The exhaust fan is the most critical component in the entire ventilation system. Exhaust fans can be located essentially anywhere in the exhaust system, but wherever they are located needs to be easily accessible to allow for service.

8.1.4.1

Utility set exhaust fans, such as the one shown in Exhibit 8.3, are typically found with large systems or in installations serving tall buildings.

EXHIBIT 8.3 *Example of a utility set exhaust fan.*

8.1.6.3.2

Grease contamination can reduce the efficiency of exhaust fans. Providing this access is crucial to ensure that the fan blades are cleaned properly.

8.2.1.1

Air velocity can have an impact on the amount of grease deposits that can accumulate in the duct. Research conducted in the mid-1990s at the University of Minnesota found that air velocities in excess of 305 m/min (1000 ft/min) actually contributed to accumulation of grease deposits.

8.2.2.1

Although NFPA 96 does not stipulate specific exhaust air volumes or the proper dimension of hood overhang above the cooking appliances, the hood design and exhaust air requirements of listed exhaust hoods, with or without exhaust dampers, are dictated by the criteria of the listing.

8.2.2.3

The use of ventilation systems, typically referred to as demand control ventilation, modulates the exhaust volume automatically based on the status of the cooking appliance(s).

8.2.3.1

The requirement to keep the fan in operation even after the extinguishing system has activated is important because the fan can help to exhaust much of the smoke and products of combustion that otherwise might build up in the cooking area and endanger the occupants.

However, one example of when a fan is required to be shut down is in the case of a carbon dioxide extinguishing system, which, by design, anticipates that a lingering "cloud" of carbon dioxide will hover over the cooking equipment after the system discharges. The continued running of the fan after the system discharges could disrupt the complete smothering effect that would have otherwise occurred.

> **Operational Compliance Tip:** Staff that work in the area should be made aware of this requirement so that they do not attempt to shut down the fan operation under panic in a fire situation.

8.2.3.2

Appliances that are in use will continue to emit residual heat even after they are turned off manually or when the extinguishing system automatically shuts off power or fuel to them. The reason that the hood exhaust fan(s) is usually required to continue operating, even after the extinguishing system has discharged, is to dissipate this residual heat and reduce the likelihood of re-ignition.

8.2.3.3

While the first two requirements of 8.2.3 are specific to the exhaust fan upon activation of the extinguishing system, this requirement is more operational in nature. This requirement calls for an interlock so that whenever a heat-producing appliance under the hood is turned on, the exhaust fan is also running. A means to detect excessive heat, such as a heat detector, can be used to trigger activation of the exhaust fans (also see 11.1.1).

8.3.1

A slight negative pressure in the kitchen area results in gentle movement of air from the dining area to the kitchen, which prevents cooking odors and heat from extending into the dining area. This negative pressure is accomplished by a properly designed heating, ventilation, and air-conditioning (HVAC) system. Air removed by an exhaust hood must be replaced. This is called *replacement air* (sometimes referred to as *makeup air)*, because it is making up what the hood is taking out. To create a negative pressure in the kitchen, the amount of makeup air introduced into the kitchen must be slightly less than the amount the hood is exhausting, which is typically between 10 percent to 20 percent less. The remaining air the hood needs comes from the dining area by pass-through windows, doors, and so forth.

As an example, assume the hood is removing 28.3 m^3/min (1000 cfm). At a 20 percent negative pressure, the kitchen makeup air system would be designed to deliver 22.6 m^3/min (800 cfm), and the HVAC system for the dining room would be designed to handle an additional 5.66 m^3/min (200 cfm) to transfer into the kitchen, creating a total of 28.3 m^3/min (1000 cfm) that the hood requires.

8.3.2

This requirement is an attempt to reduce a "fanning" effect on a fire. Examples of arrangements where makeup air is supplied internally to a hood are illustrated by examples A, B, K, and L in Figure A.5.3.4.

8.4.1

A good example of a common manifold exhaust system can be found at a shopping mall's food court. During design, the master exhaust fan is calculated to provide the volume and velocity for all the tenants being served by this main fan and its master exhaust duct. For each tenant being served by this master exhaust fan, a branch duct is extended from the tenant's hood to the master exhaust duct. However, if the branch ducts for a given tenant or tenants are blocked off due to vacancy or some other reason, the calculated exhaust volume and velocity is upset and unbalanced. To eliminate this issue, bleed air is ducted from outside or other areas and into the master exhaust duct.

8.4.4

Figure A.8.4.1 illustrates the requirements of 8.4.3 and 8.4.4. A fire damper is required in the bleed air duct at least 305 mm (12 in.) from the connection, and the NFPA 96 requirements for construction and clearance apply 305 mm (12 in.) past where the damper is placed.

9.2.3.1

Exhibit 9.1 shows lights located in a hood over cooking equipment.

EXHIBIT 9.1 *Lighting units in a hood.*

9.3

Many unique technologies have been developed in an attempt to increase the efficiency of exhaust systems. These have become especially prevalent as more focus is put on the environmental impact of the cooking effluent being released into the atmosphere. NFPA 96 does not intend to limit these technologies, but rather to ensure that where they are applied, the level of fire protection for the systems is not decreased. The requirements that follow are provided to allow for the technology as long as the equipment is listed for its intended use and does not compromise the safety that the rest of the requirements in this standard provide.

9.3.2

Many different products are listed to be used in exhaust systems for a variety of reasons, including improving efficiency. While these products can be used within the system if approved, this does not allow for the downgrading of other requirements of NFPA 96. One example would be

a piece of equipment that is said to be many times more efficient than normal grease filters and that can be used in the system. However, the use of that equipment does not allow the design to preclude the filters required by this standard.

Operational Compliance Tip: Subsection 9.3.2 must also be applied to existing systems in the event that a new listed piece of equipment is added to the system.

9.3.7

This requirement was added to the 2017 edition to enhance life safety within a commercial cooking establishment.

10.1.1

Fire-extinguishing equipment includes both automatic fire-extinguishing systems and portable fire extinguishers. Any pre-engineered systems provided for the protection of grease removal devices, hoods, duct systems, and cooking equipment must be listed for such use.

10.1.2

While 10.1.1 requires the protection of the exhaust system components without any stipulations, 10.1.2 requires the protection of cooking equipment that produces grease-laden vapors, which can be a source of ignition for grease in those exhaust system components. If you have applied the standard through to this point, based on the application requirements of Section 4.1, then the equipment is more than likely going to require protection by a fire-extinguishing system.

10.2.1

Upon activation of the fire-extinguishing system, all sources of fuel and electrical power that produce heat to all equipment requiring protection by that system are automatically shut off. If these heat-producing appliances were not shut down, they would contribute to the fire problem, possibly allowing ignition or re-ignition. Since portable fire extinguishers do not shut off these heat sources, they should only be used after the system has activated.

10.2.2

In an effort to coordinate with NFPA 17A, *Standard for Wet Chemical Extinguishing Systems*, "Class K" was added to this requirement in the 2017 edition to clearly identify which extinguishers need a placard. Exhibit 10.1 shows an example of such a placard located directly above an extinguisher.

EXHIBIT 10.1 *The placard required by 10.2.2 located directly above the fire extinguisher.*

10.2.2.1

Exhibit 10.2(a) and Exhibit 10.2(b) show the recommended wording for the Class K placard. This is the language suggested in NFPA 10, *Standard for Portable Fire Extinguishers*. The recommended size for the placard is 194 mm × 279 mm (7 ⅝ in. × 11 in.).

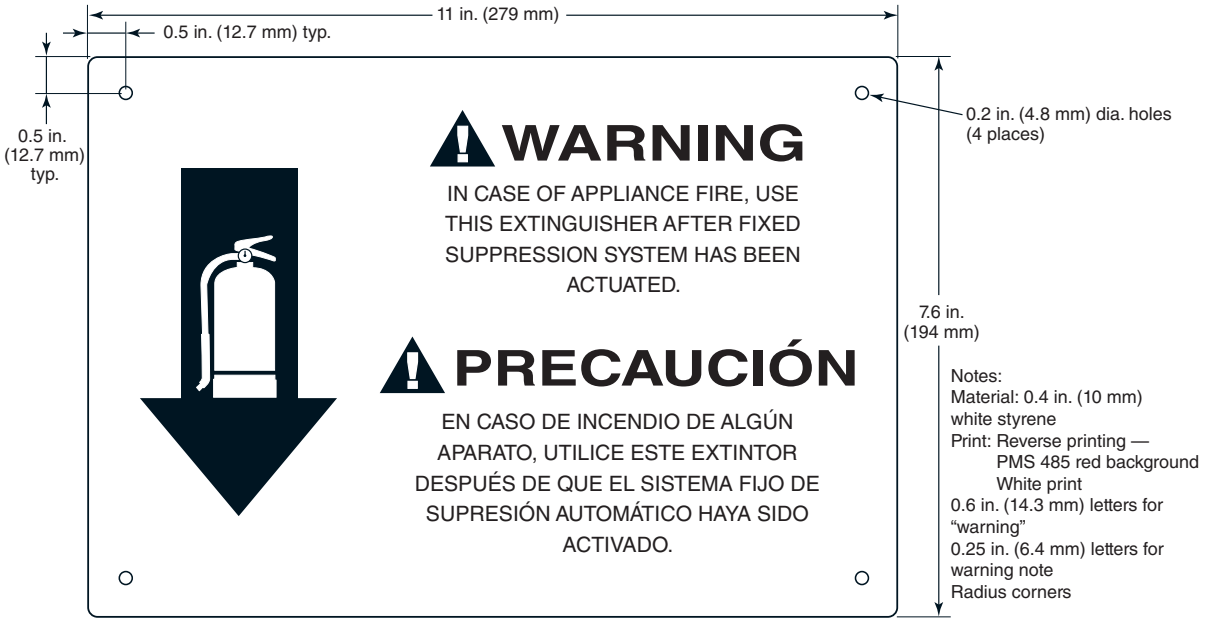


***EXHIBIT** 10.2(a) Typical Class K placard in English and Spanish. [Source: NFPA 10, 2013 edition, Figure A.5.5.5.3(a).]*

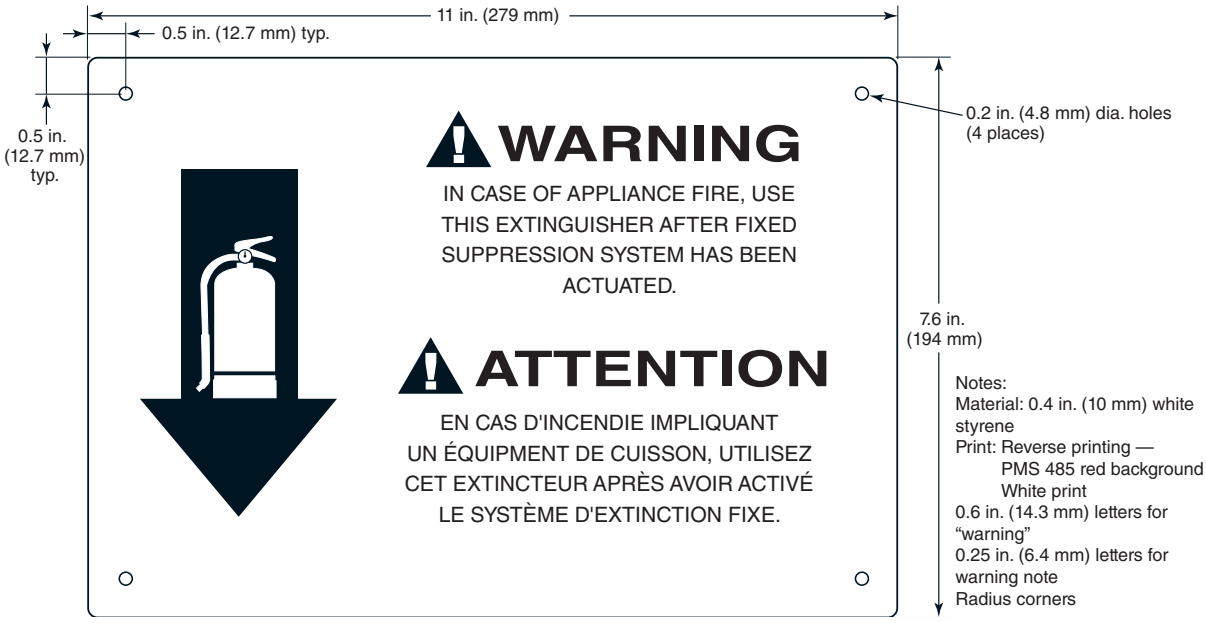


***EXHIBIT** 10.2(b) Typical Class K placard in English and French. [Source: NFPA 10, 2013 edition, Figure A.5.5.5.3(b).]*

10.2.3

ANSI/UL 300, *Standard for Fire Testing of Fire Extinguishing Systems for Protection of Commercial Cooking Equipment*, is a fire test protocol for the listing of pre-engineered extinguishing systems. In addition to establishing fire test methods, ANSI/UL 300 includes fire tests for evaluating the capability of pre-engineered systems for the protection of cooking appliances, as well as the ability to protect hoods, plenums, and ducts. The test standard takes into consideration all the special characteristics of pre-engineered systems, including the limited supply of extinguishing agent. Since there is a limited quantity of agent in pre-engineered systems that is discharged over a short period of time, these systems are designed to quickly extinguish the test fires. The severity of the test fires is intended to far exceed anything that should be encountered in the field. An example of one such system is provided in Exhibit 10.3.

EXHIBIT 10.3 *Hood suppression system. (Courtesy of Tyco Fire Protection Products)*

NFPA 13, *Standard for the Installation of Sprinkler Systems*, is commonly accepted as an equivalent standard to ANSI/UL 300. Automatic sprinkler systems installed in accordance to NFPA 13 for the protection of commercial cooking appliances are designed to discharge water over long periods of time with large quantities of water, thereby controlling the fire by cooling it and wetting the surrounding combustible materials. Additionally, NFPA 13 requires that sprinklers or automatic spray nozzles be specifically listed for the protection of fryers.

10.2.3.1

Commercial cooking operations have historically been protected with pre-engineered extinguishing systems that use an extinguishing agent that chemically reacts with cooking oil to create a thick blanket of foam. The foam suffocates the fire and prevents the escape of combustible vapors, thereby preventing re-ignition (saponification). The earlier versions of ANSI/UL 300, *Standard for Fire Testing of Fire Extinguishing Systems for Protection of Commercial Cooking Equipment*, for listing pre-engineered systems were not rigorous enough to reflect typical modern day appliances and the cooking oils used in them. The fire test standard was updated to require using actual appliances using vegetable oil. Dry chemical systems that passed the old test are not able to pass the new test protocol. Only wet chemical systems are able to pass the new fire tests and can be listed for this application.

Unfortunately, only part of the problem was solved. Although dry chemical systems can no longer be listed for the protection of cooking appliances and associated hood and duct systems, the listing standard did not impact existing installations. Similar to other listing standards, it only affects the listing of products.

Dry chemical fire-extinguishing systems are now deemed to be inadequate for the protection of cooking appliances as well as for the protection of hoods, plenums, and ducts. Therefore, these systems need to be removed and replaced with appropriate systems. Only systems that meet the currently accepted level of safety established by ANSI/UL 300 or equivalent standard are permitted to remain in place.

10.2.3.2

Since the effective date of January 1, 2014, specified in the 2014 edition, has passed, there is no need to identify a date. Annex language has been added to clarify that as of January 1, 2014, all systems (existing and new) are required to comply with ANSI/UL 300, *Standard for Fire Testing of Fire Extinguishing Systems for Protection of Commercial Cooking Equipment*, or an equivalent standard.

10.2.6

While there are currently no dry chemical systems listed to ANSI/UL 300, *Standard for Fire Testing of Fire Extinguishing Systems for Protection of Commercial Cooking Equipment*, NFPA 17, *Standard for Dry Chemical Extinguishing Systems*, is included on this list to permit the installation of an engineered dry chemical system or the possibility of a dry chemical pre-engineered system listed to ANSI/UL 300. Currently, there are no pre-engineered dry chemical systems listed to ANSI/UL 300 (2014). Paragraph 10.2.3.1 of NFPA 96 prohibits systems that are not listed to ANSI/UL 300 (2005), to remain in place.

10.2.7

> **Operational Compliance Tip:** Subsection 10.2.7 applies directly to systems that are already in use. The provisions located here ensure that changes to the cooking appliances or cooking media or modifications on the hood or duct system do not reduce the level of safety from the point when the system was first designed.

10.2.7.1

Abandoned pipe or conduit creates surfaces for the accumulation of grease, which increases the fire load.

10.2.7.2

The term *liquidtight* is defined as being constructed and performing in such a manner as to not permit the passage of any liquid at any temperature. An example of a listed patch seal for patching unwanted holes without welding is shown in Exhibit 10.4.

EXHIBIT 10.4 *Example of listed penetration device. (Courtesy of Brooks Equipment Company, Inc.)*

10.2.7.3

The distribution pattern for appliance nozzles is tested and listed only under specific conditions and does not include testing with objects that will obstruct the application of the extinguishing agent onto the cooking appliance.

10.2.8

The heading was revised in the 2017 edition to include terminology that clarifies the difference between a basic water-wash system and one that is listed as a fire-extinguishing system. A *water-wash fire-extinguishing system*, as defined in 3.3.52, is a water-wash system that is listed as a fire-extinguishing system. These types of systems provide water spray for the exhaust plenum in addition to the hood's automatic fire suppression system. A *water-wash system*, defined in 3.3.53, provides a pressurized spray of hot water and detergent to clean the hood in a timed cycle.

10.2.8.4

Supervision requirements are addressed in 10.2.10.

10.2.8.7

The delay of at least 60 seconds is necessary to allow the extinguishing agent to chemically react with cooking oil to create a thick blanket of foam to suffocate the fire and prevent the escape of combustible vapors, thereby preventing re-ignition.

10.3.1

Any area where two or more hazards can be simultaneously involved in a fire needs to have the extinguishing systems operate simultaneously so as to apply the extinguishing agent to the entire area where the fire could be occurring or where it could spread to.

10.3.1.1

While the definition of *single hazard area* identifies it as an area determined by the AHJ, this section identifies a specific type of arrangement that must be protected as a single hazard area. Paragraph 10.3.1.1.1 identifies arrangement(s) that do not need to be treated as such.

10.3.2

Each of the sprinklers typically will have its own fusible link that will activate when the temperature of that link reaches a certain point. To require simultaneous operation would require complex arrangements, and that is not the intent of this standard.

10.4.1

If heat-producing appliances are not shut down, they will likely contribute to the fire, possibly allowing re-ignition.

When a fire-extinguishing system discharges, any possible source of re-ignition should be discontinued. This is typically accomplished through the use of a solenoid such as the one shown in Exhibit 10.5. This only includes heat-producing appliances that require protection (an appliance that requires protection typically has a nozzle directed at it). Therefore, this provision

EXHIBIT 10.5 *Solenoid for providing fuel shutoff.*

requires fuel or electrical power only to appliances requiring protection to be automatically shut off. Those appliances that do not require protection and are not gas appliances under the same hood as protected appliances (see 10.4.3) are not to be shut off.

Questions have arisen regarding liquid extinguishing agents, such as wet chemical, flowing into electrical outlets and causing a shock hazard. As with sprinkler systems, there has never been any scientific evidence or experimental data to substantiate this as a valid safety concern.

10.4.2

Steam-heated appliances are typically not a fire protection concern since they do not have the capability of allowing the appliances to overheat and spontaneously ignite the cooking oil. Gas-fired and electrically heated appliances are the concern.

10.4.3

A gas appliance, even if it is not required to be protected, could contribute to the fire problem and needs to be shut off.

10.4.4

A fire-extinguishing system has an interlock that automatically shuts off all sources of fuel and electrical power that produce heat to all equipment requiring protection. A manual reset, such as the one shown in Exhibit 10.6, allows time to analyze the cause of the fire before the shut off is reset. If an automatic reset were permitted, the problem causing the fire might not be fixed before the reset operates.

EXHIBIT 10.6 *Manual reset for fuel and electric power.*

10.5

To improve correlation between NFPA 17A, *Standard for Wet Chemical Extinguishing Systems*, and NFPA 96, the requirements in this section were revised in the 2017 edition and are applicable to all types of extinguishing systems.

10.5.1.1

These pull stations should be strategically located and employees should be trained how to use them. Exhibit 10.7 shows a manual pull station located next to a door in a path of egress.

Operational Compliance Tip: Access to the manual pull station needs to be maintained during the day-to-day operations of the system. While these can be designed for an appropriate location, placing movable tables or stacking boxes in front of the pull station eliminates the purpose of 10.5.1, which is to allow for an employee to easily activate the extinguishing system as they exit the area.

EXHIBIT 10.7 *Example of a properly located manual pull station.*

10.5.3

Experience has demonstrated that many employees of commercial cooking operations have not received initial instruction. Of those who have, many forget the lessons from their initial training, resulting in inappropriate responses to fire. This new language requiring training for new employees on hiring and for all employees annually is consistent with OSHA requirements. Employees are required to be trained to manually discharge the fire-extinguishing system on noticing a fire in or around a cooking appliance. Class K extinguishers are the only extinguishers that should be used for cooking oil fires in appliances. Class K extinguishers should be used only after the system has been discharged because the system has an interlock to automatically shut down the heat source to the appliance.

Employees should be trained to use various types of portable fire extinguishers as a first line of defense for fires other than Class K fires. The importance of personal safety should be stressed, and persons should only use extinguishers if the fire is small and if the person using the extinguisher understands how to use it and is comfortable with the fire situation.

10.6.1

An audible alarm provides notification of a fire and the need for evacuation. A visual indication is typically a light, which is intended to show that the system has actuated and is in need of recharge. Either alarm will satisfy this requirement. Exhibit 10.8 illustrates examples of visual indicators that show when a system has activated.

EXHIBIT 10.8 *Two examples of visual indicators.*

10.6.2

When the fire alarm signal is activated, all people in the building should respond according to the fire emergency plan developed by the owner or tenant. Most people will evacuate using the nearest exit, while others might be assigned other duties such as actuating the fire-extinguishing system or using portable fire extinguishers if it is safe to do so.

To improve correlation between NFPA 17A, *Standard for Wet Chemical Extinguishing Systems*, and NFPA 96, the requirements in Section 10.7, which addressed system supervision requirements and are more appropriate in an installation standard, were moved to NFPA 17A.

10.7.1

Unlike other shadow areas that are shielded from the spray pattern of the automatic sprinkler system discharge and have no extinguishing agent reaching the shadow area, the area under the hood is protected with extinguishing agent from the discharge devices of the fire protection system in the hood. Therefore, commercial cooking hoods that have total fire protection installed are not considered obstructions to ceiling-installed sprinklers.

10.8.2.1

A pre-engineered kitchen fire suppression system installation and maintenance technician typically completes a classroom or online course and is required to pass an examination offered by a pre-engineered system manufacturer, an agent of a pre-engineered system manufacturer, or an organization that is approved by the AHJ.

10.9.1

Most fires start small and can be extinguished with portable fire extinguishers. Notifying the fire department as soon as a fire is discovered is essential. This notification should not be delayed by awaiting results of using portable fire extinguishers.

10.9.2

In the kitchen area, the essential hazard involves combustible cooking oils, and a Class K fire extinguisher is a match for the hazard. Class K combustible cooking media fires typically involve kitchen appliances containing quantities of cooking greases or oils that present special extinguishment and re-flash concerns. The development of high-efficiency cooking equipment with high-energy input rates and the widespread use of vegetable oils with high autoignition temperatures have highlighted the need for Class K fire extinguishers.

The wet chemical extinguisher is the only extinguisher to qualify to the Class K listing requirements. In addition to offering rapid fire extinguishment, a thick foam blanket is formed to prevent re-ignition while cooling both the appliance and the hot cooking oil.

Fire extinguishers classified for use on Class K hazards do not have a number preceding the classification letter. According to NFPA 10, *Standard for Portable Fire Extinguishers*, the maximum travel distance to a Class K extinguisher is not permitted to exceed 9.1 m (30 ft) from the hazard to the extinguisher.

10.9.3

NFPA 10, *Standard for Portable Fire Extinguishers*, uses the following classifications for fires in determining appropriate extinguishers:

- Class A: Ordinary
- Class B: Flammable liquids
- Class C: Energized electrical equipment
- Class D: Combustible metals
- Class K: Cooking appliances that involve combustible cooking media

All buildings have Class A fire hazards. Where ordinary combustibles are present, there could be the need for fire extinguishers suitable for use on Class B and Class C fires (e.g., in the dining areas of a restaurant, the principal combustibles present are wood, paper, and fabrics, which are Class A materials).

According to NFPA 10, all solid fuel cooking appliances (whether or not under a hood) with fire boxes of 0.14 m^3 (5 ft^3) volume or less are required to have at least a listed 2-A rated water-type fire extinguisher or a 6 L (1.6 gal) wet chemical fire extinguisher that is listed for Class K fires.

10.9.5

Operational Compliance Tip: The owner or occupant of a property in which portable fire extinguishers are located has an obligation for the care and use of portable fire extinguishers at all times. Chapter 7 of NFPA 10, *Standard for Portable Fire Extinguishers*, contains the minimum requirements for inspection maintenance, and recharging of portable fire extinguishers. Chapter 8 of NFPA 10 addresses the hydrostatic testing requirements.

11.1.1

When the cooking equipment is turned on, heat is being produced at all times. Even when no food is being cooked, residual grease is being heated and vaporized. Additionally, both the exhaust system and the extinguishing system are designed to function most effectively when excessive temperatures are exhausted and not lingering across the cooking surfaces and under the hood. An interlock is required in 8.2.3.3 so that the exhaust fan is activated when any appliance under the hood is turned on. This requirement can be accomplished with the installation of a separate heat detector that turns the fan on when a preset temperature is reached.

11.1.2

In the normal mode, filter-equipped exhaust systems are designed to run when filters are in place. Filter spacers are often used to fill voids when standard size filters are used. These are solid blocks that fill in any gaps left after standard size filters are put in place at a point where they do not cover the entire hood but do not leave enough room for another filter. The spacers should be used only where the space being filled is not critical to airflow. Detection devices for the extinguishing system should not be installed directly above a spacer due to limited airflow that will pass through the solid filler.

Where any of the required filters are missing, exhaust volumes will be captured from a path of lesser resistance (where the filter is missing), resulting in unfiltered smoke and vapors being introduced into the exhaust system; thus, uncaptured grease and deposits accumulate on the plenum and duct surfaces.

During maintenance, a missing filter serves as a visual indicator that service is being conducted. Operating the exhaust system during maintenance could pose a hazard to service personnel and cause damage to mechanical parts of the equipment.

11.1.3

Openings are commonly provided to afford sufficient airflow for the exhaust system to work properly to remove grease-laden vapors from the cooking area. Since covering the openings restricts airflow, covers, dampers, or other means are prohibited from being installed while the exhaust system is in operation.

11.1.4

Annex language new to the 2017 edition provides recommendations on how employees should be trained.

11.1.4.3

Operational Compliance Tip: The most common means for compliance to this requirement is to post a placard near each manual activation device for the fire-extinguishing system. The signage should be in a language commonly used by employees. Alternatively, pictographs (picture symbols) or a combination of pictographs and words can be used.

11.1.6

By its very nature, commercial cooking has been recognized as a hazard that requires appropriate protection. If the fire protection system is nonoperational, the hazard must be eliminated by discontinuing the cooking operation. Similarly, if cooking equipment were allowed to operate without the exhaust system operating, grease-laden vapors would not be removed and excessive heat would accumulate in the cooking area.

11.1.6.1

In addition to providing written notification, it is important that the owner is made aware as soon as possible that these protective systems are not operative. Not all AHJs require notification, as they might have other procedures in place to address the inoperative equipment.

11.1.7

The manufacturer's published operating guidelines should offer guidance to reduce the hazard through proper operation and should be closely followed The turnover of personne in the food service industry makes it necessary for this information to be available for training of new personnel so as to continue the safe practices of equipment operation.

11.1.8

Failure to address the service requirements of other permissible equipment could increase the hazard. Some of this equipment have frequent service intervals.

11.2.1

Most automatic fire-extinguishing systems installed for the protection of commercial cooking operations are wet chemical extinguishing systems listed to ANSI/UL 300, *Standard for Fire Testing of Fire Extinguishing Systems for Protection of Commercial Cooking Equipment*. Certification of maintenance technicians for wet chemical fire-extinguishing systems is addressed in 7.3.1 and 7.3.1.1 of NFPA 17A, *Standard for Wet Chemical Extinguishing Systems*, and it requires the service technician performing maintenance on those systems to be trained and to pass a written or online test that is acceptable to the AHJ. Those maintenance service technicians are required to possess a certification document confirming an acceptable score on that test. The certification document must be issued by a system manufacturer, an agent of a system manufacturer, or a testing organization that is acceptable to the AHJ.

11.2.2

All mechanical and electrical components require periodic testing to ensure that they remain operational. Generally, all such components are tested during the semiannual inspection or sooner depending on the volume of cooking. Where control components, such as gas or electric shutoff devices, depend on release of the extinguishing agent or compressed gas for pressurizing a switch or similar component, alternate means for testing those components must be

provided and utilized. The gas or electric shutoff is often critical for successful fire extinguishment and should be tested periodically.

11.2.3

It is important to have the semiannual and annual inspections performed on schedule. These inspections not only provide for the replacement of necessary components on schedule, they also test the actual performance of the components to ensure they are still operating normally and are not compromised by grease buildup or by other mechanical seizures that would prevent the system from performing as designed. Without properly performed inspections, the system can easily slip into a condition of decay that eventually seizes up a cable or operator of actuation and control components. Even grease buildup that thickly coats and insulates a detector link could render the system inoperable.

11.2.4

Exhibit 11.1 shows an example of a fusible link, which must be replaced semiannually.

Operational Compliance Tip: Fusible links act as the automatic activation component for most fire-extinguishing systems in hoods. The effectiveness of the extinguishing system is dependent on the fusible link activating the system in a timely manner before the fire becomes too large. The buildup of grease on the fusible link has the potential to affect its thermal characteristics and, therefore, possibly diminish the effectiveness of the extinguishing system. This is why the links are required to be replaced on a semiannual basis.

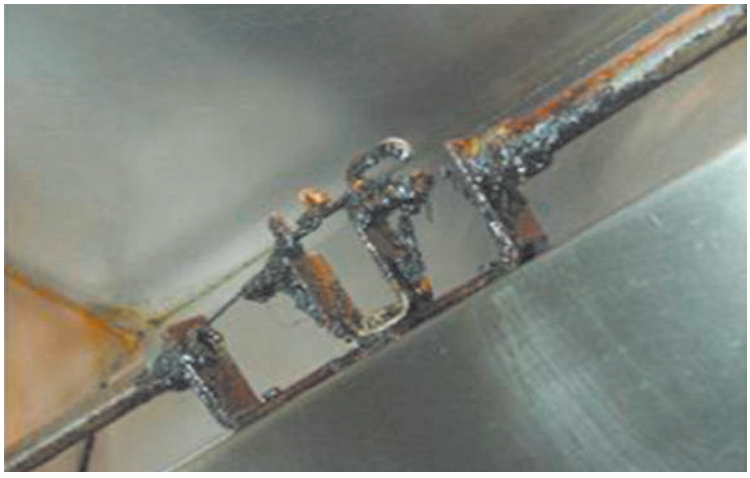


EXHIBIT 11.1 *Fusible link requiring replacement.*

11.2.5

It should be noted that the year of manufacture indicated on the fusible link is not necessarily the date the link was installed. Link replacement should be every 6 months, regardless of the date that appears on the fusible link.

11.2.5.1

The service tag is signed or initialed by the fire-extinguishing system maintenance technician who replaced the links.

11.2.5.2

Destroying links is a safety measure that prevents the removed links from ever being installed again in a fire-extinguishing system.

11.2.6

Cleaning bulb-type automatic sprinklers and fusible links is essential for them to operate as designed. When they cannot be thoroughly cleaned, they must be replaced. It is also acceptable to replace them every 12 months if cleaning is undesirable or cost prohibitive, as allowed in 11.2.7.

11.2.8

Recognizing that fire-extinguishing equipment might not operate as designed if not periodically inspected and maintained, some AHJs might require documentation of the inspections. Other AHJs might have other policies in place to address inspection and maintenance of equipment.

11.2.8.1

Permission to store and access inspection and maintenance documentation electronically is provided in NFPA 10, *Standard for Portable Fire Extinguishers*; NFPA 25, *Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems*; *NFPA 72®*, *National Fire Alarm and Signaling Code*; NFPA 80, *Standard for Fire Doors and Other Opening Protectives*; and NFPA 731, *Standard for the Installation of Electronic Premises Security Systems*. This new requirement for the 2017 edition brings NFPA 96 in line with other documents, while still allowing for documentation in hard copy format.

11.3

Fire dampers can be vital to the overall performance of the fire-extinguishing system and the integrity of the ventilation system under fire conditions. These devices are typically activated by fusible links that must be inspected and replaced at regular intervals to allow for proper operation when needed.

11.4

Excessive grease buildup increases the fire hazard. Cleaning of the exhaust hoods should be based on the amount of grease buildup witnessed during inspections. Intervals between inspections and cleaning can differ, depending on the types and volumes of cooking that take place the condition of equipment and the efficiency of the hood filtration system.

> **Operational Compliance Tip:** Table 11.4 provides minimum intervals for inspecting grease buildup in the hood and duct system. There are other features that should be inspected in an exhaust system, but those items might not need to be inspected at the same intervals.

11.6.1

This section requires cleaning to be performed by a certified person(s). (See the commentary following 3.3.10 for a discussion of *certified*.)

Some system owners will establish regular cleaning frequencies and often follow the intervals in Table 11.4, but the cleaning is only required by the standard when the inspection finds the system to be contaminated.

> **Operational Compliance Tip:** The requirement in 11.6.1 differentiates between the inspection frequency required in Section 11.4 and when cleaning is required. While inspection is required at regular intervals, the cleaning of the exhaust system is required only when "the exhaust system is found to be contaminated with deposits from grease-laden vapors."

The four provisions in 11.6.1.1 are new for the 2017 edition. These were derived from the annex language for 11.6.2 in the 2014 edition and moved into the body of the standard to ensure that a measurement system be established.

11.6.3

Switches that might start an exhaust fan, a heating element, an electrostatic precipitator, or a spray or wash system must be locked out (locked in the "off" position) to ensure safety during the cleaning process. These switches could be hazardous to those who are cleaning the exhaust system if not locked out. The agency responsible for the lockout is responsible for turning the

switches back on at the end of the cleaning process, so the systems they control can resume their intended services.

11.6.5

Interfering with the normal operation of a fire suppression system can create a serious hazard. An untrained person who attempts to disarm the suppression system during cleaning of the exhaust system could discharge the suppression system accidentally. A person who successfully disarms the system but forgets to rearm it, or rearms it incorrectly, creates a serious problem if a subsequent fire in the exhaust system occurs. By allowing only a qualified person to disarm the suppression system, the responsibility for re-arming the system remains with the qualified person.

11.6.6

These chemicals are not permitted because the fumes from flammable solvents or other flammable cleaning aids are heavier than air and invisible and can travel to an ignition source and cause a fire.

11.6.7

Some cleaning materials can cause corrosion of the detector links and the cables. This corrosion could adversely affect the system by causing premature or delayed activation.

11.6.8

Some cleaning vendors find that applying special agents to the exhaust system interior prior to cleaning can assist in the cleaning. However, coating the inside of the duct with powder or other substance after the system is cleaned can cause grease buildup. The safest approach is to leave the metal duct surfaces as bare as possible after cleaning.

11.6.9

Access panels (doors) and cover plates must be replaced with the original hardware (gaskets and fasteners) or replacements if damaged. An improperly placed access panel could allow grease to leak out of the duct and into concealed areas during the cooking operation. A subsequent duct fire could ignite this grease. In addi ion, where the e is a fire-rated chase, there are panels or cover plates as part of that fire rated chase to allow access to the panels in the enclosed grease duct. If the fire-rated chase panel is not replaced, the fire rating of the chase is compromised. It is possible that, without the chase protection, some combustible materials in the vicinity of the chase could be subjected to heat radiated from inside the duct. It is critical to totally restore all ducts and chase panels with proper gasket seals.

11.6.10

This additional documentation is intended to provide better accountability for maintaining the integrity of the system.

11.6.11

Diffusers usually are not found in the exhaust system but can be found in the supply air system. Fire dampers (not balancing dampers) can be found in some exhaust and supply systems. Typically, these dampers do not have to be moved during the exhaust system cleaning process, but, if moving is necessary, they must be returned to their original positions. This step ensures that the original airflows are maintained. Otherwise, it is possible that the hood will fail to capture all the effluent from the cooking process.

11.6.13

Exhibit 11.2 shows an example of such a certificate affixed to the exterior of the hood, showing all the required information.

EXHIBIT 11.2 *Certificate on the exterior of a hood.*

11.6.14

An area that is not cleaned should be noted so that it can, if necessary, be identified as a continuing hazard that needs to be corrected. Usually, an area is not cleaned because it is not easily accessible. In some instances, an area is not cleaned because multiple restaurants are feeding into a common duct, and there is no agreement designating who is responsib e for maintaining the common duct. In all cases, the cleaning agency must identify and keep records of the areas not cleaned with an explanation as to why those areas have not been cleaned. This information will be taken into consideration by the local AHJ when the cleaning records are reviewed.

11.6.15

This requirement provides the AHJ with documentation of the inspections and cleaning. Some AHJs might have other policies in place to address inspection and cleaning of the exhaust system.

11.6.16

This requirement is new for the 2017 edition and addresses the subject of metal grease drip collectors within hoods that can become involved in a fire before the fire-extinguishing system operates. Typically, no agent is discharged into these devices, and a fire on an appliance and within the hood that is successfully extinguished can subsequently spread from a fire that is fueled from the grease collector into the exhaust system.

11.7.2

In most cases, maintenance and cleaning can be effectively conducted without moving the cooking appliances. For cooking appliances that are moved, 12.1.2.3.1 requires that an approved method be provided to ensure that the appliances are returned to their approved designated locations. In some cases where the cooking appliance must be moved, it might be possible to do so without disconnecting any of the fire-extinguishing system nozzles.

New annex material was added to 11.7.2 for the 2017 edition to describe the hazard created by not complying with the inspection and cleaning requirements of 11.7.2.

12.1.1(1)

The allowance for listed appliances is predicated on the assumption that the appliances will be used in the manner and for the use outlined in the listing.

12.1.1(2)

Where not listed, 12.1.1(2) will normally be accomplished with the manufacturer's cut sheets for the appliance, or the manufacturer might use a testing lab with which they have contracted (for quality assurance purposes). Although it might not be a traditional testing lab, if it does produce data, it might be acceptable to an AHJ.

12.1.2.1

NFPA 54, *National Fuel Gas Code,* and NFPA 58, *Liquefied Petroleum Gas Code*, have specific instructions for proper placement and installation of gas-fueled appliances.

12.1.2.3

Operational Compliance Tip: In most cases, maintenance and cleaning can be effectively conducted without moving the cooking appliances. For cooking appliances that are moved, 12.1.2.3.1 requires that an approved method be provided to ensure that the appliances are returned to their approved designated locations. In cases where the cooking appliance must be moved, it might be possible to do so without disconnecting any of the fire-extinguishing system nozzles.

12.1.2.4

It is important to note that the distance to be measured is not between appliances or even between cooking surfaces. This minimum distance is measured between the nearest edge of the deep-fat fryer appliance and the actual surface flames of any adjacent appliance. Since electric cooking appliances typically do not have flames, the distance between them and a deep-fat fryer is not an issue. Exhibit 12.1 shows a situation where the fryer is located within 406 mm (16 in) of the other cooking equipment. However, because the other cooking equipment is electric and does not produce a flame, this separation requirement does not apply.

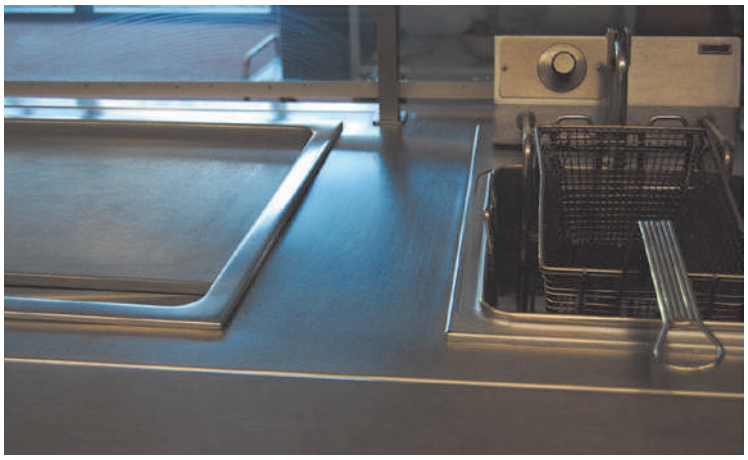


EXHIBIT 12.1 *Example of a situation where separation is not required.*

12.1.2.5

A 203 mm (8 in.) steel or tempered glass baffle plate forms a vertical barrier that will create a total distance of 406 mm (16 in.) for grease-laden vapors to have to travel between the deep-fat fryer and the flames of the adjacent appliance: 203 mm (8 in.) up and another 203 mm (8 in.) down. Exhibit 12.2 shows where such a baffle plate has been provided to meet the separation requirement of 12.1.2.5.

EXHIBIT 12.2 *Example of separation between a fryer and surface flames provided by a baffle plate.*

12.2

This arrangement ensures that if the thermostat fails the high-limit control will close a valve or open a contactor to shut off the heat source It can be beneficial to have a high-limit control with a manual reset.

Chapter 13

Chapter 13 contains the requirements for recirculating systems. These systems, which are also known as ductless systems or ventless systems, capture the effluent from a cooking appliance, process the captured air through various filters, and vent the filtered air back into the room where the appliance is located. These systems can be either portable or permanently installed, and they include an integral fire-extinguishing system to protect the hood system and appliance area. See Exhibit 3.9 for an example of cooking equipment with a recirculating system.

13.2.4

Complete, self-contained systems are listed and include the cooking appliance, hood, and fire-extinguishing system. Many of the construction and electrical performance requirements for recirculating and conventional hoods are similar, and there are some additional requirements for the recirculating hood system and fire-extinguishing system in the listing requirements.

13.2.12(2)

Although an 8-hour test is not required for conventional cooking appliances, recirculating systems are expected to meet this additional test in order to be listed. It is based on an EPA test method and is conducted to ensure that the emission of grease-laden effluent does not exceed the established average threshold.

13.4.1

Some recirculating appliances are portable and can be positioned at the discretion of owners in locations that serve their convenience. The locations should be evaluated for safety, such as proximity to the means of egress, proximity to other fired appliances, and potential burn hazard to the public.

13.5.1

Recirculating systems incorporate an automatic fire-extinguishing system that has been evaluated for the specific combination of the hood and the cooking appliances. The fire-extinguishment test criteria is similar to ANSI/UL 300, *Standard for Fire Testing of Fire Extinguishing Systems for Protection of Commercial Cooking Equipment*, but is customized to recognize the heat production and retention limitations of the specific cooking appliance that is provided as part of the recirculating system.

13.5.3

The fire-extinguishing system for the recirculating appliance is not required to have a fire alarm system. If the facility is already equipped with a fire alarm system, the activation of the fire-extinguishing system on the recirculating appliance requires connection to the facility's fire alarm system. Additionally, the fire-extinguishing system on the recirculating appliance requires an audible alarm or visual indicator that the system has activated.

13.6

Operational Compliance Tip: Section 13.6 provides the requirements that are intended to ensure that the continued use of recirculating systems is safe and that the considerations for design of the systems is maintained throughout the life of its use.

13.6.1

This requirement is intended to ensure that if automatic or manual covers are provided, their presence does not create an added obstruction to the operation of the fire protection equipment.

Chapter 14

Solid fuel cooking appliances typically use a cooking chamber that is heated with solid fuels such as briquettes, wood, or charcoal. Sometimes different types of wood are used to enhance the flavor of the cooked product. The concern with this is that burning wood creates creosote, which then mixes with the grease-laden vapors that are produced in the cooking process. The mixture of creosote and grease-laden vapors creates a vapor that is heavier than air and highly flammable. Exhibit 14 1 shows an example of a sol d fuel cooking operation.

EXHIBIT 14.1 *Example of a solid fuel cooking operation.*

14.1

The natural draft system uses the natural flow of air to provide oxygen to the fire and uses the heat of the fire to vent the cooking appliance through a "vertical chimney." Section 14.4 provides direction for the construction of the vent.

14.1.2

Subsection 14.1.2 addresses a self-contained solid fuel cooking appliance, which receives its cooking air from a dedicated separate makeup air supply outside the cooking area. It also has a dedicated vent for the exhaust.

14.1.3

Where multiple cooking appliances are vented in the kitchen area, it is important to make sure that the makeup air supply is sufficient to compensate for the amount of air venting from all the appliances that are operating. If insufficient makeup air is provided, a negative pressure will be created in the kitchen area. If negative air pressure is developed, it could prevent the solid fuel from burning properly, which could create more creosote during the burning process.

14.1.4

These referenced sections include the requirements for the construction of the exhaust systems for solid fuel cooking appliances and how the air movement for makeup air should be addressed.

14.1.5

The hood and duct system will ensure that the mixture of creosote and grease-laden vapors are captured and removed from the area. If they are not captured and removed, they will settle on other surfaces in the area, making them sticky and creating a flammable coating on those surfaces.

14.1.6

The open burning of solid fuel will cause the development of sparks. Sparks can travel to other areas such as the exhaust plenums and ducts and can cause ignition of the mixture of creosote and grease-laden vapors that have settled in the exhaust plenum and exhaust duct surfaces. Spark arresters limit the amount of sparks that can pass into the duct.

14.2.1

Access to an appliance is important for service and repair.

14.2.2

The surrounding air environment around a solid fuel cooking appliance will typically be heated. Therefore, there needs to be a capability for adequate air circulation around the appliance.

14.2.3

The listing information and the manufacturer's instructions will provide the required separation distances of the appliance from various combustible materials.

14.2.4

Solid fuel cooking appliances usually have an opening where there are open flames. Flammable vapors or gases would be exposed to those flames and could be ignited.

14.3.1

Chapter 8 discusses the air velocity and the air volume that is required to remove the grease-laden vapors from the cooking appliances.

14.3.3

The concern is that the mixture of creosote and grease-laden vapors could combine with sparks from the burning solid fuel. If the exhaust from the solid fuel cooking appliance was mixed with the exhaust from other cooking appliances, the sparks could ignite the other grease-laden exhaust materials. By separating the exhaust systems, the potential for ignition is reduced.

14.3.4

The revisions to the 2017 edition in list entries (4) and (9) bring the fuel volumes in line with the original test data.

Flavoring by the use of solid fuel is very popular. By limiting the amount of solid fuel and following the requirements listed in 14.3.4, the potential for ignition will be minimized such that a separate exhaust will not be required.

14.4.2

The intent of this requirement is that where a duct system serving solid fuel cooking is four stories in height or greater, it must be listed or approved for that use.

14.4.3

Both 14.4.3 and 14.4.1 mandate that where a hood is used, the duct must comply with the requirements of Chapter 7. The building height does not impact this provision.

14.4.4

The intent of this requirement is that all exhaust systems serving solid fuel cooking must terminate on the roof top and not in the wall.

14.6.2

A slight negative pressure in the kitchen area results in gentle movement of air from the dining area to the kitchen, which prevents cooking odors and heat from extending into the dining area. This negative pressure is accomplished by a properly designed heating, ventilation, and air-conditioning (HVAC) system. Air removed by an exhaust hood must be replaced. This is called *replacement air* (sometimes referred to as *makeup air*), because it is making up what the hood is taking out. To create a negative pressure in the kitchen, the amount of makeup air introduced into the kitchen must be slightly less than the amount the hood is exhausting, which is typically between 10 percent to 20 percent less. The remaining air the hood needs comes from the dining area by pass-through windows, doors, and so forth.

As an example, assume the hood is removing 28.3 m^3/min (1000 cfm). At a 20 percent negative pressure, the kitchen makeup air system would be designed to deliver 22 6 m^3/min (800 cfm) and the HVAC system for the dining room would be designed to handle an additional 5.66 m^3/min (200 cfm) to transfer into the kitchen, creating a total of 28.3 m^3/min (1000 cfm) that the hood requires.

14.7.1

While not specified in this requirement, 14.7 5 specifies that the fire-extinguishing system must use a water-based agent.

14.7.5

The fires in solid fuel burning appliances are more related to Class A fires, e.g., burning wood, which will require a water suppressing agent versus a chemical agent. It should be noted that wet chemical systems that are designed for cooking grease applications might not be appropriate.

14.7.9

Fire suppression is important for solid fuel cooking appliances and the fuel storage area. Solid fuel cooking appliances have enclosed cooking spaces, and the fuel storage area is also an enclosed space; therefore, alternative methods must be applied to provide fire suppression to these areas.

14.7.9.1.2

A solid stream of water might disperse the hot ashes and place them in an unsafe area where they could ignite other combustible materials.

14.8

Table 11.4 requires that systems serving solid fuel cooking operations be inspected monthly; however, specific modifications to that requirement are included in the following sections.

14.8.1

This requirement is one of the few instances in the standard where the frequency of cleaning is specified.

14.9.1

Installation clearances are critical to ensure that exposed surfaces do not overheat and become ignited. The review of the type of exposed surfaces is important to understand if the surface is combustible, limited-combustible, or noncombustible. The clearance distances are established based on the type of exposed material.

14.9.1.2

An example of applying this requirement would be placing sheet metal over a floor that has limited-combustible or noncombustible construction.

14.9.1.5

The distances in this requirement are much greater than those specified in Chapter 4, but here the separation distance is not necessarily required and some means of protection must be approved.

14.9.2

The area where solid fuel is stored, as shown in Exhibit 14.2, can present a significant hazard due to the large amount of combustible material. The requirements for its storage focus on not introducing a potential ignition source in the area. These requirements need to be observed on a continual basis as the fuel is used and replenished in this area.

EXHIBIT 14.2 *Example of properly stored solid fuel.*

14.9.2.1

The purpose of this requirement is to control the fuel load so that an accidental fire will remain small enough to suppress.

14.9.2.4

A clear path needs to be maintained for the removal of ash. Obstructing the path might make it difficult to remove the ashes, which might mean that ash removal will not be performed in a timely manner.

14.9.2.6

Clearance reduction methods for the protection of combustible or limited-combustible materials are listed in 4.2.3.

14.9.2.7

The purpose of this requirement is to isolate any solid fuel from potential ignition sources and contamination of food supplies and packaged goods.

14.9.2.8

Fire suppression is required for all fuel storage areas.

14.9.3.1

By using a defined procedure for igniting the fuel, the fire ignition and fire buildup can be controlled. If the fire is ignited by throwing burning material into the solid fuel cooking appliance, the management of the size and control of the fire might be beyond the capabilities of the user.

14.9.3.2

The burning characteristics of combustible or flammable liquids might cause ignition in the exhaust system of the solid fuel cooking appliance.

14.9.3.3

This requirement minimizes the potential to accidentally ignite the stored fuel supply or other combustible material in the area of the solid fuel cooking appliance.

14.9.3.4

A higher flame could cause ignition in the solid fuel cooking appliance exhaust system.

14.9.3.5

Safety of personnel is a primary concern. A user reaching into the firebox could receive burns and his/her clothing could ignite, which could cause burns and ignition of other items when the user removes burning material from the solid fuel cooking appliance.

14.9.3.6.1

Ash, cinders, and other fire debris are left after the burning/combustion of solid fuel such as wood or briquettes. Accumulation of ashes can interfere with the flow of air feeding the fire, thus reducing the draft to the solid fuel cooking appliance.

14.9.3.6.2

Ash development should be monitored for interference with the cooking fire. Based on the cooking activity, it might be necessary to remove the ashes more than once a day.

14.9.3.6.3

To minimize the possibility of igniting other combustible materials, the hot ashes and cinders must be cooled to extinguish any burning materials and make the ashes easy to handle. This must be done carefully to avoid spreading the ash around with too much water pressure.

14.9.3.7.4.1

A solid stream of water can disperse the hot ashes and place them in an unsafe area where they could ignite other combustible materials.

14.9.3.8.1

Although it is required to spray the ashes with water to cool them, it is possible that some of the ashes might still be hot. Therefore, they should be placed in a noncombustible container. A heavy metal container or cart can help disperse any heat remaining in the ashes.

Chapter 15

Ventilation systems are necessary for the removal of grease-laden vapors in commercial cooking operations. This includes both conventional hood and duct systems and ventilation systems known as downdraft systems. In many cases, downdraft ventilation systems are used with tabletop cooking areas, which are often used for demonstrations. An example of this type of cooking is in Japanese (Hibachi) restaurants where food is prepared and cooked on a tabletop grill in front of restaurant patrons. Ventilation openings in the table allow the vapors to be drawn downward into exhaust ductwork below the table. Fire protection system nozzles are typically provided over the tabletop cooking area and within the exhaust ductwork. Additionally, Class K portable fire extinguishers are provided as backup. Figure A.15.1 shows a typical downdraft system arrangement.

15.1.1

This section invokes the applicable requirements of Chapter 4 through Chapter 12 and requires filters be listed to ANSI/UL 1046, *Standard for Grease Filters for Exhaust Ducts*. All the requirements in the other chapters that are specified in 15.1.1 need to be observed in both the design and installation of downdraft appliances and also the use, inspection, and maintenance requirements that apply throughout the life of the system.

15.1.2

Downdraft appliance ventilation systems must be specifically designed to capture all the effluent discharging from each appliance being served. Typically, the appliances and exhaust ventilation systems are pre-engineered and must be installed according to their listing.

15.2

The fire-extinguishing systems for appliances and their downdraft ventilation systems are listed for the application. Most fire-extinguishing systems have nozzles over the tabletop grill and at the exhaust duct opening. Typically, fusible links are used as actuation devices and are installed both over the tabletop grill and at the exhaust duct opening. At least one manual pull station is installed at a location that is close to the tabletop cooking area, but it must be positioned where it can be easily reached at all times and not hindered by a fire in the cooking area. The location of the pull station must be approved by the AHJ.

15.2.2

The requirement for an interlock increases the chances that the ventilation system supply and exhaust will be operating when the heat source is turned on. This is a safety feature that eliminates relying on a person to turn on the ventilation systems. The interlock prevents cooking without supply and exhaust ventilation.

15.3.1

When a minimum airflow is not maintained, the switch or transducer interrupts the heat source to the cooking operations.

15.3.3

An automatic resetting switch is not permitted. Otherwise, the heat source could be cycling on and off as airflow fluctuates.

Annex B

Recent incidents have created an awareness of the lack of minimum fire safety requirements for the growing number of mobile and temporary cooking operations in jurisdictions throughout the world. On July 1, 2014, an explosion in Philadelphia, Pennsylvania, involving the food truck La Parrillada Chapina resulted in 13 injuries, including the deaths of the mother and daughter operating the food truck. This tragedy captured the world's attention, as this was the first food truck explosion captured on video by a nearby surveillance camera, revealing how dangerous propane systems can be if not properly inspected and maintained.

After the incident in Philadelphia, the International Fire Marshals Association (IFMA) assembled a task group to develop minimum fire safety requirements to submit as public input for new chapters to NFPA 1, *Fire Code*, and NFPA 96. It is important to note that there have been several other incidents involving food truck fires and explosions that have not been reported as such because these incidents are coded either as "Restaurant Fires" or "Vehicle Fires" in the National Fire Incident Reporting System (NFIRS). Therefore, a search for data to support the claim that this subject should be addressed will not yield persuasive statistics.

The public input submitted by the IFMA task group was reviewed by the Technical Committee on Venting Systems for Cooking Appliances at the NFPA 96 First Draft Meeting, and the Technical Committee believed the submitted language contained many requirements outside the scope of NFPA 96. However, the Technical Committee did believe that fire safety regulations for mobile and temporary cooking needed to be addressed and, therefore, developed a task group to further review IFMA's submitted language to determine which requirements are within the scope of NFPA 96.

At the Second Draft Meeting, the task group shared the content of Annex B with the Technical Committee, which voted to accept the language. Annex B includes extracts from requirements in NFPA 1; NFPA 58, *Liquefied Petroleum Gas Code*; *NFPA 70®, National Electric Code*; as well as extracts from Chapters 5 through 11 and Chapter 14 of NFPA 96 to aid the user of the document. The remaining language addresses common requirements for an operation, such as permits, portable fire extinguishers, training, and so forth.

FOOD TRUCK SAFETY REQUIREMENTS

The following information is provided to help advance the safety of mobile and temporary cooking operations and is not intended to be a comprehensive list of requirements. Exhibit B.1 and its accompanying text are included here as a useful starting point and quick reference tool. This information should not be used in replacement of a full fire safety analysis. Users should check with their local jurisdiction for specific requirements. For more information, go to nfpa.org/foodtrucksafety.

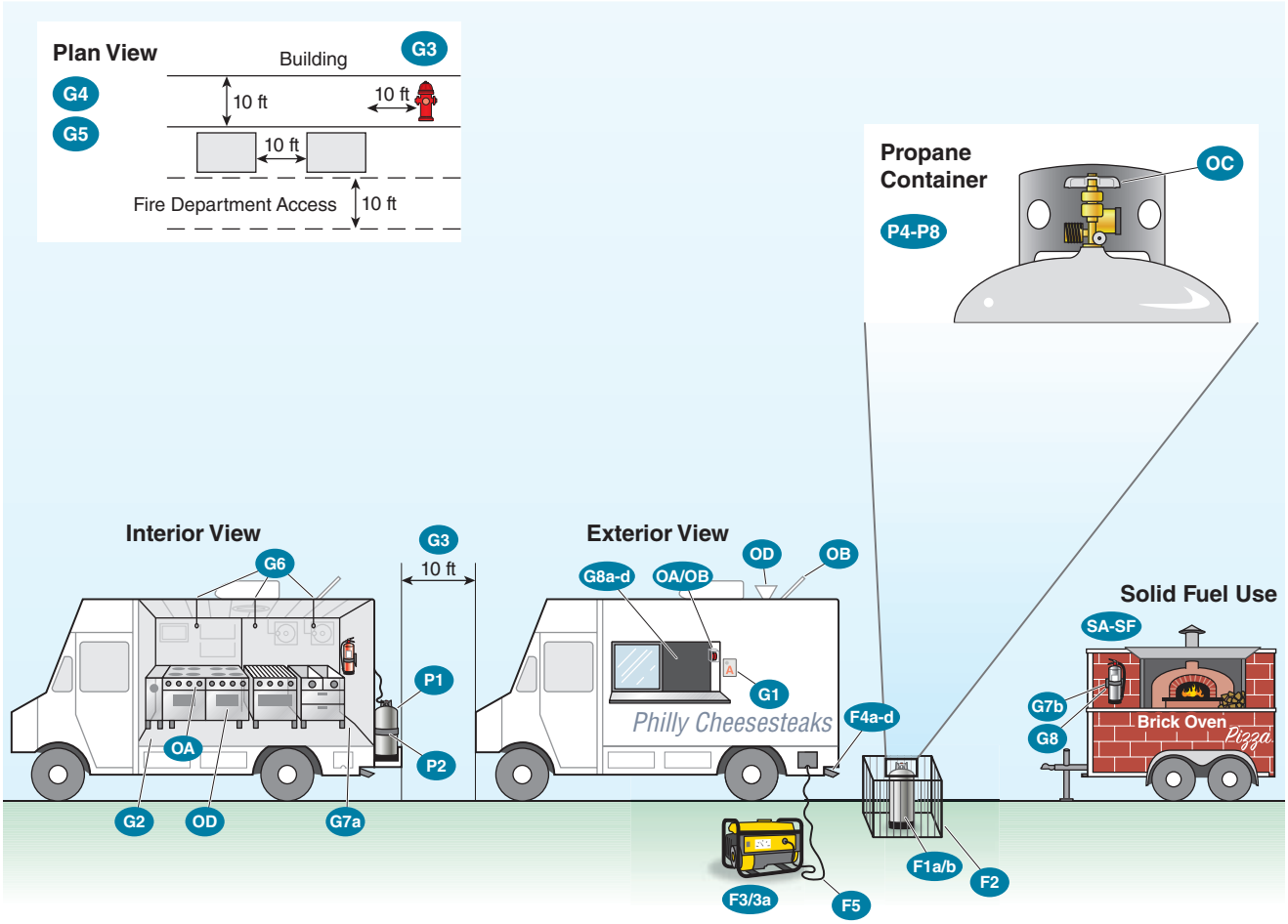


EXHIBIT B.1 *Food truck showing key requirements.*

GENERAL

Key	Safety Tip and NFPA Code Reference
G1	Obtain license or permits from the local authorities. [**1:**1.12.8(a)]
G2	Ensure there is no public seating within the mobile food truck.
G3	Check that there is a clearance of at least 3 m (10 ft) away from buildings, structures, vehicles, and any combustible materials. [**96:**7.8.2; **96:**7.8.3 for carnivals only]

G4 Verify fire department vehicular access is provided for fire lanes and access roads. [**1:**18.2.4]

G5 Ensure clearance is provided for the fire department to access fire hydrants and access fire department connections. [**1:**13.1.3; **1:**13.1.4; **1:**13.1.5]

G6 Check that appliances using combustible media are protected by an approved fire-extinguishing system. [**96:**10.1 2]

G7a Verify portable fire extinguishers have been selected and installed in kitchen cooking areas in accordance with NFPA 10. [**96:**10.9.3]

G7b Where solid fuel cooking appliances produce grease-laden vapors, make sure the appliances are protected by listed fire-extinguishing equipment. [**96:**14.7.1]

G8 Ensure that workers are trained in the following [**96:**B.15.1]:

G8a Proper use of portable fire extinguishers and extinguishing systems [**10:**1.2]

G8b Proper method of shutting off fuel sources [**96:**10.4.1]

G8c Proper procedure for notifying the local fire department [**1:**10.14.9 for carnivals only]

G8d Proper procedure for how to perform simple leak test on gas connections [**58:**6.16, 58:6.17]

FUEL AND POWER SOURCES

Key **Safety Tip and NFPA Code Reference**

F1a Verify that fuel tanks are filled to the capacity needed for uninterrupted operation during normal operating hours. [**1:**10.14.10.1 for carnivals only]

F1b Ensure that refueling is conducted only during non-operating hours. [**96:**B.18.3]

F2 Check that any engine-driven source of power is separated from the public by barriers, such as physical guards, fencing, or enclosures. [**96:**B.16.2.2]

F3 Ensure that any engine-driven source of power is shut down prior to refueling from a portable container. [**1:**11.7.2.1.2]

F3a Check that surfaces of engine-d iven source of power are cool to the touch prior to refueling from a portable container.

F4 Make sure that exhaust from engine-driven source of power complies with the following:

F4a At least 3 m (10 ft) in all directions from openings and air intakes [**96:**B.13]

F4b At least 3 m (10 ft) from every means of egress [**96:**B.13]

F4c Directed away from all buildings [**1:**11.7.2.2]

F4d Directed away from all other cooking vehicles and operations [**1:**11.7.2.2]

F5 Ensure that all electrical appliances, fixtures, equipment, and wiring comply with *NFPA 70*. [**96:**B.18]

PROPANE SYSTEM INTEGRITY

Key **Safety Tip and NFPA Code Reference**

P1 Check that the main shutoff valve on all gas containers is readily accessible. [**58:**6.26.4.1(3)]

P2 Ensure that portable gas containers are in the upright position and secured to prevent tipping over. [**58:**6.26.3.4]

P3 Inspect gas systems prior to each use. [**96:**B.19.2.3]

P4 Perform leak testing on all new gas connections of the gas system. [**58:**6.16; **58:**6.17]

P5 Perform leak testing on all gas connections affected by replacement of an exchangeable container. [**58:**6.16; **58:**6.17]

P6 Document leak testing and make documentation available for review by the authorized official. [**58:**6.26.5.1(M)]

P7 Ensure that on gas system piping, a flexible connector is installed between the regulator outlet and the fixed piping system. [**58:**6.26.5.1(B)]

P8 Where a gas detection system is installed, ensure that it has been tested in accordance with the manufacturer's instructions. [**96:**B.19.2.1]

OPERATIONAL SAFETY

Key	Safety Tip and NFPA Code Reference
OA	Do not leave cooking equipment unattended while it is still hot. (Note that this is the leading cause of home structure fires and home fire injuries.)
OB	Operate cooking equipment only when all windows, service hatches, and ventilation sources are fully opened. [**96:**14.2.2; **96:**14.2.3]
OC	Close gas supply piping valves and gas container valves when equipment is not in use. [**58:**6.26.8.3]
OD	Keep cooking equipment, including the cooking ventilation system, clean by regularly removing grease. [**96:**11.4]

SOLID FUEL SAFETY (WHERE WOOD, CHARCOAL, OR OTHER SOLID FUEL IS USED)

Key	Safety Tip and NFPA Code Reference
SA	Fuel is not stored above any heat-producing appliance or vent. [**96:**14.9.2.2]
SB	Fuel is not stored closer than 0.9 m (3 ft) to any cooking appliance. [**96:**14.9.2.2]
SC	Fuel is not stored near any combustible flammable liquids, ignition sources, chemicals, and food supplies and packaged goods. [**96:**14.9.2.7]
SD	Fuel is not stored in the path of the ash removal or near removed ashes. [**96:**14.9.2.4]
SE	Ash, cinders, and other fire debris should be removed from the firebox at regular intervals and at least once a day. [**96:**14.9.3.6.1]
SF	Removed ashes, cinders, and other removed fire debris should be placed in a closed, metal container at least 0.9 m (3 ft) in the open. [**96:**14.9 3.8]