

CHAPTER 18-28
MECHANICAL SYSTEMS*

* **Editor's note** - Chapter 18-28, Mechanical Refrigeration Systems, was added by Coun. J. 7-9-03, p. 3609, § 2, and was effective 90 days after its passage and publication (October 27, 2003). Coun. J. 11-21-17, p. 61913, § 7 amended the title of Chapter 18-28.

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Article VIII. Chimneys and Vents

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Article IX. Specific Appliances, Fireplaces and Solid Fuel-Burning Equipment

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18-28-1504.1 Collectors.

Article I. Administration (18-28-101 et seq.)

18-28-101 General.

18-28-101.1 Deliberately omitted.

18-28-101.2 Scope.

This chapter shall regulate the design, installation, maintenance, alteration and inspection of mechanical systems that are permanently installed and utilized to control environmental conditions and related processes within buildings, and any mechanical system, system component, equipment and appliance specifically addressed herein.

18-28-101.2.1 Appendices.

Provisions in the appendices shall not apply unless specifically adopted.

18-28-101.3 Intent.

The purpose of this chapter is to provide minimum standards to safeguard life or limb, health, property and public welfare by regulating and controlling the design, construction, installation, quality of materials, location, operation and maintenance or use of mechanical systems.

18-28-101.4 Deliberately omitted.

18-28-102 Applicability.

18-28-102.1 General.

The provisions of this chapter shall apply to all matters affecting or relating to structures and premises, as set forth in Sections 18-28-101.2 through 18-28-101.3. If different sections of this chapter specify different materials, methods of construction or other requirements, the most restrictive requirement shall govern.

18-28-102.2 Existing installations.

Except as otherwise provided for in this article, no provision in this chapter shall require the removal, alteration or abandonment of, nor prevent the continued use and maintenance of, an existing mechanical system lawfully in existence at the time of the adoption of this chapter.

18-28-102.3 Maintenance.

Mechanical systems, both existing and new, and all parts thereof shall be maintained in proper operating condition in accordance with the original design and in a safe and sanitary condition. Any device or safeguard which is required by this chapter shall be maintained in compliance with the provisions under which it was installed. The owner or the owner's designated agent shall be responsible for the maintenance of mechanical systems. To determine compliance with this provision, the Building Commissioner shall have the authority to require a mechanical system to be reinspected.

18-28-102.4 Additions, alterations or repairs.

All additions to, alterations and renovations of a mechanical system shall conform to the requirements for a new mechanical system without requiring the existing mechanical system to comply in its entirety with all of the requirements of this chapter. Additions, alterations or repairs shall not cause an existing mechanical system to become unsafe, hazardous or overloaded.

18-28-102.5 Change in occupancy.

It shall be unlawful to change the occupancy of any structure if that change will subject the structure to any provision of the building code applicable to the new occupancy without approval by the Building Commissioner. The Building Commissioner shall certify that such structure meets the intent of the provisions of law governing building construction for the proposed new occupancy and that such change of occupancy does not result in any hazard to public health, safety or welfare.

(Amend Coun. J. 11-13-07, p. 14999, Art. II, § 1)

18-28-102.6 Deliberately omitted.

18-28-102.7 Moved buildings.

Except as determined by Section 18-28-102.2, Existing Installations, mechanical systems that are a part of buildings or structures moved into or within the corporate limits of the City of Chicago shall comply with the provisions of the building code for new installations.

18-28-102.8 Referenced chapters and standards.

The codes and standards referenced in this chapter shall be those that are listed in Chapter 18-36, Reference Standards. Such codes and standards shall be considered as part of the requirements of this chapter to the prescribed extent of each such reference. Where differences occur between provisions of this chapter and the referenced standards, the provisions of this chapter shall apply.

18-28-102.9 Requirements not covered by this chapter.

Requirements necessary for the strength, stability or proper operation of an existing or proposed mechanical system, or for public safety, health and general welfare, not specifically covered by the building code, shall be determined by the Building Commissioner.

(Amend Coun. J. 11-13-07, p. 14999, Art. II, § 1)

18-28-103 Deliberately omitted.

18-28-104 Deliberately omitted.

18-28-105 Testing.

18-28-105.1 Deliberately omitted.

18-28-105.2 Deliberately omitted.

18-28-105.3 Required testing.

Whenever there is insufficient evidence of compliance with the provisions of this chapter or evidence that a material or method does not conform to the requirements of this chapter, or in order to substantiate claims for alternative materials or methods, the Building Commissioner shall have the authority to require tests as evidence of compliance to be made at no expense to its jurisdiction.

18-28-106 Permits.

18-28-106.1 When required.

An owner, authorized agent or contractor who desires to erect, install, enlarge, alter, repair, remove, convert or replace a mechanical system, the installation of which is regulated by the building code, or to cause such work to be done, shall first make application to the Building Commissioner and obtain the required permit for the work.

Exception: Where equipment and appliance replacements or repairs must be performed in an emergency situation, the permit application shall be submitted within the next working business day following commencement of the work.

(Amend Coun. J. 11-13-07, p. 14999, Art. II, § 1)

18-28-106.1.1 Work without a permit.

Exemption from the permit requirements of this chapter shall not be deemed to grant authorization for work to be done in violation of the provisions of this chapter or other laws or ordinances of this jurisdiction.

18-28-107 Deliberately omitted.

18-28-108 Deliberately omitted.

18-28-109 Deliberately omitted.

Article II. Definitions (18-28-201 et seq.)

18-28-201 General.

18-28-201.1 Scope.

Unless otherwise expressly stated, the following words and terms shall, for the purposes of this chapter, have the meanings indicated

in this article.

18-28-201.2 Interchangeability.

Words used in the present tense include the future tense; words in the masculine gender include the feminine and neuter genders; the singular number includes the plural number and the plural, the singular.

18-28-201.3 Terms defined in other codes.

If a term is not defined in this chapter and is defined in other chapters of Titles 13, 15 and 18, the term shall have the meanings ascribed to it in those chapters, unless the context clearly requires otherwise.

18-28-201.4 Terms not defined.

If a term is not defined within meaning of Sections 18-28-201.1 and 18-28-201.3, the term shall have its ordinarily accepted meaning unless the context clearly implies otherwise.

18-28-202 General definitions.

ABRASIVE MATERIAL. Moderately abrasive particulate in high concentrations, and highly abrasive particulate in moderate and high concentrations, such as alumina, bauxite, iron silicate, sand and slag.

ACCESS (TO). Enables a device, appliance or equipment to be reached by ready access or by a means that first requires the removal or movement of a panel, door or similar obstruction. See Ready Access (to).

AIR. All air supplied to mechanical equipment and appliances for combustion, ventilation, cooling and similar processes. Standard air is air at standard temperature and pressure, namely, 70°F (21°C) and 29.92 inches of mercury (101.3 kPa).

AIR CONDITIONING. Any treatment of air that simultaneously controls the temperature, humidity, and distribution of the air to meet the requirements of a conditioned space. See conditional space.

AIR CONDITIONING SYSTEM. A system that consists of heat exchangers, blowers, filters, supply ducts, exhaust ducts and return ducts, and any apparatus installed in connection with that system.

AIR EXHAUST. Air being removed from any space, appliance or piece of equipment and conveyed out-of-doors by means of openings or ducts.

AIR-HANDLING UNIT. A blower or fan used to distribute supply air to a room, space or area.

AIR MAKEUP. Air that replaces air being exhausted.

ALTERATION. A change in a mechanical system that involves an extension, addition or change to the arrangement, type or purpose of the original installation.

APPLIANCE. A device or apparatus that is manufactured and designed to utilize energy and for which the building code provides specific requirements.

APPLIANCE, EXISTING. Any appliance regulated by the building code which was legally installed prior to the effective date of the building code, or for which an installation permit has been issued.

APPLIANCE TYPE.

High-heat appliance. Any appliance in which the products of combustion at the point of entrance to the flue under normal operating conditions have a temperature greater than 2,000°F (1093°C).

Low-heat appliance (residential appliance). Any appliance in which the products of combustion at the point of entrance to the flue under normal operating conditions have a temperature of 1,000°F (538°C) or less.

Medium-heat appliance. Any appliance in which the products of combustion at the point of entrance to the flue under normal operating conditions have a temperature of more than 1,000°F (538°C), but not greater than 2,000°F (1093°C).

APPLIANCE UNVENTED. An appliance designed or installed in such a manner that the products of combustion are not conveyed by a vent or chimney directly to the outside atmosphere.

APPLIANCE VENTED. An appliance designed and installed in such a manner that all of the products of combustion are conveyed directly from the appliance to the outside atmosphere through an approved chimney or flue vent system.

APPROVED AGENCY. An established and nationally recognized agency that is approved by the Building Commissioner that is regularly engaged in conducting tests or furnishing inspection services.

AUTOMATIC BOILER. Any class of boiler that is equipped with the controls and limit devices specified in Article X, Boilers, Water Heaters and Pressure Vessels.

AUTOMATIC GAS SHUTOFF DEVICE. A device that causes the gas supply in a hot water supply system to shut off when the water temperature exceeds a predetermined limit.

AUTOMATIC GAS SHUTOFF VALVE. A valve used in conjunction with an automatic gas shutoff device to shut off the gas supply to a gas-fired water-heating system, including valves that are integral to the construction of the shut off device or that constitute a separate assembly.

AUTOMATIC IGNITION. Ignition of gas at the burner(s) when the gas controlling device is turned on, including re-ignition of the burner if the flame on the burner(s) has been extinguished by means other than by closing the gas controlling device.

BOILER. A closed heating appliance intended to supply hot water or steam for space heating, processing or power purposes. Low-pressure boilers operate at pressures less than or equal to 15 pounds per square inch (psi) (103 kPa) for steam and 60 psi water. High-pressure boilers operate at higher pressures.

BRAZED JOINT. A gas-tight joint obtained by the joining of metal parts with metallic mixtures or alloys that have a melting temperature above 800°F (426°C), but lower than the melting temperature of the parts to be joined.

BRAZING. A metal joining process whereby coalescence is produced using a nonferrous filler metal which has a melting temperature above 800°F (426°C), but lower than that of the base metal parts being joined. The filler material is distributed between the closely fitted surfaces of the joint by capillary attraction.

BTU. Abbreviation for British Thermal Unit, which is the quantity of heat required to raise the temperature of 1 pound (454g) of water by 1°F (0.56°C) (1 Btu = 1055 J).

BUILDING. Any structure occupied or intended to support occupancy or to shelter any occupants.

BUILDING PIPING. The piping for fuel from the point where the piping enters the building or foundation up to and including the outlets and upstream to the gas meter or LP-gas or fuel-oil tank outlet.

BURNER. A device used for the final conveyance of gas, or a mixture of gas and air, to the combustion zone.

Injection (atmospheric) type. A burner into which air at atmospheric pressure is injected by a jet of gas.

Injection (Bunsen) type. A burner which uses the energy of a jet of gas to inject air for combustion into the burner and mix it with gas.

Luminous or yellow flame. A burner which depends exclusively on secondary air for the combustion of the gas.

Power. A burner supplied by gas, air or both in which added pressure is applied at the burner either by gas at pressures exceeding the line pressure, or by air at pressures exceeding the atmospheric pressure, or by both.

Premixing. A power burner in which all or nearly all of the air for combustion is mixed with the gas as primary air.

Pressure. A burner that is supplied with an air-gas mixture under pressure - usually from 0.5 to 15 inches of water (124 to 3483 Pa) and occasionally higher.

CHIMNEY. A primarily vertical structure containing one or more flues, used to carry gaseous products of combustion and air from a fuel-burning appliance to the outside atmosphere.

Factory-built chimney. A listed and labeled chimney composed of factory-made components which is assembled in the field in accordance with the manufacturer's instructions and the conditions of its listing.

Masonry chimney. A field-constructed chimney composed of solid masonry units, bricks, stones or concrete.

CHIMNEY CONNECTOR. A pipe that connects a fuel-burning appliance to a chimney.

CLEARANCE. The minimum distance through air measured between the heat-producing surface of a mechanical appliance, device or equipment and the surface of the combustible material or assembly.

CLOSED COMBUSTION SOLID-FUEL- BURNING APPLIANCE. A heat-producing appliance that uses a combustion chamber and has no openings other than the flue collar, fuel charging door and adjustable openings to control the amount of combustion air that enters the combustion chamber.

CLOTHES DRYER. An appliance used to dry wet laundry by means of heat. Dryer classifications are as follows:

Type 1. Factory-built package, multiple production. Primarily used in family living environment. Usually the smallest unit physically and in terms of function output.

Type 2. Factory-built package, multiple production. Used in a business to benefit customer. Not designed for use in an individual family living environment.

CODE. These regulations, including any subsequent amendments thereto and any emergency rule or regulation lawfully adopted by the Building Commissioner or other authority with regulatory jurisdiction.

COMBUSTIBLE ASSEMBLY. Any wall, floor, ceiling or other assembly constructed of one or more component materials that are combustible.

COMBUSTIBLE LIQUIDS. Any liquid having a flash point at or above 100°F (38°C). Combustible liquids are classified as follows:

Class II. Any liquids having a flash point at or above 100°F (38°C) and below 140°F (60°C).

Class IIIA. Any liquids having a flash point at or above 140°F (60°C) and below 200°F (93°C).

Class IIIB. Any liquids having a flash point at above 200°F (93°C).

COMBUSTIBLE MATERIAL. Any material not defined as noncombustible.

COMBUSTION. In the context of the building code, refers to the rapid oxidation of fuel accompanied by the production of heat or heat and light.

COMBUSTION AIR. Air necessary for complete combustion of a fuel, including theoretical air and excess air.

COMBUSTION CHAMBER. The portion of an appliance in which combustion occurs.

COMBUSTION PRODUCTS. Constituents resulting from the combustion of a fuel with the oxygen of the air, including the inert gases, but excluding excess air.

COMMERCIAL FOOD HEAT-PROCESSING APPLIANCES. Any appliance used in a food- processing establishment to heat-process food or utensils and which produce grease vapors, steam, fumes, smoke or odors that must be removed through a local exhaust ventilation system. Such appliances include, but are not limited to, deep fat fryers, upright broilers, griddles, broilers, fry grills, steam jacketed kettles, hot-top ranges, charbroilers, ovens, barbecues, rotisseries, dishwashing machines, and similar appliances. For the purpose of this definition, a food- processing establishment shall include any building or portion thereof used to process food and food ingredients.

COMPRESSOR. A specific machine, with or without accessories, which compresses gas.

COMPRESSOR, POSITIVE DISPLACEMENT. A compressor in which an increase in pressure is attained by changing the internal volume of the compression chamber.

COMPRESSOR UNIT. A compressor with its prime mover and accessories.

CONCEALED GAS PIPING. Piping that is enclosed in the building construction without means of access.

CONDENSATE. The liquid that condenses from a gas (including flue gas) and is caused by a reduction in temperature.

CONDENSING UNIT. A specific refrigerating machine combination for a given refrigerant, consisting of one or more power-driven compressors, condensers, liquid receivers (when required) and any regularly furnished accessories.

CONDITIONED SPACE. An area, room or space being heated or cooled by any equipment or appliance.

CONSTRUCTION DOCUMENTS. All of the written, graphic and pictorial documents, drawn to an appropriate scale and prepared or assembled to describe the design, location and physical characteristics of the elements of a project, that are necessary to obtain a building permit.

CONTINUOUS PILOT. A pilot that burns without turndown, whether or not the main burner is firing.

CONTROL. A manual or automatic device designed to regulate the gas, air, water or electrical supply to, or operation of, a mechanical system.

CONVERSION BURNER. A burner designed to supply gaseous fuel to an appliance originally designed to use a different fuel.

COOKING APPLIANCE. See Commercial Food Heat-Processing Appliances.

CUBIC FOOT. The amount of gas which occupies 1 cubic foot (0.02832 m³) of space when, at a temperature of 60°F (16°C), the gas is saturated with water vapor and placed under a pressure equivalent to that of 30 inches of mercury (101 kPa).

DAMPER. A manually or automatically controlled device which regulates draft, or the rate of air flow, or the combustion of gases.

Volume damper. A device that, when installed, restricts, retards or directs the flow of air in a duct or the products of combustion in a heat-producing appliance, its vent connector, vent or chimney.

DAMPER VENT DEVICE, AUTOMATIC. A device installed either in the outlet or downstream of the appliance draft hood of a venting system of an individual automatically operated fuel-gas-burning appliance. The device is designed to open the venting system automatically when the appliance is in operation and to close off the venting system automatically when the appliance is in a standby or shutdown condition. Automatic damper vent devices may be operated or actuated in the following ways:

Electrically operated. Employs electrical energy to control the device.

Mechanically actuated. Dependent for operation upon the direct application or transmission of mechanical energy without employing any type of energy conversion.

Thermally actuated. Dependent for operation exclusively upon the direct conversion of the thermal energy of the vent gases into mechanical energy.

DEMAND. The maximum amount of gas input required per unit of time, usually expressed in cubic feet per hour, or Btu/h (Btu/h = 0.2931 W).

DESIGN WORKING PRESSURE. The maximum allowable working pressure for which a specific part of a system is designed.

DILUTION AIR. Air that is introduced into a draft hood and is mixed with flue gases.

DIRECT REFRIGERATION SYSTEM. A system in which the evaporator or condenser of the refrigerating system is in direct contact with the air or other substances to be cooled or heated.

DIRECT VENT APPLIANCES (SEALED COMBUSTION CHAMBER DESIGN APPLIANCES). An appliance that is constructed and installed so that all air for combustion is derived directly from the outside atmosphere and all flue gases are discharged to the outside atmosphere.

DIVERSITY FACTOR. The ratio of the maximum probable demand to the maximum possible demand.

DRAFT. The pressure difference that exists between an appliance or any of its component parts and the atmosphere, and that causes a continuous flow of air and products of combustion through the gas passages of the appliance to the atmosphere.

Induced draft. The pressure difference created by the action of a fan, blower or ejector that is located between the appliance and the chimney or vent termination.

Natural draft. The pressure difference created by a vent or chimney because of its height and the temperature difference between the flue gases and the atmosphere.

DRAFT HOOD. A device built into an appliance, or made a part of the vent connector from an appliance, that is designed to provide for the ready escape of the flue gases from the appliance in the event of no draft, back draft, or stoppage beyond the draft hood; and to prevent a back draft from entering the appliance; and to neutralize the effect of stack action of the chimney or gas vent upon the operation of the appliance.

DRIP. The container placed at a low point in a system of piping to collect condensate and from which the condensate can be removed.

DRY CLEANING SYSTEMS. Dry cleaning plants or systems classified as follows:

Type I. Those systems using Class I flammable liquid solvents having a flash point below 100°F (38°C).

Type II. Those systems using Class II combustible liquid solvents having a flash point at or above 100°F (38°C) and below 140°F (60°C).

Type III. Those systems using Class III combustible liquid solvents having a flash point at or above 140°F (60°C).

Type IV and Type V. Those systems using Class IV nonflammable liquid solvents.

DRY GAS. A gas having a moisture and hydrocarbon dew point below any normal temperature to which the gas piping is exposed.

DUCT. A tube or conduit used to convey air. The air passages of self-contained systems are not to be considered as air ducts.

DUCT FURNACE. A warm-air furnace normally installed in an air-distribution duct to supply warm air for heating. This definition shall apply only to a warm-air heating appliance that, for air circulation, depends on a blower not furnished as part of the furnace.

DUCT SYSTEM. A continuous passageway for the transmission of air, that, in addition to ducts, includes duct fittings, dampers, fans and accessory air handling equipment and appliances.

DWELLING. A building or portion thereof that contains not more than two dwelling units.

DWELLING UNIT. A single unit providing complete, independent living facilities for one or more persons, including permanent provisions for living, eating, cooking and sanitation.

ELECTRICAL HEATING APPLIANCE. An appliance that produces heat energy to create a warm environment by the application of electric power to resistance elements, refrigerant compressors or dissimilar material junctions.

EQUIPMENT. All piping, ducts, vents, control devices and other components of any system other than appliances which are permanently installed and integrated to control environmental conditions in a building. This definition shall also include other systems specifically regulated by the building code.

EQUIPMENT, EXISTING. Any equipment regulated by the building code which was legally installed prior to the effective date of the building code, or for which a permit to install has been issued.

EVAPORATIVE COOLER. A device used to reduce the sensible heat of air for cooling through evaporation of water into an airstream.

EVAPORATIVE COOLING SYSTEM. Any equipment and appliance intended or installed for the purpose of environmental cooling which uses an evaporative cooler from which conditioned air is distributed through ducts or plenums to the conditioned area.

EXCESS AIR. The amount of air provided in addition to theoretical air to achieve complete combustion of a fuel, thereby preventing the formation of dangerous products of combustion.

EXHAUST SYSTEM. An assembly of connected ducts, plenums, fittings, registers, grilles and hoods through which air is conducted and exhausted to the outside atmosphere.

FIREPLACE. An assembly consisting of a hearth and fire chamber constructed of noncombustible material and equipped with a chimney for use with solid fuels.

Factory-built fireplace. A listed and labeled fireplace and chimney system composed of factory-made components, and assembled in the field in accordance with the manufacturer's instructions and the conditions of its listing.

Masonry fireplace. A field-constructed fireplace composed of solid masonry units, bricks, stones or concrete.

FIREPLACE STOVE. A chimney-connected, solid-fuel burning stove (appliance) which has part of its fire chamber open to the room.

FLAME SAFEGUARD. A device that automatically shuts off the fuel supply to a main burner or group of burners when the means of ignition of such burners becomes inoperative, and when flame failure occurs on the burner or group of burners.

FLAME SPREAD INDEX. The numerical value assigned to a material tested in accordance with ASTM E 84.

FLAMMABILITY CLASSIFICATION. Refrigerants shall be assigned to one of the three classes - 1, 2 or 3 - in accordance with ASHRAE 34. For Classes 2 and 3, the heat of combustion shall be calculated based on the assumption that the combustion products are in a gas phase and in their most stable state.

Class 1A. Refrigerants that do not show flame propagation when tested in air at 14.7 psia (101 kPa) and 70°F (21°C).

Class 1B. Refrigerants having a lower flammability limit (LFL) of more than 0.00625 pound per cubic foot (0.10 kg/m³) at 70°F (21°C) and 14.7 psia (101 kPa) and a heat of combustion of less than 8,174 Btu/lb. (19000 kJ/kg).

Class 1C. Refrigerants that are highly flammable and have a LFL of less than or equal to 0.00625 pound per cubic foot (0.10 kg/m³) at 70°F (21°C) and 14.7 psia (101 kPa) or a heat of combustion greater than or equal to 8,174 Btu/lb. (19000 kJ/kg).

FLAMMABLE LIQUIDS. Any liquid that has a flash point below 100°F (38°C). Flammable liquids shall be known as Class I liquids and shall be divided into the following classifications:

Class 1A. Liquids having a flash point below 73°F (23°C) and having a boiling point below 100°F (38°C).

Class 1B. Liquids having a flash point below 73°F (23°C) and having a boiling point at or above 100°F (38°C).

Class 1C. Liquids having a flash point at or above 73°F (23°C) and having a boiling point below 100°F (38°C).

FLAMMABLE VAPOR OR FUMES. Any mixture of gases in the air at concentrations equal to or greater than the lower flammability limit (LFL) and less than or equal to the upper flammability limit (UFL).

FLASH POINT. The minimum temperature corrected to a pressure of 14.7 psia (101 kPa) at which the application of a test flame causes the vapors of a portion of the sample to ignite under the conditions specified by the test procedures and apparatus. The flash point of a liquid shall be determined in accordance with ASTM D 56, ASTM D 93 or ASTM D 3278.

FLOOD ZONES.

Flood-hazard zone. Areas that have been determined to be prone to flooding, but not subject to high-velocity waters or wave action.

High-hazard zone. Areas of tidal influence determined by the department of water management to be subject to wave heights in excess of 3 feet (914 mm) or subject to high-velocity wave run up or wave-induced erosion.

FLOOR FURNACE. A completely self-contained furnace installed on the floor of the space being heated which takes air for combustion from outside the space and is equipped with means to observe flames and to light the appliance from within the space.

FREE AREA. If louvered, grilled or screened openings are used to supply air for gas appliances, the "free area" of the opening is the actual area through which air can flow.

FLUE. A passageway within a chimney or vent through which gaseous combustion products exit a system.

FLUE CONNECTION (BREECHING). A passage which conducts the products of combustion from a fuel-fired appliance to the vent of chimney. See also Chimney Connector and Vent Connector.

FLUE GASES. Products of combustion and excess air.

FUEL OIL. Kerosene or any hydrocarbon oil having a flash point of not less than 100°F (38°C).

FUEL-OIL PIPING SYSTEM. A closed piping system that connects a combustible liquid from a source of supply to a fuel oil-burning appliance.

FURNACE. A completely self-contained heating unit that is designed to supply heated air to spaces remote from or adjacent to the appliance location.

FUSIBLE PLUG. A device arranged to relieve pressure by operation of a fusible member at a predetermined temperature.

GAS CONVENIENCE OUTLET. A permanently mounted, manually operated device that provides the means for connecting an appliance to, and disconnecting an appliance from, the gas supply piping. The device includes an integral, manually operated gas valve with a nondisplaceable valve member and is designed so that the appliance can only be disconnected when the manually operated gas valve is in the closed position.

GAS PIPING. An installation of pipe, valves or fittings installed on a premises or in a building and used to convey fuel gas.

HAZARDOUS LOCATION. Any location considered to be a fire hazard for flammable vapors, dust, combustible fibers or other highly combustible substances. The location is not necessarily categorized in the building code as a high-hazard use group classification.

HEAT EXCHANGER. A device that transfers heat from one medium to another.

HEAT PUMP. A refrigeration system that extracts heat from one substance and transfers it to another portion of the same substance or to a second substance at a higher temperature for a beneficial purpose.

HEAT TRANSFER LIQUID. The operating or thermal storage liquid in a mechanical system, including water or any other liquid base and additives at the concentration present under operating conditions used to move heat from one location to another. Refrigerants are not heat transfer liquids.

HIGH-PROBABILITY SYSTEMS. A refrigeration system in which the basic design or location of components is such that a leakage of refrigerant from a failed connection, seal or component will enter an occupancy classified area other than the machinery room.

HIGH-SIDE PRESSURE. The parts of a refrigerating system subject to condenser pressure.

HOOD. An air-intake device used to capture, by entrapment, impingement, adhesion or similar means, grease and similar contaminants before they enter a duct system.

Type I. A kitchen hood for collecting and removing grease vapors and smoke.

Type II. A general kitchen hood for collecting and removing steam, vapor, heat and odors.

HOUSE PIPING. See Building Piping.

IDLH (IMMEDIATELY DANGEROUS TO LIFE OR HEALTH). The concentration of airborne contaminants that poses a threat of death, immediate or delayed permanent adverse health effects, or effects that could prevent escape from such an environment. This contaminant concentration level is established by the National Institute of Occupational Safety and Health (NIOSH) based on both toxicity and flammability. It is generally expressed in parts per million by volume (ppm v/v) or milligrams per cubic meter (mg/m³).

IGNITION PILOT. A pilot that operates during the lighting cycle and discontinues operation during the main burner operation.

IGNITION SOURCE. A flame, spark or hot surface capable of igniting flammable vapors or fumes. Such sources include appliance burners, burner ignitors and electrical switching devices.

INDIRECT REFRIGERATION SYSTEM. A system in which a secondary coolant cooled or heated by the refrigerating system, is circulated to the air or to any other substance to be cooled or heated. Indirect systems are distinguished by the method of application shown described below:

Closed system. A system in which a secondary fluid is either cooled or heated by the refrigerating system and is then circulated within a closed circuit in indirect contact with the air or other substance to be cooled or heated.

Double-indirect open-spray system. A system in which the secondary substance for an indirect open spray system is heated or cooled by an intermediate coolant circulated from a second enclosure.

Vented closed system. A system in which a secondary coolant is cooled or heated by the refrigerating system and then passed through a closed circuit in the air or other substance to be cooled or heated, provided that the evaporator or condenser is placed in an open or appropriately vented tank.

INTERMITTENT PILOT. A pilot that operates during the ignition cycle and continues to operate during the main burner operation, but is shut off at other times.

JOINT, FLANGED. A joint made by bolting together a pair of flanged ends.

JOINT, FLARED. A metal-to-metal compression joint in which a conical spread is made on the end of a tube that is compressed by a flare nut against a mating flare.

JOINT, MECHANICAL. A general form of gas-tight joints obtained by the joining of metal parts through a positive-holding mechanical construction, such as a flanged joint, screwed joint or flared joint.

JOINT, PLASTIC ADHESIVE. A joint made in thermoset plastic piping using an adhesive substance which forms a continuous bond between the mating surfaces.

JOINT, PLASTIC SOLVENT CEMENT. A joint made in thermoplastic piping by using a solvent or solvent cement which forms a continuous bond between the mating surfaces.

JOINT, SOLDERED. A gas-tight joint obtained by joining metal parts with metallic mixtures of alloys which melt at temperatures between 400°F (204°C) and 800°F (426°C).

JOINT, WELDED. A gas-tight joint obtained by the joining of metal parts in a molten state.

LABELED. Devices, equipment, appliances or materials affixed with a label, seal, symbol or other identifying mark of a nationally recognized testing laboratory, inspection agency or other organization that evaluates products, periodically inspects the production of the above-labeled items and by whose label the manufacturer attests to compliance with applicable nationally recognized standards.

LEL (LOWER EXPLOSIVE LIMIT). See also LFL.

LFL (LOWER FLAMMABILITY LIMIT). The minimum concentration of refrigerant capable of propagating a flame through a homogeneous mixture of refrigerant and air.

LIMIT CONTROL. A device responsive to changes in pressure, temperature or level for turning on, shutting off or throttling the gas supply to an appliance.

LIMITED CHARGE SYSTEM. A system which uses a compressor idle to ensure that the design system's pressure is not exceeded if the refrigerant charge completely evaporates.

LIQUEFIED PETROLEUM GAS or LPS (LP-GAS). Liquefied petroleum gas composed predominately of propane, propylene, butanes, butylenes or any mixture thereof that is gaseous under normal atmospheric conditions, but is capable of being liquefied under moderate pressure at normal temperatures.

LISTED. Equipment, appliances or materials included in a list published by a nationally recognized testing laboratory, inspection agency or other organization that evaluates products, periodically inspects the production of listed equipment, appliances or materials, and whose listing states either that the equipment, appliance or material meets nationally recognized standards or have been tested and found suitable for use in a specified manner. Not all testing laboratories, inspection agencies and other organizations that evaluate products use the same means to identify listed equipment, appliances or materials. Some do not recognize equipment, appliances or materials as listed unless they are also labeled. The Building Commissioner shall utilize the system employed by the listing organization to identify a listed product.

LOG-LIGHTER, GAS-FIRED. A manually operated, gas-fired solid-fuel ignition device for installation in a vented solid-fuel-burning fireplace.

LOW-PRESSURE GAS SUPPLY SYSTEM. A gas supply system with gas pressure at or below 6 inches 0.5 psig (3.4kPa gauge) of water column.

LOW-PRESSURE STEAM-HEATING BOILER. A boiler furnishing steam at pressures not exceeding 15 psi (103 kPa).

LOW-SIDE PRESSURE. The parts of a refrigerating system subject to evaporator pressure.

MACHINERY ROOM. A room meeting prescribed safety requirements and in which refrigeration systems or components thereof are located. See Sections 18-28-1105, Machinery Room General Requirements and 18-28-1106, Machinery Room Special Requirements.

MAIN BURNER. A device or group of devices that essentially forms an integral unit for the final conveyance of gas or a mixture of gas and air to the combustion zone, and on which combustion takes place to accomplish the function for which the appliance is designed.

MAIN BURNER CONTROL VALVE. A valve that controls the gas supply to the main burner manifold.

MANUAL SHUTOFF VALVE. A manually operated, listed gas valve in the gas line used to completely turn on or shut off the gas supply.

MEASURED GAS. Gas that has passed through a meter which has measured its volume or gas that has been otherwise measured such as by weight or volume.

MECHANICAL EXHAUST SYSTEM. A system that removes air from a building by mechanical means to the out-of-doors.

MECHANICAL JOINT. A connection between pipe, fittings or pipes and fittings which is not screwed, caulked, threaded, soldered, solvent cemented, brazed or welded. A mechanical joint also includes a joint in which compression is applied along the centerline of the pieces being joined. Some mechanical joints are part of a coupling, fitting or adapter.

MECHANICAL SYSTEM. A system specifically addressed and regulated in the building code and comprising components, devices, appliances and equipment.

MEDIUM-PRESSURE GAS SUPPLY SYSTEMS. A gas supply system with gas pressure exceeding 0.5 psig (3.4 kPa gauge), but not exceeding 5 psig (34 kPa gauge).

METER. The instrument installed to measure the volume of gas delivered through it.

MODULAR BOILER. A steam or hot water heating assembly consisting of a group of individual boilers called modules and intended to be installed as a unit with no intervening stop valves. Modules are under one jacket or are individually jacketed. The individual modules shall be limited to a maximum input rating of 400,000 Btu/h (117,228 W) gas, 3 gallons per hour (gph) (11.4 L/h) oil, or 115 kW (electric).

MP REGULATOR, 2 PSI (13.8 kPa). A medium- pressure regulator that reduces the 2 psi (13.8 kPa) consumer's gas piping pressure to the appliance regulator or to the appliance utilization pressure.

NATURAL VENTILATION. The movement of air into and out of a space through intentionally provided openings, such as windows and doors, or through non-powered ventilators.

NATURAL DRAFT VENTING SYSTEM. A venting system designed to remove flue or vent gases under non-positive static vent pressure entirely by natural draft.

NONABRASIVE/ABRASIVE MATERIALS. Nonabrasive particulate in high concentrations, moderately abrasive particulate in high concentrations, moderately abrasive particulate in low and moderate concentrations, and highly abrasive particulate in low concentrations, such as alfalfa, asphalt, plaster, gypsum and salt.

NONCOMBUSTIBLE MATERIALS. Materials that, when tested in accordance with ASTM E 136, are found to have at least three of every four specimens tested meet all of the following criteria:

1. The recorded temperature of the surface and interior thermocouples does not at any time during the test rise more than 54°F (30°C) above the furnace temperature at the beginning of the test.
2. There is no flaming from the specimen after the first 30 seconds.
3. The weight loss of the specimen during testing exceeds 50 percent and the recorded temperature of the surface and interior thermocouples does not at any time during the test rise above the furnace air temperature used at the beginning of the test, and there is no flaming of the specimen.

OCCUPANCY. The purpose for which a building, or portion thereof, is utilized or occupied.

ORIFICE. The opening in a cap, spud or other device whereby the flow of gas is limited and through which the gas is discharged to the burner.

ORIFICE CAP (HOOD). A movable fitting having an orifice that permits the flow of gas to be adjusted by changing its position with respect to a fixed needle or other device.

ORIFICE SPUD. A removable plug or cap containing an orifice that permits the flow of gas to be adjusted either by substitution of a spud with a different-sized orifice or by the motion of a needle with respect to it.

OUTDOOR AIR. Air taken from the outdoors, and therefore not previously circulated through the system.

OUTDOOR OPENING. A door, window, louvre or skylight that can be opened to the outside atmosphere.

OUTLET. A threaded connection or bolted flange in a piping system to which a gas-burning appliance is attached.

OXYGEN DEPLETION SAFETY SHUTOFF SYSTEM (ODS). A system designed to shut off the gas supply to the main and pilot burners if the oxygen in the surrounding atmosphere is reduced below a predetermined level.

PANEL HEATING. A method of radiant space heating in which heat is supplied by large heated areas of room surfaces. The heating element usually consists of warm water piping, warm air ducts, or electrical resistance elements embedded in or located behind ceiling, wall or floor surfaces.

PELLET FUEL-BURNING APPLIANCE. A closed-combustion, vented appliance equipped with a fuel-feed mechanism for burning processed pellets of solid fuel of a specified size and composition.

PIPING. Piping refers to either pipe or tubing, or both.

Pipe. A rigid conduit of iron, steel, copper, brass or plastic.

Tubing. A semirigid conduit of copper, aluminum, plastic or steel.

PLASTIC THERMOPLASTIC. A plastic capable of being repeatedly softened by increasing its temperature and hardened by decreasing its temperature.

PLASTIC THERMOSETTING. A plastic that is capable of being changed into a substantially infusible or insoluble product when cured under application of heat or chemical means.

PLENUM. An enclosed portion of the building structure that is designed to allow air movement, and thereby serves as part of an air distribution system.

POWER BOILER. See Boiler.

PREMISES. A lot, plot or parcel of land, including any structure thereon.

PRESSURE FIELD TEST. A test performed in the field to prove system tightness.

PRESSURE-LIMITING DEVICE. A pressure-responsive any mechanism designed to stop automatically the operation of any pressure-imposing element at a predetermined pressure.

PRESSURE-RELIEF DEVICE. A pressure-actuated valve held closed by a spring or other means and designed to relieve pressure in excess of the device's setting automatically.

PRESSURE-RELIEF VALVE. A pressure-actuated valve or rupture member designed to relieve excessive pressure automatically.

PRESSURE VESSELS. Closed containers, tanks or vessels designed to contain liquids, gases or both, under pressure.

PRESSURE VESSELS - REFRIGERANT. Any refrigerant-containing receptacle in a refrigerating system. This term does not include evaporators where each separate section does not exceed 0.5 cubic foot (0.014 m³) of refrigerant-containing volume, regardless of the maximum inside dimensions, evaporator coils, controls, headers, pumps and piping.

PURGE. To clear of air, water or other foreign substances.

QUICK-DISCONNECT DEVICE. A hand-operated device that provides a means to connect and disconnect an appliance or an appliance connector to a gas supply and that is equipped with an automatic means to shut off the gas supply when the device is disconnected.

RADIANT HEATER. A heater designed to transfer heat primarily by direct radiation.

READY ACCESS (TO). A device, appliance or equipment that can be directly reached without requiring the removal or movement of any panel, door or similar obstruction. See Access To.

RECEIVER LIQUID. A vessel permanently connected to a refrigeration system by inlet pipes for storage of liquid refrigerant.

RECIRCULATED AIR. Air removed from a conditioned space and intended for reuse as supply air.

RECLAIMED REFRIGERANTS. Refrigerants reprocessed to the same specifications as required for new refrigerants by means such as distillation. Reclaimed refrigerants have been chemically analyzed to verify that the specifications have been met. Reclaiming usually implies the use of processes or procedures that are available only at a reprocessing or manufacturing facility.

RECOVERED REFRIGERANTS. Refrigerants removed from a system in any condition without necessarily testing or processing them.

RECYCLED REFRIGERANTS. Refrigerants from which contaminants have been reduced by oil separation, removal of noncondensable gases, and single or multiple passes through devices that reduce moisture, acidity and particulate matter, such as replaceable core filter driers. These procedures usually are performed at the field job site or in a local service shop.

REFRIGERANT. A substance utilized to produce refrigeration by its expansion or vaporization.

REFRIGERANT SAFETY CLASSIFICATION. Groupings that indicate the toxicity and flammability classes in accordance with Section 18-28-1103.1. The classification group is made up of a letter (A or B) that indicates the toxicity class, followed by a number (1, 2 or 3) that indicates the flammability class. Refrigerant blends are similarly classified, based on the compositions at their worst cases of fractionation, as separately determined for toxicity and flammability. In some cases, the worse case of fractionation is the original formulation.

Flammability.

Class 1. Indicates refrigerants that do not show flame propagation in air when tested by prescribed methods at specified conditions.

Classes 2 and 3. Indicate refrigerants with "lower flammability" and "higher flammability" respectively; the distinction depends on both the lower flammability limit (LFL) and heat of combustion.

Toxicity.

Classes A and B. Indicate refrigerants with "lower toxicity" and "higher toxicity" respectively, based on prescribed measures of chronic toxicity.

REFRIGERATED ROOM OR SPACE. A room space in which an evaporator or brine coil is located for the purpose of reducing or controlling the temperature within the room or space to below 68°F (20°C).

REFRIGERATION SYSTEM. A combination of interconnected refrigerant-containing parts constituting one closed refrigerant circuit in which a refrigerant is circulated for the purpose of extracting heat.

REFRIGERATION CAPACITY RATING. Whether expressed as 1 horsepower (0.5 kW), or 1 ton or 12,000 Btu/h (3.5 kW), all of these ratings indicate the same quantity.

REFRIGERATION SYSTEM, ABSORPTION. A heat-operated, closed-refrigeration cycle in which a secondary fluid (the absorbent) absorbs a primary fluid (the refrigerant) that has been vaporized in the evaporator.

Direct system. A system in which the evaporator is in direct contact with the material or space refrigerated, or is located in air-circulating passages communicating with such spaces.

Indirect system. A system in which a brine coil cooled by the refrigerant is circulated to the material or space refrigerated, or is utilized to cool the air circulated. Indirect systems are distinguished by the type or method of application.

REFRIGERATION SYSTEM CLASSIFICATION. Refrigeration systems classified according to the degree of probability that leaked refrigerant from a failed connection, seal or component will enter an occupied area. The distinction is based on the basic design or location of the components.

REFRIGERATION SYSTEM, MECHANICAL. A complete factory-assembled and tested system that is shipped in one or more sections and has no refrigerant-containing parts that are joined in the field by other than companion or block valves.

REGISTERED DESIGN PROFESSIONAL. An architect or engineer who is registered or licensed to practice professional architecture or engineering, as defined by the statutory requirements of the professional registration laws of the state in which the project is to be undertaken or constructed.

REGULATOR. A device to control and maintain a uniform gas supply pressure, using either a pounds- to-inches water column (MP regulator) or an inches- to-inches water column (appliance regulator).

REGULATOR, LINE GAS PRESSURE. A device placed in a gas line between the service pressure regulator and the gas appliance to control, maintain or reduce the pressure in that portion of the piping system downstream of the device.

REGULATOR, LP-GAS, FIRST STAGE. On an undiluted LP-gas system, the first pressure regulator reduces the storage container pressure.

REGULATOR, SERVICE PRESSURE. A device installed by the serving gas supplier to reduce and limit service line gas pressure to delivery pressure.

RETURN AIR. Air removed from an approved conditioned space or location and recirculated or exhausted.

RETURN AIR SYSTEM. An assembly of connected ducts, plenums, fittings, registers and grilles through which air from the space or spaces to be heated or cooled is conducted back to the supply unit. See also Supply Air System.

RISER GAS. A vertical pipe supplying fuel gas.

ROOM HEATER, UNVENTED. See Unvented Room Heater.

ROOM HEATER, VENTED. A freestanding heating unit that burns solid, liquid or gas fuel in order to heat directly the space in which the unit is located and any adjacent space. See Vented Room Heater (Gas-Fired).

SAFETY SHUTOFF DEVICE. A device that shuts off the gas supply to controlled burners if the source of ignition fails to ignite the gas at the burners. This device interrupts the flow of gas to the main burners, or to the pilot and the burners or to the pilot and burners under the safety shutoff device control.

SAFETY VALVE. A valve that relieves pressure in a steam boiler by opening fully at the rated discharge pressure. The valve is of the spring-pop type.

SELF-CONTAINED EQUIPMENT. Complete, factory-assembled and tested, heating, air conditioning or refrigeration equipment installed as a single unit, and having all working parts, complete with motive power, in an enclosed unit.

SERVICE PIPE. The pipe that brings the gas from the gas main to the point of delivery.

SHAFT. An enclosed space extending through one or more stories of a building, connecting vertical openings in successive floors, or floors and the roof.

SHAFT ENCLOSURE. The walls or construction that forms the boundaries of the shaft.

SMOKE DAMPER. A listed device designed to resist the passage of air and smoke. The device operates automatically, is controlled by a smoke detection system, and when required and if required, is capable of being positioned manually from a remote command station.

SMOKE-DEVELOPED INDEX. A numerical value assigned to a material tested in accordance with ASTM E 84.

SOURCE CAPTURE SYSTEM. A mechanical exhaust system designed and constructed to capture air contaminants at their source and to exhaust them to the outdoor atmosphere.

SPACE, CONFINED. A space with a volume less than 50 cubic feet per 1,000 Btu per hour (20 Btu per hour per cubic foot) of the aggregate input rating of all appliances installed in that space.

SPACE, UNCONFINED. A space with a volume greater than or equal to 50 cubic feet per 1,000 Btu per hour (20 Btu per hour per cubic foot) of the aggregate input rating of all appliances installed in the space. Rooms communicating directly with the space in which the appliances are installed, through openings not furnished with doors, are considered to be a part of the unconfined space.

SPECIFIC GRAVITY. As applied to gas, specific gravity is the ratio of the weight of a given volume of gas to that of the same volume of air when both are measured under the same condition.

STEAM HEATING BOILER. A boiler operated at pressures not exceeding 15 psi (103 kPa) for steam.

STOCK COCK. See Manual Shutoff Valve.

STOP VALVE. A shutoff valve to control the flow of liquid or gases.

STORY. That portion of a building included between a floor's upper surface and the upper surface of the floor immediately above; provided, however, that the topmost story is that portion of a building included between the upper surface of the top most floor and the ceiling or roof above.

STRENGTH, ULTIMATE. The highest stress level that component will tolerate without rupture.

SUPPLY AIR. That air delivered to each or any space supplied by an air distribution system or the total air delivered to all spaces supplied by an air distribution system, which is used to ventilate, heat, cool, humidify and dehumidify the space and for other similar purposes.

SUPPLY AIR SYSTEM. An assembly of connected ducts, plenums, fittings, registers and grilles through which air, heated or cooled, is conducted from the supply unit to the space or spaces to be heated or cooled. See also Return Air System.

THEORETICAL AIR. The exact amount of air required to supply the oxygen necessary for complete combustion of a given quantity of a specific fuel.

THERMAL RESISTANCE (R). A measure of a material's ability to retard the flow of heat. The R- value is the reciprocal of thermal conductance.

TLV-TWA (THRESHOLD LIMIT VALUE- TIME-WEIGHTED AVERAGE). The time-weighted average concentration of a refrigerant or other chemical in air for a normal 8-hour workday and a 40-hour workweek, to which nearly all workers are repeatedly exposed, day after day, without adverse effects, as determined by the American Conference of Government Industrial Hygienists (ACGIH).

TOILET ROOM. A room containing a water closet, a lavatory, or a bathtub, shower, spa or similar bathing fixture.

TOXICITY CLASSIFICATION. Refrigerants shall be classified for toxicity into one of two classes, in accordance with ASHRAE 34.

Class A. Refrigerants for which toxicity has not been identified at concentrations less than or equal to 400 parts per million (ppm) based on data used to determine Threshold Limit Value-Time-Weighted Average (TLV-TWA) or consistent indices.

Class B. Refrigerants for which there is evidence of toxicity at concentrations below 400 ppm, based on data used to determine Threshold Limit Value-Time-Weighted Average (TLV-TWA) or consistent indices.

TRANSITION FITTINGS, PLASTIC TO STEEL. An adapter used to join plastic pipe to steel pipe in order to provide a permanent, pressure-tight connection between two materials which cannot be joined directly one to the other.

UNIT HEATER. A self-contained appliance of the fan type, designed to deliver warm air directly into the space in which the appliance is located.

UNUSUALLY TIGHT CONSTRUCTION. Construction which meets the following requirements:

1. Walls and ceilings exposed to the outside atmosphere having a continuous water vapor retarder with a rating of 1 perm (57 ng/s x m² x Pa) or less with openings gasketed or sealed;
2. Storm windows or weather-stripping on operable windows and doors; and
3. Caulking or sealants applied to areas, such as joints around window and door frames, between sole plates and floors, between wall-ceiling joints, between wall panels, at penetrations for plumbing, electrical and gas lines, and at other openings.

VENT. A pipe or other conduit composed of factory-made components, containing a passageway for conveying combustion products and air to the atmosphere, listed and labeled for use with a specific type or class of appliance.

Pellet vent. A vent listed and labeled for use with listed pellet fuel-burning appliances.

Type L vent. A vent listed and labeled for use with oil-burning appliances that are listed for use with Type L vents.

VENT CONNECTOR. The pipe that connects an approved fuel-fired appliance to a vent.

VENT DAMPER DEVICE, AUTOMATIC. A device intended for installation in the venting system, in the outlet of an individual automatically operated fuel-burning appliance that is designed to open the venting system automatically when the appliance is in operation and to close off the venting system automatically when the appliance is in a standby or shutdown condition.

VENTILATION. The natural or mechanical process of supplying conditioned or unconditioned air to, or removing such air from, any space.

VENTILATION AIR. That portion of supply air that comes from the outside (outdoors), plus any recirculated air that has been treated to maintain the desired quality of air within a designated space.

VENTING SYSTEM. A continuous open passageway from the flue collar of an appliance to the outside atmosphere for the purpose of removing flue or vent gases. A venting system is usually composed of a vent or a chimney and vent connector, if used, assembled to form the open passageway.

WATER HEATER. Any heating appliance or equipment that heats potable water and supplies such water to the potable hot water distribution system.

(Amend Coun. J. 11-13-07, p. 14999, Art. II, § 1; Amend Coun. J. 11-8-12, p. 38872, § 317)

Article III. General Regulations (18-28-301 et seq.)

18-28-301 General.

18-28-301.1 Scope.

This chapter shall govern the approval and installation of all equipment and appliances that are part of a building's mechanical system regulated by the building code in accordance with Section 18-28-101.2, Scope.

18-28-301.2 Energy utilization.

The heating, ventilating and air-conditioning systems of all structures shall be designed and installed for efficient utilization of energy in accordance with Chapter 18-13, Energy Conservation.

18-28-301.3 Listed and labeled.

All appliances regulated by the building code shall be listed and labeled by the Underwriters Laboratories, the Canadian Standards Association or the American Gas Association.

18-28-301.4 Deliberately omitted.

18-28-301.5 Label information.

A permanent factory-applied nameplate shall be affixed to all appliances. The nameplate shall contain the following information about the appliance in legible lettering: the manufacturer's name or trademark, the model number, the serial number and a seal or mark of approval by a nationally-recognized listing agency. If required, a label containing the following information shall be affixed to the appliance:

1. *Electrical equipment and appliances.* Electrical rating in volts, amperes and motor phase; identification of individual electrical components in volts, amperes or watts; motor phase; Btu/h (W) output and required clearances.
2. *Absorption units.* Hourly rating in Btu/h (W); minimum hourly rating for units having step or automatic modulating controls; type of fuel; type of refrigerant; cooling capacity in Btu/h (W); and required clearances.
3. *Fuel-burning units.* Hourly rating in Btu/h(W); type of fuel approved for use with the appliance; and required clearances.
4. *Electric comfort heating appliances.* Name and trademark of the manufacturer; the model number or equivalent; the electric rating in volts, ampacity and phase; Btu/h (W) output rating; individual marking for each electrical component in amperes or watts, volts and phase; required clearances from combustibles.

(Amend Coun. J. 11-8-12, p. 38872, § 318)

18-28-301.6 Conflicts.

If a conflict exists between this chapter and the conditions of the listing or the manufacturer's installation instructions, the more stringent provision shall apply.

18-28-301.7 Electrical.

Electrical wiring, controls and connections to equipment and appliances regulated by this chapter shall be in accordance with Title 14E.

(Amend Coun. J. 9-6-17, p. 55278, Art. II, § 62)

18-28-301.8 Plumbing connections.

Potable water supply and building drainage system connections to equipment and appliances regulated by this chapter shall be in accordance with Chapter 18-29, Plumbing Systems.

18-28-301.9 Fuel types.

Fuel-fired appliances shall be designed for use with the type of fuel to which the appliance will be connected and for the altitude at which the appliance is installed. Appliances that are part of a building's mechanical system shall not be converted for use with a different fuel, unless the conversion is approved by the Building Commissioner and the conversion is done in accordance with the manufacturer's instructions. The fuel input rate shall not be increased or decreased beyond the limit rating for the altitude at which the appliance is installed.

(Amend Coun. J. 11-13-07, p. 14999, Art. II, § 1)

18-28-301.10 Vibration isolation.

If vibration isolation of equipment or appliances is employed, supplemental restraint shall be used to restrain the equipment or appliance.

18-28-301.11 Repair.

Defective material or parts shall be replaced or repaired in a manner that preserves the original approval or listing.

18-28-301.12 Wind resistance.

Mechanical equipment, appliances and supports exposed to wind shall be designed and installed to resist wind pressures as required by the building code.

18-28-301.13 Flood hazard.

If a structure is located in a flood-hazard zone or a high-hazard zone, its mechanical systems shall be either (1) placed above the base flood elevation; or (2) protected to prevent flood water from entering or accumulating within any equipment, appliances, ducts or plenum space.

18-28-301.14 Deliberately omitted.**18-28-302 Protection of Structure.****18-28-302.1 Penetrations of floor/ceiling assemblies and fire-resistance-rated assemblies.**

Penetrations of floor/ceiling assemblies and assemblies required to have a fire-resistance rating shall be protected in accordance with Chapters 15-8, Fire-Resistive Requirements, and 15-12, Fire Resistive Materials and Construction.

18-28-303 Equipment and Appliance Location.**18-28-303.1 General.**

The location of all equipment and appliances shall be governed by the requirements of this section, by specific requirements found elsewhere in the building code and by the conditions of the equipment and appliance listing.

18-28-303.2 Hazardous locations.

Appliances shall not be located in any hazardous location unless listed and approved for the specific installation.

18-28-304 Deliberately omitted.**18-28-305 Piping Support.****18-28-305.1 General.**

All mechanical system piping shall be supported in accordance with the requirements of this section.

18-28-305.2 Materials.

Pipe hangers and supports shall have sufficient strength to withstand all anticipated static and specified dynamic loading conditions associated with the intended use. Pipe hangers and supports that are in direct contact with piping shall be constructed of materials that are compatible with the piping and do not promote galvanic action.

18-28-305.3 Structural attachment.

Hangers and anchors shall be attached to the building construction in an appropriate manner consistent with load requirements and manufacturer's recommendations.

18-28-305.4 Interval of support.

Piping shall be either supported at distances not exceeding the spacing specified in Table 18-28-305.4, Piping Support Spacing.

**Table 18-28-305.4
Piping Support Spacing a**

Piping Material	Max. Horiz. Spacing (feet)	Max. Verti. Spacing (feet)
ABS pipe	4	10 c
Aluminum pipe and tubing	10	15
Brass pipe	10	10

Brass tubing, 1 1/4-inch diameter and smaller	6	10
Brass Tubing, 1 1/2-inch diameter and larger	10	10
Cast-iron pipe b	5	15
Copper or copper-alloy pipe	12	10
Copper or copper-alloy tubing, 1 1/4-inch diameter and smaller	6	10
Copper or copper-alloy tubing, 1 1/2-inch diameter and larger	10	10
CPVC pipe or tubing, 1 inch and smaller	3	10 c
CPVC pipe or tubing, 1 1/4-inch and larger	4	10 c
Steel Pipe	12	15
Steel Tubing	8	10
Lead pipe	Continuous	4
PB pipe or tubing	2 2/3 (32 in.)	4
PEX Tubing	2 2/3 (32 in.)	10 c
PVC pipe	4	10 c

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm.

a See Section 18-28-301.14.

b The maximum horizontal spacing of cast-iron pipe hangers shall be increased to 10 feet where 10-foot lengths of pipe are installed.

c Mid-story guide.

18-28-305.5 Sway bracing.

Rigid support sway bracing shall be provided at changes in direction greater than 45 degrees (0.8 rad) for pipe sizes 4 inches (102 mm) and larger.

18-28-306 Access and Service Space.

18-28-306.1 Refer to Article.

See Article 9, Specific Appliances, Fireplaces and Solid Fuel-Burning Equipment.

18-28-306.2 Deliberately omitted.

18-28-306.3 Deliberately omitted.

18-28-306.4 Deliberately omitted.

18-28-306.5 Equipment and appliances on roofs or elevated structures.

If any equipment or appliance requiring access is installed on a roof or elevated structure at a height exceeding 16 feet (4877 mm) above grade plane, a permanent approved means of access shall be provided, and shall extend from grade or floor level to the surface

space of the equipment and appliance. Such access shall not require any person to climb over obstructions greater than 30 inches (762 mm) high or walk on roofs having a slope greater than 4 units vertical in 12 units horizontal (33-percent slope).

18-28-306.6 Sloped roofs.

If any appliance or equipment is installed on a roof having a slope of 3 units vertical in 12 units horizontal (25-percent slope) or greater and having an edge more than 30 inches (762 mm) above grade at such edge, a level platform shall be provided on each side of the appliance to which access is required in accordance with the manufacturer's installation instructions for service, repair or maintenance.

18-28-307 Condensate Disposal.

18-28-307.1 Fuel-burning appliances.

The liquid combustion by-products of condensing appliances shall be collected and discharged in accordance with Section 18-28-801, Plumbing. Condensate piping shall be of Type M copper or Schedule 40 PVC and shall not be smaller than the drain connection on the appliance. Such piping shall maintain a minimum horizontal slope in the direction of discharge of not less than one-eighth unit vertical in 12 units horizontal (1 percent slope).

18-28-307.2 Evaporators and cooling coils.

Condensate drain systems shall be provided for all equipment and appliances containing evaporators or cooling coils. Condensate drain systems shall be designed, constructed and installed in accordance with Sections 18-28-307.2.1 through 18-28-307.2.5.

18-28-307.2.1 Condensate disposal.

Condensate from all cooling coils or evaporators shall be conveyed by gravity, vacuum or pumped from the drain pan outlet to an approved place of disposal as follows:

1. Units larger than 6 tons (21.1 kW) nominal capacity shall discharge to a sanitary sewer drain, storm sewer drain or a French drain constructed in accordance with Section 18-28-307.2.1.1. If condensate is discharged to a sanitary sewer, such drains shall be indirectly connected in accordance with the Chapter 18-29 of the Plumbing Code.
2. Units 6 tons (21.1 kW) and smaller nominal capacity shall discharge in accordance with Item 1, or shall discharge to a gutter, roof drain or other approved location.
3. Condensate drains from rooftop units shall discharge in accordance with Item 1 or 2, or shall discharge onto rooftops constructed to prevent the condensate from discharging into a street, alley or other areas so as to cause a nuisance.
4. Condensate may be pumped or conveyed by vacuum as long as no other systems are connected to the condensate removal system.

18-28-307.2.1.1 French drain.

A french drain shall consist of a pit excavated in the earth not less than 24 inches (610 mm) in any dimension and completely filled with coarse gravel. The drainpipe shall extend into the pit not less than 6 inches (152 mm) below grade and shall be securely anchored in place. The drain shall not be covered with sod until inspected and approved.

18-28-307.2.2 Drain pipe materials and sizes.

All components of the condensate disposal system shall be made of cast iron, galvanized steel, copper, polybutylene, polyethylene, ABS, CPVC or PVC pipe or tubing. All components shall be selected for the pressure and temperature rating of the installation. Condensate waste and drain line size shall be not less than 3/4-inch (19 mm) internal diameter and shall not decrease in size from the drain pan connection to the place of condensate disposal. If the drainpipes for more than one unit are manifolded together for condensate drainage, the pipe or tubing shall be sized in accordance with an approved method. All horizontal sections of drain piping shall be installed in uniform alignment at a uniform slope.

18-28-307.2.3 Auxiliary drain pans.

Except as provided for in Section 18-28-307.2.4, auxiliary drain pans shall be installed under all coils on which condensation will occur and under units containing coils that are located in attic spaces, suspended ceiling spaces, furred spaces or any area where damage will occur to the building or its contents, as a result of an overflow from the equipment or appliance drain pan or from a stoppage in the condensate drain piping. Auxiliary drain pans shall have a minimum depth of 1 1/2 inches (38 mm), shall be not less than 3 inches (76 mm) larger than the unit or coil dimensions in width and length, and shall be constructed of a corrosion-resistant

material. Metallic pans shall have a minimum thickness of not less than 0.0276-inch (0.7 mm) galvanized sheet steel. Nonmetallic pans shall have a minimum thickness of not less than 0.0625 inch (1.6 mm). A separate drain line shall extend from the pan to a conspicuous point and serve as an alarm which indicates that the primary drain is restricted. As an alternative to a separate drain line, an approved water level detector or float switch device shall be used to control overflow by automatically shutting down the equipment or appliance that produces the condensate.

18-28-307.2.4 Secondary drain system.

If an auxiliary drain pan cannot be installed under units containing cooling coils, a drain pipe shall be connected to the secondary drain (overflow) connection so that the overflowing condensate resulting from flow restrictions in the primary drain pipe will be carried away without damaging the unit and its surroundings. The overflowing condensate shall be drained to a conspicuous point and serve as an alarm which indicates that the primary drain pipe is restricted. As an alternative, overflowing condensate shall be piped to a secondary drain pan, firmly secured and located along the side of the cooling unit, from which the condensate will be drained to a conspicuous point. A secondary drain pan shall have a capacity of not less than the capacity of the condensate drain pan, shall be not less than 1 1/2 inches (38 mm) deep, and shall be constructed of not less than 0.0276-inch (0.7 mm) thick galvanized sheet metal. As an alternative to a separate drain line, a UL-listed water level detector or float switch device shall be used to control overflow by automatically shutting down the equipment or appliance that produces the condensate.

18-28-307.2.5 Traps.

Condensate drains shall be trapped as required by the equipment or appliance manufacturer.

18-28-308 Clearance Reduction.

18-28-308.1 Scope.

This section shall govern the reduction in required clearances to combustible materials and combustible assemblies for chimneys, vents, kitchen exhaust equipment, mechanical appliances, and mechanical devices and equipment.

18-28-308.2 Listed appliances and equipment.

The reduction of the required clearances to combustibles for listed and labeled appliances and equipment shall be in accordance with the requirements of this section except that such clearances shall not be reduced if reduction is specifically prohibited by the terms of the appliance or equipment listing.

18-28-308.3 Protective assembly construction and installation.

Reduced clearance protective assemblies, including structural and support elements, shall be constructed of noncombustible materials. Spacers utilized to maintain an airspace between the protective assembly and the protected material or assembly shall be noncombustible. If a space between the protective assembly and protected combustible material or assembly is specified, the same space shall be provided around the edges of the protective assembly and the spacers shall be placed so as to allow air circulation by convection in such space. Protective assemblies shall not be placed less than 1 inch (25 mm) from the mechanical appliances, devices or equipment, regardless of the allowable reduced clearance.

18-28-308.4 Allowable reduction.

The reduction of required clearances to combustible assemblies or combustible materials shall be based on the utilization of a reduced clearance protective assembly in accordance with Section 18-28-308.5 or 18-28-308.6.

18-28-308.5 Labeled assemblies.

The allowable clearance reduction shall be based on an approved reduced clearance protective assembly that has been tested and bears the label of a nationally- recognized listing agency.

18-28-308.6 Reduction table.

The allowable clearance reduction shall be based on one of the methods specified in Table 18-28-308.6, Clearance Reduction Methods. If required clearances are not listed in Table 18-28-308.6, the reduced clearances shall be determined by linear interpolation between the distances listed in the table. Reduced clearances shall not be derived by extrapolation below the range of the table.

**Table 18-28-308.6
Clearance Reduction Methods**

Type of Protective Assembly a	Required Clearance to Combustibles with Protection (Inches) a							
	Horizontal Combustible Assemblies Located Above the Heat Source				Horizontal Combustible Assemblies Located Beneath the Heat Source and All Vertical Combustible Assemblies			
	Required clearance to combustibles without protection (inches) a				Required clearance to combustibles without protection (inches) a			
	36	18	9	6	36	18	9	6
Galvanized sheet metal minimum nominal thickness of 0.024 inch (No. 24 Gauge), spaced 1 inch off the combustible assembly	18	9	5	3	12	6	3	3
Galvanized sheet metal minimum nominal thickness of 0.024 inch (No. 24 Gauge), spaced 1 inch off the combustible assembly	18	9	5	3	12	6	3	2
Two layers of galvanized sheet metal, minimum nominal thickness of 0.024 inch (No. 24 Gauge), having a 1-inch airspace between layers, spaced 1 inch off the combustible assembly	18	9	5	3	12	6	3	3
Two layer of galvanized sheet metal, minimum nominal thickness of 0.024 inch (No. 24 Gauge), having 1-inch of fiberglass insulation between layers, spaced 1 inch off the combustible assembly	18	9	5	3	12	6	3	3
0.5-inch inorganic insulating board, over 1 inch of fiberglass or mineral wool batt, against the combustible assembly	24	12	6	4	18	9	5	3
3.5-inch brick wall, spaced 1 inch off the combustible assembly	-	-	-	-	12	6	6	6
3.5-inch brick wall, against the combustible wall	-	-	-	-	24	12	6	5

For SI: 1 inch = 25.4 mm, °C = [(°F)-32]/1.8, 1 lb. per cubic foot = 16.02 kg/m³, 1.0 (Btu x in.)/(sq. ft. x hr x °F.) = 0.144 W/m² x K.

a Mineral wool batts (blanket or board) shall have a minimum density of 8 pounds per cubic foot and a minimum melting point of 1,500°F. Insulation material utilized as part of a clearance reduction system shall have a thermal conductivity of 1.0 (Btu x in.)/(sq. ft. x hr. x °F.) or less. Insulation board shall be of noncombustible material.

18-28-308.7 Solid fuel-burning appliances.

The clearance reduction methods specified in Table 18-28-308.6 shall not be used to reduce the clearance required for solid fuel-burning appliances that are labeled for installation with clearances of 12 inches (305 mm) or less. If appliances are labeled for installation with clearances greater than 12 inches (305 mm), the clearance reduction methods of Table 18-28-308.6 shall not reduce the clearance to less than 12 inches (305 mm).

18-28-308.8 Masonry chimneys.

The clearance reduction methods specified in Table 18-28-308.6 shall not be used to reduce the clearances required for masonry chimneys as specified in Article 8, Chimney and Vents, and Chapter 13-152.

18-28-308.9 Chimney connector pass-throughs.

The clearance reduction methods specified in Table 18-28-308.6 shall not be used to reduce the clearances required for chimney connector pass-throughs as specified in Section 18-28-803.10.4, "Connector pass-through."

18-28-308.10 Masonry fireplaces.

The clearance reduction methods specified in Table 18-28-308.6 shall not be used to reduce the clearances required for masonry fireplaces as specified in Article 8 and the building code.

18-28-308.11 Kitchen exhaust ducts.

The clearance reduction methods specified in Table 18-28-308.6 shall not be utilized to reduce the minimum clearances required by Section 18-28-506.3.12, Fire-resistive access opening, for kitchen exhaust ducts enclosed in a shaft.

18-28-309 Deliberately omitted.

18-28-310 Deliberately omitted.

18-28-311 Deliberately omitted.

18-28-312 Deliberately omitted.

Article IV. Ventilation (18-28-401 et seq.)

18-28-401 General.

18-28-401.1 Scope.

This article shall govern the ventilation of spaces within a building intended to be occupied.

18-28-401.2 Ventilation required.

Every occupied space shall be ventilated by natural means in accordance with Section 18-28-402 or by mechanical means in accordance with Section 18-28-403.

18-28-401.3 When required.

Ventilation shall be provided during the periods that the room or space is occupied.

18-28-401.4 Method of producing ventilation.

Ventilation may be produced by:

1. A natural ventilating system which is hereby defined as a system, the effectiveness of which depends upon natural atmospheric conditions and upon the operation of windows, transoms and other openings, the operation of which is in control of the person or persons in the room or space which is ventilated.
2. A mechanical ventilating supply system, which is hereby defined as a system for forcing air into a room or space by artificial means combined with the removal of air through windows, skylights, transoms, undercut doors, grilles, shafts, ducts, or other relief openings direct to outside atmosphere except as provided in Table 18-28-403.3.
3. A mechanical ventilating exhaust system, which is hereby defined as a system for removing air from a room or space by artificial means combined with a supply of air through windows, skylights, transoms, grilles, shafts, ducts or other relief openings direct to outside atmosphere except as provided in Table 18-28-403.3.

18-28-401.5 Ventilation openings.

Ventilating openings in any room or space are hereby defined as apertures opening upon a public way, yard, court, public park, public waterway, or onto a roof of a building or structure in which the room or space is situated. They shall be windows, skylights, transoms, or other openings which are provided for ventilating purposes and which are equipped with adjustable louvers, dampers, or other devices to deflect or diffuse the air currents. French windows and doors shall be considered to be ventilating openings in living quarters.

18-28-401.5.1 Area of the openings.

The area of ventilating openings shall be computed as follows.

18-28-401.5.1.1 Windows.

The maximum area that can be opened.

18-28-401.5.1.2 Skylights.

The area of the maximum opening to the outer air, provided that it does not exceed the area of the sashed openings to the outer atmosphere, or the area of the skylight well. If this area exceeds either the area of the sashed openings or the skylight well, the smaller area is the ventilating area.

18-28-401.5.1.3 Transoms.

The free area through the sashed opening if the transom swings through an arc of not less than 60 degrees. It is the same percentage of the free area as the maximum angle of the transom when open to 60 degrees if the transom swings through an arc of less than 60 degrees.

18-28-401.5.1.4 Auxiliary ventilating openings.

The free area when louvers, dampers, or other devices are in position to deflect or diffuse the air currents in such a manner that there will be no objectionable drafts.

18-28-401.5.1.5 Relief openings.

Relief openings (RO) as used in Table 18-28-403.3 as set out in Section 18-28-403.3, shall be considered to be any duct that connects a room to the outside. Relief openings for ductwork shall be of sufficient cross sectional area so that maximum velocity shall not exceed 800 feet per minute. Relief openings in ducts for exhaust may extend in a horizontal direction for a distance not to exceed 5 feet.

18-28-401.5.1.6 Air quantities.

The quantity of air supplied or exhausted through any relief opening shall not be less than the quantity specified in Section 18-28-403.3 for mechanical supply or mechanical exhaust systems. The termination of the duct shall be equipped with a storm-proof louver, cowl, or other equipment opening having an outlet free area not smaller than that of the duct.

18-28-401.5.1.7 Damper.

The duct may be equipped either with a gravity type damper that permits air to flow in one direction only; or with an automatic damper that closes only when the fan serving the room is not running, or both.

18-28-401.5.2 Opening location.

The intake opening which draws air from the outside atmosphere shall be located at a point that prevents contamination of the air supply and shall be unobstructed at all times. The intake opening shall be located not less than 15 feet from the discharge outlet of any exhaust fan, plumbing vent and chimney or similar object. Unless adequate means are provided to remove dust from the air, the bottom of the intake opening shall be not less than 10 feet above the surface of any abutting public way, gangway, driveway, grade, or abutting roof. No intake opening shall be placed in a horizontal position in any sidewalk, or in the pavement of any street, alley, or driveway, or within 12 inches of the level of any other surrounding grade; nor shall any intake opening take air from the lower level of any two-level street or similar construction. In loading docks, intake openings shall be located not less than 10 feet horizontally or vertically from any loading dock door.

Exceptions:

1. Interior loading spaces and appurtenant driveways. No ventilation openings for loading spaces and appurtenant driveways shall

be required if the following conditions are met:

- 1.1 Loading spaces and appurtenant driveways are used in manufacturing, storage or mercantile units;
- 1.2 Doors open directly to the outside atmosphere at each loading space;
- 1.3 The loading dock is raised at least 36 inches above the adjacent driveway;
- 1.4 The doors are situated no more than 65 feet from the dock; and
- 1.5 The dock area is separated from the interior of the unit by a wall or door or by both.

2. No ventilation openings for exterior loading spaces and appurtenant driveways shall be required if the following conditions are met:

- 2.1 The loading dock is constructed with the floor of the dock not less than 36 inches above the adjacent driveway; and
- 2.2 The driveway is not enclosed; and

2.3 At least 20 percent of the lineal footage of the total external wall of the dock or 50 percent of the lineal footage of the largest external wall of the dock consists of loading doors.

18-28-401.5.3 Points of exhaust discharge.

The air removed by every mechanical ventilating exhaust system shall be discharged outside at a point where it will not cause a nuisance, and from which it cannot again be readily drawn in by a ventilating system.

Exceptions:

1. Air which will not cause a nuisance may be discharged into a boiler room in such quantity as is required to supply the needs of combustion.

2. Air which will not cause a nuisance may be discharged into a garage used for active storage of only five or more cars, provided the garage is separately ventilated during all hours of occupancy, in accordance with the provisions of Section 18-28-403.3.

2.1 Provisions shall be made in cases as described above so that when an air system is used for smoke exhaust, the smoke shall be automatically discharged to the outside and the secondary use of the air is automatically dampered off.

18-28-401.6 Outdoor air opening and protection.

Air intake and exhaust that terminate outdoors shall be suitably protected against Chicago weather conditions, with corrosion resistant screens, louvers and grilles. Area of the outside air intake shall be sized so that at least 100 percent of the code-required outside air as required in Section 18-28-403.1 can be taken from outside at velocities not in excess of 1,000 feet per minute (304.8 mpm) through free area except for systems defined in paragraph 18-28-403.1.3.

Table 18-28-401.6

Opening Sizes in Louvers Grilles and Screens Protecting Outdoor Exhaust and Air Intake Openings

Outdoor Opening Type	Minimum and Maximum Opening Sizes in Louvers, Grilles and Screens Measured in Any Direction
Exhaust openings	Not less than 1/4 inch and not greater than 1/2 inch
Intake openings in residential occupancies	Not less than 1/4 inch and not greater than 1/2 inch
Intake openings in other than residential occupancies	Not less than 1/4 inch and not greater than 1 inch

For SI: 1 inch = 25.4 mm.

18-28-401.7 Additional ventilation.

If the air condition in any habitable room becomes objectionable due to causes other than the occupancy by human beings, and the Building Commissioner finds that the health and comfort of the human occupants is endangered, additional ventilation by natural or mechanical means shall be provided in accordance with Article 5, Exhaust Systems, or as approved by the Building Commissioner.

18-28-402 Natural Ventilation.

18-28-402.1 Natural ventilation.

See Chapter 13-172, Light and Ventilation.

18-28-403 Mechanical Ventilation.

18-28-403.1 Source of air supply.

The air supply for every ventilation system, either natural or mechanical, shall be taken from out of doors, except in the following situations:

Exceptions:

1. Recirculation. When air is supplied by a mechanical ventilating supply system, a portion of the code required air supply may be recirculated, provided the system is equipped with such devices for control of temperature and dust content in the spaces to be ventilated and that the conditions of the air so supplied, (except as to temperature) are substantially the same as though all of the supply air were taken from out-of-doors. Under such conditions, not less than thirty-three and one-third percent of the Code requirements shall be taken from out-of-doors by the mechanical ventilating supply system; and sixty-six and two-thirds percent of the code requirements may be recirculated air, plus any additional air volume of system design capacity in excess of code requirements.

2. When air is supplied by a mechanical ventilating supply system which is not equipped with devices prescribed in paragraph 1, then only such portions of the air volumes of the system design capacity in cfm that exceed the total code requirements in cfm may be recirculated during the time of room occupancy. The air intake and all equipment and ducts shall be so arranged that all of the code required air supplied by the system can be taken from outside, with provisions made for release or exhaust of such air to the atmosphere.

3. Prohibited exhaust. No air exhausted from bath, toilet, urinal, or similar room, lavatory, locker, coat room, kitchen, boiler room, or rooms of similar use in which such air might be contaminated by smoke, gases, or dust which might be noxious, dangerous, or detrimental to health shall be recirculated at any time; except that air exhausted from locker and coat rooms or kitchens may be recirculated when unoccupied.

18-28-403.1.1 Air reduction to actual load.

For Variable Air Volume (VAV) systems, the amount of air delivered to any given space shall be allowed to be reduced to track the load in the space provided that the minimum amount of air delivered to the space is not less than 1/3 of the code required air supply.

18-28-403.1.2 Demand ventilation.

The amount of outside air delivered by a mechanical supply system may be reduced during operation below the quantities listed in Table 18-28-403.3 if the system is capable of measuring and maintaining CO₂ levels in occupied spaces no greater than 1000 ppm. The system capacity shall be greater than or equal to the ordinance requirements.

18-28-403.1.3 Systems with water economizers.

If a system is equipped with a Water Economizer in accordance with the Chicago Energy Conversion Code, the amount of outside air delivered by the mechanical air handling system shall be no less than 1/3 of the code-required supply air. The area of the outside air intake shall be sized so that at least 1/3 of the code-required supply air can be taken from outdoors at velocities not in excess of 1,000 feet per minute (304.8 mpm) through the free area. The remaining air may be supplied by a recirculating air system if the system is equipped with devices to control temperature and dust content. The total quantity of air delivered to the space shall be 100 percent of the code-required air.

18-28-403.2 Structural requirements of a mechanical system.

Any system which conveys ventilation air shall be designed and installed in accordance with Article 6, Duct Systems.

18-28-403.3 Ventilation requirements.

See Table 18-28-403.3, Ventilating Requirements.

18-28-403.3.1.

If a room or department in any factory is to process, brew, or mill food or beverages, and a large floor area is occupied by permanently installed, closed tanks, vats or food processing equipment (thus reducing occupiable floor space), the minimum ventilating requirements specified in Table 18-28-403.3 shall be adjusted and determined to conform to the following requirements.

1. Rooms in which the total area of the ventilating opening is 4 percent or more than the "employees" net work floor area shall conform to the requirements for natural ventilation.
2. Rooms which have no ventilation opening or in which the total area of the ventilation opening is less than four percent of the "employees" net work floor area shall provide supply and exhaust of 1.2 cfm per square foot of net work floor area.

18-28-403.3.2 Refrigerated rooms.

If a refrigerated room or area is not used for human occupancy, no ventilation requirements shall apply. If a refrigerated room or area is used for human occupancy, supply and exhaust of 0.6 cfm per square foot shall be provided in the refrigerated room or area.

Exceptions:

1. The table of minimum ventilation requirements does not apply to any mechanically refrigerated room or area necessarily used and required to age food or beverages.
2. The table of minimum ventilation requirements does not apply to the storage and preservation of meat, food and beverage products.

18-28-403.3.3 Dangerous or noxious contaminants.

If the nature of any work being done in a room or area is of such a character that dangerous or noxious dust, fumes, mists, gases, odors or other contaminants harmful to workers or occupants may get discharged, the ventilating requirements found in Table 18-28-403.3 shall be supplemented by using a local mechanical exhaust to remove the emission at its source, to prevent the escape of contaminants to the occupied space, and to discharge the mechanical exhaust to the outside atmosphere. Such mechanical exhaust shall be equipped with suitable means for the collection and removal of the contaminates. See Article 5, Exhaust Systems.

18-28-403.3.4 Total air supply.

The total air supplied from the outside atmosphere shall be equivalent to, or greater than the total air volume removed by the general and local exhaust systems. See also Article 5, Exhaust Systems.

18-28-403.3.5 Air filter requirements.

Ventilating systems that serve anaesthetizing rooms, intensive care rooms, patient rooms, operating rooms, nurseries, delivery rooms and similar health care rooms shall have at least 2 banks of air filters and shall meet the following requirements:

1. Filter Bank No. 1 shall be installed in the suction side of the supply fan and shall have a minimum air cleaning efficiency rating of 30 percent.
2. Filter Bank No. 2 shall be installed on the pressure side of the supply fan and shall have a minimum air cleaning efficiency rating of 90 percent.
3. All air cleaning efficiencies shall be based on the National Bureau of Standards Dust Spot Test Method and Atmospheric Dust.

18-28-403.3.6 Pedestrian passage way.

The velocity of air movement due to ventilation at any cross section of a pedestrian passage way shall not exceed 60 feet per minute.

18-28-403.3.7 Air-to-air heat recovery and air energy transfer equipment.

Air-to-air heat recovery and air energy transfer equipment and systems intended to recover either sensible heat (dry bulb temperature), latent heat (humidity ratio) or enthalpy (total heat) may be used if the equipment or system is connected to an exhaust system from which recirculated air is permitted. For systems which require all air to be exhausted directly to outside, such heat

recovery may only be used if there is no more than 5% (five percent) communication between outside air and exhaust air for Class I or Class II air as defined by ASHRAE 62.1. All other applications shall be approved by the committee on standards and tests in accordance with Chapter 13-16 of this Code.

(Amend Coun. J. 9-14-16, p. 31143, § 9)

18-28-403.3.7.1 Materials and media.

No equipment or system that makes use of air-to- air heat recovery and air energy transfer, shall be used unless all of the following requirements are met:

- 1. The materials used therein are non-combustible; and
- 2. The heat transfer media are non-toxic and nonflammable.

18-28-403.3.7.2 Direct exposure of heat transfer media.

Any equipment or system which exposes heat transfer media in succeeding cycles directly to exhaust air and to air from the outside atmosphere shall not be connected to any exhaust systems from which recirculated air is forbidden under this chapter. The exhaust discharge outlet location shall conform in all respects to the requirements of this chapter.

18-28-403.3.8 Outside air requirements.

If a mechanical exhaust system is required, the outside air needed to replace the air exhausted from each room shall be obtained from ventilation openings in that room or from a mechanical ventilating supply system installed for that room.

Exceptions:

1. In foyers, living quarters, offices, rest rooms, lobbies, locker rooms, medicine rooms and picture galleries, ventilation also may be obtained from a mechanical ventilating supply system serving rooms adjacent to the designated room, either alone or in combination with the designated room, if the quantity of air supplied to the adjacent room is not less than that required for both the designated room and the adjacent rooms.

2. In public kitchens and serving pantries, ventilation air may be obtained through ventilation openings from dining rooms adjacent to designated rooms, if the area of the ventilation openings in the dining room is not less than 4 percent of the combined floor area of the dining room and the kitchen or serving pantry. Such ventilation comply with the following:

2.1 If the dining room is provided with a mechanical supply system of ventilation, air from the dining room can be taken through proper openings into the kitchen and exhausted from the kitchen. Such air shall be considered as exhaust from the dining room and as supply air into the kitchen.

2.2 A kitchen exhaust system need not be increased beyond the requirements for kitchen exhaust as indicated in Table 18-28-403.3.

2.3 If the amount of air exhausted from the dining room through the kitchen is not sufficient to provide exhaust as indicated in Table 18-28-403.3, additional exhaust shall be taken from the dining room area to make up such requirement, either by increasing exhaust from the kitchen or by installing a separate additional mechanical exhaust system.

3. In bath, toilet, and urinal rooms, check rooms, storage room, storage battery rooms, telephone switch rooms, and other rooms of similar character, ventilation may be obtained from ventilation openings in these rooms or from openings to uncontaminated rooms adjacent to the designated rooms if the following requirement is met:

3.1 The quantity of air supplied to the adjacent rooms is not less than the air exhausted through the designated rooms.

**Table 18-28-403.3
Ventilating Requirements***

For a printer-friendly PDF version of Table 18-28-403.3, please click here.

* S = Mechanical Supply; E = Mechanical Exhaust From Room; RO = Relief Opening; NR = No Requirement; NV = Natural Ventilation; Vent opening = percentage of floor area.

	Vent Opening	
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Room Purpose	Percent of Floor Area		Mechanical Ventil. CFM/SF		Remarks
	Less Than	Not Less Than	S, Supply	E, Room Exhaust	
Correctional					
Cell rooms		4	0	0	
	4		1.2	1.2	
Dry Cleaners/Laundries					
Dry Cleaning		4	0	4	See 18-28-403
	4		1.5	4	
Laundries (Residential for less than 30 units)		4	0	0	
	4		0	1	
Laundries serving general public			1.5	1.5	See 18-28-403
Linen Rooms			0.5	0.5	
Education					
Music Rooms		4	0	0	
	4		1.5	0.75	
Class Rooms/Auditoriums		4	0	0	
	4		1.5	0.75	
Cooking Rooms for Instruction only		4	0	1.5	
	4		1.0	1.5	
Libraries/Reading Rooms		4	0	0	
	4		1.2	0.6	
Food and Beverage Service					
Cafeterias/Food Courts		4	0	0	
	4		1.5	2.0	
Public Dining Rooms - no cooking equipment		4	0	0	
	4		1.5	1.5	
Public Dining Rooms - with cooking equipment		4	0	2	
	4		1.5	2	
Grills		1	0	2	
	1		1.5	2	
Kitchen, public		3	0	4	See Note 5.
	3		1.2	4	
Lounges/Bars		4	0	0	
	4		1.0	1.5	

Health Care					
Anesthesia Storage Rooms			1.2	1.2	See Note 5.
Autopsy Rooms			1.5	3.0	See Note 5.
Doctor's - Dentist exam rooms		4	0	0	
	4		0.6	0.3	
Delivery Rooms/Birthing Rooms			2.0	1.0	
Intensive Care			2.0	1.0	No recirculation within room.
Morgues			1.5	3.0	See Note 5.
Nurseries			2.0	1.0	
Operating Rooms			2.0	1.0	No recirculation within room.
Patient Rooms		4	0	0	May exhaust through toilet room.
	4		0.3	0.3	
Physiotherapy		4	0	0	
	4		0.6	0.3	
Recovery Rooms			1.0	1.0	No recirculation within room.
Sterilizing Equipment Rooms			1.6	1.6	No recirculation within room. See Note 5.
Treatment Rooms			0.6	0.3	
X-Ray operator's rooms			0.6	0.3	
Hotels, Motels and Dormitories					
Banquet Halls/Assembly Pre-function			2.0	1.5	
Hotels (Lobby)		4	0	0	
	4		1.0	NR	
Sleeping Rooms		4	0	0	May exhaust through toilet room.
	4		0.3	0.3	
Foyers except the above			0	0	
Sleeping Rooms (Dormitories)		4	NV	NV	See Chapter 1 172 Light and Ventilation.
Offices					
Lunch Rooms - no cooking		4	0	0	
	4		1.5	1.5	

Offices and computer rooms		4	0	0	
	4		0.6	0.3	
Entrance lobby		4	0	0	
	4		1.0	NR	
Private Dwellings (Single and Multiple)					
Living Quarters			NV	NV	See Chapter 1 172.
Living Quarters (Kitchen)		4	0	0	See Notes 1 an
	4		0	1.5	
Toilet Rooms (residential)		4	0	0	See Notes 2 an
	4		0	1.5	
Residential Dryers	NA	NA	0		See Notes 3 an
Multi-Purpose Rooms	NR	NR	0.3	0.3 or R.O.	
Public Spaces					
Corridors			NR	NR	
Dressing Rooms		4	0	0	
	4		1.0	1.2	
Janitor's Closet			0	2.0	See Note 5.
Locker Rooms		4	0	0	See Note 5.
	4		0.3	1.2	
Pedestrian Passageways (below grade)			1.5	1.0	
Pedestrian Passageways (above grade)		4	0	0	
	4		1.5	1.0	
Shower Rooms		4	0	0	
Smoking Rooms		4	0	0	See Note 5.
	4		1.0	1.5	
Toilet Rooms		4	0	0	See Note 5.
	4		0	2.0	
Waiting Rooms		4	0	0	
	4		1.0	1.0	
Retail Stores					
Malls		4	0	0	
	4		1.0	1.0	
Retail Stores		4	0	0	
	4		1.0	1.0	
Specialty Shops					

Auto and vehicle washing (attended)			1.0	1.0	See Note 5.
Auto repair shops			1.0	1.0	See Note 5.
Photo materials and engraving		4	0	0	See 18-28-403
	4		1.0	1.0	
Beauty Parlors/Barber Shops		4	0	0	See Note 5.
	4		1.2	1.2	
Theaters					
Auditoriums (including stage)		4	0	0	
	4		2.0	1.5	
Concert Halls		4	0	0	
	4		2.0	1.5	
Foyers in Theaters			1.0	1.0	
	4		2.0	1.0	
Studios - motion picture, radio, TV			1.5	0.75	Or RO.
Theatrical Community Centers		4	0	0	
	4		1.5	0.75	
Workrooms					
Workshops not otherwise classified		4	0	0	See 18-28- 403.3.3.
	4		1.2	1.2	
Wood working shop	0	4	0	0	See Article 5 Makeup air is required when direct exhaust is 1000 CFM.
	4		1.2	1.2	
Spray Finishing		4			See Article 5 Makeup air is required when direct exhaust is 1000 CFM.
	4		1.5	1.2	
Spray Booths		4			See Article 5 Makeup air is required when direct exhaust is 1000 CFM.
	4		1.5	1.5	
Bank Vaults Attended			0.6	0.3	
Battery Charging - Dry Cell Batteries			NR	0.5	3 or more batteries.
- Other Batteries			NR	1.0	

Sports and Amusement Bowling Alleys (seating areas)		4	0	0	
	4		1.7	0.85	
Ball Rooms		4	0	0	
	4		2.0	1.5	
Cabarets		4	0	0	
	4		2.0	1.5	
Dance Halls/Discos		4	0	0	
	4		2.0	1.5	
Game Rooms/Arcades		4	0	0	
	4		1.6	1.6	
Gymnasiums		4	0	0	Or RO.
	4		2.0	1.5	
Natatoriums (deck and seating)		4	0	0	
	4		2.0	1.5	
Recreation Rooms		4	0	0	
	4		2.0	1.5	
Skating Rinks, Ice Arenas		4	0	0	
	4		1.5	1.5	
Skating Rinks, Roller		4	0	0	
	4		2.0	1.5	
Storage					
Storage inactive			0	0	
Storage active			0.5	0.5	
Storage cold (no permanent occupancy)			0	0	
Vault, Storage			NR	NR	
Laboratories					
Laboratories		5	0	0	See 18-28-403.3.3.
	5		1.2	1.2	
Animal Rooms			0	1.5	
Religious					
Auditoriums for worship/Chapels		4	0	0	Or RO.
	4		1.5	0.75	
Special Use					
Convention Halls		4	0	0	
	4		2.0	1.5	
		4	0	0	

Council Chambers	4		2.0	1.5	
Court Rooms		4	0	0	
	4		2.0	1.5	
Exhibition Rooms			1.5	0.75	Or RO.
Fraternal Rooms			1.5	0.75	Or RO.
Lodge Halls			1.5	0.75	Or RO.
Museums			0.6	NR	Or RO.
Garages/Parking Structures					See Miscellaneous
Garages, 6 or more cars			0.75	1.0	
			RO	1.0	
Garages, less than 6 cars			RO	RO	1.0 sf of open per car.
Garages in or attached to Hospitals			0.75	1.0	Exhaust duct, gauge.
			RO	1.0	

Note 1. When a common exhaust system serves multiple kitchens, a minimum 75% of the ordinance air shall be used in sizing of central fan and ductwork, provided automatic controls are installed to shut off exhaust from individual kitchens when not in use.

Note 2. When a common exhaust serves multiple toilet rooms, a minimum 50% of the ordinance air shall be used in sizing of central fan and ductwork, provided automatic controls are installed to shut off exhaust from individual toilet rooms when not in use.

Note 3. Provide a minimum room exhaust of 110 CFM per electric dryer.

Note 4. Corridor make-up air system for residential building over 55 feet in height shall be sized to equal the total of toilet, kitchen and dryer air exhaust requirements.

Note 5. There shall be no recirculation permitted from these spaces.

(Amend Coun. J. 9-14-16, p. 31143, § 8; Amend Coun. J. 3-29-17, p. 45477, § 12)

18-28-403.4 Deliberately omitted.

18-28-403.5 Deliberately omitted.

18-28-403.6 Deliberately omitted.

18-28-403.7 Deliberately omitted.

18-28-403.8 Deliberately omitted.

18-28-403.9 Exhaust through direct openings or ducts.

If a mechanical ventilating exhaust system is required in any room, air may be exhausted to corridors or uninhabited rooms through direct openings or horizontal ducts not to exceed 5 feet (1525 mm) in length if all of the following requirements are met:

1. The room being supplied does not contain dangerous or noxious fumes, odor or dust; and
2. Adequate relief openings for mechanical exhaust exist in such corridors or uninhabited rooms.

18-28-403.10 Garages.

For the purpose of all garage ventilation requirements found in Table 18-28-403.3, the following rules shall apply: If a building is used for active storage of cars only, relief openings may be located in walls, areaways or roofs. If the garage is capable of accommodating

six cars or more and is used for active storage of cars only, the required air supply may be unheated.

(Amend Coun. J. 3-29-17, p. 45477, § 12)

18-28-403.11 Multi-purpose rooms.

If a room is used for two or more purposes, each of which is subject to different ventilating requirements, and it is possible to determine the space which will be used for each purpose, then each such space may be considered as a separate room and ventilated in accordance with the table of ventilating requirements applicable to that room. If it is not possible to determine the space which will be used for each purpose, the most restrictive, applicable ventilating requirements shall apply to the entire room.

18-28-403.12 Partitions.

If a partition stops at a distance of 2 feet or more below ceiling level, the partition shall not be considered to form an independent room; the space on both sides of the partition shall be considered to form one room. A grille with an opening of not less than 75 percent free area may be placed in the 2 feet space. Door height shall not be considered to be part of the partition.

18-28-403.13 Public garages.

If a mechanical ventilating system is used in a public garage, the system shall not be required to operate continuously if the system is equipped with an approved detection device that operates automatically upon detection of a concentration of carbon monoxide of 50 parts per million (ppm). The minimum density of carbon monoxide detectors shall be one detector for every 5,000 square feet of garage floor area. If the general exhaust of a building is discharged into a mechanically-exhausted public garage, the garage exhaust system shall exhaust at least 100 percent of the ordinance required air.

18-28-403.14 Compliance.

The applicant for any permit ventilation schedule in a form substantially similar to Table 18-28-403.14 shall be submitted with permit plans to demonstrate compliance with the Ventilation Article of this chapter.

Table 18-28-403.14

Ventilation											
Room Description			Ordinance Requirements				Actual Provided				Remarks/ Room Function
			Natural Light & Ventil. (SF)		Mechanical Ventil. (CFM)		Natural Light & Ventil. (SF)		Mechanical Ventil. (CFM)		
Room No.	Room Name	Floor Area (Sf)	Glass Area	Vent Area	Supply Area	Exhaust Air from Room	Glass Area	Vent Area	Supply Air	Exhaust Air from Room	
-	-	-	-	-	-	-	-	-	-	-	-

18-28-403.15 Miscellaneous spaces.

1. *Generator Rooms.* A room or rooms with generator(s) shall meet air flow and combustion air requirements as noted in the Chicago Electrical Code, 18-27-701, Legally Required Standby Generating Systems - Ventilating Air.

18-28-404 Deliberately omitted.

18-28-405 Deliberately omitted.

18-28-406 Deliberately omitted.

Article V. Exhaust Systems (18-28-501 et seq.)

18-28-501 General.

18-28-501.1 Scope.

This chapter shall govern the design, construction and installation of mechanical exhaust systems, including dust, stock and refuse conveyor systems and exhaust systems serving commercial food heat- processing appliances.

18-28-501.2 Independent system required.

Single or combined mechanical exhaust systems from bath, toilet, urinal, locker, service sink closets and similar rooms shall be independent of all other exhaust systems. Type I exhaust systems shall be independent of all other exhaust systems except as provided in Section 18-28-506.3.6. Single or combined Type II exhaust systems for food- processing operations shall be independent of all other exhaust systems. Kitchen exhaust systems shall be constructed in accordance with Section 18-28-505 for domestic equipment and Sections 18-28-506 through 18-28-509 for commercial equipment.

18-28-501.3 Outdoor discharge.

The air removed by every mechanical exhaust system shall be discharged outdoors at a point where it will not cause a nuisance and from which it cannot again be readily drawn in by a ventilating system. Air shall not be exhausted into an attic or crawl space.

Exception: Whole-house ventilation-type attic fans that discharge into the attic space of dwelling units having private attics shall not be prohibited.

18-28-501.4 Pressure equalization.

Mechanical exhaust systems shall be sized to remove the quantity of air required by this article to be exhausted. The system shall operate when air is required to be exhausted. Where mechanical exhaust is required in a room or space in occupancies other than in Group R-3, such space shall be maintained with a neutral or negative pressure. If a greater quantity of air is supplied by a mechanical ventilating supply system than is removed by a mechanical exhaust system for a room, adequate means shall be provided for the natural exit of the excess air supplied. If only a mechanical exhaust system is installed for a room or if a greater quantity of air is removed by a mechanical exhaust system than is supplied by a mechanical ventilating supply system for a room, adequate means shall be provided for the natural supply of the deficiency in the air supplied. Mechanical exhaust system shall have the capacity to exhaust air to the out-of-doors equal to or greater than 90% of the total outside air required by Article 4, Ventilation. This requirement can be met through the use of mechanical exhaust systems, relief openings where allowed per Article 4, Ventilation, or a combination of both.

18-28-501.5 Ducts.

Where exhaust duct construction is not specified in this chapter, such construction shall comply with Article 6, Duct System.

18-28-502 Required Systems.

18-28-502.1 General.

An exhaust system shall be provided, maintained and operated as specifically required by this section and for all occupied areas where machines, vats, tanks, furnaces, forges, salamanders and other appliances, equipment and processes in such areas produce or throw off dust or particles sufficiently light to float in the air, or which emit heat, odors, fumes, spray, gas or smoke, in such areas produce or throw off dust or particles sufficiently light to float in the air, or which emit heat, odors, fumes, spray, gas or smoke, in such quantities so as to be irritating or injurious to health or safety.

18-28-502.1.1 Exhaust location.

The inlet to an exhaust system shall be located in the area of heaviest concentration of contaminants.

18-28-502.1.2 Fuel-dispensing areas.

The bottom of an air inlet or exhaust opening in fuel-dispensing areas shall be located not more than 18 inches (457 mm) above the floor.

18-28-502.1.3 Equipment, appliance and service rooms.

Equipment, appliance and system service rooms that house sources of odors, fumes, noxious gases, smoke, steam, dust, spray or other contaminants shall be designed and constructed so as to prevent spreading of such contaminants to other occupied part of the building.

18-28-502.1.4 Hazardous exhaust.

The mechanical exhaust of high concentrations of dust or hazardous vapors shall conform to the requirements of Section 18-28-510.

18-28-502.2 Aircraft fueling and defueling.

Compartments housing piping, pumps, air eliminators, water separators, hose reels and similar equipment used in aircraft fueling and defueling operations shall be adequately ventilated at floor level or within the floor itself.

18-28-502.3 Battery-charging areas.

Ventilation shall be provided in an approved manner in battery-charging areas to prevent a dangerous accumulation of flammable gases.

18-28-502.4 Stationary lead-acid battery systems.

Ventilation shall be provided for stationary lead-acid battery systems in accordance with this chapter and Section 18-28-502.4.1 or 18-28-502.4.2.

18-28-502.4.1 Hydrogen limit.

The ventilation system shall be designed to limit the maximum concentration of hydrogen to 1.0 percent of the total volume of the room.

18-28-502.4.2 Ventilation rate.

Continuous ventilation shall be provided at a rate of not less than 1 cubic foot per minute per square foot (cfm/ft²) [0.00508m³/(s x m²)] of floor area of the room, unless a source capture system is provided to limit the maximum concentration of hydrogen to 1.0 percent of the total volume of the room.

18-28-502.5 Dry cleaning plants.

Ventilation in dry cleaning plants shall be adequate to protect employees and the public in accordance with this section and DOL 29 CFR Part 1910, 1000, where applicable.

18-28-502.5.1 Type II systems.

Type II dry cleaning systems shall be provided with a mechanical ventilation system that is designed to exhaust 1 cubic foot of air per minute for each square foot of floor area (1 cfm/ft²)[0.00508m³/(s x m²)] in dry cleaning rooms and in drying rooms. The ventilation system shall operate automatically when the dry cleaning equipment is in operation and shall have manual controls at an approved location.

18-28-502.5.2 Type IV and V systems.

Type IV and V dry cleaning systems shall be provided with an automatically activated exhaust ventilation system to maintain a minimum of 100 feet per minute (50.8 m/s) air velocity through the loading door when the door is opened.

Exception: Dry cleaning units are not required to be provided with exhaust ventilation where an exhaust hood is installed immediately outside of and above the loading door which operates at an airflow rate as follows:

$$Q = 100 \times A_{LD}$$

(Equation 5-1)

where:

Q = Flow rate exhausted through the hood, cubic feet per minute.

A_{LD} = Area of the loading door, square feet.

18-28-502.5.3 Spotting and pretreating.

Scrubbing tubs, scouring, brushing or spotting operations shall be located such that solvent vapors are captured and exhausted by the ventilating system.

18-28-502.6 Application of flammable finishes.

Mechanical exhaust as required by this section shall be provided for operations involving the application of flammable finishes.

18-28-502.6.1 During construction.

Ventilation shall be provided for operations involving the application of materials containing flammable solvents in the course of construction, alteration or demolition of a structure.

18-28-502.6.2 Limited spraying spaces.

Positive mechanical ventilation which provided a minimum of six complete air changes per hour shall be installed in limited spraying spaces. Such system shall meet the requirements of the Fire Code for handling flammable vapors. Explosion venting is not required.

18-28-502.6.3 Spraying areas.

Mechanical ventilation of spraying areas shall be provided in accordance with Sections 18-28-502.6.3.1 through 18-28-502.6.3.7.

18-28-502.6.3.1 Operation.

Mechanical ventilation shall be kept in operation at all times while spraying operations are being conducted and for a sufficient time thereafter to allow vapors from drying coated articles and finishing material residue to be exhausted. Spraying equipment shall be interlocked with the ventilation of the spraying area such that spraying operations cannot be conducted unless the ventilation system is in operation.

18-28-502.6.3.2 Recirculation.

Air exhausted from spraying operations shall not be recirculated.

Exceptions:

1. Air exhausted from spraying operations shall be permitted to be recirculated as makeup air for unmanned spray operations provided that:

1.1 Solid particulate has been removed.

1.2 The vapor concentration is less than 25 percent of the lower flammability limit (LFL).

1.3 Approved equipment is used to monitor the vapor concentration.

1.4 An alarm is sounded and spray operations are automatically shut down if the vapor concentration exceeds 25 percent of the LFL.

1.5 The spray booths, spray spaces or spray rooms involved in any recirculation process shall be provided with mechanical ventilation that shall automatically exhaust 100 percent of the required air volume in the event of shutdown by approved equipment used to monitor vapor concentrations.

2. Air exhausted from spraying operations shall be permitted to be recirculated as makeup air to manned spraying operations if all of the conditions provided in Exception 1 are included in the installation and documents have been prepared to show that the installation does not present life safety hazards to personnel inside the spray booth, spray, space or spray room.

18-28-502.6.3.3 Air velocity.

Ventilation systems shall be designed, installed and maintained such that the average air velocity over the open face of the booth, or booth cross sectional in the direction of airflow during spraying operations, is not less than 100 feet per minute (0.51 m/s).

18-28-502.6.3.4 Ventilation obstruction.

Articles being sprayed shall be positioned in a manner that does not obstruct collection of overspray.

18-28-502.6.3.5 Independent ducts.

Each spray booth and spray room shall have an independent exhaust duct system discharging to the outdoors.

Exceptions:

1. Multiple spray booths having a combined frontal area of 18 square feet (1.67m²) or less are allowed to have a common exhaust where identical spray-finishing material is used in each booth. If more than one fan serves one booth, such fans shall be interconnected so that all fans operate simultaneously.

2. Where treatment of exhaust is necessary for air pollution control or energy conservation, ducts shall be allowed to be manifolded if all of the following conditions are met:

2.1 The sprayed materials used are compatible and will not react or cause ignition of the residue in the ducts.

2.2 Nitrocellulose-based finishing material shall not be used.

2.3. A filtering system shall be provided to reduce the amount of overspray carried into the duct manifold.

2.4. Automatic sprinkler protection shall be provided at the junction of each booth exhaust with the manifold, in addition to the protection required by this chapter.

18-28-502.6.3.6 Termination point.

The termination point for exhaust ducts discharging to the out-of-doors shall be located with the following minimum distances.

1. For ducts conveying explosive or flammable vapors, fumes or dusts: 30 feet (9144 mm) from the property line; 10 feet (3048 mm) from openings into the building; 6 feet (18829 mm) from exterior walls and roofs; 30 feet (9144 mm) from combustible walls and openings into the building which are in the direction of the exhaust discharge; 10 feet (3048 mm) above adjoining grade.

2. For environmental air duct exhaust: 3 feet (914 mm) from the property line; 3 feet (914 mm) from openings into the building.

3. For environmental air duct exhaust 3 feet (914 mm) from the property line; 3 feet (914 mm) from openings into the building.

18-28-502.6.3.7 Fan motors and belts.

Electric motors driving exhaust fans shall not be placed inside booths or ducts. Fan rotating elements shall be nonferrous or nonsparking or the casing shall consist of, or be lined with, such material. Belts shall not enter the duct or booth unless the belt and pulley within the duct are tightly enclosed.

18-28-502.6.4 Dipping operations.

Vapor areas of dip tank operations shall be provided with mechanical ventilation adequate to prevent the dangerous accumulation of vapors. Required ventilation systems shall be so arranged that the failure of any ventilating fan will automatically stop the dipping conveyor system.

18-28-502.6.5 Electrostatic apparatus.

The spraying area in spray-finishing operations involving electrostatic apparatus and devices shall be ventilated in accordance with Section 18-28-502.6.3.

18-28-502.6.6 Powder coating.

Exhaust ventilation for powder-coating operations shall be sufficient to maintain the atmosphere below the LFL for the material being applied. Nondeposited, air-suspended powders shall be removed through exhaust ducts to the powder recovery cyclone or receptacle.

18-28-502.6.7 Floor resurfacing operations.

To prevent the accumulation of flammable vapors during floor resurfacing operations, mechanical ventilation at a minimum rate of 1 cfm/ft² [0.00508m³/(s x m²)] of area being finished shall be provided. Such exhaust shall be by approved temporary or portable means. Vapors shall be exhausted to the exterior of the building.

18-28-502.7 Hazardous materials - general requirements.

Exhaust ventilation systems for structures containing hazardous materials shall be provided as required in Sections 18-28-502.7.1 through 18-28-502.7.5.

18-28-502.7.1 Storage in excess of the maximum allowable quantities.

Indoor storage areas and storage buildings for hazardous materials in amounts exceeding the maximum allowable quantity per control

area shall be provided with mechanical exhaust ventilation or natural ventilation where natural ventilation can be shown to be acceptable for the materials as stored.

Exception: Storage areas for flammable solids complying with the requirements of the Fire Code.

18-28-502.7.1.1 System requirements.

Exhaust ventilation systems shall comply with all of the following:

1. The installation shall be in accordance with the building code.
2. Mechanical ventilation shall be provided at a rate of not less than 1 cfm/ft² [0.00508m³/(s x m²)] of floor area over the storage area.
3. The systems shall operate continuously unless alternate designs are approved.
4. A manual shutoff control shall be provided outside of the room in a position adjacent to the access door to the room or in another approved location. The switch shall be of the break-glass type and shall be labeled: VENTILATION SYSTEM EMERGENCY SHUTOFF.
5. The exhaust ventilation system shall be designed to consider the density of the potential fumes or vapors released. For fumes or vapors that are heavier than air, exhaust shall be taken from a point within 6 inches (152 mm) of the floor.
6. The location of both the exhaust and inlet air openings shall be designed to provide air movement across all portions of the floor or room to prevent the accumulation of vapors.
7. The exhaust ventilation shall not be recirculated within the room or building if the materials stored are capable of emitting hazardous vapors.

18-28-502.7.2 Gas rooms, exhausted enclosures and gas cabinets.

The ventilation system for gas rooms, exhausted enclosures and gas cabinets for any quantity of hazardous material shall be designed to operate at a negative pressure in relation to the surrounding area. Highly toxic and toxic gases shall also comply with Sections 18-28-502.8.7.1, 18-28-502.8.7.2 and 18-28-502.8.8.4.

18-28-502.7.3 Indoor dispensing and use.

Indoor dispensing and use areas for hazardous materials in amounts exceeding the maximum allowable quantity per control area shall be provided with exhaust ventilation in accordance with Section 18-28-502.7.1.

Exception: Ventilation is not required for dispensing and use of flammable solids other than finely divided particles.

18-28-502.7.4 Indoor dispensing and use - point sources.

Where gases, liquids or solids in amounts exceeding the maximum allowable quantity per control area and having a hazard ranking of 3 or 4 in accordance with NFPA 704 are dispensed or used, mechanical exhaust ventilation shall be provided to capture fumes, mists or vapors at the point of generation.

Exception: Where it can be demonstrated that the gases, liquids or solids do not create harmful or flammable fumes, mists or vapors.

18-28-502.7.5 Closed systems.

Where closed systems for the use of hazardous materials in amounts exceeding the maximum allowable quantity per control area are designed to be opened as part of normal operations, ventilation shall be provided in accordance with Section 18-28-502.7.4.

18-28-502.8 Hazardous materials - requirements for specific materials.

Exhaust ventilation systems for specific hazardous materials shall be provided as required in Section 18-28-502.7 and Sections 18-28-502.8.1 through 18-28-502.8.11.

18-28-502.8.1 Compressed gases - medical gas systems.

Rooms for the storage of compressed medical gases in amounts exceeding the maximum allowable exempt quantity per control area, and which do not have an exterior wall, shall be exhausted through a duct to the exterior of the building. Both separate airstreams shall

be enclosed in a 1-hour-rated shaft enclosure from the room to the exterior. Approved mechanical ventilation shall be provided at a minimum rate of 1 cfm/ft² [0.00508m³/(s x m²)] of the area of the room.

Gas cabinets for the storage of compressed medical gases in amounts exceeding the maximum allowable quantity per control area shall be connected to an exhaust system. The average velocity of ventilation at the face of access ports or windows shall be not less than 200 feet per minute (1.02 m/s) with a minimum velocity of 150 feet per minute (0.76 m/s) at any point at the access port or window.

18-28-502.8.2 Corrosives.

Where corrosive materials in amounts exceeding the maximum allowable quantity per control area are dispensed or used, mechanical exhaust ventilation in accordance with Section 18-28-502.7.4 shall be provided.

18-28-502.8.3 Cryogenics.

Storage areas for stationary or portable containers of cryogenic fluids in any quantity shall be ventilated in accordance with Section 18-28-502.7. Indoor areas where cryogenic fluids in any quantity are dispensed shall be ventilated in accordance with the requirements of Section 18-28-502.7.4 in a manner that captures any vapor at the point of generation.

Exception: Ventilation for indoor dispensing areas is not required where it can be demonstrated that the cryogenic fluids do not create harmful vapors.

18-28-502.8.4 Explosives.

Squirrel cage blowers shall not be used for exhausting hazardous fumes, vapors or gases in operating buildings and rooms for the manufacture, assembly or testing of explosives. Only nonferrous fan blades shall be used for fans located within the ductwork and through which hazardous materials are exhausted. Motors shall be located outside the duct.

18-28-502.8.5 Flammable and combustible liquids.

Exhaust ventilation systems shall be provided as required by Sections 18-28-502.8.5.1 through 18-28-502.8.5.5 for the storage, use, dispensing, mixing and handling of flammable and combustible liquids. Unless otherwise specified, this section shall apply to any quantity of flammable and combustible liquids.

Exception: This section shall not apply to flammable and combustible liquids that are exempt from the Chicago Fire Code.

18-28-502.8.5.1 Vaults.

Vaults that contain tanks of Class I liquids shall be provided with continuous ventilation at a rate of not less than 1 cfm/ft² of floor area [0.00508m³/(s x m²)], but not less than 150 cfm (4 m³/min). Failure of the exhaust airflow shall automatically shut down the dispensing system. The exhaust system shall be designed to provide air movement across all parts of the vault floor. Supply and exhaust ducts shall extend to a point not greater than 12 inches (305 mm) and not less than 3 inches (76 mm) above the floor. The exhaust system shall be installed in accordance with the provisions of NFPA 91. Means shall be provided to automatically detect any flammable vapors and to automatically shut down the dispensing system upon detection of such flammable vapors in the exhaust duct at a concentration of 25 percent of the LFL.

18-28-502.8.5.2 Storage rooms and warehouses.

Liquid storage rooms and liquid storage warehouses for quantities of liquids exceeding those specified in the Chicago Fire Code shall be ventilated in accordance with Section 18-28-502.7.1.

18-28-502.8.5.3 Cleaning machines.

Areas in which machines used for parts cleaning in accordance with the Chicago Fire Code are located shall be adequately ventilated to prevent accumulation of vapors.

18-28-502.8.5.4 Use, dispensing and mixing.

Continuous mechanical ventilation shall be provided for the use, dispensing and mixing of flammable and combustible liquids in open or closed systems in amounts exceeding the maximum allowable quantity per control area and for bulk transfer and process transfer operations. The ventilation rate shall be not less than 1 cfm/ft² [0.00508m³/(s x m²)] of floor area over the design area. Provisions shall be made for the introduction of makeup air in a manner that will include all floor areas or pits where vapors can collect. Local or spot ventilation shall be provided where needed to prevent the accumulation of hazardous vapors.

18-28-502.8.5.5 Bulk plants or terminals.

Ventilation shall be provided for portions of properties where flammable and combustible liquids are received by tank vessels as required by Sections 18-28-502.8.5.5.1 through 18-28-502.8.5.5.3.

18-28-502.8.5.5.1 General.

Ventilation shall be provided for rooms, buildings and enclosures in which Class I liquids are pumped, used or transferred. Design of ventilation systems shall consider the relatively high specific gravity of the vapors. Where natural ventilation is used, adequate openings in outside walls at floor level, unobstructed except by louvers or coarse screens, shall be provided. Where natural ventilation is inadequate, mechanical ventilation shall be provided.

18-28-502.8.5.5.2 Basements and pits.

Class I liquids shall not be stored or used within a building having a basement or pit into which flammable vapors can travel, unless such area is provided with ventilation designed to prevent the accumulation of flammable vapors therein.

18-28-502.8.5.5.3 Dispensing of Class I liquids.

Containers of Class I liquids shall not be drawn from or filled within buildings unless a provision is made to prevent the accumulation of flammable vapors in hazardous concentrations. Where mechanical ventilation is required, it shall be kept in operation while flammable vapors could be present.

18-28-502.8.6 Highly toxic and toxic liquids.

Ventilation exhaust shall be provided for highly toxic and toxic liquids as required by Sections 18-28-502.8.6.1 and 18-28-502.8.6.2.

18-28-502.8.6.1 Treatment system.

This provision shall apply to indoor and outdoor storage and use of highly toxic and toxic liquids in amounts exceeding the maximum allowable quantities per control area. Exhaust scrubbers or other systems for processing vapors of highly toxic liquids shall be provided where a spill or accidental release of such liquids can be expected to release highly toxic vapors at normal temperature and pressure.

18-28-502.8.6.2 Open and closed systems.

Mechanical exhaust ventilation shall be provided for highly toxic and toxic liquids used in open systems in accordance with Section 18-28-502.7.4. Mechanical exhaust ventilation shall be provided for highly toxic and toxic liquids used in closed systems in accordance with Section 18-28-502.7.5.

Exception: Liquids or solids that do not generate highly toxic or toxic fumes, mists or vapors.

18-28-502.8.7 High toxic and toxic compressed - any quantity.

Ventilation exhaust shall be provided for highly toxic and toxic compressed gases in any quantity as required by Sections 18-28-502.8.7.1 and 18-28-502.8.7.2.

18-28-502.8.7.1 Gas cabinets.

Gas cabinets containing highly toxic or toxic compressed gases in any quantity shall comply with Section 18-28-502.7.2 and the following requirements:

1. The average ventilation velocity at the face of gas cabinet access ports or windows shall be not less than 200 feet per minute (1.02 m/s) with a minimum velocity of 150 feet per minute (0.76 m/s) at any point at the access port or window.
2. Gas cabinets shall be connected to an exhaust system.
3. Gas cabinets shall not be used as the sole means of exhaust for any room or area.

18-28-502.8.7.2 Exhausted enclosures.

Exhausted enclosures containing highly toxic or toxic compressed gases in any quantity shall comply with Section 18-28-502.7.2 and the following requirements:

1. The average ventilation velocity at the face of the enclosure shall be not less than 200 feet per minute (1.02 m/s) with a minimum velocity of 150 feet per minute (0.76 m/s).

2. Exhausted enclosures shall be connected to an exhaust system.

3. Exhausted enclosures shall not be used as the sole means of exhaust for any room or area.

18-28-502.8.8 Highly toxic and toxic compressed gases - quantities exceeding the maximum allowable per control area.

Ventilation exhaust shall be provided for highly toxic and toxic compressed gases in amounts exceeding the maximum allowable quantities per control area as required by Sections 18-28-502.8.8.1 through 18-28-502.8.8.6.

18-28-502.8.8.1 Ventilated areas.

The room or area in which indoor gas cabinets or exhausted enclosures are located shall be provided with exhaust ventilation. Gas cabinets or exhausted enclosures shall not be used as the sole means of exhaust for any room or area.

18-28-502.8.8.2 Local exhaust for portable tanks.

A means of local exhaust shall be provided to capture leakage from indoor and outdoor portable tanks. The local exhaust shall consist of portable ducts or collection systems designed to be applied to the site of a leak in a valve or fitting on the tank. The local exhaust system shall be located in a gas room. Exhaust shall be directed to a treatment system where required by the Chicago Fire Code.

18-28-502.8.8.3 Piping and controls - stationary tanks.

Filling or dispensing connections on indoor stationary tanks shall be provided with a means of local exhaust. Such exhaust shall be designed to capture fumes and vapors. The exhaust shall be directed to a treatment system where required by the Chicago Fire Code.

18-28-502.8.8.4 Gas rooms.

The ventilation system for gas rooms shall be designed to operate at a negative pressure in relation to the surrounding area. The exhaust ventilation from gas rooms shall be directed to an exhaust system.

18-28-502.8.8.5 Treatment system.

The exhaust ventilation from gas cabinets, exhausted enclosures and gas rooms, and local exhaust systems required in Sections 18-28-502.8.8.2 and 18-28-502.8.8.3 shall be directed to a treatment system where required by the Chicago Fire Code.

18-28-502.8.8.6 Process equipment.

Effluent from indoor and outdoor process equipment containing highly toxic or toxic compressed gases which could be discharged to the atmosphere shall be processed through an exhaust scrubber or other processing system. Such systems shall be in accordance with the Chicago Fire Code.

18-28-502.8.9 Ozone gas generators.

Ozone cabinets and ozone gas-generator rooms for systems having a maximum ozone-generating capacity of 1/2 pound (0.23 kg) or more over a 24-hour period shall be mechanically ventilated at a rate of not less than six air changes per hour. For cabinets, the average velocity of ventilation at makeup air openings with cabinet doors closed shall be not less than 200 feet per minute (1.02 m/s).

18-28-502.8.10 LP-gas distribution facilities.

LP-gas distribution facilities shall be ventilated in accordance with NFPA 58.

18-28-502.8.10.1 Portable container use.

Above-grade under floor spaces or basements in which portable LP-gas containers are used or are stored awaiting use or resale shall be provided with an approved means of ventilation.

Exception: Department of Transportation (DOT) specification cylinders with a maximum water capacity of 2.5 pounds (1 kg) for use in completely self-contained hand torches and similar applications. The quantity of LP-gas shall not exceed 20 pounds (9 kg).

18-28-502.8.11 Silane gas.

Exhausted enclosures and gas cabinets for the indoor storage of silane gas in amounts exceeding the maximum allowable quantities per control area shall comply with this section.

1. Exhausted enclosures and gas cabinets shall be in accordance with Section 18-28-502.7.2.

2. The velocity of ventilation across unwelded fittings and connections on the piping system shall not be less than 200 feet per minute (1.02 m/s).

3. The average velocity at the face of the access ports or windows in the gas cabinet shall not be less than 200 feet per minute (1.02 m/s) with a minimum velocity of 150 feet per minute (0.76 m/s) at any point at the access port or window.

18-28-502.9 Hazardous production materials (HPM).

Exhaust ventilation systems and materials for ducts utilized for the exhaust of HPM shall comply with this section, other applicable provisions of the building code.

18-28-502.9.1 Where required.

Exhaust ventilation systems shall be provided in the following locations in accordance with the requirements of this section.

1. *Fabrication areas.* Exhaust ventilation for fabrication areas shall comply with requirements for Hazardous Use Units and Chicago Fire Code. Additional manual control switches shall be provided at exits from the fabrication area.
2. *Workstations.* A ventilation system shall be provided to capture and exhaust fumes and vapors at workstations.
3. *Liquid storage rooms.* Exhaust ventilation for liquid storage rooms shall comply with Section 18-28-502.7.1.1 and requirements for Hazardous Use Units and Chicago Fire Code.
4. *HPM rooms.* Exhaust ventilation for HPM rooms shall comply with Section 18-28-502.7.1.1 and other applicable codes.
5. *Gas cabinets.* Exhaust ventilation for gas cabinets shall comply with Section 18-28-502.7.2. The gas cabinet ventilation system is allowed to connect to a workstation ventilation system. Exhaust ventilation for gas cabinets containing highly toxic or toxic gases shall also comply with Sections 18-28-502.8.7 and 18-28-502.8.8.
6. *Exhausted enclosures.* Exhaust ventilation for exhausted enclosures shall comply with Section 18-28-502.7.2. Exhaust ventilation for exhausted enclosures containing highly toxic or toxic gases shall also comply with Sections 18-28-502.8.7 and 18-28-502.8.8.
7. *Gas rooms.* Exhaust ventilation for gas rooms shall comply with Section 18-28-502.7.2. Exhaust ventilation for gas cabinets containing highly toxic or toxic gases shall also comply with Sections 18-28-502.8.7 and 18-28-502.8.8.

18-28-502.9.2 Penetrations.

Exhaust ducts penetrating fire barrier assemblies shall be contained in a shaft of equivalent fire- resistive construction. Exhaust ducts shall not penetrate building separation walls. Fire dampers shall not be installed in exhaust ducts.

18-28-502.9.3 Treatment systems.

Treatment systems for highly toxic and toxic gases shall comply with the Chicago Fire Code.

18-28-502.10 Motion picture projectors.

Motion picture projectors shall be exhausted in accordance with Section 18-28-502.10.1 or 18-28-502.10.2.

18-28-502.10.1 Projectors with an exhaust discharge.

Projectors equipped with an exhaust discharge shall be directly connected to a mechanical exhaust system. The exhaust system shall operate at an exhaust rate as indicated by the manufacturer's installation instructions.

18-28-502.10.2 Projectors without exhaust connection.

Projectors without an exhaust connection shall have contaminants exhausted through a mechanical exhaust system. The exhaust rate for electric arc projectors shall be a minimum of 200 cubic feet per minute (cfm) (0.09 m³/s) per lamp. The exhaust rate for xenon projectors shall be a minimum of 300 cfm (0.14 m³/s) per lamp. Xenon projector exhaust shall be at a rate such that the exterior temperature of the lamp housing does not exceed 130°F (54°C). The lamp and projection room exhaust systems, whether combined or independent, shall not be interconnected with any other exhaust or return system within the building.

18-28-502.11 Organic coating processes.

Enclosed structures involving organic coating processes in which Class I liquids are processed or handled shall be ventilated at a rate of not less than 1 cfm/ft² [0.00508m³/(s x m²)] of solid floor area. Ventilation shall be accomplished by exhaust fans that intake at

floor levels and discharge to a safe location outside the structure. Noncontaminated intake air shall be introduced in such a manner that all portions of solid floor areas are provided with continuous uniformly distributed air movement.

18-28-502.12 Public garages.

Mechanical exhaust systems for public garages, as required in Article 4, Ventilation, shall operate continuously or in accordance with Section 18-28-403.13, Public Garages.

18-28-502.13 Motor vehicle operation.

In areas where motor vehicles operate, mechanical ventilation shall be provided in accordance with Section 18-28-403, Mechanical Ventilation. Additionally, areas in which stationary motor vehicles are operated shall be provided with a source capture system that connects directly to the motor vehicle exhaust systems.

Exceptions:

1. This section shall not apply where the motor vehicles being operated or repaired are electrically powered.
2. This section shall not apply to one- and two-family dwellings.
3. This section shall not apply to motor vehicle service areas where engines are operated inside the building only for the duration necessary to move the motor vehicles in and out of the building.

18-28-502.14 Repair garages.

Where Class I liquids or LP-gas are stored or used within a building having a basement or pit wherein flammable vapors could accumulate, the basement or pit shall be provided with ventilation designed to prevent the accumulation of flammable vapors therein.

18-28-502.15 Repair garages for natural gas- and hydrogen-fueled vehicles.

Repair garages used for the repair of natural gas- or hydrogen-fueled vehicles shall be provided with an approved mechanical ventilation system. The mechanical ventilation system shall be in accordance with Sections 18-28-502.15.1 and 18-28-502.15.2.

18-28-502.15.1 Design.

Indoor locations shall be ventilated utilizing air supply inlets and exhaust outlets arranged to provide uniform air movement to the extent practical. Inlets shall be uniformly arranged on exterior walls near floor level. Outlets shall be located at the high point of the room in exterior walls or the roof.

1. Ventilation shall be by a continuous mechanical ventilation system or by a mechanical ventilation system activated by a continuously monitoring natural gas detection system activating at a gas concentration of 20 percent of the LFL or higher. In all cases, the system shall shut down the fueling system in the event of failure of the ventilation system.
2. The ventilation rate shall be at least 1 cubic foot per minute per 12 cubic feet $[0.00138\text{m}^3/(\text{s} \times \text{m}^3)]$ of room volume.

18-28-502.15.2 Operation.

The mechanical ventilation system shall operate continuously.

Exceptions:

1. Mechanical ventilation systems that are interlocked with a gas detection system designed in accordance with the Chicago Fire Code.
2. Mechanical ventilation systems in garages that are used only for the repair of vehicles fueled by liquid fuels or odorized gases, such as CNG, where the ventilation system is electrically interlocked with the lighting circuit.

18-28-502.16 Tire rebuilding or recapping.

Each room where rubber cement is used or mixed, or where flammable or combustible solvents are applied, shall be ventilated in accordance with the applicable provisions of NFPA 91.

18-28-502.16.1 Buffing machines.

Each buffing machine shall be connected to a dust-collecting system that prevents the accumulation of the dust produced by the buffing process.

18-28-502.17 Specific rooms.

Specific rooms, including bathrooms, locker rooms, smoking lounges and toilet rooms, shall be exhausted in accordance with the ventilation requirements of Article 4, Ventilation.

18-28-503 Motors and Fans.

18-28-503.1 General.

Motors and fans shall be sized to provide the required air movement. Motors in areas that contain flammable vapors or dusts shall be of a type approved for such environments. A manually operated emergency shut off shall be installed at exits from the room or space containing flammable vapor or dust. Electrical equipment and appliances used in operations that generate explosive or flammable vapors, fumes or dusts shall be interlocked with the ventilation system so that the equipment and appliances cannot be operated unless the ventilation fans are in operation. Motors for fans used to convey flammable vapors or dusts shall be located outside the duct or shall be protected with approved shields and dust proofing. Motors and fans shall be provided with a means of access for servicing and maintenance.

18-28-503.2 Fans.

Parts of fans in contact with explosive or flammable vapors, fumes or dusts shall be of nonferrous or nonsparking materials, or their casing shall be lined or constructed of such material. When the size and hardness of materials passing through a fan are capable of producing a spark, both the fan and the casing shall be of nonsparking materials. When fans are required to be spark resistant, their bearings shall not be within the airstream, and all parts of the fan shall be grounded. Fans in systems-handling materials that are capable of clogging the blades, and fans in buffing or woodworking exhaust systems, shall be of the radial-blade or tube-axial type.

18-28-503.3 Equipment and appliances identification plate.

Equipment and appliances used to exhaust explosive or flammable vapors, fumes or dusts shall bear an identification plate stating the ventilation rate for which the system was designed.

18-28-503.4 Corrosion-resistant fans.

Fans located in systems conveying corrosives shall be of materials that are resistant to the corrosive or shall be coated with corrosion-resistant materials.

18-28-504 Clothes Dryer Exhaust.

18-28-504.1 Installation.

Clothes dryers shall be exhausted in accordance with the manufacturer's instructions. Dryer exhaust systems shall be independent of all other systems and shall convey the moisture and any products of combustion to the outside of the building.

Exception: Where the make and model of an electric dryer is known and the manufacturer's installation instructions do not require exhaust, see Article 4, Ventilation for room exhaust requirements.

18-28-504.2 Exhaust penetrations.

Ducts that exhaust clothes dryers shall not penetrate or be located within any fireblocking, draftstopping or any wall, floor/ceiling or other assembly required by the Chicago Building Code to be fire-resistance rated, unless such duct is constructed of galvanized steel or aluminum of the thickness specified in Section 603.3, Metallic Ducts and the fire-resistance rating is maintained in accordance with the Chicago Building Code.

18-28-504.3 Cleanout.

Each vertical riser shall be provided with a means for cleanout.

18-28-504.4 Exhaust installation.

Dryer exhaust ducts for clothes dryers shall terminate on the outside of the building and shall be equipped with a backdraft damper. Screens shall not be installed at the duct termination. Ducts shall not be connected or installed with sheet metal screws or other fasteners that will obstruct the exhaust flow. Clothes dryer exhaust ducts shall not be connected to a gas vent connector, gas vent or chimney. Clothes dryer exhaust ducts shall not extend into or through ducts or plenums.

18-28-504.5 Make up air.

Installations exhausting more than 200 cfm (0.09 m³/s) shall be provided with makeup air. Where a closet is designed for the installation of a clothes dryer, an opening having an area of not less than 100 square inches (0.0645 m²) shall be provided in the closet enclosure.

18-28-504.6 Domestic clothes dryer ducts.

Exhaust ducts for domestic clothes dryers shall be constructed of metal and shall have a smooth interior finish. The exhaust duct shall be a minimum nominal size of 4 inches (102 mm) in diameter. The entire exhaust system shall be supported and secured in place. The male end of the duct at overlapped duct joints shall extend in the direction of air flow. Clothes dryer transition ducts used to connect the appliance to the exhaust duct system shall be limited to single lengths not to exceed 8 feet (2438 mm) and shall be listed and labeled for the application. Transition ducts shall not be concealed within construction.

18-28-504.6.1 Maximum length.

The maximum length of a clothes dryer exhaust duct shall not exceed 25 feet (7620 mm) from the dryer location to the outlet terminal. The maximum length of the duct shall be reduced 2.5 feet (762 mm) for each 45-degree (0.79 rad) bend and 5 feet (1524 mm) for each 90-degree (1.6 rad) bend. The maximum length of the exhaust duct does not include the transition duct

Exceptions:

1. Where the make and model of the clothes dryer to be installed is known and the manufacturer's installation instructions for such dryer are provided to the Building Commissioner, the maximum length of the exhaust duct may exceed 25 feet, including any transition duct, provided it is in accordance with the dryer manufacturer's installation instructions.
2. Where a central engineered exhaust dryer system is used.

18-28-504.6.2 Rough-in required.

Where a compartment or space for a domestic clothes dryer is provided, an exhaust duct system shall be installed in accordance with Sections 18-28-504.6 and 18-28-504.6.1.

18-28-504.7 Commercial clothes dryers.

The installation of dryer exhaust ducts serving Type 2 clothes dryers shall comply with the appliance manufacturer's installation instructions. Exhaust fan motors installed in exhaust systems shall be located outside of the airstream. In multiple installations, the fan shall operate continuously or be interlocked to operate when any individual unit is operating. Ducts shall have a minimum clearance of 6 inches (152 mm) to combustible materials. Clothes dryer transition ducts used to connect the appliance to the exhaust duct system shall be limited to single lengths not to exceed 8 feet (2438 mm) in length and shall be listed and labeled for the application. Transition ducts shall not be concealed within construction.

18-28-505 Domestic Kitchen Exhaust Equipment.

18-28-505.1 Domestic systems.

Where domestic range hoods and domestic appliances equipped with downdraft exhaust are located within dwelling units, such hoods and appliances shall discharge to the outdoors through ducts constructed of galvanized steel, stainless steel, aluminum or copper. Such ducts shall have smooth inner walls and shall be air tight and equipped with a backdraft damper.

18-28-506 Commercial Kitchen Grease Ducts and Exhaust Equipment.

18-28-506.1 General.

Commercial kitchen grease ducts and exhaust equipment shall comply with the requirements of this section. Commercial kitchen grease ducts shall be designed for the type of cooking appliance and hood served.

18-28-506.2 Corrosion protection.

Ducts exposed to the outside atmosphere or subject to a corrosive environment shall be protected against corrosion in an approved manner.

18-28-506.3 Ducts serving Type I hoods.

Commercial kitchen exhaust systems serving Type I hoods shall be designed, constructed and installed in accordance with Sections 18-28-506.3.1 through 18-28-506.3.13.3.

18-28-506.3.1 Exhaust fans.

Exhaust fan housings serving a Type I hood shall be constructed of steel.

Exception: Fans listed and labeled as power roof ventilators for restaurant cooking appliances.

18-28-506.3.1.1 Fan motor.

Exhaust fan motors shall be located outside of the exhaust airstream.

18-28-506.3.2 Grease duct materials.

Grease ducts serving a Type I hood shall be constructed of steel not less than 0.055 inch (1.4 mm) (No. 16 Gauge) in thickness or stainless steel not less than 0.044 inch (1.1 mm) (No. 18 Gauge) in thickness.

18-28-506.3.3 Joints, seams and penetrations of grease ducts.

Joints, seams and penetrations of grease ducts shall be made with a continuous liquid-tight weld or braze made on the external surface of the duct system.

18-28-506.3.3.1 Duct joint types.

Duct joints shall be butt joints or overlapping duct joints of either the telescoping or bell type. Overlapping joints shall be installed to prevent ledges and obstructions from collecting grease or interfering with gravity drainage to the intended collection point. The difference between the inside cross-sectional dimensions of overlapping sections of duct shall not exceed 0.25 inch (6 mm). The length of overlap for overlapping duct joints shall not exceed 2 inches (51 mm).

18-28-506.3.3.2 Duct-to-hood joints.

Duct-to-hood joints shall be made with continuous internal or external liquid-tight welded or brazed joints. Such joints shall be smooth, accessible for inspection, and without grease traps.

Exceptions: This section shall not apply to:

1. A vertical duct-to-hood collar connection made in the top plane of the hood in accordance with all of the following:

- 1.1 The hood duct opening shall have a 1-inch-deep (25 mm), full perimeter, welded flange turned down into the hood interior at an angle of 90 degrees from the plane of the opening.

- 1.2 The duct shall have a 1-inch-deep (25 mm) flange made by a 1-inch by 1-inch (25 mm by 25 mm) angle iron welded to the full perimeter of the duct not less than 1 inch (25 mm) above the bottom end of the duct.

- 1.3 A gasket rated for use at not less than 1,500°F (815°C) is installed between the duct flange and the top of the hood.

- 1.4 The duct-to-hood joint shall be secured by stud bolts not less than 0.25 inch (6.4 mm) in diameter welded to the hood with a spacing not greater than 4 inches (102 mm) on center for the full perimeter of the opening. All bolts and nuts are to be secured with lockwashers.

2. Listed and labeled duct-to-hood collar connections installed in accordance with the provisions of this Chapter 18-28.

(Amend Coun. J. 11-9-16, p. 36266, § 36)

18-28-506.3.3.3 Duct-to-exhaust fan connections.

Duct-to-exhaust fan connections shall be flanged and gasketed at the base of the fan for listed and labeled vertical discharge fans; shall be flanged, gasketed, and bolted to the inlet of the fan for side-inlet utility fans; and shall be flanged, gasketed, and bolted to the inlet and outlet of the fan for in-line fans.

18-28-506.3.3.4 Vibration isolation.

A vibration isolation connector for connecting a duct to a fan shall consist of noncombustible packing in a metal sleeve joint of approved design or shall be a coated-fabric flexible duct connector listed and labeled for the application. Vibration isolation connectors shall be installed only at the connection of a duct to a fan inlet or outlet.

18-28-506.3.4 Grease duct supports.

Grease duct bracing and supports shall be of noncombustible material securely attached to the structure and designed to carry gravity and seismic loads within the stress limitations of the Chicago Building Code. Bolts, screws, rivets and other mechanical fasteners shall not penetrate duct walls.

18-28-506.3.5 Air velocity.

Grease duct systems serving a Type I hood shall be designed and installed to provide an air velocity within the duct system of not less than 1,500 feet per minute (7.6 m/s).

Exception: The velocity limitations shall not apply within duct transitions utilized to connect ducts to differently sized or shaped openings in hoods and fans, provided that such transitions do not exceed 3 feet (914 mm) in length and are designed to prevent the trapping of grease.

18-28-506.3.6 Separation of grease duct system.

A separate grease duct system shall be provided for each Type I hood. A separate grease duct system is not required where all of the following conditions are met:

1. All interconnected hoods are located within the same story.
2. All interconnected hoods are located within the same room or in adjoining rooms.
3. Interconnecting ducts do not penetrate assemblies required to be fire-resistance rated.
4. The grease duct system does not serve solid fuel-fired appliances.

18-28-506.3.7 Clearances.

Grease duct systems serving a Type I hood shall have a clearance to combustible construction of not less than 18 inches (457 mm).

Exception: Listed and labeled factory-built commercial kitchen grease ducts installed in accordance with the Chicago Fire Code.

18-28-506.3.8 Prevention of grease accumulation.

Duct systems serving a Type I hood shall be constructed and installed so that grease cannot collect in any portion thereof, and the system shall slope not less than one-fourth unit vertical in 12 units horizontal (2-percent slope) toward the hood or toward an approved grease reservoir. Where horizontal ducts exceed 75 feet (22 860 mm) in length, the slope shall be not less than one unit vertical in 12 units horizontal (8.3-percent slope). Exhaust fans shall be positioned so that the discharge will not impinge on the roof, other equipment or appliances or parts of the structure. A vertical discharge fan shall be manufactured with an approved drain outlet at the bottom of the housing to permit drainage of grease to an approved grease reservoir.

18-28-506.3.9 Cleanouts and other openings.

Grease duct systems shall not have openings therein other than those required for proper operation and maintenance of the system. Any portion of such system having sections not provided with access from the duct entry or discharge shall be provided with cleanout openings. Cleanout openings shall be equipped with tight-fitting doors constructed of steel having a thickness not less than that required for the duct. Doors shall be equipped with a substantial method of latching, sufficient to hold the door tightly closed. Doors shall be designed so that they are operable without the use of a tool. Door assemblies, including any frames and gasketing, shall be approved for the purpose, and shall not have fasteners that penetrate the duct. Listed and labeled access door assemblies shall be installed in accordance with the terms of the listing.

18-28-506.3.9.1 Personnel entry.

Where ductwork is large enough to allow entry of personnel, not less than one approved or listed opening having dimensions not less than 20 inches by 20 inches (508 mm by 508 mm) shall be provided in the horizontal sections, and in the top of vertical risers. Where such entry is provided, the duct and its supports shall be capable of supporting the additional load and the cleanouts specified in Section 18-28-506.3.10 are not required.

18-28-506.3.10 Horizontal cleanouts.

Cleanouts located on horizontal sections of ducts shall be spaced not more than 20 feet (6096 mm) apart. The cleanouts shall be located on the side of the duct with the opening not less than 1.5 inches (38 mm) above the bottom of the duct, and not less than 1 inch (25 mm) below the top of the duct. The opening minimum dimensions shall be 12 inches (305 mm) on each side. Where the dimensions of the side of the duct prohibit the cleanout installation prescribed herein, the openings shall be on the top of the duct or the bottom of

the duct. Where located on the top of the duct, the opening edges shall be a minimum of 1 inch (25 mm) from the edges of the duct. Where located in the bottom of the duct, cleanout openings shall be designed to provide internal damming around the opening, shall be provided with gasketing to preclude grease leakage, shall provide for drainage of grease down the duct around the dam, and shall be approved for the application. Where the dimensions of the sides, top or bottom of the duct preclude the installation of the prescribed minimum-size cleanout opening, the cleanout shall be located on the duct face that affords the largest opening dimension and shall be installed with the opening edges at the prescribed distances from the duct edges as previously set forth in this section.

18-28-506.3.11 Duct enclosure.

A grease duct serving a Type I hood that penetrates a ceiling, wall or floor shall be enclosed from the point of penetration to the outlet terminal. A duct shall only penetrate exterior walls at locations where unprotected openings are permitted by building code. Ducts shall be enclosed in accordance with building code requirements for shaft construction. The duct enclosure shall be sealed around the duct at the point of penetration and vented to the outside of the building through the use of weather-protected openings. The enclosure shall be separated from the duct by a minimum of 6 inches (152 mm) and a maximum of 12 inches (305 mm) and shall serve a single grease exhaust duct system. See Section 18-28-506.3.7.

Exceptions:

1. The shaft enclosure provisions of this section shall not be required where a duct penetration is protected with a through-penetration firestop system classified in accordance with ASTM E 814 and having an "F" and "T" rating equal to the fire-resistance rating of the assembly being penetrated and where the surface of the duct is continuously covered on all sides from the point at which the duct penetrates a ceiling wall or floor to the outlet terminal with a classified and labeled material, system, method of construction or product specifically evaluated for such purpose, in accordance with a nationally recognized standard for such enclosure materials.

2. A duct enclosure shall not be required for a grease duct that penetrates only a nonfireresistance-rated roof/ceiling assembly.

18-28-506.3.12 Fire-resistive access opening.

Where cleanout openings are located in ducts within a fireresistance-rated enclosure, access openings shall be provided in the enclosure at each cleanout point. Access openings shall be equipped with tight-fitting sliding or hinged doors that are equal in fire-resistive protection to that of the shaft or enclosure. An approved sign shall be placed on access opening panels with wording as follows:

"ACCESS PANEL. DO NOT OBSTRUCT."

18-28-506.3.13 Type I exhaust outlets.

Exhaust outlets for grease ducts serving commercial food heat-processing appliances shall conform to the requirements of Sections 18-28-506.3.13.1 through 18-28-506.3.13.3.

18-28-506.3.13.1 Termination above the roof.

Exhaust outlets that terminate above the roof shall have the discharge opening located not less than 40 inches (1016 mm) above the roof surface.

18-28-506.3.13.2 Termination through an exterior wall.

Exhaust outlets shall be permitted to terminate through exterior walls where the smoke, grease, gases, vapors, and odors in the discharge from such terminations do not create a public nuisance or a fire hazard. Such terminations shall not be located where protected openings are required by the building code. Other exterior openings shall not be located within 10 feet (914 mm) of such terminations. Horizontal runs shall be direct from hood to exterior wall termination, without passing through any wall separating one business enterprise from another.

18-28-506.3.13.3 Termination location.

Exhaust outlets shall be located not less than 15 feet (3048 mm) horizontally from parts of the same or contiguous buildings, adjacent property lines and air intake openings into any building and shall be located not less than 10 feet (3048 mm) above the adjoining grade level.

Exceptions:

1. Exhaust outlets shall terminate not less than 15 feet (1524 mm) from an adjacent building, adjacent property line and air intake openings into a building where air from the exhaust outlet discharges away from such locations.

2. The minimum horizontal distance between vertical discharge fans and parapet-type building structures shall be 2 feet (610 mm) provided that such structures are not higher than the top of the fan discharge opening.

18-28-506.4 Ducts serving Type II hoods.

Commercial kitchen exhaust systems serving Type II hoods shall comply with Sections 18-28-506.4.1 and 18-28-506.4.2.

18-28-506.4.1 Type II exhaust outlets.

Exhaust outlets for ducts serving Type II hoods shall comply with Sections 18-28-401.5 and 18-28-401.5.2. Such outlets shall be protected against local weather conditions and shall meet the provisions for exterior wall opening protectives in accordance with the building code.

18-28-506.4.2 Ducts.

Ducts and plenums serving Type II hoods shall be constructed of rigid metallic materials. Duct construction, installation, bracing and supports shall comply with Chapter 6. Ducts subject to positive pressure and ducts conveying moisture-laden or waste-heat-laden air shall be constructed, joined and sealed in an approved manner.

18-28-507 Commercial Kitchen Hoods.

18-28-507.1 General.

Commercial kitchen exhaust hoods shall comply with the requirements of this section. Hoods shall be Type I or Type II and shall be designed to capture and confine cooking vapors and residues.

18-28-507.2 Where required.

A Type I or Type II hood shall be installed at or above all commercial food heat-processing appliances. A Type II hood shall be installed above commercial dishwashing machines.

Exceptions:

1. Food heat-processing appliances installed within a dwelling unit.
2. Under-counter-type commercial dishwashing machines.

18-28-507.2.1 Type I and Type II hoods.

A Type I hood shall be installed at or above all commercial food heat-processing appliances that produce grease vapors or smoke. A Type I or Type II hood shall be installed at or above all commercial food heat-processing appliances that produce fumes, steam, odor or heat.

18-28-507.2.2 Domestic cooking appliances used for commercial purposes.

Domestic cooking appliances utilized for commercial purposes shall be provided with Type I or II hoods as required for the type of appliances and processes in accordance with Sections 18-28-507.2 and 18-28-507.2.1.

18-28-507.2.3 Solid fuel.

Type I hoods for use over solid fuel-burning cooking appliances shall discharge to an exhaust system that is independent of other exhaust systems.

18-28-507.3 Fuel-burning appliances.

Where vented fuel-burning appliances are located in the same room or space as the hood, provisions shall be made to prevent the hood system from interfering with normal operation of the appliance vents.

18-28-507.4 Type I materials.

Type I hoods shall be constructed of steel not less than 0.043 inch (1.09 mm) (No. 18 MSG) in thickness, or stainless steel not less than 0.037 inch (0.94 mm) (No. 20 MSG) in thickness.

18-28-507.5 Type II hood materials.

Type II hoods shall be constructed of steel not less than 0.030 inch (0.76 mm) (No. 22 Gauge) in thickness, stainless steel not less

than 0.024 inch (0.61 mm) (No. 24 Gauge) in thickness, copper sheets weighing not less than 24 ounces per square foot (7.3 kg/m²), or of other approved material and gauge.

18-28-507.6 Supports.

Type I hoods shall be secured in place by noncombustible supports. All Type I and Type II hood supports shall be adequate for the applied load of the hood, the unsupported ductwork, the effluent loading, and the possible weight of personnel working in or on the hood.

18-28-507.7 Hood joints, seams and penetrations.

Hood joints, seams and penetrations shall comply with Sections 18-28-507.7.1 and 18-28-507.7.2.

18-28-507.7.1 Type I hoods.

External hood joints, seams and penetrations for Type I hoods shall be made with a continuous external liquid-tight weld or braze to the lowest outermost perimeter of the hood.

Internal hood joints, seams, penetrations, filter support frames, and other appendages attached inside the hood shall not be required to be welded or brazed but shall be otherwise sealed to be grease tight.

Exceptions:

1. Penetrations shall not be required to be welded or brazed where sealed by devices that are listed for the application.
2. Internal welding or brazing of seams, joints, and penetrations of the hood shall not be prohibited provided that the joint is formed smooth or ground so as to not trap grease, and is readily cleanable.
3. External hood joints and seams tested and listed in accordance with the requirements of UL 710 shall not be required to be welded or brazed.

18-28-507.7.2 Type II hoods.

Joints, seams and penetrations for Type II hoods shall be constructed as set forth in Article 4, Duct Systems and shall be sealed on the interior of the hood and shall provide a smooth surface that is readily cleanable and water tight.

18-28-507.8 Cleaning and grease gutters.

A hood shall be designed to provide for thorough cleaning of the entire hood. Grease gutters shall drain to an approved collection receptacle that is fabricated, designed and installed to allow access for cleaning.

18-28-507.9 Clearances for Type I hood.

A Type I hood shall be installed with a clearance to combustibles of not less than 18 inches (457 mm).

Exception: Clearance shall not be required from gypsum wallboard attached to noncombustible structures provided that a smooth, cleanable, nonabsorbent and noncombustible material is installed between the hood and the gypsum wallboard over an area extending not less than 18 inches (457 mm) in all directions from the hood.

18-28-507.10 Hoods penetrating a ceiling.

Type I hoods or portions thereof penetrating a ceiling, wall or furred space shall comply with all the requirements of Section 18-28-506.3.11.

18-28-507.11 Grease filters.

Type I hoods shall be equipped with listed grease filters designed for the specific purpose. Grease- collecting equipment shall be provided with access for cleaning. The lowest edge of a grease filter located above the cooking surface shall be not less than the height specified in Table 18-28-507.11.

Table 18-28-507.11

Minimum Distance Between the Lowest Edge of a Grease Filter and the Cooking Surface or the Heating Surface

Height Above Cooking Surface

Type of Cooking Appliance	(Feet)
Without expose flame	0.5
Exposed flame and burners	2
Exposed charcoal and charbroil type	3.5

For SI: 1 foot = 304.8 mm.

18-28-507.11.1 Criteria.

Filters shall be of such size, type and arrangement as will permit the required quantity of air to pass through such units at rates not exceeding those for which the filter or unit was designed or approved. Filter units shall be installed in frames or holders so as to be readily removable without the use of separate tools, unless designed and installed to be cleaned in place and the system is equipped for such cleaning in place. Removable filter units shall be of a size that will allow them to be cleaned in a dishwashing machine or pot sink. Filter units shall be arranged in place or provided with drip-intercepting devices to prevent grease or other condensate from dripping into food or on food preparation surfaces.

18-28-507.11.2 Mounting position.

Filters shall be installed at an angle of not less than 45 degrees (0.79 rad) from the horizontal and shall be equipped with a drip tray beneath the lower edge of the filters.

18-28-507.12 Canopy size and location.

The inside lower edge of canopy-type commercial cooking hoods shall overhang or extend a horizontal distance of not less than 6 inches (152 mm) beyond the edge of the cooking surface, on all open sides. The vertical distance between the front lower lip of the hood and the cooking surface shall not exceed 4 feet (1219 mm).

Exception: The hood shall be permitted to be flush with the outer edge of the cooking surface where the hood is closed to the appliance side by a noncombustible wall or panel.

18-28-507.13 Capacity of hoods.

Canopy-type commercial cooking hoods shall exhaust a minimum quantity of air (Q) determined in accordance with this section and Sections 18-28-507.13.1 through 18-28-507.13.4.

where:

A = The horizontal surface area of the hood, in square feet (m²).

D = Distance in feet (m) between the lower lip of the hood and the cooking surface.

P = That part of the perimeter of the hood that is open, in feet (m).

Q = Quantity of air, in cubic feet per minute (m³/s).

18-28-507.13.1 Solid fuel-burning cooking appliances.

The minimum airflow for Type I hoods used for solid fuel-burning cooking appliances, grease-burning charbroilers and similar appliances shall be:

Number of exposed sides

Formula

For SI:

4 (island or central hood)	$Q = 300A$	$Q = 1.52A$
3 or less	$Q = 200A$	$Q = 1.02A$
Alternate formula	$Q = 100PD$	$Q = 0.51PD$

18-28-507.13.2 High temperature.

The minimum airflow for Type I hoods used for high-temperature appliances such as deep-fat fryers shall be determined as follows:

Number of exposed sides	Formula	For SI:
4 (island or central hood)	$Q = 150A$	$Q = 0.76A$
3 or less	$Q = 100A$	$Q = 0.51A$
Alternate formula	$Q = 100PD$	$Q = 0.51PD$

18-28-507.13.3 Medium temperature.

The minimum airflow for Type I hoods used for medium-temperature appliances such as rotisseries, grills and ranges shall be determined as follows:

Number of exposed sides	Formula	For SI:
4 (island or central hood)	$Q = 100A$	$Q = 0.51A$
3 or less	$Q = 75A$	$Q = 0.38A$
Alternate formula	$Q = 50PD$	$Q = 0.25PD$

18-28-507.13.4 Low temperature.

The minimum airflow for Type I hoods used for low-temperature appliances such as medium-to-low temperature ranges, roasters, roasting ovens, pastry ovens and appliances approved for use under a Type II hood, such as pizza ovens, shall be determined as follows:

Number of exposed sides	Formula	For SI:
4 (island or central hood)	$Q = 75A$	$Q = 0.38A$
3 or less	$Q = 50A$	$Q = 0.25A$
Alternate formula	$Q = 50PD$	$Q = 0.25PD$

18-28-507.14 Noncanopy size and location.

Noncanopy-type hoods shall be located a maximum of 3 feet (914 mm) above the cooking surface. The edge of the hood shall be set back a maximum of 1 foot (305 mm) from the edge of the cooking surface.

18-28-507.15 Capacity for noncanopy hoods.

In addition to all other requirements for hoods specified in this section, the volume of air exhausting through a noncanopy-type hood to the duct system shall be not less than 300 cfm per linear foot [0.46m³/(s x m)] of the cooking appliances.

18-28-507.16 Exhaust outlets.

Exhaust outlets located within the hood shall be located so as to optimize the capture of particulate matter. Each outlet shall serve not more than a 12-foot (3658 mm) section of hood.

18-28-507.17 Performance test.

A performance test shall be conducted upon completion and before final approval of the installation of a ventilation system serving commercial food heat-processing appliances. The test shall verify the rate of airflow and proper operation as specified in this chapter.

18-28-508 Commercial Kitchen Makeup Air.

18-28-508.1 Makeup air.

Makeup air shall be supplied during the operation of commercial kitchen exhaust systems that are provided for commercial food heat-processing appliances. The amount of makeup air supplied shall be approximately equal to the amount of exhaust air. The makeup air shall not reduce the effectiveness of the exhaust system. Makeup air shall be provided by gravity or mechanical means or both. For mechanical makeup air systems, the exhaust and makeup air systems shall be electrically interlocked to insure that makeup air is provided whenever the exhaust system is in operation.

Exception: This section shall not apply to individual dwelling units.

18-28-508.1.1 Makeup air temperature.

The temperature differential between makeup air and the air in the conditioned space shall not exceed 10°F (6°C).

Exceptions:

1. Makeup air that is part of the air-conditioning system.
2. Makeup air that does not decrease the comfort conditions of the occupied space.

18-28-508.2 Compensating hoods.

Manufacturers of compensating hoods shall provide a label indicating minimum exhaust flow and maximum makeup airflow that provides capture and containment of the exhaust effluent. A minimum of the first, four feet of makeup air duct starting at the hood shall be of the same gauge as the exhaust duct. A fire damper shall be installed between the heavier- and lighter-gauge ductwork.

18-28-509 Fire Suppression Systems.

18-28-509.1 Where required.

Commercial food heat-processing appliances required by Section 18-28-507.2.1 to have a Type I hood shall be provided with an approved automatic fire suppression system complying with the building code.

18-28-510 Hazardous Exhaust Systems.

18-28-510.1 General.

This section shall govern the design and construction of duct systems for hazardous exhaust and shall determine where such systems are required. Hazardous exhaust systems are systems designed to capture and control hazardous emissions generated from product handling or processes, and convey those emissions to the outdoors. Hazardous emissions include flammable vapors, gases, fumes, mists or dusts, and volatile or airborne materials posing a health hazard, such as toxic or corrosive materials. For the purposes of this section, the health-hazard rating of materials shall be as specified in NFPA 704.

18-28-510.2 Where required.

A hazardous exhaust system shall be required wherever operations involving the handling or processing of hazardous materials, in the absence of such exhaust systems and under normal operating conditions, have the potential to create one of the following conditions:

1. A flammable vapor, gas, fume, mist or dust is present in concentrations exceeding 25 percent of the lower flammability limit of the substance for the expected room temperature.
2. A vapor, gas, fume, mist or dust with a health-hazard rating of 4 is present in any concentration.
3. A vapor, gas, fume, mist or dust with a health-hazard rating of 1, 2 or 3 is present in concentrations exceeding 1 percent of the median lethal concentration of the substance for acute inhalation toxicity.

18-28-510.2.1 Lumber yards and woodworking facilities.

Equipment or machinery located inside buildings at lumber yards and woodworking facilities which generates or emits combustible dust shall be provided with an approved dust-collection and exhaust system installed in conformance with this section and the Chicago Fire Code. Equipment and systems that are used to collect, process or convey combustible dusts shall be provided with an approved explosion-control system.

18-28-510.2.2 Combustible fibers.

Equipment or machinery within a building which generates or emits combustible fibers shall be provided with an approved dust-collecting and exhaust system. Such systems shall comply with the building code and the Chicago Fire Code.

18-28-510.3 Design and operation.

The design and operation of the exhaust system shall be such that flammable contaminants are diluted in noncontaminated air to maintain concentrations in the exhaust flow below 25 percent of the contaminant's lower flammability limit.

18-28-510.4 Independent system.

Hazardous exhaust systems shall be independent of other types of exhaust systems. Incompatible materials, as defined in the Chicago Fire Code, shall not be exhausted through the same hazardous exhaust system. Hazardous exhaust systems shall not share common shafts with other duct systems, except where such systems are hazardous exhaust systems originating in the same fire area. Contaminated air shall not be recirculated.

18-28-510.5 Design.

Systems for removal of vapors, gases and smoke shall be designed by the constant velocity or equal friction methods. Systems conveying particulate matter shall be designed employing the constant velocity method.

18-28-510.5.1 Balancing.

Systems conveying explosive or radioactive materials shall be prebalanced by duct sizing. Other systems shall be balanced by duct sizing with balancing devices, such as dampers. Dampers provided to balance airflow shall be provided with securely fixed minimum-position blocking devices to prevent restricting flow below the required volume or velocity.

18-28-510.5.2 Emission control.

The design of the system shall be such that the emissions are confined to the area in which they are generated by air currents, hoods or enclosures and shall be exhausted by a duct system to a safe location or treated by removing contaminants.

18-28-510.5.3 Hoods required.

Hoods or enclosures shall be used where contaminants originate in a limited area of a space. The design of the hood or enclosure shall be such that air currents created by the exhaust systems will capture the contaminants and transport them directly to the exhaust duct.

18-28-510.5.4 Contaminant capture and dilution.

The velocity and circulation of air in work areas shall be such that contaminants are captured by an airstream at the area where the emissions are generated and conveyed into a product-conveying duct system. Contaminated air from work areas where hazardous contaminants are generated shall be diluted below the thresholds specified in Section 18-28-510.2 with air that does not contain other hazardous contaminants.

18-28-510.5.5 Makeup air.

Makeup air shall be provided at a rate approximately equal to the rate that air is exhausted by the hazardous exhaust system. Makeup-air intakes shall be located so as to avoid recirculation of contaminated air.

18-28-510.5.6 Clearances.

The minimum clearance between hoods and combustible construction shall be the clearance required by the duct system.

18-28-510.5.7 Ducts.

Hazardous exhaust duct systems shall extend directly to the exterior of the building and shall not extend into or through ducts and plenums.

18-28-510.6 Penetrations.

Penetrations of structure elements by a hazardous exhaust system shall conform to the building code.

18-28-510.7 Suppression required.

Ducts shall be protected with an approved automatic fire suppression system installed in accordance with the building code.

Exception: An approved automatic fire suppression system shall not be required in ducts conveying materials, fumes, mists and vapors that are nonflammable and noncombustible.

18-28-510.8 Duct construction.

Ducts utilized to convey hazardous exhaust shall be constructed of approved G90 galvanized sheet steel, with a minimum nominal thickness as specified in Table 18-28-510.8.

Nonmetallic ducts utilized in systems exhausting nonflammable corrosive fumes or vapors shall be listed and labeled. Nonmetallic duct shall have a flame spread index of 25 or less and a smoke-developed index of 50 or less, when tested in accordance with ASTM E 84. Ducts shall be approved for installation in such an exhaust system. Where the products being exhausted are detrimental to the duct material, the ducts shall be constructed of alternative materials that are compatible with the exhaust.

**Table 18-28-510.8
Minimum Duct Thickness**

Diameter of Duct or Maximum Side Dimension	Minimum Nominal Thickness		
	Nonabrasive Materials	Nonabrasive/ Abrasive Materials	Abrasive Materials
0-8 inches	0.028 inch (No. 24 Gauge)	0.034 inch (No. 22 Gauge)	0.040 inch (No. 20 Gauge)
9-18 inches	0.034 inch (No. 22 Gauge)	0.040 inch (No. 20 Gauge)	0.052 inch (No. 18 Gauge)
19-30 inches	0.040 inch (No. 20 Gauge)	0.052 inch (No. 18 Gauge)	0.064 inch (No. 16 Gauge)
Over 30 inches	0.052 inch (No. 18 Gauge)	0.064 inch (No. 16 Gauge)	0.079 inch (No. 15 Gauge)

For SI: 1 inch = 25.4 mm.

(Amend Coun. J. 11-9-16, p. 36266, § 36)

18-28-510.8.1 Duct joints.

Ducts shall be made tight with lap joints having a minimum lap of 1 inch (25 mm).

18-28-510.8.2 Clearance to combustibles.

Ducts shall have a clearance to combustibles in accordance with Table 18-28-510.8.2. Exhaust gases having temperatures in excess of 600°F (316°C) shall be exhausted to a chimney in accordance with Section 18-28-511.2.

**Table 18-28-510.8.2
Clearance to Combustibles**

Type of Exhaust or Temperature of	
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Exhaust (°F)	Clearance to Combustibles (Inches)
Less than 100	1
100 - 600	12
Flammable vapors	6

For SI: 1 inch 25.4 MM; °C [(°F) - 32]/1.8.

(Amend Coun. J. 11-8-12, p. 38872, § 320)

18-28-510.8.3 Explosion relief.

Systems exhausting potentially explosive mixtures shall be protected with an approved explosion relief system or by an approved explosion prevention system designed and installed in accordance with NFPA 69. An explosion relief system shall be designed to minimize the structural and mechanical damage resulting from an explosion or deflagration within the exhaust system. An explosion prevention system shall be designed to prevent an explosion or deflagration from occurring.

18-28-510.9 Supports.

Ducts shall be supported at intervals not exceeding 10 feet (3048 mm). Supports shall be constructed of noncombustible material.

18-28-511 Dust, Stock and Refuse Conveying Systems.

18-28-511.1 Dust, stock and refuse conveying systems.

Dust, stock and refuse conveying systems shall comply with the provisions of Section 510 and Sections 18-28-511.1.1 through 18-28-511.2.

18-28-511.1.1 Collectors and separators.

Cyclone collectors and separators and associated supports shall be constructed of noncombustible materials and shall be located on the exterior of the building or structure. A collector or separator shall not be located nearer than 10 feet (3048 mm) to combustible construction or to an unprotected wall or floor opening, unless the collector is provided with a metal vent pipe that extends above the highest part of any roof within a distance of 30 feet (9144 mm).

18-28-511.1.2 Discharge pipe.

Discharge piping shall conform to the requirements for ducts, including clearances required for high-heat appliances, as contained in the building code. A delivery pipe from a cyclone collector shall not convey refuse directly into the firebox of a boiler, furnace, dutch oven, refuse burner, incinerator or other appliance.

18-28-511.1.3 Conveying system exhaust discharge.

An exhaust system shall discharge to the outside of the building either directly by flue, or indirectly through the separator, bin or vault into which the system discharges.

18-28-511.1.4 Spark protection.

The outlet of an open-air exhaust terminal shall be protected with an approved metal or other noncombustible screen to prevent the entry of sparks.

18-28-511.1.5 Explosion relief vents.

A safety or explosion relief vent shall be provided on all systems that convey combustible refuse or stock of an explosive nature, in accordance with the requirements of the Chicago Building Code.

18-28-511.1.5.1 Screens.

Where a screen is installed in a safety relief vent. the screen shall be attached so as to permit ready release under the explosion pressure.

18-28-511.1.5.2 Hoods.

The relief vent shall be provided with an approved noncombustible cowl or hood, or with a counterbalanced relief valve or cover arranged to prevent the escape of hazardous materials, gases or liquids.

18-28-511.2 Exhaust outlets.

Outlets for exhaust that exceed 600°F (315°C) shall be designed as a chimney in accordance with Table 18-28-511.2.

The termination point for exhaust ducts discharging to the atmosphere shall not be less than the following:

1. Ducts conveying explosive or flammable vapors, fumes or dusts: 30 feet (9144 mm) from property line; 10 feet (3048 mm) from openings into the building; 6 feet (1829 mm) from exterior walls or roofs; 30 feet (9144 mm) from combustible walls or openings into the building which are in the direction of the exhaust discharge; and 10 feet (3048 mm) above adjoining grade.
2. Other product-conveying outlets: 10 feet (3048 mm) from property line; 3 feet (914 mm) from exterior wall or roof; 10 feet (3048 mm) from openings into the building; and 10 feet (3048 mm) above adjoining grade.
3. Environmental air duct exhaust: 3 feet (914 mm) from property line; and 3 feet (914 mm) from openings into the building.

**Table 18-28-511.2
Construction, Clearance and Termination Requirements for Single-wall Metal Chimneys**

Chimneys Serving	Minimum Thickness		Termination				Clearance			
	Wall	Lining	Above Roof Opening (Feet)	Above Any Part of Building Within (Feet)			Combustible Construction (Inches)		Noncombustible Construction	
				10	25	50	Interior Inst.	Exterior Inst.	Interior Inst.	Exterior Inst.
Low-heat appliances (1,000°F normal operation)	0.127" (No. 10 MSG)	None	3	2	-	-	18	6		
Medium-heat appliances (2,000°F maximum)	0.127" (No. 10 MSG)	Up to 18" dia. - 2 1/2" Over 18" - 4 1/2" on 4 1/2" bed	10	-	10	-	36	24	Up to 18" diameter, 2" Over 18" diameter, 4"	
High-heat appliances (over 2,000°F)	0.127" (No. 10)	4 1/2" laid on 4 1/2"	20	-	-	20	See Footnote C			

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, °C = [(°F)-32]1.8.

- a) Lining shall extend from bottom to top of outlet.
- b) Lining shall extend from 24 inches below connector to 24 feet above.
- c) Clearance shall be as specified by the design engineer and shall have sufficient clearance from buildings and structures to avoid overheating combustible materials (maximum 160°F).

18-28-512 Subslab Soil Exhaust Systems.

18-28-512.1 General.

When a subslab soil exhaust system is provided, the duct shall conform to the requirements of this section.

18-28-512.2 Materials.

Subslab soil exhaust system duct material shall be air duct material listed and labeled to the requirements of UL 181 for Class 0 air ducts, or any of the following piping materials that comply with the Chicago Plumbing Code as building sanitary drainage and vent pipe: cast iron; galvanized steel; brass or copper pipe; copper tube of a weight not less than that of copper drainage tube, Type DWV; and plastic piping.

18-28-512.3 Grade.

Exhaust system ducts shall not be trapped and shall have a minimum slope of one-eighth unit vertical in 12 units horizontal (1-percent slope).

18-28-512.4 Termination.

Subslab soil exhaust system ducts shall extend through the roof and terminate at least 6 inches (152 mm) above the roof and at least 10 feet (3048 mm) from any operable openings or air intake.

18-28-512.5 Identification.

Subslab soil exhaust ducts shall be permanently identified within each floor level by means of a tag, stencil or other approved marking.

18-28-513 Smoke Control Systems.

18-28-513.1

See Chapter 13-76 of this Code.

(Amend Coun. J. 11-9-16, p. 36266, § 36)

18-28-513.2 through 18-28-513.20.3 Deliberately omitted.

Article VI. Duct Systems (18-28-601 et seq.)

18-28-601 General.

18-28-601.1 Scope.

Duct systems used to move air in air-conditioning, heating, ventilating and exhaust systems shall conform to the provisions of this chapter except as otherwise specified in Articles V, Exhaust Systems and Article 7, Combustion Air.

Exception: Ducts discharging combustible material directly into any combustion chamber shall be constructed of not less than 12 U.S. gauge steel casing and shall be lined with not less than 4 1/2 in. (114 mm) of firebrick (ASTM C27) Type F, medium duty, or the equivalent. The charging hopper shall not exceed 6 ft. (1.8 m) in length, measured from the floor opening to the outside of the roof of the incinerator combustion chamber.

The charging opening shall be protected by a cover extending beyond the edges of the opening for at least 2 in. (51 mm) on all sides and lined with at least 2 1/2 in. (63.5 mm) of refractory material.

The charging floor opening shall be located in a room with walls and floor and ceiling assemblies having a fire resistance rating of at least 2 hours, with openings protected by approved self-closing or automatic-closing 3-hour fire doors suitable for Class A openings. Such doors shall be kept closed during the charging operation and at other times, except when waste material is delivered to the room.

18-28-601.2 Deliberately omitted.

18-28-601.3 Contamination prevention.

Exhaust ducts under positive pressure, chimneys, vents and sanitary storm waste and vent shall not extend into or pass through ducts or plenums.

18-28-602 Plenums.

18-28-602.1 General.

A plenum is an enclosed portion of the building structure that is designed to allow air movement, and thereby serves as part of an air distribution system. Return, exhaust, and relief air plenums shall be limited to uninhabited crawl spaces, areas above a ceiling and areas below the floor, attic space and mechanical equipment rooms. Ceiling and floor plenums may be used for supply air if they are accessible for cleaning. Plenums shall be limited to one fire area. Separations between different supply plenums shall be made of sheet metal and sealed tight. Fuel-fired appliances shall not be installed within a plenum.

18-28-602.1.1 Technology centers.

Ceiling and floor plenums may be used for supply air in Technology Centers if they are accessible for cleaning. Such supply plenums shall be limited to one fire area not to exceed 2,500 square feet. Separations between different plenums shall be made of sheet metal and sealed tight.

18-28-602.2 Construction.

Plenum enclosures shall be constructed of materials permitted for the construction classification of the building.

Gypsum boards that form plenums shall be limited to return air systems if the air temperature does not exceed 125°F (52°C) and the building and mechanical systems' design conditions are such that the gypsum board surface temperature will be maintained above the airstream dew-point temperature. Gypsum return air plenums shall not be incorporated in air-handling systems that use evaporative coolers, or in mechanical equipment rooms.

18-28-602.2.1 Materials exposed within plenums.

Materials exposed within plenums shall be noncombustible or shall have a flame spread index of not more than 25 and a smoke-developed index of not more than 50 when tested in accordance with ASTM E 84. No floor drains or sanitary waste and vent piping, storm drain piping or condensate drain piping may be exposed within a supply plenum. No material which has the potential of contaminating the air stream may be located in a supply plenum.

Exceptions:

1. Rigid and flexible ducts and connectors shall conform to Section 18-28-603.
2. Duct coverings, linings, tape and connectors shall conform to Sections 18-28-603 and 18-28-604.
3. This section shall not apply to materials exposed within plenums in one- and two-family dwellings.
4. This section shall not apply to smoke detectors.

18-28-602.3 Stud cavity and joist space plenums.

Stud wall cavities and the spaces between solid floor joists to be used as air plenums shall comply with the following conditions:

1. Such cavities or spaces shall not be used as a plenum for supply air.
2. Such cavities or spaces shall not be part of a required fire-resistance-rated assembly.
3. Stud wall cavities shall not convey air from more than one floor level.
4. Stud wall cavities joist space plenums shall comply with the floor penetration protection requirements of the building code.
5. Stud wall cavities and joist space plenums shall be isolated from adjacent concealed spaces by approved fireblocking as required

by the building code.

18-28-602.4 Deliberately omitted.

18-28-603 Duct Construction and Installation.

18-28-603.1 General.

An air distribution system shall be designed and installed to supply the required distribution of air. The installation of an air distribution system shall not affect the fire protection requirements specified in the building code. Ducts shall be constructed, braced, reinforced and installed to provide structural strength and durability.

18-28-603.2 Duct classification.

Ducts shall be classified based on the maximum operating pressure of the duct at pressures of positive or negative 0.5, 1.0, 2.0, 3.0, 4.0, 6.0, or 10.0 inches of water column. The pressure classification of ducts shall equal or exceed the design pressure of the air distribution in which the ducts are utilized.

18-28-603.3 Metallic ducts.

All ducts shall be constructed of iron, steel, aluminum or other approved material. Ducts shall be constructed as specified in the SMACNA HVAC Duct Construction Standards - Metal and Flexible.

Exception: Ducts installed within single dwelling units shall have a minimum thickness as specified in Table 18-28-603.3.

**Table 18-28-603.3
Duct Construction: Minimum Sheetmetal Thicknesses for Single Dwelling Units**

Duct Size	Galvanized Steel		Approximate Aluminum B&S Gauge
	Minimum thickness (inches)	Equivalent galvanized Gauge No.	
Round ducts and enclosed rectangular ducts			
14" or less	0.013	30	26
Over 14"	0.016	28	24
Exposed rectangular ducts			
14" or less	0.016	28	24
Over 14"	0.019	26	22

For SI: 1 inch = 25.4 mm

18-28-603.4 Deliberately omitted.

18-28-603.4.1 Gypsum ducts.

Gypsum boards that form air shafts (ducts) shall be limited to vertical return shafts where the air temperatures do not exceed 125°F (52°C) and the gypsum board surface temperature is maintained above the air stream dew point temperature.

18-28-603.5 Deliberately omitted.

18-28-603.5.1 Flexible air ducts.

Flexible air ducts, both metallic and nonmetallic, shall be tested in accordance with UL 181. Such ducts shall be listed and labeled. Non-metallic flexible air ducts shall not be allowed in residential occupancies.

18-28-603.5.1.1 Duct length.

Flexible air ducts shall not exceed 6 feet in length.

18-28-603.5.2 Flexible air connectors.

Flexible air connectors, both metallic and nonmetallic, shall be tested in accordance with UL 181. Such connectors shall be listed and labeled as Class 0 or Class I flexible air connectors and shall be installed in accordance with the provisions of this Chapter 18-28.

(Amend Coun. J. 11-9-16, p. 36266, § 36)

18-28-603.6 Deliberately omitted.

18-28-603.7 Underground ducts.

Ducts shall be approved for underground installation. Metallic ducts not having an approved protective coating shall be completely encased in a minimum of 2 inches (51 mm) of concrete.

18-28-603.7.1 Slope.

Ducts shall slope to allow drainage to a point provided with access.

18-28-603.7.2 Sealing.

Ducts shall be sealed and secured prior to pouring the concrete encasement.

18-28-603.8 Joints and connections.

All joints, longitudinal and transverse seams and connections shall be securely fastened and sealed with welds, gaskets, mastics (adhesives), mastic-lus-embedded-fabric systems or tapes. Tapes and mastics used with flexible air ducts and air connectors shall be listed and labeled in accordance with UL 181B. Duct connections to sheet metal fittings or flanges of air distribution system equipment and appliances shall be mechanically fastened.

18-28-603.9 Supports.

Ducts shall be supported with approved hangers at intervals not exceeding 10 feet (3048 mm) or as specified in the SMACNA HVAC Duct Construction Standards - Metal and Flexible or by other approved duct support systems designed in accordance with the building code. Flexible and other factory-made ducts shall be supported at least every 5 feet (1524 mm).

18-28-603.10 Furnace connections.

Ducts connecting to a furnace shall have a clearance to combustibles in accordance with the furnace manufacturer's installation instructions.

18-28-603.11 Condensation.

Provisions shall be made to prevent the formation of condensation on the exterior of any duct.

18-28-603.12 Locations.

Ducts shall not be installed in or within 6 inches (152 mm) of the earth, except if such ducts comply with Section 18-28-603.7.

18-28-603.13 Mechanical protection.

Ducts installed in locations where they are exposed to mechanical damage by vehicles or from other causes shall be protected by approved barriers.

18-28-603.14 Weather protection.

All ducts, including linings, coverings and vibration isolation connectors, installed on the exterior of the building shall be adequately protected against the elements.

18-28-603.15 Registers, grilles and diffusers.

Duct registers, grilles and diffusers shall be installed in accordance with the manufacturer's installation instructions. Balancing dampers or other means of supply air adjustment shall be provided in the branch ducts or at each individual duct register, grille or diffuser.

18-28-603.15.1 Floor registers.

Floor registers shall resist, without structural failure, a 200-pound (890 N) concentrated load on a 2-inch (51 mm) diameter-disc applied to the most critical area of the exposed face.

18-28-604 Insulation.

18-28-604.1 General.

Duct insulation shall conform to the requirements of Sections 18-28-604.2 through 18-28-604.9 and the Chicago Energy Code.

18-28-604.2 Surface temperature.

Ducts that operate at temperatures exceeding 120°F (49°C) shall have sufficient thermal insulation to limit the exposed surface temperature to 120°F (49°C).

18-28-604.3 Covering and linings.

Coverings and linings, including adhesives when used, shall have a flame spread index of not more than 25 and a smoke-developed index of not more than 50, when tested in accordance with ASTM E 84. Duct coverings and linings shall not flame, glow, smolder or smoke when tested in accordance with ASTM C 411 at the temperature to which they are exposed in service. The test temperature shall not fall below 250°F (121°C).

18-28-604.4 Deliberately omitted.

18-28-604.5 Deliberately omitted.

18-28-604.6 Deliberately omitted.

18-28-604.7 Identification.

External duct insulation and factory-insulated flexible duct shall be legibly printed or identified at intervals not greater than 36 inches (915 mm) with the name of the manufacturer; the thermal resistance R-value at the specified installed thickness; and the flame spread and smoke-developed indexes of the composite materials. All duct insulation product R-values shall be based on insulation only, excluding air films, vapor retarders, or other duct components, and shall be based on tested C-values at 75°F (24°C) mean temperature at the installed thickness, in accordance with recognized industry procedures. The installed thickness of duct insulation used to determine its R-values shall be determined as follows:

1. For duct wrap, the installed thickness shall be assumed to be 75 percent (25 percent compression) of nominal thickness.
2. For factory-made flexible air ducts, the installed thickness shall be determined by dividing the difference between the actual outside diameter and nominal inside diameter by two.

18-28-604.8 Lining installation.

Linings shall be interrupted at the area of operation of a fire damper and at a minimum of 6 inches (152 mm) upstream of and 6 inches (152 mm) downstream of electric-resistance and fuel-burning heaters in a duct system. Metal nosings or sleeves shall be installed over exposed duct liner edges that face opposite the direction of air flow.

18-28-604.9 Thermal continuity.

If a duct liner has been interrupted, a duct covering of equal thermal performance shall be installed.

18-28-604.10 Service openings.

Service openings shall not be concealed by duct coverings unless the exact location of the opening is properly identified.

18-28-604.11 Vapor retarders.

If ducts used for cooling are externally insulated, the insulation shall be covered with a vapor retarder having a maximum permeance of 0.05 perms [2.87ng/(s·m²·Pa)] or less and is not required to be covered. All joints and seams shall be sealed to maintain the continuity of the vapor retarder.

18-28-604.12 Weatherproof barriers.

Insulated exterior ducts shall be protected with an approved weatherproof barrier.

18-28-604.13 Internal insulation.

Materials used in ducts as internal insulation and exposed to the airstream shall be durable when tested in accordance with UL 181.

18-28-605 Deliberately omitted.

18-28-606 Smoke Detection Systems Control.

18-28-606.1 Control.

Air distribution systems shall be equipped with smoke detectors listed and labeled for installation in air distribution systems, as required by this section.

18-28-606.2 Where required.

Smoke detectors shall be installed where indicated in Sections 18-28-606.2.1 through 18-28-606.2.3.

Exception: Smoke detectors shall not be required where air distribution systems are incapable of spreading smoke beyond the enclosing walls, floors and ceilings of the room or space in which the smoke is generated.

18-28-606.2.1 Return air systems.

Smoke detectors shall be installed in return air systems with a design capacity greater than 2,000 cfm (0.9 m³/s), in the return air duct or plenum upstream of any filters, exhaust air connections, outdoor air connections, or decontamination equipment and appliances.

Exception: Smoke detectors are not required in the return air system where the space served by the air distribution system is protected by a system of area smoke detectors in accordance with Chapter 15-16 of this Code. The area smoke detector system shall comply with Section 18-28-606.4.

(Amend Coun. J. 11-9-16, p. 36266, § 36)

18-28-606.2.2 Common supply and return air systems.

Where multiple air-handling systems share common supply or return air ducts or plenums with a combined designed capacity greater than 2,000 cfm (0.9 m³/s), the return air system shall be provided with smoke detectors in accordance with Section 18-28-606.2.1.

Exception: Individual smoke detectors shall not be required for each variable air volume (VAV) zone unit or VAV-type fan-powered terminal unit, provided that such units do not have an individual design capacity greater than 2,000 cfm (0.9 m³/s) and will be shut down by activation of one of the following:

1. Smoke detectors required by Sections 18-28-606.2.1 and 18-28-606.2.3.
2. An approved area smoke detector system located in the return air plenum serving such units.
3. An area smoke detector system as prescribed in the exception to Section 18-28-606.2.1.

In all cases, the smoke detectors shall comply with Sections 18-28-606.4 and 18-28-606.4.1.

18-28-606.2.3 Return air risers.

Where return air risers serve two or more stories and are part of a return air system having a design capacity greater than 15,000 cfm (7.1 m³/s), smoke detectors shall be installed at each story. Such smoke detectors shall be located upstream of the connection between the return air riser and any air ducts or plenums.

18-28-606.3 Installation.

Smoke detectors required by this section shall be installed in accordance with Chapter 15-16 of this Code. The required smoke detectors shall be installed to monitor the entire airflow conveyed by the system including return air and exhaust or relief air. Access shall be provided to smoke detectors for inspection and maintenance.

(Amend Coun. J. 11-9-16, p. 36266, § 36)

18-28-606.4 Controls operation.

Upon activation, the smoke detectors shall shut down the air distribution system through a hard-wired interlock between the fans and the smoke detector, not through programming. Air distribution systems that are part of a smoke control system shall be controlled in

accordance with Chapter 13-76 of this Code.

(Amend Coun. J. 11-9-16, p. 36266, § 36)

18-28-606.4.1 Connection to fire alarm system.

In buildings with Fire Alarm system, duct smoke detectors shall be connected to the fire alarm system in accordance with Section 18-9-907, Fire Alarm and Detection Systems.

Exception: In buildings required to be equipped with a fire alarm system, actuation of a smoke detector shall activate a visible and an audible signal in an approved location. Smoke detector trouble conditions shall activate a visible or audible signal in an approved location and shall be identified as air duct detector trouble.

18-28-607 Ducts and Air Transfer Openings.

See Chapter 15-8 of this Code.

(Amend Coun. J. 11-9-16, p. 36266, § 36)

Article VII. Combustion Air (18-28-701 et seq.)

18-28-701 General.

18-28-701.1 Scope.

The provisions of this article shall govern the requirements for combustion and dilution air for fuel-burning appliances.

18-28-701.2 Combustion and dilution air required.

Every room or space containing fuel-burning appliances shall be provided with combustion and dilution air as required by this code. Combustion and dilution air shall be provided in accordance with Sections 702, 703, 704, 706 or 707 or shall be provided by an approved engineered system. Direct vent appliances or equipment that do not draw combustion air from inside of the building are not required to be considered in the determination of the combustion and dilution air requirements. Combustion air requirements shall be determined based on the simultaneous operation of all fuel-burning appliances drawing combustion and dilution air from the room or space.

(Amend Coun. J. 11-8-12, p. 38872, § 321)

18-28-701.3 Circulation of air.

The equipment and appliances within every room containing fuel-burning appliances shall be installed so as to allow free circulation of air. Provisions shall be made to allow for the simultaneous operation of mechanical exhaust systems, fireplaces or other equipment and appliances operating in the same room or space from which combustion and dilution air is being drawn. Such provisions shall prevent the operation of such appliances, equipment and systems from affecting the supply of combustion and dilution air.

18-28-701.4 Crawl space and attic space.

For the purposes of this chapter, an opening to a naturally ventilated crawl space or attic space shall be considered equivalent to an opening to the outdoors.

18-28-701.4.1 Crawl space.

Where lower-combustion air openings connect with crawl spaces, such spaces shall have unobstructed openings to the outdoors at least twice that required for the combustion air openings. The height of the crawl space shall comply with the requirements of the building code and shall be without obstruction to the free flow of air.

In addition, the lowest side of combustion air openings connecting with crawl spaces shall be a minimum of 12 inches (300 mm) above the adjoining grade level.

18-28-701.4.2 Attic space.

Where combustion air is obtained from an attic area, the attic ventilating openings shall not be subject to ice or snow blockage, and the attic shall have not less than 30 inches (762 mm) vertical clear height at its maximum point. Attic ventilation openings shall be sufficient to provide the required volume of combustion air and the attic ventilation required by the building code. The combustion air openings shall be provided with a sleeve of not less than 0.019 inch (0.5 mm) (No. 26 Gauge) galvanized steel or other approved

material extending from the appliance enclosure to at least 6 inches (152 mm) above the top of the ceiling joists and insulation.

18-28-701.5 Prohibited sources.

Openings and ducts shall not connect appliance enclosures with a space in which the operation of a fan will adversely affect the flow of combustion air. Combustion air shall not be obtained from a hazardous location, except where the fuel-fired appliances are located within the hazardous location and are installed in accordance with the building code. Combustion air shall not be taken from a refrigeration machinery room.

18-28-701.5.1

The remaining space surrounding a chimney liner, gas vent, special gas vent, or plastic piping installed within a masonry, metal or factory built chimney, shall not be used to supply combustion air.

Exception: Direct vent gas-fired appliances designed for installation in a solid fuel burning fireplace where installed in accordance with the listing and the manufacturer's instruction.

18-28-702 Air Requirements for Equipment Located in Unconfined Spaces.

18-28-702.1 Unconfined spaces.

Fuel burning space heating and/or water heating equipment with a combined input rating greater than 150,000 Btu/hour shall be provided with air from outdoors for combustion and dilution using the methods described in Section 18-28-703.3.

Exception: Single-family and two-family dwellings (including townhouses) are not required to use outdoor air for combusting and dilution. Such dwellings shall be provided with air for combustion and dilution in accordance with Sections 18-28-702, 18-28-703.2, or 18-28-703.3.

Fuel-burnings heating equipment and/or water heating equipment with a combined input rating less than or equal to 150,000 Btu/hr is not required to be provided with air from outdoors. However, the air volume within the space shall comply with the unconfined space definition for the aggregate input rating of all fuel-burning heating equipment and/or water heating equipment installed in that space. Fuel burning appliances typically used on an intermittent basis, such as clothes dryers, residential cooking equipment, and/or fireplaces are not required to be provided with air from outdoors. However, the combined air volume within the adjacent, communicating living spaces (not including bedrooms, bathrooms, and toilet rooms) shall comply with the unconfined space definition for the aggregate input rating of all fuel burning appliances installed in those living spaces.

18-28-703 Air Requirements for Equipment Located in Confined Spaces.

18-28-703.1 Confined spaces.

Fuel burning space heating and/or water heating equipment with a combined input rating greater than 150,000 Btu/hour shall be provided with air from outdoors for combustion and dilution using the methods described in Section 18-28-703.3.

(Amend Coun. J. 11-9-16, p. 36266, § 36)

Exception: Single-family and two-family dwellings (including townhouses) are not required to use outdoor air for combustion and dilution. Such dwellings shall be provided with air for combustion and dilution in accordance with Sections 18-28-702, 18-28-703.2, or 18-28-703.3.

Fuel burning heating and/or water heating equipment with a combined input rating less than or equal to 150,000 Btu/hr shall be provided with air for combustion and dilution in accordance with Sections 18-28-703.2 or 18-28-703.3. Fuel burning appliances typically used on an intermittent basis, such as clothes dryers, residential cooking equipment, and/or fireplaces shall be provided with air for combustion and dilution in accordance with Section 18-28-703.2.

18-28-703.2 Indoor air.

The confined space shall be provided with two permanent openings communicating directly with other spaces of sufficient volume so that the combined volume of all such spaces meets the criteria for an unconfined space. The total input of all fuel burning equipment installed in the combined spaces shall be used to determine the required minimum volume.

Each opening shall have a minimum free area of not less than 1 in²/1000Btu/hr (2120mm²/kW) of the total input rating of all fuel burning equipment in the confined space, but not less than 100 in² (0.06m²). One opening shall be within 12 in. (300 mm) of the top of the enclosure, and one opening shall be within 12 in. (300 mm) of the bottom of the enclosure. The minimum dimension of air openings shall be not less than 3 in. (8 cm).

18-28-703.3 Outdoor air.

All air from outdoors. The confined space shall communicate with the outdoors in accordance with methods 1 or 2, which follow. The minimum dimension of air openings shall be not less than 3 in. (80 mm). If ducts are used, the ducts shall be of the same cross-sectional area as the free area of the openings to which they connect.

1. Two permanent openings, one commencing within 12 in. (300 mm) of the top of the enclosure and one commencing within 12 in. (300 mm) of the bottom of the enclosure shall be provided. The openings shall communicate directly, or by ducts, with the outdoors or with attic spaces that freely communicate with the outdoors.

(a) If directly communicating with the outdoors or if communicating to the outdoors through vertical ducts, each opening shall have a minimum free area of 1 in.² per 4000 Btu/hr (550 mm²/kW) of the total input rating of all equipment in the enclosure.

(b) If communicating with the outdoors through horizontal ducts, such opening shall have a minimum free area of not less than 1 in.² per 2000 Btu/hr (1100 mm²/kW) of the total input rating of all equipment in the enclosure.

2. One permanent opening commencing within 12 in. (300 mm) of the top of the enclosure, shall be permitted if the equipment has clearances of at least 1 in. (25 mm) from the sides and back and 6 in. (160 mm) from the front of the appliance. The opening shall directly communicate with the outdoors or shall communicate with the outdoors through a vertical or horizontal duct or space that freely communicate with the outdoors. The opening shall have a minimum free area as follows:

(a) 1 in.²/3000 Btu/hr (700 mm² per kW) of the total input rating of all equipment located in the enclosure, and

(b) Not less than the sum of the areas of all vent connectors in the confined spaces.

18-28-704 Deliberately Omitted.

18-28-705 Engineered Installations.

18-28-705.1

Engineered combustion air installations shall provide an adequate supply of combustion and dilution air and shall be approved by the authority having jurisdiction.

18-28-706 Forced Combustion Air Supply.

18-28-706.1 Mechanical combustion air supply for oil-fired appliances.

Where all combustion air and dilution air is provided by a mechanical forced-air system, the combustion air and dilution air shall be supplied at the minimum rate of 1 cfm per 2,400 Btu/h [0.00067 m³/(s x kW)] of combined input rating of all the fuel-burning appliances served. Each of the appliances served shall be electrically interlocked to the mechanical forced-air system so as to prevent operation of the appliances when the mechanical system is not in operation. Where combustion air and dilution air is provided by the building's mechanical ventilation system, the system shall provide the specified combustion/dilution air rate in addition to the required ventilation air.

18-28-706.2 Mechanical combustion air supply for gas-fired appliances.

Where all combustion air is provided by a mechanical air supply system, the combustion air shall be supplied from outdoors at the minimum rate of 0.35 ft³/min per 1,000 Btu/hr (0.034 3/min per kW) for all appliances located within the space.

18-28-706.2.1

Where exhaust fans are installed, additional air shall be provided to replace the exhausted air.

18-28-706.2.2

Each of the appliances served shall be interlocked to the mechanical air supply system to prevent main burner operation where the mechanical air supply system is not in operation.

18-28-706.2.3

Where combustion air is provided by the building's mechanical ventilation system, the system shall provide the specified combustion air rate in addition to the required ventilation air.

18-28-707 Direct Connection.

18-28-707.1 General.

Fuel-burning appliances that are listed and labeled for direct combustion air connection to the outdoors shall be installed in accordance with the manufacturer's installation instructions.

18-28-708 Combustion Air Ducts.

18-28-708.1 General.

Combustion air ducts shall:

1. Be of galvanized steel complying with Chapter 6 or of equivalent corrosion-resistant material approved for this application.

Exception: Within dwelling units, unobstructed stud and joist spaces shall not be prohibited from conveying combustion air, provided that not more than one required fireblock is removed.

2. Have a minimum cross-sectional dimension of 3 inches (76 mm).
3. Terminate in an unobstructed space allowing free movement of combustion air to the appliances.
4. Have the same cross-sectional areas as the free area of the openings to which they connect.
5. Serve a single appliance enclosure.
6. Not serve both upper and lower combustion air openings where both such openings are used. The separation between ducts serving upper and lower combustion air openings shall be maintained to the source of combustion air.
7. Not be screened where terminating in an attic space.
8. Not slope downward toward the source of combustion air, where serving the upper required combustion air opening.

18-28-709 Opening Obstructions.

18-28-709.1 General.

The required size of openings for combustion and dilution air shall be based on the net free area of each opening. The net free area of an opening shall be that specified by the manufacturer of the opening covering. In the absence of such information, openings covered with metal louvers shall be deemed to have a net free area of 75 percent of the area of the opening, and openings covered with wood louvers shall be deemed to have a net free area of 25 percent of the opening.

18-28-709.2 Dampened openings.

Where the combusting air openings are provided with volume, smoke or fire dampers, the dampers shall be electrically interlocked with the firing cycle of the appliances served, so as to prevent operation of any appliance that draws combustion and dilution air from the room when any of the dampers are closed. Manually operated dampers shall not be installed in combustion air openings.

18-28-710 Opening Location and Protection.

18-28-710.1 General.

Combustion air openings to the outdoors shall comply with the location and protection provisions of Sections 18-28-401.5 and 18-28-401.6 applicable to outside air intake openings.

18-28-711 Carbon Monoxide Detectors.

18-28-711.1 Carbon monoxide alarms.

Carbon monoxide detectors shall be provided as required in Sections 13-64-190 through 13-64-280.

Article VIII. Chimneys and Vents (18-28-801 et seq.)

18-28-801 General.

18-28-801.1 Scope.

This article shall govern the installation, maintenance, repair and approval of factory-built chimneys, chimney liners, vents and

connectors, and the utilization of masonry chimneys.

18-28-801.2 General.

Every fuel-burning appliance shall discharge the products of combustion to a vent, factory-built chimney or masonry chimney, except for appliances exempted by Section 18-28-804. The chimney or vent shall be designed for the type of appliance being vented.

18-28-801.2.1 Oil-fired appliances.

Oil-fired appliances shall be vented in accordance with the building code and NFPA 31.

18-28-801.3 Masonry chimneys

Masonry chimneys shall be constructed in accordance with the building code.

18-28-801.4 Positive flow.

Venting systems shall be designed and constructed so as to develop a positive flow adequate to convey all combustion products to the outside atmosphere.

18-28-801.5 Design.

Venting systems shall be designed in accordance with this article or shall be approved engineered systems as determined by the Committee of Standards and Tests.

18-28-801.6 Minimum size of chimney or vent.

Except as otherwise provided for in this article, the size of the chimney or vent serving a single appliance, except for approved engineered systems, shall have a minimum free area equal to the area of the appliance connection.

18-28-801.7 Solid fuel appliance flues.

The cross-sectional area of a flue serving a solid fuel-burning appliance shall not be greater than three times the cross-sectional area of the appliance flue collar or flue outlet.

18-28-801.8 Abandoned inlet openings.

Abandoned inlet openings in chimneys and vents shall be closed by an approved method.

18-28-801.9 Positive pressure.

If an appliance equipped with a forced or induced draft system creates a positive pressure in the venting system, the venting system shall be designed for positive pressure applications.

18-28-801.10 Connection to fireplace.

Connection of appliances to chimney flues serving fireplaces shall be in accordance with Sections 18-28-801.10.1 through 18-28-801.10.3.

18-28-801.10.1 Closure and access.

A noncombustible seal shall be provided below the point of connection to prevent entry of room air into the flue. Means shall be provided for access to the flue for inspection and cleaning.

18-28-801.10.2 Connection to factory-built fireplace flue.

An appliance shall not be connected to a flue serving a factory-built fireplace unless the appliance is specifically listed for such installation. The connection shall be made in accordance with the appliance manufacturer's installation instructions.

18-28-801.10.3 Connection to masonry fireplace flue.

A connector shall extend from the appliance to a flue serving a masonry fireplace such that the flue gases are exhausted directly into the flue. The connector shall be provided with access or shall be removable for inspection and cleaning of both the connector and the flue. Listed direct connection devices shall be installed in accordance with their listing.

18-28-801.11 Multiple solid fuel prohibited.

A solid fuel-burning appliance or fireplace shall not connect to a chimney passageway venting another appliance.

18-28-801.12 Chimney entrance.

Connectors shall connect to a chimney flue at a point not less than 12 inches (305 mm) above the lowest portion of the interior of the chimney flue.

18-28-801.13 Cleanouts.

Masonry chimney flues shall be equipped with a cleanout opening that has a minimum height of 6 inches (152 mm). The upper edge of the opening shall be located not less than 6 inches (152 mm) below the lowest chimney inlet opening. The cleanout shall be provided with a tight-fitting, noncombustible cover.

Exceptions: Cleanouts shall not be required for chimney flues that serve masonry fireplaces if the flues are provided with access through the fireplace opening.

18-28-801.14 Connections to exhauster.

All appliance connections to a chimney or vent equipped with a power exhauster shall be made on the inlet side of the exhauster. All joints on the positive pressure side of the exhauster shall be sealed to prevent flue-gas leakage as specified by the manufacturer's installation instructions for the exhauster.

18-28-801.15 Fuel-fired appliances.

Masonry chimneys utilized to vent fuel-fired appliances shall be located, constructed and sized as specified in the manufacturer's installation instructions for the appliances being vented.

18-28-801.16 Flue lining.

Masonry chimneys shall be lined. The lining material shall be compatible with the type of appliance connected, in accordance with the appliance listing and the manufacturer's installation instructions. Listed materials used as flue linings shall be installed in accordance with the conditions of the listing and the manufacturer's installation instructions.

18-28-801.16.1 Residential and low-heat appliances (general).

Flue lining systems for use with residential-type and low-heat appliances shall be limited to the following:

1. Clay flue lining complying with the requirements of ASTM C 315 or the equivalent. Clay flue lining shall be installed in accordance with the building code.
2. Listed chimney lining systems complying with UL 1777.
3. Other approved materials that will resist, without cracking, softening or corrosion, flue gases and condensate at temperatures up to 1,800°F. (982°C.).

18-28-801.17 Space around lining.

The space surrounding a flue lining system or other vent installed within a masonry chimney shall not be used to vent any other appliance. This shall not prevent the installation of a separate flue lining in accordance with the manufacturer's installation instructions and the building code.

18-28-801.18 Existing chimneys and vents.

Where an appliance is permanently disconnected from an existing chimney or vent, or where an appliance is connected to an existing chimney or vent during the process of a new installation, the chimney or vent shall comply with Sections 18-28-801.18.1 through 18-28-801.18.4.

18-28-801.18.1 Size.

The chimney or vent shall be resized as necessary to control flue gas condensation in the interior of the chimney or vent and to provide the appliance or appliances served with the required draft. For venting of oil-fired appliances to masonry chimneys, the resizing shall be in accordance with NFPA 31.

18-28-801.18.2 Flue passageways.

The flue gas passageways shall be free of obstructions and combustible deposits and shall be cleaned if previously used for venting a

solid or liquid fuel-burning appliance or fireplace. The flue liner, chimney inner wall or vent inner wall shall be continuous and shall be free of cracks, gaps, perforations or other damage or deterioration which would allow the escape of combustion products, including gases, moisture and creosote. Where an oil-fired appliance is connected to an existing masonry chimney, such chimney flue shall be repaired or relined in accordance with NFPA 31.

18-28-801.18.3 Cleanout.

Masonry chimneys shall be provided with a cleanout opening in compliance with Section 18-28-801.13.

18-28-801.18.4 Clearances.

Chimneys and vents shall have airspace clearance to combustibles in accordance with the building code and the chimney or vent manufacturer's installation instructions.

Exception: Masonry chimneys equipped with a chimney lining system tested and listed for installation in chimneys in contact with combustibles in accordance with UL 1777, and installed in accordance with the manufacturer's instructions, shall not be required to have clearance between combustible materials and exterior surfaces of the masonry chimney. Noncombustible fireblocking shall be provided in accordance with the building code.

18-28-801.19 Multistory prohibited.

Common venting systems for appliances located on more than one floor level shall be prohibited, except if all of the appliances served by the common vent are located in rooms or spaces that are accessed only from the outdoors. The appliance enclosures shall not communicate with the occupiable areas of the building.

18-28-802 Vents.

18-28-802.1 General.

All vent systems shall be listed and labeled. Type L vents and pellet vents shall be tested in accordance with UL 641.

18-28-802.2 Vent application.

The application of vents shall be in accordance with Table 18-28-802.2.

**Table 18-28-802.2
Vent Applications**

Vent Types	Appliance Types
Type L oil vents	Oil-burning appliances listed and labeled for venting with Type L vents; gas appliances listed and labeled for venting with Type B vents.
Pellet vents	Pellet fuel-burning appliances listed and labeled for venting with pellet vents.

18-28-802.3 Installation.

Vent systems shall be sized, installed and terminated in accordance with the vent and appliance manufacturer's installation instructions.

18-28-802.4 Vent termination caps required.

Type L vents shall terminate with a listed and labeled cap in accordance with the vent manufacturer's installation instructions.

18-28-802.5 Type L vent terminations.

Type L vents shall terminate not less than 2 feet (610 mm) above the highest point of the roof penetration and not less than 2 feet (610 mm) higher than any portion of a building within 10 feet (3048 mm).

18-28-802.6 Minimum vent heights.

Vents shall terminate not less than 5 feet (1524 mm) in vertical height above the highest connected appliance draft hood outlet or flue collar.

Exceptions:

1. Venting systems of direct vent appliances shall be installed in accordance with the appliance and the vent manufacturer's instructions.

2. Appliances listed for outdoor installations incorporating venting means shall be installed in accordance with their listings and the manufacturer's installation instructions.

3. Pellet vents shall be installed in accordance with the appliance and the vent manufacturer's installation instruction.

18-28-802.7 Support of vents.

All portions of gas vents shall be adequately supported for the design and weight of the materials employed.

18-28-802.8 Installation shield.

Where vents pass through insulated assemblies, an insulation shield constructed of not less than 26 gauge sheet metal shall be installed to provide clearance between the vent and the insulation material. The clearance shall be not less than the clearance to combustibles specified by the vent manufacturer's installation instructions. Where vents pass through attic space, the shield shall terminate not less than 2 inches (51 mm) above the insulation materials and shall be secured in place to prevent displacement. Insulation shields provided as part of a listed vent system shall be installed in accordance with the manufacturer's installation instructions.

18-28-803 Connectors.

18-28-803.1 Connectors required.

Connectors shall be used to connect appliances to the vertical chimney or vent, except where the chimney or vent is attached directly to the appliance.

18-28-803.2 Location.

Connectors shall be located entirely within the room in which the connecting appliance is located, except as provided in Section 18-28-803.10.4. Where passing through an unheated space, a connector serving a gas appliance shall not be constructed of single-wall pipe.

18-28-803.3 Size.

The connect shall not be smaller than the size of the flue collar or the size of the outlet of the draft hood supplied by the manufacturer of the appliance except as provided in Section 18-28-804. Where the appliance has more than one flue outlet, and in the absence of the manufacturer's specific instructions, the connector area shall be not less than the combined area of the flue outlets for which it acts as a common connector.

18-28-803.4 Branch connectors.

All branch connectors to the vent connector shall be made in accordance with the vent manufacturer's instructions.

18-28-803.5 Manual dampers.

Manual dampers shall not be installed in connectors except in chimney connectors serving solid fuel-burning appliances.

18-28-803.6 Automatic dampers.

Automatic dampers shall be listed and labeled in accordance with UL 17 for oil-fired heating appliances. The dampers shall be installed in accordance with the manufacturer's installation instructions. An automatic vent damper device shall not be installed on an existing appliance installation unless the appliance is listed and labeled and equipped with a draft hood, and the device is installed in accordance with the terms of its listing. The name of the installer and date of installation shall be marked on a label affixed to the damper device.

18-28-803.7 Connectors serving two or more appliances.

Where two or more connectors enter a common gas vent or chimney, the smaller connector shall enter at the highest level consistent

with available headroom or clearance to combustible material.

18-28-803.8 Vent connector construction.

Vent connectors shall be constructed of metal. The minimum nominal thickness of the connector shall be 0.019 inch (0.5 mm) (No. 28 Gauge) for galvanized steel, 0.022 inch (0.6 mm)(No. 26 B&S Gauge) for copper and 0.020 inch (0.5 mm) (No. 24 B&S Gauge) for aluminum.

18-28-803.9 Chimney connector construction.

Chimney connectors for low-heat appliances shall be made of sheet steel pipe that is resistant to corrosion and heat not less than that required for galvanized steel as specified in Table 18-28-803.9(1). Connectors for medium-heat appliances and high-heat appliances shall be of sheet steel not less than the thickness specified in Table 18-28-803.9(2).

**Table 18-28-803.9(1)
Minimum Chimney Connector Thickness for Low- Heat Appliances**

Diameter of Connector (inches)	Minimum Nominal Thickness (Galvanized) (inches)
5 and smaller	0.022 (No. 26 Gauge)
Larger than 5 and up to 10	0.028 (No. 24 Gauge)
Larger than 10 and up to 16	0.034 (No. 22 Gauge)
Larger than 16	0.064 (No. 16 Gauge)

For SI: 1 inch = 25.4 mm, 1 square inch = 645.16 mm².

**Table 18-28-803.9(2)
Minimum Chimney Connector Thickness for Medium- and High-Heat Appliances**

Area (square inches)	Equivalent Round Diameter (inches)	Minimum Nominal Thickness (inches)
0 - 154	0 - 14	0.060 (No. 16 Gauge)
155 - 201	15 - 16	0.075 (No. 14 Gauge)
202 - 254	17 - 18	0.105 (No. 12 Gauge)
Greater than 254	Greater than 18	0.135 (No. 10 Gauge)

For SI: 1 inch=25.4 mm, 1 square inch = 645.16 mm².

18-28-803.10 Installation.

Connectors shall be installed in accordance with Sections 18-28-803.10 through 18-28-803.10.6.

18-28-803.10.1 Supports and joints.

Connectors shall be supported in an approved manner, and joints shall be fastened with sheet metal screws, rivets or other approved means.

18-28-803.10.2 Length.

The maximum horizontal length of a single-wall connector, shall be 75 percent of the height of the chimney or vent.

18-28-803.10.3 Connection.

The connector shall extend to the inner face of the chimney or vent liner but not beyond. A connector entering a masonry chimney shall be cemented to masonry in an approved manner. If thimbles are installed to facilitate removal of the connector from the masonry chimney, the thimble shall be permanently cemented in place with high-temperature cement.

18-28-803.10.4 Connector pass-through.

Chimney connectors shall not pass through any floor or ceiling, nor through a fire-resistance-rated wall assembly. Chimney connectors for domestic-type appliances shall not pass through walls or partitions constructed of combustible material to reach a masonry chimney unless:

1. The connector is labeled for wall pass-through and is installed in accordance with the manufacturer's instructions; or
2. The connector is put through a device labeled for wall pass-through; or
3. The connector has a diameter not larger than 10 inches (254 mm) and is installed in accordance with one of the methods identified in Table 18-28-803.10.4. Concealed metal parts of the pass-through system in contact with flue gases shall be made of stainless steel or equivalent material that resists corrosion, softening or cracking up to 1,800°F (980°C).

Table 18-28-803.10.4
Chimney Connector Systems and Clearances to Combustible
Wall Materials for Domestic Heating Appliances a, b, c, d

System A (12-inch clearance)	A 3 1/2-inch-thick brick wall shall be framed into the combustible wall. A 5/8-inch-thick fire-clay liner (ASTM C 315 or equivalent) c shall be firmly cemented in the center of the brick wall maintaining a 12-inch clearance to combustibles. The clay liner shall run from the outer surface of the bricks to the inner surface of the chimney liner.
System B (9-inch clearance)	A labeled solid-insulated factory-built chimney section (1-inch insulation) the same inside diameter as the connector shall be utilized. Sheet metal supports cut to maintain a 9-inch clearance to combustibles shall be fastened to the wall surface and to the chimney section. Fasteners shall not penetrate the chimney flue liner. The chimney length shall be flush with the masonry chimney liner and sealed to the masonry with water-insoluble refractory cement. Chimney manufacturer's parts shall be utilized to fasten securely the chimney connector to the chimney section.
System C (6-inch clearance)	A sheet metal (minimum No. 24 Gauge) ventilated thimble having two 2-inch air channels shall be installed with a sheet steel chimney connector (minimum No. 24 Gauge). Sheet steel supports (minimum No 24 Gauge) shall be cut to maintain a 6-inch clearance between the thimble and combustibles. One side of the support shall be fastened to the wall on all sides. Glass-fiber insulation shall fill the 6-inch space between the thimble and the supports.
	A labeled solid-insulated factory-built chimney section (1-inch insulation) with a diameter 2 inches larger than the chimney connector shall be installed with a sheet steel chimney connector (minimum No.

System D (2-inch clearance)	24 Gauge). Sheet metal supports shall be positioned to maintained a 2-inch clearance to combustibles and to hold the chimney connector to ensure that a 1-inch airspace surrounds the chimney connector through the chimney section. The steel support shall be fastened to the wall on all sides and the chimney shall not penetrate the liner of the chimney section.
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For SI: 1 inch = 25.4 mm.

a Insulation material that is part of the wall pass-through system shall be non-combustible and have a thermal conductivity of 1.0 Btu x in/ft² x h x °F or less.

b All clearances and thicknesses are minimums.

c Materials utilized to seat penetrations for the connector shall be noncombustible.

d Connectors for all systems except System B shall extend through the wall pass-through system to the inner face of the flue liner.

ASTM C 315.

18-28-803.10.5 Pitch.

Connectors shall rise vertically to the chimney or vent with a minimum pitch equal to one-fourth unit vertical in 12 units horizontal (2-percent slope).

18-28-803.10.6 Clearances.

Connectors shall have a minimum clearance to combustibles in accordance with Table 18-28-803.10.6. The clearances specified in Table 18-28-803.10.6 apply, except where the listing and labeling of an appliance specifies a different clearances, in which case the labeled clearance shall apply. The clearance to combustibles for connectors shall be reduced only in accordance with Section 18-28-308.

**Table 18-28-803.10.6
Connector Clearances to Combustibles**

Type of Appliance	Minimum Clearance (Inches)
Domestic-type appliances	
Chimney and vent connectors	
Electric and oil incinerators	18
Oil and solid fuel appliances	18
Oil appliances labeled for venting with Type L vents	9
Commercial, industrial-type appliances	
Low-heat appliances	
Chimney connectors	
Oil and solid fuel boilers, furnaces and water heaters	18
Oil unit heaters	18
Other low-heat industrial appliances	18
Medium-heat appliances	
Chimney connectors	

All gas, oil and solid fuel appliances	36
High-heat appliances	
Masonry or metal connectors	
All gas, oil and solid fuel appliances	(As determined by the code official)

For SI: 1 inch = 25.4mm.

18-28-804 Direct-Vent, Integral Vent, Mechanical Vent and Ventilation/Exhaust Hood Venting.

18-28-804.1 Direct-vent terminations.

Vent terminals for direct-vent appliances shall be installed in accordance with the manufacturer's installation instructions.

18-28-804.2 Appliances with integral vents.

Appliances incorporating integral venting means shall be installed in accordance with their listings and the manufacturer's installation instructions.

18-28-804.2.1 Terminal clearances.

Appliances designed for natural draft venting and incorporating integral venting means shall be located so that a minimum clearance of 9 inches (229 mm) is maintained between vent terminals and from any openings through which combustion products enter the building. Appliances using forced draft venting shall be located so that a minimum clearance of 12 inches (305 mm) is maintained between vent terminals and from any openings through which combustion products enter the building.

18-28-804.3 Mechanical draft systems.

Mechanical draft systems of either forced or induced draft design shall comply with Sections 18-28-804.3.1 through 18-28-804.3.7.

18-28-804.3.1 Forced draft systems.

Forced draft systems and all portions of induced draft systems under positive pressure during operation shall be designed and installed so as to be gas tight to prevent leakage of combustion products into a building.

18-28-804.3.2 Automatic shutoff.

Power exhausters shall be electrically connected to each appliance to prevent operation of the appliance when the power exhauster is not in operation.

18-28-804.3.3 Termination.

The termination of chimneys or vents equipped with power exhausters shall be located a minimum of 10 feet (3048 mm) from the lot line or from adjacent buildings. The exhaust shall be directed away from the building.

18-28-804.3.4 Horizontal terminations.

Horizontal terminations shall comply with the following requirements:

1. Where located adjacent to walkways, the termination of mechanical draft systems shall be not less than 7 feet (2134 mm) above the level of the walkway.
2. Vents shall terminate at least 3 feet (914 mm) above any forced air inlet located within 10 feet (3048 mm).
3. The vent system shall terminate at least 4 feet (1219 mm) below, 4 feet (1219 mm) horizontally from or 1 foot (305 mm) above any door, window or gravity air inlet into the building.
4. The vent termination point shall not be located closer than 3 feet (914 mm) to an interior corner formed by two walls perpendicular to each other.
5. Vent termination shall not be mounted directly above or within 3 feet (914 mm) horizontally from an oil tank vent or gas meter.

6. The bottom of the vent termination shall be located at least 12 inches (305 mm) above finished grade.

18-28-804.3.5 Vertical terminations.

Vertical terminations shall comply with the following requirements:

1. Where located adjacent to walkways, the termination of mechanical draft systems shall be not less than 7 feet (2134 mm) above the level of the walkway.
2. Vents shall terminate at least 3 feet (914 mm) above any forced air inlet located within 10 feet (3048 mm).
3. Where the vent termination is located below an adjacent roof structure, the termination point shall be located at least 3 feet (914 mm) from such structure.
4. The vent shall terminate at least 4 feet (1219 mm) below, 4 feet (1219 mm) horizontally from, or 1 foot (305 mm) above any door, window or gravity air inlet for the building.
5. A vent cap shall be installed to prevent rain from entering the vent system.
6. The vent termination shall be located at least 3 feet (914 mm) horizontally from any portion of the roof structure.

18-28-804.3.6 Exhauster connections.

An appliance vented by natural draft shall not be connected into a vent, chimney or vent connector on the discharge side of a mechanical flue exhauster.

18-28-804.3.7 Exhauster sizing.

Mechanical flue exhausters and the vent system served shall be sized and installed in accordance with the manufacturer's installation instructions.

18-28-805 Factory Built Chimneys.

18-28-805.1 Listing.

Factory-built chimneys shall be listed and labeled and shall be installed and terminated in accordance with the manufacturer's installation instructions.

18-28-805.2 Solid fuel appliances.

Factory-built chimneys for use with solid fuel- burning appliances shall comply with the Type HT requirements of UL 103.

Exception: Chimneys for use with fireplace stoves listed only to UL 737 shall comply with the requirements of UL 103.

18-28-805.3 Factory-built fireplaces.

Chimneys for use with factory-built fireplaces shall comply with the requirements of UL 127.

18-28-805.4 Support.

Where factory-built chimneys are supported by structural members, such as joists and rafters, such members shall be designed to support the additional load.

18-28-805.5 Medium-heat appliances.

Factory-built chimneys for medium-heat appliances producing flue gases having a temperature above 1,000°F(538°C), measured at the entrance to the chimney, shall comply with UL 959.

18-28-805.6 Decorative shrouds.

Decorative shrouds shall not be installed at the termination of factory-built chimneys except where such shrouds are listed and labeled for use with the specific factory-built chimney system and are installed in accordance with the provisions of this Chapter 18-28.

(Amend Coun. J. 11-9-16, p. 36266, § 36)

18-28-806 Metal Chimneys.

18-28-806.1 General.

Metal chimneys shall be constructed and installed in accordance with NFPA 211.

18-28-807 Engine Generator Exhaust Systems.

18-28-807.1.

This section applies to venting of the products of combustion of stationary combustion engines and gas turbines.

18-28-807.1.1.

Engine generator exhaust systems shall be designed and constructed such that the system can withstand the anticipated exhaust gas temperature.

18-28-807.1.2.

Exhaust systems shall include provisions to prevent damage caused by ignition of unburned fuel.

18-28-807.1.3.

Low points of exhaust systems shall have suitable drains.

18-28-807.1.4.

Exhaust systems shall be connected to the engine to prevent the escape of sparks, flame or flue gas within the structure.

18-28-807.1.5.

Where necessary, engine generator exhaust systems shall have one or more flexible connectors to minimize the possibility of a leak in the engine exhaust system because of engine vibration or thermal expansion.

18-28-807.1.6.

Exhaust systems shall be metal, masonry, or factory built chimney.

18-28-807.2 Exhaust systems termination.

The exit terminal of an engine generator exhaust system shall be located as follows:

1. Not less than 15 feet above any forced air inlet or operable window located within 20 feet horizontally on the same or adjacent buildings.
2. Not less than 10 feet from an adjacent building and not less than 8 feet above grade where located adjacent to a public walkway.
3. The exit terminal shall be so arranged that flue gases are not directed to buildings within 20 feet and are directed so as not to jeopardize people.
4. Through-the-wall engine exhaust systems shall not terminate in an area where condensate, vapor, or odor could create a nuisance or hazard.
5. Where necessary, exhaust systems shall be shielded to prevent personnel burns.

Article IX. Specific Appliances, Fireplaces and Solid Fuel-Burning Equipment (18-28-901 et seq.)

18-28-901 General.

18-28-901.1 Scope.

This chapter shall govern the approval, design, installation, construction, maintenance, alteration and repair of the appliances and equipment specifically identified herein and factory-built fireplaces.

18-28-901.2 General.

The requirements of this chapter shall apply to the mechanical equipment and appliances regulated by this chapter, in addition to the other requirements of the building code.

18-28-901.3 Hazardous locations.

Fireplaces and solid fuel-burning appliances shall not be installed in hazardous locations.

18-28-901.4 Fireplace accessories.

Listed fireplace accessories shall be installed in accordance with the conditions of the listing and the manufacturer's installation instructions.

18-28-901.5 Installation in private garages.

Gas appliances are not allowed in private garages unless all of the following conditions exist:

1. The gas appliance is a direct vent heater intended to heat only the garage space and does not communicate its heated air to the rest of the building. The heater shall be installed so that all burner and ignition devices are greater than 18" above the garage floor. The heater shall be located or protected so that it is not subject to vehicular damage; or
2. A separate utility room is constructed in the garage with one means of access, and:
 - a) The appliance is installed on a noncombustible surface and all burner and burner ignition devices are located 18" above the garage floor; and
 - b) The utility room is constructed with one hour fire-resistant walls and a one-hour fire-resistant ceiling; and
 - c) The entry door to the utility room is a 45-minute, Class C, self-closing, weather-stripped door; and
 - d) All air for combustion and dilution air is taken from an area other than the garage in accordance with Article 7, Combustion Air; and
 - e) The entry door to the utility room is clearly marked: DANGER-KEEP DOOR CLOSED; and
 - f) All openings in the utility room for pipes, conduit, or ducts are sealed airtight; and
3. The garage is not heated by the same forced air system that heats the habitable space.

18-28-901.6 Borrowed light concept.

Gas appliances may be installed in the bedroom area of a residential loft unit constructed in accordance with the borrowed light concept, as long as the following conditions are met:

1. The walls surrounding the bedroom area do not extend to the ceiling.
2. The habitable space communicating directly with the bedroom area meets the requirements of an unconfined space.

18-28-902 Masonry Fireplaces.

18-28-902.1 General.

Masonry fireplaces shall be constructed in accordance with Chapter 13-140, Masonry Construction.

18-28-902.2 Masonry fireplaces utilizing wood or other solid fuels.

Masonry fireplaces utilizing wood or other solid fuels shall be provided with additional combustion air from the outdoors through the use of a UL listed outside air kit.

18-28-902.3 Gas-fired log lighters.

18-28-902.3.1 Approval and installation.

Gas-fire log lighters shall be installed in accordance with the manufacturers' installation instructions.

18-28-902.3.2 Prohibited installations.

Gas-fire log lighters shall not be installed in bedrooms, bathrooms or toilet rooms.

18-28-902.3.3 Combustion and circulating air.

Combustion and circulating air shall be provided in accordance with Article 7, Combustion Air.

18-28-903 Factory-Built Fireplaces.

18-28-903.1 General.

Factory-built fireplaces shall be listed and labeled and shall be installed in accordance with the conditions of the listing. Factory-built fireplaces shall be tested in accordance with UL 127.

18-28-903.1.1 Additional combustion air.

Factory-built fireplaces using wood or other solid fuels shall be provided with additional combustion air from the outdoors through the use of a UL listed outside air kit. The outside air kit shall be compatible with the make and model of the factory-built fireplace and shall be installed in accordance with the manufacturer's installation instructions.

18-28-903.1.2 Direct vent fireplaces.

Listed direct vent gas fireplaces may be installed in all habitable rooms. Listed direct vent gas fireplaces shall be installed in accordance with manufacturers' instructions.

18-28-903.1.3 Vented gas fireplaces (not including direct vent) located in habitable rooms (not including bathrooms and sleeping rooms).

Vented gas fireplaces may be installed in habitable rooms (not including bathrooms and sleeping rooms) provided that:

1. The fireplace is listed.
2. The habitable room is an unconfined space.
3. The fireplace is installed in accordance with manufacturers' instructions.

18-28-903.1.4 Vented gas fireplaces (not including direct vent) located in bathrooms and sleeping rooms.

Vented gas fireplaces (not including direct vent) may be installed in bathrooms and sleeping rooms provided that:

1. The fireplace is listed.
2. The habitable room is an unconfined space.
3. The fireplace is installed in accordance with manufacturers' instructions.
4. An approved carbon monoxide detector is installed inside the bathroom or sleeping room and is energized by the permanent electrical wiring present inside the bathroom or sleeping room.

18-28-903.1.5 Unvented gas fireplaces.

1. Unvented gas fireplaces may be installed in habitable rooms other than bathrooms and sleeping rooms provided
 - a) The appliance is listed.
 - b) The habitable room is an unconfined space.
 - c) The appliance is installed in accordance with manufacturers' instructions.
2. Unvented gas fireplaces may be installed in sleeping rooms provided that:
 - a) The sleeping room is an unconfined space.
 - b) The unvented gas fireplace is set in the wall.
 - c) The appliance is equipped with an oxygen depletion safety shutoff system.
 - d) The input rating of the appliance does not exceed 10,000 Btu/hr.
 - e) The appliance is installed in accordance with manufacturers' instructions.
 - f) An approved carbon monoxide detector is installed inside the sleeping room and is energized by the permanent electrical wiring present inside the sleeping room.
3. Unvented gas fireplaces may be installed in bathrooms provided that:

- a) The bathroom is an unconfined space.
- b) The unvented gas fireplace is set in the wall.
- c) The appliance is equipped with an oxygen depletion safety shutoff system.
- d) The input rating of the appliance does not exceed 6,000 Btu/hr.
- e) The appliance is installed in accordance with manufacturers' instructions.
- f) An approved carbon monoxide detector is installed inside the bathroom and is energized by the permanent electrical wiring present inside the bathroom.

18-28-903.2 Hearth extensions.

Hearth extensions of approved factory-built fireplaces and fireplace stoves shall be installed in accordance with the listing of the fireplace. The hearth extension shall be readily distinguishable from the surrounding floor area.

18-28-903.3 Unvented gas log heaters.

An unvented gas log heater shall not be installed in a factory-built fireplace unless the fireplace system has been specifically tested, listed and labeled for such use in accordance with UL 127.

18-28-903.3.1 Decorative appliances for installation in vented fireplaces.

18-28-903.3.1.1 Prohibited installations.

Decorative appliances for installation in vented fireplaces shall not be installed in bathrooms or sleeping rooms unless the appliance is listed and the sleeping room or bathroom is an unconfined space. In addition, an approved carbon monoxide detector shall be installed in the bathroom or sleeping room and shall be energized by the permanent electrical wiring present inside the bathroom or sleeping room..

18-28-903.3.1.2 Installation.

A decorative appliance for installation in a vented fireplace shall be installed only in a vented fireplace having a working chimney flue and constructed of noncombustible materials. These appliances shall not be thermostatically controlled.

18-28-903.3.1.3.

A listed decorative appliance for installation in a vented fireplace shall be installed in accordance with this listing and the manufacturer's instructions.

18-28-903.3.1.4.

A decorative appliance for installation in a vented fireplace where installed in a manufactured home shall be listed for installation in manufactured homes.

18-28-903.3.1.5 Fireplace screens.

A fireplace screen shall be installed with a decorative appliance for installation in a vented fireplace.

18-28-903.3.2 Gas-fired log lighters.

18-28-903.3.2.1 Approval and installation.

Gas-fired log lighters shall be installed in accordance with the manufacturers' installation instructions.

18-28-903.3.2.2 Prohibited installations.

Gas-fired log lighters shall not be installed in bedrooms, bathrooms or toilet rooms.

18-28-903.3.2.3 Combustion and circulating air.

Combustion and circulating air shall be provided in accordance with Article 7, Combustion Air.

18-28-904 Pellet Fuel-Burning Appliances.

18-28-904.1 General.

Pellet fuel-burning appliance shall be listed and labeled and shall be installed in accordance with the terms of the listing.

18-28-905 Fireplace Stoves and Room Heaters.

18-28-905.1 General.

Fireplace stoves and solid-fuel-type room heaters shall be listed and labeled and shall be installed in accordance with the conditions of the listing. Fireplace stoves shall be tested in accordance UL 737. Solid-fuel- type room heaters shall be tested in accordance with UL 1482. Fireplace inserts intended for installation in fireplaces shall be listed and labeled in accordance with the requirements of UL 1482 and shall be installed in accordance with the manufacturers' installation instructions.

18-28-905.1.1 Additional combustion air.

Fireplace stoves and/or room heaters using wood or other solid fuels shall be provided with additional combustion air from the outdoors through the use of a UL listed outside air kit. The outside air kit shall be compatible with the make and model of the fireplace stove or room heater and shall be installed in accordance with the manufacturers' installation instructions.

18-28-905.1.2 Direct vent gas room heaters.

Listed direct vent room heaters may be installed in all habitable rooms. Listed direct vent room heaters shall be installed in accordance with manufacturers' instructions.

18-28-905.1.3 Unvented gas room heaters.

1. Unvented gas room heaters may be installed in habitable rooms other than bathrooms and sleeping rooms provided:

- a) The appliance is listed.
- b) The habitable room is an unconfined space.
- c) The appliance is installed in accordance with manufacturers' instructions.

2. Unvented gas room heaters may be installed in sleeping rooms provided that:

- a) The sleeping room is an unconfined space.
- b) The unvented gas room heater is wall- mounted.
- c) The appliance is equipped with an oxygen depletion safety shutoff system.
- d) The input rating of the appliance does not exceed 10,000 Btu/hr.
- e) The appliance is installed in accordance with manufacturers' instructions.

f) An approved carbon monoxide detector is installed inside the sleeping room and is energized by the permanent electrical wiring present inside the sleeping room.

3. Unvented gas room heaters may be installed in bathrooms provided that:

- a) The bathroom is an unconfined space.
- b) The unvented gas room heater is wall mounted.
- c) The appliance is equipped with an oxygen depletion safety shutoff system.
- d) The input rating of the appliance does not exceed 6,000 Btu/hr.
- e) The appliance is installed in accordance with manufacturers' instructions.

f) An approved carbon monoxide detector is installed inside the bathroom and is energized by the permanent electrical wiring present inside the bathroom.

18-28-905.2 Connection fireplace.

The connection of solid fuel appliances to chimney flues serving fireplaces shall comply with Sections 18-28-801.7 and 18-28-801.10.

18-28-906 Factory-Built Barbecue Appliances.

18-28-906.1 General.

Factory-built barbecue appliances shall be of an approved type and shall be installed in accordance with the manufacturer's installation instructions, this article and Articles 3, 5, 7 and 8.

18-28-906.2 Natural gas barbecue grills located on balconies of multi-family buildings.

If natural gas supplies a barbecue grill, the gas shall be hard piped out to the balcony and a listed readily accessible shutoff valve shall be located outside, on the wall, at the point where the pipe protrudes out from the wall. A listed, readily accessible gas convenience outlet, which includes a shutoff valve as an integral part of its design may be used as an alternative to a standard shutoff valve.

18-28-907 Incinerators and Crematories.

18-28-907.1 General.

Incinerators and crematories shall be listed and labeled in accordance with UL 791 and shall be installed in accordance with the manufacturer's installation instructions.

18-28-908 Cooling Towers, Evaporative Condensers and Fluid Coolers.

18-28-908.1 General.

A cooling tower used in conjunction with an air-conditioning appliance shall be installed in accordance with the manufacturer's installation instructions.

18-28-908.2 Access.

Cooling towers, evaporative condensers and fluid coolers shall be provided with ready access.

18-28-908.3 Location.

Cooling towers, evaporative condensers and fluid coolers shall be located to prevent the discharge vapor plumes from entering occupied spaces. Plume discharges shall be not less than 5 feet (1524 mm) above or 20 feet (6096 mm) away from any ventilation inlet to a building. Location on the property shall be as required for buildings in accordance with the building code.

18-28-908.4 Support and anchorage.

Supports for cooling towers, evaporative condensers and fluid coolers shall be designed in accordance with the building code's structural requirements.

18-28-908.5 Water supply.

Water supplies and protection shall be as required by the Chapter 18-29 of the building code and the Chicago Department of Water Management.

18-28-908.6 Drainage.

Drains, overflows and blow-down provisions shall be indirectly connected to an approved disposal location. Discharge of chemical waste shall be approved by the appropriate regulatory authority.

18-28-908.7 Refrigerants and hazardous fluids.

Heat exchange equipment that contains a refrigerant and that is part of a closed refrigeration system shall comply with Chapter 11. Heat exchange equipment containing heat transfer fluids which are flammable, combustible or hazardous shall comply with the building code.

18-28-909 Vented Wall Furnaces.

18-28-909.1 General.

Vented wall furnaces shall be installed in accordance with their listing and the manufacturer's installation instructions. Oil-fired furnaces shall be tested in accordance with UL 730.

18-28-909.2 Location.

Vented wall furnaces shall be located so as not to cause a fire hazard to walls, floors, combustible furnishings or doors. Vented wall furnaces installed between bathrooms and adjoining rooms shall not circulate air from bathrooms to other parts of the building.

18-28-909.3 Door swing.

Vented wall furnaces shall be located so that a door cannot swing within 12 inches (305 mm) of an air inlet or air outlet of such furnace measured at right angles to the opening. Doorstops or door closers shall not be installed to obtain this clearance.

18-28-909.4 Ducts prohibited.

Ducts shall not be attached to wall furnaces. Casing extension boots shall not be installed unless listed as part of the appliance.

18-28-909.5 Manual shutoff valve.

A manual shutoff valve shall be installed ahead of all controls.

18-28-909.6 Access.

Vented wall furnaces shall be provided with access for cleaning of heating surfaces, removal of burners, replacement of sections, motors, controls, filters and other working parts, and for adjustments and lubrication of parts requiring such attention. Panels, grilles and access doors that must be removed for normal servicing operations shall not be attached to the building construction.

18-28-909.7 Combustion and circulating air.

Combustion and circulating air shall be provided in accordance with Article 7, Combustion Air.

18-28-909.8 Gas-fired vented wall furnaces.

Vented wall furnaces connected to a Type B-W gas vent system listed only for single story shall be installed only in single-story buildings or the top story of multistory buildings. Vented wall furnaces connected to a Type B-W gas vent system listed for installation in multistory buildings shall be permitted to be installed in single-story or multistory buildings. Type B-W gas vents shall be attached directly to a solid header plate that serves as a firestop at that point and that shall be permitted to be an integral part of the vented wall furnace. The stud space in which the vented wall furnace is installed shall be ventilated at the first ceiling level by installation of the ceiling plate spaces furnished with the gas vent. Firestop spacers shall be installed at each subsequent ceiling or floor level penetrated by the vent.

18-28-909.9 Gas-fired direct-vent wall furnaces.

Direct-vent wall furnaces shall be installed with the vent-air intake terminal in the outside atmosphere. The thickness of the walls on which the furnace is mounted shall be within the range of wall thickness marked on the furnace and covered in the manufacturers' installation instructions.

18-28-910 Floor Furnaces.

18-28-910.1 General.

Floor furnaces shall be installed in accordance with their listing and the manufacturer's installation instructions. Oil-fired furnaces shall be tested in accordance with UL 729.

18-28-910.2 Placement.

Floor furnaces shall not be installed in the floor of any aisle or passageway of any auditorium, public, hall, place of assembly, or in any egress element from any such room or space.

With the exception of wall register models, a floor furnace shall not be placed closer than 6 inches (152 mm) to the nearest wall, and wall register models shall not be placed closer than 6 inches (152 mm) to a corner.

The furnace shall be placed such that a drapery or similar combustible object will not be nearer than 12 inches (305 mm) to any portion of the register of the furnace. Floor furnaces shall not be installed in concrete floor construction built on grade. The controlling thermostat for a floor furnace shall be located within the same room or space as the floor furnace or shall be located in an adjacent room or space that is permanently open to the room or space containing the floor furnace.

18-28-910.3 Bracing.

The floor around the furnace shall be braced and headed with a support framework design in accordance with the structural requirements of the building code.

18-28-910.4 Clearance.

The lowest portion of the floor furnace shall have not less than a 6-inch (152 mm) clearance from the grade level; except where the lower 6-inch (152 mm) portion of the floor furnace is sealed by the manufacturers to prevent entrance of water, the minimum clearance shall be reduced to not less than 2 inches (51 mm). Where these clearances are not present, the ground below and to the sides shall be excavated to form a pit under the furnace so that the required clearance is provided beneath the lowest portion of the furnace. A 12-inch (305 mm) minimum clearance shall be provided on all sides except the control side, which shall have an 18-inch (457 mm) minimum clearance.

18-28-911 Duct Furnaces.

18-28-911.1 General.

Duct furnaces shall be installed in accordance with the manufacturer's installation instructions. Electric furnaces shall be tested in accordance with UL 1995.

18-28-911.2 Gas-fired duct furnaces.

18-28-911.2.1 Clearances.

The installation of duct furnaces shall comply with the following clearance requirements:

1. Listed duct furnaces shall be installed with clearances of at least 6 inches (150 mm) between adjacent walls, ceilings, and floors of combustible material and the furnace draft hood. Furnaces listed for installation at lesser clearances shall be installed in accordance with their listings. In no case shall the clearance be such as to interfere with combustion air and accessibility.

18-28-911.2.2 Erection of equipment.

Duct furnaces shall be erected and firmly supported in accordance with the manufacturers' instructions.

18-28-911.2.3 Access panels.

The ducts connected to duct furnaces shall have removable access panels on both the upstream and downstream sides of the furnace.

18-28-911.2.4 Location of draft hood and controls.

The controls, combustion air inlet, and draft hoods for duct furnaces shall be located outside the ducts. The draft hood shall be located in the same enclosure from which combustion air is taken.

18-28-911.2.5 Circulating air.

Where a duct furnace is installed so that supply ducts carry air circulated by the furnace to areas outside the space containing the furnace, the return air shall also be handled by a duct(s) sealed to the furnace casing and terminating outside the space containing the furnace. The duct furnace shall be installed on the positive-pressure side of the circulating air blower.

18-28-911.2.6 Duct furnaces used with refrigeration systems.

1. A duct furnace shall not be installed in conjunction with a refrigeration coil where circulation of cooled air is provided by the blower.

Exception: Where the blower has sufficient capacity to overcome the external static resistance imposed by the duct system, furnace, and the cooling coil and the air throughput necessary for heating or cooling, whichever is greater.

2. Duct furnaces used in conjunction with cooling equipment shall be installed in parallel with or on the upstream side of cooling coils to avoid condensation within heating elements. With a parallel flow arrangement, the dampers or other means used to control the flow of air shall be sufficiently tight to prevent any circulation of cooled air through the unit.

Exception: Where the duct furnace has been specifically listed for downstream installation.

3. Where duct furnaces are to be located upstream from cooling units, the cooling unit shall be so designed or equipped as to not develop excessive temperatures or pressures.

4. Where a duct furnace is installed downstream of an evaporative cooler or air washer, the heat exchanger shall be constructed of corrosion-resistant materials. Stainless steel, ceramic-coated steel, and an aluminum-coated steel in which the bond between the steel and the aluminum is an iron-aluminum alloy are considered to be corrosion resistant. Air washers operating with chilled water that deliver air below the dew point of the ambient air at the equipment are considered as refrigeration systems.

18-28-912 Infrared Radiant Heaters.

18-28-912.1 Support.

Infrared radiant heaters shall be safely and adequately fixed in an approved position independent of fuel and electric supply lines. Hangers and brackets shall be noncombustible material.

18-28-912.2 Clearances.

Heaters shall be installed with clearances from combustible material in accordance with the manufacturer's installation instructions. In locations used for the storage of combustible materials, signs shall be posted to specify the maximum permissible stacking height to maintain required clearances from the heater to the combustibles.

18-28-912.3 Installation in commercial garages.

18-28-912.3.1 Parking structures.

Gas utilization equipment installed in enclosed, basement, and underground parking structures shall be installed in accordance with NFPA 88A, Standard for Parking Structures.

18-28-912.3.2 Repair garages.

Gas utilization equipment installed in repair garages shall be installed in a detached building or room, separated from repair areas by walls or partitions, floors, or floor ceiling assemblies that are constructed so as to prohibit the transmission of vapors and having a fire resistance rating of not less than 1 hour and that have no openings in the wall separating the repair area within 8 feet (2.4 m) of the floor. Wall penetrations shall be firestopped. Air for combustion purposes shall be obtained from outside the building. The heating room shall not be used for the storage of combustible materials.

Exceptions:

1. Overhead heaters where installed not less than 8 feet (2.4 m) above the floor shall be permitted.
2. Heating equipment for vehicle repair areas where there is no dispensing or transferring of Class I or Class H flammable or combustible liquids or liquefied petroleum gas shall be installed in accordance with NFPA 30A, Automotive and Marine Service Station Code.

18-28-912.3.3 Installation in aircraft hangars.

Heaters in aircraft hangars shall be installed in accordance with NFPA 409, Standard on Aircraft Hangars.

18-28-913 Clothes Dryers.

18-28-913.1 General.

Clothes dryers shall be installed in accordance with the manufacturer's installation instructions. Electric residential clothes dryers shall be tested in accordance with an approved test standard. Electric commercial clothes dryers shall be tested in accordance with UL 1240. Electric coin-operated clothes dryers shall be tested in accordance with UL 2158.

18-28-913.2 Exhaust required.

Clothes dryers shall be exhausted in accordance with Section 18-28-504.

18-28-913.3 Clearances.

Clothes dryers shall be installed with clearance to combustible tin accordance with the manufacturer's instructions.

18-28-914 Sauna Heaters.

18-28-914.1 Location and protection.

Sauna heaters shall be located so as to minimize the possibility of accidental contact by a person in the room.

18-28-914.1.1 Guards.

Sauna heaters shall be protected from accidental contact by an approved guard or barrier of material having a low coefficient of thermal conductivity. The guard shall not substantially affect the transfer of heat from the heater to the room.

18-28-914.2 Installation.

Sauna heaters shall be listed and labeled and shall be installed in accordance with their listing and the manufacturer's installation instructions.

18-28-914.2.1 Combustion and dilution air intakes.

Sauna heaters of other than the direct-vent type shall be installed with the draft hood and combustion air intake located outside the sauna room. Where the combustion air inlet and the draft hood are in a dressing room adjacent to the sauna room, there shall be provisions to prevent physically blocking the combustion air inlet and the draft hood inlet, and to prevent physical contact with the draft hood and vent assembly, or warning notices shall be posted to avoid such contact. Any warning notice shall be easily readable, shall contrast with its background, and the wording shall be in letters not less than 1/4 inch (6.4 mm) high.

18-28-914.2.2 Combustion and ventilation air.

Combustion air shall not be taken from inside the sauna room. Combustion air for a sauna heater not of the direct-vent type shall be provided to the area in which the combustion air inlet and draft hood are located in accordance with Article 7, Combustion Air.

18-28-914.3 Access.

Panels, grilles and access doors that are required to be removed for formal servicing operations shall not be attached to the building.

18-28-914.4 Heat and time controls.

Sauna heaters shall be equipped with a thermostat that will limit room temperature to 194°F (90°C). If the thermostat is not an integral part of the sauna heater, the heat-sensing element shall be located within 6 inches (152 mm) of the ceiling. If the heat-sensing element is a capillary tube and bulb, the assembly shall be attached to the wall or other support and shall be protected against physical damage.

18-28-914.4.1 Timers.

A timer, if provided to control main burner operation, shall have a maximum operating time of 1 hour. The control for the timer shall be located outside the sauna room.

18-28-914.5 Sauna room.

A ventilation opening into the sauna room shall be provided. The opening shall be not less than 4 inches by 8 inches (102 mm by 203 mm) located near the top of the door into the sauna room.

18-28-914.5.1 Warning notice.

The following permanent notice, constructed of approved material, shall be mechanically attached to the sauna room on the outside:

WARNING: DO NOT EXCEED 30 MINUTES IN SAUNA. EXCESSIVE EXPOSURE CAN BE HARMFUL TO HEALTH. ANY PERSON WITH POOR HEALTH SHOULD CONSULT A PHYSICIAN BEFORE USING SAUNA.

The words shall contrast with the background and the wording shall be in letters not less than 0.25-inch (6.2 mm) high.

Exception: This section shall not apply to one- and two-family dwellings.

18-28-915 Engine and Gas Turbine-Powered Equipment and Appliances.

18-28-915.1 General.

The installation of liquid-fueled stationary internal combustion engines, gas engines, and gas turbines, including fuel storage and pipings shall meet the requirements of NFPA 37.

18-28-916 Pool and Spa Heaters.

18-28-916.1 General.

Pool and spa heaters shall be installed in accordance with the manufacturer's instructions and Section 18-29-501, Plumbing. Oil-fired pool heaters shall be tested in accordance with UL 726.

18-28-916.2 Gas-fired pool heaters.

18-28-916.2.1 Location.

A pool heater shall be located or protected so as to minimize accidental contact of hot surfaces by persons.

18-28-916.2.2 Clearance.

The installation of pool heaters shall comply with the following requirements:

1. In no case shall the clearances be such as to interfere with combustion air, draft hood or vent terminal clearance and relief, and accessibility for servicing.
2. A listed pool heater shall be installed in accordance with its listing and the manufacturer's instructions.

18-28-916.2.3 Temperature- or pressure-limiting devices.

18-28-916.2.3.1.

Where a pool heater is provided with over temperature protection only and is installed with any device in the discharge line of the heater that can restrict the flow of water from the heater to the pool (such as a check valve, shutoff valve, therapeutic pool valving, or flow nozzles), a pressure relief valve shall be installed either in the heater or between the heater and the restrictive device.

18-28-916.2.3.2 Bypass valves.

Where an integral bypass system is not provided as a part of the pool heater, a bypass line and valve shall be installed between the inlet and outlet piping for use in adjusting the flow of water through the heater.

18-28-916.2.3.3 Venting.

A pool heater listed for outdoor installation shall be installed with the venting means supplied by the manufacturer and in accordance with the manufacturer's instructions.

18-28-917 Cooking Appliances.

18-28-917.1 Cooking appliances.

Cooking appliances that are designed for permanent installation, including ranges, ovens, stoves, broilers, grills, fryers, griddles and barbecues, shall be listed, labeled and installed in accordance with the manufacturer's installation instructions. Oil-burning stoves shall be tested in accordance with UL 896. Solid fuel-fired ovens shall be tested in accordance with UL 2162.

18-28-917.2 Prohibited location.

Cooking appliances designed, tested, listed and labeled for use in commercial occupancies shall not be installed within dwelling units or within any area where domestic cooking operations occur.

18-28-917.3 Domestic appliances.

Cooking appliances installed within dwelling units and within areas where domestic cooking operations occur shall be listed and labeled as household-type appliances for domestic use.

18-28-917.4 Gas-fired food service equipment, floor-mounted.

18-28-917.4.1 Clearance for listed equipment.

Listed floor-mounted food service equipment, such as ranges for hotels and restaurants, deep fat fryers, unit broilers, gas-fired kettles, steam cookers, steam generators, and baking and roasting ovens, shall be installed at least 6 inches (150 mm) from combustible materials except that at least a 2 inch (50 mm) clearance shall be maintained between a draft hood and combustible material. Floor-mounted food service equipment listed for installation at lesser clearances shall be installed in accordance with its listing and the

manufacturer's instructions. Equipment designed and marked "For use only in noncombustible locations" shall not be installed elsewhere.

18-28-917.4.2 Clearance for unlisted equipment.

Unlisted floor-mounted food service equipment shall be installed to provide a clearance to combustible material of not less than 18 inches (460 mm) from the sides and rear of the equipment and from the vent connector and not less than 48 inches (1.2 m) above cooking tops and at the front of the equipment. Clearances for unlisted equipment installed in partially enclosed areas such as alcoves shall not be reduced.

18-28-917.4.3 Mounting on combustible floor.

18-28-917.4.3.1

Listed floor-mounted food service equipment that is listed specifically for installation on floors constructed of combustible material shall be permitted to be mounted on combustible floors in accordance with its listing and the manufacturer's instructions.

18-28-917.4.3.2

Floor-mounted food service equipment that is not listed for mounting on a combustible floor shall be mounted in accordance with 18-28-917.4.4 or be mounted in accordance with one of the following:

1. Where the equipment is set on legs that provide not less than 18 inches (460 mm) open space under the base of the equipment or where it has no burners and no portion of any oven or broiler within 18 inches (460 mm) of the floor, it shall be permitted to be mounted on a combustible floor without special floor protection, provided there is at least one sheet metal baffle between the burner and the floor.
2. Where the equipment is set on legs that provide not less than 8 inches (200 mm) open space under the base of the equipment, it shall be permitted to be mounted on combustible floors, provided the floor under the equipment is protected with not less than 3/8 inch (9.5 mm) insulating millboard covered with sheet metal not less than 0.0195 inches (0.5 mm) thick. The preceding specified floor protection shall extend not less than 6 inches (150 mm) beyond the equipment on all sides.
3. Where the equipment is set on legs that provide not less than 4 inches (100 mm) under the base of the equipment, it shall be permitted to be mounted on combustible floors provided the floor under the equipment is protected with hollow masonry not less than 4 inches (100 mm) in thickness covered with sheet metal not less than 0.0195 inches (0.5 mm) thick. Such masonry courses shall be laid with ends unsealed and joints matched in such a way as to provide for free circulation of air through the masonry.
4. Where the equipment does not have legs at least 4 inches (100 mm) high, it shall be permitted to be mounted on combustible floors, provided the floor under the equipment is protected by two courses of 4 inches (100 mm) hollow clay tile, or equivalent, with courses laid at right angles and with ends unsealed and joints matched in such a way as to provide for free circulation of air through such masonry courses, and covered with steel plate not less than 3/16 inch (4.8 mm) in thickness.

18-28-917.4.4 Mounting on noncombustible floor.

Listed floor-mounted food service equipment that is designed and marked "For use only in noncombustible locations" shall be mounted on floors of noncombustible construction with noncombustible flooring and surface finish and with no combustible material against the underside thereof, or on noncombustible slabs or arches having no combustible material against the underside thereof. Such construction shall in all cases extend not less than 12 inches (300 mm) beyond the equipment on all sides.

18-28-917.4.5 Combustible material adjacent to cooking top.

Any portion of combustible material adjacent to a cooking top section of a food service range, even though listed for close-to-wall installation, that is not shielded from the wall by a high shelf, warming closet, and so on, shall be protected as specified in 18-28-917.4.2 for a distance of at least 2 feet (0.6 m) above the surface of the cooking top.

18-28-917.4.6 For use with casters.

Floor-mounted equipment with casters shall be listed for such construction and shall be installed in accordance with their listing and the accompanying instructions for limiting the movement of the equipment to prevent strain on the connection.

18-28-917.4.7 Level installation.

Floor-mounted food service equipment shall be installed level on a firm foundation.

18-28-917.4.8 Ventilation.

Means shall be provided to properly ventilate the space in which food service equipment is installed to permit proper combustion of the gas.

18-28-917.5 Gas-fired food service equipment - counter appliances.

18-28-917.5.1 Vertical clearance.

A vertical distance of not less than 48 inches (1.2 m) shall be provided between the top of all food service hot plates and griddles and combustible material.

18-28-917.5.2 Clearance for listed appliances.

Listed food service counter appliances such as hot plates and griddles, food and dish warmers, and coffee brewers and urns, where installed on combustible surfaces, shall be set on their own bases or legs and shall be installed with a minimum horizontal clearance of 6 inches (150 mm) from combustible material, except that at least a 2-inch (50 mm) clearance shall be maintained between a draft hood and combustible material. Food service counter appliances listed for installation at lesser clearances shall be installed in accordance with their listing and the manufacturers' instructions.

18-28-917.5.3 Clearance for unlisted appliances.

Unlisted food service hot plates and griddles shall be installed with a horizontal clearance from combustible material of not less than 18 inches (460 mm). Unlisted gas food service counter appliances, including coffee brewers and urns, waffle bakers, and hot water immersion sterilizers, shall be installed with a horizontal clearance from combustible material of not less than 12 inches (300 mm). Unlisted food and dish warmers shall be installed with a horizontal clearance from combustible material of not less than 6 inches (150 mm).

18-28-917.5.4 Mounting of unlisted appliances.

Unlisted food service counter appliances shall not be set on combustible material unless they have legs that provide not less than 4 inches (100 mm) of open space below the burners and the combustible surface is protected with insulating millboard at least 1/4 inch (6 mm) thick covered with sheet metal not less than 0.0122 inch (0.3 mm) thick, or with equivalent protection.

18-28-917.6 Gas-fired hot plates.

18-28-917.6.1

Listed domestic hot plates installed on combustible surfaces shall be set on their own legs or bases. They shall be installed with minimum horizontal clearances of 6 inches (150 mm) from combustible material.

18-28-917.6.2

Unlisted domestic hot plates shall be installed with horizontal clearances to combustible material of not less than 12 inches (300 mm). Combustible surfaces under unlisted domestic hot plates shall be protected in an approved manner.

18-28-917.6.3.

The vertical distance between tops of all domestic hot plates and combustible material shall be at least 30 inches (760 mm).

18-28-917.7 Gas-fired household cooking appliances.

18-28-917.7.1 Floor-mounted units.

18-28-917.7.1.1 Clearance from combustible material.

The clearances specified as follows shall not interfere with combustion air, accessibility for operation, and servicing:

1. Listed floor-mounted household cooking appliances, where installed on combustible floors, shall be set on their own bases or legs and shall be installed in accordance with their listing and the manufacturer's instructions.
2. Listed household cooking appliances with listed gas room heater sections shall be installed so that the warm air discharge side shall have a minimum clearance of 18 inches (460 mm) from adjacent combustible material. A minimum clearance of 36 inches (910 mm) shall be provided between the top of the heater section and the bottom of cabinets.
3. Listed household cooking appliances that include a solid or liquid fuel-burning section shall be spaced from combustible material

and otherwise installed in accordance with the standards applying to the supplementary fuel section of the appliance.

4. Unlisted floor-mounted household cooking appliances shall be installed with at least 6 inches (150 mm) clearance at the back and sides to combustible material. Combustible floors under unlisted appliances shall be protected in an approved manner.

18-28-917.7.1.2 Vertical clearance above cooking top.

Household cooking appliances shall have a vertical clearance above the cooking top of not less than 30 inches (760 mm) to combustible material or metal cabinets. A minimum clearance of 24 inches (610 mm) is permitted when one of the following is installed:

1. The underside of the combustible material or metal cabinet above the cooking top is protected with not less than 1/4 inch (6 mm) insulating millboard covered with sheet metal not less than 0.0122 inch (0.3 mm)
2. A metal ventilating hood of sheet metal not less than 0.0122 inch (0.3 mm) thick is installed above the cooking top with a clearance of not less than 1/4 inch (6 mm) between the hood and the underside of the combustible material or metal cabinet, and the hood is at least as wide as the appliance and is centered over the appliance.
3. A listed cooking appliance or microwave oven is installed over a listed cooking appliance and will conform to the terms of the upper appliance's listing and the manufacturers' instructions.

18-28-917.7.1.3 Level installation.

Cooking appliances shall be installed so that the cooking top or oven racks are level.

18-28-917.7.2 Built-in units.

18-28-917.7.2.1 Installation.

Listed built-in household cooking appliances shall be installed in accordance with their listing and the manufacturer's instructions. The installation shall not interfere with combustion air, accessibility for operation, and servicing. Unlisted built-in household cooking appliances shall not be installed in, or adjacent to, combustible material.

18-28-917.7.2.2 Vertical clearance.

Built-in top (or surface) cooking appliances shall have a vertical clearance above the cooking top of not less than 30 inches (760 mm) to combustible material or metal cabinets. A minimum clearance of 24 inches (610 mm) is permitted when one of the following is installed:

1. The underside of the combustible material or metal cabinet above the cooking top is protected with not less than 1/4 inch (6 mm) insulating millboard covered with sheet metal not less than 0.0122 inch (0.3 mm) thick.
2. A metal ventilating hood of sheet metal not less than 0.0122 inch (0.3 mm) thick is installed above the cooking top with a clearance of not less than 1/4 inch (6 mm) between the hood and the underside of the combustible material or metal cabinet, and the hood is at least as wide as the appliance and is centered over the appliance.
3. A listed cooking appliance or microwave oven is installed over a listed cooking appliance and will conform to the terms of the upper appliance's listing and the manufacturer's instructions.

18-28-917.7.2.3 Horizontal clearance.

The minimum horizontal distance from the center of the burner head(s) of a listed top (or surface) cooking appliance to vertical combustible walls extending above the top panel shall be not less than that distance specified by the permanent marking on the appliance.

18-28-917.7.2.4 Level installation.

Built-in household cooking appliances shall be installed so that the cooking top, broiler pan, or oven racks are level.

18-28-917.8 Gas-fired open-top broiler units.

18-28-917.8.1 Listed units.

Listed open-top broiler units shall be installed in accordance with their listing and the manufacturers instructions.

18-28-917.8.2 Unlisted units.

Unlisted open-top broiler units shall be installed in accordance with the manufacturers' instructions, but shall not be installed in combustible material.

18-28-917.8.3 Protection above domestic units.

Domestic open-top broiler units shall be provided with a metal ventilating hood not less than 0.0122 inch (0.3 mm) thick with a clearance of not less than 1/4 inch (6 mm) between the hood and the underside of combustible material or metal cabinets. A clearance of at least 24 inches (610 mm) shall be maintained between the cooking top and the combustible material or metal cabinet, and the hood shall be at least as wide as the open-top broiler unit and centered over the unit. Listed domestic open-top broiler units incorporating an integral exhaust system and listed for use without a ventilating hood need not be provided with a ventilating hood if installed in accordance with 18.28-917.7.1.2(1)

18-28-917.8.4 Commercial units.

Commercial open-top broiler units shall be provided with ventilation in accordance with Article 4, Ventilation.

18-28-918 Forced-Air Warm-Air Furnaces.

18-28-918.1 Forced-air furnaces.

Forced-air furnaces shall be installed in accordance with the listings and the manufacturer's installation instructions. Oil-fired furnaces shall be tested in accordance with UL 727. Electric furnaces shall be tested in accordance with UL 1096 or UL 1995. Solid fuel furnaces shall be tested in accordance with UL 391.

18-28-918.2 Minimum duct sizes.

The minimum unobstructed total area of the outside and return air ducts or openings to a forced-air warm-air furnace shall be not less than 2 square inches per 1,000 Btu/h (4402 mm²/kW) output rating capacity of the furnace and not less than that specified in the furnace manufacturer's installation instructions. The minimum unobstructed total area of supply ducts from a forced-air warm-air furnace shall not be less than 2 square inches for each 1,000 Btu/h (4402 mm²/kW) output rating capacity of the furnace and not less than that specified in the furnace manufacturer's installation instructions.

Exception: The total area of the supply air ducts and outside and return air ducts shall not be required to be larger than the minimum size required by the furnace manufacturer's installation instructions.

18-28-918.3 Heat pumps.

The minimum unobstructed total area of the outside and return air ducts or openings to a heat pump shall be not less than 6 square inches per 1,000 Btu/h (13,208 mm²/kW) output rating or as indicated by the conditions of listing of the heat pump. Electric heat pumps shall be tested in accordance with UL 559 or UL 1995.

18-28-918.4 Dampers.

Volume dampers shall not be placed in the air inlet to a furnace in a manner that will reduce the required air to the furnace.

18-28-918.5 Circulating air ducts for forced-air warm-air furnaces.

Circulating air for fuel-burning, forced-air-type, warm-air furnaces shall be conducted into the blower housing from outside the furnace enclosure by continuous air-tight ducts.

18-28-918.6 Prohibited sources.

Outside or return air for a forced-air heating system shall not be taken from the following locations:

1. Closer than 10 feet (3048 mm) from an appliance vent outlet, a vent opening from a plumbing drainage system or the discharge outlet of an exhaust fan, unless the outlet is 3 feet (914 mm) above the outside air inlet.
2. Where there is the presence of objectionable odors, fumes or flammable vapors; or where located less than 10 feet (3048 mm) above the surface of any abutting public way or driveway; or where located at grade level by a sidewalk, street, alley or driveway.
3. A hazardous or insanitary location or a refrigeration machinery room as defined in the building code.
4. A room or space, the volume of which is less than 25 percent of the entire volume served by such system. Where connected by a permanent opening having an area sized in accordance with Sections 18-28-918.2 and 18-28-918.3, adjoining rooms or spaces shall be considered as a single room or space for the purpose of determining the volume of such rooms or spaces.

Exception: The minimum volume requirement shall not apply where the amount of return air taken from a room or space is less than or equal to the amount of supply air delivered to such room or space.

5. A closet, bathroom, toilet room, kitchen, garage, mechanical room, boiler room or furnace room.
6. A room or space containing a fuel-burning appliance where such room or space serves as the sole source of return air.

Exceptions:

1. This shall not apply where the fuel-burning appliance is a direct-vent appliance.

2. This shall not apply where the room or space complies with the following requirements:

2.1 The return air shall be taken from a room or space having a volume exceeding 1 cubic foot for each 10 Btu/h (9.6 L/W) of combined input rating of all fuel-burning appliances therein.

2.2 The volume of supply air discharged back into the same space shall be approximately equal to the volume of return air taken from the space.

2.3 Return-air inlets shall not be located within 10 feet (3048 mm) of any appliance firebox or draft hood in the same room or space.

3. This shall apply to rooms or spaces containing solid fuel-burning appliances, provided that return-air inlets are located not less than 10 feet (3048 mm) from the firebox of such appliances.

18-28-918.7 Outside opening protection.

Outdoor air intake openings shall be protected in accordance with section 401.6.

18-28-918.8 Return-air limitation.

The installation of conversion burners shall conform to ANSI Z21.8, Installation of Domestic Gas Conversion Burners.

18-28-918.9 Gas-fired forced-air, warm-air furnaces.

18-28-918.9.1 General.

Due to safety and health considerations, a central heating furnace may only supply heated air to a single residential living unit.

18-28-918.9.2.

Central heating furnace installations in bedrooms or bathrooms shall comply with one of the following:

1. Central heating furnaces shall be installed in a closet located in the bedroom or bathroom, the closet shall have a weather-stripped solid door with a self-closing device, and all combustion air shall be obtained from the outdoors.

2. Central heating furnaces shall be of the direct vent type.

18-28-918.9.3 Clearance.

18-28-918.9.3.1.

Listed central heating furnaces installed in rooms large in comparison with the size of the equipment shall be installed with clearances per the terms of their listing and the manufacturer's instructions.

18-28-918.9.3.2.

Central heating furnaces installed in rooms that are not large (such as alcoves and closets) in comparison with the size of the equipment shall be listed for such installations.

18-28-918.9.3.3.

Front clearance shall be sufficient for servicing the burner and the furnace.

18-28-918.9.3.4.

Where the furnace plenum is adjacent to plaster on metal lath or noncombustible material attached to combustible material, the

clearance shall be measured to the surface of the plaster or other noncombustible finish where the clearance specified is 2 inches (50 mm) or less.

18-28-918.9.3.5.

The clearance to this equipment shall not interfere with combustion air, draft hood clearance and relief, and accessibility for servicing.

18-28-918.9.4 Assembly and installation.

A central heating furnace shall be installed in accordance with the manufacturer's instructions and shall be installed on a floor of noncombustible construction with noncombustible flooring and surface finish and with no combustible material against the underside thereof, or on fire-resistive slabs or arches having no combustible material against the underside thereof.

Exceptions:

1. Appliances listed for installation on a combustible floor.
2. Installation on a floor protected in an approved manner.

18-28-918.9.4.1.

A furnace plenum supplied as a part of a furnace shall be installed in accordance with the manufacturer's instructions.

18-28-918.9.4.2.

Where a furnace plenum is not supplied with the furnace, any fabrication and installation instructions provided by the manufacturer shall be followed. The method of connecting supply and return ducts shall facilitate proper circulation of air.

18-28-918.9.4.3

Where a furnace is installed so supply ducts carry air circulated by the furnace to areas outside the space containing the furnace, the return air shall also be handled by a duct(s) sealed to the furnace casing and terminating outside the space containing the furnace.

18-28-918.9.5 Combustion and circulating air.

18-28-918.9.5.1.

Combustion and circulating air shall be provided in accordance with Article 7, Combustion Air.

18-28-918.9.6 Furnace plenums and air ducts.

18-28-918.9.6.1.

Furnace plenums and air ducts shall be installed in accordance with Article 6, Duct Systems.

18-28-918.10 Gas-fired horizontal furnaces above dropped ceilings.

1. The air space above the dropped ceiling does not have free air communication with the space below.
2. Horizontal furnaces may be installed above dropped ceilings provided that:
 - a) The horizontal furnace is listed.
 - b) The horizontal furnace is installed in accordance with the manufacturer's instructions.

c) The space above the dropped ceilings is itself unconfined or directly communicates with a horizontally adjacent space through two permanent openings, such that the combined volume of the two spaces is unconfined. The two permanent openings shall be installed on the same wall. One opening shall be located within 12 inches of the top of the space above the dropped ceiling and the second opening shall be located within 12 inches of the bottom of the space above the dropped ceiling.

Note: The two openings shall not be installed in the dropped ceiling itself and the use of outdoor air to supply combustion air to spaces above dropped ceilings is not allowed.

18-28-918.11 Gas-fired furnaces located above bathrooms, toilet rooms or bedrooms.

If a gas-fired furnace is located on a platform above a solid ceiling of a bathroom, toilet room or bedroom, the space above such

rooms shall be subject to the same conditions as if they were located in a closet accessed directly from those rooms (if access is provided from those rooms and the space is enclosed by walls and a ceiling).

(a) Gas-fired furnaces shall meet the following criteria if installed in this space:

1. The platform shall be designed to support the weight of the gas furnace.
2. The gas furnace shall be specifically designed for installation in alcoves or closets.
3. Gas furnace shall be installed in accordance with the manufacturer's specifications and shall be installed on a floor of noncombustible construction with noncombustible flooring and surface finish and with no combustible material against the underside of the gas furnace, or on fire-resistive slabs or arches with no combustible materials against the underside of the gas furnace.
4. Combustion air shall be provided in accordance with Section 18-28-703.2.

Exception: Where there are vertical and/or horizontal space limitations, it is permissible for the two permanent combustion air openings to abut one another.

18-28-919 Conversion Burners.

18-28-919.1 Conversion burners.

The installation of conversion burners shall conform to ANSI Z21.8, Installation of Domestic Gas Conversion Burners.

18-28-920 Unit Heaters.

18-28-920.1 General.

Unit heaters shall be installed in accordance with the listing and the manufacturer's installation instructions. Oil-fired unit heaters shall be tested in accordance with UL 731.

18-28-920.2 Support.

Suspended-type unit heaters shall be supported by elements that are designed and constructed to accommodate the weight and dynamic loads. Hangers and brackets shall be of noncombustible material. Suspended-type oil-fired unit heaters shall be installed in accordance with NFPA 31.

18-28-920.3 Ductwork.

A unit heater shall not be attached to a warm-air duct system unless listed for such installation.

18-28-920.4 Gas-fired unit heaters.

18-28-920.4.1 Support.

Suspended-type unit heaters shall be safely and adequately supported with due consideration given to their weight and vibration characteristics. Hangers and brackets shall be of noncombustible material.

18-28-920.4.2 Clearance.

18-28-920.4.2.1 Suspended-type unit heaters.

Suspended-type unit heaters shall comply with the following requirements:

1. A listed unit heater shall be installed with clearances from combustible material of not less than 18 inches (460 mm) at the sides, 12 inches (300 mm) at the bottom and 6 inches (150 mm) above the top where the unit heater has an internal draft hood, or 1 inch (25 mm) above the top of the sloping side of a vertical draft hood. A unit heater listed for reduced clearances shall be installed in accordance with its listing and the manufacturer's instructions.

2. Clearances for servicing shall be in accordance with the manufacturers' recommendations contained in the installation instructions.

18-28-920.4.2.2 Floor-mounted-type unit heaters.

Floor-mounted-type unit heaters shall comply with the following requirements:

1. A listed unit heater shall be installed with clearances from combustible material at the back and one side only of not less than 6

inches (150 mm). Where the flue gases are vented horizontally, the 6 inches (150 mm) clearance shall be measured from the draft hood or vent instead of the rear wall of the unit heater. A unit heater listed for reduced clearances shall be installed in accordance with its listing and the manufacturer's instructions.

2. Floor-mounted-type unit heaters installed on combustible floors shall be listed for such installation.
3. Combustible floors under unlisted floor-mounted unit heaters shall be protected in an approved manner.
4. Clearances for servicing shall be in accordance with the manufacturer's recommendations contained in the installation instructions.

18-28-920.4.3 Combustion and circulating air.

Combustion and circulating air shall be provided in accordance with Article 7, Combustion Air.

18-28-920.4.4 Ductwork.

A unit heater shall not be attached to a warm air duct system unless listed and marked for such installation.

18-28-920.4.5 Installation in commercial garages.

18-28-920.4.5.1 Parking structures.

Gas utilization equipment installed in enclosed, basement, and underground parking structures shall be installed in accordance with NFPA 88A, Standard for Parking Structures.

18-28-920.4.5.2 Repair garages.

Gas utilization equipment installed in repair garages shall be installed in a detached building or room, separated from repair areas by walls or partitions, floors, or floor ceiling assemblies that are constructed so as to prohibit the transmission of vapors and having a fire resistance rating of not less than 1 hour, and that have no openings in the wall separating the repair area within 8 feet (2.4 m) of the floor. Wall penetrations shall be firestopped. Air for combustion purposes shall be obtained from outside the building. The heating room shall not be used for the storage of combustible materials.

Exceptions:

1. Overhead heaters where installed not less than 8 feet (2.4 m) above the floor shall be permitted.
2. Heating equipment for vehicle repair areas where there is no dispensing or transferring of Class I or Class II flammable or combustible liquids or liquefied petroleum gas shall be installed in accordance with NFPA 30A, Automotive and Marine Service Station Guide.

18-28-920.4.6 Installation in aircraft hangars.

Heaters in aircraft hangars shall be installed in accordance with NFPA 409, Standard on Aircraft Hangars.

18-28-921 Vented Room Heaters.

18-28-921.1 General.

Vented room heaters shall be listed and labeled and shall be installed in accordance with the conditions of the listing and the manufacturer's instructions.

18-28-922 Kerosene and Oil-Fired Stoves.

18-28-922.1 General.

Kerosene and oil-fired stoves shall be listed and labeled and shall be installed in accordance with the conditions of the listing and the manufacturer's installation instructions. Kerosene and oil-fired stoves shall comply with NFPA 31. Oil-fired stoves shall be tested in accordance with UL 896.

18-28-923 Small Ceramic Kilns.

18-28-923.1 General.

The provisions of this section shall apply to kilns that are used for ceramics, have a maximum interior volume of 20 cubic feet (0.566

m³) and are used for hobby and non-commercial purposes.

(Amend Coun. J. 11-8-12, p. 38872, § 322)

18-28-923.1.1 Installation.

Kilns shall be installed in accordance with the manufacturer's installation instructions and the provisions of the building code.

18-28-924 Stationary Fuel Cell Power Plants.

18-28-924.1 General.

Stationary fuel cell power plants having a power output not exceeding 1,000 kW, shall be tested in accordance with ANSI Z21.83 and shall be installed in accordance with the manufacturer's installation instruction.

18-28-924.2 Natural gas energized fuel cell power plants.

Fuel cell power plants with a power output of less than 50 kW shall be listed and installed in accordance with the manufacturer's instructions. Fuel cell power plants with a power output of greater than 50 kW shall be installed in accordance with NFPA 853, Standard for Installation of Stationary Fuel Cell Power Plants.

18-28-925 Gas-Fired Air Conditioners.

18-28-925.1 Independent gas piping.

Gas piping serving heating gas utilization equipment shall be permitted to also serve cooling equipment where heating and cooling equipment cannot be operated simultaneously.

18-28-925.2 Connection of gas engine-powered air conditioners.

To protect against the effects of normal vibration in service, gas engines shall not be rigidly connected to the gas supply piping.

18-28-925.3 Clearances for indoor installation.

The installation of air-conditioning equipment shall comply with the following requirements:

1. Listed air conditioning equipment installed in rooms that are large in comparison with the size of the equipment shall be installed with clearances per the terms of their listing and the manufacturer's instructions.
2. Air-conditioning equipment installed in rooms that are not large (such as alcoves and closets) in comparison with the size of the equipment shall be listed for such installations and installed in accordance with the manufacturer's instructions.

18-28-925.4 Assembly and installation.

Air-conditioning equipment shall be installed in accordance with the manufacturer's instructions. Unless the equipment is listed for installation on a combustible surface such as a floor or roof, or unless the surface is protected in an approved manner, it shall be installed on a surface of noncombustible construction with noncombustible material and surface finish and with no combustible material against the underside thereof.

18-28-925.5 Furnace plenums and air ducts.

A furnace plenum supplied as a part of the air-conditioning equipment shall be installed in accordance with the manufacturers instructions. Where a furnace plenum is not supplied with the equipment, any fabrication and installation instructions provided by the manufacturer shall be followed. The method of connecting supply and return ducts shall facilitate proper circulation of air. Where the air conditioner is installed within a room not large in comparison with the size of the equipment, the air circulated by the equipment shall be handled by ducts that are sealed to the casing of the equipment and that separate the circulating air from the combustion and ventilation air.

18-28-926 Non-Recirculating Direct Gas-Fired Industrial Air Heaters.

18-28-926.1 Application.

Direct gas-fired industrial air heaters of the non- recirculating type shall be listed in accordance with ANSI Z83.4/CSA 3.7, Non-Recirculating Direct Gas- Fired Industrial Air Heaters.

18-28-926.2 Prohibited installations.

18-28-926.2.1

Non-recirculating direct gas-fired industrial air heaters shall not serve any area containing sleeping quarters.

18-28-926.2.2

Non-recirculating direct gas-fired industrial air heaters shall not recirculate room air.

18-28-926.3 Installation.

Installation of direct gas-fired industrial air heaters shall comply with the following requirements:

18-28-926.3.1

Non-recirculating direct gas-fired industrial air heaters shall be installed in accordance with manufacturer's instructions.

18-28-926.3.2

Non-recirculating direct gas-fired industrial air heaters shall be installed only in industrial or commercial occupancies.

18-28-926.3.3

Non-recirculating direct gas-fired industrial air heaters shall be permitted to provide fresh air ventilation.

18-28-926.3.4

Non-recirculating direct gas-fired industrial air heaters shall be provided with access for removal of burners; replacement of motors, controls, filters and other working parts; and for adjustment and lubrication of parts requiring maintenance.

18-28-926.4 Clearance from combustible materials.

Non-recirculating direct gas-fired industrial air heaters shall be installed with a clearance from combustible materials of not less than that shown on the rating plate and the manufacturer's instructions.

18-28-926.5 Air supply.

All air to the non-recirculating direct gas-fired industrial air heater shall be ducted directly from outdoors. Where outside air dampers or closing louvers are used, they shall be verified to be in the open position prior to main burner operation.

18-28-926.6 Atmospheric vents or gas reliefs or bleeds.

Non-recirculating direct gas-fired industrial air heaters with valve train components equipped with atmospheric vents, gas reliefs, or bleeds shall have their vent lines, gas reliefs, or bleeds lead to a safe point outdoors. Means shall be employed on these lines to prevent water from entering and to prevent blockage from insects and foreign matter. An atmospheric vent line shall not be required to be provided on a valve train component equipped with a listed vent limiter.

18-28-926.7 Relief openings.

The design of the installation shall include adequate provisions to permit the non-recirculating direct gas-fired industrial air heater to operate at its rated airflow without over-pressurizing the space served by the heater by taking into account the structure's designed infiltration rate, properly designed relief openings, an interlocked powered exhaust system, or a combination of these methods.

18-28-926.7.1

The structure's designed infiltration rate and the size of relief opening(s) shall be determined by approved engineering methods.

18-28-926.7.2

Louver or counterbalanced gravity damper relief openings shall be permitted.

Where motorized dampers or closeable louvers are used, they shall be proved to be in their open position prior to main burner operation.

18-28-926.8 Purging.

Inlet ducting, when used, shall be purged with at least four air changes prior to an ignition attempt.

18-28-927 Recirculating Direct Gas-Fired Industrial Air Heaters.

18-28-927.1 Application.

Direct gas-fired industrial air heaters of the recirculating type shall be listed in accordance ANSI Z 83.18, Recirculating Direct Gas-Fired industrial Air Heaters.

18-28-927.2 Prohibited installations.

18-28-927.2.1

Recirculating direct gas-fired industrial air heaters shall not serve any area containing sleeping quarters.

18-28-927.2.2

Recirculating direct gas-fired industrial air heaters shall not recirculate room air in buildings that contain flammable solids, liquids, or gases, explosive materials, or substances that can become toxic when exposed to flame or heat.

18-28-927.3 Installation.

Installation of direct gas-fired industrial air heaters shall comply with the following requirements:

1. Recirculating direct gas-fired industrial air heaters shall be installed in accordance with the manufacturer's instructions.
2. Recirculating direct gas-fired industrial air heaters shall be installed only in industrial or commercial occupancies.
3. Recirculating direct gas-fired industrial air heaters shall be permitted to provide fresh air ventilation only for the amount that exceeds the minimum ventilation air specified on the heater's rating plate to maintain the combustion level created by the heater in the space being served by the heater below 25 ppm for carbon monoxide, 3 ppm for nitrogen dioxide, and 5000 ppm for carbon dioxide. Where gas-powered fork trucks or other fossil fueled equipment are utilized in the conditioned space, additional ventilation requirements for the facility must be addressed separately.
4. Recirculating direct gas-fired industrial air heaters shall be provided with access for removal of burners; replacement of motors, controls, filters, and other working parts; and for adjustment and lubrication of parts requiring maintenance.

18-28-927.4 Clearance from combustible materials.

Recirculating direct gas-fired industrial air heaters shall be installed with a clearance from combustible materials of not less than that shown on the rating plate and the manufacturer's instructions.

18-28-927.5 Air supply.

Ventilation air to the recirculating direct gas-fired industrial air heater shall be ducted directly from outdoors. Air to the recirculating direct gas-fired industrial air heater in excess of the minimum ventilation air specified on the heater's rating plate shall be taken from the building, ducted directly from outdoors, or a combination of both. Where outside air dampers or closing louvers are used, they shall be verified to be in the open position prior to main burner operation.

18-28-927.6 Atmospheric vents, gas reliefs, or bleeds.

Recirculating direct gas-fired industrial air heaters with valve train components equipped with atmospheric, vents, gas reliefs, or bleeds shall have their vent lines, gas reliefs, or bleeds lead to a safe point outdoors. Means shall be employed on these lines to prevent water from entering and to prevent blockage from insects and foreign matter. An atmospheric vent line shall not be required to be provided on a valve train component equipped with a listed vent limiter.

18-28-927.7 Relief openings.

The design of the installation shall include adequate provisions to permit the recirculating direct gas-fired industrial air heater to operate at its rated airflow without over-pressurizing the space served by the heater by taking into account the structure's designed infiltration rate, properly designed relief openings, an interlocked powered exhaust system, or a combination of these methods.

18-28-927.7.1

The structure's designed infiltration rate and the size of relief opening(s) shall be determined by approved engineering methods.

18-28-927.7.2

Louver or counterbalanced gravity relief openings shall be permitted.

Where motorized dampers or closeable louvers are used, they shall be proved to be in their open position prior to main burner operation.

18-28-927.8 Purging.

Inlet ducting, when used, shall be purged with at least four air changes prior to an ignition attempt.

18-28-928 Gas-Fired Illuminating Appliances.

18-28-928.1 Clearances for listed appliances.

Listed illuminating appliances shall be installed in accordance with their listing and the manufacturers' instructions.

18-28-928.2 Clearances for unlisted appliances.

18-28-928.2.1 Enclosed type.

Clearance shall comply with the following:

1. Unlisted enclosed illuminating appliances installed outdoors shall be installed with clearances in any direction from combustible material of not less than 12 inches (300 mm).
2. Unlisted enclosed illuminating appliances installed indoors shall be installed with clearances in any direction from combustible material of not less than 18 inches (460 mm).

18-28-928.2.2 Open-flame type.

Clearance shall comply with the following:

1. Unlisted open-flame illuminating appliances installed outdoors shall have clearances from combustible material not less than that specified in Table 18-28-928.2.2(1). The distance from ground level to the base of the burner shall be a minimum of 7 feet (2.1 m) where installed within 2 feet (0.6 m) of walkways. Lesser clearances shall be permitted to be used where acceptable to the authority having jurisdiction.

**Table 18-28-928.2.2(1)
Table Clearances for Unlisted Outdoor Open- Flame Illuminating Appliances**

Flame Height Above Burner Head (in.)	Minimum Clearance from Combustible Material (ft)*	
	Horizontal	Vertical
12	2	6
18	3	8
24	3	10
30	4	12

For SI units: 1 in. = 25.4 mm; 1 ft = 0.305 m.

* Measured from the nearest portion of the burner head.

2. Unlisted open-flame illuminating appliances installed outdoors shall be equipped with a limiting orifice or other limiting devices that will maintain a flame height consistent with the clearance from combustible material as given in Table 18-28-928.2.2(1).

3. Appliances designed for flame heights in excess of 30 inches (760 mm) shall be permitted to be installed if acceptable to the authority having jurisdiction. Such appliances shall be equipped with a safety shutoff device or automatic ignition.

4. Unlisted open-flame illuminating appliances installed indoors shall have clearances from combustible material acceptable to the authority having jurisdiction.

18-28-928.3 Mounting on buildings.

Illuminating appliances designed for wall or ceiling mounting shall be securely attached to substantial structures in such a manner that they are not dependent on the gas piping for support.

18-28-928.4 Mounting on posts.

Illuminating appliances designed for post mounting shall be securely and rigidly attached to a post. Posts shall be rigidly mounted. The strength and rigidity of posts greater than 3 feet (0.9 m) in height shall be at least equivalent to that of a 2 1/2 inches (64 mm) diameter post constructed of 0.064 inch (1.6 mm) thick steel or a 1 inch (25 mm) schedule 40 steel pipe. Posts 3 feet (0.9 m) or less in height shall not be smaller than a 3/4 inch (20 mm) Schedule 40 steel pipe. Drain openings shall be provided near the base of posts where there is a possibility of water collecting inside them.

18-18-928.5 Gas appliance pressure regulators.

Where a gas appliance pressure regulator is not supplied with an illuminating appliance and the service line is not equipped with a service pressure regulator, an appliance pressure regulator shall be installed in the line serving one or more illuminating appliances.

18-28-929 Appliances for Installation in Manufactured Housing.

18-28-929.1

Appliances installed in manufactured housing after the initial sale shall be listed for installation in manufactured housing, or approved, and shall be installed in accordance with the requirements of the building code and the manufacturers' installation instructions. Appliances installed in the living space of manufactured housing shall be in accordance with the requirements of Article 7, Combustion Air.

Article X. Boilers, Water Heaters and Pressure Vessels (18-28-1001 et seq.)

18-28-1001 General.

18-28-1001.1 Scope.

This article shall govern the installation, alteration and repair of fired and unfired pressure vessels that fall under the jurisdiction of the ASME Code.

18-28-1002 Water Heaters.

18-28-1002.1 General.

Potable water heaters and hot water storage tanks shall be listed, labeled and installed in accordance with the manufacturer's installation instructions, the plumbing code and the building code. Potable hot water storage tanks heated by indirect means shall be designed, constructed, and installed in accordance with Section VIII of the ASME Code unless all of the following requirements are met:

1. The storage tank has a heat input of less than 200,000 BTU/hr.
2. The storage tank has a capacity of less than 120 gallons.
3. The storage tank maximum operating temperature is less than 210°F (99°C).

Potable hot water storage tanks heated by indirect means that meet all three of the above requirements shall be governed by the plumbing code.

All water heaters shall be capable of being removed without first having to remove a permanent portion of the building structure. The potable water connections and relief valves for all water heaters shall conform to the requirements of the plumbing code. Water heaters with open flames that use combustion air from a machinery room shall not be installed in a machinery room except as allowed in Article 11, Refrigeration, Section 18-28-1105.

18-28-1003 Unfired Pressure Vessels.

18-28-1003.1 General.

All pressure vessels shall be constructed in accordance with the Section VIII of the ASME Code and the manufacturer's installation

instructions.

18-28-1003.2 Piping.

All piping materials, fittings, joints, connections and devices associated with systems used in conjunction with pressure vessels shall be designed for the specific application. Piping components such as pipe, flanges, bolting, gaskets, valves, expansion joints and fittings shall be designed, constructed, and installed per ASME and ANSI B 31.1 and B 31.9.

18-28-1003.3 Welding.

Welding on pressure vessels shall be performed by approved welders in compliance with nationally recognized standards and in accordance with ASME, Section IX.

18-28-1004 Boilers.

18-28-1004.1 Standards.

Oil-fired boilers and their control systems shall be listed and labeled in accordance with UL 726. Electric boilers and their control systems shall be listed and labeled in accordance with UL 834. Boilers shall be designed, constructed and installed in accordance with the requirements of the ASME Code Sections I, II, IV, V and IX of the ASME Code.

Boiler external piping falls within the jurisdiction of the ASME Code and shall be ASME Code certified.

18-28-1004.1.1 Non-boiler external piping.

Non-boiler external piping connected to regulated boilers shall be designed, constructed and installed in accordance with the requirements of ASME and ANSI B31.1 and B31.9.

18-28-1004.2 Installation.

In addition to the requirements of the building code, the installation of boilers shall conform to the ASME Code, the National Board Inspection Code, and the manufacturer's instructions. Operating instructions of a permanent type shall be attached to the boiler. Boilers shall have all controls set, adjusted and tested by the installer. The manufacturer's rating data and the nameplate shall be attached to the boiler.

18-28-1004.3 Working clearance.

Clearances shall be maintained around boilers, generators, heaters, tanks and related equipment and appliances so as to permit inspection, servicing, repair, replacement and visibility of all gauges. If boilers are installed or replaced, clearance shall be provided to allow access for inspection, maintenance and repair. Passageways around all sides of boilers shall have an unobstructed width of not less than 18 inches (457 mm), unless otherwise approved.

18-28-1004.3.1 Top clearance.

The following boilers shall have a minimum clearance of 7 feet (2134 mm) from the top of the boiler to the ceiling: High-pressure steam boilers that have a steam-generating capacity in excess of 5,000 pounds per hour (2268 kg/h), or a heating surface in excess of 1,000 square feet (93 m²), or an input in excess of 5,000,000 BTU/hr (1465 kW). The following boilers shall have a minimum clearance of 3 feet (914 mm) from the top of the boiler to the ceiling: (1) Steam-heating boilers and hot-water-heating boilers that exceed one of the following limits: 5,000,000 BTU/hr input (1465 kW); or 5,000 pounds of steam per hour (2268 kg/h) capacity or a heating surface in excess of 1,000 square-foot (93 m²); and (2) high-pressure steam boilers that do not exceed one of the following limits: 5,000,000 BTU/hr input (1465 kW); or 5,000 pounds of steam per hour (2268 kg/h) Capacity or heating surface in excess of a 1,000-square-foot (93 m²); and (3) all boilers with manholes on top of the boiler. The following boilers shall have a minimum clearance of 2 feet (610 mm) from the ceiling: package boilers, steam-heating boilers and hot-water-heating boilers which do not have manholes on top of the shell and which do not exceed any one of the limits of this section.

18-28-1004.4 Mounting.

Equipment and appliances shall be set or mounted on a level base capable of supporting and distributing the weight contained thereon. Boilers, tanks, equipment and appliances shall be securely anchored to the structure. Equipment and appliances requiring vibration isolation shall be installed as designed by a registered design professional.

18-28-1004.5 Floors.

Boilers shall be mounted on noncombustible floors with noncombustible flooring and surface finish and with no combustible material

against the underside thereof; or, on fire resistance slabs or arches having no combustible materials against the underside thereof unless the boiler is specifically listed for installation on a combustible floor or the floor is protected in an approved manner and the installation is approved by a registered professional engineer.

18-28-1004.6 Boiler rooms and enclosures.

Boiler rooms and enclosures and access thereto shall comply with the building code and Article 3. Boiler rooms shall be equipped with a floor drain or other approved means for disposing of liquid waste. Boilers with open flames that use combustion air from a room shall not be installed in any machinery room except as allowed in Article 11, Refrigeration.

18-28-1004.7 Operating adjustments and instructions.

Hot water and steam boilers shall have all operating and safety controls set and operationally tested by the installing contractor. A complete control diagram and the boiler operating instructions shall be furnished to the building owner by the installer for each installation.

18-28-1004.8 Stationary Engineers and Boiler Tenders.

The following steam engine, steam boiler and high temperature hot water boilers subject to the provisions of the building code shall be used, managed or operated, by an engineer or boiler or water tender who is duly licensed and who has and can exhibit a certificate thereof.

1. Steam boilers with an output capacity in excess of 50 boiler horsepower operating at a pressure in excess of 15 psig.
2. Hot water boilers intended for operation in excess of 160 psi and/or temperatures in excess of 250°F (121°C).

18-28-1005 Boiler Connections.

18-28-1005.1 Valves.

Every boiler or modular boiler shall have a shutoff valve in the supply and return piping. For multiple boiler or multiple modular boiler installations, each boiler or modular boiler shall have individual shut off valves in the supply and return piping in accordance with the ASME Code.

Exception: Shutoff valves are not required in a system having a single low-pressure steam boiler.

18-28-1005.2 Potable water supply.

The water supply to all boilers shall be connected in accordance with the Plumbing Code and the department of water management. (Amend Coun. J. 11-8-12, p. 38872, § 323)

18-28-1006 Safety and Pressure Relief Valves and Controls.

18-28-1006.1 Safety valve for steam boilers.

All steam boilers shall be protected with a safety valve or valves as required by the ASME Code.

18-28-1006.2 Safety relief valves for hot water boilers.

Hot water boilers shall be protected with a safety relief valve or valves as required by the ASME Code.

18-28-1006.3 Pressure relief for pressure vessels.

All pressure vessels shall be protected with a pressure relief valve or pressure-limiting device, such as a rupture disc, as required by the manufacturer's installation instructions for the pressure vessel in accordance with Section VIII of the ASME Code.

18-28-1006.4 Approval of safety and safety relief valves.

Safety and safety relief valves shall be listed and labeled by the ASME Code. Safety and safety relief valves shall have a minimum rated capacity for the equipment or appliances served. Safety and safety relief valves shall be set in accordance with the ASME Code.

18-28-1006.5 Installation.

Safety or relief valves or other approved pressure relieving devices shall be connected to the safety or relief valve opening on the

boiler or pressure vessel. No valves shall be located on either side of a safety or relief valve connection. The relief valve discharge shall allow water to be drained with no buildup. The relief valve shall discharge by gravity.

18-28-1006.6 Safety and relief valve discharge.

Safety and relief valve discharge pipes shall be constructed of rigid pipe that is approved for the temperature of the system. The discharge pipe shall be the same diameter as the safety or relief valve outlet. Safety and relief valves shall not discharge in a manner that creates a hazard or a potential cause of damage or otherwise constitutes a nuisance. High-pressure-steam safety valves shall be vented to the outside of the structure. If a low-pressure safety valve or a relief valve discharges to the drainage system, the installation shall conform to the ASME Code and the Plumbing Code.

18-28-1006.7 Boiler safety devices.

Boilers shall be equipped with controls and limit devices as required by the ASME Code, the manufacturer's installation instructions and the conditions of the listing.

18-28-1006.8 Electrical requirements.

The power supply to the electrical control system shall be from a two-wire branch circuit that has a grounded conductor, or from an isolation transformer with a two-wire secondary. If an isolation transformer is provided, one conductor of the secondary winding shall be grounded. Control voltage shall not exceed 150 volts nominal line to line. Control and limit devices shall interrupt the ungrounded side of the circuit. A means of manually disconnecting the control circuit shall be provided and controls shall be arranged so that when de-energized, the burner shall be inoperative. Such disconnecting means shall be capable of being locked in the off position and shall be provided with ready access. Electrical conduit and wire shall not be installed in the floor slab under a boiler.

18-28-1007 Boiler Low-Water Cutoff.

18-28-1007.1 General.

All steam and hot water boilers shall be protected with a low-water cutoff control or controls as required by Section VIII of the ASME Code.

(Amend Coun. J. 11-8-12, p. 38872, § 324)

18-28-1007.2 Operation.

The low-water cutoff shall automatically stop the combustion operation of the appliance when the water level drops below the lowest safe water level as defined in the ASME Code.

18-28-1008 Steam Blowoff Valve.

18-28-1008.1 General.

Every steam boiler shall be equipped with a quick-opening blowoff valve. Steam boilers with an allowable working pressure in excess of 100 psi shall include a second valve; the valve closest to the boiler shall be quick-acting; the second valve shall be slow-acting. The valve(s) shall be installed in the opening provided on the boiler. The minimum size of the valve or valves shall be specified in accordance with Sections I and IV the ASME Code.

18-28-1008.2 Discharge.

Blowoff valves shall discharge to a safe place of disposal. Blowoff valves for high pressure steam boilers shall discharge into a tank in accordance with the ASME Code Section VIII.

18-28-1009 Hot Water Boiler Expansion Tank.

18-28-1009.1 Where required.

An expansion tank shall be installed in every hot water system. For multiple boiler installations, a minimum of one expansion tank is required. Expansion tanks shall be of the closed or open type. Tanks shall be rated for the pressure of the hot water system. Expansion tanks for systems designed to operate above 30 psi shall be constructed in accordance with the ASME Code, Section VIII, Division I.

18-28-1009.2 Closed-type expansion tanks.

Closed-type expansion tanks shall be installed in accordance with the manufacturer's installation instructions. The size of the tank shall be based on the capacity of the hot-water-heating system.

18-28-1009.3 Open-type expansion tanks.

Open-type expansion tanks shall be located a minimum of 4 feet (1219 mm) above the highest heating element. The tank shall be adequately sized for the hot water system. An overflow with a minimum diameter of 1 inch (25.4 mm) shall be installed at the top of the tank. The overflow shall discharge to the drainage system in accordance with the Plumbing Code.

18-28-1010 Gauges.

18-28-1010.1 Hot water boiler gauges.

Every hot water boiler shall have a pressure gauge and a temperature gauge, or a combination pressure and temperature gauge. The gauges shall indicate the temperature and pressure within the normal range of the system's operation.

18-28-1010.2 Steam boiler gauges.

Every steam boiler shall have a water-gauge glass and a pressure gauge. The pressure gauge scale shall be in accordance with the ASME Code and shall indicate the pressure up to 1 1/2 times the maximum allowable working pressure of the boiler, but not less than 30 psi.

18-28-1010.2.1 Water-gauge glass.

The gauge glass shall be installed so that the midpoint is at the normal boiler water level. The lowest point of the gauge glass shall be a minimum of one inch above the lowest permissible water level recommended by the boiler manufacturer.

18-28-1011 Tests.

18-28-1011.1 Tests.

Upon completion of the assembly and installation of boilers and pressure vessels, acceptance tests shall be conducted in accordance with the requirements of the ASME Boiler and Pressure Vessel Code. If field assembly of pressure vessels or boilers is required, a copy of the completed U-1 Manufacturers Data Report required by the ASME Boiler and Pressure Vessel Code shall be submitted to the Department of Buildings.

18-28-1011.2 Test gauges.

An indicating test gauge shall be connected directly to the boiler or pressure vessel and located where it is visible to the operator throughout the duration of the test. The pressure gauge scale shall be graduated over a range of not less than one and one-half times the maximum test pressure and not greater than four times the maximum test pressure. All gauges utilized for testing shall be calibrated and certified by the test operator.

18-28-1012 Vessel Repair.

18-28-1012.1 Qualification.

All pressure vessels covered by the building code must be repaired by an organization in possession of a valid "R" Certificate of Authorization issued by the National Board of Boiler and Pressure Vessel Inspectors.

18-28-1012.2 Repair.

All repairs shall be made in accordance with the applicable chapter of the National Board inspection Code issued by the National Board of Boiler & Pressure Vessel Inspectors.

18-28-1012.3 High pressure boiler inspection and repair.

See Section 11-4-900 of this Code.

(Amend Coun. J. 11-9-16, p. 36266, § 36)

18-28-1013 Carbon Monoxide Detector.

18-28-1013.1

Carbon monoxide detectors shall be installed in accordance with for Residential or Institutional Occupancies covered in the above sections. A carbon monoxide detector shall be installed in every room that contains a fossil-fuel burning boiler or water heater. A carbon monoxide detector shall be installed in unit immediately adjacent to or one floor above any room containing a fossil-fueled burning boiler or hot water heater.

Article XI. Refrigeration (18-28-1101 et seq.)

18-28-1101 General.

18-28-1101.1 Scope.

This article shall govern the design, installation, construction and repair of refrigeration systems that vaporize and liquefy a fluid during the refrigeration cycle. Refrigerant piping design and installation, including pressure vessels and pressure relief devices, shall conform to this article. Permanently installed refrigerant storage systems and other components shall be considered as part of the refrigeration system to which they are attached.

18-28-1101.2 Standards for Pressure Vessels.

Pressure vessels for refrigeration systems over 6 inches (152.4 mm) inside diameter with a design pressure of 15-psig (6.304 kg) or greater shall be designed, constructed, tested and stamped in accordance with the American Society of Mechanical Engineers Code for Unfired Pressure Vessels. Pressure vessels 6 inches (152.4 mm) inside diameter and smaller or under 15 psig (6.304 kg) pressure shall be designated and constructed in accordance with the American Society of Mechanical Engineers Code requirements for Unfired Pressure Vessels.

18-28-1101.3 Protection.

Any portion of a refrigeration system that may be exposed to physical damage, shall be appropriately and permanently protected against such damage in an approved manner.

18-28-1101.4 Fuel gas connection.

Fuel gas devices, equipment and appliances used with refrigeration systems shall be installed in accordance with Article 14, Fuel Gas Piping.

18-28-1101.5 Signage - General.

Every refrigeration system, containing over 100 pounds (45.36kg) of refrigerant, must have posted as near as practicable to the pressure imposing element of such system a sign having letters not less than 1 inch in height with the wording:

HIGH PRESSURE REFRIGERANT - DANGER UN REFRIGERANTE DE ALTA PRESION - PELIGRO

All refrigeration piping shall be coded at 30 foot (9.144m) intervals and in every separate area through which the piping extends. A permanent means of identification shall be affixed, having a yellow background and black letters legible from the work floor, dimensioned according to the table below and with the following wording:

HIGH PRESSURE REFRIGERANT - DANGER UN REFRIGERANTE DE ALTA PRESION - PELIGRO

Pipe Labeling

Outer Diameter of Pipe Covering or Lagging (In Inches)	Letter Heights (In Inches)
3/4 to 1 1/4	1/2
1 1/2 to 2	3/4
2 1/2 to 8	1 1/4
8 1/4 to 10	2 1/2

The background of the sign shall be yellow, with black letters.

18-28-1101.6 Condensate disposal.

Condensate disposal shall be according to 18-28-307.

18-28-1101.7 General.

Reference systems shall comply with requirements of the building code and except as modified by the building code, ANSI/ASHRAE 15. Ammonia refrigeration systems shall comply with the building code and except as modified by ANSI/ASHRAE 15 and ANSI/IIAR-2.

18-28-1101.8 Ammonia dump valve.

All ammonia refrigeration systems containing more than 100 pounds (45.36 kg) of ammonia shall be provided with a hand-operated emergency valve. Such device shall be connected to the low side of the refrigeration system and be located where the emergency valve is readily available for Fire Department use. Valves shall be identified and operation for the use of the emergency valve shall be provided at the location of the valve. Discharge from above hand operated emergency valve shall be into a mixing chamber made from ASTM Schedule 40 black iron pipe with weld cap ends. The mixing chamber shall have a minimum length of 72 inches (1.288 m) and a nominal pipes size as found in column "A" of Table 18-28-1107. Dumped refrigerants shall flow into the mixing chamber through an inlet tube extending longitudinally into the mixing chamber for a minimum length of 64 inches (1.6256m). The inlet tube shall be made of ASTM Schedule 40 black iron pipe and shall have a nominal pipe size as found in column "D" of Table 18-28-1107. The downstream end of the inlet tube shall be capped with a weld cap fitting and the sides of the inlet tube near the weld cap fitting on the downstream end shall be perforated with one-quarter (1/4 inch)(12.2 mm) drilled holes spaced on 1-inch (25.4 mm) centers and arranged in rows. The minimum number of perforations in the inlet pipe shall relate to the system refrigerant charge in accordance with column "C" of Table 18-28-1107. Flushing water shall be supplied through a 3 inch (76.2 mm) Fire Department approved cast iron Siamese fitting, or equivalent with two flappers, welded into the side of the mixing chamber on a 45-degree angle to its longitudinal axis near the inlet end.

The effluent mixture of water and refrigerant shall flow longitudinally out of the discharge end of the mixing chamber through an ASTM Schedule 40 black iron pipe welded into the end cap of the chamber. The nominal pipe size of the discharge pipe shall be as found in column "B" of Table 18-28-1107. The discharge pipe shall connect to the city sewer through a solid connection without intervening valves or traps.

**Table 18-28-1107
Ammonia Systems Emergency Valve Components***

Pounds (lbs.) of Ammonia	A	B	C	D
100 - 1000	6 inches	3 inches	144	2 inches
1001 - 2000	6 inches	3 inches	216	3 inches
2001 - 5000	6 inches	4 inches	216	3 inches
5001 - 10,000	8 inches	4 inches	216	3 inches

* See Section 18-28-1101.8 for identification of columns A through D.

(Amend Coun. J. 11-8-12, p. 38872, § 326; Amend Coun. J. 11-9-16, p. 36266, § 36)

18-28-1101.9 Maintenance.

Mechanical refrigeration systems shall be maintained in proper operating condition, free from accumulations of oil, dirt, waste, excessive corrosion, other debris and leaks.

18-28-1101.10 Location of condensing unit.

The condensing unit of every refrigeration system shall be placed in a readily accessible location and such location shall be provided with adequate means of ventilation and light. Refrigerating equipment containing over 10 pounds (4.536 kg) of refrigerant shall not be located in retail areas or other areas routinely accessed by the general public. No refrigeration system shall be placed under or on stairways, stairway lands, under or on fire escape passageways, entrance or exits of buildings, unless it is a self-contained system servicing that stairway.

18-28-1101.11 Stairways and exitways.

Piping associated with refrigeration systems shall not be installed in an enclosed public stairway, stair landing, or means of egress.

18-28-1101.12 General limitations.

Spaces subject to limitations as to the type of equipment and the kind and amount of refrigerant permitted; which adjoin horizontally or vertically a space having greater restrictions, and which are not separated there from by a floor or wall having no openings, shall be subject to the greater restrictions.

18-28-1101.13 Refrigerant discharge.

Notification of refrigerant discharge shall be provided to the Department of Buildings, Refrigeration Bureau.

18-28-1101.14 Safety equipment.

Two self-contained breathing air apparatuses (SCBA), minimum 30 minutes rated, approved by the Bureau of Mines of the United States Department of the Interior, shall be kept outside the entrance to the Machinery Room. If a Group 3 Refrigerant is used, two suits of full protective clothing that meet the Occupational Safety and Health Administration (OSHA.) Fire Brigade Standard (29 CRF 1910.156) must be provided and kept in the same cabinet.

18-28-1101.15 Recirculation of water used for cooling purposes.

To promote the conservation of water, no new or newly remodeled refrigeration system employing water from the city water mains for condensing purposes in commercial, industrial, or residential systems used for comfort cooling shall be permitted within the City of Chicago unless such system is a closed system employing recirculation of water used for cooling purposes. No exceptions to this provision shall be permitted except by action of the Commissioner of the Department of Water Management.

18-28-1102 System Requirements.

18-28-1102.1 General.

The system classification, allowable refrigerants, the maximum quantity, enclosure requirements, location limitations, and field pressure test requirements shall be determined as follows:

1. The refrigeration system's classification shall be determined in accordance with Section 18-28-1103.3.
2. The refrigerant classification shall be determined by Table 18-28-1103.1, Refrigerant and Amounts.
3. The system enclosure requirements shall be determined by Section, 18-28-1104, Systems Application Requirements, based on type of refrigerant, system classification, and occupancy.
4. The system enclosure shall be determined in accordance with Section 18-28-1104, Systems Application Requirements.
5. Refrigeration equipment and appliance location and installation shall be subject to the limitations of Article 3, General Regulations.
6. Non-factory-tested, field-erected equipment and appliances shall be pressure tested in accordance with Section 18-28-1108, Field Test.

18-28-1102.2 Refrigerants.

The refrigerant shall be of a type for which the equipment or appliance was designed to utilize or converted to utilize. Refrigerants not identified in Table 18-28-1103.1 must be approved before use, except for lithium bromide absorption systems using water as the refrigerant. Approval shall be obtained from the Committee on Building Standards and Tests.

18-28-1102.2.1 Mixing.

Refrigerants, including refrigerant blends, with different designations in ASHRAE 34 shall not be mixed in a system.

Exception: The refrigerant used shall meet the purity specifications set by the manufacturer of the equipment or appliance in which such refrigerant is used.

18-28-1102.3 Pressure relief.

Every refrigeration system shall be protected by a pressure relief device. Soft soldered joints, rubber or synthetic gaskets, or fusible plugs shall not be considered relief devices meeting the requirements of this article. All pressure devices shall bear the label of an approved agency. The device shall be rated for the capacity of the refrigerant system. The pressure relief device shall be rated for the capacity of the refrigerant system. The pressure relief device shall be set at the maximum design pressure of the system or equipment.

Absorption systems employing a steam coil in the generator of the system must be provided with an approved pressure relief valve in the steam piping, located as near as practicable to the generator and other vessels in the system. The capacity of such pressure relief valve shall be based on the total possible energy that can be imposed on the absorption system.

Exception: Refrigeration systems that are UL 1995 approved and contain: Less than 6 pounds of a Group 2 Refrigerant, or 30 pounds or less of a Group 1 refrigerant do not require a pressure relief device.

18-28-1102.3.1 Discharge piping.

Pressure relief devices shall discharge to the atmosphere at a location not less than 15 feet (4.522 m) above the adjoining ground level and not less than 20 feet (6.096m) from an operating window, ventilation opening, fire escape or exit in any building.

18-28-1102.3.2 Sizing.

Discharge piping shall be sized for simultaneous relief of the maximum quantity of refrigerant in the system, via the sum of the system's pressure relief devices. Systems utilizing different classifications of refrigerant of different pressures shall not have discharge piping interconnected. Discharge piping cannot be smaller than the opening on the relief valve. If run longer than 100 feet (30.48 m), increase pipe one size.

18-28-1103 Refrigeration System Classification.

18-28-1103.1 Refrigerant classification.

Refrigerants shall be classified in accordance with ASHRAE 34 as listed in Table 18-28-1103.1.

**Table 18-28-1103.1
Refrigerant and Amounts**

Refrigerant Number	Chemical Name	Chemical Formula	Quantity of Refrigerant per Occupied Space		
			Pounds per 1,000 Cubic Feet	Ppm by Volume	g/m ³ A, C
Group A1					
R-11	Trichlorofluoromethane	CCl ₃ F	1.6	4,000	25
R-12	Dichlorodifluoromethane	CCl ₂ F ₂	12	40,000	200
R-13	Chlorotrifluoromethane	CClF ₃	18	67,000	290
R-13B1	Bromotrifluoromethane	CBrF ₃	22	57,000	350
R-14	Tetrafluoromethane (carbon tetrafluoride)	CF ₄	15	67,000	240
R-22	Chlorodifluoromethane	CHClF ₂	9.4	42,000	150
R-113	Trichlorotrifluoromethane	CCl ₂ FCCl	1.9	4,000	31

R-114	Dichlorotetrafluoroethane	CClF ₂ CClF ₂	9.4	21,000	150
R-123	2,2-dichloro-1,1,1-trifluoroethane	CHCl ₂ CF ₃	0.4	1,000	6.3
R-134a	1,1,1,2-tetrafluoroethane	CH ₂ FCF ₃	16	60,000	250
R-400	R-12 and R-114	CCl ₂ F ₂ / C ₂ Cl ₂ F ₄	d	d	d
R-500	R-12/152a (73.8/26.2)	CCl ₂ F ₂ / CH ₃ CHF ₂	12	47,000	200
R-502	R-22/115 (48.8/51.2)	CHClF ₂ / CClF ₂ CF ₃	19	65,000	300
R-503	R-23/13(40.1/59.9)	CHF ₃ /CClF ₃	15	67,000	240
R-718	Water	H ₂ O	f	f	f
R-744	Carbon Dioxide	CO ₂	5.7	50,000	91
Group A2					
R-142b	1-Chloro-1,1, - Difluoroethane	CH ₃ CClF ₂	3.7	14,000	60
R-152a	1,1-Difluoroethane	CH ₃ CHF ₂	1.2	7,000	20
Group A3					
R-170	Ethane	C ₂ H ₆	0.50	6,400	8.0
R-290	Propane	C ₃ H ₈	0.50	4,400	8.0
R-600	Butane	C ₄ H ₁₀	0.51	3,400	8.2
R-600a	2-Methyl propane (Isobutane)	CH(CH ₃) ₃	0.51	3,400	8.2
R-1150	Ethene (Ethylene)	C ₂ H ₄	0.38	5,200	6.0
R-1270	Propene (Propylene)	C ₃ H ₆	0.37	3,400	5.9
Group B1					
R-123	2,2-Dichloro-1,1,1 - Trifluoroethane	CHCl ₂ CF ₃	0.40	1,000	6.3
R 764	Sulfur Dioxide	SO ₂	0.016	100	0.26
Group B2					
R-40	Chloromethane (Methyl Chloride)	CH ₃ Cl	1.3	10,000	21
R-611	Methyl Formate	HCOOCH ₃	0.78	5,000	12
R-717	Ammonia	NH ₃	0.022	500	0.35

a The refrigerant safety groups in Table 1 are not part of ASHRAE Standard 15. The classifications shown are from ASHRAE

Standard 34, which governs in the event of a difference.

b To be used only in conjunction with Section 7.

c To correct for height, H(ft), above sea level, multiply these values by $(1 - 2.42 \times 10^{-6}H)$. To correct for height, H(km), above sea level, multiply these values by $(1 - 7.94 \times 10^{-2}h)$.

d The quantity of each component shall comply with the limits set in Table 1 for the pure compound, and the total volume % of all components shall be calculated per Appendix A (not to exceed 67,000 ppm by volume for any refrigerant blend).

e The basis of the table quantities is a single event where a complete discharge of any refrigerant system into the occupied space occurs. The quantity of refrigerant is the most restrictive of a minimum oxygen concentration of 19.5% or as follows:

Group 1 - 80% of the cardiac sensitization level for R-11, R-12, R-13B1, R-22, R-113, R-114, R-134a, R-500, and R-502. 100% of the IDLH(21) for R-744. Others are limited by levels where oxygen deprivation begins to occur.

Group A2, A3 - Approximately 20% of LFL.

Group B1 - 100% of IDLH for R-764, and 100% the measure consistent with the IDLH for R-123.

Groups B2, B3 - 100% of IDLH or 20% of LFL, whichever is lower.

f The quantity is unlimited when R-718 (water) is used as the refrigerant.

18-28-1103.2 Occupancy classification.

Locations of refrigerating systems are described by occupancy classifications that consider the ability of people to respond to potential exposure to refrigerants. Where equipment or appliances, other than piping, are located outside a building and within 20 feet (6096 mm) of any building opening, such equipment or appliances shall be governed by the occupancy classification of the building.

18-28-1103.2.1 Institutional systems - general.

A refrigeration system installed in buildings, or parts thereof, designed or used for the harboring of 3 or more persons for medical, correctional, penal, or other care, treatment or detention, as defined in Chapter 3 (13-56), Classification of Buildings by Occupancy, shall be classified as an Institutional System.

18-28-1103.2.2 Industrial systems - general.

A refrigeration system used in the manufacturing, processing, or storage of materials located in a building or space used exclusively for industrial purposes, as defined in Chapter 3 (13-56), Classification of Buildings by Occupancy, shall be classified as an Industrial System.

18-28-1103.2.3 Commercial systems - general.

A refrigeration system installed in a business, assembly unit, or mercantile occupancy, as defined in Chapter 3 (13-56), Classification of Buildings by Occupancy, shall be classified as a Commercial System.

18-28-1103.2.4 Multiple dwelling systems - general.

A refrigeration system installed in a Class A-2 Multiple Dwelling, as defined in Chapter 3 (13-56), Classification of Buildings by Occupancy, having 4 or more family units, shall be classified as a Multiple Dwelling System.

18-28-1103.3 System classification.

Refrigeration systems shall be classified according to the degree of probability that refrigerant leaked from a failed connection, seal, or component could enter an occupied area. The distinction is based on the basic design or location of the components.

18-28-1103.3.1 Low-probability systems.

Double-indirect open-spray systems, indirect closed system and indirect-vented closed systems shall be classified as low-probability systems, provided that all refrigerant-containing piping and fittings are isolated when the quantities in Table 18-28-1103.1 are exceeded.

18-28-1103.3.2 High-probability systems.

Direct systems and indirect open-spray systems shall be classified as high-probability systems.

Exception: An indirect open-spray system shall not be required to be classified as a high-probability system if the pressure of the secondary coolant is at all times (operating and standby) greater than the pressure of the refrigerant.

18-28-1104 System Application Requirements.

18-28-1104.1 General.

The refrigerant, occupancy and system classification cited in this section shall be determined in accordance with Sections 18-28-1103.1, 18-28-1103.2 and 18-28-1103.3, respectively. For refrigerant blends assigned dual classifications, as formulated and for the worst case of fractionation, the classifications for the worst case of fractionation shall be used.

18-28-1104.2 Machine room.

All components containing refrigerant shall be located either outdoors or in a machinery room when the quantity of refrigerant in an independent circuit of a system exceeds the amounts shown in Table 18-28-1103.1. For refrigerant blends not listed in Table 18-28-1103.1, the same requirement shall apply when the amount for any blend component exceeds that indicated in Table 18-28-1103.1 for that component. This requirement shall also apply when the combined amount of the blend components exceeds a limit of 69,100 parts per million by volume. Machinery rooms required by this section shall be constructed and maintained in accordance with Section 1105 for Group A1 and B1 refrigerants and in accordance with Sections 18-28-1105 and 18-28-1106 for Group A2, B2, A3 refrigerants.

Exceptions:

1. Machinery rooms are not required for listed equipment or appliances containing not more than 6.6 pounds (3 kg) of refrigerant, regardless of the refrigerant's safety classification, where installed in accordance with the equipment's or appliance's listing and the equipment or appliance manufacturer's installation instructions.
2. Piping in conformance with Section 18-28-1107 is allowed in other locations to connect components installed in a machinery room with those installed outdoors.

18-28-1104.2.1 Institutional occupancies.

High probability systems shall not be allowed in areas of institutional occupancy.

Exception: High probability systems shall be allowed in areas of institutional occupancy where the amount of refrigerant in the largest refrigerant circuit does not exceed the lesser of:

1. 50 percent of the pounds of refrigerant allowed in Table 18-28-1103, or
2. 30 pounds. The value of cubic feet used to calculate the maximum amount of refrigerant allowed by Table 18-28-1103.1 shall be based on the smallest contiguous space where refrigerant can collect in the vent of a discharge.

The total of all Group A2, B2, A3 and B3 refrigerants shall not exceed 550 pounds (250 kg) in occupied areas or machinery rooms.

18-28-1104.2.2 Industrial occupancies and refrigerated rooms.

This section applies only to industrial occupancies and refrigerated rooms for manufacturing, food and beverage preparation, meat cutting, other processes, and storage. Machinery rooms are not required where all of the following conditions are met:

1. The space containing the machinery is separated from other occupancies by tight construction with tight-fitting, self-closing doors.
2. Access is restricted to authorized personnel.
3. The floor area per occupant is not less than 100 square feet (9.3m) where machinery is located on floor levels where there exists more than 6.6 feet (2m) above ground. Where provided with egress directly to the outdoors or into approved building exists, the minimum floor area shall not apply.
4. Refrigerant detectors are installed as required for machinery rooms in accordance with Section 18-28-1105.5.
5. Surfaces having temperatures exceeding 800°F. (426.7°C.) and open flames are not present where any Group A2, B2, A3 or B3 refrigerant is used. (See Section 18-28-1104.3.4).
6. All electrical equipment and appliances conform to Class 1, Division 2, or NEPA 70 where the quantity of any Group A2, B2, A3, or B3 refrigerant in a single independent circuit would exceed 25 percent of the lower flammability limit upon release to the space.

7. All refrigerant-containing parts in systems exceeding 100 HP (74.6 kW) drive power, except evaporators used for refrigeration or dehumidification; control and pressure-relief valves for either; and connecting piping, shall be located either outdoors or in a machinery room.

18-28-1104.2.3 Multiple dwelling location provisions.

Compressors, condensers, and shell-type apparatus serving multiple dwelling units, which are not located within the family unit, shall be located in either a Class S or Class R Machinery Room, or other locked suitable enclosure, or outdoors. This apparatus shall not be located under stairways, or within elevator machinery rooms.

18-28-1104.3 Refrigerant restrictions.

Refrigerant applications, maximum quantities and use shall be restricted in accordance with Sections 18-28-1104.3.1 through 18-28-1104.3.4.

18-28-1104.3.1 Air-conditioning for human comfort.

In other than industrial occupancies where the quantity of refrigerant in any independent circuit does not exceed the amount in Table 18-28-1103.1, Group B1, B2 and B3 refrigerants shall not be used in high probability systems for air-conditioning for human comfort.

18-28-1104.3.2 Nonindustrial occupancies.

Group A2 and B2 refrigerants shall not be used in high probability systems where the quantity of refrigerant in any independent refrigerant circuit exceeds the amount shown in Table 18-28-1103.1. Group A3 and B3 refrigerants shall not be used except where approved. Use of these refrigerants is prohibited except in laboratories in commercial occupancies. Only unit systems containing not more than 6.6 lb (3 kg) of Group A3 or B3 refrigerant shall be used unless the laboratory is occupied by less than one person per 100ft² (9.3m²) of floor area, in which case the requirements of industrial occupancies shall apply. Note that 7.4.1 permits a refrigerant charge of 6.6 lb (3 kg) or less (any refrigerant) of any system meeting the requirements of this rule.

Exception: This section does not apply to laboratories where the floor area per occupant is not less than 100 square feet (9.3m²).
(Amend Coun. J. 11-8-12, p. 38872, § 327)

18-28-1104.3.3 All occupancies.

The total of all Group A2, B2, A3 and B3 refrigerants other than R-717 ammonia, shall not exceed 1,100 pounds (500 kg) except where approved.

18-28-1104.3.4 Protection from refrigerant decomposition.

Where any device having an open flame or surface temperature greater than 800°F (426°C) is used in an independent circuit, a hood and exhaust system shall be provided in accordance with Article 5, Exhaust Systems. Such exhaust system shall discharge combustion products to the outdoors.

Exception: A hood and exhaust system shall not be required.

1. Where the refrigerant is R-717, R-718m R-744;
2. Where the combustion air is ducted from the outdoors in a manner that prevents leaked refrigerant from being combusted.

18-28-1104.4.

18-28-1104.4.1 Nonconnecting spaces.

Where a refrigerating system or a part thereof is located in one or more enclosed occupied spaces that do not connect through permanent openings or HVAC ducts, the volume of the smallest occupied space shall be used to determine the refrigerant quantity limit in the system. Where different stories and floor levels connect through an open atrium or mezzanine arrangement, the volume to be used in calculating the refrigerant quantity limit shall be determined by multiplying the floor area of the lowest space by 8.2 feet (2.5 m).

18-28-1104.4.2 Ventilated spaces.

Where a refrigerating system or a part thereof is located within an air handler, an air distribution duct system, or in an occupied space served by a mechanical ventilation system, the entire air distribution system shall be analyzed to determine the worst case

distribution of leaked refrigerant. The worst case or the smallest volume in which the leaked refrigerant disperses shall be used to determine the refrigerant quantity limit in the system, subject to the following criteria.

18-28-1104.4.3 Closures.

Closures in the air distribution system shall be considered. If one or more spaces of several arranged in parallel can be closed off from the source of the refrigerant leak, their volume(s) shall not be used in the calculation.

Exceptions: The following closure devices are not considered:

1. Smoke dampers, fire dampers, and combination smoke/fire dampers that close only in an emergency not associated with a refrigerant leak,
2. Dampers, such as VAV boxes, that provide limited closure where air flow is not reduced below 10 percent of its maximum (with the fan running).

18-28-1104.4.4 Plenums.

The space above a suspended ceiling shall not be included in calculating the refrigerant quantity limit in the system unless such space is part of the air supply or return system.

18-28-1104.4.5 Supply and return ducts.

The volume of the supply and return ducts and plenums shall be included when calculating the refrigerant quantity limit in the system.

18-28-1105 Machinery Room General Requirements.

18-28-1105.1 Access.

A machinery room shall be restricted to authorized personnel. A sign shall be posted on the machinery room door prohibiting access by others.

18-28-1105.2 Dimensions.

A machinery room shall be dimensioned so parts are accessible with space for service and as to provide clearances required by Article 3. There shall be clear headroom of not less than 7 1/2 feet (2210 mm) below equipment and appliances located over passageways.

18-28-1105.3 Doors.

Each machinery room shall have self-closing, tight fitting doors opening in the direction of egress travel. Doors and door openings shall comply with the requirements of the building code.

18-28-1105.4 Openings.

Openings to other parts of the building that permit passage of escaping refrigerant to other parts of the building are prohibited. Ducts and air handlers in the machinery room that operate at a lower pressure than the room shall be sealed to prevent any refrigerant leakage from entering the airstream.

Exceptions:

1. Egress doors serving the machinery room.
2. Access doors and panels in air ducts and air-handling units, provided that such openings are gasketed and tight fitting.

18-28-1105.5 Refrigerant detector.

Machinery rooms shall contain a refrigerant detector with an audible and visual alarm. The detector, or a sampling tube that draws air to the detector, shall be located in an area where refrigerant from a leak will concentrate. The alarm shall be actuated at a value not greater than the corresponding TLV-TWA values shown in Table 18-28-1103.1. Audible alarm(s) shall be placed directly outside of the machinery room. Visual alarm(s) shall consist of a flashing yellow light placed directly over the machinery room door(s) with a sign that states:

DANGER

DO NOT ENTER WHEN LIGHT IS FLASHING
PELIGRO
NO ENTRAR CUANDO LA LUZ ESTE

18-28-1105.6 Tests.

Periodic tests of the detector, alarm and mechanical ventilating system shall be performed in accordance with manufacturer's specifications and as required by the Building Commissioner.

18-28-1105.7 Fuel-burning appliance.

Open flames that use combustion air from the machinery room shall not be installed in a machinery room, when said machinery room is required by Section 18-28-1104.2.

Exceptions:

1. Matches, lighters, halide leak detectors and similar devices.
2. Where the refrigerant is carbon dioxide or water.

3. Fuel-burning appliances shall not be prohibited in the same machinery room with refrigerant- containing equipment or appliances where combustion air is ducted from outside the machinery room and sealed in such a manner as to prevent any refrigerant leakage from entering the combustion chamber.

18-28-1105.8 Ventilation.

Machinery rooms shall be mechanically ventilated to the outdoors. Mechanical ventilation shall be capable of exhausting the minimum quantity of air both at the normal and emergency conditions. Multiple fans or multi speed fans shall be allowed in order to produce the emergency ventilation rate and to obtain a reduced airflow for normal ventilation. Location of the openings shall be based on the relative density of the refrigerant to air. The free-aperture cross section for the ventilation of the machinery room shall be not less than:

$$F = \sqrt{G}$$

For SI: $F = 0.138 \sqrt{G}$

where:

F = The free opening area in square feet (m²).

G = The mass of refrigerant in pounds (kg) in the largest system, any part of which is located in the machinery room.

Exception: Where a refrigerating system is located outdoors more than 20 feet (6069 mm) from any building and is enclosed by a penthouse, lean-to or other open structure, natural or mechanical ventilation shall be provided. Location of the openings shall be based on the relative density of the refrigerant to air.

18-28-1105.8.1 Discharge location.

The discharge of the air shall be to the outdoors in accordance with Article 5. Exhaust from mechanical ventilation systems shall be discharged not less than 20 feet (6096 mm) from a property line or openings into buildings.

18-28-1105.8.2 Make-up air.

Provisions shall be made for make-up air to replace the air that is being exhausted. Openings for make-up air shall be located to avoid intake of exhaust air. Supply and exhaust ducts to the machinery room shall serve no other area, shall be constructed in accordance with Article 5 and shall be covered with corrosion-resistant screen of not less than 1/4-inch (6.4 mm) mesh.

18-28-1105.8.3 Quantity - normal ventilation.

During occupied conditions, the mechanical ventilation system shall exhaust the larger of the following:

1. Not less than 0.5 cfm per square foot (0.0025 m³/s m²) of machinery room area or 20cfm (0.009 m³/s) per person; or

2. A volume required to limit the room temperature rise to 18°F (10°C) taking into account the ambient heating effect of all machinery in the room.

18-28-1105.8.4 Quantity - emergency conditions.

Upon actuation of the refrigerant detector required in Section 18-28-1105.5, the mechanical ventilation system shall exhaust air from the machinery room in the following quantity:

$$Q = 100 \times \sqrt{G}$$

For SI: $Q = 1.07 \times \sqrt{G}$

where:

Q = The airflow in cubic feet per minute (m³/s).

G = The design mass of refrigerant in pounds (kg) in the largest system, any part of which is located in the machinery room.

18-28-1105.9 Termination of relief devices.

Pressure-relief devices, and purge systems located within the machinery room shall terminate outside of the structure at a location not less than 15 feet (4572 mm) above the adjoining grade level and not less than 20 feet (6096 mm) from any window, ventilation opening or exit.

18-28-1105.10 Ammonia discharge.

Pressure-relief valves for ammonia systems shall discharge in accordance with ASHRAE 15. Piping from Ammonia Refrigerant (Group B2) shall terminate above the roof of the highest story of the building and shall be at least 40 feet (12.192m) from any adjoining building which extends above the roof and at least 40 feet (12.192m) from any penthouse, skylight, fixed ladder or exhaust duct system. Piping shall terminate downward at an angle of 45 degrees from the horizontal, and shall be provided with a permanent warning sign attached to the piping at the point of termination. The sign shall have a yellow background and shall state in black letters not less than 3 inches (76.2 mm) in height in both Spanish and English.

AMMONIA VENT - DANGER AMONIACO DESCARGA - PELIGRO
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18-28-1105.11 Safety equipment.

Two self-contained, breathing air apparatuses (SCBA) approved by the Bureau of Mines of the United States Department of the interior shall be kept in a suitable cabinet immediately outside the entrance to the machinery room for every system containing over one 1000 pounds (453.6 kg) of a Group A1 refrigerant that operates above atmospheric pressure or over 100 pounds (45.36 kg) of Ammonia (R-717) refrigerant. SCBA equipment shall be rated for at least 30 minutes. When a machinery room is required, at least two approved self-contained breathing apparatus, suitable for the refrigerant used, shall be located outside of, but close to, the machinery room. SCBA equipment shall be fire-resistance rated for at least 30 minutes.

18-28-1106 Machinery Room Special Requirements.

18-28-1106.1 General.

Where required by Section 18-28-1104.2, the machinery room shall meet the requirements of this section in addition to the requirements of Section 18-28-1105.

18-28-1106.2 Elevated temperature.

There shall not be an open flame-producing device or continuously operating hot surface over 800°F (427°C) permanently installed in the room.

18-28-1106.3 Construction requirements.

The machinery room shall be separated from other occupied space with smoke-tight, 1-hour fire-resistance-rated construction.

18-28-1106.4 Opening protectives.

Opening protection between the machinery room and other occupied spaces shall be approved, self-closing, tight-fitting fire doors with a minimum fire-resistance rating of hour.

18-28-1106.5 Pipe penetrations.

All pipe penetrations of the interior walls, ceiling or floor of machinery rooms shall be sealed vapor tight and protected in accordance with the building code.

18-28-1106.6 Deliberately omitted.

18-28-1106.7 Egress.

Each machinery room shall be provided with a minimum of one exit door that opens directly to the outside.

Exception: Self-closing, tight fitting doors opening into a protected exit connecting to an outside exit as required by the building code.

18-28-1106.8 Ammonia room ventilation.

Ventilation systems in ammonia machinery rooms shall be operated continuously. In machinery rooms containing refrigeration equipment using Group 2 refrigerants, the inlet to the exhaust fan or fans, or air-duct connection, shall be located near the ceiling, and the outlet from the fan or fans, or air-duct connection, shall terminate outside the building above the roof of the highest story of the building, and shall be at least 30 feet (9.144m) from any penthouse, skylight, or ventilation air-intake.

18-28-1106.9 Flammable refrigerants.

Where refrigerants of Groups A2, A3, B2 and B3 are used, the machinery room shall conform to the Class I, Division 2, hazardous location classification requirements of NFPA 70.

Exception: Ammonia machinery rooms.

18-28-1106.10 Remote controls.

Remote control of the mechanical equipment and appliances located in the machinery room shall be provided at an approved location immediately outside the machinery room and adjacent to its principal entrance.

18-28-1106.10.1 Refrigeration system.

A clearly identified switch of the break-glass-type shall provide off-only control of all electrically energized equipment and appliances in the machinery room, other than refrigerant leak detectors and machinery room ventilation.

18-28-1106.10.2 Ventilation system.

A clearly identified switch of the break-glass-type shall provide on-only control of the machinery room ventilation fans.

18-28-1106.11 Fireman's dump system.

Refer to 18-28-1101.8.

18-28-1106.12 Hand-operated emergency valves.

All Direct Expansion Refrigeration Systems containing more than 100 pounds (45.36 kg) of refrigerant shall be provided with a hand operated emergency valve. Such device shall be connected to the low side of the refrigeration system and be located where the emergency valve is readily available for Fire Department use. Valves shall be identified and operating instructions for the use of the emergency valve shall be provided at the location of the valve. Hand operated emergency valves shall be of the following sizes and a maximum inlet pipe length of one hundred (100) feet (30.48m):

Pounds of Refrigerant In System	Valve Size

100-200	1 inch nominal pipe size
201-300	1 1/4 inches nominal pipe size
301-500	1 1/2 inches nominal pipe size
501-1000	2 inches nominal pipe size
above 1000	3 inches nominal pipe size

18-28-1106.12.1 Hand-operated emergency valve discharge - Group 1 refrigerants.

Discharge from a hand-operated emergency valve for dumping Group 1 refrigerants shall be in accordance with 18-28-1106.13.

18-28-1106.13 Provisions for discharge of refrigerants.

Refrigerants shall be discharged as follows:

a) Where the discharge of a refrigerant from a pressure relief valve or hand operated emergency valve to the outside atmosphere is required for systems containing more than 20 pounds (9.072 kg) of Group 1 refrigerants, the discharge pipe outlet shall be at least 12 feet (3.6576 m) above the ground, at least 20 feet (6.096 m) from any fire escape and at least 10 feet (3.048 m) from any door, fixed or operable window, air intake or exhaust duct. Piping shall terminate downward at an angle of 45 degrees from the horizontal.

b) Where the discharge of a refrigerant from a pressure relief valve to the outside atmosphere is required for systems containing not more than 20 pounds (9.072 kg) of Group 1 refrigerants, the discharge pipe outlet shall be at least 12 feet (3.6576 m) above ground, at least 20 feet (6.096 m) from any fire escape and at least 2 feet (0.6096 m) from any door, fixed or operable window, air intake or exhaust duct. Piping shall terminate downward at an angle of 45 degrees from the horizontal.

c) Where the discharge of a refrigerant from a pressure relief valve to the outside atmosphere is required for a system containing Group 2 refrigerants, piping shall terminate above the roof of the highest story of the building, and shall be at least 40 feet (12.192 m) from any adjoining building which extends above the roof and at least 40 feet (12.192 m) from any penthouse, skylight, fixed ladder or other means of access to the roof, or air intake or exhaust duct system. Piping shall terminate downward at an angle of 45 degrees from the horizontal, and shall be provided with a permanent warning sign attached to the piping at the point of termination. The sign shall have a yellow background and shall state in black letters not less than 3 inches (76.2 mm) in height and with the following wording:

<p>AMMONIA VENT - DANGER AMONIACO DESCARGA - PELIGRO</p>
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d) Relief valves may be vented to the low pressure side of a system, provided that the low pressure side is equipped with a relief device vented to the outside atmosphere.

e) Discharge piping from a relief device which does not exceed 100 feet (30.48 m) in length shall have a nominal pipe size which is not smaller than the outlet size of the relief device. When discharge piping exceeds 100 feet (30.48 m) in length pipe size shall be increased to the next larger nominal pipe size.

f) Discharge from more than one relief valve may run into a common header provided that the cross-sectional area of the common header is equal to or greater than the aggregate cross-sectional area of the discharge ports of all the valves connected to the common header.

18-28-1107 Refrigerant Piping.

18-28-1107.1 General.

All refrigerant piping shall be installed, tested, and placed in operation in accordance with this chapter.

18-28-1107.2 Pipe enclosures.

Rigid or flexible metal enclosures or pipe ducts shall be provided for soft, annealed copper tubing and used for refrigerant piping erected on the premises and containing other than Group A1 or B1 refrigerants. Enclosures shall not be required for connections between condensing units and the nearest riser box(es), provided such connections do not exceed 6 feet (1829 mm) in length.

18-28-1107.2.1 Location prohibition.

Refrigerant piping shall not be located under stairways, fire escapes, enclosed hallways, elevators, dumbwaiters, and other shafts containing moving objects.

18-28-1107.3 Condensation.

All refrigerating piping and fittings, brine piping and fittings that, during normal operation, will reach a surface temperature below the dew point of the surrounding air, and are located in spaces or areas where condensation will cause a safety hazard to the building occupants, structure, electrical equipment or any other equipment or appliances, shall be protected in an approved manner to prevent such damage.

18-28-1107.3.1 Cooling coil condensation requirements.

Each cooling coil located in an air stream for which moisture may be condensed shall have a nonsweating condensate drip pan of sufficient size and depth to catch all of the condensate from the coil. Each condensate drip pan shall be provided with a drain pipe of adequate size to prevent overflow of the drip pan but in no case shall such drain be less than 3/4 inch (19.05 mm) nominal pipe size. Condensate drain piping shall discharge through an air gap into the waste receptor. The minimum air gap shall be equal to two times the internal diameter of the condensate drain piping. Condensate drain piping and condenser water piping shall comply with the applicable provisions of the Building Services Piping Code, ANSI B 31.9.

18-28-1107.4 Materials for refrigerants pipe and tubing.

Piping materials shall be as set forth in Section 18-28-1107.4.1 through 18-28-1107.4.5.

18-28-1107.4.1 Steel pipe.

Steel pipe up to 1 1/2-inches (38.1 mm) industry pipe standard (IPS) shall be ASTM A53-1978 Grade B. Steel Pipe 2-inches (50.8 mm) (IPS) and larger shall be either ASTM A53-1978 Grade B seamless or ASTM A106-1978 Grade B seamless. ASTM Schedule 40 or heavier steel pipe shall be used where fabricated and assembled by the fusion-welded process. If fabricated and assembled by the threading process, ASTM Schedule 80 steel pipe shall be used. Threaded and flanged fittings shall be cast steel.

18-28-1107.4.2 Copper and brass pipe.

Standard iron-pipe size, copper and red brass (not less than 80 percent copper) pipe shall conform to ASTM B42 and ASTM B43.

18-28-1107.4.3 Copper tube.

Copper tube used for refrigerant piping erected on the premises shall be seamless copper tube of type ACR, manufactured in accordance with ASTM B280. Where required and approved for systems in excess of the rated pressure of Type ACR tube, copper tube shall be seamless copper tube of Type K complying with ASTM B819, or Type K complying with ASTM B88 and shall be internally cleaned and capped. Annealed temper copper tube shall not be used where the system contains more than 100 pounds (45.36kg) of refrigerant in sizes larger than 7/8 inch (22mm) nominal size. Fittings shall be forged brass, wrought copper, or bronze alloy.

18-28-1107.4.4 Copper tube joints.

Copper tubing used in refrigerating systems shall be brazed. Soldered joints and mechanical joints shall not be used.

18-28-1107.4.5 Aluminum tube.

Type 3003-0 aluminum tubing with high-pressure fittings shall not be used with methyl chloride and other refrigerants known to attack aluminum.

18-28-1107.5 Joints and refrigerant-containing parts in air ducts.

All connections located within a ventilation system shall be formed by fusion welding or socket type brazed fittings. No valves, devices or connections thereto shall be located in a ventilation system, except systems containing less than 100 pounds (45.36 kg) of refrigerant and do not contain a warm air furnace or electric resistance heating coil.

18-28-1107.6 Exposure of refrigerant pipe joints.

Refrigerant pipe joints erected on the premises shall be exposed for visual inspection prior to being covered or enclosed.

18-28-1107.7 Stop valves.

All systems containing more than 6.6 pounds (3 kg) of a refrigerant in systems using positive-displacement compressors, shall have stop valves installed at the inlet of each compressor, compressor unit or condensing unit.

Exceptions:

1. Systems that have a refrigerant pump out function capable of storing the entire refrigerant charge in a receiver or heat exchanger.
2. Systems that are equipped with provisions for pump out of the refrigerant using either portable or permanently installed recovery equipment.
3. Self-contained systems.

18-28-1107.7.1 Liquid receivers.

All systems containing 100 pounds (45 kg) or more of a refrigerant, other than systems utilizing non-positive displacement compressors, shall have stop valves, in addition to those required by Section 18-28-1107.7, on each inlet of a receiver. Stop valves shall not be required on the inlet of a receiver in a condensing unit, nor on the inlet of a receiver which is an integral part of the condenser.

18-28-1107.7.2 Copper tubing.

Stop valves used with soft annealed copper tubing or hard-drawn copper tubing 7/8-inch (22mm) OD standard size or smaller shall be securely mounted, independent of tubing fastenings or supports.

18-28-1107.7.3 Identification.

Stop valves shall be identified where their intended purpose is not obvious. Numbers shall not be used to label the valves, unless a key to the numbers is located near the valves.

18-28-1108 Field Test.

18-28-1108.1 General.

It shall be the duty of any person installing refrigeration systems to apply tests to the systems as required by the Building Commissioner:

1. The testing of every refrigeration system shall include a pressure or vacuum test of the complete piping system, preferably with the evaporator installed, but valves may be closed to prevent withdrawal of the refrigerant.
2. Under these tests, a partial vacuum of 20 inches (.508 m) of mercury shall be produced with the system, and shall be held for a period of at least one hour with no detectable change.
3. Every part of every refrigeration system shall be designed, constructed, assembled and tested to withstand safety and without injury, the required minimum test pressures. These test pressures shall be held by every refrigeration system under test for a period of one hour or over with no detectable change.
4. Pressure tests of refrigeration systems shall be made with air, carbon dioxide, nitrogen, or other inert gas approved by the Building Commissioner. When practicable, water may be used. When testing with air, care should be taken to prevent the temperature at any point from rising above 130°F (54.44°C).

(Amend Coun. J. 11-8-12, p. 38872, § 325)

5. The means used to build up the test pressure shall have either a pressure-limiting device or a pressure-reducing device and a gauge on the outlet side.
6. Tests shall be performed with dry nitrogen or another nonflammable, nonreactive, dried gas. Oxygen, air, or mixtures containing them shall not be used. The means used to build up the test pressure shall have either a pressure-limiting device or a pressure-reducing device and a gauge on the outlet side. The pressure-relief device shall be set above the test pressure, but low enough to prevent permanent deformation of the system's components.

Exceptions:

1. Mixtures of dry nitrogen, inert gases, or a combination of them with nonflammable refrigerants in concentrations of a refrigerant weight fraction (mass fraction) not exceeding 5% are allowed for tests.

2. Mixtures of dry nitrogen, inert gases, or a combination of them with flammable refrigerants in concentrations not exceeding the lesser of a refrigerant weight fraction (mass fraction) of 5% or 25% of the LFL are allowed for tests.

3. Compressed air without added refrigerant is allowed for tests provided the system is subsequently evacuated to less than 1,000 microns (132 Pa) before charging with refrigerant.

4. Systems erected on the premises using Group A1 refrigerant and with copper tubing not exceeding 0.62 inches (16 mm) outside diameter shall be tested by means of the refrigerant charged into the system at the saturated vapor pressure of the refrigerant at 68°F (20°C) minimum.

7. A dated declaration of test shall be provided for all systems containing 55 lb (25 kg) or more of refrigerant. The declaration shall give the name of the refrigerant and the field test pressure applied to the highside and the lowside of the system. The declaration of test shall be signed by the installer and, if an inspector is present at the tests, the inspector shall also sign the declaration. When requested, copies of this declaration shall be furnished to the authority having jurisdiction.

Article XII. Hydronic Piping (18-28-1200 et seq.)

18-28-1200 General.

18-28-1201.1 Scope.

The provisions of this article shall govern the construction, installation, alteration and repair of hydronic piping systems. This chapter shall apply to hydronic piping systems that are parts of heating, ventilation and air-conditioning systems. Such piping systems shall include steam, hot water, chilled water, steam condensate and ground source heat pump loop systems. Potable cold and hot water distribution systems shall be installed in accordance with the plumbing code.

18-28-1201.2 Pipe sizing.

Piping for hydronic systems shall be sized for the demand of the system.

18-28-1202 Material.

18-28-1202.1 Piping.

Piping material shall conform to the standards cited in this section.

Exception: Embedded piping regulated by Section 18-28-1209.

18-28-1202.2 Used materials.

Reused pipe, fittings, valves or other materials shall be clean and free of foreign materials and shall be approved by the code official for reuse.

18-28-1202.3 Material rating.

Materials shall be rated for the operating temperature and pressure of the hydronic system. Materials shall be suitable for the type of fluid in the hydronic system.

18-28-1202.4 Piping materials standards.

Hydronic pipe shall conform to the standards listed in Table 18-28-1202.4. The exterior of the pipe shall be protected from corrosion and degradation.

**Table 18-28-1202.4
Hydronic Pipe**

Material	Standard (see Chapter 16)
Acrylonirile butadiene styrene (ABS) plastic pipe	ASTM D 1527; ASTM D 2282
Brass pipe	ASTM B 43

Brass tubing	ASTM B 135
Copper or copper- alloy pipe	ASTM B 42; ASTM B 302
Copper or copper- alloy tube (Type K, L, or M)	ASTM B 75; ASTM B 88; ASTM B 251
Chlorinated polyvinyl chloride (CPVC) plastic pipe	ASTM D 2846; ASTM F 441; ASTM F 442
Cross-linked polyethylene/ aluminum/cross- linked polyethylene (PEX-AL-PEX) pressure pipe	CSA CAN/ CSA-B-137. 10
Cross-linked polyethylene (PEX) tubing	ASTM F 876; ASTM F 877
Lead pipe	FS WW-P 325B
Polybutylene (PB) plastic pipe and tubing	ASTM D 3309
Polyvinyl chloride (PVC) plastic pipe	ASTM D 1785; ASTM D 2241
Steel pipe	ASTM A 53; ASTM A 106
Steel tubing	ASTM A 254

18-28-1202.5 Pipe fittings.

Hydronic pipe fittings shall be approved for installation with the piping materials to be installed, and shall conform to the respective pipe standards or to the standards listed in Table 18-28-1202.5.

**Table 18-28-1202.5
Hydronic Pipe Fittings**

Material	Standard (see Article 15)
Bronze	ASME B 16.24
Copper and copper alloys	ASME B 16.15; ASME B 16.18; ASME B 16.22; ASME B 16.23; ASME B 16.26; ASME B 16.29
Gray iron	ASTM A 126
Malleable iron	ASME B 16.3
Plastic	ASTM D 2466; ASTM D 2467; ASTM D 2468; ASTM F 438; ASTM F 439; ASTM F 877
Steel	ASME B 16.5; ASME B 16.9; ASME B 16.11; ASME B 16.28; ASTM A 420

18-28-1202.6 Valves.

Valves shall be constructed of materials that are compatible with the type of piping material and fluids in the system. Valves shall be rated for the temperatures and pressures of the systems in which the valves are installed.

18-28-1202.7 Flexible connectors, expansion and vibration compensators.

Flexible connectors, expansion and vibration control devices and fittings shall be of an approved type.

18-28-1203 Joints and Connections.

18-28-1203.1 Approval.

Joints and connections shall be of an approved type. Joints and connections shall be tight for the pressure of the hydronic system.

18-28-1203.1.1 Joints between different piping materials.

Joints between different piping materials shall be made with approved adapter fittings. Joints between different metallic piping materials shall be made with approved dielectric fittings or brass converter fittings.

18-28-1203.2 Preparation of pipe ends.

Pipe shall be cut square, reamed and chamfered, and shall be free of burrs and obstructions, Pipe ends shall have full-bore openings and shall not be undercut.

18-28-1203.3 Joint preparation and installation.

When required by Sections 18-28-1203.4 through 18-28-1203.14, the preparation and installation of brazed, mechanical, soldered, solvent-cemented, threaded and welded joints shall comply with Sections 18-28-1203.3 through 18-28-1203.3.7.

18-28-1203.3.1 Brazed joints.

Joint surfaces shall be cleaned. An approved flux shall be applied where required. The joint shall be brazed with a filler metal conforming to AWS A5.8.

18-28-1203.3.2 Mechanical joints.

Mechanical joints shall be installed in accordance with the manufacturer's instructions.

18-28-1203.3.3 Soldered joints.

Joint surfaces shall be cleaned. A flux conforming to ASTM B 813 shall be applied. The joint shall be soldered with a solder conforming to ASTM B 32.

18-28-1203.3.4 Solvent-cemented joints.

Joint surfaces shall be clean and free of moisture. An approved primer shall be applied to CPVC and to PVC pipe-joint surfaces. Joints shall be made while the cement is wet. Solvent cement conforming to the following standards shall be applied to all joint surfaces:

1. ASTM D 2235 for ABS joints.
2. ASTM F 493 for CPVC joints.
3. ASTM D 2564 for PVC joints.

CPVC joints shall be made in accordance with ASTM D 2846.

18-28-1203.3.5 Threaded joints.

Threads shall conform to ASME B1 20.1. Schedule 80 or heavier plastic pipe shall be threaded with dies specifically designed for plastic pipe. Thread lubricant, pipe-joint compound or tape shall be applied on the male threads only and shall be approved for application on the piping material.

18-28-1203.3.6 Welded joints.

Joint surfaces shall be cleaned by an approved procedure. Joints shall be welded with an approved filler metal.

18-28-1203.3.7 Grooved and shouldered joints.

Grooved and shouldered joints shall be approved and installed in accordance with the manufacturer's installation instructions.

18-28-1203.4 ABS plastic pipe.

Joints between ABS plastic pipe or fittings shall be solvent-cemented or threaded joints conforming to Section 18-28-1203.3.

18-28-1203.5 Brass pipe.

Joints between brass pipe or fittings shall be brazed, mechanical, threaded or welded joints conforming to Section 18-28-1203.3.

18-28-1203.6 Brass tubing.

Joints between brass tubing or fittings shall be brazed, mechanical or soldered joints conforming to Section 18-28-1203.3.

18-28-1203.7 Copper or copper-alloy pipe.

Joints between copper or copper-alloy pipe or fittings shall be brazed, mechanical, soldered, threaded or welded joints conforming to Section 18-28-1203.3.

18-28-1203.8 Copper or copper-alloy tubing.

Joints between copper or copper-alloy tubing or fittings shall be brazed, mechanical or soldered joints conforming to Section 18-28-1203.3 or flared joints conforming to Section 18-28-1203.8.1.

18-28-1203.8.1 Flared joints.

Flared joints shall be made by a tool designed for that operation.

18-28-1203.9 CPVC plastic pipe.

Joints between CPVC plastic pipe or fittings shall be solvent-cemented or threaded joints conforming to Section 18-28-1203.3.

18-28-1203.10 Polybutylene plastic pipe and tubing.

Joints between polybutylene plastic pipe and tubing or fittings shall be mechanical joints conforming to Section 18-28-1203.3 or heat-fusion joints conforming to Section 18-28-1203.10.1.

18-28-1203.10.1 Heat-fusion joints.

Joints shall be of the socket-fusion or butt-fusion type. Joint surfaces shall be clean and free of moisture. Joint surfaces shall be heated to melt temperatures and joined. The joint shall be undisturbed until cool. Joints shall be made in accordance with ASTM D 3309.

18-28-1203.11 Cross-linked polyethylene (PEX) plastic tubing.

Joints between cross-linked polyethylene plastic tubing and fittings shall conform to Sections 18-28-1203.11.1 and 18-28-1203.11.2. Mechanical joints shall conform to Section 18-28-1203.3.

18-28-1203.11.1 Compression-type fittings.

If compression-type fittings include inserts and ferrules or O-rings, the fittings shall be installed without omitting the inserts and ferrules or O-rings.

18-28-1203.11.2 Plastic-to-metal connections.

Soldering on the metal portion of the system shall be performed at least 18 inches (457 mm) from a plastic-to-metal adapter in the same water line.

18-28-1203.12 PVC plastic pipe.

Joints between PVC plastic pipe and fittings shall be solvent-cemented or threaded joints conforming to Section 18-28-1203.3.

18-28-1203.13 Steel pipe.

Joints between steel pipe or fittings shall be mechanical joints that are made with an approved elastomeric seal, or shall be threaded or welded joints conforming to Section 18-28-1203.3.

18-28-1203.14 Steel tubing.

Joints between steel tubing or fittings shall be mechanical or welded joints conforming to Section 18-28-1203.3.

18-28-1204 Pipe Insulation.

18-28-1204.1 Insulation characteristics.

Pipe insulation installed in buildings shall conform to the requirements of the energy code, shall be tested in accordance with ASTM E 84 and shall have a maximum flame spread index of 25 and a smoke-developed index not exceeding 450. Insulation installed in an air plenum shall comply with Section 18-28-602.2.1.

Exception: The maximum flame spread index and smoke-developed index shall not apply to one- and two-family dwellings.

18-28-1204.2 Required thickness.

Hydronic piping shall be insulated to the thickness required by the energy code.

18-28-1205 Valves.

18-28-1205.1 Where required.

Shut off valves shall be installed in hydronic piping systems in the locations indicated in Sections 18-28-1205.1.1 through 18-28-1205.1.6.

18-28-1205.1.1 Heat exchangers.

Shutoff valves shall be installed on the supply and return side of a heat exchanger.

Exception: Shut off valves shall not be required when heat exchangers are integral with a boiler; or are a component of a manufacturer's boiler and heat exchanger packaged unit, and are capable of being isolated from the hydronic system by the supply and return valves required by Section 18-28-1005.1.

18-28-1205.1.2 Central systems.

Shutoff valves shall be installed on the building supply and return of a central utility system.

18-28-1205.1.3 Pressure vessels.

Shutoff valves shall be installed on the connection to any pressure vessel.

18-28-1205.1.4 Pressure-reducing valves.

Shutoff valves shall be installed on both sides of a pressure-reducing valve.

18-28-1205.1.5 Equipment and appliances.

Shutoff valves shall be installed on connections to mechanical equipment and appliances. This requirement does not apply to components of a hydronic system such as pumps, air separators, metering devices and similar equipment.

18-28-1205.1.6 Expansion tanks.

Shutoff valves shall be installed at connections to nondiaphragm-type expansion

18-28-1205.2 Reduced pressure.

A pressure relief valve shall be installed on the low-pressure side of a hydronic piping system that has been reduced in pressure. The relief valve shall be set at the maximum pressure of the system design. The valve shall be installed in accordance with Section 18-28-1006.

18-28-1206 Piping Installation.

18-28-1206.1 General.

Piping, valves, fittings and connections shall be installed in accordance with the conditions of approval.

18-28-1206.1.1 Prohibited tee applications.

Fluid in the supply side of a hydronic system shall not enter a tee fitting through the branch opening.

18-28-1206.2 System drain down.

Hydronic piping systems shall be designed and installed to permit the system to be drained. Where the system drains to the plumbing drainage system, the installation shall conform to the requirements of the plumbing code.

18-28-1206.3 Protection of potable water.

The potable water system shall be protected from backflow in accordance with the plumbing code.

18-28-1206.4 Pipe penetrations.

Openings for pipe penetrations in walls, floors or ceilings shall be larger than the penetrating pipe. Openings through concrete or masonry building elements shall be sleeved. The annular space surrounding pipe penetrations shall be protected in accordance with the building code.

18-28-1206.5 Clearance to combustibles.

A pipe in a hydronic piping system in which the exterior temperature exceeds 250°F (121°C) shall have a minimum clearance of 1 inch (25.4 mm) to combustible materials.

18-28-1206.6 Contact with building material.

A hydronic piping system shall not be in direct contact with building materials that cause the piping material to degrade or corrode, or that interfere with the operation of the system.

18-28-1206.7 Water hammer.

The flow velocity of the hydronic piping system shall be controlled to reduce the possibility of water hammer. Where a quick-closing valve creates water hammer, an approved water-hammer arrester shall be installed. The arrester shall be located within a range as specified by the manufacturer of the quick-closing valve.

18-28-1206.8 Steam piping pitch.

Steam piping shall be installed to drain to the boiler or the steam trap. Steam systems shall not have drip pockets that reduce the capacity of the steam piping.

18-28-1206.9 Strains and stresses.

Piping shall be installed so as to prevent detrimental strains and stresses in the pipe. Provisions shall be made to protect piping from damage resulting from expansion, contraction and structural settlement. Piping shall be installed so as to avoid structural stresses or strains within building components.

18-28-1206.9.1 Flood hazard.

Piping located in a flood-hazard zone or high-hazard zone shall be capable of resisting hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, during the occurrence of flooding to the base flood elevation.

18-28-1206.10 Pipe support.

Pipe shall be supported in accordance with Section 18-28-305.

18-28-1206.11 Condensation.

Provisions shall be made to prevent the formation of condensation on the exterior of piping.

18-28-1207 Transfer Fluid.

18-28-1207.1 Flash point.

The flash point of transfer fluid in a hydronic piping system shall be a minimum of 50°F (28°C) above the maximum system operating temperature.

18-28-1207.2 Makeup water.

The transfer fluid shall be compatible with the makeup water supplied to the system.

18-28-1208 Tests.

18-28-1208.1 General.

Hydronic piping systems shall be tested hydrostatically at one and one-half times the maximum system design pressure, but not less than 100 psi (689 kPa).

18-28-1209 Embedded Piping.

18-28-1209.1 Materials.

Piping for heating panels shall be standard-weight steel pipe, Type L copper tubing, polybutylene or other approved plastic pipe or tubing rated at 100 psi (689 kPa) at 180°F (82°C).

18-28-1209.2 Pressurizing during installation.

Piping to be embedded in concrete shall be pressure tested prior to pouring concrete. During pouring, the pipe shall be maintained at the proposed operating pressure.

18-28-1209.3 Embedded joints.

Joints of pipe or tubing that are embedded in a portion of a building, such as a building's concrete or plaster, shall be in accordance with the requirements of Sections 18-28-1209.3.1 through 18-28-1209.3.3.

18-28-1209.3.1 Steel pipe joints.

Steel pipe shall be welded using the electrical arc or oxygen/acetylene method.

18-28-1209.3.2 Copper tubing joints.

Copper tubing shall be joined by brazing with filler metals that have a melting point of at least 1,000°F (538°C).

18-28-1209.3.3 Polybutylene joints.

Polybutylene pipe and tubing shall be installed in continuous lengths or shall be joined by heat fusion in accordance with Section 18-28-1203.10.1.

18-28-1209.4 Not embedded related piping.

Joints of other piping located in cavities or running exposed shall be joined by approved methods in accordance with the manufacturer's installation instructions and related sections of the building code.

Article XIII. Fuel Oil Piping and Storage (18-28-1301 et seq.)

18-28-1301 General.

18-28-1301.1 Scope.

This chapter shall govern the design, installation, construction and repair of fuel oil storage and piping systems. Quantities of fuel oil that exceed the quantity limitations of this chapter and flammable and combustible liquids shall be stored in accordance with the fire prevention code.

18-28-1301.2 Storage systems.

Fuel oil storage and piping systems shall be installed in accordance with the requirements of the building code, the fire prevention code and NFPA 31.

18-28-1301.3 Fuel type.

An appliance shall be designed for use with the type of fuel to which the appliance will be connected. Such appliance shall not be converted from the fuel specified on the rating plate for use with a different fuel without first securing re-approval from the Building Commissioner.

18-28-1301.4 Fuel tanks, piping and valves.

The tank, piping and valves for appliances that burn oil shall be installed in accordance with the requirements of this chapter. If an oil burner is served by a tank, any part of which is above the level of the burner inlet connection, and if the fuel supply line is taken from the top of the tank, an approved antisiphon valve or other siphon-breaking device shall be installed in lieu of the shutoff valve.

18-28-1302 Material.

18-28-1302.1 General.

Storage tanks and piping materials shall conform to the standards cited in this section.

18-28-1302.2 Rated for system.

All materials shall be rated for the operating temperatures and pressures of the system and shall be compatible with the type of liquid used.

18-28-1302.3 Storage tanks.

All shop-fabricated fuel oil storage tanks shall be listed and labeled. Fuel oil tanks shall comply with one of the appropriate standards listed in Table 18-28-1302.3.

**Table 18-28-1302.3
Fuel Oil Storage Tanks**

Material	Standard
Glass-fiber reinforced plastic	UL 1316
Glass-fiber reinforced polyester	ASTM D 4021
Steel	API 12B; API 12D; API 12F; API 650; UL 58; UL 80; UL 142; UL 443; STI Standard for Dual Wall Underground Steel Storage Tanks

18-28-1302.4 Pipe standards.

Fuel oil pipe shall comply with one of the standards listed in Table 18-28-1302.4.

**Table 18-28-1302.4
Fuel Oil Piping**

Material	Standard
Brass pipe	ASTM B 43
Brass Tubing	ASTM B 135
Copper or copper-alloy pipe	ASTM B 42; ASTM B 302
Copper or copper-alloy tubing (Type K, L or M)	ASTM B 75; ASTM B 88; ASTM B 280
Labeled pipe	(see Section 18-28-1302.5)
Nonmetallic pipe	ASTM D 2996
Steel pipe	ASTM A 53; ASTM A 106
Steel tubing	ASTM A 254; ASTM A 539

18-28-1302.5 Nonmetallic pipe.

All nonmetallic pipe for flammable and combustible liquids shall be listed and labeled as acceptable for the intended application. Nonmetallic pipe shall only be installed outside and underground.

18-28-1302.6 Fittings and valves.

Fittings and valves shall be approved for the piping system, and shall be compatible with, or of the same material as, the pipe or tubing.

18-28-1302.7 Bending of pipe.

Pipe shall be approved for bending. Pipe bends shall be made with approved equipment. The bend shall not exceed the structural limitations of the pipe.

18-28-1302.8 Pumps.

Pumps that are not part of an appliance shall be of a positive-displacement type. The pump shall automatically shut off the supply when not in operation. Pumps shall be listed and labeled.

18-28-1302.9 Flexible connectors and hoses.

Flexible connectors and hoses shall be listed and labeled.

18-28-1303 Joints and Connections.

18-28-1303.1 Approval.

Joints and connections shall be approved and of a type approved for fuel-oil piping systems. All threaded joints and connections shall be made tight with suitable lubricant or pipe compound. Unions requiring gaskets or packings, right or left couplings, and sweat fittings employing solder having a melting point of less than 1,000°F (538°C) shall not be used in oil lines. Cast-iron fittings shall not be used. Joints and connections shall be tight for the pressure required by test.

18-28-1303.1.1 Joints between different piping materials.

Joints between different piping materials shall be made with approved adapter fittings. Joints between different metallic piping materials shall be made with approved dielectric fittings or bass converter fittings.

18-28-1303.2 Preparation of pipe ends.

All pipe shall be cut square, reamed and chamfered and shall be free of all burrs and obstructions. Pipe ends shall have full-bore openings and shall not be undercut.

18-28-1303.3 Joint preparation and installation.

If required by Sections 18-28-1303.4 through 18-28-1303.10, the preparation and installation of brazed, mechanical, threaded and welded joints shall comply with Sections 18-28-1303.3.1 through 18-28-1303.3.4.

18-28-1303.3.1 Brazed joints.

All joint surfaces shall be cleaned. An approved flux shall be applied if required. The joints shall be brazed with a filler metal conforming to AWS A5.8.

18-28-1303.3.2 Mechanical joints.

Mechanical joints shall be installed in accordance with the manufacturer's instructions.

18-28-1303.3.3 Threaded joints.

Threads shall conform to ASME B1.20.1. Pipe joint compound or tape shall be applied on the male threads only.

18-28-1303.3.4 Welded joints.

All joint surfaces shall be cleaned by approved procedure. The joint shall be welded with an approved filler metal.

18-28-1303.4 Brass pipe.

Joints between brass pipe or fittings shall be brazed, mechanical, threaded or welded joints complying with Section 18-28-1303.3.

18-28-1303.5 Brass tubing.

Joints between brass tubing or fittings shall be brazed or mechanical joints complying with Section 18-28-1303.3.

18-28-1303.6 Copper or copper-alloy pipe.

Joints between copper or copper-alloy pipe or fittings shall be brazed, mechanical, threaded or welded joints complying with Section 18-28-1303.3.

18-28-1303.7 Copper or copper-alloy tubing.

Joints between copper or copper-alloy tubing or fittings shall be brazed or mechanical joints complying with Section 18-28-1303.3 or flared joints. Flared joints shall be made by a tool designed for that operation.

18-28-1303.8 Nonmetallic pipe.

Joints between nonmetallic pipe or fittings shall be installed in accordance with the manufacturer's instructions for the labeled pipe and fittings.

18-28-1303.9 Steel pipe.

Joints between steel pipe or fittings shall be threaded or welded joints complying with Section 18-28-1303.3 or mechanical joints complying with Section 18-28-1303.9.1.

18-28-1303.9.1 Mechanical joints.

Joints shall be made with an approved elastomeric seal. Mechanical joints shall be installed in accordance with the manufacturer's instructions. Mechanical joints shall be installed outside, underground, unless otherwise approved.

18-28-1303.10 Steel tubing.

Joints between steel tubing or fittings shall be mechanical or welded joints complying with Section 18-28-1303.3.

18-28-1303.11 Piping protection.

Proper allowance shall be made for expansion, contraction, jarring and vibration. Piping other than tubing connected to underground tanks, except straight fill lines and test wells, shall be provided with flexible connectors, or otherwise arranged to permit the tanks to settle without impairing the tightness of the piping connections.

18-28-1304 Piping Support.

18-28-1304.1 General.

Pipe supports shall be in accordance with Section 18-28-305.

18-28-1305 Fuel Oil System Installation.

18-28-1305.1 Size.

The fuel oil system shall be sized for the maximum capacity of fuel oil required. The minimum size of a supply line shall be 3/8-inch (9.5mm) inside diameter nominal pipe or 3/8-inch (9.5mm) OD tubing. The minimum size of a return line shall be 1/4 inch (64mm) inside diameter nominal pipe or 5/16-inch (7.9 mm) outside diameter tubing. Copper tubing shall have 0.035-inch (0.9 mm) nominal and 0.032-inch (0.8 mm) minimum wall thickness.

18-28-1305.2 Protection of pipe, equipment and appliances.

All fuel oil pipe, equipment and appliances shall be protected from physical damage.

18-28-1305.2.1 Flood hazard.

All fuel oil pipe located in a flood-hazard zone or a high-hazard zone shall be capable of resisting hydrostatic and hydrodynamic loads and stresses, including the effects of buoyancy, during the occurrence of flooding to the base flood elevation.

18-28-1305.3 Supply piping.

Supply piping shall connect to the top of the fuel oil tank. Fuel oil shall be supplied by a transfer pump or automatic pump or by other approved means.

Exception: This section shall not apply to inside or above-ground fuel oil tanks.

18-28-1305.4 Return piping.

Return piping shall connect to the top of the fuel oil tank. Valves shall not be installed on return piping.

18-28-1305.5 System pressure.

The system shall be designed for the maximum pressure required by the fuel-oil-burning appliance. Air or other gases shall not be used to pressurize tanks.

18-28-1305.6 Fill piping.

A fill pipe shall terminate outside of a building at a point at least 2 feet (610 mm) from any building opening at the same or lower level. A fill pipe shall terminate in a manner designed to minimize spilling when the filling hose is disconnected. Fill opening shall be equipped with a tight metal cover designed to discourage tampering.

18-28-1305.7 Vent piping.

Liquid fuel vent pipes shall terminate outside of buildings at a point not less than 2 feet (610 mm) measured vertically or horizontally from any building opening. Outer ends of vent pipes shall terminate in a weather-proof vent cap or fitting or be provided with a weather-proof hood. All vent caps shall have a minimum free open area equal to the cross-sectional area of the vent pipe and shall not employ screens finer than No. 4 mesh. Vent pipes shall terminate sufficiently above the ground to avoid being obstructed with snow or ice. Vent pipes from tanks containing heaters shall be extended to a location where oil vapors discharging from the vent will be readily diffused. If the static head with a vent pipe filled with oil exceeds 10 psi (69 kPa), the tank shall be designed for the maximum static head which will be imposed. Liquid fuel vent pipes shall not be cross connected with fill pipes, lines from burners or overflow lines from auxiliary tanks.

18-28-1306 Oil Gauging.

18-28-1306.1 Level indication.

All tanks in which a constant oil level is not maintained by an automatic pump shall be equipped with a method of determining the oil level.

18-28-1306.2 Test wells.

Test wells shall not be installed inside buildings. For outside service, test wells shall be equipped with a tight metal cover designed to discourage tampering.

18-28-1306.3 Inside tanks.

The gauging of inside tanks by means of measuring sticks shall not be permitted. An inside tank provided with fill and vent pipes shall be provided with a device to indicate either visually or audibly at the fill point when the oil in the tank has reached a predetermined safe level.

18-28-1306.4 Gauging devices.

Gauging devices such as liquid level indicators or signals shall be designed and installed so that oil vapor will not be discharged into a building from the liquid fuel supply system.

18-28-1306.5 Gauge glass.

A tank used in connection with any oil burner shall not be equipped with a glass gauge or any gauge which, when broken, will permit the escape of oil from the tank.

18-28-1307 Fuel Oil Valves.

18-28-1307.1 Building shutoff.

A shutoff valve shall be installed on the fuel-oil supply line at the entrance to the building. Inside or above-ground tanks may have valves installed at the tank. The valve shall be capable of stopping the flow of fuel oil to the building or to the appliance served if the valve is installed at a tank inside the building.

18-28-1307.2 Appliance shutoff.

A shutoff valve shall be installed at the connection to each appliance where more than one fuel-oil-burning appliance is installed.

18-28-1307.3 Pump relief valve.

A relief valve shall be installed on the pump discharge line if a valve is located downstream of the pump and the pump is capable of

exceeding the pressure limitations of the fuel oil system.

18-28-1307.4 Fuel-oil heater relief valve.

A relief valve shall be installed on the discharge line of fuel-oil-heating appliances.

18-28-1307.5 Relief valve operation.

The relief valve shall discharge fuel oil if the pressure exceeds the limitations of the system. The discharge line shall connect to the fuel oil tank.

18-28-1308 Testing.

18-28-1308.1 Testing required.

Fuel oil piping shall be tested in accordance with NFPA 31.

Article XIV. Fuel-Gas Piping (18-28-1401 et seq.)

18-28-1401 General.*

* **Editor's note** - Coun. J. 7-9-03, p. 3609, did not provide for this section number or caption, both of which have been inserted at the discretion of the editor.

Chapter 4 - Gas Piping Installation, of the International Fuel Gas Code, (IFGC) 2000 Edition, is adopted in its entirety by reference and with modifications as contained in this chapter.

Section 403 - Piping Materials is adopted with the following additions:

403.5.4.1 Concealed fittings. While the brass mechanical attachment fittings in the CSST system are listed for concealed use in accordance with the ANSI LC-1 standard, concealed fittings are not allowed in the City of Chicago except for connection of CSST to the thru-wall rigid pipe at meter and appliance sub-outs.

403.5.4.2 Manifolds. Distribution manifolds comprised of standard malleable tees and listed brass fittings are not approved to be concealed at this time. For this installation, an access panel shall be installed to provide access to the manifold assembly.

Deletions - 406.2 Test medium. The test medium shall be air or an inert gas. Oxygen shall not be used.

Addition - 406.2 Test medium. The test medium shall be nitrogen. Oxygen shall not be used.

Section 414 - Supplemental and Standby Gas Supply is adopted with the following addition:

414.3 Gas Boosters. Where a customer is boosting gas pressure with a booster, an approved customer-owned back pressure valve (check valve) must be installed at the outlet of the meter owned and maintained by the local natural gas utility company.

Article XV. Solar Systems (18-28-1501 et seq.)

18-28-1501 General.

18-28-1501.1 Scope.

This chapter shall govern the construction, installation, alteration and repair of systems, equipment and appliances intended to utilize solar energy for space heating or cooling, domestic hot water heating, swimming pool heating or process heating.

18-28-1501.2 Potable water supply.

Potable water systems shall be protected against contamination in accordance with Chapter 18-29, Plumbing Systems.

18-28-1501.3 Heat exchangers.

Heat exchangers used in domestic water-heating systems shall be approved for the intended use. The system shall have adequate protection to ensure that the potability of the water supply and distribution system is properly safeguarded.

18-28-1501.4 Solar energy equipment and appliances.

Solar energy equipment and appliances shall conform to the requirements of this chapter and shall be installed in accordance with the manufacturer's installation instructions.

18-28-1501.5 Ducts.

Ducts utilized in solar heating and cooling systems shall be constructed and installed in accordance with Article 6, Duct Systems of the building code.

18-28-1502 Installation.

18-28-1502.1 Access.

Access shall be provided to solar energy equipment and appliances shall be provided for maintenance.

18-28-1502.2 Controlling condensation.

If attics or structural spaces are part of a passive solar system, ventilation of such spaces is not required if other approved means of controlling condensation are provided.

18-28-1502.3 Roof-mounted collectors.

Roof-mounted solar collectors that also serve as a roof covering shall provide moisture and weather protection in a manner consistent with good construction practice.

Exception: Plastic solar collector covers shall be limited to those approved by the Building Commissioner.

18-28-1502.3.1 Collectors mounted above the roof.

If mounted on or above the roof covering, the collector array and supporting construction shall be constructed of noncombustible materials or fire-retardant-treated wood.

18-28-1502.4 Equipment.

The solar energy system shall be equipped in accordance with the requirements of Section 18-28-1502.4.1 through 18-28-1502.4.4.

18-28-1502.4.1 Pressure and temperature.

Solar energy system components that contain pressurized fluids shall be protected against pressures and temperatures that exceed design limitations with a pressure and temperature relief valve. Each section of the system in which excessive pressures are capable of developing shall have a relief device that is located so that no section of the system can be valved off or otherwise isolated from a relief device. Relief valves shall comply with the requirements of Section 18-28-1006.4 and discharge in accordance with Section 18-28-1006.6.

18-28-1502.4.2 Vacuum.

If solar energy system components are subjected to a vacuum while the system is in operation or during shutdown, the components shall be designed to withstand the vacuum or shall be protected from the vacuum with vacuum relief valves.

18-28-1502.4.3 Protection from freezing.

System components shall be protected from damage by freezing of heat transfer liquids at the lowest ambient temperatures that will be encountered during the operation of the system.

18-28-1502.4.4 Expansion tanks.

Liquid single-phase solar energy systems shall be equipped with expansion tanks sized in accordance with Article 10, Boilers, Water Heaters and Pressure Vessels.

18-28-1502.5 Roof penetrations.

Roof penetrations shall be flashed to prevent entry of water through the roof.

18-28-1502.6 Filtering.

Air transported to occupied spaces through rock or dust-producing materials by means other than natural convection shall be filtered at the outlet from the heat storage system.

18-28-1503 Heat Transfer Fluids.

18-28-1503.1 Flash point.

The flash point of any heat transfer liquid used in solar system equipment and appliances shall not be less than the highest temperature as determined from the following:

1. Fifty degrees (28°C) above the design maximum operating (flow) temperature of the fluid in the solar system.
2. Two hundred degrees (111°C) below the design maximum non-operating (no-flow) temperature of the fluid attained in the collector, if the collector manifold assembly is located outside of the building and is exposed to the weather, and the relief valves located adjacent to the collector or collector manifold do not discharge directly into the building.
3. The design maximum no-flow temperature in other collector manifold and relief valve configurations.

18-28-1503.2 Flammable gases and liquids.

No flammable liquid or gas shall be used as a heat transfer fluid. The flash point of liquids used in industrial (G1 and G2), Storage (H1 and H2) and Hazardous (Class 1) occupancies shall not be lower unless approved.

18-28-1504 Materials.

18-28-1504.1 Collectors.

Factory-built collectors shall be listed and labeled, and shall bear a label showing the manufacturer's name and address, the collector's model number, the collector's dry weight, the collector's maximum allowable operating and non-operating temperatures and the types of heat transfer fluids that are compatible with the collector. The label shall make it clear that these specifications apply only to the collector.

18-28-1504.2 Thermal storage units.

Pressurized thermal storage units shall be listed and labeled, and shall bear a label showing the manufacturer's name and address, the unit's model number, the unit's serial number, the unit's maximum and minimum allowable operating temperatures, the unit's maximum and minimum allowable operating pressures and the types of heat transfer fluids compatible with the unit. The label shall make it clear that these specifications apply only to the thermal storage unit.

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