Chapter 8: New York City Mechanical Code

Editor's note: *this chapter has been amended by L.L. 2021/126, 11/7/2021, eff. 11/7/2022. For related unconsolidated provisions, see Appendix A at L.L. 2021/126.*

Article 801: Enactment and Update of the New York City mechanical Code

§ 28-801.1 Update.

No later than the third year after the effective date of this section 28-801.1 and every third year thereafter, the commissioner shall submit to the city council proposed amendments that he or she determines should be made to this code to bring it up to date with the latest edition of the International Mechanical Code or otherwise modify the provisions thereof. In addition, prior to the submission of such proposal to the city council, such proposal shall be submitted to an advisory committee established by the commissioner pursuant to this title for review and comment.

§ 28-801.2 Enactment of the New York city mechanical code.

The New York city mechanical code based on the 2003 edition of the International Mechanical Code published by the International Code Council, with changes that reflect the unique character of the city and amendments that bring it up to date with the 2009 edition of such International Mechanical Code, is hereby adopted to read as follows:

Chapter 1: Administration

Section MC 101: General

101.1 Title.

This code shall be known and may be cited as the *"New York City Mechanical Code,"* "NYCMC" or "MC". All section numbers in this code shall be deemed to be preceded by the designation "MC".

101.2 Scope.

This code shall regulate the design, installation, maintenance, alteration and inspection of mechanical systems that are permanently installed and utilized to provide control of environmental conditions and related processes within buildings. This code shall also regulate those mechanical systems, system components, equipment and appliances specifically addressed herein. The installation of fuel gas distribution piping and equipment, fuel gas-fired appliances and fuel gas-fired appliance venting systems shall be regulated by the *New York City Fuel Gas Code.*

101.3 Intent.

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

101.4 Severability.

If a section, subsection, sentence, clause or phrase of this code is, for any reason, held to be unconstitutional, such decision shall not affect the validity of the remaining portions of this code.

Section MC 102: Applicability

102.1 General.

Where there is a conflict between a general requirement and a specific requirement, the specific requirement shall govern. Where, in a specific case, different sections of this code specify different materials, methods of construction or other requirements, the most restrictive shall govern.

102.2 Existing installations.

Except as otherwise provided for in this chapter or elsewhere in this code, a provision in this code shall not require the removal, alteration or abandonment of, nor prevent the continued utilization and maintenance of, a mechanical system lawfully in existence on the effective date of this code.

102.3 Maintenance.

Mechanical systems, both existing and new, and parts thereof shall be maintained in proper operating condition in accordance with the original design and in a safe and sanitary condition. Devices or safeguards that are required by this code shall be maintained in compliance with the applicable provisions under which they were installed.

102.3.1 Owner responsibility.

The owner shall be responsible for maintenance of mechanical systems. To determine compliance with this provision, the commissioner shall have the authority to require existing mechanical systems to be inspected.

102.4 Additions, alterations or repairs.

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

102.4.1 Minor additions, alterations, renovations and repairs.

Minor additions, alterations, renovations and repairs to existing mechanical systems shall meet the provisions for new construction, unless such work is done in the same manner and arrangement as was in the existing system, is not hazardous and is approved.

102.4.2 Special provisions for prior code buildings.

In addition to the requirements of Sections 102.4 and 102.4.1, the provisions of Sections 102.4.2.1 through 102.4.2.6 shall apply to prior code buildings.

102.4.2.1 Fire and smoke dampers.

In cases where the building's passive fire-resistance protection design, including rated construction, corridors and fire separations, complies with 1968 or prior codes, the determination as to whether a fire or smoke damper is required shall be permitted to be made pursuant to the *1968 Building Code*, or at the election of the applicant, the *New York City Mechanical Code.*

102.4.2.2 Guards and access to roofs and elevated structures.

The provisions of Section 304.10 relating to guards and Section 306.5 relating to permanent means of access shall not apply where the equipment or appliances replace existing equipment or appliances in the same location.

102.4.2.3 Vibration isolators for cooling towers.

Where a replacement cooling tower is installed and physical limitations prohibit compliance with the vibration isolator requirements of Section 928.3.7, such isolators may be omitted provided the devices shall comply with the *New York City Noise Control Code.*

102.4.2.4 Noncombustible fill for cooling towers.

Where an existing exterior cooling tower with combustible fill within 15 feet (4572 mm) of the lot line is replaced, such replacement shall be permitted to have combustible fill, notwithstanding the provisions of Section 908.3.2.

102.4.2.5 Seismic supports.

The determination as to whether seismic requirements apply to an alteration shall be made in accordance with the *1968 Building Code* and interpretations by the department relating to such determinations. Any applicable seismic loads and requirements shall be permitted to be determined in accordance with Chapter 16 of the *New York City Building Code* or the *1968 Building Code* and Reference Standard RS 9-6 of such code.

102.4.2.6 Wind resistance.

Equipment, appliances and supports that are exposed to wind shall be designed and installed to resist the wind pressures determined in accordance with Chapter 16 of the *New York City Building Code.*

102.5 Change in occupancy.

Refer to Chapter 1 of Title 28 of the *Administrative Code.*

102.6 [Reserved.]

102.7 [Reserved.]

102.8 Referenced standards.

The standards referenced herein shall be those that are listed in Chapter 15 and in the rules of the department and such standards shall be considered as part of the requirements of this code to the prescribed extent of each such reference. Where differences occur between provisions of this code and the referenced standards, the provisions of this code shall apply. Refer to Article 103 of Chapter 1 of Title 28 of the *Administrative Code* for additional provisions relating to referenced standards.

102.8.1 Editions of referenced standards.

References to standards in this code shall be to the editions of those standards provided for in Chapter 15 of this code, or as otherwise provided by rule.

102.9 Requirements not covered by this code.

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

102.10 Application of references.

Reference to chapter section numbers, or to provisions not specifically identified by number, shall be construed to refer to such chapter, section or provision of this code.

Section MC 103: Department of Buildings

103.1 General.

Refer to the New York City Charter and Chapter 1 of Title 28 of the *Administrative Code.*

Section MC 104: Duties and Powers of the Commissioner Of Buildings

104.1 General.

The commissioner shall have the authority to render interpretations of this code and to adopt rules, policies, and procedures in order to clarify and implement its provisions. Such interpretations, policies, procedures, and rules shall be in compliance with the intent and purpose of this code. See the New York City Charter and Chapter 1 of Title 28 of the *Administrative Code* for additional provisions relating to the authority of the Commissioner of Buildings.

Section MC 105: Permits

105.1 General.

Permits shall comply with this section, with Article 105 of Chapter 1 of Title 28 of the *Administrative Code,* and with requirements found elsewhere in this code.

105.2 Required.

Any owner or authorized agent who intends to construct, add to, alter, repair, move, demolish, or change the occupancy of a building or structure, or to erect, install, add to, alter, repair, remove, convert or replace any gas, mechanical or plumbing system, the installation of which is regulated by this code, or to cause any such work to be done, shall first make application for construction document approval in accordance with Chapter 1 of Title 28 of the *Administrative Code* and this chapter and obtain the required permit.

105.3 Work exempt from permit.

Exemptions from permit requirements of this code as authorized in Chapter 1 of Title 28 of the *Administrative Code* and the rules of the department shall not be deemed to grant authorization for any work to be done in any manner in violation of the provisions of this code or any other laws or rules.

105.4 Validity of permit.

The issuance or granting of a permit shall not be construed to be a permit for, or an approval of, any violation of any of the provisions of this code or of any other law. Permits presuming to give authority to violate or cancel the provisions of this code or other law shall not be valid. The issuance of a permit based on construction documents and other data shall not prevent the commissioner from requiring the correction of errors in the construction documents and other data. The commissioner is also authorized to prevent occupancy or use of a structure where in violation of this code or of any other law.

Section MC 106: Construction Documents

106.1 General.

Construction documents shall comply with Article 104 of Chapter 1 of title 28 of the *Administrative Code* and other applicable provisions of this code and its referenced standards. Such construction documents shall be coordinated with architectural, structural and means of egress plans.

106.2 Required documents.

The applicant shall submit all of the documents specified in Sections 106.3 through 106.10 as appropriate to the nature and extent of the work proposed. Construction documents shall indicate the heating, ventilation, refrigeration, and other mechanical work to be performed, so drawn as to conform to the architectural and structural aspects of the building and to show in detail compliance with this code.

106.2.1 Composite plans.

Composite plans showing compliance of architectural, structural, and mechanical parts of a building may be submitted provided that a clear understanding of each part is not impaired.

106.3 Lot diagram.

The lot diagram shall be provided where applicable to the work proposed, including but not limited to the installation of exterior or rooftop equipment.

106.4 Building classification statement.

Where applicable to the proposed work, the statement shall identify:

1. The occupancy group or groups that apply to parts of the building in accordance with Section 302 of the *New York City Building Code;*
2. The occupancy group of the main use or dominant occupancy of the building;
3. The construction class of the building in accordance with Section 602 of the *New York City Building Code;*
4. The structural occupancy / risk category in accordance with Table 1604.5 of the *New York City Building Code;*
5. The height of the building as defined in Section 502.1 of the *New York City Building Code;*
6. The applicable measurements to the highest and lowest level of fire department access; and
7. Whether the building is inside or outside of the fire districts.

106.5 Fuel-burning and fuel-oil storage equipment plans.

Construction documents for fuel-burning and fuel oil storage equipment shall contain plans that include the following data and information:

1. Diagrams of all distribution piping, including vent and fill piping for oil systems, and all safety cut-off and relief devices and valves in piping; indications of the sizes of distribution piping to be used and the fire resistive ratings of the shafts or spaces containing distribution piping where required to be fire rated.
2. Diagrammatic floor plans showing the size, location, material for all fuel oil and transfer distribution piping and related equipment.
3. Floor plans or partial floor plans showing the location, layout, size, and listing information for all fuel-burning equipment, tanks, vents, and chimneys. The plans shall also indicate the method or means of providing air to the equipment space, including duct and opening sizes.
4. Plans indicating the location and type of any relevant smoke and heat detectors, alarm, and fire extinguishing systems.
5. Seismic protection and restraint details for piping and equipment as required by Chapter 16 of the *New York City Building Code.*
6. Details indicating the location, size and materials for all breechings; the thickness and type of insulation materials; and the clearances from combustible walls, partitions, and ceiling; and the fire-resistive ratings of rooms and spaces containing the equipment.
7. Details describing the type, material, listing information, height, and termination distances to adjacent properties and structures for chimneys and vents.
8. Details showing structural supports for fuel-burning equipment where required.
9. A statement as to the kind or grade of fuel to be used.
10. Plans indicating the location, arrangement, size, load, and maximum capacity of the burning, storage and fuel-pumping equipment.
11. In areas of special flood hazards, construction documents shall comply with Appendix G of the *New York City Building Code.*

106.6 Heating systems.

Construction documents for heating systems shall include the temperature to be maintained in every room and the output capacity in BTU per hour of the central heating source.

106.7 Boilers.

Construction documents for boiler installations shall indicate the output capacity in BTU per hour, the operating weight of each boiler, the pressure setting of the relief valves, and such other data and information as required by this code.

106.8 Air conditioning and ventilating systems.

Construction documents for air conditioning and ventilating systems shall contain plans that include the following data and information:

1. The location and sizes of all ducts; the location of all fire and smoke dampers, motors, fans, and filters; the type, air capacity, and size of all equipment; and where not shown on accompanying structural plans, the operating weight and manner of support of equipment.
2. The locations of smoke detecting devices.
3. The location and size of the fresh air intake, the design population, and the required ventilation for each room or space.
4. The amount of air to be exhausted or supplied from each outlet for each room or space.
5. In the case of ventilating or exhaust systems for ranges, fryers, ovens, and other similar types of restaurant or bakery equipment, for which a hood is required, the plans shall also show the gas controls, method of joining ducts, method and location of discharging exhaust from building, and the quantity in cfm designed for each hood.

(Am. L.L. 2018/195, 12/1/2018, eff. 5/30/2019)

Editor's note: For related unconsolidated provisions, see Appendix A atL.L. 2018/195.

106.9 Refrigerating systems.

Construction documents for refrigerating systems shall contain plans that include the following data and information:

1. The location of all machinery; the horsepower of compressors; the type and number of pounds of refrigerant to be used; and the air quantities for,

and means of, ventilating the machinery space.

2. The location of emergency switches for compressors and for ventilation in the machinery rooms.
3. The location of pressure relief piping and any city water connections and water-saving devices.
4. The tonnage capacity of the machine and the suction and discharge pressures at which the machine is rated.
5. The operating weight of the equipment.
6. The safety group classification of refrigerant utilized.
7. The refrigerant concentration limit calculations for any refrigerating system that contains more than 6.6 pounds (3.0 kg) of refrigerant.

106.10 Energy efficiency.

Construction documents shall include compliance documentation as required by the *New York City Energy Conservation Code.*

Section MC 107: Inspections and Testing

107.1 General.

Except as otherwise specified, inspections required by this code or by the department during the progress of work may be performed on behalf of the owner by approved agencies or, if applicable, by special inspectors. However, in the interest of public safety, the commissioner may direct that any of such inspections be performed by the department. All inspections shall be performed at the sole cost and expense of the owner. Refer to Article 116 of Chapter 1 of Title 28 of the *Administrative Code* for additional provisions relating to inspections.

107.2 Required inspections and testing.

In addition to any inspections otherwise required by this code or applicable rules, the following inspections shall be required:

1. **Progress inspections:**

1.1. Underground inspection shall be made after trenches or ditches are excavated and bedded, piping installed, and before backfill is put in place. When excavated soil contains rocks, broken concrete, frozen chunks and other rubble that would damage or break the piping or cause corrosive action, clean backfill shall be on the job site.

Exception: Ground-source heat pump loop systems tested in accordance with Section 1208.1.1 shall be permitted to be backfilled prior to inspection.

1.2. Rough-in inspection shall be made after the roof, framing, fireblocking and bracing are in place and all ducting and other components to be concealed are complete, and prior to the installation of wall or ceiling membranes.

1.3. Inspections required by the *New York City Energy Conservation Code* shall be made in accordance with rules of the department, as applicable.

2. **Special inspections.** Special inspections shall be performed in accordance with this code and Chapter 17 of the *New York City Building Code.*

3. **Final inspection.** Refer to Article 116 of Chapter 1 of Title 28 of the *Administrative Code.*

4. **Issuance of certificate of compliance.** Upon satisfactory inspection of service equipment and the satisfaction of all the requirements for sign-off, the department shall issue a certificate of compliance as applicable for the following service equipment:

4.1. Air-conditioning and ventilation systems

4.2. Fuel-burning and fuel-oil storage equipment, including generators,

4.3. Refrigeration systems,

4.4. Heating systems, and

4.5. Boilers.

The requirements of Section 107.2 shall not be considered to prohibit the operation of any heating equipment or appliances installed to replace existing heating equipment or appliances serving an occupied portion of a structure provided that a request for inspection of such heating equipment or appliances has been filed with the department not more than 48 hours after such replacement work is completed, and before any portion of such equipment or appliances is concealed by any permanent portion of the structure.

107.2.1 Approved inspection agencies.

Refer to Articles 114 and 115 of Chapter 1 of Title 28 of the *Administrative Code.*

107.2.2 Inspection of prefabricated construction assemblies.

Prior to the approval of a prefabricated construction assembly having concealed mechanical work and the issuance of a permit, the department shall require the submittal of an evaluation report by an approved agency on each prefabricated construction assembly, indicating the complete details of the mechanical system, including a description of the system and its components, the basis upon which the system is being evaluated, test results and similar information, and other data as necessary for the commissioner to determine conformance to this code.

107.2.2.1 Test and inspection records.

Required test and inspection records shall be available to the commissioner at all times during the fabrication of the mechanical system and the erection of the building; or such records as the commissioner designates shall be filed.

107.3 Testing.

Mechanical systems shall be tested as required in this code and in accordance with Sections 107.3.1 through 107.3.3. Tests shall be made by the permit holder and witnessed by the department or an approved agency.

107.3.1 New, altered, extended or repaired systems.

New mechanical systems and parts of existing systems, that have been altered, extended, renovated or repaired, shall be tested as prescribed herein to disclose leaks and defects.

107.3.2 Apparatus, material and labor for tests.

Apparatus, material and labor required for testing a mechanical system or part thereof shall be furnished by the permit holder.

107.3.3 Reinspection and testing.

Where any work or installation does not pass an initial test or inspection, the necessary corrections shall be made so as to achieve compliance with this code. The work or installation shall then be resubmitted to the department for inspection and testing.

107.4 Sign-off of completed work.

Refer to Article 116 of Chapter 1 of Title 28 of the *Administrative Code.*

107.5 Temporary connection.

The commissioner shall have the authority to authorize the temporary connection of a mechanical system to the sources of energy for the purpose of testing mechanical systems or for use under a temporary certificate of occupancy.

Section MC 108: Violations

108.1 General.

Refer to Chapters 2 and 3 of Title 28 of the *Administrative Code.*

Chapter 2: Definitions

Section MC 201: General

201.1 Scope.

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

201.2 Interchangeability.

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

201.3 Terms defined in other codes.

Where terms are not defined in this code and are defined in the *New York City Building Code,* the *New York City Electrical Code,* the *New York City Fire Code,* the *New York City Fuel Gas Code* or the *New York City Plumbing Code,* such terms shall have meanings ascribed to them as in those codes.

201.4 Terms not defined.

Where terms are not defined through the methods authorized by this section, such terms shall have ordinarily accepted meanings such as the context implies.

Section MC 202: General Definitions

1968 OR PRIOR CODE BUILDINGS OR STRUCTURES (PRIOR CODE BUILDINGS). See Section 28-101.5 of the *Administrative Code*.

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

ABSORPTION SYSTEM. A refrigerating system in which refrigerant is pressurized by pumping a chemical solution of refrigerant in absorbent, and then separated by the addition of heat in a generator, condensed (to reject heat), expanded, evaporated (to provide refrigeration), and reabsorbed in an absorber to repeat the cycle; the system may be single or multiple effect, the latter using multiple stages or internally cascaded use of heat to improve efficiency.

ACCESS (TO). That which 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 also "Ready access (to)").

AIR. All air supplied to mechanical equipment and appliances for combustion, ventilation, cooling, etc. 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. The treatment of air so as to control simultaneously the temperature, humidity, cleanness and distribution of the air to meet the requirements of a conditioned space.

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

AIR DISPERSION SYSTEM. Any diffuser system designed to both convey air within a room, space or area and diffuse air into that space while operating under positive pressure. Systems are commonly constructed of, but not limited to, fabric or plastic film.

AIR DISTRIBUTION SYSTEM. Any system of ducts, plenums and air-handling equipment that circulates air within a space or spaces and includes systems made up of one or more air-handling units.

AIR, EXHAUST. Air being removed from any space, appliance or piece of equipment and conveyed directly to the atmosphere by means of openings or ducts.

AIR-HANDLING UNIT. A blower or fan used for the purpose of distributing supply air to a room, space or area.

AIR, INTAKE. Air supplied from the outdoors to any space, appliance or piece of equipment.

AIR, MAKEUP. Air that is provided to replace air being exhausted.

AIR, RELIEF. Air removed from any space, appliance or piece of equipment.

AIR TRANSFER OPENING. An opening designed to allow the movement of environmental air between two contiguous spaces.

ALTERATION. Any construction, addition, change of use or occupancy, or renovation to a building or structure in existence. See Section 28-101.5 of the *Administrative Code*.

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

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

APPLIANCE, FUEL-FIRED. An appliance that burns solid, liquid and/or gaseous fuel, including but not limited to wood stoves, household cooking ranges, furnaces, boilers, water heaters, clothes dryers and gas-fired refrigerators.

APPLIANCE, GAS (EQUIPMENT). Any apparatus or equipment that uses gas as a fuel or raw material to produce light, heat, power, refrigeration or air conditioning.

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, 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 outdoor atmosphere through an approved chimney or vent system.

APPROVED. In reference to construction documents, the determination by the department after full examination that submitted construction documents comply with this code and other applicable laws and rules. In reference to materials, the determination by the commissioner that material is acceptable for its intended use. See Section 28-101.5 of the *Administrative Code*.

APPROVED AGENCY. An established and recognized agency, or other qualified person, engaged in conducting tests or furnishing inspection services, when approved pursuant to department rules as qualified to perform or witness identified testing or inspection services. See Chapter 1 of Title 28 of the *Administrative Code*.

APPROVED INSPECTION AGENCY. An approved agency that is approved by the department as qualified to perform one or more of the inspections required by this code. See Chapter 1 of Title 28 of the *Administrative Code*.

APPROVED TESTING AGENCY. An approved agency that is approved by the department as qualified to test and evaluate the performance of one or more of the materials regulated in their use by this code. Such term shall include, when approved pursuant to department rules, a third-party testing or certification agency, evaluation agency, testing laboratory, testing service, licensed concrete testing laboratory, or other entity concerned with product evaluation. See Chapter 1 of Title 28 of the *Administrative Code*.

ARCHITECT. A person licensed and registered to practice the profession of architecture under the Education Law of the State of New York.

AUTOMATIC BOILER. Any class of boiler that is equipped with the controls and limit devices specified in Chapter 10.

BATHROOM. A room containing a bathtub, shower, spa or similar bathing fixture.

BOILER, HIGH-PRESSURE. An appliance (equipment) for supplying steam or hot water that, for a steam boiler, operates at a pressure of more than 15 psig (103 kPa gauge), and for a hot water boiler, operates at a pressure exceeding 160 psig (1103 kPa gauge) or at a temperature exceeding 250°F (121°C).

BOILER, LOW-PRESSURE. A self-contained appliance for supplying steam or hot water as follows:

Hot water heating boiler. A boiler in which no steam is generated, from which hot water is circulated for heating purposes and then returned to the boiler, and that operates at water pressures not exceeding 160 pounds per square inch gauge (psig) (1103 kPa gauge) and at water temperatures not exceeding 250°F (121°C) at or near the boiler outlet.

Hot water supply boiler. A boiler, completely filled with water, which furnishes hot water to be used externally to itself, and that operates at water pressures not exceeding 160 psig (1103 kPa gauge) and at water temperatures not exceeding 250°F (121°C) at or near the boiler outlet.

Steam heating boiler. A boiler in which steam is generated and that operates at a steam pressure not exceeding 15 psig (103 kPa gauge).

BOILER ROOM. A room primarily utilized for the installation of a boiler.

BRAZED JOINT. A gas-tight joint obtained by the joining of metal parts with metallic mixtures or alloys which melt at a temperature above 1,000°F (538°C), but lower than the melting temperature of the parts to be joined.

BRAZING. A metal joining process wherein coalescence is produced by the use of a nonferrous filler metal having a melting point above 1,000°F (538°C), but lower than that of the base metal being joined. The filler material is distributed between the closely fitted surfaces of the joint by capillary attraction.

BREATHING ZONE. The region within an occupied space between planes 3 and 72 inches (76 and 1829 mm) above the floor and more than 2 feet (610 mm) from the walls of the space or from fixed air-conditioning equipment.

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

BUILDING. Any structure used or intended for supporting or sheltering any use or occupancy. The term shall be construed as if followed by the phrase "structure, premises, lot or part thereof" unless otherwise indicated by the text. See Section 28-101.5 of the *Administrative Code*.

CEILING RADIATION DAMPER. A listed device installed in a ceiling membrane of a fire-resistance-rated floor/ceiling or roof/ceiling assembly to limit automatically the radiative heat transfer through an air inlet/outlet opening.

CHIMNEY. A primarily vertical structure containing one or more flues, for the purpose of carrying gaseous products of combustion and air from a fuel-burning appliance to the outdoor atmosphere.

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

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

Metal chimney. A field-constructed chimney composed of metal.

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 the 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 employs a combustion chamber that has no openings other than the flue collar, fuel charging door and adjustable openings provided 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 function output.

Type 2. Factory-built package, multiple production. Used in business with direct intercourse of the function with the public. Not designed for use in individual family living environment.

COMBINATION FIRE/SMOKE DAMPER. A listed device installed in ducts and air transfer openings designed to close automatically upon the detection of heat and resist the passage of flame and smoke. The device is installed to operate automatically, be controlled by a smoke detection system, and where required, is capable of being positioned from a fire command center.

COMBUSTIBLE ASSEMBLY. Wall, floor, ceiling or other assembly constructed of one or more component materials that are not defined as noncombustible.

COMBUSTIBLE LIQUIDS. Any liquids having a closed cup flash point at or above 100°F (38°C), and that are divided into the following classifications:

Class II. Liquids having closed cup flash points at or above 100°F (38°C) and below 140°F (60°C).

Class IIIA. Liquids having closed cup flash points at or above 140°F (60°C) and below 200°F (93°C).

Class IIIB. Liquids having closed cup flash points at or above 200°F (93°C).

COMBUSTIBLE MATERIAL. Any material not defined as noncombustible.

COMBUSTION. In the context of this 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 within 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 COOKING APPLIANCES. Appliances used in a commercial food service establishment for heating or cooking food and which produce grease vapors, steam, fumes, smoke or odors that are required to be removed through a local exhaust ventilation system. Such appliances include deep fat fryers; upright broilers; griddles; broilers; steam-jacketed ket-tles; hot-top ranges; under-fired broilers (charbroilers); ovens; barbecues; rotisseries; and similar appliances. For the purpose of this definition, a food service establishment shall include any building or a portion thereof used for the preparation and serving of food.

COMMERCIAL COOKING RECIRCULATING SYSTEM. Self-contained system consisting of the exhaust hood, the cooking equipment, the filters and the fire suppression system. The system is designed to capture cooking vapors and residues generated from commercial cooking equipment. The system removes contaminants from the exhaust air and recirculates the air to the space from which it was withdrawn.

COMMERCIAL KITCHEN EXHAUST HOODS.

Backshelf Hood. A backshelf hood is also referred to as a low-proximity hood, or as a sidewall hood where wall mounted. Its front lower lip is low over the appliance(s) and is "set back" from the front of the appliance(s). It is always closed to the rear of the appliances by a panel where free-standing, or by a panel or wall where wall mounted, and its height above the cooking surface varies. (This style of hood can be constructed with partial end panels to increase its effectiveness in capturing the effluent generated by the cooking operation).

Double island canopy hood. A double island canopy hood is placed over back-to-back appliances or appliance lines. It is open on all sides and overhangs both fronts and the sides of the appliance(s). It could have a wall panel between the backs of the appliances. (The fact that exhaust air is drawn from both sides of the double canopy to meet in the center causes each side of this hood to emulate a wall canopy hood, and thus it functions much the same with or without an actual wall panel between the backs of the appliances).

Eyebrow hood. An eyebrow hood is mounted directly to the face of an appliance, such as an oven and dishwasher, above the opening(s) or door(s) from which effluent is emitted, extending past the sides and overhanging the front of the opening to capture the effluent.

Pass-over hood. A pass-over hood is a free-standing form of a backshelf hood constructed low enough to pass food over the top.

Single island canopy hood. A single island canopy hood is placed over a single appliance or appliance line. It is open on all sides and overhangs the front, rear and sides of the appliance(s). A single island canopy is more susceptible to cross drafts and requires a greater exhaust air flow than an equivalent sized wall-mounted canopy to capture and contain effluent generated by the cooking operation(s).

Wall canopy hood. A wall canopy hood is mounted against a wall above a single appliance or line of appliance(s), or it could be free-standing with a back panel from the rear of the appliances to the hood. It overhangs the front and sides of the appliance(s) on all open sides. The wall acts as a back panel, forcing the makeup air to be drawn across the front of the cooking equipment, thus increasing the effectiveness of the hood to capture and contain effluent generated by the cooking operation(s).

COMMISSIONER. The Commissioner of Buildings of the City of New York or his or her duly authorized representative. See Section 28-101.5 of the *Administrative Code*.

COMPENSATING HOODS. Compensating hoods are those having integral (built-in) makeup air supply. The makeup air supply for such hoods is generally supplied from: short-circuit flow from inside the hood, air curtain flow from the bottom of the front face, and front face discharge from the outside front wall of the hood. The compensating makeup airflow can also be supplied from the rear or side of the hood, or the rear, front or sides of the cooking equipment. The makeup airflow can be one or a combination of methods.

COMPRESSOR. A specific machine, with or without accessories, for compressing a gas.

COMPRESSOR, POSITIVE DISPLACEMENT. A compressor in which 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 LOCATION. A location that cannot be accessed without damaging permanent parts of the building structure or finished surface. Spaces above, below or behind readily removable panels or doors shall not be considered as concealed.

CONDENSATE. The liquid that condenses from a gas (including flue gas) caused by a reduction in temperature or increase in pressure.

CONDENSER. A heat exchanger designed to liquefy refrigerant vapor by removal of heat.

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 the regularly furnished accessories.

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

CONFINED SPACES. A space having a volume less than 50 cubic feet per 1,000 British thermal units per hour (Btu/h) (4.8 m3/kW) of the aggregate input rating of all appliances installed in that space.

CONSTRUCTION DOCUMENTS. Plans and specifications and other written, graphic and pictorial documents, prepared or assembled for describing the design, location, physical characteristics and other elements of the project necessary for obtaining a building permit. See Section 28-101.5 of the *Administrative Code*.

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 utilize another fuel.

COOKING APPLIANCE. See "Commercial cooking appliances".

DAMPER. A manually or automatically controlled device to regulate draft or the rate of flow of air or combustion gases.

Volume damper. A device that, when installed, will restrict, retard or direct the flow of air in a duct, or the products of combustion in a heat-producing appliance, its vent connector, vent or chimney therefrom.

DECORATIVE SHROUD. A partial non-combustible enclosure for aesthetic purposes that is installed at the termination of a venting system that surrounds or conceals the chimney or vent cap.

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

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. Appliances that are constructed and installed so that all air for combustion is derived from the outdoor atmosphere and all flue gases are discharged to the outdoor atmosphere.

DRAFT. The pressure difference existing between the appliance or any component part and the atmosphere, 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.

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

DRY CLEANING SYSTEMS. Dry cleaning plants or systems are 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).

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

DUCT. A tube or conduit utilized for conveying air. The air passages of self-contained systems are not to be construed 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, plenums, fans and accessory air-handling equipment and appliances.

DWELLING. A building or structure which is occupied in whole or in part as the home, residence or sleeping place of one or more families.

DWELLING UNIT. A single unit consisting of one or more habitable rooms and occupied or arranged to be occupied as a unit separate from all other units within a dwelling.

ELECTRIC 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.

ENERGY RECOVERY VENTILATION SYSTEM. Systems that employ air-to-air heat exchangers to recover energy from or reject energy to exhaust air for the purpose of preheating, precooling, humidifying or dehumidifying outdoor ventilation air prior to supplying such air to a space, either directly or as part of an HVAC system.

ENGINEER. A person licensed and registered to practice the profession of engineering under the Education Law of the State of New York.

ENGINEERED SMOKE CONTROL SYSTEM. Refer to Smoke Control System in Section 909 of the New York City Building Code.

ENVIRONMENTAL AIR. Air that is supplied, returned, recirculated, or exhausted from a space for the purpose of modifying the existing atmosphere within a building.

EQUIPMENT. All piping, ducts, vents, control devices and other components of systems other than appliances which are permanently installed and integrated to provide control of envi-ronmental conditions for buildings. This definition shall also include other systems specifically regulated in this code.

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

EVAPORATIVE COOLER. A device used for reducing the sensible heat of air for cooling by the process of evaporation of water into an airstream.

EVAPORATIVE COOLING SYSTEM. The equipment and appliances intended or installed for the purpose of environmental cooling by an evaporative cooler from which the condi-tioned air is distributed through ducts or plenums to the conditioned area.

EVAPORATOR. That part of the system in which liquid refrigerant is vaporized to produce refrigeration.

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 from a space or spaces and exhausted to the outdoor atmosphere.

EXTRA-HEAVY-DUTY COOKING APPLIANCE. Extra-heavy-duty cooking appliances include appliances utilizing solid fuel such as wood, charcoal, briquettes, and mesquite to provide all or part of the heat source for cooking.

FIELD ERECTED BOILER. A boiler where the pressure vessel is constructed partially or totally in the field. Field erected boilers do not include cast iron sectional boilers which are considered factory built since each section is a separate pressure vessel.

FIRE DAMPER. A listed device installed in ducts and air transfer openings designed to close automatically upon detection of heat and to restrict the passage of flame. Fire dampers are classified for use in either static systems that will automatically shut down in the event of a fire, or in dynamic systems that continue to operate during a fire. A dynamic fire damper is tested and rated for closure under elevated temperature airflow.

FIREPLACE. An assembly consisting of a hearth and fire chamber of noncombustible material and provided 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 manufacturer's instructions and the conditions of the listing.

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

FIREPLACE STOVE. A free-standing chimney-connected solid-fuel-burning heater, designed to be operated with the fire chamber doors in either the open or closed position.

FLAME SAFEGUARD. A device that will automatically shut 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 or UL 723.

FLAMMABILITY CLASSIFICATION. Refrigerants shall be assigned to one of the three classes – 1, 2 or 3 – in accordance with ASHRAE 34.

FLAMMABLE LIQUIDS. Any liquid that has a closed cup flash point below 100°F (38°C), and has a vapor pressure not exceeding 40 psia (276 kPa) at 100°F (38°C). Flammable liquids shall be known as Class I liquids and shall be divided into the following classifications:

Class IA. Liquids having a closed cup flash point below 73°F (23°C) and a boiling point below 100°F (38°C).

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

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

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

FLASH POINT. The minimum temperature 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.

FLOOR AREA, NET. The actual occupied area, not including unoccupied accessory areas or thicknesses of walls.

FLOOR FURNACE. A completely self-contained furnace suspended from the floor of the space being heated, taking air for combustion from outside such space and with means for observing flames and lighting the appliance from such space.

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

FLUE CONNECTION (BREECHING). A passage for connecting the products of combustion from a fuel-fired appliance to the vent or chimney (see also "Chimney connector" and "Vent connector").

FLUE GASES. Products of combustion and excess air.

FLUE LINER (LINING). A system or material used to form the inside surface of a flue in a chimney or vent, for the purpose of protecting the surrounding structure from the effects of combustion products and conveying combustion products without leakage to the atmosphere.

FUEL GAS. A natural gas, manufactured gas, liquefied petroleum gas or a mixture of these.

FUEL OIL. Kerosene or any hydrocarbon oil having a flash point 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.

FURNACE ROOM. A room primarily utilized for the installation of fuel-burning, space-heating and water-heating appliances other than boilers (see also "Boiler room").

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

GROUND SOURCE HEAT PUMP LOOP SYSTEM. Piping buried in horizontal or vertical excavations or placed in a body of water for the purpose of transporting heat transfer liquid to and from a heat pump. Included in this definition are closed loop systems in which the liquid is recirculated and open loop systems in which the liquid is drawn from a well or other source.

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 *New York City 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 other liquid base, and additives at the concentration present under operating conditions used to move heat from one location to another. Refrigerants are not included as heat transfer liquids.

HEAVY-DUTY COOKING APPLIANCE. Heavy-duty cooking appliances include electric under-fired broilers, electric chain (conveyor) broilers, gas under-fired broilers, gas chain (conveyor) broilers, gas open-burner ranges (with or without oven), electric and gas wok ranges, and electric and gas over-fired

(upright) broilers and salamanders.

HIGH-PROBABILITY SYSTEMS. A refrigeration system in which the basic design or the 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, moisture, heat and similar contaminants before they enter a duct system.

Type I. A kitchen hood for collecting and removing grease vapors and smoke. Such hoods are equipped with a fire suppression system.

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

HOOD, FUME. A hood used for hazardous exhaust systems.

HYDROGEN GENERATING APPLIANCE. A self-contained package or factory-matched packages of integrated systems for generating gaseous hydrogen. Hydrogen generating appliances utilize electrolysis, reformation, chemical, or other processes to generate hydrogen.

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.

IMMEDIATELY DANGEROUS TO LIFE OR HEALTH (IDLH). 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/m^3).

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

Closed system. A system in which a secondary fluid is either cooled or heated by the refrigerating system and 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.

Open-spray system. A system in which a secondary coolant is cooled or heated by the refrigerating system and then circulated in direct contact with the air or other substance to be cooled or heated.

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, except that the evaporator or condenser is placed in an open or appropriately vented tank.

INTEGRAL VENT APPLIANCES. Appliances designed for outdoor installation that have built-in natural or mechanical venting means and are constructed and installed so that all air for combustion is derived from the outdoor atmosphere and all flue gases are discharged to the outdoor atmosphere through an integral vent termination.

INTERLOCK. A device actuated by another device with which it is directly associated, to govern succeeding operations of the same or allied devices. A circuit in which a given action cannot occur until after one or more other actions have taken place.

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 flanged joint, screwed joint or flared joint.

JOINT, PLASTIC ADHESIVE. A joint made in thermoset plastic piping by the use of an adhesive substance which forms a continuous bond between the mating surfaces without dis-solving either one of them.

JOINT, PLASTIC HEAT FUSION. A joint made in thermoplastic piping by heating the parts sufficiently to permit fusion of the materials when the parts are pressed together.

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

JOINT, SOLDERED. A gas-tight joint obtained by the joining of metal parts with metallic mixtures of alloys which melt at temperatures between 400°F (204°C) and 1,000°F (538°C).

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

LABEL. Identification applied to material by the manufacturer or an approved agency that contains the name of the manufacturer, the function and performance characteristics of the material, and the name and identification of the approved agency that conducted the evaluation of a representative sample of such material.

LABELED. Material or product to which has been attached a label, symbol or other identifying mark of the manufacturer that contains the name of the manufacturer, the function and performance characteristics of the product or material, and the name and identification of an approved agency and that indicates that a representative sample of the material has been tested and evaluated by an approved agency for compliance with nationally recognized standards or tests to determine suitable usage in a specified manner. See Section 28-101.5 of the *Administrative Code*.

LIGHT-DUTY COOKING APPLIANCE. Light-duty cooking appliances include gas and electric ovens (including standard, bake, roasting, revolving, retherm, convection, combination convection/steamer, countertop conveyorized baking/finishing, deck and pastry), electric and gas steam-jacketed kettles, electric and gas pasta cookers, electric and gas compartment steamers (both pressure and atmospheric) and electric and gas cheesemelters.

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 in which, with the compressor idle, the design pressure will not be exceeded when the refrigerant charge has completely evaporated.

LIMITED COMBUSTIBLE MATERIAL. A building construction material not complying with the definition of noncombustible material, which, in the form in which it is used, has a potential heat value not exceeding 3500 Btu/lb (8141 kj/kg) and complies with the following: Materials, in the form and thickness used, having neither a flame spread index/rating greater than 25 nor evidence of continued combustion, and of such composition that surfaces that would

be exposed by cutting through the material on any plane would have neither a flame spread index/rating greater than 25 nor evidence of continued progressive combustion. Materials subject to increase in combustibility or flame spread index/rating beyond the limits herein established through the effects of age, moisture, or other atmospheric condition shall be considered combustible.

LISTED. Material identified in a list published by an approved agency that maintains periodic inspection of production of listed material or periodic evaluation of services and whose listing states either that the material meets identified nationally recognized standards or has been tested and found suitable for a specified purpose when installed in accordance with the manufacturer's installation instructions. See Section 28-101.5 of the *Administrative Code*.

LIVING SPACE. Space within a dwelling unit utilized for living, sleeping, eating, cooking, bathing, washing and sanitation purposes.

LOWER EXPLOSIVE LIMIT (LEL). See "LFL".

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

LOW-PRESSURE HOT-WATER-HEATING BOILER. A boiler furnishing hot water at pressures not exceeding 160 psig (1103 kPa) and at temperatures not exceeding 250°F (121°C).

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

LOW-PROBABILITY SYSTEMS. A refrigeration system in which the basic design or the location of components is such that a leakage of refrigerant from a failed connection, seal or component will not enter an occupancy-classified area, other than the machinery room.

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 1105 and 1106 of this code, and Section 1015.4 of the *New York City Building Code*).

MECHANICAL DRAFT SYSTEM. A venting system designed to remove flue or vent gases by mechanical means, that consists of an induced-draft portion under nonpositive static pressure or a forced-draft portion under positive static pressure.

Forced-draft venting system. A portion of a venting system using a fan or other mechanical means to cause the removal of flue or vent gases under positive static pressure.

Induced-draft venting system. A portion of a venting system using a fan or other mechanical means to cause the removal of flue or vent gases under nonpositive static vent pressure.

Power venting system. A portion of a venting system using a fan or other mechanical means to cause the removal of flue or vent gases under positive static vent pressure.

MECHANICAL EQUIPMENT/APPLIANCE ROOM. A room or space in which nonfuel-fired mechanical equipment and appliances are located.

MECHANICAL EXHAUST SYSTEM. A system for removing air from a room or space by mechanical means.

MECHANICAL JOINT. A connection between pipes, fittings, or pipes and fittings, which is neither screwed, caulked, threaded, soldered, solvent cemented, brazed nor welded. Also, a joint in which compression is applied along the centerline of the pieces being joined. Some joints are part of a coupling, fitting or adapter. These joints include both the press-type and push-fit joining systems.

MECHANICAL SYSTEM. A system specifically addressed and regulated in this code and composed of components, devices, appliances and equipment which become part of the building.

MEDIUM-DUTY COOKING APPLIANCE. Medium-duty cooking appliances include electric discrete element ranges (with or without oven), electric and gas hot-top ranges, electric and gas griddles, electric and gas double-sided griddles, electric and gas fryers (including open deep fat fryers, donut fryers, kettle fryers and pressure fryers), electric and gas conveyor pizza ovens, electric and gas tilting skillets (braising pans) and electric and gas rotisseries.

MODULAR BOILER. A steam or hot-water-heating assembly consisting of a group of individual boilers called modules 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).

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

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

NET OCCUPIABLE FLOOR AREA. The floor area of an occupiable space defined by the inside surfaces of its walls but excluding shafts, column enclosures and other permanently enclosed, inaccessible and unoccupiable areas. Obstructions in the space such as furnishings, display or storage racks and other obstructions, whether temporary or permanent, shall not be deducted from the space area.

NONABRASIVE/ABRASIVE MATERIALS. Nonabrasive 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, have at least three of four specimens tested meeting all of the following criteria:

1. The recorded temperature of the surface and interior thermocouples shall 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 shall not be flaming from the specimen after the first 30 seconds.

3. If the weight loss of the specimen during testing exceeds 50 percent, the recorded temperature of the surface and interior thermocouples shall not at any time during the test rise above the furnace air temperature at the beginning of the test, and there shall not be flaming of the specimen.

OCCUPANCY. The purpose or activity for which a building or space is used or is designed, arranged or intended to be used.

OCCUPIABLE SPACE. An enclosed space intended for human activities, excluding those spaces intended primarily for other purposes, such as storage rooms and equipment rooms, that are only intended to be occupied occasionally and for short periods of time.

OFFSET (VENT). A combination of approved bends that make two changes in direction bringing one section of the vent out of line but into a line parallel with the other section.

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

OUTDOOR OPENING. A door, window, louver or skylight openable to the outdoor atmosphere.

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

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. Where used in this code, "piping" refers to either pipe or tubing, or both.

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

Tubing. Semirigid conduit of copper, aluminum, plastic or steel.

PLASTIC, THERMOPLASTIC. A plastic that is capable of being repeatedly softened by increase of temperature and hardened by decrease of 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. A compartment or chamber located in one story only to which one or more air ducts are connected and which forms part of the air supply or return system and may be part of the building construction, such as the concealed space above a ceiling.

PORTABLE FUEL CELL APPLIANCE. A fuel cell generator of electricity, which is not fixed in place. A portable fuel cell appliance utilizes a cord and plug connection to a grid-iso-lated load and has an integral fuel supply.

POWER BOILER. See "Boiler".

PREMISES. Land, improvements thereon, or any part thereof.

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

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

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

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

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

PRESSURE VESSELS.REFRIGERANT. Any refrigerant-containing receptacle in a refrigerating system. This does not include evaporators where each separate section does not exceed 0.5 cubic foot (0.014 m^3) of refrigerant-containing volume, regardless of the maximum inside dimensions, evaporator coils, controls, headers, pumps and piping.

PROTECTIVE ASSEMBLY (REDUCED CLEARANCE). Any noncombustible assembly that is labeled or constructed in accordance with Table 308.6 and is placed between combustible materials or assemblies and mechanical appliances, devices or equipment, for the purpose of reducing required airspace clearances. Protective assemblies attached directly to a combustible assembly shall not be considered as part of that combustible assembly.

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

PUSH-FIT JOINTS. A type of mechanical joint consisting of elastomeric seals and corrosion-resistant tube grippers. Such joints are permanent or removable depending on the design.

QUICK-OPENING VALVE. A valve that opens completely by fast action, either manually or automatically controlled. A valve requiring one-quarter round turn or less is considered to be quick opening.

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

READY ACCESS (TO). That which enables a device, appliance or equipment to 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 and outlet 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 for new refrigerants by means including distillation. Such 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 dryers. These procedures usually are performed at the field job site or in a local service shop.

REFRIGERANT. A substance used for heat transfer in a refrigerating system; the refrigerant absorbs heat and transfers it at a higher temperature and higher pressure, usually with a change of state.

REFRIGERANT SAFETY CLASSIFICATIONS. Groupings that indicate the toxicity and flammability classes in accordance with ASHRAE 34.

REFRIGERATED ROOM OR SPACE. A room or 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).

REFRIGERATING 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 MACHINERY ROOM. See "Machinery room".

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 so circulated. Indirect systems are distinguished by the type or method of application.

REFRIGERATION SYSTEM CLASSIFICATION. Refrigeration systems are 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 combination of interconnected refrigeration-containing parts constituting one closed refrigerant circuit in which a refrigerant is circulated for the purpose of extracting heat and in which a compressor is used for compressing the refrigerant vapor.

REFRIGERATION SYSTEM, SELF-CONTAINED. 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. Refer to Chapter 1 of Title 28 of the *New York City Administrative Code*.

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

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").

ROOM HEATER VENTED. A free-standing heating unit burning solid or liquid fuel for direct heating of the space in and adjacent to that in which the unit is located.

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 of said machinery.

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 forming the boundaries of a shaft.

SLEEPING UNIT. A dwelling unit, which may contain either toilet or kitchen facilities but not both. Any sleeping unit housing more than one family shall also be classified as a congregate living unit. The creation of or conversion to sleeping units shall be limited by Section 27-2077 of the *New York City Housing Maintenance Code*.

SMOKE DAMPER. A listed device installed in ducts and air transfer openings designed to resist the passage of smoke. The device is installed to operate automatically, controlled by a smoke detection system, and where required, is capable of being positioned from a fire command center.

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

SOLID FUEL (COOKING APPLICATIONS). Applicable to commercial food service operations only, solid fuel is any bulk material such as hardwood, mesquite, charcoal or briquettes that is combusted to produce heat for cooking operations.

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

STATIONARY FUEL CELL POWER PLANT. A self-contained package or factory-matched package which constitute an automatically operated assembly of integrated systems for generating useful electrical energy and recoverable thermal energy that is permanently connected and fixed in place.

STOP VALVE. A shutoff valve for controlling the flow of liquid or gases.

STORY. That portion of a building included between the upper surface of a floor and the upper surface of the floor next above, except that the topmost story shall be that portion of a building included between the upper surface of the topmost floor and the ceiling or roof above.

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

SUPPLY AIR. That air delivered to each or any space supplied by the air distribution system or the total air delivered to all spaces supplied by the air distribution system, which is provided for ventilating, heating, cooling, humidification, dehumidification and 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 oxygen for complete combustion of a given quantity of a specific fuel.

THERMAL RESISTANCE (R). A measure of the 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 adopted by the American Conference of Government Industrial Hygienists (ACGIH).

TOILET ROOM. A room containing a water closet and, frequently, a lavatory, but not a bathtub, shower, spa or similar bathing fixture.

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

TRANSITION FITTINGS, PLASTIC TO STEEL. An adapter for joining plastic pipe to steel pipe. The purpose of this fitting is to provide a permanent, pressure-tight connection between two materials which cannot be joined directly one to another.

UNCONFINED SPACE. A space having a volume not less than 50 cubic feet per 1,000 Btu/h (4.8m ^{3} /kW) of the aggregate input rating of all appliances installed in that space. Rooms communicating directly with the space in which the appliances are installed, through openings not furnished with doors, are considered a part of the unconfined space.

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

UNUSUALLY TIGHT CONSTRUCTION. Construction meeting all of the following requirements:

1. Walls exposed to the outside atmosphere having a continuous water vapor retarder with a rating of 1 perm (57 ng/s • m ^{2} • Pa) or less with openings gasketed or sealed; and
2. Openable windows and doors meeting the air leakage requirements of the *New York City Energy Conservation Code*, Section 502.4.1; and
3. Caulking or sealants are 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 the following:

1. Oil-burning appliances that are listed for use with Type L vents.
2. Gas-fired appliances that are listed for use with Type B 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.

ZONE. One occupiable space or several occupiable spaces with similar occupancy classification (see Table 403.3), occupant density, zone air distribution effectiveness and zone primary airflow rate per unit area.

Chapter 3: General Regulations

Section MC 301: General

301.1 Scope.

This chapter shall govern the approval and installation of all equipment and appliances that comprise parts of the building mechanical systems regulated by this code in accordance with Section 101.2.

301.2 Energy utilization.

Heating, ventilating and air-conditioning systems of all structures shall be designed and installed for efficient utilization of energy in accordance with the *New York City Energy Conservation Code.*

301.3 Fuel gas appliances and equipment.

The approval and installation of fuel gas distribution piping and equipment, fuel gas-fired appliances and fuel gas-fired appliance venting systems shall be in accordance with the *New York City Fuel Gas Code.*

301.4 Listed and labeled.

Appliances regulated by this code shall be listed and labeled for the application in which they are installed.

Exception: Listing and labeling of equipment and appliances used for refrigeration shall be in accordance with Section 1101.2.

301.5 Testing of materials.

Refer to Section 28-113 of the *Administrative Code.*

301.6 Label information.

A permanent factory-applied name-plate(s) shall be affixed to appliances on which shall appear in legible lettering, the manufacturer's name or trademark, the model number, serial number and the seal or mark of the approved agency. A label shall also include the following:

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 trade-mark 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; and a seal indicating approval of the appliance by an approved agency.

301.7 Electrical.

Electrical wiring, controls and connections to equipment and appliances regulated by this code shall be in accordance with the *New York City Electrical Code.*

301.8 Plumbing connections.

Potable water supply and building drainage system connections to equipment and appliances regulated by this code shall be in accordance with the *New York City Plumbing Code.*

301.9 Fuel types.

Fuel-fired appliances shall be designed for use with the type of fuel to which they will be connected and the altitude at which they are installed. Appliances that comprise parts of the building mechanical system shall not be converted for the usage of a different fuel, except where approved and converted 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.

301.10 Vibration isolation.

Where vibration isolation of equipment and appliances is employed, supplemental restraint shall be used to accomplish the support and restraint.

301.11 Repair.

Defective material or parts shall be replaced or repaired in such a manner so as to preserve the original approval or listing.

301.12 Wind resistance.

Mechanical equipment, appliances and supports that are exposed to wind shall be designed and installed to resist the wind pressures determined in accordance with the *New York City Building Code.*

301.13 Flood hazard.

For structures located in areas of special flood hazard, and buildings that include I-2 occupancies that are hospitals located in shaded X-Zones, mechanical systems, equipment and appliances shall comply with Appendix G of the *New York City Building Code.*

301.14 Rodent proofing.

Buildings or structures and the walls enclosing habitable or occupiable rooms and spaces in which persons live, sleep or work, or in which feed, food or foodstuffs are stored, prepared, processed, served or sold, shall be constructed to protect against the entrance of rodents in accordance with the *New York City Building Code.*

301.15 Seismic resistance.

When earthquake loads are applicable in accordance with the *New York City Building Code,* mechanical system supports shall be designed and installed for the seismic forces in accordance with the *New York City Building Code.*

Section MC 302: Protection of Structure

302.1 Structural safety.

The building or structure shall not be weakened by the installation of mechanical systems. Where floors, walls, ceilings or any other portion of the building or structure are required to be altered or replaced in the process of installing or repairing any system, the building or structure shall be left in a safe structural condition in accordance with the *New York City Building Code.*

302.2 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 the *New York City Building Code.*

302.3 Cutting, notching and boring in wood framing.

The cutting, notching and boring of wood framing members shall comply with Sections 302.3.1 through 302.3.4.

302.3.1 Joist notching.

Notches on the ends of joists shall not exceed one-fourth the joist depth. Holes bored in joists shall not be within 2 inches (51 mm) of the top or bottom of the joist, and the diameter of any such hole shall not exceed one-third the depth of the joist. Notches in the top or bottom of joists shall not exceed one-sixth the depth and shall not be located in the middle third of the span.

302.3.2 Stud cutting and notching.

In exterior walls and bearing partitions, any wood stud is permitted to be cut or notched not to exceed 25 percent of its depth. Cutting or notching of studs not greater than 40 percent of their depth is permitted in nonbearing partitions supporting no loads other than the weight of the partition.

302.3.3 Bored holes.

A hole not greater in diameter than 40 percent of the stud depth is permitted to be bored in any wood stud. Bored holes not greater than 60 percent of the depth of the stud are permitted in nonbearing partitions or in any wall where each bored stud is doubled, provided not more than two such successive doubled studs are so bored. In no case shall the edge of the bored hole be nearer than 0.625 inch (15.9 mm) to the edge of the stud. Bored holes shall not be located at the same section of stud as a cut or notch.

302.3.4 Engineered wood products.

Cuts, notches and holes bored in trusses, structural composite veneer lumber, structural glue-laminated members and I-joists are prohibited except where permitted by the manufacturer's recommendations or where the effects of such alterations are specifically considered in the design of the member.

302.4 Alterations to trusses.

Truss members and components shall not be cut, drilled, notched, spliced or otherwise altered in any way without written concurrence and approval of a registered design professional. Alterations resulting in the addition of loads to any member (e.g., HVAC equipment, water heaters) shall not be permitted without verification that the truss is capable of supporting such additional loading.

302.5 Cutting, notching and boring in steel framing.

The cutting, notching and boring of steel framing members shall comply with Sections 302.5.1 through 302.5.3.

302.5.1 Cutting, notching and boring holes in structural steel framing.

The cutting, notching and boring of holes in structural steel framing members shall be as prescribed by the registered design professional.

302.5.2 Cutting, notching and boring holes in cold-formed steel framing.

Flanges and lips of load-bearing cold-formed steel framing members shall not be cut or notched. Holes in webs of load-bearing cold-formed steel framing members shall be permitted along the centerline of the web of the framing member and shall not exceed the dimensional limitations, penetration spacing or minimum hole edge distance as prescribed by the registered design professional. Cutting, notching and boring holes of steel floor/roof decking shall be as prescribed by the registered design professional.

302.5.3 Cutting, notching and boring holes in nonstructural cold-formed steel wall framing.

Flanges and lips of nonstructural cold-formed steel wall studs shall not be cut or notched. Holes in webs of nonstructural cold-formed steel wall studs shall be permitted along the centerline of the web of the framing member, shall not exceed 1 1/2 inches (38 mm) in width or 4 inches (102 mm) in length, and shall not be spaced less than 24 inches (610 mm) center to center from another hole or less than 10 inches (254 mm) from the bearing end.

Section MC 303: Equipment and Appliance Location

303.1 General.

Equipment and appliances shall be located as required by this section, specific requirements elsewhere in this code and the conditions of the equipment

and appliance listing.

303.2 Hazardous locations.

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

303.3 Prohibited locations.

Appliances shall not be located in sleeping rooms, bathrooms, toilet rooms, storage closets or surgical rooms, or in a space that opens only into such rooms or spaces, except where the installation complies with one of the following exceptions:

Exceptions: This section shall not apply to the following appliances:

1. In rooms other than those used for sleeping purposes, direct-vent appliances that obtain all combustion air directly from the outdoors and are installed in accordance with the conditions of the listing and manufacturer's instructions.

2. In rooms other than those used for sleeping purposes, vented room heaters, wall furnaces, vented decorative appliances, vented gas fireplaces, vented gas fireplace heaters and decorative appliances for installation in vented solid fuel-burning fireplaces that are installed in rooms that meet the required volume criteria of Section 702.

3. Appliances installed in a dedicated enclosure in which all combustion air is taken directly from the outdoors, in accordance with Section 703. Access to such enclosure shall be through a solid door, weather-stripped in accordance with the exterior door air leakage requirements of the *New York City Energy Conservation Code* and equipped with an approved self-closing device.

303.4 Protection from physical damage.

Appliances shall not be installed in a location where subject to physical damage, including vehicular impact, unless protected by approved barriers meeting the requirements of the *New York City Fire Code.*

303.5 Indoor locations.

Fuel-fired furnaces, water heaters and boilers installed in closets and alcoves shall be listed for such installation. For purposes of this section, a closet or alcove shall be defined as a room or space having a volume less than 12 times the total volume of fuel-fired appliances other than boilers and less than 16 times the total volume of boilers. Room volume shall be computed using the gross floor area and the actual ceiling height up to a maximum computation height of 8 feet (2438 mm).

303.6 Outdoor locations.

Appliances installed in other than indoor locations shall be listed and labeled for outdoor installation.

303.7 Pit locations.

Appliances installed in pits or excavations shall not come in direct contact with the surrounding soil. The sides of the pit or excavation shall be held back a minimum of 12 inches (305 mm) from the appliance. Where the depth exceeds 12 inches (305 mm) below adjoining grade, the walls of the pit or excavation shall be lined with concrete or masonry. Such concrete or masonry shall extend a minimum of 4 inches (102 mm) above adjoining grade and shall have sufficient lateral load-bearing capacity to resist collapse. The appliance shall be protected from flooding.

303.8 Elevator shafts.

Mechanical systems shall not be located in an elevator shaft.

Section MC 304: Installation

304.1 General.

Equipment and appliances shall be installed as required by the terms of their approval, in accordance with the conditions of the listing, the manufacturer's installation instructions and this code. Manufacturer's installation instructions shall be available on the job site at the time of inspection.

304.2 Conflicts.

Where conflicts between this code and the conditions of listing or the manufacturer's installation instructions occur, the provisions of this code shall apply.

Exception: Where a code provision is less restrictive than the conditions of the listing of the equipment or appliance or the manufacturer's installation instructions, the conditions of the listing and the manufacturer's installation instructions shall apply.

304.3 Elevation of ignition source.

Equipment and appliances having an ignition source and located in hazardous locations and public garages, private garages, repair garages, automotive motor fuel-dispensing facilities and parking garages shall be elevated such that the source of ignition is not less than 18 inches (457 mm) above the floor surface on which the equipment or appliance rests. For the purpose of this section, rooms or spaces that are not part of the living space of a dwelling unit and that communicate directly with a private garage through openings shall be considered to be part of the private garage.

304.3.1 Parking garages.

Connection of a parking garage with any room in which there is a fuel-fired appliance shall be by means of a vestibule providing a two-doorway separation, except that a single door is permitted where the sources of ignition in the appliance are elevated in accordance with Section 304.3.

Exception: This section shall not apply to appliance installations complying with Section 304.6.

304.4 Prohibited equipment and appliance location.

Equipment and appliances having an ignition source shall not be installed in Group H occupancies or control areas where open use, handling or dispensing of combustible, flammable or explosive materials occurs.

304.5 Hydrogen generating and refueling operations.

Hydrogen generating and refueling operations shall be prohibited except as permitted by the Commissioner of the Fire Department.

304.6 Public garages.

Appliances located in public garages, motor fueling-dispensing facilities, repair garages or other areas frequented by motor vehicles, shall be installed a minimum of 8 feet (2438 mm) above the floor. Where motor vehicles are capable of passing under an appliance, the appliance shall be installed at the clearances required by the appliance manufacturer and not less than 1 foot (305 mm) higher than the tallest vehicle garage door opening.

Exception: The requirements of this section shall not apply where the appliances are protected from motor vehicle impact and installed in accordance with Section 304.3 of this code and NFPA 30A.

304.7 Private garages.

Appliances located in private garages and carports shall be installed with a minimum clearance of 6 feet (1829 mm) above the floor.

Exception: The requirements of this section shall not apply where the appliances are protected from motor vehicle impact and installed in accordance with Section 304.3.

304.8 Construction and protection.

Boiler rooms and furnace rooms shall be protected as required by the *New York City Building Code.*

304.9 Clearances to combustible construction.

Heat-producing equipment and appliances shall be installed to maintain the required clearances to combustible construction as specified in the listing and manufacturer's instructions. Such clearances shall be reduced only in accordance with Section 308. Clearances to combustibles shall include such considerations as door swing, drawer pull, overhead projections or shelving and window swing, shutters, coverings and drapes. Devices such as doorstops or limits, closers, drapery ties or guards shall not be used to provide the required clearances.

304.10 Clearances from grade.

Equipment and appliances installed at grade level shall be supported on a level concrete slab or other approved material extending not less than 3 inches (76 mm) above adjoining grade or shall be suspended not less than 6 inches (152 mm) above adjoining grade. Such support shall be in accordance with the manufacturer's installation instructions.

304.11 Guards.

Guards shall be provided where appliances, equipment, fans or other components that require service and roof hatch openings are located within 10 feet (3048 mm) of a roof edge or open side of a walking surface and such edge or open side is located more than 30 inches (762 mm) above the floor, roof or grade below. The guard shall extend not less than 30 inches (762 mm) beyond each end of such appliances, equipment, fans, components and roof hatch openings and the top of the guard shall be located not less than 42 inches (1067 mm) above the elevated surface adjacent to the guard. The guard shall be constructed so as to prevent the passage of a 21-inch-diameter (533 mm) sphere and shall comply with the loading requirements for guards specified in the *New York City Building Code.*

304.12 Area served.

Appliances serving different areas of a building other than where they are installed shall be permanently marked in an approved manner that uniquely identifies the appliance and the area it serves.

304.13 Rooftop access and obstructions.

Equipment and appliances installed on rooftops of buildings shall be installed in accordance with the requirements of the *New York City Fire Code* regarding rooftop access and obstructions, and shall not obstruct or interfere with firefighting operations or the operation of any doors, windows, fire escapes, or other means of egress or other building components requiring operation or access.

Section MC 305: Piping Support

305.1 General.

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

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 of materials that are compatible with the piping and that will not promote galvanic action.

305.3 Structural attachment.

Hangers and anchors shall be attached to the building structure.

305.4 Interval of support.

Piping shall be supported at distances not exceeding the spacing specified in Table 305.4, or in accordance with MSS SP-69.

Table 305.4

Piping Support Spacing [a,b,c]

Piping Material	Maximum HorizontalSpacing (feet)	Maximum VerticalSpacing (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]
Lead pipe	Continuous	4
PB pipe or tubing	2 2/3 (32 inches)	4
PEX tubing	2 2/3 (32 inches)	10 [c]
Polypropylene (PP) pipe ortubing, 1 inch or smaller	2 2/3 (32 inches)	10 [c]
Polypropylene (PP) pipe ortubing, 1 1/4 inches or larger	4	10 [c]
PVC pipe	4	10 [c]
Steel tubing	8	10
Steel pipe	12	15

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

a. See Section 301.15.

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.

305.5 Protection against physical damage.

In concealed locations where piping, other than cast-iron or steel, is installed through holes or notches in studs, joists, rafters or similar members less than 1 1/2 inches (38 mm) from the nearest edge of the member, the pipe shall be protected by shield plates. Protective steel shield plates having a minimum thickness of 0.0575-inch (1. 463 mm) (No. 16 gage) shall cover the area of the pipe where the member is notched or bored, and shall extend a minimum of 2 inches (51 mm) above sole plates and below top plates.

Section MC 306: Access and Service Space

306.1 Access for maintenance and replacement.

Appliances shall be accessible for inspection, service, repair and replacement without disabling the function of a fire-resistance-rated assembly or removing permanent construction, other appliances, venting systems or any other piping or ducts not connected to the appliance being inspected, serviced, repaired or replaced. A level working space at least 30 inches deep and 30 inches wide (762mm by 762mm) shall be provided in front of the control side to service an appliance. Clearance shall also be provided as required by the *New York City Electrical Code*.

306.1.1 Central furnaces.

Central furnaces within compartments or alcoves shall have a minimum working space clearance of 3 inches (76 mm) along the sides, back and top with a total width of the enclosing space being at least 12 inches (305 mm) wider than the furnace. Furnaces having a firebox open to the atmosphere shall have at least 6 inches (152 mm) working space along the front combustion chamber side. Combustion air openings at the rear or side of the compartment shall comply with the requirements of Chapter 7.

Exception: This section shall not apply to replacement appliances installed in existing compartments and alcoves where the working space clearances are in accordance with the equipment or appliance manufacturer's installation instructions.

306.2 Appliances in rooms.

Rooms containing appliances shall be provided with a door and an unobstructed passageway measuring not less than 36 inches (914 mm) wide and 80 inches (2032 mm) high.

Exception: Within a dwelling unit, appliances installed in a compartment, alcove, basement or similar space shall be accessed by an opening or door and an unobstructed passageway measuring not less than 24 inches (610 mm) wide and large enough to allow removal of the largest appliance in the space, provided that a level service space of not less than 30 inches (762 mm) deep and the height of the appliance, but not less than 30 inches (762 mm), is present at the front or service side of the appliance with the door open.

306.3 Appliances in attics.

Attics containing appliances shall be provided with an opening and unobstructed passageway large enough to allow removal of the largest appliance. The passageway shall not be less than 30 inches (762mm) high and 22 inches (559mm) wide and not more than 20 feet (6096 mm) in length measured along the centerline of the passageway from the opening to the appliance. The passageway shall have continuous solid flooring not less than 24 inches (610 mm) wide. A level service space not less than 30 inches (762 mm) deep and 30 inches (762 mm) wide shall be present at the front or service side of the appliance. The clear access opening dimensions shall be a minimum of 20 inches by 30 inches (508 mm by 762 mm), and large enough to allow removal of the largest appliance.

Exceptions:

1. The passageway and level service space are not required where the appliance is capable of being serviced and removed through the required opening.

2. Where the passageway is unobstructed and not less than 6 feet (1829 mm) high and 22 inches (559 mm) wide for its entire length, the passageway shall be not greater than 50 feet (15 250 mm) in length.

306.3.1 Electrical requirements.

A luminaire controlled by a switch located at the required passageway opening and a receptacle outlet shall be provided at or near the appliance location in accordance with the *New York City Electrical Code.*

306.4 Appliances under floors.

Underfloor spaces containing appliances shall be provided with an access opening and unobstructed passageway large enough to remove the largest appliance. The passageway shall not be less than 30 inches (762 mm) high and 22 inches (559 mm) wide, nor more than 20 feet (6096 mm) in length

measured along the centerline of the passageway from the opening to the appliance. A level service space not less than 30 inches (762 mm) deep and 30 inches (762 mm) wide shall be present at the front or service side of the appliance. If the depth of the passageway or the service space exceeds 12 inches (305 mm) below the adjoining grade, the walls of the passageway shall be lined with concrete or masonry. Such concrete or masonry shall extend a minimum of 4 inches (102 mm) above the adjoining grade and shall have sufficient lateral-bearing capacity to resist collapse. The clear access opening dimensions shall be a minimum of 22 inches by 30 inches (559 mm by 762 mm), and large enough to allow removal of the largest appliance.

Exceptions:

1. The passageway is not required where the level service space is present when the access is open and the appliance is capable of being serviced and removed through the required opening.

2. Where the passageway is unobstructed and not less than 6 feet (1829 mm) high and 22 inches (559 mm) wide for its entire length, the passageway shall not be limited in length.

306.4.1 Electrical requirements.

A luminaire controlled by a switch located at the required passageway opening and a receptacle outlet shall be provided at or near the appliance location in accordance with the *New York City Electrical Code.*

306.5 Equipment and appliances on roofs or elevated structures.

Where equipment and appliances requiring access are installed on roofs or elevated structures at a height exceeding 16 feet (4877 mm), such access shall be provided by a permanent approved means of access, the extent of which shall be from grade or floor level to the equipment and appliances' level service space. Such access shall not require climbing over obstructions greater than 30 inches (762mm) high or walking on roofs having a slope greater than 4 units vertical in 12 units horizontal (33-percent slope). Where access involves climbing over parapet walls, the height shall be measured to the top of the parapet wall.

Permanent ladders installed to provide the required access shall comply with the following minimum design criteria:

1. The side railing shall extend above the parapet or roof edge not less than 30 inches (762 mm).

2. Ladders shall have a rung spacing not to exceed 12 inches (305 mm) on center.

3. Ladders shall have a toe spacing not less than 7 inches (177.8 mm) deep.

4. There shall be a minimum of 18 inches (457 mm) between rails.

5. Rungs shall have a minimum 0.75-inch (19 mm) diameter and be capable of withstanding a 300-pound (136.1 kg) load.

6. Where a cage, well or ladder safety device is provided, ladders over 20 feet (6096 mm) in height shall be provided with landing platforms for each 30 feet (9144 mm) of height. Where a cage, well or ladder safety device is not provided, ladders over 20 feet (6096 mm) in height shall be provided with landing platforms for each 20 feet (6096 mm) of height. Landings shall be capable of withstanding 100 pounds (488.2 kg/m ^{2}) per square foot (488.2 kg/m ^{2}). Landing dimensions shall be not less than 30 inches (762 mm) in length and not less than 24 inches (610 mm) in width. A guard rail and toeboard shall be provided on all open sides of the landing.

7. Where ladder extensions are installed, the side rails of through or side-step ladder extensions shall extend 3 1/2 feet (1067 mm) above the parapets and landings. For through ladder extensions, the rungs shall be omitted from the extensions and shall have not less than 18 (457 mm) nor more than 24 inches (610 mm) of clearance between rails. For side-step or offset fixed ladder sections, at landings, the side rails and rungs shall be carried to the next regular rung beyond or above the 3 1/2 feet (1067 mm) minimum.

8. Ladders shall be protected against corrosion.

9. Catwalks installed to provide the required access shall be not less than 24 inches (610 mm) wide and shall have railings as required for service platforms.

Exception: This section shall not apply to Group R-3 occupancies.

306.5.1 Sloped roofs.

Where appliances, equipment, fans or other components that require service are 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 or equipment to which access is required for service, repair or maintenance. The platform shall be not less than 30 inches (762 mm) in any dimension and shall be provided with guards. The guards shall extend not less than 42 inches (1067 mm) above the platform, shall be constructed so as to prevent the passage of a 21-inch diameter (533 mm) sphere and shall comply with the loading requirements for guards specified in the *New York City Building Code.* Access shall not require walking on roofs having a slope greater than four units vertical in 12 units horizontal (33-percent slope). Where access involves obstructions greater than 30 inches (762 mm) in height, such obstructions shall be provided with ladders installed in accordance with Section 306.5 or stairs installed in accordance with the requirements specified in the *New York City Building Code* in the path of travel to and from appliances, fans or equipment requiring service.

306.5.2 Electrical requirements.

A receptacle outlet shall be provided at or near the equipment location in accordance with the *New York City Electrical Code.*

Section MC 307: Condensate Disposal

307.1 Fuel-burning appliances.

Liquid combustion by-products of condensing appliances shall be collected and discharged to a plumbing fixture or disposal area in accordance with the manufacturer's installation instructions. Condensate piping shall be of corrosion-resistant material 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 1/8 unit vertical in 12 units horizontal (1-percent slope).

307.1.1 Condensate disposal.

Condensate from all fuel-burning appliances and associated flues shall be neutralized to a pH of at least 6 and no more than 8 prior to disposal to a sanitary system.

307.2 Evaporators and cooling coils.

Condensate drain systems shall be provided for equipment and appliances containing evaporators or cooling coils. Condensate drain systems shall be designed, constructed and installed in accordance with Sections 307.2.1 through 307.2.4.

307.2.1 Condensate disposal.

Condensate from all cooling coils and evaporators shall be conveyed from the drain pan outlet to an approved place of disposal. 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). Condensate shall not discharge into a street, alley or other areas so as to cause a nuisance.

307.2.2 Drain pipe materials and sizes.

Components of the condensate disposal system shall be cast iron, galvanized steel, copper, cross-linked polyethylene, polybutylene, polyethylene, ABS, CPVC or PVC pipe or tubing. All components shall be selected for the pressure and temperature rating of the installation. Joints and connections shall be made in accordance with the applicable provisions of Chapter 7 of the *New York City Plumbing Code* relative to the material type. 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. Where the drain pipes from more than one unit are manifolded together for condensate drainage, the pipe or tubing shall be sized in accordance with Table 307.2.2.

Table 307.2.2

Condensate Drain Sizing

Equipment Capacity	Minimum Condensate Pipe Diameter
Up to 20 tons of refrigeration	3/4 inch
Over 20 tons to 40 tons of refrigeration	1 inch
Over 40 tons to 90 tons of refrigeration	1 1/4 inch
Over 90 tons to 125 tons of refrigeration	1 1/2 inch
Over 125 tons to 250 tons of refrigeration	2 inch

For SI: 1 inch = 25.4 mm, 1 ton = 3.517 kW.

307.2.3 Auxiliary and secondary drain systems.

In addition to the requirements of Section 307.2.1, where damage to any building components could occur as a result of overflow from the equipment primary condensate removal system, one of the following auxiliary protection methods shall be provided for each cooling coil or fuel-fired appliance that produces condensate:

1. An auxiliary drain pan with a separate drain shall be provided under the coils on which condensation will occur. The auxiliary pan drain shall discharge to a conspicuous point of disposal to alert occupants in the event of a stoppage of the primary drain. The pan shall have a minimum depth of 1 1/2 inches (38 mm), shall not be less than 3 inches (76 mm) larger than the unit or the coil dimensions in width and length and shall be constructed of corrosion-resistant material. Metallic pans shall have a minimum thickness of not less than 0.0236 inches (0.6010 mm) (No. 24 gage) for galvanized sheet metal pans, .0179 inches (0.4546 mm) (No. 26 gage) for stainless steel pans, or 0.0320 inches (0.8128 mm) (No. 20 gage) for aluminum pans. Nonmetallic pans shall have a minimum thickness of not less than 0.0625 inch (1.6 mm).

2. A separate overflow drain line shall be connected to the drain pan provided with the equipment. Such overflow drain shall discharge to a conspicuous point of disposal to alert occupants in the event of a stoppage of the primary drain. The overflow drain line shall connect to the drain pan at a higher level than the primary drain connection.

3. An auxiliary drain pan without a separate drain line shall be provided under the coils on which condensate will occur. Such pan shall be equipped with a water-level detection device that will shut off the equipment served prior to overflow of the pan. The auxiliary drain pan shall be constructed in accordance with Item 1 of this section.

4. A water-level detection device shall be provided that will shut off the equipment served in the event that the primary drain is blocked. The device shall be installed in the primary drain line, the overflow drain line, or in the equipment-supplied drain pan, located at a point higher than the primary drain line connection and below the overflow rim of such pan.

Exception: Fuel-fired appliances that automatically shut down operation in the event of a stoppage in the condensate drainage system.

307.2.3.1 Water-level monitoring devices.

On down-flow units and all other coils that do not have a secondary drain or provisions to install a secondary or auxiliary drain pan, a water-level monitoring device shall be installed inside the primary drain pan. This device shall shut off the equipment served in the event that the primary drain becomes restricted. Devices installed in the drain line shall not be permitted.

307.2.3.2 Appliance, equipment or insulation in pans.

Where an appliance, equipment or insulation is subject to water damage when auxiliary drain pans fill, that portion of the appliance, equipment or insulation shall be installed above the rim of the pans. Supports located inside of the pans to support the appliance or equipment or insulation shall be water resistant and approved.

307.2.4 Traps.

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

307.3 Exceptions.

This section applies to permanently installed equipment. Window units and through-the-wall air-conditioning units are exempt from the requirements of this section.

Section MC 308: Clearance Reduction

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.

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 where reduction is specifically prohibited by the terms of the appliance or equipment listing.

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. Where 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.

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 308.5 or 308.6.

308.5 Labeled assemblies.

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

308.6 Reduction table.

The allowable clearance reduction shall be based on one of the methods specified in Table 308.6. Where required clearances are not listed in Table 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 308.6

Clearance Reduction Methods[b]

Type of Protective Assembly[a]	Reduced Clearance 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 combustible without protection (inches)[a]			
	36	18	9	6	36	18	9	6
Galvanized sheet metal, minimum nominal thickness of .0296 inch (No. 22 Gage), mounted on 1-inch glass fiber or mineral wool batt reinforced with wire on the back, 1 inch off the combustible assembly	18	9	5	3	12	6	3	3
Two layers of galvanized sheet metal, minimum nominal thickness of 0.024 inch (No. 24 Gage), having a 1-inch airspace between layers, spaced 1 inch off the combustible assembly	18	9	5	3	12	6	3	3
Two layers of galvanized sheet metal,minimum nominal thickness of 0.024 inch (No. 24 Gage), 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 1/2-inch brick wall, spaced 1 inch off thecombustible wall	—	—	—	—	12	6	6	6
3 1/2-inch brick wall, against the combustible wall	—	—	—	—	24	12	6	5

For SI: 1 inch = 25.4 mm, °C = [(°F)-32]/1.8, 1 pound per cubic foot = 16.02 kg/m ^{3} , 1.0 Btu · in/ft ^{2}· h & · °F = 0.144 W/m ^{2}· K.

a. Mineral wool and glass fiber 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 · in./(ft ^{2}· h · °F) or less. Insulation board shall be formed of noncombustible material.

b. For limitations on clearance reducation for solid fuel-burning appliance, masonry chimneys, connector pass-throughs, masonry fireplaces and kitchen ducts, see Sections 308.7 through 308.11.

308.7 Solid fuel-burning appliances.

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

308.8 Masonry chimneys.

The clearance reduction methods specified in Table 308.6 shall not be utilized to reduce the clearances required for masonry chimneys as specified in

Chapter 8 of this code and the *New York City Building Code.*

308.9 Chimney connector pass-throughs.

The clearance reduction methods specified in Table 308.6 shall not be utilized to reduce the clearances required for chimney connector pass-throughs as specified in Section 803.10.4.

308.10 Masonry fireplaces.

The clearance reduction methods specified in Table 308.6 shall not be utilized to reduce the clearances required for masonry fireplaces as specified in Chapter 8 of this code and the *New York City Building Code.*

308.11 Kitchen exhaust ducts.

The clearance reduction methods specified in Table 308.6 shall not be utilized to reduce the minimum clearances required by Section 506.3.10 for kitchen exhaust ducts enclosed in a shaft.

Section MC 309: Temperature Control

309.1 Space-heating systems.

Interior spaces intended for human occupancy shall be provided with active or passive space-heating systems capable of maintaining a minimum indoor temperature of 68°F (20°C) at a point 3 feet (914 mm) above floor on the design heating day. The installation of portable space heaters shall not be used to achieve compliance with this section. Refer to Section 1204 of the *New York City Building Code.*

Exception: Interior spaces where the primary purpose is not associated with human comfort.

Section MC 310: Explosion Control

310.1 Required.

Structures occupied for purposes involving explosion hazards shall be provided with explosion control in compliance with rules of the Commissioner of the Fire Department. Explosion control systems shall be designed and installed in accordance with the *New York City Fire Code.*

Section MC 311: Smoke and Heat Vents

311.1 Required.

Approved smoke and heat vents shall be installed in the roofs of one-story buildings where required by the *New York City Fire Code.* Smoke and heat vents shall be designed and installed in accordance with the *New York City Fire Code.*

Section MC 312: Heating and Cooling Load Calculations

312.1 Load calculations.

Heating and cooling system design loads for the purpose of sizing systems, appliances and equipment shall be determined in accordance with the procedures described in the ASHRAE Handbook of Fundamentals. Heating and cooling loads shall be adjusted to account for load reductions that are achieved when energy recovery systems are utilized in the HVAC system in accordance with the ASHRAE Handbook—HVAC Systems and Equipment. Alternatively, design loads shall be determined by an approved equivalent computation procedure, using the design parameters specified in Chapter 3 of the *New York City Energy Conservation Code.* Heating and cooling system design loads for the purpose of sizing systems, appliances and equipment shall also comply with the requirements of Section 1204 of the *New York City Building Code.*

Chapter 4: Ventilation

Section MC 401: General

401.1 Scope.

This chapter shall govern the ventilation of spaces within a building intended to be occupied. Mechanical exhaust systems, including exhaust systems serving clothes dryers and cooking appliances; hazardous exhaust systems; dust, stock and refuse conveyor systems; subslab soil exhaust systems; smoke control systems; energy recovery ventilation systems and other systems specified in Section 502 shall comply with Chapter 5.

401.2 Ventilation required.

Every occupiable space shall be ventilated by natural means in accordance with Section 402 or by mechanical means in accordance with Section 403. Every habitable space shall be ventilated by natural means in accordance with Section 402, and, if required by Table 403.3, by mechanical means in accordance with Section 403.

401.3 When required.

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

401.4 Intake opening location.

Air intake openings shall comply with the following:

1. Intake openings shall be located a minimum of 10 feet (3048 mm) from lot lines or buildings on the same lot. For buildings on lots measuring less than 20 feet (6096 mm) in width, intake openings shall be located at the centerline between lot lines. Where openings front on a street or public way, the distance shall be measured to the centerline of the street or public way.

2. Outdoor intakes for high-rise office buildings having occupied floors located more than 75 feet (22 860 mm) above the lowest level of fire department vehicle access serving spaces above the second story and serving spaces greater than 10,000 square feet (929 m^2) of floor area shall be located at least 20 feet (6096 mm) above ground level, at least 30 feet (9144mm) from exhaust outlets and other exhaust discharges, and at least 20 feet (6096 mm) from areas that may collect vehicular exhaust, such as off street loading bays.

3. Mechanical and gravity outdoor air intake openings shall be located not less than 10 feet (3048 mm) horizontally from any hazardous or noxious contaminant source, such as vents, exhausts (including but not limited to exhaust from dry cleaning establishments, spray booths, and cooling towers), streets, alleys, parking lots and loading docks, except as specified in Item 3 of Section 501.2.1.

4. Where the requirements of Item 3 above cannot be achieved, intake openings shall be located not less than 3 feet (914 mm) below contaminant sources where such sources are located within 10 feet (3048 mm) of the opening.

5. Intake openings in Group I occupancies shall comply with ANSI/ASHRAE/ASHE 170, as required.

6. Intake openings on structures in flood hazard areas shall comply with Appendix G of the *New York City Building Code.*

Exception: Group R-3 occupancies are not required to comply with Section 401.4.

401.4.1 Required dampers in intake openings.

An outdoor air intake opening with gross area of more than 144 square inches (0.0929 m^2) shall be provided with fire dampers and smoke dampers, or combined fire and smoke dampers when such opening is located as follows:

1. Less than 30 feet (9144 mm) above grade.
2. Less than 30 feet (9144mm) in any direction from any opening in another building.
3. Less than 15 feet (4572 mm) from a lot line.
4. Less than 50 feet (15240mm) above and less than 50 feet (15 240 mm) in any direction from a roof constructed of combustible material or a building in which the exterior walls are constructed wholly or partly of wood.
5. Where fire dampers are required by Section 607.5.6.

Exceptions:

1. Smoke dampers shall not be required for outdoor air intake openings installed in any construction required to have a fire-resistance rating that is less than 2 hours.
2. Smoke dampers shall not be required for outdoor air intake openings of systems greater than 15,000 cfm (7.1 m^3 /s) which are provided with smoke dampers in accordance with Chapter 6 of this code and arranged so as to not introduce smoke into the building or space in which the equipment is located.

401.5 Intake opening protection.

Air intake openings that terminate outdoors shall be protected with corrosion-resistant screens, louvers or grilles. Openings in louvers, grilles and screens shall be sized in accordance with Table 401.5, and shall be protected against local weather conditions. Outdoor air intake openings located in exterior walls shall meet the provisions for exterior wall opening protectives in accordance with the **New York City Building Code.**

Table 401.5

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 ScreensMeasured in Any Direction
Intake openings in residential occupancies	Not < 1/4 inch and not > 1/2 inch
Intake openings in other than residentialoccupancies	Not < 1/4 inch and not > 1 inch

For SI: 1 inch = 25.4 mm.

401.6 Contaminant sources.

Stationary local sources producing air-borne particulates, heat, odors, fumes, spray, vapors, smoke or gases in such quantities as to be irritating or injurious to health shall be provided with an exhaust system in accordance with Chapter 5 or a means of collection and removal of the contaminants. Such exhaust shall discharge directly to an approved location at the exterior of the building.

401.6.1 Wind-driven rain rating.

All exterior louvers for building ventilation systems shall either:

1. Receive an A rating according to AMCA Standard 550 for wind-driven rain penetration for a 50 mile per hour (80.4 km/h) wind velocity with a rainfall rate of eight inches (203 mm) per hour; or
2. Be installed on a plenum configured to intercept any wind-driven rain penetrating the louver and to prevent the rain from entering the building ductwork system. Such plenum shall be waterproofed and equipped with a drainage system to convey water penetrating the louver to storm or sanitary drains.

Section MC 402: Natural Ventilation

402.1 General.

Natural ventilation of occupied and habitable spaces shall comply with Chapter 12 of the *New York City Building Code.*

402.2 [Reserved.]

402.3 [Reserved.]

402.4 [Reserved.]

Section MC 403: Mechanical Ventilation

403.1 Ventilation system.

Mechanical ventilation shall be provided by a method of supply air and return or exhaust air. The amount of supply air shall be approximately equal to the amount of return and exhaust air. The system shall not be prohibited from producing negative or positive pressure. The system to convey ventilation air shall be designed and installed in accordance with Chapter 6.

403.2 Outdoor air required.

The minimum outdoor airflow rate shall be determined in accordance with Section 403.3. Ventilation supply systems shall be designed to deliver the required rate of outdoor airflow to the breathing zone within each occupiable space.

Exception: Where a registered design professional demonstrates that an engineered ventilation system design will prevent the maximum concentration of contaminants from exceeding that obtainable by the rate of outdoor air ventilation determined in accordance with Section 403.3, the minimum required rate of outdoor air shall be reduced in accordance with such engineered system design.

403.2.1 Recirculation of air.

The outdoor air required by Section 403.3 shall not be recirculated. Air in excess of that required by Section 403.3 shall not be prohibited from being recirculated as a component of supply air to building spaces, except that:

1. Ventilation air shall not be recirculated from one dwelling unit to another or to dissimilar occupancies.

2. Supply air to a swimming pool and associated deck areas shall not be recirculated unless such air is dehumidified to maintain the relative humidity of the area at 60 percent or less. Air from this area shall not be recirculated to other uses or occupancies.

3. Where mechanical exhaust is required by Note b of Table 403.3, recirculation of air from such spaces shall be prohibited. All air supplied to such spaces shall be exhausted, including any air in excess of that required by Table 403.3.

4. Where mechanical exhaust is required by Note g of Table 403.3, mechanical exhaust is required and recirculation is prohibited.

403.2.2 Transfer air.

Except where recirculation from such spaces is prohibited by Table 403.3, air transferred from occupiable spaces is not prohibited from serving as makeup air for required exhaust systems in such spaces as kitchens, baths, toilet rooms, elevators and smoking lounges. The amount of transfer air and exhaust air shall be sufficient to provide the flow rates as specified in Section 403.3. The required outdoor airflow rates specified in Table 403.3 shall be introduced directly into such spaces or into the occupied spaces from which air is transferred or a combination of both.

403.3 Outdoor airflow rate.

Ventilation systems shall be designed to have the capacity to supply the minimum outdoor airflow rate determined in accordance with this section. The occupant load utilized for design of the ventilation system shall not be less than the number determined from the estimated maximum occupant load rate indicated in Table 403.3. Ventilation rates for occupancies not represented in Table 403.3 shall be those for a listed occupancy classification that is most similar in terms of occupant density, activities and building construction; or shall be determined by an approved engineering analysis. The ventilation system shall be designed to supply the required rate of ventilation air continuously during the period the building is occupied, except as otherwise stated in other provisions of the code.

With the exception of non-tobacco hookah establishments, the ventilation rates in Table 403.3 are based on the absence of smoking in occupiable spaces. Where smoking is anticipated in a space other than a non-tobacco hookah establishments, the ventilation system serving the space shall be designed to provide ventilation over and above that required by Table 403.3 in accordance with accepted engineering practice.

Exceptions:

1. The occupant load is not required to be determined, based on the estimated maximum occupant load rate indicated in Table 403.3, where approved statistical data documents the accuracy of an alternate anticipated occupant density.

2. The occupant load used in computing the required ventilation shall be the maximum number who will occupy the room or space simultaneously during any 2-hour period.

3. Dynamic reset (Demand Controlled Ventilation). The system may be designed to reset the design outdoor air intake airflow and/or space or zone airflow as operating conditions change. These conditions include, but are not limited to:

3.1. Variations in occupancy or ventilation airflow in one or more individual zones for which ventilation airflow requirements will be reset.

Note: Examples of measures for estimating such variations include: occupancy scheduled by time of day, a direct count of occupants, or an estimate of occupancy or ventilation rate per person using occupancy sensors such as those based on indoor CO_2 concentrations.

3.2. Variations in the efficiency with which outdoor air is distributed to the occupants under different ventilation system airflows and temperatures.

3.3. A higher fraction of outdoor air in the air supply due to intake of additional outdoor air for free cooling or exhaust air makeup.

Table 403.3

Minimum Ventilation Rates

Occupancy Classification	People Outdoor Airflow Rate in Breathing Zone CFM/Person	Area Outdoor Airflow Rate in Breathing Zone R_a CFM/FT 2a	Default Occupant Density #/1,000 Ft 2a	Exhaust Airflow Rate CFM/Ft 2a
Occupancy Classification	**People Outdoor Airflow Rate in Breathing Zone CFM/Person**	**Area Outdoor Airflow Rate in Breathing Zone R_a CFM/FT 2a**	**Default Occupant Density #/1,000 Ft 2a**	**Exhaust Airflow Rate CFM/Ft 2a**
Correctional facilities				
Cells				
without plumbing fixtures	5	0.12	25	—
with plumbing fixtures[g]	5	0.12	25	1.0
Dining halls (see food and beverage service)	—	—	—	
				—
Guard stations	5	0.06	15	—
Day room	5	0.06	30	—
Booking/waiting	7.5	0.06	50	—
Dry cleaners, laundries				

Coin-operated dry cleaner	15	—	20	—
Coin-operated laundries	7.5	0.06	20	—
Commercial dry cleaner[l]	30	—	30	—
Commercial laundry	25	—	10	—
Storage, pick up	7.5	0.12	30	—
Education				
Auditoriums	5	0.06	150	—
Corridors (see public spaces)	—	—	—	—
Media center	10	0.12	25	—
Sports locker rooms[g]	—	—	—	0.5
Music/theater/dance	10	0.06	35	—
Smoking lounges[b]	60	—	70	—
Day care (through age 4)	10	0.18	25	—
Classrooms (ages 5-8)	10	0.12	25	—
Classrooms (age 9 plus)	10	0.12	35	—
Lecture classroom	7.5	0.06	65	—
Lecture hall (fixed seats)	7.5	0.06	150	—
Art classroom	10	0.18	20	0.7
Science laboratories[g, k]	10	0.18	25	1.0
Wood/metal shops[g]	10	0.18	20	0.5
Computer lab	10	0.12	25	—
Multiuse assembly	7.5	0.06	100	—
Locker/dressing rooms[g]	—	—	—	0.25
Food and beverage service				
Bars, cocktail lounges	7.5	0.18	100	—
Cafeteria, fast food	7.5	0.18	100	—
Dining rooms	7.5	0.18	70	—
Kitchens (cooking)[b]	—	—	—	0.7
Non-tabacco smoking establishments[b]	60	—	70	—
Hospitals, nursing and convalescent homes				
Autopsy rooms[b]	—	—	—	0.5
Medical procedure rooms	15	—	20	—
Operating rooms	30	—	20	—
Patient rooms	25	—	10	—
Physical therapy	15	—	20	—
Recovery and ICU	15	—	20	—
Hotels, motels, resorts and dormitories				
Multipurpose assembly	5	0.06	120	—
Bathrooms/toilet—private [g]	—	—	—	25/50 [f]
Bedroom/living room	5	0.06	10	—
Conference/meeting	5	0.06	50	—
Dormitory sleeping areas	5	0.06	20	—
Gambling casinos	7.5	0.18	120	—
Lobbies/prefunction	7.5	0.06	30	—
Laboratories[j]				
Biological	—	1.0	—	1.0
Chemical	—	1.0	—	1.0

Industrial and nonteaching	—	1.0	—	1.0
Nonproduction chemical labs	—	1.0	—	1.0
Offices				
Conference rooms	5	0.06	50	—
Office spaces	5	0.06	5	—
Reception areas	5	0.06	30	—
Telephone/data entry	5	0.06	60	—
Main entry lobbies	5	0.06	10	—
Private dwellings, single and multiple				
Garages, common for multiple units[b]	—	—	—	0.75
Garages, separate for each dwelling[b]	—	—	—	100 cfm per car
Kitchens[b]	—	—	—	25/100 [f]
Living areas[c,i]	0.35 ACH but not less than 15 cfm/person	—	Based upon number of bedrooms. First bedroom, 2; each additional bedroom, 1	—
Toilet rooms and bathrooms[g]	—	—	—	20/50 [f]
Public spaces				
Corridors	—	0.06	—	—
Elevator car	—	—	—	1.0
Shower room (per shower head)[g]	—	—	—	50/20 [f]
Smoking lounges[b]	60	—	70	—
Toilet rooms-public[g]	—	—	—	50/70 [e]
Places of religious worship	5	0.06	120	—
Courtrooms	5	0.06	70	—
Legislative chambers	5	0.06	50	—
Libraries	5	0.12	10	—
Museums (children's)	7.5	0.12	40	—
Museums/galleries	7.5	0.06	40	—
Retail stores, sales floors and showroom floors				
Sales (except as below)	7.5	0.12	15	—
Dressing rooms	—	—	—	0.25
Mall common areas	7.5	0.06	40	—
Shipping and receiving	—	0.12	—	—
Smoking lounges and non-tobacco smoking establishments[b]	60	—	70	—
Storage rooms	—	0.12	—	—
Warehouses (see storage)	—	—	—	—
Specialty shops				
Automotive motor-fuel dispensing stations[b]	—	—	—	1.5
Barber	7.5	0.06	25	0.5
Beauty and nail salons[b, h]	20	0.12	25	0.6
Embalming room[b]	—	—	—	2.0
Pet shops (animal areas)[b]	7.5	0.18	10	0.9

Supermarkets	7.5	0.06	8	—
Sports and amusement				
Disco/dance floors	20	0.06	100	—
Bowling alleys (seating areas)	10	0.12	40	—
Game arcades	7.5	0.18	20	—
Ice arenas without combustion engines	—	0.30	—	0.5
Gym, stadium, arena (play area)	—	0.30	—	—
Spectator areas	7.5	0.06	150	—
Swimming pools (pool and deck area)	—	0.48	—	—
Health club/aerobics room	20	0.06	40	—
Health club/weight room	20	0.06	10	—
Storage				
Repair garages, enclosed parking garages[b,d]	—	—	—	0.75
Warehouses	—	0.06	—	—
Theaters				
Auditoriums (see education)	—	—	—	—
Lobbies	5	0.06	150	—
Stages, studios	10	0.06	70	—
Ticket booths	5	0.06	60	—
Transportation				
Platforms	7.5	0.06	100	—
Transportation waiting	7.5	0.06	100	—
Workrooms				
Bank vaults/safe deposit	5	0.06	5	—
Darkrooms	—	—	—	1.0
Copy, printing rooms	5	0.06	4	0.5
Meat processing[c]	15	—	10	—
Pharmacy (prep. area)	5	0.18	10	—
Photo studios	5	0.12	10	—
Computer (without printing)	5	0.06	4	—

For SI: 1 cubic foot per minute = 0.0004719 m^3/s, 1 ton = 908 kg, 1 cubic foot per minute per square foot = 0.00508 $m^3/(s\ m^2)$, C = ((F) -32) /1.8, 1 square foot = 0.0929 m^2.

a. Based upon net occupiable floor area.

b. Mechanical exhaust required and the recirculation of air from such spaces is prohibited (see Section 403.2.1, Item 4).

c. Spaces unheated or maintained below 50°F are not covered by these requirements unless the occupancy is continuous.

d. Ventilation systems in enclosed parking garages shall comply with Section 404.

e. Rates are per water closet or urinal. The higher rate shall be provided where periods of heavy use are expected to occur, such as toilets in theaters, schools and sports facilities. The lower rate shall be permitted where periods of heavy use are not expected.

f. Rates are per room unless otherwise indicated. The higher rate shall be provided where the exhaust system is designed to operate intermittently. The lower rate shall be permitted where the exhaust system is designed to operate continuously during normal hours of use.

g. Mechanical exhaust is required and recirculation is prohibited.

h. For nail salons, the required exhaust shall include ventilation tables or other systems that capture the contaminants and odors at their source and are capable of exhausting a minimum of 50 cfm/ft^2 per station.

i. For R-2 buildings less than 125 feet in height, outdoor ventilation air provided by mechanical means serving dwelling units designed to exceed 100 cfm per dwelling unit, whether intermittent or continuous, shall be required. For buildings 125 feet and greater, outdoor ventilation air shall be provided by mechanical means when the sum of the exhaust designed to exceed 75 cfm, whether continuous or intermittent, per dwelling unit. Manually operated openable exterior wall openings shall not be used to provide outside ventilation air except where calculations are submitted showing that such openings are located at or below the lowest calculated neutral pressure plane (calculated at the winter outdoor design temperature, and taking into account a composite mass flow air balance of the building including all mechanical systems.)

j. During unoccupied hours the ventilation rate and exhaust rates may be reduced to 0.5 cfm/ft^2.

k. When an educational science laboratory is occupied and hoods are not in use and hazardous materials are not present, then ventilation rates shall be consistent with actual use of the space, but not less than 0.5 cfm/ft ^{2} .

l. See Section 502.6 for additional requirements.

(Am. L.L. 2017/187, 10/16/2017, eff. 10/16/2020)

Editor's note: For related unconsolidated provisions, see Appendix A atL.L. 2017/187.

403.3.1 Zone outdoor airflow.

The minimum outdoor airflow required to be supplied to each zone shall be determined as a function of occupancy classification and space air distribution effectiveness in accordance with Sections 403.3.1.1 through 403.3.1.3.

403.3.1.1 Breathing zone outdoor airflow.

The outdoor airflow rate required in the breathing zone $_{(Vbz)}$ of the occupiable space or spaces in a zone shall be determined in accordance with Equation 4-1.

$$Vbz = RpPz + RaAz \qquad \textbf{(Equation 4-1)}$$

where:

A_z	=	Zone floor area: the net occupiable floor area of the space or spaces in the zone.
P_z	=	Zone population: the number of people in the space or spaces in the zone.
R_p	=	People outdoor air rate: the outdoor airflow rate required per person from Table 403.3.
R_a	=	Area outdoor air rate: the outdoor airflow rate required per unit area from Table 403.3.

403.3.1.2 Zone air distribution effectiveness.

The zone air distribution effectiveness (E_z) shall be determined using Table 403.3.1.2.

Table 403.3.1.2

Zone Air Distribution Effectiveness [a,b,c,d,e]

Air Distribution Configuration	E_z
Ceiling or floor supply of cool air	1.0 [f]
Ceiling or floor supply of warm air and floor return	1.0
Ceiling supply of warm air and ceiling return	0.8 [g]
Floor supply of warm air and ceiling return	0.7
Makeup air drawn in on the opposite side of the roomfrom the exhaust and/or return	0.8
Makeup air drawn in near to the exhaust and/or returnlocation	0.5

For SI: 1 foot = 304.8 mm, 1 foot per minute = 0.00506 m/s, °C = ((°F) - 32) /1.8.

a. "Cool air" is air cooler than space temperature.

b. "Warm air" is air warmer than space temperature.

c. "Ceiling" includes any point above the breathing zone.

d. "Floor" includes any point below the breathing zone.

e. "Makeup air" is air supplied or transferred to a zone to replace air removed from the zone by exhaust or return systems.

f. Zone air distribution effectiveness of 1.2 shall be permitted for systems with a floor supply of cool air and ceiling return, provided that low-velocity displacement ventilation achieves unidirectional flow and thermal stratification.

g. Zone air distribution effectiveness of 1.0 shall be permitted for systems with a ceiling supply of warm air, provided that supply air temperature is less than 15°F above space temperature and provided that the 150 foot-per-minute supply air jet reaches to within 4 1/2 feet of floor level.

403.3.1.3 Zone outdoor airflow.

The zone outdoor air flow rate (V_{oz}), shall be determined in accordance with Equation 4-2.

403.3.2 System outdoor airflow.

The outdoor air required to be supplied by each ventilation system shall be determined in accordance with Sections 403.3.2.1 through 403.3.2.3 as a function of system type and zone outdoor airflow rates.

403.3.2.1 Single zone systems.

Where one air handler supplies a mixture of outdoor air and recirculated return air to only one zone, the system outdoor air intake flow rate (V_{ot}) shall be determined in accordance with Equation 4-3.

$$V_{ot} = V_{oz} \quad \textbf{(Equation 4-3)}$$

403.3.2.2 100-percent outdoor air systems.

Where one air handler supplies only outdoor air to one or more zones, the system outdoor air intake flow rate (V_{ot}) shall be determined using Equation 4-4.

$$V_{ot} = \sum_{all\ zones} V_{oz} \quad \textbf{(Equation 4-4)}$$

403.3.2.3 Multiple zone recirculating systems.

Where one air handler supplies a mixture of outdoor air and recirculated return air to more than one zone, the system outdoor air intake flow rate (V_{ot}) shall be determined in accordance with Sections 403.3.2.3.1 through 403.3.2.3.4.

403.3.2.3.1 Primary outdoor air fraction.

The primary outdoor air fraction (Z_p) shall be determined for each zone in accordance with Equation 4-5.

$$Z_p = \frac{V_{oz}}{V_{pz}} \quad \textbf{(Equation 4-5)}$$

where:

V_{pz} = Primary airflow: The airflow rate supplied to the zone from the air-handling unit at which the outdoor air intake is located. It includes outdoor intake air and recirculated air from that air-handling unit but does not include air transferred or air recirculated to the zone by other means. For design purposes, V_{pz} shall be the zone design primary airflow rate, except for zones with variable air volume supply and V_{pz} shall be the lowest expected primary air-flow rate to the zone when it is fully occupied.

403.3.2.3.2 System ventilation efficiency.

The system ventilation efficiency (E_v) shall be determined using Table 403.3.2.3.2 or Appendix A of ASHRAE 62.1.

Table 403.3.2.3.2

System Ventilation Efficiency [a,b]

Max (Z_p)	E_v
<0.15	1
<0.25	0.9
<0.35	0.8
<0.45	0.7
<0.55	0.6
<0.65	0.5
<0.75	0.4
>0.75	0.3

a. *Max* (Z_p) is the largest value of Z_p calculated using Equation 4-5 among all the zones served by the system.

b. Interpolating between table values shall be permitted.

403.3.2.3.3 Uncorrected outdoor air intake.

The uncorrected outdoor air intake flow rate (V_{ou}) shall be determined in accordance with Equation 4-6.

$$V_{ou} = D \sum_{all\ zones} R_p P_z + \sum_{all\ zones} R_a A_z \quad \textbf{(Equation 4-6)}$$

where:

D = Occupant diversity: the ratio of the system population to the sum of the zone populations, determined in accordance with Equation 4-7.

$$D = \frac{P_s}{\sum all\ zones\ P_z} \quad \textbf{(Equation 4-7)}$$

where:

P_s = System population: The total number of occupants in the area served by the system. For design purposes, P_s shall be the maximum number of occupants expected to be concurrently in all zones served by the system.

403.3.2.3.4 Outdoor air intake flow rate.

The outdoor air intake flow rate (V_{ot}) shall be determined in accordance with Equation 4-8.

$$V_{ot} = \frac{V_{ou}}{E_v} \quad \textbf{(Equation 4-8)}$$

403.4 Short-term conditions.

If it is known that peak occupancy will be of short duration and/or ventilation will be varied or interrupted for a short period of time, the design may be based on the average conditions over a time period T determined by Equation 4-9.

$T = 3\ _V / V_{bz}$ **(Equation 4-9)** (US)

$T = 50\ _V / V_{bz}$ **(Equation 4-9)** (SI)

where:

T = averaging time period, minutes
V = the volume of the zone of which averaging is being applied, cubic feet
V_{bz} = the breathing zone outdoor airflow calculated using equation 4-1 and design valve of the zone population P_Z , cfm

Acceptable design adjustments based on this optional provision include the following:

1. Zone with fluctuating occupancy: the zone population (P_Z) may be averaged over time T.

2. Zone with intermittent interruption of supply air: the average outdoor airflow supplied to breathing zone over time T shall be no less than the breathing zone outdoor airflow (V_{bz}) calculated using equation 4-1.

3. A system with intermittent closure of outdoor air intake: the average outdoor air intake over time T shall be no less than the minimum outdoor air intake (Vot) calculated using equation 4-3, 4-4 or 4-8 as appropriate.

403.5 Exhaust ventilation.

Exhaust airflow rate shall be provided in accordance with the requirements in Table 403.3. Exhaust makeup air shall be permitted to be any combination of outdoor air, recirculated air and transfer air, except as limited in accordance with Section 403.2.

403.6 System operation.

The minimum flow rate of outdoor air that the ventilation system must be capable of supplying during its operation shall be permitted to be based on the rate per person indicated in Table 403.3 and the actual number of occupants present.

403.7 Variable air volume system control.

Variable air volume air distribution systems, other than those designed to supply only 100-percent outdoor air, shall be provided with controls to regulate the flow of outdoor air. Such control system shall be designed to maintain the flow rate of outdoor air at a rate of not less than that required by Section 403.3 over the entire range of supply air operating rates.

403.8 Balancing.

The ventilation air distribution system shall be provided with means to adjust the system to achieve at least the minimum ventilation airflow rate as required by Sections 403.3 and 403.4. Ventilation systems shall be balanced by an approved method. Such balancing shall verify that the ventilation system is capable of supplying and exhausting the airflow rates required by Sections 403.3 and 403.4.

Section MC 404: Enclosed Parking Garages

404.1 Enclosed parking garages.

Mechanical ventilation systems for enclosed parking garages shall be permitted to operate intermittently where the system is arranged to operate automatically upon detection of a concentration of carbon monoxide of 25 parts per million (ppm) by approved automatic detection devices.

404.2 Minimum ventilation.

Automatic operation of the system shall not reduce the ventilation airflow rate below 0.05 cfm per square foot (0.00025 m^3/s Å m^2) of the floor area and the system shall be capable of producing a ventilation airflow rate of 0.75 cfm per square foot (0.0038 m^3/s Å m^2) of floor area.

404.3 Occupied spaces accessory to public garages.

Connecting offices, waiting rooms, ticket booths and similar uses that are accessory to a public garage shall be maintained at a positive pressure and shall be provided with ventilation in accordance with Section 403.3.

Section MC 405: Systems Control

405.1 General.

Mechanical ventilation systems shall be provided with manual or automatic controls that will operate such systems whenever the spaces are occupied. Air-conditioning systems that supply required ventilation air shall be provided with controls designed to automatically maintain the required outdoor air supply rate during occupancy.

405.2 Manual control.

Each air distribution system shall be provided with not less than one manual control to stop the operation of the supply, return, and exhaust fans(s) in an emergency. The manual control shall be provided at an approved location. A disconnect switch shall not be considered a manual control.

405.2.1 Office buildings.

Any building where the main use or dominant occupancy is classified in occupancy group B having occupied floors located more than 75 feet (22 860 mm) above the lowest level of fire department vehicle access, where a system serves a floor or floors other than the floor on which the equipment is located, shall be provided with the following controls, in addition to the controls required by this chapter:

1. Manual controls for operating individually each air supply and each exhaust or return fan in the system located as follows:

   1.1. At the Fire Command Center, and

   1.2. In the room containing the affected air-handling fans.

2. Manual controls for operating individually or in groups each remote control reversible fire shutter, when such shutters are provided in accordance with the provisions of the *New York City Building Code,* or each smoke damper provided in accordance with the provisions of the *New York City Building Code.* Such controls shall be located at the Fire Command Center.

Section MC 406: Ventilation of Uninhabited Spaces

406.1 General.

Uninhabited spaces, such as crawl spaces and attics, shall be provided with natural ventilation openings as required by the *New York City Building Code* or shall be provided with a mechanical exhaust and supply air system. The mechanical exhaust rate shall be not less than 0.02 cfm per square foot ($0.00001\ m^3/s \cdot m^2$) of horizontal area and shall be automatically controlled to operate when the relative humidity in the space served exceeds 60 percent.

406.1.1 Methane and radon venting.

The design and materials used in the installation of the methane and radon vent systems shall be approved by the commissioner and shall comply with all applicable rules of the Fire Department.

Section MC 407: Ventilation of Non-production Chemical Laboratories

407.1 General.

Non-production chemical laboratories complying with the hazardous materials quantity limitations of Section 424 of the *New York City Building Code* shall provide a mechanical ventilation system in accordance with Table 403.3 of this code and NFPA 45, except that ducts constructed of combustible materials shall not be permitted.

Chapter 5: Exhaust Systems

Section MC 501: General

501.1 Scope.

This chapter shall govern the design, construction and installation of mechanical exhaust systems, including exhaust systems serving clothes dryers and cooking appliances; hazardous exhaust systems; dust, stock and refuse conveyor systems; subslab soil exhaust systems; smoke control systems; energy recovery ventilation systems; and other systems specified in Section 502.

501.2 Exhaust discharge.

The air removed by every mechanical exhaust system shall be discharged outdoors at a point where it will not cause a nuisance and the air shaft will be located not less than the distances specified in Section 501.2.1. The air shall be discharged to a location from which it cannot again be readily drawn in by a ventilating system. Air shall not be exhausted into an attic or crawl space.

Exceptions:

1. Whole-house ventilation-type attic fans shall be permitted to discharge into the attic space of dwelling units having private attics.

2. Commercial cooking recirculating systems.

501.2.1 Location of exhaust outlets.

The termination point of exhaust outlets and ducts discharging to the outdoors shall be located within the following minimum distances:

1. For ducts conveying noxious, toxic, explosive or flammable vapors, fumes or dusts (including but not limited to exhaust from dry cleaning establishments and spray booths): 30 feet (9144 mm) from property lines; 10 feet (3048 mm) from operable openings into buildings; 6 feet (1829 mm) from exterior walls and roofs; 30 feet (9144 mm) from combustible walls and operable openings into buildings which are in the direction of the exhaust discharge; 10 feet (3048 mm) above adjoining grade. Additional requirements may apply to Hazardous Exhaust Systems; see Section 510.

2. For other product-conveying outlets: 10 feet (3048 mm) from the property lines; 3 feet (914 mm) from exterior walls and roofs; 10 feet (3048 mm) from operable openings into buildings; 10 feet (3048 mm) above adjoining grade; 10 feet from any exterior fire escape, stair, or balcony.

3. For all environmental air exhaust outlets: 3 feet (914 mm) from property lines; 3 feet (914 mm) from operable openings into buildings for all occupancies other than Group U, and 10 feet (3048 mm) from mechanical air intakes. Such exhaust outlets shall not be considered hazardous or noxious.

4. Exhaust outlets and openings serving structures in flood hazard areas shall be installed in accordance with Appendix G of the New York City Building Code.

5. For specific systems see the following sections:

5.1. Clothes dryer exhaust, Section 504.4.

5.2. Kitchen hoods and other kitchen exhaust equipment, Sections 506.3.12, 506.4 and 506.5.

5.3. Dust stock and refuse conveying systems, Section 511.

5.4. Subslab soil exhaust systems, Section 512.4.

5.5. Smoke control systems, Section 513.10.3.

5.6. Refrigerant discharge, Section 1105.7.

5.7. Machinery room discharge, Section 1105.6.1.

6. In Occupancy Groups R-2 and R-3 each dwelling unit may be individually exhausted directly to the outdoors with a dedicated, exhaust fan and shall comply with the following:

6.1. The exhaust system for the kitchen and the toilet/baths may be combined to the inlet of a continuously operated single fan, provided such exhaust system serves only one dwelling unit.

6.2. The dedicated exhaust from each dwelling unit shall be directed away from any window serving the same dwelling unit from which the exhaust is taken, and in addition, such exhaust opening shall terminate at least:

6.2.1. Two feet (610 mm) from any operational window or door serving the same dwelling unit.

6.2.2. Three feet (1219 mm) from any operational window or door serving an adjoining dwelling unit.

6.2.3. Three feet (1219 mm) from any operational window or door serving another occupancy group in the same building.

6.2.4. Ten feet (3048 mm) from any outdoor air intake opening.

6.2.5. Ten feet (3048 mm) above the public sidewalk adjoining the same building.

6.2.6 All other minimum distances prescribed in items 1 through 5 of Section 501.2.1 shall be satisfied

501.2.1.1 Exhaust discharge.

Exhaust air shall not be directed onto walkways.

501.2.2 Exhaust opening protection.

Exhaust openings that terminate outdoors shall be protected with corrosion-resistant screens, louvers or grilles. Openings in screens, louvers and grilles shall be sized not less than 1/4 inch (6 mm) and not larger than 1/2 inch (13 mm). Openings shall be protected against local weather conditions. Outdoor openings located in exterior walls shall meet the provisions for exterior wall opening protectives in accordance with the *New York City Building Code*.

501.2.2.1 Wind-driven rain rating.

All exterior louvers for building exhaust systems shall either:

1. Receive an A rating according to AMCA Standard 550 for wind-driven rain penetration for a 50 mile per hour (80.4 km/h) wind velocity with a rainfall rate of eight inches (203 mm) per hour; or

2. Be installed on a plenum configured to intercept any wind-driven rain penetrating the louver and to prevent the rain from entering the building ductwork system. Such plenum shall be waterproofed and equipped with a drainage system to convey water penetrating the louver to storm or sanitary drains.

501.3 Pressure equalization.

Mechanical exhaust systems shall be sized to remove the quantity of air required by this chapter 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 other than occupancies in 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 for a room, adequate means shall be provided for the natural or mechanical exhaust 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 makeup air consisting of supply air, transfer air or outdoor air shall be provided to satisfy the deficiency. The calculated building infiltration rate and openable area shall not be used to satisfy the requirements of this section.

501.4 Ducts.

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

501.5 Independent system required.

1. 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, except as permitted in Section 501.2.1.

2. A separate grease duct system shall be provided for each Type I hood except as provided in Section 506.3.5.

3. Hazardous exhaust systems shall be independent of other types of exhaust systems as provided in Section 510.

Section MC 502: Required Systems

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 quantities so as to be irritating or injurious to health or safety.

502.1.1 Exhaust location.

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

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.

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 parts of the building.

502.1.4 Hazardous exhaust.

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

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 in an approved manner at floor level or within the floor itself.

502.3 Battery-charging areas for powered vehicles and equipment.

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

502.4 Stationary storage battery systems.

Stationary storage battery systems, as regulated by Section 608 of the *New York City Fire Code,* shall be provided with ventilation in accordance with this chapter and Section 502.4.1 or 502.4.2.

Exception: Lithium-ion batteries shall not require ventilation.

502.4.1 Hydrogen limit in rooms.

For flooded lead acid, flooded nickel cadmium and VRLA batteries, the ventilation system shall be designed to limit the maximum concentration of hydrogen to 1.0 percent of the total volume of the room.

502.4.2 Ventilation rate in rooms.

Continuous ventilation shall be provided at a rate of not less than 1 cubic foot per minute per square foot (cfm/ft ^{2}) (0.00508 m ^{3} /(s · m ^{2})]) of floor area of the room.

502.5 Valve-regulated lead-acid batteries in cabinets.

Valve-regulated lead-acid (VRLA) battery systems installed in cabinets, as regulated by Section 608.6.2 of the *New York City Fire Code,* shall be provided with ventilation in accordance with Section 502.5.1 or 502.5.2.

502.5.1 Hydrogen limit in cabinets.

The cabinet ventilation system shall be designed to limit the maximum concentration of hydrogen to 1.0 percent of the total volume of the cabinet during the worst-case event of simultaneous boost charging of all batteries in the cabinet.

502.5.2 Ventilation rate in cabinets.

Continuous cabinet ventilation shall be provided at a rate of not less than 1 cubic foot per minute per square foot (cfm/ft ^{2}) (0.00508 m ^{3} /(s · m ^{2})) of floor area covered by the cabinet. The room in which the cabinet is installed shall also be ventilated as required by Section 502.4.1 or 502.4.2.

502.6 Dry cleaning plants.

Mechanical ventilation in dry cleaning plants shall be provided and shall be adequate to protect employees and the public in accordance with this section and DOL 29 CFR Part 1910.1000, where applicable. Dry cleaning separations must comply with the requirements of Section 415.6.4 of the *New York City Building Code* and NFPA 32.

502.6.1 Type II and III systems.

Type II and III 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/ft ^{2}) (0.00508 m ^{3} /(s · m ^{2})) 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.

502.6.2 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 (0.51 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:

$$Q = 100 \times A_{LD} \qquad \textbf{(Equation 5-1)}$$

where:

Q	=	Flow rate exhausted through the hood, cubic feet per minute.
A_{LD}	=	Area of the loading door, square feet.

502.6.3 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.

502.7 Application of flammable finishes.

Mechanical exhaust as required by this section shall be provided for operations involving the application of flammable finishes and shall comply with the *New York City Fire Code*.

502.7.1 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.

502.7.2 Limited spraying spaces.

Positive mechanical ventilation which provides a minimum of six complete air changes per hour shall be installed in limited spraying spaces. Such system

shall meet the requirements of the *New York City Fire Code* for handling flammable vapors. Explosion venting is not required.

502.7.3 Flammable vapor areas.

Mechanical ventilation of flammable vapor areas shall be provided in accordance with Sections 502.7.3.1 through 502.7.3.6.

502.7.3.1 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 flammable vapor area such that spraying operations cannot be conducted unless the ventilation system is in operation.

502.7.3.2 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 flammable 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. In the event of shutdown of the vapor concentration monitor, 100 percent of the air volume specified in Section 510 is automatically exhausted.

2. Air exhausted from spraying operations is allowed to be recirculated as makeup air to manned spraying operations where 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 pose life safety hazards to personnel inside the spray booth, spraying space or spray room.

502.7.3.3 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 section in the direction of airflow during spraying operations, is not less than 100 feet per minute (0.51 m/s).

502.7.3.4 Ventilation obstruction.

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

502.7.3.5 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 (1.67 m^2) 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.

502.7.3.6 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.

502.7.4 Dipping operations.

Flammable 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.

502.7.5 Electrostatic apparatus.

The flammable vapor area in spray-finishing operations involving electrostatic apparatus and devices shall be ventilated in accordance with Section 502.7.3.

502.7.6 Powder coating.

Exhaust ventilation for powder-coating operations shall be sufficient to maintain the atmosphere below one-half of the minimum explosive concentration for the material being applied. Nondeposited, air-suspended powders shall be removed through exhaust ducts to the powder recovery system.

502.7.7 Floor resurfacing operations.

To prevent the accumulation of flammable vapors during floor resurfacing operations, mechanical ventilation at a minimum rate of 1 cfm/ft^2 (0.00508 $m^3/(s \cdot m^2)$) 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. Such exhaust equipment shall be kept in operation while the floor finishing operations are conducted and until any flammable vapors have been exhausted to the exterior of the building.

502.7.8 Resin application areas.

Exhaust ventilation for resin application areas shall comply with Section 502.7.3.

Exception: Mechanical ventilation is not required for buildings that are unenclosed for at least 75 percent of the perimeter.

502.8 Hazardous materials—general requirements.

Exhaust ventilation systems for structures containing hazardous materials shall be provided as required in Sections 502.8.1 through 502.8.5 and shall comply with the *New York City Fire Code.*

502.8.1 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 *New York City Fire Code.*

502.8.1.1 System requirements.

Exhaust ventilation systems shall comply with all of the following:

1. The installation shall be in accordance with this code.
2. Mechanical ventilation shall be provided at a rate of not less than 1 cfm/ft ^{2} (0.00508 m ^{3} /(s · m ^{2})) 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 a break-glass or other approved type and shall be labeled: VENTILATION SYSTEM EMERGENCY SHUTOFF.
5. The exhaust ventilation 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 12 inches (305 mm) of the floor. For fumes or vapors that are lighter than air, exhaust shall be taken from a point within 12 inches (305 mm) of the highest point of the room.
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 air shall not be recirculated to occupied areas if the materials stored are capable of emitting hazardous vapors and contaminants have not been removed. Air contaminated with explosive or flammable vapors, fumes or dusts; flammable, highly toxic or toxic gases; or radioactive materials shall not be recirculated.

502.8.2 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 502.9.7.1, 502.9.7.2 and 502.9.8.4.

502.8.3 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 502.8.1.

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

502.8.4 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 gases, 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 gases, fumes, mists or vapors.

502.8.5 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 502.8.4.

502.9 Hazardous materials—requirements for specific materials.

Exhaust ventilation systems for specific hazardous materials shall be provided as required in Section 502.8 and Sections 502.9.1 through 502.9.11 and shall comply with the *New York City Fire Code.*

502.9.1 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. Each space shall be separately exhausted, and each exhaust air stream 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/ft ^{2} (0.00508 m ^{3} /(s · m ^{2})) of the area of the room. Gas cabinets for the storage of compressed medical gases in amounts exceeding the maximum allowable exempt 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.

502.9.2 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 502.8.4 shall be provided.

502.9.3 Cryogenics.

Storage areas for stationary or portable containers of cryogenic fluids in any quantity shall be ventilated in accordance with Section 502.8. Indoor areas where cryogenic fluids in any quantity are dispensed shall be ventilated in accordance with the requirements of Section 502.8.4 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.

502.9.4 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.

502.9.5 Flammable and combustible liquids.

Exhaust ventilation systems shall be provided as required by Sections 502.9.5.1 through 502.9.5.5 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 *New York City Fire Code.*

502.9.5.1 Vaults.

Vaults that contain tanks of Class I liquids shall be provided with continuous ventilation at a rate of not less than 1 cfm/ft ^{2} of floor area (0.00508 m ^{3} /(s · m ^{2})), but not less than 150 cfm (4 m ^{3} /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.

502.9.5.2 Storage rooms and warehouses.

Liquid storage rooms and liquid storage warehouses for quantities of liquids exceeding those specified in the *New York City Fire Code* shall be ventilated in accordance with Section 502.8.1.

502.9.5.3 Cleaning machines.

Areas containing machines used for parts cleaning in accordance with the *New York City Fire Code* shall be adequately ventilated to prevent accumulation of vapors.

502.9.5.4 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/ft ^{2} (0.00508 m ^{3} /(s · m ^{2})) 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.

502.9.5.5 Bulk plants or terminals.

Ventilation shall be provided for portions of properties where flammable and combustible liquids are received by tank vessels, pipelines, tank cars or tank vehicles and which are stored or blended in bulk for the purpose of distributing such liquids by tank vessels, pipelines, tank cars, tank vehicles or containers as required by Sections 502.9.5.5.1 through 502.9.5.5.3.

502.9.5.5.1 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. The natural ventilation design shall be approved for each specific application by the commissioner prior to installation and/or use.

502.9.5.5.2 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.

502.9.5.5.3 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.

502.9.6 Highly toxic and toxic liquids.

Ventilation exhaust shall be provided for highly toxic and toxic liquids as required by Sections 502.9.6.1 and 502.9.6.2.

502.9.6.1 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.

502.9.6.2 Open and closed systems.

Mechanical exhaust ventilation shall be provided for highly toxic and toxic liquids used in open systems in accordance with Section 502.8.4. Mechanical exhaust ventilation shall be provided for highly toxic and toxic liquids used in closed systems in accordance with Section 502.8.5.

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

502.9.7 Highly toxic and toxic compressed gases—Any quantity.

Ventilation exhaust shall be provided for highly toxic and toxic compressed gases in any quantity as required by Sections 502.9.7.1 and 502.9.7.2.

502.9.7.1 Gas cabinets.

Gas cabinets containing highly toxic or toxic compressed gases in any quantity shall comply with Section 502.8.2 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.

502.9.7.2 Exhausted enclosures.

Exhausted enclosures containing highly toxic or toxic compressed gases in any quantity shall comply with Section 502.8.2 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.

502.9.8 Highly toxic and toxic compressed gases—quantities exceeding the maximum allowable quantity 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 502.9.8.1 through 502.9.8.6.

502.9.8.1 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.

502.9.8.2 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 *New York City Fire Code.*

502.9.8.3 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 *New York City Fire Code.*

502.9.8.4 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.

502.9.8.5 Treatment system.

The exhaust ventilation from gas cabinets, exhausted enclosures and gas rooms, and local exhaust systems required in Sections 502.9.8.2 and 502.9.8.3 shall be directed to a treatment system where required by the *New York City Fire Code.*

502.9.8.6 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 *New York City Fire Code.*

502.9.9 Ozone gas generators.

Ozone cabinets and ozone gas-generator rooms for systems having a maximum ozone-generating capacity of one-half 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).

502.9.10 LP-gas distribution facilities.

LP-gas distribution facilities shall conform to the requirements of the *New York City Fire Code.*

502.9.11 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 502.8.2.

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.

502.10 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 this code, the *New York City Building Code* and the *New York City Fire Code.*

502.10.1 Where required.

Exhaust ventilation systems shall be provided in the following locations in accordance with the requirements of this section and the *New York City Building Code:*

1. Fabrication areas: Exhaust ventilation for fabrication areas shall comply with the *New York City Building Code.* Additional manual control switches shall be provided where required by the commissioner.

2. Workstations: A ventilation system shall be provided to capture and exhaust gases, fumes and vapors at workstations.

3. Liquid storage rooms: Exhaust ventilation for liquid storage rooms shall comply with Section 502.8.1.1 and the *New York City Building Code.*

4. HPM rooms: Exhaust ventilation for HPM rooms shall comply with Section 502.8.1.1 and the *New York City Building Code.*

5. Gas cabinets: Exhaust ventilation for gas cabinets shall comply with Section 502.8.2. 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 502.9.7 and 502.9.8.

6. Exhausted enclosures: Exhaust ventilation for exhausted enclosures shall comply with Section 502.8.2. Exhaust ventilation for exhausted enclosures containing highly toxic or toxic gases shall also comply with Sections 502.9.7 and 502.9.8.

7. Gas rooms: Exhaust ventilation for gas rooms shall comply with Section 502.8.2. Exhaust ventilation for gas cabinets containing highly toxic or toxic gases shall also comply with Sections 502.9.7 and 502.9.8.

502.10.2 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 fire walls. Fire dampers shall not be installed in exhaust ducts.

502.10.3 Treatment systems.

Treatment systems for highly toxic and toxic gases shall comply with the *New York City Fire Code.*

502.11 Motion picture projectors.

Motion picture projectors shall be exhausted in accordance with Section 502.11.1 or 502.11.2.

502.11.1 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.

502.11.2 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 m^3/s) per lamp. The exhaust rate for xenon projectors shall be a minimum of 300 cfm (0.14 m^3/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.

502.12 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/ft^2 (0.00508 $m^3/(s \cdot m^2)$) 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.

502.13 Public garages.

Mechanical exhaust systems for public garages, as required in Chapter 4, shall operate continuously or in accordance with Section 404.

502.14 Motor vehicle operation.

In areas where motor vehicles operate, mechanical ventilation shall be provided in accordance with Section 403. 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.

502.15 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.

502.16 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 502.16.1 and 502.16.2.

Exception: Where approved by the commissioner, natural ventilation shall be permitted in lieu of mechanical ventilation.

502.16.1 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, or for hydrogen, a continuously monitoring flammable gas detection system, each activating at a gas concentration of 25 percent of the lower flammable limit (LFL). 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 $m^3/(s \cdot m^3)$) of room volume.

502.16.2 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 *New York City Building 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.

502.17 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.

502.17.1 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.

502.18 Specific rooms.

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

502.19 Domestic kitchen exhaust systems.

In all Group R occupancies a minimum of No. 18 Gage galvanized sheet metal shall be used, except that ductwork that complies with Section 603.6.1.2 shall be permitted for independent apartment exhaust systems providing general exhaust ventilation of kitchen and toilet areas.

502.20 Nonproduction chemical laboratories.

Nonproduction chemical laboratories shall comply with Section 424 of the *New York City Building Code* and NFPA 45.

502.21 Indoor firing ranges.

Ventilation shall be provided in an approved manner in areas utilized as indoor firing ranges.

Section MC 503: Motors and Fans

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 remote control installed at an approved location shall be provided to shut off fans or blowers in flammable vapor or dust systems. 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 dustproofing. Motors and fans shall be provided with a means of access for servicing and maintenance.

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.

503.3 Equipment and appliance 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.

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.

503.5 Fan location.

Fans exhausting noxious, toxic, hot vapor or grease laden air shall be located as close to the terminus as practicable, at the roof or within a mechanical equipment room, immediately below the roof.

Exception: Where the fan is listed or approved for such an application.

Section MC 504: Clothes Dryer Exhaust

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. For the installation of gas dryers, refer to Section 614 of the *New York City Fuel Gas Code.*

Exception: This section shall not apply to listed and labeled condensing (ductless) electric clothes dryers.

504.2 Exhaust penetrations.

Where a clothes dryer exhaust duct penetrates a wall or ceiling membrane, the annular space shall be sealed with noncombustible material, approved fire caulking or a noncombustible dryer exhaust duct wall receptacle. 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 *New York City Building Code* to be fire-resistance rated, unless such duct is constructed of galvanized steel or aluminum of the thickness specified in Section 603.4 and the fire-resistance rating is maintained in accordance with the *New York City Building Code.* Fire dampers, combination fire/smoke dampers and any similar devices that will obstruct the exhaust flow shall be prohibited in clothes dryer exhaust ducts.

504.3 Cleanout.

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

504.4 Exhaust installation.

Dryer exhaust ducts for clothes dryers shall terminate on the outside of the building. Single dryer installations shall be equipped with a backdraft damper. Multiple dryer installations shall not have 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 vent connector, vent or chimney. Clothes dryer exhaust ducts shall not extend into or through ducts or plenums.

504.5 Makeup air.

Installations exhausting more than 200 cfm (0.09 m^3/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 m^2) shall be provided in the closet enclosure or makeup air shall be provided by other approved means.

504.6 Domestic clothes dryer ducts.

Exhaust ducts for domestic clothes dryers shall conform to the requirements of Sections 504.6.1 through 504.6.7.

504.6.1 Material and size.

Exhaust ducts shall have a smooth interior finish and shall be constructed of metal a minimum 0.016 inch (0.4 mm) thick. The exhaust duct size shall be 4 inches (102 mm) nominal in diameter.

Exception: 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, the maximum length of the exhaust duct, including any transition duct, shall be permitted to be in accordance with the dryer manufacturer's installation instructions.

504.6.2 Duct installation.

Exhaust ducts shall be supported at 4-foot (1219 mm) intervals and secured in place. The insert end of the duct shall extend into the adjoining duct or fitting in the direction of airflow. Ducts shall not be joined with screws or similar fasteners that protrude into the inside of the duct.

504.6.3 Transition ducts.

Transition ducts used to connect the dryer to the exhaust duct system shall be a single length that is listed and labeled in accordance with UL 2158A. Transition ducts shall be a maximum of 8 feet (2438 mm) in length and shall not be concealed within construction.

504.6.4 Duct length.

The maximum allowable exhaust duct length shall be determined by one of the methods specified in Section 504.6.4.1 or 504.6.4.2.

504.6.4.1 Specified length.

The maximum length of the exhaust duct shall be 35 feet (10 668 mm) from the connection to the transition duct from the dryer to the outlet terminal. Where fittings are used, the maximum length of the exhaust duct shall be reduced in accordance with Table 504.6.4.1.

Table 504.6.4.1

Dryer Exhaust Duct Fitting Equivalent Length

Dryer Exhaust Duct Fitting Type	Equivalent Length
Dryer Exhaust Duct Fitting Type	Equivalent Length
4" radius mitered 45-degree elbow	2 feet 6 inches
4" radius mitered 90-degree elbow	5 feet
6" radius smooth 45-degree elbow	1 foot
6" radius smooth 90-degree elbow	1 foot 9 inches
8" radius smooth 45-degree elbow	1 foot
8" radius smooth 90-degree elbow	1 foot 7 inches
10" radius smooth 45-degree elbow	9 inches
10" radius smooth 90-degree elbow	1 foot 6 inches

For SI: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 degree = 0.0175 rad.

504.6.4.2 Manufacturer's instructions.

The maximum length of the exhaust duct shall be determined by the dryer manufacturer's installation instructions. The code official shall be provided with a copy of the installation instructions for the make and model of the dryer. Where the exhaust duct is to be concealed, the installation instructions shall be provided to the code official prior to the concealment inspection. In the absence of fitting equivalent length calculations from the clothes dryer manufacturer, Table 504.6.4.1 shall be used.

504.6.5 Length identification.

Where the exhaust duct is concealed within the building construction, the equivalent length of the exhaust duct shall be identified on a permanent label or tag. The label or tag shall be located within 6 feet (1829 mm) of the exhaust duct connection.

504.6.6 Exhaust duct required.

Where space for a clothes dryer is provided, an exhaust duct system shall be installed. Where the clothes dryer is not installed at the time of occupancy, the exhaust duct shall be capped at the location of the future dryer.

Exception: Where a listed condensing clothes dryer is installed prior to occupancy of structure.

504.6.7 Protection required.

Protective shield plates shall be placed where nails or screws from finish or other work are likely to penetrate the clothes dryer exhaust duct. Shield plates shall be placed on the finished face of all framing members where there is less than 1 1/4 inches (32 mm) between the duct and the finished face of the framing member. Protective shield plates shall be constructed of steel, have a thickness of 0.062 inch (1.6 mm) and extend a minimum of 2 inches (51 mm) above sole plates and below top plates.

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.

504.8 Common exhaust systems for clothes dryers located in multistory structures.

Where a common multistory duct system is designed and installed to convey exhaust from multiple clothes dryers, the construction of the system shall be in accordance with all of the following:

1. The shaft in which the duct is installed shall be constructed and fire-resistance rated as required by the *New York City Building Code.*
2. Dampers shall be prohibited in the exhaust duct.
3. Rigid metal ductwork shall be installed within the shaft to convey the exhaust. The ductwork shall be constructed of sheet steel having a minimum thickness of 0.0187 inch (0.47 mm) (No. 26 gage) and in accordance with SMACNA Duct Construction Standards.
4. Exhaust ducts 20 square inches or less connected into dryer exhaust shafts shall not require fire dampers when the exhaust fan runs continuously. Exhaust ducts greater than 20 square inches shall not be connected into a common shaft with other laundry exhausts.
5. The exhaust fan motor design shall be in accordance with Section 503.2.
6. The exhaust fan motor shall be located outside of the airstream.
7. The exhaust fan shall run continuously, and shall be connected to a standby power source, where a building standby power source is required per the *New York City Building Code.*
8. Exhaust fan operation shall be monitored in an approved location and shall initiate an audible or visual signal when the fan is not in operation.
9. Makeup air shall be provided for the exhaust system.
10. A cleanout opening shall be located at the base of the shaft and all offsets to provide access to the duct to allow for cleaning and inspection. The finished opening shall be not less than 12 inches by 12 inches (305 mm by 305 mm).
11. Screens shall not be installed at the termination.

Section MC 505: Domestic Kitchen Equipment Exhaust

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. Such exhaust system shall be installed in strict compliance with the manufacturer's recommendations as well as the requirements of the listing.

Exceptions:

1. Where installed in accordance with the manufacturer's installation instructions and where mechanical or natural ventilation is otherwise provided in accordance with Chapter 4, listed and labeled ductless range hoods shall not be required to discharge to the outdoors.

2. Ducts for domestic kitchen cooking appliances equipped with downdraft exhaust systems shall be permitted to be constructed of Schedule 40 PVC pipe and fittings provided that the installation complies with all of the following:

2.1. The duct shall be installed under a concrete slab poured on grade.

2.2. The underfloor trench in which the duct is installed shall be completely backfilled with sand or gravel.

2.3. The PVC duct shall extend not greater than 1 inch (25 mm) above the indoor concrete floor surface.

2.4. The PVC duct shall extend not greater than 1 inch (25 mm) above grade outside of the building.

2.5. The PVC ducts shall be solvent cemented.

505.2 Makeup air required.

Exhaust hood systems capable of exhausting in excess of 400 cfm (0.19 m^3/s) shall be provided with makeup air at a rate in accordance with Table 403.3. Such makeup air systems shall be equipped with a means of closure and shall be automatically controlled to start and operate simultaneously with the exhaust system.

Section MC 506: Commercial Kitchen Hood Ventilation System Ducts and Exhaust Equipment

506.1 General.

Commercial kitchen hood ventilation 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. All ducts shall lead directly to the exterior of the building and terminate as required by Section 506.3.12 for Type 1 hoods and Section 506.4.2 for Type II hoods,

506.2 Corrosion protection.

Ducts exposed to the outside atmosphere or subject to a corrosive environment shall be protected against corrosion in accordance with the following.

1. At the base of each duct and at its termination point a clearly identifiable permanent sign shall be installed identifying the facility from which the duct originates. All exterior ducts shall be protected on the exterior by paint or other weatherproof protective coating. Stainless steel ducts shall not require paint or weatherproof protective coating.

2. No portion of an exterior metal duct shall be nearer than 24 inches (610 mm) to any door or window or to any exit, or located where it would be readily accessible to the public, unless it is insulated or shielded to avoid injury to any person coming in contact with the duct.

Exception: Listed and labeled factory-built commercial kitchen grease ducts may be used when installed in accordance with Section 304.1.

506.3 Ducts serving Type I hoods.

Type I exhaust ducts shall be independent of all other exhaust systems except as provided in Section 506.3.5. Commercial kitchen duct systems serving Type I hoods shall be designed, constructed and installed in accordance with Sections 506.3.1 through 506.3.12.3.

506.3.1 Duct materials.

Ducts serving Type I hoods shall be constructed of materials in accordance with Sections 506.3.1.1 and 506.3.1.2.

506.3.1.1 Grease duct materials.

Grease ducts serving Type I hoods, and located within buildings, shall be constructed as follows:

1. Ducts with a cross-sectional area up to and including 155 square inches (100 000 mm^2) shall be constructed of 0.0598-inch (1.52 mm) No. 16 Gage steel;

2. Ducts with a cross-sectional area over 155 square inches (100 000 mm^2), but not more than 200 square inches (0.129 m^2) shall be constructed of 0.074-inch (1.9 mm) No. 14 Gage steel; and

3. Ducts with a cross-sectional area equal to or more than 200 square inches (0.129 m^2) shall be constructed of 0.1046-inch (2.66 mm) No. 12 Gage steel.

If stainless steel is used for ducts of any of the cross-sectional areas listed above, the Gage steel may be increased upwards (resulting in a smaller thickness) by 1 even Gage size.

Exception: Listed and labeled factory-built commercial kitchen grease ducts shall be listed and labeled in accordance with UL 1978 and installed in accordance with Section 304.1 and as approved by the commissioner.

506.3.1.2 Makeup air ducts.

Make up air ducts connecting to or within 18 inches (457 mm) of a Type I hood shall be constructed and installed in accordance with Sections 603.1, 603.3, 603.4, 603.9, 603.10, and 603.12. Duct insulation installed within 18 inches (457 mm) of a Type I hood shall be noncombustible or shall be listed for the application.

506.3.2 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.

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 shall not be prohibited provided that the joint is formed or ground smooth and is provided with ready access for inspection.

3. Factory-built commercial kitchen grease ducts listed and labeled in accordance with UL 1978 and installed in accordance with Section 304.1.

506.3.2.1 Duct joint types.

Duct joints shall be butt joints, welded flange joints with a maximum flange depth of 1/2 inch (12.7 mm) 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 1/4 inch (6.4 mm). The length of overlap for overlapping duct joints shall not exceed 2 inches (51 mm).

506.3.2.2 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 (1.57 rad) 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 25mm) 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 1/4 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 Section 304.1.

506.3.2.3 Duct-to-exhaust fan connections.

Duct-to-exhaust fan connections shall be flanged and gasketed at the base of the fan for 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. Approved flexible connectors may be provided.

506.3.2.4 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.

506.3.2.5 Grease duct test.

Prior to the use or concealment of any portion of a grease duct system, a leakage test shall be performed. Ducts shall be considered to be concealed where installed in shafts or covered by coatings or wraps that prevent the ductwork from being visually inspected on all sides. The duct installer shall be responsible for providing the necessary equipment and performing the grease duct leakage test. A duct leakage test, in accordance with this section, shall be performed for the entire duct system, including the hood-to-duct connection. The duct work shall be permitted to be tested in sections, provided that every joint is tested. To determine the tightness of the grease duct construction, a smoke test shall be made in accordance with the following conditions and requirements:

1. The test shall be performed in the presence of the special inspector.

2. The grease duct shall be filled with a thick penetrating smoke produced by one or more smoke machines, or smoke bombs. A static pressure equal to or not less than 2" wg shall be maintained throughout the test. The test shall be applied for a length of time sufficient to permit the inspection of the grease duct.

3. If the test shows any evidence of leakage or other defects, such defects shall be corrected in accordance with the requirements of this chapter, and the test shall be repeated until there is no visible smoke observed.

506.3.3 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 *New York City Building Code.* Bolts, screws, rivets and other mechanical fasteners shall not penetrate duct walls.

506.3.4 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 500 feet per minute (2.5 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.

506.3.5 Separation of grease duct system.

A separate grease duct system shall be provided for each Type I hood.

Exceptions:

1. A separate grease duct system is not required where all of the following conditions are met:

1.1. All interconnected hoods are located within the same story, provided that they are part of the same facility and under the control of one owner or tenant.

1.2. All interconnected hoods are located within the same room or in adjoining rooms, provided that they are part of the same facility and under the control of one owner or tenant.

1.3. Interconnecting ducts do not penetrate assemblies required to be fire-resistance rated.

1.4. The grease duct system does not serve solid fuel-fired appliances.

2. Branch ducts from other equipment in the same kitchen area, or from registers exhausting the kitchen space in general, may be connected to the

main hood exhaust duct if the following requirements are complied with:

2.1. A fusible link fire damper of the same gage as the hood exhaust duct shall be added at the point of connection of the branch duct to the exhaust duct.

2.2. If the branch connection is made to the portion of the ductwork that will contain the fire-extinguishing medium, then the fire dampers required in Exception 2.1 shall be arranged to close automatically upon the operation of the fire-extinguishing system.

2.3. The branch connection shall be made in either the top or sides of the main duct in a manner to prevent grease from flowing into the branch duct.

2.4. The branch ducts shall be constructed of steel, aluminum, or copper of the gages and weights required in Chapter 6, and they shall be insulated with 2 inches (51 mm) of magnesia or other material having equivalent insulative and fire resistance qualities.

2.5. All registers in these branches shall have fusible link actuated dampers.

2.6. Where branch ductwork is to be used to exhaust vapors from dishwashers, pot sinks, or other similar equipment of a commercial type from which moisture is emitted, copper or aluminum of the minimum gage and weights required in Chapter 6 shall be used. Such ductwork shall be installed so that condensate cannot leak from it.

2.7 Type I and Type II exhaust systems can be interconnected downstream of filters with a fire damper at the connection to the exhaust system.

506.3.6 Grease duct clearances.

Where enclosures are not required, grease duct systems and exhaust equipment serving a Type I hood shall have a clearance to combustible construction of not less than 18 inches (457 mm), and shall have a clearance to noncombustible construction and gypsum wallboard attached to noncombustible structures of not less than 3 inches (76 mm).

Exceptions:

1. For factory-built commercial kitchen grease ducts ' listed and labeled in accordance with UL 1978, the required clearance shall be in accordance with the listing of such material and as approved by the commissioner.

2. Listed and labeled exhaust equipment installed in accordance with Section 304.1.

3. Where commercial kitchen grease ducts are continuously covered on all sides with a listed and labeled field-applied grease duct enclosure material, system, product or method of construction specifically evaluated for such purpose in accordance with ASTM E 2336, the required clearance shall be in accordance with the listing of such material, system, product or method.

4. Grease ducts protected with a minimum insulation covering of 2 inches (51 mm) of magnesium or calcium silicate block, with staggered joints, attached with galvanized steel wire or material assembly equivalent in insulating and fire-resistant qualities which cannot be penetrated by grease. Such protection shall be applied to all ducts inside of the building as approved by the commissioner.

506.3.7 Prevention of grease accumulation in grease ducts.

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 not be less than one unit vertical in 12 units horizontal (8.3-percent slope). Dampers shall not be installed in the grease duct systems, except as required by Section 506.3.5, Exception 2.

506.3.7.1 Residue trap.

A residue trap shall be provided at the base of each vertical riser with provision for cleanout in accordance with NFPA 96.

506.3.8 Grease duct 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 provided at every change indirection, within 3 feet (914 mm) of the exhaust fan, and as required under Section 506.3.9. 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 shall have a gasket or sealant that is noncombustible and liquid tight, 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. Signage shall be provided at all required access doors and openings in accordance with Section 506.3.11.

506.3.8.1 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 22 inches by 20 inches (559 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 506.3.8 are not required. Where personnel entry is not possible for cleaning the interior of vertical ducts, suitable provisions shall be made to clean the vertical duct in its entirety as well as for cleaning the base of the vertical riser.

506.3.8.2 Cleanouts serving in-line fans.

A suitable cleanout shall be provided for both the inlet side and outlet side of an in-line fan except where a duct does not connect to the fan. Such cleanouts shall be located within 3 feet (914 mm) of the fan duct connections to permit a thorough cleaning of the inlet and discharge ducts connected to the in-line fan as well as the interior of the fan itself.

Exception: Where suitable cleanouts for in-line fans cannot be provided, the in-line fan shall be of "clam shell" construction which shall permit the fan to be opened and thoroughly cleaned while remaining in place.

506.3.9 Grease duct horizontal cleanouts.

Cleanouts located on horizontal sections of ducts shall be spaced not more than 20 feet (6096 mm) apart, unless the opening prescribed by Section 506.3.8.1 is not possible, in which case openings large enough to permit thorough cleaning shall be provided at 12-foot (3658 mm) intervals. 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.

506.3.10 Grease duct enclosure.

A grease duct serving a Type I hood that penetrates a ceiling, wall or floor shall be enclosed from the first point of penetration to the outlet terminal. A duct shall penetrate exterior walls only at locations where unprotected openings are permitted by the *New York City Building Code.* The duct enclosure shall serve a single grease duct and shall not contain other ducts, piping or wiring systems. Duct enclosures shall be either field-applied or factory-built. Duct enclosures shall have a fire-resistance rating not less than that of the fire-resistance rated assembly penetrated, but need not exceed 2 hours. Duct enclosures shall be as prescribed by Section 506.3.10.1, 506.3.10.2 or 506.3.10.3.

506.3.10.1 Shaft enclosure.

Commercial kitchen grease ducts constructed in accordance with Section 506.3.1 shall be permitted to be enclosed in accordance with the *New York City Building Code* requirements for shaft construction. Such grease duct systems and exhaust equipment shall have a clearance to combustible construction of not less than 18 inches (457 mm), and shall have a clearance to noncombustible construction and gypsum wallboard attached to noncombustible structures of not less than 6 inches (152 mm). Duct enclosures 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.

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, which material, system, method of construction or product is approved by the commissioner and installed according to the manufacturer's instructions. Exposed duct wrap systems shall be protected where subject to physical damage.

2. As an alternative to Exception 1 of this section, a minimum insulation covering of 2 inches (51 mm) of magnesium or calcium silicate block, with staggered joints, attached with galvanized steel wire or material assembly equivalent in insulating and fire-resistant qualities which cannot be penetrated by grease, and as approved by the commissioner, shall be applied to all ducts inside of the building.

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

4. A listed and labeled factory-built commercial kitchen grease duct system, evaluated as an enclosure system for reduced clearances to combustibles, and approved by the commissioner and installed according to manufacturer's instructions.

506.3.10.2 Field-applied grease duct enclosure.

Commercial kitchen grease ducts constructed in accordance with Section 506.3.1 shall be enclosed by a field-applied grease duct enclosure that is a listed and labeled material, system, product or method of construction specifically evaluated for such purpose in accordance with ASTM E 2336. The surface of the duct shall be continuously covered on all sides from the point at which the duct originates to the outlet terminal. Duct penetrations shall be protected with a through-penetration firestop system classified in accordance with ASTM E 814 or UL 1479 and having an "F" and "T" rating equal to the fire-resistance rating of the assembly being penetrated. Such systems shall be installed in accordance with the listing and the manufacturer's installation instructions. Exposed duct wrap systems shall be protected where subject to physical damage.

506.3.10.3 Factory-built grease duct assemblies.

Factory-built grease duct assemblies incorporating integral enclosure materials shall be listed and labeled for use as commercial kitchen grease duct assemblies in accordance with UL 2221. Duct penetrations shall be protected with a through-penetration firestop system classified in accordance with ASTM E 814 or UL 1479 and having an "F" and "T" rating equal to the fire-resistance rating of the assembly being penetrated. Such assemblies shall be installed in accordance with the listing and the manufacturer's installation instructions.

506.3.10.4 Duct enclosure not required.

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

506.3.11 Grease duct fire-resistive access opening.

Where cleanout openings are located in ducts within a fire-resistance-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." Cleanout openings provided in ducts that are not located within a fire-resistance-rated enclosure shall be provided with signage at the required opening that contains the same wording.

506.3.12 Exhaust outlets serving Type I hoods.

Exhaust outlets for grease ducts serving Type I hoods shall conform to the requirements of Sections 506.3.12.1 through 506.3.12.3.

506.3.12.1 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. The exhaust flow shall be directed away from the surface of the roof.

506.3.12.2 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 *New York City Building Code.* Other exterior openings shall not be located within 3 feet (914 mm) of such terminations.

506.3.12.3 Termination location.

Exhaust outlets shall be located not less than 10 feet (3048 mm) horizontally from parts of the same or contiguous buildings, adjacent buildings and adjacent property lines and shall be located not less than 10 feet (3048 mm) above the adjoining grade level. Exhaust outlets shall be located not less than 10 feet (3048 mm) horizontally from and not less than 3 feet (914 mm) above air intake openings into any building.

Exception: Exhaust outlets shall terminate not less than 5 feet (1524 mm) from parts of the same or contiguous building, an adjacent building, adjacent property line and air intake openings into a building where air from the exhaust outlet discharges away from such locations.

506.4 Ducts serving Type II hoods.

Single or combined Type II exhaust systems for food-processing operations shall be independent of all other exhaust systems. Commercial kitchen exhaust systems serving Type II hoods shall comply with Sections 506.4.1 and 506.4.2.

506.4.1 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.

506.4.2 Type II terminations.

Exhaust outlets serving Type II hoods shall terminate in accordance with the hood manufacturer's installation instructions and shall comply with all of the following:

1. Exhaust outlets shall terminate not less than 3 feet (914 mm) in any direction from openings into the building.
2. Outlets shall terminate not less than 10 feet (3048 mm) from property lines or buildings on the same lot.
3. Outlets shall terminate not less than 10 feet (3048 mm) above grade.
4. Outlets that terminate above a roof shall terminate not less than 30 inches (762 mm) above the roof's surface.
5. Outlets shall terminate not less than 30 inches (762 mm) from exterior vertical walls.
6. Outlets shall be protected against local weather conditions.
7. Outlets shall not be directed onto walkways.
8. Outlets shall be in accordance with the provisions for exterior wall opening protectives in the *New York City Building Code.*

506.4.2.1 Cooking spaces.

For all buildings other than those classified as residential occupancy, a minimum of No. 16 Gage for galvanized sheet duct shall be used for nongrease duct exhaust applications.

506.5 Exhaust equipment.

Exhaust equipment, including fans and grease reservoirs, shall comply with Section 506.5.1through 506.5.5 and shall be of an approved design or shall be listed for the application.

506.5.1 Exhaust fans.

Exhaust fan housings serving a Type I hood shall be constructed as required for grease ducts in accordance with Section 506.3.1.1.

Exception: Fans listed and labeled in accordance with UL 762.

506.5.1.1 Fan motor.

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

506.5.2 Exhaust fan discharge.

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 serving a Type 1 hood shall be manufactured with an approved drain outlet at the lowest point of the housing to permit drainage of grease to an approved grease reservoir.

506.5.3 Exhaust fan mounting.

An upblast fan shall be hinged and supplied with a flexible weatherproof electrical cable to permit inspection and cleaning. The ductwork shall extend a minimum of 18 inches (457 mm) above the roof surface.

506.5.4 [Reserved.]

506.5.5 Termination location.

The outlet of exhaust equipment serving Type I hoods, shall be in accordance with Section 506.3.12.

Exception: 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.

506.5.6 Exhaust fan operation.

The operation of the exhaust fan shall be in accordance with the following requirements:

1. The hood exhaust fan(s) shall continue to operate after the extinguishing system has been activated unless fan shutdown is required by a listed component of the ventilation system or by the design of the extinguishing system.
2. The hood exhaust fan shall not be required to start automatically upon activation of the extinguishing system if the exhaust fan and all cooking equipment served by the fan have previously been shut down.
3. The cooking appliances shall be interlocked with the exhaust hood system to prevent appliance operation when the exhaust hood system is not operating.

506.6 Exterior duct installations.

The installation of exterior ducts shall comply with the following requirements:

1. The exterior portion of the ductwork shall be vertical wherever possible and shall be installed and supported on the exterior of a building.
2. Bolts, screws, rivets, and other mechanical fasteners shall not penetrate duct walls.
3. Clearance of any ducts shall comply with Section 506.3.6.
4. All ducts shall be protected on the exterior by paint or other suitable weather-protective coating.
5. Ducts constructed of stainless steel shall not be required to have additional paint or weather-protective coatings.
6. Ductwork subject to corrosion shall have minimal contact with the building surface.

506.7 Identification of ducts.

All duct systems serving Type I and Type II exhaust equipment shall be permanently labeled: "CAUTION: KITCHEN EXHAUST SYSTEM."

Section MC 507: Commercial Kitchen Hoods

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. Commercial kitchen exhaust hood systems shall operate at all times while cooking equipment is in operation. For additional interlock requirements pertaining to gas appliances, refer to Section 505.1 of the *New York City Fuel Gas Code.*

Exceptions:

1. Factory-built commercial exhaust hoods which are tested in accordance with UL 710, listed, labeled and installed in accordance with Section 304.1 shall not be required to comply with Sections 507.4, 507.7, 507.11, 507.12, 507.13, 507.14 and 507.15.

2. Hoods used with electric cooking equipment shall be in accordance with UL 710B and have a grease removal and fire suppression system.

3. Net exhaust volumes for hoods shall be permitted to be reduced during part-load cooking conditions, where engineered or listed multispeed or variable-speed controls automatically operate the exhaust system to maintain capture and removal of cooking effluents as required by this section. Reduced volumes shall not be below that required to maintain capture and removal of effluents from the idle cooking appliances that are operating in a standby mode.

507.2 Where required.

A Type I or Type II hood shall be installed at or above all commercial cooking appliances in accordance with Sections 507.2.1 and 507.2.2. Where any cooking appliance at or under a single hood requires a Type I hood, a Type I hood shall be installed. Where a Type II hood is required, a Type I or Type II hood shall be installed.

507.2.1 Type I hoods.

Type I hoods shall be installed where cooking appliances produce grease or smoke. Type I hoods shall be installed over medium-duty, heavy-duty and extra-heavy-duty cooking appliances. Type I hoods shall be installed over light-duty cooking appliances that produce grease or smoke.

507.2.1.1 Operation.

Type I hood systems shall be designed and installed to automatically activate the exhaust fan whenever cooking operations occur. The activation of the exhaust fan shall occur through an interlock with the cooking appliances, by means of heat sensors or by means of other approved methods. Commercial cooking appliances equipped with integral down draft exhaust shall meet the requirements of Section 507.2

507.2.2 Type II hoods.

Type II hoods shall be installed above dishwashers and light-duty appliances that produce heat or moisture and do not produce grease or smoke, except where the heat and moisture loads from such appliances are incorporated into a separate removal system. Type II hoods shall be installed above all light-duty appliances that produce products of combustion and do not produce grease or smoke. Spaces containing cooking appliances that do not require Type II hoods shall be ventilated in accordance with Section 403.3. For the purpose of determining the floor area required to be ventilated, each individual appliance that is not required to be installed under a Type II hood shall be considered as occupying not less than 100 square feet (9.3 m^2). Type II hoods or heat and water exhaust systems installed in accordance with the manufacturer's recommendations are required for commercial dishwashers and pot washer equipment.

507.2.3 Domestic cooking appliances used for commercial purposes.

Domestic cooking appliances utilized for commercial purposes shall be provided with Type I or Type II hoods as required for the type of appliances and processes in accordance with Sections 507.2, 507.2.1 and 507.2.2.

507.2.4 Extra-heavy-duty.

Type I hoods for use over—extra-heavy-duty cooking appliances shall not cover heavy-, medium- or light-duty appliances. Such hoods shall discharge to an exhaust system that is independent of other exhaust systems.

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.

507.4 Type I materials.

Type I hoods shall be constructed of steel having a minimum thickness of 0.0466 inch (1.18 mm) (No. 18 gage) or stainless steel not less than 0.0335 inch (0.8525 mm) (No. 20 MSG) in thickness.

507.5 Type II hood materials.

Type II hoods shall be constructed of steel having a minimum thickness of 0.0296 inch (0.7534 mm) (No. 22 gage) or stainless steel not less than 0.0220 inch (0.5550 mm) (No. 24 gage) in thickness, copper sheets weighing not less than 24 ounces per square foot (7.3 kg/m^2) or of other approved material and gage.

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.

507.7 Hood joints, seams and penetrations.

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

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.

507.7.2 Type II hoods.

Joints, seams and penetrations for Type II hoods shall be constructed as set forth in Chapter 6, shall be sealed on the interior of the hood and shall provide a smooth surface that is readily cleanable and water tight.

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.

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 or 1/2-inch (12.7 mm) or thicker cementitious wallboard attached to noncombustible structures provided that a smooth, cleanable, nonabsorbent and noncombustible material is installed between the hood and the gypsum or cementitious wallboard over an area extending not less than 18 inches (457 mm) in all directions from the hood.

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 506.3.10.

507.11 Grease filters.

Type I hoods shall be equipped with UL 1046 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 507.11.

Table 507.11

Minimum Distance Between the Lowest Edge of a Grease Filter

and the Cooking Surface or the Heating Surface

Type of Cooking Appliance	Height Above Cooking Surface (feet)
Without exposed flame	0.5
Exposed flame and burners	2
Exposed charcoal and charbroil type	3.5

For SI: 1 foot = 304.8 mm.

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.

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.

507.11.3 Filter servicing.

Filters shall be serviced and replaced regularly by qualified employees of the owner or by a cleaning agency. A record indicating the name of the person or firm doing the servicing and the dates when filters were cleaned or replaced shall be available for inspection by the commissioner. They shall be cleaned or replaced as frequently as necessary, but at least every three months, and no exhaust system shall be operated while cooking is being carried on without the filters installed in place.

507.12 Canopy size and location.

The inside lower edge of canopy-type Type I and II commercial hoods shall overhang or extend a horizontal distance of not less than 6 inches (152 mm) beyond the edge of the top horizontal surface of the appliance on all open sides. The vertical distance between the front lower lip of the hood and such 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.

507.13 Capacity of hoods.

Commercial food service hoods shall exhaust a minimum net quantity of air determined in accordance with this section and Sections 507.13.1 through 507.13.5. The net quantity of exhaust air shall be calculated by subtracting any airflow supplied directly to a hood cavity from the total exhaust flow rate of a hood. Where any combination of heavy-duty, medium-duty and light-duty cooking appliances are utilized under a single hood, the exhaust rate required by this section for the heaviest duty appliance covered by the hood shall be used for the entire hood.

507.13.1 Extra-heavy-duty cooking appliances.

The minimum net airflow for hoods, as determined by Section 507.2, used for extra-heavy-duty cooking appliances shall be determined as follows:

Type of Hood	CFM per linear foot of hood
Backshelf/pass-over	Not allowed
Double island canopy (per side)	550
Eyebrow	Not allowed
Single island canopy	700
Wall-mounted canopy	550

For SI: 1 cfm per linear foot = 1.55 L/s per linear meter.

507.13.2 Heavy-duty cooking appliances.

The minimum net airflow for hoods, as determined by Section 507.2, used for heavy-duty cooking appliances shall be determined as follows:

Type of Hood	CFM per linear foot of hood

Backshelf/pass-over	400
Double island canopy (per side)	400
Eyebrow	Not allowed
Single island canopy	600
Wall-mounted canopy	400

For SI: 1 cfm per linear foot = 1.55 L/s per linear meter.

507.13.3 Medium-duty cooking appliances.

The minimum net airflow for hoods, as determined by Section 507.2, used for medium-duty cooking appliances shall be determined as follows:

Type of Hood	CFM per linear foot of hood
Backshelf/pass-over	300
Double island canopy (per side)	300
Eyebrow	250
Wall-mounted canopy	300
Single island canopy	500

For SI: 1 cfm per linear foot = 1.55 L/s per linear meter.

507.13.4 Light-duty cooking appliances.

The minimum net airflow for hoods, as determined by Section 507.2, used for light-duty cooking appliances and food service preparation shall be determined as follows:

Type of Hood	CFM per linear foot of hood
Backshelf/pass-over	250
Double island canopy (per side)	250
Eyebrow	250
Single island canopy	400
Wall-mounted canopy	200

For SI: 1 cfm per linear foot = 1.55 L/s per linear meter.

507.13.5 Dishwashing appliances.

The minimum net airflow for Type II hoods used for dishwashing appliances shall be 100 CFM per linear foot of hood length.

Exception: Dishwashing appliances and equipment installed in accordance with Section 507.2.2.

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.

507.15 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.

507.16 Performance test.

A performance test shall be conducted upon completion of and before final approval of the installation of a ventilation system serving commercial cooking appliances. The test shall verify the rate of exhaust airflow required by Section 507.13, makeup airflow required by Section 508, and proper operation as specified in this chapter. The permit holder shall furnish the necessary test equipment and devices required to perform the tests. The performance test shall be witnessed by a special inspector.

Section MC 508: Commercial Kitchen Makeup Air

508.1 Makeup air.

Makeup air shall be supplied during the operation of commercial kitchen exhaust systems that are provided for commercial cooking appliances. The amount of makeup air supplied to the building from all sources shall be approximately equal to the amount of exhaust air for all exhaust systems for the building. The makeup air shall not reduce the effectiveness of the exhaust system. Makeup air shall be provided by gravity or mechanical means or both. Mechanical makeup air systems shall be automatically controlled to start and operate simultaneously with the exhaust system. Makeup air intake opening locations shall comply with Section 401.4.

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) except where the added heating and cooling loads of the makeup air do not exceed the capacity of the HVAC system.

508.2 Compensating hoods.

Manufacturers of compensating hoods shall provide a label indicating minimum exhaust flow and/or maximum makeup airflow that provides capture and containment of the exhaust effluent.

Exception: Compensating hoods with makeup air supplied only from the front face discharge and side face discharge openings shall not be required to be labeled with the maximum makeup airflow.

Section MC 509: Fire Suppression Systems

509.1 Where required.

Commercial cooking appliances required by Section 507.2.1 to have a Type I hood shall be provided with an approved automatic fire suppression system complying with the *New York City Building Code* and the *New York City Fire Code*.

Section MC 510: Hazardous Exhaust Systems

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. For the purposes of the provisions of Section 510, a laboratory shall be defined as a building or portion thereof wherein chemicals or gases are used or synthesized on a nonproduction basis for testing, research, experimental, instructional or educational purposes.

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.

Exception: Laboratories, as defined in Section 510.1, except where the concentrations listed in Item 1 are exceeded, or a vapor, gas, fume, mist or dust with a health-hazard rating of 1, 2, 3 or 4 is present in concentrations exceeding 1 percent of the median lethal concentration of the substance for acute inhalation toxicity.

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 *New York City Fire Code.* Equipment and systems that are used to collect, process or convey combustible dusts shall be provided with an approved explosion-control system.

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 this code and the *New York City Fire Code.*

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.

510.4 Independent system.

Hazardous exhaust systems shall be independent of other types of exhaust systems. Incompatible materials, as defined in the *New York City 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.

Exception: The provision of this section shall not apply to laboratory exhaust systems where all of the following conditions apply:

1. All of the hazardous exhaust ductwork and other laboratory exhaust within both the occupied space and the shafts are under negative pressure while in operation.

2. The hazardous exhaust ductwork manifolded together within the occupied space must originate within the same fire area.

3. Each control branch has a flow regulating device.

4. Perchloric acid hoods and connected exhaust shall be prohibited from manifolding.

5. Radioisotope hoods are equipped with filtration and/or carbon beds where required by the registered design professional.

6. Biological safety cabinets are filtered.

7. Provision is made for continuous maintenance of negative static pressure in the ductwork.

Contaminated air shall not be recirculated to occupiable areas. Air containing explosive or flammable vapors, fumes or dusts; flammable, highly toxic or toxic gases; or radioactive material shall be considered to be contaminated.

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.

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 air flow shall be provided with securely fixed minimum-position blocking devices to prevent restricting flow below the required volume or velocity.

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.

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.

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 510.2 with air that does not contain other hazardous contaminants.

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.

510.5.6 Clearances.

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

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.

510.6 Penetrations.

Penetrations of structural elements by a hazardous exhaust system shall conform to Sections 510.6.1 through 510.6.4.

Exception: Duct penetrations within H-5 occupancies as allowed by the *New York City Building Code.*

510.6.1 Fire dampers and smoke dampers.

Fire dampers and smoke dampers are prohibited in hazardous exhaust ducts.

510.6.2 Floors.

Hazardous exhaust systems that penetrate a floor/ceiling assembly shall be enclosed in a fire-resistance-rated shaft constructed in accordance with the *New York City Building Code.*

510.6.3 Wall assemblies.

Hazardous exhaust duct systems that penetrate fire-resistance-rated wall assemblies shall be enclosed in fire-resistance-rated construction from the point of penetration to the outlet terminal, except where the interior of the duct is equipped with an approved automatic fire suppression system. Ducts shall be enclosed in accordance with the *New York City Building Code* requirements for shaft construction and such enclosure shall have a minimum fire-resistance-rating of not less than the highest fire-resistance-rated wall assembly penetrated.

510.6.4 Fire walls.

Ducts shall not penetrate a fire wall.

510.7 Suppression required.

Ducts shall be protected with an approved automatic fire suppression system installed in accordance with the *New York City Building Code.*

Exceptions:

1. An approved automatic fire suppression system shall not be required in ducts conveying materials, fumes, mists and vapors that are nonflammable and noncombustible under all conditions and at any concentrations.

2. An approved automatic fire suppression system shall not be required in ducts where the largest cross-sectional diameter of the duct is less than 10 inches (254 mm).

3. For laboratories, as defined in Section 510.1, approved automatic fire suppression systems shall not be required in laboratory hoods or exhaust systems.

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 510.8. Nonmetallic ducts utilized in systems exhausting nonflammable corrosive fumes or vapors shall be listed and labeled. Nonmetallic ducts 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 or UL 723. 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 510.8

Minimum Duct Thickness

Diameter of Duct of Maximum Side Dimension	Minimum Nominal Thickness		
	Nonabrasive Materials	Nonabrasive/ AbrasiveMaterials	Abrasive Materials
0-8 inches	0.028 inch (No. 24 Gage)	0.034 inch (No. 22 Gage)	0.040 inch (No. 20 Gage)
9-18 inches	0.034 inch (No. 22 Gage)	0.040 inch (No. 20 Gage)	0.052 inch (No. 18 Gage)
19-30 inches	0.040 inch (No. 20 Gage)	0.052 inch (No. 18 Gage)	0.064 inch (No. 16 Gage)
Over 30 inches	0.052 inch (No. 18 gage)	0.064 inch (No. 16 gage)	0.079 inch (No. 14 inch)

For SI: 1 inch = 25.4 mm.

510.8.1 Duct joints.

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

510.8.2 Clearance to combustibles.

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

Table 510.8.2

Clearance to Combustibles

Type of Exhaust or Temperature of 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.

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.

510.9 Supports.

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

Section MC 511: Dust, Stock and Refuse Conveying Systems

511.1 Dust, stock and refuse conveying systems.

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

511.1.1 Collectors and separators.

Collectors and separators involving such systems as centrifugal separators, bag filter systems and similar devices, 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).

Exceptions:

1. Collectors such as "Point of Use" collectors, close extraction weld fume collectors, spray finishing booths, stationary grinding tables, sanding booths, and integrated or machine-mounted collectors shall be permitted to be installed indoors provided the installation is in accordance with the New York City Fire Code and NFPA 70.

2. Collectors in independent exhaust systems handling combustible dusts shall be permitted to be installed indoors provided that such collectors are installed in compliance with the New York City Fire Code and NFPA 70.

511.1.2 Discharge pipe.

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

511.1.3 Conveying systems exhaust discharge.

An exhaust system shall discharge to the outside of the building either directly by flue or indirectly through the, bin or vault into which the system discharges except where the contaminants have been removed. Exhaust system discharge shall be permitted to be recirculated provided that the solid particulate has been removed at a minimum efficiency of 99.9 percent at 10 microns (10.01 mm), vapor concentrations are less than 25 percent of the LFL, and approved equipment is used to monitor the vapor concentration.

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.

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 *New York City Building Code.*

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.

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.

511.2 Exhaust outlets.

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

Table 511.2

Construction Clearance and Termination Requirements for Single-Wall Metal Dust, Stock and Refuse Conveying Systems

	Minimum Thickness	Termination	Clearance

Serving Temperature Range	Walls (inch)	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.
High-heat appliances (Over 2,000°F)[a]	0.127 (No. 10 MSG)	4 1/2" laid on 4 1/2" bed	20	—	—	20	See Note c			
Low-heat appliances (1,000°F normal operation)	0.127 (No. 10 MSG)	None	3	2	—	—	18	6	Up to 18" diameter, 2" Over 18" diameter, 4"	
Medium-heat appliances (2,000°F maximum)[b]	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"	

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).

Section MC 512: Subslab Soil Exhaust Systems

512.1 General.

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

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 *New York City 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.

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).

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.

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.

Section MC 513: Smoke Control Systems

513.1 Scope and purpose.

This section applies to mechanical and passive smoke control systems that are required by the *New York City Building Code*. The purpose of this section is to establish minimum requirements for the design, installation and acceptance testing of smoke control systems that are intended to provide a tenable environment for the evacuation or relocation of occupants. These provisions are not intended for the preservation of contents, the timely restoration of operations, or for assistance in fire suppression or overhaul activities. Smoke control systems regulated by this section serve a different purpose than the smoke- and heat-venting provisions found in Section 910 of the *New York City Building Code.*

513.2 General design requirements.

Buildings, structures, or parts thereof required by this code to have a smoke control system or systems shall have such systems designed in accordance with the applicable requirements of Section 909 of the *New York City Building Code* and the generally accepted and well-established principles of engineering relevant to the design. The construction documents shall include sufficient information and detail to describe adequately the elements of the design necessary for the proper implementation of the smoke control systems. These documents shall be accompanied with sufficient information and analysis to demonstrate compliance with these provisions

513.3 Special inspection and test requirements.

In addition to the ordinary inspection and test requirements which buildings, structures and parts thereof are required to undergo, smoke control systems subject to the provisions of Section 909 of the *New York City Building Code* shall undergo special inspections and tests sufficient to verify the proper commissioning of the smoke control design in its final installed condition. The design submission accompanying the construction documents shall clearly detail procedures and methods to be used and the items subject to such inspections and tests. Such commissioning shall be in accordance with generally accepted engineering practice and, where possible, based on published standards for the particular testing involved. The special inspections and tests required by this section shall be conducted under the same terms as found in Section 1704 of the *New York City Building Code*.

513.4 Analysis.

A rational analysis supporting the types of smoke control systems to be employed, their methods of operation, the systems supporting them, and the methods of construction to be utilized shall accompany the submitted construction documents and shall include, but not be limited to, the items indicated in Sections 513.4.1 through 513.4.6.

513.4.1 Stack effect.

The system shall be designed such that the maximum probable normal or reverse stack effects will not adversely interfere with the system's capabilities. In determining the maximum probable stack effects, altitude, elevation, weather history and interior temperatures shall be used.

513.4.2 Temperature effect of fire.

Buoyancy and expansion caused by the design fire in accordance with Section 513.9 shall be analyzed. The system shall be designed such that these effects do not adversely interfere with its capabilities.

513.4.3 Wind effect.

The design shall consider the adverse effects of wind. Such consideration shall be consistent with the wind-loading provisions of the *New York City Building Code*.

513.4.4 HVAC systems.

The design shall consider the effects of the heating, ventilating and air-conditioning (HVAC) systems on both smoke and fire transport. The analysis shall include all permutations of systems' status. The design shall consider the effects of fire on the HVAC systems.

513.4.5 Climate.

The design shall consider the effects of low temperatures on systems, property and occupants. Air inlets and exhausts shall be located so as to prevent snow or ice blockage.

513.4.6 Duration of operation.

All portions of active or passive smoke control systems shall be capable of continued operation after detection of the fire event for a period of not less than 20 minutes and 1.5 times the calculated egress time, whichever is more.

513.5 Smoke barrier construction.

Smoke barriers shall comply with the *New York City Building Code*. Smoke barriers shall be constructed and sealed to limit leakage areas exclusive of protected openings. The maximum allowable leakage area shall be the aggregate area calculated using the following leakage area ratios:

1.	Walls:	$A/A_W = 0.00100$
2.	Exit enclosures:	$A/A_W = 0.00035$
3.	All other shafts:	$A/A_W = 0.00150$
4.	Floors and roofs:	$A/A_F = 0.00050$

where:

A	=	Total leakage area, square feet (m^2).
A_F	=	Unit floor or roof area of barrier, square feet (m^2).
A_W	=	Unit wall area of barrier, square feet (m^2).

The leakage area ratios shown do not include openings due to doors, operable windows or similar gaps. These shall be included in calculating the total leakage area.

513.5.1 Leakage area.

Total leakage area of the barrier is the product of the smoke barrier gross area times the allowable leakage area ratio, plus the area of other openings such as gaps and operable windows. Compliance shall be determined by achieving the minimum air pressure difference across the barrier with the system in the smoke control mode for mechanical smoke control systems. Passive smoke control systems tested using other approved means such as door fan testing shall be as approved by the commissioner.

513.5.2 Opening protection.

Openings in smoke barriers shall be protected by automatic-closing devices actuated by the required controls for the mechanical smoke control system. Door openings shall be protected by door assemblies complying with the requirements of the *New York City Building Code* for doors in smoke barriers.

Exceptions:

1. Passive smoke control systems with automatic-closing devices actuated by spot-type smoke detectors listed for releasing service installed in accordance with the *New York City Building Code.*

2. Fixed openings between smoke zones which are protected utilizing the airflow method.

3. In Group I-2 where such doors are installed across corridors, a pair of opposite-swinging doors without a center mullion shall be installed having vision panels with approved fire-rated glazing materials in approved fire-rated frames, the area of which shall not exceed that tested. The doors shall be close-fitting within operational tolerances, and shall not have undercuts, louvers or grilles. The doors shall have head and jamb stops, astragals or rabbets at meeting edges and automatic-closing devices. Positive latching devices are not required.

4. Group I-3.

5. Openings between smoke zones with clear ceiling heights of 14 feet (4267 mm) or greater and bank down capacity of greater than 20 minutes as determined by the design fire size.

513.5.2.1 Ducts and air transfer openings.

Ducts and air transfer openings are required to be protected with a minimum Class II, 250°F (121°C) smoke damper complying with the *New York City Building Code.*

513.6 Pressurization method.

The primary mechanical means of controlling smoke shall be by pressure differences across smoke barriers. Maintenance of a tenable environment is not required in the smoke control zone of fire origin.

513.6.1 Minimum pressure difference.

The minimum pressure difference across a smoke barrier shall be 0.05-inch water Gage (12.4 Pa) in fully sprinklered buildings. In buildings permitted to be other than fully sprinklered, the smoke control system shall be designed to achieve pressure differences at least two times the maximum calculated pressure difference produced by the design fire.

513.6.2 Maximum pressure difference.

The maximum air pressure difference across a smoke barrier shall be determined by required door-opening or closing forces. The actual force required to open exit doors when the system is in the smoke control mode shall be in accordance with the *New York City Building Code.* Opening and closing forces for other doors shall be determined by standard engineering methods for the resolution of forces and reactions. The calculated force to set a side-hinged, swinging door in motion shall be determined by:

$F = F_{dc}+K(WA\Delta P)/2(W-d)$ **(Equation 5-2)**

where:

A = Door area, square feet (m^2).

d = Distance from door handle to latch edge of door, feet (m).

F = Total door opening force, pounds (N).

F_{dc} = Force required to overcome closing device, pounds (N).

K = Coefficient 5.2 (1.0).

W = Door width, feet (m).

ΔP = Design pressure difference, inches (Pa) water gage.

513.7 Airflow design method.

When approved by the commissioner, smoke migration through openings fixed in a permanently open position, which are located between smoke control zones by the use of the airflow method, shall be permitted. The design airflows shall be in accordance with this section. Air-flow shall be directed to limit smoke migration from the fire zone. The geometry of openings shall be considered to prevent flow reversal from turbulent effects.

513.7.1 Velocity.

The minimum average velocity through a fixed opening shall not be less than:

$v = 217.2\ [h(T_f-T_O)/(T_f + 460)]^{1/2}$ **(Equation 5-3)**

For SI: $v = 119.9\ [h(T_f-T_O)/T_f]^{1/2}$

where:

h = Height of opening, feet (m).

T_f = Temperature of smoke, °F (K).

T_O = Temperature of ambient air, °F (K).

v = Air velocity, feet per minute (m/minute).

513.7.2 Prohibited conditions.

This method shall not be employed where either the quantity of air or the velocity of the airflow will adversely affect other portions of the smoke control system, unduly intensify the fire, disrupt plume dynamics or interfere with exiting. In no case shall airflow toward the fire exceed 200 feet per minute (1.02 m/s). Where the formula in Section 513.7.1 requires airflow to exceed this limit, the airflow method shall not be used.

513.8 Exhaust method.

When approved by the commissioner, mechanical smoke control for large enclosed volumes, such as in atriums or malls, shall be permitted to utilize the exhaust method. Smoke control systems using the exhaust method shall be designed in accordance with NFPA 92B.

513.8.1 Exhaust rate.

The height of the lowest horizontal surface of the accumulating smoke layer shall be maintained at least 6 feet (1829 mm) above any walking surface which forms a portion of a required egress system within the smoke zone.

513.9 Design fire.

The design fire shall be based on a rational analysis performed by the registered design professional and approved by the commissioner. The design fire shall be based on the analysis in accordance with Section 513.4 and this section.

513.9.1 Factors considered.

The engineering analysis shall include the characteristics of the fuel, fuel load, effects included by the fire, and whether the fire is likely to be steady or unsteady.

513.9.2 Design fire fuel.

Determination of the design fire shall include consideration of the type of fuel, fuel spacing and configuration.

513.9.3 Heat-release assumptions.

The analysis shall make use of the best available data from approved sources and shall not be based on excessively stringent limitations of combustible material.

513.9.4 Sprinkler effectiveness assumptions.

A documented engineering analysis shall be provided for conditions that assume fire growth is halted at the time of sprinkler activation.

513.10 Equipment.

Equipment such as, but not limited to, fans, ducts, automatic dampers and balance dampers shall be suitable for their intended use, suitable for the probable exposure temperatures that the rational analysis indicates, and as approved by the commissioner.

513.10.1 Exhaust fans.

Components of exhaust fans shall be rated and certified by the manufacturer for the probable temperature rise to which the components will be exposed. This temperature rise shall be computed by:

$$T_s = (Q_c / mc)\ (T_a) \qquad \textbf{(Equation 5-4)}$$

where:

c	=	Specific heat of smoke at smoke-layer temperature, Btu/lb°F (kJ/kg × K).
m	=	Exhaust rate, pounds per second (kg/s).
Q_c	=	Convective heat output of fire, Btu/s (kW).
T_a	=	Ambient temperature, °F (K).
T_s	=	Smoke temperature, °F (K).

Exception: Reduced T_s as calculated based on the assurance of inadequate dilution air.

513.10.2 Ducts.

Duct materials and joints shall be capable of withstanding the probable temperatures and pressures to which they are exposed as determined in accordance with Section 513.10.1. Ducts shall be constructed and supported in accordance with Chapter 6. Ducts shall be leak tested to 1.5 times the maximum design operating pressure in accordance with nationally accepted practices. Measured leakage shall not exceed 5 percent of design flow. Results of such testing shall be a part of the documentation procedure. Ducts shall be supported directly from fire-resistance-rated structural elements of the building by substantial, noncombustible supports.

Exception: Flexible connections, for the purpose of vibration isolation, that are constructed of approved fire-resistance-rated materials.

513.10.3 Equipment, inlets and outlets.

Equipment shall be located so as to not expose uninvolved portions of the building to an additional fire hazard. Outdoor air inlets shall be located so as to minimize the potential for introducing smoke or flame into the building. Exhaust outlets shall be so located as to minimize reintroduction of smoke into the building and to limit exposure of the building or adjacent buildings to an additional fire hazard.

513.10.4 Automatic dampers.

Automatic dampers, regardless of the purpose for which they are installed within the smoke control system, shall be listed and conform to the requirements of approved recognized standards.

513.10.5 Fans.

In addition to other requirements, belt-driven fans shall have 1.5 times the number of belts required for the design duty with the minimum number of belts being two. Fans shall be selected for stable performance based on normal temperature and, where applicable, elevated temperature. Calculations and manufacturer's fan curves shall be part of the documentation procedures. Fans shall be supported and restrained by noncombustible devices in accordance with the structural design requirements of the *New York City Building Code.* Motors driving fans shall not be operating beyond their nameplate horsepower (kilowatts) as determined from measurement of actual current draw. Motors driving fans shall have a minimum service factor of 1.15.

513.11 Power systems.

The smoke control system shall be supplied with two sources of power. Primary power shall be the normal building power systems. Secondary power shall be from an approved standby power source complying with the *New York City Electrical Code.* The standby power source and its transfer switches shall be in a room separate from the normal power transformers and switch gear and ventilated directly to and from the exterior. The room shall be enclosed with not less than 2-hour fire-resistance-rated fire barriers constructed in accordance with Section 707 of the *New York City Building Code* or horizontal assemblies constructed in accordance with Section 712 of *New York City Building Code,* or both. Power distribution from the two sources shall be by independent routes. Transfer to full standby power shall be automatic and within 60 seconds of failure of the primary power. The systems shall comply with the *New York City Electrical Code.*

513.11.1 Power sources and power surges.

Elements of the smoke management system relying on volatile memories or the like shall be supplied with integral uninterruptible power sources of sufficient duration to span 15-minute primary power interruption. Elements of the smoke management system susceptible to power surges shall be suitably protected by conditioners, suppressors or other approved means.

513.12 Detection and control systems.

Fire detection systems providing control input or output signals to mechanical smoke control systems or elements thereof shall comply with the requirements of Chapter 9 of the *New York City Building Code* and NFPA 72. Such systems shall be equipped with a control unit complying with UL 864 and listed as smoke control equipment. Control systems for mechanical smoke control systems shall include provisions for verification. Verification shall include positive confirmation of actuation, testing, manual override, the presence of power downstream of all disconnects and, through a preprogrammed weekly test sequence report, abnormal conditions audibly, visually and by printed report.

513.12.1 Wiring.

In addition to meeting the requirements of the *New York City Electrical Code,* all wiring, regardless of voltage, shall be fully enclosed within continuous raceways.

513.12.2 Activation.

Smoke control systems shall be activated in accordance with the *New York City Building Code.*

513.12.3 Automatic control.

Where completely automatic control is required or used, the automatic control sequences shall be initiated from an appropriately zoned automatic sprinkler system complying with Chapter 9 of the *New York City Building Code* or from manual controls that are readily accessible to the Fire Department, and any smoke detectors required by engineering analysis.

513.13 Control-air tubing.

Control-air tubing shall be of sufficient size to meet the required response times. Tubing shall be flushed clean and dry prior to final connections. Tubing shall be adequately supported and protected from damage. Tubing passing through concrete or masonry shall be sleeved and protected from abrasion and electrolytic action.

513.13.1 Materials.

Control-air tubing shall be hard-drawn copper, Type L, ACR in accordance with ASTM B 42, ASTM B 43, ASTM B 68, ASTM B 88, ASTM B 251 and ASTM B 280. Fittings shall be wrought copper or brass, solder type in accordance with ASME B 16.18 or ASME B 16.22. Changes in direction shall be made with appropriate tool bends. Brass compression-type fittings shall be used at final connection to devices; other joints shall be brazed using a BCuP5 brazing alloy with solids above 1,100°F (593°C) and liquids below 1,500°F (816°C). Brazing flux shall be used on copper-to-brass joints only.

Exception: Nonmetallic tubing used within control panels and at the final connection to devices provided all of the following conditions are met:

1. Tubing shall be listed by an approved agency for flame and smoke characteristics.

2. Tubing and connected device shall be completely enclosed within a galvanized or paint-grade steel enclosure having a minimum thickness of 0.0296 inch (0.7534 mm) (No. 22 gage). Entry to the enclosure shall be by copper tubing with a protective grommet of neoprene or Teflon or by suitable brass compression to male barbed adapter.

3. Tubing shall be identified by appropriately documented coding.

4. Tubing shall be neatly tied and supported within the enclosure. Tubing bridging cabinets and doors or moveable devices shall be of sufficient length to avoid tension and excessive stress. Tubing shall be protected against abrasion. Tubing serving devices on doors shall be fastened along hinges.

513.13.2 Isolation from other functions.

Control tubing serving other than smoke control functions shall be isolated by automatic isolation valves or shall be an independent system.

513.13.3 Testing.

Test control-air tubing at three times the operating pressure for not less than 30 minutes without any noticeable loss in gauge pressure prior to final connection to devices.

513.14 Marking and identification.

The detection and control systems shall be clearly marked at all junctions, accesses and terminations.

513.15 Control diagrams.

Identical control diagrams shall be provided and maintained as required by the *New York City Fire Code.*

513.16 Fire fighter's smoke control panel.

A fire fighter's smoke control panel for Fire Department emergency response purposes only shall be provided in accordance with the *New York City Fire Code.*

513.17 System response time.

Smoke control system activation shall comply with the *New York City Fire Code.*

513.18 Acceptance testing.

Devices, equipment, components and sequences shall be tested in accordance with the *New York City Fire Code.*

513.19 System acceptance.

Acceptance of the smoke control system shall be in accordance with the *New York City Fire Code.*

Section MC 514: Energy Recovery Ventilation Systems

514.1 General.

Energy recovery ventilation systems shall be installed in accordance with this section. Where required for purposes of energy conservation, energy recovery ventilation systems shall also comply with the *New York City Energy Conservation Code.*

514.2 Prohibited applications.

Energy recovery ventilation systems shall not be used in the following systems, unless specifically designed and/or listed for the specific applications and as part of an engineered system.

1. Hazardous exhaust systems covered in Section 510.
2. Dust, stock and refuse systems that convey explosive or flammable vapors, fumes or dust.
3. Smoke control systems covered in Section 513.
4. Commercial kitchen exhaust systems serving Type I and Type II hoods.
5. Clothes dryer exhaust systems covered in Section 504.

514.3 Access.

A means of access shall be provided to the heat exchanger and other components of the system as required for service, maintenance, repair or replacement.

Section MC 515: Post-fire Smoke Purge Systems

515.1 General.

Post-fire smoke purge systems shall be provided as required by Chapter 9 of the *New York City Building Code.*

Chapter 6: Duct Systems

Section MC 601: General

601.1 Scope.

Duct systems used for the movement of air in air-conditioning, heating, ventilating and exhaust systems shall conform to the provisions of this chapter except as otherwise specified in Chapters 5 and 7.

Exception: Ducts discharging combustible material directly into any combustion chamber shall conform to the requirements of NFPA 82.

601.2 Air movement in corridors.

Corridors shall not be used as a portion of direct supply, return, or exhaust air system serving adjoining areas. Air transfer opening(s) shall not be permitted in walls or in doors separating public corridors from adjoining areas.

Exceptions:

1. Where located within dwelling units, the use of corridors for conveying return air shall not be prohibited.
2. Where located within tenant spaces of 1,000 square feet (93 m^2) or less in area, the use of corridors for conveying return air is permitted.
3. Corridors in Group B office buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 of the *New York City Building Code*.
4. Incidental air movement from pressurized rooms within health care facilities, provided that the corridor is not the primary source of supply or return to the room.
5. Air transfer openings serving toilet rooms, bathrooms, shower rooms, sink closets, and similar auxiliary spaces opening onto the public corridor.
6. Group I-3 detention and correctional occupancies with corridor separations of open construction (e.g., grating doors or grating partitions).
7. Air transfer in openings because of pressure differential in Group I-2 health care occupancies from corridors is permitted.
8. Where door clearances do not exceed those specified for fire doors in the *New York City Building Code,* air transfer caused by pressure differentials shall be permitted.
9. Use of egress corridors as part of an engineered smoke control system is permitted.

601.2.1 Corridor ceiling.

Use of the space between the corridor ceiling and the floor or roof structure above as a return air plenum is permitted for one or more of the following conditions:

1. The corridor is not required to be of fire-resistance-rated construction;
2. The corridor is separated from the plenum by fire-resistance-rated construction;
3. The air-handling system serving the corridor is shut down upon activation of the air-handling unit smoke detectors required by this code;
4. The air-handling system serving the corridor is shut down upon detection of sprinkler waterflow where the building is equipped throughout with an automatic sprinkler system; or
5. The space between the corridor ceiling and the floor or roof structure above the corridor is used as a component of an approved engineered smoke control system.

601.3 Exits.

Equipment and ductwork for exit enclosure ventilation shall comply with one of the following items:

1. Such equipment and ductwork shall be located exterior to the building and shall be directly connected to the exit enclosure by ductwork enclosed in construction as required by the *New York City Building Code* for shafts.
2. Where such equipment and ductwork is located within the exit enclosure, the intake air shall be taken directly from the outdoors and the exhaust air shall be discharged directly to the outdoors, or such air shall be conveyed through ducts enclosed in construction as required by the *New York City Building Code* for shafts.
3. Where located within the building, such equipment and ductwork shall be separated from the remainder of the building, including other mechanical equipment, with construction as required by the New York City Building Code for shafts.

In each case, openings into fire-resistance-rated construction shall be limited to those needed for maintenance and operation and shall be protected by self-closing fire-resistance-rated devices in accordance with the *New York City Building Code* for enclosure wall opening protectives. Exit enclosure ventilation systems shall be independent of other building ventilation systems.

601.4 Contamination prevention.

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

Section MC 602: Plenums

602.1 General.

Supply, return, exhaust, relief and ventilation air plenums shall be limited to uninhabited crawl spaces, areas above a finished ceiling or below the finished floor, attic spaces and mechanical equipment rooms. Plenums shall be limited to one fire area. Fuel-fired appliances shall not be installed within a plenum.

602.2 Construction.

Plenum enclosures shall be constructed of materials permitted for the type of construction classification of the building. The temperature of air delivered to or through these plenums shall not exceed 250°F (121°C), except where used as part of an engineered smoke control system. The use of gypsum boards to form plenums shall be limited to systems where the air temperatures do not exceed 125°F (52°C) and the building and mechanical system design conditions are such that the gypsum board surface temperature will be maintained above the air stream dew-point temperature. Air plenums formed by

gypsum boards shall not be incorporated in air-handling systems utilizing evaporative coolers.

602.2.1 Materials within plenums.

Except as required by Sections 602.2.1.1 through 602.2.1.6, materials 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 or UL 723.

Exceptions:

1. Rigid and flexible ducts and connectors shall conform to Section 603.
2. Duct coverings, linings, tape and connectors shall conform to Sections 603 and 604.
3. Materials exposed within plenums in one- and two-family dwellings.
4. Smoke detectors.
5. Combustible materials fully enclosed in continuous noncombustible (i) raceways or enclosures, (ii) approved gypsum board assemblies or (iii) materials listed and labeled for such application.

602.2.1.1 Wiring.

Combustible electrical or electronic wiring methods and materials, optical fiber cable, and optical fiber raceway exposed within a plenum shall have a peak optical density not greater than 0.50, an average optical density not greater than 0.15, and a flame spread not greater than 5 feet (1524 mm) when tested in accordance with NFPA 262. Only type OFNP (plenum rated nonconductive optical fiber cable) shall be installed in plenum-rated optical fiber raceways. Wiring, cable, and raceways addressed in this section shall be listed and labeled as plenum rated and shall be installed in accordance with *New York City Electrical Code.*

602.2.1.2 Fire sprinkler piping.

Plastic fire sprinkler piping exposed within a plenum shall be used only in wet pipe systems and shall have a peak optical density not greater than 0.50, an average optical density not greater than 0.15, and a flame spread of not greater than 5 feet (1524 mm) when tested in accordance with UL 1887. Piping shall be listed and labeled.

602.2.1.3 Pneumatic tubing.

Combustible pneumatic tubing exposed within a plenum shall have a peak optical density not greater than 0.50, an average optical density not greater than 0.15, and a flame spread of not greater than 5 feet (1524 mm) when tested in accordance with UL 1820. Combustible pneumatic tubing shall be listed and labeled.

602.2.1.4 Electrical equipment in plenums.

Electrical equipment exposed within a plenum shall comply with Sections 602.2.1.4.1 and 602.2.1.4.2.

602.2.1.4.1 Equipment in metallic enclosures.

Electrical equipment with metallic enclosures exposed within a plenum shall be permitted.

602.2.1.4.2 Equipment in combustible enclosures.

Electrical equipment with combustible enclosures exposed within a plenum shall be listed and labeled for such use in accordance with UL 2043.

602.2.1.5 Foam plastic insulation.

Foam plastic insulation used as wall or ceiling finish in plenums shall exhibit a flame spread index of 75 or less and a smoke developed index of 450 or less when tested in accordance with ASTM E 84 or UL 723 and shall also comply with Section 602.2.1.5.1, 602.2.1.5.2 or 602.2.1.5.3.

602.2.1.5.1 Separation required.

The foam plastic insulation shall be separated from the plenum by a thermal barrier complying with Section 2603.4 of the New York City Building Code.

602.2.1.5.2 Approval.

The foam plastic insulation shall be approved based on tests conducted in accordance with Section 2603.9 of the *New York City Building Code.*

602.2.1.5.3 Covering.

The foam plastic insulation shall be covered by corrosion-resistant steel having a base metal thickness of not less than 0.0160 inch (0.4 mm).

602.2.1.6 Semiconductor fabrication areas.

Group H, Division 5 fabrication areas and the areas above and below the fabrication area that share a common air recirculation path with the fabrication area shall not be subject to the provisions of Section 602.2.1.

602.3 Stud cavity and joist space plenums.

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

1. Such cavities or spaces shall not be utilized 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 and joist space plenums shall comply with the floor penetration protection requirements of the *New York City Building Code.* Stud wall cavities and joist space plenums shall be isolated from adjacent concealed spaces by approved fireblocking as required in the *New York City Building Code.*

602.4 Flood hazard.

For structures located in areas of special flood hazard, plenum spaces shall comply with Appendix G of the New York City Building Code.

602.5 Firestopping.

Where required by the *New York City Building Code,* through penetrations shall be firestopped in accordance with Section 713 of the *New York City Building Code.*

602.6 Materials.

Materials used in the construction of a plenum shall be suitable for continuous exposure to the temperature and humidity conditions of the environmental

air in the plenum.

Section MC 603: Duct Construction and Installation

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 *New York City Building Code*. Ducts shall be constructed, braced, reinforced and installed to provide structural strength and durability.

603.2 Duct sizing.

Ducts installed within a single dwelling unit shall be sized in accordance with ACCA Manual D or other approved methods. Ducts installed within all other buildings shall be sized in accordance with the ASHRAE Handbook of Fundamentals or other equivalent computation procedure.

603.3 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.

603.4 Metallic ducts.

All metallic 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 603.4.

Table 603.4

Duct Construction Minimum Sheet Metal Thickness

for Single Dwelling Units

Duct Size	Galvanized		Aluminum Minimum Thickness (inches)
	Minimum Thickness (inches)	Equivalent Galvanized Gage No	
Round ducts and enclosed Rectangular ducts			
14 inches or less	0.0157	28	0.0175
16 and 18 inches	0.0187	26	0.018
20 inches or over	0.0236	24	0.023
Exposed rectangular ducts			
14 inches or less	0.0157	28	0.0175
14 inches[a]	0.0187	26	0.018

For SI: 1 inch = 25.4 mm, 1 inch water gage - 249 Pa.

a. For duct gages and reinforcements at static pressures of 1/2-inch, 1-inch and 2-inch w.g, SMACNA HVAC Duct Construction Standards, Tables 2-1, 2-2 and 2-3, shall apply.

603.4.1 Minimum fasteners.

Round metallic ducts shall be mechanically fastened by means of at least three sheet metal screws or rivets spaced equally around the joint.

Exception: Where a duct connection is made that is partially inaccessible, three screws or rivets shall be equally spaced on the exposed portion so as to prevent a hinge effect.

603.5 Nonmetallic ducts.

Nonmetallic ducts shall be constructed with Class 0 or Class 1 duct material in accordance with UL 181. Fibrous duct construction shall conform to the SMACNA Fibrous Glass Duct Construction Standards or NAIMA Fibrous Glass Duct Construction Standards. The maximum air temperature within nonmetallic ducts shall not exceed 250°F (121°C).

603.6 Air ducts and air connectors.

Air ducts, both metallic and nonmetallic, shall comply with Section 603.6.1. Air connectors, both metallic and nonmetallic, shall comply with Sections 603.6.2 and 603.6.3.

603.6.1 Air ducts.

Air ducts shall be permitted to be rigid or flexible and shall be constructed of materials that are reinforced and sealed to satisfy the requirements for the use of the air duct system, such as the supply air system, the return or exhaust air system, and the variable volume/pressure air system.

603.6.1.1 Materials.

All air duct materials shall be suitable for continuous exposure to the temperature and humidity conditions of the environmental air in the air duct. Air ducts shall be constructed of any of the following materials: 1. Iron, steel, aluminum, copper, concrete, masonry or clay tile. 2. Class 0 or Class 1 rigid or flexible air ducts tested in accordance with UL 181 and installed in conformance with the conditions of the listing.

Exceptions:

1. Class 0 or Class 1 rigid or flexible air duct shall not be used as a vertical air duct that is more than two stories in height.
2. Class 0 or Class 1 rigid or flexible air ducts shall not be used for air ducts containing air at temperatures in excess of 250°F (121°C).
3. Where the temperature of the conveyed air does not exceed 125°F (52°C) in normal service, negative pressure exhaust or return air ducts shall be permitted to be constructed of gypsum board having a maximum flame spread index/rating of 25 without evidence of continued progressive combustion and a maximum smoke developed index/rating of 50. Air ducts formed by gypsum boards shall have a surface temperature maintained above the air stream dew-point temperature, and shall not be used in air-handling systems utilizing evaporative coolers.

Exception: The maximum conveyed air temperature of 125°F (52°C) shall not apply to gypsum board material used for post-fire smoke purge.

603.6.1.2 Installation.

The materials, thickness, construction, and installation of ducts shall provide structural strength and durability in conformance with recognized good practice. Air ducts shall be considered to be in compliance with this requirement where constructed and installed in accordance with the New York City Building Code. Where no standard exists for the construction of air ducts, they shall be constructed to withstand both the positive and negative pressures of the system.

603.6.2 Air connectors.

Air connectors are limited-use, flexible air ducts that are required to conform to other provisions applicable to air ducts and shall meet the following requirements:

1. Air connectors shall conform to the requirements for Class 0 or Class 1 connectors when tested and approved in accordance with UL 181.
2. Class 0 or Class 1 air connectors shall not be used for ducts containing air at temperatures in excess of 250°F (121°C).
3. Air connector runs shall not exceed 14 feet (4267 mm) in length.
4. Air connectors shall not penetrate any rated wall, partition, or shaft that is required to have a fire-resistance rating of 1 hour or more.
5. Air connectors shall not pass through floors.

603.6.3 Flexible air duct and air connector clearance.

Flexible air ducts and air connectors shall be installed with a minimum clearance to an appliance as specified in the appliance manufacturer's installation instructions.

603.7 Rigid duct penetrations.

Duct system penetrations of walls, floors, ceilings and roofs and air transfer openings in such building components shall be protected as required by Section 607. Ducts in a private garage and ducts penetrating the walls or ceilings separating a dwelling from a private garage shall be continuous and constructed of a minimum 26 gage 0.0187 inch (0.4712 mm) galvanized sheet metal and shall not have openings into the garage. Fire and smoke dampers are not required in such ducts passing through the wall or ceiling separating a dwelling from a private garage except where required by Chapter 7 of the *New York City Building Code.*

603.8 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.

603.8.1 Slope.

Ducts shall have a minimum slope of 1/8 inch per foot (10.4 mm/m) to allow drainage to a point provided with access.

603.8.2 Sealing.

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

603.8.3 Plastic ducts and fittings.

Plastic ducts shall be constructed of PVC having a minimum pipe stiffness of 8 psi (55 kPa) at 5 percent deflection when tested in accordance with ASTM D 2412. Plastic duct fittings shall be constructed of either PVC or high-density polyethylene. Plastic duct and fittings shall be utilized in underground installations only. The maximum design temperature for systems utilizing plastic duct and fittings shall be 150°F (66°C).

603.9 Joints, seams and connections.

All longitudinal and transverse joints, seams and connections in metallic and nonmetallic ducts shall be constructed as specified in SMACNA HVAC Duct Construction Standards—Metal and Flexible and NAIMA Fibrous Glass Duct Construction Standards. All joints; and longitudinal and transverse seams and connections in ductwork shall be securely fastened and sealed with welds, gaskets, mastics (adhesives), mastic-plus-embedded-fabric systems, liquid sealants or tapes. Closure systems used to seal ductwork listed and labeled in accordance with UL 181A shall be marked "181A-P" for pressure-sensitive tape, "181 A-M" for mastic or "181 A-H" for heat-sensitive tape. Closure systems used to seal flexible air ducts and flexible air connectors shall comply with UL 181B and shall be marked "181B-FX" for pressure-sensitive tape or "181B-M" for mastic. Duct connections to flanges of air distribution system equipment shall be sealed and mechanically fastened. Mechanical fasteners for use with flexible nonmetallic air ducts shall comply with UL 181B and shall be marked "181B-C." Closure systems used to seal metal ductwork shall be installed in accordance with the manufacturer's installation instructions. Unlisted duct tape is not permitted as a sealant on any metal ducts.

Exception: Continuously welded and locking-type longitudinal joints and seams in ducts operating at static pressures less than 2 inches of water column (500 Pa) pressure classification shall not require additional closure systems.

603.10 Supports.

Ducts shall be supported with approved hangers at intervals not exceeding 10 feet (3048 mm) or by other approved duct support systems designed in accordance with the *New York City Building Code.* Flexible and other factory-made ducts shall be supported in accordance with the manufacturer's installation instructions. Ducts shall not be hung from or supported by suspended ceilings.

603.11 Furnace connections.

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

603.11.1 Air duct at heat sources.

Where heat sources from electrical equipment, fossil fuel-burning equipment, or solar energy collection equipment are installed in air ducts, the installation shall avoid the creation of a fire hazard. Air ducts rated as Class 1 in accordance with UL 181, air duct coverings, and linings shall be interrupted at the immediate area of operation of such heat sources in order to meet the clearances specified in the equipment listing.

Exceptions:

1. Appliances listed for zero clearance from combustibles where installed with the conditions of their listings.

2. Insulation specifically suitable for the maximum temperature that reasonably can be anticipated on the duct surface shall be permitted to be installed at the immediate area of operation of such appliances.

603.12 Condensation.

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

603.13 Flood hazard areas.

For structures in areas of special flood hazard, ducts shall comply with Appendix G of the *New York City Building Code.*

603.14 Location.

Ducts shall not be installed in or within 4 inches (102 mm) of the earth, except where such ducts comply with Section 603.8.

603.15 Mechanical protection.

Ducts installed in locations where they are exposed to mechanical damage by vehicles or from other causes shall be protected by approved vehicle barriers as required by the *New York City Building Code.*

603.16 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.

603.17 Registers, grilles and diffusers.

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

603.17.1 Floor registers.

Floor registers shall resist, without structural failure, a 200- pound (90.8 kg) concentrated load on a 2-inch-diameter (51 mm) disc applied to the most critical area of the exposed face.

603.17.2 Prohibited locations.

Duct registers, grilles and diffusers shall be prohibited in the toilet and bathing room floors and their upward extensions, to the extent those areas are required by the *New York City Building Code* to have smooth, hard and nonabsorbent surfaces.

Exception: In R-3 occupancies.

603.18 Vibration isolation connectors.

Vibration isolation connectors in duct systems shall be made of an approved flame-retardant fabric or shall consist of sleeve joints with packing of approved material, each having a maximum flame spread index/rating of 25 and a maximum smoke-developed rating of 50. The fabric shall have a maximum length of 10 inches (254 mm) in the direction of airflow.

Section MC 604: Insulation

604.1 General.

Duct insulation shall conform to the requirements of Sections 604.2 through 604.13 and the *New York City Energy Conservation Code.*

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).

604.3 Coverings and linings.

Coverings and linings, including adhesives when used, shall have a flame spread index not more than 25 and a smoke-developed index not more than 50, when tested in accordance with ASTM E 84 or UL 723, using the specimen preparation and mounting procedures of ASTM E 2231. 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).

604.4 Foam plastic insulation.

Foam plastic used as duct coverings and linings shall conform to the requirements of Section 604.

604.5 Appliance insulation.

Listed and labeled appliances that are internally insulated shall be considered as conforming to the requirements of Section 604.

604.6 Penetration of assemblies.

Duct coverings shall not penetrate a wall or floor required to have a fire-resistance rating or required to be fireblocked.

604.7 Identification.

External duct insulation, except spray polyurethane foam, and factory-insulated flexible duct shall be legibly printed or identified at intervals not greater than 36 inches (914 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 board, duct liner and factory-made rigid ducts not normally subjected to compression, the nominal insulation thickness shall be used.

2. For duct wrap, the installed thickness shall be assumed to be 75 percent (25 percent compression) of nominal thickness.

3. 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.

4. For spray polyurethane foam, the aged R-value per inch, measured in accordance with recognized industry standards, shall be provided to the customer in writing at the time of foam application.

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 airflow.

604.9 Thermal continuity.

Where a duct liner has been interrupted, a duct covering of equal thermal performance shall be installed.

604.10 Service openings.

Service openings shall not be concealed by duct coverings unless the exact location of the opening is properly identified.

604.11 Vapor retarders.

Where ducts used for cooling are externally insulated, the insulation shall be covered with a vapor retarder having a maximum permeance of 0.05 perm (2.87 ng/(Pa · s Å m ^{2})) or aluminum foil having a minimum thickness of 2 mils (0.05 1 mm). Insulations having a permeance of 0.05 perm (2.87 ng/(Pa · s · m ^{2})) or less shall not be required to be covered. All joints and seams shall be sealed to maintain the continuity of the vapor retarder.

604.12 Weatherproof barriers.

Insulated exterior ducts shall be protected with an approved weatherproof barrier.

604.13 Internal insulation.

Materials used as internal insulation and exposed to the airstream in ducts shall be shown to be durable when tested in accordance with UL 181. Exposed internal insulation that is not impermeable to water shall not be used to line ducts or plenums from the exit of a cooling coil to the downstream end of the drain pan.

Section MC 605: Air Filters

605.1 General.

Heating and air-conditioning systems of the central type shall be provided with approved air filters. Filters shall be installed in the return air system, upstream from any heat exchanger or coil, in an approved convenient location. Liquid adhesive coatings used on filters shall have a flash point not lower than 325°F (163°C).

605.2 Standards.

Media-type and electrostatic-type air filters shall be listed and labeled. Media-type air filters shall comply with UL 900. High-efficiency particulate air filters shall comply with UL 586. Electrostatic-type air filters shall comply with UL 867. Air filters utilized within dwelling units shall be designed for the intended application and shall not be required to be listed and labeled.

605.2.1 Standards for air-handling units.

Air-handling units of mechanical ventilation systems, any portion of which provide outdoor air ventilation, shall be equipped with a particulate matter filtration system in accordance with ASHRAE 62.1 or ASHRAE 62.2 and shall have a minimum efficiency reporting value (MERV) of 11 or greater in accordance with ASHRAE 52.2.

Exceptions:

1. This section shall not apply to the alteration or repair of a mechanical ventilation system that was installed prior to January 1, 2013 unless such alteration or repair includes the replacement or addition of an air-handling unit in such system.

2. This section shall not apply to the replacement of an air handling unit in a mechanical ventilation system installed prior to January 1, 2013 if the department determines that the design of such replacement air-handling unit cannot be made to comply with the allowable fan system power limitations of the *New York City Energy Conservation Code*.

3. This section shall not apply to any air-handling unit with a design capacity of less than 5,000 cfm (2.4 m ^{3} /s).

4. This section shall not apply for combustion outside air, ventilation air for mechanical room and inhabitable spaces.

605.3 Airflow over the filter.

Ducts shall be constructed to allow an even distribution of air over the entire filter.

605.4 Liquid adhesive tanks.

Tanks for liquid adhesives, into which removable filters are dipped, shall be located either outside the building or, if such a location is not available, in a separate fire resistive room and stored in accordance with NFPA 30. Such tanks shall be metal, equipped with tight-fitting covers and shall be kept tightly covered when not in actual use.

605.5 Filter maintenance.

All air filters shall be kept free of excess dust and combustible material. Unit filters shall be renewed or cleaned when the resistance to airflow has increased to two times the original resistance or when the resistance has reached a value of recommended replacement by the manufacturer. A permanently installed draft gauge or differential pressure transmitter shall be provided for all systems equal to or greater than 4000 cfm (1.89 m ^{3} /s). Where the filters are of the automatic liquid adhesive type, sludge shall be removed from the liquid adhesive reservoir regularly.

Section MC 606: Smoke Detection Systems Control

606.1 Controls required.

Air distribution systems shall be equipped with smoke detectors listed and labeled for installation in air distribution systems, as required by this section. Duct smoke detectors shall comply with UL 268A. Other smoke detectors shall comply with UL 268.

606.2 Where required.

Smoke detectors shall be installed where indicated in Sections 606.2.1 through 606.2.4.

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.

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 m^3/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 all portions of the building served by the air distribution system are protected by area smoke detectors connected to a fire alarm system in accordance with the *New York City Fire Code.* The area smoke detection system shall comply with Section 606.4.

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 design capacity greater than 2,000 cfm (0.9 m^3/s), the return air system shall be provided with smoke detectors in accordance with Section 606.2.1.

Exception: Individual smoke detectors shall not be required for each fan-powered terminal unit, provided that such units do not have an individual design capacity greater than 2,000 cfm (0.9 m^3/s) and will be shut down by activation of one of the following:

1. Smoke detectors required by Sections 606.2.1 and 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 606.2.1. In all cases, the smoke detectors shall comply with Sections 606.4 and 606.4.1.

606.2.3 Return air risers.

Where return air risers serve two or more stories and serve any portion of a return air system having a design capacity greater than 15,000 cfm (7.1 m^3/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.

606.2.4 Supply air systems.

Smoke detectors listed for use in air distribution systems shall be installed downstream of the air filters and ahead of any branch connections in air supply systems having a capacity greater than 2,000 cfm (0.9 m^3/s).

606.3 Installation.

Smoke detectors required by this section shall be installed in accordance with the *New York City Electrical Code.* The required smoke detectors shall be installed to monitor the entire airflow conveyed by the system. Access shall be provided to smoke detectors for inspection and maintenance.

606.4 Controls operation.

Upon activation, the smoke detectors shall shut down all operational capabilities of the air distribution systems serving the affected areas in accordance with the listing and labeling of appliances used in the system. Air distribution systems that are part of a smoke control system shall switch to the smoke control mode upon activation of a detector.

606.4.1 Supervision.

The duct smoke detectors shall be connected to a fire alarm system where a fire alarm system is required by Section 907.2 of the *New York City Building Code.* The actuation of a duct smoke detector shall activate a visible and audible alarm signal at a constantly attended location.

Exceptions:

1. The alarm signal at a constantly attended location is not required where the duct smoke detector activates the building's alarm-indicating appliances.
2. In occupancies not required to be equipped with a fire alarm system, actuation of either area or duct smoke detector shall activate a visible and an audible alarm signal in an approved location. Additionally, duct smoke detector trouble conditions shall activate a visible or audible alarm signal in an approved location and shall be identified as air duct detector trouble.

606.4.2 Fan shutdown.

When any building or floor is provided with an air system utilizing recirculated air and is protected by an automatic sprinkler system or an automatic fire alarm system, provisions shall be made to automatically stop the fans serving the affected area when the sprinkler system or fire alarm system are installed in the area, it shall be required to have only one of these systems arranged to stop the fans.

Exceptions:

1. Activation of a manual pull station shall not be required to automatically stop the fans.
2. Systems having a capacity of 2,000 cfm (0.2 m^3/s) or less or serving not more than one floor.

606.4.3 Manual restart of fans after automatic fire detecting device or fire alarm system shut down.

Fans or fan systems which have been automatically shut down on activation of an automatic fire detecting device or fire alarm system shall be arranged and equipped so that they do not automatically restart when either the automatic fire detecting device or fire alarm system is reset. The manual means of restarting the fans or fan system shall function independently from the manual resetting of either the automatic fire detecting device or fire alarm system.

Section MC 607: Ducts and Air Transfer Openings

607.1 General.

The provisions of this section shall govern the protection of duct penetrations and air transfer openings in fire-resistance-rated assemblies required to be protected.

607.1.1 Ducts that penetrate fire-resistance-rated assemblies without dampers.

Ducts that penetrate fire-resistance-rated assemblies and are not required by this section to have dampers shall comply with the requirements of Sections 713.2 through 713.3.3 of the *New York City Building Code.* Ducts that penetrate horizontal assemblies not required to be contained within a shaft and not required by this section to have dampers shall comply with the requirements of Sections 713.4 through 713.4.1.4.2 of the *New York City Building Code.*

Exception: Ducts 20 square inches (129 cm^2) or less passing through fire-resistance rated assemblies shall not require fire dampers or fire smoke dampers.

607.1.1.1 Ducts that penetrate nonfire-resistance-rated assemblies.

The space around a duct penetrating a nonfire-resistance-rated floor assembly shall comply with Section 716.6.3 of the *New York City Building Code.*

607.2 Installation.

Fire dampers, smoke dampers, combination fire/smoke dampers and ceiling radiation dampers located within air distribution and smoke control systems shall be installed in accordance with the requirements of this section, and the manufacturer's installation instructions and the damper's listing.

607.2.1 Smoke control system.

Where the installation of a fire damper will interfere with the operation of a required smoke control system in accordance with Section 909 of the *New York City Building Code,* approved alternative protection shall be used. Where mechanical systems including ducts and dampers used for normal building ventilation serve as part of the smoke control system, the expected performance of these systems in smoke control mode shall be addressed in the rational analysis required by Section 909.4 of the *New York City Building Code.*

607.2.1.1 Remote operation.

Combination fire and smoke dampers shall be operable by remote controls where necessary for smoke removal. Such dampers shall have provisions that allow them to reclose automatically upon reaching the damper's maximum degradation test temperature in accordance with UL 555S.

607.2.2 Hazardous exhaust ducts.

Fire dampers for hazardous exhaust duct systems shall comply with Section 510.

607.2.3 Supply air systems.

Smoke dampers listed for use in air distribution systems shall be installed both upstream and downstream of filters and ahead of any branch connections in supply air-handling apparatus and systems having a capacity equal to or greater than 15,000 cfm (7.1 m^3 /s).

Exceptions:

1. Where the air-handling unit is located on the floor that it serves and serves only that floor.
2. Where the air-handling unit is located on the roof and serves only the floor immediately below the roof.

607.3 Damper testing, ratings and actuation.

Damper testing, ratings and actuation shall be in accordance with Sections 607.3.1 through 607.3.3.

607.3.1 Damper testing.

Dampers shall be listed and bear the label of an approved testing agency indicating compliance with the standards in this section. Fire dampers shall comply with the requirements of UL 555. Only fire dampers labeled for use in dynamic systems shall be installed in heating, ventilation and air-conditioning systems designed to operate with fans on during a fire. Smoke dampers shall comply with the requirements of UL 555S. Combination fire/smoke dampers shall comply with the requirements of both UL 555 and UL 555S. Ceiling radiation dampers shall comply with the requirements of UL 555C-Ceiling Dampers.

607.3.2 Damper ratings.

Damper ratings shall be in accordance with Sections 607.3.2.1 through 607.3.2.3.

607.3.2.1 Fire damper ratings.

Fire dampers shall have the minimum fire protection rating specified in Table 607.3.2.1 for the type of penetration.

Table 607.3.2.1

Fire Damper Rating

Type of Penetration	Minimum Damper Rating (hour)
Less than 3-hour fire-resistance-rated assemblies	1 1/2
3-hour or greater fire-resistance-rated assemblies	3

607.3.2.2 Smoke damper ratings.

Smoke damper leakage ratings shall not be less than Class II. Elevated temperature ratings shall not be less than 250°F (121°C).

607.3.2.3 Combination fire/smoke damper ratings.

Combination fire/smoke dampers shall have the minimum fire protection rating specified for fire dampers in Table 607.3.2.1 for the type of penetration and shall also have a minimum Class II leakage rating and a minimum elevated temperature rating of 250°F (121°C).

607.3.3 Damper actuation.

Damper actuation shall be in accordance with Sections 607.3.3.1 through 607.3.3.4 as applicable.

607.3.3.1 Fire damper actuation device.

The fire damper actuation device shall meet one of the following requirements:

1. The operating temperature shall be approximately 50°F (28°C) above the normal temperature within the duct system, but not less than 160°F (71°C).

2. The operating temperature shall be not more than 350°F (177°C) where located in a smoke control system complying with Section 909 of the New York City Building Code.

607.3.3.2 Smoke damper actuation.

The smoke damper shall close upon actuation of a listed smoke detector or detectors installed in accordance with Section 606 of this code and Section 907.3 of the New York City Building Code and one of the following methods, as applicable:

1. Where a smoke damper is installed within a duct, a smoke detector shall be installed in the duct within 5 feet (1524 mm) of the damper with no air outlets or inlets between the detector and the damper. The detector shall be listed for the air velocity, temperature and humidity anticipated at the point where it is installed. Other than in mechanical smoke control systems, dampers shall be closed upon fan shutdown where local smoke detectors require a minimum velocity to operate.

Exceptions:

1. Duct smoke detectors will not be required at each fire smoke damper provided the supply fan shall shut down and all the fire smoke dampers associated with the supply system automatically close upon actuation of any automatic alarm initiating device on the floor(s).

2. Duct smoke detectors will be required within 5 feet (1.5 m) downstream of any electric duct reheat coil.

3. Non-ducted return air systems shall have a smoke detector located within 5 feet (1.5 m) upstream of each return air protected opening in a 2 hour fire rated barrier.

4. Ducted return air systems shall have a duct smoke detector located within 5 feet (1.5 m) of a smoke damper; additional smoke detectors will not be required at fire smoke dampers located downstream where there are no additional return air inlets.

2. Where a smoke damper is installed above smoke barrier doors in a smoke barrier, a spot-type detector listed for releasing service shall be installed on either side of the smoke barrier door opening.

3. Where a smoke damper is installed within an unducted opening in a wall, a spot-type detector listed for releasing service shall be installed within 5 feet (1524 mm) horizontally of the damper.

4. Where a smoke damper is installed in a corridor wall, the damper shall be permitted to be controlled by a smoke detection system installed in the corridor.

5. Where a total-coverage smoke detector system is provided within all areas served by an HVAC system, dampers shall be permitted to be controlled by the smoke detection system.

6. Smoke dampers that are part of an engineered smoke control system shall be capable of being positioned manually from a command station. Such positioning devices shall be provided for supply and return/exhaust dampers grouped by floor and by type. Damper switch positions shall indicate whether the related dampers are commanded to be either open or closed. Smoke damper positioning switches shall be located at the Fire Command Station, or in a Mechanical Control Center in buildings without a Fire Command Station.

607.3.3.3 Combination fire/smoke damper actuation.

Combination fire/smoke damper actuation shall be in accordance with Sections 607.3.3.1 and 607.3.3.2. Combination fire/smoke dampers installed in smoke control system shaft penetrations shall not be activated by local area smoke detection unless it is secondary to the smoke management system controls.

607.3.3.4 Ceiling radiation damper actuation.

The operating temperature of a ceiling radiation damper actuation device shall be 50°F (28°C) above the normal temperature within the duct system, but not less than 160°F (71°C).

607.4 Access and identification.

Fire and smoke dampers shall be provided with an approved means of access, large enough to permit inspection and maintenance of the damper and its operating parts. The access shall not affect the integrity of fire-resistance-rated assemblies. The access openings shall not reduce the fire-resistance rating of the assembly. Access points shall be permanently identified on the exterior by a label having letters not less than 0.5 inch (12.7 mm) in height reading: FIRE/SMOKE DAMPER, SMOKE DAMPER or FIRE DAMPER, followed by an identification marking that is individual and unique to the damper accessed. Access doors in ducts shall be tight fitting and suitable for the required duct construction.

607.5 Where required.

Fire dampers, smoke dampers, and combination fire/smoke dampers shall be provided at the locations prescribed in this section. Where an assembly is required to have both fire dampers and smoke dampers, combination fire/smoke dampers or a fire damper and a smoke damper shall be required.

Exceptions:

1. Ducts 20 square inches (129 cm^2) or less passing through fire-resistance rated assemblies shall not require fire dampers or smoke dampers.

2. Smoke dampers shall not be required to be located within a prescribed distance of a fire-rated enclosure within a prescribed distance of a fire-rated enclosure and where isolation smoke dampers are used in air-handling equipment.

607.5.1 Fire walls.

Ducts and air transfer openings permitted in firewalls in accordance with Section 706.11 of the *New York City Building Code* shall be protected with listed fire dampers and smoke dampers installed in accordance with their listing.

Exception: Smoke dampers shall not be required in ducts where the air continues to move and the air-handling system installed is arranged to prevent recirculation of exhaust or return air under fire emergency conditions.

607.5.1.1 Horizontal exits.

A listed smoke damper designed to resist the passage of smoke shall be provided at each point that a duct or air transfer opening penetrates a fire wall that serves as a horizontal exit.

Exception: Smoke dampers shall not be required in ducts where the air continues to move and the air-handling system installed is arranged to prevent recirculation of exhaust or return air under fire emergency conditions.

607.5.2 Fire barriers.

Ducts and air transfer openings that penetrate fire barriers shall be protected with listed fire dampers installed in accordance with their listing. Ducts and air transfer openings shall not penetrate exit enclosures and exit passageways except as permitted by Sections 1022.4 and 1022.6, respectively, of the *New York City Building Code*. In addition, smoke dampers shall be installed in penetrations of public corridor and horizontal exit walls in accordance with Section 607.5.2.1.

Exceptions: Fire dampers are not required at penetrations of fire barriers where any of the following apply:

1. Penetrations are tested in accordance with ASTM E 119 or UL 263 as part of the fire-resistance-rated assembly.

2. Ducts are used as part of an engineered smoke control system in accordance with Section 513 of this Code and Section 909 of the *New York City Building Code* and where the fire damper would interfere with the operation of the smoke control system.

3. Such walls are penetrated by ducted HVAC systems, have a required fire resistance rating of 1 hour or less, are in areas other than Group H and are in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2 of the *New York City Building Code.* For the purposes of this exception, a ducted HVAC system shall be a duct system for the structure's HVAC system. Such a duct system shall be constructed of sheet metal not less than 26—gage (0.0217 inch) thickness and shall be continuous from the air-handling appliance or equipment to the air outlet and inlet terminals.

607.5.2.1 Horizontal exits.

A listed smoke damper designed to resist the passage of smoke shall be provided at each point that a duct or air transfer opening penetrates a fire barrier that serves as a horizontal exit.

Exception: Smoke dampers shall not be required in ducts where the air continues to move and the air-handling system installed is arranged to prevent recirculation of exhaust or return air under fire emergency conditions.

607.5.2.2 Public corridors.

A listed smoke damper designed to resist the passage of smoke shall be provided at each point a duct or air transfer opening penetrates a public corridor wall constructed as a fire barrier.

Exceptions:

1. Smoke dampers are not required where the building is equipped throughout with an approved smoke control system in accordance with Section 909 of the *New York City Building Code,* and smoke dampers are not necessary for the operation and control of the system.

2. Smoke dampers are not required in corridor penetrations where the duct is constructed of steel not less than 0.019 inch (0.48 mm) in thickness and there are no openings serving the corridor.

3. Smoke dampers are not required in corridor penetrations in Group R-2 buildings and public corridors serving R-2 spaces in mixed use buildings.

4. Smoke dampers shall not be required in ducts where the air continues to move and the air-handling system installed is arranged to prevent recirculation of exhaust or return air under fire emergency conditions.

607.5.3 Fire partitions.

Ducts and air transfer openings that penetrate fire partitions shall be protected with listed fire dampers installed in accordance with their listing.

Exceptions: In occupancies other than Group H, fire dampers are not required where any of the following apply:

1. The partitions are tenant separation and corridor walls in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 or 903.3.1.2 of the *New York City Building Code* and the duct is protected as a through penetration in accordance with the *New York City Building Code.*

2. The partitions are tenant partitions in covered mall buildings where the walls are not required by provisions elsewhere in the *New York City Building Code* to extend to the underside of the floor or roof sheathing, slab or deck above.

3. The duct system is constructed of approved materials in accordance with this code and the duct penetrating the wall meets all of the following minimum requirements:

3.1. The duct shall not exceed 100 square inches (0.06 m^2).

3.2. The duct shall be constructed of steel a minimum of 0.0217 inch (0.55 mm) in thickness.

3.3. The duct shall not have openings that communicate the corridor with adjacent spaces or rooms.

3.4. The duct shall be installed above a ceiling.

3.5. The duct shall not terminate at a wall register in the fire-resistance-rated wall.

3.6. A minimum 12-inch-long (304.8 mm) by 0.060-inch-thick (1.52 mm) steel sleeve shall be centered in each duct opening. The sleeve shall be secured to both sides of the wall and all four sides of the sleeve with minimum 1 1/2-inch by 1 1/2-inch by 0.060-inch (38 mm by 38 mm by 1.52 mm) steel retaining angles. The retaining angles shall be secured to the sleeve and the wall with No. 10 (M5) screws. The annular space between the steel sleeve and the wall opening shall be filled with rock (mineral) wool batting or approved equivalent on all sides.

607.5.4 Smoke barriers.

A listed smoke damper designed to resist the passage of smoke shall be provided at each point where a duct or an air transfer opening penetrates a smoke barrier wall enclosure required to have smoke and draft control doors in accordance with the *New York City Building Code.* Smoke dampers and smoke damper actuation methods shall comply with Section 607.5.4.1.

Exceptions:

1. Smoke dampers are not required in smoke barrier penetrations where the openings in ducts are limited to a single smoke compartment and the ducts are constructed of steel.

2. Smoke dampers are not required in ducts where the air continues to move and the air-handling system installed is arranged to prevent recirculation of exhaust or return air under fire emergency conditions.

607.5.4.1 Smoke damper.

The smoke damper shall close upon actuation of a listed smoke detector or detectors installed in accordance with the *New York City Building Code* and Section 607.3.3.2.

607.5.5 Shaft enclosures.

Ducts and air transfer openings shall not penetrate a shaft serving as an exit enclosure except as permitted by Section 1022.4 of the *New York City Building Code*. Shaft enclosures that are permitted to be penetrated by ducts and air transfer openings shall be protected with approved fire and smoke dampers installed in accordance with their listing.

Exceptions:

1. Fire dampers are not required at penetrations of shafts where:

1.1. Steel exhaust subducts extend at least 22 inches (559 mm) vertically in exhaust shafts provided there is a continuous airflow upward to the outside;

1.2. Penetrations are tested in accordance with ASTM E 119 or UL 263 as part of the fire-resistance-rated assembly;

1.3. Ducts are used as part of an engineered smoke control system designed and installed in accordance with Section 909 of the *New York City Building Code,* and where the fire damper will interfere with the operation of the smoke control system; or

1.4. The penetrations are in parking garage exhaust or supply shafts that are separated from other building shafts by not less than 2-hour fire-resistance-rated construction.

2. In Group B and R occupancies equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 of the *New York City Building Code,* smoke dampers are not required at penetrations of shafts where kitchen, bathroom and toilet room exhaust openings with steel exhaust subducts, having a minimum thickness of 0.0187 inch (0.4712 mm) (No. 26 gage), extend at least 22 inches (559 mm) vertically, and where the exhaust fan at the upper terminus is powered continuously and maintains airflow upward to the outdoors.

3. Smoke dampers are not required at penetrations of exhaust or supply shafts in parking garages that are separated from other building shafts by not less than 2-hour fire-resistance-rated construction.

4. Smoke dampers are not required at penetrations of shafts where ducts are used as part of an engineered mechanical smoke control system designed in accordance with Section 909 of the New *York City Building Code* and where the smoke damper will interfere with the operation of the smoke control system.

5. Fire dampers and/or smoke dampers are not required at a shaft where the shaft is acting as an extension of the mechanical equipment room that it serves and the shaft and mechanical equipment room maintain fire and smoke separation required by the greater of the two spaces from the occupied portions of the building and meet the requirements of Section 708.11 of the *New York City Building Code.*

6. Smoke dampers are not required to be located within a prescribed distance of a fire-rated enclosure within which the air handling equipment is located and where isolation smoke dampers are used in air-handling equipment. See Section 607.2.3 for additional requirements.

7. Smoke dampers are not required in ducts where the air continues to move and the air-handling system installed is arranged to prevent recirculation of exhaust or return air during a fire emergency condition.

8. Smoke dampers are not required in exhaust ducts or shafts where the exhaust fan is maintained in operation during occupancy, such as in bathrooms and toilet room exhausts.

607.5.5.1 Enclosure at the bottom.

Shaft enclosures that do not extend to the bottom of the building or structure shall be protected in accordance with Section 708.11 of the *New York City Building Code.*

607.5.5.2 Limitations.

Shafts that constitute air ducts or that enclose air ducts used for the movement of environmental air shall not enclose:

1. Exhaust ducts used for the removal of smoke and grease-laden vapors from cooking equipment;
2. Ducts used for removal of flammable vapors;
3. Ducts used for moving, conveying, or transporting stock, vapor or dust;
4. Ducts used for the removal of nonflammable corrosive fumes and vapors; 5. Refuse and linen chutes; or
6. Piping.

Exception: Shafts that constitute air ducts or that enclose air ducts used for the movement of environmental air may enclose noncombustible piping conveying water or other nonhazardous or nontoxic materials.

607.5.6 Exterior walls.

Ducts and air transfer openings in fire-resistance-rated exterior walls required to have protected openings in accordance with Section 705.10 of the *New York City Building Code* shall be protected with listed fire dampers installed in accordance with their listing.

607.5.7 Smoke partitions.

A listed smoke damper designed to resist the passage of smoke shall be provided at each point where an air transfer opening penetrates a smoke partition. Smoke dampers and smoke damper actuation methods shall comply with Section 607.3.3.2.

Exceptions:

1. Where the installation of a smoke damper will interfere with the operation of a required smoke control system in accordance with Section 513, approved alternate protection shall be used.

2. Smoke dampers shall not be required in ducts where the air continues to move and the air-handling system installed is arranged to prevent recirculation of exhaust or return air under fire emergency conditions.

607.6 Horizontal assemblies.

Penetrations by air ducts of a floor, floor/ceiling assembly or the ceiling membrane of a roof/ceiling assembly shall be protected by a shaft enclosure that complies with the *New York City Building Code* or shall comply with this section.

607.6.1 Through penetrations.

In occupancies other than Groups I-2 and I-3, a duct and air transfer opening system constructed of approved materials in accordance with this code that penetrates a fire-resistance-rated floor/ceiling assembly that connects not more than two stories is permitted without shaft enclosure protection, provided that a listed fire damper is installed at the floor line and the penetration is firestopped or the duct is protected in accordance with Section 713.4 of the *New York City Building Code.* For air transfer openings, see Exception 7, Section 708.2 of the *New York City Building Code.*

Exception: A duct serving a dwelling unit is permitted to penetrate three floors or less without a fire damper at each floor provided such duct meets all of the following requirements.

1. The duct is contained and located within the cavity of a wall and is constructed of steel having a minimum thickness of 0.0187 inch (0.4712 mm) (No. 26 gage).

2. The duct opens into only one dwelling or sleeping unit and the duct system is continuous from the unit to the exterior of the building.

3. The duct does not exceed a 5 inch (127 mm) nominal diameter and the total area of such ducts does not exceed 100 square inches (64 516 mm^2) for any 100 square feet (9.3 m^2) of the floor area.

4. The annular space around the duct is protected with materials that prevent the passage of flame and hot gases sufficient to ignite cotton waste where subjected to ASTM E 119 or UL 263 time-temperature conditions under a minimum positive pressure differential of 0.01 inch (2.49 Pa) of water at the location of the penetration for the time period equivalent to the fire-resistance rating of the construction penetrated.

5. Grille openings located in a ceiling of a fire-resistance-rated floor/ceiling or roof/ceiling assembly is protected with a listed ceiling radiation damper installed in accordance with Section 607.6.2.1.

607.6.2 Membrane penetrations.

Ducts and air transfer openings constructed of approved materials, in accordance with Section 603, that penetrate the ceiling membrane of a fire-resistance-rated floor/ceiling or roof/ceiling assembly shall be protected with one of the following:

1. A shaft enclosure in accordance with Section 708 of the *New York City Building Code.*

2. A listed ceiling radiation damper and firestopping installed at the ceiling line where a duct penetrates the ceiling of a fireresistance-rated floor/ceiling or roof/ceiling assembly.

3. A listed ceiling radiation damper and firestopping installed at the ceiling line where a diffuser with no duct attached penetrates the ceiling of a fire-resistance-rated floor/ceiling or roof/ceiling assembly.

607.6.2.1 Ceiling radiation dampers.

Ceiling radiation dampers shall be tested as part of a fire-resistance-rated floor/ceiling or roof/ceiling assembly in accordance with ASTM E 119 or UL 263. Ceiling radiation dampers shall be installed in accordance with the details listed in the fire-resistance-rated assembly and the manufacturer's installation instructions and the listing. Ceiling radiation dampers are not required where either of the following applies:

1. Tests in accordance with ASTM E 119 or UL 263 have shown that ceiling radiation dampers are not necessary to maintain the fire-resistance rating of the assembly.

2. Exhaust duct penetrations are protected in accordance with Section 713.4.1.2 of the *New York City Building Code,* are located within the cavity of a wall and do not pass through another dwelling unit or tenant space.

607.6.3 Nonfire-resistance-rated floor assemblies.

Duct systems constructed of approved materials in accordance with Section 603 that penetrate nonfire-resistance-rated floor assemblies shall be protected by any of the following methods:

1. A shaft enclosure in accordance with Section 708 of the *New York City Building Code.*

2. The duct connects not more than two stories, and the annular space around the penetrating duct is protected with an approved noncombustible material that resists the free passage of flame and the products of combustion.

3. The duct connects not more than three stories, and the annular space around the penetrating duct is protected with an approved noncombustible material that resists the free passage of flame and the products of combustion, and a listed fire damper is installed at each floor line.

Exception: Fire dampers are not required in ducts within individual residential dwelling units.

607.7 Flexible ducts and air connectors.

Flexible ducts and air connectors shall not pass through any fire-resistance-rated assembly. Flexible air connectors shall not pass through any wall, floor or ceiling.

Section MC 608: Air Outlets and Air Inlets

608.1 Air Outlets.

Air outlets shall comply with sections 608.1.1 through 608.1.3

608.1.1 General.

Air supplied to any space shall not contain flammable vapors, flyings, or dust in quantities and concentrations that would introduce a hazardous condition.

608.1.2 Construction of air outlets.

Air outlets shall be constructed of noncombustible material or a material that has a maximum smoke developed index/rating of 50 and a maximum flame spread index/rating of 25.

608.1.3 Location of air outlets.

The location of air outlets shall comply with the following requirements:

1. Air outlets shall be located at least 3 inches (76 mm) above the floor.

Exception: Air outlets may be located less than 3 inches (76mm) above the floor where provisions have been made to prevent dirt and dust accumulations from entering the system.

2. Where located less than 7 feet (2134 mm) above the floor, outlet openings shall be protected by a grille or screen having openings through which a 1/2-inch (12.7 mm) sphere cannot pass.

3. Grilles may be located in floors provided they are installed so that they may be removed for cleaning purposes and provided they are constructed as follows:

3.1 Grilles up to 3 square feet (0.2787 m^2) in gross area shall be designed to support a concentrated live load of 250 pounds (114 kg) on any 4 square inches (2580 mm^2) of surface.

3.2 Grilles over 3 square feet (0.2787 m^2) in gross area shall be designed to support the same loads as the floor in the area where used.

3.3 If located where they may be walked upon, the opening in grilles shall reject a 1/2-inch (12.7 mm) sphere.

608.2 Air inlets (return or exhaust or return and exhaust).

Air inlets shall be constructed in accordance with 608.2.1 through 608.2.3.

608.2.1 General.

Air shall not be recirculated from any space in which flammable vapors, flyings, or dust is present in quantities and concentrations that would introduce a hazardous condition into the return air system.

608.2.2 Construction of air inlets.

Air inlets shall be constructed of noncombustible material or a material that has a maximum flame spread index/rating of 25 and a maximum smoke developed index/rating of 50.

608.2.3 Location of air inlets.

The location of air inlets shall comply with the following requirements.

1. Air inlets shall be located at least 3 inches (76 mm) above the floor.

Exception: Air inlets may be located less than 3 inches (76mm) above the floor where provisions have been made to prevent dirt and dust accumulations from entering the system.

2. Where located less than 7 feet (2134 mm) above the floor, inlet openings shall be protected by a grille or screens having openings through which a $\frac{1}{2}$- inch (12.7 mm) sphere cannot pass.

3. Grilles may be located in floors provided they are installed so that they may be removed for cleaning purposes and provided they are constructed as follows:

3.1. Grilles up to 3 square feet (0.2787 m^2) in gross area shall be designed to support a concentrated live load of 250 pounds (114 kg) on any 4 square inches (2580 mm^2) of surface.

3.2. Grilles over 3 square feet (0.2787 m^2) in gross area shall be designed to support the same loads as the floor in the area where used.

3.3. If located where they may be walked upon, the opening in grilles shall reject a 1/2-inch (12.7 mm) sphere.

Section MC 609: Service Openings

609.1 General.

Horizontal air ducts and plenums shall be provided with service openings to facilitate the removal of accumulations of dust and combustible materials. Service openings shall be located at approximately 20 feet (6096 mm) intervals along the air duct and at the base of each vertical riser.

Exceptions:

1. Removable air outlet or air inlet devices of adequate size shall be permitted in lieu of service openings.

2. Service openings shall not be required in supply ducts where the supply air has previously passed through an air filter, air cleaner, or water spray. Such air filters and air cleaners shall be properly maintained and replaced when needed.

3. Service openings shall not be required where all of the following conditions exist:

3.1. The occupancy has no process producing combustible material such as dust, lint, or greasy vapors. Such occupancies include banks, office buildings, houses of worship, hotels, and health care facilities (but not kitchens, laundries, and manufacturing portions of such facilities).

3.2. The air inlets are at least 7 feet (2134 mm) above the floor or are protected by corrosion-resistant metal screens of at least 14 mesh (0.07 inches) (1.8 mm) that are installed at the inlets so that they cannot draw papers, refuse, or other combustible solids into the return air duct.

3.3. The minimum design velocity in the return duct for the particular occupancy is 1,000 feet/minute (5.080 m/s).

Chapter 7: Combustion, Ventilation, and Dilution Air

Section MC 701: General

701.1 Scope.

The provisions of this chapter shall govern the requirements for combustion, ventilation, and dilution air for fuel-burning appliances other than gas-fired appliances. The requirements for combustion, ventilation, and dilution air for gas-fired appliances shall be in accordance with the *New York City Fuel Gas Code.*

701.2 Combustion, ventilation, and dilution air required.

Every room or space containing fuel-burning appliances shall be provided with combustion, ventilation, and dilution air as required by this code. Combustion, ventilation, and dilution air shall be provided in accordance with Section 702, 703, 704, 705, 706 or 707 of this code. 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 and shall be installed in accordance with the equipment manufacturer's instructions and listing. Combustion air requirements shall be determined based on the simultaneous operation of all fuel-burning appliances drawing combustion, ventilation, and dilution air from the room or space. Combustion, ventilation, and dilution air shall be obtained solely from the outdoors for fuel-burning appliances with an input greater than 350,000 Btu/h (1025 kW).

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, ventilation, and dilution air is being drawn. Such provisions shall prevent the operation of such appliances, equipment and systems from affecting the supply of combustion, ventilation, and dilution air.

701.3.1 Makeup air for fuel burning devices.

Where exhaust fans are installed, makeup air shall be provided to replace the exhausted air. Calculations shall be provided on the construction documents to validate the use of the exhaust fan(s) and compliance with this chapter.

701.3.2 Ventilation air for fuel burning devices.

Where ventilation air is brought in by mechanical means for heat generation mitigation, provisions must be made for proper air balance to prevent a negative or positive pressure in the boiler room and to discharge the ventilation air directly to the outside.

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.

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 *New York City Building Code* and shall be without obstruction to the free flow of air.

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 *New York City Building Code.* The combustion air openings shall be provided with a sleeve of not less than 0.019 inch (0.48 mm) (No.26 Gage) 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.

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 the combustion, ventilation, and dilution air. Combustion, ventilation, and dilution air shall not be subject to ice or snow blockage. No combustion, ventilation, and dilution air inlet shall be less than 30 inches (762 mm) above grade. Combustion, ventilation, and dilution 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 this code. Combustion, ventilation, and dilution air shall not be taken from a refrigeration machinery room, except where a refrigerant vapor detector system is installed to automatically shut off the combustion process in the event of refrigerant leakage. For structures in areas of special flood hazard, air shall be obtained from a location complying with Appendix G of the *New York City Building Code.*

Section MC 702: Inside Air

702.1 All air from indoors.

Combustion, ventilation, and dilution air shall be permitted to be obtained entirely from the indoors in buildings that are not of unusually tight construction. In buildings of unusually tight construction, combustion air shall be obtained from the outdoors in accordance with Section 703, 705, 706 or 707.

702.2 Air from the same room or space.

The room or space containing fuel-burning appliances shall be an unconfined space as defined in Section 202.

702.3 Air from adjacent spaces.

Where the volume of the room in which the fuel-burning appliances are located does not comply with Section 702.2, additional inside combustion, ventilation, and dilution air shall be obtained by opening the room to adjacent spaces so that the combined volume of all communicating spaces meets the volumetric requirement of Section 702.2. Openings connecting the spaces shall comply with Sections 702.3.1, 702.3.2 and Figure A-1 of Appendix A of this code.

702.3.1 Number and location of openings.

Two openings shall be provided, one within 1 foot (305 mm) of the ceiling of the room and one within 1 foot (305 mm) of the floor.

702.3.2 Size of openings.

The net free area of each opening, calculated in accordance with Section 708, shall be a minimum of 1 square inch per 1,000 Btu/h (2201 mm^2 /kW) of input rating of the fuel-burning appliances drawing combustion, ventilation, and dilution air from the communicating spaces and shall be not less than 100 square inches (64 516 mm^2).

Section MC 703: Outdoor Air

703.1 All air from the outdoors.

Where all combustion, ventilation, and dilution air is to be provided by outdoor air, the required combustion, ventilation, and dilution air shall be obtained by direct opening by louver or a duct(s) from the boiler room to the outdoors. Openings connecting the room to the outdoor air shall comply with Sections 703.1.1 through 703.1.4, and Figures A-2, A-3 and A-4 of Appendix A of this code. The size of the openings connecting the room to the outdoor air supply shall also comply with any applicable rules of the New York City Department of Environmental Protection.

703.1.1 Two-permanent-openings method.

Two permanent openings, one commencing within 12 inches (305 mm) of the top and one commencing within 12 inches (305 mm) of the bottom of the room, shall be provided. The openings shall communicate directly, or by ducts, with the outdoors or spaces that freely communicate with the outdoors as follows:

1. Where directly communicating with the outdoors, or where communicating with the outdoors through vertical ducts, each opening shall have a minimum free area of 1 square inch per 4,000 Btu/h (550 mm^2 /kW) of total input rating of all equipment in the room.

2. Where communicating with the outdoors through horizontal ducts, each opening shall have a minimum free area of not less than 1 square inch per 2,000 Btu/h (1100 mm^2 /kW) of total input rating of all equipment in the room.

703.1.2 One-permanent-opening method.

One permanent opening, commencing within 12 inches (305 mm) of the top of the enclosure, shall be provided. The equipment shall have clearances of at least 1 inch (25 mm) from the sides and back and 6 inches (152 mm) from the front of the appliance. The opening shall directly communicate with the outdoors or through a vertical or horizontal duct to the outdoors or spaces that freely communicate with the outdoors and shall have a minimum free area of 1 square inch per 3,000 Btu/h (734 mm^2 /kW) of the total input rating of all equipment located in the enclosure, and not less than the sum of the areas of all vent connectors in the space.

Section MC 704: Combined Use of Inside and Outdoor Air (condition 1)

704.1 Combination of air from inside and outdoors.

This section shall apply only to appliances located in confined spaces in buildings not of unusually tight construction. Where the volumes of rooms and spaces are combined for the purpose of providing indoor combustion air, such rooms and spaces shall communicate through permanent openings in compliance with Sections 702.3.1 and 702.3.2. The required combustion, ventilation, and dilution air shall be obtained by opening the room to the outdoors using a combination of inside and outdoor air, prorated in accordance with Section 704.1.6. The ratio of interior spaces shall comply with Section 704.1.5. The number, location and ratios of openings connecting the space with the outdoor air shall comply with Sections 704.1.1 through 704.1.4.

704.1.1 Number and location of openings.

At least two openings shall be provided, one within 1 foot (305 mm) of the ceiling of the room and one within 1 foot (305 mm) of the floor.

704.1.2 Ratio of direct openings.

Where direct openings to the outdoors are provided in accordance with Section 703.1, the ratio of direct openings shall be the sum of the net free areas of both direct openings to the outdoors, divided by the sum of the required areas for both such openings as determined in accordance with Section 703.1.2.

704.1.3 Ratio of horizontal openings.

Where openings connected to the outdoors through horizontal ducts are provided in accordance with Section 703.1, the ratio of horizontal openings shall be the sum of the net free areas of both such openings, divided by the sum of the required areas for both such openings as determined in accordance with Section 703.1.3.

704.1.4 Ratio of vertical openings.

Where openings connected to the outdoors through vertical ducts are provided in accordance with Section 703.1, the ratio of vertical openings shall be the sum of the net free areas of both such openings, divided by the sum of the required areas for both such openings as determined in accordance with Section 703.1.4.

704.1.5 Ratio of interior spaces.

The ratio of interior spaces shall be the available volume of all communicating spaces, divided by the required volume as determined in accordance with Sections 702.2 and 702.3.

704.1.6 Prorating of inside and outdoor air.

In spaces that utilize a combination of inside and outdoor air, the sum of the ratios of all direct openings, horizontal openings, vertical openings and interior spaces shall equal or exceed 1.

Section MC 705: Combined Use of Inside and Outdoor Air (condition 2)

705.1 General.

This section shall apply only to appliances located in unconfined spaces in buildings of unusually tight construction. Combustion air supplied by a combined use of indoor and outdoor air shall be supplied through openings and ducts extending to the appliance room or to the vicinity of the appliance.

705.1.1 Openings and supply ducts.

Openings shall be provided, located and sized in accordance with Sections 702.3.1 and 702.3.2; additionally, there shall be one opening to the outdoors having a free area of at least 1 square inch per 5,000 Btu/h (440 mm^2 /kW) of total input of all appliances in the space.

Section MC 706: Mechanical Combustion Air Supply

706.1 Rate of air supplied.

Where all combustion air is provided by a mechanical air supply system, the combustion air shall be supplied from the outdoors at a rate of not less than 0.35 cubic feet per minute per 1,000 Btu/h (0.034 m^3 /min per kW) of total input rating for all the fuel-burning appliances located within the space. Combustion air rates shall also comply with any applicable rules of the New York City Department of Environmental Protection. The mechanical air supply shall be sufficient to accommodate combustion air, ventilation air, and dilution air requirements of the installation.

706.1.1 Appliance interlock.

Each of the appliances served shall be interlocked with the mechanical air supply system to prevent main burner operation when the mechanical air supply system is not in operation. The air flow and the damper operation shall be proven prior to burner operation.

Section MC 707: Direct Connection

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.

Section MC 708: Combustion Air Ducts

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.
9. Be constructed so that the remaining space surrounding a chimney or chimney liner, installed within a masonry, metal or factory-built chimney cannot be used to supply combustion, ventilation and dilution air, except for direct vent appliances designed and installed in accordance with the equipment manufacturer's instructions and listing.

Section MC 709: Opening Obstructions

709.1 General.

The required size of openings for combustion, ventilation, 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 60 percent of the area of the opening, and openings covered with wood louvers shall be deemed to have a net free area of 10 percent of the area of the opening. Louvers and grills shall be fixed in the open position.

Exception: Operable louvers shall be interlocked with the appliance so that they are proven to be in the full open position prior to main burner ignition and during main burner operation. Means shall be provided to prevent the main burner from igniting if the louvers fail to open during burner startup and to shut down the main burner if the louvers close during operation.

709.2 Dampered openings.

Where the combustion air openings are provided with automatic, smoke or fire dampers, the dampers shall be electrically interlocked with the appliances served, so as to prevent operation of any appliance when any of the dampers are closed. Manually operated dampers shall not be installed in combustion air openings. The damper opening shall be proven prior to burner operation.

709.3 Caution sign.

A sign stating, "Louvers, dampers and/or ventilation openings must not be blocked or disabled." shall be permanently affixed, in clear view, and adjacent to the opening(s) within the room containing the equipment. The letters used on the sign shall be at least 1-inch (25 mm) in height.

Section MC 710: Opening Location and Protection

710.1 General.

Combustion air openings to the outdoors shall comply with the location and protection provisions applicable to outside air intake openings of Sections 401.5 and 401.6 of this code.

Chapter 8: Chimneys and Vents

Section MC 801: General

801.1 Scope.

This chapter shall govern the installation, maintenance, design, minimum safety requirements, repair and approval of factory-built chimneys, chimney liners, vents and connectors, and field built chimneys and connectors for all non-gas-fired appliances. This chapter shall also govern the utilization of masonry chimneys. Gas-fired appliances shall be vented in accordance with the *New York City Fuel Gas Code.*

801.1.1 Adjoining chimneys and vents.

Adjoining chimneys and vents shall be in accordance with Sections 801.1.1.1 through 801.1.1.8.

801.1.1.1 Responsibility of owner of taller building.

Whenever a building is erected, enlarged, or increased in height so that any portion of such building, except chimneys or vents, extends higher than the top of any previously constructed chimneys or vents within 100 feet (30 480 mm), the owner of such new or altered building shall have the responsibility of altering such chimneys or vents to make them conform with the requirements of this chapter. A chimney or vent that is no longer connected with a fireplace or combustion or other equipment for which a chimney or vent was required, shall be exempt from this requirement. Such alterations shall be accomplished by one of the following means or a combination thereof:

1. Carry up the previously constructed chimneys or vents to the height required in this chapter.

2. Offset such chimneys or vents to a distance beyond that required in Chapter 5 from the new or altered building provided that the new location of the outlet of the offset chimney or vent shall otherwise comply with the requirements of this chapter.

Such requirements shall not dispense with or modify any additional requirements that may be applicable pursuant to rules of the New York City Department of Environmental Protection.

801.1.1.2 Protection of draft.

After the alteration of a chimney or vent as required by this section, it shall be the responsibility of the owner of the new or altered building to provide any mechanical equipment or devices necessary to maintain the proper draft in the equipment.

801.1.1.3 Written notification.

The owner of the new or altered building shall notify the owner of the building affected in writing at least forty-five days before starting the work required and request written consent to do such work. Such notice shall be companied by plans indicating the manner in which the proposed alterations are to be made.

801.1.1.4 Approval.

The plans and method of alteration shall be subject to the approval of the commissioner.

801.1.1.5 Refusal of consent.

If consent is not granted by the owner of the previously constructed building to do the alteration work required by this section, such owner shall signify his or her refusal in writing to the owner of the new or altered building and to the commissioner; and the owner of the new or altered building having submitted plans that conform to the requirements of this section, shall thereupon be released from any responsibility for the proper operation of the equipment due to loss of draft and for any health hazard or nuisance that may occur as a result of the new or altered building. Such responsibilities shall then be assumed by the owner of the previously constructed building. Similarly, should such owner fail to grant consent within forty-five days from the date of written request or fail to signify his or her refusal, he or she shall then assume all responsibilities as prescribed above.

801.1.1.6 Procedure.

It shall be the obligation of the owner of the new or altered building to:

1. Schedule this work so as to create a minimum of disturbance to the occupants of the affected building; and

2. Provide such essential services as are normally supplied by the equipment while it is out of service; and

3. Where necessary, support such extended chimneys, vents and equipment from this building or to carry up such chimneys or vents within his or her building; and

4. Provide for the maintenance, repair, and/or replacement of such extensions and added equipment; and

5. Make such alterations of the same material as the original chimney or vent so as to maintain the same quality and appearance, except where the affected owner of the chimney or vent shall give his or her consent to do otherwise. All work shall be done in such fashion as to maintain the architectural aesthetics of the existing building. Where there is practical difficulty in complying strictly with the provisions of this Item, the commissioner may permit an equally safe alternative.

801.1.1.7 Existing violations.

Any existing violations on the previously constructed equipment shall be corrected by the owner of the equipment before any equipment is added or alterations made at the expense of the owner of the new or altered building.

801.1.1.8 Variance.

The commissioner may grant a variance in accordance with the provisions of this code.

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 vented in accordance with Section 804. The chimney or vent shall be designed for the type of appliance being vented.

Exception: Commercial cooking appliances vented by a Type I hood installed in accordance with Section 507.

801.2.1 Design.

Chimneys and vents shall be designed and constructed so as to provide the necessary draft and capacity for each appliance connected to completely exhaust the products of combustion to the outside air. The temperature on adjacent combustible surfaces shall not be raised above 160°F (71°C). Chimneys and vents shall be designed to resist the effects of condensation that would cause deterioration of the chimney or vent.

801.2.2 Outlets.

The outlet shall be arranged so that the flue gases are not directed so that they jeopardize people, overheat combustible structures, or enter building openings in the vicinity of the outlet.

801.2.3 Support.

Chimneys and vents shall not be supported by the equipment they serve unless such equipment has been specifically designed for such loads.

801.2.4 Oil-fired appliances.

Oil-fired appliances shall be vented in accordance with this code and NFPA 31.

801.2.5 Gas fired appliances.

Gas fired appliances shall be vented in accordance with the *New York City Fuel Gas Code.*

801.3 Masonry chimneys.

Masonry chimneys shall be constructed in accordance with the *New York City Building Code.*

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.

801.5 Design.

Venting systems shall be designed in accordance with this chapter and comply with the requirements of the *New York City Air Pollution Control Code.*

801.6 Minimum size of chimney or vent.

Except as otherwise provided for in this chapter, the size of the chimney or vent, serving a single appliance, except engineered systems, shall have a minimum area equal to the area of the appliance connection.

801.7 Solid fuel appliance flues.

The cross-sectional area of a flue serving a solid fuel-burning appliance shall be not greater than three times the cross-sectional area of the appliance flue collar or flue outlet.

801.8 Abandoned inlet openings.

Abandoned inlet openings in chimneys and vents shall be closed by an approved method, sealed air-tight and permanently labeled as abandoned.

801.9 Positive pressure.

Where an appliance equipped with a forced or induced draft system creates a positive pressure in the venting system, the venting system shall be designed and listed for positive pressure applications.

801.10 Connection to fireplace.

Connection of appliances to chimney flues serving fireplaces shall be in accordance with Sections 801.10.1 through 801.10.3.

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.

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.

801.10.3 Connection to masonry fireplace flue.

A connector shall extend from the appliance to the 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.

801.11 Multiple solid fuel prohibited.

A solid fuel-burning appliance or fireplace shall not connect to a chimney passageway venting another appliance.

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.

801.13 Cleanouts.

Masonry chimney flues shall be provided with a cleanout opening having 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

of a minimum size of 8 inches by 8 inches (203 mm by 203 mm).

Exception: Cleanouts shall not be required for chimney flues serving masonry fireplaces, if such flues are provided with access through the fireplace opening.

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 and piping on the positive pressure side of the exhauster shall be listed for positive pressure applications as specified by the manufacturer's installation instructions for the exhauster or in accordance with this code.

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.

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 manufacturer's installation instructions. Listed materials used as flue linings shall be installed in accordance with their listings and the manufacturer's installation instructions.

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 equivalent. Clay flue lining shall be installed in accordance with the *New York City Building Code.*

2. Listed chimney lining systems complying with UL 1777 (new and existing chimneys) or ULC-S635 (existing chimneys) or ULC-S640 (new chimneys).

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).

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 this code.

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 801.18.1 through 801.18.4.

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 the venting of oil-fired appliances to masonry chimneys, the resizing shall be in accordance with NFPA 31.

801.18.2 Flue passageways.

The flue gas passageway 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.

801.18.3 Cleanout.

Masonry chimneys shall be provided with a cleanout opening complying with Section 801.13.

801.18.4 Clearances.

Chimneys and vents shall have air-space clearance to combustibles in accordance with the *New York City Building Code* and the chimney or vent manufacturer's installation instructions.

Exception: Masonry chimneys without the required airspace clearances shall be permitted to be used if lined or relined with a chimney lining system listed for use in chimneys with reduced clearances in accordance with UL 1777 or ULC-S635. The chimney clearance shall be not less than permitted by the terms of the chimney liner listing and the manufacturer's instructions.

801.18.4.1 Fireblocking.

Noncombustible fireblocking shall be provided in accordance with the *New York City Building Code.*

801.19 Multistory prohibited.

Common venting systems for appliances located on more than one floor level shall be prohibited.

801.20 Termination requirements.

Terminations shall comply with the appliance listing and manufacturer's instructions, and the following:

1. Chimneys serving appliances less than 600°F (316°C) shall extend at least 3 feet (914 mm) above the highest construction, such as a roof ridge, parapet wall or penthouse, but within 10 feet (3048 mm) of the chimney outlet, whether the construction is on the same building as the chimney or on another building. Any chimney located in an area that is more than 10 feet (3048 mm) from such construction but not more than the distance determined by Equation 8-1, shall be at least as high as the highest construction in such area. For purposes of determining the required height of a chimney, such construction shall not include other chimneys, vents or open structural framing.

2. Chimneys serving appliances between 600°F (316°C) and 1,000°F (538°C) shall extend at least 10 feet (3048 mm) above the highest construction, such as a roof ridge, or parapet wall or penthouse within 20 feet (6096 mm) of the chimney outlet, whether the construction is on the same building as the chimney or on another building. Any chimney located in an area more than 20 feet (6096 mm) from such construction, but not more than the distance determined from Equation 8-1, shall be at least as high as the highest construction in such area. For purposes of determining the required height of the chimney, such construction does not include other chimneys, vents or open structural framing.

3. Chimneys serving appliances greater than 1,000°F (538°C) shall extend at least 20 feet (6096 mm) above the highest construction, such as roof ridge, parapet wall, penthouse, or other obstruction within 50 feet (15 240 mm) of the chimney outlet, whether the construction is on the same building as the chimney or in another building. Any chimney located in an area that is more than 50 feet (15 240 mm) from such construction, but not more than the distance determined from Equation 8-1, shall be at least as high as the highest construction located in such area. For purposes of determining the

required height of the chimney, such construction does not include other chimneys, vents, or open structural framing.

4. [Reserved.]

5. The following formula shall be used in order to determine the distance referred to in Items 1, 2 and 3 of this section:

$$D = F \times \sqrt{A} \qquad \textbf{(Equation 8-1)}$$

where:

D	=	Distance, in feet, measured from the center of the chimney outlet to the nearest edge of the construction.
F	=	Value determined from Table 801.20.
A	=	Free area, in square inches, of chimney flue space.

Table 801.20

"F" Factor for Determining Chimney Distances

Type of Fuel	"F" Factor		
	600°F (316°C) and less	600°F (316°C) to 1,000°F	Greater than 1,000°F
No. 2 Fuel Oil	2.5	2.5	3
No. 4, 6 Fuel Oil, Solid Fuels	3	3	3

801.21 Drains.

A drain shall be provided for all chimneys and gas vents to remove rain water and condensation. The drain shall be a minimum of 1 inch (25 mm) in size and shall be equipped with an appropriately-sized p-trap with automatic trap seal primer in accordance with Section 1002 of the *New York City Plumbing Code* or a float drain trap installed in accordance with the manufacturer's installation requirements. The drain shall be sized by the design engineer and shall be suitable for the chimney area. For listed chimneys and gas vents, the connection tap into the chimney shall be determined by the manufacturer and connected to the drain piping in accordance with the listing and installation instructions. On all outdoor chimneys and gas vents, the connection and drain shall be installed indoors as close as practicable to the chimney base to prevent freezing.

801.22 Thermal safety (spill) switches.

Thermal safety (spill) switches shall be installed on barometric dampers, draft hoods, draft diverters, and all other appurtences that allow dilution air into chimneys or gas vents. Thermal safety (spill) switches shall be interlocked with all of the appliances connected to the same chimney or gas vent.

Section MC 802: Vents

802.1 General.

All vent systems shall be listed and labeled or field fabricated in accordance with NFPA 211. Type L vents shall be tested in accordance with UL 641.

802.2 Vent application.

The application of vents shall be in accordance with Table 802.2.

Table 802.2

Vent Application

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.

802.3 Installation.

Vent systems shall be sized, installed and terminated in accordance with the vent and appliance manufacturer's installation instructions.

802.4 Vent termination caps.

Vent termination caps shall not be permitted and a drain installed to receive condensed or rain water shall be required. A positive means, such as offsets, shall be provided to prevent water from entering the appliance.

802.5 Type L vent terminations.

Type L vents shall terminate in accordance with Section 801.20.

802.6 Minimum vent heights.

Vents shall terminate not less than 5 feet (1524 mm) in vertical height above the highest connected appliance 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 integral venting means shall be installed in accordance with their listings and the manufacturer's installation instructions.

802.7 Support of vents.

All portions of vents shall be installed in accordance with the manufacturer's listing and installation instructions and shall be adequately supported for the design and weight of the materials employed.

802.8 Insulation shield.

Where vents pass through insulated assemblies, an insulation shield constructed of not less than No. 26 Gage 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.

Section MC 803: Connectors

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.

803.2 Location.

Connectors shall be located entirely within the room in which the connecting appliance is located, except as provided for in Section 803.10.4. Where passing through an unheated space, a connector shall not be constructed of single-wall pipe.

803.3 Size.

The connector shall not be smaller than the size of the flue collar supplied by the manufacturer of the appliance. 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.

803.4 Branch connections.

All branch connections to the vent connector shall be made in accordance with the vent manufacturer's instructions.

803.5 Manual dampers.

Manual dampers shall not be installed in connectors except in chimney connectors serving solid fuel-burning appliances.

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 unless the appliance is listed and labeled 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.

803.7 Connectors serving two or more appliances.

Where two or more connectors enter a common vent or chimney, the smaller connector shall enter at the highest level consistent with available headroom or clearance to combustible material.

803.8 Vent connector construction.

A vent connector for a nonresidential, low-heat appliance shall be a factory-built chimney section or steel pipe having resistance to heat and corrosion equivalent to that for the appropriate galvanized pipe as specified in Table 803.8. Factory-built chimney sections shall be joined together in accordance with the chimney manufacturers' instructions.

Table 803.8

Minimum Thickness for Galvanized Steel Vent Connectors

for Low-Heat Appliances

Diameter of Connector (inches)	Minimum Thickness (inches)
Less than 6	0.019
6 to less than 10	0.023
10 to 12 inclusive	0.029
14 to 16 inclusive	0.034
Over 16	0.056

For SI: 1 inch = 25.4 mm.

803.9 Chimney connector construction.

Chimney connectors for low-heat appliances shall be of sheet steel pipe having resistance to corrosion and heat not less than that of galvanized steel specified in Table 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 803.9(2).

Table 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 Gage)
Larger than 5 and up to 10	0.028 (No. 24 Gage)
Larger than 10 and up to 16	0.034 (No. 22 Gage)

Larger than 16	0.064 (No. 16 Gage)

For SI: 1 inch = 25.4 mm.

Table 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	0.0575 (No. 16 Gage)
155-201	15-16	0.075 (No. 14 Gage)
202-254	17-18	0.0994 (No. 12 Gage)
Greater than 254	Greater than 18	0.1292 (No. 10 Gage)

For SI: 1 inch = 25.4 mm, 1 square inch = 645.16 mm^2 .

803.10 Installation.

Connectors shall be installed in accordance with Sections 803.10.1 through 803.10.6.

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.

803.10.2 Length.

The maximum horizontal length of a single- wall connector shall not affect the capability of the system to produce adequate draft.

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. Where 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.

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 in Table 803.10.4.

Concealed metal parts of the pass-through system in contact with flue gases shall be of stainless steel or equivalent material that resists corrosion, softening or cracking up to 1,800°F (980°C).

Table 803.10.4

Chimney Connector Systems and Clearances to Compustible Wall

Materials for Domestic heating Appliances [a, b, c, d, e]

System A (12-inch clearance)	A 3.5-inch-thick brick wall shall be framed into the combustible wall. A 0.625-inch-thick fire-clay liner (ASTM C 315 or equivalent)[e] 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 steel 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 manufacturers' parts shall be utilized to securely fasten the chimney connector to the chimney section.

System C (6-inch clearance)	A sheet metal (minimum number 24 Gage) ventilated thimble having a minimum thickness of 0.0236 inch (No. 24 gage) having two 1-inch air channels shall be installed. Steel supports shall be cut to maintain a 6-inch clearance with a sheet steel chimney connector between the thimble and combustibles. The chimney connector and steel supports shall have a minimum thickness of 0.0236 inch (No. 24 gage). 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.
System D (2-inch clearance)	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 steel chimney connector having a minimum thickness of 0.0236 inch (24 gage). Sheet steel supports shall be positioned to maintain 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 section shall be fastened to the supports. Fasteners shall not penetrate the liner of the chimney section.

For SI: 1 inch = 25.4 mm, 1.0 Btu × in/ft ^{2} • h • °F = 0.144 W/m ^{2} • °K.

a. Insulation material that is part of the wall pass-through system shall be noncombustible and shall have a thermal conductivity of 1.0 Btu - in/ft ^{2} • h • °F or less.

b. All clearances and thicknesses are minimums.

c. Materials utilized to seal 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.

e. ASTM C 315.

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).

803.10.6 Clearances.

Connectors shall have a minimum clearance to combustibles in accordance with Table 803.10.6. The clearances specified in Table 803.10.6 apply, except where the listing and labeling of an appliance specifies a different clearance, in which case the labeled clearance shall apply. The clearance to combustibles for connectors shall be reduced only in accordance with Section 308 or via the use of a listed chimney or vent connector system.

Table 803.10.6

Connector Clearances to Combustibles

Type of Appliance	**Minimum Clearance (inches)**
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 oil and solid fuel appliances	36
High-heat appliances	
Masonry or metal connectors	
All oil and solid fuel appliances	In accordance with NFPA 211

For SI: 1 inch = 25.4 mm.

Section MC 804: Direct-vent, Integral Vent and Mechanical Draft Systems

804.1 Direct-vent terminations.

Vent terminals for direct-vent appliances shall be installed in accordance with the manufacturer's installation instructions. In addition, direct vent terminations shall comply with the following requirements:

1. Where located adjacent to walkways, the termination 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, other than the forced air inlet for the subject direct vent appliance, 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. The vent termination shall not be mounted directly above or within 3 feet (914 mm) horizontally from any gas or electric metering, regulating, venting relief equipment or other building opening.

6. The bottom of the vent termination shall be located at least 24 inches (610 mm) above finished grade.

7. The maximum heat input of an appliance served by single horizontal vent termination shall be 350,000 Btu/h (1025 kW), unless otherwise approved by the commissioner.

8. The maximum heat input of all appliances served by horizontal vent terminations located within a 10 foot (3048 mm) radius shall be 350,000 Btu/h (1025 kW), unless otherwise approved by the commissioner.

9. The vent termination shall be located a minimum of 4 feet from the lot line or from adjacent buildings. The termination shall be installed in accordance with the vent manufacturer's listing and installation instructions.

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. In addition, integral vent terminals shall comply with the following requirements:

1. Where located adjacent to walkways, the vent terminal shall be not less than 7 feet (2134 mm) above the level of the walkway.

2. The vent terminal shall be at least 3 feet (914 mm) above any forced air inlet, other than the forced air inlet for the subject integral vent appliance, located within 10 feet (3048 mm).

3. The vent terminal shall be 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 terminal shall not be located closer than 3 feet (914 mm) to an interior corner formed by two walls perpendicular to each other.

5. The vent terminal shall not be mounted directly above or within 3 feet (914 mm) horizontally from any gas or electric metering, regulating, venting relief equipment or other building opening.

6. The bottom of the vent terminal shall be located at least 24 inches (610 mm) above finished grade.

7. The maximum heat input of an appliance served by single horizontal vent terminal shall be 350,000 Btu/h (1025 kW), unless otherwise approved by the commissioner.

8. The maximum heat input of all appliances served by horizontal vent terminals located within a 10 foot (3048 mm) radius shall be 350,000 Btu/h (1025 kW), unless otherwise approved by the commissioner.

9. The vent terminal shall be located a minimum of 4 feet from the lot line or from adjacent buildings. The termination shall be installed in accordance with the vent manufacturer's listing and installation instructions.

804.2.1 [Reserved.]

804.3 Mechanical draft systems.

Mechanical draft systems of either forced or induced draft design shall comply with Sections 804.3.1 through 804.3.8.

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.

804.3.2 Automatic shutoff.

Power exhausters serving automatically-fired appliances shall be electrically connected to each appliance to prevent operation of the appliance when the power exhauster is not in operation.

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, unless otherwise approved by the Commissioner. The exhaust shall be directed away from the building.

804.3.4 Horizontal terminations.

Horizontal terminations and discharges, including any horizontal direct vent terminations subject to Section 804.1 and horizontal integral vent terminals subject to Section 804.2, shall not be permitted, unless otherwise authorized by the commissioner.

804.3.5 Vertical terminations.

Vertical terminations and discharges shall comply with Section 801.20.

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.

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.

804.3.8 Mechanical draft systems for manually fired appliances and fireplaces.

A mechanical draft system shall be permitted to be used with manually fired appliances and fireplaces where such system complies with all of the following requirements:

1. The mechanical draft device shall be listed and installed in accordance with the manufacturer's installation instructions.

2. A device shall be installed that produces visible and audible warning upon failure of the mechanical draft device or loss of electrical power, at any time that the mechanical draft device is turned on. This device shall be equipped with a battery backup if it receives power from the building wiring.

3. A smoke detector or alarm, and a carbon monoxide detector or alarm, shall be installed in the room with the appliance or fireplace. This device shall be equipped with a battery backup if it receives power from the building wiring.

Section MC 805: Factory-built Chimneys

805.1 Listing.

Factory-built chimneys shall be listed and labeled and shall be installed and terminated in accordance with this code and the manufacturer's installation instructions.

805.2 Solid fuel appliances.

Factory-built chimneys installed in dwelling units with solid fuel-burning appliances shall comply with the Type HT requirements of UL 103 and shall be marked "Type HT" and "Residential Type and Building Heating Appliance Chimney".

Exceptions:

1. Chimneys for use with open combustion chamber fireplaces shall comply with the requirements of UL 103 and shall be marked "Residential Type and Building Heating Appliance Chimney".

2. Chimneys for use with open combustion chamber appliances installed in buildings other than dwelling units shall comply with the requirements of UL 103 and shall be marked "Building Heating Appliance Chimney" or "Residential Type and Building Heating Appliance Chimney."

805.3 Factory-built fireplaces.

Chimneys for use with factory-built fireplaces shall comply with the requirements of UL 127.

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.

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.

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 Section 304.1.

Section MC 806: Metal Chimneys

806.1 General.

Metal chimneys shall be constructed and installed in accordance with NFPA 211.

806.2 Exterior metal chimneys.

Exterior metal chimneys shall be stainless steel or galvanized, painted on the exterior surface with a heat-resisting paint.

Section MC 807: Changes In Appliance Fuels

807.1 Changes in appliance fuels.

Conversion of appliances from solid or liquid fuel to, or the addition of, natural gas shall be installed per the *New York City Fuel Gas Code.* Conversion from natural gas to, or the addition of, #2 fuel oil for a heating appliance shall be made only if:

1. The chimney design meets the requirements of this chapter for the conversion fuel, and the chimney is test run and smoke tested in accordance with Section 810.

2. The chimney is sized to provide adequate draft and vent the combustion products for the new fuel.

3. The chimney is thoroughly cleaned prior to the conversion to remove collected flue deposits.

Section MC 808: Reduction of Flue Size

808.1 Reduction of flue size.

Conversion from one fuel to another or the use of an existing chimney to service a fireplace or wood-burning appliance may require a flue size change for proper operation. This may be done if the redesigned flue meets the criteria for the fuel and chimney type to be used as set forth in this chapter.

Section MC 809: Chimney Supported from Equipment

809.1 Chimney support.

Chimneys shall not be supported by the equipment they serve, unless such equipment has been specifically designed for such loads.

Section MC 810: Test Run and Smoke Test

810.1 Test run.

All new chimneys shall be test run under operating conditions to demonstrate fire safety and the complete exhausting of smoke and the products of combustion to the outer air. The test run shall be conducted by a registered design professional responsible for the test, and the results of such test run shall be certified as correct by such professional and submitted in writing to the department.

810.2 Requirement of a smoke test.

A smoke test shall be made as outlined in Section 810.3. Any faults or leaks found shall be corrected. Such smoke test shall be witnessed by a representative of the commissioner. In lieu thereof, the commissioner may accept the test report of a registered design professional responsible for the test which shall be submitted in writing to the department.

810.3 Smoke test.

To determine the tightness of chimney construction, a smoke test shall be made in accordance with the following conditions and requirements:

1. The equipment, materials, power and labor necessary for such test shall be furnished by, and at the expense of, the owner or holder of the work permit.

2. If the test shows any evidence of leakage or other defects, such defects shall be corrected in accordance with the requirements of this chapter, and the test shall be repeated until the results are satisfactory.

3. The chimney shall be filled with a thick penetrating smoke produced by one or more smoke machines, or smoke bombs, or other equivalent method. As the smoke appears at the stack opening on the roof, such opening shall be tightly closed and a pressure equivalent to ^{1}- inch (13 mm) column of water measured at the base of the stack, shall be applied. The test shall be applied for a length of time sufficient to permit the inspection of the chimney.

Section MC 811: Exhaust Gases from Internal Combustion Engines and Turbines

811.1 Exhaust pipe construction.

The exhaust pipe from internal combustion engines shall be constructed in accordance with NFPA 211, NFPA 37, and based on the temperature of the gases entering the exhaust pipe, and in accordance with the following:

1. The exhaust pipe, if factory fabricated, shall be installed in accordance with its listing and manufacturer's instructions.

2. The exhaust pipe, if field fabricated, shall be constructed of at least 3/16-inch (5 mm) steel, or of other equivalent metal of similar strength and resistance to the temperature and corrosive action of the exhaust gases. No lining shall be required.

3. Where the exhaust pipe runs inside a building, it shall be insulated with insulation adequate for the temperature of the pipe, so that the surface temperature shall be not more than 200°F (93°C).

4. Where the exhaust pipe runs inside a building outside of the room containing the equipment, it shall be enclosed in fire-rated construction with a fire rating equal to the fire rating of the construction of the room.

5. All joints shall be constructed so as to be gas tight under all operating conditions and tested in accordance with Section 810.

811.2 Emergency and standby generator discharge opening termination requirements.

The location of discharge openings for emergency and standby generators shall comply with the requirements of NFPA 37 so that the flue gases are not directed to jeopardize the health or safety of people, overheat combustible structures, nor enter building openings in the vicinity of the outlet, nor shall the location of such openings cause the condensate leaving the outlet to come into contact with people.

811.2.1 Interference.

No discharge opening shall be located and constructed so as to interfere with the proper functioning of other openings in the same building or adjoining buildings, to interfere unreasonably with the occupants of the same building or adjoining buildings, or with the general public, or to create a fire or health hazard.

811.2.2 Chimneys.

The exhaust pipe may be connected to a chimney used for other equipment, provided that the operation of the engine does not adversely affect the operation of the other equipment so that it is in violation of the *New York City Air Pollution Control Code.*

811.3 All other engine and turbine discharge opening termination requirements.

The location of the discharge outlet from all other engines and turbines shall comply with the requirements of Section 801.20.2 or Section 801.20.3 based on the temperature of the gases entering the exhaust pipe.

Chapter 9: Specific Appliances, Fireplaces, Solid Fuel-burning Equipment, and Noise Control Requirements

Section MC 901: General

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. The approval, design, installation, construction, maintenance, alteration and repair of gas-fired appliances shall be regulated by the *New York City Fuel Gas Code.*

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 this code, and installed in accordance with the requirements of NFPA 31, NFPA 54 and NFPA 211.

901.3 Solid fuel-burning fireplaces and appliances.

All solid fuel-burning fireplaces and appliances shall be installed, altered and maintained in buildings in conformity with the applicable provisions of the New York City *Air Pollution Control Code* and no new solid fuel-burning fireplaces or appliances shall be permitted except those that burn the types of fuel allowed by such code.

(L.L. 2015/038, 5/6/2015, eff. 5/6/2016)

901.4 Hazardous locations.

Fireplaces and solid fuel-burning appliances shall not be installed in hazardous locations.

(Am. L.L. 2015/038, 5/6/2015, eff. 5/6/2016)

901.5 Fireplace accessories.

Listed fireplace accessories shall be installed in accordance with the conditions of the listing and the manufacturer's installation instructions.

(Am. L.L. 2015/038, 5/6/2015, eff. 5/6/2016)

901.6 Inspection of solid fuel-burning heating appliances, chimneys and flues.

Inspections of solid fuel burning heating appliances, chimneys and flues shall be in accordance with the *New York City Building Code*.

(Am. L.L. 2015/038, 5/6/2015, eff. 5/6/2016)

901.7 Fireplaces.

Fireplaces (solid-fuel-type or ANSI Z21.50) shall be installed with tight-fitting noncombustible fireplace doors to control infiltration losses in construction types listed here:

1. Masonry or factory-built fireplaces designed to allow an open burn.

2. Decorative appliances (ANSI Z21.60 gas-log style unit) installed in a vented solid fuel fireplace.

3. Vented decorative gas fireplace appliances (ANSI Z21.50 unit). Fireplaces shall be provided with a source of combustion air as required by the fireplace construction provisions of the *New York City Building Code* and Chapter 7 of this code.

(Am. L.L. 2015/038, 5/6/2015, eff. 5/6/2016)

Section MC 902: Masonry Fireplaces

902.1 General.

Masonry fireplaces shall be constructed in accordance with the *New York City Building Code*.

Section MC 903: Factory-built Fireplaces

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.

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.

903.3 Unvented gas log heaters.

The installation of unvented gas fired space heaters, gas stoves, gas logs, gas fireplaces and gas fireplace inserts is prohibited.

903.4 Flues.

Separate flues shall be provided for every fireplace and fireplace stove.

903.5 Combustion air supply.

All installations of factory-built fireplaces shall comply with the requirements of the *New York City Energy Conservation Code* concerning combustion air supply.

Section MC 904: Pellet Fuel-burning Appliances

904.1 General.

Pellet fuel-burning appliances shall be listed and labeled in accordance with ASTM E 1509 and shall be installed in accordance with the terms of the listing. If permitted, such appliances shall be operated in accordance with the *New York City Air Pollution Control Code.*

Section MC 905: Fireplace Stoves and Room Heaters

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 with 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 manufacturer's installation instructions.

905.2 Connection to fireplace.

The connection of solid fuel appliances to chimney flues serving fireplaces shall comply with Sections 801.7 and 801.10.

905.3 Air pollution.

All fireplace stoves and room heaters shall comply with the requirements of the *New York City Air Pollution Control Code.*

905.4 Combustion air supply.

All fireplace stoves and room heaters shall comply with the requirements of the *New York City Energy Conservation Code* concerning combustion air supply.

905.5 Flues.

Separate flues and independent combustion air source shall be provided for every fireplace stove and room heater. Combustion air shall be provided in accordance with the manufacturer's recommendations and Chapter 7.

Section MC 906: Factory-built Barbecue Appliances

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 chapter, Chapters 3, 5, 7, 8 of this code, and the *New York City Fuel Gas Code.* All provisions for the construction and installation of fireplaces shall be complied within the construction and installation of barbecue grills.

Section MC 907: Incinerators and Crematories

907.1 General.

Incinerators and crematories shall be listed and labeled in accordance with UL 791 and NFPA 82 and shall be installed in accordance with the manufacturer's installation instructions.

907.2 Compliance.

All incinerators and crematories shall be installed, altered and maintained in buildings in conformity with the applicable provisions of the *Administrative Code* and the *New York City Air Pollution Control Code.*

Section MC 908: Cooling Towers, Evaporative Condensers and Fluid Coolers

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.

908.2 Access.

Cooling towers, evaporative condensers and fluid coolers shall be provided with ready access.

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 *New York City Building Code*.

908.3.1 Indoor.

Cooling towers, evaporative condensers and fluid coolers located inside of buildings shall be constructed of noncombustible materials including fill and drift eliminators.

908.3.2 Outside.

Cooling towers shall be constructed of noncombustible materials.

Exceptions:

1. Fill and drift eliminators of limited combustible materials may be considered non-combustible if the cooling towers are provided with automatic sprinkler protection in compliance with Chapter 9 of the *New York City Building Code.*

2. Fill and drift eliminators may be made of limited combustible materials provided all the following conditions are met:

2.1. The cooling tower is located on a building of construction Types IA or IB of the New York City Building Code.

2.2. The cooling tower, fill and drift eliminators are located at least 30 feet (9144mm) away from windows or fresh air intakes which are at an elevation above the roof on which the cooling tower is located, whether in the same building or in an adjoining building.

2.3. The cooling tower is located not less than 15 feet (4572 mm) from the lot line.

2.4. The cooling tower is located not less than 10 feet (3048 mm) from any chimney, except that the distance shall not be less than 20 feet (6096 mm) from a chimney venting products of combustion other than from gas- or oil-fired appliances, whether on the same or an adjoining building.

908.4 Support and anchorage.

Supports for cooling towers, evaporative condensers and fluid coolers shall be designed in accordance with the *New York City Building Code*. Seismic restraints shall be as required by the *New York City Building Code*. Adequate vibration isolation shall be provided in accordance with the manufacturer's installation guidelines and as required for the supporting structure, and in accordance with Sections 928.3.7 and 928.3.8.

908.5 Water supply.

Water supplies and protection shall be as required by the *New York City Plumbing Code.*

908.6 Drainage.

Drains, overflows and blowdown provisions shall be indirectly connected to an approved disposal location. Discharge of chemical waste shall be approved by the appropriate regulatory authority.

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 combustible or hazardous shall comply with the *New York City Fire Code.* Flammable heat transfer fluids are prohibited.

Section MC 909: Vented Wall Furnaces

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.

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.

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.

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.

909.5 Manual shutoff valve.

A manual shutoff valve shall be installed ahead of all controls.

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.

Section MC 910: Floor Furnaces

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. Unvented floor furnaces are prohibited.

910.2 Placement.

Floor furnaces shall not be installed in any corridor, 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. Floor furnaces shall be located so as to be accessible. Floor furnaces shall be installed only in floors of noncombustible construction having at least a 2-hour fire rating, except as where required for one- and two-family dwellings.

910.3 Bracing.

The floor around the furnace shall be braced and headed with a support framework design in accordance with the *New York City Building Code*.

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 manufacturer 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.

910.5 Enclosures.

Enclosures of floor furnaces shall be constructed entirely of noncombustible materials with a fire-resistance rating of at least 1 hour and shall be provided with adequate outdoor air to ensure proper combustion. The enclosure shall be provided with adequate means of access for servicing the furnace.

910.6 Duct temperature.

The outlet duct temperature of warm air heating furnaces shall not be greater than 250°F (121°C).

910.7 One- and two- family dwellings.

Floor furnace enclosures shall be constructed of noncombustible materials with a fire-resistance rating of at least 1 hour. Means shall be provided for supporting the furnace when the grille is removed. Clearances shall be provided as per NFPA 54.

Section MC 911: Duct Furnaces

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. Unvented furnaces are prohibited.

911.2 Access panels.

Ducts connected to duct furnaces shall have removable access panels on both the upstream and downstream sides of the furnace.

911.3 Location of draft hood and controls.

The controls, combustion air inlets and draft hoods for duct furnaces shall be located outside of the ducts. The draft hood shall be located in the same enclosure from which combustion air is taken.

911.4 Circulating air.

Where a duct furnace is installed so that supply ducts convey air to areas outside the space containing the furnace, the return air shall also be conveyed 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.

911.5 Duct Temperature.

The outlet duct temperature of duct furnaces shall not be greater than 250°F (121°C).

Section MC 912: Infrared Radiant Heaters

912.1 Support.

Infrared radiant heaters shall be fixed in a position independent of fuel and electric supply lines. Hangers and brackets shall be noncombustible material.

912.2 Clearances.

Heaters shall be installed with clearances from combustible material in accordance with the manufacturer's installation instructions.

Section MC 913: Clothes Dryers

913.1 General.

Clothes dryers shall be installed in accordance with the manufacturer's installation instructions. Electric commercial clothes dryers shall be tested in accordance with UL 1240. Electric residential and coin-operated clothes dryers shall be tested in accordance with UL 2158.

913.2 Exhaust required.

Clothes dryers shall be exhausted in accordance with Section 504.

Exception: Electric clothes dryers provided with a condensate drain.

913.3 Clearances.

Clothes dryers shall be installed with clearance to combustibles in accordance with the manufacturer's instructions.

Section MC 914: Sauna Heaters

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.

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.

914.2 Installation.

Sauna heaters shall be listed and labeled in accordance with UL 875 and shall be installed in accordance with their listing and the manufacturer's installation instructions.

914.3 Access.

Panels, grilles and access doors that are required to be removed for normal servicing operations shall not be attached to the building.

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.

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.

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.

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 (6.4 mm) high.

Exception: This section shall not apply to one- and two-family dwellings.

Section MC 915: Engine and Gas Turbine-powered Equipment And Appliances

915.1 General.

The installation of liquid-fueled stationary internal combustion engines and gas turbines, including combustion air, exhaust, fuel storage and piping, shall meet the requirements of NFPA 37 and Chapters 7, 8, and 13 of this code. Stationary engine generator assemblies shall meet the requirements of UL 2200.

915.2 Powered equipment and appliances.

Permanently installed equipment and appliances powered by internal combustion engines and turbines shall be installed in accordance with the manufacturer's installation instructions and NFPA 37.

Section MC 916: Pool and Spa Heaters

916.1 General.

Pool and spa heaters shall be installed in accordance with the manufacturer's installation instructions. Oil-fired pool and spa heaters shall be tested in accordance with UL 726. Electric pool and spa heaters shall be tested in accordance with UL 1261.

Section MC 917: Cooking Appliances

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-fired cooking appliances are prohibited. Commercial electric cooking appliances shall be listed and labeled in accordance with UL 197. Household electric ranges shall be listed and labeled in accordance with UL 858. Microwave cooking appliances shall be listed and labeled in accordance with UL 923. Oil-burning stoves shall be listed and labeled in accordance with UL 896. Solid-fuel-fired ovens shall be listed and labeled in accordance with UL 2162.

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.

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.

917.4 Domestic range installation.

Domestic ranges installed on combustible floors shall be set on their own bases or legs and shall be installed with clearances of not less than that shown on the label.

917.5 Open-top broiler unit hoods.

A ventilating hood shall be provided above a domestic open-top broiler unit, unless otherwise listed for forced down draft ventilation.

917.5.1 Clearances.

A minimum clearance of 24 inches (610 mm) shall be maintained between the cooking top and combustible material above the hood. The hood shall be at least as wide as the open-top broiler unit and be centered over the unit.

917.6 Commercial cooking appliance venting.

Commercial cooking appliances, other than those exempted by Section 501.8 of the *New York City Fuel Gas Code,* shall be vented by connecting the

appliance to a vent or chimney in accordance with this code and the appliance manufacturer's instructions or the appliance shall be vented in accordance with Section 505.1.1 of the *New York City Fuel Gas Code.*

917.7 Domestic ventilation.

When a hood is required for proper ventilation of a domestic cooking appliance, the exhaust and make-up air systems shall be properly engineered and designed in accordance with Chapter 5.

Section MC 918: Forced-air Warm-air Furnaces

918.1 Forced-air furnaces.

Oil-fired furnaces shall be tested in accordance with UL 727. Electric furnaces shall be tested in accordance with UL 1995. Solid fuel furnaces shall be tested in accordance with UL 391. Forced-air furnaces shall be installed in accordance with the listings and the manufacturer's installation instructions. Forced-air warm-air furnaces shall be installed in accordance with the requirements of NFPA 31 and the *New York City Fuel Gas Code.* Unvented furnaces are prohibited.

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 mm^2/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 mm^2/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 and in accordance with NFPA 54.

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 mm^2/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 1995.

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.

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.

918.6 Prohibited sources.

Outdoor or return air for a forced-air heating system shall not be taken from the following locations:

1. Less 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 outdoor 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 unsanitary location or a refrigeration machinery room as defined in this 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 918.2 and 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, furnace room or unconditioned attic.

Exception: Where return air intakes are located not less than 10 feet (3048mm) from cooking appliances, and serve the kitchen area only, taking return air from a kitchen shall not be prohibited.

6. An unconditioned crawl space by means of direct connection to the return side of a forced air system. Transfer openings in the crawl space enclosure shall not be prohibited.

7. 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 not 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.

918.7 Outside opening protection.

Outdoor air intake openings shall be protected in accordance with Section 401.5.

918.8 Return-air limitation.

Return air from one dwelling unit shall not be discharged into another dwelling unit.

Section MC 919: Conversion Burners

919.1 Conversion burners.

The installation of conversion burners shall conform to ANSI Z21.8.

Section MC 920: Unit Heaters

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.

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.

920.3 Ductwork.

A unit heater shall not be attached to a warm-air duct system unless listed for such installation.

Section MC 921: Vented Room Heaters

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.

Section MC 922: Kerosene and Oil-fired Stoves

922.1 General.

The installation of kerosene and oil-fired stoves is prohibited.

Section MC 923: Small Ceramic Kilns

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 m^3) and are used for hobby and noncommercial purposes.

923.1.1 Installation.

Kilns shall be installed in accordance with the manufacturer's installation instructions and the provisions of this code.

Section MC 924: Stationary Fuel Cell Power Plants

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 instructions and NFPA 853. Such fuel cell plants shall be powered by hydrogen derived on-site from piped natural gas, except where the storage, handling and use of hydrogen or other flammable gas is authorized by the *New York City Fire Code* for such purposes and approved by the fire commissioner.

Section MC 925: Masonry Heaters

925.1 General.

Masonry heaters shall be constructed in accordance with the *New York City Building Code*.

Section MC 926: Gaseous Hydrogen Systems

926.1 Installation.

The installation of gaseous hydrogen systems shall be in accordance with the applicable requirements of this code, the *New York City Fire Code,* the *New York City Fuel Gas Code* and the *New York City Building Code.*

Section MC 927: Heat Recovery Ventilators

927.1 Ducted heat recovery ventilators.

Ducted heat recovery ventilators shall be listed and labeled in accordance with UL 1812.

927.2 Nonducted heat recovery ventilators.

Nonducted heat recovery ventilators shall be listed and labeled in accordance with UL 1815.

Section MC 928: Noise Control Requirements

928.1 General.

Interior and exterior mechanical equipment and systems shall comply with the provisions of this section.

928.2 Noise from exterior mechanical equipment.

Mechanical equipment located outside of the building in a yard or court or on a roof, or located inside a building but open to the exterior of the building, shall comply with the requirements of Sections 928.2.1 and 928.2.2.

928.2.1 Design and installation.

The applicant shall select and design any such exterior mechanical equipment in order to achieve compliance with the applicable requirements of Sections 24-218, 24-227, 24-228 and 24-232 of the *Administrative Code,* also known as the *New York City Noise Control Code,* in accordance with generally acceptable engineering practices.

928.2.2 Operation.

The operation of such exterior mechanical equipment shall comply with any applicable requirements of Sections 24-218, 24-227, 24-228 and 24-232 of the *New York City Noise Control Code,* as enforced by the Department of Environmental Protection.

928.3 Minimum structure-borne noise and vibration isolation requirements.

All isolators shall comply with the requirements of Sections 928.3.1 through Section 928.3.10.

928.3.1 Boiler rooms.

928.3.1.1 Boilers.

All boilers supported on floors directly above a story having dwelling units shall be supported on resilient isolators having a minimum static deflection of 1 inch (25 mm). The isolators shall be installed directly under the structural frame of the boiler.

928.3.1.2 Boiler breeching and piping.

When boilers are equipped with mechanical draft fans, the boiler breeching and piping that are supported from or on slabs, floors or walls that are contiguous to the dwelling unit shall be supported for a distance of 50 pipe diameters on or from resilient isolators. Each isolator shall have a minimum static deflection of 1 inch (25 mm).

928.3.2 Refuse charging chutes.

928.3.2.1 Metal chutes.

Metal chutes, metal chute supports, and/or metal chute bracing shall be free of direct contact with the shaft enclosure and the openings provided in the floor construction. Metal chutes shall be resiliently supported at each structural support location. Isolators shall provide a minimum static deflection of 0.30 inches (7.62 mm). All chutes shall be plumb.

928.3.2.2 Masonry chutes.

The interior chute wall shall be plumb and without obstructions for the full height of the shaft and shall have a smooth interior finish.

928.3.3 Piping.

Equipment piping shall be installed as follows:

1. Metal piping connected to power driven equipment shall be resiliently supported from or on the building structure for a distance of 50 pipe diameters from the power driven equipment. The resilient isolators shall have a minimum static deflection of 1 inch (25 mm) for all piping with a 4 inch (25 mm) or larger in actual outside diameter and 1/2 inch (12.7 mm) for piping with less than 4 inches (25 mm) in actual outside diameter. Piping connected to fluid pressure-reducing valves shall be resiliently isolated for a distance of 50 pipe diameters from pressure-reducing valves and isolators shall provide a minimum static deflection of 1/2 inch (12.7 mm).

2. Equipment such as heat exchangers, absorption refrigeration machines, or similar equipment, that is located on any floor or roof other than a floor on grade, and that is not power driven but is connected by metal piping to power driven equipment, shall be resiliently supported from or on the building structure, for a distance of 50 pipe diameters from the power driven equipment. The resilient supports shall be vibration isolators having a minimum static deflection of 1 inch (25 mm) and shall incorporate approved resilient pads having a minimum thickness of 1/4 inch (6.4 mm).

928.3.4 Fans.

All fan equipment with motors in excess of 1/2 horsepower (0.37 kW), located on any roof or floor other than a floor on grade shall be mounted on or from vibration isolators. Fan equipment with motor drives separated from the fan equipment shall be supported on an isolated integral rigid structural base supporting both the fan and motor. Fan equipment with motor drives supported from the fan equipment shall be mounted directly on vibration isolators. Each isolator shall have provision for leveling. Isolators shall incorporate resilient pads having a minimum thickness of 1/4 inch (6.4 mm). The vibration isolators shall provide a minimum isolation efficiency of 90 percent at fan rotor rpm with a maximum deflection of 2 inches (51 mm). Fans and compressors assembled in unitary containers may meet this requirement with isolators internal to the container providing the isolators meet the above minimum isolator efficiencies.

928.3.5 Pumps.

All pumps of 3 horsepower (2.25 kW) or more located on any floor other than a floor on grade shall be supported on vibration isolators having a minimum isolation efficiency of 90 percent at the lowest disturbing frequency. Each isolator shall incorporate a leveling device and a resilient pad having a minimum thickness of 1/4 inch (6.4 mm).

928.3.6 Compressors.

Compressors and drives located on a floor other than a floor on grade shall be mounted on vibration isolators having a minimum isolation efficiency of 90 percent at the lowest disturbing frequency. Each isolator shall incorporate a leveling device and a resilient pad having a minimum thickness of 1/4 inch (6.4 mm).

928.3.7 Cooling towers and fluid coolers.

All moving parts of cooling towers and fluid coolers located on a roof or floor other than a floor on grade shall be installed on vibration isolators providing a minimum isolation efficiency of 90 percent at fan rotor rpm with a maximum static deflection of 4 inches (102 mm). Each isolator shall incorporate a leveling device and a resilient pad having a minimum thickness of 1/4 inch (6.4 mm). Vibration cutoff switches shall be provided.

928.3.8 Evaporative condensers.

Evaporative and air cooled condensers located on a roof or floor other than a floor on grade shall be mounted on vibration isolators providing a minimum isolation efficiency of 90 percent at fan rotor rpm with a maximum static deflection of 4 inches (102 mm). Each isolator shall incorporate a leveling device and a resilient pad having a minimum thickness of 1/4 inch (6.4 mm). Vibration cutoff switches shall be provided on evaporative condensers.

928.3.9 Duct connections to fans.

Flexible connections shall be installed between fan equipment and connecting ductwork.

928.3.10 Ceiling suspended packaged HVAC units with compressors.

Equipment such as heat pumps, AC units, or similar equipment, that is suspended from a structure shall be resiliently supported from or on the building structure. Vibration isolators shall have a minimum isolation efficiency of 90 percent at the lowest disturbing frequency.

Chapter 10: Boilers, Water Heaters and Pressure Vessels

Section MC 1001: General

1001.1 Scope.

This chapter shall establish the minimum safety requirements for and shall govern the installation, alteration and repair of boilers, water heaters and pressure vessels.

Exceptions:

1. Pressure vessels used for unheated water supply.

2. Portable unfired pressure vessels and Interstate Commerce Commission containers.

3. Containers for bulk oxygen and medical gas.

4. Unfired pressure vessels having a volume of 5 cubic feet (0.14 m^3) or less operating at pressures not exceeding 250 pounds per square inch (psi) (1724 kPa) and located within occupancies of Groups B, F, H, M, R, S and U.

5. Pressure vessels used in refrigeration systems that are regulated by Chapter 11 of this code.

6. Pressure tanks used in conjunction with coaxial cables, telephone cables, power cables and other similar humidity control systems.

7. Any boiler or pressure vessel subject to inspection by federal inspectors.

1001.2 Thermal safety (spill) switches.

Thermal safety (spill) switches shall be installed on barometric dampers, draft hoods, draft diverters, and all other appurtenances that allow dilution air into a chimney or gas vent. Thermal safety (spill) switches shall be interlocked with all of the appliances connected to the same chimney or gas vent.

Section MC 1002: Water Heaters

1002.1 General.

Potable water heaters and hot water storage tanks shall be listed and labeled and installed in accordance with the manufacturer's installation instructions, the *New York City Plumbing Code* and this code. All water heaters shall be capable of being removed without first removing 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 *New York City Plumbing Code.* Domestic electric water heaters shall comply with UL 174 or UL 1453. Commercial electric water heaters shall comply with UL 1453. Oil-fired water heaters shall comply with UL 732. Approval for oil-fired water heaters 350,000 Btu/h input (1025 kW) and above shall be obtained from the New York City Department of Environmental Protection.

1002.2 Water heaters utilized for space heating.

Water heaters utilized both to supply potable hot water and provide hot water for space-heating applications shall be listed and labeled for such applications by the manufacturer, and shall be built in accordance with Section IV of the *ASME Boiler and Pressure Vessel Code* with an "H" code stamp. They shall be installed in accordance with the manufacturer's installation instructions, the ASME Boiler and Pressure Vessel Code and the *New York City Plumbing Code.*

1002.2.1 Sizing.

Water heaters utilized for both potable water heating and space-heating applications shall be sized to prevent the space-heating load from diminishing the required potable water-heating capacity.

1002.2.2 Temperature limitation.

Where a combination potable water-heating and space-heating system requires water for space heating at temperatures higher than 140°F (60°C), a temperature actuated mixing valve that conforms to ANSI/ASSE 1017 shall be provided to temper the water supplied to the potable hot water distribution system to a temperature of 140°F (60°C) or less.

1002.3 Supplemental water-heating devices.

Potable water-heating devices that utilize refrigerant-to-water heat exchangers shall be approved and installed in accordance with the *New York City Plumbing Code* and the manufacturer's installation instructions.

Section MC 1003: Pressure Vessels

1003.1 General.

All pressure vessels shall be constructed in accordance with the *ASME Boiler and Pressure Vessel Code* and shall bear the label of an approved agency. Pressure vessels shall be installed in accordance with the manufacturer's installation instructions.

1003.2 Piping.

All piping materials, fittings, joints, connections and devices associated with systems utilized in conjunction with pressure vessels shall be designed for the specific application and shall comply with the *ASME Boiler and Pressure Vessel Code* and this code.

1003.3 Welding.

Welding on pressure vessels shall be performed by welders certified in compliance with nationally recognized standards, *ASME Boiler and Pressure Vessel Code,* Section IX, 12 NYCRR 4-6.2, and 12 NYCRR 14-3.3 through 14-3.18.

Section MC 1004: Boilers

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 and constructed in accordance with the requirements of ASME CSD-1 and as applicable: the *ASME Boiler and Pressure Vessel Code;* 12 NYCRR Parts 4 and 14; and NFPA 85. Approval for oil-fired boilers 350,000 Btu/h input (1025 kW) and above shall be obtained from the New York City Department of Environmental Protection.

1004.1.1 Field erected boilers requirements.

1. The vessel erector shall hold the appropriate ASME stamp for vessel construction.

2. The licensed installer is responsible for the installation of all controls and burners which shall be designed and constructed in accordance with the requirements of ASME CSD-1 and, as applicable, the *ASME Boiler and Pressure Vessel Code,* 12 NYCRR Parts 4 and 14, and NFPA 85.

3. The New York City Department of Environmental Protection shall approve the installation of the boiler and burner for compatibility, controls and safety devices.

4. Boiler vessels shall comply with one of the following listings:

4.1. UL 726 or UL 795 as applicable; 4.2. UL 2106; or

Exception: Unlisted equipment shall obtain Department approval.

5. Controls and safety devices shall be tested and inspected in accordance with ASME CSD-1 and, as applicable, the *ASME Boiler and Pressure Vessel Code,* 12 NYCRR Parts 4 and 14, and NFPA 85. Testing and inspection shall be performed by the burner manufacturer's authorized representative in the presence of the licensed installer.

6. Inspection of the installed boiler assembly shall be performed by the department.

1004.2 Installation.

In addition to the requirements of this code, the installation of boilers shall conform to the manufacturer's instructions. Operating instructions of a permanent type shall be located in the boiler room and readily accessible. 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.

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. When boilers are installed or replaced, clearance shall be provided to allow access for maintenance and repair per the boiler's listing and manufacturer's installation instructions. Passageways for inspection around all sides of boilers shall have an unobstructed width of not less than 18 inches (457mm) unless the boiler's listing or department approval or manufacturer's installation instructions state otherwise.

1004.3.1 Top clearance.

High-pressure steam boilers having a steam-generating capacity in excess of 5,000 pounds per hour (2268 kg/h) or having a heating surface in excess of 1,000 square feet (93 m^2) or input in excess of 5,000,000 Btu/h (1465 kW) shall have a minimum clearance of 7 feet (2134 mm) from the top of the boiler to the ceiling. Steam-heating boilers and hot-water-heating boilers that exceed one of the following limits: 5,000,000 Btu/h input (1465 kW); 5,000 pounds of steam per hour (2268 kg/h) capacity or a 1,000-square-foot (93 m^2) heating surface; and high-pressure steam boilers that do not exceed one of the following limits: 5,000,000 Btu/h input (1465 kW); 5,000 pounds of steam per hour (2268 kg/h) capacity or a 1,000-square-foot (93 m^2) heating surface; and all boilers with manholes on top of the boiler, shall have a minimum clearance of 3 feet (914mm) from the top of the boiler to the ceiling. Package boilers, steam-heating boilers and hot-water-heating boilers without manholes on top of the shell and not exceeding one of the limits of this section shall have a minimum clearance of 2 feet (610 mm) from the ceiling.

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 and equipment shall be securely anchored to the structure. Equipment and appliances requiring vibration isolation shall be installed as designed by a registered design professional in accordance with the manufacturer's installation instructions.

1004.5 Floors.

Boilers shall be mounted on floors of noncombustible construction, unless listed for mounting on combustible flooring.

1004.6 Boiler rooms and enclosures.

Boiler rooms and enclosures and access thereto shall comply with the *New York City Building Code* and Chapter 3 of this code. Boiler rooms shall be equipped with a floor drain or other approved means for disposing of liquid waste in accordance with the *New York City Plumbing Code*.

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 boiler operating instructions shall be furnished by the installer for each installation. A complete control diagram of a permanent type shall be located in the boiler room and shall be readily accessible.

1004.8 Burner controls.

Gas and oil modulating burners shall be provided with burner controls (oil and gas equivalent ratings) in accordance with Table 1004.8.

Table 1004.8

Minimum Control Requirements

Type of Control	Gross Output Firing Rate of the Boiler or the Burner Oil Delivery Rate (gph),Whichever is Greater		
Combustion Controls	**#6 Oil**	**#4 Oil**	**#2 Oil**
On-Off	—	—	<10
Low-High-Off with low fire start	20 to <30	10 to <30	10 to <30
Low-High-Low-Off with proven low fire start	30 to <50	30 to <50	30 to <50
Full Modulation with proven low fire start	≥ 50	≥ 50	≥ 50
Full Modulation with proven low fire start as well as cross-limited oxygen trim (dry cell electrochemical type)	≥ 350	≥ 350	≥ 350

Section MC 1005: Boiler Connections

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 shutoff valves in the supply and return piping.

Exception: Shutoff valves are not required in a system having a single low-pressure steam boiler of 350,000 Btu/h (103 kW) output or less.

1005.2 Potable water supply.

The water supply to all boilers shall be connected in accordance with the *New York City Plumbing Code*.

Section MC 1006: Safety and Pressure Relief Valves And Controls

1006.1 Safety valves for steam boilers.

All steam boilers shall be protected with a safety valve.

1006.2 Safety relief valves for hot water boilers.

Hot water boilers shall be protected with a safety relief valve.

1006.3 Pressure relief for pressure vessels.

All pressure vessels shall be protected with a pressure relief valve or pressure-limiting device as required by the manufacturer's installation instructions for the pressure vessel.

1006.4 Standards of safety and safety relief valves.

Safety and safety relief valves shall be listed and labeled, and shall have a minimum rated capacity for the equipment or appliances served. Safety and safety relief valves shall be set at a maximum of the nameplate pressure rating of the boiler or pressure vessel.

1006.5 Installation.

Safety or relief valves shall be installed directly into the safety or relief valve opening on the boiler or pressure vessel. Valves shall not be located on either side of a safety or relief valve connection. The safety or relief valve shall discharge without obstruction to a nonhazardous point of discharge. The discharge piping shall drain by gravity without traps.

1006.6 Safety and relief valve discharge.

Safety and relief valve discharge pipes shall be of rigid pipe that is approved for the temperature of the system. The discharge pipe shall, at a minimum, be the same diameter as the safety or relief valve outlet. Safety and relief valves shall not discharge so as to be a hazard, a potential cause of damage or otherwise a nuisance. High-pressure-steam safety valves shall be vented to the outside of the structure. Where a low-pressure safety valve or a relief valve discharges to the drainage system, the installation shall conform to the *New York City Plumbing Code.*

1006.7 Boiler safety devices.

Boilers shall be equipped with controls and limit devices as required by the manufacturer's installation instructions and the conditions of the listing.

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. Where 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 deenergized, 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.

1006.8.1 Remote control (shutdown).

A remote control shall be provided to stop the flow of oil and/or gas and combustion air to any burner or fuel burning internal combustion equipment. Such control shall be located outside all means of egress to the room in which the burner or equipment is located and as close to such entrances as practicable, except that when an outside location is impracticable, such control may be located immediately inside the room in which the burner or equipment is located, provided such location is accessible at all times. All such controls shall be labeled: "REMOTE CONTROL FOR BURNER".

Section MC 1007: Boiler Low-water Cutoff

1007.1 General.

All steam and hot water boilers shall be protected with dual low-water cutoff control.

Exception: Hot water boilers located within a dwelling unit supplying only that unit and having a total heat input of less than 350,000 Btu/h (1025 kW) may be protected by only one low water cutoff control.

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 established by the manufacturer and in accordance with ASME CSD-1.

Section MC 1008: Boiler Blowoff/blowdown Valves

1008.1 General.

Every boiler shall be equipped with blowoff/blowdown valve(s). The valve(s) shall be installed in the openings provided on the boiler. The minimum quantity and size of each valve shall be the quantity and size specified by the boiler manufacturer or the quantity and size of the boiler blowoff/blowdown valve opening.

1008.2 Discharge.

Blowoff/blowdown valves shall discharge to a safe place of disposal. Where discharging to the drainage system, the installation shall conform to the *New York City Plumbing Code.*

Section MC 1009: Hot Water Boiler Expansion Tank

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. Lockable shutoff valves shall be installed at connections to all expansion tanks. Valves shall remain locked in the open position.

1009.2 Closed-type expansion tanks.

Closed-type expansion tanks shall be installed in accordance with the manufacturer's instructions. The size of the tank shall be based on the capacity of the hot-water-heating system. The minimum size of the tank shall be determined in accordance with the following equation:

$$V_t = \frac{(0.00041T - 0.0466)V_s}{\left(\frac{P_a}{P_f}\right) - \left(\frac{P_a}{P_o}\right)}$$

For SI:

$$V_t = \frac{(0.000738T - 0.03348)V_s}{\left(\frac{P_a}{P_f}\right) - \left(\frac{P_a}{P_o}\right)}$$

where:

V_t	=	Minimum volume of tanks (gallons) (L).
V_S	=	Volume of system, not including expansion tanks (gallons) (L).
T	=	Average operating temperature (°F) (°C).
P_a	=	Atmospheric pressure (psi) (kPa).
P_f	=	Fill pressure (psi) (kPa).
P_o	=	Maximum operating pressure (psi) (kPa).

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 mm) shall be installed at the top of the tank. The overflow shall discharge to the drainage system in accordance with the *New York City Plumbing Code.*

Section MC 1010: Gauges

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.

1010.2 Steam boiler gauges.

Every steam boiler shall have a water-gauge glass and a pressure gauge. The pressure gauge installed with a siphon shall indicate the pressure within the normal range of the system's operation.

1010.2.1 Water-gauge glass.

The gauge glass shall be installed so that the midpoint is at the normal boiler water level.

Section MC 1011: Tests

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. Boilers shall not be placed in operation upon completion of construction until they have been inspected and tested and a certificate of compliance has been issued by the commissioner. All final inspections and tests for boilers shall be made by a qualified boiler inspector in the employ of the department or a duly authorized insurance company as provided in Section 204 of the *Labor Law of the State of New York.* Equipment having an input of not more than 350,000 Btu/h (103 kW) shall be exempt from this requirement. Where field assembly of pressure vessels or boilers is required, a copy of the completed H-2, P-2 or U-1 Manufacturer's Data Report and the completed Appendix C of ASME CSD-1 required by the *ASME Boiler and Pressure Vessel Code* shall be submitted to the department.

1011.2 Test gauges.

An indicating test gauge shall be connected directly to the boiler or pressure vessel 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 and not greater than four times the maximum test pressure. All gauges utilized for testing shall be calibrated and certified annually in accordance with ASME B40.100 by the test operator.

1011.3 Periodic boiler inspections.

Periodic boiler inspections shall be performed in accordance with Section 28-303 of the *Administrative Code.*

Section MC 1012: Maximum Temperature

1012.1 Maximum temperature.

Maximum indoor temperature in spaces surrounding boilers, water heaters, and pressure vessels shall not exceed the operational temperature of the installed equipment or 104°F (40°C).

Chapter 11: Refrigeration

Section MC 1101: General

1101.1 Scope.

This chapter shall govern the design, installation, construction, alteration and repair of refrigeration systems that vaporize and liquefy a fluid during the refrigerating cycle. Refrigerant piping design and installation, including pressure vessels and pressure relief devices, shall conform to this code. Permanently installed refrigerant storage systems and other components shall be considered as part of the refrigeration system to which they are attached. This chapter shall also govern the change of refrigerants in existing refrigerating systems having a different safety group classification.

1101.2 Factory-built equipment and appliances.

Listed and labeled self-contained, factory-built equipment and appliances shall be tested in accordance with UL 207, 412, 471 or 1995. Such equipment and appliances are deemed to meet the design, manufacture and factory test requirements of this code if installed in accordance with their listing and the manufacturer's installation instructions.

1101.3 Protection.

Any portion of a refrigeration system that is subject to physical damage shall be protected in an approved manner.

1101.4 Water connection.

Water supply and discharge connections associated with refrigeration systems shall be made in accordance with this code and the *New York City Plumbing Code.*

1101.5 Fuel-oil and fuel-gas connection.

Refrigeration system devices, equipment and appliances utilizing fuel oil or fuel gas for combustion shall be installed in accordance with the applicable provisions of the *New York City Fuel Gas Code* and this code.

1101.6 General.

Refrigeration systems shall comply with the requirements of this code and, except as modified by this code, ASHRAE 15. Ammonia-refrigerating systems shall comply with this code and, except as modified by this code, ASHRAE 15 and IIAR 2.

1101.7 Maintenance.

Mechanical refrigeration systems shall be maintained in proper operating condition, free from accumulations of oil, dirt, waste, excessive corrosion, other debris and leaks.

1101.8 Change in refrigerant type.

The type of refrigerant in refrigeration systems having a refrigerant circuit containing more than 220 pounds (99.8 kg) of Group A1 or 30 pounds (13.6 kg) of any other group refrigerant shall not be changed without prior notification to the commissioner and compliance with the applicable code provisions for the new refrigerant type. The refrigerant being considered shall be evaluated for suitability by an engineer. Whenever change in the type of refrigerant is to be done, consideration shall be given to the following:

1. The effects of the substitute refrigerant on materials in the system;
2. The possibility of overloading the liquid receiver, which shall not be more than 80 percent full of liquid;
3. The possibility of exceeding motor rating, design working pressure, or other requirements that would violate any of the provisions of this code;
4. The proper size of refrigerant controls;
5. The effect of the operation and setting of safety devices;
6. The possible hazards created by mixture of the original and the substituted refrigerant; and
7. The effect of the classification of the refrigerant as provided.

1101.9 Refrigerant discharge.

Notification of refrigerant discharge shall be provided in accordance with the *New York City Fire Code.*

1101.10 Gas and oil fired absorption systems.

Refrigeration systems utilizing fuel oil or fuel gas for combustion shall be installed in accordance with the applicable provisions of the *New York City Fuel Gas Code* and this code.

1101.11 Signs, nameplates, and operation and emergency shutdown instructions.

Signs, nameplates, and operation and emergency shutdown instructions for refrigeration systems shall comply with the following:

1. Sections 9.15, 11.2.1, 11.2.2, 11.2.4, and 11.7 of ASHRAE 15.
2. Each refrigeration unit or system shall be provided with a nameplate indicating the horsepower of the prime mover or compressor and the equivalent of such horsepower in kilowatts.
3. Section 1105.11 of this code.

1101.12 Locking access port caps.

Refrigerant circuit access ports located outdoors shall be fitted with locking-type tamper-resistant caps requiring a special tool or key to open.

Section MC 1102: System Requirements

1102.1 General.

The system classification, allowable refrigerants, maximum quantity, enclosure requirements, location limitations, and field pressure test requirements shall be determined as follows:

1. Determine the refrigeration systems classification, in accordance with Section 1103.3.
2. Determine the refrigerant classification in accordance with Section 1103.1.
3. Determine the maximum allowable quantity of refrigerant in accordance with Section 1104, based on type of refrigerant, system classification, and occupancy.
4. Determine the system enclosure requirements in accordance with Section 1104.
5. Refrigeration equipment and appliance location and installation shall be subject to the limitations of Chapter 3.
6. Nonfactory-tested, field-erected equipment and appliances shall be pressure tested in accordance with Section 1108.

1102.2 Refrigerants.

The refrigerant shall be that which the equipment or appliance was designed to utilize or converted to utilize. Refrigerants not identified in Table 1103.1 shall be approved by the department before use. Refrigerants not identified in Table 1103.1, other than those having a Safety Group Classification of A-1,

shall also be approved by the Fire Department before use.

1102.2.1 Mixing.

Refrigerants, including refrigerant blends, with different designations in ASHRAE 34 shall not be mixed in a system.

Exception: Addition of a second refrigerant is allowed where permitted by the equipment or appliance manufacturer to improve oil return at low temperatures. The refrigerant and amount added shall be in accordance with the manufacturer's instructions.

1102.2.2 Purity.

Refrigerants used in refrigeration systems shall be new, recovered or reclaimed refrigerants in accordance with Section 1102.2.2.1, 1102.2.2.2 or 1102.2.2.3. Where required by the equipment or appliance owner, the installer shall furnish a signed declaration that the refrigerant used meets the requirements of Section 1102.2.2.1, 1102.2.2.2 or 1102.2.2.3.

Exception: The refrigerant used shall meet the purity specifications set by the manufacturer of the equipment or appliance in which such refrigerant is used where such specifications are different from that specified in Sections 1102.2.2.1, 1102.2.2.2 and 1102.2.2.3.

1102.2.2.1 New refrigerants.

Refrigerants shall be of a purity level specified by the equipment or appliance manufacturer.

1102.2.2.2 Recovered refrigerants.

Refrigerants that are recovered from refrigeration and air-conditioning systems shall not be reused in other than the system from which they were recovered and in other systems of the same owner. Recovered refrigerants shall be filtered and dried before reuse. Recovered refrigerants that show clear signs of contamination shall not be reused unless reclaimed in accordance with Section 1102.2.2.3.

1102.2.2.3 Reclaimed refrigerants.

Used refrigerants shall not be reused in a different owner's equipment or appliances unless tested and found to meet the purity requirements of ARI 700. Contaminated refrigerants shall not be used unless reclaimed and found to meet the purity requirements of ARI 700.

Section MC 1103: Refrigeration System Classification

1103.1 Refrigerant classification.

Refrigerants shall be classified in accordance with ASHRAE 34 as listed in Table 1103.1.

Refrigerant Number	Chemical Name	Chemical Formula	OELd. ppm v/v	Safety[C] Group	RCL (ppm v/v)	RCL (g/m^3)	RCL lb/Mcf
Methane Series							
11b	trichlorofluoromethane	CCl_3F	C1000	A1	1,100	6.2	.39
12b	dichlorodifluoromethane	CCl_2F_2	1,000	A1	18,000	90	5.6
13b	chlorotrifluoromethane	$CClF_3$	1,000	A1			
13B1b	bromotrifluoromethane	$CBrF_3$	1,000	A1			
14	tetrafluoromethane (carbon tetrafluoride)	CF_4	1,000	A1	110,000	400	25
21	dichlorofluoromethane	$CHCl_2F$		B1			
22	chlorodifluoromethane	$CHClF_2$	1,000	A1	59,000	210	13
23	trifluoromethane	CHF_3	1,000	A1	41,000	120	7.3
30	dichloromethane (methylene chloride)	CH_2Cl_2		B2			
32	difluoromethane (methylene fluoride)	CH_2F_2	1,000	A2L	36,000	77	4.8
40	chloromethane (methyl chloride)	CH_3Cl		B2			
50	methane	CH_4	1,000	A3			
Ethane Series							
113b	1,1,2-trichloro-1,2,2-trifluoroethane	CCl_2FCClF_2	1,000	A1	2,600	20	1.2
114b	1,2-dichloro-1,1,2,2- tetrafluoroethane	$CClF_2CClF_2$	1,000	A1	20,000	140	8.7
115b	chloropentafluoroethane	$CClF_2CF_3$	1,000	A1	120,000	760	47
116	hexafluoroethane	CF_3CF_3	1,000	A1	97,000	550	34
123	2,2-dichloro-1,1,1,-trifluoroethane	$CHCl_2CF_3$	50	B1	9,100	57	3.5
124	2-chloro-1,1,1,2-tetrafluoroethane	$CHClFCF_3$	1,000	A1	10,000	56	3.5
125	pentafluoroethane	CHF_2CF_3	1,000	A1	75,000	370	23
134a	1,1,1,2-tetrafluoroethane	CH_2FCF_3	1,000	A1	50,000	210	13
142b	1-chloro-1, 1-difluoroethane	CH_3CClF_2	1,000	A2	20,000	83	5.1
143a	1,1,1-trifluoroethane	CH_3CF_3	1,000	A2L	21,000	70	4.5
152a	1,1-difluoroethane	CH_3CHF_2	1,000	A2	12,000	32	2.0
170	ethane	CH_3CH_3	1,000	A3	7,000	8.7	0.54
Ethers							
E170	methoxymethane (dimethyl ether)	CH_3OCH_3	1,000	A3	8,500	16	1.0
Propane							
218	octafluoropropane	CF_3,CF_2CF_3	1,000	A1	90,000	690	43

227ea	1,1,1,2,3,3,3-heptafluoropropane	CF_3CHFCF_3	1,000	A1	84,000	580	36
236fa	1,1,1,3,3,3-hexafluoropropane	$CF_3CH_2CF_3$	1,000	A1	55,000	340	21
245fa	1,1,1,3,3-pentafluoropropane	$CHF_2CH_2CF_3$	300	B1	34,000	190	12
290	propane	$CH_3CH_2CH_3$	1,000	A3	5,300	9.5	0.56
Cyclic Organic Compounds							
C318	octafluorocyclobutane	$-(CF_2)_4-$	1,000	A1	80,000	660	41
Miscellaneous Organic Compounds Hydrocarbons							
600	butane	$CH_3CH_2CH_2CH_3$	1,000	A3			.51
600a	2-methylpropane (isobutane)	$CH(CH_3)_2CH_3$	1,000	A3	4,000	9.6	.59
601	pentane	$CH_3CH_2CH_2CH_2CH_3$	600	A3	1,000	2.9	.18
601a	2-methylbutane (isopentane)	$(CH_3)_2CHCH_2CH_3$	600	A3	1,000	2.9	.18
611	methyl formate	$HCOOCH_3$	100	B2			
Inorganic Compounds							
702	hydrogen	H_2		A3			
704	helium	He		A1			
717	ammonia	NH_3	25	B2L	320	0.22	.014
718	water	H_2O		A1			-
720	neon	Ne		A1			
728	nitrogen	N_2		A1			
740	argon	Ar		A1			
744	carbon dioxide	CO_2	5000	A1	40,000	72	4.5
764	sulfur dioxide	SO_2		B1			
Unsaturated Organic Compounds							
1150	ethene (ethylene)	$CH_2=CH_2$	200	A3			
1234yf	2,3,3,3-tetrafluoro-1-propene	$CF_3CF=CH_2$	500	A2L	16,000	75	4.7
1234ze(E)	trans-1,3,3,3-tetrafluoro-1-propene	$CF_3CH=CHF$	800	A2L	16,000	75	4.7
1270	propene (propylene)	$CH_3CH=CH_2$	500	A3	1,000	1.7	.1
Zeotropes (Refrigerant Blends)							
400 (50%/50%)[b]	R-12/114 (50.0/50.0)		1,000	A1	28,000	160	10
400 (60%/40%)[b]	R-12/114 (60.0/40.0)		1,000	A1	30,000	170	11
401A	R-22/152a/124 (53.0/13.0/34.0)	(±2.0/0.5, -1.5;/±1.0)	1,000	A1	27,000	110	6.6
401B	R-22,/152a/124 (61.0/11.0/28.0)	(±2.0/0.5, -1.5/±1.0)	1,000	A1	30,000	120	7.2
401C	R-22,/152a/124 (33.0/15.0/52.0)	(±2.0/0.5, -1.5/±1.0)	1,000	A1	20,000	84	5.2
402A	R-125/290/22 (60.0/2.0/38.0)	(±2.0/0.1, -1.0/±2.0)	1,000	A1	33,000	140	8.5
402B	R-125/290/22 (38.0/2.0/60.0)	(±2.0/0.1, -1.0/±2.0)	1,000	A1	63,000	240	15
403A	R-290/22/218 (5.0/75.0/20.0)	(.2, -2.0/±2.0/±2.0)	1,000	A2	33,000	120	7.6
403B	R-290/22/218 (5.0/56.0/39.0)	(.2, -2.0/±2.0/±2.0)	1,000	A1	70,000	290	18
404A	R-125/143a/134a (44.0/52.0/4.0)	(±2.0/±1.0/±2.0)	1,000	A1	130,000	500	31
406A	R-22/600a/142b (55.0/4.0/41.0)	(±2.0/±1.0/±1.0)	1,000	A2	21,000	25	4.7
407A	R-32/125/134a (20.0/40.0/40.0)	(±2.0/±2.0/±2.0)	1,000	A1	83,000	300	19
407B	R-32/125/134a (10.0/70.0/20.0)	(±2.0/±2.0/±2.0)	1,000	A1	79,000	330	21
407C	R-32/125/134a (23.0/25.0/52.0)	(±2.0/±2.0/±2.0)	1,000	A1	81,000	290	18
407D	R-32/125/134a (15.0/15.0/70.0)	(±2.0/±2.0/±2.0)	1,000	A1	68,000	250	16
407E	R-32/125/134a (25.0/15.0/60.0)	(±2.0/±2.0/±2.0)	1,000	A1	80,000	280	17
407F	R-32/125/134a (30.0/30.0/40.0)	(±2.0/±2.0/±2.0)	1,000	A1	95,000	320	20
408A	R-125/143a/22 (7.0/46.0/47.0)	(±2.0/±1.0/±2.0)	1,000	A1	95,000	110	21
409A	R-22/124/142b (60.0/25.0/15.0)	(±2.0/±2.0/±1.0)	1,000	A1	29,000	120	7.1
409B	R-22/124/142b (65.0/25.0/10.0)	(±2.0/±2.0/±1.0)	1,000	A1	30,000	390	7.3
410A	R-32/125 (50.0/50.0)	(0.5, -1.5/1.5, -0.5)	1,000	A1	140,000	420	26
410B	R-32/125 (45.0/55.0)	(±1.0/±1.0)		A1	140,000	430	27
411A	R-1270/22/152a(1.5/87.5/11.0)	(0.0, -1.0/2.0,-0.0/0.0, -1.0)	990	A2	14,000	46	2.9
411B	R-1270/22/152a(3.0/94.0/3.0)	(0.0, -1.0/2.0,-0.0/0.0, -1.0)	980	A2	13,000	45	2.8
412A	R-22/218/142b (70.0/5.0/25.0)	(±2.0/±2.0/±1.0)	1,000	A2	22,000	82	5.1
413A	R-218/134a/600a (9.0/88.0/3.0)	±1.0/±2.0/0.0,-1.0)	1,000	A2	22,000	95	5.8
414A	R-22/124/600a/142b(51.0/28.5/4.0/16.5)	(±2.0/±2.0/±0.5 /0.5, -1.0)	1,000	A1	26,000	100	6.4
414B	R-22/124/600a/142b(50.0/39.0/1.5/9.5)	(±2.0/±2.0/±0.5 /0.5, -1.0)	1,000	A1	23,000	95	6.0
415A	R-22/152a (82.0/18.0)	(±1.0/±1.0)	1,000	A2	57,000	190	12
415B	R-22/152a (25.0/75.0)	(±1.0/±1.0)	1,000	A2	52,000	120	9.3

416A	R-134a/124/600(59.0/39.5/1.5)	(0.5, -1.0/1.0,-0.5/1.0, -0.2)	1,000	A1	14,000	62	3.9
417A	R-125/134a/600 (46.6/50.0/3.4)	(±1.1/±1.0/0.1,-0.4)	1,000	A1	13,000	56	3.5
417B	R-125/134a/600 (79.0/18.3/2.7)	(±1.0/±1.0/0.1,-0.5)	1,000	A1	15,000	70	4.3
418A	R-290/22/152a (1.5/96.0/2.5	(±0.5/±1.0/±0.5)	1,000	A2	59,000	200	13
419A	R-125/134a/E170 (77.0/19.0/4.0)	(1.0/1.0/1.0)	1,000	A2	70,000	310	19
420A	R-134a/142b (88.0/12.0)	(1.0,-0.0/0.0,-1.0)	1,000	A1	45,000	190	12
421A	R-125/134a (58.0/42.0)	(±1.0/±1.0)	1,000	A1	61,000	280	17
421B	R-125/134a (85.0/15.0)	(±1.0/±1.0)	1,000	A1	69,000	330	21
422A	R-125/134a/600a (55.0/42.0/3.0)	(±1.0/±1.0/0.1,-0.4)	1,000	A1	63,000	290	18
422B	R-125/134a/600a (82.0/15.0/3.0)	(±1.0/±1.0/0.1,-0.5)	1,000	A1	56,000	250	16
422C	R-125/134a/600a (82.0/15.0/3.0)	(±1.0/±1.0/0.1,-0.5)	1,000	A1	62,000	290	18
422D	R-125/134a/600a(65.1/31.5/3.4)	(0.9,-1.1/±1.0/0.1,-0.4)	1,000	A1	58,000	260	16
423A	R-134a/227ea (52.5/47.5)	(±1.0/±1.0)	1,000	A1	59,000	310	19
424A	R-125/134a/600a/600/601a(50.5/47.0/0.9/1.0/0.6)	(±1.0/±1.0/0.1,-0.2/0.1, 0.2/0.1,-0.2)	970	A1	23,000	100	6.2
425A	R-32/134a/227ea (18.5/69.5/12.0)	(±0.5/±0.5/±0.5)	1,000	A1	72,000	260	16
426A	R-125/134a/600/601a(5.1/93.0/1.3/0.6)	(±1.0/±1.0/0.1,-0.2/0.1, -0.2)	990	A1	20,000	83	5.2
427A	R-32/125/143a/134a(15.0/25.0/10.0/50.0)	(±2.0/±2.0/±2.0/;±2.0)	1,000	A1	79,000	290	18
428A	R-125/143a/290/600a(77.5/20.0/0.6/1.9)	(±1.0/±1.0/0.1,-0.2/0.1, -0.2)	1,000	A1	83,000	370	23
429A	R-E170/152a/600a(60.0/10.0/30.0)	(±1.0/±1.0/±1.0)	1,000	A3	6,300	13	.81
430A	R-152a/600a (76.0/24.0)	(±1.0/±1.0)	1,000	A3	8,000	21	1.3
431A	R-290/152a (71.0/29.0)	(±1.0/±1.0)	1,000	A3	5,500	11	.69
432A	R-1270/E170 (80.0/20.0)	(±1.0/±1.0)	710	A3	1,200	2.1	.13
433A	R-1270/290 (30.0/70.0)	(±1.0/±1.0)	880	A3	3,100	5.5	.34
433B	R-1270/290 (5.0/95.0)	(±1.0/±1.0)	950	A3	4,500	8.1	.51
433C	R-1270/290 (25.0/75.0)	(±1.0/±1.0)	790	A3	3,600	6.6	.41
434A	R-125/143a/134a/600a(63.2/18.0/16.0/2.8)	(±1.0/±1.0±1.0/0.1,-0.2)	1,000	A1	73,000	320	20
435A	R-E170/152a (80.0/20.0)	(±1.0/±1.0)	1,000	A3	8,500	17	1.1
436A	R-290/600a (56.0/44.0)	(±1.0/±1.0)	1,000	A3	4,000	8.1	.5
436B	R-290/600a (52.0/48.0)	(±1.0/±1.0)	1,000	A3	4,000	8.1	.5
437A	R-125/134a/600/601(19.5/78.5/1.4/0.6)	(0.5,-1.8/1.5,-0.7/0.1,-0.2/0.1,-0.2)	990	A1	19,000	81	5.0
438A	R-32/125/134a/600/601a(8.5/45.0/44.2/1.7/0.6)	(0.5,-1.5/±1.5/±1.5/0.1,-0.2/0.1,-0.2)	990	A1	20,000	79	4.9
439A	R-32/125/600a(50.0/47.0/3.0)	(±1.0/±1.0/±0.5)	990	A2	26,000	76	4.7
440A	R-290/134a/152a(0.6/1.6/97.8)	(±1.0/±0.6/±0.5)	1,000	A2	12,000	31	1.9
441A	R-179/290/600a/600(3.1/54.8/6.0/36.1)	(±0.3/±2.0/±0.6/±2.0)	1,000	A3	3,200	6.3	.39
Azeotropes (Refrigerant Blends)							
500[b]	R-12/152a (73.8/26.2)		1,000	A1	30,000	120	7.6
501[b]	R-22/12 (75.0/25.0)		1,000	A1	54,000	210	13
502[b]	R-22/115 (48.8/51.2)		1,000	A1	73,000	330	21
504	R-32/115 (48.2/51.8)		1,000		140,000	450	28
507A	R-125/143a (50.0/50.0)		1,000	A1	130,000	520	32
508A	R-23/116 (39.0/61.0)		1,000	A1	55,000	220	14
508B	R-23/116 (46.0/54.0)		1,000	A1	52,000	200	13
509A	R-22/218 (44.0/56.0)		1,000	A1	75,000	390	24
510A	R-E170/600a (88.0/12.0)	(±0.5/±0.5)	1,000	A3	7,300	14	.87
511A	R-290/E170 (95.0,5.0)	(±1.0/±1.0)	1,000	A3	5,300	9.5	.59

For SI: 1 pound = 0.454 kg, 1 cubic foot = 0.0283 m^3 .

a. Data based on ASHRAE 34 including Addenda a through o. For more complete data see ASHRAE 34 and Addenda. Use of Addenda issued after Addendum o is subject to approval as set forth in Section 1102.2.

b. Class I ozone depleting refrigerant. Not permitted for new installations.

c. Refrigerants in Safety Group "A2L" shall comply with all applicable requirements for "A2" refrigerants. Refrigerants in Safety Group "B2L" shall comply with all applicable requirements for "B2" refrigerants.

d. **OCCUPATIONAL EXPOSURE LIMIT (OEL).** The time-weighted average (TWA) concentration for a normal eight-hour workday and a 40-hour workweek to which nearly all workers can be repeatedly exposed without adverse effect, based on the OSHA PEL, ACGIH TLV-TWA, AIHA WEEL, or consistent value.

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. Occupancy classifications of buildings shall be in accordance with the building classifications in the *New York City Building Code.*

1. Institutional occupancy shall include Occupancy Groups I-1, I-2, I-3 and I-4.

2. Public assembly occupancy shall include Occupancy Groups A-1, A-2, A-3, A-4, A-5 and E.

3. Residential occupancy shall include Occupancy Groups R-1, R-2 and R-3.

4. Commercial occupancy shall include Occupancy Groups M and B, except Occupancy Group M with retail stores having an occupant load of more than 100 persons on any floor other than street level.

5. Large mercantile occupancy shall include Occupancy Group M with retail stores having an occupant load of more than 100 persons on any floor other than street level.

6. Industrial occupancy shall include Occupancy Groups F-1, F-2, H-1, H-2, H-3, H-4, H-5, S-1 and S-2.

7. Mixed occupancy occurs when two or more occupancies are located within the same building. When each occupancy is isolated from the rest of the building by tight walls, floors and ceilings and by self-closing doors, the requirements for each occupancy shall apply to its portion of the building. When the various occupancies are not so isolated, the occupancy having the most stringent requirements shall be the governing occupancy.

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.

1103.3.1 Low-probability systems.

Double-indirect open-spray systems, indirect closed systems 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 1103.1 are exceeded.

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.

Section MC 1104: System Application Requirements

1104.1 General.

The refrigerant, occupancy and system classification cited in this section shall be determined in accordance with Sections 1103.1, 1103.2 and 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. For blends assigned only a single safety group classification in Table 1103.1 or ASHRAE 34, that classification shall be used. Use of a Group A3 or Group B3 refrigerant is prohibited. In an industrial occupancy, a Group A3 or Group B3 refrigerant may be used in high- or low-probability systems only when approved by the commissioner and the Commissioner of the Fire Department. Such use will be approved only if the applicant can demonstrate to the satisfaction of the commissioner and the Commissioner of the Fire Department that the use of the refrigerant is a necessity and does not represent a substantial risk to life, limb, health or property.

1104.2 Machinery room.

Except as provided in Sections 1104.2.1 and 1104.2.2, all components containing the refrigerant shall be located either outdoors or in a machinery room where the quantity of refrigerant in an independent circuit of a system exceeds the amounts shown in Table 1103.1. For refrigerant names not listed in Table 1103.1, the same requirement shall apply when the amount for any named component exceeds that indicated in Table 1103.1 for that component. This requirement shall also apply when the combined amount of the named components exceeds a limit of 69,100 parts per million (ppm) 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 1105 and 1106 for Group A2, B2, A3 and B3 refrigerants. Nothing in this section shall be construed to allow the use of Group A3 and B3 refrigerants if otherwise prohibited.

Exceptions:

1. Machinery rooms are not required for listed equipment and 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 1107 of this chapter and Section 8.10 of ASHRAE 15 is allowed in other locations to connect components installed in a machinery room with those installed outdoors.

1104.2.1 Institutional occupancies.

The amounts shown in Table 1103.1 shall be reduced by 50 percent for all areas of institutional occupancies except kitchens, laboratories and mortuaries. The total of all Group A2, B2, A3 and B3 refrigerants shall not exceed 550 pounds (250 kg) in occupied areas or machinery rooms. Nothing in this section shall be construed to allow the use of Group A3 and B3 refrigerants if otherwise prohibited.

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 doors.

2. Access is restricted to authorized personnel.

3. The floor area per occupant is not less than 100 square feet (9.3 m^2). Where provided with egress directly to the outdoors or into building exits meeting the requirements of the *New York City Building Code,* the minimum floor area shall not apply.

4. Refrigerant detectors are installed as required for machinery rooms in accordance with Section 1105.3.

5. Surfaces having temperatures exceeding 800°F (427°C) and open flames are not present where any Group A2, B2, A3 or B3 refrigerant is used (see Section 1104.3.3). Nothing in this section shall be construed to allow the use of Group A3 and B3 refrigerants if otherwise prohibited.

6. All electrical equipment and appliances conform to Class 1, Division 2, hazardous location classification requirements of the *New York City Electrical Code* where the quantity of any Group A2, B2, A3 or B3 refrigerant, other than ammonia, in a single independent circuit would exceed 25 percent of the lower flammability limit (LFL) upon release to the space based on the volume determined by Section 1104.4. Nothing in this section shall be construed to allow the use of Group A3 and B3 refrigerants if otherwise prohibited.

7. All refrigerant-containing parts in systems exceeding 100 hp (74.6 kW) drive power, except evaporators used for refrigeration or dehumidification; condensers used for heating; control and pressure relief valves for either; and connecting piping, shall be located either outdoors or in a machinery room.

1104.3 Refrigerant restrictions.

Refrigerant applications, maximum quantities and use shall be restricted in accordance with Sections 1104.3.1 through 1104.3.3.

1104.3.1 Air-conditioning for human comfort.

Group A2, A3, B1, B2 and B3 refrigerants shall not be used in high-probability air conditioning systems for human comfort.

Exceptions:

1. Sealed absorption and unit air conditioning systems having refrigerant quantities not exceeding those set forth in Table 1104.3.1.
2. Industrial occupancies.

Nothing in this section shall be construed to allow the use of Group A3 and B3 refrigerants if otherwise prohibited.

Table 1104.3.1

Special Quantity Limits for Sealed Ammonia/Water Absorption

and Self-Contained Systems

Type of Refrigeration System	Maximum lb for Various Occupancies			
	Institutional	Public Assembly/ Large Mercantile	Residential	Commercial
Sealed Ammonia/Water Absorption System				
In exit access or lobbies	0	0	3.3	3.3
In adjacent outdoor locations	0	0	22	22
In other than exit access lobbies	0	6.6	6.6	22
Unit Systems				
In other than exit access or lobbies	0	0	6.6	22

For SI: 1 pound = 0.454 kg.

1104.3.2 All occupancies.

The total of all Group A2, B2, A3 and B3 refrigerants other than R-717, ammonia, shall not exceed 1,100 pounds (499 kg) except where approved. Nothing in this section shall be construed to allow the use of Group A3 and B3 refrigerants if otherwise prohibited.

1104.3.3 Protection from refrigerant decomposition.

Where any device having an open flame or surface temperature greater than 800°F (427°C) is used in a room containing more than 6.6 pounds (3 kg) of refrigerant in a single independent circuit, a hood and exhaust system shall be provided in accordance with Section 510. Such exhaust system shall exhaust combustion products to the outdoors.

Exception: A hood and exhaust system shall not be required:

1. Where the refrigerant is R-717, R-718 or R-744;
2. Where the combustion air is ducted from the outdoors in a manner that prevents leaked refrigerant from being combusted; or
3. Where a refrigerant detector is used to stop the combustion in the event of a refrigerant leak (see Sections 1105.3 and 1105.5).

1104.4 Volume calculations.

Volume calculations shall be in accordance with Sections 1104.4.1 through 1104.4.3.

1104.4.1 Noncommunicating spaces.

Where the refrigerant-containing parts of a system are located in one or more spaces that do not communicate through permanent openings or HVAC ducts, the volume of the smallest, enclosed occupied space shall be used to determine the permissible quantity of refrigerant in the system.

1104.4.2 Communicating spaces.

Where an evaporator or condenser is located in an air duct system, the volume of the smallest, enclosed occupied space served by the duct system shall be used to determine the maximum allowable quantity of refrigerant in the system.

Exception: If airflow to any enclosed space cannot be reduced below one-quarter of its maximum, the entire space served by the air duct system shall be used to determine the maximum allowable quantity of refrigerant in the system.

1104.4.3 Plenums.

Where the space above a suspended ceiling is continuous and part of the supply or return air plenum system, this space shall be included in calculating the volume of the enclosed space.

Section MC 1105: Machinery Room, General Requirements

1105.1 Design and construction.

Machinery rooms shall be designed and constructed in accordance with the *New York City Building Code* and this section.

1105.2 Openings.

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.

1105.3 Refrigerant detector.

Refrigerant detectors in machinery rooms shall be provided as required by ASHRAE 15.

1105.4 Tests.

Periodic tests of the mechanical ventilating system shall be performed in accordance with manufacturer's specifications and as required by the Commissioner of the Fire Department.

1105.5 Fuel-burning appliances.

Open flames that use combustion air from the machinery room shall not be installed in a machinery room.

Exceptions:

1. Where the refrigerant is carbon dioxide or water.

2. 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, or where a refrigerant vapor detector is employed to automatically shut off the combustion process in the event of refrigerant leakage.

1105.6 Ventilation.

Machinery rooms shall be mechanically ventilated to the outdoors. Mechanical ventilation shall be capable of exhausting the minimum quantity of air both at normal operating and emergency conditions. Multiple fans or multispeed fans shall be allowed in order to produce the emergency ventilation rate and to obtain a reduced airflow for normal ventilation. Location of the mechanical ventilation openings shall be based on the relative density of the refrigerant to air. When compressors or self-contained unit system are housed in a machinery space, other than in a machinery room or plenum, the space shall be ventilated in accordance with the requirements of Section 1105.6.3.

Exception: Where a refrigerating system is located outdoors more than 20 feet (6096 mm) from any building opening 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. The free-aperture cross section for the ventilation of the machinery room shall be not less than:

$F = \sqrt{G}$ **(Equation 11-1)**

For SI: $F = 0.138\sqrt{G}$

where:

F = The free opening area in square feet (m^2).

G = The mass of refrigerant in pounds (kg) in the largest system, any part of which is located in the machinery room

1105.6.1 Discharge location.

The discharge of the air shall be to the outdoors in accordance with Chapter 5. Exhaust from mechanical ventilation systems shall be discharged not less than 20 feet (6096 mm) from outdoor air intake or openings into buildings and 10 feet (3048 mm) from a fire escape or exterior stair.

1105.6.2 Makeup air.

Provisions shall be made for makeup air to replace that being exhausted. Openings for makeup 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 Chapter 5 and shall be covered with corrosion-resistant screen of not less than 1/4-inch (6.4 mm) mesh.

Exception: The requirement for supply and exhaust ducts to the machinery room to serve no other area shall not apply to a change in the type of refrigerant in a lawfully installed existing refrigerating system being maintained and operated in accordance with these approved installation requirements:

1. Where the replacement refrigerant has a safety classification of Group A1; or

2. Where the replacement refrigerant is R123 and the engineer or architect demonstrates to the satisfaction of the commissioner that providing such air supply and exhaust ducts represents a hardship and that the proposed alternative provides an equivalent level of safety.

1105.6.3 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 $m^3/s\ m^2$) of machinery room area or 20 cfm (0.009 m^3/s) per person; or

2. A volume required to limit the room temperature rise to18°F (10°C) taking into account the ambient heating effect of all machinery in the room but not above a maximum temperature of 122°F (50°C).

1105.6.4 Quantity-emergency conditions.

Upon actuation of the refrigerant detector required in Section 1105.3, the mechanical ventilation system shall exhaust air from the machinery room in the following quantity:

$Q = 100 \times \sqrt{G}$ **(Equation 11-2)**

For SI: $Q = 0.07\sqrt{G}$

Q = The airflow in cubic feet per minute (m^3/s).

G = The design mass of refrigerant in pounds (kg) in the largest system, any part of which is located in the machinery room

1105.7 Termination of relief devices.

In addition to the requirements of Section 9.7.8 of ASHRAE 15, pressure relief devices, fusible plugs 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.

1105.7.1 Discharge of Group A2, B2, A3 and B3 refrigerants.

Discharge of systems containing Group A2 or B2 refrigerants shall be acceptable to the commissioner. Discharge of systems containing Group A3 or B3 refrigerants shall be subject to the approval of the commissioner and the Commissioner of the Fire Department. Nothing in this section shall be construed to approve the use of Group A3 and B3 refrigerants if otherwise prohibited.

1105.7.2 Certificate of qualification.

Discharge of pressure relief devices, fusible plugs and purge systems for refrigerating systems containing flammable, toxic and highly toxic refrigerants and ammonia shall comply with Section 606 of the *New York City Fire Code.*

1105.8 Ammonia discharge.

Pressure relief valves for ammonia systems shall discharge in accordance with ASHRAE 15.

1105.9 Emergency pressure control system.

Refrigeration systems containing more than 6.6 pounds (3 kg) of a refrigerant other than a Group A1 refrigerant shall be provided with an emergency pressure control system in accordance with Sections 1105.9.1 and 1105.9.2.

1105.9.1 Automatic crossover valves.

Each high- and intermediate-pressure zone in a refrigerating system shall be provided with a single automatic valve providing a crossover connection to a lower pressure zone. Such automatic crossover valves shall comply with Sections 1105.9.1.1 through 1105.9.1.3.

1105.9.1.1 Overpressure limit setpoint.

Automatic crossover valves shall be arranged to automatically relieve excess system pressure to a lower pressure zone if the pressure in a high- or intermediate-pressure zone rises to within 15 psi (108.4 kPa) of the set point for pressure-relief devices.

1105.9.1.2 Manual operation.

Automatic crossover valves shall be capable of manual operation for refrigerating systems containing more than 200 pounds (90.8 kg) of refrigerant.

1105.9.1.3 System design pressure.

Refrigerating system zones that are connected to a higher pressure zone by an automatic crossover valve shall be designed to safely contain the maximum pressure that can be achieved by interconnection of the two zones.

1105.9.2 Automatic emergency stop.

An automatic emergency stop feature shall be provided in accordance with Sections 1105.9.2.1 and 1105.9.2.2.

1105.9.2.1 Automatic crossover valves.

A refrigerating system equipped with an automatic crossover valve shall be designed, when such valve is activated, to cause all compressors on the affected system to immediately cease operating. Dedicated pressure-sensing devices located immediately adjacent to crossover valves may be used as a means for activating such crossover valve. To ensure that the automatic crossover valve system provides a redundant means of ceasing operation of the compressors in an overpressure condition, high-pressure cutout sensors associated with compressors shall not be used for purposes of activating such crossover valve.

1105.9.2.2 Overpressure in low-pressure zone.

The lowest pressure zone in a refrigerating system shall be provided with a dedicated means of determining a rise in system pressure to within 15 psi (103.4 kPa) of the zone pressure relief device setpoint. Activation of such overpressure sensing device shall cause all compressors on the effected system to immediately cease operation.

1105.10 Remote control.

A clearly identified switch of the break-glass type shall provide off-only control of the compressors in the machinery room. A second clearly identified switch of the break-glass type shall provide on-only control of the machinery room ventilation fans. Such switches shall be located outside each entrance to the machinery room and as close to the entrance as practicable, except that when an outside location is impracticable, such switches may be located immediately inside the machinery room provided such location is accessible at all times.

1105.11 Emergency signs.

Signs shall comply with the following:

1. Sections 8.11.8 and 11.2.4 of ASHRAE 15.

2. Refrigeration units or systems having a refrigerant circuit containing more than 220 pounds (100kg) of Group A1 or 30 pounds (14 kg) of any other group refrigerant shall be provided with approved emergency signs, charts, and labels in accordance with NFPA 704.

1105.12 Storing refrigerant.

The total amount of refrigerant stored in a machinery room shall be the lesser of: (i) not more than twenty percent of the normal charge in the system; or (ii) not more than 330 pounds (150 kg) in addition to the charge in the system and the refrigerant contained in a permanently attached receiver. Refrigerant shall be stored in containers meeting the requirements of the *New York City Fire Code.*

Exception: Recovery service containers used for storing refrigerant during periods of system maintenance or replacement may exceed 330 pounds (150 kg) provided such containers are securely fixed in position and have pressure relief valves piped to the outside in conformance with this code.

Section MC 1106: Machinery Room, Special Requirements

1106.1 General.

Where required by Section 1104.2, the machinery room shall meet the requirements of this section in addition to the requirements of Section 1105.

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.

1106.3 Ammonia room ventilation.

Ventilation systems in ammonia machinery rooms shall be operated continuously at the emergency ventilation rate determined in accordance with Section 1105.6.4.

Exceptions:

1. Machinery rooms equipped with a vapor detector that will automatically start the ventilation system at the emergency rate determined in accordance with Section 1105.6.4, and that will actuate an alarm at a detection level not to exceed 1,000 ppm; or

2. Machinery rooms conforming to the Class 1, Division 2, hazardous location classification requirements of the *New York City Electrical Code.*

1106.4 Flammable refrigerants.

Where refrigerants of Groups A2, A3, B2 and B3 are used, the machinery room shall conform to the Class 1, Division 2, hazardous location classification requirements of the *New York City Electrical Code*.

Exception: Ammonia machinery rooms. Nothing in this section shall be construed to approve the use of Group A3 and B3 refrigerants if otherwise prohibited.

1106.5 Remote controls.

Remote control of the mechanical equipment and appliances located in the machinery room shall be provided at an accessible location immediately outside the machinery room and adjacent to its principal entrance.

1106.5.1 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.

1106.6 [Reserved.]

Section MC 1107: Refrigerant Piping

1107.1 General.

All refrigerant piping shall be installed, tested and placed in operation in accordance with this chapter.

1107.1.1 Protection of refrigerant piping located inside buildings.

All refrigerant piping and fittings installed at a height less than 7 feet 3 inches (2210 mm) above the floor shall be concealed or otherwise protected from mechanical damage except at the point of connection to terminal equipment.

1107.2 Piping location.

Refrigerant piping that crosses an open space that affords passageway in any building shall be not less than 7 feet 3 inches (2210 mm) above the floor unless the piping is located against the ceiling of such space. Refrigerant piping shall not be placed in any elevator, dumbwaiter or other shaft containing a moving object or in any shaft that has openings to living quarters or to means of egress. Refrigerant piping shall not be installed in an enclosed public stairway, stair landing or an exit.

1107.2.1 Piping in public corridors.

Refrigerant piping shall not be installed in public corridors.

Exception: Refrigerant piping in public corridors that complies with all of the following conditions:

1. The refrigeration system to which the piping is associated utilizes a Group A-1 refrigerant and contains not more than 10 pounds (4.54 kg) of refrigerant per system, and there is not more than one system's refrigerant piping per tenant per public corridor; and

2. A complete discharge of any one refrigerant system's charge into the volume of the public corridor would be insufficient to achieve 50% of the allowable refrigerant densities set forth in Table 1103.1; and

3. Refrigerant piping and fittings within a public corridor are installed with brazed joints or the refrigerant equipment manufacturer provided pre-charged tubing systems installed in accordance with the refrigerant equipment manufacturers instructions. Refrigerant piping and fittings shall be concealed or otherwise protected from mechanical damage.

1107.2.2 Piping in concrete floors.

Refrigerant piping installed in concrete floors shall be encased in pipe ducts. The piping shall be isolated and supported to prevent damaging vibration, stress and corrosion.

1107.2.3 Refrigerant piping penetrations.

Refrigerant piping shall not penetrate floors, ceilings or roofs.

Exceptions:

1. Penetrations connecting the basement and the first floor.

2. Penetrations connecting the top floor and a machinery penthouse or roof installation.

3. Penetrations connecting adjacent floors served by the refrigeration system.

4. Penetrations by piping in a direct system where the refrigerant quantity does not exceed Table 1103.1 for the smallest occupied space through which the piping passes.

5. In other than industrial occupancies and where the refrigerant quantity exceeds Table 1103.1 for the smallest space, penetrations for piping that connects separate pieces of equipment that are either:

5.1. Enclosed by an approved gas-tight, fire- resistive duct or shaft with openings to those floors served by the refrigeration system or

5.2. Located on the exterior of the building where vented to the outdoors or to the space served by the system and not used as an air shaft, closed court or similar space.

1107.3 Pipe enclosures.

Rigid or flexible metal enclosures or pipe ducts shall be provided for soft, annealed copper tubing used for refrigerant piping erected on the premises and containing other than Group A1 refrigerant. 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.

1107.4 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.

1107.5 Materials for refrigerant pipe and tubing.

Piping materials shall be as set forth in Sections 1107.5.1 through 1107.5.7.

1107.5.1 Steel pipe.

Carbon steel pipe with a wall thickness not less than Schedule 80 shall be used for Group A2, A3, B2 or B3 refrigerant liquid lines for sizes 1.5 inches (38 mm) and smaller. Carbon steel pipe with a wall thickness not less than Schedule 40 shall be used for Group A1 or B 1 refrigerant liquid lines 6 inches (152 mm) and smaller, Group A2, A3, B2 or B3 refrigerant liquid lines sizes 2 inches (51 mm) through 6 inches (152mm) and all refrigerant suction and discharge lines 6 inches (152 mm) and smaller. Type F steel pipe shall not be used for refrigerant lines having an operating temperature less than -20°F (-29°C).

1107.5.2 Copper and brass pipe.

Standard iron-pipe size, copper and red brass (not less than 80-percent copper) pipe shall conform to ASTM B 42 and ASTM B 43.

1107.5.3 Copper tube.

Copper tube used for refrigerant piping erected on the premises shall be seamless copper tube of Type ACR (hard or annealed) complying with ASTM B 280. Where approved, copper tube for refrigerant piping erected on the premises shall be seamless copper tube of Type K or L (drawn or annealed) in accordance with ASTM B 88. Annealed temper copper tube shall not be used in sizes larger than a 2-inch (51 mm) nominal size. Mechanical joints shall not be used on annealed temper copper tube in sizes larger than 7/8-inch (22.2 mm) OD size.

1107.5.4 Copper tubing joints.

Copper tubing joints used in refrigerating systems containing Group A2, A3, B1, B2 or B3 refrigerants shall be brazed. Soldered joints shall not be used in such refrigerating systems. Brazed joints shall be made in accordance with *ASME Boiler and Pressure Vessel Code,* Section IX Welding and Brazing Qualifications or in accordance with American Welding Society AWS B2.2 Standard for Brazing Procedure and Performance Qualification.

1107.5.5 Soldered joints.

Soldered joints shall be made as follows: soldered joint surfaces shall be cleaned, a flux conforming to ASTM B 813 shall be applied, and the joint shall be soldered with a solder conforming to ASTM B32.

1107.5.6 Aluminum tube.

Type 3003-0 aluminum tubing with high-pressure fittings shall not be used with methyl chloride and other refrigerants known to deteriorate aluminum.

1107.5.7 Insulation.

Pipe and other refrigerant-containing components' insulation shall meet the requirements of Section 1204.1 of this code.

1107.6 Joints and refrigerant-containing parts in air ducts.

Joints and all refrigerant-containing parts of a refrigerating system located in an air duct of an air-conditioning system carrying conditioned air to and from human-occupied space shall be constructed to withstand, without leakage, a pressure of 150 percent of the higher of the design pressure or pressure relief device setting.

1107.7 Exposure of refrigerant pipe joints.

Refrigerant pipe joints erected on the premises shall be exposed for visual inspection prior to being covered or enclosed.

1107.8 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 as follows:

1. At the inlet of each compressor, compressor unit or condensing unit.
2. At the discharge outlet of each compressor, compressor unit or condensing unit and of each liquid receiver.

Exceptions:

1. Systems that have a refrigerant pumpout function capable of storing the entire refrigerant charge in a receiver or heat exchanger.
2. Systems that are equipped with provisions for pumpout of the refrigerant using either portable or permanently installed recovery equipment.
3. Self-contained systems.

1107.8.1 Liquid receivers.

All systems containing 100 pounds (45 kg) or more of a refrigerant, other than systems utilizing nonpositive displacement compressors, shall have stop valves, in addition to those required by Section 1107.8, on each inlet of each liquid 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.

1107.8.2 Copper tubing.

Stop valves used with soft annealed copper tubing or hard-drawn copper tubing 7/8-inch (22.2 mm) OD standard size or smaller shall be securely mounted, independent of tubing fastenings or supports.

1107.8.3 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.

Section MC 1108: Field Test

1108.1 General.

Every refrigerant-containing part of every system that is erected on the premises, except compressors, condensers, vessels, evaporators, safety devices, pressure gauges and control mechanisms that are listed and factory tested, shall be tested and proved tight after complete installation, and before operation. Tests shall include both the high- and low-pressure sides of each system at not less than the lower of the design pressures or the setting of the pressure relief device(s). The design pressures for testing shall be those listed on the condensing unit, compressor or compressor unit name-plate, as required by ASHRAE 15.

Exceptions:

1. Gas bulk storage tanks that are not permanently connected to a refrigeration system.

2. Systems using an A1 refrigerant erected on the premises with copper tubing not exceeding 5/8-inch (15.8 mm) OD, with wall thickness as required by ASHRAE 15, shall be tested in accordance with Section 1108.1, or by means of refrigerant charged into the system at the saturated vapor pressure of the refrigerant at 70°F (21°C) or higher.

3. Limited-charge systems equipped with a pressure relief device, erected on the premises, shall be tested at a pressure not less than one and one-half times the pressure setting of the relief device. If the equipment or appliance has been tested by the manufacturer at one and one-half times the design pressure, the test after erection on the premises shall be conducted at the design pressure.

1108.1.1 Booster compressor.

Where a compressor is used as a booster to obtain an intermediate pressure and discharges into the suction side of another compressor, the booster

compressor shall be considered a part of the low side, provided that it is protected by a pressure relief device.

1108.1.2 Centrifugal/nonpositive displacement compressors.

In field-testing systems using centrifugal or other nonpositive displacement compressors, the entire system shall be considered as the low-side pressure for field test purposes.

1108.2 Test gases.

Tests shall be performed with an inert-dried gas including, but not limited to, nitrogen and carbon dioxide. Oxygen, air, flammable gases and mixtures containing such gases shall not be used.

Exceptions:

1. The use of air is allowed to test R-717, ammonia, systems provided that they are subsequently evacuated before charging with refrigerant.
2. 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.

1108.3 Test apparatus.

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.

1108.4 Declaration.

A certificate of test shall be provided for all systems containing 55 pounds (25 kg) or more of refrigerant. The certificate shall give the name of the refrigerant and the field test pressure applied to the high side and the low side of the system. The certification of test shall be signed by the installer and shall be made part of the public record.

Section MC 1109: Periodic Testing

1109.1 Testing required.

The following emergency devices and systems shall be periodically tested and the results logged in accordance with the manufacturer's instructions and as required by the Commissioner of the Fire Department:

1. Treatment and flaring systems.
2. Valves and appurtenances necessary to the operation of emergency refrigeration control boxes.
3. Fans and associated equipment intended to operate emergency purge ventilation systems.
4. Detection and alarm systems.

1109.2 Operation.

Operating permits and qualification of operators for refrigeration systems shall comply with the requirements of the *New York City Fire Code.*

Chapter 12: Hydronic Piping

Section MC 1201: General

1201.1 Scope.

The provisions of this chapter shall govern the construction, installation, alteration and repair of hydronic piping systems. This chapter shall apply to hydronic piping systems that are part of heating, ventilation and air-conditioning systems. Such piping systems shall include steam, hot water, chilled water, condenser water, cooling coil condensate drain, steam condensate and ground source heat pump loop systems. Potable cold and hot water distribution systems shall be installed in accordance with the *New York City Plumbing Code.*

1201.2 Sizing.

Piping and piping system components for hydronic systems shall be sized for the design requirements of the system.

1201.3 Standards.

As an alternative to the provisions of Sections 1202 and 1203, piping shall be designed, installed, inspected and tested in accordance with ASME B31.1 and ASME B31.9, as applicable.

Section MC 1202: Material

1202.1 Piping.

Piping material, other than those contained within this section and conforming with the ASTM standards listed within this chapter, shall be of an approved type.

Exception: Embedded piping regulated by Section 1209.

1202.2 Used existing materials.

Reused pipe, fittings, valves or other materials shall be clean and free of foreign materials.

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.

1202.4 Piping materials standards.

Hydronic pipe shall conform to the standards listed in Table 1202.4. The exterior of the pipe shall be protected from corrosion and degradation.

Table 1202.4

Hydronic Pipe

Material	Standard (see Chapter 15)
Material	**Standard (see Chapter 15)**

Acrylonitrile 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	ASTM F 1281;CSA CAN/CSA-B-137.10
Cross-linked polyethylene (PEX) tubing	ASTM F 876; ASTM F 877
Ductile iron pipe	AWWA C151/A21.51; AWWA C115/A21.15
Polyethylene/aluminum/polyethylene (PE-AL-PE) pressure pipe	ASTM F 1282; CSA B137.9
Polyethylene (PE) pipe, tubing and fittings (for ground source heat pump loop systems)	ASTM D 2513; ASTM D 3035;ASTM D 2447; ASTM D 2683;ASTM F 1055; ASTM D 2837;ASTM D 3350; ASTM D 1693
Polypropylene (PP) plastic pipe	ASTM F 2389
Polyvinyl chloride (PVC) plastic pipe	ASTM D 1785; ASTM D 2241
Raised temperature polyethylene (PE-RT)	ASTM F 2623
Steel pipe	ASTM A 53; ASTM A 106
Steel tubing	ASTM A 254

1202.5 Pipe fittings.

Hydronic pipe fittings shall conform to the respective pipe standards or to the standards listed in Table 1202.5.

Table 1202.5

Hydronic Pipe Fittings

Material	**Standard (see Chapter 15)**
Material	**Standard (see Chapter 15)**
Brass	ASTM F 1974
Bronze	ASME B 16.24
Copper and copper alloys	ASME B 16.15; ASME B 16.18; ASME B 16.22; ASEM B 16.23; ASME B 16.26; ASME B 16.29
Ductile iron and gray iron	ANSI/AWWA C110/A21.10
Ductile iron	ANSI/AWWA C153/A21.53
Gray iron	ASTM A 126
Malleable iron	ASME B16.3
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

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.

1202.7 Flexible connectors, expansion and vibration compensators.

Flexible connectors, expansion and vibration control devices and fittings, when used, shall protect the components of the hydronic system from damage caused by expansion, contraction, transverse movement, angular deflection and vibration, shall be rated for the temperatures and pressures of the systems in which the devices are installed, and shall be compatible with the fluid and all materials provided.

Section MC 1203: Joints and Connections

1203.1 Approval.

Joints and connections, other than those contained in Section 1203 and conforming to the ASTM standards listed in Section 1203, shall be of an approved type. Joints and connections shall be tight for the pressure of the hydronic system.

1203.1.1 Joints between different piping materials.

Joints between different piping materials shall be rated for the temperatures and pressures of the systems in which the devices are installed and shall be compatible with the fluid and all materials provided.

1203.1.2 Joints between dissimilar metallic piping materials.

Joints between dissimilar metallic piping materials shall be provided to protect against galvanic corrosion. Such joints shall be made with dielectric fittings conforming to ANSI B16.39 or ASTM F-492, as applicable, shall be rated for the temperatures and pressures of the systems in which the devices are

installed and shall be compatible with the fluid and all materials provided.

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.

1203.3 Joint preparation and installation.

When required by Sections 1203.4 through 1203.14, the preparation and installation of brazed, mechanical, soldered, solvent-cemented, threaded and welded joints shall comply with Sections 1203.3.1 through 1203.3.7.

1203.3.1 Brazed joints.

All joints shall be brazed with a brazing procedure developed and qualified in accordance with the *ASME Boiler and Pressure Vessel Code,* Section IX (Welding and Brazing Qualifications) or in accordance with AWS B2.2 standard for Brazing Procedure and Performance Qualification.

1203.3.2 Mechanical joints.

Mechanical joints shall be installed in accordance with the manufacturer's instructions.

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.

1203.3.4 Solvent-cemented joints.

Joint surfaces shall be clean and free of moisture. A primer, compatible with both the piping material and the cement shall be applied to pipe-joint surfaces, in accordance with the manufacturer's requirements. 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.

1203.3.5 Threaded joints.

Threads shall conform to ASME B 1.20.1. 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 compatible for application on the piping material and fluid.

1203.3.6 Welded joints.

All joints shall be welded with a welding procedure developed and qualified in accordance with the ASME *Boiler and Pressure Vessel Code*, Section IX (Welding and Brazing Qualifications) or in accordance with AWS B2.1 Specifications for Welding Procedure and Performance Qualification.

1203.3.7 Grooved and shouldered mechanical joints.

Grooved and shouldered mechanical joints shall conform to the requirements of ASTM F 1476 and shall be installed in accordance with the manufacturer's installation instructions.

1203.3.8 Mechanically formed tee fittings.

Mechanically extracted outlets shall have a height not less than three times the thickness of the branch tube wall.

1203.3.8.1 Full flow assurance.

Branch tubes shall not restrict the flow in the run tube. A dimple/depth stop shall be formed in the branch tube to ensure that penetration into the outlet is of the correct depth. For inspection purposes, a second dimple shall be placed 0.25 inch (6.4 mm) above the first dimple. Dimples shall be aligned with the tube run.

1203.3.8.2 Brazed joints.

Mechanically formed tee fittings shall be brazed in accordance with Section 1203.3.1.

1203.4 ABS plastic pipe.

Joints between ABS plastic pipe or fittings shall be solvent-cemented or threaded joints conforming to Section 1203.3.

1203.5 Brass pipe.

Joints between brass pipe or fittings shall be brazed, mechanical, threaded or welded joints conforming to Section 1203.3.

1203.6 Brass tubing.

Joints between brass tubing or fittings shall be brazed, mechanical or soldered joints conforming to Section 1203.3.

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 1203.3.

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 1203.3, flared joints conforming to Section 1203.8.1 or push-fit joints conforming to Section 1203.8.2.

1203.8.1 Flared joints.

Flared joints shall be made by a tool designed for that operation.

1203.8.2 Push-fit joints.

Push-fit joints shall be installed in accordance with the manufacturer's instructions.

1203.9 CPVC plastic pipe.

Joints between CPVC plastic pipe or fittings shall be solvent-cemented or threaded joints conforming to Section 1203.3.

1203.10 [Reserved.]

1203.11 Cross-linked polyethylene (PEX) plastic tubing.

Joints between cross-linked polyethylene plastic tubing and fittings shall conform to Sections 1203.11.1 and 1203.11.2. Mechanical joints shall conform to Section 1203.3.

1203.11.1 Compression-type fittings.

When compression-type fittings include inserts and ferrules or O-rings, the fittings shall be installed without omitting the inserts and ferrules or O-rings.

1203.11.2 Plastic-to-metal connections.

Soldering on the metal portion of the system shall be performed at least 18 inches (457mm) from a plastic-to-metal adapter in the same water line.

1203.12 PVC plastic pipe.

Joints between PVC plastic pipe and fittings shall be solvent-cemented or threaded joints conforming to Section 1203.3.

1203.13 Steel pipe.

Joints between steel pipe or fittings shall be mechanical, threaded or welded joints conforming to Section 1203.3.

1203.14 Steel tubing.

Joints between steel tubing or fittings shall be mechanical or welded joints conforming to Section 1203.3.

1203.15 Polyethylene plastic pipe and tubing for ground source heat pump loop systems.

Joints between polyethylene plastic pipe and tubing or fittings for ground source heat pump loop systems shall be heat fusion joints conforming to Section 1203.15.1, electrofusion joints conforming to Section 1203.15.2, or stab-type insertion joints conforming to Section 1203.15.3.

1203.15.1 Heat-fusion joints.

Joints shall be of the socket-fusion, saddle-fusion or butt-fusion type, joined in accordance with ASTM D 2657. 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. Fittings shall be manufactured in accordance with ASTM D 2683 or ASTM D 3261.

1203.15.2 Electrofusion joints.

Joints shall be of the electrofusion type. Joint surfaces shall be clean and free of moisture, and scoured to expose virgin resin. Joint surfaces shall be heated to melt temperatures for the period of time specified by the manufacturer. The joint shall be undisturbed until cool. Fittings shall be manufactured in accordance with ASTM F 1055.

1203.15.3 Stab-type insert fittings.

Joint surfaces shall be clean and free of moisture. Pipe ends shall be chamfered and inserted into the fittings to full depth. Fittings shall be manufactured in accordance with ASTM F 1924.

1203.16 Polypropylene (PP) plastic.

Joints between PP plastic pipe and fittings shall comply with Sections 1203.16.1 and 1203.16.2.

1203.16.1 Heat-fusion joints.

Heat-fusion joints for polypropylene (PP) pipe and tubing joints shall be installed with socket-type heat-fused polypropylene fittings, electrofusion polypropylene fittings or by butt fusion. Joint surfaces shall be clean and free from moisture. The joint shall be undisturbed until cool. Joints shall be made in accordance with ASTM F 2389.

1203.16.2 Mechanical and compression sleeve joints.

Mechanical and compression sleeve joints shall be installed in accordance with the manufacturer's instructions.

1203.17 Raised temperature polyethylene (PE-RT) plastic tubing.

Joints between raised temperature polyethylene tubing and fittings shall conform to Sections 1203.17.1 and 1203.17.2. Mechanical joints shall conform to Section 1203.3.

1203.17.1 Compression-type fittings.

Where compression-type fittings include inserts and ferrules or O-rings, the fittings shall be installed without omitting the inserts and ferrules or O-rings.

1203.17.2 PE-RT-to-metal connections.

Solder joints in a metal pipe shall not occur within 18 inches (457 mm) of a transition from such metal pipe to PE-RT pipe.

1203.18 Polyethylene/aluminum/polyethylene (PE-AL-PE) pressure pipe.

Joints between polyethylene/aluminum/polyethylene pressure pipe and fittings shall conform to Sections 1203.18.1 and 1203.18.2. Mechanical joints shall comply with Section 1203.3.

1203.18.1 Compression-type fittings.

Where compression-type fittings include inserts and ferrules or O-rings, the fittings shall be installed without omitting the inserts and ferrules or O-rings.

1203.18.2 PE-AL-PE-to-metal connections.

Solder joints in a metal pipe shall not occur within 18 inches (457mm) of a transition from such metal pipe to PE-AL-PE pipe.

1203.19 Cross-linked polyethylene/aluminum/cross-linked olyethylene (PEX-AL-PEX) pressure pipe.

Joints between cross-linked polyethylene/aluminum/cross-linked polyethylene pressure pipe and fittings shall conform to Sections 1203.19.1 and 1203.19.2. Mechanical joints shall comply with Section 1203.3.

1203.19.1 Compression-type fittings.

Where compression-type fittings include inserts and ferrules or O-rings, the fittings shall be installed without omitting the inserts and ferrules or O-rings.

1203.19.2 PEX-AL-PEX-to-metal connections.

Solder joints in a metal pipe shall not occur within 18 inches (457 mm) of a transition from such metal pipe to PEX-AL-PEX pipe.

Section MC 1204: Pipe Insulation

1204.1 Insulation characteristics.

Pipe insulation installed in buildings shall conform to the requirements of the *New York City Energy Conservation Code,* shall be tested in accordance with ASTM E 84 or UL 723, using the specimen preparation and mounting procedures of ASTM E 2231; 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 602.2.1.

1204.2 Required thickness.

Hydronic piping shall be insulated to the thickness required by the *New York City Energy Conservation Code.*

Section MC 1205: Valves

1205.1 Where required.

Shutoff valves shall be installed in hydronic piping systems in the locations indicated in Sections 1205.1.1 through 1205.1.6.

1205.1.1 Heat exchangers.

Shutoff valves shall be installed on the supply and return side of a heat exchanger.

Exception: Shutoff 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 1005.1.

1205.1.2 Central systems.

Shutoff valves shall be installed on the building supply and return of central utility systems, and district heating and cooling systems.

1205.1.3 Pressure vessels.

Shutoff valves shall be installed on the connection to any pressure vessel.

1205.1.4 Pressure-reducing valves.

Shutoff valves shall be installed on both sides of a pressure-reducing valve.

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.

1205.1.6 Expansion tanks.

Lockable shutoff valves shall be installed at connections to all expansion tanks. Valves shall be locked in the open position.

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 1006.

Section MC 1206: Piping Installation

1206.1 General.

Piping, valves, fittings and connections shall be installed in accordance with the conditions of approval.

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 New York City Plumbing Code.

Exception: The buried portions of systems embedded underground.

1206.3 Protection of potable water.

The potable water system shall be protected from backflow in accordance with the *New York City Plumbing Code.*

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 *New York City Building Code.*

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 mm) to combustible materials.

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.

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 engineered water-hammer arrestor shall be installed. The arrestor shall be located within a range as specified by the manufacturer of the quick-closing valve.

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.

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.

1206.9.1 Flood hazard.

Piping located in areas of special flood hazard shall comply with Appendix G of the *New York City Building Code.*

1206.10 Pipe support.

Pipe shall be supported in accordance with Section 305. Seismic supports shall be provided where required by the *New York City Building Code.*

1206.11 Condensation.

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

Section MC 1207: Transfer Fluid

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.

1207.2 Makeup water.

The transfer fluid shall be compatible with the makeup water supplied to the system.

Section MC 1208: Tests

1208.1 General.

Hydronic piping systems other than ground-source heat pump loop systems shall be tested hydrostatically at one and one half times the system design operating pressure, but not less than 100 psi (689 kPa). The duration of each test shall be not less than 2 hours. Ground-source heat pump loop systems shall be tested in accordance with Section 1208.1.1.

1208.1.1 Ground source heat pump loop systems.

Before connection (header) trenches are backfilled, the assembled loop system shall be pressure tested with water at 100 psi (689 kPa) for 30 minutes with no observed leaks. Flow and pressure loss testing shall be performed and the actual flow rates and pressure drops shall be compared to the calculated design values. If actual flow rate or pressure drop values differ from calculated design values by more than 10 percent, the problem shall be identified and corrected.

Section MC 1209: Embedded Piping

1209.1 Materials.

Piping for heating panels shall be standard-weight steel pipe, Type L copper tubing, or plastic pipe or tubing, in accordance with Section 1202, rated at 100 psi (689 kPa) at 180°F (82°C).

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.

1209.3 Embedded joints.

Joints of pipe or tubing that are embedded in a portion of the building, such as concrete or plaster, shall be in accordance with the requirements of Sections 1209.3.1 and 1209.2.

1209.3.1 Steel pipe joints.

Steel pipe shall be welded by electrical arc or oxygen/acetylene method.

1209.3.2 Copper tubing joints.

Copper tubing joints shall be brazed in accordance with Section 1203.3.

1209.4 Not embedded related piping.

Joints of other piping in cavities or running exposed shall be joined in accordance with manufacturer's installation instructions and related sections of this code.

1209.5 Thermal barrier required.

Radiant floor heating systems shall be provided with a thermal barrier in accordance with Sections 1209.5.1 through 1209.5.4.

Exception: Insulation shall not be required in engineered systems where it can be demonstrated that the insulation will decrease the efficiency or have a negative effect on the installation.

1209.5.1 Slab-on-grade installation.

Radiant piping utilized in slab-on-grade applications shall be provided with insulating materials installed beneath the piping having a minimum *R*-value of 5.

1209.5.2 Suspended floor installation.

In suspended floor applications, insulation shall be installed in the joist bay cavity serving the heating space above and shall consist of materials having a minimum *R*-value of 11.

1209.5.3 Thermal break required.

A thermal break shall be provided consisting of asphalt expansion joint materials or similar insulating materials at a point where a heated slab meets a foundation wall or other conductive slab.

1209.5.4 Thermal barrier material marking.

Insulating materials utilized in thermal barriers shall be installed such that the manufacturer's *R*-value mark is readily observable upon inspection.

Section MC 1210: High-pressure Steam and High Temperature Hot water Piping Systems

1210.1 Scope.

The provisions of this section shall apply to high-pressure steam piping system, which is defined as a system operating at a steam pressure of more than 15 psi (103 kPa), and high temperature water intended for operation at pressures in excess of 160 psi (827 kPa) and temperatures in excess of 250°F (101°C). For purposes of this section, loops, bends or offsets of the piping shall not be considered expansion joints.

1210.2 New systems.

For purposes of this section, the replacement of existing steam piping systems, the installation of a new system in existing buildings, as well as installations in buildings hereafter constructed, shall be considered to be new high-pressure steam piping systems. The following requirements are applicable:

1210.2.1 Design.

The design of new steam piping systems shall be conducted as follows:

1. The system shall be designed by an engineer. An application and plans shall be filed and the approval of the department obtained. The plans and application shall contain, but not be limited to, the following information:

1.1. Size and location of all steam piping.

1.2. The operating pressures and temperatures.

1.3. The location, type, specifications and details of all expansion joints.

1.4. The design, size, material and location of all anchors, guides and auxiliary steel, and the stresses thereon.

2. Systems using utility street steam shall be designed for a pressure of 200 psig (1379 kPa) and 413°F (2 12°C) up to and including the steam pressure reducing valve or valves which reduce the pressure of 90 psig (621 kPa) or below. For steam pressures between 90 psig (621 kPa) and 16 psig (110 kPa), the system shall be designed for 125 psig (108 kPa).

3. Steam distribution systems utilizing pressure reducing valves.

3.1. Safety Shutoff Valves ("SSO") to protect downstream piping from overpressure shall be allowed in lieu of a safety relief valve vented to the outdoors as required by Section 1006.6.

3.2. SSO shall be designed to automatically close at or below the design pressure of the downstream piping system that is being protected, to provide positive shut-off against full upstream pressure. Manual reset shall be required to reopen the SSO.

3.3. SSO shall be designed in accordance with the Steam Distribution Utility System requirements of the utility company having jurisdiction and ASME B31.1.

4. Bellows expansion joints shall not be utilized on high pressure steam piping.

Exception: Bellows expansion joints shall be permitted for final connection to equipment where readily accessible for inspection and service and within Mechanical Equipment Rooms.

1210.2.2 Installation.

The installation of new steam piping systems shall be conducted as follows:

1. Installations, including any welding, shall be subject to special inspection.

2. Welders shall be qualified for all required pipe sizes, wall thicknesses and positions in accordance with the *ASME Boiler and Pressure Vessel Code*, Section IX. Requalification is required every five years or sooner if the commissioner has a specific reason to doubt a welder's ability to make acceptable welds.

3. Welder qualification testing shall be performed by an approved agency listed with the department, and the inspector witnessing the test shall be an authorized AWS Certified Welding Inspector. If the testing is by radiography, the test specimen shall be evaluated by personnel having a minimum radiography qualification of Level II in accordance with the ASNT, Document No. SNT-TC-1A, Supplement A. A successful radiographic test of a production weld made within the 6 months prior to requalification may be considered as an acceptable requalification test.

4. Copies of the certified welder qualification reports shall be maintained by the responsible welding agency and the company performing the welding, and shall be made available upon request to the department.

5. No reports from any welding inspection agency shall be accepted unless such agency has first requested and obtained approval from the department in accordance with rules of the department.

6. Pipe welding shall conform to the following:

6.1. All piping over 2 inches (51 mm) shall be butt-welded. Piping 2 inches (76 mm) and under may be socket-welded or threaded, providing Schedule 80 piping is utilized.

6.2. Threaded piping may continue to be used for existing construction in sizes of 6 inches (152 mm) and under.

6.3. Where welding is not feasible, the commissioner may allow an acceptable alternative.

7. Radiographic examination, when required, shall be performed on butt-welds in accordance with ASME B31.1 based on the piping system design pressure and shall be as follows:

Piping System Design Pressure	Percentage
90 psig (621 kPa) or below	Not Required
91 psig (627 kPa) to 150 psig (1034 kPa)	10 at Random
Over 150 psig (1034 kPa)	100

However, if, in the opinion of the engineer responsible for special inspection, radiographic examination is not required for piping at pressure between 90 psig (621 kPa) and 150 psig (1034 kPa), the engineer shall so specify in writing, and the final report on the installation may omit the foregoing, and be predicated on all of the other requirements noted in this section, and a hydrostatic test.

1210.2.3 Testing.

Hydrostatic testing shall be conducted on the completed installation at 150 percent of the design pressure for all piping pressure. Where the changes in an existing steam system involve less than 30 percent of the piping in the system, the testing may be in accordance with ASME B31.1.

1210.2.4 Relocation.

The commissioner, where deemed necessary, shall require the replacement or relocation of any expansion joints, guides or anchors. The commissioner shall cause the expansion joints in potentially hazardous locations, such as those that are located adjacent to tenant occupied spaces, to be relocated, unless means exist or are provided for eliminating the hazard.

1210.3 Existing systems.

Existing steam piping systems shall be in accordance with Sections 1210.3.1 through 1210.3.3. Upon the completion of a new high-pressure steam piping system and department approval of same, the rules relating to maintenance requirements and the keeping of records for existing high-pressure steam piping systems shall apply.

1210.3.1 Maintenance inspections.

Expansion joints, anchorage and guides shall be inspected as follows:

1. Expansion joints shall be visually inspected monthly.

2. The anchorage and guides shall be visually inspected annually. Exposure of the structural attachments to the buildings of the anchorages or guides shall not be required.

3. A record of such inspections shall be kept by the person in charge of the mechanical equipment of the building or other qualified person designated by the owner and acceptable to the commissioner. The records shall be available at the premises and subject to inspection by the commissioner.

1210.3.2 Work approval.

No joint, anchorage or guides shall be repaired, replaced or relocated without a work permit issued by the department. The application for the permit shall contain all pertinent information and shall be filed by an engineer knowledgeable as to high-pressure steam piping systems. The engineer shall be responsible for the special inspection of the proposed work in accordance with the approved application. This provision shall not apply to the repacking of a slip or ball joint; however, records of such repacking shall be kept in the inspection records as provided in Section 1210.3.1, Item 3. When, in the opinion of the engineer, the requirement for prior department approval would create an imminent health or safety hazard, the engineer may permit the work to proceed without prior approval. In such cases, the engineer shall, prior to the repair, replacement or relocation, notify by telephone the borough commissioner of the borough in which the building is located; and, if the emergency occurs at other than normal working hours, he or she shall notify the department in a manner prescribed by the commissioner. This shall be followed by the filing of the application for department approval as specified in Section 28-105.4.1 of the *Administrative Code.*

Chapter 13: Fuel-oil Piping and Storage

Section MC 1301: General

1301.1 Scope.

This chapter shall govern the design, installation, construction and repair of fuel-oil storage and piping systems. The storage of flammable and combustible liquids not addressed in this chapter shall be in accordance with the *New York City Fire Code.*

1301.2 Storage and piping systems.

Fuel-oil storage and piping systems shall comply with the requirements of Chapter 13 and, to the extent not otherwise provided for in this code, shall comply with the requirements of NFPA 31. All above-ground and underground storage facilities with a combined storage capacity of over 1,100 gallons (4160 L) shall also comply with the requirements of the *New York State Department of Environmental Conservation's Petroleum Bulk Storage Code.*

1301.3 Fuel type.

An appliance shall be designed for use with the type of fuel to which it will be connected. Such appliance shall not be converted from the fuel specified on the rating plate for use with a different fuel without conforming with its listing and manufacturers specifications and securing re-approval from the commissioner.

1301.4 Fuel tanks, piping and valves.

The tank, piping and valves for appliances burning oil shall be installed in accordance with the requirements of this chapter. When oil burning equipment is served by a tank located such that any part of the tank is above the level of the burner inlet connection and where the fuel supply line is taken from the top of the tank, an approved anti-siphon valve or other siphon-breaking device shall be installed. The anti-siphon valve or siphon-breaking device shall be located at the highest point in the supply line.

Exceptions: An anti-siphon valve or other siphon-breaking device shall not be required where either:

1. An approved foot valve is used in the tank, or

2. No. 6 fuel oil is used.

1301.5 Tanks abandoned or removed.

All exterior above-grade fill piping shall be removed when tanks are abandoned or removed. Tank abandonment and removal shall be in accordance with Section 3404 of the *New York City Fire Code.*

1301.6 Out of service system.

Fuel-oil storage systems that are temporarily or permanently taken out of service shall comply with the requirements of the *New York City Fire Code* and of the *New York State Department of Environmental Conservation's Petroleum Bulk Storage Code.*

1301.7 Fuel-oil spill and overfill prevention equipment.

Fuel-oil spill and overfill prevention equipment shall comply with EPA 40 CFR Parts 280, and Section 1305.6.6.

1301.8 Portable fire extinguishers.

Portable fire extinguishers shall be provided as required by the *New York City Fire Code* and NFPA 10.

1301.9 Absorbent materials.

The building owner shall maintain a sufficient quantity of absorbent materials near fuel-oil storage tanks, pumps, and related equipment to control leaks and slipping hazards.

1301.10 Certificate of fitness.

Where fuel-oil piping systems utilize pumps to transfer fuel oil to equipment at levels above the lowest floor or to storage tanks at levels above the lowest floor in buildings, a qualified employee or contracted general company holding a certificate of fitness from the Fire Department shall maintain the fuel-oil system.

Section MC 1302: Material

1302.1 General.

Piping materials shall conform to the ASTM standards cited in this section.

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 being handled by the system.

1302.3 Pipe standards.

Fuel-oil pipe shall comply with the standards listed in Table 1302.3.

Exception: Piping for fuel-oil systems utilizing a transfer pump to equipment at levels above the lowest floor or to storage tanks at levels above the lowest floor in buildings shall comply with the requirements of Section 1305.9.5.

Table 1302.3[a]

Fuel Oil Piping

Material	Standard (see Chapter 15)
Material	**Standard (see Chapter 15)**
Brass pipe	ASTM B 43
Copper or copper-alloy pipe	ASTM B 42; ASTM B 302
Copper or copper-alloy tubing (Type K, or L(PVC coated)	ASTM B 75; ASTM B 88;ASTM B 280
Labeled pipe	(See Section 1302.4)
Nonmetallic pipe	ASTM D 2996
Steel pipe	ASTM A 53M; ASTM A 106
Steel tubing[b]	ASTM A 254; ASTM A 539

a. Brass tubing, and copper tubing type M are not permitted.

b. Steel tubing shall only be permitted when installed by the equipment manufacturer in accordance with UL 2200 and UL labeled.

1302.4 Nonmetallic pipe.

All nonmetallic pipe shall be listed and labeled as being acceptable for the intended application for flammable and combustible liquids. Nonmetallic pipe shall be installed only outside, underground.

1302.5 Fittings and valves.

Fittings and valves for the piping systems shall be compatible with, or shall be of the same material as, the pipe or tubing, and shall conform with Table 1202.5.

1302.6 Bending of pipe.

Pipe shall be suitable for bending and shall conform with Table 1302.3. Pipe bends shall be made with approved equipment. The bend shall not exceed the structural limitations of the pipe.

1302.7 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 in accordance with UL 343.

1302.8 Flexible connectors and hoses.

Flexible metal connectors and hoses used where rigid connections are impractical or to reduce the effect of jarring and vibration shall be listed and labeled in accordance with UL 536 and shall be installed in compliance with its label and the manufacturer's installation instructions and shall not exceed 18 inches (457 mm). Connectors made from combustible materials shall not be used inside buildings or above ground outside of buildings.

Section MC 1303: Joints and Connections

1303.1 General.

Joints and connections shall conform to the ASTM Standards listed in Section 1203, shall be of a type approved for fuel-oil piping systems, shall be rated for the temperatures and pressures of the systems in which the devices are installed, and shall be compatible with the fluid and all materials used. All threaded joints and connections shall be made tight with suitable lubricant or pipe compound. Unions and flanges, right or left couplings, and sweat fittings shall be brazed in accordance with *ASME Boiler and Pressure Vessel Code,* Section IX (Welding and Brazing Qualifications) or in accordance with AWS B2.2 Standard for Brazing Procedure and Performance Qualification. Cast-iron fittings shall not be used. Joints and connections shall be tight for the pressure required by test. Flanged joints requiring gaskets or packing shall be equipped with gaskets rated for a minimum of 750°F (399°C).

1303.1.1 Joints between different piping materials.

Joints between different piping materials shall be made with adapter fittings. Joints between different metallic piping materials shall be made with dielectric fittings. All such fittings shall conform with the requirements of Section 1203.

1303.2 [Reserved.]

1303.3 Joint preparation and installation.

Where required by Sections 1303.4 through 1303.10, the preparation and installation of brazed, mechanical, threaded and welded joints shall comply with Sections 1303.3.1 through 1303.3.4.

1303.3.1 Brazed joints.

All joints shall be brazed in accordance with *ASME Boiler and Pressure Vessel Code,* Section IX Welding and Brazing Qualifications or in accordance with American Welding Society AWS B2.2 Standard for Brazing Procedure and Performance Qualification.

1303.3.2 Mechanical joints.

Mechanical joints utilizing an elastomeric and/or compression seal are not permitted.

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 and shall be compatible for application on the piping material and fluid.

1303.3.4 Welded joints.

All joints shall be welded in accordance with *ASME Boiler and Pressure Vessel Code,* Section IX Welding and Brazing Qualifications or in accordance with AWS B2.1 Specifications for Welding Procedure and Performance Qualification.

1303.4 Brass pipe.

Joints between brass pipe or fittings shall be brazed, mechanical, threaded or welded joints complying with Section 1303.3.

1303.5 [Reserved.]

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 1303.3.

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 1303.3 or flared joints. Flared joints shall be made by a tool designed for that operation.

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.

1303.9 Steel pipe.

Joints between steel pipe or fittings shall be threaded or welded joints complying with Section 1303.3.

1303.10 [Reserved.]

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. Piping serving equipment at levels above the lowest floor or storage tanks at levels above the lowest floor in buildings shall also comply with the requirements of Section 1305.9.6 and 1305.9.7.

Section MC 1304: Piping Support

1304.1 General.

Pipe supports shall be in accordance with Section 305. Piping serving equipment at levels above the lowest floor or storage tanks at levels above the lowest floor in buildings shall also comply with the requirements of Section 1305.9.6 and 1305.9.7.

Section MC 1305: Fuel-oil System Installation

1305.1 General.

Fuel-oil piping systems shall be installed in accordance with this section.

1305.2 Protection of pipe, equipment and appliances.

All fuel-oil pipe, equipment and appliances shall be protected from physical damage. Piping serving equipment at levels above the lowest floor or storage tanks at levels above the lowest floor in buildings shall also comply with the requirements of Section 1305.9.

1305.2.1 Flood hazard.

All fuel-oil pipe, tanks, equipment and appliances located in areas of special flood hazard shall comply with Appendix G of the *New York City Building Code.*

1305.3 Supply piping.

Supply piping shall comply with the requirements of Sections 1305.3.1 through 1305.3.7.

1305.3.1 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 (9.5 mm) inside diameter nominal pipe or 3/8-inch (9.5 mm) OD tubing.

1305.3.2 Connections to tank.

Supply piping shall connect to the top of the fuel-oil tank.

Exception: Storage tanks in buildings that comply with all of the following conditions:

1. The tank is located above ground on the lowest floor;
2. The tank does not exceed 330 gallons (1250 L); and
3. The tank is provided with a 3/4-inch (19.1 mm) opening for gravity discharge and a 1-inch (25 mm) opening in the bottom for cleaning and protection against corrosion.

1305.3.3 Pumps.

Fuel oil shall be supplied by a transfer pump or automatic pump or by other approved means.

1305.3.4 Smoke detectors.

Appropriate safeties shall be provided so that detection of smoke or heat within the generator or equipment room shall prevent additional fuel oil from being pumped into the piping system within such room, including a fusible link operated lever gate valve in the supply pipe at the wall of the generator or equipment room.

1305.3.5 Horizontal runouts.

Horizontal runouts from risers to the generator or equipment room shall follow as direct a route as practicable.

1305.3.6 Direct feed.

Systems where day tanks are absent (such as generator installations where fuel oil is taken directly from a fuel-oil pipe or header into the engine) shall comply with Section 1305.9.12.

1305.3.7 Piping from transfer pump to equipment or storage tanks above the lowest floor.

Supply piping from a transfer pump to equipment at levels above the lowest floor or storage tanks at levels above the lowest floor in buildings shall also comply with the requirements of Section 1305.9.

1305.4 Return piping.

Return piping shall connect to the top of the fuel-oil tank. The minimum size of a return line shall be no less than the size of the supply piping specified in Section 1305.3.1. Valves shall not be installed on return piping unless a means of relieving overpressure is provided. Return piping serving equipment at levels above the lowest floor or storage tanks at levels above the lowest floor in buildings shall also comply with the requirements of Section 1305.9.

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. Pressure in a storage tank for the purpose of discharging oil shall be prohibited.

1305.6 Fill piping.

Fill piping shall comply with the requirements of Section 1305.6.1 through 1305.6.6.

1305.6.1 Size.

Fill piping shall be a minimum of 2 inches (51 mm) in diameter or 3 inches (76 mm) for No. 6 fuel oil.

1305.6.2 Termination location.

A fill pipe shall terminate outside of a building at or above grade at a point least 2 feet (610 mm) from any building opening and 5 feet (1524 mm) away from any subway grating at the same or lower level. A fill pipe shall terminate in a manner designed to minimize spilling when the filling hose is disconnected. Where No. 6 fuel oil is used, the fill pipe terminal shall be within 3 feet (914 mm) of the curb unless otherwise required by the Department of Transportation or the Transit Authority. If facilities exist for an oil delivery truck to drive onto the premises, the fuel-oil terminal may be located elsewhere other than the curb.

1305.6.3 Separate fill piping.

Each storage tank shall be provided with a separate fill pipe, except that where a battery of tanks containing the same grade of oil is installed, a common fill and header pipe may be installed.

1305.6.4 Check valve.

Where the top of the storage tank is above the fill pipe terminal, the fill pipe shall be connected to the top of the tank and provided with a shut-off valve and swing check valve, both of which shall be located at the fill pipe terminal. The shut-off valve and swing check valve may be installed in an accessible location inside the building at or below the level of the fill pipe terminal.

1305.6.5 Terminal opening.

The fill opening shall be equipped with a tight metal cover designed to discourage tampering. All fill pipe terminals shall be of an approved type and shall be provided with lugs for embedding in concrete. In lieu of lugs, a set screw or threads to fasten the terminal to the fill pipe may be used. The outer flange of the fill pipe terminal or the seal cap shall be permanently marked: FUEL OIL. The fill pipe terminal shall be right-handed thread or provided with other equivalent means to receive the seal cap. The seal cap shall be suitably slotted for receiving an opening wrench, and an oilproof gasket inserted in a groove in the fill pipe terminal shall be provided so as to make the seal cap leakproof. A strainer shall not be required but if used, shall be of at least 1/8-inch (3.2 mm) mesh. Where a storage system for volatile flammable oil and a storage system for fuel oil are to be used in the same premises, the terminal of the volatile oil pipe shall be provided with a left-handed thread and the fill pipe fitting shall be of a different size than that required for the fill pipes to the tanks containing the volatile flammable oil.

1305.6.6 Spill containment.

For fill terminal openings serving tanks greater than 660 gallons (2500 L), an approved overflow/spill containment device shall be provided.

1305.7 Normal vent piping.

Normal vent piping shall comply with the requirements of Section 1305.7.1 through 1305.7.9.

1305.7.1 Size.

Normal vent sizes shall comply with the sizes listed in Tables 1305.7(1) and 1305.7(2); provided, however, for tanks other than those complying with the alternate tank design and construction standards contained in Section 1305.14, the normal vent shall not be smaller in size than the supply pipe.

Table 1305.7(1)

Vent Piping for Underground Tanks

Tank Size	Minimum Vent Diameter
660 gallons (2500 L) or less	1 1/4 inch (32 mm)
661 gallons (2505 L) to 3,000 gallons (11 355 L)	1 1/2 inch (38 mm)
3,001 gallons (11 360 L) to 10,000 gallons (37 850 L)	2 inch (51 mm)
10,001 gallons (37 855 L) to 20,000 gallons (75 700 L)	2 1/2 inch (64 mm)
Larger than 20,000 gallons (75 700 L)	3 inch (76 mm)

Table 1305.7(2)

Vent Piping for Tanks Installed Inside Buildings

Tank Size	Minimum Vent Diameter
660 gallons (2500 L) or less	1 1/4 inch (32 mm)[a]

Larger than 660 gallons (2500 L)	Sized to prevent abnormal pressure in the tank during filling but not smaller than the pipe size specified in Table 1305.7(1)

a. For tanks constructed to UL 80 specifications, the minimum vent diameter shall be 2 inches (51 mm). For tanks constructed to UL 142 specifications, the minimum vent diameter shall not be less than as required by Section 1305.8.4.

1305.7.2 Termination location.

The location of the normal vent pipe terminations shall comply with the following:

1. Liquid fuel normal vent pipes shall terminate outside of buildings in a nonhazardous location at a point not less than 2 feet (610 mm) measured vertically or horizontally from any building opening and not less than 2 feet (610 mm) nor more than 12 feet (3658 mm) above the fill pipe terminal.

2. If the normal vent pipe terminal is not visible from the fill pipe terminal location, a 1-inch (25 mm) tell-tale line shall be connected to the tank and shall parallel the fill pipe and terminate at the fill pipe terminal with an unthreaded end. Such tell-tale lines shall be provided with a check valve set to prevent flow of surface water to the storage tank.

3. Normal vent pipes shall terminate sufficiently above the ground to avoid being obstructed with snow or ice.

4. Normal vent pipes from tanks containing heaters shall be extended to a location where oil vapors discharging from the normal vent will be readily diffused.

1305.7.3 Termination caps.

Outer ends of normal vent pipes shall terminate in a weatherproof vent cap or fitting or be provided with a weatherproof hood. All normal vent caps shall have a minimum free open area equal to the cross-sectional area of the normal vent pipe and shall not employ screens finer than No. 4 mesh.

1305.7.4 Tank pressure.

The tank shall be designed for the maximum static head that will be imposed with the normal vent piping filled with oil.

1305.7.5 Multiple Tanks.

A normal vent pipe shall be provided for each storage tank. Normal vent piping from multiple tanks of the same grade oil with not more than 660 gallons (2500 L) aggregate capacity may be combined. Where a battery of storage tanks complying with the alternate tank design and construction standards contained in Section 1305.14 designed to hold the same grade of oil with not more than 660 gallons (2500 L) aggregate capacity is installed, normal vent pipes may be run into a main header.

1305.7.6 Pitch.

Normal vent pipes shall drain toward the tank. The normal vent pipes shall have no sags or traps where liquid can collect.

1305.7.7 Protection.

Normal vent pipes shall be located so that they are not subjected to physical damage.

1305.7.8 Cross-connection.

Liquid fuel normal vent pipes shall not be cross-connected with fill pipes, lines from burners or overflow lines from auxiliary tanks.

1305.7.9 Tanks above the lowest floor.

For tanks installed above the lowest floor, the normal vent shall be piped, in an approved manner, into the vent or top of tank of the lowest floor storage tank that supplies the fuel to such tank.

1305.8 Emergency relief vent piping.

Each primary tank, the interstitial space of a secondary containment tank and each compartment of a compartment tank complying with UL 142 shall be provided with emergency relief venting. A tank's emergency relief vent piping and normal vent piping shall be combined. The design and installation of the combined normal and emergency relief vent shall be in accordance with Section 1305.7 and Sections 1305.8.1 through 1305.8.4. Tanks designed in accordance with Section 1305.14 shall not require emergency relief vent piping.

1305.8.1 Piping.

The combination normal and emergency relief venting shall be provided through an open vent pipe connected directly, as applicable, to the primary tank, interstitial space or compartment. The use of a self-closing manway cover, a manway cover provided with long bolts that permit the cover to lift under internal pressure, or other type emergency relief vent device, shall be prohibited.

1305.8.2 Termination.

Combination normal and emergency relief vent piping shall terminate outdoors.

1305.8.3 Tanks above the lowest floor.

For tanks installed inside of buildings above the lowest floor, the combination normal and emergency vent piping shall be piped, in an approved manner, into the vent or top of tank of the lowest floor storage tank that supplies the fuel to such tank. Normal and emergency vents are to be sized in accordance with NFPA 30.

1305.8.4 Capacity.

The total relief venting capacity of the combination normal and emergency relief venting shall be in accordance with Section 4.2.5.2 of NFPA 30. Construction documents shall include calculations demonstrating that the extension of the normal and emergency vent piping is adequately sized to provide the required emergency vent flow while limiting the back pressure to less than the maximum pressure permitted by the design of the tank. Additionally, consistent with Section 4.2.5.2.5 of NFPA 30, where the design provides for a reduction in the required emergency relief venting capacity based upon the properties of the fuel oil to be stored in the tank, the construction documents shall include supporting calculations.

1305.9 Supplemental requirements for piping from transfer pumps to equipment or storage tanks above lowest floor.

Fuel-oil piping systems utilizing pumps to transfer fuel-oil to equipment at levels above the lowest floor or storage tanks at levels above the lowest floor in buildings shall comply with the requirements of Section 1305.9.1 through 1305.9.12.

1305.9.1 Shaft enclosure.

The piping from a transfer pump to equipment at levels above the lowest floor or storage tanks at levels above the lowest floor in buildings, the return

piping, and vent piping shall be enclosed in a shaft constructed of 4-inch (102 mm) concrete or masonry having a 4-inch (102 mm) clearance from all pipe or pipe covering, except that no such enclosures shall be required within the room containing the pump, tank, or equipment where such room is itself enclosed with construction and materials having at least a 2-hour fire resistance rating. Multiple fuel oil risers serving multiple systems are permitted within a common shaft enclosure. All shaft penetrations must be fire stopped.

1305.9.2 Ducts or other piping in shafts.

Pipe shafts containing fuel-oil piping shall not be penetrated by or contain other piping or ducts.

1305.9.3 Horizontal offsets.

Where it is necessary to make horizontal offsets in the supply and overflow/return piping and pipe shafts, including the lowest level, such piping shall be enclosed in a sleeve of other piping of at least No. 10 standard Gage steel, two sizes larger than the supply piping and arranged to drain into the shaft. Horizontal piping offsets shall be further enclosed in construction having a 2-hour fire-resistance rating except that no such enclosure or pipe sleeve shall be required for the pipes serving the equipment within the room containing the pump, tank, or equipment where such room is itself enclosed with construction and materials having at least a 2-hour fire-resistance rating. Horizontal piping shall include all piping at or above the roof level. No 2-hour fire-resistance rated enclosure is required for horizontal piping offsets located outside the building.

1305.9.4 Drain at base of shafts; leak detection.

A drain pipe shall be installed at the base of shafts enclosing the supply and overflow/return piping. The pipe shall lead to a dedicated sump or minimum 55 gallon (208 L) container with a leak detection alarm, arranged so as to sound an alarm and stop the transfer pump. The alarm shall be connected to a local audible alarm and to a remote alarm located at a supervising station. The wiring shall comply with the *New York City Electrical Code.*

1305.9.5 Piping materials.

Oil lines for equipment or tanks shall be steel pipe ASTM A 53 or ASTM A 106, grade B seamless Schedule 40 with welded connections up to the oil tank or equipment, except that fittings at the tank or equipment, shut-off valves and other fuel-oil flow and control devices may be screwed or flanged.

1305.9.6 Expansion.

Provision shall be made for expansion in piping without the use of expansion joints.

1305.9.7 Movement and vibration.

The piping shall be located and secured from movement so as to prevent undue stress on the piping and to isolate the piping from vibrations from any equipment.

1305.9.8 Connections to header.

Pipe connections to the main header (supply or return) shall be made from the top of the header, except for systems with equipment above the lowest floor where such equipment is designed to operate utilizing fuel pumped as needed from the lowest floor and without utilizing fuel oil stored above the lowest floor.

1305.9.9 Air vents and breakers.

Required air vents and vacuum breakers shall be designed for their required use.

1305.9.10 Curb or pan.

All air vents and vacuum breakers shall be hard-piped to a curb or pan.

1305.9.11 Pipe size; fuel storage above the lowest floor.

In systems with equipment above the lowest floor where such equipment is designed to operate utilizing fuel stored above the lowest floor, piping diameters shall not exceed 4 inches (102 mm). However, where an applicant demonstrates by the inclusion of calculations in the construction documents that a greater diameter is necessary to ensure the proper flow for the functioning of the system, such greater diameter may be permitted. Piping shall not be used for fuel storage purposes.

1305.9.12 Pipe size; without fuel storage above the lowest floor.

In systems with equipment above the lowest floor, where such equipment is designed to operate utilizing fuel pumped as needed from the lowest floor and without utilizing fuel oil stored above the lowest floor, piping diameters throughout such systems shall not exceed the design flow (three times the maximum firing rate as calculated by the engineer or architect). However, piping diameters within rooms containing such equipment may exceed the calculated design flow pipe size to provide limited reservoir storage to prime equipment, provided such reservoir storage is counted toward the maximum permitted oil storage per story, as provided for in Section 1305.11.1.3.

1305.10 Devices to control flow to oil-burning equipment including generators.

The following requirements shall apply:

1. The pressure in oil lines to oil-burning equipment located above the lowest floor of a building shall not be more than is required to circulate oil to and from the burners, and all parts of the oil system shall be capable of withstanding the maximum working pressure in that part of the system.

2. A remote control shall be provided to stop the flow of oil to any burner wherever located, and to any oil-burning equipment located on levels above the lowest floor in buildings. Such control shall be located outside the entrance to the room in which the burner is located and as close to such entrance as practicable, except that when an outside location is impracticable, such control may be located immediately inside the room in which the burner is located, provided such location is accessible at all times. All such controls shall be permanently labeled: "REMOTE CONTROL FOR BURNER," or as appropriate to the oil-burning equipment. On storage tanks of 60 gallons (227 L) or less capacity used with manually operated equipment, such remote control may be installed in the supply lines between tank and burner.

3. In systems where either steam or air is used for atomizing the oil, the oil and the atomizing supply shall be interlocked so that where the supply of either is interrupted, the supply of the other will be immediately cut off.

1305.11 Limitations on quantities of fuel-oil storage.

Quantities of fuel-oil storage shall be limited in accordance with the provisions of this section. For the purposes of this section, fuel oil stored on roofs shall be deemed inside of buildings and located on the floor to which they are adjacent.

1305.11.1 Inside of buildings.

A total of not more than 100,000 gallons (378 000 L) shall be stored inside of any building. Oil-storage inside of buildings shall also comply with applicable requirements of Sections 1305.11.1.1 through 1305.11.1.3.

1305.11.1.1 Inside of buildings; below ground.

The maximum size of each below-ground oil-storage tank inside of a building shall be 35,000 gallons (132 475 L).

1305.11.1.2 Inside of buildings; above ground on the lowest floor.

Fuel-oil storage tanks installed above ground on the lowest floor of a building shall be mounted on and anchored by adequate noncombustible supports. The maximum size of each individual tank shall be 660 gallons (2500 L), and a total of not more than 1375 gallons (5200 L) shall be stored within the same 2-hour fire area.

Exceptions. Fuel-oil storage tanks shall be permitted to exceed 660 gallons (2500 L), and the total quantity within a fire area shall be permitted to exceed 1375 gallons (5200 L) in accordance with any one of the following options:

1. **Buildings of Type I, II, IIIA, IV or VA construction with a total limit of 15,000 gallons.** The maximum size of each individual tank shall be 15,000 gallons (56 775 L) provided that all such tanks are located in a room or enclosure dedicated to oil storage that is separated from the rest of the building by fire-resistance-rated construction of at least 3 hours. Notwithstanding Section 1305.11.1, in such cases, the maximum total quantity in the building shall be limited to 15,000 gallons (56 775 L).

2. **Buildings of Type IIIB or VB construction with a total limit of 10,000 gallons.** The maximum size of each individual tank shall be 10,000 gallons (37 850 L) provided that all such tanks are located in a room or enclosure dedicated to oil storage that is separated from the rest of the building by fire-resistance-rated construction of at least 3 hours. Notwithstanding Section 1305.11.1, in such cases, the maximum total quantity in the building shall be limited to 10,000 gallons (56 775 L).

3. **Buildings of any type construction with a total limit of 100,000 gallons.** The maximum size of each individual tank shall be 25,000 gallons (94 625 L) provided that all such tanks are enclosed in a vault (i) with walls, floor, and top having a fire-resistance rating of not less than 3 hours, (ii) with such walls bonded to the floor, and (iii) with such top and walls of the vault independent of the building structure. An exterior building wall having a fire-resistance rating of not less than 3 hours shall be permitted to serve as a wall of the vault. The vault shall be located in a dedicated room or area of the building that is cut off vertically and horizontally from other areas and floors of the building by assemblies having a fire-resistance rating of not less than 2 hours. Where the aggregate fuel-oil storage on the lowest level of the building exceeds 50,000 gallons (189 250 L), such storage shall be protected with an alternative automatic fire-extinguishing system complying with this code and the *New York City Fire Code*.

(Am. L.L. 2018/195, 12/1/2018, eff. 5/30/2019)

Editor's note: For related unconsolidated provisions, see Appendix A atL.L. 2018/195.

1305.11.1.3 Inside of buildings; above the lowest floor.

Fuel-oil above the lowest floor inside of a building shall be limited to 330 gallons (1249 L) per story. The maximum quantity shall include oversized piping as described in 1305.9.12. Piping installations shall comply with the requirements of Section 1305.9.

Exception: Fuel-oil storage capacity in areas of special flood hazard and shaded X-Zones, as defined in Section G201.2 of Appendix G of the New York City Building Code, shall comply with Section G307.4 of Appendix G of the New York City Building Code.

1305.11.2 Outside of buildings.

Oil-storage outside of buildings shall comply with applicable requirements of Sections 1305.11.2.1 and 1305.11.2.2.

1305.11.2.1 Outside of buildings; below ground.

The maximum size of each below-ground oil-storage tank outside of a building shall be 35,000 gallons (132 475 L).

1305.11.2.2 Outside of buildings; above ground.

The maximum size of each above-ground oil-storage tank outside of a building shall be 100,000 gallons (37 800 L).

1305.12 Standards for Tank Design.

Tanks shall be designed and constructed in compliance with Sections 1305.12.1 and 1305.12.2.

1305.12.1 Below ground.

Tanks located below ground, inside or outside of buildings, shall comply with any one of the following design standards, as appropriate for the specific installation as determined by the engineer:

1. UL 58; such tanks shall be listed and labeled;
2. UL 1316; such tanks shall be listed and labeled; or
3. Alternate tank design and construction standards contained in Section 1305.14

1305.12.2 Above ground.

Tanks located above ground, inside or outside of buildings, shall comply with any one of the following design standards, as appropriate for the specific installation as determined by the engineer:

1. UL 80; such tanks shall be listed and labeled;
2. UL 142; such tanks shall be listed and labeled;
3. ASME Boiler and Pressure Vessel Code, Section VIII, Division 1 or 2; such tanks shall be labeled; or
4. Alternate tank design and construction standards contained in Section 1305.14

1305.13 Installation of tanks.

Tanks shall be installed in accordance with the provisions of section 1305.13.1 through 1305.13.4. For the purposes of this section, fuel oil stored on roofs shall be deemed inside of buildings.

1305.13.1 Below ground.

Tanks located below ground, inside or outside of buildings, shall comply with the following requirements:

1. **Containment.** Fuel-oil tanks having a capacity of more than 660 gallons (2500 L) shall be provided with secondary containment intended to prevent any leakage of fuel oil from the tank from entering the environment. The capacity of the containment shall equal or exceed the capacity of the tank served.

2. **Burial.** Regardless of capacity, fuel-oil tanks shall be buried with the top of the tank at least 2 feet (610 mm) below ground. Tanks shall be placed in firm soil and shall be surrounded by clean sand or well-tamped earth, free from ashes or other corrosive substance, and free from stones that will not pass a 1-inch (25 mm) mesh.

3. **Anchorage.** When necessary to prevent floating, fuel-oil tanks, regardless of capacity, shall be securely anchored.

4. **Distance to foundations.** Regardless of capacity, no fuel-oil tank shall be buried within 3 feet (914 mm) of any foundation wall or footing.

5. **Special limitations near subways.** Regardless of capacity, no fuel-oil tank shall be placed within 20 feet (6096 mm) of the outside line of a subway wall. For the purpose of the foregoing requirement, a subway shall be deemed to include any subsurface railroad or rapid transit roadbed.

1305.13.2 Above ground; on the lowest floor inside a building.

Tanks located above ground, on the lowest floor inside of buildings, shall comply with the following requirements:

1. **Enclosure of room.** Installation of tank(s) and enclosure of room shall comply with Section 1305.11.1.2.

2. **Fire-extinguishing system.** Fire extinguishing systems shall comply with Section 1305.11.1.2.

3. **Ventilation.** Rooms containing fuel-oil tanks which exceed 1375 gallons (5200 L) shall be ventilated to limit the concentration of vapors within the room at or below 25 percent of the Lower Flammable Limit (LFL) of the fuel oil being used.

4. **Containment.** Fuel-oil tanks having a capacity of more than 660 gallons (2500 L) storage shall be provided with secondary containment intended to capture any leakage of fuel oil from the tank. The capacity of the containment shall equal or exceed the capacity of the tank served. For fuel storage, the capacity shall include the portion of the tank up to the height of the containment.

5. **Special limitations near subways.** Regardless of capacity, fuel-oil tanks located within the outer lines of the subway, or within 20 feet (6096mm) of the outside line of a subway shall be placed within a welded steel oil-tight pan of not less than No. 18 Gage metal suitably reinforced and of capacity to contain the contents of the tank. For the purpose of the foregoing requirement, a subway shall be deemed to include any subsurface railroad or rapid transit roadbed.

1305.13.3 Above ground; above the lowest floor inside a building.

Regardless of capacity, fuel-oil tanks and fuel-oil-burning equipment located above ground, above the lowest floor inside of buildings, shall comply with the following requirements:

1. **Enclosure of room.** Fuel-oil tanks and fuel-oil-burning equipment shall be located in a dedicated room or enclosure, having a fire resistance rating of at least 2 hours. Rooftop tanks need not be enclosed provided that all exterior walls and roof surfaces within 10 feet (3048 mm) horizontally and 20 feet (6096 mm) vertically have a fire resistance rating of at least 2 hours.

2. **Fire extinguishing system.** Rooms containing fuel-oil tanks and fuel-oil-burning equipment shall be equipped with an automatic sprinkler system in accordance with section 903.3.1 of the New York City Building Code. To prevent overfilling of the containment barriers, sprinkler shut-offs shall be located on the outside of tank and generator rooms and prominently placarded for immediate control by the Fire Department.

3. **Smoke detection.** Rooms containing fuel-oil tanks and fuel-oil-burning equipment shall be equipped with automatic smoke detection in accordance with Section 907 of the *New York City Building Code,* except that heat detectors may be utilized where, during normal operation, products of combustion are present in sufficient quantity to actuate a smoke detector.

4. **Ventilation.** Rooms containing fuel-oil tanks shall be ventilated to limit the concentration of vapors within the room at or below 25% of the Lower Flammable Limit (LFL) of the fuel oil being used.

5. **Containment.** Fuel-oil tanks, fuel-oil-burning equipment, and related equipment shall be provided with secondary containment area intended to capture any leakage of fuel oil. Floor drains shall be prohibited in containment areas. For tanks, the capacity of the containment area shall equal or exceed 2 times the capacity of the tank served. For fuel storage, the capacity shall include the portion of the tank up to the height of the containment. For fuel-oil-burning equipment, and related equipment the capacity of the containment area shall equal or exceed 1.5 times the fuel capacity of the equipment.

6. **Transfer pumps.** Fuel-oil tanks shall be filled by means of a transfer pump supplied from a primary storage tank located on the lowest floor. A separate transfer pump and piping circuit shall be provided for each storage tank installed above the lowest floor. No intermediate pumping stations shall be provided between the storage tank and the transfer pump. Appropriate devices shall be provided for the automatic and manual starting and stopping of the transfer pumps so as to prevent the overflow of oil from these storage tanks.

7. **Indicators and alarms.** Indicators and alarms shall be provided for fuel oil tanks and rooms containing fuel-oil-burning equipment, including a level sensor for height and capacity of fuel oil, high and low levels, and leak detection. The float switch shall be provided within the containment areas and shall be arranged so as to sound an alarm and stop the transfer pump in case of failure of the tank or the control in the tank. These indicators shall be connected to a local audible alarm in the tank room and to a remote alarm located at a supervising station. The wiring shall comply with the *New York City Electrical Code.*

8. **Weekly testing.** The operation of the float switch shall be tested at least once each week by the holder of the certificate of fitness as provided for in Sections 1301.10 and 1308.3.

1305.13.4 Above ground; outside a building.

Tanks located above ground, outside of buildings, shall comply with the following requirements:

1. **Containment.** Regardless of capacity, each fuel-oil storage tank shall be protected by an embankment or dike. Such protection shall have a capacity at least 1 1/2 times the capacity of the tank so surrounded (including the portion of the tank up to the height of the containment) and shall be at least 4 feet (1219 mm) high, but in no case shall the protection be higher than 1/4 the height of the tank when the height of the tank exceeds 16 feet (4877 mm). Embankments or dikes shall be made of earthwork with clay core, of masonry, of reinforced concrete or of steel. Earth work embankments shall be firmly and compactly built of good earth free from stones, vegetable matter, or other similar material, and shall have a flat section of at least 3 feet (914 mm) at the top and a slope of at least 1 1/2 (457 mm) rise to 2 feet (610 mm) of run on all sides. Concrete, masonry or steel dikes shall be designed so as to contain safely all of the oil in the tank so surrounded. Embankments or dikes shall be continuous and unpierced, and the outside toe shall be located at least 5 feet (1524 mm) inside of the property line, and no less than 5 feet (1524 mm) from a driveway or parking area.

2. **Distances to buildings, lot lines, and other tanks.** Storage tanks of a capacity greater than 330 gallons (1250 L) shall be not less than 1 1/4 tank diameters and in no case less than 10 feet (3048 mm) from the tax lot line, the nearest building or adjacent tank. However, in no case shall the clearance between individual tanks and the tax lot line be less than the distance fixed by the following formula:

$$M.C. = 10 + 4\,((G - 275)/5000) \qquad \textbf{(Equation 13-1)}$$

where:

$M.C.$	=	minimum clearance from nearest surface of tank to tax lot line, in feet.
G	=	Capacity of tank, in gallons.

3. **Means of egress.** Tanks shall be located so as not to obstruct or interfere with any means of egress.

1305.14 Alternate tank design and construction standards.

Oil-storage tanks, other than those conforming to *ASME Boiler and Pressure Vessel Code,* Section VIII, Division 1 or 2, UL 58, UL 80, UL 142, or UL 1316 shall be designed, constructed and installed in accordance with the requirements of Section 1305.14.1 through 1305.14.5.

1305.14.1 General construction standards.

All tanks shall comply with the requirements of Section 1305.14.1.1 through 1305.14.1.9.

1305.14.1.1 Materials and workmanship.

All fuel-oil storage tanks shall be built of steel plates or sheets, made by the open hearth or basic oxygen process. Such steel shall be free from physical imperfections, and shall be new, in good condition, and free from rust.

1305.14.1.2 Assembly.

Tanks, flanges or other pipe connections shall be welded. Filler of any kind between plates shall be prohibited.

1305.14.1.3 Corrosion resistance.

Tanks to be buried shall be cleaned and then coated on the outside with two coats of corrosion protective material. They shall be further protected by a coating of hot tar, asphalt, or equivalent rust resistive material, applied at the work site. Tanks installed inside buildings above ground shall be coated with one coat of corrosion protective material.

1305.14.1.4 External loads on underground tanks.

All buried storage tanks shall be constructed of at least 1/4-inch (6.4 mm) thick metal and shall be designed to withstand any external loads to which the tank may be subjected.

1305.14.1.5 Identification.

At the time of installation all storage tanks shall bear a permanently-fixed plate, spot welded or equivalent, bearing the name of the tank manufacturer, the gage of the material, and capacity of the tank. Shop-fabricated storage tanks shall be installed without structural alteration.

1305.14.1.6 Openings.

All openings shall be through the top of the storage tank, except that storage tanks of 275 gallon (1041 L) capacity or less, located above ground but below the lowest story, may be provided with a 3/4-inch (19.1 mm) opening for gravity discharge and a 1-inch (25 mm) opening in the bottom for cleaning and protection against corrosion.

1305.14.1.7 Manholes.

Tanks for No. 1, No. 2, No. 3 and No. 4 commercial grade oils need not have manholes. However, if manholes are used for tanks containing such oils, the manhole covers shall be bolted and made gas tight. Tanks for No. 5 and No. 6 commercial grade oils shall have manhole covers bolted or otherwise secured to the tanks and kept hydrostatically tight at all times. Tanks 275 gallons (1041 L) capacity or less, and all other tanks without manholes, shall be provided with a 2 screwed connection on the top of the tank to permit measuring the level of the oil within.

1305.14.1.8 Electrical grounding.

Tanks outside of buildings shall be electrically grounded in accordance with the requirements for equipment grounding of the *New York City Electrical Code.*

1305.14.1.9 Protection from heat and flame.

Tanks shall be located at least 7 feet (2134 mm), measured in the most direct manner, from any source of exposed flame unless protected as provided in Section 1305.11.1.2, exception 3, and at least 2 feet (610 mm) from any surface where the temperature exceeds 165° F (74° C).

1305.14.2 Additional construction standards for cylindrical tanks exceeding 275 gallons (1041 L).

Cylindrical tanks, including oval, elongated oval, or round tanks, exceeding 275 gallons (1041 L) shall comply with the requirements of Section 1305.14.2.1 through 1305.14.2.3.

Exception: Such above-ground vertical tanks that are outside of buildings shall comply with Section 1305.14.1 and 1305.14.5.

1305.14.2.1 Thickness.

The minimum thickness shall be as follows:

1. Tanks 36 inches (914 mm) in diameter or less shall have at least a 1/4-inch (6.4 mm) shell and 1/4-inch (6.4 mm) heads.
2. Tanks 37 inches (940 mm) to 72 inches (1829 mm) in diameter shall have at least a 1/4-inch (6.4 mm) shell and 5/16-inch (7.9 mm) heads.
3. Tanks 73 inches (1854 mm) to 120 inches (3048 mm) in diameter shall have at least a 5/16-inch (7.9 mm) shell and 3/8-inch (9.5 mm) heads.
4. Tanks over 120 inches (3048 mm) in diameter shall be of at least 3/8-inch (9.5 mm) steel and shall be stiffened by angle rings or equivalent members so as to retain their cylindrical form.

1305.14.2.2 Dished heads.

Dished heads for such tanks shall have a curvature the radius of which is not greater than the diameter of the tank. Dished heads shall be formed with an adequate cylindrical extension rim to provide a welding surface.

1305.14.2.3 Flat heads.

If flat heads are used, they shall be braced in the same manner as described for the bracing of flat sides of rectangular tanks as provided for in Section 1305.14.3.

1305.14.3 Additional construction standards for rectangular tanks exceeding 275 gallons (1041 L).

Rectangular tanks exceeding 275 gallons (1241 L) capacity shall comply with the requirements of Section 1305.14.3.1 through 1305.14.3.6.

1305.14.3.1 Thickness.

Plates for rectangular tanks of more than 275 gallon (1040 L) capacity shall be at least 5/16 inches (7.9 mm) thick.

1305.14.3.2 Corners.

Corners may be made up by bending the plates or by using angles.

1305.14.3.3 Seams.

All tanks shall have full penetration 5/16 welds at all seams.

1305.14.3.4 Bracing.

All flat surfaces of rectangular tanks shall be braced by structural members or rods.

1305.14.3.5 Structural work.

All structural members shall be designed in accordance with the requirements of the *New York City Building Code.*

1305.14.3.6 Connections.

Connections between bracing members and the sides of the tank shall be designed so that the connection will not fail before the member will fail.

1305.14.4 Additional construction standards for tanks 275 gallons (1041 L) or less.

Storage tanks with a capacity of less than or equal to 275 gallons (1041 L) shall have a minimum thickness of shell and head plates of No. 10 manufacturer's standard Gage steel plate. Storage tanks of 60 gallon (227 L) capacity or less shall be similarly constructed but need not be thicker than No.14 manufacturer's standard Gage.

Exceptions:

1. Such vertical above-ground cylindrical tanks outside of buildings shall comply with Sections 1305.14.1 and 1305.14.5.
2. Such underground tanks need comply only with Sections 1305.14.1.
3. Storage containers of 6 gallons (23 L) or less used with burners or oil burning heaters need only be designed so as to withstand a hydrostatic pressure test of at least 5 psi (34 kPa) without permanent deformation, rupture, or leakage, and shall be approved. Such containers shall be installed with rigid metal fasteners for wall, floor, or stand-type installations, and shall be protected against mechanical damage. Portable storage containers of 6 gallons (23 L) or less may be filled by a pump mounted on a storage tank, provided that the pump is approved.

1305.14.5 Additional construction standards for vertical above-ground cylindrical tanks outside of buildings exceeding 6 gallons (23 L).

Vertical above-ground cylindrical storage tanks exceeding 6 gallons (23 L) that are located outside of buildings shall comply with the requirements of Sections 1305.14.5.1 through 1305.14.5.3.

1305.14.5.1 Plates.

Such tanks shall be built of steel plates of the quality required for cylindrical tanks in accordance with Section 1305.14.2.

1305.14.5.2 Thickness.

The minimum thickness of shell or bottom plates shall be 1/4 inches (6.4 mm), and the minimum thickness of roof plates 1/8 inches (3.2 mm). The thickness of shell plates shall be determined in accordance with the following formula:

$$t = \frac{P \times R \times F}{T \times E}$$ **(Equation 13-2)**

where:

t	=	Thickness of shell plate in inches.
P	=	Head pressure at bottom of ring under consideration in psi.
R	=	Radius of shell, in inches.
F	=	Factor of safety (taken as 5).
T	=	Tensile strength of plate, in psi as verified by mill test certificate.
E	=	Efficiency of vertical joint in ring under consideration.E shall in no case be taken greater than 1.00.

1305.14.5.3 Seams.

Roof plates shall have welded water-tight seams, and the roof shall be built to shed water. Bottom plates shall have welded seams. Shell plate seams shall be designed to develop the full strength of the plate.

Section MC 1306: Oil Gauging

1306.1 Level indication.

All tanks located inside buildings shall be equipped with a method of determining the oil level.

1306.2 Test wells.

Test wells shall not be installed inside buildings. Unused tank openings shall be permanently sealed. For outside service, test wells shall be equipped with a tight metal cover designed to discourage tampering.

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.

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.

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.

1306.6 Storage above lowest floors.

Fuel-oil stored above the lowest floor shall also comply with the indicator requirements of Section 1305.13.3, Item 7.

Section MC 1307: Fuel-oil Valves

1307.1 Building shutoff.

For outside or below ground tanks, a shutoff valve shall be installed on the fuel-oil supply line at the entrance to the building. Inside or above-ground tanks shall 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 where the valve is installed at a tank inside the building.

1307.2 Appliance shutoff.

A shutoff valve shall be installed at the supply connection to each appliance and a check valve installed at the return connection.

1307.3 Pump relief valve.

A relief valve shall be installed on the pump discharge line where a valve is located downstream of the pump.

1307.4 Fuel-oil heater relief valve.

A relief valve shall be installed on the discharge line of fuel-oil-heating appliances.

1307.5 Relief valve operation.

Relief valves shall be set to discharge at not more than 1 1/2 times the maximum working pressure of the system. The discharge from relief valves shall be returned to the storage tank or to the supply line. Shut-off valves are not permitted in the line of relief.

Section MC 1308: Testing

1308.1 Testing required.

Fuel-oil storage tanks, other than tanks complying with the alternate tank design and construction standards contained in Section 1305.14, shall be tested in accordance with NFPA 31.

1308.2 Hydrostatic test.

All liquid-fuel piping, and all tanks complying with the alternate tank design and construction standards contained in Section 1305.14, shall be hydrostatically tested for tightness by the contractor who made the installation before the work is closed in and before the system is operated. The piping shall be tested at 1 1/2 times the maximum working pressure applicable to that part of the piping system but at a pressure not less than the test pressure required for the storage tank. The minimum pressure for testing tanks shall be 1 1/2 times the maximum working pressure applicable to the tank but in no case less than 25 psig (172 kPag), except as provided for containers 6 gallons (23 L) or less in capacity as provided for in Section 1305.14.4 Exception 3. The hydrostatic pressure shall be maintained until all joints and connections have been visually inspected for leaks, but in no case for less than 1/2 hour. The tank shall not show any permanent deformation as a result of the test. A record shall be kept of the pressure tests showing the name of the contractor and the pressures at which the piping and the tank were tested.

1308.3. Weekly testing.

For fuel-oil tanks and fuel-oil-burning equipment located above ground, above the lowest floor inside of buildings, the operation of the float switch shall be tested at least once each week by the holder of the certificate of fitness as provided for in Section 1301.9 and Section 1305.13.3, item 8.

Chapter 14: Solar Systems

Section MC 1401: General

1401.1 Scope.

This chapter shall govern the design, 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.

1401.2 Potable water supply.

Potable water supplies to solar systems shall be protected against contamination in accordance with the *New York City Plumbing Code.*

Exception: Where all solar system piping is a part of the potable water distribution system, in accordance with the requirements of the *New York City Plumbing Code,* and all components of the piping system are listed for potable water use, cross connection protection measures shall not be required.

1401.3 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.

1401.4 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.

1401.5 Ducts.

Ducts utilized in solar heating and cooling systems shall be constructed and installed in accordance with Chapter 6 of this code.

Section MC 1402: Installation

1402.1 Access.

Access shall be provided to solar energy equipment and appliances for maintenance. Solar systems and appurtenances shall be installed in accordance with the requirements of Chapter 5 of the *New York City Fire Code* regarding rooftop access and obstructions, and shall not obstruct or interfere with fire-fighting operations or the operation of any doors, windows, fire escapes, or other means of egress or other building components requiring operation or access.

1402.2 Protection of equipment.

Solar equipment exposed to vehicular traffic shall be installed not less than 6 feet (1829 mm) above the finished floor.

Exception: This section shall not apply where the equipment is protected from motor vehicle impact.

1402.3 Controlling condensation.

Where attics or structural spaces are part of a passive solar system, ventilation of such spaces, as required by Section 406, is not required where other approved means of controlling condensation are provided.

1402.4 Roof-mounted collectors.

Roof-mounted solar collectors that also serve as a roof covering shall conform to the requirements for roof coverings in accordance with the *New York City Building Code.*

Exception: The use of plastic solar collector covers shall be limited to those approved plastics meeting the requirements for plastic roof panels in the *New York City Building Code.*

1402.4.1 Collectors mounted above the roof.

When mounted on or above the roof covering, the collector array and supporting construction shall be constructed of noncombustible materials or fire-retardant-treated wood conforming to the *New York City Building Code* to the extent required for the type of roof construction of the building to which the collectors are accessory.

Exception: The use of plastic solar collector covers shall be limited to those approved plastics meeting the requirements for plastic roof panels in the *New York City Building Code.*

1402.5 Equipment.

The solar energy system shall be equipped in accordance with the requirements of Sections 1402.5.1 through 1402.5.4.

1402.5.1 Pressure and temperature.

Solar energy system components containing pressurized fluids shall be protected against pressures and temperatures exceeding 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 located so that a section cannot be valved off or otherwise isolated from a relief device. Relief valves shall comply with the requirements of Section 1006.4 and discharge in accordance with Section 1006.6.

1402.5.2 Vacuum.

The solar energy system components that are subjected to a vacuum while in operation or during shutdown shall be designed to withstand such vacuum or shall be protected with vacuum relief valves.

1402.5.3 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.

1402.5.4 Expansion tanks.

Liquid single-phase solar energy systems shall be equipped with expansion tanks sized in accordance with Section 1009.

1402.6 Penetrations.

Roof and wall penetrations shall be flashed and sealed to prevent entry of water, rodents and insects.

1402.7 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.

Section MC 1403: Heat Transfer Fluids

1403.1 Flash point.

The flash point of the actual heat transfer fluid utilized in a solar system shall be not less than 50°F (28°C) above the design maximum nonoperating (no-flow) temperature of the fluid attained in the collector.

1403.2 Flammable gases and liquids.

A flammable liquid or gas shall not be utilized as a heat transfer fluid.

Section MC 1404: Materials

1404.1 Collectors.

Factory-built collectors shall be listed and labeled, and bear a label showing the manufacturer's name and address, model number, collector dry weight, collector maximum allowable operating and nonoperating temperatures and pressures, minimum allowable temperatures and the types of heat transfer fluids that are compatible with the collector. The label shall clarify that these specifications apply only to the collector.

1404.2 Thermal storage units.

Pressurized thermal storage units shall be listed and labeled, and bear a label showing the manufacturer's name and address, model number, serial number, storage unit maximum and minimum allowable operating temperatures, storage unit maximum and minimum allowable operating pressures and the types of heat transfer fluids compatible with the storage unit. The label shall clarify that these specifications apply only to the thermal storage unit.

Chapter 15: Referenced Standards

Section MC 1501: General

1501.1 General.

This chapter lists the standards that are referenced in various sections of this document. The standards are listed herein by the promulgating agency of the standard, the standard identification, the effective date and title and the section or sections of this document that reference the standard.

1501.2 Subsequent additions, modifications, or deletions.

Refer to the rules of the department for any subsequent additions, modifications or deletions that may have been made to these standards in accordance with Section 28-103.19 of the *Administrative Code.*

1501.3 Applicability.

The application of the referenced standards shall be as specified in Section 102.8.

Section MC 1502: Standards

ACCA	Air Conditioning Contractors of America 1712 New Hampshire Ave, NW Washington, DC 20009	
Standard Reference Number	**Title**	**Referenced in code section number**
Manual D—95	Residential Duct Systems	603.2

AMAC	Air Movement and Control Association International 30 West University Drive Arlington Heights, IL 60004	
Standard Reference Number	**Title**	**Referenced in code section number**
550-09	Test Method for High Velocity Wind Driven Rain Resistant Louvers	401.6.1, 501.2.2.1

ANSI	American National Standards Institute 11 West 42nd Street New York, NY 10036	
Standard Reference Number	**Title**	**Referenced in code section number**

ANSI	American National Standards Institute 11 West 42nd Street New York, NY 10036	
Standard Reference Number	**Title**	**Referenced in code section number**
ANSI/ASHRAE/ ASHE 170-2008	Ventilation of Health Care Facilities	401.4
ANSI/ASSE 1017-2003	Performance Requirements for Temperature Actuated Mixing Valves for Hot Water Distributions Systems	1002.2.2
Z21.8—1994 (R2002)	Installation of Domestic Gas Conversion Burners	919.1
Z21.50—2003	Vented Gas Fireplaces	901.6, 901.6.3
Z21.60—2003	Decorative Gas Appliances for Installation in Solid-Fuel Burning Fireplaces	901.6
Z21.83—1998	Fuel Cell Power Plants	924.1

ARI	Air-Conditioning and Refrigeration Institute Suite 425 4301 North Fairfax Drive Arlington, VA 22203	
Standard Reference Number	**Title**	**Referenced in code section number**
700—99	Purity Specifications for Fluorocarbon and Other Refrigerants	1102.2.2.3

ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. 1791 Tullie Circle, NE Atlanta, GA 30329-2305	
Standard Reference Number	**Title**	**Referenced in code section number**

ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. 1791 Tullie Circle, NE Atlanta, GA 30329-2305	
Standard Reference Number	**Title**	**Referenced in code section number**
ASHRAE—2005	ASHRAE Fundamentals Handbook—2005	312.1, 603.2
15—2010	Safety Standard for Refrigeration Systems	1101.6, 1101.11, 1104.2, 1105.3, 1105.8, 1105.11, 1108.1
34—2010	Designation and Safety Classification of Refrigerants	202, 1102.2.1, 1103.1, Table 1103.1, 1104.1
ASHRAE—2000	HVAC Systems and Equipment Handbook—2000	312.1
52.2—2012	Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size	605.2.1
62.1—2007	Ventilation for Acceptable Indoor Air Quality	403.3.2.3.2, 605.2.1
62.2—2010	Ventilation and Acceptable Indoor Air Quality in Low- Rise Residential Buildings	605.2.1

ASME	American Society of Mechanical Engineers Three Park Avenue New York, NY 10016-5990	
Standard Reference Number	**Title**	**Referenced in code section number**
ASME	American Society of Mechanical Engineers Three Park Avenue New York, NY 10016-5990	
Standard Reference Number	**Title**	**Referenced in code section number**
B1.20.1—1983 (R2006)	Pipe Threads, General Purpose (Inch)	1203.3.5, 1303.3.3
B16.3—2006	Malleable Iron Threaded Fittings, Classes 150 & 300	Table 1202.5
B16.5—2003	Pipe Flanges and Flanged Fittings NPS 1/2 through NPS 24	Table 1202.5
B16.9—2003	Factory Made Wrought Steel Buttwelding Fittings	Table 1202.5
B16.11—2005	Forged Fittings, Socket-Welding and Threaded	Table 1202.5
B16.15—2006	Cast Bronze Threaded Fittings	Table 1202.5
B16.18—2001 (Reaffirmed 2005)	Cast Copper Alloy Solder Joint Pressure Fittings	513.13.1, Table 1202.5
B16.22—2001 (Reaffirmed 2005)	Wrought Copper and Copper Alloy Solder Joint Pressure Fittings —with B16.22a—1998 Addenda	513.13.1, Table 1202.5
B16.23—2002 (Reaffirmed 2006)	Cast Copper Alloy Solder Joint Drainage Fittings - DWV	Table 1202.5
B16.24—2001	Cast Copper Alloy Pipe Flanges and Flanged Fittings: Class 150, 300, 400, 600, 900, 1500 and 2500	Table 1202.5
B16.26—2006	Cast Copper Alloy Fittings for Flared Copper Tubes	Table 1202.5
B16.28—1994	Wrought Steel Buttwelding Short Radius Elbows and Returns	Table 1202.5
B16.29—2001	Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV	Table 1202.5
B16.39—1986 (R1998)	Malleable Iron Threaded Pipe Unions	1203.1.2
B31.1—2012	Power Piping Code	1201.3, 1210.2.1, 1210.2.2, 1210.2.3
B31.9—2004	Building Services Piping	1201.3
B40.100—2005	Pressure Gauges and Gauge Attachments	1011.2
BPVC—2010	Boiler & Pressure Vessel Code	1002.2, 1003.1, 1003.2, 1003.3, 1004.1, 1004.1.1, 1011.1, 1107.5.4, 1203.3.1, 1203.3.6, 1210.2.2, 1303.1, 1303.3.1, 1303.3.4, 1305.12.2, 1305.14
CSD-1—2004	Controls and Safety Devices for Automatically Fired Boilers	1004.1, 1004.1.1, 1007.2, 1011.1

ASNT	American Society for Nondestructive Testing PO Box 28518 1711 Arlington Lane Columbus, OH 43228-0518	
Standard Reference Number	**Title**	**Referenced in code section number**
SNT—TC—1A —1980	Recommended Practice	1210.2.2

ASTM	ASTM International 100 Barr Harbor Drive West Conshohocken, PA 19428	
Standard Reference Number	**Title**	**Referenced in code section number**
A 53/A 53M—06a	Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless	Table 1202.4, Table 1302.3, 1305.9.5
A 106/A106M—06 a	Specification for Seamless Carbon Steel Pipe for High-Temperature Service	Table 1202.4, Table 1302.3, 1305.9.5
A 126—04	Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fitting	Table 1202.5
A 254—97(2002)	Specification for Copper Brazed Steel Tubing	Table 1202.4, Table 1302.3
A 420/A 420M—07	Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Low-Temperature Service	Table 1202.5
A 539—99	Specification for Electric-Resistance-Welded Coiled Steel Tubing for Gas and Fuel Oil Lines	Table 1302.3
B 32—04	Specification for Solder Metal	1203.3.3, 1107.5.5
B 42—(02e01)	Specification for Seamless Copper Pipe, Standard Sizes	513.13.1, 1107.5.2, Table 1202.4, Table 1302.3
B 43—98(2004)	Specification for Seamless Red Brass Pipe, Standard Sizes	513.13.1, 1107.5.2, Table 1202.4, Table 1302.3
B 68—02	Specification for Seamless Copper Tube, Bright Annealed	513.13.1
B 75—02	Specification for Seamless Copper Tube	Table 1202.4, Table 1302.3
B 88—03	Specification for Seamless Copper Water Tube	513.13.1, 1107.5.3, Table 1202.4, Table 1302.3
B 135—02	Specification for Seamless Brass Tube	Table 1202.4
B 251—02e01	Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube	513.13.1, Table 1202.4
B 280—03	Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service	513.13.1, 1107.5.3, Table 1302.3
B 302—02	Specification for Threadless Copper Pipe, Standard Sizes	Table 1202.4, Table 1302.3
B 813—00e01	Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube	1203.3.3, 1107.5.5
C 315—07	Specification for Clay Flue Linings	801.16.1, Table 803.10.4
C 411—05	Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation	604.3
D 56—05	Test Method for Flash Point by Tag Closed Tester	202
D 93—07	Test Method for Flash Point of Pensky-Martens Closed Cup Tester	202
D 1527—99(2005)	Specification for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe, Schedules 40 and 80	Table 1202.4
D 1693—07	Test Method for Environmental Stress-Cracking of Ethylene Plastics	Table 1202.4
D 1785—06	Specification for Poly (Vinyl Chloride)(PVC) Plastic Pipe, Schedules 40, 80 and 120	Table 1202.4
D 2235—04	Specifications for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings	1203.3.4
D 2241—05	Specification for Poly (Vinyl Chloride)(PVC) Pressure-Rated Pipe (SDR-Series)	Table 1202.4
D 2282—99(2005)	Specification for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe (SDR-PR)	Table 1202.4
D 2412—02	Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading	603.8.3
D 2447—03	Specification for Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter	Table 1202.4
D 2466—06	Specification for Poly (Vinyl Chloride)(PVC) Plastic Pipe Fittings, Schedule 40	Table 1202.5
D 2467—06	Specification for Poly (Vinyl Chloride)(PVC) Plastic Pipe Fittings, Schedule 80	Table 1202.5
D 2468—96a	Specification for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe Fittings, Schedule 40	Table 1202.5
D 2513—07a	Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings	Table 1202.4
D 2564—04e01	Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems	1203.3.4

D 2657-07	Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings	1203.15.1
D 2683—04	Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing	Table 1202.4, 1203.15.1
D 2837—04e01	Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials	Table 1202.4
D 2846/D 2846M—06	Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Hot and Cold Water Distribution Systems	Table 1202.4
D 2996—07(2007)e 01	Specification for Filament-Wound Fiberglass (Glass Fiber Reinforced Thermosetting Resin) Pipe	Table 1302.3
D 3035—06	Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter	Table 1202.4
D 3261-03	Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing	1203.15.1
D 3278—96(2004)e 01	Test Methods for Flash Point of Liquids by Small Scale Closed-Cup Apparatus	202
D 3350—06	Specification for Polyethylene Plastics Pipe and Fittings Materials	Table 1202.4
E 84—07	Test Method for Surface Burning Characteristics of Building Materials	202, 510.8, 602.2.1, 602.2.1.5, 604.3, 1204.1
E 119—07	Test Method for Fire Tests of Building Construction and Materials	607.5.2, 607.5.5, 607.6.1, 607.6.2, 607.6.2.1
E 136—04	Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C	202
E 814—06	Test Method for Fire Tests of Through-Penetration Fire Stops	506.3.10.1, 506.3.10.2, 506.3.10.3
E 1509-04	Specification for Room Heaters, Pellet Fuel-burning Type	904.1
E 2231-04	Standard Practice For Specimen Preparation and Mounting of Pipe and Duct Insulation Materials to Assess Surface Burning Characteristics	604.3, 1204.1
E 2236-04	Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems	506.3.10.2
F 438—04	Specification for Socket Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40	Table 1202.5
F 439—06	Specification for Socket Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80	Table 1202.5
F 441/F 441M—02	Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80	Table 1202.4
F 442/F 442M—(2005)	Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR)	Table 1202.4
F 492-95	Specification for Propylene and Polypropylene (PP) Plastic-Lined Ferrous Metal Pipe and Fittings	1203.1.2
F 493—04	Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings	1203.3.4
F 876—06	Specification for Crosslinked Polyethylene (PEX) Tubing	Table 1202.4
F 877—07	Specification for Crosslinked Polyethylene (PEX) Plastic Hot and Cold-Water Distribution Systems	Table 1202.4, Table 1202.5
F 1055—98(2006)	Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing	Table 1202.4, 1203.15.2
F 1281—07	Specification for Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene (PEX-AL-PEX) Pressure Pipe	Table 1202.4
F 1282-06	Specification for Polyethylene/Aluminum/Polyethylene (PE-AL-PE) Composite Pressure Pipe	Table 1202.4
F 1476-07	Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications	1203.3.7
F 1924-05	Standard Specification for Plastic Mechanical Fittings for Use on Outside Diameter Controlled Polyethylene Gas Distribution Pipe and Tubing	1203.15.3
F 1974—04	Standard Specification for Metal Insert Fittings for Polyethylene/Aluminum/Polyethylene and Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene Composite Pressure Pipe	Table 1202.5
F 2389-06	Specification for Pressure-Rated Polypropylene Piping Systems	Table 1202.4, 1203.16.1
F 2623-07	Standard Specification for Polyethylene of Raised Temperature (PE-RT) SDR 9 Tubing 1	Table 1202.4

AWWA	American Water Work Association 6666 West Quincy Avenue Denver, CO 80235	
Standard Reference Number	**Title**	**Referenced in code section number**
C110/A21.10-03	Standard for Ductile Iron & Gray Iron Fittings, 2 inches through 48 inches for Water	Table 1202.5
C115/A21.15-99	Standard for Flanged Ductile-iron Pipe with Ductile Iron or Grey-iron Threaded Flanges	Table 1202.4
C151/A21.51-02	Standard for Ductile-Iron Pipe, Centrifugally Cast for Water	Table 1202.4
C153/A21.53-00	Standard for Ductile-Iron Compact Fittings for Water Service	Table 1202.5

AWS	American Welding Society 550 N.W. LeJeune Road P.O. Box 351040 Miami, FL 33135	
Standard Reference Number	**Title**	**Referenced in code section number**
B2.1-2009	Specification for Brazing Procedure and Performance Qualification	1203.3.6
B2.2-2010	Specification for Brazing Procedure and Performance Qualification	1203.3.1, 1303.1, 1303.3.1, 1107.5.4

CAN/ULC	Standards Council of Canada 270 Albert Street, Suite 200 Ottawa ON KIP 6N7 Canada	
Standard Reference Number	**Title**	**Referenced in code section number**
S635-00	Standard for Lining Systems for Existing Masonry or Factory-Built Chimneys and Vents	801.16.1, 801.18.4
S640-91	Standard for Lining Systems for New Masonry Chimneys	801.16.1

CSA	Canadian Standards Association 178 Rexdale Blvd. Rexdale (Toronto), Ontario, Canada M9W 1R3	
Standard Reference Number	**Title**	**Referenced in code section number**
CAN/CSA B137.10-02	Crosslinked Polyethylene/Aluminum/Polyethylene Composite Pressure Pipe Systems	Table 1202.4
B137.9-M91 CAN/CSA	Polyethylene/Aluminum/Polyethylene (PE-AL-PE) Composite Pressure-Pipe Systems	Table 1202.4

DOL	Department of Labor Occupational Safety and Health Administration c/o Superintendent of Documents U.S. Government Printing Office Washington, DC 20402-9325	
Standard Reference Number	**Title**	**Referenced in code section number**
29 CFR Part 1910.1000 (1974)	Air Contaminants	502.6

IIAR	International Institute of Ammonia Refrigeration Suite 700 1101 Connecticut Ave., NW Washington, DC 20036	
Standard Reference Number	**Title**	**Referenced in code section number**
2—99 (with Addendum A-2005)	Addendum A to Equipment, Design, and Installation of Ammonia Mechanical Refrigerating Systems	1101.6

MSS	Manufacturers Standardization Society of the Valve & Fittings Industry, Inc. 127 Park Street, N.E. Vienna, VA 22180	
Standard Reference Number	**Title**	**Referenced in code section number**
SP-69—2002	Pipe Hangers and Supports—Selection and Application	305.4

NAIMA	North American Insulation Manufacturers Association Suite 310 44 Canal Center Plaza Alexandria, VA 22314	
Standard Reference Number	**Title**	**Referenced in code section number**
AH116—02	Fibrous Glass Duct Construction Standard	603.5, 603.9

NFPA	National Fire Protection Association Batterymarch Park Quincy, MA 02269	
Standard Reference Number	**Title**	**Referenced in code section number**
10—07	Portable Fire Extinguishers	1301.8
30—00	Flammable and Combustible Liquids Code	605.4, 1305.8.3, 1305.8.4, 1308.1
30A—03	Code for Motor Fuel Dispensing Facilities and Repair Garages	304.6
31—11	Installation of Oil-Burning Equipment	801.2.4, 801.18.1, 801.18.2, 901.2, 918.1, 920.2, 1301.2, 1308.1
32—11	Standard for Drycleaning Plants	502.6
37—10	Stationary Combustion Engines and Gas Turbines	811.1, 811.2, 915.1, 915.2
45—04	Fire Protection for Laboratories Using Chemicals	407.1, 502.20
54—06	National Fuel Gas Code	901.2, 910.7, 918.2
69—08	Explosion Prevention Systems	510.8.3
70—02	National Electrical Code	511.1.1
72—07	National Fire Alarm Code	513.12
82—04	Incinerators and Waste and Linen Handling Systems and Equipment	601.1, 907.1
85—2011	Boiler and Combustion Systems Hazards Code	1004.1, 1004.1.1
92B—05	Smoke Management Systems in Malls, Atria and Large Spaces	513.8
96—84	Installation of Equipment for the Removal of Smoke and Grease-laden Vapors from Commercial Cooking Equipment	506.3.7.1
211—10	Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances	802.1, Table 803.10.6, 806.1, 811.1, 901.2
262—07	Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces	602.2.1.1
704—07	Identification of the Hazards of Materials for Emergency Response	502.8.4, 510.1, 1105.11
853—07	Installation of Stationary Fuel Power Plants	924.1

SMACNA	Sheet Metal & Air Conditioning Contractors National Assoc., Inc. 4021 Fafayette Center Road Chantilly, VA 22021	
Standard Reference Number	**Title**	**Referenced in code section number**
SMACNA/ANSI —2005	HVAC Duct Construction Standards—Metal and Flexible (2005)	504.8, 603.4, 603.9
SMACNA—03	Fibrous Glass Duct Construction Standards	603.5

UL	Underwriters Laboratories, Inc. 333 Pfingsten Road Northbrook, IL 60062-2096	
Standard Reference Number	**Title**	**Referenced in code section number**
17—94	Vent or Chimney Connector Dampers for Oil-Fired Appliances—with Revisions through September 1998	803.6
58—96	Steel Underground Tanks for Flammable and Combustible Liquids	1305.12.1, 1305.14
80—04	Steel Tanks for Oil-Burner Fuel	Table 1305.7(2), 1305.12.2, 1305.14
103—01	Factory-Built Chimneys, Residential Type and Building Heating Appliance—with Revisions through March 1999	805.2
127—96	Factory-Built Fireplaces—with Revisions through November 1999	805.3, 903.1
142—02	Aboveground Tanks for Flammable and Combustable Liquids	Table 1305.7(2), 1305.81, 1305.12.2, 305.14
174—04	Household Electric Storage Tank Water Heaters—with revisions through May 2006	1002.1
181—05	Factory-made Air Ducts and Air Connectors—with Revisions through December 1998	512.2, 603.5, 603.6.1.1, 603.6.2, 603.11.1, 604.13
181A—05	Closure Systems for Use with Rigid Air Ducts and Air Connectors—with Revisions through December 1998	603.9
181B—05	Closure Systems for Use with Flexible Air Ducts and Air Connectors—with Revisions through December 1998	603.9
197—93	Commercial Electric Cooking Appliances—with Revisions Through January 2000	917.1
207—01	Refrigerant-Containing Components and Accessories, Nonelectrical—with Revisions Through November 2004	1101.2
263—03	Standard for Fire Test of Building Construction and Materials	607.5.2, 607.5.5, 607.6.1, 607.6.2
268—06	Smoke Detectors for Fire Prevention Signaling Systems—with Revisions through October 2003	606.1
268A—98	Smoke Detectors for Duct Applications—with Revisions through April 2006	606.1
343—97	Pumps for Oil-Burning Appliances—with revisions through December 22, 1999	1302.7
391—2006	Solid-Fuel and Combination-Fuel Central and Supplementary Furnaces	918.1
412—04	Refrigeration Unit Coolers—with Revisions through February 2007	1101.2
471—06	Commercial Refrigerators and Freezers—with Revisions through March 2006	1101.2
536—97	Flexible metallic Hose—with revisions through October 2000	1302.8
555—06	Fire Dampers—with Revisions through January 2002	607.3, 607.3.1
555C—06	Ceiling Dampers	607.3.1, 607.6.2
555S—99	Smoke Dampers—with Revisions through July 2006	607.2.1.1, 607.3, 607.3.1, 607.3.1.1
586—96	High-Efficiency, Particulate, Air Filter Units—with Revisions through August 2004	605.2
641—95	Type L Low-Temperature Venting Systems—with Revisions through April 1999	802.1
710—95	Exhaust Hoods for Commercial Cooking Equipment—with Revisions through February 2007	507.1
710B—04	Recirculating Systems	507.1
723—03	Standard for Test for Surface Burning Characteristics of Building Materials—with Revisions through May 2005	202, 510.8, 602.2.1, 602.2.1.5, 604.3, 1204.1
726—95	Oil-Fired Boiler Assemblies—with Revisions through March 2006	916.1, 1004.1, 1004.1.1
727—06	Oil-Fired Centeral Furnaces	918.1
729—03	Oil-Fired Floor Furnaces—with Revisions through January 1999	910.1
730—03	Oil-Fired Wall Furnaces—with Revisions through January 1999	909.1
731—95	Oil-Fired Unit Heaters—with Revisions through February 2006	920.1
732—95	Oil-Fired Storage Tank Water Heaters—with Revisions through February 2005	1002.1
737—96	Fireplace Stoves—with Revisions through January 2000	905.1
762—03	Outline of Investigation for Power Ventilators for Restaurant Exhaust Appliances	506.5.1
791—06	Residential Incinerators	907.1
795—05	Commercial-Industrial Gas Heating Equipment	1004.1.1
834—04	Heating, Water Supply and Power Boilers Electric—with Revisions Through March 2006	1004.1
858—05	Household Electric Ranges—with Revisions through January 1999	917.1
864—03	Control Units and Accessories for Fire Alarm Systems	513.12
867—00	Electrostatic Air Cleaners	605.2
875—04	Electric Dry Bath Heater—with Revisions through March 2006	914.2
896—93	Oil-Burning Stoves—with Revisions through November 1999	917.1
900—04	Air Filter Units	605.2
923—02	Microwave Cooking Appliances—with Revisions through February 2006	917.1
959—01	Medium Heat Appliance Factory-Built Chimneys	805.5
1046—00	Grease Filters for Exhaust Ducts	507.11
1240—05	Electric Commercial Clothes Drying Equipment	913.1

1261—01	Electric Water Heaters for Pools and Tubs—with revisions through November 25, 1998	916.1
1316—94	Glass-Fiber Reinforced Plastic Underground Storage Tanks for Petroleum Products, Alcohols, and Alcohol-Gasoline Mixtures	1305.12.1, 1305.14
1453—06	Electronic Booster and Commercial Storage Tank Water Heaters—with Revisions through May 2006	1002.1
1479—06	Fire Tests of Through-Penetration Firestops	506.3.10.3
1482—96	Solid-Fuel Type Room Heaters—with Revisions through November 2006	905.1
1777—04	Chimney Liners—with Revisions through July 1998	801.16.1, 801.18.4
1812—05	Standard for Ducted Heat Recovery Ventilators—with Revisions through January 2006	927.1
1815—01	Standard for Nonducted Heat Recovery Ventilators—with Revisions through January 2006	927.2
1820—04	Fire Test of Pneumatic Tubing for Flame and Smoke Characteristics	602.2.1.3
1887—04	Fire Tests of Plastic Sprinkler Pipe for Visible Flame and Smoke Characteristics	602.2.1.2
1978—95	Grease Ducts	506.3.1.1, 506.3.2, 506.3.6
1995—05	Heating and Cooling Equipment	911.1, 918.1, 918.3, 1101.2
2043—96	Fire Test for Heat and Visible Smoke Release for Discrete Products and their Accessories Installed in Air-Handling Spaces—with Revisions through February 1998	602.2.1.4
2106—09	Standard for Field Erected Boiler Assemblies	1004.1.1
2158—97	Outline of Investigation Electric Clothes Dryer—with Revisions through May 2004	913.1
2185A—06	Clothes Dryer Transition Duct	504.6.3
2162—01	Outline of Investigation for Commercial Wood-Fired Baking Ovens—Refractory Type	917.1
2200—04	Stationary Engine Generator Assemblies	915.1, 1302.6

APPENDIX A COMBUSTION AIR OPENINGS AND CHIMNEY CONNECTOR PASS-THROUGHS

Figures A-1 through A-4 are illustrations of appliances located in confined spaces.

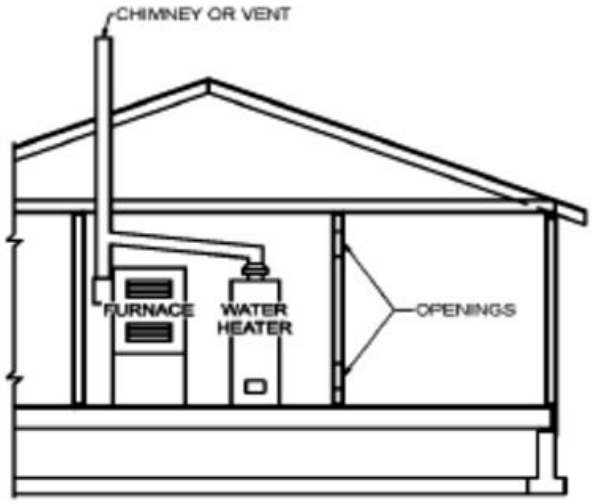

FIGURE A-1
ALL AIR FROM INSIDE THE BUILDING

NOTE: Each opening shall have a free area of not less than 1 square inch per 1,000 Btu per hour of the total input rating of all appliances in the enclosure and not less than 100 square inches.

For SI: 1 square inch = 645 mm^2 , 1 British thermal unit per hour = 0.2931 W.

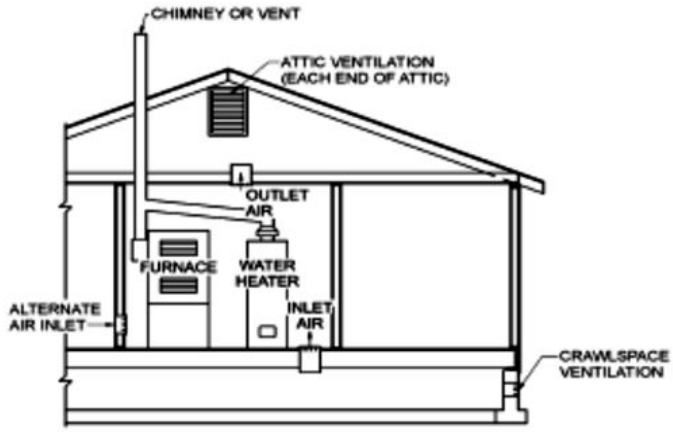

FIGURE A-2
ALL AIR FROM OUTDOORS—INLET AIR FROM VENTILATED CRAWL SPACE AND OUTLET AIR TO VENTILATED ATTIC

NOTE: The inlet and outlet air openings shall each have a free area of not less than 1 square inch per 4,000 Btu per hour of the total input rating of all appliances in the enclosure. For SI: 1 square inch = 645 mm^2 , 1 British thermal unit per hour = 0.2931 W.

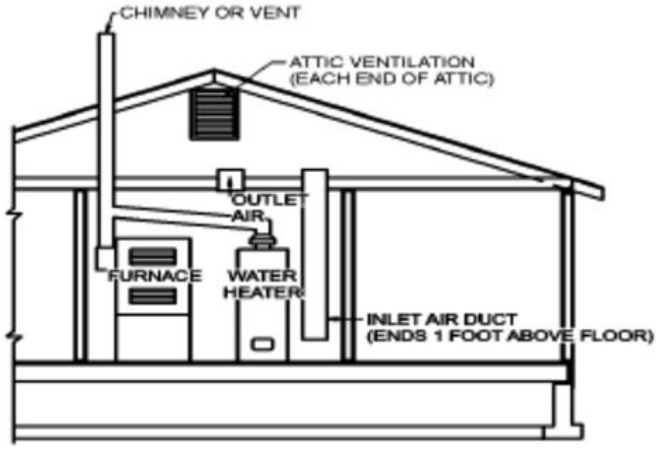

FIGURE A-3
ALL AIR FROM OUTDOORS THROUGH VENTILATED ATTIC

NOTE: The inlet and outlet air openings shall each have a free area of not less than 1 square inch per 4,000 Btu per hour of the total input rating of all appliances in the enclosure. For SI: 1 foot = 304.8 mm, 1 square inch = 645 mm^2 , 1 British thermal unit per hour = 0.2931 W.

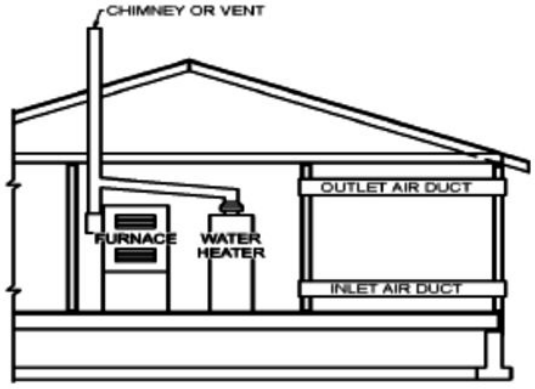

FIGURE A-4
ALL AIR FROM OUTDOORS THROUGH HORIZONTAL DUCTS OR DIRECT OPENINGS

NOTE: Each air duct opening shall have a free area of not less than 1 square inch per 2,000 Btu per hour of the total input rating of all appliances in the enclosure. If the appliance room is located against an outside wall and the air openings communicate directly with the outdoors, each opening shall have a free area of not less than 1 square inch per 4,000 Btu per hour or the total input rating of all appliances in the enclosure. For SI: 1 foot = 304.8 mm, 1 square inch = 645 mm^2 , 1 British thermal unit per hour = 0.2931 W.

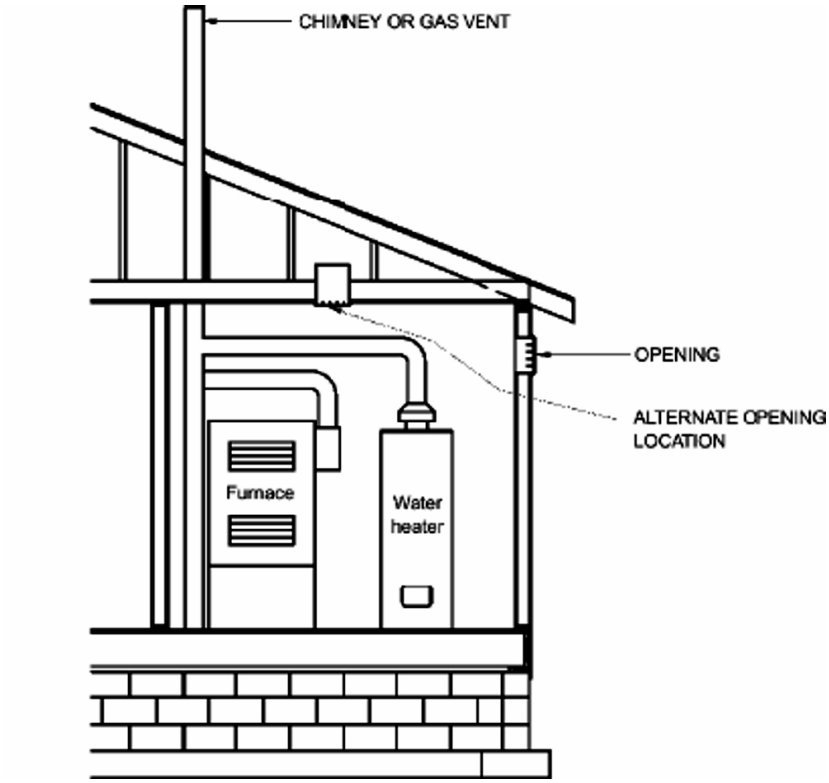

FIGURE A-4.1 ALL AIR FROM OUTDOORS THROUGH A SINGLE DUCT OR DIRECT OPENING

For SI: 1 foot = 304.8 mm, 1 square inch = 645 mm ^{2} , 1 British thermal unit per hour = 0.2931 W.

NOTE: The air duct or direct opening shall have a free area of not less than 1 square inch per 3,000 Btu/h (734 mm ^{2} /kW) of the total input rating of all appliances in the enclosure.

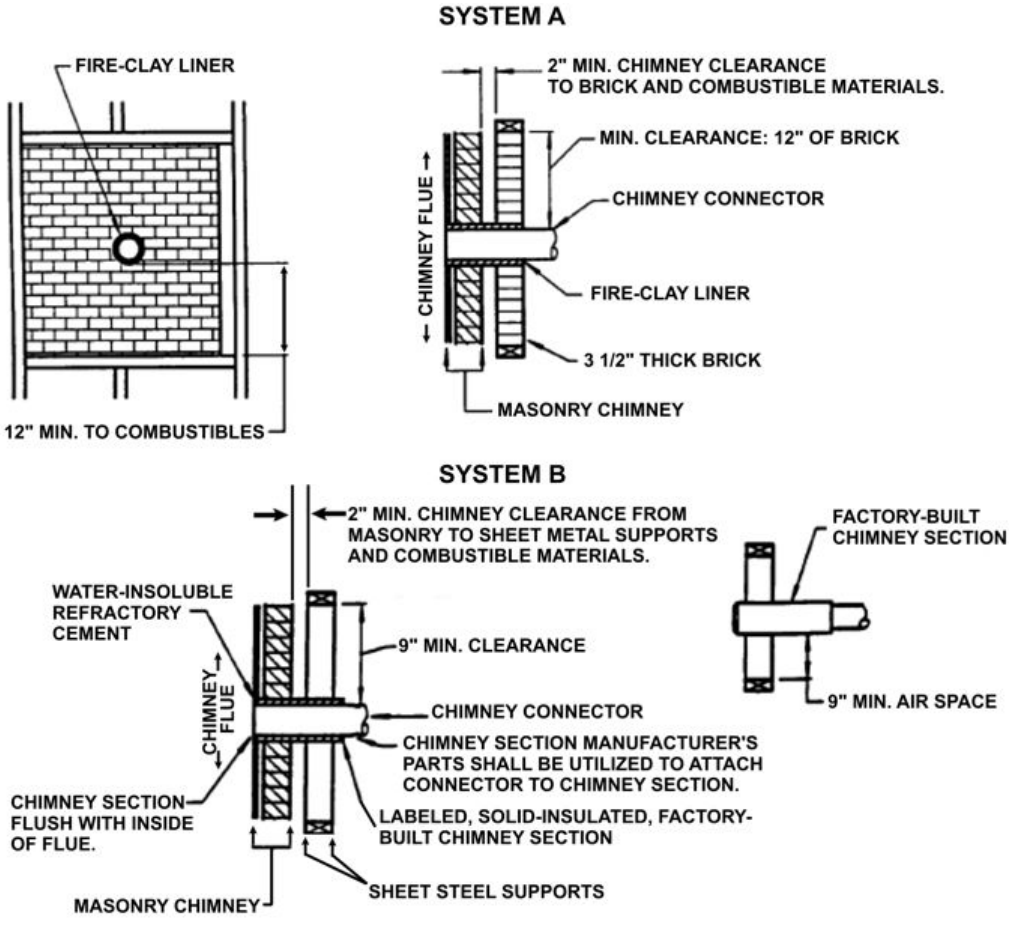

FIGURE A-5
CHIMNEY CONNECTOR SYSTEMS

For SI:1 inch = 25.4 mm.

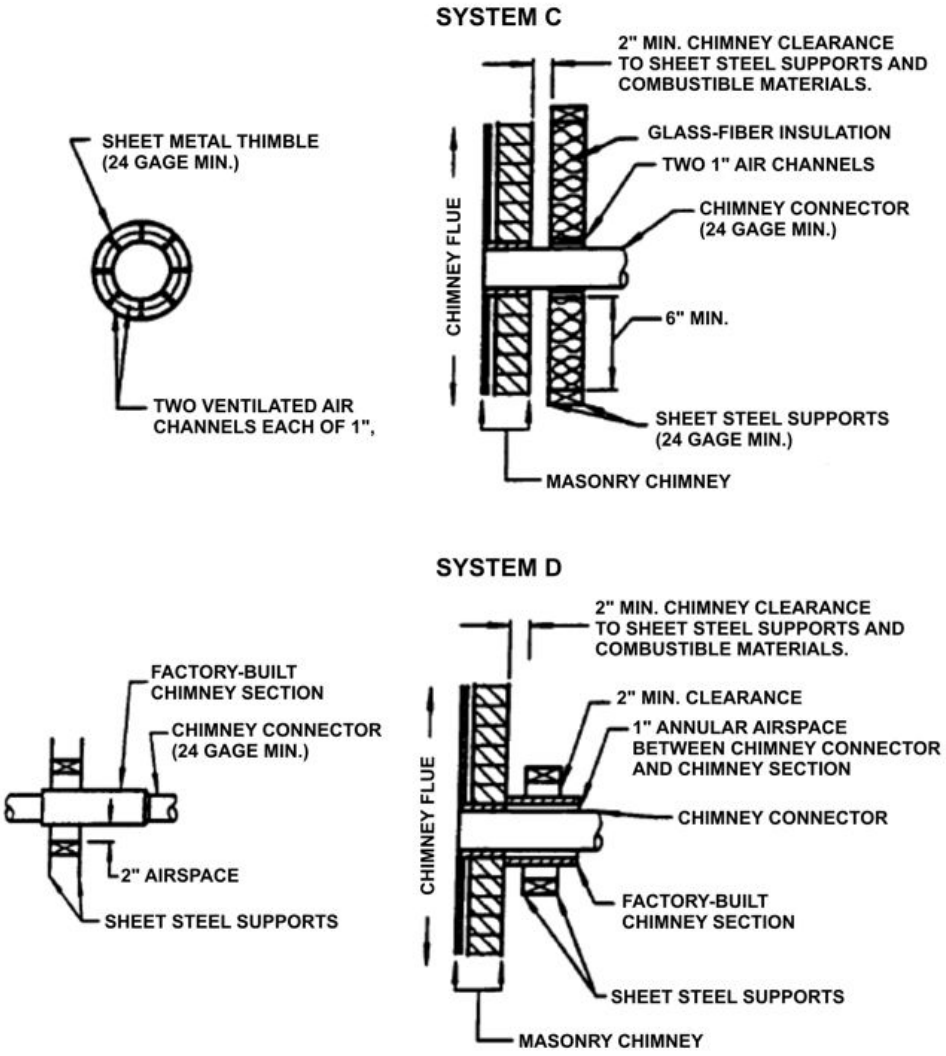

FIGURE A-5—continued
CHIMNEY CONNECTOR SYSTEMS

For SI:1 inch = 25.4 mm.

Appendix B: [RESERVED]