Chapter 3:
General Regulations

General Comments

A fundamental principle of the code is its dependence on the listing and labeling method of approval for appliances and equipment. Section 301.4 prohibits the installation of unlisted appliances except where approved in accordance with Section 105.

Purpose

Chapter 3 contains requirements for the safe and proper installation of mechanical equipment and appliances to ensure protection of life and property.

SECTION 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.

❖ This section states that this chapter governs the approval and installation of all mechanical equipment and appliances that are regulated by the code. Section 101.2 establishes the scope of application of the code (see commentary, 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 *International Energy Conservation Code*.

❖ Appliances and equipment that use energy sources must be designed and installed to use energy efficiently. This is especially important where the energy is not a renewable source. Saving energy is a commendable goal regardless of the affordability or abundance of energy. Energy use, especially of nonrenewable energy, impacts the environment. The *International Energy Conservation Code*® (IECC®) is the applicable document for regulating the efficiency and performance of the appliances and heating, ventilating and air-conditioning (HVAC) systems. Special applications such as process heating or cooling should be designed for the maximum energy efficiency attainable.

301.3 Identification. Each length of pipe and tubing and each pipe fitting utilized in a mechanical system shall bear the identification of the manufacturer.

❖ The manufacturer is given the option of determining the type of marking for the material. If there is no applicable standard or the applicable standard does not require that a material be identified, identification of the manufacturer is still required by the code. Where the code indicates compliance with an approved standard, the manufacturer must comply with the requirements for marking in accordance with the applicable standard.

301.4 Plastic pipe, fittings and components. Plastic pipe, fittings and components shall be *third-party certified* as conforming to NSF 14.

❖ Plastic piping, fittings and plastic pipe-related components, including solvent cements, primers, tapes, lubricants and seals used in mechanical systems, must be tested and certified as conforming to NSF 14. This includes all piping and fittings and plastic piping system components, including but not limited to pipes, fittings, valves, joining materials, gaskets and appurtenances. This section does not apply to components that include only plastic parts such as brass valves with a plastic stem.

301.5 Third-party testing and certification. Piping, tubing and fittings shall comply with the applicable referenced standards, specifications and performance criteria of this code and shall be identified in accordance with Section 301.3. Piping, tubing and fittings shall either be tested by an approved third-party testing agency or certified by an approved *third-party certification agency*.

❖ The term “third party” refers to an outside organization with no financial or other interest in the outcome. The term “tested” means that the product or material was initially tested, a report or documentation was developed, but retesting at a later date is not performed. The term “certified” means that the product or material was initially tested and a program of periodic testing ensures that the product or material continues to meet the specified requirements. See definitions in Chapter 2 for “Third-party certified” and “Third-party tested.”

301.6 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 *International Fuel Gas Code*.

❖ With the development of the *International Fuel Gas Code*® (IFGC®) in 1997, the provisions that exclusively addressed fuel-gas installations were deleted from this code. The creation of the IFGC was the result of an agreement between the International Code Council® (ICC®) and the American Gas Association (AGA) to

develop and maintain a stand-alone fuel gas code for the family of International Codes® (I-Codes®). With the support and input of the fuel gas industry, the IFGC is kept current with new developments and technology in the fuel gas industry. Any code provision that addressed only a fuel-gas-related subject was removed from the code. Code provisions that could apply to other types of fuel (oil, kerosene, wood, coal, pellets, etc.) as well as fuel gas were modified to no longer refer to fuel-gas-related subjects. The IFGC is an inseparable partner to the IMC. Together, they cover all currently used fuels with the most up-to-date text possible.

301.7 Listed and labeled. *Appliances* regulated by this code shall be *listed* and *labeled* for the application in which they are installed and used, unless otherwise *approved* in accordance with Section 105.

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

❖ Mechanical appliances must be listed and labeled by an approved agency to show that they comply with the applicable national standards. The code requires listing and labeling for appliances such as boilers, furnaces, space heaters, direct-fired heaters, cooking appliances, clothes dryers, rooftop HVAC units, etc. The code also requires listing for system components as specifically stated in the text addressing those components. The label is the primary, if not the only, assurance to the installer, the inspector and the end-user that a similar appliance has been tested and evaluated by an approved agency and has been determined to perform safely and efficiently where installed and operated in compliance with its listing.

The presence of a label is part of the information that the code official is to consider in the approval of appliances. The only exception to the labeling requirement is when the code official approves the use of a specific appliance with the authority granted in Section 105. The requirement that appliances are to be used only in accordance with their listing is intended to prevent the use of products that have a listing for a particular application but are being used in an application for which they have not been tested. An example would be an appliance that is listed for indoor use only being installed outdoors. Another potential misapplication example could be a factory-built chimney that has been tested and listed for use only with wood-burning heating appliances being used as a grease duct. Such misapplications have the potential to create hazardous conditions.

Caution must be exercised when considering the approval of unlisted and unlabeled appliances in accordance with Section 105. Approval of unlabeled appliances must be based on documentation that demonstrates equivalence to appliances that are in compliance with the applicable standards or, where no product standards exist, that the appliance is appropriate for the intended use and will provide the same level of performance as would listed and labeled appliances. A fundamental principle of the code is the reliance on the listing and labeling process to ensure appliance performance; approvals granted in accordance with Section 105 must be well justified with supporting documentation. To the code official, the installer and the end-user, very little is known about the performance of an appliance that is not tested and built to an appliance standard.

301.8 Labeling. Labeling shall be in accordance with the procedures set forth in Sections 301.8.1 through 301.8.2.3.

❖ As the commentary for Section 301.7 states, the product label is the primary, if not the only, assurance to the code official that the appliance is safe for installation. The labeling of an appliance ensures that testing in compliance with an applicable standard has been performed and that the product will perform acceptably where installed and operated in accordance with the appliance's listing. Before an appliance or other component can be labeled, the code requires specific actions by qualified agencies and personnel. Sections 301.8.1 through 301.8.2.3 describe the requirements that must be complied with before a label can be issued for the appliance or equipment.

301.8.1 Testing. An *approved* agency shall test a representative sample of the mechanical *equipment* and *appliances* being *labeled* to the relevant standard or standards. The *approved* agency shall maintain a record of all of the tests performed. The record shall provide sufficient detail to verify compliance with the test standard.

❖ An approved agency is one that complies with the requirements of Sections 301.8.2.1 through 301.8.2.3 and is approved by the code official (see commentary, Section 301.8.2.1). The only way that an approved agency can verify that equipment and appliances meet the requirements of the relevant standard(s) is by testing of the appliance or equipment under controlled conditions in a testing laboratory. For mass-produced identical products, the approved agency rarely tests each product. Typically, a representative random sample of a "production run" of products is tested. For example, a test protocol might require that 3 units out of 1,000 units produced be tested. As long as the design and manufacturing processes for identically produced products do not change, the established sampling and testing frequency provides a high level of assurance that each produced product would pass the test if actually tested.

The approved agency is responsible for maintaining a record of specific information concerning the product tested, as well as the results of the tests performed. The test standards detail what information is important to record. The records provide proof that the testing was actually performed and that appliance or equipment met or exceeded the minimum requirements of the applicable product standards.

There are numerous standards, not all of which are specifically referenced in the code, applicable to various appliances and equipment. For this reason, the approved agency determines the standards to be used for testing and then, in turn, as the basis for labeling. Each standard contains safety requirements for a given appliance or piece of equipment and specifies tests that must be performed. The labeling agency

must maintain sufficient detailed documentation to demonstrate compliance with the test standard. The code official may require that copies of the test reports be submitted to determine the validity of the label.

Examples of the many standards that are used as a basis for testing and labeling include:

- UL 641—Low-Temperature Venting Systems, Type L.
- UL 727—Oil-Fired Central Furnaces.
- UL 1482—Room Heaters, Solid-Fuel Type.

The basis for a label is the requirement for testing a representative, perhaps identical, sample of the appliance to indicate conformance to a required standard. For this reason, the appliance must meet the requirements of the standard (see commentary, Section 304.1).

301.8.2 Inspection and identification. The *approved* agency shall periodically perform an inspection, which shall be in-plant if necessary, of the mechanical *equipment* and *appliances* to be *labeled*. The inspection shall verify that the *labeled* mechanical *equipment* and *appliances* are representative of the mechanical *equipment* and *appliances* tested.

❖ The approved agency whose identification insignia appears on the label is required to perform periodic in-plant inspections to verify that the manufactured product is equivalent to the sample that was tested. Because the label is good only for the products that were tested, the in-plant inspections are intended to discover any design changes or production quality control problems. If any discrepancies are found, the labeling agency would discontinue labeling of the particular product, and the manufacturer would be required to resolve the problem and, if necessary, have the revised product retested before the labeling process is resumed. The code official may require copies of the periodic inspection reports to determine that the in-plant inspections are being performed in compliance with the requirements for a labeled product.

Because appliances and equipment are tested under specific conditions of installation and operation in accordance with the manufacturer's instructions, the issuance of a label requires that these instructions be provided to the installer and end-user to ensure that the product is not misapplied or improperly installed. Because the code requires that the labeled appliances and equipment be installed and operated in accordance with the manufacturer's instructions, the instructions must be attached to or shipped with each appliance. In-plant inspections by the approved agency ensure that the instructions are being shipped with the product, that the design of the product has not substantially changed and that any change in manufacturing processes will not require a change in the testing protocol.

301.8.2.1 Independent. The agency to be *approved* shall be objective and competent. To confirm its objectivity, the agency shall disclose all possible conflicts of interest.

❖ As a part of the basis for a code official's approval of a particular labeling agency, the agency must demonstrate its independence from the manufacturer of the product as well as its competence to perform the required tests. The judgment of objectivity is linked to the financial and fiduciary independence of the agency. The competence of the agency is judged by its experience and organization, and the experience of its personnel. As a hypothetical example, the Acme Inspection Agency is testing oil-fired furnaces for the Real Hot Furnace Company. After some investigation, it is discovered that both Acme and Real Hot are subsidiaries of the same parent company. The inspection agency and manufacturer clearly have a relationship that is inappropriate from the standpoint of conflict of interest, and the objectivity of the inspection agency is sufficiently questionable for the code official to justify not approving Acme as a testing and labeling agency for equipment produced by the Real Hot Furnace Company.

While code officials could do their own investigations of testing agencies, many rely on accredited third-party evaluation services to perform such investigations. One such service is the ICC Evaluation Service (ICC-ES®). ICC-ES evaluation reports are public documents, available free of charge on the World Wide Web, not only to building regulators and manufacturers, but also to contractors, specifiers, architects, engineers and anyone else with an interest in the building industry.

301.8.2.2 Equipment. An *approved* agency shall have adequate *equipment* to perform all required tests. The *equipment* shall be periodically calibrated.

❖ An agency must have proper equipment to perform the specific tests and inspections as required by the product and test standards. Referring to the example in the commentary for Section 301.8.2.1, if the Acme Inspection Agency had the facilities to test only fire doors, they would not be the appropriate agency for testing of an oil-fired furnace. Although this example is oversimplified, the point is that the inspection agency must have all of the necessary equipment to perform the testing required by the applicable standard.

The agency must also keep records of maintenance and calibration of their test and inspection equipment to demonstrate that the equipment can be relied on to produce accurate, consistent and reproducible results. Often testing apparatus, instruments and equipment must be capable of measurements using very small units of measure within a specified tolerance. To produce accurate, dependable readings and reliable test results, testing apparatus, many pieces of equipment and instruments must be routinely calibrated to established references, such as those maintained by the National Institute of Standards and Technology (NIST).

While code officials could question specific testing agencies with respect to their testing equipment, many rely on accredited third-party evaluation services to perform such verifications. One such service is the ICC-ES.

301.8.2.3 Personnel. An *approved* agency shall employ experienced personnel educated in conducting, supervising and evaluating tests.

❖ The competence of an inspection agency is based on the agency having the proper equipment to perform

the test, as stated in Section 301.8.2.2, and also on the experience and abilities of its personnel. The best calibrated equipment can produce accurate results only when operated by experienced personnel who are trained to conduct, supervise and evaluate tests. For example, consider a newly formed agency that has employed individuals who do not have experience related to the testing to be conducted and have not been adequately trained. The code official may require information that demonstrates the agency personnel have the capability to properly perform the tests. The capabilities and experience of supervisory personnel overseeing their work are also important.

While code officials could question specific testing agencies with respect to their testing personnel, many rely on accredited third-party evaluation services to perform such verifications. One such service is the ICC-ES.

301.9 Label information. A permanent factory-applied nameplate(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 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*: electric rating in volts, amperes and phase; Btu/h (W) output rating; individual marking for each electrical component in amperes or watts, volts and phase; and required *clearances* from combustibles.

❖ This section requires that the label be a plate, tag or other item made and printed of materials that will have a permanence to last the intended life of the product. In general, label materials other than metal tags or plates usually consist of material that is similar in appearance to a decal, and the label, its adhesive, and the printed information are all durable and water resistant. Because of the important information given by a label, the intent is that the label be permanent, not susceptible to damage and legible for the life of the appliance or equipment to which it is attached. The standards that appliances are tested against usually specify the required label performance criteria, the method of attachment and required label information. The code requires that the label be affixed permanently and intends that the label be in a prominent location on the appliance or equipment. Although this section specifies the information that must appear on the label, relevant product standards might require additional information or the manufacturer might choose to provide additional information on the label. Commentary Figure 301.9 shows a typical appliance label.

301.10 Electrical. Electrical wiring, controls and connections to *equipment* and *appliances* regulated by this code shall be in accordance with NFPA 70.

❖ Field-installed power wiring and control wiring for appliances and equipment must be installed in accordance with the NEC (NFPA 70).

The power wiring includes all the wiring, disconnects, overcurrent protection devices, starters and related hardware used to supply electrical power to the appliance or equipment. The control wiring includes all the wiring, devices and related hardware that connect the main unit to all external controls and accessories, such as temperature and pressure sensors, thermostats, exhausters, equipment contactors, interlock controls and remote damper motors. The internal factory wiring of appliances and equipment is not covered by this section unless it is specifically addressed in NFPA 70; however, such wiring is covered by the testing and review performed by an approved agency as part of the labeling process.

The mechanical or electrical code official responsible for the inspection of appliances and equipment must be familiar with the applicable sections of NFPA 70.

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

❖ Plumbing connections to appliances and equipment regulated by the code must be in accordance with the *International Plumbing Code*® (IPC®).

Hydronic systems normally require a means of supplying fill and makeup water to replace any water lost to evaporation, leakage or intentional draining. Where direct connections are made to the potable water supply, the connections must be isolated from the potable water source. This provision is intended to protect the potable water system from contamination by backflow when a direct connection is made to a hydronic system. Hydronic systems are normally pressurized, contain nonpotable water and fluids, and can contain conditioning chemicals or antifreeze solutions. Low-temperature hydronic fluids and cooling towers have also been associated with disease-causing organisms such as the Legionnaires' disease bacterium. The potable water system must be protected from potential contamination resulting from connection to hydronic systems, water-wash filter systems, cooling towers, solar systems, water-cooled heat exchangers, cooking appliances, ice makers, humidifiers, evaporative coolers, etc.

In addition, water heaters must also be considered as both mechanical appliances and plumbing appliances and, therefore, must comply with both this code and the IPC.

A water heater installation is complex in that it has a fuel or power supply; a chimney or vent connection, if fuel fired; a combustion air supply, if fuel fired; connections to the plumbing potable water distribution system; and controls and devices to prevent a multitude of potential hazards from conditions such as excessively high temperatures, pressures and ignition failure.

Chapter 4: Ventilation

General Comments

Mechanical ventilation uses fans or blowers to force the movement of air to and from the ventilated spaces. These systems can be dedicated to ventilation or can be part of a heating, cooling and air-conditioning system that serves the space to be ventilated. Spaces not served by an air-handling system, such as those heated and cooled by hot and chilled water, often depend on air-moving equipment that is devoted solely to providing ventilation.

Ventilation air is distinct from combustion air. Ventilation air is required for the occupants of the building; combustion air is necessary for the proper operation of fuel-burning appliances.

The term “occupied” or “occupiable” as used in this chapter also includes those spaces that are inhabited or habitable.

Natural ventilation is dependent on several factors, including: the location of ventilation openings; wind speed and direction; seasonal climate; temperature differences between indoors and outdoors; the building infiltration rate; ventilation opening shape and configuration; barometric pressure; the shape, height and proximity of adjacent structures; ventilation opening size; the number and distribution of openings in the open position; and the personal habits and desires of the occupants. Natural ventilation, other than building infiltration and exfiltration through cracks and joints in the building envelope, occurs only when required openings to the outdoors are open.

Natural ventilation is not an exact science. The actual quantity of air movement through windows, doors and other gravity openings cannot be predicted because of the changing variables that affect airflow. The most unpredictable variable affecting natural ventilation is the fact that all such ventilation, other than infiltration and exfiltration, is dependent on one or more manual operations by the occupants of the room or space.

Where contaminants are known to be present in quantities large enough to be irritating or harmful to the occupants’ health, naturally ventilated spaces must have mechanical exhaust systems capable of collecting and removing those contaminants. The mechanical exhaust system must comply with this chapter and Chapter 5, which contains exhaust system design criteria. Section 401.6 contains examples of the types of contaminant sources that require a mechanical exhaust system. The application of this section requires the judgment of the designer and the code official on a case-by-case basis. Chapter 5 also prescribes ventilation design for special areas listed there. Spaces designated by Note b of Table 403.3.1.1 are examples of spaces requiring mechanical exhaust systems to control contaminants.

In all but mild seasonal temperatures, natural ventilation and human comfort are in direct conflict. It is human nature to avoid opening windows and doors in the winter or summer months when the outdoor conditions are not within the human comfort zone, especially when energy is being expended to heat or cool the building interior.

Section 401 states the scope of the chapter and addresses by what means and when ventilation is to occur. It also covers general installation requirements and exhaust systems for local sources of contamination.

Section 402 contains all the requirements for natural ventilation.

Section 403 addresses mechanical means of ventilation.

Section 404 contains requirements for the ventilation of enclosed parking garages.

Section 405 states the minimum requirements for ventilation system controls.

Section 406 contains requirements for the ventilation of crawl spaces, attic spaces and similar uninhabited spaces.

Section 407 addresses healthcare facilities.

Purpose

Chapter 4 includes means for protecting building occupant health by controlling the quality of indoor air and protecting property from the effects of inadequate ventilation. In some cases, ventilation is required to prevent or reduce a health hazard by removing contaminants at their source.

Ventilation is the exchange of air from one space to another, usually between an interior space and the outdoors. Ventilation is both necessary and desirable for the control of air contaminants, moisture and temperature. Habitable and occupiable spaces are ventilated to promote a healthy and comfortable environment for the occupants. Uninhabited and unoccupied spaces are ventilated to protect the building structure from the harmful effects of excessive humidity and heat. Ventilation of specific occupancies is necessary to minimize the potential for toxic or otherwise harmful substances to reach dangerously high concentrations in the air.

SECTION 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.

❖ This section establishes the scope of the chapter and the basic requirements for where, when and how ventilation is to be provided. This chapter regulates ventilation for rooms and spaces within building interiors that are intended for occupancy or inhabitability. This chapter also includes provisions for the ventilation of unoccupied spaces such as attics and crawl spaces (see commentary, Section 406).

Smoke control systems, smoke venting, mechanical exhaust systems and combustion air supplies are not within the scope of this chapter, but are regulated by other sections of the code, the *International Fuel Gas Code*® (IFGC®) and the *International Building Code*® (IBC®) as follows:

Smoke Control Systems	Section 513 IBC Section 909
Combustion Air (for appliances not fuel-gas fired)	Chapter 7
Combustion Air (for fuel-gas-fired appliances)	IFGC Section 304

Chapter 5 addresses exhaust systems; however, ventilation is often accomplished using an exhaust-and-makeup-air arrangement such as for toilet rooms, bathrooms, kitchens and specific occupancies denoted by Notes b, g and h in Table 403.3.1.1.

401.2 Ventilation required. Every occupied space shall be ventilated by natural means in accordance with Section 402 or by mechanical means in accordance with Section 403. *Dwelling units* complying with the air leakage requirements of the *International Energy Conservation Code* or ASHRAE 90.1 shall be ventilated by mechanical means in accordance with Section 403. Ambulatory care facilities and Group I-2 *occupancies* shall be ventilated by mechanical means in accordance with Section 407.

❖ Two distinct requirements are established by this section: all occupied spaces must be ventilated, and ventilation can be accomplished by either natural (gravity) or mechanical means, with exceptions. The method of ventilation, mechanical or natural, is the choice of the owner or designer except for ambulatory care facilities and Group I-2 occupancies. The *International Energy Conservation Code*® (IECC®) mandates that dwelling units be tested for air infiltration to further its goal of creating tighter buildings for the purpose of energy conservation, and this same testing is also an indicator of when a building has become too tight to rely on natural ventilation. Testing is performed with an apparatus called a blower door and involves measuring the amount of air that the blower has to push into or pull out of a building in order to maintain a pressure differential between the indoors and outdoors of 0.2 inches of water column (50 Pa). The greater the volumetric flow rate through the blower to maintain the constant pressure differential, the greater the leakage in the building envelope. Multiple studies have shown that natural ventilation alone is not sufficient for dwellings that are tightly sealed such that their infiltration rate is below 5 air changes per hour (ACH). For perspective, 50 Pa = 0.2 inches water column; 1-inch water column = 250 Pa. Traditionally, 0.35 air changes per hour or 15 cfm per occupant has been the required mechanical ventilation rate allowed as an alternative to natural ventilation. An ACH of 0.35 at typical ambient pressure differentials is roughly equivalent to 7 to 10 ACH at a 50 Pa differential, thus the threshold of 5 ACH50 is comparable to the traditional ventilation rate. Note that the IECC intends for the infiltration rate to be 5 ACH50 or less, consistent with the trend for tighter building envelopes. As dwelling envelopes become more airtight, there is evidence that indoor contaminants levels are rising. Poor indoor air quality, the inability to predict ventilation rates from natural ventilation and the decreasing rates of infiltration have all led to this requirement for mechanical ventilation in dwellings. Also, several state codes now mandate mechanical ventilation in dwellings. The requirement for mechanical ventilation applies whether or not the natural ventilation provisions of Section 402 are applied. This section has been simplified by tying the ventilation requirement to compliance with an energy code.

The requirement for mechanical ventilation in R-2 dwelling units is no longer tied to a residential blower door testing requirement. This eliminates the distinction between commercial and residential R-2 buildings as defined in the IECC. The IMC does not regulate one- and two-family dwellings and townhouses, but does regulate R-2 multiple-family buildings, and the intent of this code section is now evident regarding R-2 buildings; that is, dwelling units under the scope of the IMC must be mechanically ventilated if such units comply with the air leakage requirements of the applicable energy code. In other words, if the building is constructed to significantly limit air leakage through the thermal envelope, then the building will have few air changes per hour and mechanical ventilation will be necessary to provide a healthy environment in the dwelling units. Section 403.1 was revised for consistency, as the number of stories above grade is no longer relevant. See Commentary Figure 401.2.

The ventilation methodology of this chapter assumes that either the natural or mechanical ventilation method is being used. The code assumes that a building will be in full compliance with one method or the other. There are no provisions in the code for a ventilation system that depends simultaneously on both natural and mechanical ventilation. No criteria are given to evaluate ventilation effectiveness when natural and mechanical ventilation methods are used simultaneously for a room or space. This would be combining apples and oranges because mechanical ventilation is quantifiable and natural ventilation is not. On the other hand, the code does not expressly prohibit the combined use of both natural and mechanical

methods. If both natural and mechanical means of ventilation are viable as stand-alone methods, logic would dictate that, for example, 50 percent of the required natural ventilation combined with 50 percent of the required mechanical ventilation would satisfy the intent of the code. Of course, the sum of such fractions (percentages) of the two methods would have to equal or exceed 100 percent. A possible drawback to such a hybrid system would be that the occupants might assume that because some mechanical ventilation is installed, it is therefore unnecessary to open any windows, not realizing that the mechanical ventilation is providing only a portion of the required outdoor air. Note that a system using both natural and mechanical ventilation methods would supply varying and unpredictable ventilation because the natural ventilation component will be unquantifiable.

Of course, naturally ventilated spaces can be served by exhaust systems, such as those prescribed by Section 401.6, and such designs can easily demonstrate compliance with the applicable code provisions.

A building may contain more than one type of ventilation system for different spaces within the same building. For example, an office building with an attached parking garage might use a natural ventilation system for the office structure and mechanical ventilation systems for the parking garage, toilet rooms and smoking lounges. Ambulatory care facilities and Group I-2 occupancies are defined in the IBC.

ASHRAE 170 is a ventilation standard for health care facilities, and it contains special provisions for the unique nature of such occupancies. The health care industry helped develop ASHRAE 170 to address the special needs for ventilation of health care facilities. Ambulatory care facilities are those where the patients enter and exit the facility under their own power, but the patients are incapacitated for some period of time while receiving treatment or testing. The facilities include oral surgery offices, eye surgery clinics and colonoscopy clinics, among others.

See Section 407.

Commentary Figure 401.2
GROUP R-2 APARTMENT BUILDING
(Courtesy of gettyimages.com/Lana2011)

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

❖ Ventilation must be provided at all times that the room or space is occupied but can cease when the room or space is unoccupied. This requires a mechanical ventilation system to be designed with controls that provide for continuous ventilation air movement during the entire time that the building is occupied. For example, if a building uses the heating, ventilation and air-conditioning (HVAC) system as the means of providing mechanical ventilation, the HVAC system is not allowed to cycle the air handler off and on. Rather than cycling the blower with the call for heat or cooling, the blower must run continuously while the building is occupied if it is the means of providing mechanical ventilation. This is typically accomplished with timers and energy management control systems (see Section 405.1). Note that even though ventilation must be continuous while the building is occupied, Section 403.3.1.3 allows the mechanical ventilation rate to modulate in proportion to the number of occupants in the space being ventilated. Ventilation required by Section 406 is not related to occupancy.

401.4 Intake opening location. Air intake openings shall comply with all of the following:

1. Intake openings shall be located not less than 10 feet (3048 mm) from lot lines or buildings on the same lot.
2. 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, streets, alleys, parking lots and loading docks, except as specified in Item 3 or Section 501.3.1. Outdoor air intake openings shall be permitted to be located less than 10 feet (3048 mm) horizontally from streets, alleys, parking lots and loading docks provided that the openings are located not less than 25 feet (7620 mm) vertically above such locations. Where openings front on a street or public way, the distance shall be measured from the closest edge of the street or public way.
3. 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. Separation is not required between intake air openings and living space *exhaust air* openings of an individual *dwelling unit* or *sleeping unit* where an approved factory-built intake/exhaust combination termination fitting is used to separate the air streams in accordance with the manufacturer's instructions.
4. Intake openings on structures in flood hazard areas shall be at or above the elevation required by Section 1612 of the *International Building Code* for utilities and attendant equipment.

❖ This section addresses intake openings, and Section 501.3.1 addresses exhaust openings. These two sections must be applied in harmony because they both can affect the separation between intakes and exhaust openings. To prevent the introduction of contaminants into the ventilation air of a building, Item 1 requires a minimum separation of 10 feet (3048 mm) between

outdoor air intake openings and any lot lines or buildings on the same lot. The distance to a lot line considers the fact that a building could be built next to that lot line in the future. Item 2 addresses powered intakes, (mechanical) and gravity (non-mechanical) intakes and requires separation from potentially harmful contaminant sources including chimneys and vents, plumbing vents and areas where motor vehicles operate. In this item, the 10-foot (3048 mm) distance would be measured from the closest edge of a street, alley, parking lot and loading dock. The last sentence of Item 2 addresses intake openings that face a street or public way [see Commentary Figures 401.4(1) and 401.4(2)]. Item 2 has a built-in exception that would allow lesser clearances where the intake opening is 25 feet or more above the source of contamination.

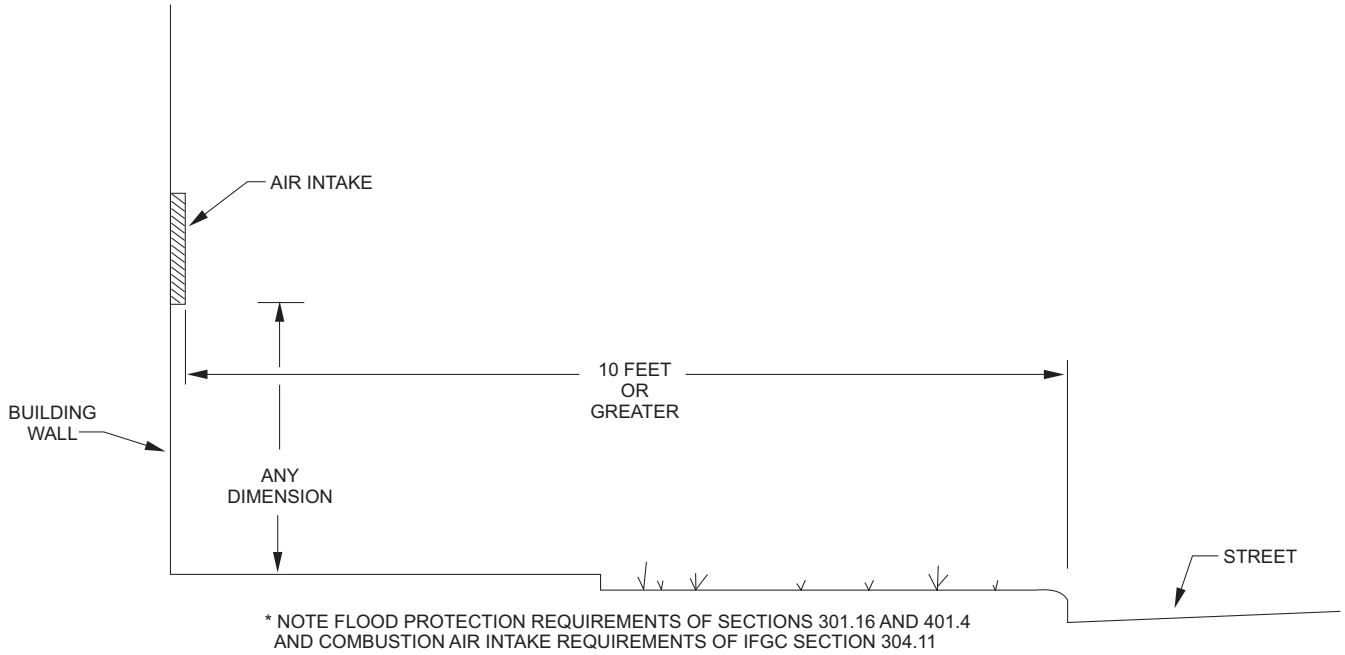
Item 3 addresses those cases where the required 10-foot (3048 mm) separation cannot be met. For example, if the 10-foot (3048 mm) horizontal separation required in Item 2 cannot be achieved, the intake could be located at least 3 feet (914.4 mm) below the contaminant source. The code assumes that the contaminants likely to be present are buoyant in air because of their temperature or specific gravity, and they will rise above and away from the intake opening.

It is often difficult to maintain the code-prescribed clearances between exhaust openings and air intake openings for reasons such as window placements, proximity to neighboring buildings and dwelling units, and lack of sufficient exterior wall area for locating intakes and outlets. The recognition of special factory-built and engineered dual-purpose fittings can solve many clearance problems in new construction and in existing construction where exhaust fans, air intake openings or energy recovery ventilator equipment is being installed. Such fittings are not intended to be "homemade" shop- or field-constructed fittings, rather they are intended to be engineered designs that are factory-built. The code official has approval discretion for such fittings. Such fittings are designed to severely limit the amount of exhaust air that can be entrained in the intake airflow. Also, combination termination fittings allow a single exterior wall penetration as opposed to two separate exhaust and intake penetrations. There are benefits to reducing wall penetrations, including less labor, less envelope air infiltration, less potential for moisture penetration and improved aesthetics. See Commentary Figure 401.4(3).

Item 4 intends to prevent floodwaters from entering a building through an air intake opening. IBC Section 1612 refers to ASCE 24 which requires mechanical systems, equipment and appliances and air intake openings to meet specific elevation requirements. In addition, this prevents water from floods, up to the specified elevation, from entering a building through air intake openings and causing damage to equipment.

See Chapter 8 and the IFGC for specific regulations for the location of chimney, vent, exhauster, mechanical draft system and appliance vent terminations for fuel-fired appliances. The specific provisions of Chapter 8 and the IFGC take precedence over the general provisions of this section.

See Sections 501.3 and 501.3.1 and consider the fact that an existing intake opening can be impacted by the installation of a new exhaust termination, as well as the fact that an existing exhaust termination can affect the location of a newly installed intake opening.



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

Commentary Figure 401.4(1)
INTAKE OPENING