

International Building Code – Fire Resistance Rated Construction

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CHAPTER 7

FIRE-RESISTANCE-RATED CONSTRUCTION

SECTION BC 701 GENERAL

701.1 Scope. The provisions of this chapter shall govern the materials and assemblies used for structural fire resistance and fire-resistance-rated construction separation of adjacent spaces to safeguard against the spread of fire and smoke within a building and the spread of fire to or from buildings.

SECTION BC 702 DEFINITIONS

702.1 Definitions. The following words and terms shall, for the purposes of this chapter, and as used elsewhere in this code, have the meanings shown herein.

ANNULAR SPACE. The opening around the penetrating item.

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.

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

CONCEALED SPACES. Enclosed spaces within partitions, walls, floors, roofs, stairs, furring, pipe chases and column enclosures and other similar spaces.

DAMPER. See "Ceiling radiation damper," "Combination fire/smoke damper," "Fire damper" and "Smoke damper."

DRAFT STOP. A material, device or construction installed to restrict the movement of air within open spaces of concealed areas of building components such as crawl spaces, floor/ceiling assemblies, roof/ceiling assemblies and attics.

F RATING. The time period that the through-penetration fire stop system limits the spread of fire through the penetration when tested in accordance with ASTM E 814.

FIRE AREA. The aggregate floor area enclosed and bounded by firewalls, fire barriers, exterior walls or fire-resistance-rated horizontal assemblies of a building.

FIRE BARRIER. A fire-resistance-rated vertical or horizontal assembly of materials complying with Section 706 designed to restrict the spread of fire in which openings are protected.

FIRE DAMPER. A listed device, installed in ducts and air transfer openings of an air distribution system or smoke control system, designed to close automatically upon detection of heat, to interrupt migratory airflow, 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 a dynamic system that continues to operate during a fire. A dynamic fire damper is tested and rated for closure under air- flow.

FIRE DOOR. The door component of a fire door assembly.

FIRE DOOR ASSEMBLY. Any combination of a fire door, frame, hardware, and other accessories that together, as an opening protective, provide a specific degree of fire protection to the opening.

FIRE PARTITION. A vertical assembly of materials complying with Section 708, designed to restrict the spread of fire in which openings are protected.

FIRE PROTECTION RATING. The period of time that an opening protective assembly will maintain the ability to confine a fire as determined by tests prescribed in Section 715. Ratings are stated in hours or minutes.

FIRE RESISTANCE. That property of materials or their assemblies that prevents or retards the passage of excessive heat, hot gases or flames under conditions of use.

FIRE-RESISTANCE RATING. The period of time a building element, component or assembly maintains the ability to withstand fire exposure, continues to perform a given structural function, or both, as determined by the tests, or the methods based on tests, prescribed in Section 703.

FIRE-RESISTANT JOINT SYSTEM. An assemblage of specific materials or products that are designed, tested, and fire-resistance rated in accordance with either ASTM E 1966 or UL 2079 to resist for a prescribed period of time the passage of fire through joints made in or between fire-resistance-rated assemblies.

FIRE SEPARATION DISTANCE. The distance measured from the building face to the closest interior tax lot line, to the centerline of a street or other public space, or to an imaginary line between two buildings on the same tax lot. The distance shall be measured at right angles from the face of the wall.

FIRE WALL. A fire-resistance-rated smoke-tight wall having protected openings, which restricts the spread of fire and extends continuously from the foundation to or through the roof, with sufficient structural stability under fire conditions to allow collapse of construction on either side without collapse of the wall.

FIRE WINDOW ASSEMBLY. A window, as an opening protective, constructed and glazed to give protection against the passage of fire, smoke and hot gases.

FIREBLOCKING. A building material or an assembly of building materials that may or may not have a fire-resistance rating installed to resist the free passage of flame or hot gases to other areas of the building through concealed spaces in accordance with Section 717.



FIRESTOPPING. A through-penetration firestop or a membrane penetration firestop.

FLOOR FIRE DOOR ASSEMBLY. A combination of a fire door, a frame, hardware and other accessories installed, as an opening protective, in a horizontal plane, which together provide a specific degree of fire protection to a through opening in a fire-resistance-rated floor (see Section 712.4.6).

MEMBRANE PENETRATION. An opening made through one side (wall, floor or ceiling membrane) of an assembly.

MEMBRANE PENETRATION FIRESTOP. A material, device, or assemblage of specific materials or products that is designed, tested and fire-resistance rated to resist for a prescribed time period the passage of flame and heat through openings in a protective membrane in order to accommodate cables, cable trays, conduit, tubing, pipes or similar items.

PENETRATION FIRESTOP. A through-penetration firestop or a membrane penetration firestop.

SELF-CLOSING. As applied to a fire door or other opening, means equipped with an approved device that will ensure closing after having been opened.

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

SHAFT ENCLOSURE. The walls or construction forming the boundaries of a shaft.

SMOKE BARRIER. A continuous membrane, either vertical or horizontal, such as a wall, floor, or ceiling assembly, that is designed and constructed in accordance with Section 709 to restrict the movement of smoke.

SMOKE COMPARTMENT. A space within a building enclosed by smoke barriers on all sides, including the top and bottom.

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

SMOKE PARTITION. A continuous vertical assembly that is designed and constructed to restrict the movement of smoke and is not generally required to have a fire-resistance rating in accordance with Section 710.

T RATING. The time period that the penetration firestop system, including the penetrating item, limits the maximum temperature rise to 325° F (163°C) above its initial temperature through the penetration on the non-fire side when tested in accordance with ASTM E 814.

THROUGH PENETRATION. An opening that passes through an entire assembly.

THROUGH-PENETRATION FIRESTOP SYSTEM. An assemblage of specific materials or products that are designed, tested and fire-resistance rated to resist for a prescribed period of time the spread of fire through penetrations. The F and T rating criteria for penetration firestop systems shall be in

accordance with ASTM E 814. See definitions of "F rating" and "T rating."

SECTION BC 703 FIRE-RESISTANCE RATINGS AND FIRE TESTS

703.1 Scope. Materials prescribed herein for fire resistance shall conform to the requirements of this chapter.

703.2 Fire-resistance ratings. The fire-resistance rating of building elements shall be determined in accordance with the test procedures set forth in ASTM E 119 or in accordance with Section 703.3. Where materials, systems or devices that have not been tested as part of a fire-resistance-rated assembly are incorporated into the assembly, sufficient data shall be made available to the commissioner to show that the required fire-resistance rating is not reduced. Materials and methods of construction used to protect joints and penetrations in fire-resistance- rated building elements shall not reduce the required fire-resistance rating.

Exception: In determining the fire-resistance rating of exterior bearing walls, compliance with the ASTM E 119 criteria for unexposed surface temperature rise and ignition of cotton waste due to passage of flame or gases is required only for a period of time corresponding to the required fire-resistance rating of an exterior nonbearing wall with the same fire separation distance, and in a building of the same group. When the fire-resistance rating determined in accordance with this exception exceeds the fire-resistance rating determined in accordance with ASTM E 119, the fire expo- sure time period, water pressure, and application duration criteria for the hose stream test of ASTM E 119 shall be based upon the fire-resistance rating determined in accordance with this exception.

703.2.1 Nonsymmetrical wall construction. Interior walls and partitions of nonsymmetrical construction shall be tested with both faces exposed to the furnace, and the assigned fire-resistance rating shall be the shortest duration obtained from the two tests conducted in compliance with ASTM E 119. When evidence is furnished to show that the wall was tested with the least fire-resistant side exposed to the furnace, subject to acceptance of the commissioner, the wall need not be subjected to tests from the opposite side (see Section 704.5 for exterior walls).

703.2.2 Combustible components. Combustible aggregates may be integrated with other materials to form a noncombustible material provided that the entire mixture, in the form in which it is to be used in construction, meets the requirement of this code for noncombustible construction.

703.2.1 Restrained classification. Fire-resistance-rated assemblies tested under ASTM E 119 shall not be considered to be restrained unless evidence satisfactory to the commissioner is furnished by the registered design professional showing that the construction qualifies for a restrained classification in accordance with ASTM E 119. Restrained construction shall be identified on the plans.



703.3 Alternative methods for determining fire resistance. The application of any of the alternative methods listed in this section shall be based on the fire exposure and acceptance criteria specified in ASTM E 119. The required fire resistance of a building element shall be permitted to be established by any of the following methods or procedures:

- 1. Fire-resistance designs documented in approved sources.
- 2. Prescriptive designs of fire-resistance-rated building elements as prescribed in Section 720.
- 3. Calculations in accordance with Section 721.
- 4. Engineering analysis based on a comparison of building element designs having fire-resistance ratings as determined by the test procedures set forth in ASTM E 119.
- 5. Alternative protection methods as allowed by Section 104.1.
- 703.4 Non-combustibility tests. The tests indicated in Sections

703.4.1 and 703.4.2 shall serve as criteria for acceptance of building materials as set forth in Sections 602.2, 602.3 and 602.4 in Type I, II, III and IV construction. The term "noncombustible" does not apply to the flame spread characteristics of interior finish or trim materials. A material shall not be classified as a noncombustible building construction mate- rial if it is subject to an increase in combustibility or flame spread beyond the limitations herein established through the effects of age, fabrication or erection techniques, moisture or other atmospheric conditions.

703.4.1 Elementary materials. Materials required to be noncombustible shall be tested in accordance with ASTM E 136.

703.4.2 Composite materials. Materials having a structural base of noncombustible material as determined in accordance with Section 703.4.1 with a surfacing not more than 0.125 inch (3.18 mm) thick that has a flame spread index not greater than 50 when tested in accordance with ASTM E 84 shall be acceptable as noncombustible materials.

SECTION BC 704 EXTERIOR WALLS

704.1 General. Exterior walls shall be fire-resistance rated and have opening protection as required by this section. Exterior wall construction shall comply with the provisions of Chapter 14 and Appendix D where applicable.

704.2 Projections. Cornices, eave overhangs, exterior balconies and similar architectural appendages, including but not limited to, fascia's, belt courses, pilasters, surrounds, gutters, leaders, half-timber work, shutters, trellises, which extend beyond the floor area shall conform to the requirements section and Section 1406, provided, if removed or destroyed, will not reduce the structural stability of the building enclosure, and installed so as not to reduce the required fire-resistance rating of the enclosure. Exterior egress balconies and exterior exit stairways shall comply with the requirements of this section and Sections 1013.5 and‡ 1022.1. Projections shall not extend

beyond the distance determined by the following two methods, whichever results in the lesser projection:

- 1. A point one-third the distance to the lot line from an assumed vertical plane located where protected openings are required in accordance with Section 704.8.
- 2. More than 12 inches (305 mm) into areas where openings are prohibited.

704.2.1 Type III, IV or V construction. Projections from walls of Type III, IV or V construction shall be of any approved material.

704.2.2 Combustible projections. Combustible projections located where openings are not permitted or where protection of openings is required shall be of at least 1-hour fire-resistance-rated construction, Type IV construction, or as required by Section 1406.3.

704.3 Buildings on the same lot. For the purposes of determining the required wall and opening protection and roof-covering requirements, buildings on the same tax lot shall be assumed to have an imaginary line between them.

Exception: Two or more buildings on the same tax lot shall either be regulated as separate buildings or shall be considered as portions of one building if the aggregate area of such buildings is within the limits specified in Chapter 5 for a single building. Where the buildings contain different occupancy groups or are of different types of construction, the area shall be that allowed for the most restrictive occupancy or construction.

704.4 Materials. Exterior walls shall be of materials permitted by the building type of construction.

704.5 Fire-resistance ratings. Exterior walls shall be fire-resistance rated in accordance with Tables 601, 602, and Appendix D where applicable. The fire-resistance rating of exterior walls with a fire-separation distance of greater than 5 feet (1524 mm) shall be rated for exposure to fire from the inside. The fire-resistance rating of exterior walls with a fire-separation distance of 5 feet (1524 mm) or less shall be rated for exposure to fire from both sides.

704.6 Structural stability. The wall shall extend to the height required by Section 704.11 and shall have sufficient structural stability such that it will remain in place for the duration of time indicated by the required fire-resistance rating.

704.7 Unexposed surface temperature. Where protected openings are not limited by Section 704.8, the limitation on the rise of temperature on the unexposed surface of exterior walls as required by ASTM E 119 shall not apply. Where protected openings are limited by Section 704.8, the limitation on the rise of temperature on the unexposed surface of exterior walls as required by ASTM E 119 shall not apply provided that a correction is made for radiation from the unexposed exterior wall surface in accordance with the following formula:

$$A_{e} = A + (A \times F_{f})$$

(Equation 7-1)

where:

- A_e = Equivalent area of protected openings.
- A = Actual area of protected openings.



- A_f = Area of exterior wall surface in the story under consideration exclusive of openings, on which the temperature limitations of ASTM E 119 for walls are exceeded.
- F_{eo} = An "equivalent opening factor" derived from Figure 704.7 based on the average temperature of the unexposed wall surface and the fire-resistance rating of the wall.

704.8 Allowable area of openings. The maximum area of unprotected or protected openings permitted in an exterior wall in any story shall not exceed the values set forth in Table 704.8. Where both unprotected and protected openings are located in the exterior wall in any story, the total area of the openings shall comply with the following formula:

 $\frac{A}{a} + \frac{A_u}{a_u} \le 1.0$ (Equation 7-2)

where:

- A = Actual area of protected openings, or the equivalent area of protected openings, A_e (see Section 704.7).
- *a* = Allowable area of protected openings.
- A_u = Actual area of unprotected openings.

 a_u = Allowable area of unprotected openings.

704.8.1 Automatic sprinkler system. In buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, the maximum allowable

area of unprotected openings in occupancies other than Groups H-1, H-2 and H-3 shall be the same as the tabulated limitations for protected openings.

704.8.2 First story. In occupancies other than Group H, unlimited unprotected openings are permitted in the first story of exterior walls facing a street that have a fire separation distance of greater than 15 feet (4572 mm) or facing an unoccupied space. The unoccupied space shall be on the same lot or dedicated for public use, shall not be less than 30 feet (9144 mm) in width, and shall have access from a street by a posted fire lane in accordance with the *New York City Fire Code*.

704.9 Vertical separation of openings. Openings in exterior

walls in adjacent stories shall be separated vertically to protect against fire spread on the exterior of the buildings where the openings are within 5 feet (1524 mm) of each other horizontally in accordance with Section 715.4.8. Such openings shall be separated vertically at least 3 feet (914 mm) by spandrel girders, exterior walls or other similar assemblies that have a fire-resistance rating of at least 1 hour or by flame barriers that extend horizontally at least 30 inches (762 mm) beyond the exterior wall and that are at least as wide as the opening. Flame barriers shall also have a fire-resistance rating of at least 1 hour. The unexposed surface temperature limitations specified in ASTM E 119 shall not apply to the flame barriers or vertical separation unless otherwise required by the provisions of this code. Where a curtain wall assembly is used on the exterior



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