

2021 Virginia Construction Code

CHAPTER 7 FIRE AND SMOKE PROTECTION FEATURES

SECTION 704 FIRE-RESISTANCE RATING OF STRUCTURAL MEMBERS

704.1 Requirements.

The *fire-resistance ratings* of structural members and assemblies shall comply with this section and the requirements for the type of construction as specified in [Table 601](#). The *fire-resistance ratings* shall be not less than the ratings required for the fire-resistance-rated assemblies supported by the structural members.

Exception: *Fire barriers, fire partitions, smoke barriers and horizontal assemblies* as provided in [Sections 707.5, 708.4, 709.4 and 711.2](#), respectively.

704.2 Column protection.

Where columns are required to have protection to achieve a *fire-resistance rating*, the entire column shall be provided individual encasement protection by protecting it on all sides for the full column height, including connections to other structural members, with materials having the required *fire-resistance rating*. Where the column extends through a ceiling, the encasement protection shall be continuous from the top of the foundation or floor/ceiling assembly below through the ceiling space to the top of the column.

Exception: Columns that meet the limitations of [Section 704.4.1](#).

704.3 Protection of the primary structural frame other than columns.

Members of the *primary structural frame* other than columns that are required to have protection to achieve a *fire-resistance rating* and support more than two floors or one floor and roof, or support a *load-bearing wall* or a *nonload-bearing wall* more than two stories high, shall be provided individual encasement protection by protecting them on all sides for the full length, including connections to other structural members, with materials having the required *fire-resistance rating*.

Exception: Individual encasement protection on all sides shall be permitted on all exposed sides provided that the extent of protection is in accordance with the required *fire-resistance rating*, as determined in [Section 703](#).

704.4 Protection of secondary structural members.

Secondary structural members that are required to have protection to achieve a *fire-resistance rating* shall be protected by individual encasement protection.

704.4.1 Light-frame construction.

Studs, columns and boundary elements that are integral elements in *walls of light-frame construction* and are located entirely between the top and bottom plates or tracks shall be permitted to have required *fire-resistance ratings* provided by the membrane protection provided for the *wall*.

704.4.2 Horizontal assemblies.

Horizontal assemblies are permitted to be protected with a membrane or ceiling where the membrane or ceiling provides the required *fire-resistance rating* and is installed in accordance with [Section 711](#).

704.5 Truss protection.

The required thickness and construction of fire-resistance-rated assemblies enclosing trusses shall be based on the results of full-scale tests or combinations of tests on truss components or on *approved* calculations based on such tests that satisfactorily demonstrate that the assembly has the required *fire resistance*.

704.6 Attachments to structural members.

The edges of lugs, brackets, rivets and bolt heads attached to structural members shall be permitted to extend to within 1 inch (25 mm) of the surface of the fire protection.

704.6.1 Secondary attachments to structural members.

Where primary and secondary structural steel members require fire protection, secondary steel attachments to those structural members shall be protected with the same fire-resistive material and thickness as required for the structural member. The protection shall extend away from the structural member a distance of not less than 12 inches (305 mm), or shall be applied to the entire length where the attachment is less than 12 inches (305 mm) long. Where an attachment is hollow and the ends are open, the fire-resistive material and thickness shall be applied to both exterior and interior of the hollow steel attachment.

704.7 Reinforcing.

Thickness of protection for concrete or masonry reinforcement shall be measured to the outside of the reinforcement except that stirrups and spiral reinforcement ties are permitted to project not more than 0.5 inch (12.7 mm) into the

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protection.

704.8 Embedments and enclosures.

Pipes, wires, conduits, ducts or other service facilities shall not be embedded in the required fire protective covering of a structural member that is required to be individually encased.

704.9 Impact protection.

Where the fire protective covering of a structural member is subject to impact damage from moving vehicles, the handling of merchandise or other activity, the fire protective covering shall be protected by corner guards or by a substantial jacket of metal or other noncombustible material to a height adequate to provide full protection, but not less than 5 feet (1524 mm) from the finished floor.

Exception: Corner protection is not required on concrete columns in parking garages.

704.10 Exterior structural members.

Load-bearing structural members located within the *exterior walls* or on the outside of a building or structure shall be provided with the highest *fire-resistance rating* as determined in accordance with the following:

1. As required by [Table 601](#) for the type of *building element* based on the type of construction of the building.
2. As required by [Table 601](#) for exterior bearing walls based on the type of construction.
3. As required by [Table 705.5](#) for *exterior walls* based on the *fire separation distance*.

704.11 Bottom flange protection.

Fire protection is not required at the bottom flange of lintels, shelf angles and plates, spanning not more than 6 feet 4 inches (1931 mm) whether part of the *primary structural frame* or not, and from the bottom flange of lintels, shelf angles and plates not part of the structural frame, regardless of span.

704.12 Seismic isolation systems.

Fire-resistance ratings for the isolation system shall meet the *fire-resistance rating* required for the columns, walls or other structural elements in which the isolation system is installed in accordance with [Table 601](#). Isolation systems required to have a *fire-resistance rating* shall be protected with *approved* materials or construction assemblies designed to provide the same degree of *fire resistance* as the structural element in which the system is installed when tested in accordance with [ASTM E119](#) or [UL 263](#) (see [Section 703.2](#)).

Such isolation system protection applied to isolator units shall be capable of retarding the transfer of heat to the isolator unit in such a manner that the required gravity load-carrying capacity of the isolator unit will not be impaired after exposure to the standard time-temperature curve fire test prescribed in [ASTM E119](#) or [UL 263](#) for a duration not less than that required for the *fire-resistance rating* of the structure element in which the system is installed.

Such isolation system protection applied to isolator units shall be suitably designed and securely installed so as not to dislodge, loosen, sustain damage or otherwise impair its ability to accommodate the seismic movements for which the isolator unit is designed and to maintain its integrity for the purpose of providing the required fire-resistance protection.

704.13 Sprayed fire-resistant materials (SFRM).

Sprayed fire-resistant materials (SFRM) shall comply with [Sections 704.13.1](#) through [704.13.5](#).

704.13.1 Fire-resistance rating.

The application of SFRM shall be consistent with the *fire-resistance rating* and the listing, including, but not limited to, minimum thickness and dry density of the applied SFRM, method of application, substrate surface conditions and the use of bonding adhesives, sealants, reinforcing or other materials.

704.13.2 Manufacturer's installation instructions.

The application of SFRM shall be in accordance with the manufacturer's installation instructions. The instructions shall include, but are not limited to, substrate temperatures and surface conditions and SFRM handling, storage, mixing, conveyance, method of application, curing and *ventilation*.

704.13.3 Substrate condition.

The SFRM shall be applied to a substrate in compliance with [Sections 704.13.3.1](#) and [704.13.3.2](#).

704.13.3.1 Surface conditions.

Substrates to receive SFRM shall be free of dirt, oil, grease, release agents, loose scale and any other condition that prevents adhesion. The substrates shall be free of primers, paints and encapsulants other than those fire tested and *listed* by a nationally recognized testing agency. Primed, painted or encapsulated steel shall be allowed, provided that testing has demonstrated that required adhesion is maintained.

704.13.3.2 Primers, paints and encapsulants.

Where the SFRM is to be applied over primers, paints or encapsulants other than those specified in the listing, the material shall be field tested in accordance with [ASTM E736](#). Where testing of the SFRM with primers, paints or

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encapsulants demonstrates that required adhesion is maintained, SFRM shall be permitted to be applied to primed, painted or encapsulated wide flange steel shapes in accordance with the following conditions:

1. The beam flange width does not exceed 12 inches (305 mm); or
2. The column flange width does not exceed 16 inches (400 mm); or
3. The beam or column web depth does not exceed 16 inches (400 mm).
4. The average and minimum bond strength values shall be determined based on not fewer than five bond tests conducted in accordance with [ASTM E736](#). Bond tests conducted in accordance with [ASTM E736](#) shall indicate an average bond strength of not less than 80 percent and an individual bond strength of not less than 50 percent, when compared to the bond strength of the SFRM as applied to clean, uncoated $\frac{1}{8}$ -inch-thick (3.2 mm) steel plate.

704.13.4 Temperature.

A minimum ambient and substrate temperature of 40°F (4.44°C) shall be maintained during and for not fewer than 24 hours after the application of the SFRM, unless the manufacturer's instructions allow otherwise.

704.13.5 Finished condition.

The finished condition of SFRM applied to structural members or assemblies shall not, upon complete drying or curing, exhibit cracks, voids, spalls, delamination or any exposure of the substrate. Surface irregularities of SFRM shall be deemed acceptable.