9.1 * Basic Requirements.

9.1.1 *

The requirements for spacing, location, and position of sprinklers shall be based on the following principles:

(1) Sprinklers shall be installed throughout the premises.
(2) Sprinklers shall be located so as not to exceed the maximum protection area per sprinkler.
(3)* Sprinklers shall be positioned and located so as to provide satisfactory performance with respect to activation time and distribution.
(4) Sprinklers shall be permitted to be omitted from areas specifically allowed by this standard.
(5) When sprinklers are specifically tested and test results demonstrate that deviations from clearance requirements to structural members do not impair the ability of the sprinkler to control or suppress a fire, their positioning and locating in accordance with the test results shall be permitted.
(6) Clearance between sprinklers and ceilings exceeding the maximums specified in this standard shall be permitted, provided that tests or calculations demonstrate comparable sensitivity and performance of the sprinklers to those installed in conformance with these sections.

9.2 Allowable Sprinkler Omission Locations.

9.2.1 * Concealed Spaces Not Requiring Sprinkler Protection.

9.2.1.1 *

Concealed spaces of noncombustible and limited-combustible construction with minimal combustible loading having no access shall not require sprinkler protection.

9.2.1.1.1

The space shall be considered a concealed space even with small openings such as those used as return air for a plenum.

9.2.1.1.2 *

Small openings with both of the following limits shall be permitted:

(1) A combined total area of not more than 20 percent of the ceiling, construction feature, or plane shall be used to determine the boundaries of the concealed space.
(2) Gaps greater than 4 ft (1.2 m) long shall not be more than 8 in. (200 mm) wide.

9.2.1.2

Concealed spaces of noncombustible and limited-combustible construction with limited access and not permitting occupancy or storage of combustibles shall not require sprinkler protection.

9.2.1.2.1

The space shall be considered a concealed space even with small openings such as those used as return air for a plenum.

9.2.1.2.2 *

The space shall be considered a concealed space even with non-fuel-fired equipment and access panels.

9.2.1.3

Concealed spaces formed by studs or joists with less than 6 in. (150 mm) between the inside or near edges of the studs or joists shall not require sprinkler protection. *(See Figure 10.2.7.1.5.1.)*

9.2.1.4

Concealed spaces formed by bar joists with less than 6 in. (150 mm) between the roof or floor deck and ceiling shall not require sprinkler protection.

9.2.1.5 *

Concealed spaces formed by ceilings attached directly to or within 6 in. (150 mm) of wood joist or similar solid member construction shall not require sprinkler protection.

9.2.1.6 *

Concealed spaces formed by ceilings attached to composite wood joist construction either directly or onto metal channels not exceeding 1 in. (25 mm) in depth, provided the joist channels as measured from the top of the batt insulation are separated into volumes each not exceeding 160 ft^3 (4.5 m^3) using materials equivalent to the web construction and at least $3\frac{1}{2}$ in. (90 mm) of batt insulation is installed at the bottom of the joist channels when the ceiling is attached utilizing metal channels, shall not require sprinkler protection.

9.2.1.7

Concealed spaces filled with noncombustible insulation shall not require sprinkler protection.

9.2.1.7.1

A maximum 2 in. (50 mm) air gap at the top of the space shall be permitted.

9.2.1.8

Concealed spaces within wood joist construction having noncombustible insulation filling the space from the ceiling up to the bottom edge of the joist of the roof or floor deck shall not require sprinkler protection.

9.2.1.9

Concealed spaces within composite wood joist construction having noncombustible insulation filling the space from the ceiling up to the bottom edge of the composite wood joist of the roof or floor deck and with the joist channels separated into volumes each not exceeding 160 ft^3 (4.5 m^3) to the full depth of the composite wood joist, with material equivalent to the web construction, shall not require sprinkler protection.

9.2.1.10

Concealed spaces over isolated small compartments not exceeding 55 ft^2 (5.1 m^2) in area shall not require sprinkler protection.

9.2.1.11 *

Concealed spaces created by soffits of combustible construction below noncombustible or limited combustible ceilings separated into volumes each not exceeding 160 ft^3 (4.5 m^3) by noncombustible or limited combustible materials shall not require sprinkler protection.

9.2.1.12

Concealed spaces where rigid materials are used and the exposed surfaces, in the form in which they are installed, comply with one of the following shall not require sprinkler protection:

(1) The surface materials have a flame spread index of 25 or less, and the materials have demonstrated that the flame front does not progress more than 10.5 ft (3.2 m) beyond the centerline of the burners at any time during the 30-minute test period, when tested in accordance with ASTM E84, *Standard Test Method for Surface Burning Characteristics of Building Materials*, or UL 723, *Test for Surface Burning Characteristics of Building Materials*, extended for an additional 20 minutes.
(2) The surface materials comply with the requirements of ASTM E2768, *Standard Test Method for Extended Duration Surface Burning Characteristics of Building Materials (30 min Tunnel Test)*.

9.2.1.13 *

Concealed spaces in which the exposed materials are constructed entirely of fire retardant–treated wood as defined by NFPA 703 shall not require sprinkler protection.

9.2.1.14

Noncombustible concealed spaces having exposed combustible insulation where the heat content of the facing and substrate of the insulation material does not exceed 1000 Btu/ft^2 (11,400 kJ/m^2) shall not require sprinkler protection.

9.2.1.15

Concealed spaces below insulation that is laid directly on top of or within wood joists or composite wood joists used as ceiling joists in an otherwise sprinklered concealed space, with the ceiling attached directly to the bottom of the joists, shall not require sprinkler protection.

9.2.1.16

Sprinklers shall not be required in vertical pipe chases under 10 ft^2 (0.9 m^2).

9.2.1.16.1

Pipe chases in accordance with 9.2.1.16 shall contain no sources of ignition.

9.2.1.16.2

In buildings having more than a single story, blocking shall be required at pipe penetrations at each floor.

9.2.1.17

Exterior columns under 10 ft^2 (0.9 m^2) in area, formed by studs or wood joist supporting exterior canopies that are fully protected with a sprinkler system, shall not require sprinkler protection.

9.2.1.18 *

Concealed spaces formed by noncombustible or limited-combustible ceilings suspended from the bottom of wood joists, composite wood joists, wood bar joists, or wood trusses that have insulation filling all of the gaps between the bottom of the trusses or joists, and where sprinklers are present in the space above the insulation within the trusses or joists, shall not require sprinkler protection.

9.2.1.18.1

The heat content of the facing, substrate, and support of the insulation material shall not exceed 1000 Btu/ft^2 (11,400 kJ/m^2).

9.2.1.19 *

Concealed spaces formed by noncombustible or limited-combustible ceilings suspended from the bottom of wood joists and composite wood joists with a maximum nominal chord width of 2 in. (50 mm), where joist spaces are full of noncombustible batt insulation with a maximum 2 in. (50 mm) air space between the decking material and the top of the batt insulation shall not require sprinklers.

9.2.1.19.1

Facing that meets the requirements for noncombustible or limited-combustible material covering the surface of the bottom chord of each joist and secured in place per the manufacturer’s recommendations shall not require sprinklers.

9.2.1.20 Exterior Soffits, Eaves, Overhangs, and Decorative Frame Elements.

9.2.1.20.1

Sprinklers shall be permitted to be omitted from within combustible soffits, eaves, overhangs, and decorative frame elements that are constructed in accordance with 9.2.1.20.2 through 9.2.1.20.5.

9.2.1.20.2

Combustible soffits, eaves, overhangs, and decorative frame elements shall not exceed 4 ft 0 in. (1.2 m) in width.

9.2.1.20.3

Combustible soffits, eaves, overhangs, and decorative frame elements shall be draftstopped, with a material equivalent to that of the soffit, into volumes not exceeding 160 ft^3 (4.5 m^3).

9.2.1.20.4

Combustible soffits, eaves, overhangs, and decorative frame elements shall be separated from the interior of the building by walls or roofs of noncombustible or limited-combustible construction.

9.2.1.20.5

Combustible soffits, eaves, overhangs, and decorative frame elements shall have no openings or unprotected penetrations directly into the building.

9.2.2 Spaces Under Ground Floors, Exterior Docks, and Exterior Platforms.

Sprinklers shall be permitted to be omitted from spaces under ground floors, exterior docks, and exterior platforms where all of the following conditions exist:

(1) The space is not accessible for storage purposes and is protected against accumulation of wind-borne debris.
(2) The space contains no equipment such as conveyors or fuel-fired heating units.
(3) The floor over the space is constructed in such a manner as to prevent the passage of debris into the space below.
(4) No combustible or flammable liquids or materials that under fire conditions would convert into combustible or flammable liquids are processed, handled, or stored on the floor above the space.

9.2.3 * Exterior Projections.

9.2.3.1 *

Sprinklers shall be permitted to be omitted where the exterior canopies, roofs, porte-cocheres, balconies, decks, and similar projections are constructed with materials that are noncombustible, limited-combustible, or fire retardant–treated wood as defined in NFPA 703, or where the projections are constructed utilizing a noncombustible frame, limited-combustibles, or fire retardant–treated wood with an inherently flame-resistant fabric overlay as demonstrated by Test Method 2 in accordance with NFPA 701.

9.2.3.2

Sprinklers shall be permitted to be omitted from below the exterior projections of combustible construction, provided the exposed finish material on the exterior projections are noncombustible, limited-combustible, or fire retardant–treated wood as defined in NFPA 703, and the exterior projections contain only sprinklered concealed spaces or any of the following unsprinklered combustible concealed spaces:

(1) Combustible concealed spaces filled entirely with noncombustible insulation
(2) Light or ordinary hazard occupancies where noncombustible or limited-combustible ceilings are directly attached to the bottom of solid wood joists so as to create enclosed joist spaces 160 ft^3 (4.5 m^3) or less in volume, including space below insulation that is laid directly on top or within the ceiling joists in an otherwise sprinklered attic *[see 19.2.3.1.5.2(4)]*
(3) Concealed spaces over isolated small exterior projections not exceeding 55 ft^2 (5.1 m^2) in area

9.2.3.2.1

Sprinklers shall be required for porte-cocheres that are located directly below floors intended for occupancy.

9.2.3.3

Sprinklers shall be permitted to be omitted from an exterior exit corridor where the exterior wall of the corridor is at least 50 percent open and where the corridor is entirely of noncombustible construction.

9.2.3.4

Sprinklers shall be installed under all exterior projections greater than 4 ft (1.2 m) where combustibles are stored.

9.2.4 Dwelling Units.

9.2.4.1 Bathrooms.

9.2.4.1.1 *

Unless sprinklers are required by 9.2.4.1.2 or 9.2.4.1.3, sprinklers shall not be required in bathrooms that are located within dwelling units, that do not exceed 55 ft^2 (5.1 m^2) in area, and that have walls and ceilings of noncombustible or limited-combustible materials with a 15-minute thermal barrier rating, including the walls and ceilings behind any shower enclosure or tub.

9.2.4.1.1.1

Bathrooms in accordance with 9.2.4.1.1 that are located under stairs that are part of the path of egress shall not be required to be protected provided that the bathroom is separated from the stairs by fire-resistive construction in accordance with the local building code.

9.2.4.1.2

Sprinklers shall be required in bathrooms of limited care facilities and nursing homes, as defined in NFPA *101*.

9.2.4.1.3

Sprinklers shall be required in bathrooms opening directly onto public corridors or exitways.

9.2.5 Closets and Pantries.

9.2.5.1

Sprinklers shall not be required in clothes closets, linen closets, and pantries, with or without doors, within dwelling units in hotels and motels where the area of the space does not exceed 24 ft^2 (2.2 m^2) and the walls and ceilings are surfaced with noncombustible or limited-combustible materials.

9.2.5.2 * Hospital Clothes Closets.

Sprinklers shall not be required in clothes closets of patient sleeping rooms in hospitals where the area of the closet does not exceed 6 ft^2 (0.6 m^2), provided the distance from the sprinkler in the patient sleeping room to the back wall of the closet does not exceed the maximum distance permitted by 9.5.3.2.

9.2.5.3

Sprinklers shall not be required in closets and pantries where other governing laws, codes, or standards permit their omission.

9.2.6 * Electrical Equipment Rooms.

Sprinklers shall not be required in electrical equipment rooms where all of the following conditions are met:

(1) The room is dedicated to electrical equipment only.
(2) Only dry-type or liquid-type with listed K-class fluid electrical equipment is used.
(3) Equipment is installed in a 2-hour fire-rated enclosure including protection for penetrations.
(4) Storage is not permitted in the room.

9.2.7 Cloud Ceilings.

9.2.7.1 *

Sprinklers shall be permitted to be omitted above cloud ceilings where all of the following apply:

(1)* The combined total area of the openings around the cloud are less than or equal to 20 percent of the area of the ceiling, construction feature, or plane used to determine the boundaries of the compartment.
(2) The width of the gap and the maximum sprinkler protection area are in accordance with Table 9.2.7.1.
(3) The requirements of 9.2.7.2 are met.
(4) Spaces above cloud ceilings contain either noncombustible or limited-combustible construction with minimal combustible loading.

Table 9.2.7.1 Maximum Sprinkler Protection Area Based on Ceiling Cloud Width and Opening Width

Ceiling Cloud — Minimum Width Dimension (ft)	Maximum Area (ft^2) — Opening Width ≤0.5 in./ft of Ceiling Height	Maximum Area (ft^2) — Opening Width ≤0.75 in./ft of Ceiling Height	Maximum Area (ft^2) — Opening Width ≤1 in./ft of Ceiling Height
2–<2.5	175	70	NP
2.5–4	225	120	70
>4	225	150	150

9.2.7.2

When sprinklers are omitted from above a cloud ceiling in accordance with 9.2.7.1, the requirements of this section shall apply.

9.2.7.2.1

All sprinklers shall be quick response standard spray or extended coverage pendent or upright sprinklers.

9.2.7.2.2

Maximum cloud ceiling height shall not exceed 20 ft (6.1 m).

9.2.7.2.3

Maximum spacing and area of protection shall not exceed the maximum requirements of Table 10.2.4.2.1(a) for light hazard and Table 10.2.4.2.1(b) for ordinary hazard.

9.2.7.2.3.1

Where extended coverage sprinklers are used, the maximum distance between sprinklers shall not exceed 16 ft (4.9 m).

9.2.7.2.4

Cloud ceilings shall be of smooth ceiling construction.

9.2.7.2.5 *

For irregular shaped ceiling clouds (not rectangular) the minimum width dimension shall be the smallest width dimension of the cloud and for the gap shall be the greatest dimension between clouds or adjacent walls as applicable.

9.2.8 Revolving Doors Enclosures.

Sprinkler protection shall not be required within revolving door enclosures.

9.2.9 * Furniture and Cabinets.

9.2.9.1

Sprinklers shall not be required to be installed in furniture, cabinets, and similar items not intended for occupancy.

9.2.9.2

This type of feature shall be permitted to be attached to the finished structure.

9.2.9.3

Where sprinklers are omitted from furniture, sprinklers in the surrounding area shall be located based on covering the area to the wall behind the furniture.

9.2.10 Small Temporarily Occupied Enclosures.

9.2.10.1 *

Sprinklers shall not be required in small isolated temporarily occupied enclosures that do not extend to the ceiling.

9.2.10.2

The maximum area of the small temporarily occupied enclosures shall not exceed 24 ft^2 (2.2 m^2), and storage shall not be permitted.

9.2.11 * Equipment Enclosures.

Sprinklers shall not be required to be installed within electrical equipment, mechanical equipment, or air handling units not intended for occupancy.

9.2.12 Noncombustible Vertical Shafts.

Sprinklers shall not be required at the top of noncombustible or limited-combustible, nonaccessible vertical duct, electric, and mechanical shafts as permitted by 9.3.3.1.1 and 9.3.3.1.2.

9.2.13 Noncombustible Stairways.

9.2.13.1

Sprinklers shall not be required at the bottom of stairwells complying with the provisions of 9.3.4.2.3.1.

9.2.13.2

Sprinklers shall not be required for exterior stair towers complying with the provisions of 9.3.4.2.4.

9.2.14 Elevator Hoistways and Machine Rooms.

9.2.14.1 Elevators.

Sprinklers shall be permitted to be omitted in elevator machine rooms, machinery spaces, control rooms, control spaces, and hoistways in accordance with 9.2.14 unless required by 9.3.6.

9.2.14.2 Elevator Pits.

Sprinklers shall not be required in elevator pits.

9.2.14.3 Elevator Machine Rooms, Machinery Spaces, Control Rooms, Control Spaces, and Hoistways.

Sprinklers shall not be required in elevator machine rooms, machinery spaces, control rooms, control spaces, or top of hoistways of elevators installed in accordance with the applicable provisions in NFPA *101*, or the applicable building code, where all the following conditions are met:

(1) The elevator machine rooms, machinery spaces, control rooms, control spaces, or hoistways are dedicated to elevator equipment only.
(2) The elevator machinery spaces, control rooms, control spaces, or hoistways are separated from the remainder of the building by walls and floor/ceiling or roof/ceiling assemblies having a fire resistance rating of not less than that specified by the applicable building code.

(3) No materials unrelated to elevator equipment are permitted to be stored in elevator machine rooms, machinery spaces, control rooms, control spaces, or hoistways.
(4) The elevator machinery is not of the hydraulic type.

9.2.14.4 Hydraulic Elevators.

9.2.14.4.1

Sprinklers shall not be required in the elevator machine rooms, machinery spaces, control rooms, and control spaces where noncombustible hydraulic fluid is used.

9.2.14.4.2

Sprinklers shall not be required at the top of hoistways of hydraulic elevators.

9.2.14.5 Suspension Means.

Sprinklers shall not be required in elevator hoistways where the suspension means is in accordance with one of the following:

(1) A noncombustible suspension means
(2) A combustible suspension means in accordance with the FT-1 test method and tested to the vertical burn test requirements of UL 2556, *Wire and Cable Test Methods*, that does not continue to burn for more than 60 seconds and the indicator flag does not burn more than 25 percent

9.2.14.6 * Noncombustible and Limited-Combustible Elevators.

Sprinklers shall not be required at the top of the hoistway where the hoistway for elevators is noncombustible or limited-combustible and the car enclosure materials meet the requirements of ASME A17.1/CSA B44, *Safety Code for Elevators and Escalators*.

9.2.15 Duct Protection.

Sprinklers shall not be required in vertical duct risers complying with 9.3.9.1.2.

9.2.16 Open-Grid Ceilings.

Sprinklers shall not be required below open grid ceiling installations complying with 9.3.10.

9.2.17 Drop-Out Ceilings.

Sprinklers shall not be required below drop-out ceilings complying with 9.3.11.

9.2.18 Skylights.

Sprinklers shall not be required in skylights complying with 9.3.16.

9.3 Special Situations.

9.3.1 Heat-Producing Devices with Composite Wood Joist Construction.

Where heat-producing devices such as furnaces or process equipment are located in the joist channels above a ceiling attached directly to the underside of composite wood joist construction that would not otherwise require sprinkler protection of the spaces, the joist channel containing the heat-producing devices shall be sprinklered by installing sprinklers in each joist channel, on each side, adjacent to the heat-producing device.

9.3.2 Horizontal Combustible Concealed Spaces.

Unless the requirements of 9.2.1.19 are met, sprinklers used in horizontal combustible concealed spaces (with a slope not exceeding 2 in 12) with wood truss, wood joist construction, or bar joist construction having a combustible upper surface and where the depth of the space is less than 36 in. (900 mm) from deck to deck, from deck to ceiling, or with double wood joist construction with a maximum of 36 in. (900 mm) between the top of the bottom joist and the bottom of the upper joist shall be listed for such use.

9.3.2.1

Sprinklers specifically listed to provide protection of combustible concealed spaces described in 9.3.2 shall be permitted to be used in accordance with 9.4.1.2 where the space is less than 12 in. (300 mm) from deck to deck or deck to ceiling

9.3.2.2

Sprinklers specifically listed to provide protection of combustible concealed spaces described in 9.3.2 shall be permitted to be used in accordance with 9.4.1.2 throughout the area when a portion of the area exceeds a depth of 36 in. (900 mm).

9.3.2.3

Sprinklers specifically listed to provide protection of combustible concealed spaces described in 9.3.2 shall be permitted to be used in accordance with 9.4.1.2 to protect composite wood joist construction.

9.3.3 Vertical Shafts.

9.3.3.1 General.

Unless the requirements of 9.3.3.1.1 or 9.3.3.1.2 are met, one sprinkler shall be installed at the top of shafts.

9.3.3.1.1

Noncombustible or limited-combustible, nonaccessible vertical duct shafts shall not require sprinkler protection.

9.3.3.1.2

Noncombustible or limited-combustible, nonaccessible vertical electrical or mechanical shafts shall not require sprinkler protection.

9.3.3.2 * Shafts with Combustible Surfaces.

9.3.3.2.1

Where vertical shafts have combustible surfaces, one sprinkler shall be installed at each alternate floor level.

9.3.3.2.2

Where a shaft having combustible surfaces is trapped, an additional sprinkler shall be installed at the top of each trapped section.

9.3.3.3 Accessible Shafts with Noncombustible Surfaces.

Where accessible vertical shafts have noncombustible surfaces, one sprinkler shall be installed near the bottom.

9.3.4 Stair Shafts.

9.3.4.1 Combustible Construction.

Sprinklers shall be installed in stair shafts of combustible construction in accordance with 9.3.4.1.1, 9.3.4.1.2, and 9.3.4.1.3.

9.3.4.1.1

Sprinklers shall be installed at the top of combustible stair shafts to protect the entire footprint of the shaft.

9.3.4.1.2 *

Sprinklers shall be installed under the landings at each floor level.

9.3.4.1.3

Sprinklers shall be installed beneath the lowest intermediate landing.

9.3.4.2 Noncombustible Construction.

9.3.4.2.1

In noncombustible stair shafts having noncombustible stairs with noncombustible or limited-combustible finishes, sprinklers shall be installed at the top of the shaft to protect the entire footprint of the shaft and under the first accessible landing above the bottom of the shaft.

9.3.4.2.2

Where noncombustible stair shafts are divided by walls or doors, sprinklers shall be provided on each side of the separation.

9.3.4.2.3

Sprinklers shall be installed beneath landings or stairways where the area beneath is used for storage.

9.3.4.2.3.1 *

Sprinklers shall be permitted to be omitted under the first accessible landing above the bottom of the shaft when the space under the stairs at the bottom is blocked off so that storage cannot occur.

9.3.4.2.4

Sprinklers shall be permitted to be omitted from exterior stair towers when the exterior walls of the stair tower are at least 50 percent open and when the stair tower is entirely of noncombustible construction.

9.3.4.3 * Stairs Serving Two or More Areas.

When stairs have openings to each side of a fire wall(s), sprinklers shall be installed in the stair shaft at each floor landing with multiple openings.

9.3.5 * Vertical Openings.

9.3.5.1 * General.

Unless the requirements of 9.3.5.4 are met, where moving stairways, staircases, or similar floor openings are unenclosed and where sprinkler protection is serving as the alternative to enclosure of the vertical opening, the floor openings involved shall be protected by closely spaced sprinklers in combination with draft curtains in accordance with 9.3.5.2 and 9.3.5.3.

9.3.5.2 Draft Curtains.

Draft curtains shall meet all of the following criteria:

(1) The draft curtains shall be located immediately adjacent to the opening.
(2) The draft curtains shall be at least 18 in. (450 mm) deep.
(3) The draft curtains shall be of noncombustible or limited-combustible material that will stay in place before and during sprinkler operation.

9.3.5.3 Sprinklers.

9.3.5.3.1

Sprinklers shall be spaced not more than 6 ft (1.8 m) apart and placed 6 in. to 12 in. (150 mm to 300 mm) from the draft curtain on the side away from the opening.

9.3.5.3.2

Where sprinklers are closer than 6 ft (1.8 m), cross baffles shall be provided in accordance with 10.2.6.4.2.

9.3.5.4 Large Openings.

Closely spaced sprinklers and draft curtains are not required around large openings such as those found in shopping malls, atrium buildings, and similar structures where all adjoining levels and spaces are protected by automatic sprinklers in accordance with this standard and where the openings have all horizontal dimensions between opposite edges of 20 ft (6.1 m) or greater and an area of 1000 ft^2 (93 m^2) or greater.

9.3.6 Elevators.

9.3.6.1 Combustible Suspension Means.

Sprinklers shall be installed at the top of hoistways where elevators use combustible suspension means that do not meet the requirements of 9.2.14.5(2).

9.3.6.2 Machine Rooms, Machinery Spaces, Control Rooms, and Control Spaces.

Sprinklers shall be required in elevator machine rooms, machinery spaces, control rooms, and control spaces containing combustible hydraulic fluid.

9.3.6.3

Where provided, sprinklers in elevator machine rooms, machinery spaces, control rooms, control spaces, or hoistways shall be standard response spray sprinklers.

9.3.7 * Library Stack Areas and Record Storage.

Where books or records are stored in fixed open book shelves, sprinklers shall be installed in accordance with one of the following:

(1) Sprinklers shall be permitted to be installed without regard to aisles where clearance between sprinkler deflectors and tops of stacks is 18 in. (450 mm) or more.
(2) Where the 18 in. (450 mm) clearance between sprinkler deflectors and tops of stacks cannot be maintained, sprinklers shall be installed in every aisle and at every tier of stacks with distance between sprinklers along aisles not to exceed 12 ft (3.7 m) in accordance with Figure 9.3.7(a).
(3) Where the 18 in. (450 mm) clearance between sprinkler deflectors and tops of stacks cannot be maintained and where vertical shelf dividers are incomplete and allow water distribution to adjacent aisles, sprinklers shall be permitted to be omitted in alternate aisles on each tier, and where ventilation openings are also provided in tier floors, sprinklers shall be staggered vertically in accordance with Figure 9.3.7(b).

Figure 9.3.7(a) Sprinklers in Multitier Bookstacks with Complete Vertical Dividers.

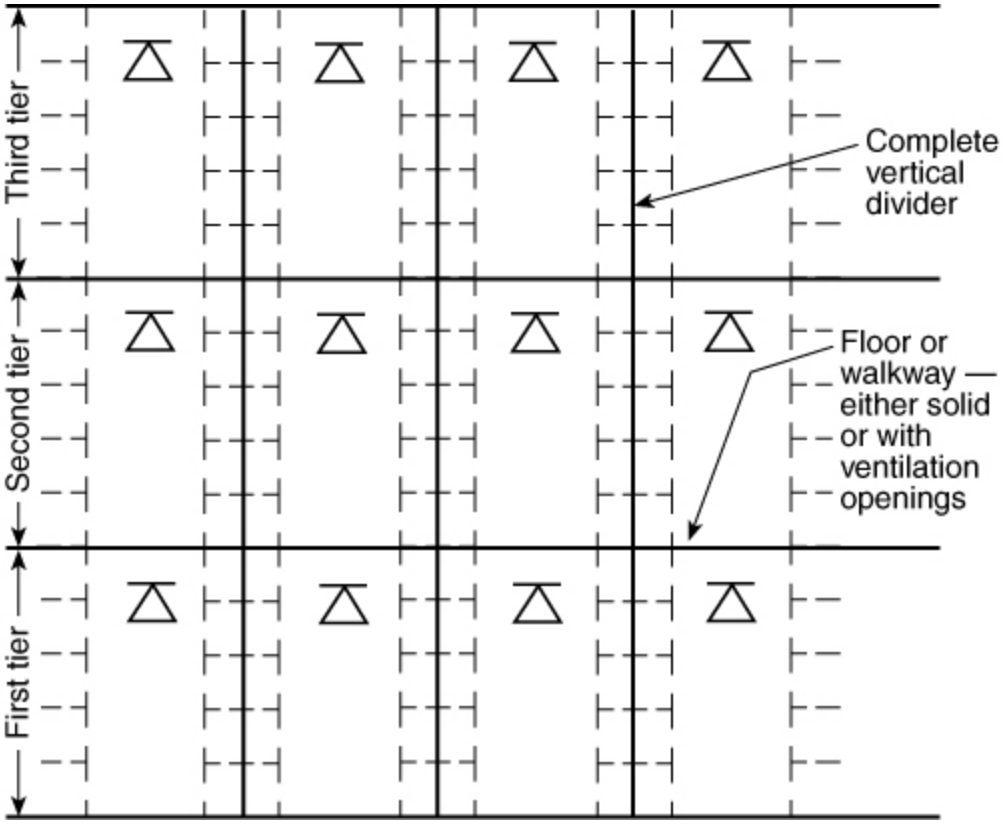
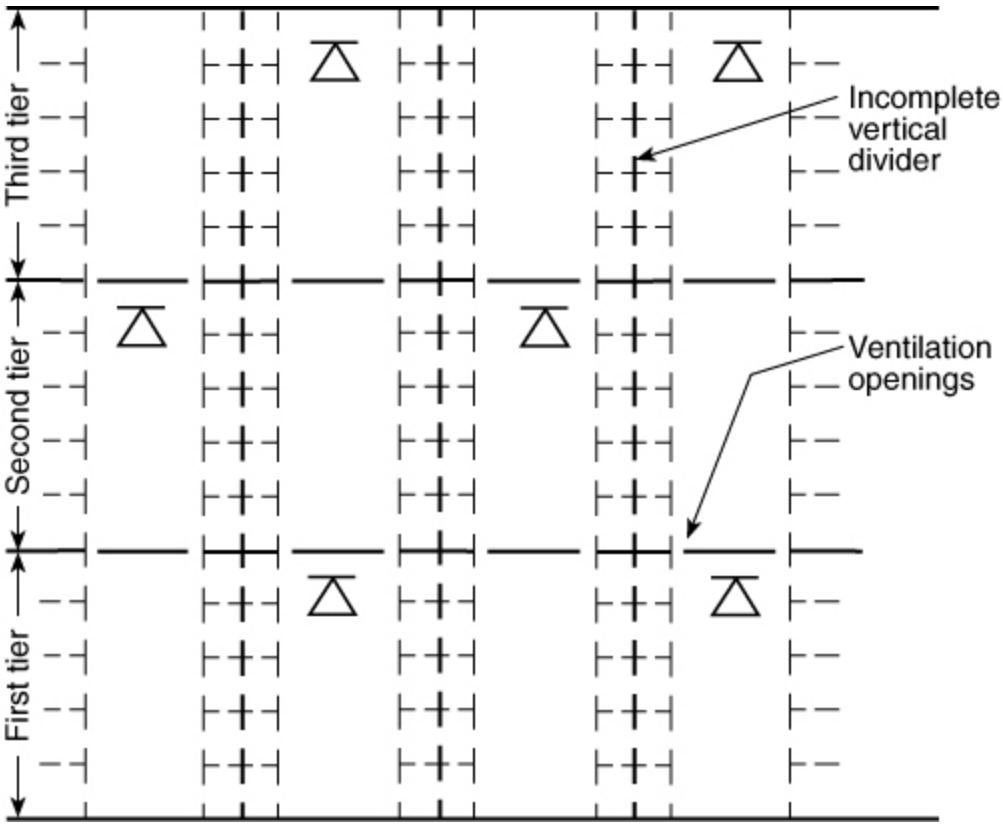


Figure 9.3.7(b) Sprinklers in Multitier Bookstacks with Incomplete Vertical Dividers.



9.3.8 * Industrial Ovens and Furnaces.

9.3.9 Duct Protection.

Duct protection shall be required to meet the requirements of 9.3.9 where required by the authority having jurisdiction or the applicable referenced code or standard.

9.3.9.1 Sprinkler Location.

9.3.9.1.1

Unless the requirements of 9.3.9.1.2 or 9.3.9.1.3 are met, ducts shall have one sprinkler located at the top of each vertical riser and at the midpoint of each offset.

9.3.9.1.2

Sprinklers shall not be required in a vertical riser located outside of a building, provided the riser does not expose combustible material or provided the interior of the building and the horizontal distance between the hood outlet and the vertical riser is at least 25 ft (7.6 m).

9.3.9.1.3

Horizontal exhaust ducts shall have sprinklers located on 10 ft (3.0 m) centers beginning no more than 5 ft (1.5 m) from the duct entrance.

9.3.9.2 Protection Against Freezing.

Sprinklers in exhaust ducts subject to freezing shall be properly protected against freezing. *(See 16.4.1.)*

9.3.9.3 Sprinkler Access.

Access shall be provided to all sprinklers for inspection, testing, and maintenance.

9.3.9.4 Strainers.

A listed line strainer shall be installed in the main water supply preceding sprinklers having nominal K-factors smaller than K-2.8 (40).

9.3.10 * Open-Grid Ceilings.

Open-grid ceilings shall only be installed beneath sprinklers where one of the following is met:

(1) Open-grid ceilings in which the openings are $\frac{1}{4}$ in. (6 mm) or larger in the least dimension, where the thickness or depth of the material does not exceed the least dimension of the opening, and where such openings constitute 70 percent of the area of the ceiling material. The spacing of the sprinklers over the open-grid ceiling shall then comply with the following:
   (a) In light hazard occupancies where sprinkler spacing (either spray or old-style sprinklers) is less than 10 ft × 10 ft (3 m × 3 m), a minimum clearance of at least 18 in. (450 mm) shall be provided between the sprinkler deflectors and the upper surface of the open-grid ceiling. Where spacing is greater than 10 ft × 10 ft (3 m × 3 m) but less than 10 ft × 12 ft (3 m × 3.7 m), a clearance of at least 24 in. (600 mm) shall be provided from spray sprinklers and at least 36 in. (900 mm) from old-style sprinklers. Where spacing is greater than 10 ft × 12 ft (3 m × 3.7 m), a clearance of at least 48 in. (1.2 m) shall be provided.
   (b) In ordinary hazard occupancies, open-grid ceilings shall be permitted to be installed beneath spray sprinklers only. Where sprinkler spacing is less than 10 ft × 10 ft (3 m × 3 m), a minimum clearance of at least 24 in. (600 mm) shall be provided between the sprinkler deflectors and the upper surface of the open-grid ceiling. Where spacing is greater than 10 ft × 10 ft (3 m × 3 m), a clearance of at least 36 in. (900 m) shall be provided.

(2) Other types of open-grid ceilings shall be permitted to be installed beneath sprinklers where they are listed for such service and are installed in accordance with instructions contained in each package of ceiling material.

9.3.11 Drop-Out Ceilings and Ceiling Materials.

9.3.11.1 *

Drop-out ceilings and ceiling materials shall be permitted to be installed beneath sprinklers where the ceiling panels or ceiling materials are listed for that service and are installed in accordance with their listings.

9.3.11.2

Drop-out ceilings and ceiling materials meeting the criteria in 9.3.11.1 shall not be installed below quick-response or extended coverage sprinklers unless specifically listed for that application.

9.3.11.3

Drop-out ceilings and ceiling materials meeting the criteria in 9.3.11.1 shall not be considered ceilings within the context of this standard.

9.3.11.4 *

Piping installed above drop-out ceilings and ceiling materials meeting the criteria in 9.3.11.1 shall not be considered concealed piping.

9.3.11.5 *

Sprinklers shall not be installed beneath drop-out ceilings or ceiling materials meeting the criteria in 9.3.11.1.

9.3.12 * Fur Storage Vaults.

Old-style/conventional sprinklers shall be installed in fur storage vaults.

9.3.13 Stages.

9.3.13.1

Sprinklers shall be installed under the roof at the ceiling, in spaces under the stage either containing combustible materials or constructed of combustible materials, and in all adjacent spaces and dressing rooms, storerooms, and workshops.

9.3.13.2

Where proscenium opening protection is required, a deluge system shall be provided with open sprinklers located not more than 3 ft (900 mm) away from the stage side of the proscenium arch and spaced up to a maximum of 6 ft (1.8 m) on center. *(See Chapter 19 for design criteria.)*

9.3.14 Spaces Above Ceilings.

9.3.14.1

Where spaces have ceilings that are lower than the rest of the area, the space above this lower ceiling shall be sprinklered unless it complies with the rules of 9.2.1 for allowable unsprinklered concealed spaces.

9.3.14.2

Where the space above a ceiling is sprinklered, the sprinkler system shall conform to the rules of 19.1.2 and Section 20.13.

9.3.14.3 *

Where there is a noncombustible space above a noncombustible or limited-combustible ceiling that is sprinklered because it is open to an adjacent sprinklered space and where there is no possibility for storage above the drop ceiling, the sprinkler system shall be permitted to extend only as far into the space as 0.6 times the square root of the design area of the sprinkler system in the adjacent space.

9.3.14.3.1

The sprinkler system shall extend at least 24 ft (7.3 m) into the space above the ceiling.

9.3.15 * Sprinkler-Protected Glazing.

Where sprinklers are used in combination with glazing as an alternative to a required fire-rated wall or window assembly, the sprinkler-protected assembly shall comply with the following:

(1) Sprinklers shall be listed as specific application window sprinklers unless the standard spray sprinklers are specifically permitted by the building code.
(2) Sprinklers shall be supplied by a wet pipe system.
(3) Glazing shall be heat-strengthened, tempered, or glass ceramic and shall be fixed.
(4) Where the assembly is required to be protected from both sides, sprinklers shall be installed on both sides of the glazing.
(5) The use of sprinkler-protected glazing shall be limited to non-load-bearing walls.
(6) The glazed assembly shall not have any horizontal members that would interfere with uniform distribution of water over the surface of the glazing, and there shall be no obstructions between sprinklers and glazing that would obstruct water distribution.
(7) The water supply duration for the design area that includes the window sprinklers shall not be less than the required rating of the assembly

9.3.16 Skylights.

9.3.16.1

Sprinklers shall be permitted to be omitted from skylights not exceeding 32 ft^2 (3.0 m^2) in area, regardless of hazard classification, that are separated by at least 10 ft (3.0 m) horizontally from any other unprotected skylight or unprotected ceiling pocket.

9.3.16.1.1

When a sprinkler is installed directly beneath a skylight that does not allow venting and does not exceed 32 ft^2 (3.0 m^2), the distance to the ceiling shall be measured to the plane of the ceiling as if the skylight was not present.

9.3.16.2 *

Where skylights do not meet the requirements of 9.3.16.1, the skylight shall be permitted to be protected as a ceiling pocket in accordance with the appropriate sprinkler installation requirements in Chapter 10 through Chapter 14.

9.3.16.3

Skylights not exceeding 32 ft^2 (3.0 m^2) shall be permitted to have a plastic cover.

9.3.16.4

Skylights that allow venting, other than smoke and heat venting per 20.9.5, shall be provided with sprinkler protection installed in the skylight.

9.3.17 Concealed Spaces.

9.3.17.1 Concealed Spaces Requiring Sprinkler Protection.

Concealed spaces of exposed combustible construction shall be protected by sprinklers except in concealed spaces where sprinklers are not required to be installed by 9.2.1.1 through 9.2.1.20 and 9.2.2.

9.3.17.1.1 * Concealed Space Design Requirements.

Sprinklers in concealed spaces having no access for storage or other use shall be installed in accordance with the requirements for light hazard occupancy.

9.3.17.1.2 Localized Protection of Exposed Combustible Construction or Exposed Combustibles.

When otherwise noncombustible or limited-combustible concealed spaces that would not require sprinkler protection have localized exposed combustible construction, or contain localized areas of exposed combustibles, the combustibles shall be permitted to be protected as follows:

(1) If the exposed combustibles are in the vertical partitions or walls around all or a portion of the enclosure, a single row of sprinklers spaced not over 12 ft (3.7 m) apart nor more than 6 ft (1.8 m) from the inside of the partition shall be permitted to protect the surface. The first and last sprinklers in such a row shall not be over 5 ft (1.5 m) from the ends of the partitions.
(2) If the exposed combustibles are in the horizontal plane, the area of the combustibles shall be permitted to be protected with sprinklers on a light hazard spacing. Additional sprinklers shall be installed no more than 6 ft (1.8 m) outside the outline of the area and not more than 12 ft (3.7 m) on center along the outline. When the outline returns to a wall or other obstruction, the last sprinkler shall not be more than 6 ft (1.8 m) from the wall or obstruction.

9.3.18 Spaces Under Ground Floors, Exterior Docks, and Platforms.

9.3.18.1

Unless the requirements of 9.2.2 are met, sprinklers shall be installed in spaces under all combustible ground floors and combustible exterior docks and platforms.

9.3.19 Exterior Projections.

9.3.19.1 *

Unless the requirements of 9.2.3.1, 9.2.3.2, or 9.2.3.3 are met, sprinklers shall be installed under exterior projections exceeding 4 ft (1.2 m) in width.

9.3.19.2 *

Sprinklers shall be installed under all exterior projections greater than 4 ft (1.2 m) where combustibles are stored.

9.3.20 * Balconies and Decks Serving Dwelling Units.

9.3.20.1 *

Where a roof, deck, or balcony greater than 4 ft (1.2 m) wide is provided above, sprinklers shall be installed to protect attached exterior balconies, attached exterior decks, and ground floor patios directly serving dwelling units in buildings of Type V construction.

9.3.20.2

Where sprinklers are installed beneath roofs, overhangs, decks, or balconies, sprinklers shall be permitted to be installed with deflectors positioned in accordance with 9.3.20.3 or 9.3.20.4 or the manufacturer’s installation instructions.

9.3.20.3

Sidewall sprinklers shall not be less than 4 in. (100 mm) or more than 6 in. (150 mm) below structural members under a smooth ceiling and not less than 1 in. (25 mm) or more than 6 in. (150 mm) below exposed structural members, provided that the deflector is not more than 14 in. (350 mm) below the underside surface of the deck above the exposed structural members.

9.3.20.4

Pendent sprinklers shall be positioned in accordance with the requirements of NFPA 13 for the sprinkler type installed.

9.3.21 Electrical Equipment.

9.3.21.1

Unless the requirements of 9.2.6 are met, sprinkler protection shall be required in electrical equipment rooms.

9.4 Use of Sprinklers.

9.4.1 General.

9.4.1.1 *

Sprinklers shall be installed in accordance with their listing.

9.4.1.2

Where no sprinklers are specifically listed for construction features or other special situations that require unusual water distribution, the requirements of 9.4.1.1 shall not apply and listed sprinklers shall be permitted to be installed in positions other than anticipated by their listing to achieve specific results.

9.4.1.3 *

Upright sprinklers shall be installed with the frame arms parallel to the branch line, unless specifically listed for other orientation.

9.4.1.4

Where solvent cement is used as the pipe and fittings bonding agent, sprinklers shall not be installed in the fittings prior to the fittings being cemented in place.

9.4.1.5 Protective Caps and Straps.

9.4.1.5.1 *

Protective caps and straps shall be removed using means that are in accordance with the manufacturer's installation instructions.

9.4.1.5.2 *

Protective caps and straps shall be removed from all sprinklers prior to the time when the sprinkler system is placed in service.

9.4.1.5.3

Protective caps and straps on all upright sprinklers or on any sprinklers installed more than 10 ft (3.0 m) above the floor shall be permitted to be removed from sprinklers immediately following their installation.

9.4.2 Temperature Ratings.

9.4.2.1 *

Unless the requirements of 9.4.2.2, 9.4.2.3, 9.4.2.4, or 9.4.2.5 are met, ordinary or intermediate-temperature sprinklers shall be permitted to be used throughout buildings and compartments.

9.4.2.2

Where maximum ceiling temperatures exceed 100°F (38°C), sprinklers with temperature ratings in accordance with the maximum ceiling temperatures of Table 7.2.4.1(a) or Table 7.2.4.1(b) shall be used.

9.4.2.3

High-temperature sprinklers shall be permitted to be used throughout ordinary and extra hazard occupancies, storage occupancies, and as allowed in this standard and other NFPA codes and standards.

9.4.2.4

Sprinklers of intermediate- and high-temperature classifications shall be installed in specific locations as required by 9.4.2.5.

9.4.2.5 *

The following practices shall be observed to provide sprinklers of other than ordinary-temperature classification unless other temperatures are determined or unless high-temperature sprinklers are used throughout, and temperature selection shall be in accordance with Table 9.4.2.5(a), Table 9.4.2.5(b), and Figure 9.4.2.5:

(1)* Sprinklers in the high-temperature zone shall be of the high-temperature classification, and sprinklers in the intermediate-temperature zone shall be of the intermediate-temperature classification.

(2) Sprinklers located within 12 in. (300 mm) to one side or 30 in. (750 mm) above an uncovered steam main, heating coil, or radiator shall be of the intermediate-temperature classification.

(3) Sprinklers within 7 ft (2.1 m) of a low-pressure blowoff valve that discharges free in a large room shall be of the high-temperature classification.

(4) Sprinklers under glass or plastic skylights exposed to the direct rays of the sun shall be of the intermediate-temperature classification.

(5) Sprinklers in attics (peaked or flat) shall be of the intermediate-temperature classification.

(6) Sprinklers in enclosed show windows shall be of the intermediate-temperature classification.

(7) Sprinklers protecting commercial-type cooking equipment and ventilation systems shall be of the high- or extra-high-temperature classification as determined by use of a temperature-measuring device. *(See 8.9.6.)*

(8) Sprinklers protecting residential areas installed near specific heat sources identified in Table 9.4.2.5(b) shall be installed in accordance with Table 9.4.2.5(b).

(9) Ordinary-temperature sprinklers located adjacent to a heating duct that discharges air that is less than 100°F (38°C) are not required to be separated in accordance with Table 9.4.2.5(a) or Table 9.4.2.5(b).

(10) Sprinklers in walk-in type coolers and freezers with automatic defrosting shall be of the intermediate-temperature classification or higher.

(11) Sprinklers in closets containing ventless clothes dryers shall be of the intermediate-temperature classification or higher.

Table 9.4.2.5(a) Temperature Ratings of Sprinklers Based on Distance from Heat Sources

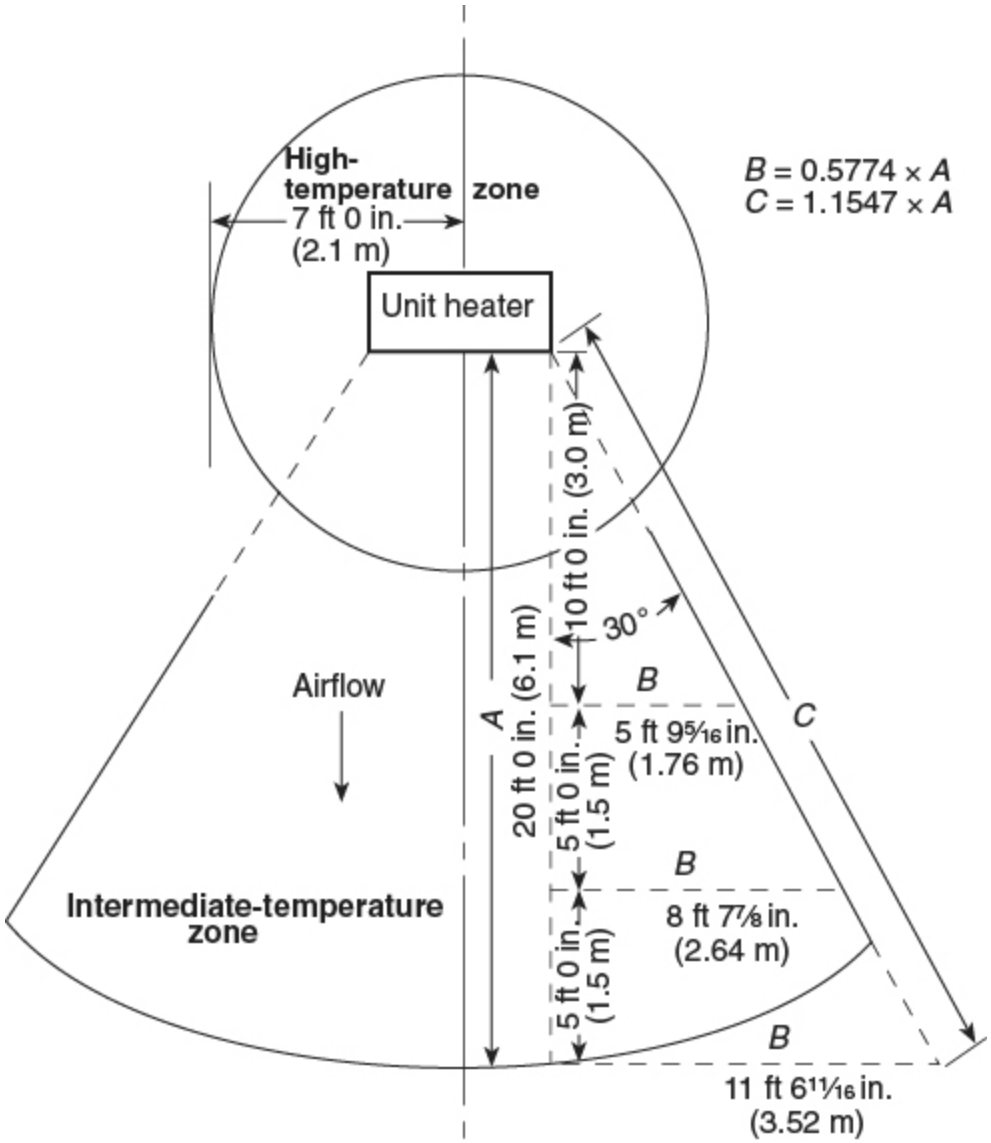
Type of Heat Condition	Ordinary-Temperature Rating	Intermediate-Temperature Rating	High-Temperature Rating
(1) Heating ducts			
(a) Above	More than 2 ft 6 in. (750 mm)	2 ft 6 in. or less (750 mm)	
(b) Side and below	More than 1 ft 0 in. (300 mm)	1 ft 0 in. or less (300 mm)	
(c) Diffuser	Any distance except as shown under Intermediate-Temperature Rating column	*Downward discharge:* Cylinder with 1 ft 0 in. (300 mm) radius from edge extending 1 ft 0 in. (300 mm) below and 2 ft 6 in. (750 mm) above	
		Horizontal discharge: Semicylinder or cylinder with 2 ft 6 in. (750 mm) radius from edge in direction of flow extending 1 ft 0 in. (300 mm) below and 2 ft 6 in. (750 mm) above	
(2) Unit heater and radiant heater			
(a) Horizontal discharge		*Discharge side:* 7 ft 0 in. (2.1 m) to 20 ft 0 in. (6.1 m) radius pie-shaped cylinder *(see Figure 9.4.2.5)* extending 7 ft 0 in. (2.1 m) above and 2 ft 0 in. (600 mm) below heater; also 7 ft 0 in. (2.1 m) radius cylinder more than 7 ft 0 in. (2.1 m) above unit heater	7 ft 0 in. (2.1 m) radius cylinder extending 7 ft 0 in. (2.1 m) above and 2 ft 0 in. (600 mm) below unit heater
(b) Vertical downward discharge *(for sprinklers below unit heater, see Figure 9.4.2.5)*		7 ft 0 in. (2.1 m) radius cylinder extending upward from an elevation 7 ft 0 in. (2.1 m) above unit heater	7 ft 0 in. (2.1 m) radius cylinder extending from the top of the unit heater to an elevation 7 ft 0 in. (2.1 m) above unit heater

Type of Heat Condition	Ordinary-Temperature Rating	Intermediate-Temperature Rating	High-Temperature Rating
(3) Steam mains (uncovered)			
(a) Above	More than 2 ft 6 in. (750 mm)	2 ft 6 in. or less (750 mm)	
(b) Side and below	More than 1 ft 0 in. (300 mm)	1 ft 0 in. or less (300 mm)	
(c) Blowoff valve	More than 7 ft 0 in. (2.1 m)		7 ft 0 in. or less (2.1 m)

Table 9.4.2.5(b) Temperature Ratings of Sprinklers in Specified Residential Areas

	Minimum Distance from Edge of Source to Ordinary-Temperature Sprinkler		Minimum Distance from Edge of Source to Intermediate-Temperature Sprinkler	
Heat Source	in.	mm	in.	mm
Side of open or recessed fireplace	36	900	12	300
Front of recessed fireplace	60	1500	36	900
Coal- or wood-burning stove	42	1050	12	300
Kitchen range	18	450	9	225
Wall oven	18	450	9	225
Hot air flues	18	450	9	225
Uninsulated heat ducts	18	450	9	225
Uninsulated hot water pipes	12	300	6	150
Side of ceiling- or wall-mounted hot air diffusers	24	600	12	300
Front of wall-mounted hot air diffusers	36	900	18	450
Hot water heater or furnace	6	150	3	75
Light fixture except LED:				
0 W–250 W	6	150	3	75
250 W–499 W	12	300	6	150

Figure 9.4.2.5 High-Temperature and Intermediate-Temperature Zones at Unit Heaters and Radiant Heaters.



9.4.2.6

In case of occupancy change involving temperature change, the sprinklers shall be changed accordingly.

9.4.2.7 *

The minimum temperature rating of ceiling sprinklers in general storage, rack storage, rubber tire storage, roll paper storage, and baled cotton storage applications shall be 150°F (66°C).

9.4.2.8

Listed residential sprinklers of intermediate temperature rating shall be permitted to be installed throughout areas where residential sprinklers are required or permitted.

9.4.2.9

Listed quick response sprinklers of ordinary and/or intermediate temperature rating shall be permitted to be installed throughout areas where quick response sprinklers are required or permitted.

9.4.3 Thermal Sensitivity.

9.4.3.1

Sprinklers in light hazard occupancies shall be one of the following:

(1) Quick-response type as defined in 3.3.223.4.16
(2) Residential sprinklers in accordance with the requirements of Chapter 12
(3) Quick-response CMSA sprinklers

(4) ESFR sprinklers

9.4.3.2

Where quick-response sprinklers are installed, all sprinklers within a compartment shall be quick-response unless otherwise permitted in 9.4.3.3, 9.4.3.4, or 9.4.3.5.

9.4.3.3

Where there are no listed quick-response sprinklers in the temperature range required, standard-response sprinklers shall be permitted to be used.

9.4.3.4

The provisions of 9.4.3.2 shall not apply to in-rack sprinklers.

9.4.3.5

In other than light hazard occupancies, where a sprinkler carries a listing for both standard-response protection and quick-response protection at different coverage areas, that sprinkler shall be permitted to be installed within a compartment at the spacing for both the quick-response and standard-response listings without any separation between the areas so covered.

9.4.4 Sprinklers with K-Factors Less than K-5.6 (80).

9.4.4.1

Sprinklers shall have a minimum nominal K-factor of 5.6 (80) unless otherwise permitted by 9.4.4.

9.4.4.2

For light hazard occupancies, sprinklers having a nominal K-factor smaller than K-5.6 (80) shall be permitted, subject to the following restrictions:

(1) The system shall be hydraulically calculated.
(2) Sprinklers with nominal K-factors of less than K-5.6 (80) shall be installed only in wet pipe sprinkler systems or in accordance with the limitations of 9.4.4.3 or 9.4.4.4.
(3) A listed strainer shall be provided on the supply side of sprinklers with nominal K-factors of less than K-2.8 (40).

9.4.4.3

Sprinklers with nominal K-factors of less than K-5.6 (80) shall be permitted to be installed in conformance with 19.3.2 for protection against exposure fires.

9.4.4.4

Sprinklers with nominal K-factors of K-4.2 (57) shall be permitted to be installed on dry pipe and preaction systems protecting light hazard occupancies where piping is corrosion resistant or internally galvanized.

9.4.5 Sprinklers in Ordinary Hazard Group 2 Occupancies with Ceilings Over 30 ft (9.1 m).

Sprinklers having a nominal K-factor less than K-11.2 (K-160) shall not be permitted for use in Ordinary Hazard Group 2 and higher occupancy hazards where the ceiling height is greater than 30 ft (9.1 m).

9.4.6 Thread Size Limitations.

Sprinklers having a K-factor exceeding K-5.6 (80) and having $\frac{1}{2}$ in. (15 mm) National Pipe Thread (NPT) shall not be installed in new sprinkler systems.

9.5 Position, Location, Spacing, and Use of Sprinklers.

9.5.1 General.

9.5.1.1

Sprinklers shall be located, spaced, and positioned in accordance with the requirements of Section 9.5.

9.5.1.2

Sprinklers shall be positioned to provide protection of the area consistent with the overall objectives of this standard by controlling the positioning and allowable area of coverage for each sprinkler.

9.5.1.3 *

In light and ordinary hazard occupancies, small areas created by architectural features shall be evaluated as follows:

(1) Where no additional floor area is created by the architectural features, no additional sprinkler protection is required.
(2) Where additional floor area is created by an architectural feature, no additional sprinkler protection is required, provided all of the following conditions are met:
    (a) The floor area does not exceed 18 ft^2 (1.7 m^2).
    (b) The floor area is not greater than 2 ft (0.61 m) in depth at the deepest point of the architectural feature to the plane of the primary wall where measured along the finished floor.
    (c) The floor area is not greater than 9 ft (2.7 m) in length where measured along the plane of the primary wall.
    (d) Measurement from the deepest point of the architectural feature shall not exceed the maximum listed spacing of the sprinkler.
(3) The hydraulic design is not required to consider the area created by the architectural feature.

9.5.1.4

The requirements of 9.5.2 through 9.5.5 shall apply to all sprinkler types unless modified by more restrictive rules in Chapters 10 through 15.

9.5.2 Protection Areas per Sprinkler.

9.5.2.1 Determination of Protection Area of Coverage.

9.5.2.1.1

The protection area of coverage per sprinkler (A_s) shall be determined as follows:

(1) Along branch lines as follows:
    (a) Determine distance between sprinklers (or to wall or obstruction in the case of the end sprinkler on the branch line) upstream and downstream
    (b) Choose the larger of either twice the distance to the wall or the distance to the next sprinkler
    (c) Define dimension as *S*
(2) Between branch lines as follows:
    (a) Determine perpendicular distance to the sprinkler on the adjacent branch line (or to a wall or obstruction in the case of the last branch line) on each side of the branch line on which the subject sprinkler is positioned
    (b) Choose the larger of either twice the distance to the wall or obstruction or the distance to the next sprinkler
    (c) Define dimension as *L*

9.5.2.1.2

The protection area of coverage of the sprinkler shall be established by multiplying the *S* dimension by the *L* dimension, as follows:

$$A_s = S \times L \qquad [9.5.2.1.2]$$

9.5.2.2 Maximum Protection Area of Coverage.

9.5.2.2.1

The maximum allowable protection area of coverage for a sprinkler (A_s) shall be in accordance with the value indicated in the section for each type or style of sprinkler.

9.5.2.2.2

The maximum area of coverage of any sprinkler shall not exceed 400 ft^2 (37 m^2).

9.5.3 Sprinkler Spacing.

9.5.3.1 Maximum Distance Between Sprinklers.

9.5.3.1.1

The maximum distance permitted between sprinklers shall be based on the centerline distance between adjacent sprinklers.

9.5.3.1.2

The maximum distance shall be measured along the slope of the ceiling.

9.5.3.1.3

The maximum distance permitted between sprinklers shall comply with the value indicated in the applicable section for each type or style of sprinkler.

9.5.3.2 Maximum Distance from Walls.

9.5.3.2.1

The distance from sprinklers to walls shall not exceed one-half of the allowable maximum distance between sprinklers.

9.5.3.2.2

The distance from the wall to the sprinkler shall be measured perpendicular to the wall.

9.5.3.2.3 *

The distance from the wall to the sprinkler shall be measured to the wall behind furniture.

9.5.3.2.4

The distance from the wall to the sprinkler shall be measured to the wall when sprinklers are spaced near windows and no additional floor space is created.

9.5.3.3 Minimum Distance from Walls.

9.5.3.3.1

The minimum distance permitted between a sprinkler and the wall shall comply with the value indicated in the applicable section for each type or style of sprinkler.

9.5.3.3.2

The distance from the wall to the sprinkler shall be measured perpendicular to the wall.

9.5.3.4 Minimum Distance Between Sprinklers.

9.5.3.4.1

A minimum distance shall be maintained between sprinklers to prevent operating sprinklers from wetting adjacent sprinklers and to prevent skipping of sprinklers.

9.5.3.4.2

The minimum distance permitted between sprinklers shall comply with the value indicated in the applicable section for each type or style of sprinkler.

9.5.3.4.3

The minimum distance to be maintained between sprinklers shall not apply when either one of the affected sprinklers is capable of protecting the room or space without the other sprinkler having to operate.

9.5.4 Deflector Position.

9.5.4.1 * Distance Below Ceilings.

9.5.4.1.1

The distances between the sprinkler deflector and the ceiling above shall be selected based on the type of sprinkler and the type of construction.

9.5.4.1.2 Corrugated Metal Deck Roofs.

9.5.4.1.2.1

For corrugated metal deck roofs up to 3 in. (75 mm) in depth, the distance shall be measured to the sprinkler from the bottom of the deck.

9.5.4.1.2.2

For decks deeper than 3 in. (75 mm), the distance shall be measured to the highest point on the deck.

9.5.4.1.3

For ceilings that have insulation installed directly against underside of the ceiling or roof structure, the deflector distance shall be measured from the bottom of the insulation and shall be in accordance with 9.5.4.1.3.1, 9.5.4.1.3.2, and 9.5.4.1.3.3.

9.5.4.1.3.1

Insulation used to measure sprinkler deflector distance shall be batt insulation or insulation that withstands 3 lb/ft^2 (0.13 kg/m^2) uplift force.

9.5.4.1.3.2

For insulation that is installed directly against the ceiling or roof structure and is installed flat and parallel to the ceiling or roof structure, the deflector distance shall be measured to the underside of the insulation.

9.5.4.1.3.3

For insulation that is installed in a manner that causes it to deflect or sag down from the ceiling or roof structure, the deflector distance shall be measured as half of the distance of the deflection from the insulation high point to the insulation low point.

(A)

If the deflection or sag in the insulation exceeds 6 in. (150 mm), the deflector distance shall be measured to the high point of the insulation.

(B)

The deflector shall not be positioned above the low point of the insulation.

9.5.4.1.4 *

Heat collectors shall not be used as a means to assist the activation of a sprinkler.

9.5.4.2 Deflector Orientation.

Except as required in 9.5.4.3, deflectors of sprinklers shall be aligned parallel to ceilings, roofs, or the incline of stairs.

9.5.4.3

Deflectors of sprinklers shall be oriented as follows:

(1) Where ceilings have a slope of 2 in 12 or less, deflectors of sprinklers shall be aligned parallel to ceilings, roofs, or the incline of stairs, or parallel to the floor.
(2) Where ceilings have a slope of more than 2 in 12 and sprinklers protect nonstorage hazards in accordance with Chapter 19, deflectors of sprinklers shall be aligned parallel to ceilings, roofs, or the incline of stairs, or parallel to the floor.
(3)* Where sprinklers are installed under ceilings with a slope that exceeds 2 in 12 (16.7 percent) and protect storage in accordance with Chapters 20 through 26, deflectors of sprinklers shall be aligned parallel to the floor of the storage area.

9.5.5 Obstructions to Sprinkler Discharge.

9.5.5.1 * General.

Sprinklers shall be arranged in accordance with 9.5.5.2 and 9.5.5.3 to minimize obstructions to discharge, or supplemental sprinklers shall be provided to ensure adequate coverage of the hazard.

9.5.5.2 * Obstructions to Sprinkler Discharge Pattern Development.

9.5.5.2.1

Obstructions, continuous or noncontinuous, individual or grouped, less than or equal to 18 in. (450 mm) below the sprinkler deflector that prevent the pattern from fully developing shall comply with 9.5.5.2.

9.5.5.2.2

Sprinklers shall be positioned in accordance with the minimum distances and special requirements of Section 10.2 through Section 14.2 so that they are located sufficiently away from obstructions such as truss webs and chords, pipes, columns, and fixtures.

9.5.5.3 Obstructions that Prevent Sprinkler Discharge from Reaching Hazard.

9.5.5.3.1 *

Obstructions, continuous or noncontinuous, individual or grouped, that interrupt the water discharge in a horizontal plane more than 18 in. (450 mm) below the sprinkler deflector in a manner to limit the distribution from reaching the protected hazard shall comply with 9.5.5.3.

9.5.5.3.2 Obstructions Over 4 ft (1.2 m) in Width.

9.5.5.3.2.1 *

Supplemental sprinklers shall be installed below fixed obstructions, including open grate flooring, over 4 ft (1.2 m) in width.

9.5.5.3.2.2 *

Supplemental sprinklers shall not be required below obstructions that are not fixed in place.

9.5.5.3.2.3

Supplemental sprinklers shall not be required below noncombustible obstructions over 4 ft (1.2 m) wide where the bottom of the obstruction is 24 in. (600 mm) or less above the floor or deck.

9.5.5.3.3 Supplemental Sprinklers.

9.5.5.3.3.1

Supplemental sprinklers shall be quick response, or have a fast-response thermal element, having a nominal ordinary temperature rating unless otherwise required by 7.2.4 or 9.4.2.5.

9.5.5.3.3.2

Unless the requirements of 9.5.5.3.3.3 are met, supplemental sprinklers shall have the same K-factor value, orientation, and coverage type characteristics as the ceiling sprinklers.

9.5.5.3.3.3

Supplemental sprinklers shall be permitted to have different K-factor value, orientation, and coverage-type characteristics than those of the ceiling sprinklers when the requirements of Section 19.5 are met.

9.5.5.3.3.4

Supplemental sprinklers shall be equipped with a water shield or otherwise shielded from the discharge of overhead sprinklers where they are installed for any of the following conditions:

(1) Under non-flat obstructions
(2) Under non-solid obstructions
(3) Beyond the outer edges of the obstructions
(4) Under open grating

9.5.5.3.4 Position and Spacing of Supplemental Sprinklers.

9.5.5.3.4.1 *

Supplemental sprinklers shall be positioned below obstructions in accordance with one of the following:

(1) Installed below the obstruction
(2) Installed adjacent to the obstruction not more than 3 in. (75 mm) from the outside edge of the obstruction

9.5.5.3.4.2

Supplemental sprinklers shall be permitted to be spaced in accordance with unobstructed construction requirements for the hazards they protect, unless otherwise modified elsewhere in this standard.

9.5.5.4 Closets.

In all closets and compartments, including those closets housing mechanical equipment, that are not larger than 400 ft^3 (11.3 m^3) in size, a single sprinkler at the highest ceiling level shall be sufficient without regard to clearance, obstructions, or minimum distance to the wall.