19.1 General.

The requirements of Section 19.1 shall apply to all sprinkler systems unless modified by a specific section of Chapter 19 or Chapter 20.

19.1.1 *

A building or portion thereof shall be permitted to be protected in accordance with any applicable design approach at the discretion of the designer.

19.1.2 * Adjacent Hazards or Design Methods.

For buildings with two or more adjacent hazards or design methods, the following shall apply:

(1) Where areas are not physically separated by a draft curtain, barrier, or partition capable of delaying heat from a fire in one area from fusing sprinklers in the adjacent area, the required sprinkler protection for the more demanding design basis shall extend 15 ft (4.6 m) beyond its perimeter.
(2) The requirements of 19.1.2(1) shall not apply where the areas are separated by a draft curtain, or barrier located above an aisle, where the aisle has a minimum 2 ft (600 mm) horizontal separation from the adjacent hazard on each side, or a partition that is capable of delaying heat from a fire in one area from fusing sprinklers in the adjacent area.
(3) The requirements of 19.1.2(1) shall not apply to the extension of more demanding criteria from an upper ceiling level to beneath a lower ceiling level where the difference in height between the ceiling levels is at least 2 ft (600 mm), located above an aisle, where the aisle has a minimum 2 ft (600 mm) horizontal separation from the adjacent hazard on each side.

19.1.3

For hydraulically calculated systems, the total system water supply requirements for each design basis shall be determined in accordance with the procedures of Section 28.2 unless modified by a section of Chapter 19 or Chapter 20.

19.1.4 Water Demand.

19.1.4.1

The water demand requirements shall be determined from the following:

(1) Occupancy hazard fire control approach and special design approaches of Chapter 19
(2) Storage design approaches of Chapter 20 through Chapter 25
(3) Special occupancy approaches of Chapter 27

(See A.4.2.)

19.1.4.2 *

The minimum water demand requirements for a sprinkler system shall be determined by adding the hose stream allowance to the water demand for sprinklers.

19.1.5 Water Supplies.

19.1.5.1

The minimum water supply shall be available for the minimum duration specified in Chapter 19.

19.1.5.2 *

Tanks shall be sized to supply the equipment that they serve.

19.1.5.3 *

Pumps shall be sized to supply the equipment that they serve.

19.1.6 Hose Allowance.

19.1.6.1 Systems with Multiple Hazard Classifications.

For systems with multiple hazard classifications, the hose stream allowance and water supply duration shall be in accordance with one of the following:

(1) The water supply requirements for the highest hazard classification within the system shall be used.
(2) The water supply requirements for each individual hazard classification shall be used in the calculations for the design area for that hazard.
(3)* For systems with multiple hazard classifications where the higher classification only lies within single rooms less than or equal to 400 ft^2 (37 m^2) in area with no such rooms adjacent, the water supply requirements for the principal occupancy shall be used for the remainder of the system.

19.1.6.2 *

Water allowance for outside hose shall be added to the sprinkler requirement at the connection to the city main or a private fire hydrant, whichever is closer to the system riser.

19.1.6.3

Where inside hose connections are planned or are required, the following shall apply:

(1) A total water allowance of 50 gpm (190 L/min) for a single hose connection installation shall be added to the sprinkler requirements.
(2) A total water allowance of 100 gpm (380 L/min) for a multiple hose connection installation shall be added to the sprinkler requirements.
(3) The water allowance shall be added in 50 gpm (190 L/min) increments beginning at the most remote hose connection, with each increment added at the pressure required by the sprinkler system design at that point.

19.1.6.3.1

Where the system is a combined sprinkler/standpipe system (Class I or Class III) and the building is fully sprinklered in accordance with NFPA 13, no inside hose demand shall be required at any of the standpipe outlets.

19.1.6.4 *

When hose valves for fire department use are attached to wet pipe sprinkler system risers in accordance with 16.15.2, the following shall apply:

(1) The sprinkler system demand shall not be required to be added to standpipe demand as determined from NFPA 14.
(2) Where the combined sprinkler system demand and hose stream allowance of Table 19.2.3.1.2 exceeds the requirements of NFPA 14, this higher demand shall be used.
(3) For partially sprinklered buildings, the sprinkler demand, not including hose stream allowance, as indicated in Chapters 19 through 28 shall be added to the requirements given in NFPA 14.

19.1.7 * High Volume Low Speed (HVLS) Fans.

19.1.7.1

The installation of HVLS fans in buildings equipped with sprinklers, including ESFR sprinklers, shall comply with the following:

(1) The maximum fan diameter shall be 24 ft (7.3 m).
(2) The HVLS fan shall be centered approximately between four adjacent sprinklers.
(3) The vertical clearance from the HVLS fan to sprinkler deflector shall be a minimum of 36 in. (900 mm).
(4) All HVLS fans shall be interlocked to shut down immediately upon a waterflow alarm.

19.1.7.2

Where a building is protected with a fire alarm system, the interlock required by 19.1.7.1(4) shall be in accordance with the requirements of *NFPA 72* or other approved fire alarm code.

19.2 Occupancy Hazard Fire Control Approach for Spray Sprinklers.

19.2.1 General.

19.2.1.1 *

The water demand requirements shall be determined by either the pipe schedule method in accordance with 19.2.2 or the hydraulic calculation method in accordance with 19.2.3.

19.2.1.2 Occupancy Classifications.

19.2.1.2.1

Occupancy classifications for this standard shall relate to sprinkler installations and their water supplies only.

19.2.1.2.2

Occupancy classifications shall not be used as a general classification of occupancy hazards.

19.2.1.2.3

Occupancies or portions of occupancies shall be classified according to the quantity and combustibility of contents, the expected rates of heat release, the total potential for energy release, the heights of stockpiles, and the presence of flammable and combustible liquids, using the definitions contained in 4.3.2 through 4.3.5.

19.2.1.2.4

Classifications shall be as follows:

(1) Light hazard
(2) Ordinary hazard (Groups 1 and 2)
(3) Extra hazard (Groups 1 and 2)
(4) Special occupancy hazard *(see Chapter 27)*

19.2.2 Water Demand Requirements — Pipe Schedule Method.

19.2.2.1

Table 19.2.2.1 shall be used in determining the minimum water supply requirements for light and ordinary hazard occupancies protected by systems with pipe sized according to the pipe schedules of Section 28.5.

Table 19.2.2.1 Water Supply Requirements for Pipe Schedule Sprinkler Systems

Occupancy Classification	Minimum Residual Pressure Required		Acceptable Flow at Base of Riser (Including Hose Stream Allowance)		Duration (minutes)
	psi	bar	gpm	L/min	
Light hazard	15	1	500–750	1900–2850	30 or 60
Ordinary hazard	20	1.4	850–1500	3200–5700	60 or 90

19.2.2.2

Pressure and flow requirements for extra hazard occupancies shall be based on the hydraulic calculation methods of 19.2.3, except as permitted by 19.2.2.3(2).

19.2.2.3

The pipe schedule method shall be permitted as follows:

(1) New systems of 5000 ft^2 (465 m^2) or less
(2) New systems exceeding 5000 ft^2 (465 m^2) where the flows required in Table 19.2.2.1 are available at a minimum residual pressure of 50 psi (3.4 bar) at the highest elevation of sprinkler

19.2.2.4

The lower duration value of Table 19.2.2.1 shall be acceptable only where the sprinkler system waterflow alarm device(s) and supervisory device(s) are electrically supervised and such supervision is monitored at an approved, constantly attended location.

19.2.2.5 * Residual Pressure.

19.2.2.5.1

The residual pressure requirement of Table 19.2.2.1 shall be met at the elevation of the highest sprinkler.

19.2.2.5.2 Friction Loss Due to Backflow Prevention Valves.

19.2.2.5.2.1

When backflow prevention valves are installed on pipe schedule systems, the friction losses of the device shall be accounted for when determining acceptable residual pressure at the top level of sprinklers.

19.2.2.5.2.2

The friction loss of this device [in psi (bar)] shall be added to the elevation loss and the residual pressure at the top row of sprinklers to determine the total pressure needed at the water supply.

19.2.2.6

The lower flow figure of Table 19.2.2.1 shall be permitted only where the building is of noncombustible construction or the potential areas of fire are limited by building size or compartmentation such that no open areas exceed 3000 ft^2 (280 m^2) for light hazard or 4000 ft^2 (370 m^2) for ordinary hazard.

19.2.3 Water Demand Requirements — Hydraulic Calculation Methods.

19.2.3.1 General.

19.2.3.1.1

The water demand for sprinklers shall be determined only from one of the following, at the discretion of the designer:

(1) For new systems, the density/area selected from Table 19.2.3.1.1 in accordance with the density/area method of 19.2.3.2
(2) The room that creates the greatest demand in accordance with the room design method of 19.2.3.3
(3) Special design areas in accordance with 19.2.3.4

Table 19.2.3.1.1 Density/Area Criteria

Hazard Classification	Density/Area Criteria for Situations Where the Design Area is Not Required to be 3000 ft^2 (280 m^2) per 19.2.3.1.5	Density/Area Criteria for Situations Where the Design Area is Required to be 3000 ft^2 (280 m^2) per 19.2.3.1.5
Light Hazard	0.1 gpm per ft^2 over 1500 ft^2 (4.1 mm/min over 140 m^2)	0.07 gpm per ft^2 over 3000 ft^2(2.9 mm/min over 280 m^2)
Ordinary Hazard (Group 1)	0.15 gpm per ft^2 over 1500 ft^2(6.1 mm/min over 140 m^2)	0.12 gpm per ft^2 over 3000 ft^2(4.9 mm/min over 280 m^2)
Ordinary Hazard (Group 2)	0.2 gpm per ft^2 over 1500 ft^2 (8.1 mm/min over 140 m^2)	0.17 gpm per ft^2 over 3000 ft^2(6.9 mm/min over 280 m^2)
Extra Hazard (Group 1)	0.3 gpm per ft^2 over 2500 ft^2 (12.2 mm/min over 230 m^2)	0.28 gpm per ft^2 over 3000 ft^2(11.4 mm/min over 280 m^2)
Extra Hazard (Group 2)	0.4 gpm per ft^2 over 2500 ft^2 (16.3 mm/min over 230 m^2)	0.38 gpm per ft^2 over 3000 ft^2(15.5 mm/min over 280 m^2)

19.2.3.1.2

The minimum water supply shall be available for the minimum duration specified in Table 19.2.3.1.2.

Table 19.2.3.1.2 Hose Stream Allowance and Water Supply Duration Requirements for Hydraulically Calculated Systems

	Inside Hose		Total Combined Inside and Outside Hose		
Occupancy	gpm	L/min	gpm	L/min	Duration (minutes)
Light hazard	0, 50, or 100	0, 190, or 380	100	380	30
Ordinary hazard	0, 50, or 100	0, 190, or 380	250	950	60 or 90
Extra hazard	0, 50, or 100	0, 190, or 380	500	1900	90 or 120

19.2.3.1.3

The lower duration values in Table 19.2.3.1.2 shall be permitted where the sprinkler system waterflow alarm device(s) and supervisory device(s) are electrically supervised and such supervision is monitored at an approved, constantly attended location.

19.2.3.1.4 Restrictions.

When either the density/area method or room design method is used, the following shall apply:

(1)* For areas of sprinkler operation less than 1500 ft^2 (140 m^2) used for light and ordinary hazard occupancies, the density for 1500 ft^2 (140 m^2) shall be used.

(2) For areas of sprinkler operation less than 2500 ft^2 (230 m^2) for extra hazard occupancies, the density for 2500 ft^2 (230 m^2) shall be used.

19.2.3.1.5 Unsprinklered Combustible Concealed Spaces.

19.2.3.1.5.1 *

When using the density/area or room design method, unless the requirements of 19.2.3.1.5.2 are met for buildings having unsprinklered combustible concealed spaces, as described in 9.2.1 and 9.2.2, the minimum area of sprinkler operation for that portion of the building shall be 3000 ft^2 (280 m^2).

(A)

The design area of 3000 ft^2 (280 m^2) shall be applied only to the sprinkler system or portions of the sprinkler system that are adjacent to the qualifying combustible concealed space.

(B)

The term *adjacent* shall apply to any sprinkler system protecting a space above, below, or next to the qualifying concealed space except where a barrier with a fire resistance rating at least equivalent to the water supply duration completely separates the concealed space from the sprinklered area.

19.2.3.1.5.2

The following unsprinklered concealed spaces shall not require a minimum area of sprinkler operation of 3000 ft^2 (280 m^2):

(1) Noncombustible and limited-combustible concealed spaces with minimal combustible loading having no access, including those with small openings such as those used as return air for a plenum

(2) Noncombustible and limited-combustible concealed spaces with limited access and not permitting occupancy or storage of combustibles, including those with small openings such as those used as return air for a plenum

(3) Combustible concealed spaces filled entirely with noncombustible insulation

(4)* Light or ordinary hazard occupancies where noncombustible or limited-combustible ceilings are directly attached to the bottom of solid wood joists or solid limited-combustible construction or noncombustible construction 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 concealed space

(5) Concealed spaces where rigid materials are used and the exposed surfaces comply with one of the following in the form in which they are installed in the space:

(a) 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 in the form in which they are installed in the space

(b) 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)*

(6) Concealed spaces in which the exposed materials are constructed entirely of fire-retardant-treated wood as defined by NFPA 703

(7) Concealed spaces over isolated small rooms not exceeding 55 ft^2 (5.1 m^2) in area

(8) Vertical pipe chases under 10 ft^2 (0.9 m^2), provided that in multifloor buildings the chases are constructed with blocking at each floor and pipe penetrations at each floor are properly sealed, and where such pipe chases contain no sources of ignition, and piping is noncombustible

(9) Exterior columns under 10 ft^2 (0.9 m^2) in area formed by studs or wood joists, supporting exterior canopies that are fully protected with a sprinkler system

(10)* Light or ordinary hazard occupancies where noncombustible or limited-combustible ceilings are attached to the bottom of composite wood joists either directly or on to metal channels not exceeding 1 in. (25 mm) in depth, provided the adjacent joist channels are constructed with blocking so that volumes not exceeding 160 ft^3 (4.5 m^3) using materials equivalent to $\frac{1}{2}$ in. (13 mm) gypsum board, 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

(11) Cavities within unsprinklered wall spaces

(12) Exterior soffits, eaves, overhangs, and decorative frame elements complying with 9.2.1.20

19.2.3.2 Density/Area Method.

19.2.3.2.1 Water Supply.

19.2.3.2.1.1

The water supply requirement for sprinklers only shall be calculated from Table 19.2.3.1.1 or from Chapter 27 where density/area criteria are specified for special occupancy hazards.

19.2.3.2.2 Sprinklers.

19.2.3.2.2.1

The densities and areas provided in Table 19.2.3.1.1 shall be for use only with spray sprinklers.

19.2.3.2.2.2

Quick-response sprinklers shall not be permitted for use in extra hazard occupancies or other occupancies where there are substantial amounts of flammable liquids or combustible dusts.

19.2.3.2.2.3

For extended coverage sprinklers, the minimum design area shall be that corresponding to the hazard in Table 19.2.3.1.1 or the area protected by five sprinklers, whichever is greater.

19.2.3.2.2.4

Extended coverage sprinklers shall be listed with and designed for the minimum flow corresponding to the density selected from the smallest design area of Table 19.2.3.1.1 for the hazard as specified.

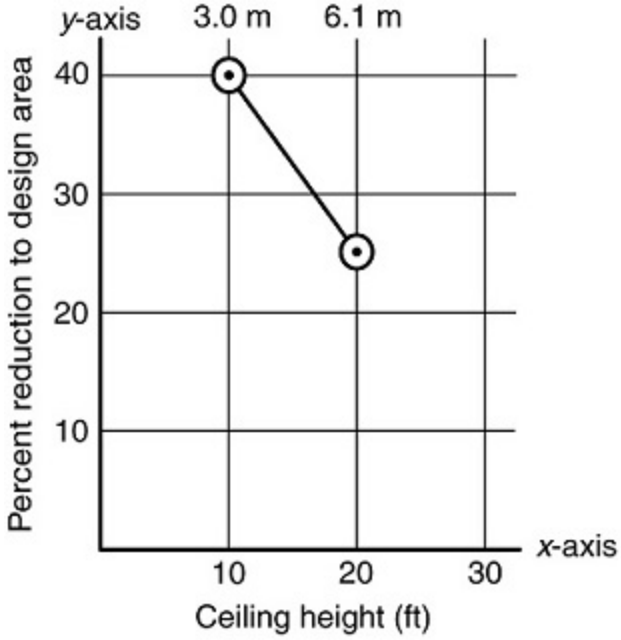
19.2.3.2.3 Quick-Response Sprinklers.

19.2.3.2.3.1

Where listed quick-response sprinklers, including extended coverage quick-response sprinklers, are used throughout a system or portion of a system having the same hydraulic design basis, the system area of operation shall be permitted to be reduced without revising the density as indicated in Figure 19.2.3.2.3.1 when all of the following conditions are satisfied:

(1) Wet pipe system
(2) Light hazard or ordinary hazard occupancy
(3) 20 ft (6.1 m) maximum ceiling height
(4) No unprotected ceiling pockets as allowed by 10.2.10 and 11.2.7 exceeding 32 ft^2 (3.0 m^2)
(5) No unprotected areas above cloud ceilings as allowed by 9.2.7

Figure 19.2.3.2.3.1 Design Area Reduction for Quick-Response Sprinklers.



Note: $y = \frac{-3x}{2} + 55$ for US Customary Units

Note: $y = -4.8x + 54.6$ for SI Units

For ceiling height ≥10 ft and ≤20 ft, $y = \frac{-3x}{2} + 55$

For ceiling height <10 ft, $y = 40$

For ceiling height >20 ft, $y = 0$

For SI units, 1 ft = 0.31 m.

19.2.3.2.3.2

The number of sprinklers in the design area shall never be fewer than five.

19.2.3.2.3.3

Where quick-response sprinklers are used on a sloped ceiling or roof, the maximum ceiling or roof height shall be used for determining the percent reduction in design area.

19.2.3.2.4 Sloped Ceilings.

Where spray sprinklers, including extended-coverage and quick-response sprinklers, are installed under a ceiling/roof deck with a slope that exceeds 2 in 12, one of the following requirements shall be implemented:

(1) A horizontal false ceiling capable of withstanding an uplift force of 3 lb/ft^2 (14.6 kg/m^2) is installed below the sloped ceiling and supplemented with ceiling sprinklers.
(2) The design area for the ceiling sprinkler system is increased by 30 percent for unobstructed construction.
(3) Where the ceiling slope does not exceed 4 in 12, apply the sprinkler system criteria specified in Chapter 19 when all of the following conditions are met:
    (a) Purlins or beams supporting the roof deck run across the roof slope.
    (b) Purlins or beams do not exceed 18 in. (450 mm) deep.
    (c) Purlins or beams do not exceed 5 ft (1.5.m) on center.
    (d) Bays created by the solid structural members are not more than 40 ft (12 m) on center.
    (e) Purlin or beam channels are provided with blocking above each solid structural member.
(4) For obstructed construction where the ceiling slope does not exceed 4 in 12, install sprinklers in every channel.
(5) For obstructed construction that does not meet (3) or (4), the design area for the ceiling sprinkler system is increased by 30 percent.

19.2.3.2.5 * Sprinklers for Ceiling Heights Over 30 ft (9.1 m).

19.2.3.2.5.1 *

Sidewall sprinklers shall not be permitted for use in Ordinary Hazard Group 1 and higher occupancy hazards where the ceiling height is greater than 30 ft (9.1 m).

(A) *

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).

(B) *

Extended-coverage pendent sprinklers having a nominal K-factor of K-22.4 (K-320) or less 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).

(C) *

Standard-response standard-coverage sprinklers shall not be permitted for use in Ordinary Hazard Group 2 occupancies where the ceiling height is greater than 40 ft (12.2 m).

19.2.3.2.5.2 Sprinkler Density/Areas for Ceiling Heights Over 30 ft (9.1 m).

(A) *

For Ordinary Hazard Group 1 occupancies where the ceiling height is greater than 30 ft (9.1 m), the design areas obtained from Table 19.2.3.1.1 shall be increased by 30 percent.

(B) *

For Ordinary Hazard Group 2 occupancies where the ceiling height is greater than 30 ft (9.1 m) but does not exceed 40 ft (12.2 m), the ceiling sprinkler system shall use a minimum density of 0.37 gpm/ft^2 (15.1 mm/min) in combination with the design area obtained from Table 19.2.3.1.1.

(C) *

For Ordinary Hazard Group 2 occupancies where the ceiling height is greater than 40 ft (12.2 m), the ceiling sprinkler system shall comply with the following:

(1) Use a minimum density of 0.45 gpm/ft^2 (18.3 mm/min)
(2) Increase the design areas obtained from Table 19.2.3.1.1 by 30 percent
(3) Use the design areas from Table 19.2.3.1.1, without a 30 percent increase, where an extended-coverage sprinkler having a minimum nominal K-factor of K-25.2 (K-360) is used

(D) *

For Extra Hazard Groups 1 and 2 occupancies where the ceiling height is greater than 30 ft (9.1 m), the ceiling sprinkler system shall use a minimum density of 0.45 gpm/ft^2 (18.3 mm/min) in combination with the design areas obtained from Table 19.2.3.1.1.

19.2.3.2.6 * Dry Pipe and Double Interlock Preaction Systems.

For dry pipe systems and double interlock preaction systems, the area of sprinkler operation shall be increased by 30 percent without revising the density.

19.2.3.2.7 Extra Hazard Occupancies.

19.2.3.2.7.1

For extra hazard occupancies with ceilings not exceeding 30 ft (9.1 m) in height, the system area of sprinkler operation shall be permitted to be reduced by 25 percent without revising the density, but not to less than 2000 ft^2 (185 m^2) where one of the following conditions occurs:

(1) High-temperature sprinklers are used.
(2) K-11.2 (160) or larger sprinklers are used.

19.2.3.2.7.2

The 25 percent reduction permitted by 19.2.3.2.7.1 shall only be permitted to be applied once.

19.2.3.2.8 * Multiple Adjustments.

19.2.3.2.8.1

Where multiple adjustments to the area of operation are required to be made in accordance with 19.2.3.2.3, 19.2.3.2.4, 19.2.3.2.6, or 19.2.3.2.7, these adjustments shall be compounded based on the area of operation originally selected from Table 19.2.3.1.1.

19.2.3.2.8.2

If the building has unsprinklered combustible concealed spaces, the rules of 19.2.3.1.5 shall be applied after all other modifications have been made.

19.2.3.3 Room Design Method.

19.2.3.3.1 *

The water supply requirements for sprinklers only shall be based upon the room that creates the greatest demand.

19.2.3.3.2

The density selected shall be that from Table 19.2.3.1.1 corresponding to the occupancy hazard classification and room size.

19.2.3.3.3

All interior walls enclosing the room shall have a fire resistance rating equal to the water supply duration indicated in Table 19.2.3.1.2.

19.2.3.3.4

If the room is smaller than the area specified in Table 19.2.3.1.1 the provisions of 19.2.3.1.4(1) and 19.2.3.1.4(2) shall apply.

19.2.3.3.5

The minimum protection required for openings in interior walls shall be as follows:

(1) Light hazard — Nonrated automatic or self-closing doors shall be required.
(2) Light hazard with no opening protection — Calculations shall include the sprinklers in the room and two sprinklers in the communicating space nearest each such unprotected opening unless the communicating space has only one sprinkler, in which case calculations extend to the operation of that sprinkler. The selection of the room and communicating space sprinklers to be calculated shall be that which produces the greatest hydraulic demand. A minimum lintel depth of 8 in. (200 mm) shall be required for openings and openings shall not exceed 8 ft (2.4 m) in width. It shall be permitted to have a single opening of 36 in. (900 mm) or less without a lintel, provided there are no other openings to adjoining spaces.
(3) Ordinary and extra hazard — Automatic or self-closing doors with appropriate fire resistance ratings for the enclosure shall be required.

19.2.3.3.6

Where the room design method is used and the area under consideration is a corridor protected by a single row of sprinklers with protected openings in accordance with 19.2.3.3.5, the maximum number of sprinklers that needs to be calculated is five or, when extended coverage sprinklers are installed, all sprinklers contained within 75 linear feet (23 linear meters) of the corridor.

19.2.3.3.7

Where the area under consideration is a corridor protected by a single row of sprinklers with unprotected openings, in a light hazard occupancy, the design area shall include all sprinklers in the corridor to a maximum of five or, when extended coverage sprinklers are installed, all sprinklers within 75 linear feet (23 linear meters) of the corridor.

19.2.3.4 Special Design Areas.

19.2.3.4.1

Where the design area consists of a building service chute supplied by a separate riser, the maximum number of sprinklers that needs to be calculated is three, each with a minimum discharge of 15 gpm (57 L/min).

19.2.3.4.2 *

Where an area is to be protected by a single line of sprinklers, the design area shall include all sprinklers on the line up to a maximum of seven.

19.2.3.4.3

Sprinklers in ducts as described in Section 8.9 and 9.3.9 shall be hydraulically designed to provide a discharge pressure of not less than 7 psi (0.5 bar) at each sprinkler with all sprinklers within the duct flowing.

19.2.3.4.4 Stair Towers.

Stair towers, or other construction with incomplete floors, if piped on independent risers, shall be treated as one area with reference to pipe sizes.

19.3 Special Design Approaches.

19.3.1 Residential Sprinklers.

19.3.1.1 *

The design area shall be the area that includes the four adjacent sprinklers that produce the greatest hydraulic demand.

19.3.1.1.1

The room design method, in accordance with 19.2.3.3 and using light hazard criteria, shall be permitted.

19.3.1.2 *

Unless the requirements of 19.2.3.1.5.2 are met for buildings having unsprinklered combustible concealed spaces, as described in 9.2.1 and 9.3.18, the minimum design area of sprinkler operation for that portion of the building shall be eight sprinklers.

19.3.1.2.1

The design area of eight sprinklers shall be applied only to the portion of the residential sprinklers that are adjacent to the qualifying combustible concealed space.

19.3.1.2.2 *

The term *adjacent* shall apply to any sprinkler system protecting a space above, below, or next to the qualifying concealed space except where a barrier with a fire resistance rating at least equivalent to the water supply duration completely separates the concealed space from the sprinklered area.

19.3.1.3

The minimum required discharge from each design area sprinkler shall be the greater of the following:

(1) In accordance with minimum flow rates indicated in the sprinkler listings
(2) In rooms or compartments greater than 800 ft^2 (74 m^2), calculated based on delivering a minimum of 0.1 gpm/ft^2 (4.1 mm/min) over the design area in accordance with the provisions of 9.5.2.1
(3) In rooms or compartments 800 ft^2 (74 m^2) or less calculated based on delivering a minimum of 0.1 gpm/ft^2 (4.1 mm/min) over the room or the compartment using the area of the room divided by the number of sprinklers in the room

19.3.1.4

Where areas such as attics, basements, or other types of occupancies are outside of dwelling units but within the same structure, these areas shall be protected as a separate design basis in accordance with Section 19.1.

19.3.1.5

Hose stream allowance and water supply duration requirements shall be in accordance with those for light hazard occupancies in Table 19.2.3.1.2.

19.3.2 Exposure Protection.

19.3.2.1 *

Piping shall be hydraulically calculated in accordance with Section 28.2 to furnish a minimum of 7 psi (0.5 bar) at any sprinkler with all sprinklers facing the exposure operating.

19.3.2.2

Where the water supply feeds other fire protection systems, it shall be capable of furnishing total demand for such systems as well as the exposure system demand.

19.3.3 Water Curtains.

19.3.3.1

Sprinklers in a water curtain, such as that described in 9.3.5 or 9.3.13.2, shall be hydraulically designed to provide a discharge of 3 gpm per lineal foot (37 L/min per lineal meter) of water curtain with no sprinklers discharging less than 15 gpm (57 L/min).

19.3.3.2

For water curtains employing automatic sprinklers, the number of sprinklers calculated in this water curtain shall correspond to the length parallel to the branch lines in the area determined by 28.2.4.2.

19.3.3.3

If a single fire is expected to operate sprinklers within the water curtain and within the design area of a hydraulically calculated system, the water supply to the water curtain shall be added to the water demand of the hydraulic calculations and balanced to the calculated area demand.

19.3.3.4

Hydraulic design calculations shall include a design area selected to include ceiling sprinklers adjacent to the water curtain.

19.3.3.5

For a deluge system water curtain providing proscenium opening protection in accordance with 9.3.13.2, the water curtain shall be calculated to supply all of the open sprinklers attached thereto.

19.3.4 Sprinklers Under Roof or Ceiling in Combustible Concealed Spaces of Wood Joist or Wood Truss Construction with Members 3 ft (0.9 m) or Less on Center and Slope Having Pitch of 4 in 12 (33.3 percent) or Greater.

19.3.4.1

Where sprinkler spacing does not exceed 8 ft (2.4 m) measured perpendicular to the slope, the minimum sprinkler discharge pressure shall be 7 psi (0.5 bar).

19.3.4.2

Where sprinkler spacing exceeds 8 ft (2.4 m) measured perpendicular to the slope, the minimum sprinkler discharge pressure shall be 20 psi (1.4 bar).

19.3.4.3

Hose stream allowance and water supply duration requirements shall be in accordance with those for light hazard occupancies in Table 19.2.3.1.2.

19.3.5 Sprinkler-Protected Glazing.

Where the sprinkler-protected glazing is required to comply with 9.3.15, the water supply duration for the design area that includes the window sprinklers shall be not less than the required rating of the assembly.

19.3.5.1

For sprinkler-protected glazing, the number of sprinklers calculated for the glazing shall be the number in the length corresponding to the length parallel to the branch lines in the area determined by 28.2.4.2.

19.3.5.2

If a single fire can be expected to operate sprinklers for the sprinkler-protected glazing and within the design area of a hydraulically calculated system, the water supply to the sprinkler-protected glazing shall be added to the water demand of the hydraulic calculations and shall be balanced to the calculated area demand.

19.3.5.3

Hydraulic design calculations shall include a design area selected to include ceiling sprinklers adjacent to the sprinkler-protected glazing.

19.3.6

Where special sprinklers are listed for protection of features, system design shall be based on the listing requirements identified in the manufacturer’s instructions for the individual sprinkler being used, unless otherwise approved.

19.4 Deluge Systems.

Open sprinkler and deluge systems shall be hydraulically calculated according to applicable standards.

19.5 Design Approaches for Supplemental Sprinklers.

When required to be included in the hydraulic calculations in accordance with 28.2.4.7.4.3, the design approach for supplemental sprinklers shall be permitted to be based on the hazard located directly below the obstruction.