11.5.1.15 *High volume low speed (HVLS) ceiling-mounted fans*

For high volume low speed (HVLS) ceiling-mounted fans, a means of automatic shutdown shall be provided to shut down the power to the fan within 90 s after the first sprinkler operates (see Note). Where detectors are used, they shall be installed and spaced uniformly above the fan blade area to the detector spacing requirements.

The installation of the HVLS fan support structure and the fan drive assembly shall not obstruct the discharge pattern of the ceiling sprinklers.

NOTE: Smoke detection, heat detection, and water flow alarm devices may be used to achieve automatic shutdown of fans.

11.5.1.16 *Aisle storage*

Aisles located between storage racks shall be free of combustibles.

11.5.1.17 *Maximum floor area per installation control assembly*

The maximum floor area controlled by one installation control assembly shall be in accordance with Clauses 2.3.1.2, 2.3.1.3, 2.3.1.4 or 2.3.1.5, as appropriate.

11.5.1.18 *Clearance between top of storage and ceiling-level sprinkler deflector*

A minimum 0.9 m clearance shall be maintained between the top of the storage and the ceiling-level sprinkler deflectors.

11.5.1.19 *Obstructions*

11.5.1.19.1 *General*

Storage sprinklers shall be installed in accordance with Clauses 11.5.1.19.2 and 11.5.1.19.3 to ensure the water discharged from sprinklers is not significantly obstructed.

The two main factors affecting sprinkler system performance are—

(a) prompt sprinkler operation; and

(b) unobstructed sprinkler discharge to the fire area.

The sprinkler spray pattern orientation for evaluating obstructions shall be considered by determining the distance between the sprinkler and the closest point of the obstruction when measured horizontally relative to the floor as shown in Figure 11.5.1.19.1.

NOTE: The structure and services of a building have a major impact on both of these critical factors.

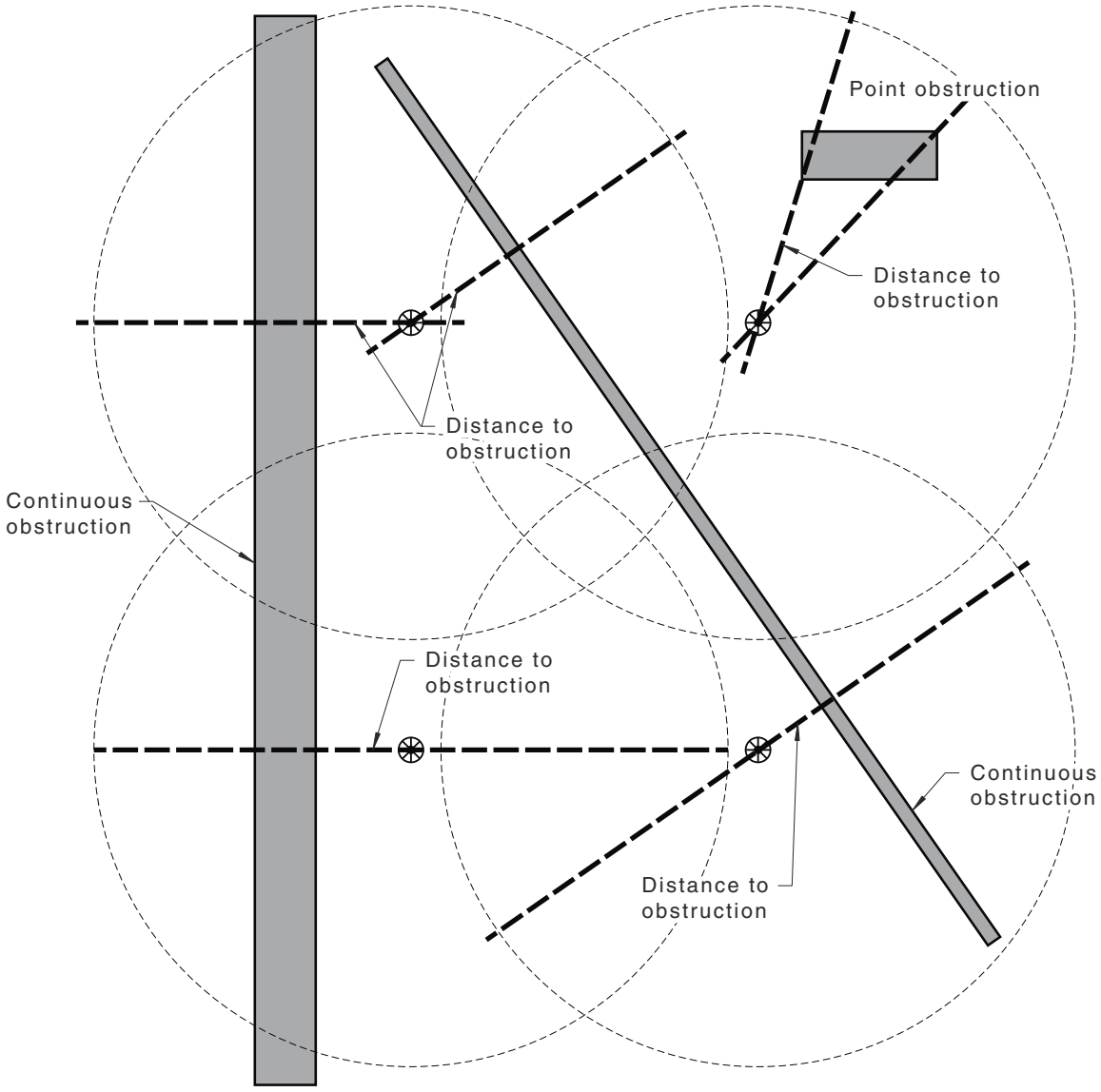

FIGURE 11.5.1.19.1 PLANE FOR MEASUREMENTS OF DISTANCE TO CONTINUOUS AND POINT OBSTRUCTIONS FOR BOTH SPRAY PATTERNS

11.5.1.19.2 *Obstruction to the spray pattern of ceiling-level storage sprinklers*

In addition to the relevant requirements in Clause 11.5.1, pendent and upright storage sprinklers shall be installed on standard spacing in accordance with Table 11.5.1.19.2(A) to avoid obstructing the sprinkler's spray pattern. Objects shall not be located less than 300 mm horizontally from the sprinkler below the horizontal plane of the sprinkler's deflector.

In addition to the relevant requirements in Clause 11.5.1, pendent and upright extended coverage storage sprinklers shall be installed in accordance with Table 11.5.1.19.2(B). Objects shall not be located less than 450 mm horizontally from the sprinkler below the horizontal plane of the sprinkler's deflector.

An object, located at or near ceiling level, that is entirely within the checkerboard pattern shown in Figure 11.5.1.19.2(A) or 11.5.1.19.2(B) shall not be deemed to be an obstruction to the sprinkler's spray pattern.

Any object located at or near ceiling level that extends downward into the area below the checkerboard pattern shown in Figure 11.5.1.19.2(A) or 11.5.1.19.2(B) shall be deemed to be an obstruction to the sprinkler's spray pattern, except under the following conditions:

(a) The object located at or near ceiling level is a structure member or similar that is at least 70% open.

(b) The object located at or near ceiling level is not wider than 75 mm in its least dimension and is separated from other objects by a minimum of 225 mm (see Clause 11.2.15.).

Obstructions shall be accounted for by using either one of the two following methods:

(i) The obstructed sprinkler shall be relocated so it complies with the horizontal and vertical distances recommended in Figure 11.5.1.19.2(A) or 11.5.1.19.2(B), while still meeting the installation requirements in Clause 11.5.

(ii) Sprinklers shall be installed on both sides of the obstruction at equal horizontal distances from the obstruction, and a minimum of 300 mm horizontally from the edge of the obstruction as follows.

NOTE: For a diagram of this arrangement, see Figure 11.5.1.19.2(C).

For objects wider than 600 mm that obstruct a sprinkler's spray distribution pattern, sprinklers shall be installed in accordance with Clause 11.5.1.19.3.

NOTE: Sprinklers are not required to be at equal horizontal distances from the obstruction if they are less than half the maximum allowable spacing from the obstruction on both sides.

TABLE 11.5.1.19.2(A)

MINIMUM HORIZONTAL DISTANCE OF CEILING OBJECTS TO AVOID OBSTRUCTING THE UMBRELLA PATTERNS OF STORAGE SPRINKLERS (NOT EXTENDED COVERAGE)

Maximum vertical distance of ceiling object located below sprinkler deflector, mm	Minimum horizontal distance from sprinkler to avoid obstructing umbrella pattern, mm
50	300
100	500
150	700
200	800
300	1000
500	1300
900	1800

TABLE 11.5.1.19.2(B)

MINIMUM HORIZONTAL DISTANCE OF CEILING OBJECTS TO AVOID OBSTRUCTING THE UMBRELLA PATTERNS OF EXTENDED COVERAGE SPRINKLERS

Maximum vertical distance of ceiling object located below sprinkler deflector, mm	Minimum horizontal distance from sprinkler to avoid obstructing umbrella pattern, mm
50	450
100	1200
150	1500
200	1800
300	2100
500	2700
900	3300

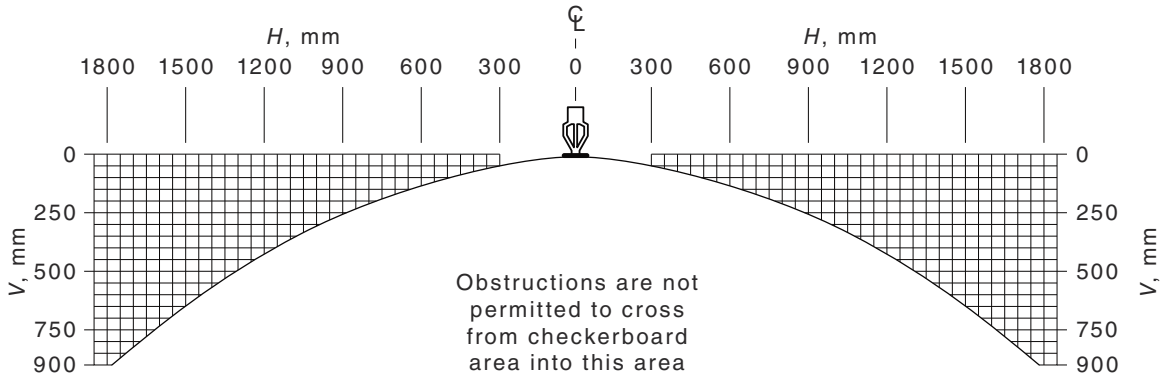

FIGURE 11.5.1.19.2(A) OBSTRUCTION TO SPRINKLER SPRAY PATTERN

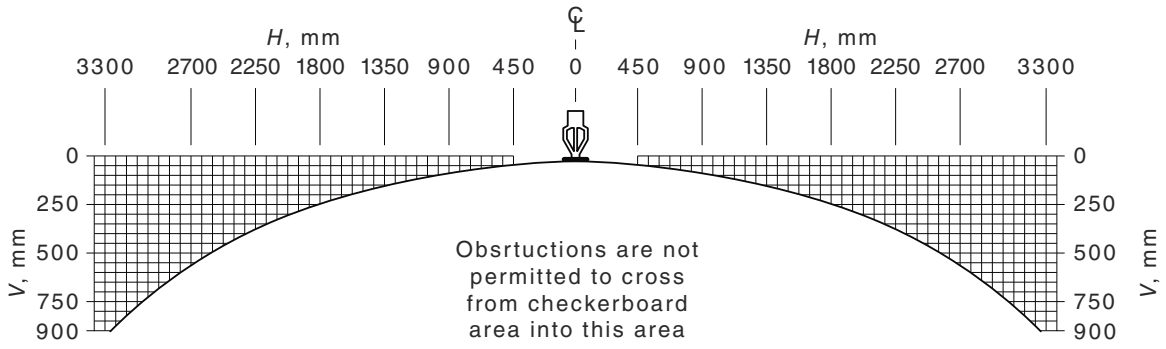

FIGURE 11.5.1.19.2(B) OBSTRUCTION TO EXTENDED COVERAGE SPRINKLER SPRAY PATTERN

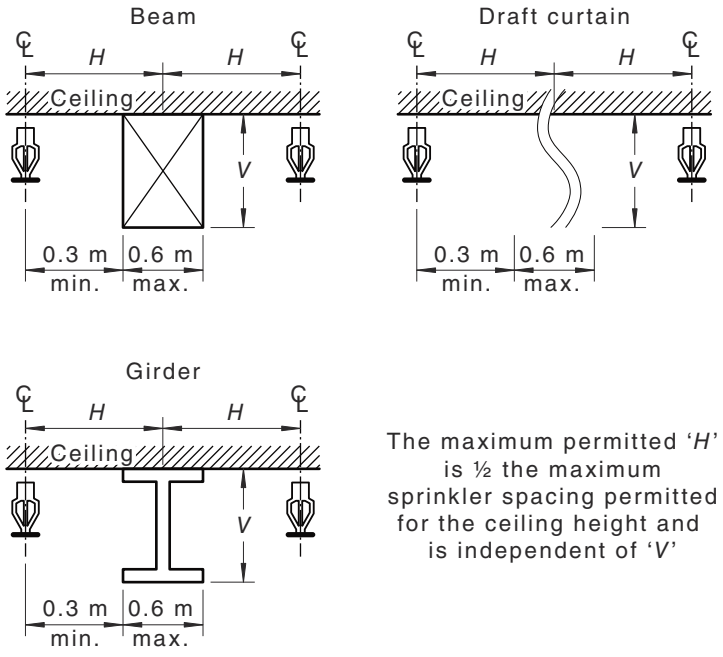

FIGURE 11.5.1.19.2(C) OBSTRUCTIONS FROM THE CEILING

11.5.1.19.3 *Obstruction to inner core discharge pattern of ceiling-level storage sprinklers*

In addition to other relevant requirements of Clause 11.5.1 and Clause 11.5.1.19.2, storage sprinklers shall be installed in accordance with Table 11.5.1.19.3 to avoid the sprinkler's inner core distribution pattern being obstructed by individual or grouped objects located below the sprinklers.

NOTE: For a definition of an individual object, see Clause 11.2.17; for a grouped object, see Clause 11.2.15.

An upright storage sprinkler shall be used as a replacement for an obstructed pendent sprinkler, provided all of the following criteria are met:

(a) The upright storage sprinkler has the same *K* factor, nominal temperature rating, nominal RTI, and specified spacing as the obstructed pendent storage sprinkler.

(b) The upright storage sprinkler is as specified in Tables 11.6.3(A) to 11.6.3(J) for the occupancy hazard.

(c) The upright storage sprinkler is not obstructed (see Note 1 to Table 11.5.1.19.3).

TABLE 11.5.1.19.3

AVOIDING OBSTRUCTIONS TO INNER CORE DISTRIBUTION PATTERN

Width of object in least dimension	The object shall not be installed	Figure
Up to 20 mm	Within 300 mm either side and down to 100 mm below	11.5.1.19.3(A)
>20 mm to 32 mm	Within 300 mm either side and down to 400 mm below	11.5.1.19.3(A)
>32 mm to 50 mm	Within 300 mm either side and down to 600 mm below	11.5.1.19.3(A)
>50 mm to 300 mm	Within 300 mm either side and shall be a minimum 450 mm above any flue space that is parallel and directly under the object	11.5.1.19.3(B)
>300 mm to 600 mm (Note 2)	Within 600 m either side and shall be a minimum 900 mm above any flue space that is parallel and directly under the object	11.5.1.19.3(C)
>600 mm	Without sprinklers under the object as specified in Clause 11.5.1.19.4	11.5.1.19.4(A) 11.5.1.19.4(B) 11.5.1.19.4(C) 11.5.1.20.4(D)

NOTES:

1 Upright sprinklers can tolerate objects up to 100 mm wide located directly below them at any vertical distance.

2 If the object is up to 600 mm wide in its maximum dimension, the object shall be located a minimum 300 mm horizontally from the nearest sprinkler.

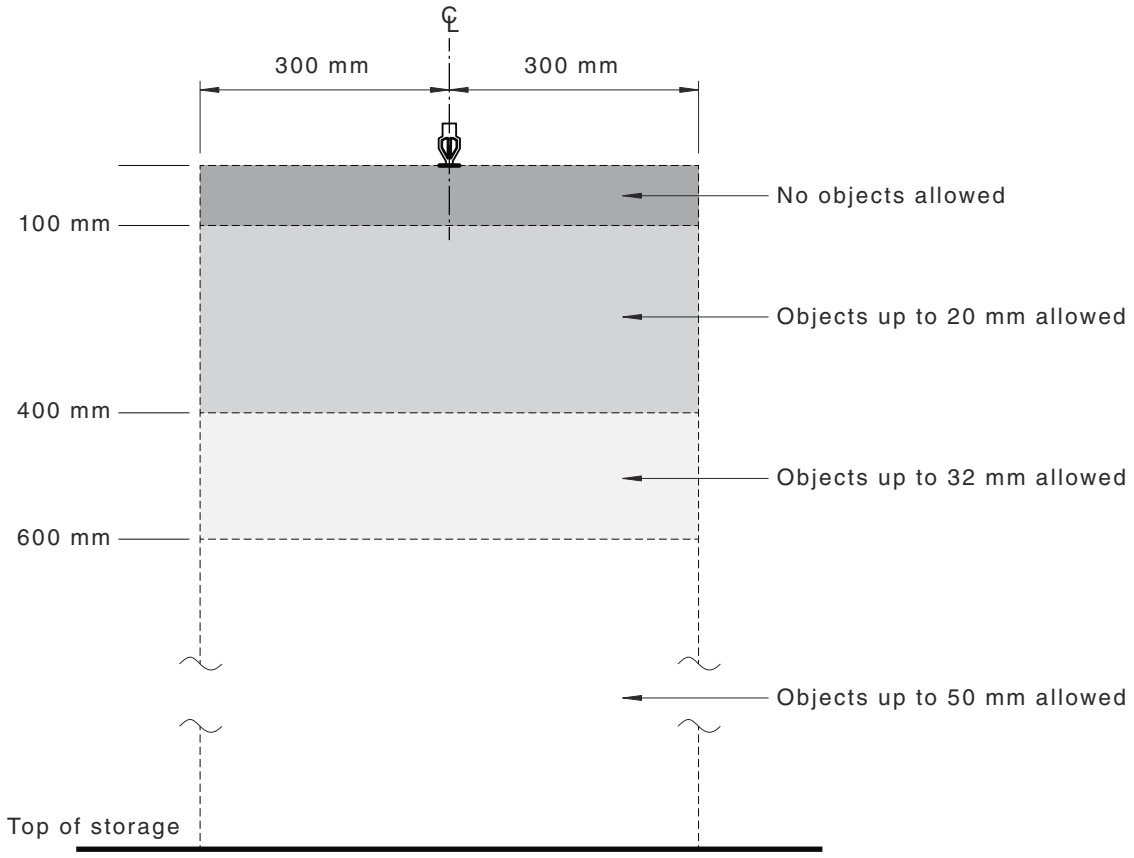

FIGURE 11.5.1.19.3(A) OBSTRUCTION AREA TO INNER CORE DISCHARGE PATTERN OF PENDENT STORAGE SPRINKLERS FOR OBJECTS UP TO 20 mm WIDE AND 50 mm WIDE

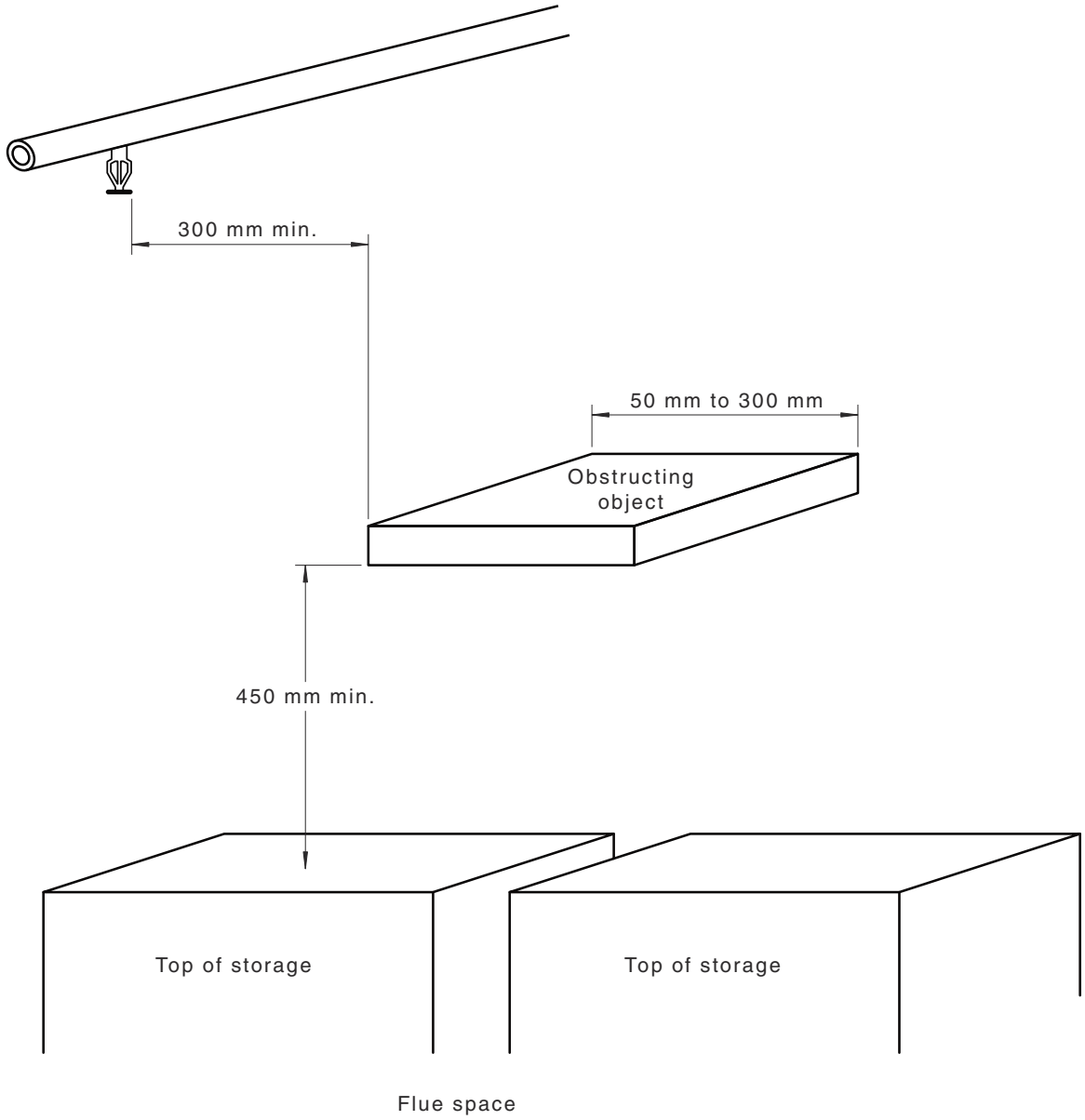

FIGURE 11.5.1.19.3(B) OBSTRUCTION AREA TO INNER CORE DISCHARGE PATTERN OF PENDENT STORAGE SPRINKLERS FOR OBJECTS OVER 50 mm AND UP TO 300 mm WIDE

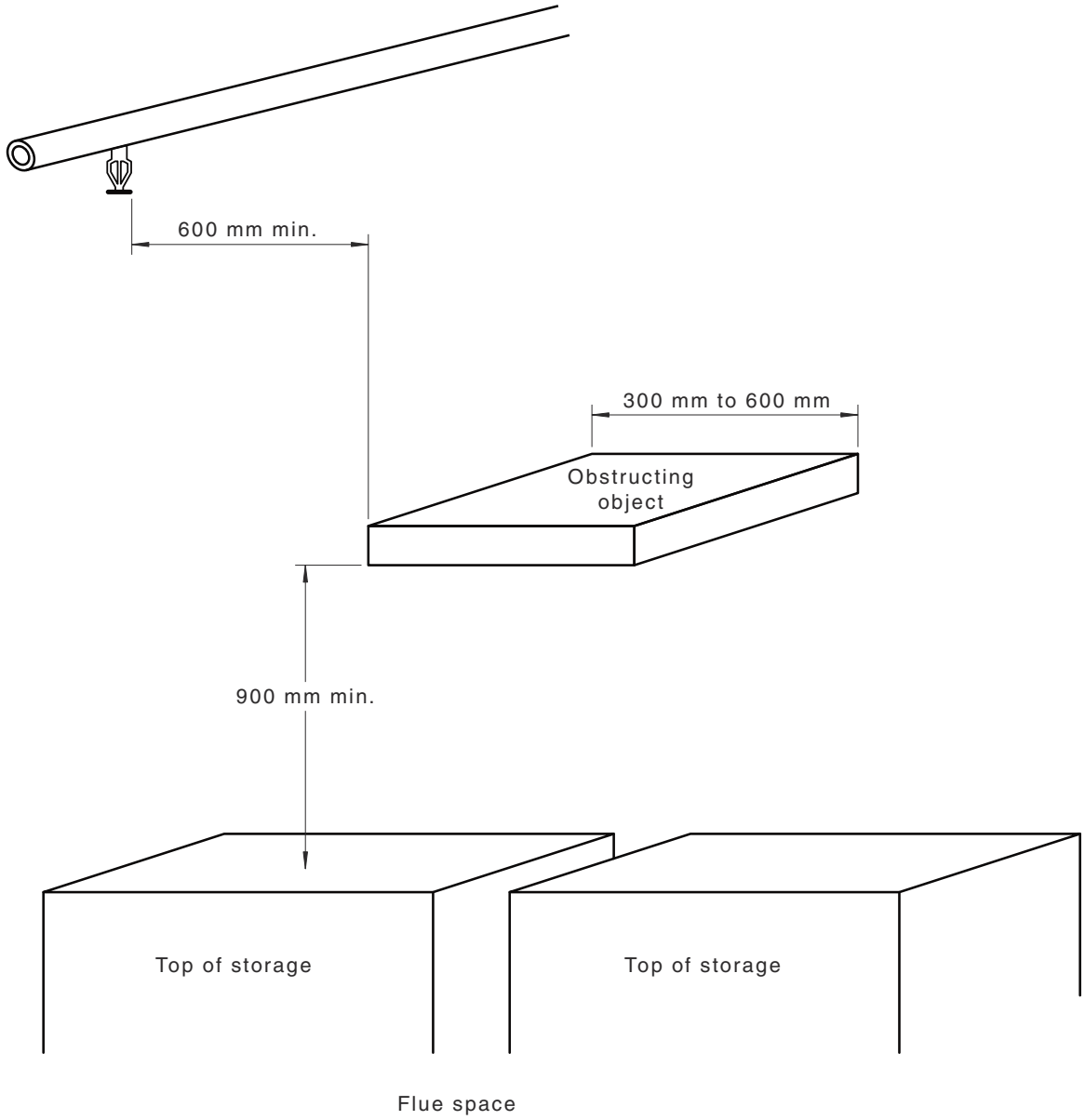

FIGURE 11.5.1.19.3(C) POSITION OF OBJECTS OVER 300 mm AND UP TO 600 mm WIDE

11.5.1.19.4 *Additional sprinklers for objects wider than 600 mm, in least dimension, that obstruct a sprinkler's inner core or spray distribution pattern*

For objects wider than 600 mm that obstruct a sprinkler's inner core distribution pattern, sprinklers shall be installed by one of the following means:

(a) For flat, continuous, solid objects up to 1.2 m wide, a single line of ceiling-level sprinklers shall be installed centred under the object on a maximum linear spacing of 2.4 m fed by the same range pipe size used at ceiling-level, as shown in Figure 11.5.1.19.4(A).

(b) For flat, continuous, solid objects from 1.2 m wide to 3.0 m wide, two lines of ceiling-level sprinklers shall be installed under the object on a maximum linear spacing of 2.4 m, area spacing of 6.0 m^2 and fed by the same range pipe size used at ceiling-level. A minimum 0.9 m vertical distance shall be maintained between the sprinkler deflector and the top of storage, as shown in Figure 11.5.1.19.4(A).

(c) For flat, continuous, solid objects over 3.0 m wide, the underside of the object shall be treated as a ceiling, and ceiling-level type sprinklers for this area shall be installed and fed by the same range pipe size used at ceiling-level and in accordance with Clause 11.5.1.19.4(a) and maintained at a minimum vertical distance of 0.9 m between the sprinkler deflector and the top of storage.

(d) For non-flat, non-continuous, or non-solid objects, a flat, continuous, solid barrier of equal width shall be installed under the object and sprinklers shall be installed as specified in Item (a), (b), or (c), depending on the width of the object, as shown in Figure 11.5.1.19.4(B).

A2 (e) As an alternative to Item (d), quick response ceiling-level type sprinklers shall be installed centred under the object on a maximum 1.2 m linear spacing and a maximum 1.5 m^2 area spacing and fed by the same range pipe size used at ceiling-level. A minimum 0.9 m vertical distance shall be maintained between the sprinkler deflector and the top of storage, as shown in Figure 11.5.1.19.4(C).

(f) As an alternative to Item (a) to Item (e) when protecting rack storage, ceiling-level sprinklers shall be installed at the top of the storage rack at all flue space intersections (face and longitudinal) that are affected in a 'plan view' by the obstructing object, and fed using the same range pipe size used at ceiling-level. The height of storage above these sprinklers shall be limited to 1.5 m maximum, as shown in Figure 11.5.1.19.4(D).

For Items (a), (b), (c), (d) and (e) a minimum 0.9 m vertical distance shall be maintained between the deflector of the additional sprinklers and the top of storage (see Note 3).

NOTES:

1 For Items (a), (b) (c) (d), (e) and (f), the additional sprinklers installed under the obstruction are not required to be added to the hydraulic design of the ceiling-level sprinkler system.

2 Items (e) and (f) negate the need for a flat, continuous, solid barrier under the obstructing object. Item (f) may also be implemented when a minimum 0.9 m clearance cannot be maintained between the deflectors of the additional sprinklers and the top of storage.

3 This is not required for Item (f) because the additional sprinklers are installed as in-rack sprinklers.

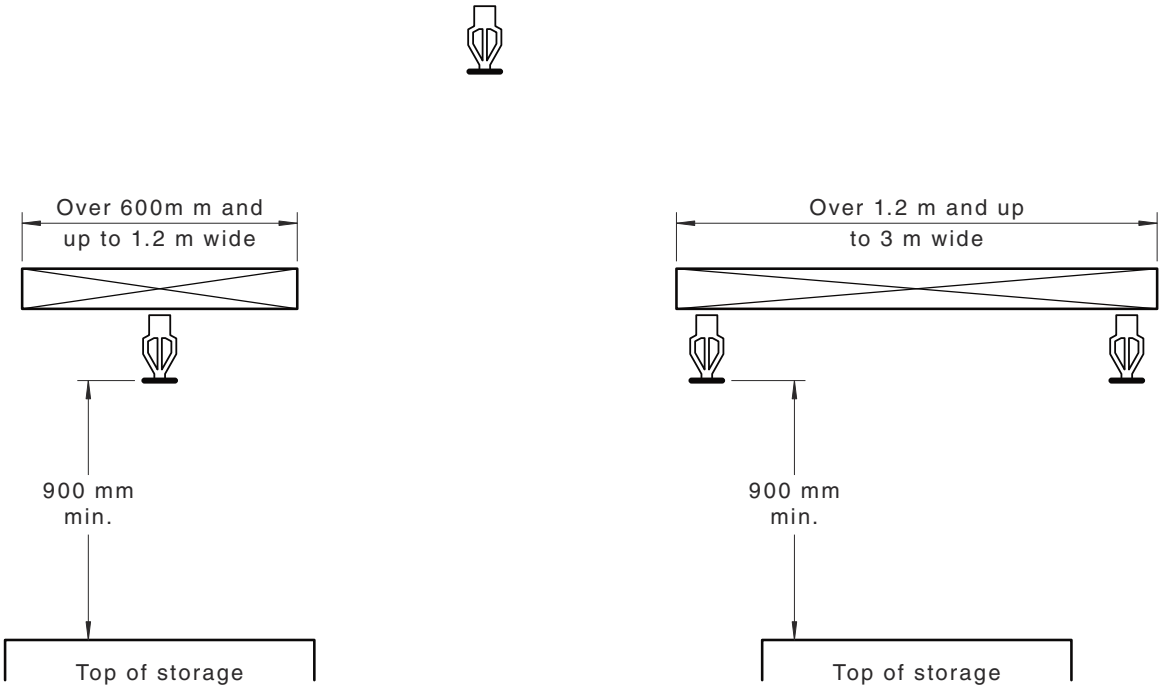

FIGURE 11.5.1.19.4(A) ADDITIONAL SPRINKLERS INSTALLED BELOW FLAT, CONTINUOUS, SOLID OBSTRUCTIONS OVER 600 mm WIDE TO 3.0 m WIDE