

Closely Spaced Sprinklers Protecting Vertical Openings

Justification for sprinkler spacing less than 1.8 m where cross baffles are provided

1.8 m value in the NFPA 13 vertical-opening sprinkler rule is a maximum spacing, not a minimum spacing. Sprinklers closer than 1.8 m are expressly contemplated, provided cross baffles are installed in accordance with NFPA 13^{1 2}.

Important terminology: NFPA 13 uses the term "closely spaced sprinklers" and not "closed-space sprinklers".

30th May 2026

¹ National Fire Protection Association, *NFPA 13: Standard for the Installation of Sprinkler Systems* (2025 edn, National Fire Protection Association 2025) s 9.3.5.3.1.

² NFPA 13 (n 1) s 9.3.5.3.2.

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1. Executive summary

This report concludes that a sprinkler spacing of less than 1.8 m can be justified for closely spaced sprinklers protecting an unenclosed vertical opening, including an escalator or moving stairway opening, provided the installation follows the specific NFPA 13 vertical-opening provisions and incorporates the cross-baffle requirement where sprinkler spacing is below 1.8 m³⁴⁵.

The central point is legal and technical. NFPA 13 does not state that the vertical-opening sprinklers must be spaced exactly 1.8 m apart. It states that they shall be spaced "not more than" 1.8 m apart. In drafting terms, that is a maximum-spacing rule. It permits closer spacing unless another provision prohibits it. NFPA 13 then removes any remaining doubt by expressly stating that, where these sprinklers are closer than 1.8 m, cross baffles shall be provided^{6,7}.

The ordinary 1.8 m minimum-spacing rule remains important, but it is not absolute. NFPA 13 itself qualifies that rule by allowing sprinklers to be placed less than 1.8 m apart when the specified baffles are installed. The same standard separately requires those baffles for vertical-opening sprinklers closer than 1.8 m⁸⁹.

³ NFPA 13 (n 1) s 9.3.5.1.

⁴ NFPA 13 (n 1) s 9.3.5.3.1.

⁵ NFPA 13 (n 1) s 9.3.5.3.2.

⁶ NFPA 13 (n 1) s 9.3.5.3.1.

⁷ NFPA 13 (n 1) s 9.3.5.3.2.

⁸ NFPA 13 (n 1) s 10.2.6.4.1.

⁹ NFPA 13 (n 1) s 10.2.6.4.2.

The engineering reason for the general minimum-spacing rule is sprinkler skipping, also described in practice as cold soldering. This occurs when discharge from an operating sprinkler wets or cools the thermal element of an adjacent sprinkler, delaying or preventing operation. That concern is real. It is also the exact concern addressed by cross baffles¹⁰¹¹¹².

Accordingly, the strongest authority submission is not that the 1.8 m rule is irrelevant. The stronger and more defensible submission is that NFPA 13 gives a specific compliance path i.e., sprinklers around the vertical opening may be closer than 1.8 m, but a design must show cross baffles complying with Section 10.2.6.4.2 and must satisfy all draft-curtain, positioning, obstruction and hydraulic design requirements¹³.

2. Scope, assumptions and limits of opinion

This report addresses the narrow question whether closely spaced sprinklers installed around a vertical opening may be spaced at centres less than 1.8 m.

Assumptions

- NFPA 13:2025 is the sprinkler installation standard forming the basis of the design.
- The opening under consideration is an unenclosed moving stairway, escalator, staircase, or similar floor opening where sprinkler protection is used as an alternative to shaft enclosure.
- The opening is not being treated as a "large opening" for which NFPA 13 states that closely spaced sprinklers and draft curtains are not required, or alternatively the authority still requires the closely spaced sprinkler and draft curtain arrangement for the specific project.
- The proposed sprinkler line will be located 150 mm to 300 mm from the draft curtain on the side away from the opening, and the draft curtain will be at least 450 mm deep and of suitable material¹⁴.
- Where the actual sprinkler spacing is less than 1.8 m, cross baffles will be shown, detailed, specified and installed¹⁵.

3. NFPA 13 code analysis

Specific vertical-opening rule

NFPA 13 provides a specific installation arrangement for unenclosed vertical openings. Where moving stairways, staircases or similar floor openings are unenclosed, and sprinkler protection is used as the alternative to enclosure of the vertical opening, the openings are to be protected by closely spaced sprinklers in combination with draft curtains¹⁶.

The draft curtain is not incidental. NFPA 13 requires it to be immediately adjacent to the opening, at least 450 mm deep, and of noncombustible or limited-combustible material that remains in place before and during sprinkler operation¹⁷.

The sprinkler rule then states that sprinklers shall be spaced not more than 1.8 m apart and placed 150 mm to 300 mm from the draft curtain on the side away from the opening. The words "not more than" are decisive. The phrase sets an upper limit, not a lower limit. A spacing of 1.5 m, 1.2 m or another lesser centre-to-centre distance is not inconsistent with that phrase¹⁸.

¹⁰ NFPA 13 (n 1) s 9.5.3.4.1.

¹¹ Arthur E Cote (ed), *Fire Protection Handbook* (20th edn, National Fire Protection Association 2008) ch 16.

¹² J A Milke, "Smoke Control by Mechanical Exhaust or Natural Venting" in Morgan J Hurley (ed), *SFPE Handbook of Fire Protection Engineering* (5th edn, Springer 2016) .

¹³ NFPA 13 (n 1) ss 9.3.5.2-9.3.5.3.2 and 10.2.6.4.2.

¹⁴ NFPA 13 (n 1) ss 9.3.5.2-9.3.5.3.1.

¹⁵ NFPA 13 (n 1) s 9.3.5.3.2.

¹⁶ NFPA 13 (n 1) s 9.3.5.1.

¹⁷ NFPA 13 (n 1) s 9.3.5.2.

¹⁸ NFPA 13 (n 1) s 9.3.5.3.1.

NFPA 13 expressly addresses sprinklers closer than 1.8 m

NFPA 13 then expressly states that where sprinklers are closer than 1.8 m, cross baffles shall be provided in accordance with Section 10.2.6.4.2. This is the controlling provision for the present issue. It would be internally inconsistent to read 1.8 m as an absolute minimum when the very next sprinkler provision states what must be done when the sprinklers are closer than 1.8 m¹⁹.

Relationship with the general minimum-spacing rule

The general standard spray sprinkler rule states that sprinklers are to be spaced not less than 1.8 m on centre unless the requirements of the baffle provision or another stated exception are met. The baffle provision then permits sprinklers to be placed less than 1.8 m apart where baffles are arranged to protect the actuating elements and satisfy the specified construction and positioning criteria^{20,21}.

The vertical-opening section therefore operates as a specific application of the same control strategy. NFPA 13 does not ignore the skipping/cold-solder issue. It requires baffles precisely because that issue exists.

Code interpretation matrix

NFPA 13 provision	Text effect	Correct interpretation	Design implication
s 9.3.5.3.1	Sprinklers not more than 1.8 m apart.	1.8 m is a maximum, not a minimum.	Closer spacing is not prohibited by this section.
s 9.3.5.3.2	Where sprinklers are closer than 1.8 m, cross baffles are required.	NFPA 13 expressly contemplates spacing below 1.8 m.	Provide and detail cross baffles.
s 10.2.6.4.1	General rule: not less than 1.8 m unless baffle/exception conditions are met.	The general rule is conditional, not absolute.	A less-than-1.8 m design must satisfy the exception.
s 10.2.6.4.2	Baffles must protect actuating elements and meet dimensional/position criteria.	Baffles are the code control against wetting/cooling adjacent sprinklers.	Show baffle dimensions, material, rigidity and position.

4. Engineering basis of the 1.8 m minimum-spacing rule

Sprinkler skipping and cold soldering

The general minimum distance between sprinklers exists to manage activation reliability. NFPA 13 states the purpose directly. A minimum distance is maintained to prevent operating sprinklers from wetting adjacent sprinklers and to prevent sprinkler skipping²².

The Fire Protection Handbook states the same practical concern. It warns that minimum spacing is as important as maximum spacing because it helps prevent cold soldering and skipping of adjacent sprinklers. In the storage context, the Handbook also explains that water shields are used to guard against cooling or cold soldering of unactivated sprinklers by spray from other sprinklers²³.

¹⁹ NFPA 13 (n 1) s 9.3.5.3.2.

²⁰ NFPA 13 (n 1) s 10.2.6.4.1.

²¹ NFPA 13 (n 1) s 10.2.6.4.2.

²² NFPA 13 (n 1) s 9.5.3.4.1.

²³ Arthur E Cote (ed), *Fire Protection Handbook* (20th edn, National Fire Protection Association 2008) ch 16.

The SFPE Handbook gives the mechanism in more explicit thermal terms. Where ceiling-jet-convected droplets strike a sprinkler link or bulb, evaporative cooling reduces the rate of heating of that thermal element. The result can be a significant and unpredictable delay in sprinkler discharge. That delayed operation is the phenomenon referred to as sprinkler skipping²⁴.

Why skipping matters in ordinary ceiling-grid design

In a conventional sprinkler grid protecting a floor hazard, the design depends on the expected pattern of sprinkler operation near the fire. Hydraulic calculations quantify discharge, but they do not predict exactly when individual sprinklers will operate or how the discharge sequence will develop after first operation. Sprinklers must both deliver water to the burning fuel and adjacent combustibles, and respond to the heat layer and ceiling jet that develop above the fire²⁵.

For that conventional application, premature cooling of adjacent thermal elements is a serious design concern. If sprinklers immediately adjacent to the fire are delayed or skipped while more remote sprinklers open, the operating pattern may be less effective than the design assumption. That is why the general rule controls both maximum spacing and minimum spacing.

What the 1.8 m rule is not

The 1.8 m minimum-spacing value is not a universal prohibition against closer sprinkler centres in every NFPA 13 application. NFPA 13 itself qualifies the general rule and provides a baffle-based compliance path. In other words, the rule is not: "sprinklers shall never be closer than 1.8 m". Instead, the rule is, sprinklers shall generally be at least 1.8 m apart unless the stated exception is satisfied²⁶²⁷.

5. Application to closely spaced sprinklers around vertical openings

Functional difference from ordinary floor-hazard sprinkler spacing

Closely spaced sprinklers at a vertical opening are not an ordinary ceiling sprinkler grid laid out to protect a uniform floor hazard below. They are a special linear arrangement used with a draft curtain to protect the opening where enclosure is not provided. The draft curtain forms a local reservoir boundary for smoke and hot gases, while the closely spaced sprinkler line is located immediately outside that boundary on the side away from the opening²⁸²⁹³⁰.

Because the arrangement is special and linear, NFPA 13 controls it using a maximum sprinkler spacing of 1.8 m rather than by requiring a conventional minimum separation between sprinklers. The standard then applies the necessary anti-skipping safeguard by requiring cross baffles where the sprinklers are closer than 1.8 m³¹.

6. Conditions required to be shown on design drawings

The design drawings, schedules and hydraulic calculations should demonstrate the following items.

Item	Required evidence in submission	Reason
Terminology	Use "closely spaced sprinklers" throughout the report and drawings.	Matches NFPA terminology and avoids ambiguity.

²⁴ J A Milke, "Smoke Control by Mechanical Exhaust or Natural Venting" in Morgan J Hurley (ed), *SFPE Handbook of Fire Protection Engineering* (5th edn, Springer 2016) 1850.

²⁵ H S Wass Jr and R P Fleming, *Sprinkler Hydraulics: A Guide to Fire System Hydraulic Calculations* (Springer/SFPE 2020) 195-197.

²⁶ NFPA 13 (n 1) s 10.2.6.4.1.

²⁷ NFPA 13 (n 1) s 10.2.6.4.2.

²⁸ NFPA 13 (n 1) s 9.3.5.1.

²⁹ NFPA 13 (n 1) s 9.3.5.2.

³⁰ NFPA 13 (n 1) s 9.3.5.3.1.

³¹ NFPA 13 (n 1) s 9.3.5.3.2.

Item	Required evidence in submission	Reason
Sprinkler spacing	Show actual centre-to-centre spacing. Confirm spacing is not more than 1.8 m.	Satisfies the vertical-opening maximum-spacing rule.
Cross baffles	Where spacing is less than 1.8 m, show cross baffles between sprinklers. Include dimensions, material, rigidity and installation position.	Satisfies the express condition for sprinklers closer than 1.8 m.
Baffle dimensions	Confirm baffles are at least 200 mm long and 150 mm high, and positioned relative to upright or pendent deflectors as required.	Ensures baffles protect actuating elements rather than becoming decorative details.
Draft curtain	Show draft curtain immediately adjacent to opening, minimum 450 mm depth, noncombustible or limited-combustible, and capable of remaining in place during sprinkler operation.	The sprinkler line and draft curtain function as a combined vertical-opening protection arrangement.
Sprinkler location from curtain	Show sprinkler line 150 mm to 300 mm from the draft curtain on the side away from the opening.	This is a specific NFPA 13 location requirement.
Obstructions	Check baffles, curtain, ceiling features, beams, signage, escalator structure and architectural finishes against obstruction rules and sprinkler listing requirements.	The baffle must solve the skipping concern without creating a discharge obstruction problem.
Hydraulic design	Include the actual number of sprinklers expected to operate in the calculation basis, including interaction with adjacent ceiling sprinklers where applicable.	Closer spacing can increase the number of sprinklers in the relevant operating area.
Inspection	Include installation notes requiring verification of baffle position and sprinkler-to-curtain distance before handover.	The compliance issue is installation-sensitive.

The baffle must be coordinated with sprinkler deflectors and thermal elements. NFPA 13 requires the baffles to protect the actuating elements, be solid and rigid, remain in place before and during sprinkler operation, and meet the specified dimensions and relative positioning³².

7. Final determination

The proposed sprinkler spacing of less than 1.8 m for closely spaced sprinklers protecting an escalator or similar vertical opening is technically and code defensible under NFPA 13 where the following conditions are met:

- the sprinklers are installed as closely spaced sprinklers forming part of the NFPA 13 vertical-opening arrangement³³;
- the centre-to-centre spacing does not exceed 1.8 m³⁴;
- cross baffles are provided wherever sprinklers are closer than 1.8 m³⁵;
- the cross baffles comply with the construction and positioning criteria in Section 10.2.6.4.2³⁶;
- the draft curtain is immediately adjacent to the opening, at least 450 mm deep, and remains in place during sprinkler operation³⁷;

³² NFPA 13 (n 1) s 10.2.6.4.2.

³³ NFPA 13 (n 1) s 9.3.5.1.

³⁴ NFPA 13 (n 1) s 9.3.5.3.1.

³⁵ NFPA 13 (n 1) s 9.3.5.3.2.

³⁶ NFPA 13 (n 1) s 10.2.6.4.2.

³⁷ NFPA 13 (n 1) s 9.3.5.2.

- the sprinkler line is located 150 mm to 300 mm from the draft curtain on the side away from the opening³⁸;
- the hydraulic calculations, obstruction analysis and sprinkler listings are coordinated with the actual installation.

8. Bibliography

National Fire Protection Association, *NFPA 13: Standard for the Installation of Sprinkler Systems* (2025 edn, National Fire Protection Association 2025).

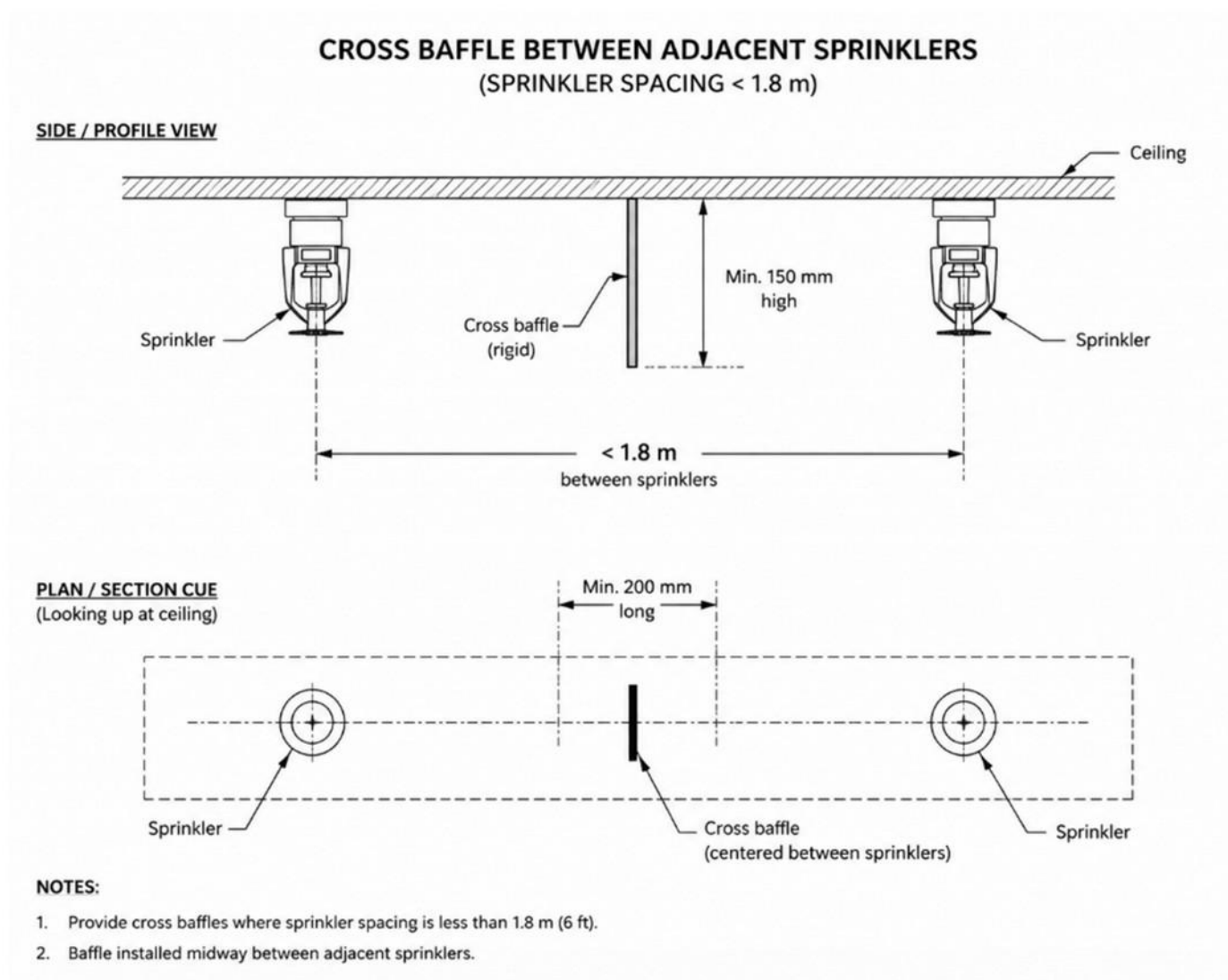
Arthur E Cote (ed), *Fire Protection Handbook* (20th edn, National Fire Protection Association 2008).

J A Milke, "Smoke Control by Mechanical Exhaust or Natural Venting" in Morgan J Hurley (ed), *SFPE Handbook of Fire Protection Engineering* (5th edn, Springer 2016).

H S Wass Jr and R P Fleming, *Sprinkler Hydraulics: A Guide to Fire System Hydraulic Calculations* (Springer/SFPE 2020).

National Fire Protection Association, *NFPA 13: Standard for the Installation of Sprinkler Systems* (2025 edn, National Fire Protection Association 2025).

9. Appendix – Baffle illustration



³⁸ NFPA 13 (n 1) s 9.3.5.3.1.