NFSA NATIONAL FIRE SPRINKLER ASSOCIATION
The Voice of the Fire Sprinkler Industry

TechNotes

Editor - Roland Asp, CET #487 05/10/2022

Best of April 2022

The following are a dozen questions answered by the NFSA's Codes, Standards, and Public Fire Protection staff as part of the Expert of the Day (EOD) member assistance program during the month of April 2022. This information is being brought forward as the "Best of April 2022." If you have a question for the NFSA EOD submit your question online through the "My EOD" portal.

It should be noted that the following are the opinions of the NFSA Engineering, Codes, and Standards staff, generated as members of the relevant NFPA and ICC technical committees and through our general experience in writing and interpreting codes and standards. They have not been processed as formal interpretations in accordance with the NFPA Regulations Governing Committee Projects or ICC Council Policy #11 and should therefore not be considered, nor relied upon, as the official positions of the NFSA, NFPA, ICC, or its Committees. Unless otherwise noted the most recent published edition of the standard referenced was used.

Question #1 – FDC Labeling

A single building often includes several different types of standpipes (manual wet, automatic dry and automatic wet, combined, etc.) There are times when a single fire department connection serves multiple system types. In these cases, determining the proper signage can be confusing.

Can the signage requirements of 2016 edition of NFPA 14 for the fire department connections be summarized?

Three things are generally required on a fire department connection (FDC) by the standards. There are often locally amended requirements that might also need to be considered.

1. System types, including if the standpipe is manual wet or dry
2. System demand pressure greater than 150 psi
3. Where a FDC services only a portion of a building or multiple buildings

A fire department connection supplementing or supplying both automatic fire sprinkler and standpipe systems would be required to be marked as a combined system. STANDPIPE AND AUTOSPKR" or "AUTOSPKR AND STANDPIPE with 1-inch letters. (NFPA 14 Section 6.4.5.2.1 and 8.17.2.4.7.1)

Signage is also required to include the pressure required to provide system demand when greater than 150 psi. (NFPA 14 Section 8.17.2.4.7.2 and 8.17.2.4.7.3).

Manual standpipes, both "wet" and "dry" are also required to be identified as such on the signage. (NFPA 14 2016 Section 6.4.5.2)

Note: Combined FDC are required to be sized to the system demand of the sprinkler or standpipe system whichever is greater, at 250 gpm per 2 ½ in. inlets with a minimum of 2 – 2 ½ in. inlets, up to a maximum of 5 – 2 ½ in. for a building full sprinklered through in accordance with NFPA 13R (Section 7.10.1.1.5).

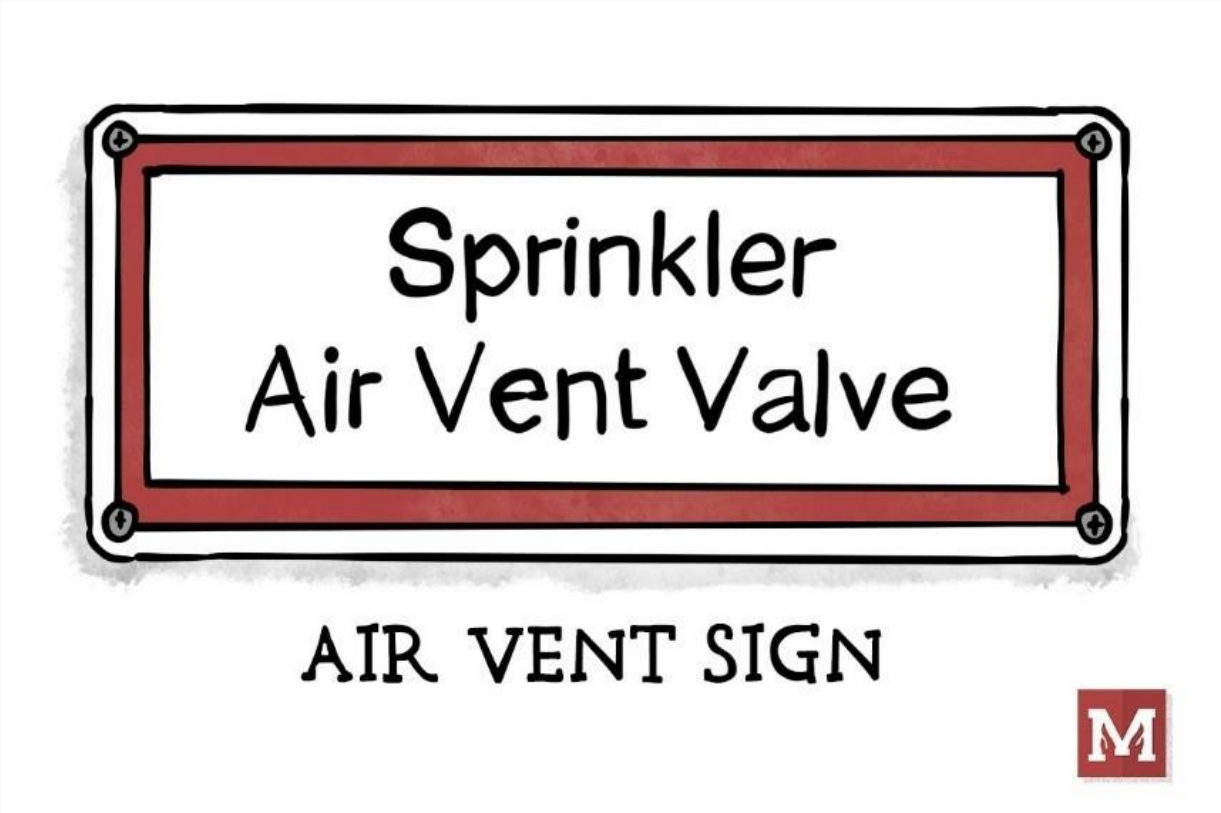
Question #2 – Air Vent Sign

Would a sign, similar to an auxiliary drain sign, need to be provided with an air vent. Based on the summary found in A.16.17 and the air vent section it does not appear as if one is required.

Is it a requirement to provide an identification sign for an air vent?

Yes, Section 16.9.12.1 of NFPA 13 (2019 edition) states "All control, drain, venting, and test connection valves shall be provided with permanently marked weatherproof metal or rigid plastic identification signs."

It is important to provide signs from an operational perspective to allow proper identification when needed for future use.



Question #3 – Closet vs Concealed Space – NFPA 13R

An apartment building is to be equipped with a sprinkler system in accordance with the 2019 edition of NFPA 13R. There is a mechanical heating unit (electric) in a corner of the room with walls on all four sides. There are no doors into this space but there is an access panel/louver for maintenance purposes.

There is confusion as to if this space would be considered a "closet" or a "concealed space". If this is considered a closet, then section 6.6.4 of the 2019 edition may apply which requires sprinklers in closets with heating or air conditioning equipment. However, if this space is considered a concealed space, then sprinklers are not required in accordance with section 6.6.6.

Is this space considered a closet or a concealed space?

The answer is that the space described would be considered a concealed space and not a closet. This is supported by language found in the 2022 edition of NFPA 13.

Section 9.2.1.2.2 was added in the 2022 edition of NFPA 13 and states that spaces *"shall be considered a concealed space even with non-fuel-fired equipment and access panels."*

This concept was added to NFPA 13 specifically to clarify the exact situation that has been described. This section states that regardless of the presence of the mechanical heating unit, a space without doors and only equipped with access panels is considered a concealed space.

Although this language is not found in NFPA 13R, section 6.6.8 specifically states that sprinkler location and position situations *"that are not directly discussed by NFPA 13R shall be in accordance with NFPA 13."*

As this space would be considered a concealed space, section 6.6.6 of NFPA 13R would apply which specifically states that sprinklers are not required in concealed spaces.

Question #4 – Obstructed Construction

NFPA 13, 2019 edition, Section 3.3.41.1 defines obstructed construction and the annex (A.3.3.41.1(2)) provides the example of concrete tee construction as obstructed construction, but no dimensional limitations are provided in the example. All other examples of obstructed construction in NFPA 13 Annex are described with dimensional limitations, such as panel construction. The lack of dimensional limitations for the concrete tee examples makes these examples unclear.

Is concrete tee construction with members approximately 8 feet on center creating an area between beams exceeding 300 square feet obstructed construction?

No, concrete tee construction, with members greater than 7 ½ ft apart are considered unobstructed construction. Section 3.3.41.2, the definition for unobstructed construction, is applied to concrete tees or other structural members when over 7 ½ feet apart. The area between the beams or tees would be a flat, smooth ceiling and be considered unobstructed construction.

Question #5 - Are Pipe Schedule Systems limited to Ordinary and Light Hazard Occupancies?

There is a building with an existing Ordinary Hazard pipe schedule system. The owner is planning to add rack storage of Class II commodities stored no higher than 12 ft. It is being discussed if the pipe schedule system can be modified for this use.
Three questions were asked:

1. Where in the 2022 edition of NFPA 13 does it state that pipe schedule systems are only allowed in Light and Ordinary Hazard systems?

2. When was the Extra Hazard schedule discontinued?

3. Can pipe schedule systems be used to protect rack storage typically limited to 12ft (low pile) storage as OH system?

Three questions were asked.

Q1: Can you please point out in the standard where pipe scheduled systems are only recognized as an OH2 system?

A1: The pipe schedule system method is acceptable for new and existing light hazard and ordinary hazard occupancies and for modifications to existing extra hazard occupancies. It is not acceptable in new extra hazard occupancies. In the 2022 edition of NFPA 13 this requirement is found in Section 19.2.2.3 and Section 28.5.1.2.

- Additions and modifications to existing pipe schedule systems
- Additions and modifications to existing extra hazard pipe schedule systems
- New systems of 5,000 sq ft or less
- New systems of unlimited size where the flows found in Table 19.2.2.1 are met (at 50 psi residual pressure at the highest elevation)

Section 28.5.1.2 further limits the use of the pipe schedule method by stating that the following must be hydraulically calculated:

- Systems with sprinklers other than 5.6K
- Systems with pipe other than those found in Table 7.3.1.1
- Extra hazard systems (both group 1 and 2)
- Exposure systems

Additionally, Section 28.5.4 specifically states that extra hazard occupancies must be hydraulically calculated.

New pipe schedule systems are also limited to light and ordinary hazard occupancy simply because the body of the standard does not include any pipe schedule tables except for light and ordinary hazard.

Q2: When was the extra hazard schedule discontinued?

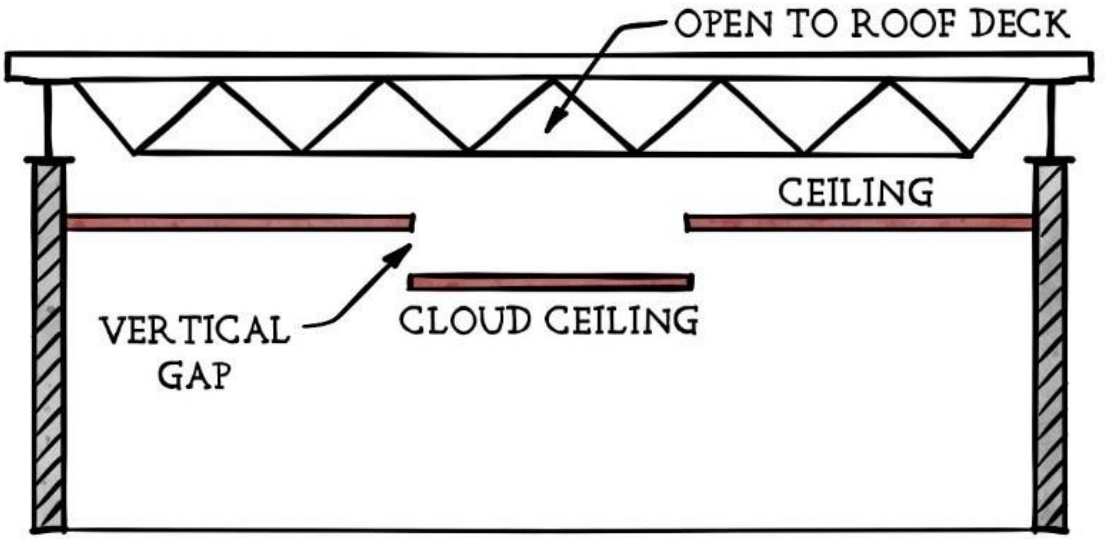
A2: The extra hazard pipe schedule systems tables (for new systems) was removed from NFPA 13 in the 1991 edition. As the pipe schedule system can still be used to modify existing extra hazard pipe schedule systems, the annex section A.28.5.4 does include an extra hazard pipe schedule system table.

Q3: Can pipe schedule systems by used to protect rack storage typically limited to 12ft (low pile) storage as OH system?

A3: NFPA 13 does not specifically address the use of pipe schedules with storage (low-piled or high piled) however as low piled storage is often protected as ordinary hazard the argument can be made that the pipe schedule system would be acceptable for the ceiling system in this case, as long as K-5.6 sprinklers are used. If in-rack sprinklers are to be installed, they must be in accordance with section 25.2.2 (see section 4.3.1.7.2.2). It is not acceptable per chapter 25 to size the in-rack sprinklers based upon pipe schedules.

Question #6 – Vertical Cloud Ceiling Gap to Existing Upper Ceiling

There is an unconventional cloud ceiling layout with a vertical gap between the cloud ceiling and the upper ceiling above.



Can the "cloud ceiling" provisions of the 2016 edition of NFPA 13 be used to omit sprinklers above the clouds?

No. The cloud ceiling provision (and the research it was based upon) only addresses cloud ceilings at a single horizontal plan with horizontal openings. There is no allowance in the prescriptive requirements of the standard for vertical openings in a cloud ceiling as described.

This concept is outlined in the definition of cloud ceiling found in Section 3.3.5.1. This definition clearly states that a cloud ceiling is installed "in the same plane with horizontal openings…" Based upon this definition, the arrangement described cannot use the provisions found in Section 8.15.24 to allow sprinklers to be omitted above this ceiling structure.

Question #7 –Building Code Provisions for Protruding Objects in Stairwells and Standpipes

Are hose valves attached directly to vertical standpipe in stairways, which are outside of the egress path subject to the post mounted object rules in Section 1003.3.2 of the 2018 edition of the International Building Code (IBC)?

The standpipe is not subject to IBC Section 1003.3.2 because it is not a post or pylon, but the same rules in the next Section 1003.3.3 do apply to standpipes. In short, the hose valve cannot protrude more than four inches into the circulation path/minimum egress width.

The minimum egress or stair width of 44 inches is allowed to arc around the landing and is commonly accepted by code officials. The arc or minimum stair width to the outside enclosure walls and corner is outside the clear width requirement of the stair and circulation path. This is supported by Figure 1007.3.1 (in the IBC Commentary) which shows the "arc" of the minimum required width as required. Another figure from the same commentary (1009.5) on landing width section states: "…it is not the intent of this section to require that a stairway landing be shaped as a square or rectangle…as long as the landing provides an area described by an arc with a radius equal to the actual stairway width." *NFPA 101, Life Safety Code Handbook*, Section 7.2. also has the same arc in the stair enclosure.

A standpipe outside of this minimum clear width or arc still needs to comply with the accessibility requirements, found in IBC Section 1003 and ICC A117.1. This section (1003) and A117.1 code deal with all persons, able-bodied and disabled, circulating through the building. Take for example, a blind person, walking down the stairs; what is in their path that they may not sense or feel, or what could protrude in the path that injures them? The standpipe still needs to comply with the IBC/ANSI when outside the minimum egress width arc because it is continuous from floor to ceiling. The hose connection is permitted to intrude 4 inches into the arc (circulation path) as long as it is 27 inches or greater from the floor surface (1003.3). The same 4-inch rule (1003.3) extends up to 80 inches.

Question #8 – Horizontal Standpipes

Section 7.10.1.2.2 in the 2013 edition of NFPA 14 is for a horizontal standpipe that serves three or more hose connections on any floor. A system includes several hose connections dropping from the sprinkler system at their own independent location.

Do systems that supply two hose connections need to meet the requirements of this section? If not, does that mean these setups have no flow/pressure requirement?

No, individual hose connections being supplied from a combined sprinkler/standpipe riser are considered branch lines and do not meet the definition of a horizontal standpipe.

The 2013 edition of NFPA 14, *Standard for the Installations of Standpipes and Hose Systems*, defines branch lines as not more than one hose connection on a piping system connecting to a standpipe system (Section 3.3.2).

Horizontal standpipes are defined in Section 3.3.14.1 as a portion of the system piping that supplies two or more hose connections on a single level. When a horizontal standpipe supplies three or more hose connections, the requirements of Section 7.10.1.1.2 must be followed, adding an additional 250 gpm to the calculation for a total of 750 gpm.

Hose connections on branch line must meet the same requirements for pressure (Section 7.8) and flow (Section 7.10) referenced in the standard. They exist for convenience but essentially form additional standpipes that need to be considered in the hydraulic calculations.

Section 7.10.1.1.6 states that where a lateral piping services a single hose connection, the flow for the system shall be determined as if the hose connection is being served from a separate standpipe.

The annex note for Section A.7.10.1.1.6 gives some guidance on when two additional single outlets on each floor are served from a lateral pipe (branch line) but, by definition, are not considered a horizontal standpipe, which concludes that the standpipe pipe actually services more than two hose outlets and suggests that the hydraulic calculations be taken in accordance with Figure A.7.10.1.1.6 and an additional 250 gpm calculation is taken from the most remote standpipe.

The maximum flow rate shall be 1000 gpm for buildings that are sprinklered throughout, in accordance with NFPA 13, and 1250 gpm for all other buildings.

More information on this subject can be found here: Calculating Standpipe Branch Lines Blog

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Question #9 – 3-year and 5-year tests in NFPA 25

The NFPA 25 (2011) mandated five-year internal assessment was recently completed on a building, however it was noted that the required 3-year flow test of the dry pipe system was not performed.

Does the five-year internal assessment satisfy the requirements for the three-year flow test of the dry system?

No, five-year internal assessments do not satisfy the requirements for the three-year full flow test of a dry pipe system.

The five-year internal inspection required by Section 14.2.1 is intended to identify material that could obstruct water from being discharged through a sprinkler. The full flow test is required by Section 13.4.4.2.2.2 to compare how the system performs now as compared to the original acceptance test.

Section 14.4.3.1 (14) states that when there is 50% increase in time for water to flow steadily from inspector's test outlet that an obstruction investigation is required by Section 14.3.2.

An obstruction investigation is not frequency based but is required when triggers are identified in accordance with Section 14.3.1.

Question #10 – Occupancy Classification for Accessory Rooms

A sprinkler system is being designed for a school and it was noted that the small room rule which is limited to light hazard occupancies is being applied to areas such as mechanical rooms.

Can accessory spaces of a school be lumped into the light hazard classification, or is further investigation of the contents of the room justified? Does the 2013 edition of NFPA 13 have a section similar to the Section 311.1.1 in International Building Code?

No, all areas of a school (or other occupancy types) are not automatically assigned the same hazard classification as the main occupancy type and further investigation of the combustibility, quantities, and heat release rates of the contents in each area would be needed.

The classification of light hazard for educational as described in the general examples listed in Annex Section A.5.1 is intended to describe a typical classroom as stated in *The 2013 Automatic Sprinkler Handbook.* Other areas of the school such as storage/mechanical/electrical/chem prep rooms or janitor closets may warrant a higher occupancy hazard classification. Again, this determination is performed by evaluating the quantity, storage height, combustibility, and heat release rate of the associated contents.

Classification of occupancy is a vital aspect of the fire sprinkler design as indicated by NFSA's general statement on this topic as printed below:

Questions regarding hazard or commodity classification are difficult except in those circumstances where an NFPA committee has specifically addressed the issue. This is especially true because the classification is considered in many states to be the most important aspect of fire protection system design, and an obligation of the responsible design professional. One reason many states require involvement of a responsible design professional is to ensure that the site-specific attributes of the project are recognized and properly addressed, which cannot be accomplished in a generic manner.

Finally, NFPA 13 for hazard classification, does not have a statement similar to the IBC section 311.1.1 for occupancy classification which generally states that the storage spaces that are associated with a certain occupancy are classified as part of that occupancy.

Question #11 – Idle Wood Pallets stored Indoors

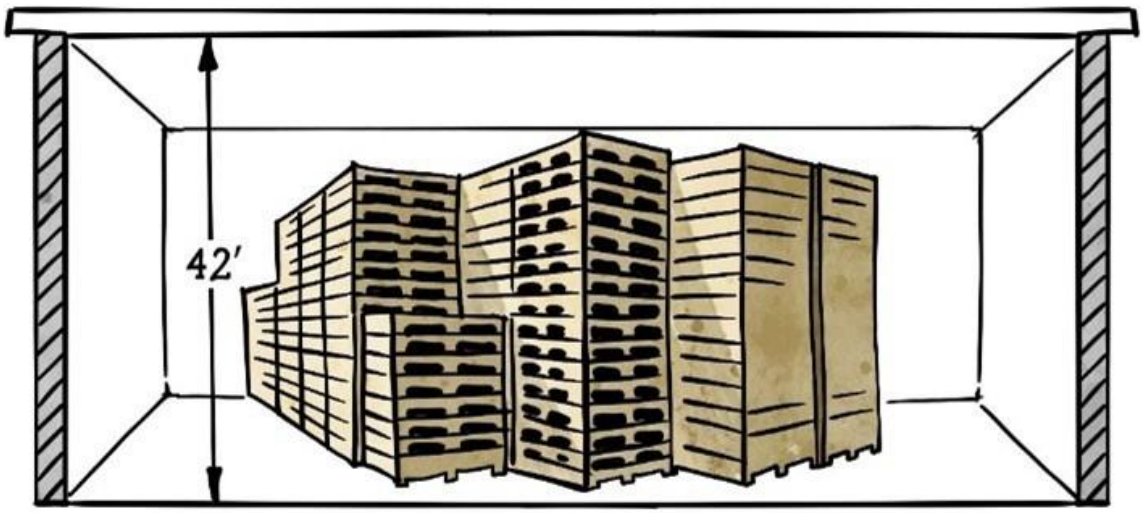
A warehouse with a ceiling height of 43 ft. will include rack storage of idle wood pallets within the building. The highest maximum ceiling/roof height indicated in the 2019 edition of NFPA 13 in Table 20.14.1.2(c) is 40 ft.

Is indoor storage of idle wood pallets allowed in buildings with a maximum roof height above 40 ft?

No, based upon the requirements of Section 20.14, *Protection of Idle Pallets*, in the 2019 edition of NFPA 13, there is no prescriptive criteria to protect indoor storage of idle wood pallets in buildings over 40 ft in height.

- For CMDA sprinklers, Table 20.14.1.2(a) lists a maximum ceiling height of 30 feet
- For CMSA sprinklers, Table 20.14.1.2(b) lists a maximum ceiling height of 40 feet
- For ESFR sprinklers, Table 20.14.1.2(c) lists a maximum ceiling height of 40 feet

One reason for this limitation is the severe fire challenge that idle wood pallets can present. As the annex states in A.20.14, stacks of idle pallets are one of the greatest challenges to sprinklers. The undersides of the pallets create a dry area on which a fire can grow and expand to adjacent pallets. This process will continue until the fire bursts through the top of the stack. At this point, it may not be possible for ceiling sprinklers to control this high challenge fire. Due to the severe fire conditions possible with idle pallet storage, the rules of Section 20.14 are used to mitigate these challenges. A protection criterion outside those listed in this section would be outside the scope of NFPA 13.



INDOOR IDLE WOOD PALLET STORAGE

Question #12 – Sidewall sprinkler with duct two inches above.

A residential sidewall sprinkler (listed to be installed 6 in. to 12 in. below the ceiling) is installed 12-inches below the ceiling. A 10 in. deep duct is being installed directly above the sidewall sprinkler. The distance from the deflector to the duct is to be 2 inches.

Can a duct be installed 2 inches above the residential sidewall sprinkler as long as the maximum distance below the ceiling is maintained?

Based upon the description, the answer is “no.” Residential sidewall sprinklers (like extended coverage sidewalls) require 4 inches of clear space above the deflector with no obstructions.

Section 6.4.6.2.1 of the 2019 edition of 13R requires a minimum distance from the sprinkler deflector to the ceiling of 4 in. In the described arrangement, the distance from the deflector to duct above is only 2 in. which is not permitted. In this case, the issue is not the maximum distance between the deflector and the ceiling but rather is the minimum required distance.

It should be noted that a similar concept is specifically referenced in NFPA 13 (2019) for standard spray sidewall sprinklers under soffits. Section 10.3.5.1.3.3 and its annex figure state that standard spray sprinklers are allowed to be installed under a soffit as long as *"both the minimum distance from the sprinkler deflector to the bottom of the soffit and maximum distance from the sprinkler deflector to the high ceiling is maintained".* Again, in the case described, the minimum deflector distance is not maintained.

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