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

TechNotes

Editor - Roland Asp, CET #510 04/25/2023

This edition of TechNotes was written by Roland Asp, Manager of Codes and Standards for the NFSA.

Residential Sprinklers and Systems

When the term “Residential Sprinkler System” is used, many of us automatically think of NFPA 13D, *The Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes.* However, the term Residential in this context has a much greater reach and includes most occupancies where people sleep: single-family homes, two-family homes, condominiums, townhouses, multifamily occupancies, board and care facilities, lodging and rooming houses, dormitories, and patient room portions of nursing homes.

Further, residential sprinkler systems are not limited to the NFPA 13D standard but may also be built using NFPA 13 or NFPA 13R.

America’s Fire Problem

People deserve to be safe in the places where they live and spend their time. The sad truth is that we are not. America’s fire problem is a residential fire problem. Residential sprinkler systems are the solution.

About 80% of structure fires, fire deaths, and fire-related injuries in the United States happen in residential occupancies. With the staggering losses in residential buildings, it was clear that America’s fire problem is a residential problem.

Residential fires became a national focus in the early 1970s. At that time, more than 12,000 fire deaths were being reported each year and more than 300,000 people each year were being hospitalized due to fires. Of these 300,000 people, more than 50,000 were hospitalized for more than 6 weeks. The cost of fire was a staggering $11.4 billion (in 1971 dollars). To try and get a handle on why America’s fire losses were so great, President Nixon appointed a special National Commission on Fire Prevention and Control to study America’s fire problem and report back with specific suggestions on how to reduce our fire losses.

The Commission worked for two years, and in 1973 delivered a groundbreaking report to the President called “America Burning.” This 177-page report contains 90 specific suggestions on mechanisms and concepts that could be developed to reduce America’s fire problem.

Recommendation Number 75 was, “Support the development of the necessary technology for improved automatic extinguishing systems that would find ready acceptance by Americans in all kinds of dwelling units.”

Residential Sprinklers

By 1981, the Grinnell Corporation was successful in getting the first residential sprinkler listed by Underwriters Laboratories. This sprinkler, like all residential sprinklers now, is different from all other sprinklers in the following three ways:

- Response characteristics — Residential sprinklers are faster to respond to a fire than standard response sprinklers and are better able to intervene in residential occupancy fires before the tenability criteria has been exceeded.
- Water flow — Residential sprinklers use less water than standard spray sprinklers and in a more efficient manner in an effort to work with the existing water supplies common to residential occupancies.
- Water distribution — By breaking the water droplets up more than a standard spray sprinkler, the discharge from a residential sprinkler can absorb more heat from a fire and control the conditions better in the room of fire origin. Also, the pattern is much broader and flatter, maintaining the cool conditions at the levels necessary to help people evacuate, and better distributing water to the perimeters of the small rooms that are typical in residential occupancies.

The development of the residential sprinkler has resulted in an effective means to protect residential occupancies from the ravages of fire and counter the unacceptable loss of life in the places where we live.

Residential Installation Standards

Now that an effective weapon was developed (residential sprinklers), installation guidelines have been developed to guide in the design and installation of these devices. NFPA has three standards pertaining to the installation of fire sprinkler systems in residential occupancies: NFPA 13, NFPA 13R and NFPA 13D. Each of these standards are specific to particular residential occupancies.

NFPA 13: NFPA 13 is the *Standard for the Installation of Sprinkler Systems*. It applies to all occupancies, including residential situations. The first edition of NFPA 13 was published in 1896 and

subsequent editions have been published approximately every 3 years. The most recent edition of NFPA 13 is the 2022 edition although the technical committees are actively developing the next edition (2025).

NFPA 13 is typically used in large apartments, condominiums, hotels, board and care occupancies and other dwelling units. NFPA 13 is considered the highest level of property protection of each of the three standards and provides a high level of safety to life.

The goal of NFPA 13 is provide *"a reasonable degree of protection for life and property from fire … ."* in order to meet the life safety aspect of the stated purpose, NFPA 13 requires the use of either residential or quick response sprinklers in residential areas of a building. Chapter 12 of the 2022 edition of NFPA 13 outlines the installation requirements for residential sprinklers.

Residential sprinklers are permitted to be used in the dwelling unit portion of a residential occupancy, and in the corridors leading to dwelling units. It does not matter if there are other rooms off of the corridor that are not dwelling units (such as mechanical rooms or electrical rooms). As long as the corridor leads to dwelling units, residential sprinklers are permitted in the corridor.

Section 3.3.65 of NFPA 13 defines a dwelling unit as, "One or more rooms arranged for the use of one or more individuals living together as in a single housekeeping unit normally having cooking, living, sanitary and sleeping facilities that include, but are not limited to, hotel rooms, dormitory rooms, apartments, condominiums, sleeping rooms in nursing homes, and similar living units." Note that sleeping rooms in nursing homes are included in the definition of a dwelling unit, but hospital rooms are not. This is a line of demarcation that the health care industry is using to determine where residential sprinklers can be used.

NFPA 13D: The first edition of NFPA 13D was developed in 1975 as a part of the effort to respond to the America Burning report that has been discussed earlier in this article. The 1975 edition of NFPA 13D could only rely on the standard spray sprinkler technology, because the residential sprinkler had not yet been invented, so it was not very useful as an installation standard and very few sprinkler systems were installed under this document.

In 1980, NFPA 13D was revised and required the use of residential sprinklers. Technically, the first residential sprinkler had not yet received its listing, but the writers of NFPA 13D knew that it was coming and hence required its use. It has been modified many times since 1980 (approximately every three years), but the core assumptions under which the document was written have not changed.

NFPA 13D is intended to be used in single-family homes, two-family homes, manufactured homes, and townhouses. Because manufactured homes are only intended for one- or two-family use, it seems redundant to list them separately in the scope of the document, but the NFPA feels that it is important to point out that this is the appropriate standard to use because manufactured homes are regulated by a different governmental body than traditionally constructed homes.

The goal of NFPA 13D is to provide life safety, even in the room of fire origin, while also keeping the cost as affordable as possible. To keep the cost down, some elements of property protection have been removed from the standard. The stated purpose is to aid in control and detection of residential fires and provide:

- Improved protection “against injury and life loss”
- Prevent flashover in room of fire origin (where sprinklered)
- Improve chance for occupants to escape or be evacuated

Unlike NFPA 13 and NFPA 13R, 13D is not intended as a property protection standard. However, experience has shown that 13D systems are often successful in mitigating property damage.

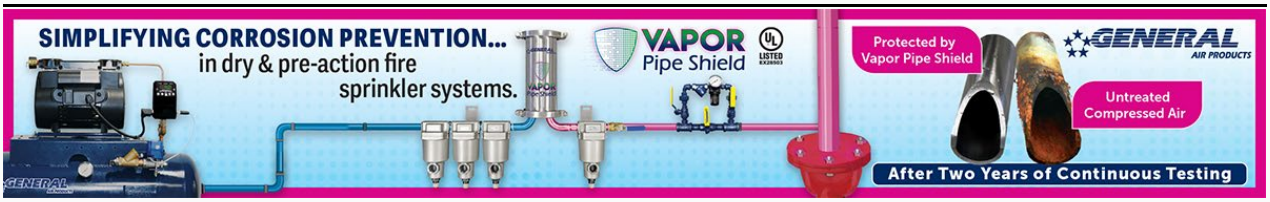
NFPA 13R: In the mid-1980s there was a push to start providing sprinkler protection for low-rise residential apartments and hotels. Owners of these buildings were concerned with the price of full NFPA 13 systems and in the late 1980s, the NFPA Committee on Automatic Sprinklers was asked to draft a standard with a higher degree of reliability than NFPA 13D and a lower cost than NFPA 13 for use in multiple-family buildings and hotels. The committee complied with the request and developed NFPA 13R, which was first approved by the NFPA membership at its 1988 Fall meeting and adopted as the 1989 edition. Since then, numerous other editions have been published, with the most recent being the 2022 edition.

NFPA 13R is a residential sprinkler design standard focused on low-rise residential occupancies. The intent is to provide a sprinkler system that aids in the control of residential fires and provides improved protection against injury and life loss in multi-family dwellings, and it stated purpose is to aid in control and detection of residential fires and provide:

- Improved protection “against injury, loss of life and property damage”
- Prevent flashover in room of fire origin (where sprinklered)
- Improve chance for occupants to escape or be evacuated

NFPA 13R is titled the *Standard for the Installation of Sprinkler Systems in Low-Rise Residential Occupancies.* The scope of NFPA 13R says that it is for use in residential occupancies that are up to four stories in height that are located in buildings not exceeding 60 feet above grade plane. Basically, NFPA 101 and model building codes, such as the International Building Code (IBC) contain four categories of residential occupancies that would typically be appropriate for use with this standard:

- Apartments (which include condominiums, cooperatives, and other multiple-family buildings, regardless of who owns the individual units)
- Lodging and Rooming Houses (which includes places where small groups of people sleep like some military barracks and bunk rooms of fire stations)
- Board and Care Facilities (which NFPA 101 allows NFPA 13R systems to be used in, but adds requirements for additional sprinklers)
- Hotels, Motels and Dormitories



Progress on Residential Fire Loss

A great deal of progress has been made in the years since the America Burning report was issued. Each year, the NFPA's Fire Analysis and Research Division publishes a report called "Fire Loss in the United States" that evaluates the most recent data from fire departments around the country. The most recent year's report that is available at the time this text is being written is the 2020 report. The following are some bullet points from that report:

All structure fires

- 481,500 fires
- Approximately 2,980 fire deaths
- Approximately 13,900 civilian injuries
- Approximately $12.3 billion in property damage

Residential occupancies

- 361,500 fires
- Approximately 2,800 fire deaths
- Approximately 12,700 civilian injuries
- Approximately $8 billion in property damage

The good news is that fire deaths are down significantly since 1971. But the bad news is that fire deaths have been at this plateau for a long time and no additional strategies seem to be working to reduce fire losses even more. Additional bad news is that 80% of the losses are still occurring in residential occupancies. It is clear that smoke detectors and other fire protection concepts have done what they can. To reduce fire losses even more, the next step has to be to get residential sprinklers

installed in more residential occupancies, including single-family homes and existing high-rise residential buildings.

References

NFPA 13: *Standard for the Installation of Sprinkler Systems, 2022 edition*

NFPA 13D: *Standard for the Installation of Sprinkler Systems in One- and Two-Family Dwellings and Manufactured Homes, 2022 edition*

NFPA 13R: *Standard for the Installation of Sprinkler Systems in Low-Rise Residential Occupancies, 2022 edition*

Layout, Detail and Calculation of Fire Sprinkler Systems 3rd edition, 2022, NFSA

Training and Education

LTP
Layout Technician Pathway

Sign-Up for one of our Layout Technician Pathway Courses
Four in-person options to chose from!

NFSA's newly updated fire sprinkler Layout Technician Pathway (LTP) prepares fire sprinkler layout and design professionals for NICET Levels I & II certifications. It also provides a great refresher for those who have been designing systems but need a comprehensive refresher. Students will receive a hard copy of the recently updated and revised "Layout Book" as well as a copy of the 2022 edition of the NFPA 13 standard.

The LTP consists of two parts. Students must first complete the on-line Part 1: Fundamentals before attending the in-person Part 2: Application session. The 25 self-paced online modules cover everything from "Parts of a Sprinkler" to "Introduction to Fire Sprinkler Calculations." The 3-day in-person instructor-led Part 2: Application class applies the content learned in the

previous Fundamentals course. There are four in-person and one virtual session offered in 2023.

NOTE: Students must register for Part 1: Application at least one month before the start of in-person Part 2: session in order to allow enough time to complete the on-line modules.

Layout Technician Pathway cost:
Members: $2,200.00
Non-members: $4,400.00 – **Join here** to save 50%!

2023 Registration Deadlines	Part 1: Fundamentals completion deadline	Part 2: Application session dates	Part 2: Application session locations
June 25	July 24	July 25-27	Shoreview, MN
Aug. 28	Sept. 25	Sept. 26-28	Tacoma, WA
Oct. 14	Nov. 13	Nov. 14-16	Linthicum Heights, MD

Check Out All Options Here

All 2023 Tech Tuesdays are NOW available for registration!

Our next Tech Tuesday will be May 16th, 2023 at 12:30 - 1:30 PM eastern time. The topic will be Residential Sprinklers and Systems

America's fire problem is a residential fire problem and residential sprinklers are the solution. This presentation will give an overview of the various residential sprinkler system standards and highlight the concepts behind these life-safety systems.

**NFSA now uses Adobe Connect for Tech Tuesdays. The link to the virtual classroom will be included in your confirmation and reminder emails. When entering the virtual classroom, log on using your NFSA username and password. All participants must be individually registered and must individually access the class to receive credit.

You may find it easier to access the meeting if you download Adobe Connect.

Register for the next Tech Tuesday Here

National Fire Sprinkler Association
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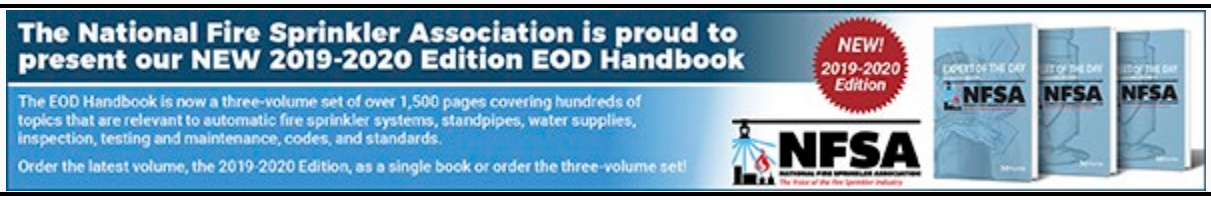
1-800-683-NFSA (6372)



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