



This edition of TechNotes was written by Michael Joanis, PE, Chief Engineer with the NFSA.

Gaps in Sprinkler Rules

NFPA 13 has been the primary installation standard for fire sprinklers since 1896. Taking a quick look on my bookshelf, the 1985 handbook edition of NFPA 13 is 477 pages, including NFPA 13A (now NFPA 25) and NFPA 13D. The current NFPA 13 handbook is over 1200 pages, it does not include other standards, and the pages are 70% larger. There have been many significant revisions to the standard throughout my career.

NFPA 13 has a long and proven history of ensuring system performance. Ninety-six percent of fires are controlled by four or fewer sprinklers. Sprinklers confine the fire to the object or room of origin and are effective eighty-eight percent of the time. However, with fifty-seven percent of system failures attributed to the system being shut off, there is always an opportunity to improve sprinkler system performance. For more information on sprinkler performance, please reference the technically speaking article on page 13, by NFSA's data specialist Jon Nisja, at this link: [National Fire Sprinkler Magazine, Issue No. 239, May-June 2023](#).

One would expect that after 127 years of development, NFPA 13 must have it all covered. However, the built environment is constantly changing. Building occupancies, hazards, and stored commodities are evolving. The most notable change has been the evolution of synthetic materials which have replaced natural materials within the contents of our buildings and homes.

The NFPA revision process is deliberate, slow, and consistently behind in addressing modern technologies. It is also not possible for the standard to address every situation. This creates gaps in the prescriptive requirements of the standard. Current examples of this include lithium-ion batteries, electric vehicles, car stacking systems, and storage in open top containers.

The focus of this TechNotes is on who is responsible for hazard and commodity classification and how gaps in the standard can be addressed. This information forms the foundation for many subsequent decisions regarding design criteria and installation rules. Proper hazard and commodity classification is essential to ensure the NFPA 13 stated purpose of a reasonable degree of protection for life and property is achieved.



Who is Responsible?

Today's laws and model codes clearly place the ultimate responsibility for fire safety on the building owner. Owners defer and share this responsibility by hiring professionals, including engineers and sprinkler contractors. The general requirements in Chapter 4 of NFPA 13, 2022 edition, outline the owner's responsibility in the process. This includes an owner's certificate which provides the information required to form the basis of design. The intended use of the building, the materials within the building, and the maximum height of any storage

must be provided by the owner to ensure the appropriate hazard and commodity classification is selected.

The roles of the owner's engineer or design professional and the contractor's layout technician are then further defined. The design professional is responsible for determining the classification of the hazard(s), storage arrangements and commodities to be protected, and the design criteria. The layout technician is responsible for applying applicable codes and standards based on the design professional's basis of design to layout and prepare installation drawings, material submittals, and calculations. These roles and responsibilities can be reviewed in more detail at [The Engineer and the Engineering Technician Designing Fire Protection Systems](#).

Current Prescriptive Requirements

NFPA 13 currently provides prescriptive requirements that address many hazards and commodities. We start there to determine if prescriptive requirements are currently available.

Chapter 4 provides the requirements for hazard classification. Hazard classification is based on fuel load and not simply how the space is being used or occupied. They are based on the normal expected fuel load for that type of occupancy. The hazard classifications include miscellaneous storage, low pile storage, miscellaneous tire storage, light hazard, ordinary hazard, extra hazard, high pile storage, or special occupancy hazards. Light, ordinary, and extra hazard are further defined based on the quantity and combustibility of the contents as well as stockpile height. Annex A for the hazard classification sections provides examples of occupancies for each hazard classification.

High-piled storage is defined as storage arrangements that do not meet the requirements of miscellaneous storage, low-piled storage, or miscellaneous tire storage having storage of Class I through Class IV commodities more than 12 feet or Group A plastics more than 5 feet in height. For high-piled storage, the commodity classification is deferred to Chapter 20. Sections 20.3 and 20.4 along with the associated Annex section provide definitions and examples of the various commodity classifications.

It is common to have a mix of commodities. In this case, mixed commodity storage must be protected based on the requirements for the highest commodity classification. There is an exception that allows up to ten random pallet loads of a higher hazard commodity in an area not exceeding 40,000 square feet to be protected based on the lower commodity classification. The standard also makes provisions to allow mixed commodities to be segregated.

Special occupancy hazards are defined in Chapter 27. This includes thirty-four defined special occupancies. In many cases, NFPA 13 references other NFPA standards for special occupancies. Where the requirements of the referenced standard differ from the requirements of NFPA 13, the referenced standard shall take precedence.

Annex Table A.20.4(a) provides examples of commodities that are specifically not addressed by the prescriptive requirements of the current standard. These are the most common gaps in the sprinkler rules including lithium-ion batteries, boat storage on racks, carpet rolls, combustible metals, nitrate fertilizers, fireworks, and storage containers.



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How Do We Address the Gaps?

When the standard does not provide prescriptive requirements for classification of your hazard or commodity, the gaps in the sprinkler requirements are addressed through equivalency as permitted by Section 1.5.

This section allows the use of systems, methods, or devices that are of equivalent or superior quality, strength, fire resistance, effectiveness, durability, and safety. It allows the user to submit documentation that the proposed equivalent method of protection meets or exceeds the prescriptive requirements of the standard.

It is important to start with thorough knowledge of the current prescriptive hazard and commodity classifications to be able to determine equivalency. The equivalency statement provides documentation and may include some or all the following items:

1. Why is the proposed hazard or commodity classification not currently addressed by the standard?
2. Existing test data for the hazard and commodity classifications currently addressed in the standard.
3. New test data on the proposed hazard or commodity classification.
4. Why the proposed hazard or commodity classification is equivalent or superior to that prescribed in the current standard?
5. Manufacture listings or approvals that address a specific hazard or commodity classification and their supporting data.
6. Computer modeling of a specific hazard or commodity classification.

The standard requires the authority having jurisdiction approve all proposed equivalent methods. In the case of determining an equivalent hazard and commodity classification, the authority having jurisdiction will often reach out to independent third-party industry experts for support when it is beyond their level of expertise.

Additional Resources

Additional resources that may assist with filling gaps in the NFPA 13 hazard and commodity classifications include the following:

1. The International Fire Code, 2021 edition, Section 3203. This section provides definitions and examples of commodity classifications: [IFC 2021](#)
2. Factory Mutual Data Sheet 8-1 for Commodity Classification. This includes definitions and examples of commodity classification by Factory Mutual including lithium-ion batteries. Section 3.0 provides support for these recommendations and detailed backup information on burning characteristics, testing, and factors affecting commodity classification: [FM Data Sheets](#)
3. Publicly available test results from owners with specific hazards or commodities
4. Publicly available test results from Underwriters Laboratory and Factory Mutual
5. Test reports available from manufacturers based on specific product listings and approvals.
6. NFPA Research Foundation Reports: [NFPA Research Foundation Reports](#)
7. SFPE Handbook of Fire protection Engineering, fifth edition: [SFPE Handbook](#)
8. NFSA Expert of the Day (EOD) Handbook. There is a section specific to hazard and occupancy classification with over thirty NFSA member questions and staff responses: [NFSA EOD Handbooks](#)

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Our next Tech Tuesday will be August 15th, 2023, from 12:30 pm to 1:30 pm eastern time. The topic will be Gaps in Sprinkler Rules.

Building and fire codes with reference to installation standards provide prescriptive requirements for the classification of hazards and commodities as well as the associated design criteria. It is not possible for the prescriptive standards to address every possible scenario in the built environment, therefore gaps exist that must be addressed.

The design professional has the responsibility for determining hazard and commodity classifications in accordance with the process and guidance provided by the standards. There are also many special occupancies identified that provide an associated design criteria. When there are gaps in the standards we must identify methods to address them and provide proper sprinkler protection based on additional resources.

Member Cost: Free

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