

**High-Piled Combustible Storage
Application Guide, 2024 Edition:
Based on the 2024 *International
Fire Code*[®]**

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Preface

Recent decades have seen significant changes in the retail and wholesale economy. Consumer demands are diverse, and multiple types and styles of products or goods are constantly being manufactured and updated. Many of these products comprise significant fuel loads.

Consumers once visited “brick and mortar” stores for shopping; now with a few mouse clicks or the use of special apps, products are delivered to their home or workplace within a matter of days or even hours.

Wholesalers likewise have changed: moving their storage, shipping and distribution operations to centralized operational nodes near major transportation corridors. Huge warehouses are erected in strategic locations to assure timely receipt from suppliers and delivery to customers. These warehouses often rely on high-piled storage to maximize the amount of product per square foot while improving material handling with powered industrial trucks, robots or automated storage systems.

High-piled combustible storage is economical to manufacturers and their logistics or supply chains because more goods can be stored within a given area with solid-pile, palletized, shelf, bin-box, rack, automated or carousel storage, reducing the storage or display cost for each Group S (storage) or Group M (mercantile) square foot.

Because high-piled combustible storage allows greater amounts of combustible materials in a variety of packaging methods within a given floor area, the increased fuel load increases the potential fire dollar-loss for each square foot. Fast-spreading fire plumes can reach the top of a storage array in only seconds or leap across aisles to ignite adjacent combustibles. Egress for workers and the public may be compromised by fast-spreading fires. Firefighters face significant challenges and dangers locating and suppressing fires. Fire, smoke and water damage among stored goods can result in property losses surpassing a building’s construction cost.

While not all high-piled storage configurations require automatic fire sprinkler protection, those that do provide challenges to verify a systems’ ability to control, confine or suppress fires among the diverse commodities that may be found in any storage array.

The property protection insurance industry and the fire protection engineering community continue to research fire protection strategies and designs to safeguard high-piled storage configurations. New automatic sprinklers are designed specifically for high-piled combustible storage, including sprinklers that are triggered by heat detectors and discharge over a design area predicted by sophisticated computer algorithms. Fire protection design options have increased, and the National Fire Protection Association (NFPA) or FM automatic sprinkler protection require-

ments continue to be modified extensively as new products are created and small- and full-scale fire testing results are evaluated.

In addition to generic commodity sprinkler designs, specific design criteria for some hazardous products in large mercantile or storage occupancies have been added to NFPA Standard 13, *Installation of Sprinkler Systems*. These criteria are very detailed and are influenced by commodity arrangement, packaging, rack and shelf layouts and the commodity storage methods. The NFPA 13 2022 edition referenced in this application guide includes eight separate chapters addressing general and high-piled storage based on the sprinkler type, commodity and storage arrangement.

This application guide is intended to familiarize code officials and design professionals with of the 2024 *International Fire Code*® (IFC®) Chapter 32 High-Piled Combustible Storage and the 2024 *International Building Code*® (IBC®) Section 413 Combustible Storage. This guide also will introduce readers to the 2022 edition of NFPA 13 storage occupancy fire sprinkler requirements. It includes an analysis of the predominant storage automatic sprinkler design methods and the variables that can affect sprinkler performance for high-piled combustible storage protection.

Special Note: *At the time of this Application Guide's publication, concurrent code changes were in development to the 2027 IFC from the 2024 IFC code editions. These changes affect products and storage arrangements that include plastic materials and updated 2024 IFC content. (See Module 2: Commodity Classification). References to the 2024 and 2027 IFC editions are included where needed to explain the differences.*

The information and opinions expressed in this application guide are those of the present and past authors and do not necessarily represent the official position of the International Code Council® (ICC®). Additionally, the opinions may not represent the viewpoint of any code enforcement agency. Opinions expressed in this publication are intended only to be a resource for the application of IFC Chapter 32, IBC Chapter 4, NFPA 13 and other cited codes or standards. The code official is not obligated to accept such opinions. The code official is the final authority in rendering interpretations of the code and its adopted standards. (See IFC or IBC Section 202 for the definition of “approved.”)

Questions or comments concerning this application guide are encouraged. Please direct any correspondence to applicationguide@iccsafe.org.

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The High-Piled Combustible Storage Application Guide originally was produced in 1990 by Elley Klausbruckner, P.E., of Klausbruckner and Associates, San Diego, CA. Scott Stookey, Engineering Associate for the City of Austin, Texas Fire Department, provided extensive comment.

The second edition was revised by Kevin H. Scott, president of KH Scott & Associates. Kevin has extensive experience in the development of fire safety, building safety and hazardous materials regulations. Kevin has worked actively for more than 35 years developing fire code, building code and fire safety regulations at the local, state, national and international levels.

Kevin has developed and presented many seminars on a variety of technical subjects, including means of egress, high-piled combustible storage, hazardous materials, and plan review and inspection practices.

Building upon that solid foundation, Rob Neale of Integra Code Consultants in Frederick, MD has updated this latest edition to the 2024 *International Fire Code* and *International Building Code* requirements and referenced standards. Rob spent several decades in municipal fire protection and eventually retired as the National Fire Academy deputy superintendent for curriculum and instruction. Like the previous contributors, Rob has developed and presented many seminars on a variety of technical subjects.

About the Publication

Description

The High-piled Combustible Storage Application Guide, 2024 edition provides a basic understanding of the hazards associated with high-piled combustible storage. It introduces readers to Chapter 32 of the 2024 IFC and IBC Section 413. This publication places special emphasis on commodity classification and understanding the NFPA 13 storage design criteria.

This Application Guide is intended to work in concert with ICC professional development efforts such as Learn Live, in-person and online training. Like the 2024 IFC *High-piled Storage* training program, this guide is divided into four modules. Each training program module is designed to work as a standalone 90-minute session or, when combined, the four modules provide a full day of professional training.

ICC's extensive training library can be found at shop.iccsafe.org/training.html.

Goal

This application guide is intended to familiarize readers with high-piled combustible storage hazards and provide a basic understanding of Chapter 32, High-piled combustible storage provisions, of the 2024 IFC.

Learning Objectives

Upon completion of this publication, readers will be better able to:

Module 1: Scope and Application

1. Describe the scope and application of Chapter 32 of the IFC.
2. List the six “material-specific requirements” identified in Chapter 32 Scope.
3. Identify documentation required for construction and operational permits.
4. Recognize at least three high-piled storage configurations.

Module 2: Commodity Classification

1. Analyze commodity classification accuracy based on permit applicant-provided data and IFC Table 3203.8.
2. Question Group A, B and C plastics’ impact on permit applicant-provided commodity classifications.
3. Infer mixed commodity classification accuracy based on permit applicant-provided data and Figures 3203.9(1) and 3203.9(2) of the IFC.
4. Discriminate among pallet types for their impact on permit applicant-provided commodity classes.

Module 3: High-Piled Storage Areas and Fire Protection

1. Explain designated high-piled storage area requirements and options.
2. Distinguish among designated high-piled storage area separation options.
3. Analyze the fire protection and life safety requirements and options of IFC Table 3206.2.
4. Explain the importance of aisles for egress, access and fire control.
5. Compare the passive and mechanical smoke control requirements found in Section 910 of the IFC.

Module 4: Storage Area Operational Controls

1. Compare storage limit capacities among solid-pile, shelf and palletized arrays.
2. Interpret the fire sprinkler protection differences between solid-pile or shelf storage or rack-storage as found in Chapter 32 of the IFC.
3. Apply Chapter 32 housekeeping and maintenance requirements.
4. Explain the differences between longitudinal and transverse flue spaces.

Appendix: Automatic Sprinkler Protection for High-Piled Combustible Storage

Target Audience

This guide is for the use of Building Inspectors, Building Officials, Fire Inspectors, Fire Code Officials, Architects, Engineers and Warehouse Owner/Operators.

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[A] = Administrative Code Development Committee;

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[FG] = International Fuel Gas Code Development Committee;

[M] = International Mechanical Code Development Committee; and

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