

**Fire Code Essentials:
Based on the 2024 International
Fire Code®**

Kevin H. Scott

International Code Council Staff:

Chief Operating Officer:
Mark A. Johnson

Chief Knowledge Officer/Executive Vice
President:
Joan O'Neil

Senior Vice President, Business and
Product Development:
Hamid Naderi

Vice President, Product Development:
Sandra Hyde, PE

Product Development Coordinator
and Analyst:
Isabella Monteiro

Publisher:
Katie Mohr

Publications Manager:
Anne F. Kerr

Manager of Publications Production:
Jen Fitzsimmons

Project Manager/Senior Editor:
Mary Lou Luif

Series Editor:
Jillaine Newman

Production Technician:
Linda Foegen

Marketing Manager:
Joram Suede

Cover Design:
Stephanie Hess

COPYRIGHT © 2025
by International Code Council, Inc.

ALL RIGHTS RESERVED.



ISBN: 978-1-964970-10-3 (soft-cover edition)
ISBN: 978-1-964970-11-0 (PDF download)

This publication is a copyrighted work owned by the International Code Council, Inc. ("ICC"). Without separate written permission from the ICC, no part of this publication may be reproduced, distributed or transmitted in any form or by any means, including, without limitation, electronic, optical or mechanical means (by way of example, and not limitation, photocopying or recording by or in an information storage and/or retrieval system). For information on use rights and permissions, please contact: ICC Publications, 4051 Flossmoor Road, Country Club Hills, Illinois 60478; 1-888-ICC-SAFE (422-7233); <https://www.iccsafe.org/about/periodicals-and-newsroom/icc-logo-license/>.

The information contained in this document is believed to be accurate; however, it is being provided "as-is" without representation or warranty for informational purposes only and is intended for use only as a guide. Publication of this document by the ICC should not be construed as the ICC engaging in or rendering engineering, legal or other professional services. Use of the information contained in this publication should not be considered by the user as a substitute for the advice of a registered professional engineer, attorney or other professional. If such advice is required, it should be sought through the services of a registered professional engineer, licensed attorney or other professional.

Trademarks: "International Code Council," the "International Code Council" logo, "ICC," the "ICC" logo, "International Fire Code," "IFC" and other names and trademarks appearing in this publication are registered trademarks of the International Code Council, Inc., and/or its licensors (as applicable), and may not be used without permission.

Errata on various ICC publications may be available on the Content Updates site at www.iccsafe.org/contentupdates.

First Printing: November 2025

PRINTED IN THE USA

Table of Contents

Preface	ix
About the International Code Council	xi
About the International Fire Code	xiii
Acknowledgments	xiii
About the Author	xiv
Prerequisite Reading—Occupancy Classification	xv

PART I: CODE ADMINISTRATION AND ENFORCEMENT 1

Chapter 1: Introduction to Building and Fire Codes	2
Code Development	3
The Building and Fire Codes—Scope	5
International Building Code® (IBC®)	6
International Residential Code® (IRC®)	7
International Wildland-Urban Interface Code® (IWUIC®) ..	8
International Mechanical Code® (IMC®)	8
International Fuel Gas Code® (IFGC®)	9
International Property Maintenance Code® (IPMC®)	9

International Fire Code	10
Applicability of the IFC	12
Retroactive Construction Requirements in the IFC	14
Change of Use or Occupancy	15
Historic Buildings	17
Referenced Codes and Standards	18
Chapter 2: Legal Aspects, Permits and Inspections	20
Code Adoption	20
Adoption of the IFC	21
Amending the IFC	22
Appendices	22
Local and State Laws	23
Authority	24
Authority and Duties of the Fire Code Official	24
Technical Assistance	26
Alternative Materials and Methods	26
Modifications to the Code	28
Authority at Fires and Other Emergencies	29
Permits	31
Operational and Construction Permits	31
Construction Documents	33
Permit Application	34
Fees	36
Inspections	37
Right of Entry	38
Liability	39
Testing and Operation	42
Unsafe Structures and Equipment	42
Stop Work Order	43
Board of Appeals	45

PART II: CODE ADMINISTRATION AND ENFORCEMENT 47

Chapter 3: General Precautions Against Fire	48
Combustible Materials	49
Combustible Waste	50
Valet Trash Collection	50
Outdoor Pallet Storage	51
Ignition Sources	53
Open Flames	53
Vacant Premises	54
Indoor Displays	57
Hazards to Firefighters	58
Vegetative and Landscaped Roofs	58

Additive Manufacturing (3D Printing)	60
Lithium-Ion and Lithium Metal Battery Storage	61
Powered Micromobility Devices	64

Chapter 4: Emergency Planning and Preparedness 65

Emergency Forces Notification	66
Public Assemblies and Events	66
Crowd Managers	67
Fire Safety and Evacuation Plans	68
Emergency Evacuation Drills	69
Employee Training and Response	72

PART III: SITE AND BUILDING SERVICES

75

Chapter 5: Fire Service Features 76

Fire Apparatus Access Roads	77
Appendix D	79
Access to Buildings	81
Hazards to Firefighters during Access	84
Fire Protection Water Supplies	84
Appendix B	85
Inspection and Maintenance	86
Emergency Responder Communication Coverage	88

Chapter 6: Building Systems 93

Elevators	94
Fuel-Fired Appliances	97
Commercial Cooking Operations	104
Commercial Kitchen Exhaust Hoods	104
Cooking Oil Storage	106
Automatic Fire-Extinguishing Systems	109
Mechanical Refrigeration	110
Electrical Wiring and Equipment	111
Emergency and Standby Power Systems	113
Solar Photovoltaic Power Systems	119
Stationary Fuel Cell Power Systems	121
Energy Storage Systems	122
Stationary Storage Battery Systems	123
Clothes Dryers	125

Chapter 7: Interior Finish and Decorative Material 127

Purpose of the Requirements	128
Interior Wall and Ceiling Finish and Trim	130
Foam Plastics	135

Upholstered Furniture and Mattresses	135
Decorative Materials	136

PART IV: FIRE/LIFE SAFETY SYSTEMS AND FEATURES **139**

Chapter 8: Requirements for All Fire Protection Systems	140
Where Are Fire Protection Systems Required?	141
Construction Documents and Acceptance Testing	145
Inspection, Testing and Maintenance	149
Fire Protection System Impairment	152
Fire Protection System Monitoring	154
Chapter 9: Automatic Sprinkler Systems	156
Level of Exit Discharge and Fire Area	157
Design and Installation Standards	159
Types of Automatic Sprinkler Systems	162
Occupancies Requiring Automatic Sprinkler Protection	167
Fire Sprinklers ‘Throughout’ and Exempt Locations	175
Fire Department Connection	178
Chapter 10: Fire Alarm and Detection Systems	180
Design and Installation Standards	181
Fundamental Components	184
Occupancies Requiring Fire Alarm and Detection Systems	188
Carbon Monoxide Alarms	197
Gas Detection Systems	199
Chapter 11: Means of Egress	201
Introduction to Means of Egress	202
Occupant Load	208
Egress Width	211
Exit Access and Exit Access Travel Distance	214
Exit Doors and Exit Access Doors	220
Exit Signs and Means of Egress Illumination	223
Means of Egress Maintenance	226

PART V: SPECIAL PROCESSES AND BUILDING USES 231

Chapter 12: Motor Fuel-Dispensing Facilities and Repair Garages. 232

Applicable Requirements by Fuel.	233
Dispensing Operations and Devices—All Fuels	233
Flammable and Combustible Liquid Fuel Dispensing	238
Liquefied Petroleum Gas Dispensing.	246
Hydrogen Dispensing	249
Mobile Fueling	251

Chapter 13: Flammable Finishes. 254

Types of Flammable Finishing Processes	255
Spray Booth and Spray Room Construction	257
Mechanical Ventilation.	262
Illumination.	265
Interlocks.	267
Fire Protection.	268

Chapter 14: High-Piled Combustible Storage 271

What Is High-Piled Combustible Storage?	272
Commodity Classification	273
High-Piled Combustible Storage Areas.	280
Storage Methods	286
Aisles.	291

Chapter 15: Other Special Uses and Processes 294

Combustible Dust-Producing Operations.	295
Fire Safety during Construction and Demolition.	299
Welding and Other Hot Work.	303
Higher Education Laboratories	306
Marijuana Grow and Processing Facilities	309
Distilled Spirits and Wines.	311
Temporary Heating and Cooking	313

PART VI: HAZARDOUS MATERIALS 315

Chapter 16: General Requirements for Hazardous Materials 316

Material Classification	319
Hazardous Materials Reporting.	325
Storage and Use	328

Maximum Allowable Quantity per Control Area	330
Control Areas	339
Hazard Identification Signs	343
Separation of Incompatible Materials	345
Chapter 17: Compressed Gases	348
Cylinders, Containers and Tanks	351
Pressure Relief Devices	352
Markings	354
Security	356
Valve Protection	358
Separation from Hazardous Conditions	358
Exhausted Enclosures and Gas Cabinets	360
Leaks, Damage or Corrosion	361
LP-Gas Cylinder Exchange Program	363
Liquid Carbon Dioxide for Beverage Dispensing	364
Chapter 18: Flammable and Combustible Liquids	366
Classification of Liquids	367
Maximum Allowable Quantities	370
Containers, Portable Tanks and Stationary Tanks . .	372
Design and Construction of Storage Tanks	375
Storage Tank Openings	381
Normal Vent	382
Emergency Vent	383
Glossary	387
Index	391



Preface

Fire code enforcement is an important public safety function because unwanted fires injure and kill thousands annually. Unwanted fires also inflict a monetary impact on communities because fires remove businesses from the tax rolls while the damaged building is rebuilt. Statistics confirm that over 40 percent of the businesses that experience a fire never reopen because they lose their customer base. Of concern to any community is the accidental release of hazardous materials because of the potential for fire, explosion, or injury due to incapacitation by the chemical's constituents. All of these incidents require a response by the fire department, which places firefighters in danger, especially when an interior rescue and fire attack is required. Given the broad scope of hazards in society, the job of enforcing the fire code is challenging. This is especially true when dealing with hazardous materials, high-piled combustible storage and combustible dust-producing operations.

Fire Code Essentials: Based on the 2024 International Fire Code® (IFC®) was developed to address the need for an illustrated text explaining the basics of the fire code. It is intended to provide an

understanding of the proper application of the code to the most commonly encountered hazards found in many communities and cities. The text is presented and organized in a user-friendly manner with an emphasis on technical accuracy and clear noncode language. The content is directed to fire service professionals, code officials, designers, life safety professionals and others in the building construction industry.

The content of *Fire Code Essentials* is organized to correspond with the arrangement of the 2024 IFC. It commences with a review of the legal aspects associated with the adoption and enforcement of the fire code provisions, including permitting, right of entry and inspector liability. It progresses through common hazards that can be found in any occupancy; site and building features that must be addressed with any new construction; fire and life safety systems; hazards presented by special processes and operations; and it concludes with a review of the most commonly encountered hazardous materials. This format is useful to readers because it pulls together related information from the various sections of the IFC into one convenient location that does not necessarily follow the sequence in the code. Though the code format often results in requirements being found in different chapters, the book's format is intended to address a given situation or operation. This will provide a familiar frame of reference to those with code enforcement experience. The book is formatted to follow the steps of new building construction or renovation as well as areas of focus during any fire inspection. This format and arrangement offers the reader a means to understanding why fire code enforcement is an important public safety function and why it is so important to the safety of emergency responders.

Anyone involved in the design, construction or inspection of buildings or industrial processes and hazards will benefit from this book. Beginning and experienced fire inspectors, plans examiners, contractors, engineers, architects, environmental specialists, health and safety professionals, and students in fire science, fire protection, and building inspection technology curriculum or related fields of study and work will gain a fundamental understanding and practical application of the frequently used provisions of the 2024 edition of the IFC.

Reasonable and correct application of the code provisions is enhanced by a basic understanding of the fire code development process, the scope, intent and correlation of the family of the

International Codes, and the proper administration of those codes. This fundamental information is provided in the opening chapters of this book. The book also explains the interaction of the fire code with other local and state regulations. Because the content is focused on the fire code, the book includes prerequisite reading that is important in understanding the *International Building Code*® (IBC®) occupancy classification system, how buildings are assigned occupancy classifications, and how these classifications are used in the application of the IFC.

This book is not intended to cover all provisions of the IFC or all of the accepted materials and methods for the construction of fire protection systems, fire and life safety features, or the storage and handling of combustible and hazardous materials. Focusing in some detail on the most common hazards that are found in nearly every community affords an opportunity to fully understand the basics without exploring every variable and alternative. This is not to say that information not covered is any less important or valid. This book is best used as a companion to the IFC and appropriate National Fire Protection Association standards, which should be referenced for additional information.

Fire Code Essentials features full color illustrations and photographs to assist the reader in visualizing the application of the code requirements. Practical examples, simplified tables and highlights of particularly useful information also aid in understanding the provisions and determining code compliance. References to the applicable 2024 IFC sections are cited to assist readers in locating the corresponding code language and related topics in the code.

ABOUT THE INTERNATIONAL CODE COUNCIL®

The International Code Council is the leading global source of model codes and standards and building safety solutions that include product evaluation, accreditation, technology, codification, consulting, training and certification. The International Code Council's codes, standards and solutions are used to ensure safe, affordable and sustainable communities and buildings worldwide.

The International Code Council family of solutions includes the ICC Evaluation Service (ICC ES), S. K. Ghosh Associates, the

International Accreditation Service (IAS), General Code, ICC NTA, ICC Community Development Solutions, Alliance for National & Community Resilience (ANCR) and American Legal Publishing.

Office Locations:

Headquarters:

200 Massachusetts Avenue, NW, Suite 250
Washington, DC 20001
888-ICC-SAFE (888-422-7233)
www.iccsafe.org

Eastern Regional Office

900 Montclair Road
Birmingham, AL 35213

Central Regional Office

4051 Flossmoor Road
Country Club Hills, IL 60478

Western Regional Office

3060 Saturn Street, Suite 100
Brea, CA 92821

MENA Regional Office

Dubai Association Centre Office, One Central
Building 2, Office 8, Dubai World Trade Centre Complex
PO Box 9292, Dubai, UAE

OCEANIA Regional Office

Level 9, Nishi Building
2 Phillip Law Street
Canberra ACT 2601 Australia

Family of Solutions:



ABOUT THE INTERNATIONAL FIRE CODE

The *International Fire Code*® (IFC®) is a comprehensive, stand-alone model code that regulates minimum fire and life safety requirements for new and existing buildings, facilities, storage and processes. The IFC addresses fire prevention, fire protection, egress and the storage and use of hazardous materials in new and existing buildings, facilities and processes. The IFC provides a total approach of mitigating hazards in all buildings and sites, regardless of the hazard being located indoors or outdoors.

The IFC contains criteria for design, construction and maintenance. For example, before one constructs a building, the site must be provided with an adequate water supply for firefighting operations and a means of building access for emergency responders in the event of a medical emergency, fire or natural or technological disaster. Depending on the building's occupancy and uses, the IFC regulates the various hazards that may be housed within the building, including refrigeration systems, application of flammable finishes, fueling of motor vehicles, storage of high-piled combustible materials and storage and use of hazardous materials. The IFC sets forth minimum requirements for these and other hazards and contains requirements for maintaining the life safety of building occupants, the protection of emergency responders, and to limit the damage to a building and its contents as the result of a fire, explosion or unauthorized hazardous material discharge.

ACKNOWLEDGMENTS

Scott Stookey, previously a Senior Technical Staff member with the International Code Council and currently with the Austin, Texas, Fire Department, authored the 2009 *Building Code Basics: Fire*. That book was the basis for this publication series. The 2012, 2015, 2018, 2021 and 2024 editions have built on that original text. *Fire Code Essentials* is the result of a collaborative effort, and the author is grateful for the valuable contributions by the following talented staff of ICC: Senior Staff Architect Jay Woodward, for his contributions throughout this project. As always, his assistance and guidance on various provisions were extremely helpful.

ABOUT THE AUTHOR

Kevin H. Scott

President

KH Scott & Associates LLC

Kevin Scott is President of KH Scott & Associates LLC. Kevin has extensive experience in the development of fire safety, building safety and hazardous materials regulations. Kevin has actively worked for over 35 years in the development of fire code, building code and fire safety regulations at the local, state, national and international levels. Kevin previously worked as a Senior Regional Manager with the International Code Council, and before that, he was Deputy Chief for the Kern County Fire Department, California, where he worked for 30 years. He 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.

Kevin was a member of the original IFC Drafting Committee that worked to create the first edition of the IFC. He served for 7 years on the IFC Code Development Committee and was chairperson for the committee from 2001 to 2004. Kevin has actively participated in numerous technical committees to evaluate specific hazards and technologies, and to create regulations specific to those hazards. Some of the more significant committees include:

- High-piled Combustible Storage Committee
- Hydrogen Gas Ad Hoc Committee
- Task Group 400
- Technical Advisory Committee on Retail Storage of Group ‘A’ Plastic Commodities
- Underwriters Laboratories (UL) Fire Council.

Kevin’s constant work to improve fire and life safety has been recognized on many levels. His contributions have been acknowledged by various organizations with the presentation of the following awards:

- William R. Goss Award for Fire & Life Safety in 2021—presented by California State Firefighters Association.
- Honorary Member of the International Code Council in 2016—nominated by peers and approved by the voting members of the International Code Council.
- Mary Eriksen-Rattan Award in 2013—presented by the Southern California State Fire Prevention Officers’ Association.

- William Goss Award in 2009—presented by the California State Firefighters Association.
- Fire Official of the Year Award in 2005—presented by the California Building Officials.
- Robert W. Gain Award in 2003—presented by the International Fire Code Institute.

PREREQUISITE READING—OCCUPANCY CLASSIFICATION

Before readers of this book proceed into its content, they must understand that most communities regulate their buildings based on the occupancy classification, which is assigned based on the use and character of a building. A building's use is evaluated for life safety and fire risks, and its character represents the functions and activities that are expected to occur in the building. An occupancy classification is based on the relative hazards within a building, and similar uses are grouped into occupancy categories. A correct occupancy classification establishes the foundation for all the code requirements that are intended for the building's safe use.

Occupancies are classified into groups and subgroups using the requirements in the *International Building Code*® (IBC®). In most communities, the fire code official does not have the legal authority to assign an occupancy classification; this task is normally assigned to the building code official. The IBC addresses not only fire and life safety aspects, but also includes requirements for accessibility of mobility-impaired persons; building sanitation such as potable and wastewater systems; building ventilation such as the fresh air supply and heating, ventilating and air-conditioning systems as well as various structural loads of the building itself and external loads including snow, wind, rain and seismic ground movements. A building's occupancy classification influences these and other building code provisions. The *International Fire Code*® (IFC®) is primarily concerned with control of combustible materials and ignition sources; proper design, construction and maintenance of fire protection systems; safety of emergency responders and mitigation of processes or uses that represent a fire hazard or a high potential of injury or death, such as the release of hazardous materials, through safe design, construction, operation and maintenance.

The factors that govern the classification of a building's use must be carefully considered so that those uses or occupancies having approximately equivalent combustible content and similar fire and life hazard characteristics will be classified under the same occupancy heading. Occupancies are grouped so that fire protection requirements and height and area limitations applicable to the occupancy groups are rational for all building uses within that group. Every classification must be based on the premise that the uses covered by each will have similar fire hazards and life safety problems and that they share like characteristics. Within any given occupancy group or subgroup, no wide differentiation should exist between the fire hazards of the most hazardous and the least hazardous uses.

The occupancy groups include 10 major classifications as follows:

- A Assembly
- B Business
- E Educational
- F Factory/Industrial
- H Hazardous
- I Institutional
- M Mercantile
- R Residential
- S Storage
- U Utility and Miscellaneous

In addition to these major classifications, the occupancy groups of Assembly, Factory/Industrial, Hazardous, Institutional, Residential and Storage are further divided into subgroups in order to accommodate some variations in the hazards associated with the uses within each group (for example, hotel versus an apartment building in the Residential classification). The fire load characteristics in Factory/Industrial and Storage occupancies vary considerably depending on the product or process involved and, therefore, these uses are further classified into subgroups of low and moderate hazard, depending on the potential fire severity.

The occupancy subgroups for specific classifications are as follows:

A Assembly

- A-1 Fixed seating for entertainment, i.e., theater or concert hall
- A-2 Drinking and dining establishments

A-3 General assembly classification if others don't apply

A-4 Indoor sports facility

A-5 Outdoor sports facility

F Factory/Industrial

F-1 Moderate-hazard factory—manufacture or assembly of combustible products

F-2 Low-hazard factory—manufacture or assembly of non-combustible products

H Hazardous

H-1 Use or storage of hazardous materials with a detonation potential

H-2 Use or storage of hazardous materials with a deflagration potential

H-3 Use or storage of hazardous materials which present a significant physical hazard

H-4 Use or storage of hazardous materials which present a health hazard

H-5 Semiconductor fabrication facilities or research labs

I Institutional

I-1 24-hour care where a supervised environment or custodial care is provided

I-2 24-hour medical care or hospital facility

I-3 Detention facility or jail

I-4 Day care facility

R Residential

R-1 Hotel or motel—transient stay

R-2 Apartment or dormitory—nontransient stay

R-3 General residential classification if other classifications do not apply

R-4 Halfway house or group home

S Storage

S-1 Moderate-hazard storage—combustible products

S-2 Low-hazard storage—noncombustible products

As more and more buildings are being designed either for a single specialized purpose or as a part of a larger type of building complex, the need for more special code considerations has been recognized. Some examples of these special uses include automobile parking

structures, domed stadiums, high-rise buildings, covered mall and open mall buildings, airport terminals and large industrial complexes such as steel mills and assembly plants. For additional information or details of the various occupancy classifications, refer to Chapters 3 and 4 of the *International Building Code*.