Fire Code Essentials: Based on the 2021 International Fire Code®

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# Table of Contents

1

Prefaceix
About the International Code Council
About the International Fire Code xiii
Acknowledgments xiii
About the Author xiv
Prerequisite Reading—Occupancy Classification

## PART I: CODE ADMINISTRATION AND ENFORCEMENT

Chapter 1: Introduction to Building and Fire Codes	2
Code Development	
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	· · · · · <b>10</b>
Applicability of the IFC	
Retroactive Construction Requirements	
in the IFC	
Change of Use or Occupancy	
Historic Buildings	17
Referenced Codes and Standards	17
Chapter 2: Legal Aspects, Permits and Inspections	19
Code Adoption	20
Adoption of the IFC	20
Amending the IFC	20
Appendices	
Local and State Laws	
Authority	23
Authority and Duties of the Fire Code Official	24
Technical Assistance	
Alternative Materials and Methods	
Authority at Fires and Other Emergencies	
Permits	30
Operational and Construction Permits	
Construction Documents	
Permit Application	
Fees	
Inspections	36
Right of Entry	
Liability	
Testing and Operation	41
Unsafe Structures and Equipment	
Stop Work Order	
Board of Appeals	43

## PART II: GENERAL SAFETY REQUIREMENTS

Chapter 3: General Precautions against Fire
Combustible Waste
Outdoor Pallet Storage48
Ignition Sources
Open Flames
Vacant Premises
Indoor Displays
Hazards to Fire Fighters53
Landscaped Roofs
Mobile Food-preparation Vehicles
Additive Manufacturing (3D Printing)55

Chapter 4: Emergency Planning and Preparedness	57
Emergency Forces Notification	<b>58</b>
Public Assemblies and Events	<b>58</b>
Crowd Managers	<b>59</b>
Fire Safety and Evacuation Plans	59
Emergency Evacuation Drills	61
Employee Training and Response	63

## PART III: SITE AND BUILDING SERVICES 65

Chapter 5: Fire Service Features	66
Fire Apparatus Access Roads	67
Appendix D	69
Access to Buildings	71
Hazards to Fire Fighters during Access	72
Fire Protection Water Supplies	73
Appendix B	74
Inspection and Maintenance	74
Emergency Responder Communication Coverage	76
Chanter 6: Building Systems	81
Fuel-fired Appliances	
Mechanical Refrigeration	
Elevators	
Commercial Cooking Operations	
Commercial Kitchen Exhaust Hoods	90
Cooking Oil Storage	92
Automatic Fire-extinguishing Systems	
Emergency and Standby Power Systems	
Solar Photovoltaic Power Systems	
Stationary Fuel Cell Power Systems	101
Energy Storage Systems	101
Stationary Storage Battery Systems	102
Capacitor Energy Storage Systems	104
Chanter 7: Interior Finish and Decorative Material	105
Purpose of the Requirements	106
Interior Wall and Ceiling Finish and Trim	
Foam Plastics	
Upholstered Furniture and Mattresses	
-F	

## PART IV: FIRE/LIFE SAFETY SYSTEMS AND FEATURES

Chapter 8: Requirements for All Fire Protection Systems116
Where Are Fire Protection Systems Required?117
Construction Documents and Acceptance Testing120
Inspection, Testing and Maintenance
Fire Protection System Impairment124
Fire Protection System Monitoring128
Chapter 9: Automatic Sprinkler Systems
Level of Exit Discharge and Fire Area
Design and Installation Standards133
Types of Automatic Sprinkler Systems
Occupancies Requiring Automatic Sprinkler Protection141
Fire Sprinklers "Throughout" and Exempt Locations146
Fire Department Connection149
Chapter 10: Fire Alarm and Detection Systems
Design and Installation Standards152
Fundamental Components155
Occupancies Requiring Fire Alarm and
Detection Systems
Carbon Monoxide Alarms165
Gas Detection Systems167
Chapter 11: Means of Egress168
Introduction to Means of Egress169
Occupant Load
Egress Width
Exit Access and Exit Access Travel Distance
Exit Signs and Means of Egress Illumination
Means of Egress Maintenance
-

## PART V: SPECIAL PROCESSES AND BUILDING USES

189

115

Chapter 12: Motor Fuel-dispensing Facilities and	
Repair Garages	190
Applicable Requirements by Fuel	191
Dispensing Operations and Devices—All Fuels	191
Flammable and Combustible Liquid Fuel Dispensing	194
Liquefied Petroleum Gas Dispensing	201
Hydrogen Dispensing	204
On-demand Mobile Fueling	205

Chapter 13: Flammable Finishes
Types of Flammable Finishing Processes
Spray Booth and Spray Room Construction
Mechanical Ventilation214
Illumination
Interlocks
Fire Protection
Chapter 14: High-piled Combustible Storage221
What Is High-piled Combustible Storage?
Commodity Classification
High-piled Combustible Storage Areas
Storage Methods232
Aisles
Chapter 15: Other Special Uses and Processes
Combustible Dust-producing Operations
Fire Safety during Construction and Demolition
Welding and Other Hot Work
Higher Education Laboratories
Marijuana Grow and Processing Facilities
Distilled Spirits and Wines256

## PART VI: HAZARDOUS MATERIALS 259

Chapter 16: General Requirements for Hazardous
Materials
Material Classification262
Hazardous Materials Reporting
Storage and Use
Maximum Allowable Quantity per Control Area
Control Areas
Hazard Identification Signs
Separation of Incompatible Materials
Chapter 17: Compressed Gases
Cylinders, Containers and Tanks
Pressure Relief Devices
Markings
Security
Valve Protection
Separation from Hazardous Conditions
Exhausted Enclosures and Gas Cabinets
Leaks. Damage or Corrosion
LP-gas Cylinder Exchange Program
Liquid Carbon Dioxide for Reverage Dispensing

Chapter 18: Flammable and Combustible Liquids	<b>302</b>
Classification of Liquids	303
Containers, Portable Tanks and Stationary Tanks	306
Design and Construction of Storage Tanks	309
Storage Tank Openings	314
Normal Vent	.315
Emergency Vent	316
Glossary	319
Index	323



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 fire fighters 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 2021 International Fire Code*<sup>®</sup> (IFC<sup>®</sup>) 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 2021 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 2021 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*<sup>®</sup> (*IBC*<sup>®</sup>) 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 2021 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, training and certification. The 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, the International Accreditation Service, General Code, S. K. Ghosh Associates, NTA Inc., Progressive Engineering Inc., ICC Community Development Solutions and the Alliance for National & Community Resilience. The Code Council is the largest international association of building safety professionals and is the trusted source of model codes and standards that establish the baseline for building safety globally and creating a level playing field for designers, builders and manufacturers.

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## **ABOUT THE INTERNATIONAL FIRE CODE**

The *International Fire Code*<sup>®</sup> (IFC<sup>®</sup>) is a comprehensive, stand-alone model code that regulates minimum fire safety requirements for new and existing buildings, facilities, storage and processes. The IFC addresses fire prevention, fire protection, life safety 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 fire-fighting 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 document series. The 2012, 2015, 2018 and 2021 editions have built on that original document. *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: Hamid Naderi, P.E., C.B.O., Senior Vice President Product Development; Doug Thornburg, A.I.A., C.B.O., Vice President and Technical Director of Product Development; Senior Staff Architect Jay Woodward and retired Managing Director of ICC Product Development, Stephen Van Note, C.B.O., for their contributions throughout this project. As always, their 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 30 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:

- 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 the same 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 noncombustible 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*.