

CONST-181

Building Code Interpretation:

Non-Structural

Chapter 1 & 35: Learning Objective

To obtain an understanding of the administrative provisions of the International Building Code.

- Understand the scope and purpose of the code,
- Duties of the building official
- Issuance of permits
- Inspection procedures
- Special inspections
- Existing buildings and referenced standards.

Introduction

- The provisions of the International Building Code shall apply to the construction, alteration, relocation, enlargement, replacement, repair, equipment, use and occupancy, location, maintenance, removal and demolition of every building or structure or any appurtenances connected or attached to such buildings or structures.

Introduction: Exception

- Detached one- and two-family dwellings and multiple single-family dwellings (town-houses) not more than three stories above grade plane in height with a separate means of egress, and their accessory structures not more than three stories above grade plane in height, shall comply with the IBC or the International Residential Code.



Source: 2021 IBC: IBC 101.2, Exception

Introduction: Exception

The *International Residential Code* is applicable to townhouses a maximum of _____ above grade plane in height and provided with separate means of egress.

- a. 35 feet
- b. 40 feet
- c. three stories
- d. four stories

IBC Appendix

- Provisions in the appendices shall not apply unless specifically adopted.

| | |
|-------------------|---|
| Appendix A | Employee Qualifications |
| Appendix B | Board of Appeals |
| Appendix C | Group U — Agricultural Buildings |
| Appendix D | Fire Districts |
| Appendix E | Supplementary Accessibility Requirements |
| Appendix F | Rodentproofing |
| Appendix G | Flood-Resistant Construction |
| Appendix H | Signs |
| Appendix I | Patio Covers |
| Appendix J | Grading |
| Appendix K | Administrative Provisions |
| Appendix L | Earthquake Recording Instrumentation |
| Appendix M | Tsunami-Generated Flood Hazard |
| Appendix N | Replicable Buildings |
| Appendix O | Performance-Based Application |

Conflicts between IBC and referenced codes

Provisions of the appendix do not apply unless _____.

- a. specified in the code
- b. applicable to unique conditions
- c. specifically adopted
- d. relevant to fire or life safety

International Existing Building Code (IEBC)

- The provisions of the International Existing Building Code shall apply to matters governing the repair, alteration, change of occupancy, addition to and relocation of existing buildings.



Source: 2021 IBC: **Reference:** IBC 101.4.7

102.4 Conflicts between IBC and referenced codes

- The codes and standards referenced in the IBC shall be considered part of the requirements.
- Where conflicts occur between provisions of the IBC and referenced codes and standards, the provisions of the IBC shall apply.
- The IBC is, for the most part, a performance-based code, relying on numerous referenced standards to assist the builder and code official in its application. Where standards are referenced in the body of the IBC, the applicable portions of the standard relating to the specific code provision under consideration are considered a part of the code. However, where a referenced standard contains requirements that parallel those in the IBC, the requirements of the IBC take precedence.

IBC Appendix

If there is a conflict in the code between a general requirement and a specific requirement, the _____ requirement shall apply.

- a. general
- b. specific
- c. least restrictive
- d. most restrictive

103 Code Compliance Agency

- The building official is an appointed officer of the jurisdiction and charged with the administrative responsibilities of the department of building safety. It is not uncommon for the jurisdiction to use a different position title to identify the building official, such as Chief Building Inspector, Superintendent of Central Inspection or Director of Code Enforcement. Regardless of the jurisdictional title, the code recognizes the individual in charge as the building official.

103 Code Compliance Agency



Inspectors, plan reviewers and other technical staff members are typically given some degree of authority to act for the building official in the decision-making process, including the making of appropriate interpretations of various provisions of the code.

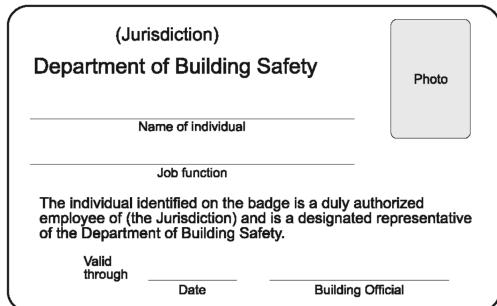
103 Code Compliance Agency

The _____ is considered by the code as the term to describe the individual in charge of the code compliance agency.

- a. building official
- b. code official
- c. code administrator
- d. chief building inspector

104.1 Duties and Powers of Building Official

- The building official is hereby authorized and directed to enforce the provisions of the IBC. The building official shall have the authority to render interpretations of the IBC and to adopt policies and procedures in order to clarify the application of its provisions. Such interpretations, policies and procedures shall be in compliance with the intent and purpose of the IBC. Such policies and procedures shall not have the effect of waiving requirements specifically provided for in the IBC.



**Sample of Required Identification
Section 104.5**

Although the IBC gives broad authority to the building official in interpreting the code, this authority also comes with great responsibility. The building official must restrict all decisions to the intent and purpose of the code, with the waiving of any requirements being strictly prohibited.

Source: 2021 IBC: IBC 104.1

104.1 Duties and Powers of Building Official

The building official has the authority to _____ the provisions of the code.

- a. ignore
- b. waive
- c. violate
- d. interpret

104.8 Duties and Powers of Building Official

- The building official, member of the board of appeals or employee charged with the enforcement of the IBC, while acting for the jurisdiction in good faith and without malice in the discharge of the duties required by the IBC or other pertinent law or ordinance, shall not thereby be civilly or criminally rendered liable personally and is hereby relieved from personal liability for any damage accruing to persons or property as a result of any act or by reason of an act or omission in the discharge of official duties.

104.11 Duties and Powers of Building Official

- The provisions of the IBC are not intended to prevent the installation of any material or to prohibit any design or method of construction not specifically prescribed by the IBC; provided that any such alternative has been approved. An alternative material, design or method of construction shall be approved where the building official finds that the proposed alternative meets all of the following:
 - The alternative material, design or method of construction is satisfactory and complies with the intent of the provisions of the IBC, and
 - Provides established equivalency to that prescribed in the IBC.

104.11 Duties and Powers of Building Official

In order for an alternative material, design or method of construction to be considered acceptable, it must be equivalent to the code based on all but which of the following criteria?

- a. durability
- b. practicality
- c. strength
- d. fire resistance

104.11.1 Duties and Powers of Building Official

- Supporting data, where necessary to assist in the approval of materials or assemblies not specifically provided for in the IBC, shall consist of valid research reports from approved sources.



Although ICC Evaluation Service Reports are generally recognized nationally as valid reports developed by an approved source, the building official is the final authority on the acceptance of any research report for the purpose of accepting an alternate material, method or design.

Source: 2021 IBC; IBC 104.11.1

104.11.1 Duties and Powers of Building Official

Tests performed by _____ may be required by the building official where there is insufficient evidence of code compliance.

- a. the owner
- b. the contractor
- c. an approved agency
- d. a design professional

105.1-2 Permits

- Any owner or owner's authorized agent who intends to construct, enlarge, alter, repair, move, demolish, or change the occupancy of a building or structure . . . shall first make application to the building official and obtain the required permit. See thirteen exemptions where a building permit is not required. Exemptions from permit requirements of the IBC shall not be deemed to grant authorization for any work to be done in any manner in violation of the provisions of the IBC or any other laws or ordinances of this jurisdiction.

105.1-2 Permits: Work exempt

Work exempt from permit:

- One-story detached accessory buildings where limited to 120 square feet in floor area
- Fences not over 7 feet high
- Oil derricks
- Retaining walls limited to 4 feet in height, unless supporting a surcharge or impounding Class I, II or III-A liquids
- Water tanks supported directly on grade, limited to capacity of 5,000 gallons and a ratio of height to diameter not exceeding 2 to 1
- Sidewalks and driveways limited to 30 inches above grade, not over any basement or story below, and not part of an accessible route
- Painting, papering, carpeting, cabinets, counter tops and similar finish work
- Temporary motion picture, television and theater stage sets and scenery
- Prefabricated swimming pools accessory to a Group R-3 occupancy when capacity is limited to 5,000 gallons, depth limited to 24 inches and installed entirely above ground
- Shade cloth structures used for nursery or agricultural purposes
- Swings and other playground equipment accessory to detached one- and two-family dwellings
- Window awnings supported by an exterior wall in Groups R-3 and U, where the maximum projection is 54 inches
- Movable fixtures, racks, cases, counters and partitions limited to 5 feet 9 inches in height

Whether or not a building permit is required by the code, it is intended that all work be done in accordance with the code requirements. The owner is responsible for all construction being done properly and safely.

107.1 Submittal Documents

- Submittal documents consisting of construction documents, statement of special inspections, geotechnical report and other data shall be submitted in two or more sets, or in a digital format where allowed by the building official, with each permit application. The construction documents shall be prepared by a registered design professional where required by the statutes of the jurisdiction in which the project is to be constructed. See the exception for projects where nature of work is such that review of construction documents is unnecessary.



Source: 2021 IBC: IBC 107.1

108 Temporary Structures and Uses

- The building official is authorized to issue a permit for temporary structures and temporary uses. Such permits shall be limited as to time of service, but shall not be permitted for more than 180 days. The building official is authorized to grant extensions for demonstrated cause. The building official is authorized to terminate such permit for a temporary structure or use and to order the temporary structure or use to be discontinued.



Source: 2021 IBC

108 Temporary Structures and Uses

Unless extended by the building official, what is the maximum time period allowed to be granted for a permit issued on a temporary structure?

- a. 90 days
- b. 180 days
- c. 1 year
- d. 2 years

109 Permit Fees

- The building official is authorized to issue a permit for temporary structures and temporary uses. Such permits shall be limited as to time of service, but shall not be permitted for more than 180 days. The building official is authorized to grant extensions for demonstrated cause. The building official is authorized to terminate such permit for a temporary structure or use and to order the temporary structure or use to be discontinued.

| PERMIT APPLICATION | | |
|---|--|------------------------------|
| →NOTE! INCOMPLETE OR ILLEGIBLE APPLICATIONS CANNOT BE PROCESSED.← | | |
| APPLICATION IS HEREBY MADE FOR PERMISSION TO: (PLEASE PRINT Or TYPE Detailed Description of Work To Be Done) | | |
| Has work commenced on this project? No _____ Yes _____ | | |
| PROJECT NAME _____ | SUBDIVISION _____ | |
| PROJECT ADDRESS _____ | PARCEL _____ | LOT# _____ |
| PROJECT TYPE <input type="checkbox"/> Residential <input type="checkbox"/> Commercial <input type="checkbox"/> Industrial <input type="checkbox"/> New <input type="checkbox"/> Alteration / Remodeling <input type="checkbox"/> Addition <input type="checkbox"/> Demolition | | |
| APPLICANT'S VALUATION \$_____ | CITY'S VALUATION \$_____ | TOTAL SQUARE FEET _____ |
| WATER METER SIZE: _____ | | |
| PLANS SUBMITTED BY: <input type="checkbox"/> Architect <input type="checkbox"/> Contractor <input type="checkbox"/> Owner <input type="checkbox"/> Tenant <input type="checkbox"/> Other | | |
| CONTACT PERSON _____ | PHONE () _____ | FAX () _____ |
| WHO IS CONTACT PERSON? <input type="checkbox"/> Architect <input type="checkbox"/> Contractor <input type="checkbox"/> Owner <input type="checkbox"/> Tenant <input type="checkbox"/> Other | | |
| OWNER INFORMATION | | |
| OWNER _____ | PHONE () _____ | |
| ADDRESS _____ | CITY _____ | STATE _____ ZIP _____ |
| CONTRACTOR INFORMATION | | |
| COMPANY _____ | PHONE () _____ | |
| ADDRESS _____ | CITY _____ | STATE _____ ZIP _____ |
| LICENSE NO. _____ | CLASS _____ | ARIZONA STATE TAX NO. _____ |
| The Following Information is Required for Commercial, Industrial, and Multi-Family Projects Only | | |
| PROPOSED USE _____ | EXISTING USE _____ | |
| PROPOSED CONSTRUCTION TYPE WALLS: <input type="checkbox"/> Combustible <input type="checkbox"/> Noncombustible | ROOF STRUCTURE: <input type="checkbox"/> Combustible <input type="checkbox"/> Noncombustible | |
| EXISTING CONSTRUCTION TYPE WALLS: <input type="checkbox"/> Combustible <input type="checkbox"/> Noncombustible | ROOF STRUCTURE: <input type="checkbox"/> Combustible <input type="checkbox"/> Noncombustible | |
| IF THIS IS AN EXISTING BUILDING, DOES IT HAVE A FIRE SPRINKLER SYSTEM? <input type="checkbox"/> | | |
| OCCUPANCY LOAD: _____ | IBC OCCUPANCY TYPE: _____ | IBC CONSTRUCTION TYPE: _____ |
| FIRE ALARM SYSTEM? _____ | | |
| UNDER PENALTY OF INTENTIONAL MISREPRESENTATION AND / OR PERJURY, I DECLARE that I have examined and / or made this application and it is true and correct to the best of my knowledge and belief. I agree to construct said improvements in compliance with all provisions of the Ordinance of the City of Phoenix, Arizona, and that the plans and specifications I have submitted for examination and approval for issuance of a permit applied for and approval of any plans in connection therewith shall not be construed to permit any construction upon said premises or use thereof in violation of any provision of the Ordinance of the City of Phoenix, Arizona, or any other ordinance or to excuse the owner or his successors in interest from complying therewith. WHERE NO WORK HAS BEEN STARTED WITHIN 180 DAYS AFTER THE ISSUANCE OF A PERMIT OR WHEN MORE THAN 180 DAYS LAPSES BETWEEN THE DATE REQUIRED FOR THE ISSUANCE OF A PERMIT AND THE DATE OF THIS DECLARATION, I hereby certify that I am the OWNER at this address or that, for the purposes of obtaining this approval, I am acting on behalf of the owner. All contract work on this project will be done by a contractor holding a valid privilege tax license and contractor's license issued by the State of Arizona and the City of Phoenix. | | |
| APPLICANT (Please Print Name): _____ SIGNATURE: _____ | | |
| ADDRESS _____ | CITY _____ | STATE _____ ZIP _____ |
| PHONE Home () _____ | Office () _____ | |
| Amount Paid: \$ _____ Date: _____ Application received by: _____ | | |

109 Permit Fees

The final permit valuation shall be set by the _____.

- a. owner
- b. building official
- c. design professional
- d. general contractor

110.1 Inspections

- Construction or work for which a permit is required shall be subject to inspection by the building official and such construction or work shall remain visible and able to be accessed for inspection purposes until approved. Approval as a result of an inspection shall not be construed to be an approval of a violation of the provisions of the IBC or of other ordinances of the jurisdiction.

110.1 Required Inspections

- Footing and foundation
- Concrete slab or under-floor
- Lowest floor elevation
- Frame
- Types IV-A, IV-B and IV-C connection protection
- Lath, gypsum board and gypsum-panel product
- Weather-exposed elevated walking surfaces waterproofing
- Fire and smoke resistant penetrations
- Energy efficiency
- Others as required by the building official
- Special inspections
- Final

110.1 Required Inspections

- Who is responsible for ensuring that the work is accessible and exposed for inspection purposes?
 - a. owner or owner's authorized agent
 - b. contractor
 - c. permit applicant or their authorized agent
 - d. design professional

110.6 Inspections

- Work shall not be done beyond the point indicated in each successive inspection without first obtaining the approval of the building official. The building official, upon notification, shall make the requested inspections and shall either indicate the portion of the construction that is satisfactory as completed, or notify the permit holder or his or her agent wherein the same fails to comply with the IBC. Any portions that do not comply shall be corrected and such portions shall not be covered or concealed until authorized by the building official.



Source: 2021 IBC

110.6 Certificate of Occupancy

- A building or structure shall not be used or occupied in whole or in part, and a change of occupancy of a building or structure or portion thereof shall not be made, until the building official has issued a certificate of occupancy therefor as provided herein. Issuance of a certificate of occupancy shall not be construed as an approval of a violation of the provisions of the IBC or of other ordinances of the jurisdiction. See the exception for work exempt from permits.

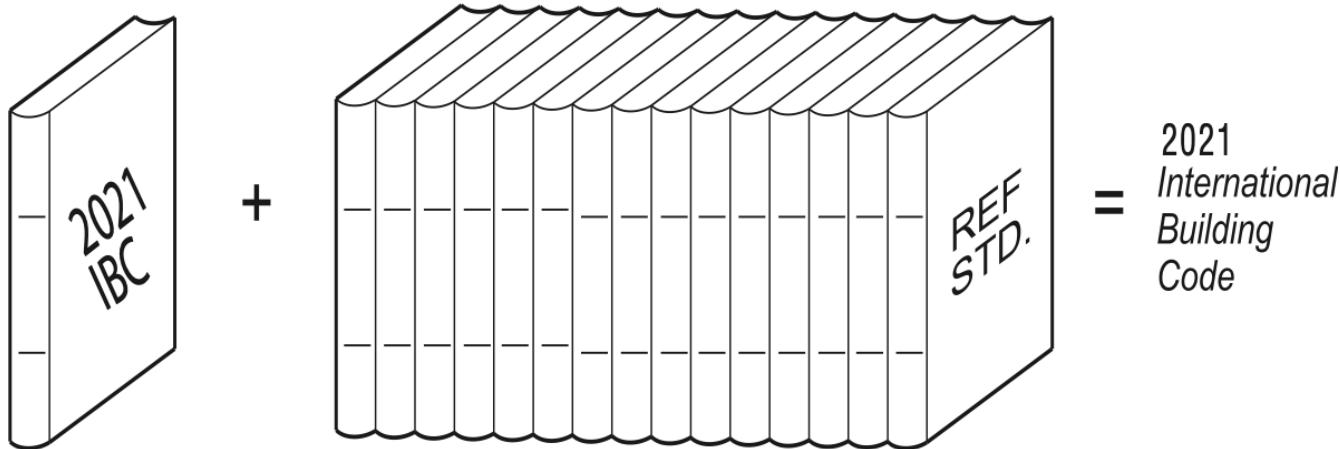
The form is titled "Certificate of Occupancy" in blue, with "(Address of Structure)" in parentheses below it. It contains a statement about inspection compliance, followed by several lines for handwritten information: Building permit number, Applicable edition of code, Use and occupancy, Type of construction, Design occupant load, Sprinkler system required, Special conditions, and Building Official. At the bottom, there is a line for "Name and address of owner".

Sample of Certificate of Occupancy

Source: 2021 IBC

Chapter 35 Standards

- Chapter 35 lists the standards that are referenced in various sections of the IBC. The standards are listed herein by the promulgation agency of the standard, the standard identification, the effective date and title, and the section or sections of the IBC that reference the standard. The application of the referenced standards shall be as specified in Section 102.4.



Chapter 35 Standards

The referenced standard dealing with accessible buildings is _____.

- a. ASME A17.1—CSA 19/CSA B44-19
- b. DOC PS 1—19
- c. ICC A117.1—17
- d. FEMA 4880—2017

Class 2: Chapter 3, Section 508/509: Learning Objective

Chapter 3, Section 508/509: Learning Objective

To gain an understanding of how an occupancy is classified based on its intended use and how a building with incidental uses and/or mixed occupancies is addressed.

302.1 Occupancy Classification

- Occupancy classification is the formal designation of the primary purpose of the building, structure or portion thereof. Where a structure is proposed for a purpose which is not specifically listed in Section 302.1, such structure shall be classified in the occupancy it most nearly resembles, based on the fire safety and relative hazard.
- Occupancy groupings are divided into two general categories: those related to people and those related to content.
 - People-related hazards include the number and density of the occupants, their age and mobility, and their awareness of surrounding conditions.
 - Content-related hazards include the storage and use of hazardous materials, as well as the presence of large quantities of combustible materials

302.1 Occupancy Classification

- Assembly (see Section 303): Groups A-1, A-2, A-3, A-4 and A-5.
- Business (see Section 304): Group B.
- Educational (see Section 305): Group E.
- Factory and Industrial (see Section 306): Groups F-1 and F-2.
- High Hazard (see Section 307): Groups H-1, H-2, H- 3, H-4 and H-5.
- Institutional (see Section 308): Groups I-1, I-2, I-3 and I-4.
- Mercantile (see Section 309): Group M.
- Residential (see Section 310): Groups R-1, R-2, R-3 and R-4.
- Storage (see Section 311): Groups S-1 and S-2.
- Utility and Miscellaneous (seeSection312):GroupU

302.1 Occupancy Classification

1. An institutional occupancy is typically considered Group _____ .
 - a. A
 - b. B
 - c. I
 - d. R

302.1 Occupancy Classification

1. An institutional occupancy is typically considered Group _____.

- a. A
- b. B
- c. I
- d. R

302.1 Occupancy Classification

2. A Group _____ occupancy is the general classification for miscellaneous and utility structures.
- a. A
 - b. M
 - c. S
 - d. U

302.1 Occupancy Classification

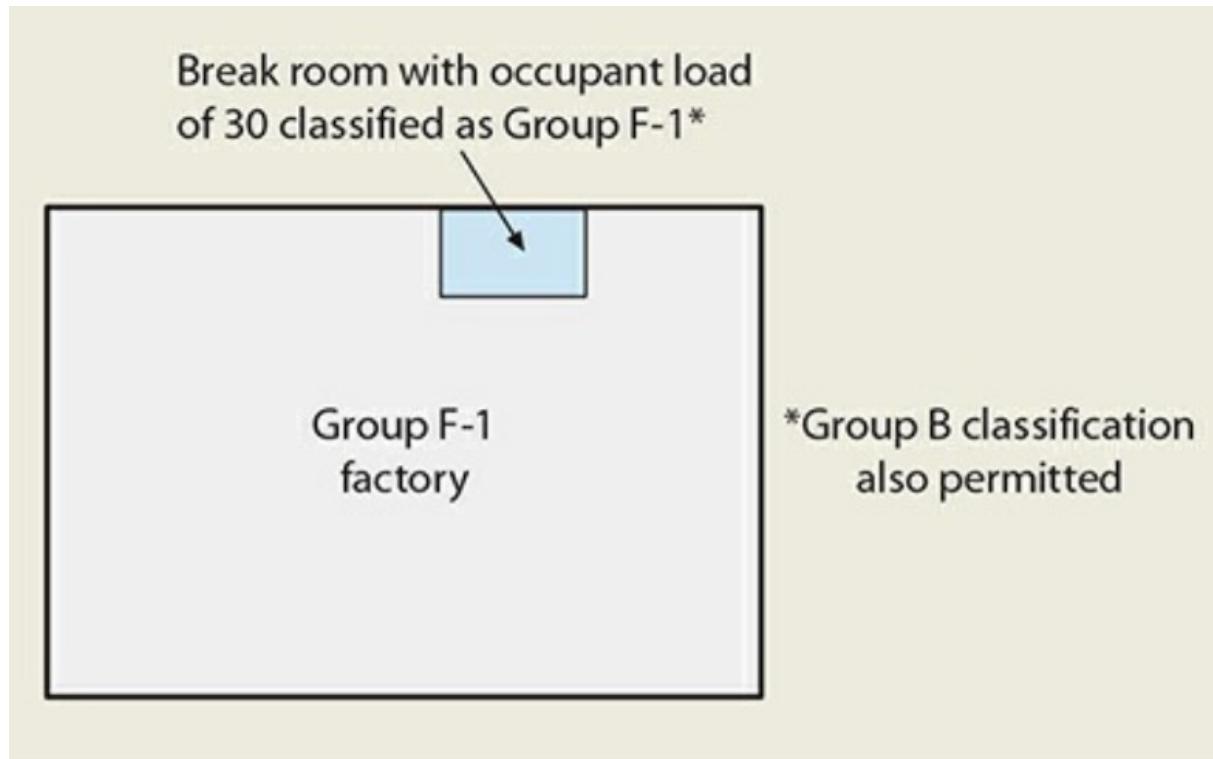
2. A Group _____ occupancy is the general classification for miscellaneous and utility structures.

- a. A
- b. M
- c. S
- d. U



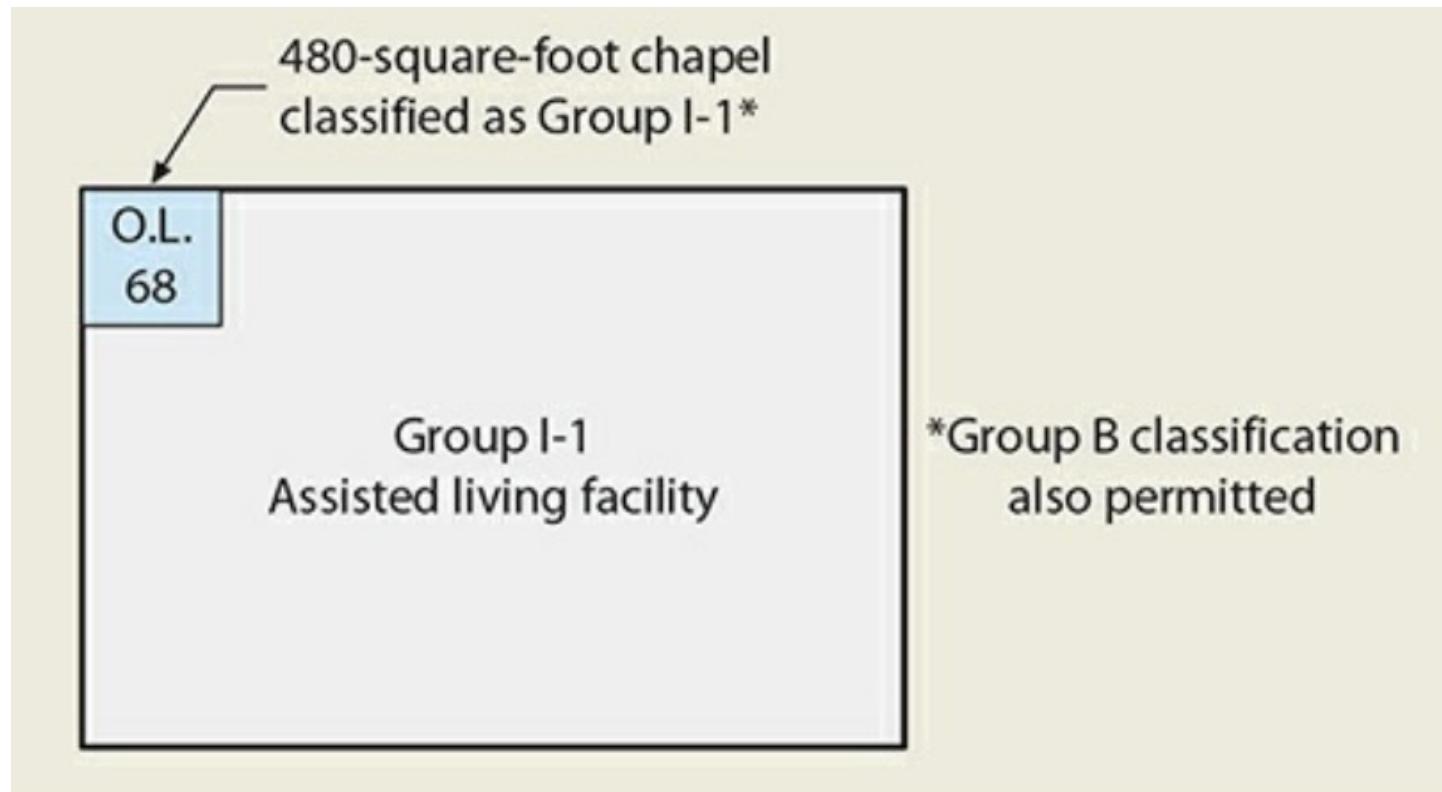
302.1 Mixed Classification

Break room with an occupant load of 30 in a large manufacturing facility could simply be considered a portion of the Group F occupancy. As an option to the designer, a Group B classification can be assigned to the break room.



302.1 Mixed Classification

A small 480-square-foot (44-m²) chapel, having an occupant load of 68 and located within an assisted living facility classified as a Group I-1 occupancy, can simply be classified as an extension of the Group I-1 classification



302.1 Occupancy Classification

3. Accessory religious educational rooms need not be considered separate occupancies where the occupant load is less than _____ occupants.
- a. 100
 - b. 150
 - c. 200
 - d. 300

302.1 Occupancy Classification

3. Accessory religious educational rooms need not be considered separate occupancies where the occupant load is less than _____ occupants.
- a. 100
 - b. 150
 - c. 200
 - d. 300

302.1 Occupancy Classification

- Assembly Group A occupancy includes, among others, the use of a building or structure, or a portion thereof, for the gathering of persons for purposes such as civic, social or religious functions, recreation, food or drink consumption or awaiting transportation. See other classification allowances for assembly buildings and assembly spaces with an occupant load of less than 50, accessory assembly spaces less than 750 square feet in floor area, and those assembly spaces associated with Group E occupancies.

302.1 Occupancy Classification

4. An accessory assembly area may be classified as a Group B occupancy where the floor area is a maximum of _____ square feet.
- a. 120
 - b. 399
 - c. 749
 - d. 1,000

302.1 Occupancy Classification

4. An accessory assembly area may be classified as a Group B occupancy where the floor area is a maximum of _____ square feet.
- a. 120
 - b. 399
 - c. 749
 - d. 1,000

303.1 Occupancy Classification

Group A-1

Motion picture theaters
Theaters
Symphony and
concert halls

Group A-3

Amusement arcades
Art galleries
Bowling alleys
Places of worship
Community halls
Conference rooms
Exhibition halls
Lecture halls
Libraries
Museums
Passenger stations

Group A-4

Arenas
Skating rinks
Swimming pools
Tennis courts

Group A-2

Banquet halls
Casino gaming areas
Night clubs
Restaurants
Taverns

Group A-5

Amusement park
structures
Bleachers
Grandstands
Stadiums

Unique conditions are represented by the classifications of Groups A-1, A-2, A-4 and A-5. However, the category Group A-3 includes a variety of broad and diverse assembly uses. It is not uncommon to find high combustible loading in Group A-3 occupancies.

303.1 Occupancy Classification A-1

- A factor involving human behavior in theaters classified as Group A-1 assembly rooms is the fact that in many cases the occupants are not familiar with their surroundings and the lighting level is usually low.
- When an emergency arises, the occupants may perceive the danger to be greater than presented, and panic may occur because of the fear of not being able to reach an exit for escape. In addition, the concentration of occupants in such uses is quite dense.

| Group A-1 |
|--|
| Motion picture theaters Theaters Symphony and concert halls |



303.1 Occupancy Classification A-2

- The fire record in occupancies of this type is not very good, based in part on the delay in occupant response to a fire or other emergency incident.
- Presence of loose tables and chairs, aisles are often difficult to maintain, resulting in obstructions to egress travel.
- Overcrowding conditions, low-lighting levels, and the consumption of alcoholic beverages also increase the risks associated with many of these types of occupancies.

Group A-2

Banquet halls
Casino gaming areas
Night clubs
Restaurants
Taverns

303.1 Occupancy Classification A-2

The gaming floor of a large casino shall be classified as a Group _____ occupancy.

- a. A-2
- b. A-3
- c. B
- d. M

303.1 Occupancy Classification A-2

The gaming floor of a large casino shall be classified as a Group _____ occupancy.

- a. A-2
- b. A-3
- c. B
- d. M

303.1 Occupancy Classification A-3

Multipurpose rooms:

- Varying degrees of occupant density, numerous types and numbers of furnishings and equipment, and fire loading that can vary from low to high.
- Hazards are similar to most of those found in Group A-1 and A-2 occupancies. Where a use does not conveniently fit into one of the other four Group A classifications, a Group A-3 designation is typically appropriate.
- The classification of an assembly occupancy as a Group A-3 is also common where varying assembly uses are likely to occur at different times within the same space.
- For example, a meeting room at a hotel is typically used at differing times for various functions, including seminar presentations, dining activities, trade shows, and wedding receptions.

Group A-3

Amusement arcades
Art galleries
Bowling alleys
Places of worship
Community halls
Conference rooms
Exhibition halls
Lecture halls
Libraries
Museums
Passenger stations

303.1 Occupancy Classification A-4

The combination of spectator seating and sporting events creates a condition within a building that warrants a specific occupancy classification within the Group A classification.

A Group A-4 facility contains those occupant-related hazards found in other assembly occupancies, namely high occupant loads in concentrated areas, along with large areas having limited occupants and little, if any, fire loading conditions.

Group A-4

Arenas
Skating rinks
Swimming pools
Tennis courts

303.1 Occupancy Classification A-4

Which of the following uses is typically considered a Group A-4 occupancy?

- a. restaurant with a dance floor b. school library
- c. outdoor football stadium d. indoor hockey arena

303.1 Occupancy Classification A-4

Which of the following uses is typically considered a Group A-4 occupancy?

- a. restaurant with a dance floor b. school library
- c. outdoor football stadium d. indoor hockey arena

304.1 Occupancy Classification: Group B

- Business Group B occupancy includes, among others, the use of a building or structure, or a portion thereof, for office, professional or service-type transactions, including storage of records and accounts.
- Business occupancies typically have a low to moderate fire load, a moderate density level, and occupants who are usually mobile and have a general awareness of the surrounding conditions. As such, business occupancies are grouped into a classification based upon a relatively moderate fire hazard level. Group B occupancies are not restricted by occupant load, as the number of people in a business use, such as an office, can range from one person to thousands of people.

304.1 Occupancy Classification: Group B

Group B

- Ambulatory care facilities
- Animal hospitals, kennels and ponds
- Banks
- Barber and beauty shops
- Car wash
- Civil administration
- Clinic-outpatient
- Educational occupancies above the 12th grade
- Food processing \leq 2,500 sf
- Laboratories; testing and research
- Motor vehicle showrooms
- Post offices
- Print shops
- Professional services
- Radio and television stations
- Training and skill development

304.1 Occupancy Classification: Group B

Which of the following uses is not considered a Group B occupancy?

- a. convenience store
- b. motor vehicle showroom
- c. car wash
- d. ambulatory care facility

304.1 Occupancy Classification: Group B

Which of the following uses is not considered a Group B occupancy?

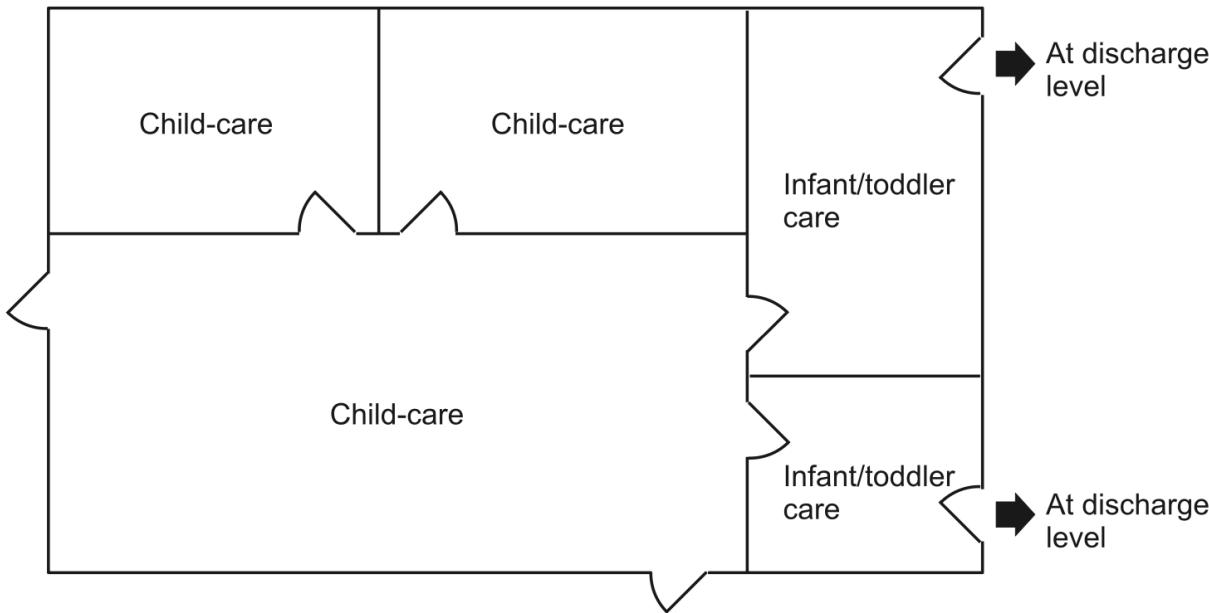
- a. convenience store
- b. motor vehicle showroom
- c. car wash
- d. ambulatory care facility

305.1 Occupancy Classification: Group E

- Educational Group E occupancy includes, among others, the use of a building or structure, or a portion thereof, by six or more persons at any one time for educational purposes through the 12th grade. This group includes buildings and structures or portions thereof occupied by more than five children older than 2½ years of age who receive educational, supervision or personal care services for fewer than 24 hours per day.
- Educational occupancies include classroom uses for students of high school age and younger.
- Education facilities limited to use by older students, such as college classrooms, are classified as Group B occupancies; however, a Group A classification should be considered for lecture halls and similar large occupant load spaces.

305.1 Occupancy Classification: Group E

Entire building can be considered a Group E occupancy



Although a child-care facility that provides care for infants and toddlers (children $2\frac{1}{2}$ years of age or less) is generally considered a Group I-4 occupancy, Section 308.5.1 permits a Group E classification under specific conditions.

305.1 Occupancy Classification: Group E

5. In a Group E middle school, an assembly area associated with the Group E shall be classified as what occupancy?
 - a. Group E
 - b. Group A-5
 - c. Group I-1
 - d. Group U

305.1 Occupancy Classification: Group E

5. In a Group E middle school, an assembly area associated with the Group E shall be classified as what occupancy?
 - a. Group E
 - b. Group A-5
 - c. Group I-1
 - d. Group U

306.1 Occupancy Classification: Group F

- Factory Industrial Group F occupancy includes, among others, the use of a building or structure, or a portion thereof, for assembling, disassembling, fabricating, finishing, manufacturing, packaging, repair or processing operations that are not classified as a Group H hazardous or Group S storage occupancy.
- Although the potential hazard and fire severity varies among the many uses categorized as Group F occupancies, the uses still share elements in common. The occupants are adults who are awake and who generally have enough familiarity with the premises to be able to exit the building with reasonable efficiency.
- Public occupancy is usually quite limited, if at all, and most occupants are aware of the potential hazards the use creates.
- Contain some degree of hazardous material as a necessary part of the manufacturing process. However, where the amount of hazardous material does not exceed the maximum allowable quantities.

306.1 Occupancy Classification: Group F

Group F-1

- Aircraft
- Appliances
- Automobiles
- Bakeries
- Business machines
- Carpets and rugs
- Clothing
- Electric generation
- ESS (dedicated use)
- Food processing > 2,500 sf
- Furniture
- Laundries
- Millwork
- Paper mills or products
- Plastic products
- Printing or publishing
- Refuse incineration
- Textiles
- Water/sewer treatment
- Woodworking

Group F-2

- Brick and masonry
- Ceramic products
- Foundries
- Glass products
- Gypsum
- Ice
- Metal products

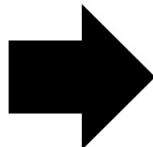
Classification as a Group F-2 occupancy is strictly limited because of the restrictions placed on such uses. The fabrication or manufacture of noncombustible materials, as well as their finishing, packaging or processing operations, cannot involve a significant fire hazard.

307.1 Occupancy Classification: Group H

- High-hazard Group H occupancy includes, among others, the use of a building or structure, or a portion thereof, that involves the manufacturing, processing, generation or storage of materials that constitute a physical or health hazard in quantities in excess of those allowed in control areas complying with Section 414, based on the maximum allowable quantity limits for control areas set forth in Tables 307.1(1) and 307.1(2).
- There is only one fundamental type of Group H occupancy—that which is designated based solely on excessive quantities of hazardous materials contained therein. The quantities of hazardous materials that necessitate a Group H classification vary, based on the type, quantity, condition (use or storage) and environment of the materials. Where the use does not exceed the maximum allowable quantities set forth in the code, a classification other than Group H is appropriate.

307.1 Occupancy Classification: Group H

Where hazardous materials and processes are involved.



References
for detailed
provisions



Although the *International Building Code* is limited to general construction regulations and occupancy-specific requirements, the *International Fire Code®* (IFC®) sets forth special detailed provisions relating to hazardous materials and the specific conditions of their storage, use and handling.

Source: 2021 IBC

307.1 Occupancy Classification: Group H

A Group _____ occupancy classification is to be assigned to a facility where combustible dusts are generated in a manner that creates a fire or explosion hazard.

- a. H-1
- b. H-2
- c. H-4
- d. H-5

307.1 Occupancy Classification: Group H

A Group _____ occupancy classification is to be assigned to a facility where combustible dusts are generated in a manner that creates a fire or explosion hazard.

- a. H-1
- b. H-2
- c. H-4
- d. H-5

307.1 Occupancy Classification: Exceptions to Group H

Four other options are available to further increase the quantities of hazardous materials in any building:

- Provide additional control areas as limited by Table 414.2.2,
- Provide one or more fire walls in conformance with Section 706,
- Apply the allowances for unlimited quantities in Section 307.1.1,
- Construct the building as required for a Group H occupancy.

307.1 Occupancy Classification: Exceptions to Group H

GIVEN: A fully sprinklered Group F-1 storage building housing Class II combustible liquids. The Class II liquids are all stored in approved safety cans. The entire building is a single control area.

DETERMINE: The maximum allowable quantity of the Class II liquids in storage in order to maintain the Group F-1 classification.

TABLE 307.1(1)

MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA OF HAZARDOUS MATERIALS POSING A PHYSICAL HAZARD^{a, j, m, n, p}

| MATERIAL | CLASS | GROUP WHEN THE MAXIMUM ALLOWABLE QUANTITY IS EXCEEDED | STORAGE ^b | | | USE-CLOSED SYSTEMS ^b | | | USE-OPEN SYSTEMS ^b | |
|------------------------------------|--------------------|---|---------------------------|-------------------------|-------------------------|---------------------------------|-------------------------|-------------------------|-------------------------------|-------------------------|
| | | | Solid pounds (cubic feet) | Liquid gallons (pounds) | Gas (cubic feet at NTP) | Solid pounds (cubic feet) | Liquid gallons (pounds) | Gas (cubic feet at NTP) | Solid pounds (cubic feet) | Liquid gallons (pounds) |
| Combustible dust | NA | H-2 | See Note q | NA | NA | See Note q | NA | NA | See Note q | NA |
| Combustible fiber ^d | Loose | H-3 | (100) | NA | NA | (100) | NA | NA | (20) | NA |
| | Baled ^e | | (1,000) | | | (1,000) | | | (200) | |
| Combustible liquid ^{c, i} | II | H-2 or H-3 | NA | 120 ^{d, e} | NA | 120 ^d | NA | NA | 30 ^d | NA |
| | IIIA | H-2 or H-3 | | 330 ^{d, e} | | 330 ^d | | | 80 ^d | |
| | IIIB | NA | | 13,200 ^{e, f} | | 13,200 ^f | | | 3,300 ^f | |

For SI: 1 cubic foot = 0.028 m³, 1 pound = 0.454 kg, 1 gallon = 3.785 L.

NL = Not Limited; NA = Not Applicable; UD = Unclassified Detonable.

- a. For use of control areas, see Section 414.2.
- b. The aggregate quantity in use and storage shall not exceed the quantity specified for storage.
- c. The quantities of alcoholic beverages in retail and wholesale sales occupancies shall not be limited provided the liquids are packaged in individual containers not exceeding 1.3 gallons. In retail and wholesale sales occupancies, the quantities of medicines, foodstuffs or consumer products, and cosmetics containing not more than 50 percent by volume of water-miscible liquids with the remainder of the solutions not being flammable, shall not be limited, provided that such materials are packaged in individual containers not exceeding 1.3 gallons.
- d. Maximum allowable quantities shall be increased 100 percent in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1. Where Note e also applies, the increase for both notes shall be applied accumulatively.
- e. Maximum allowable quantities shall be increased 100 percent when stored in approved storage cabinets, day boxes, gas cabinets, gas rooms or exhausted enclosures or in listed safety cans in accordance with Section 5003.9.10 of the *International Fire Code*. Where Note d also applies, the increase for both notes shall be applied accumulatively.
- f. Quantities shall not be limited in a building equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
- g. Allowed only in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

307.1 Occupancy Classification: Exceptions to Group H

GIVEN: A fully sprinklered Group F-1 storage building housing Class II combustible liquids. The Class II liquids are all stored in approved safety cans. The entire building is a single control area.

DETERMINE: The maximum allowable quantity of the Class II liquids in storage in order to maintain the Group F-1 classification.

TABLE 307.1(1)

MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA OF HAZARDOUS MATERIALS POSING A PHYSICAL HAZARD^{a, j, m, n, p}

| MATERIAL | CLASS | GROUP WHEN THE MAXIMUM ALLOWABLE QUANTITY IS EXCEEDED | STORAGE ^b | | | USE-CLOSED SYSTEMS ^b | | | USE-OPEN SYSTEMS ^b | |
|------------------------------------|--------------------|---|---------------------------|-------------------------|-------------------------|---------------------------------|-------------------------|-------------------------|-------------------------------|-------------------------|
| | | | Solid pounds (cubic feet) | Liquid gallons (pounds) | Gas (cubic feet at NTP) | Solid pounds (cubic feet) | Liquid gallons (pounds) | Gas (cubic feet at NTP) | Solid pounds (cubic feet) | Liquid gallons (pounds) |
| Combustible dust | NA | H-2 | See Note q | NA | NA | See Note q | NA | NA | See Note q | NA |
| Combustible fiber ^d | Loose | H-3 | (100) | NA | NA | (100) | NA | NA | (20) | NA |
| | Baled ^e | | (1,000) | | | (1,000) | | | (200) | |
| Combustible liquid ^{c, i} | II | H-2 or H-3 | | 120 ^{d, e} | | | 120 ^d | | | 30 ^d |
| | IIIA | H-2 or H-3 | NA | 330 ^{d, e} | NA | NA | 330 ^d | NA | NA | 80 ^d |
| | IIIB | NA | | 13,200 ^{e, f} | | | 13,200 ^f | | | 3,300 ^f |

For SI: 1 cubic foot = 0.028 m³, 1 pound = 0.454 kg, 1 gallon = 3.785 L.

NL = Not Limited; NA = Not Applicable; UD = Unclassified Detonable.

- a. For use of control areas, see Section 414.2.
- b. The aggregate quantity in use and storage shall not exceed the quantity specified for storage.
- c. The quantities of alcoholic beverages in retail and wholesale sales occupancies shall not be limited provided the liquids are packaged in individual containers not exceeding 1.3 gallons. In retail and wholesale sales occupancies, the quantities of medicines, foodstuffs or consumer products, and cosmetics containing not more than 50 percent by volume of water-miscible liquids with the remainder of the solutions not being flammable, shall not be limited, provided that such materials are packaged in individual containers not exceeding 1.3 gallons.
- d. Maximum allowable quantities shall be increased 100 percent in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1. Where Note e also applies, the increase for both notes shall be applied accumulatively.
- e. Maximum allowable quantities shall be increased 100 percent when stored in approved storage cabinets, day boxes, gas cabinets, gas rooms or exhausted enclosures or in listed safety cans in accordance with Section 5003.9.10 of the *International Fire Code*. Where Note d also applies, the increase for both notes shall be applied accumulatively.
- f. Quantities shall not be limited in a building equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
- g. Allowed only in buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.

307.1 Occupancy Classification: Exceptions to Group H

GIVEN: A fully sprinklered Group F-1 storage building housing Class II combustible liquids. The Class II liquids are all stored in approved safety cans. The entire building is a single control area.

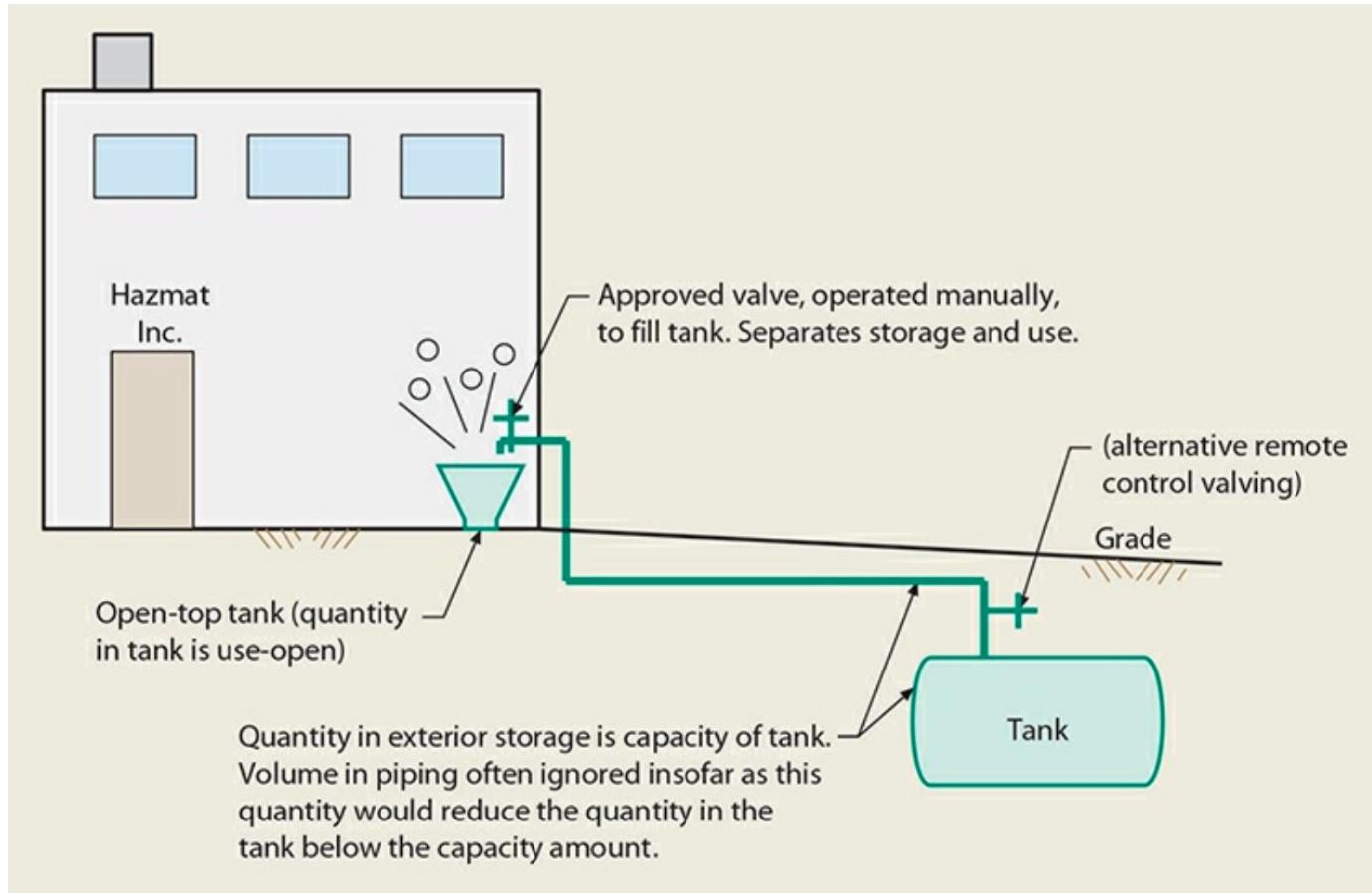
DETERMINE: The maximum allowable quantity of the Class II liquids in storage in order to maintain the Group F-1 classification.

SOLUTION:

| | |
|---|---------------|
| Basic MAQs per Table 307.1(1) | 120 gallons |
| Sprinkler increase per Footnote d (100%) | + 120 gallons |
| | <hr/> |
| Safety can increase per Footnote e (100%) | 240 gallons |
| Total of maximum permitted for | + 240 gallons |
| | <hr/> |
| Group F-1 classification | 480 gallons |

307.1 Occupancy Classification: Storage

- The maximum allowable quantities in the code are based on three potential situations: storage, use-closed, and use-open.



307.1 Occupancy Classification: Storage

Buildings containing materials that present a detonation hazard are typically considered _____ occupancies.

- a. Group H-1
- b. Group H-2
- c. Group H-3
- d. Group H-5

307.1 Occupancy Classification: Storage

Buildings containing materials that present a detonation hazard are typically considered _____ occupancies.

- a. Group H-1
- b. Group H-2
- c. Group H-3
- d. Group H-5

308.1 Occupancy Classification: Group I

- Institutional Group I occupancy includes, among others, the use of a building or structure, or a portion thereof, in which care or supervision is provided to persons who are or are not capable of self preservation without physical assistance or in which persons are detained for penal or correctional purposes or in which the liberty of the occupants is restricted. Institutional occupancies shall be classified as Group I-1, I-2, I-3 or I-4.
- The institutional uses classified as Group I occupancies are of three broad types. The first is a facility in which care is provided for the very young, sick or injured. The second category includes those facilities in which the personal liberties of the inmates or residents are restricted. Thirdly, supervised care facilities are regulated. Though the hazard due to combustible contents is quite low in institutional uses, the occupants' lack of mobility limits their egress ability.

308.1 Occupancy Classification: Group I

308.2 Institutional Group I-1. Institutional Group I-1 occupancy shall include buildings, structures or portions thereof for more than 16 persons, excluding staff, who reside on a *24-hour basis* in a supervised environment and receive *custodial care*. Buildings of Group I-1 shall be classified as one of the occupancy conditions specified in Section 308.2.1 or 308.2.2 and shall comply with Section 420. This group shall include, but not be limited to, the following:

- Alcohol and drug centers
- Assisted living facilities
- Congregate care facilities
- Group homes*
- Halfway houses
- Residential board and care facilities
- Social rehabilitation facilities

308.4 Institutional Group I-3. Institutional Group I-3 occupancy shall include buildings and structures that are inhabited by more than five persons who are under restraint or security. A Group I-3 facility is occupied by persons who are generally *incapable of self-preservation* due to security measures not under the occupants' control. This group shall include, but not be limited to, the following:

- Correctional centers
- Detention centers
- Jails
- Prerlease centers
- Prisons
- Reformatories

308.3 Institutional Group I-2. Institutional Group I-2 occupancy shall include buildings and structures used for *medical care* on a *24-hour basis* for more than five persons who are *incapable of self-preservation*. This group shall include, but not be limited to, the following:

- Foster care facilities*
- Detoxification facilities*
- Hospitals*
- Nursing homes*
- Psychiatric hospitals*

308.5 Institutional Group I-4, day care facilities. Institutional Group I-4 occupancy shall include buildings and structures occupied by more than five persons of any age who receive *custodial care* for fewer than 24 hours per day by persons other than parents or guardians; relatives by blood, marriage or adoption; and in a place other than the home of the person cared for. This group shall include, but not be limited to, the following:

- Adult day care
- Child day care

309.1 Occupancy Classification: Group I

Group I-1

Alcohol and drug centers
Assisted living facilities
Congregate care facilities
Group homes
Halfway houses
Residential board and care facilities
Social rehabilitation facilities

Group I-2

Foster care facilities
Detoxification facilities
Hospitals
Nursing homes
Psychiatric hospitals

Group I-3

Correctional centers
Detention centers
Jails
Prerelease centers
Prisons
Reformatories

Group I-4

Adult day care
Child day care

308.1 Occupancy Classification: Group I

A foster-care facility providing care on a 24-hour basis to six or more infants/toddlers ($2\frac{1}{2}$ years of age or less) is classified as a Group _____ occupancy.

- a. E
- b. I-1
- c. I-2
- d. R-4

308.1 Occupancy Classification: Group I

A foster-care facility providing care on a 24-hour basis to six or more infants/toddlers ($2\frac{1}{2}$ years of age or less) is classified as a Group _____ occupancy.

- a. E
- b. I-1
- c. I-2
- d. R-4

309.1 Occupancy Classification: Group M

- Mercantile Group M occupancy includes, among others, the use of a building or a structure or a portion thereof, for the display and sale of merchandise, and involves stocks of goods, wares or merchandise incidental to such purposes and where the public has access.
- A Group M occupancy is a retail or wholesale facility, or a store. An entire building can be classified as a Group M occupancy, such as a department store, or a portion of a building can be considered a mercantile use, such as the sales room in a manufacturing facility. A service station, including a canopy over the pump islands, is also classified as a Group M occupancy. In limited instances, a sales operation is designated as a Group B occupancy, as in the case of automobile showrooms.

309.1 Occupancy Classification: Group M

Group M

- Department stores
- Drug stores
- Greenhouses (display and sale)
- Markets
- Motor fuel-dispensing facilities
- Retail or wholesale stores
- Sales rooms

310 Occupancy Classification: Group R

- Residential Group R occupancy includes, among others, the use of a building or structure, or a portion thereof, for sleeping purposes when not classified as an Institutional Group I or when not regulated by the International Residential Code.
- Residential occupancies are characterized by: (1) their use by people for living and sleeping purposes, (2) a relatively low potential fire severity, and (3) the worst fire record of all structure types. Because occupants of these types of buildings spend up to one-third of each day sleeping, there is a high potential of a fire to rage out of control before the occupants awaken. After awakening, the residents will typically be disoriented for a short period of time, further decreasing the opportunity for immediate egress. A major difference between the Group R-1 and R-2 occupancy classifications is the transient nature of the use. “Transient” is defined as occupancy of a dwelling unit or sleeping unit for not more than 30 days.

310 Occupancy Classification: Group R

Group R-1

Boarding houses (transient)
 > 10 occupants
Congregate living facilities (transient) > 10 occupants
Hotels (transient)
Motels (transient)

Group R-2

Apartment houses
Congregate living facilities (nontransient)
 > 16 occupants
Hotels (nontransient)
Live/work units
Motels (nontransient)
Vacation timeshare properties

Group R-3

Buildings with \leq two dwelling units
Care facilities \leq 5 persons receiving care
Congregate living facilities (nontransient) \leq 16 occupants
Congregate living facilities (transient) \leq 10 occupants
Lodging houses with \leq 5 guest rooms and \leq 10 occupants

Group R-4

Alcohol and drug centers
Assisted living facilities
Congregate care facilities
Convalescent facilities
Group homes
Halfway houses
Residential board and custodial care facilities
Social rehabilitation facilities

Occupancy Classification: Group R

Live/work units are to be classified as _____ occupancies.

- a. Group B
- b. Group R-2
- c. accessory
- d. mixed

Occupancy Classification: Group R

Live/work units are to be classified as _____ occupancies.

- a. Group B
- b. Group R-2
- c. accessory
- d. mixed

311 Occupancy Classification: Group S

- Storage Group S occupancy includes among others, the use of a building or structure, or a portion thereof, for storage that is not classified as a hazardous occupancy.
- Where a warehouse or other storage facility does not contain significant amounts of hazardous commodities (as determined by Section 307), it should be considered a Group S occupancy. A facility used for the storage of combustible goods is classified as Group S- 1, whereas a Group S-2 occupancy shall be used only for the storage of noncombustible materials. If it is reasonable to believe that a storage building will house combustible goods for any significant period of time, it would be appropriate to consider the structure a Group S-1 occupancy, designed and constructed accordingly. Motor-vehicle-related uses are also included in the Group S category, with repair garages classified as Group S- 1 and parking garages (both open and enclosed) as Group S-2 occupancies.

311 Occupancy Classification: Group S

Group S-1

Aerosols products
Level 2 and Level 3
Aircraft repair hangar
Bags; cloth, burlap, paper
Belting; canvas, leather
Books
Paper in rolls
Cardboard and cardboard boxes
Clothing
Furniture
Grains
Lumber
Motor vehicle repair garages
Self-service storage facility
Tires, bulk storage of
Tobacco, cigars, cigarettes
Upholstery and mattresses

Group S-2

Aircraft hangar
Asbestos
Cement in bags
Chalk and crayons
Dairy products
Dry cell batteries
Electric motors
Food products
Fresh fruits and vegetables
Frozen foods
Glass
Gypsum board
Meats
Metals
Open parking garages
Enclosed parking garages
Porcelain and pottery

312 Occupancy Classification: Group U

- Buildings and structures of an accessory character and miscellaneous structures not classified in any specific occupancy shall be constructed, equipped and maintained to conform to the requirements of the IBC commensurate with the fire and life hazard incidental to their occupancy.
- Those structures not ordinarily occupied by the general public are typically classified as Group U occupancies. The fire load in these structures varies considerably but is usually not excessive. Because these types of uses are not normally occupied, the concern for fire severity is not very great, and as a group they constitute a low hazard. Several of the structures regulated as Group U occupancies are never occupied, such as fences, towers and tanks.

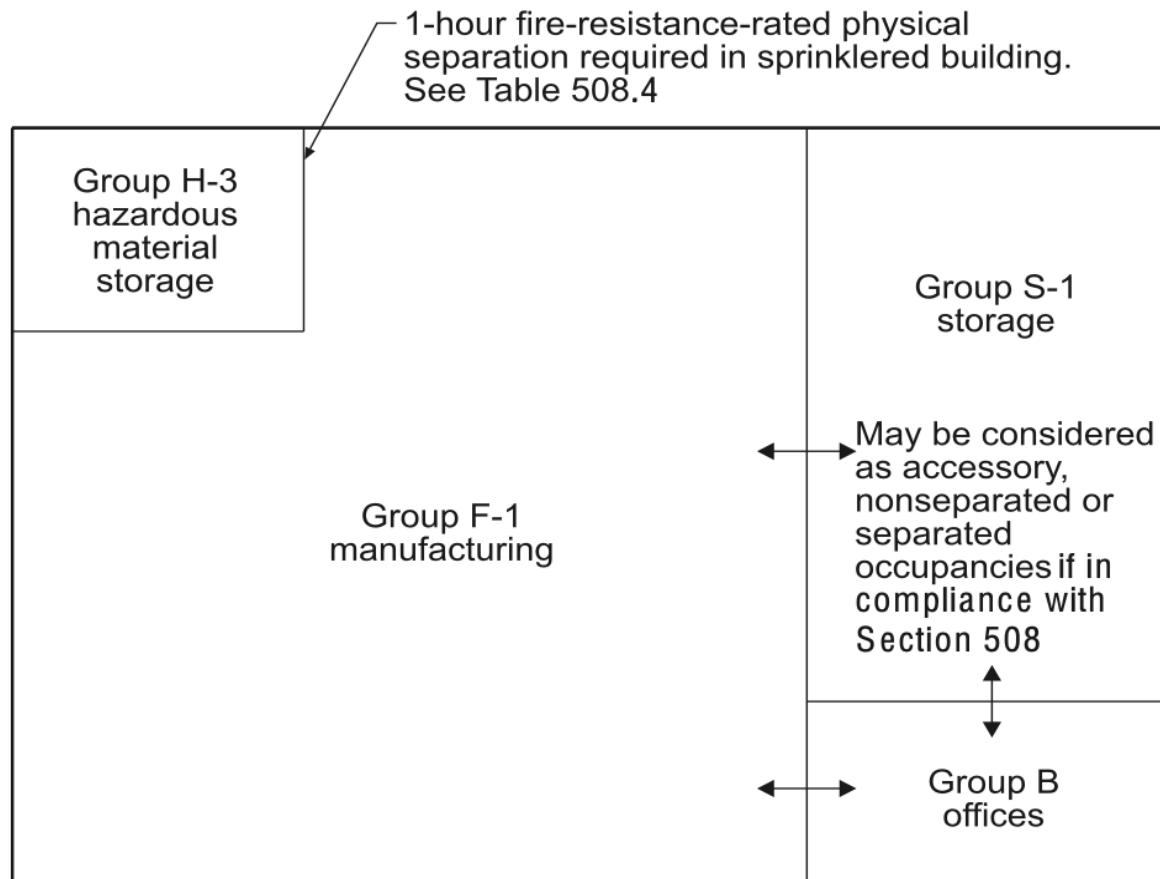
312 Occupancy Classification: Group U

| Group U |
|-----------------------------------|
| Agricultural buildings |
| Barns |
| Carports |
| Fences more than 7 feet in height |
| Livestock shelters |
| Private garages |
| Retaining walls |
| Sheds |
| Stables |
| Tanks |
| Towers |

508.1 Occupancy Classification: Mixed Occupancies

- Each portion of a building shall be individually classified in accordance with Section 302.1. Where a building contains more than one occupancy group, the building or portion thereof shall comply with the applicable provisions of Section 508.2 (Accessory Occupancies), 508.3 (Nonseparated Occupancies), 508.4 (Separated Occupancies), or 508.5 (Live/Work Units), or a combination of these sections. See the exceptions for: (1) occupancies separated in accordance with Section 510 (Special Provisions), and (2) Group H- 1, H-2 and H-3 occupancies required by Table 415.6.5 to be located in a separate and detached building.
- It is not uncommon for two or more distinct occupancy classifications to occur in the same building. Where such conditions exist, the code requires that such multiple occupancies be either (1) isolated from each other using fire-resistive separation elements (fire barriers and/or horizontal assemblies), or (2) imposed with special provisions that eliminate the need for such fire separations.

508.1 Occupancy Classification: Mixed Occupancies



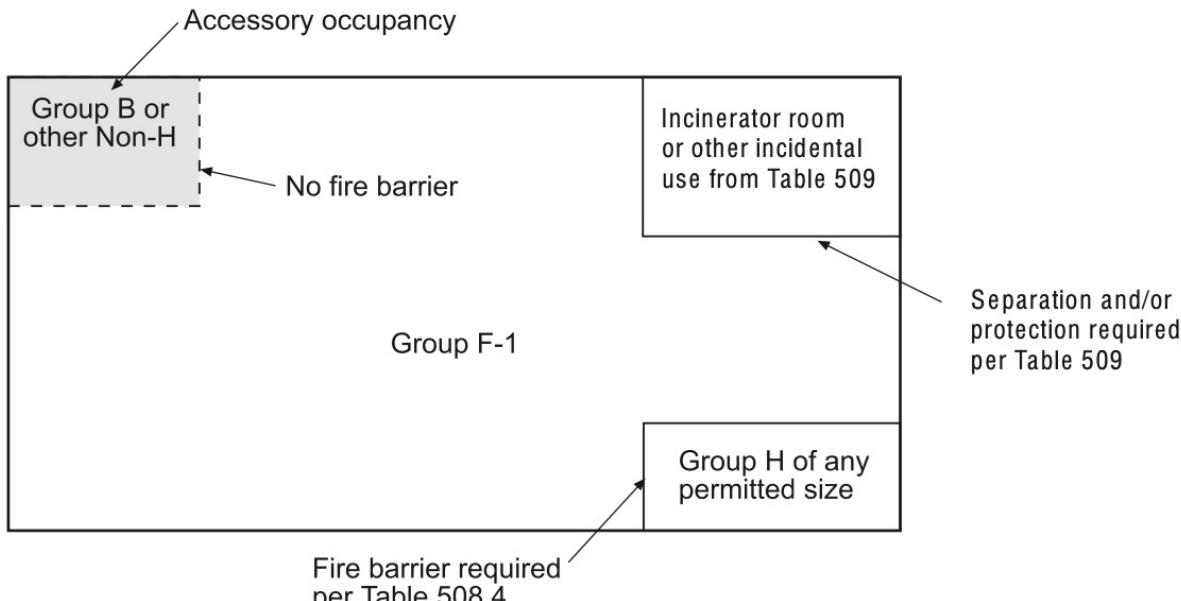
508.2/3 Accessory Occupancy

- Accessory occupancies are those occupancies that are ancillary to the main occupancy of the building or portion thereof. Aggregate accessory occupancies shall not occupy more than 10 percent of the area of the story in which they are located and shall not exceed the tabular values for nonsprinklered buildings in Table 506.2 for each such accessory occupancy.
- The mixed-occupancy method of “Accessory Occupancies” is one of the three design options that the code provides when dealing with mixed-occupancy buildings. This approach is only applicable where one or more of the occupancies is quite small in relationship to the major occupancy in the building. The aggregate floor area of all accessory occupancies is limited to 10 percent of the floor area of the story in which the accessory occupancies are located. In addition, the aggregate floor area of the accessory occupancies cannot exceed the allowable floor area taken from Table 506.2 for a nonsprinklered building.

508.2/3 Accessory Occupancy

Example:

Given a 100,000 sq ft mixed-occupancy building (F-1, B, H)



It is possible to have more than one space or occupancy designated an accessory occupancy. Under such circumstances, the 10 percent and tabular area limitations, per story, are to be based upon the aggregate floor area of all of the accessory occupancies.

508.2.1 Nonseparated Occupancy

Given: A nonsprinklered Type VB building contains both Group B and Group E occupancies.

Determine: The height and area limitations if the occupancies are not separated under the nonseparated occupancies provisions of Section 508.3.

TABLE 504.4
ALLOWABLE NUMBER OF STORIES ABOVE GRADE PLANE^{a, b}

| OCCUPANCY CLASSIFICATION | See Footnotes | TYPE OF CONSTRUCTION | | | | | | | | | |
|--------------------------|---------------|----------------------|----|---------|----|----------|----|---------|----|----|----|
| | | Type I | | Type II | | Type III | | Type IV | | | |
| | | A | B | A | B | A | B | A | B | C | HT |
| A-1 | NS | UL | 5 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 3 |
| | S | UL | 6 | 4 | 3 | 4 | 3 | 9 | 6 | 4 | 4 |
| A-2 | NS | UL | 11 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 3 |
| | S | UL | 12 | 4 | 3 | 4 | 3 | 18 | 12 | 6 | 4 |
| A-3 | NS | UL | 11 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 2 |
| | S | UL | 12 | 4 | 3 | 4 | 3 | 18 | 12 | 6 | 4 |
| A-4 | NS | UL | 11 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 2 |
| | S | UL | 12 | 4 | 3 | 4 | 3 | 18 | 12 | 6 | 4 |
| A-5 | NS | UL | UL | UL | UL | UL | UL | 1 | 1 | 1 | UL |
| | S | UL | UL | UL | UL | UL | UL | UL | UL | UL | UL |
| B | NS | UL | 11 | 5 | 3 | 5 | 3 | 5 | 5 | 5 | 3 |
| | S | UL | 12 | 6 | 4 | 6 | 4 | 18 | 12 | 9 | 6 |
| E | NS | UL | 5 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 1 |
| | S | UL | 6 | 4 | 3 | 4 | 3 | 9 | 6 | 4 | 2 |

508.2.1 Nonseparated Occupancy

Given: A nonsprinklered Type VB building contains both Group B and Group E occupancies.

Determine: The height and area limitations if the occupancies are not separated under the nonseparated occupancies provisions of Section 508.3.

TABLE 504.4
ALLOWABLE NUMBER OF STORIES ABOVE GRADE PLANE^{a, b}

| OCCUPANCY CLASSIFICATION | See Footnotes | TYPE OF CONSTRUCTION | | | | | | | | | |
|--------------------------|---------------|----------------------|----|---------|----|----------|----|---------|----|----|----|
| | | Type I | | Type II | | Type III | | Type IV | | | |
| | | A | B | A | B | A | B | A | B | C | HT |
| A-1 | NS | UL | 5 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 3 |
| | S | UL | 6 | 4 | 3 | 4 | 3 | 9 | 6 | 4 | 4 |
| A-2 | NS | UL | 11 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 3 |
| | S | UL | 12 | 4 | 3 | 4 | 3 | 18 | 12 | 6 | 4 |
| A-3 | NS | UL | 11 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 2 |
| | S | UL | 12 | 4 | 3 | 4 | 3 | 18 | 12 | 6 | 4 |
| A-4 | NS | UL | 11 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 2 |
| | S | UL | 12 | 4 | 3 | 4 | 3 | 18 | 12 | 6 | 4 |
| A-5 | NS | UL | UL | UL | UL | UL | UL | 1 | 1 | 1 | UL |
| | S | UL | UL | UL | UL | UL | UL | UL | UL | UL | UL |
| B | NS | UL | 11 | 5 | 3 | 5 | 3 | 5 | 5 | 5 | 3 |
| | S | UL | 12 | 6 | 4 | 6 | 4 | 18 | 12 | 9 | 4 |
| E | NS | UL | 5 | 3 | 2 | 3 | 2 | 3 | 3 | 3 | 1 |
| | S | UL | 6 | 4 | 3 | 4 | 3 | 9 | 6 | 4 | 2 |

508.2.1 Nonseparated Occupancy

Example:

Given: A nonsprinklered Type VB building contains both Group B and Group E occupancies.

Determine: The height and area limitations if the occupancies are not separated under the nonseparated occupancies provisions of Section 508.3.

| OCCUPANCY | ALLOWABLE HEIGHT ¹ | ALLOWABLE AREA ² |
|----------------------|-------------------------------|-----------------------------|
| Group B ² | 2 stories | 9,000 square feet |
| Group E ³ | 1 story | 9,500 square feet |

1 Based on Table 504.4

2 Based on Table 506.2 assuming no frontage increase.

3 Most restrictive fire protection requirements of Chapter 9 also applicable to entire building.

^Thus, for nonseparated occupancies, the maximum building size would be 1 story and 9,000 square feet.

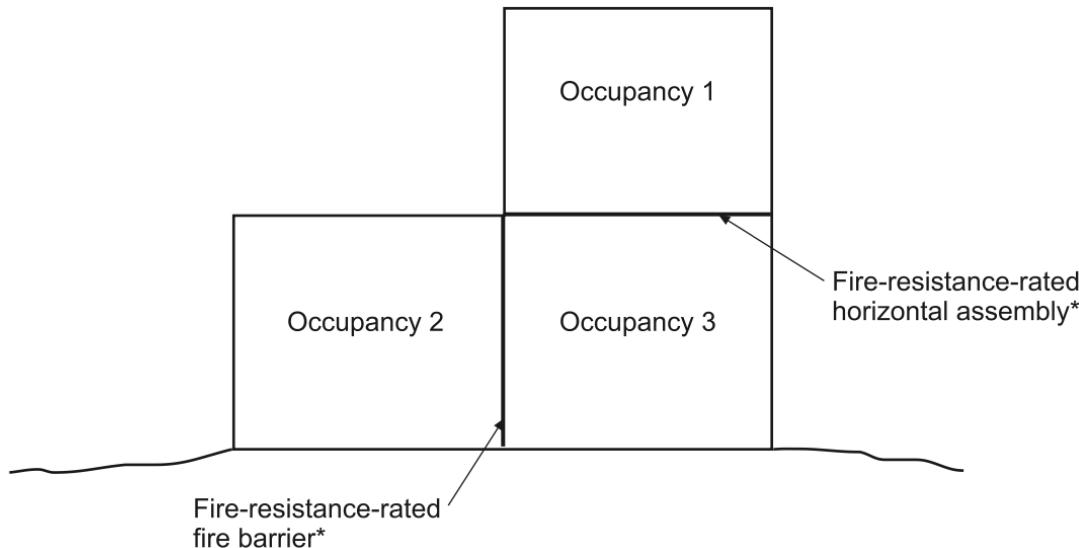
Nonseparated Occupancies

The use of the nonseparated occupancies method is not applicable to high-hazard occupancies. Those areas or spaces classified as Group H occupancies must be isolated from other occupancies within the building by fire barriers and/or horizontal assemblies in accordance with Table 508.4 for occupancy separations.

508.4 Separated Occupancy

- Separated occupancies shall be individually classified in accordance with Section 302.1. Each separated space shall comply with the IBC based on the occupancy classification of that portion of the building.
- Under the provisions for “Separated Occupancies,” each of the distinct uses is to be individually classified as to occupancy. This approach is consistent with that for accessory occupancies and nonseparated occupancies. The concept of separated occupancies provides for a fire-resistance-rated separation in order to isolate the hazards associated with a specific occupancy from other portions of the building.

508.4 Nonseparated Occupancy



*Minimum fire-resistance rating based on Table 508.4

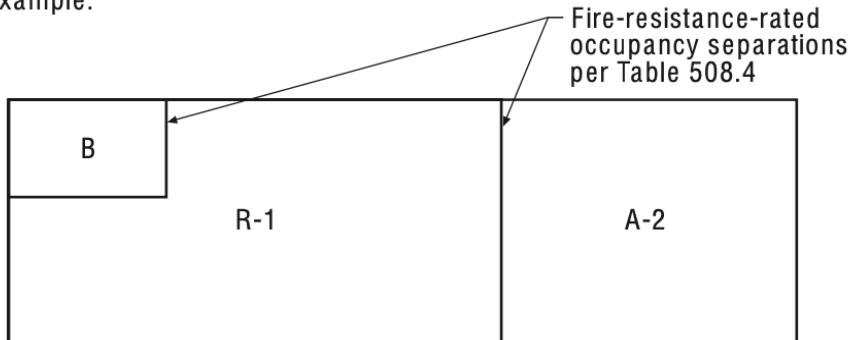
For those mixed-occupancy buildings containing a Group H occupancy, the separated occupancy provisions will always need to be applied. Any Group H occupancy must be physically and fire-resistively separated from other occupancies within the same structure.

508.4.2/3 Separated Occupancy

- In each story, the building area shall be such that the sum of the ratios of the actual building area of each separated occupancy divided by the allowable area of each separated occupancy shall not exceed 1. Each separated occupancy shall comply with the building height limitations and story limitations based on the type of construction of the building in accordance with Section 503.1. See exception where Section 510 is applied.
- The approach to separated occupancies mandates that the ratios of the actual and allow- able floor areas be calculated in order to determine compliance. Often known as the “unity formula,” this calculation recognizes the relationship between the permitted sizes of the various occupancies involved. The unity formula is only applicable where the separated occupancy method is utilized and does not apply to accessory occupancies or non-separated occupancies.

508.4.2/3 Separated Occupancy

Example:



Allowable height per Section 504 for each individual occupancy

$$\frac{\text{Actual area A-2}}{\text{Allowable area A-2}} + \frac{\text{Actual area B}}{\text{Allowable area B}} + \frac{\text{Actual area R-1}}{\text{Allowable area R-1}} \leq 1.0$$

The height limitations for separated occupancies are based upon the general provisions of Section 504. The height limit, in both feet and stories, is to be measured from the grade plane, and the measurement must include all intervening fire areas.

508.4.2/3 Separated Occupancy

GIVEN: A one-story nonsprinklered building housing day care classified as Group E, Group B offices, and a Group A-3 conference room. The building is of Type VA construction. Insufficient open space is available for area increase purposes. Floor areas are as follows:

| | |
|----------------|-------------------|
| Office (B) | 4,500 square feet |
| Assembly (A-3) | 1,000 square feet |
| Day care (E) | 6,000 square feet |

DETERMINE: If the building area is within the allowable area under the "separated occupancies" provisions.

TABLE 506.2
ALLOWABLE AREA FACTOR ($A_i = NS, S1, S13R, S13D$ or SM , as applicable) IN SQUARE FEET^{a, b}

| OCCUPANCY CLASSIFICATION | SEE FOOTNOTES | TYPE OF CONSTRUCTION | | | | | | | | | | A | B | | |
|--------------------------|---------------|----------------------|-----|---------|--------|----------|--------|---------|---------|---------|---------|--------|--------|--|--|
| | | Type I | | Type II | | Type III | | Type IV | | | | | | | |
| | | A | B | A | B | A | B | A | B | C | HT | | | | |
| A-1 | NS | UL | UL | 15,500 | 8,500 | 14,000 | 8,500 | 45,000 | 30,000 | 18,750 | 15,000 | 11,500 | 5,500 | | |
| | S1 | UL | UL | 62,000 | 34,000 | 56,000 | 34,000 | 180,000 | 120,000 | 75,000 | 60,000 | 46,000 | 22,000 | | |
| | SM | UL | UL | 46,500 | 25,500 | 42,000 | 25,500 | 135,000 | 90,000 | 56,250 | 45,000 | 34,500 | 16,500 | | |
| A-2 | NS | UL | UL | 15,500 | 9,500 | 14,000 | 9,500 | 45,000 | 30,000 | 18,750 | 15,000 | 11,500 | 6,000 | | |
| | S1 | UL | UL | 62,000 | 38,000 | 56,000 | 38,000 | 180,000 | 120,000 | 75,000 | 60,000 | 46,000 | 24,000 | | |
| | SM | UL | UL | 46,500 | 28,500 | 42,000 | 28,500 | 135,000 | 90,000 | 56,250 | 45,000 | 34,500 | 18,000 | | |
| A-3 | NS | UL | UL | 15,500 | 9,500 | 14,000 | 9,500 | 45,000 | 30,000 | 18,750 | 15,000 | 11,500 | 6,000 | | |
| | S1 | UL | UL | 62,000 | 38,000 | 56,000 | 38,000 | 180,000 | 120,000 | 75,000 | 60,000 | 46,000 | 24,000 | | |
| | SM | UL | UL | 46,500 | 28,500 | 42,000 | 28,500 | 135,000 | 90,000 | 56,250 | 45,000 | 34,500 | 18,000 | | |
| A-4 | NS | UL | UL | 15,500 | 9,500 | 14,000 | 9,500 | 45,000 | 30,000 | 18,750 | 15,000 | 11,500 | 6,000 | | |
| | S1 | UL | UL | 62,000 | 38,000 | 56,000 | 38,000 | 180,000 | 120,000 | 75,000 | 60,000 | 46,000 | 24,000 | | |
| | SM | UL | UL | 46,500 | 28,500 | 42,000 | 28,500 | 135,000 | 90,000 | 56,250 | 45,000 | 34,500 | 18,000 | | |
| A-5 | NS | | | | | | | | | | | | | | |
| | S1 | UL | UL | UL | UL | UL | UL | UL | UL | UL | UL | | | | |
| | SM | | | | | | | | | | | | | | |
| B | NS | UL | UL | 37,500 | 23,000 | 28,500 | 19,000 | 108,000 | 72,000 | 45,000 | 36,000 | 18,000 | 9,000 | | |
| | S1 | UL | UL | 150,000 | 92,000 | 114,000 | 76,000 | 432,000 | 288,000 | 180,000 | 144,000 | 72,000 | 36,000 | | |
| | SM | UL | UL | 112,500 | 69,000 | 85,500 | 57,000 | 324,000 | 216,000 | 135,000 | 108,000 | 54,000 | 27,000 | | |
| E | NS | UL | UL | 26,500 | 14,500 | 23,500 | 14,500 | 76,500 | 51,000 | 31,875 | 25,500 | 18,500 | 9,500 | | |
| | S1 | UL | UL | 106,000 | 58,000 | 94,000 | 58,000 | 306,000 | 204,000 | 127,500 | 102,000 | 74,000 | 38,000 | | |
| | SM | UL | UL | 79,500 | 43,500 | 70,500 | 43,500 | 229,500 | 153,000 | 95,625 | 76,500 | 55,500 | 28,500 | | |
| | NS | TTT | TTT | 25,000 | 15,500 | 18,000 | 12,000 | 100,500 | 67,000 | 41,875 | 33,500 | 14,000 | 8,500 | | |

Source: 2021 IBC

508.4.2/3 Separated Occupancy

GIVEN: A one-story nonsprinklered building housing day care classified as Group E, Group B offices, and a Group A-3 conference room. The building is of Type VA construction. Insufficient open space is available for area increase purposes. Floor areas are as follows:

| | |
|----------------|-------------------|
| Office (B) | 4,500 square feet |
| Assembly (A-3) | 1,000 square feet |
| Day care (E) | 6,000 square feet |

DETERMINE: If the building area is within the allowable area under the "separated occupancies" provisions.

TABLE 506.2
ALLOWABLE AREA FACTOR ($A_i = NS, S1, S13R, S13D$ or SM , as applicable) IN SQUARE FEET^{a, b}

| OCCUPANCY CLASSIFICATION | SEE FOOTNOTES | TYPE OF CONSTRUCTION | | | | | | | | | | A | B | | |
|--------------------------|---------------|----------------------|-----|---------|--------|----------|--------|---------|---------|---------|---------|--------|--------|--|--|
| | | Type I | | Type II | | Type III | | Type IV | | | | | | | |
| | | A | B | A | B | A | B | A | B | C | HT | | | | |
| A-1 | NS | UL | UL | 15,500 | 8,500 | 14,000 | 8,500 | 45,000 | 30,000 | 18,750 | 15,000 | 11,500 | 5,500 | | |
| | S1 | UL | UL | 62,000 | 34,000 | 56,000 | 34,000 | 180,000 | 120,000 | 75,000 | 60,000 | 46,000 | 22,000 | | |
| | SM | UL | UL | 46,500 | 25,500 | 42,000 | 25,500 | 135,000 | 90,000 | 56,250 | 45,000 | 34,500 | 16,500 | | |
| A-2 | NS | UL | UL | 15,500 | 9,500 | 14,000 | 9,500 | 45,000 | 30,000 | 18,750 | 15,000 | 11,500 | 6,000 | | |
| | S1 | UL | UL | 62,000 | 38,000 | 56,000 | 38,000 | 180,000 | 120,000 | 75,000 | 60,000 | 46,000 | 24,000 | | |
| | SM | UL | UL | 46,500 | 28,500 | 42,000 | 28,500 | 135,000 | 90,000 | 56,250 | 45,000 | 34,500 | 18,000 | | |
| A-3 | NS | UL | UL | 15,500 | 9,500 | 14,000 | 9,500 | 45,000 | 30,000 | 18,750 | 15,000 | 11,500 | 6,000 | | |
| | S1 | UL | UL | 62,000 | 38,000 | 56,000 | 38,000 | 180,000 | 120,000 | 75,000 | 60,000 | 46,000 | 24,000 | | |
| | SM | UL | UL | 46,500 | 28,500 | 42,000 | 28,500 | 135,000 | 90,000 | 56,250 | 45,000 | 34,500 | 18,000 | | |
| A-4 | NS | UL | UL | 15,500 | 9,500 | 14,000 | 9,500 | 45,000 | 30,000 | 18,750 | 15,000 | 11,500 | 6,000 | | |
| | S1 | UL | UL | 62,000 | 38,000 | 56,000 | 38,000 | 180,000 | 120,000 | 75,000 | 60,000 | 46,000 | 24,000 | | |
| | SM | UL | UL | 46,500 | 28,500 | 42,000 | 28,500 | 135,000 | 90,000 | 56,250 | 45,000 | 34,500 | 18,000 | | |
| A-5 | NS | | | | | | | | | | | | | | |
| | S1 | UL | UL | UL | UL | UL | UL | UL | UL | UL | UL | | | | |
| | SM | | | | | | | | | | | | | | |
| B | NS | UL | UL | 37,500 | 23,000 | 28,500 | 19,000 | 108,000 | 72,000 | 45,000 | 36,000 | 18,000 | 9,000 | | |
| | S1 | UL | UL | 150,000 | 92,000 | 114,000 | 76,000 | 432,000 | 288,000 | 180,000 | 144,000 | 72,000 | 36,000 | | |
| | SM | UL | UL | 112,500 | 69,000 | 85,500 | 57,000 | 324,000 | 216,000 | 135,000 | 108,000 | 54,000 | 27,000 | | |
| E | NS | UL | UL | 26,500 | 14,500 | 23,500 | 14,500 | 76,500 | 51,000 | 31,875 | 25,500 | 18,500 | 9,500 | | |
| | S1 | UL | UL | 106,000 | 58,000 | 94,000 | 58,000 | 306,000 | 204,000 | 127,500 | 102,000 | 74,000 | 38,000 | | |
| | SM | UL | UL | 79,500 | 43,500 | 70,500 | 43,500 | 229,500 | 153,000 | 95,625 | 76,500 | 55,500 | 28,500 | | |
| | NS | TTT | TTT | 25,000 | 15,500 | 18,000 | 12,000 | 100,500 | 67,000 | 41,875 | 22,500 | 14,000 | 8,500 | | |

Source: 2021 IBC

508.4.2/3 Separated Occupancy

GIVEN: A one-story nonsprinklered building housing day care classified as Group E, Group B offices, and a Group A-3 conference room. The building is of Type VA construction. Insufficient open space is available for area increase purposes. Floor areas are as follows:

| | |
|----------------|-------------------|
| Office (B) | 4,500 square feet |
| Assembly (A-3) | 1,000 square feet |
| Day care (E) | 6,000 square feet |

DETERMINE: If the building area is within the allowable area under the "separated occupancies" provisions.

SOLUTION: In accordance with Section 508.4.2:

$$\frac{\text{Actual area of office}}{\text{Allowable area of office}} + \frac{\text{Actual area of assembly}}{\text{Allowable area of assembly}} + \frac{\text{Actual area of E}}{\text{Allowable area of E}} \leq 1$$

$$\frac{4,500}{18,000} + \frac{1,000}{11,500} + \frac{6,000}{18,500} \stackrel{?}{\leq} 1$$

$$0.25 + 0.09 + 0.32 \stackrel{?}{\leq} 1$$

$$0.66 \leq 1, \text{ therefore OK}$$

Building is within the allowable area.

For SI: 1 square foot = 0.093 m².

508.4.2/3 Separated Occupancy

In the determination of allowable building area for a mixed occupancy building, the _____ occupancies method requires the sum of the ratios of the actual building area of each occupancy divided by the allowable building area of each occupancy to be not greater than 1.0.

- a. accessory
- b. incidental
- c. nonseparated
- d. separated

508.4.2/3 Separated Occupancy

In the determination of allowable building area for a mixed occupancy building, the _____ occupancies method requires the sum of the ratios of the actual building area of each occupancy divided by the allowable building area of each occupancy to be not greater than 1.0.

- a. accessory
- b. incidental
- c. nonseparated
- d. separated

508.4.4/508.4.4.1 Separated Occupancy

- Individual occupancies shall be separated from adjacent occupancies in accordance with Table 508.4. Required separations shall be fire barriers constructed in accordance with Section 707 or horizontal assemblies constructed in accordance with Section 711, or both, so as to completely separate adjacent occupancies.
- A matrix, Table 508.4, has been established to identify any required fire-resistance-rated separation between various occupancies. The table is based on the perceived degree of dissimilarity between the occupancies involved. Where Table 508.4 requires a level of fire-resistance between the adjoining occupancies, fire barriers and/or horizontal separations are to be used. The intended result is that the hazards associated with one occupancy be completely isolated from those present in the remainder of the building.

508.4.4/508.4.4.1 Separated Occupancy

TABLE 508.4
REQUIRED SEPARATION OF OCCUPANCIES (HOURS)^f

| OCCUPANCY | A, E | | I-1 ^a , I-3, I-4 | | I-2 | | R ^a | | F-2, S-2 ^b , U | | B ^e , F-1, M, S-1 | | H-1 | | H-2 | | H-3, H-4 | | H-5 | |
|------------------------------|------|----|-----------------------------|----|-----|----|----------------|----------------|---------------------------|----------------|---------------------------------|----|-----|----|-----|----|----------------|----|-----|----|
| | S | NS | S | NS | S | NS | S | NS | S | NS | S | NS | S | NS | S | NS | S | NS | S | NS |
| A, E | N | N | 1 | 2 | 2 | NP | 1 | 2 | N | 1 | 1 | 2 | NP | NP | 3 | 4 | 2 | 3 | 2 | NP |
| I-1 ^a , I-3, I-4 | 1 | 2 | N | N | 2 | NP | 1 | NP | 1 | 2 | 1 | 2 | NP | NP | 3 | NP | 2 | NP | 2 | NP |
| I-2 | 2 | NP | 2 | NP | N | N | 2 | NP | 2 | NP | 2 | NP | NP | NP | 3 | NP | 2 | NP | 2 | NP |
| R ^a | 1 | 2 | 1 | NP | 2 | NP | N | N | 1 ^c | 2 ^c | 1 | 2 | NP | NP | 3 | NP | 2 | NP | 2 | NP |
| F-2, S-2 ^b , U | N | 1 | 1 | 2 | 2 | NP | 1 ^c | 2 ^c | N | N | 1 | 2 | NP | NP | 3 | 4 | 2 | 3 | 2 | NP |
| B ^e , F-1, M, S-1 | 1 | 2 | 1 | 2 | 2 | NP | 1 | 2 | 1 | 2 | N | N | NP | NP | 2 | 3 | 1 | 2 | 1 | NP |
| H-1 | NP | NP | NP | NP | NP | NP | NP | NP | NP | NP | NP | NP | N | NP | NP | NP | NP | NP | NP | NP |
| H-2 | 3 | 4 | 3 | NP | 3 | NP | 3 | NP | 3 | 4 | 2 | 3 | NP | NP | N | NP | 1 | NP | 1 | NP |
| H-3, H-4 | 2 | 3 | 2 | NP | 2 | NP | 2 | NP | 2 | 3 | 1 | 2 | NP | NP | 1 | NP | 1 ^d | NP | 1 | NP |
| H-5 | 2 | NP | 2 | NP | 2 | NP | 2 | NP | 2 | NP | 1 | NP | NP | NP | 1 | NP | 1 | NP | N | NP |

S = Buildings equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1.

NS = Buildings not equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1.

N = No separation requirement.

NP = Not Permitted.

a. See Section 420.

b. The required separation from areas used only for private or pleasure vehicles shall be reduced by 1 hour but not to less than 1 hour.

c. See Sections 406.3.2 and 406.6.4.

d. Separation is not required between occupancies of the same classification.

e. See Section 422.2 for *ambulatory care facilities*.

f. Occupancy separations that serve to define fire area limits established in Chapter 9 for requiring fire protection systems shall also comply with Section 707.3.10 and Table 707.3.10 in accordance with Section 901.7.

509.1/3 Incidental Uses

- Incidental uses are ancillary functions associated with a given occupancy that generally pose a greater level of risk to that occupancy and are limited to those uses listed in Table 509.1. Incidental uses shall not be individually classified in accordance with Section 302.1. Incidental uses shall be included in the building occupancies within which they are located. Incidental uses shall not occupy more than 10 percent of the building area of the story in which they are located.
- It is common to find uses that are typical of the general occupancy classification of the building, yet which create a hazard different from the other hazards found in the occupancy. An example would be a chemistry laboratory classroom in a high school building. The code addresses such conditions by requiring incidental uses to be separated from the remainder of the building with fire-resistance-rated construction, or to be protected with an automatic sprinkler system. An incidental use should be assigned an occupancy classification consistent with the portion of the building in which it is located.

509.1/3 Incidental Uses

[F]TABLE 509.1
INCIDENTAL USES

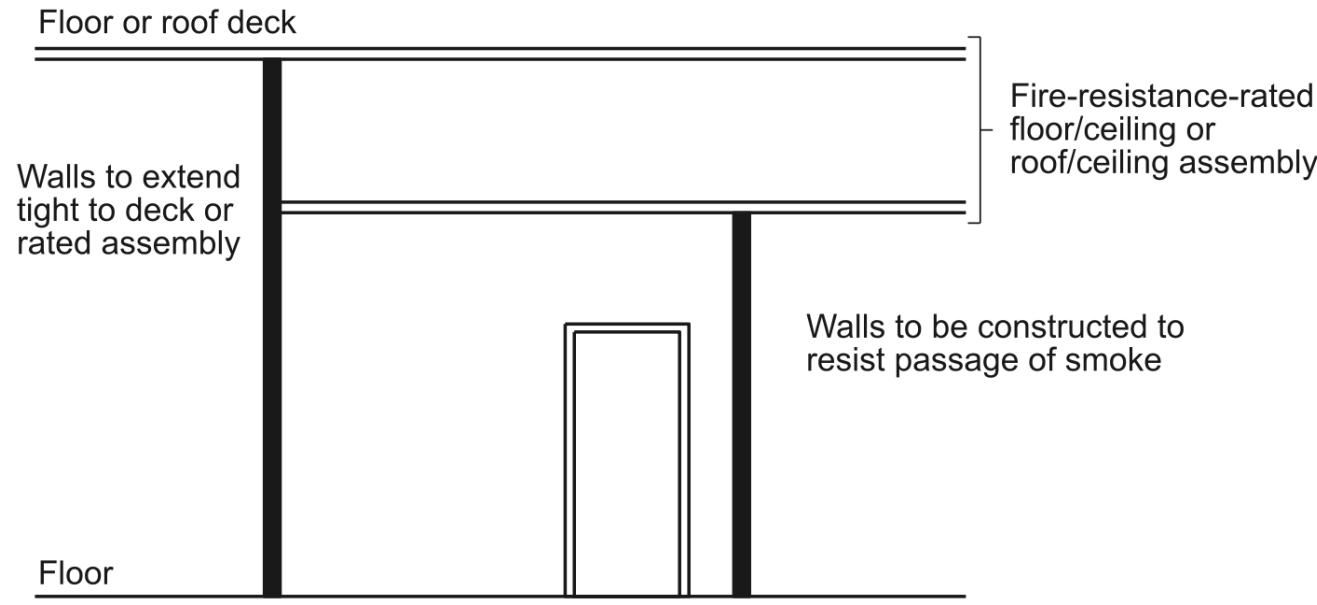
| ROOM OR AREA | SEPARATION AND/OR PROTECTION |
|--|---|
| Furnace room where any piece of equipment is over 400,000 Btu per hour input | 1 hour or provide automatic sprinkler system |
| Rooms with boilers where the largest piece of equipment is over 15 psi and 10 horsepower | 1 hour or provide automatic sprinkler system |
| Refrigerant machinery room | 1 hour or provide automatic sprinkler system |
| Hydrogen fuel gas rooms, not classified as Group H | 1 hour in Group B, F, M, S and U occupancies; 2 hours in Group A, E, I and R occupancies. |
| Incinerator rooms | 2 hours and provide automatic sprinkler system |
| Paint shops, not classified as Group H, located in occupancies other than Group F | 2 hours; or 1 hour and provide automatic sprinkler system |
| In Group E occupancies, laboratories and vocational shops not classified as Group H | 1 hour or provide automatic sprinkler system |
| In Group I-2 occupancies, laboratories not classified as Group H | 1 hour and provide automatic sprinkler system |
| In <i>ambulatory care facilities</i> , laboratories not classified as Group H | 1 hour or provide automatic sprinkler system |
| Laundry rooms over 100 square feet | 1 hour or provide automatic sprinkler system |
| In Group I-2, laundry rooms over 100 square feet | 1 hour |
| Group I-3 cells and Group I-2 patient rooms equipped with padded surfaces | 1 hour |
| In Group I-2, physical plant maintenance shops | 1 hour |
| In ambulatory care facilities or Group I-2 occupancies, waste and linen collection rooms with containers that have an aggregate volume of 10 cubic feet or greater | 1 hour |
| In other than ambulatory care facilities and Group I-2 occupancies, waste and linen collection rooms over 100 square feet | 1 hour or provide automatic sprinkler system |
| In ambulatory care facilities or Group I-2 occupancies, storage rooms greater than 100 square feet | 1 hour |
| Electrical installations and transformers | See Sections 110.26 through 110.34 and Sections 450.8 through 450.48 of NFPA 70 for protection and separation requirements. |

For SI: 1 square foot = 0.0929 m², 1 pound per square inch (psi) = 6.9 kPa, 1 British thermal unit (Btu) per hour = 0.293 watts, 1 horsepower = 746 watts, 1 gallon = 3.785 L, 1 cubic foot = 0.0283 m³.

509.4 Incidental Uses

- Where Table 509.1 specifies a fire-resistance-rated separation, the incidental uses shall be separated from the remainder of the building by a fire barrier constructed in accordance with Section 707 or a horizontal assembly constructed in accordance with Section 711, or both. Where Table 509.1 permits an automatic sprinkler system without a fire barrier, the incidental uses shall be separated from the remainder of the building by construction capable of resisting the passage of smoke.
- In utilizing Table 509.1, it is common that two options are available for addressing rooms or areas considered incidental uses. A fire barrier may often be used to isolate the specific hazard from the remainder of the building. As an alternative, a sprinkler system may be used to limit any fire in the incidental use to that space only. By incorporating smoke containment construction, little if any smoke created would be transferred to other portions of the building.

509.4 Incidental Uses



Note: Doors shall:

- be self-closing or automatic-closing upon detection of smoke
- have no air transfer openings
- have no excessive undercuts

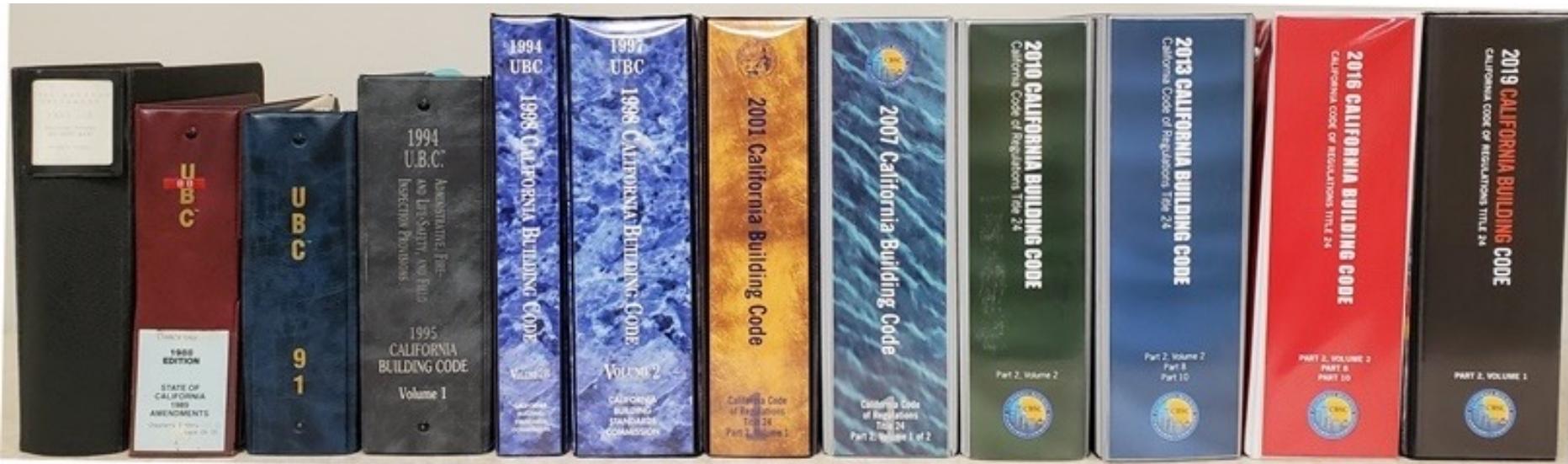
Construction to resist the passage of smoke

Class 3: Chapter 6 Learning Objective

602.1 Construction Classification

- To gain an understanding of how a building is classified as a specific type of construction, based on the construction materials and the various building elements' resistance to fire.

History Building Codes ?



| California Building Code Part 2 of Title 24 | Effective Date | Model Code |
|--|----------------------------|----------------------|
| 1981 | See history note appendix | UBC 1979 |
| 1985 | See history note appendix | UBC 1979, 1982, 1985 |
| 1989 | July 1, 1989 | UBC 1988 |
| 1992 | July 1, 1992 | UBC 1991 |
| 1995 | January 1, 1996 | UBC 1994 |
| 1998 | July 1, 1999 | UBC 1997 |
| 2001 | November 1, 2002 | UBC 1997 |
| 2004 | 2001 CBC remains in effect | |
| 2007 | January 1, 2008 | IBC 2006 |
| 2010 | January 1, 2011 | IBC 2009 |
| 2013 | January 1, 2014 | IBC 2012 |
| 2016 | January 1, 2017 | IBC 2015 |
| 2019 | January 1, 2020 | IBC 2018 |

History

- In order to build a structure bigger, it must be built better
- Fire-resistance requirements were developed by specifying the type and thickness of materials used.
- Herbert Hoover, then Secretary of Commerce (1921 –28)
 - Concepts in previous building codes that have carried over to today.
- Pre 1920s "The building codes of this country have not been developed on scientific data, but rather on compromise; they are not uniform in practice and in many instances involve an additional cost of construction without assuring more useful or more durable buildings."

602.1 Construction Types

- Buildings and structures erected or to be erected, altered or extended in height or area shall be classified in one of the five construction types defined in Sections 602.2 through 602.5.
- Protected, where the major structural elements are provided with some degree of fire resistance.
- Unprotected, where no fire protection of the building elements is typically mandated. Protected construction is further distinguished in Type I buildings where the required protection for many structural elements exceeds a 1-hour fire-resistance rating.

602.1 Construction Classification

| | | | | |
|--------------------------------------|--|-----|---|----|
| Noncombustible | Exterior and interior (bearing or nonbearing) walls, floors, roofs and structural elements are to be of noncombustible materials | I | A | B |
| | | II | A | B |
| Noncombustible or combustible | Exterior walls are to be of noncombustible materials | III | A | B |
| | | IV | A | B |
| | V | A | B | C |
| | | | | HT |

It is the intent of the *International Building Code* that each building be classified as a single type of construction. The construction materials and the degree to which such materials are protected determine the classification based on the criteria of Table 601 and Chapter 6.

Source: 2021 IBC

1. The Five Basic Construction Types

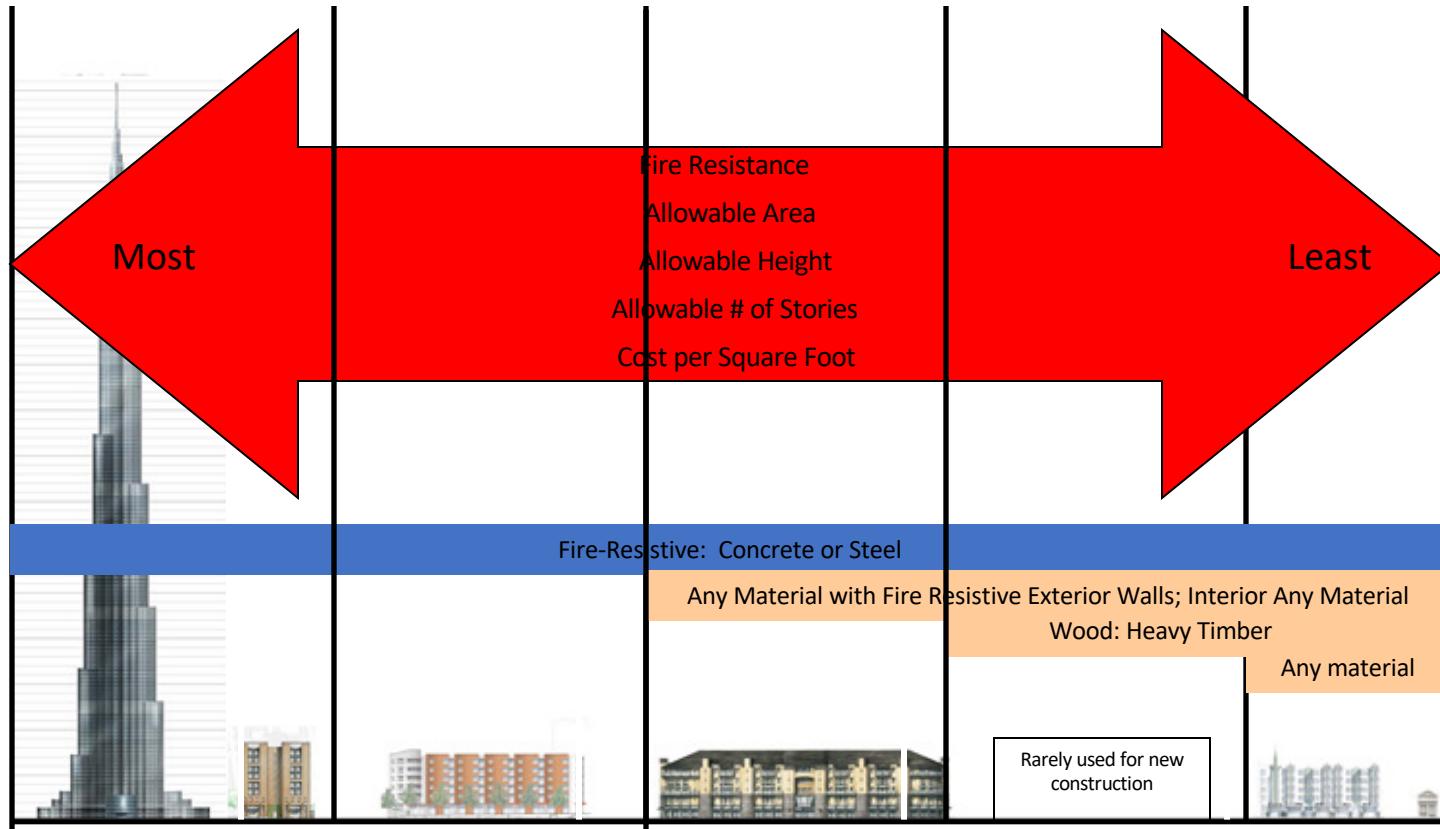


TABLE 503

Excerpt from IBC Table 503 Showing allowable building heights (with and without sprinklers) number of stories (with sprinklers) and proportionate floor areas per story)

| Construction Type | Type I | Type II | Type III | Type IV | Type V |
|-------------------------------|-----------------------------|-------------------------------------|-------------------------------------|--------------|-------------------------------------|
| | Fire-Resistive Construction | Fire-Resistive Construction | Fire-Resistive Exterior Walls Only | Heavy Timber | |
| R-2 (Apartment) | Unlimited Unlimited | 65/85 ft., 5 Stories 24,000 s.f. | 65/85 ft., 5 stories 24,000 s.f. | | 50/70 ft., 4 stories 12,000 s.f. |
| | | | | | |
| Exterior Bearing Walls Rating | 3 HR | 1 HR | 2 HR | | 1 HR |
| Fire Walls Rating | 3 HR | 2 HR | 3 HR | | 2 HR |

Sprinklered Buildings: + 20 ft./ 1 Story, OR + Area

Allowable area may be increased depending on fire-fighting access.

Wood and hours

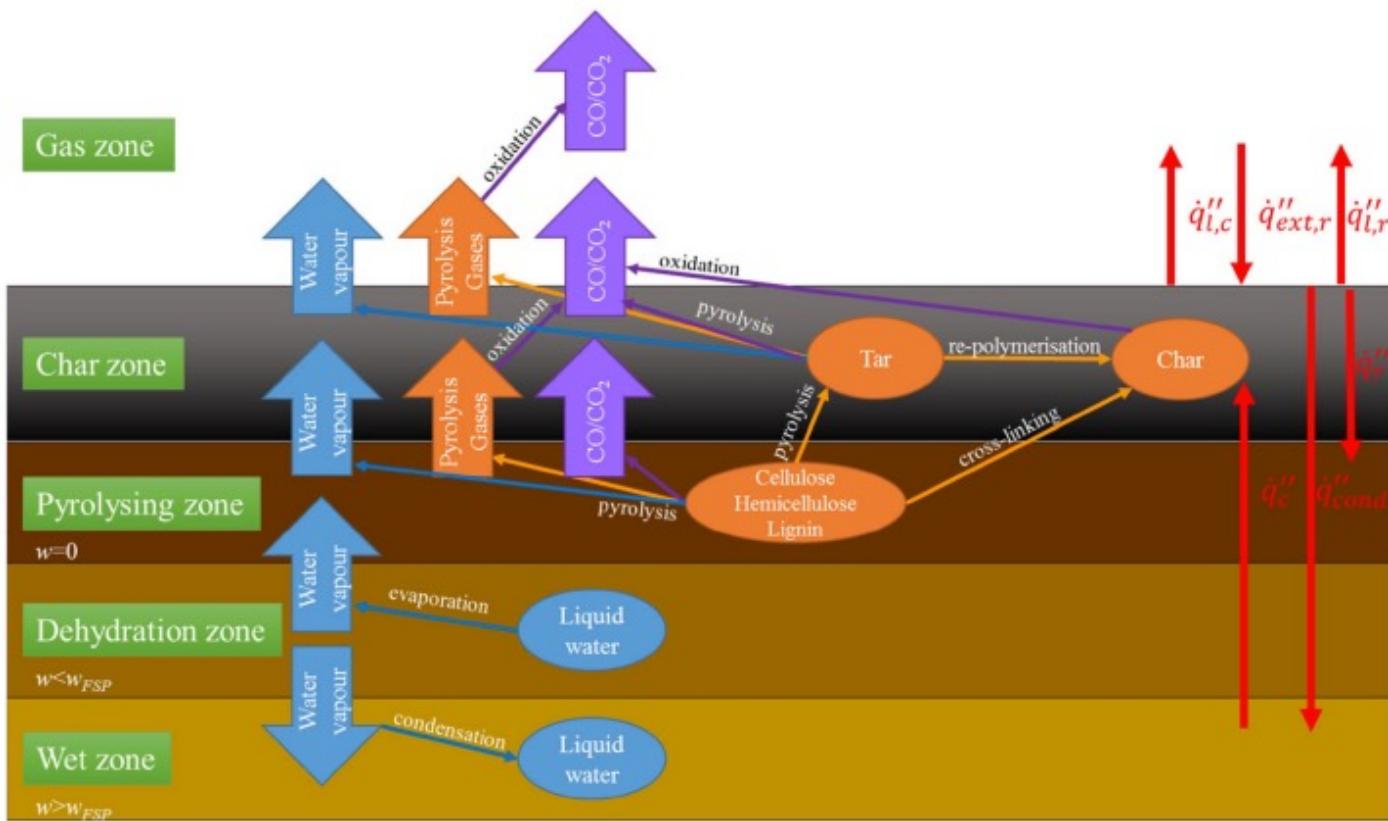


Figure 1. Chemical and physical processes within a burning timber sample; $\dot{q}_{l,c}''$ is the surface heat losses by convection, $\dot{q}_{l,r}''$ is the surface heat losses by radiation, $\dot{q}_{ext,r}''$ is the external heat flux, \dot{q}_r'' is in-depth radiation, \dot{q}_{cond}'' is conduction into the sample, and \dot{q}_c'' is convective heat transfer through cracks in the sample.

Wood and hours



Test 1-3 compartment 3 hours and 6 minutes after ignition.
NIST

Source: 2021 IBC

RELATIVE CONSTRUCTION COSTS – Based on Construction Type

| | CONSTRUCTION TYPE | # OF RES. STORIES | RELATIVE COST / SF | WHY |
|------------------------------|-------------------|--------------------------------|--------------------|--|
| RESIDENTIAL FLOORS | TYPE V: | WOOD | 4 MAX | 1.00 |
| | | METAL (plywood deck) | | 1.04 |
| | TYPE III: * | WOOD | 5 MAX | 1.03 |
| | | METAL (plywood deck) | | + fire-treated lumber framing at exterior walls 1.07 + metal |
| | TYPE II: | METAL (metal deck) | 5 MAX | 1.10 |
| | TYPE I: | MID-RISE (concrete) | 8 MAX | 1.25 |
| | | HIGH-RISE (concrete) | UNLIMITED | 1.30 + fire safety features + 1% per floor over 9 |
| | TYPE I: | GARAGE ON GRADE (multi-level) | | 0.40 |
| | | GARAGE ON GRADE (single level) | | 0.50 |
| | | GARAGE BELOW GRADE | | 0.60 + shoring, waterproofing |
| GARAGE/UNFINISHED T.I. SPACE | | | | |

* Man lift and possibly tower crane needed for buildings over 60'. Cost per square foot varies.

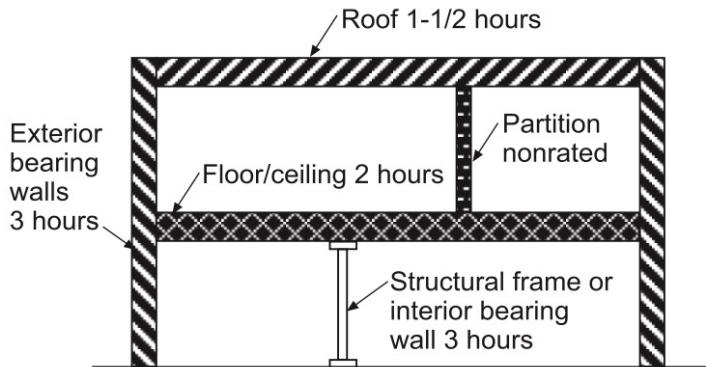
Relative costs courtesy of Scott Smith of the James E. Roberts-Obayashi Corporation

602.2 Types I and II Construction

- Types I and II construction are those types of construction in which the building elements listed in Table 601 are of noncombustible materials, except as permitted in Section 603 and elsewhere in the IBC.
- Type I buildings are noncombustible, and the building elements are also provided with a mandated degree of fire resistance. This type of construction requires the highest level of fire protection specified in the code. Type II buildings are also of noncombustible construction; however, the level of fire resistance is usually less than that required for Type I structures. Buildings of Type II construction may have a limited degree of fire resistance (Type IIA) or no fire resistance whatsoever (Type IIB). There are limited allowances for the use of fire-retardant-treated wood in nonbearing partitions, nonbearing exterior walls and roof construction.

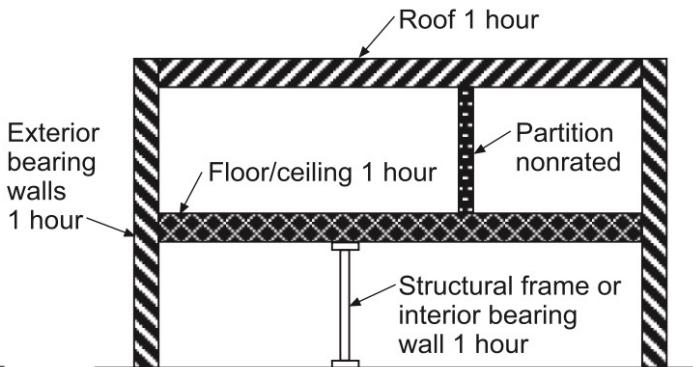
602.2 Types I and II Construction

Type I-A



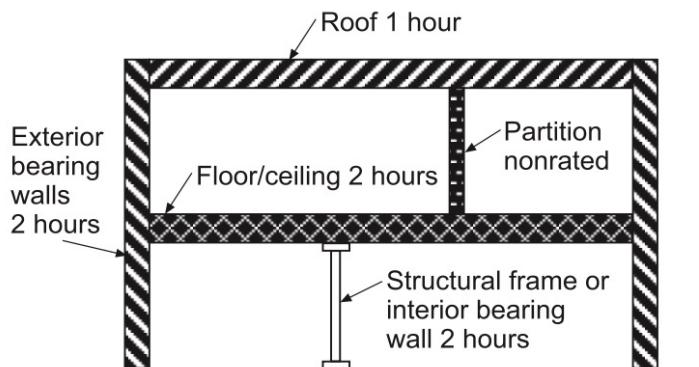
*See Notes to Table 601

Type II-A



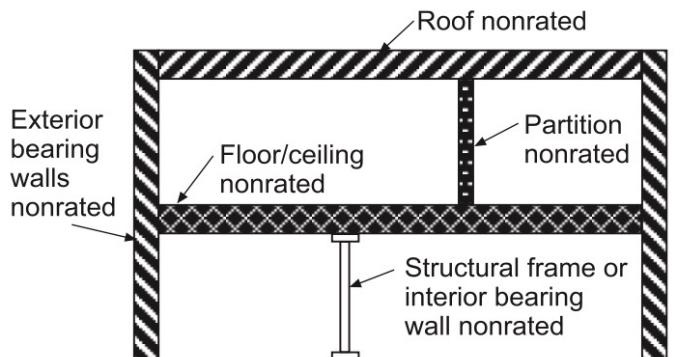
*See Notes to Table 601

Type I-B



*See Notes to Table 601

Type II-B



*See Notes to Table 601

Steel, iron, concrete, masonry and aluminum are considered those types of noncombustible materials used as building elements or components of building elements in Type I or II buildings. Section 703.5.2 also recognizes gypsum board as a noncombustible material.

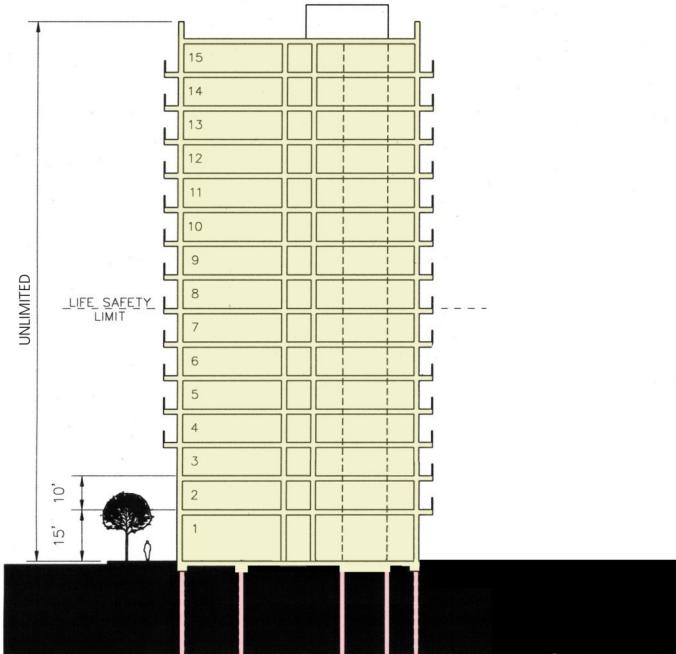
Source: 2021 IBC

601 Construction

9. In a building of Type IB construction, what is the minimum required fire-resistance rating of the floor construction?
 - a. 3 hours
 - b. 2 hours
 - c. 1 hour
 - d. 0 hours (no rating required)

TYPICAL CONFIGURATIONS

Type I High-rise



International Hotel

Herman Coliver Locus Architecture

New Tech : Type I High-rise



The Lake Mjøsa Skyscraper in Brumunddal, Norway

Recent Startup Fundings

Real estate developer turned prefab home builder Veev closes on \$400M in fresh funding

Mary Ann Azevedo @bayareawriter / 6:00 AM PST • March 1, 2022

 Comment

ICON raises \$185M in Tiger-led round to build more homes with its 3D printing tech, now approaching \$2B valuation

Mary Ann Azevedo @bayareawriter / 7:16 AM PST • February 18, 2022

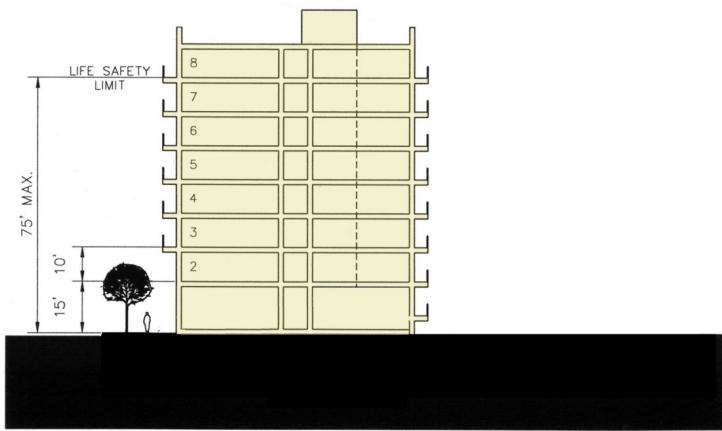
 Comment

Homebuilding startup Cover: Big dreams, small realities

The custom backyard homebuilder has raised \$75M with hopes to dent the affordability crisis. It's been slow going so far.

TYPICAL CONFIGURATIONS

Type I Midrise



PLAZA APARTMENTS

LMS/ Paulett Taggart Architects

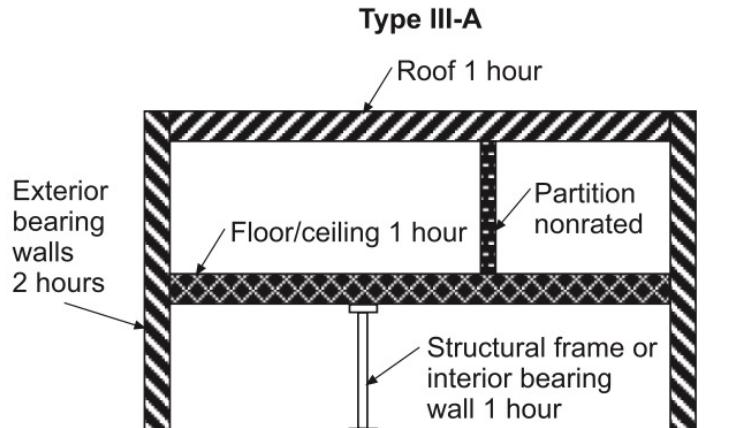
602.3 Type III Construction

1. What types of construction are considered “noncombustible”?
 - a. I, II
 - b. I, II, III, IV
 - c. III, IV
 - d. III, IV, V

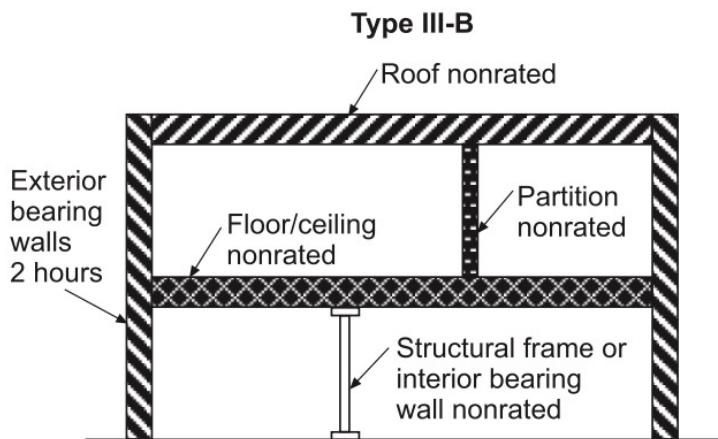
602.3 Type III Construction

- Type III construction is that type of construction in which the exterior walls are of non-combustible materials and the interior building elements are of any material permitted by the IBC. Fire-retardant-treated wood framing and sheathing complying with Section 2303.2 shall be permitted within exterior wall assemblies of a 2-hour rating or less.
- Type III buildings are considered combustible buildings and are either protected or unprotected. This building type was developed out of the necessity to prevent conflagrations in heavily built-up areas where buildings were erected side-by-side in congested downtown business districts. To limit the spread of fire from building to building, exterior walls were required to be of both noncombustible and fire-resistant construction.

602.3 Type III Construction



*See Notes to Table 601



*See Notes to Table 601

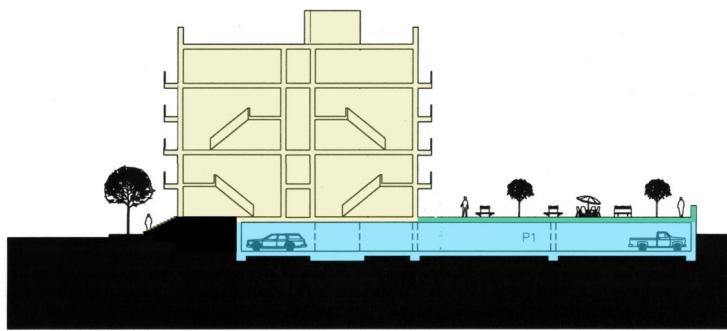
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Source: 2021 IBC

Historically referred to as “ordinary masonry construction,” Type III buildings usually consist of concrete or masonry exterior walls with wood floor and roof systems. However, the IBC permits such walls to contain fire-retardant-treated wood as an element of the exterior wall construction.

TYPICAL CONFIGURATIONS

TYPE II or Type III over TYPE I PODIUM



101 San Fernando

602.3 Type III Construction

2. Type III buildings are constructed with _____ or fire-retardant-treated wood exterior walls and interior elements _____.
 - a. fire-resistant, of noncombustible materials
 - b. noncombustible, of noncombustible materials
 - c. noncombustible, of any material permitted by the code
 - d. fire-resistant, of any material permitted by the code

602.3 Type III Construction

4. In buildings of Type III construction, under what condition is fire-retardant-treated wood framing permitted within an exterior wall assembly?
 - a. the wall has a 2-hour rating or less
 - b. the fire separation distance exceeds 10 feet
 - c. wood columns of heavy-timber sizes are used
 - d. the wall is a nonbearing element

602.3 Type IV Construction

- Type IV construction is that type of construction in which the building elements are mass timber or noncombustible materials and have fire-resistance ratings in accordance with Table 601. Mass timber elements shall meet the fire-resistance rating requirements of Section 602.4 based on either the fire-resistance rating of the noncombustible protection, the mass timber, or a combination of both and shall be determined in accordance with Section 703.2.
- Mass timber is defined as those structural elements of Type IV construction primarily of solid, built-up, panelized or engineered wood products that meet minimum cross-section dimensions of Type IV construction. The term “mass timber” represents the large wood building elements permitted for heavy timber (Type IV-HT) construction and is deemed to meet fire-resistance requirements based solely on the required minimum dimensions of the wood element. It also represents construction Types IV-A, IV-B and IV-C, which are required to have a fire-resistance rating, in many cases provided by both the mass timber element itself and noncombustible protection applied to the mass timber element.

602.1 Construction Types



While mass timber can be fully exposed in Type IV-C construction and partially exposed in Type IV-B construction, it must in other cases be protected with a noncombustible material, such as gypsum board. It must also have a protection time assigned based on testing that is prescribed elsewhere in the code.

602.4.1 Type IV-A Construction

7. Combustible concealed spaces in buildings of Type _____ construction must be protected.
- a. I
 - b. III
 - c. IV
 - d. V

602.4.1 Type IV-A Construction

- The outside face of exterior walls of mass timber construction shall be protected with non-combustible protection with a minimum assigned time of 40 minutes, as specified in Table 722.7.1(1). Interior faces of all mass timber elements, including the inside faces of exterior mass timber walls and mass timber roofs, shall be protected with materials complying with Section 703.3. The floor assembly shall contain a noncombustible materials not less than 1 inch (25 mm) in thickness above the mass timber. The interior surfaces of roof assemblies shall be protected in accordance with Section 602.4.1.2 (consistent with protection of interior walls).

TABLE 722.7.1(1)
PROTECTION REQUIRED FROM NONCOMBUSTIBLE COVERING MATERIAL

| REQUIRED FIRE-RESISTANCE RATING OF BUILDING ELEMENT PER TABLE 601 AND TABLE 705.5 (hours) | MINIMUM PROTECTION REQUIRED FROM NONCOMBUSTIBLE PROTECTION (minutes) |
|--|---|
| 1 | 40 |
| 2 | 80 |
| 3 or more | 120 |

TABLE 722.7.1(2)
PROTECTION PROVIDED BY NONCOMBUSTIBLE COVERING MATERIAL

| NONCOMBUSTIBLE PROTECTION | PROTECTION CONTRIBUTION (minutes) |
|---|-----------------------------------|
| $\frac{1}{2}$ -inch Type X gypsum board | 25 |
| $\frac{5}{8}$ -inch Type X gypsum board | 40 |

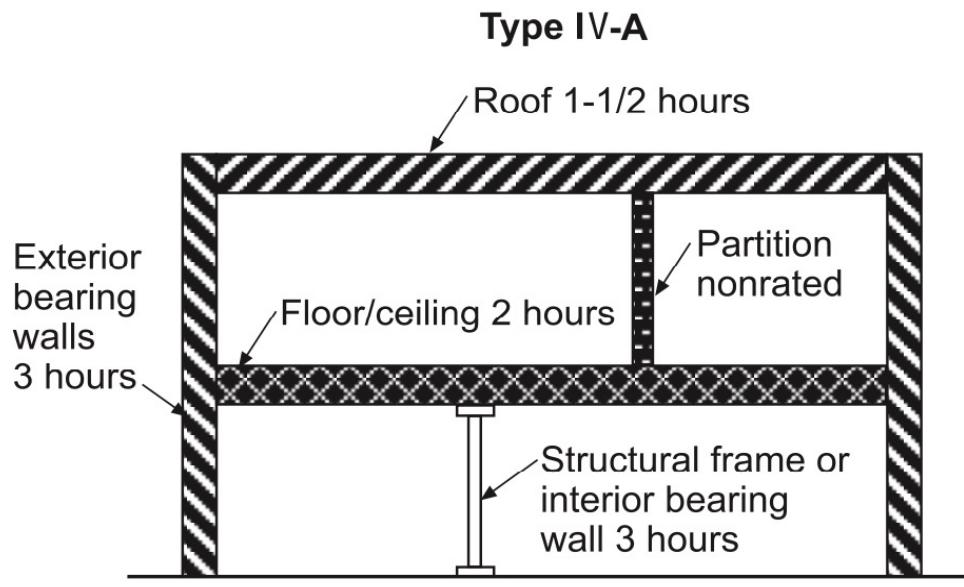
602.4.1 Type IV-A Construction

- The outside face of exterior walls of mass timber construction shall be protected with non-combustible protection with a minimum assigned time of 40 minutes, as specified in Table 722.7.1(1). Interior faces of all mass timber elements, including the inside faces of exterior mass timber walls and mass timber roofs, shall be protected with materials complying with Section 703.3. The floor assembly shall contain a noncombustible materials not less than 1 inch (25 mm) in thickness above the mass timber. The interior surfaces of roof assemblies shall be protected in accordance with Section 602.4.1.2 (consistent with protection of interior walls).
- Type IV-A construction is composed of mass timber elements that are completely protected with noncombustible materials. The contribution of the noncombustible protection to the overall fire-resistance rating of a mass timber member or assembly is established through a performance path set forth in Section 703.6. In addition, noncombustible assemblies such as those of light-gage steel are also permitted. However, light-frame combustible assemblies, including those consisting of wood studs, joists or furring, are specifically prohibited.

602.4 Construction Type

3. The type of construction where building elements are mass timber or noncombustible is _____.
- a. Type I
 - b. Type II
 - c. Type III
 - d. Type IV

602.4.1 Type IV-A Construction



*See Notes to Table 601

Construction adhesive or other sealant is required at joint and intersections to prevent air flow. Where a wall or horizontal assembly serves as the separation between two atmospheres, it is necessary to properly seal any voids that could serve as a conduit for air movement during a fire.

602.4.2/3 Type IV-B/C Construction

- In Type IV-B construction, interior faces of all mass timber elements, including the inside face of exterior mass timber walls and mass timber roofs, shall be protected, as required by Section 602.4.2.2, with materials complying with Section 707.3. Unprotected portions of mass timber ceilings and walls are permitted when complying with Section 602.4.2.2.4 (separation distance between unprotected mass timber elements) and the following: [see allowances for unprotected portions of mass timber ceilings (limited to 20 percent of floor area in any dwelling unit or fire area) and mass timber walls (limited to 40 percent of floor area in any dwelling unit or fire area)]. In Type IV-C construction, mass timber elements (interior walls, ceilings, columns and beams) are permitted to be unprotected.
- Type IV-B construction permits portions of interior mass timber surfaces to be exposed. The amount of exposed surface permitted, as well as the required separation between unprotected portions, is regulated to limit potential contribution of the structure to an interior fire. Type IV-C construction permits fully exposed mass timber on the interior of the building except in specific areas such as concealed spaces, shafts, elevator hoistways and interior exit stairway enclosures.

Source: 2021 IBC

602.4.2/3 Type IV-B/C Construction

707.3 Fire-resistance rating. The *fire-resistance rating* of the *fire barriers* shall comply with this section.

707.3.1 Shaft enclosures. The *fire-resistance rating* of the *fire barrier* separating building areas from a *shaft* shall comply with Section 713.4.

707.3.2 Interior exit stairway and ramp construction. The *fire-resistance rating* of the *fire barrier* separating building areas from an *interior exit stairway or ramp* shall comply with Section 1023.1.

707.3.3 Enclosures for exit access stairways. The *fire-resistance rating* of the *fire barrier* separating building areas from an *exit access stairway or ramp* shall comply with Section 713.4.

707.3.4 Exit passageway. The *fire-resistance rating* of the *fire barrier* separating building areas from an *exit passageway* shall comply with Section 1024.3.

707.3.5 Horizontal exit. The *fire-resistance rating* of the separation between building areas connected by a *horizontal exit* shall comply with Section 1026.1.

707.3.6 Atriums. The *fire-resistance rating* of the *fire barrier* separating *atriums* shall comply with Section 404.6.

707.3.7 Incidental uses. The *fire barrier* separating *incidental uses* from other spaces in the building shall have a *fire-resistance rating* of not less than that indicated in Table 509.1.

707.3.8 Control areas. *Fire barriers* separating *control areas* shall have a *fire-resistance rating* of not less than that required in Section 414.2.4.

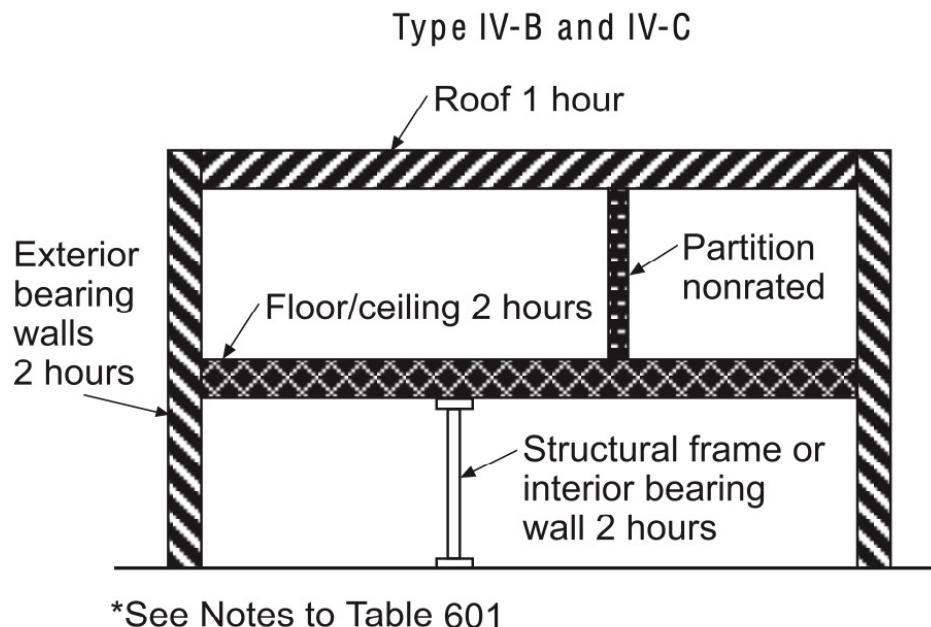
707.3.9 Separated occupancies. Where the provisions of Section 508.4 are applicable, the *fire barrier* separating mixed occupancies shall have a *fire-resistance rating* of not less than that indicated in Table 508.4 based on the occupancies being separated.

707.3.10 Fire areas. The *fire barriers*, *fire walls*, *horizontal assemblies* or combinations thereof separating a single occupancy into different *fire areas* shall have a *fire-resistance rating* of not less than that indicated in Table 707.3.10. The *fire barriers*, *fire walls*, *horizontal assemblies* or combinations thereof separating *fire areas* of mixed occupancies shall have a *fire-resistance rating* of not less than the highest value indicated in Table 707.3.10 for the occupancies under consideration.

TABLE 707.3.10
FIRE-RESISTANCE-RATING
REQUIREMENTS FOR FIRE BARRIERS, FIRE WALLS
OR HORIZONTAL ASSEMBLIES BETWEEN FIRE AREAS

| OCCUPANCY GROUP | FIRE-RESISTANCE RATING (hours) |
|--------------------------------------|--------------------------------|
| H-1, H-2 | 4 |
| F-1, H-3, S-1 | 3 |
| A, B, E, F-2, H-4, H-5, I, M, R, S-2 | 2 |
| U | 1 |

602.4.2/3 Type IV-B/C Construction

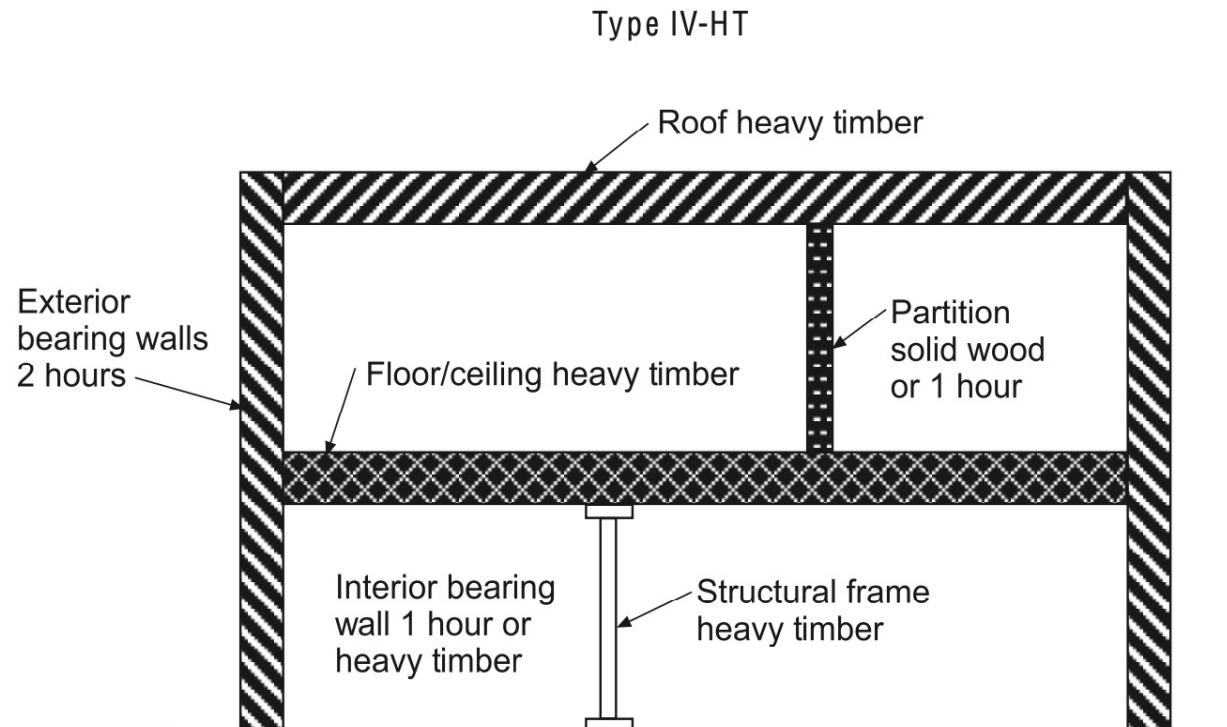


Exterior walls are required to be protected in the same manner for Types IV-A, IV-B and IV-C construction, which requires noncombustible protection of at least 40 minutes on the exterior side of exterior mass timber walls and prohibits all combustible materials on the exterior side of mass timber walls other than the water-resistive barrier.

602.4.4 Type IV-HT Construction

- Type IV-HT (Heavy Timber) construction is that type of construction in which the exterior walls are of noncombustible materials and the interior building elements are of solid wood, laminated heavy timber or structural composite lumber (SCL), without concealed spaces or with concealed spaces complying with Section 602.4.4.3. The minimum dimensions for permitted materials shall comply with the provisions of Section 602.3.3 and Section 2304.11. Exterior walls complying with Section 602.4.4.1 or 602.4.4.2 shall be permitted. Interior walls and partitions not less than 1-hour fire-resistance rated or heavy timber conforming to Section 2304.11.2.2 shall be permitted.
- Historically referred to as “heavy-timber,” buildings of Type IV-HT construction are essentially Type III buildings with an interior of wood members of significant mass. To conform to Type IV-HT construction, building members must be of substantial thickness. Given the characteristics of massive wood members, there is little chance for sudden structural collapse during or after a fire.

602.4.4 Type IV-HT Construction

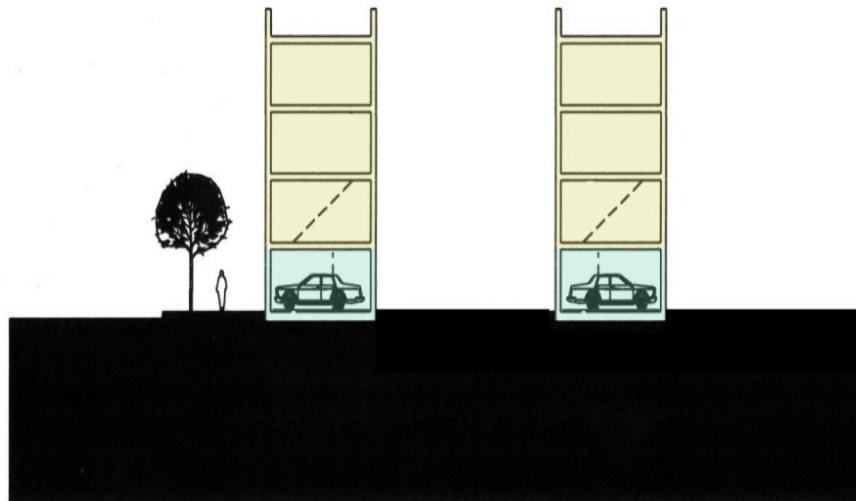


*See Notes to Table 601

Although it is generally viewed that heavy-timber construction and 1-hour fire-resistance-rated construction are equivalent, they are typically not interchangeable. Although heavy-timber roof construction is permitted in Type IB, II, III and VA buildings, 1-hour construction can only be substituted for heavy-timber construction in interior bearing walls of Type IV buildings.

TYPICAL CONFIGURATIONS

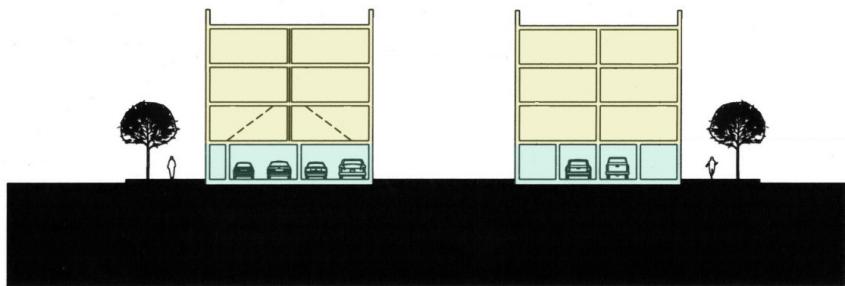
TYPE V



Fulton Grove

TYPICAL CONFIGURATIONS

TYPE V



Del Carlo Court

2304.11 Heavy-Timber Construction

5. Where supporting floor loads, solid sawn wood columns of Type IV-HT construction shall be of what minimum nominal size?
 - a. 5 inches by 5 inches
 - b. 6 inches by 6 inches
 - c. 6 inches by 8 inches
 - d. 8 inches by 8 inches

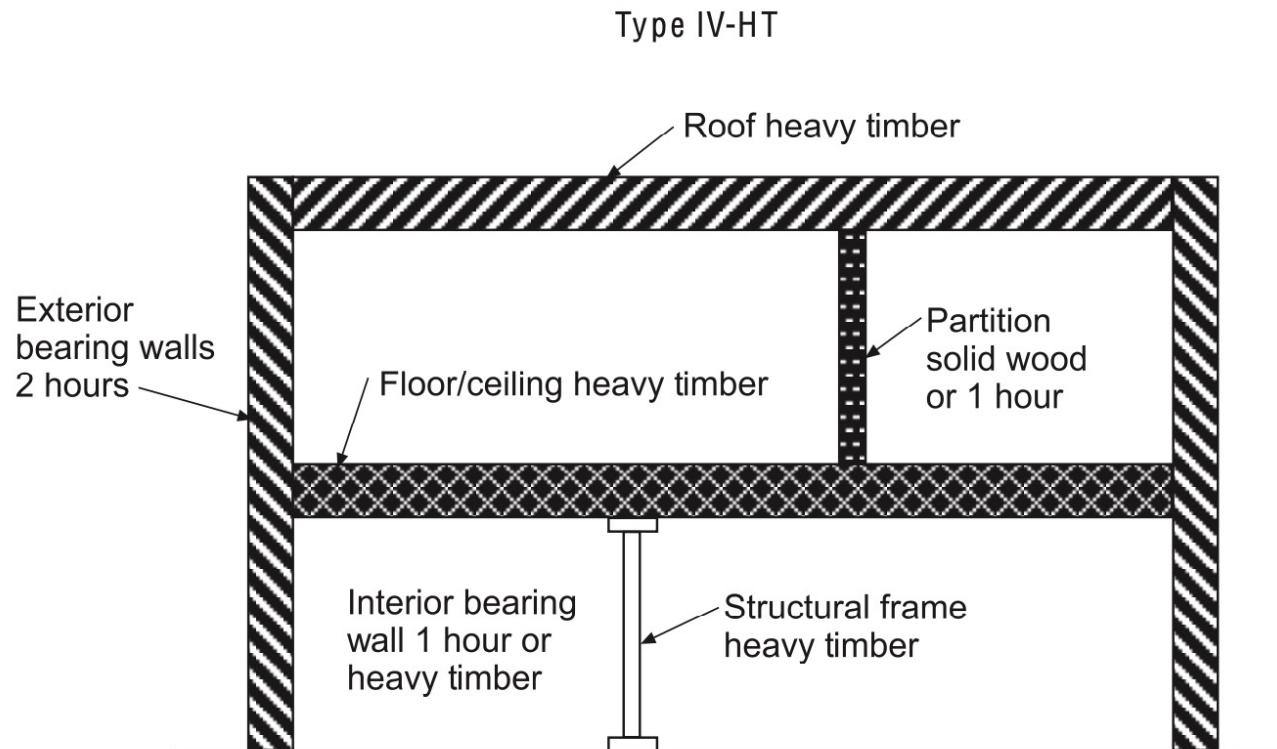
2304.11 Heavy-Timber Construction

6. Where used in floor framing, solid sawn wood beams of Type IV-HT construction shall be of what minimum nominal size?
 - a. 4 inches by 8 inches
 - b. 4 inches by 10 inches
 - c. 6 inches by 10 inches
 - d. 8 inches by 10 inches

2304.11 Heavy-Timber Construction

- Where a structure, portion thereof or individual structural elements are required by provisions of the IBC to be of heavy timber, the building elements therein shall comply with the applicable provisions of Sections 2304.11.1 through 2304.11.4. Minimum dimensions of heavy timber shall comply with the applicable requirements in Table 2304.11 based on roofs or floors supported and the configuration of each structural element, or in Sections 2304.11.2 through 2304.11.4.
- Solid-sawn wood members, glued-laminated timbers and structural composite lumber are manufactured with different methods and procedures: therefore, they do not have the same dimensions. However, they both have the same inherent fire-resistive capability that has been long recognized in the code.

2304.11 Heavy-Timber Construction



*See Notes to Table 601

Although it is generally viewed that heavy-timber construction and 1-hour fire-resistance-rated construction are equivalent, they are typically not interchangeable. Although heavy-timber roof construction is permitted in Type IB, II, III and VA buildings, 1-hour construction can only be substituted for heavy-timber construction in interior bearing walls of Type IV buildings.

Source: 2021 IBC

602.4.4.2 / 2304.11 Cross – Laminate Timer

- Cross-laminated timber (CLT) not less than 4 inches (102 mm) in thickness complying with Section 2303.1.4 shall be permitted within exterior wall assemblies with a 2-hour rating or less, provided the exterior surface of the cross-laminated timber and heavy timber elements are protected by (1) fire-retardant-treated wood not less than 15/32 inch (12 mm) thick, (2) gypsum board not less than 1/2 inch (12.7 mm) thick, or (3) a noncombustible material. Cross-laminated timber floors shall be not less than 4 inches (102 mm) in actual thickness. Cross-laminated timber roofs shall be not less than 3 inches (76 mm) nominal in thickness.
- Cross-laminated timber (CLT) is a prefabricated engineered wood product consisting of not less than three layers of solid-sawn lumber or structural composite lumber where the adjacent layers are cross oriented and bonded with structural adhesive to form a solid wood element. First developed in Europe, CLT has been used extensively there for a large section of structural lumber. When of the specified size, it is considered as Type IV heavy-timber construction.

602.4.4.2 / 2304.11 Cross – Laminate Timer



Cross-laminated timber floors regulated as Type IV heavy-timber construction must be continuous from support to support and mechanically fastened to one another. Unlike sawn or glued-laminated plank floors, CLT is permitted to be connected to walls without a shrinkage gap if swelling or shrinking is considered in the design.

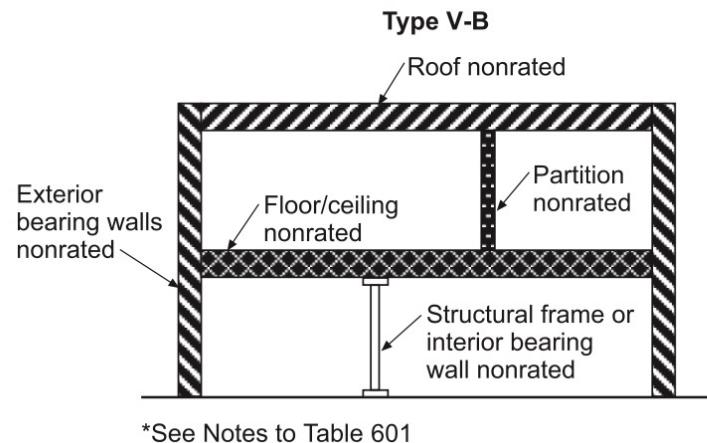
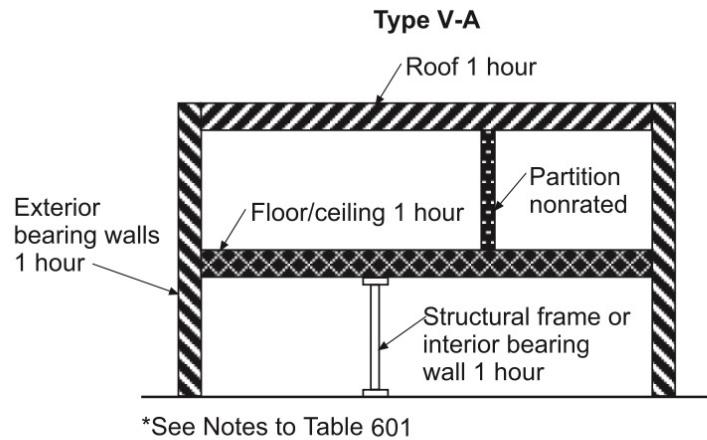
602.5 Cross – Type V Construction

7. Combustible concealed spaces in buildings of Type _____ construction must be protected.
- a. I
 - b. III
 - c. IV
 - d. V

602.5 Cross – Type V Construction

- Type V construction is that type of construction in which the structural elements, exterior walls and interior walls are of any materials permitted by the IBC.
- Type V buildings are essentially construction systems that will not fit into any of the other higher types of construction specified by the IBC. Although the construction normally considered Type V is the conventional light-frame wood building, any combination of approved materials can be considered Type V construction. Section 602.1.1 indicates that a building is not required to conform to the details of a type of construction higher than the type that meets the minimum requirements based on occupancy, even though certain features of such a building actually conform to a higher construction type.

602.5 Cross – Type V Construction



In the design and review of a building for type of construction requirements, it is wise to determine first if the structure can be built as a Type VB building, based on occupancy, location on the lot, height and floor area. If so, any other building type is also permitted.

Source: 2021 IBC

602.1 Fire-Resistance Ratings

8. Which of the following materials is permitted in a building of Type VB construction?
 - a. wood
 - b. steel
 - c. masonry
 - d. all of the above

602.1 Fire-Resistance Ratings

- The building elements shall have a fire-resistance rating not less than that specified in Table 601. The protection of openings, ducts and air transfer openings in building elements shall not be required unless required by other provisions of the IBC.
- The building elements regulated by Table 601 for types of construction include primary structural frame members, such as columns, girders and trusses; bearing walls, both interior and exterior; floor construction, including supporting beams and joists; and roof construction, consisting of supporting beams, joists, rafters and other members. The required fire-resistance rating for each of these elements is based on the specific type of construction assigned to the building. The required fire-resistance rating can be as high as a 3-hour or as little as a 0-hour (no fire-resistance rating required).

602.1 Fire-Resistance Ratings

TABLE 601
FIRE-RESISTANCE RATING REQUIREMENTS FOR BUILDING ELEMENTS (HOURS)

| BUILDING ELEMENT | TYPE I | | TYPE II | | TYPE III | | TYPE IV | | | | TYPE V | |
|--|-------------------------------|--------------------|------------------|----------------|------------------|---|------------------|----------------|----------------|-----------------------|------------------|---|
| | A | B | A | B | A | B | A | B | C | HT | A | B |
| Primary structural frame ^f (see Section 202) | 3 ^{a,b} | 2 ^{a,b,c} | 1 ^{b,c} | 0 ^c | 1 ^{b,c} | 0 | 3 ^a | 2 ^a | 2 ^a | HT | 1 ^{b,c} | 0 |
| Bearing walls | | | | | | | | | | | | |
| Exterior ^{e,f} | 3 | 2 | 1 | 0 | 2 | 2 | 3 | 2 | 2 | 2 | 1 | 0 |
| Interior | 3 ^a | 2 ^a | 1 | 0 | 1 | 0 | 3 | 2 | 2 | 1/HT ^g | 1 | 0 |
| Nonbearing walls and partitions | | | | | | | See Table 705.5 | | | | | |
| Exterior | | | | | | | | | | | | |
| Nonbearing walls and partitions | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | See Section 2304.11.2 | 0 | 0 |
| Interior ^d | | | | | | | | | | | | |
| Floor construction and associated secondary structural members (see Section 202) | 2 | 2 | 1 | 0 | 1 | 0 | 2 | 2 | 2 | HT | 1 | 0 |
| Roof construction and associated secondary structural members (see Section 202) | 1 ^{1/2} ^b | 1 ^{b,c} | 1 ^{b,c} | 0 ^c | 1 ^{b,c} | 0 | 1 ^{1/2} | 1 | 1 | HT | 1 ^{b,c} | 0 |

For SI: 1 foot = 304.8 mm.

- a. Roof supports: Fire-resistance ratings of primary structural frame and bearing walls are permitted to be reduced by 1 hour where supporting a roof only.
- b. Except in Group F-1, H, M and S-1 occupancies, fire protection of structural members in roof construction shall not be required, including protection of primary structural frame members, roof framing and decking where every part of the roof construction is 20 feet or more above any floor immediately below. Fire-retardant-treated wood members shall be allowed to be used for such unprotected members.
- c. In all occupancies, heavy timber complying with Section 2304.11 shall be allowed for roof construction, including primary structural frame members, where a 1-hour or less fire-resistance rating is required.
- d. Not less than the fire-resistance rating required by other sections of this code.
- e. Not less than the fire-resistance rating based on fire separation distance (see Table 705.5).
- f. Not less than the fire-resistance rating as referenced in Section 704.10.
- g. Heavy timber bearing walls supporting more than two floors or more than a floor and a roof shall have a fire resistance rating of not less than 1 hour.

Where a structure is separated by one or more fire walls, the code treats those individual compartments created by the fire walls as separate buildings for the purpose of classification by type of construction.

T601, 202 Primary Structural Frames

- The primary structural frame shall include all of the following structural members: (1) the columns; (2) structural members having direct connections to the columns, including girders, beams, trusses and spandrels; (3) members of the floor construction and roof construction having direct connections to the columns; and (4) members that are essential to the vertical stability of the primary structural frame under gravity loading.
- To maintain stability of the building as a whole, the major structural elements are regulated for endurance when subjected to a fire. In addition to the columns, beams and girders, both interior bearing walls and exterior bearing walls are regulated to a level of fire resistance equal to or greater than that of other structural elements. Secondary members, such as floor joists, roof joists or rafters, are protected within the rated floor-ceiling or roof-ceiling assemblies.

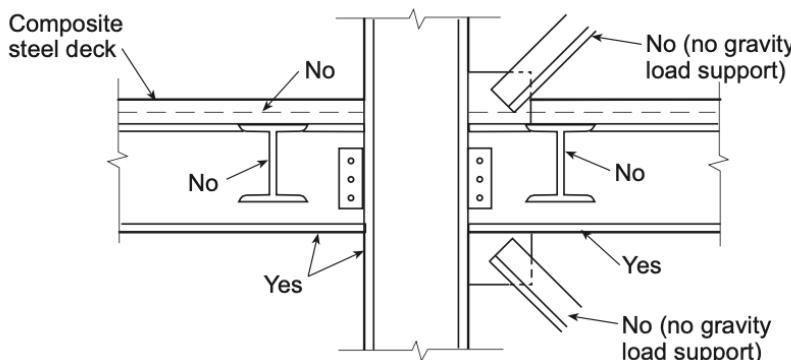
T601, 202 Primary Structural Frames

- **Columns**

- **Girders**
- **Beams**
- **Trusses**
- **Spandrels**
- **Floor Construction**
- **Roof Construction**
- **Members essential to vertical stability of primary structural frame under gravity loading**



Having direct connection to the columns



Components of primary structural frame

Lateral force bracing is not considered part of the structural frame where it serves no other purpose than to resist the lateral loads. For example, lateral load bracing within exterior nonbearing walls or interior partitions would be protected by the wall or partition construction. Such bracing elements would be considered secondary members.

T601, 202 Primary Structural Frames

10. Which one of the following members is not considered to be a part of the primary structural frame?
- a. columns supporting only a roof load
 - b. girders supporting no more than a floor and a roof
 - c. members essential to the vertical stability of the frame under gravity loads
 - d. floor joists not having direct connections to the columns

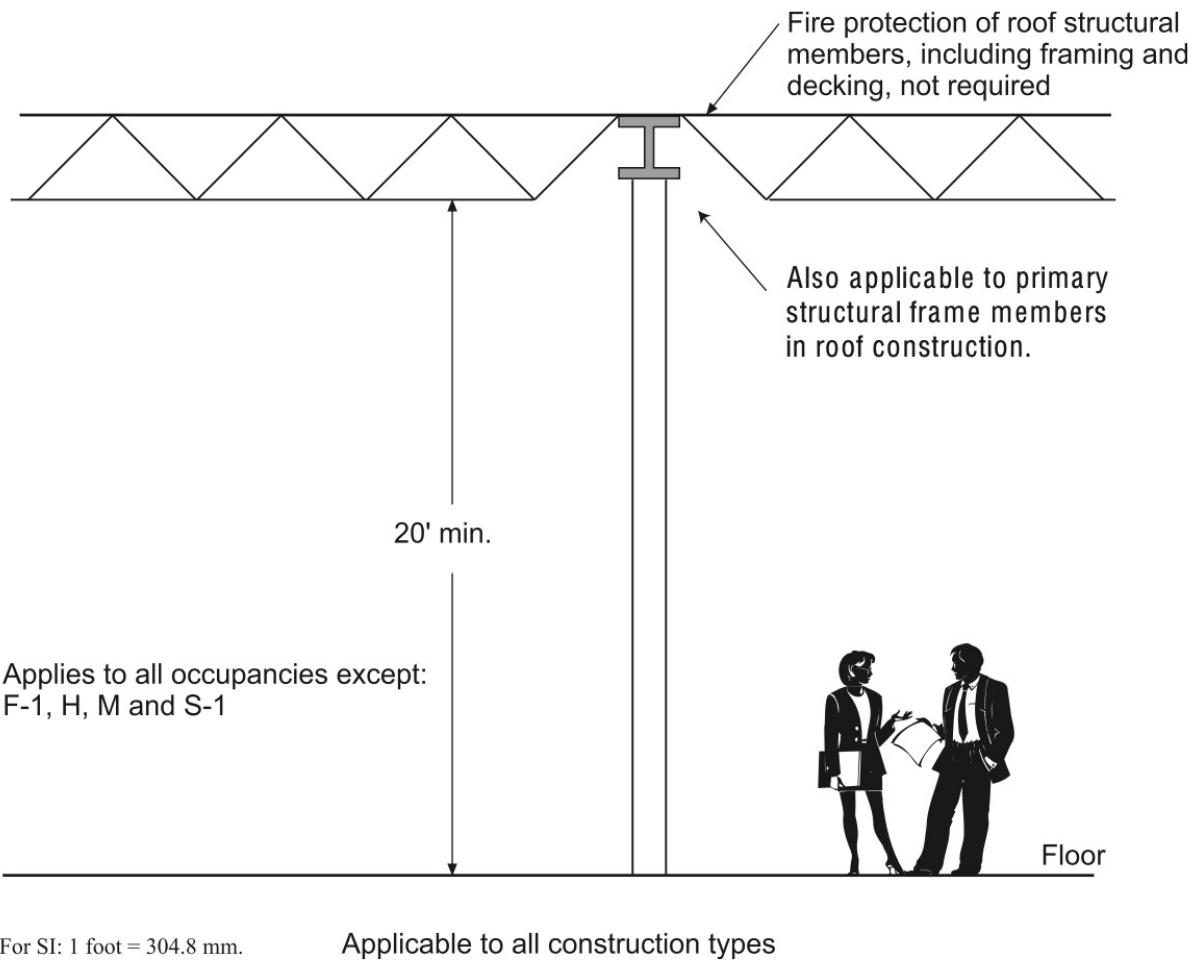
601, Note b Roof Construction

- Except in Group F-1, H, M and S-1 occupancies, fire protection of structural members shall not be required, including protection of primary structural frame members, roof framing and decking, where every part of the roof construction is 20 feet or more above any floor immediately below. Fire-retardant-treated wood members shall be allowed to be used for such unprotected members.
- Where there is limited potential for a fire to be of a severe nature at the roof structure due to its height above the floor below, an elimination of the required fire-resistance rating of the roof construction is permitted in construction of Types I, IIA, IIIA and VA. Elimination of the required fire resistance is not allowed where combustible or hazardous materials are located adjacent to the roof.

202 Primary Structural Frames

11. In a building of Type IIB construction, what is the minimum required fire-resistance rating of the roof construction?
- a. 0 hours (no rating required)
 - b. 1 hour
 - c. $1\frac{1}{2}$ hours
 - d. 2 hours

601, Note b Roof Construction



It is important to note that the entire roof construction must be located at a height of at least 20 feet above the floor in order for the provision to apply. It is not intended that only those portions of a sloping roof less than 20 feet above the floor be protected.

Source: 2021 IBC

603.1 Allowable Uses

- Combustible materials shall be permitted in buildings of Type I and II construction in the following applications: (27 applications listed).
- Materials used in the construction of buildings classified as either Type I or Type II are intended to be noncombustible, thereby not increasing the potential fire loading (fuel contribution). There are, however, a number of applications where the presence of combustible building materials is desirable in otherwise noncombustible structures. Such materials are typically permitted where they are adequately protected, limited in use or amount, or installed in accordance with the International Fire Code, International Mechanical Code®, or other provisions of the International Building Code.

603.1 Allowable Uses

Combustible materials permitted in buildings of Type I and Type II construction in the following applications:

- Fire-retardant-treated wood in
 - Roof construction of most buildings.
 - Nonbearing partitions with fire-resistance rating \leq 2 hours.
 - Nonbearing exterior walls requiring no fire rating.
- Thermal and acoustical insulation with limited flame spread.
- Foam plastics per Chapter 26.
- A, B or C roof coverings.
- Interior floor finish, trim, millwork such as, doors, frames, etc.
- Stages and platforms per Section 410.
- Blocking for handrails, fixtures, windows and door frames, etc.
- Light-transmitting plastics per Chapter 26.
- Nailing or furring strips per Section 803.15.
- Heavy timber for specific components.
- Additional applications as specified.

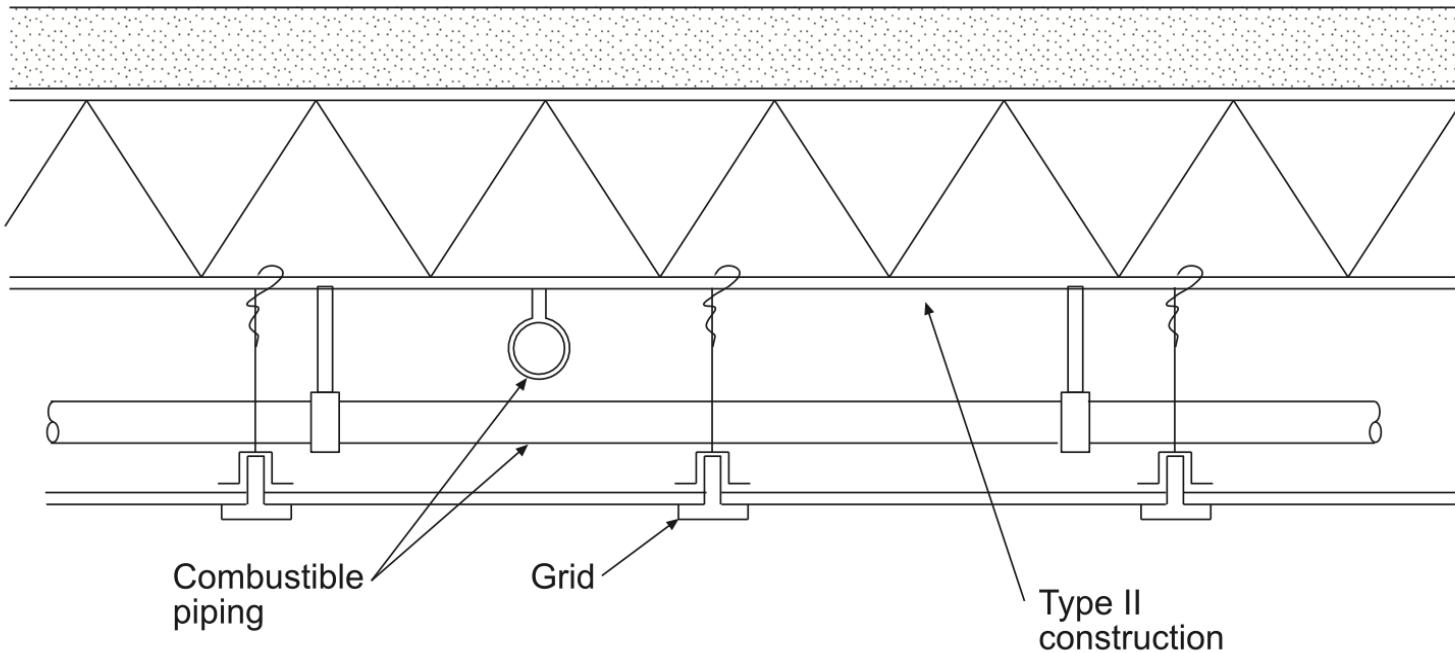
In Type I and II construction, the use of fire-retardant-treated wood is permitted in roof construction of all Type IB and II buildings and those buildings of Type IA construction that do not exceed two stories or have a top-story height of at least 20 feet.

Source: 2021 IBC

603.1.1/3 Ducts, Piping and Electrical

- Combustible materials shall be permitted in buildings of Type I or II construction in accordance with Sections 603.1.1 through 603.1.3. The use of nonmetallic ducts shall be permitted when installed in accordance with the limitations of the International Mechanical Code. The use of combustible piping materials shall be permitted when installed in accordance with the limitations of the International Mechanical Code and the International Plumbing Code. The use of electrical wiring methods with combustible insulation, tubing, raceways and related components shall be permitted when installed in accordance with the limitations of the IBC.
- The IMC contains requirements for nonmetallic ducts that address the issues of flammability, flame spread and smoke development. The IPC regulates the use of combustible piping materials, such as plastic, and also addresses those same characteristics applicable to nonmetallic ducts. Similar regulations apply to combustible wiring materials. These provisions in Chapter 6 clarify that such combustible materials are acceptable for installation in buildings of Type I and II construction, provided they meet the limitations set forth in the appropriate code.

603.1.1/3 Ducts, Piping and Electrical



Additional allowances for combustible mechanical and plumbing materials in Type I and II buildings are established by Exception 24 of Section 603. Specified combustible materials are permitted in concealed spaces under the provisions of Section 718.5.