

Advanced Occupancies






1

Steve Thomas, CBO Shums Coda Associates


- Colorado Regional Manager, Education Director
- Over 40 years' experience in code administration and enforcement
- ICC Means of Egress Code Committee, Codes & Standards Committee, Code Correlation Committee
- Author
 - Building Code Basics, Commercial (2009, 2012)
 - Building Code Essentials (2015, 2018, 2021)
 - Applying Codes to Cannabis Facilities



© 2022 Shums Coda Associates, Inc

2

Class Summary




- Advanced review of Chapters 3, 4 & 5
- Mixed occupancies, unlimited area buildings, Health Care and hazardous occupancies.
- Address unusual projects
- Effective use of the code

© 2022 Shums Coda Associates, Inc

3

302.1 Occupancy classification



- Occupancy classification is the formal designation of the primary purpose of the building, structure or portion thereof.
- Structures shall be classified into one or more of the occupancy groups listed in this section based on the nature of the hazards and risks to building occupants generally associated with the intended purpose of the building or structure.

© 2022 Shums Coda Associates, Inc

4

Use and Occupancy Classification

- The objective of the assignment of use and occupancy classification is to identify the primary uses of buildings and facilities, and portions of buildings and facilities, and to identify risk factors associated with these uses, in order to facilitate design and construction in accordance with other provisions of this code.



© 2022 Shums Coda Associates, Inc

5

5

Determination of Use

- The principal purpose or function of the building or facility
- The hazard-related risk(s) to the users of the building or facility.



© 2022 Shums Coda Associates, Inc

6

6

Occupancy Classification

- Nature of Hazard
- Number of Occupants
- Length of Occupancy
- Sleeping Characteristics
- Familiarity
- Vulnerability
- Relationships



© 2022 Shums Coda Associates, Inc

7

7

Nature of the hazard

- The nature of the hazard, whether it is likely to originate internal or external to the building or facility, and how it may impact the occupants, the building or facility, and the contents.



© 2022 Shums Coda Associates, Inc

8

8

Number of occupants



- The number of persons normally occupying, visiting, employed in or otherwise using the building, facility or portion of the building or facility.

© 2022 Shums Coda Associates, Inc

9

9

Length of occupancy

- The length of time the building or facility is normally occupied by people.



© 2022 Shums Coda Associates, Inc

10

10

Sleeping characteristics



- Whether people normally sleep in the building

© 2022 Shums Coda Associates, Inc

11

11

Familiarity

- Whether the building or facility occupants and other users are expected to be familiar with the building or facility layout and means of egress.



© 2022 Shums Coda Associates, Inc

12

12

Vulnerability

- Whether a significant percentage of the building or facility occupants are, or are expected to be, members of vulnerable population groups such as infants, young children, elderly persons, persons with physical disabilities, persons with mental disabilities, or persons with other conditions or impairments that could affect their ability to make decisions, egress without the physical assistance of others or tolerate adverse conditions.

© 2022 Shums Coda Associates, Inc

13

13

Relationships



- Whether a significant percentage of building or facility occupants and other users have family or dependent relationships

© 2022 Shums Coda Associates, Inc

14

14

Occupancy Classifications Review

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



© 2022 Shums Coda Associates, Inc

15

15

Assembly Group A



- Assembly Group A-1
 - Fixed seating, viewing of the performing arts or motion pictures
- Assembly Group A-2
 - Food and/or drink consumption
- Assembly Group A-3
 - Worship, recreation or amusement and other assembly uses
- Assembly Group A-4
 - Viewing of indoor sporting events and activities with spectator seating
- Assembly Group A-5
 - Viewing outdoor activities

© 2022 Shums Coda Associates, Inc

16

16

Business Group B 304

- 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.
- Education over 12th grade



© 2022 Shums Coda Associates, Inc

17

17

Educational Group E 305

- 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.
 - Accessory religious educational rooms and religious auditoriums, occupant < 100, an A-3 occupancy



© 2022 Shums Coda Associates, Inc

18

18

Factory Industrial Group F 306

- Assembling, disassembling, fabricating, finishing, manufacturing, packaging, repair or processing operations that are not classified as a Group H hazardous or a Group S storage occupancy.
- F-1 Moderate-Hazard
- F-2 Low-Hazard



© 2022 Shums Coda Associates, Inc

19

19

High-Hazard Group H 307

- Group H-1
 - Contain materials that pose a detonation hazard
- Group H-2 Structures
 - Contain materials that present a deflagration hazard or a hazard from accelerated burning
- Group H-3 Structures
 - Contain materials that readily support combustion or present a physical hazard
- Group H-4 Structures
 - Contain materials that are health hazards
- Group H-5 Structures
 - Semiconductor fabrication facilities and comparable research and development areas



© 2022 Shums Coda Associates, Inc

20

20

Institutional Group I 308



- Group I-1
 - 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 308.3.1 or 308.3.2.
- Group I-2
 - Buildings and structures used for medical care on a 24-hour basis for more than five persons who are incapable of self-preservation.

© 2022 Shums Coda Associates, Inc

21

21

Institutional Group I 308

- Group I-3 Structures
 - 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.
- Group I-4 Structures
 - 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.



© 2022 Shums Coda Associates, Inc

22

22

Mercantile Group M 309



- Buildings and structures or a portion thereof, for the display and sale of merchandise, and involves stocks of goods, wares or merchandise incidental to such purposes and accessible to the public.

© 2022 Shums Coda Associates, Inc

23

23

Residential Group R 310

- Residential Group R-1
 - Occupants are primarily transient in nature
- Residential Group R-2
 - More than two dwelling units where the occupants are primarily permanent in nature



© 2022 Shums Coda Associates, Inc

24

24

Residential Group R 310



- Residential Group R-3
 - Residential occupancies where the occupants are primarily permanent
 - Buildings do not contain more than two dwelling units
 - Adult facilities for five or fewer persons of any age for less than 24 hours.
 - Child care facilities for five or fewer persons of any age for less than 24 hours.
 - Congregate living facilities with 16 or fewer occupants
- Residential Group R-4
 - Residential Care/Assisted Living Facilities including more than five but not more than 16 occupants, excluding staff.

© 2022 Shums Coda Associates, Inc

25

25

Storage Group S 311



- The use of a building or structure, or a portion thereof, for storage that is not classed as a hazardous occupancy
 - Moderate Hazard S-1
 - Motor Vehicle Repair Garages
 - Low Hazard S-2
 - Parking Structures

© 2022 Shums Coda Associates, Inc

26

26

Utility Group U 312



- Accessory character and miscellaneous structures not classified in any specific occupancy
- Shall be constructed, equipped and maintained to conform to the requirements of this code commensurate with the fire and life hazard incidental to their occupancy.

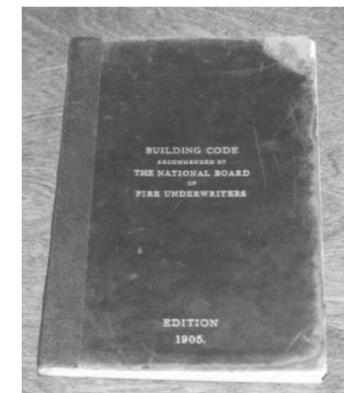
© 2022 Shums Coda Associates, Inc

27

27

History of Types of Construction

- 1905 Building Code
 - Thickness of Brick Walls based on occupancy and height.
 - Fireproof Construction
 - Noncombustible materials
 - Non-Fireproof Construction



© 2022 Shums Coda Associates, Inc

28

28

History of Types of Construction

- 1927 Uniform Building Code
 - Type I Buildings
 - Fire-Resistive
 - Type II Buildings
 - Heavy Timber Constructions
 - Type III Buildings
 - Ordinary Masonry
 - Type IV Buildings
 - Metal Frame
 - Type V Buildings
 - Wood Frame



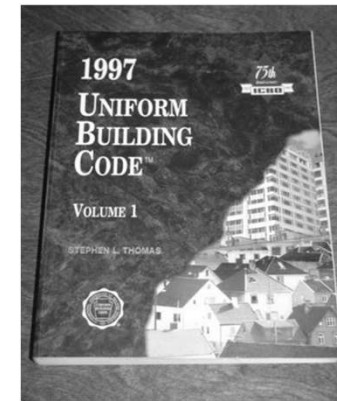
© 2022 Shums Coda Associates, Inc

29

29

History of Types of Construction

- 1997 Uniform Building Code
 - Type I Fire Resistive
 - Type II Fire Resistive
 - Type II One-Hour
 - Type II Non-Rated
 - Type III One-Hour
 - Type III Non-Rated
 - Type IV Heavy Timber
 - Type V One-Hour
 - Type V Non-Rated



© 2022 Shums Coda Associates, Inc

30

30

How is Type Construction Determined?

- Designer?
- Materials?
- Allowable Area ?
- Allowable Height?



© 2022 Shums Coda Associates, Inc

31

31

602.1.1 Minimum Requirements

- A building or portion thereof shall not be required to conform to the details of a type of construction higher than that type, which meets the minimum requirements based on occupancy even though certain features of such a building actually conform to a higher type of construction.



© 2022 Shums Coda Associates, Inc

32

32

Construction Classification Table 601

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 5 ^c	1 ^b c	0 ^d	1 ^b c	0	3 ^a	2 ^a	2 ^a	HT	1 ^b c	0
Bearing walls												
Exterior ^{e,1}	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												
Exterior	See Table 705.5											
Nonbearing walls and partitions												
Interior ^d	0	0	0	0	0	0	0	0	0	See Section 2304.11.2	0	0
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 ^d	1 ^b c	0	1 ^{1/2}	1	1	HT	1 ^b c	0

© 2022 Shums Coda Associates, Inc

33

33

703.3 Noncombustibility Tests

- The tests indicated in Section 703.3.1 shall serve as criteria for acceptance of building materials as set forth in Sections 602.2, 602.3 and 602.4 in Types I, II, III and IV construction.
- The term “noncombustible” does not apply to the flame spread characteristics of interior finish or trim materials.



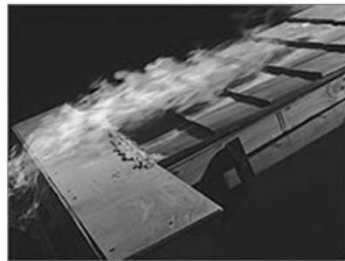
© 2022 Shums Coda Associates, Inc

34

34

703.5 Noncombustibility Tests

- A material shall not be classified as a noncombustible building construction material if it is subject to an increase in combustibility or flame spread beyond the limitations herein established through the effects of age, moisture or other atmospheric conditions.



© 2022 Shums Coda Associates, Inc

35

35

703.3.1 Noncombustible Materials

- Materials required to be noncombustible shall be tested in accordance with ASTM E136. Alternately, materials required to be noncombustible shall be tested in accordance with ASTM E2652 using the acceptance criteria prescribed by ASTM E136.



© 2022 Shums Coda Associates, Inc

36

36

703.3.1 Noncombustible Materials



- Exception:
- Materials having a structural base of noncombustible material as determined in accordance with ASTM E136, or with ASTM E2652 using the acceptance criteria prescribed by ASTM E136, with a surfacing of not more than 0.125 inch in thickness having a flame spread index not greater than 50 when tested in accordance with ASTM E84 or UL 723 shall be acceptable as noncombustible.

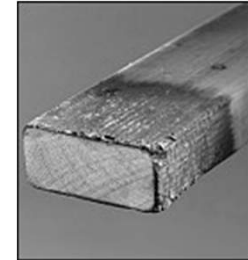
© 2022 Shums Coda Associates, Inc

37

37

Combustible Materials Permitted 603

1. Fire-retardant-treated wood shall be permitted in:
 - Nonbearing partitions where the required fire-resistance rating is 2 hours or less.
 - Nonbearing exterior walls where fire rating is required.
 - Roof construction, including girders, trusses, framing and decking.
 - Exceptions
 - Balconies, porches, decks and exterior stairways not used as required exits on buildings three stories or less above grade plane.



© 2022 Shums Coda Associates, Inc

38

38

Combustible Materials Permitted 603



2. Thermal and acoustical insulation, other than foam plastics, having a flame spread index of not more than 25.
 - Exceptions:
 - Insulation placed between two layers of noncombustible materials without an intervening airspace shall be allowed to have a flame spread index of not more than 100.
 - Insulation installed between a finished floor and solid decking without intervening airspace shall be allowed to have a flame spread index of not more than 200.

© 2022 Shums Coda Associates, Inc

39

39

Combustible Materials Permitted 603

3. Foam plastics in accordance with Chapter 26.



© 2022 Shums Coda Associates, Inc

40

40

Combustible Materials Permitted 603

- 4. Roof coverings that have an A, B or C classification.



© 2022 Shums Coda Associates, Inc

41

41

Combustible Materials Permitted 603

- 5. Interior floor finish and interior finish, trim and millwork such as doors, door frames, window sashes and frames.



© 2022 Shums Coda Associates, Inc

42

42

Combustible Materials Permitted 603

- 6. Millwork such as doors, door frames, window sashes and frames.



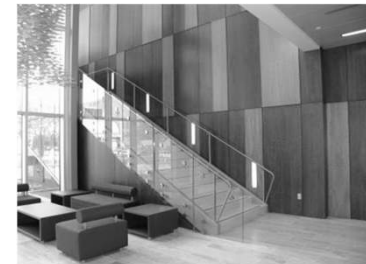
© 2022 Shums Coda Associates, Inc

43

43

Combustible Materials Permitted 603

- 7. Interior wall and ceiling finishes installed in accordance with Sections 801 and 803.



© 2022 Shums Coda Associates, Inc

44

44

Combustible Materials Permitted 603

- 8. Trim installed in accordance with Section 806.



© 2022 Shums Coda Associates, Inc

45

45

Combustible Materials Permitted 603

- 9. Where not installed greater than 15 feet above grade, show windows, nailing or furring strips and wooden bulkheads below show windows, including their frames, aprons and show cases.



© 2022 Shums Coda Associates, Inc

46

46

Combustible Materials Permitted 603

- 10. Finish flooring installed in accordance with Section 805.



© 2022 Shums Coda Associates, Inc

47

47

Combustible Materials Permitted 603

- 11. Partitions dividing portions of stores, offices or similar places occupied by one tenant only and that do not establish a corridor serving an occupant load of 30 or more shall be permitted to be constructed of fire-retardant-treated wood, 1-hour fire-resistance-rated construction or of wood panels or similar light construction up to 6 feet in height.



© 2022 Shums Coda Associates, Inc

48

48

Combustible Materials Permitted 603

- 12. Stages and platforms constructed in accordance with Sections 410.3 and 410.4, respectively.



© 2022 Shums Coda Associates, Inc

49

49

Combustible Materials Permitted 603

- 13. Combustible exterior wall coverings, balconies and similar projections and bay or oriel windows in accordance with Chapter 14.



© 2022 Shums Coda Associates, Inc

50

50

Combustible Materials Permitted 603

- 14. Blocking such as for handrails, millwork, cabinets and window and door frames.



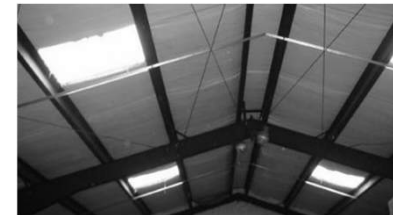
© 2022 Shums Coda Associates, Inc

51

51

Combustible Materials Permitted 603

- 15. Light-transmitting plastics as permitted by Chapter 26.
- 16. Mastics and caulking materials applied to provide flexible seals between components of exterior wall construction.
- 17. Exterior plastic veneer installed in accordance with Section 2605.2.



© 2022 Shums Coda Associates, Inc

52

52

Combustible Materials Permitted 603



- 18. Nailing or furring strips as permitted by Section 803.4.
- 19. Heavy timber as permitted by Note c to Table 601 and Sections 602.4.4.4 and 705.2.3.1
- 20. Aggregates, component materials and admixtures as permitted by Section 703.2.1.2.

© 2022 Shums Coda Associates, Inc

53

53

Combustible Materials Permitted 603

- 21. Sprayed fire-resistant materials and intumescent and mastic fire-resistant coatings, determined on the basis of fire-resistance tests in accordance with Section 703.2 and installed in accordance with Section 1705.5 and 1705.16, respectively.



© 2022 Shums Coda Associates, Inc

54

54

Combustible Materials Permitted 603

- 22. Materials used to protect penetrations in fire-resistance-rated assemblies in accordance with Section 714.
- 23. Materials used to protect joints in fire-resistance-rated assemblies in accordance with Section 715.



© 2022 Shums Coda Associates, Inc

55

55

Combustible Materials Permitted 603

- 24. Materials allowed in the concealed spaces of buildings of Type I and II construction in accordance with Section 718.5.
 - Combustible materials in accordance with Section 603.
 - Combustible materials exposed within plenums complying with Section 602 of the IMC.
 - Class A interior finish materials classified in accordance with Section 803.
 - Combustible piping within partitions or shaft enclosures installed in accordance with the provisions of this code.
 - Combustible piping within concealed ceiling spaces installed in accordance with the IMC and the IPC.
 - Combustible insulation and covering on pipe and tubing, installed in concealed spaces other than plenums, complying with Section 720.7.

© 2022 Shums Coda Associates, Inc

56

56

Combustible Materials Permitted 603

- 25. Materials exposed within plenums complying with Section 602 of the IMC.



© 2022 Shums Coda Associates, Inc

57

57

Combustible Materials Permitted 603

- 26. Wall construction of freezers and coolers of less than 1,000 square feet, in size, lined on both sides with noncombustible materials and the building is protected throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.



© 2022 Shums Coda Associates, Inc

58

58

Combustible Materials Permitted 603

- 27. Wood nailers for parapet flashing and roof cants.

© 2022 Shums Coda Associates, Inc

59

59

Combustible Materials Permitted 603

- Ducts in accordance with IMC
- Combustible piping in accordance with IMC and IPC
- Electrical wiring methods with combustible insulation, tubing, raceways and related components in accordance with IBC



© 2022 Shums Coda Associates, Inc

60

60

603.1.2 Piping

- The use of combustible piping materials shall be permitted where installed in accordance with the limitations of the IMC and the IPC.



© 2022 Shums Coda Associates, Inc

61

61

603.1.3 Electrical

- The use of electrical wiring methods with combustible insulation, tubing, raceways and related components shall be permitted where installed in accordance with the limitations of this code.



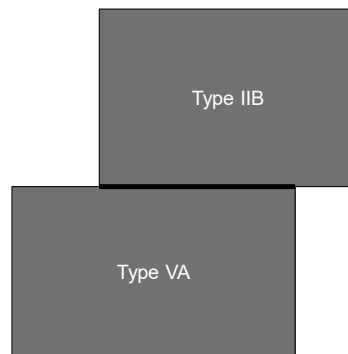
© 2022 Shums Coda Associates, Inc

62

62

Multiple Types of Construction in a single building?

- Must be separate buildings separated by fire wall.



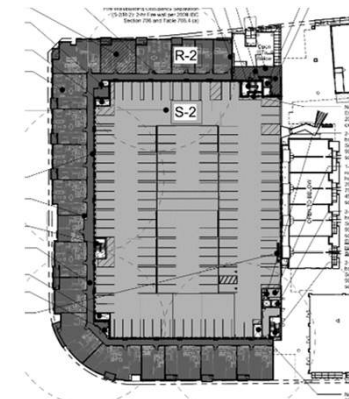
© 2022 Shums Coda Associates, Inc

63

63

705.3 Buildings on the same lot

- Exception 2
- Where an S-2 parking garage of Construction Type I or IIA is erected on the same lot as a Group R-2 building, and there is no fire separation distance between these buildings, then the adjoining exterior walls between the buildings are permitted to have occupant use openings in accordance with Section 706.8.
- However, opening protectives in such openings shall only be required in the exterior wall of the S-2 parking garage, not in the exterior wall openings in the R-2 building, and these opening protectives in the exterior wall of the S-2 parking garage shall be not less than 1 1/2-hour fire protection rating.



© 2022 Shums Coda Associates, Inc

64

64

Mixed Uses and Occupancies

- Non-Separated Occupancies
- Separated Occupancies
- Accessory Occupancies
- Special Provisions (509)
- Fire Wall Separation



© 2022 Shums Coda Associates, Inc

65

65

Non-Separated Occupancies 508.3



- Classify each occupancy
- Code requirements apply to each portion based on the classification of the space
- Most restrictive provisions of 403 and Chapter 9 apply to entire building
- Allowable area and height based on most restrictive allowances for the occupancy groups
- No separation required except some H occupancies and dwelling and sleeping units

© 2022 Shums Coda Associates, Inc

66

66

Separated Occupancies 508.4

- Classify each occupancy
- Sum of the ratios calculated for each story
- Occupancy limited in height based on Table 503
- Occupancies separated per Table 508.4



© 2022 Shums Coda Associates, Inc

67

67

Combination Mixed Occupancy

- Section 508.1
 - Where a building contains more than one occupancy group, the building or portion thereof shall comply with the applicable provisions of Section 508.2, 508.3 or 508.4, **or a combination of these sections.**



© 2022 Shums Coda Associates, Inc

68

68

Special Provisions 510.1

- The provisions in this section shall permit the use of special conditions that are exempt from, or modify, the specific requirements of this chapter regarding the allowable heights and areas of buildings based on the occupancy classification and type of construction, provided the special condition complies with the provisions specified in this section for such condition and other applicable requirements of this code.
- The provisions of Sections 509.2 through 509.8 are to be considered independent and separate from each other.



© 2022 Shums Coda Associates, Inc

69

69

Platform/Podium Buildings 510.2

- A building shall be considered as separate and distinct buildings for the purpose of determining area limitations, continuity of fire walls , limitation of number of stories and type of construction where all of the following conditions are met:



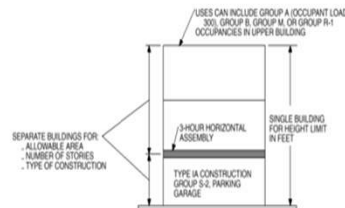
© 2022 Shums Coda Associates, Inc

70

70

Horizontal Building Separation Allowance 510.2

1. The buildings are separated with a horizontal assembly having a minimum 3-hour fire-resistance rating. Where vertical offsets are provided as part of a horizontal assembly, the vertical offset and the structure supporting the vertical offset shall have a fire-resistance rating of not less than 3 hours.
2. The building below the horizontal assembly is of Type IA construction.



© 2022 Shums Coda Associates, Inc

71

71

Horizontal Building Separation Allowance 510.2

3. Shaft, stairway , ramp and escalator enclosures through the horizontal assembly shall have not less than a 2-hour fire-resistance rating with opening protectives in accordance with Section 715.4.

Exception: Where the enclosure walls below the horizontal assembly have not less than a 3-hour fire-resistance rating with opening protectives in accordance with Section 715.4, the enclosure walls extending above the horizontal assembly shall be permitted to have a 1-hour fire-resistance rating , provided:

1. The building above the horizontal assembly is not required to be of Type I construction;
2. The enclosure connects less than four stories ; and
3. The enclosure opening protectives above the horizontal assembly have a minimum 1-hour fire protection rating .

© 2022 Shums Coda Associates, Inc

72

72

Horizontal Building Separation Allowance 510.2

- 4. Interior exit stairways located within the Type IA building are permitted to be of combustibile materials where the following requirements are met:
 - 4.1. The building above the Type IA building is of Type III, IV, or V construction.
 - 4.2. The stairway located in the Type IA building is enclosed by 3-hour fire-resistance-rated construction with opening protectives in accordance with Section 716.

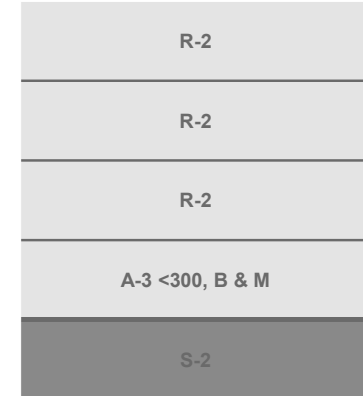
© 2022 Shums Coda Associates, Inc

73

73

Horizontal Building Separation Allowance 510.2

- 5. The building or buildings above the horizontal assembly shall be permitted to have multiple Group A occupancy uses, each with an occupant load of less than 300, or Group B, M, R or S occupancies.



© 2022 Shums Coda Associates, Inc

74

74

Horizontal Building Separation Allowance 510.2

- 5. The building below the horizontal assembly shall be protected throughout by an approved automatic sprinkler system in accordance with Section 903.3.1.1, and shall be permitted to be any occupancy allowed by this code except Group H.



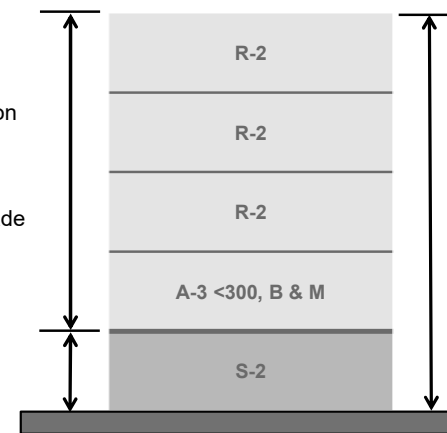
© 2022 Shums Coda Associates, Inc

75

75

Horizontal Building Separation Allowance 510.2

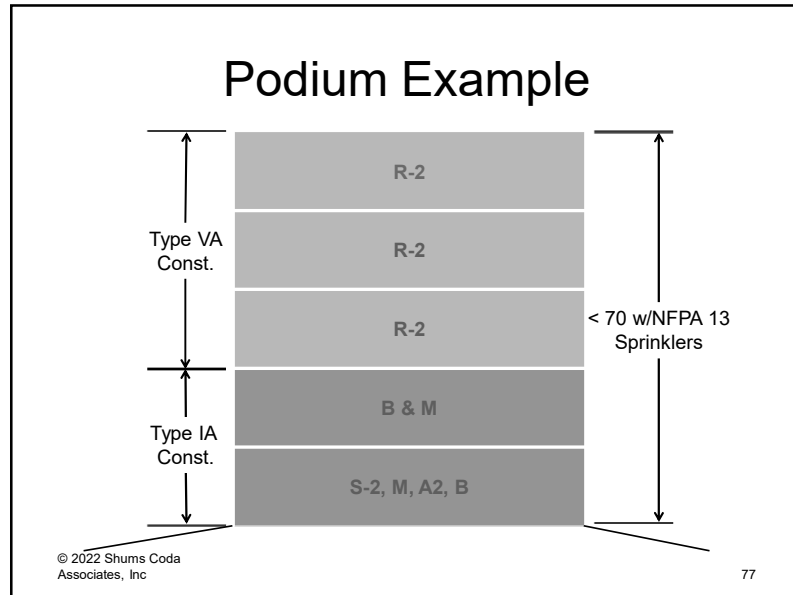
- 6. The maximum building height in feet shall not exceed the limits set forth in Section 504.3 for the building having the smaller allowable height as measured from the grade plane .



© 2022 Shums Coda Associates, Inc

76

76



77

Group S-2 Enclosed Parking Garage With Group S-2 Open Parking Garage Above - 510.3

- A Group S-2 enclosed parking garage with no more than one story above grade plane and located below a Group S-2 open parking garage shall be classified as a separate and distinct building for the purpose of determining the type of construction where all of the following conditions are met:
 - Five Conditions

© 2022 Shums Coda Associates, Inc

78

78

Group S-2 Enclosed Parking Garage With Group S-2 Open Parking Garage Above - 510.3

1. The allowable area of the building shall be such that the sum of the ratios of the actual area divided by the allowable area for each separate occupancy shall not exceed 1.
2. The Group S-2 enclosed parking garage is of Type I or II construction and is at least equal to the fire-resistance requirements of the Group S-2 open parking garage .
3. The height and the number of tiers of the Group S-2 open parking garage shall be limited as specified in Table 406.3.5.

© 2022 Shums Coda Associates, Inc

79

79

Group S-2 Enclosed Parking Garage With Group S-2 Open Parking Garage Above - 510.3

4. The floor assembly separating the Group S-2 enclosed parking garage and Group S-2 open parking garage shall be protected as required for the floor assembly of the Group S-2 enclosed parking garage. Openings between the Group S-2 enclosed parking garage and Group S-2 open parking garage, except exit openings, shall not be required to be protected.
5. The Group S-2 enclosed parking garage is used exclusively for the parking or storage of private motor vehicles, but shall be permitted to contain an office, waiting room and toilet room having a total area of not more than 1,000 square feet, and mechanical equipment rooms incidental to the operation of the building.

© 2022 Shums Coda Associates, Inc

80

80

Parking beneath Group R 510.4

- Where a maximum one story above grade plane Group S-2 parking garage, enclosed or open, or combination thereof, of Type I construction or open of Type IV construction, with grade entrance, is provided under a building of Group R, the number of stories to be used in determining the minimum type of construction shall be measured from the floor above such a parking area.
- The floor assembly between the parking garage and the Group R above shall comply with the type of construction required for the parking garage and shall also provide a fire-resistance rating not less than the mixed occupancy separation required in Section 508.4.



© 2022 Shums Coda Associates, Inc

81

81

507 Unlimited Area Buildings

- The area of buildings of the occupancies and configurations specified in Sections 507.1 through 507.13 shall not be limited. Basements not more than one story below grade plane shall be permitted.



© 2022 Shums Coda Associates, Inc

82

82

507.1.1 Accessory occupancies

- Accessory occupancies shall be permitted in unlimited area buildings in accordance with the provisions of Section 508.2, otherwise the requirements of Sections 507.3 through 507.13 shall be applied, where applicable.



© 2022 Shums Coda Associates, Inc

83

83

Reduced Open Space 507.2.1

- 60 feet may be reduced to 40 feet provided:
 - Reduced space not allowed for more than 75 % of building perimeter
 - Exterior wall facing reduced space must be 3 hour fire-resistive-rated
 - Exterior openings facing reduced space - 3 hour fire-resistance-rated



© 2022 Shums Coda Associates, Inc

84

Unlimited Area Buildings 507.3

- Non-sprinklered Building
 - The area of a one-story, Group F-2 or S-2 building is not be limited when building is surrounded and adjoined by public ways or yards not less than 60 feet in width.



© 2022 Shums Coda Associates, LLC

85

Unlimited Area Buildings 507.4

- Sprinklered, one-story
 - The area of a Group B, F, M or S building no more than one story above grade plane, or a Group A-4 building no more than one story above grade plane of other than Type V construction, shall not be limited when the building is provided with an automatic sprinkler system throughout in accordance with Section 903.3.1.1 and is surrounded and adjoined by public ways or yards not less than 60 feet in width.
 - Exceptions:
 - Type I & II construction w/rack storage not limited in height, with no public access and must conform to 507.4, 903.3.1.1 & Chapter 32 of IFC
 - Sprinklers not required in indoor participant sports w/exit doors directly to outside and fire alarm system

© 2022 Shums Coda Associates, LLC

86

Unlimited Area Buildings 507.4.1

- Group A-1 and A-2 Occupancies of other than Type V Construction
 - Assembly occupancies separated from other spaces as required in 508.4.4 without sprinkler reduction
 - Assembly area cannot exceed allowable area
 - All exit doors shall discharge directly to the exterior



© 2022 Shums Coda Associates, LLC

87

Unlimited Area Buildings 507.5

- Sprinklered, two-story
 - The area of a Group B, F, M or S building no more than two stories above grade plane shall not be limited when the building is equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1 and is surrounded and adjoined by public ways or yards not less than 60 feet in width.



© 2022 Shums Coda Associates, LLC

88

Group A-3 Buildings 507.6



- The area of a Group A-3 building no more than one story above grade plane, used as a place of religious worship, community hall, dance hall, exhibition hall, gymnasium, lecture hall, indoor swimming pool or tennis court of Type II construction, shall not be limited when all of the following criteria are met:
 1. The building shall not have a stage other than a platform.
 2. The building shall be equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1.
 3. The building shall be surrounded and adjoined by public ways or yards not less than 60 feet in width.

© 2022 Shums Coda Associates, LLC

89

Other Unlimited Areas 507.7 - 507.11

- 507.8- High-hazard use groups
- 507.9 Group H-5 Occupancies
- 507.10 - Aircraft paint hanger
- 507.11 - Group E buildings
- 507.12 – Sprinklered motion picture theaters of Type II construction
- 507.13 – Covered mall buildings and anchor stores.

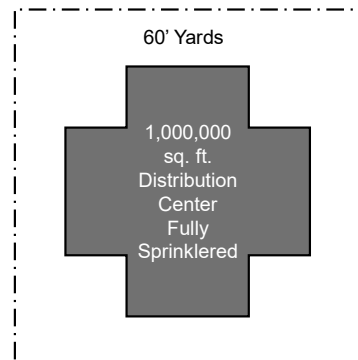


© 2022 Shums Coda Associates, LLC

90

Unlimited Area Buildings Challenges

- Super Large Buildings
 - Exit Access Travel Distance
 - Fire Department Access
 - Standpipe locations

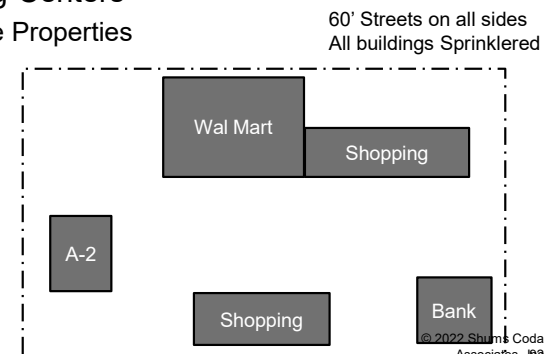


© 2022 Shums Coda Associates, LLC

91

Unlimited Area Buildings Challenges

- Shopping Centers
 - Multiple Properties



© 2022 Shums Coda Associates, LLC

92

Unlimited Area Buildings Challenges

- Mixed Unlimited Area Buildings ?

Moving
And
Storage
Company





Charter School

Fully Sprinklered
60' Yards on all sides

© 2022 Shums Coda Associates, Inc

93

Special Detailed Requirements Based On Use And Occupancy Chapter 4







© 2022 Shums Coda Associates, Inc

94

422 Ambulatory Care Facility

- Classified as a Group B Occupancy.
- Creates a mini-hospital
- Higher protection than doctor's office




© 2022 Shums Coda Associates, Inc

95

202 Definitions

- AMBULATORY CARE FACILITY
- Buildings or portions thereof used to provide medical, surgical, psychiatric, nursing or similar care on a less than 24-hour basis to persons who are rendered incapable of self-preservation by the services provided or staff has accepted responsibility for care recipients already incapable.



© 2022 Shums Coda Associates, Inc

96

**202
Definitions**



- CLINIC, OUTPATIENT
- Buildings or portions thereof used to provide medical care on less than a 24-hour basis to persons who are not rendered incapable of self-preservation by the services provided.

© 2022 Shums Coda Associates, Inc

97

97

**202
Definitions**

- INCAPABLE OF SELF-PRESERVATION
- Persons who, because of age, physical limitations, mental limitations, chemical dependency or medical treatment, cannot respond as an individual to an emergency situation.



© 2022 Shums Coda Associates, Inc

98

98

**422.2
Separation**



- Ambulatory care facilities where the potential for four or more care recipients are to be incapable of self-preservation at any time, whether rendered incapable by staff or staff accepted responsibility for a care recipient already incapable, shall be separated from adjacent spaces, corridors or tenants with a fire partition installed in accordance with Section 708.
- (One Hr. Wall, 45 Min. Openings)

© 2022 Shums Coda Associates, Inc

99

99

**422.3
Smoke compartments**

- Where the aggregate area of one or more ambulatory care facilities is greater than 10,000 square feet on one story, the story shall be provided with a smoke barrier to subdivide the story into no fewer than two smoke compartments.
- The area of any one such smoke compartment shall be not greater than 22,500 square feet



© 2022 Shums Coda Associates, Inc

100

100

202
Definition

- **SMOKE COMPARTMENT**
- A space within a building enclosed by smoke barriers on all sides, including the top and bottom.

SB – Smoke Compartments

© 2022 Shums Coda Associates, Inc. **101**

101

422.3
Smoke compartments

- The distance of travel from any point in a smoke compartment to a smoke barrier door shall be not greater than 200 feet.
- The smoke barrier shall be installed in accordance with Section 709 with the exception that smoke barriers shall be continuous from outside wall to an outside wall, a floor to a floor, or from a smoke barrier to a smoke barrier or a combination thereof.
- (1 Hr. Wall, 20 min. openings)

© 2022 Shums Coda Associates, Inc. **102**

102

422.3.1
Means of egress

- Where ambulatory care facilities require smoke compartmentation in accordance with Section 422.3, the fire safety evacuation plans provided in accordance with Section 1001.4 shall identify the building components necessary to support a defend-in-place emergency response in accordance with Sections 403 and 404 of the IFC.

© 2022 Shums Coda Associates, Inc. **103**

103

422.3.2
Refuge area


- Not less than 30 net square feet for each nonambulatory care recipient shall be provided within the aggregate area of corridors, care recipient rooms, treatment rooms, lounge or dining areas and other low-hazard areas within each smoke compartment.
- Each occupant of an ambulatory care facility shall be provided with access to a refuge area without passing through or utilizing adjacent tenant spaces.

© 2022 Shums Coda Associates, Inc. **104**

104

**422.3.3
Independent egress**

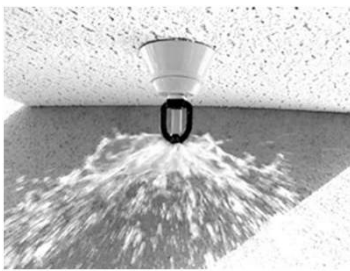
- A means of egress shall be provided from each smoke compartment created by smoke barriers without having to return through the smoke compartment from which means of egress originated.



© 2022 Shums Coda Associates, Inc 105

105

**422.4
Automatic sprinkler systems**




- Automatic sprinkler systems shall be provided for ambulatory care facilities in accordance with Section 903.2.2.

© 2022 Shums Coda Associates, Inc 106

106

**903.2.2
Ambulatory care facilities**

- An automatic sprinkler system shall be installed throughout the entire floor containing an ambulatory care facility where either of the following conditions exist at any time:
 1. Four or more care recipients are incapable of self-preservation, whether rendered incapable by staff or staff has accepted responsibility for care recipients already incapable.
 2. One or more care recipients that are incapable of self-preservation are located at other than the level of exit discharge serving such a facility.




© 2022 Shums Coda Associates, Inc 107

107

**903.2.2
Ambulatory care facilities**

- In buildings where ambulatory care is provided on levels other than the level of exit discharge, an automatic sprinkler system shall be installed throughout the entire floor where such care is provided as well as all floors below, and all floors between the level of ambulatory care and the nearest level of exit discharge, including the level of exit discharge.



© 2022 Shums Coda Associates, Inc 108

108

422.5 Fire alarm systems



- A fire alarm system shall be provided for ambulatory care facilities in accordance with Section 907.2.2.

© 2022 Shums Coda Associates, Inc

109

109

907.2.2 Group B



- A manual fire alarm system shall be installed in Group B occupancies where one of the following conditions exists:
 3. The fire area contains an ambulatory care facility.
- Exception: Manual fire alarm boxes are not required where the building is equipped throughout with an automatic sprinkler system installed in accordance with Section 903.3.1.1 and the occupant notification appliances will activate throughout the notification zones upon sprinkler water flow.

© 2022 Shums Coda Associates, Inc

110

110

907.2.2.1 Ambulatory care facilities

- Fire areas containing ambulatory care facilities shall be provided with an electronically supervised automatic smoke detection system installed within the ambulatory care facility and in public use areas outside of tenant spaces, including public corridors and elevator lobbies.
- Exception: Buildings equipped throughout with an automatic sprinkler system in accordance with Section 903.3.1.1, provided the occupant notification appliances will activate throughout the notification zones upon sprinkler waterflow.



© 2022 Shums Coda Associates, Inc

111

111

422.6 Electrical systems

- In ambulatory care facilities, the essential electrical system for electrical components, equipment and systems shall be designed and constructed in accordance with the provisions of Chapter 27 and NFPA 99.



© 2022 Shums Coda Associates, Inc

112

112

422.7 Domestic cooking

- Installation of cooking appliances used in domestic cooking facilities shall comply with all of the following:
 1. The types of cooking appliances permitted are limited to ovens, cooktops, ranges, warmers and microwaves.
 2. Domestic cooking hoods installed and constructed in accordance with Section 505 of the International Mechanical Code shall be provided over cooktops or ranges.
 3. A shutoff for the fuel and electrical supply to the cooking equipment shall be provided in a location to which only staff has access.
- 4. A timer shall be provided that automatically deactivates the cooking appliances within a period of not more than 120 minutes.
- 5. A portable fire extinguisher shall be provided. Installation shall be in accordance with Section 906 and the extinguisher shall be located within a 30-foot (9144 mm) distance of travel from each domestic cooking appliance.

© 2022 Shums Coda Associates, Inc

113

113

407 Group I-2



© 2022 Shums Coda Associates, Inc

114

114

407.2 Corridors continuity and separation

- Corridors in occupancies in Group I-2 shall be continuous to the exits and shall be separated from other areas in accordance with Section 407.3 except spaces conforming to Sections 407.2.1 through 407.2.4.



© 2022 Shums Coda Associates, Inc

115

115

407.2.1 Waiting and similar areas



- Waiting areas, public-use areas or group meeting spaces constructed as required for corridors shall be permitted to be open to a corridor, only where all of the following criteria are met:
 1. The spaces are not occupied as care recipient's sleeping rooms, treatment rooms, incidental uses in accordance with Section 509, or hazardous uses.
 2. The open space is protected by an automatic fire detection system installed in accordance with Section 907.

© 2022 Shums Coda Associates, Inc

116

116

**407.2.1
Waiting and similar areas**



3. The corridors onto which the spaces open, in the same smoke compartment, are protected by an automatic fire detection system installed in accordance with Section 907, or the smoke compartment in which the spaces are located is equipped throughout with quick-response sprinklers in accordance with Section 903.3.2.
4. The space is arranged so as not to obstruct access to the required exits.

© 2022 Shums Coda Associates, Inc

117

117

**407.2.2
Care providers' stations**

- Spaces for care providers', supervisory staff, doctors' and nurses' charting, communications and related clerical areas shall be permitted to be open to the corridor, where such spaces are constructed as required for corridors.



© 2022 Shums Coda Associates, Inc

118

118

**407.2.3
Psychiatric treatment areas**

- Areas wherein psychiatric care recipients who are not capable of self-preservation are housed, or group meeting or multipurpose therapeutic spaces other than incidental uses in accordance with Section 509, under continuous supervision by facility staff, shall be permitted to be open to the corridor, where the following criteria are met:

1. Each area does not exceed 1,500 square feet.
2. The area is located to permit supervision by the facility staff.
3. The area is arranged so as not to obstruct any access to the required exits.
4. The area is equipped with an automatic fire detection system installed in accordance with Section 907.2.
5. Not more than one such space is permitted in any one smoke compartment.
6. The walls and ceilings of the space are constructed as required for corridors.

© 2022 Shums Coda Associates, Inc

119

119

**407.2.4
Gift shops**

- Gift shops and associated storage that are less than 500 square feet in area shall be permitted to be open to the corridor where such spaces are constructed as required for corridors.



© 2022 Shums Coda Associates, Inc

120

120

**407.2.5
Nursing home housing units**

- In Group I-2, Condition 1, occupancies, in areas where nursing home residents are housed, shared living spaces, group meeting or multipurpose therapeutic spaces shall be permitted to be open to the corridor, where all of the following criteria are met:



© 2022 Shums Coda Associates, Inc

121

121

**407.2.5
Nursing home housing units**

1. The walls and ceilings of the space are constructed as required for corridors.
2. The spaces are not occupied as resident sleeping rooms, treatment rooms, incidental uses in accordance with Section 509, or hazardous uses.
3. The open space is protected by an automatic fire detection system installed in accordance with Section 907.



© 2022 Shums Coda Associates, Inc

122

122

**407.2.5
Nursing home housing units**

4. The corridors onto which the spaces open, in the same smoke compartment, are protected by an automatic fire detection system installed in accordance with Section 907, or the smoke compartment in which the spaces are located is equipped throughout with quick-response sprinklers in accordance with Section 903.3.2.
5. The space is arranged so as not to obstruct access to the required exits.



© 2022 Shums Coda Associates, Inc

123

123

**407.2.6
Nursing home cooking facilities**

- In Group I-2, Condition 1, occupancies, rooms or spaces that contain a cooking facility with domestic cooking appliances shall be permitted to be open to the corridor where all of the following criteria are met:
 1. The number of care recipients housed in the smoke compartment shall not be greater than 30.
 2. The number of care recipients served by the cooking facility shall not be greater than 30.
 3. Not more than one cooking facility area shall be permitted in a smoke compartment.



© 2022 Shums Coda Associates, Inc

124

124

407.2.6
Nursing home cooking facilities

- 4. The types of domestic cooking appliances permitted shall be limited to ovens, cooktops, ranges, warmers and microwaves.
- 5. The corridor shall be a clearly identified space delineated by construction or floor pattern, material or color.
- 6. The space containing the domestic cooking facility shall be arranged so as not to obstruct access to the required exit.
- 6. The cooking appliance shall comply with Section 407.2.7.



© 2022 Shums Coda Associates, Inc

125

125

407.2.7
Domestic cooking appliances.

- In Group I-2 occupancies, installation of cooking appliances used in domestic cooking facilities shall comply with all of the following:
 - 1. The types of cooking appliances permitted shall be limited to ovens, cooktops, ranges, warmers and microwaves.
 - 2. Domestic cooking hoods installed and constructed in accordance with Section 505 of the International Mechanical Code shall be provided over cooktops and ranges.



© 2022 Shums Coda Associates, Inc

126

126

407.2.7
Domestic cooking appliances.

- 3. Cooktops and ranges shall be protected in accordance with Section 904.14.
- 4. A shut-off for the fuel and electrical power supply to the cooking equipment shall be provided in a location to which only staff has access.
- 5. A timer shall be provided that automatically deactivates the cooking appliances within a period of not more than 120 minutes.
- 6. A portable fire extinguisher shall be provided. Installation shall be in accordance with Section 906, and the extinguisher shall be located within a 30-foot distance of travel from each domestic cooking appliance.



© 2022 Shums Coda Associates, Inc

127

127

407.2.7
Domestic cooking appliances.

- Exceptions:
 - 1. Cooktops and ranges located within smoke compartments with no patient sleeping or patient care areas are not required to comply with this section.
 - 2. Cooktops and ranges used for care recipient training or nutritional counseling are not required to comply with Item 3 of this section.

© 2022 Shums Coda Associates, Inc


128

128

Corridor wall construction

407.3

- Corridor walls shall be constructed as smoke partitions in accordance with Section 710.




© 2022 Shums Coda Associates, Inc 129

129

407.3.1

Corridor doors

- Corridor doors, other than those in a wall required to be rated by Section 509.4 or for the enclosure of a vertical opening or an exit, shall not have a required fire protection rating and shall not be required to be equipped with self-closing or automatic-closing devices, but shall provide an effective barrier to limit the transfer of smoke and shall be equipped with positive latching.
- Roller latches are not permitted.
- Other doors shall conform to Section 716.



© 2022 Shums Coda Associates, Inc 130

130

407.3.1.1

Door construction


- Doors in corridors not required to have a fire protection rating shall comply with the following:
 - Solid doors shall have close-fitting operational tolerances, head and jamb stops.
 - Dutch-style doors shall have an astragal, rabbet or bevel at the meeting edges of the upper and lower door sections. Both the upper and lower door sections shall have latching hardware. Dutch-style doors shall have hardware that connects the upper and lower sections to function as a single leaf.
 - To provide makeup air for exhaust systems in accordance with Section 1020.7, Exception 1, doors are permitted to have louvers or to have a clearance between the bottom of the door and the floor surface that is 2/3 inch maximum.

© 2022 Shums Coda Associates, Inc 131

131

407.4

Means of egress




- Group I-2 occupancies shall be provided with means of egress complying with Chapter 10 and Sections 407.4.1 through 407.4.4. The fire safety and evacuation plans provided in accordance with Section 1002.2 shall identify the building components necessary to support a defend-in-place emergency response in accordance with Sections 403 and 404 of the IFC.

© 2022 Shums Coda Associates, Inc 132

132

Direct access to a corridor 407.4.1




- Habitable rooms in Group I-2 occupancies shall have an exit access door leading directly to a corridor.
- Exceptions:
 - Rooms with exit doors opening directly to the outside at ground level.
 - Rooms arranged as care suites complying with Section 407.4.4

© 2022 Shums Coda Associates, Inc 133

133

407.4.1.1 Locking devices

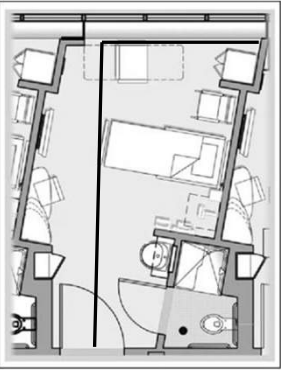
- Locking devices that restrict access to a care recipient's room from the corridor and that are operable only by staff from the corridor side shall not restrict the means of egress from the care recipient's room.
- Exceptions:
 - This section shall not apply to rooms in psychiatric treatment and similar care areas.
 - Locking arrangements in accordance with Section 1010.2.14.



© 2022 Shums Coda Associates, Inc 134

134

Distance of Travel 407.4.2




- The distance of travel between any point in a Group I-2 occupancy sleeping room, not located in a care suite, and an exit access door in that room shall be not greater than 50 feet

© 2022 Shums Coda Associates, Inc 135

135

407.4.3 Projections in nursing home corridors

- In Group I-2, Condition 1, occupancies, where the corridor width is a minimum of 96 inches, projections shall be permitted for furniture where all of the following criteria are met:
 - The furniture is attached to the floor or to the wall.
 - The furniture does not reduce the clear width of the corridor to less than 72 inches except where other encroachments are permitted in accordance with Section 1005.7.



© 2022 Shums Coda Associates, Inc 136

136

407.4.3 Projections in nursing home corridors

- 3. The furniture is positioned on only one side of the corridor.
- 4. Each arrangement of furniture is 50 square feet maximum in area.
- 5. Furniture arrangements are separated by 10 feet minimum.
- 6. Placement of furniture is considered as part of the fire and safety plans in accordance with Section 1002.2.



© 2022 Shums Coda Associates, Inc

137

137

Group I-2 care suites 407.4.4

- Care suites in Group I-2 shall comply with Sections 407.4.4.1 through 407.4.4.4 and either Section 407.4.4.5 or 407.4.4.6.



© 2022 Shums Coda Associates, Inc

138

138

Exit access through care suites 407.4.4.1



- Exit access from all other portions of a building not classified as a care suite shall not pass through a care suite.
- In a care suite required to have more than one exit, one exit access is permitted to pass through an adjacent care suite provided all of the other requirements of Sections 407.4 and 1016.2 are satisfied.

© 2022 Shums Coda Associates, Inc

139

139

Separation 407.4.4.2

- Care suites shall be separated from other portions of the building by a smoke partition complying with Section 710.




© 2022 Shums Coda Associates, Inc

140

140

**407.4.4.3
Access to corridor**

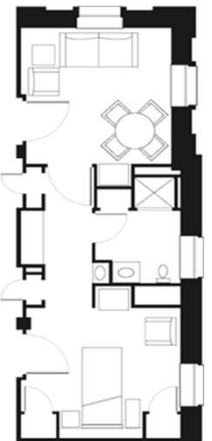


- Every care suite shall have a door leading directly to an exit access corridor or horizontal exit.
- Movement from habitable rooms within a care suite shall not require more than 100 feet of travel within the care suite to a door leading to the exit access corridor or horizontal exit.
- Where a care suite is required to have more than one exit access door by Section 407.4.4.5.2 or 407.4.4.6.2, the additional door shall lead directly to an exit access corridor, exit or an adjacent suite.

© 2022 Shums Coda Associates, Inc 141

141

**407.4.4.4
Doors within care suites**

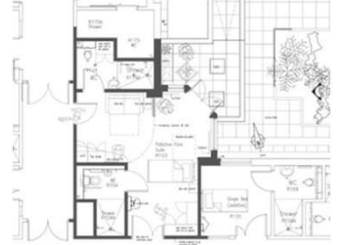


- Doors in care suites serving habitable rooms shall be permitted to comply with one of the following:
 1. Manually operated horizontal sliding doors permitted in accordance with Exception 9 to Section 1010.1.2.
 2. Power-operated doors permitted in accordance with Section 1010.1.2, Exception 7.
 3. Means of egress doors complying with Section 1010.

© 2022 Shums Coda Associates, Inc 142

142

**Care suites containing sleeping room areas -
407.4.4.5**




- Sleeping rooms shall be permitted to be grouped into care suites where one of the following criteria is met:
 1. The care suite is not used as an exit access for more than eight care recipient beds.
 2. The arrangement of the care suite allows for direct and constant visual supervision into the sleeping rooms by care providers.
 3. An automatic smoke detection system is provided in the sleeping rooms and installed in accordance with NFPA 72.

© 2022 Shums Coda Associates, Inc 143

143

**Area
407.4.4.5.1**

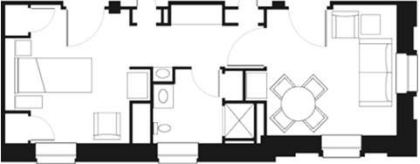


- Care suites containing sleeping rooms shall be not greater than 7,500 square feet in area.
- Exception: Care suites containing sleeping rooms shall be permitted to be not greater than 10,000 square feet in area where an automatic smoke detection system is provided throughout the care suite and installed in accordance with NFPA 72.

© 2022 Shums Coda Associates, Inc 144

144

Exit access
407.4.4.5.2




- Any sleeping room, or any care suite that contains sleeping rooms, of more than 1,000 square feet shall have no fewer than two exit access doors from the care suite located in accordance with Section 1007.

© 2022 Shums Coda Associates, Inc 145

145

407.4.4.6
Care suites not containing sleeping rooms

- Areas not containing sleeping rooms, but only treatment areas and the associated rooms, spaces or circulation space, shall be permitted to be grouped into care suites and shall conform to the limitations in Sections 407.4.4.6.1 and 407.4.4.6.2.




© 2022 Shums Coda Associates, Inc 146

146

407.4.4.6.1
Area

- Care suites of rooms, other than sleeping rooms, shall have an area not greater than 12,500 square feet.
- Exception: Care suites not containing sleeping rooms shall be permitted to be not greater than 15,000 square feet in area where an automatic smoke detection system is provided throughout the care suite in accordance with Section 907.




© 2022 Shums Coda Associates, Inc 147

147

407.4.4.6.2
Exit access

- Care suites, other than sleeping rooms, with an area of more than 2,500 square feet shall have no fewer than two exit access doors from the care suite located in accordance with Section 1007.




© 2022 Shums Coda Associates, Inc 148

148

Smoke Barriers

407.5

- Smoke barriers shall be provided to subdivide every story used by persons receiving care, treatment or sleeping into not fewer than two smoke compartments.
- Smoke barriers shall be provided to subdivide other stories with an occupant load of 50 or more persons, into not fewer than two smoke compartments.
- The smoke barrier shall be in accordance with Section 709.




© 2022 Shums Coda Associates, Inc. 149

149

407.5.1

Smoke compartment size

- Stories shall be divided into smoke compartments with an area of not more than 22,500 square feet in Group I-2 occupancies.
 - Two Exceptions




150

150

407.5.1

Smoke compartment size

- 1. A smoke compartment in Group I-2, Condition 2 is permitted to have an area of not more than 40,000 square feet provided that all patient sleeping rooms within that smoke compartment are configured for single patient occupancy and any suite within the smoke compartment complies with Section 407.4.4.




© 2022 Shums Coda Associates, Inc. 151

151

407.5.1

Smoke compartment size

- 2. A smoke compartment in Group I-2, Condition 2 without patient sleeping rooms is permitted to have an area of not more than 40,000 square feet.



© 2022 Shums Coda Associates, Inc. 152

152

407.5.2
Exit access travel distance

- The distance of travel from any point in a smoke compartment to a smoke barrier door shall be not greater than 200 feet.

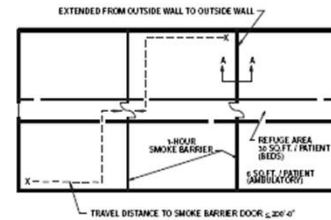


© 2022 Shums Coda Associates, Inc

153

153

Refuge Area
407.5.3



- Refuge areas shall be provided within each smoke compartment.
- The size of the refuge area shall accommodate the occupants and care recipients from the adjoining smoke compartment.
- Where a smoke compartment is adjoined by two or more smoke compartments, the minimum area of the refuge area shall accommodate the largest occupant load of the adjoining compartments.

© 2022 Shums Coda Associates, Inc

154

154

Refuge Area
407.5.3

- The size of the refuge area shall provide the following:
 1. Not less than 30 net square feet for each care recipient confined to bed or litter.
 2. Not less than 6 square feet for each ambulatory care recipient not confined to bed or litter and for other occupants.
- Areas or spaces permitted to be included in the calculation of refuge area are corridors, sleeping areas, treatment rooms, lounge or dining areas and other low-hazard areas.

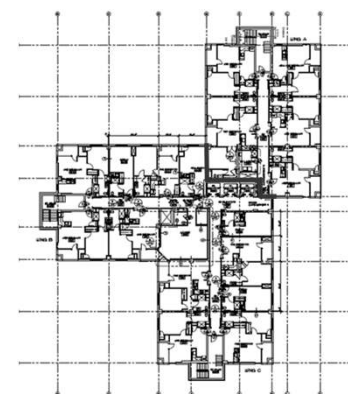


© 2022 Shums Coda Associates, Inc

155

155

407.5.4
Independent egress



- A means of egress shall be provided from each smoke compartment created by smoke barriers without having to return through the smoke compartment from which means of egress originated.
- Smoke compartments that do not contain an exit shall be provided with direct access to not less than two adjacent smoke compartments.

© 2022 Shums Coda Associates, Inc

156

156

Horizontal Assemblies

407.5.5



- Horizontal assemblies supporting smoke barriers required by this section shall be designed to resist the movement of smoke. Elevator lobbies shall be in accordance with Section 3006.2.

© 2022 Shums Coda Associates, Inc

157

157

407.6

Automatic-closing doors

- Automatic-closing doors with hold-open devices shall comply with Sections 709.5 and 716.2.



© 2022 Shums Coda Associates, Inc

158

158

407.6.1

Activation of automatic-closing doors

- Automatic-closing doors on hold-open devices in accordance with Section 716.2.6.6 shall also close upon activation of a fire alarm system, an automatic sprinkler system, or both.
- The automatic release of the hold-open device on one door shall release all such doors within the same smoke compartment.

© 2022 Shums Coda Associates, Inc

159

159

Automatic sprinkler system

407.7

- *Smoke compartments* containing sleeping rooms shall be equipped throughout with an *automatic fire sprinkler system* in accordance with Sections 903.3.1.1 and 903.3.2.




© 2022 Shums Coda Associates, Inc

160

160

Fire alarm system
407.8

- A fire alarm system shall be provided in accordance with Section 907.2.6.




© 2022 Shums Coda Associates, Inc 161

161

407.9
Automatic fire detection

- Corridors in Group I-2, Condition 1 occupancies and spaces permitted to be open to the corridors by Section 407.2 shall be equipped with an automatic fire detection system.
- Group I-2, Condition 2 occupancies shall be equipped with smoke detection as required in Section 407.2.
- 2 Exceptions




© 2022 Shums Coda Associates, Inc 162

162

407.9
Automatic fire detection

- Exceptions:
- 1. Corridor smoke detection is not required where sleeping rooms are provided with smoke detectors that comply with UL 268. Such detectors shall provide a visual display on the corridor side of each sleeping room and an audible and visual alarm at the care provider's station attending each unit.




© 2022 Shums Coda Associates, Inc 163

163

407.9
Automatic fire detection

- 2. Corridor smoke detection is not required where sleeping room doors are equipped with automatic door-closing devices with integral smoke detectors on the unit sides installed in accordance with their listing, provided that the integral detectors perform the required alerting function.




© 2022 Shums Coda Associates, Inc 164

164

Secured yards
407.10

- Grounds are permitted to be fenced and gates therein are permitted to be equipped with locks, provided that safe dispersal areas having 30 net square feet for bed and litter care recipients and 6 net square feet for ambulatory care recipients and other occupants are located between the building and the fence.
- Such provided safe dispersal areas shall not be located less than 50 feet from the building they serve.




© 2022 Shums Coda Associates, Inc. 165

165

407.11
Electrical systems


- In Group I-2 occupancies, the essential electrical system for electrical components, equipment and systems shall be designed and constructed in accordance with the provisions of Chapter 27 and NFPA 99.



© 2022 Shums Coda Associates, Inc. 166

166

Hazardous Materials
414



- **Maximum Allowable Quantities**
- **Control Areas**
- **Ventilation**
- **Storage**
 - Indoor
 - Outdoor
- **Alarm Systems**

© 2022 Shums Coda Associates, Inc. 167

167

Hazardous Materials
414

- “The provisions of Sections 414.1 through 414.6 shall apply to buildings and structures occupied for the manufacturing, processing, dispensing, use or storage of hazardous materials.”
- **Explanation:**
 - This basic provisions section applies whether the use qualifies for an “H” occupancy label or whether it is exempt.
 - Any hazardous material in any amount is controlled by this section.

© 2022 Shums Coda Associates, Inc. 168

168

Other Provisions

414.1.1

- “Buildings and structures with an occupancy in Group H shall also comply with the applicable provisions of Section 415 and the IFC.”
- Section 415 goes through each H occupancy in detail and shows what to do when a material is in excess of the exempt amounts.
- IFC provides further information

© 2022 Shums Coda Associates, Inc

169

169

Materials

414.1.2

- The safe design of hazardous material occupancies is material dependent. Individual material requirements are also found in Sections 307 and 415, and in the IMC and the IFC.
- Explanation: the bldg. design depends on the material!
- Every type of material poses a different hazard, so it requires different precautions.
- i.e./You do different things where things blow up than you do where a liquid could burn you.

© 2022 Shums Coda Associates, Inc

170

170

Aerosol Products

414.1.2.1

- Level 2 and 3 aerosol products, aerosol cooking spray products and plastic aerosol 3 products shall be stored and displayed in accordance with the International Fire Code.
- See Section 311.2 and the IFC for occupancy group requirements.



© 2022 Shums Coda Associates, Inc

171

171

Information Required

414.1.3

- A report SHALL be submitted to the building official that identifies:
 - Maximum expected amounts
 - Identify if it's stored, use-open or use-closed
 - Identify classification categories
 - Methods of protection to be used
- Must be a report prepared by an approved person or agency



© 2022 Shums Coda Associates, Inc

172

172

Material safety data sheets

- MSDS:
- Provides basic information
- May give you info for something to look up on HMEX
- Tells of specific dangers for handling
- View it as just another piece of information along with labels
- It may not give you everything or anything you need



© 2022 Shums Coda Associates, Inc

173

173

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 fibers	Loose Baled ^r	H-3	(100) (1,000)	NA	NA	(100) (1,000)	NA	NA	(20) (200)	NA
Combustible liquid ^{s, t}	II IIA IIIB	H-2 or H-3 H-2 or H-3 NA	NA	120 ^{u, v} 330 ^{u, v}	NA	NA	120 ^{u, v} 330 ^{u, v}	NA	NA	30 ^u 90 ^u 3,300 ^u
Consumer fireworks	1-4G	H-3	125 ^{u, v}	NA	NA	NA	NA	NA	NA	NA
Cryogenic flammable	NA	H-2	NA	45 ^u	NA	NA	45 ^u	NA	NA	10 ^u
Cryogenic inert	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cryogenic oxidizing	NA	H-3	NA	45 ^u	NA	NA	45 ^u	NA	NA	10 ^u
Explosives	Division 1.1	H-1	1 ^g	(1) ^g	0.25 ^g	(0.25) ^g	0.25 ^g	(0.25) ^g	0.25 ^g	(0.25) ^g
	Division 1.2	H-1	1 ^g	(1) ^g	0.25 ^g	(0.25) ^g	0.25 ^g	(0.25) ^g	0.25 ^g	(0.25) ^g
	Division 1.3	H-1 or H-2	5 ^g	(5) ^g	1 ^g	(1) ^g	1 ^g	(1) ^g	1 ^g	(1) ^g
	Division 1.4	H-3	50 ^g	(50) ^g	NA	NA	50 ^g	(50) ^g	NA	NA
	Division 1.4G	H-3	125 ^{u, v, w}	NA	NA	NA	NA	NA	NA	NA
	Division 1.5	H-1	1 ^g	(1) ^g	0.25 ^g	(0.25) ^g	0.25 ^g	(0.25) ^g	0.25 ^g	(0.25) ^g
Division 1.6	H-1	1 ^g	(1) ^g	0.25 ^g	(0.25) ^g	0.25 ^g	(0.25) ^g	0.25 ^g	(0.25) ^g	
Flammable gas	Gaseous Liquefied	H-2	NA NA	NA (150) ^z	1,000 ^z NA	NA (150) ^z	NA NA	1,000 ^z NA	NA NA	NA NA
Flammable liquid	IA IB and IC	H-2 or H-3	NA	30 ^{u, v} 120 ^{u, v}	NA	NA	30 ^{u, v} 120 ^{u, v}	NA	NA	10 ^u 30 ^u
Flammable liquid, combination (IA, IB, IC)	NA	H-2 or H-3	NA	120 ^{u, v, w}	NA	NA	120 ^{u, v, w}	NA	NA	30 ^{u, v}

© 2022 Shums Coda Associates, Inc

174

174

TABLE 307.1(1)—continued
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)
Flammable solid	NA	H-3	125 ^{u, v}	NA	NA	125 ^{u, v}	NA	NA	25 ^d	NA
Inert gas	Gaseous Liquefied	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA	NA NA
Organic peroxide	UD	H-1	1 ^g	(1) ^g	0.25 ^g	(0.25) ^g	0.25 ^g	(0.25) ^g	0.25 ^g	(0.25) ^g
	I	H-2	5 ^g	(5) ^g	1 ^g	(1) ^g	1 ^g	(1) ^g	1 ^g	(1) ^g
	II	H-3	50 ^g	(50) ^g	NA	NA	50 ^g	(50) ^g	NA	NA
	III	H-3	125 ^{u, v}	(125) ^{u, v}	NA	NA	125 ^{u, v}	(125) ^{u, v}	NA	NA
	IV V	NA NA	NL NL	NL NL	NL NL	NL NL	NL NL	NL NL	NL NL	NL NL
Oxidizer	4	H-1	1 ^g	(1) ^g	0.25 ^g	(0.25) ^g	0.25 ^g	(0.25) ^g	0.25 ^g	(0.25) ^g
	3 ^h	H-2 or H-3	10 ^g	(10) ^g	2 ^g	(2) ^g	2 ^g	(2) ^g	2 ^g	(2) ^g
	2	H-3	250 ^g	(250) ^g	NA	NA	250 ^g	(250) ^g	NA	NA
	1	NA	4,000 ^{h, i}	(4,000) ^{h, i}	4,000 ^{h, i}	(4,000) ^{h, i}	4,000 ^{h, i}	(4,000) ^{h, i}	1,000 ^{h, i}	(1,000) ^{h, i}
Oxidizing gas	Gaseous Liquefied	H-3	NA NA	NA (150) ^z	1,500 ^z NA	NA (150) ^z	1,500 ^z NA	NA NA	NA NA	NA NA
	Pyrophoric	NA	H-2	1 ^g	(1) ^g	50 ^g	(50) ^g	10 ^g	0	0
Unstable (reactive)	4	H-1	1 ^g	(1) ^g	0.25 ^g	(0.25) ^g	0.25 ^g	(0.25) ^g	0.25 ^g	(0.25) ^g
	3	H-1 or H-2	5 ^g	(5) ^g	1 ^g	(1) ^g	1 ^g	(1) ^g	1 ^g	(1) ^g
	2	H-3	50 ^g	(50) ^g	750 ^g	(750) ^g	750 ^g	(750) ^g	10 ^g	(10) ^g
Water reactive	3	H-2	5 ^g	(5) ^g	NA	NA	5 ^g	(5) ^g	1 ^g	(1) ^g
	2	H-3	50 ^g	(50) ^g	NA	NA	50 ^g	(50) ^g	10 ^g	(10) ^g
1	NA	NL	NL	NL	NL	NL	NL	NL	NL	

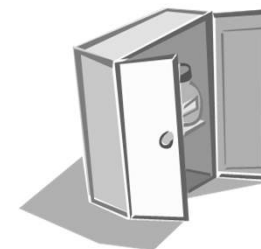
© 2022 Shums Coda Associates, Inc

175

175

Use Table 307 Footnotes and prevent an “h” occupancy label

- Safety & Protection occur when we:
- Reduce amounts
- Separate materials into protected areas (control areas)
- Put it into approved cabinets/day boxes
- Enclose it instead of making it open to the air
- Sprinkle the building
- This is more of the compartmentation concept as already exists in the code



© 2022 Shums Coda Associates, Inc

176

176

Table 307.1(1) footnotes

- 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 listed 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 cumulatively.
 - 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 cumulatively.
 - 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.
 - h. Containing not more than the maximum allowable quantity per control area of Class IA, IB or IC flammable liquids.
 - i. The maximum allowable quantity shall not apply to fuel oil storage complying with Section 503.3.2 of the International Fire Code.
 - j. Quantities in parenthesis indicate quantity units in parenthesis at the head of each column.
 - k. A maximum quantity of 200 pounds of solid or 20 gallons of liquid Class 3 oxidizers is allowed when such materials are necessary for maintenance purposes, operation or sanitation of equipment when the storage containers and the manner of storage are approved.
 - l. Net weight of the pyrotechnic composition of the fireworks. Where the net weight of the pyrotechnic composition of the fireworks is not known, 25 percent of the gross weight of the fireworks, including packaging, shall be used.
 - m. For gallons of liquids, divide the amount in pounds by 10 in accordance with Section 5003.1.2 of the International Fire Code.
 - n. For storage and display quantities in Group M and storage quantities in Group S occupancies complying with Section 414.2.5, see Tables 414.2.5(1) and 414.2.5(2).
 - o. Densely packed baled cotton that complies with the packing requirements of ISO 8115 shall not be included in this material class.
 - p. The following shall not be included in determining the maximum allowable quantities:
 1. Liquid or gaseous fuel in fuel tanks on vehicles.
 2. Liquid or gaseous fuel in fuel tanks on motorized equipment operated in accordance with the International Fire Code.
 3. Gaseous fuels in piping systems and fired appliances regulated by the International Fuel Gas Code.
 4. Liquid fuels in piping systems and fired appliances regulated by the International Mechanical Code.
 5. Alcohol-based hand rubs classified as Class I or II liquids in dispensers that are installed in accordance with Sections 2705.5 and 5705.5.1 of the International Fire Code. The location of the alcohol-based hand rub (ABHR) dispensers shall be provided in the construction documents.
 - q. Where manufactured, generated or used in such a manner that the concentration and conditions create a fire or explosion hazard based on information prepared in accordance with Section 414.1.3.

© 2022 Shums Coda Associates, Inc

177

177

Footnote “a” control areas

- Definition of CONTROL AREA.

Spaces within a building where quantities of hazardous materials not exceeding the maximum allowable quantities per control area are stored, dispensed, used or handled. See also the definition of "Outdoor control area" in the IFC.



© 2022 Shums Coda Associates, Inc

178

178

footnote “e”; what makes an approved cabinet or can?

- Cabinets are allowed for liquids, solids, gas bottles
- Liquids in cabinets in IFC 5704.3.2
- Gas bottles in cabinets in IFC 5003.8.6



© 2022 Shums Coda Associates, Inc

179

179

Footnote “e”; what is a safety can?

- Safety Cans: IFC 5003.9.10
- Must be metal and meet UL 30 to increase amounts
- May be non-metallic and meet UL 1313 if not increasing amounts



© 2022 Shums Coda Associates, Inc

180

180

**Footnote “e”;
what is a day box?**

• DAY BOX.

A portable magazine designed to hold explosive materials and constructed in accordance with the requirements for a Type 3 magazine as defined and classified in Chapter 56 of the IFC.



© 2022 Shums Coda Associates, Inc

181

181

**Multiple hazards
307.8**

- Buildings and structures containing a material or materials representing hazards that are classified in one or more of Groups H-1, H-2, H-3 and H-4 shall conform to the code requirements for each of the occupancies so classified.
- Example: Anhydrous Ammonia
 - Flammable gas; H-2 if over exempt amounts
 - Corrosive so also H-4
- Requirements of both occupancies must be followed

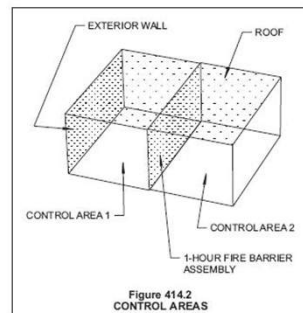
© 2022 Shums Coda Associates, Inc

182

182

**hazardous materials
414.2 control Areas**

- The control area can be the whole building, the whole floor or the whole room or rooms.
- Separated by fire barriers or horizontal assemblies
- Floors & supporting construction must be 2 hr rated
- Exceptions for 1 hr in Type IIA, IIIA, VA sprinkled buildings of 3 stories or less



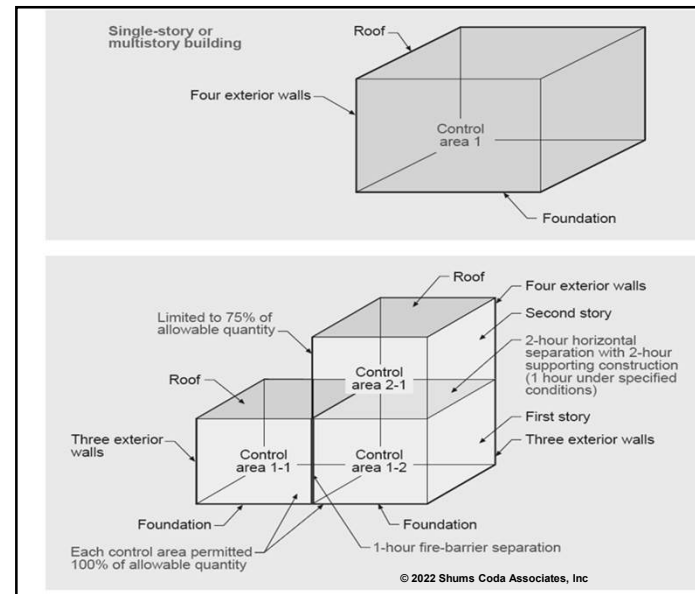
4-73

IBC Commentary

© 2022 Shums Coda Associates, Inc

183

183



© 2022 Shums Coda Associates, Inc

184

184

Construction Requirements

414.2.1

- Control areas shall be separated from each other by fire barriers or horizontal assemblies, or both.



© 2022 Shums Coda Associates, Inc

185

185

Control Areas

Table 414.2.2

[F] TABLE 414.2.2
DESIGN AND NUMBER OF CONTROL AREAS

STORY	PERCENTAGE OF THE MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA ^a	NUMBER OF CONTROL AREAS PER STORY	FIRE-RESISTANCE RATING FOR FIRE BARRIERS IN HOURS ^b
Above grade plane	Higher than 9	5	1
	7-9	5	2
	6	12.5	2
	5	12.5	2
	4	12.5	2
	3	50	2
Below grade plane	2	75	3
	1	100	4
	Lower than 2	Not Allowed	Not Allowed

a. Percentages shall be of the maximum allowable quantity per control area shown in Tables 307.1(1) and 307.1(2), with all increases allowed in the notes to those tables.
b. Separation shall include fire barriers and horizontal assemblies as necessary to provide separation from other portions of the building.

© 2022 Shums Coda Associates, Inc

186

186

414.2.3 Number

- The maximum number of control areas within a building shall be in accordance with Table 414.2.2.
- For the purposes of determining the number of control areas within a building, each portion of a building separated by one or more fire walls complying with Section 706 shall be considered a separate building.

© 2022 Shums Coda Associates, Inc

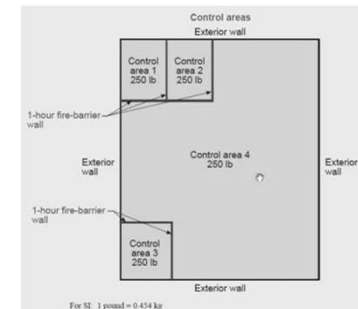
187

187

Fire Resistance Ratings

414.2.4

- The required fire-resistance rating for fire barriers shall be in accordance with Table 414.2.2. The floor assembly of the control area and the construction supporting the floor of the control area shall have a minimum 2-hour fire-resistance rating.



2009 IBC Handbook

© 2022 Shums Coda Associates, Inc

188

188

Fire Resistance Ratings

414.2.4

- Exceptions: The floor assembly of the control area and the construction supporting the floor of the control area are allowed to be 1-hour fire-resistance-rated in buildings of Types IIA, IIIA and VA construction, provided that both of the following conditions exist:
 - 1. The building is equipped throughout with an automatic sprinkler system in accordance NFPA 13; and
 - 2. The building is three stories or less above grade plane .

© 2022 Shums Coda Associates, Inc

189

189

Hazardous Materials in Groups M and S

414.2.5

- Hazardous materials located in Group M and Group S occupancies shall be in accordance with Sections 414.2.5.1 through 414.2.5.3.



© 2022 Shums Coda Associates, Inc

190

190

414.2.5.1 Nonflammable solids and nonflammable and noncombustible liquids

- The aggregate quantity of nonflammable solid and nonflammable or noncombustible liquid hazardous materials permitted within a single control area of a Group M display and storage area, a Group S storage area or an outdoor control area is permitted to exceed the maximum allowable quantities per control area specified in Tables 307.1(1) and 307.1(2) without classifying the building or use as a Group H occupancy, provided that the materials are displayed and stored in accordance with the IFC and quantities do not exceed the maximum allowable specified in Table 414.2.5(1).



© 2022 Shums Coda Associates, Inc

191

191

Hazardous Materials in Groups M and S 414.2.5

(F) TABLE 414.2.5(1)
MAXIMUM ALLOWABLE QUANTITY PER INDOOR AND OUTDOOR CONTROL AREA IN GROUP M AND S OCCUPANCIES
NONFLAMMABLE SOLIDS AND NONFLAMMABLE AND NONCOMBUSTIBLE LIQUIDS^{a, b, c}

Material ^a	Class	MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA	
		Solids pounds	Liquids gallons
A. Health-hazard materials—nonflammable and noncombustible solids and liquids			
1. Corrosives ^{b, c}	Not Applicable	9,750	975
2. Highly toxics	Not Applicable	20 ^c	2 ^c
3. Toxics ^{b, c}	Not Applicable	1,000	100
B. Physical-hazard materials—nonflammable and noncombustible solids and liquids			
1. Oxidizers ^{a, c}	4	Not Allowed	Not Allowed
	3	1,350 ^c	115
	2	2,250 ^c	225
	1	18,000 ^c	1,800 ^c
	4	Not Allowed	Not Allowed
2. Unstable (reactives) ^{b, c}	3	550	55
	2	1,150	115
	1	Not Limited	Not Limited
3. Water reactives	3 ^c	550	55
	2 ^c	1,150	115
	1	Not Limited	Not Limited

© 2022 Shums Coda Associates, Inc

192

192

414.2.5.2 Flammable and combustible liquids



- In Group M occupancy wholesale and retail sales uses, indoor storage of flammable and combustible liquids shall not exceed the maximum allowable quantities per control area as indicated in Table 414.2.5(2), provided that the materials are displayed and stored in accordance with the IFC.

© 2022 Shums Coda Associates, Inc

193

193

[F] TABLE 414.2.5(2)
MAXIMUM ALLOWABLE QUANTITY OF FLAMMABLE AND COMBUSTIBLE LIQUIDS IN WHOLESALE AND RETAIL SALES OCCUPANCIES PER CONTROL AREA*

TYPE OF LIQUID	MAXIMUM ALLOWABLE QUANTITY PER CONTROL AREA (gallons)		
	Sprinklered in accordance with note b densities and arrangements	Sprinklered in accordance with Tables 5704.3.6.3(4) through 5704.3.6.3(8) and 5704.3.7.5.1 of the International Fire Code	Nonsprinklered
Class IA	60	60	30
Class IB, IC, II and IIIA	7,500 ^a	15,000 ^a	1,600
Class IIIB	Unlimited	Unlimited	13,200

For SI: 1 foot = 304.8 mm, 1 square foot = 0.0929 m², 1 gallon = 3.785 L, 1 gallon per minute per square foot = 40.75 L/min/m².

a. Control areas shall be separated from each other by not less than a 1-hour fire barrier wall.

b. To be considered as sprinklered, a building shall be equipped throughout with an approved automatic sprinkler system with a design providing minimum densities as follows:

1. For uncartoned commodities on shelves 6 feet or less in height where the ceiling height does not exceed 18 feet, quantities are those permitted with a minimum sprinkler design density of Ordinary Hazard Group 2.

2. For cartoned, palletized or racked commodities where storage is 4 feet 6 inches or less in height and where the ceiling height does not exceed 18 feet, quantities are those permitted with a minimum sprinkler design density of 0.21 gallon per minute per square foot over the most remote 1,500-square-foot area.

c. Where wholesale and retail sales or storage areas exceed 50,000 square feet in area, the maximum allowable quantities are allowed to be increased by 2 percent for each 1,000 square feet of area in excess of 50,000 square feet, up to not more than 100 percent of the table amounts. A control area separation is not required. The cumulative amounts, including amounts attained by having an additional control area, shall not exceed 30,000 gallons.

© 2022 Shums Coda Associates, Inc

194

194

414.2.5.3 Aerosol products



- The maximum quantity of aerosol products, aerosol cooking spray products or plastic aerosol products in Group M occupancy retail display areas, storage areas adjacent to retail display areas and retail storage areas shall be in accordance with the International Fire Code.

© 2022 Shums Coda Associates, Inc

195

195

414.3 Ventilation.

- Rooms, areas or spaces in which explosive, corrosive, combustible, flammable or highly toxic dusts, mists, fumes, vapors or gases are or may be emitted due to the processing, use, handling or storage of materials shall be mechanically ventilated where required by this code, the IFC and the IMC.
- Emissions generated at workstations shall be confined to the area in which they are generated as specified in the IFC and the IMC.



© 2022 Shums Coda Associates, Inc

196

196

414.4 Hazardous material systems.

- Systems involving hazardous materials shall be suitable for the intended application.
- Controls shall be designed to prevent materials from entering or leaving process or reaction systems at other than the intended time, rate or path.
- Automatic controls, where provided, shall be designed to be fail safe.



© 2022 Shums Coda Associates, Inc

197

197

414.5 Inside storage, dispensing and use.

- The inside storage, dispensing and use of hazardous materials shall be in accordance with Sections 414.5.1 through 414.5.3 of this code and the IFC.



© 2022 Shums Coda Associates, Inc

198

198

Explosion control 414.5.1

- Explosion control shall be provided in accordance with the IFC as required by Table 414.5.1 where quantities of hazardous materials specified in that table exceed the maximum allowable quantities in Table 307.1(1)
- or where a structure, room or space is occupied for purposes involving explosion hazards as required by Section 415 or the IFC.



© 2022 Shums Coda Associates, Inc

199

199

explosion control cont'd. 414.5.1

[F] TABLE 414.5.1
EXPLOSION CONTROL REQUIREMENTS*

HAZARD CATEGORY	MATERIAL CLASS	EXPLOSION CONTROL METHODS	
		Barricade construction	Explosion (deflagration) venting or explosion (deflagration) prevention systems ^b
Combustible dusts ^a	—	Not Required	Required
Cryogenic flammables	—	Not Required	Required
Explosives	Division 1.1	Required	Not Required
	Division 1.2	Required	Not Required
	Division 1.3	Not Required	Required
	Division 1.4	Not Required	Required
	Division 1.5	Required	Not Required
	Division 1.6	Required	Not Required
Flammable gas	Gaseous	Not Required	Required
	Liquefied	Not Required	Required
Flammable liquid	IA ^b	Not Required	Required
	IB ^b	Not Required	Required
Organic peroxides	U	Required	Not Permitted
	I	Required	Not Permitted
Oxidizer liquids and solids	4	Required	Not Permitted
Pyrophoric gas	—	Not Required	Required
Unstable (reactive)	4	Required	Not Permitted
	3 Detonable 3 Handonorable	Required	Not Permitted
Water-reactive liquids and solids	3	Not Required	Required
	2 ^b	Not Required	Required
SPECIAL USES			
Acetylene generator rooms	—	Not Required	Required
Grain processing	—	Not Required	Required
Liquefied petroleum gas-distribution facilities	—	Not Required	Required
Where explosion hazards exist ^c	Detonation	Required	Not Permitted
	Deflagration	Not Required	Required

© 2022 Shums Coda Associates, Inc

200

200

explosion control cont'd.**414.5.1**

- Barricade Const.
- Per NFPA 69 or 495
- A structure made to withstand explosion and that is shielded by dirt mounds or natural hills or thick forests



© 2022 Shums Coda Associates, Inc

201

201

Standby or emergency power**414.5.2**

- Where required by the IFC or this code, mechanical ventilation, treatment systems, temperature control, alarm, detection or other electrically operated systems shall be provided with emergency or standby power in accordance with Section 2702.
- For storage and use areas for highly toxic or toxic materials, see Sections 6004.2.2.8 and 6004.3.4.2 of the IFC.



© 2022 Shums Coda Associates, Inc

202

202

Spill control, drainage and containment**414.5.3**

- Rooms, buildings or areas occupied for the storage of solid and liquid hazardous materials shall be provided with a means to control spillage and to contain or drain off spillage and fire protection water discharged in the storage area where required in the IFC.
- The methods of spill control shall be in accordance with the IFC.



© 2022 Shums Coda Associates, Inc

203

203

414.6 Outdoor storage, dispensing and use.

- The outdoor storage, dispensing and use of hazardous materials shall be in accordance with the IFC.




© 2022 Shums Coda Associates, Inc

204

204

Weather protection
414.6.1

- Where weather protection is provided for sheltering outdoor hazardous material storage or use areas, such areas shall be considered outdoor storage or use when the weather protection structure complies with Sections 414.6.1.1 through 414.6.1.3.




© 2022 Shums Coda Associates, Inc 205

205

Walls
414.6.1.1

- Walls shall not obstruct more than one side of the structure.
- Exception: Walls shall be permitted to obstruct portions of multiple sides of the structure, provided that the obstructed area does not exceed 25 percent of the structure's perimeter.




© 2022 Shums Coda Associates, Inc 206

206

Separation distance
414.6.1.2

- The distance from the structure to buildings, lot lines, public ways or means of egress to a public way shall not be less than the distance required for an outside hazardous material storage or use area without weather protection.




© 2022 Shums Coda Associates, Inc 207

207

Noncombustible construction
414.6.1.3

- The overhead structure shall be of approved noncombustible construction with a maximum area of 1,500 square feet.
- Exception: The increases permitted by Section 506 apply.



© 2022 Shums Coda Associates, Inc 208

208

SECTION 415**GROUPS H-1, H-2, H-3, H-4 & H-5**

- The provisions of Sections 415.1 through 415.11 shall apply to the storage and use of hazardous materials in excess of the maximum allowable quantities per control area listed in Section 307.1.
- Buildings and structures with an occupancy in Group H shall also comply with the applicable provisions of Section 414 and the IFC.



© 2022 Shums Coda Associates, Inc

209

209

Definitions

- **GAS CABINET.** A fully enclosed, noncombustible enclosure used to provide an isolated environment for compressed gas cylinders in storage or use. Doors and access ports for exchanging cylinders and accessing pressure-regulating controls are allowed to be included.



© 2022 Shums Coda Associates, Inc

210

210

Definitions Cont'd.

- **EXHAUSTED ENCLOSURE.** An appliance or piece of equipment that consists of a top, a back and two sides providing a means of local exhaust for capturing gases, fumes, vapors and mists. Such enclosures include laboratory hoods, exhaust fume hoods and similar appliances and equipment used to locally retain and exhaust the gases, fumes, vapors and mists that could be released.
- Rooms or areas provided with general ventilation, in themselves, are not exhausted enclosures.



© 2022 Shums Coda Associates, Inc

211

211

Definitions cont'd.

- **STORAGE, HAZARDOUS MATERIALS.**
 1. The keeping, retention or leaving of hazardous materials in closed containers, tanks, cylinders or similar vessels, or
 2. Vessels supplying operations through closed connections to the vessel.



Sodium Hypochlorite: a corrosive.
MAQ 500 gallons

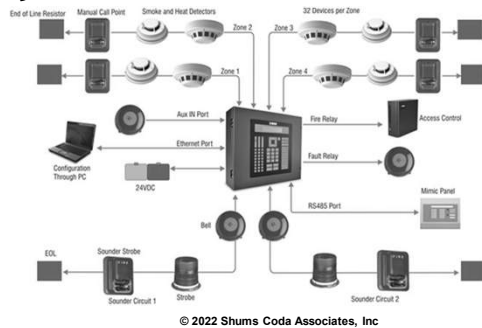
© 2022 Shums Coda Associates, Inc

212

212

415.3 Automatic fire detection systems

- Group H occupancies shall be provided with an automatic fire detection system in accordance with Section 907.2.



© 2022 Shums Coda Associates, Inc

213

213

415.4 Automatic sprinkler system

- Group H occupancies shall be equipped throughout with an automatic sprinkler system in accordance with Section 903.2.5.



© 2022 Shums Coda Associates, Inc

214

214

Emergency alarms 415.5

- Emergency alarms for the detection and notification of an emergency condition in Group H occupancies shall be provided as set forth herein.



© 2022 Shums Coda Associates, Inc

215

215

Storage 415.5.1

- An approved manual emergency alarm system shall be provided in buildings, rooms or areas used for storage of hazardous materials.
- Emergency alarm-initiating devices shall be installed outside of each interior exit or exit access door of storage buildings, rooms or areas.
- Activation of an emergency alarm-initiating device shall sound a local alarm to alert occupants of an emergency situation involving hazardous materials.



© 2022 Shums Coda Associates, Inc

216

216

Dispensing, use and handling

415.5.2

- Where hazardous materials having a hazard ranking of 3 or 4 in accordance with NFPA 704 are transported through corridors or exit enclosures, there shall be an emergency telephone system, a local manual alarm station or an approved alarm-initiating device at not more than 150-foot intervals and at each exit and exit access doorway throughout the transport route.
- The signal shall be relayed to an approved central, proprietary or remote station service or constantly attended on-site location and shall also initiate a local audible alarm.

© 2022 Shums Coda Associates, Inc

217

217

Supervision

414.5.3

- Emergency alarm systems required by Section 415.5.1 or 415.5.2 shall be electrically supervised and monitored by an approved central, proprietary or remote station service or shall initiate an audible and visual signal at a constantly attended on-site location.



© 2022 Shums Coda Associates, Inc

218

218

415.5.4

Emergency alarm systems



- Emergency alarm systems required by Section 415.5.1 or 415.5.2 shall be provided with emergency or standby power in accordance with Section 2702.2.

© 2022 Shums Coda Associates, Inc

219

219

Fire separation distance

415.6

- Group H occupancies shall be located on property in accordance with the other provisions of this chapter. In Groups H-2 and H-3, not less than 25 percent of the perimeter wall of the occupancy shall be an exterior wall .
- 415.6.1 Rooms for flammable or combustible liquid use, dispensing or mixing in open systems having a floor area of not more than 500 square feet need not be located on the outer perimeter of the building where they are in accordance with the IFC and NFPA 30.
- 415.6.2 Liquid storage rooms and rooms for flammable or combustible liquid use in closed systems, having a floor area of not more than 1,000 square feet (93 m²) need not be located on the outer perimeter where they are in accordance with the IFC and NFPA 30.
- 415.6.3 Spray paint booths that comply with the International Fire Code need not be located on the outer perimeter.

© 2022 Shums Coda Associates, Inc

220

220

415.6.1 Group H occupancy minimum fire separation distance.

- Regardless of any other provisions, buildings containing Group H occupancies shall be set back to the minimum fire separation distance as set forth in Sections 415.5.1.1 through 415.5.1.4.
- Distances shall be measured from the walls enclosing the occupancy to lot lines, including those on a public way.



© 2022 Shums Coda Associates, Inc

221

221

415.6.1 group H occupancy minimum fire sep. distance

- Distances to assumed lot lines established for the purpose of determining exterior wall and opening protection are not to be used to establish the minimum fire separation distance for buildings on sites where explosives are manufactured or used when separation is provided in accordance with the quantity distance tables specified for explosive materials in the IFC .



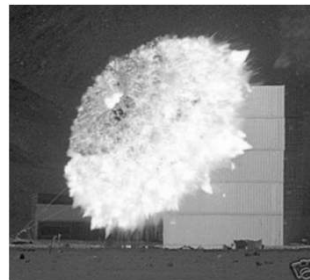
© 2022 Shums Coda Associates, Inc

222

222

415.6.1.1 group H-1 occupancy minimum fire sep. distance

- Not less than 75 feet and not less than required by the IFC .
- Exception:
 - Fireworks manufacturing buildings separated in accordance with NFPA 1124.



© 2022 Shums Coda Associates, Inc

223

223

415.6.1 group H occupancy minimum fire sep. distance

- Group H-2.
 - Not less than 30 feet where the area of the occupancy exceeds 1,000 square feet and it is not required to be located in a detached building.
- Groups H-2 and H-3.
 - Not less than 50 feet where a detached building is required (see Table 415.6.5).
- Explosive materials.
 - Group H-2 and H-3 occupancies containing materials with explosive characteristics shall be separated as required by the International Fire Code.
 - Where separations are not specified, the distances required shall be determined by a technical report issued in accordance with Section 414.1.3.

© 2022 Shums Coda Associates, Inc

224

224

**[F] TABLE 415.6.2
DETACHED BUILDING REQUIRED**

A DETACHED BUILDING IS REQUIRED WHEN THE QUANTITY OF MATERIAL EXCEEDS THAT LISTED HEREIN


Material	Class	Solids and Liquids (tons) ^{a, b}	Gases (cubic feet) ^{a, b}
Explosives	Division 1.1	Maximum Allowable Quantity	Not Applicable
	Division 1.2	Maximum Allowable Quantity	
	Division 1.3	Maximum Allowable Quantity	
	Division 1.4	Maximum Allowable Quantity	
	Division 1.4 ^c	1	
	Division 1.5 Division 1.6	Maximum Allowable Quantity Maximum Allowable Quantity	
Oxidizers	Class 4	Maximum Allowable Quantity	Maximum Allowable Quantity
Unstable (reactives) detonable	Class 3 or 4	Maximum Allowable Quantity	Maximum Allowable Quantity
Oxidizer, liquids and solids	Class 3	1,200	Not Applicable
	Class 2	2,000	Not Applicable
Organic peroxides	Detonable	Maximum Allowable Quantity	Not Applicable
	Class I	Maximum Allowable Quantity	Not Applicable
	Class II Class III	25 50	Not Applicable Not Applicable
Unstable (reactives) nondetonable	Class 3	1	2,000
	Class 2	25	10,000
Water reactives	Class 3	1	Not Applicable
	Class 2	25	Not Applicable
Pyrophoric gases	Not Applicable	Not Applicable	2,000

© 2022 Shums Coda Associates, Inc 225

225

415.6.2 Detached buildings for Group H-1, H-2 or H-3 occupancy.

- The storage or use of hazardous materials in excess of those amounts specified in Table 415.6.5 shall be in accordance with the applicable provisions of Sections 415.7 and 415.8.
- Where a detached building is required by Table 415.6.5, wall and opening protection based on fire separation distance is not required.



© 2022 Shums Coda Associates, Inc 226

226

415.7 Special provisions for Group H-1 occupancies.


- Located in buildings used for no other purpose
- No more than one story, & no basements
- No crawl spaces or other under floor spaces
- Roofs shall be lightweight const. and have thermal insulation to prevent sensitive material from reaching decomposition temp.
- Bldgs. containing materials that are both physical and health hazards and exceed MAQ shall meet requirements of both H1 & H4.

© 2022 Shums Coda Associates, Inc 227

227

415.7.1 Floors in H-1 storage rooms.

- Floors in storage areas for organic peroxides, pyrophoric materials and unstable (reactive) materials shall be of liquid-tight, noncombustible construction.



© 2022 Shums Coda Associates, Inc 228

228

415.8 Special provisions for Group H-2 and H-3 occupancies.

- Group H-2 and H-3 occupancies containing quantities of hazardous materials in excess of those set forth in Table 415.6.5 shall be in detached buildings used for manufacturing, processing, dispensing, use or storage of hazardous materials.
- Materials listed for Group H-1 occupancies in Section 307.3 are permitted to be located within Group H-2 or H-3 detached buildings provided the amount of materials per control area do not exceed the maximum allowed quantity specified in Table 307.1(1).



© 2022 Shums Coda Associates, Inc

229

229

415.8.1 Multiple hazards

- Group H-2 or H-3 occupancies containing materials that are in themselves both physical and health hazards in quantities exceeding the maximum allowable quantities per control area in Table 307.1(2) shall comply with requirements for Group H-2, H-3 or H-4 occupancies as applicable

© 2022 Shums Coda Associates, Inc

230

230

415.8.2 Separation of incompatible materials

- Hazardous materials other than those specified in Table 415.6.5 shall be allowed in manufacturing, processing, dispensing, use or storage areas when separated from incompatible materials in accordance with the provisions of the International Fire Code.

© 2022 Shums Coda Associates, Inc

231

231

415.8.3 Water Reactives

- Piping for conveying liquids shall not be over or through areas containing water reactives, unless isolated by approved liquid-tight construction.
- Exception: Fire protection piping shall be permitted over or through areas containing water reactives without isolating it with liquid-tight construction.



© 2022 Shums Coda Associates, Inc

232

232

415.8.4 Floors in storage rooms

- Floors in storage areas for organic peroxides, oxidizers, pyrophoric materials, unstable (reactive) materials and water-reactive solids and liquids shall be of liquid-tight, noncombustible construction.



© 2022 Shums Coda Associates, Inc

233

233

415.8.5 Waterproof room.

- Rooms or areas used for the storage of water-reactive solids and liquids shall be constructed in a manner that resists the penetration of water through the use of waterproof materials. Piping carrying water for other than approved automatic fire sprinkler systems shall not be within such rooms or areas.



© 2022 Shums Coda Associates, Inc

234

234

415.9 Group H-2.

- Occupancies in Group H-2 shall be constructed in accordance with Sections 415.9.1 through 415.9.3 and the IFC.



© 2022 Shums Coda Associates, Inc

235

235

415.9.1 Flammable and combustible liquids.

- The storage, handling, processing and transporting of flammable and combustible liquids in Groups H-2 and H-3 occupancies shall be in accordance with Sections 415.9.1.1 through 415.9.1.9, the IMC and the IFC.



© 2022 Shums Coda Associates, Inc

236

236

**415.9.1.1
Mixed occupancies.**

- Where the storage tank area is located in a building of two or more occupancies and the quantity of liquid exceeds the maximum allowable quantity for one control area, the use shall be completely separated from adjacent occupancies in accordance with the requirements of Section 508.4.



© 2022 Shums Coda Associates, Inc

237

237

**415.9.1.1.1
Height exception.**

- Where storage tanks are located within a building no more than one story above grade plane, the height limitation of Section 504 shall not apply for Group H.



© 2022 Shums Coda Associates, Inc

238

238

415.9.1.2 Tank protection.

- Storage tanks shall be noncombustible and protected from physical damage.
- Fire barriers or horizontal assemblies or both around the storage tank(s) shall be permitted as the method of protection from physical damage.



© 2022 Shums Coda Associates, Inc

239

239

415.9.1.3 Tanks.

- Storage tanks shall be approved tanks conforming to the requirements of the IFC.
- IFC 5704 covers tank storage provisions for flammable and combustible liquids



© 2022 Shums Coda Associates, Inc

240

240

415.9.1.4 Leakage containment.

- A liquid-tight containment area compatible with the stored liquid shall be provided. The method of spill control, drainage control and secondary containment shall be in accordance with the IFC .



© 2022 Shums Coda Associates, Inc

241

241

415.9.1.4 leakage containment.

- Exception:
 - Rooms where only double-wall storage tanks conforming to Section 415.9.1.3 are used to store Class I, II and IIIA flammable and combustible liquids shall not be required to have a leakage containment area.



© 2022 Shums Coda Associates, Inc

242

242

415.9.1.5 Leakage alarm.

- An approved automatic alarm shall be provided to indicate a leak in a storage tank and room.
- The alarm shall sound an audible signal, 15 dBA above the ambient sound level, at every point of entry into the room in which the leaking storage tank is located.
- An approved sign shall be posted on every entry door to the tank storage room
- Sign must indicate the potential hazard of the interior room or,
 - the sign shall state: **WARNING, WHEN ALARM SOUNDS, THE ENVIRONMENT WITHIN THE ROOM MAY BE HAZARDOUS.**
- The leakage alarm shall be supervised in accordance with Chapter 9 to transmit a trouble signal.

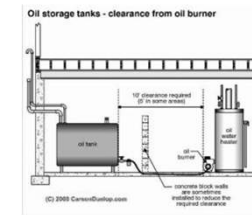
© 2022 Shums Coda Associates, Inc

243

243

415.9.1.6 Tank vent.

- Storage tank vents for Class I, II or IIIA liquids shall terminate to the outdoor air in accordance with the IFC.



© 2022 Shums Coda Associates, Inc

244

244

415.9.1.7 Room ventilation.

- Storage tank areas storing Class I, II or IIIA liquids shall be provided with mechanical ventilation. The mechanical ventilation system shall be in accordance with the IMC and the IFC .



© 2022 Shums Coda Associates, Inc

245

245

415.9.1.8 Explosion venting.

- Where Class I liquids are being stored, explosion venting shall be provided in accordance with the IFC.
- IFC 911 Explosion control.



© 2022 Shums Coda Associates, Inc

246

246

415.9.1.9 Tank openings other than vents.

- Tank openings other than vents from tanks inside buildings shall be designed to ensure that liquids or vapor concentrations are not released inside the building.



© 2022 Shums Coda Associates, Inc

247

247

415.9.2 Liquefied petroleum gas facilities.

- The construction and installation of liquefied petroleum gas facilities shall be in accordance with the requirements of this code, the IFC, the IMC , the International Fuel Gas Code and NFPA 58.



© 2022 Shums Coda Associates, Inc

248

248

415.9.3 Dry cleaning plants.

- The construction and installation of dry cleaning plants shall be in accordance with the requirements of this code, and
- the IMC,
- the IPC and NFPA 32.
- Dry cleaning solvents and systems shall be classified in accordance with the IFC .



© 2022 Shums Coda Associates, Inc

249

249

415.10 Groups H-3 and H-4.

- Groups H-3 and H-4 shall be constructed in accordance with the applicable provisions of this code and the IFC .



© 2022 Shums Coda Associates, Inc

250

250

415.10.1 Flammable and combustible liquids.

- The storage, handling, processing and transporting of flammable and combustible liquids in Group H-3 occupancies shall be in accordance with Section 415.9.1. (the same as it was for H2 and H3)



© 2022 Shums Coda Associates, Inc

251

251

415.10.2 Gas rooms.

- When gas rooms are provided, such rooms shall be separated from other areas by not less than 1-hour fire barriers or horizontal assemblies, or both.



© 2022 Shums Coda Associates, Inc

252

252

415.10.3 Floors in storage rooms.

- Floors in storage areas for corrosive liquids and highly toxic or toxic materials shall be of liquid-tight, noncombustible construction.



© 2022 Shums Coda Associates, Inc

253

253

415.10.4 Separation-highly toxic solids and liquids.

- Highly toxic solids and liquids not stored in approved hazardous materials storage cabinets shall be isolated from other hazardous materials storage by not less than 1-hour fire barriers or horizontal assemblies, or both.



© 2022 Shums Coda Associates, Inc

254

254

415.11 Group H-5

- In addition to the requirements set forth elsewhere in this code, Group H-5 shall comply with the provisions of Sections 415.11.1 through 415.11.11 and the IFC.



© 2022 Shums Coda Associates, Inc

255

255

"Shums Coda Associates, Inc." is a Registered Provider with *The American Institute of Architects Continuing Education Systems (AIA/CES)*. Credit(s) earned on completion of this program will be reported to *AIA/CES* for AIA members. Certificates of Completion for both AIA members and non-AIA members are available upon request.

This program is registered with *AIA/CES* for continuing professional education. As such, it does not include content that may be deemed or construed to be an approval or endorsement by the AIA of any material of construction or any method or manner of handling, using, distributing, or dealing in any material or product.

Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.



© 2022 Shums Coda Associates, Inc

256

256

Copyright Materials

This presentation is protected by US and International Copyright laws. Reproduction, distribution, display and use of the presentation without written permission of the speaker is prohibited.

© 2021 Shums Coda Associates, Inc.



© 2022 Shums Coda Associates, Inc

257

257

Steve Thomas Shums Coda Associates, Inc.

4610 S Ulster, Suite 150
Denver, CO 80237

Ph. 303-400-6564
Fax 303-693-0630

www.shumscoda.com
Steve.Thomas@shumscoda.com



© 2022 Shums Coda Associates, Inc

258

258