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Introduction

The Saudi Industrial Property Authority, in collaboration with the General Directorate of Civil Defense, purposes to clarify the preventive fire safety requirements that shall be followed within the industrial cities, to raise the safety level of factories and the related supporting services located within the industrial cities.

From this point of view, this guide’s purpose is to clarify the industrial safety and security requirements, the precautions that must be taken, and to ease the understanding of these requirements by the responsible authorities and employees of the industrial cities.

This guide includes important preventive requirements related to fire safety in buildings of different types and uses of such as offices, residential, mercantile, industrial, storages, and car parking areas located within the industrial cities. The requirements tackle mainly fire protection, fire alarm, and fire fighting issues related to each type of occupancies.

This guide includes also the minimum requirements related to life and fire safety necessary to reduce danger to life from the effects of fire without interfering with the daily operation of buildings and taking into account the panic caused by fire, by eliminating the causes of panic in emergency situations and facilitating the access of firefighters to the building, and considering the following important issues:

- The fire resistance of the building’s structural elements
- The occupant types and occupant load
- The occupancy classification

The following shall be noted:

- The guide is applicable on new buildings rather than existing buildings.
- The fire safety requirements for high rise buildings are not included in this guide. These requirements are included in Annex 1 of this guide.
- The publications, local regulations, local standards referenced in this guide are included in Annex 2 of this guide.
Executive Summary

This guide is issued to specify the technical requirements related to the industrial safety and security in industrial buildings and the related supporting services located within the industrial cities. It includes four chapters and three annexes.

Chapter one is related to the fire safety requirements for all building construction types, the fire department access roads, and site arrangements. It explains the methodology for the hazard classification of buildings, the requirements related to the fire resistance of the buildings’ structure, and the fire compartmentation. It includes samples of fire safety plans that shall be submitted as part of the permit file.

Chapter two is related to the requirements for firefighting and fire alarm systems, the classification of these systems and the related equipment, and the related method of installation depending on the fire classification of the building’s materials. It includes also the types and methods of installation of portable fire extinguishers and the types of firefighting systems appropriate for each fire class.

Chapter three is related to the requirements for means of egress and it is subdivided into five main sections: the means of egress, the stairs, the exit access corridors, the fire barriers and the smoke barriers.

Chapter four includes the fire safety requirements for buildings according to their occupancy uses which are classified in five occupancies: assembly, residential, business and mercantile, industrial in addition to storage and car parking. Each occupancy class is defined and the related requirements for fire compartmentation, means of egress, firefighting and fire alarm systems are set.

The annexes are related to the requirements of accessible means of egress related to disabled access persons, sample of fire and emergency evacuation plan, and fire safety requirements for high rise buildings.
The definitions contained in this section shall apply to the terms used in this guide. Where terms are not defined in this section, they shall be defined using their ordinary accepted meanings within their context.

**Area of Refuge**: An area that is either (1) a story in a building where the building is protected throughout by an approved, supervised automatic sprinkler system and has not less than two accessible rooms or spaces separated from each other by smoke-resisting partitions; or (2) a space located in a path of travel leading to a public way that is protected from the effects of fire, either by means of separation from other spaces in the same building or by virtue of location, thereby permitting a delay in egress travel from any level.

**Automatic sprinkler system with partial coverage**: Automatic sprinkler system which is not covering part or parts of the building.

**Basement**: Underground story.

**Building no hazard content**: Building with low hazard content such as the storage of non combustible materials.

**Building with low hazard content**: Building with low hazard content shall be classified as those of such low combustibility that no self-propagating fire therein can occur such as the storage of non combustible materials.

**Common path of travel**: The portion of exit access that must be traversed before two separate and distinct paths of travel to two exits are available.

**Fire Barrier**: A continuous membrane or a membrane with discontinuities created by protected openings with a specified fire protection rating, where such membrane is designed and constructed with a specified fire resistance rating to limit the spread of fire, that also restricts the movement of smoke.

**High Hazard Areas**: Area containing high hazard materials.

**High Hazard Materials**: High hazard materials shall be classified as those that are likely to burn with extreme rapidity or from which explosions are likely to occur.

**Highrise buildings**: A building where the floor of an occupiable story is greater than 23m above the lowest level of fire department vehicle access.

**Horizontal Evacuation Areas**: An area within the building that is enclosed by fire barriers.

**Hotel transient**: Transients are those who occupy accommodations for less than 30 days.

**Main corridor**: Main exit access corridors.

**Means of Egress**: A continuous and unobstructed way of travel from any point in a building or structure to a public way consisting of exit doors, exit access corridors, horizontal exits, exit stairs, and ramps.
**Definitions**

**Mezzanine area limitations:** The aggregate area of mezzanines located within a room shall not exceed one-third the open area of the room in which the mezzanines are located. Enclosed space shall not be included in a determination of the size of the room in which the mezzanine is located.

**Mixed Occupancy:** A multiple occupancy where the occupancies are intermingled. The building shall comply with the most restrictive requirements of the occupancies involved.

**Multiple Occupancy:** A building or structure in which two or more classes of occupancy exist.

**Residential investment building:** Apartments Hotel

**Secondary corridors:** the first part of the means of egress leading the main corridor in order to reach the exit.

**Separated Occupancy:** A multiple occupancy where the occupancies are separated by fire resistance-rated assemblies.

**Smoke Barrier:** A continuous membrane, or a membrane with discontinuities created by protected openings, where such membrane is designed and constructed to restrict the movement of smoke.
General Requirements for Fire Protection for Buildings Structures
Chapter 1: General Requirements for Fire Protection for Buildings Structures

1.1 Principles of Fire Protection in Buildings and Structures ...................................................... 19
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1.1 Principles of Fire Protection in Buildings and Structures

The minimum fire protection requirements shall be provided in buildings and structures as per the below:

- The building’s structure shall be designed to control fire, smoke, gas leak and panic risks on the building occupants. The structure should facilitate emergency evacuation of occupants.

- The fire resistance of the building structure is reliant on the time of occupant’s evacuation from the building in case of emergency.

- The minimum number and capacity of means of egress (emergency exits) are provided for each building and structure without considering the passages located within the building that are used for fire fighting.

- Horizontal fire evacuation areas are protected from smoke or gas leaks coming from other parts of the building. These areas are intended to provide protection and relatively safe places until the end of the emergency.

- The means of egress shall be impeded, and the doors opening direction shall be adequate to the egress direction.

- Marking of exits and means of egress is ensured.

- The proper firefighting systems are ensured.

- The appropriate lighting, emergency lighting systems supplied from an emergency power supply system (generator), and the appropriate fire alarm system shall be ensured.
1.2 Buildings and Structures Hazard Content Classification

The hazard of contents of any building or structures shall be classified as low, medium, or high in accordance with Table 1.

**Table 1:**

<table>
<thead>
<tr>
<th>Hazard Classification</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low Hazard</td>
<td>Low hazard contents shall be classified as those of such low combustibility that no selfpropagating fire therein can occur for example storage of non combustible materials</td>
</tr>
<tr>
<td>Medium Hazard</td>
<td>Medium hazard contents shall be classified as those that are likely to burn with moderate rapidity or to give off a considerable volume of smoke. These are ordinary contents that can be found in most of the buildings</td>
</tr>
<tr>
<td>High Hazard</td>
<td>High hazard contents shall be classified as those that are likely to burn with extreme rapidity or from which explosions are likely to occur. High hazard contents are mainly found in occupancies where flammable liquids are handled or used or are stored under conditions involving possible release of flammable vapors; where grain dust, wood flour or plastic dust, aluminum or magnesium dust, or other explosive dusts are produced; where hazardous chemicals or explosives are manufactured, stored, or handled; where materials are processed or handled under conditions producing flammable flyings; and other situations of similar hazard</td>
</tr>
</tbody>
</table>

The fire-resistive properties of building materials are determined by fire test methods as per the following:

- NFPA 255 Standard Method of Test of Surface Burning Characteristics of Building Materials

Protection from any area having a degree of hazard greater than that normal to the general occupancy of the building or structure shall be provided by one of the following means:

- Enclosing the area with a fire barrier without windows that has a 1-hour fire resistance rating
- Protecting the area with automatic extinguishing systems
- Applying both (1) and (2) where the hazard is severe

When submitting the site and other plans to
1.3 Site Arrangement and Fire Protection Requirements

obtain the authorities’ approval, the building
construction code shall be respected and
the following points shall be specified: the
location of the project, the location and uses
of the neighboring buildings, and the site’s
surrounding streets. The easy access of the civil
defense vehicles and equipment to the nearest
point of the construction shall be considered.
The below shall be considered for multiple
buildings project– such as residential complex:

▪ The provision of adequate internal roads
▪ The provision of easy access for civil defense
  vehicles and equipment
▪ The provision of adequate vehicles entrances
  and exits

Water tanks used exclusively for firefighting
shall be provided.

▪ The capacity of these water tanks shall be
designed as per the firefighting system
standards for each building. For example,
NFPA13 for the automatic sprinkler system;
NFPA14 for the standpipe and hose systems;
NFPA 22 for water tanks for private fire
protection.
▪ Fire hydrant shall be provided around the
buildings.
▪ The design and installation of the fire
pumps shall be in accordance with a specific
standard for example NFPA20 standard for
the installation of stationary pumps for fire
protection
▪ 20% of the plot area of the industrial zones
shall be provided for the use of fire protection
operation, and this shall be coordinated and
approved by the civil defense by construction
of natural separation between buildings of
the same plot (square one) or between the
buildings of the same plot and the buildings
of the neighboring plots.
▪ Fire department access roads shall be
provided to facilitate the access for the civil
defense vehicles and equipment to reach the
required distance from the building
1.4 Requirements for Fire Department Vehicles Access Roads

The fire department access roads shall meet the following:

- Adequate access roads shall be provided for the civil defense vehicles and equipment to the required distance from the building.
- The minimum width of the fire department access roads is 6m without obstructions.
- Adequate vehicles maneuvering areas shall be provided having a diameter of no less than 18m (refer to figures 1 and 2).
- The height of the roads entrance and doors shall be a minimum of 4.5m.
- The roads and manholes covers shall be designed to resist the load of the civil defense vehicles and equipment.
- The roads and the infrastructure works shall be designed to resist the load of the fire department vehicles and equipment. Unless otherwise required by the civil defense department, the following load mentioned here below could be used for the roads and infrastructure works design.
- The vehicle load is considered to be 130 kN on 4.5m between front and rear axels (40 kN on the front axel and 90 kN on the rear axel).
- The punching shear resistance for the fire department access roads used by the fire trucks with ladders shall be considered for 100 kN on a circular area having 20m diameter.

SU: Single unit
P: Path of Vehicle

Figure 1: Examples of civil defense Vehicles Maneuvering and turning areas (AASHTO- 6th Edition 2011)
Figure 2: Alternatives to civil defense vehicles maneuvering and turning areas (for a length of 12m)
1.5 Requirements for Civil Defense Buildings Access Roads

The distance between the building’s limit and the nearest point that must be reached by the civil defense vehicles depending on the type and size of the building is as follows:

▪ In buildings protected by dry standpipe system, the distance from the entrance of the exit stair containing the dry standpipe system is not more than 17m.

▪ In buildings protected by wet standpipe system, the distance from the entrance of the exit stair containing the wet standpipe system is not more than 17m.

▪ In buildings of more than two stories, and having low hazard contents, fire department access roads shall be provided such that any portion of the facility or any portion of an exterior wall of the ground floor of the building is located not more than 46m from fire department access roads. When buildings are protected throughout with automatic sprinkler system the distance shall be permitted to be increased to 137m.

▪ In non industrial buildings having 3 to 4 stories and having an area of more than 139m², the distance shall not exceed 28m from any point of the ground floor.

▪ For industrial buildings, the civil defense vehicles must reach 5-6m along the building’s facade length. However, if the height of the building is more than the height mentioned in this section, the civil defense vehicles must reach 5-6m along the length of two or more facades according to the type of fire hazard and the civil defense assessment.

▪ The length of the civil defense vehicles access roads shall not be more than 46m if the road has a dead end; the civil defense approval shall be considered in case this length is exceeded.
1.6 Design Requirements

- The building shall be designed to provide the appropriate means and capabilities to facilitate the civil defense access to the building for the firefighting and rescue operation.
- No barriers and obstacles shall be installed on the exterior windows above the ground floor of the building unless they can be easily opened and approved by the Civil Defense.
- The following requirements shall be considered for the design and installation of the firefighting equipment used by the civil defense such as the landing valves, the siamese connections at the ground floor:
  - They shall be provided at clear locations easily accessible to the civil defense with impediments.
  - They shall be remote from the fire hazard, glass, scattered materials in construction and other hazards types.
  - Readily visible and clear Marking signs shall be provided.
  - The technical and particular specifications and standards shall be followed for the installation of the firefighting systems and equipment.
- Siamese connections for civil defense use shall be clearly located and visible from the nearest point of the fire department access road or from the building’s road side.
- Connections of the Civil Defense departments shall be placed and arranged so that the hose systems can be connected to the network’s pumping lower points without interference of nearby objects, including buildings, fences, columns, landscaping, car, or other connections of the civil defense departments.
- If the site area is more than 5000m², a second emergency entrance shall be ensured from the site’s outer fence in order to ease the access of the civil defense vehicles.
- A guide framed plan shall be installed at the main entrance of the building, the plan shall include the information related to the fire safety of the building to ease the fire fighters operation.
- The siamese connections shall be installed at a height between 457mm and 1219mm from the last floor level or side walk.
- Siamese connections shall be marked by signs having characters of not less than 2.5cm height, and another sign showing the necessary pressure at the pumping points necessary for the firefighting system.
- The design and installation of the stand pipes and hose system shall be in accordance with international standards especially <<NFPA14 Standard for the Installation of Standpipe and Hose Systems>>.
1.7 Fire Safety Plans

- The ground floor plans shall include the location of the building connection to the main public network.
- Floor explanatory plans shall be provided and include the following:
  - Fire compartments
  - Exits
  - Locations of the special hazard content rooms

*Figure 3:* Sample of the fire safety plans for “Pain d’Or” manufacture in Riyadh.
Figure 4: Sample of fire safety plan "King Abdallah Financial Center"
1.8 First Aid Signage Method

- Illustrated signage shall be provided to specify the first aid case for the industrial accidents
- Emergency plan shall be submitted to the authority having jurisdiction inclusive of the below:
  - Procedures for reporting of emergencies
  - Occupant and staff response to emergencies
  - Evacuation procedures appropriate to the building, its occupancy, emergencies, and hazards
- Appropriateness of the use of elevators
- Design and conduct of fire drills
- Type and coverage of building fire protection systems
- Other items required by the civil defense

A sample of fire and emergency evacuation plan is enclosed in Annex 2 of this guide.

**Figure 5:** Sample of evacuation plans including definitions of some annotations
1.9 Requirements for Fire Resistance of the Building Structure

Scope
The fire resistance requirements of the building structure is aimed to ensure the safety of the building structure from fire hazard in a way to be resistant to collapse during fire for an adequate time necessary for the building occupants evacuation and for the firefighting and fire control operations within the lesser compartmented area of the building, and to prevent the fire transmission to the neighboring construction.

Classification of buildings’ structure in terms of fire resistance
The buildings are classified in terms of fire resistance of the structure as per Table 2 here below:

Type I and Type II
Buildings of Type I (442) or (332) and Type II (222) or (1111) or (000) have fire barriers, structural elements, walls, arches, slabs, roofs constructed of non combustible or limited combustible materials.

Type III
Buildings of Type III (211 or 200) shall have exterior walls and structural elements that are parts of exterior walls made from noncombustible or limited-combustible materials; while fire walls, interior structural elements, walls, arches, floors, and roofs are entirely or partially of wood of smaller dimensions than required for Type IV construction is of noncombustible, limited-combustible, or other combustible materials.

Type IV
Type IV (2HH) construction with fire walls, exterior walls, interior bearing walls and structural elements that are parts of such be made of noncombustible or limited combustible materials. Other interior structural elements, arches, floors, and roofs shall be of solid or laminated wood without concealed spaces.

Type V
Type V (111 or 000) construction with structural elements, walls, arches, floors, and roofs made of entirely or partially of wood or other approved material.
## Table 2:
Fire Resistance Ratings for Type I through Type V construction (hours)

<table>
<thead>
<tr>
<th></th>
<th>Type I</th>
<th>Type II</th>
<th>Type III</th>
<th>Type IV</th>
<th>Type V</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>442</td>
<td>332</td>
<td>222</td>
<td>000</td>
<td>200</td>
</tr>
<tr>
<td><strong>Exterior Bearing Walls</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supporting more than one floor, columns, or other bearing walls</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Supporting one floor only</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Supporting a roof only</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td><strong>Internal Bearing Walls</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supporting more than one floor, columns, or other bearing walls</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Supporting one floor only</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Supporting a roof only</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td><strong>Columns</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supporting more than one floor, columns, or other bearing walls</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Supporting one floor only</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Supporting a roof only</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td><strong>Beams, Griders, Trusses, and Arches</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supporting more than one floor, columns, or other bearing walls</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Supporting one floor only</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Supporting a roof only</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td><strong>Floor-Ceiling Assemblies</strong></td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td><strong>Roof-Ceiling Assemblies</strong></td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1/2</td>
<td>1</td>
</tr>
<tr>
<td><strong>Interior Nonbearing Walls</strong></td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Exterior Nonbearing Walls</strong></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

H: heavy timber members
The heights permitted according to the type of building and protection level

The allowable building heights depend on the building's construction type and occupancy use. Table 3 specifies the allowable heights and areas depending on the building type and required level of protection for buildings protected by an approved, supervised automatic sprinkler system as per the NFPA 13 standard. It is to be noted that the protection level indicated in Table 3 is related to the hazard content classification.

**High Hazard Level 1 Contents**
High hazard Level 1 contents shall include materials that present a detonation hazard including, but not limited to, the following:

- Explosives
- Unclassified detonable organic peroxides
- Class 4 oxidizers
- Detonable pyrophoric materials
- Class 3 detonable and Class 4 unstable (reactive) materials

**High Hazard Level 2 Contents**
High hazard Level 2 contents shall include materials that present a deflagration hazard or a hazard from accelerated burning including, but not limited to, the following:

- Class I, Class II, or Class III-A flammable or combustible liquids that are used or stored in normally open containers or systems, or in closed containers or systems at gauge pressures of more than 15 psi (103 kPa)
- Combustible dusts stored, used, or generated in a manner creating a severe fire or explosion hazard
- Flammable gases and flammable cryogenic liquids
- Class I organic peroxides
- Class 3 solid or liquid oxidizers that are used or stored in normally open containers or systems, or in closed containers or systems at gauge pressures of more than 15 psi (103 kPa)
- Nondetonable pyrophoric materials
- Class 3 nondetonable unstable (reactive) materials
- Class 3 water-reactive materials

**High Hazard Level 3 Contents**
High hazard Level 3 contents shall include materials that readily support combustion or present a physical hazard including, but not limited to, the following:

- Level 2 and Level 3 aerosols
- Class I, Class II, or Class III-A flammable or combustible liquids that are used or stored in normally closed containers or systems at gauge pressures of less than 15 psi (103 kPa)
- Consumer Fireworks, 1.4 G
- Flammable solids, other than dusts classified as high hazard Level 2, stored, used, or generated in a manner creating a high fire hazard
- Class II and Class III organic peroxides
- Class 2 solid or liquid oxidizers
- Class 3 solid or liquid oxidizers that are used or stored in normally closed containers or systems at gauge pressures of less than 15 psi (103 kPa)
- Oxidizing gases and oxidizing cryogenic liquids
- Class 2 unstable (reactive) materials
- Class 2 water-reactive materials

**High Hazard Level 4 Contents**

High hazard Level 4 contents shall include materials that are acute health hazards including, but not limited to, the following:

- Corrosives
- Highly toxic materials
- Toxic materials

**High Hazard Level 5 Contents**

High hazard Level 5 contents shall include hazardous production materials (HPM) used in the fabrication of semiconductors or semiconductor research and development.
## Table 3:
Allowable Building Height and Area

<table>
<thead>
<tr>
<th>Construction Type</th>
<th>Type I</th>
<th>Type II</th>
<th>Type II</th>
<th>Type IV</th>
<th>Type V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum building height (ft)</td>
<td>UL</td>
<td>UL</td>
<td>126</td>
<td>120</td>
<td>54</td>
</tr>
</tbody>
</table>

### Occupancy

| Assembly > 1000 | UL | 4 | UL | 4 | 12 | 4 | 3 | 2 | 1 | NP | 3 | 2 | NP | NP | 3 | 2 | 3 | 2 | NP |
| Assembly > 300 | UL | 4 | UL | 4 | 12 | 4 | 4 | 3 | 2 | 1 | 4 | 2 | 1 | 1 | 4 | 2 | 4 | 2 | 1 | 1 |
| Assembly ≤ 300 | UL | 7 | UL | 7 | 12 | 7 | 4 | 3 | 2 | 1 | 4 | 3 | 2 | 1 | 4 | 3 | 4 | 3 | 2 | 1 |
| Assembly, outdoor | UL | UL | UL | UL | UL | UL | UL | UL | UL | 4 | 3 | 2 | 4 | 3 | 3 | 2 | 2 | 2 | 1 |
| Business | UL | UL | UL | 12 | 11 | 6 | 5 | 5 | 4 | 6 | 5 | 5 | 4 | 6 | 5 | 4 | 3 | 3 | 2 |
| Industrial, ordinary hazard | UL | UL | UL | UL | 12 | 11 | 5 | 4 | 3 | 2 | 5 | 4 | 3 | 2 | 5 | 4 | 3 | 2 | 1 |
| Industrial, low hazard | UL | UL | UL | 12 | 11 | 6 | 5 | 4 | 3 | 5 | 4 | 4 | 3 | 6 | 5 | 4 | 3 | 3 | 2 |
| Mercantile | UL | UL | UL | 12 | 11 | 5 | 4 | 4 | 5 | 5 | 4 | 5 | 4 | 5 | 4 | 4 | 3 | 2 | 1 |
| Residential | UL | UL | UL | 12 | 11 | 5 | 4 | 4 | 5 | 5 | 4 | 5 | 4 | 5 | 4 | 4 | 3 | 3 | 2 |
| Storage, ordinary hazard | UL | UL | UL | 12 | 11 | 5 | 4 | 4 | 3 | 5 | 4 | 3 | 3 | 5 | 4 | 4 | 3 | 2 | 1 |
| Storage, low hazard | UL | UL | UL | 12 | 11 | 6 | 5 | 5 | 4 | 6 | 5 | 5 | 4 | 6 | 5 | 5 | 4 | 3 | 2 |

S: Allowable building height in meter and allowable number of stories in buildings protected with an automatic sprinkler system
N: Allowable building height in meter and allowable number of stories in buildings not protected with an automatic sprinkler system
UL: unlimited
NP: not permitted

Note: within each occupancy category and protection level, the top row refers to the allowable number of stories, and the bottom row refers to the allowable area per story.

Continued on the next page
### Allowable Building Height and Area

<table>
<thead>
<tr>
<th>Construction Type</th>
<th>Type I</th>
<th>Type II</th>
<th>Type II</th>
<th>Type IV</th>
<th>Type V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum building height (ft)</td>
<td>UL UL 126 120</td>
<td>54 48 25 19 22 16</td>
<td>19 22 16</td>
<td>25 19</td>
<td>15 18 12</td>
</tr>
</tbody>
</table>

### High Hazard Contents

<table>
<thead>
<tr>
<th>Protection Level 1</th>
<th>Protection Level 2</th>
<th>Protection Level 3</th>
<th>Protection Level 4</th>
<th>Protection Level 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 NP 1 NP 1 NP 1 NP 1 NP 1 NP 1 NP 1 NP 1 NP</td>
<td>1 NP 1 NP 1 NP 1 NP 1 NP 1 NP 1 NP 1 NP 1 NP</td>
<td>1 NP 1 NP 1 NP 1 NP 1 NP 1 NP 1 NP 1 NP 1 NP</td>
<td>1 NP 1 NP 1 NP 1 NP 1 NP 1 NP 1 NP 1 NP 1 NP</td>
<td>1 NP 1 NP 1 NP 1 NP 1 NP 1 NP 1 NP 1 NP 1 NP</td>
</tr>
<tr>
<td>1953 1953 1534 1023 651</td>
<td>883 651 976 697</td>
<td>279</td>
<td>465</td>
<td></td>
</tr>
</tbody>
</table>

**Use values for appropriate occupancy class. For industrial or storage occupancies, use values for ordinary hazard.**

---

*S*: Allowable building height in meter and allowable number of stories in buildings protected with an automatic sprinkler system.

*N*: Allowable building height in meter and allowable number of stories in buildings not protected with an automatic sprinkler system.

**UL**: Unlimited.

**NP**: Not permitted.

**Note**: within each occupancy category and protection level, the top row refers to the allowable number of stories, and the bottom row refers to the allowable area per story.
In order to control the fire in the smaller compartmented space as possible and to prevent its spread within the same building or to neighboring buildings, the following preventive requirements to reduce the spread of fire shall be met:

- The building or the floor shall be subdivided onto separated compartments i.e. compartments that prevent the spread of fire. Each fire compartment shall be separated by fire rated doors that prevent the transfer of smoke and close automatically in case of fire.
- The separation between the building's fire compartments shall be by fire barriers (walls, partitions, doors) having the same fire resistance rating of the building construction type indicated in Table 3.
- The area or volume of a fire compartment shall not exceed the permitted limit indicated in Table 4 “Subdivision of the building to separate fire compartment.”
Table 4:

<table>
<thead>
<tr>
<th>Use</th>
<th>Permitted Maximum</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industrial Constructions with high hazard content</td>
<td>1000</td>
<td>Facilities for manufacturing, assembling or production of combustible, explosive materials, or materials with toxic gas release</td>
</tr>
<tr>
<td>Professions workshops with medium hazard content</td>
<td>5000</td>
<td>Facilities for manufacturing, assembling or production of noncombustible materials or repair workshops</td>
</tr>
<tr>
<td>Storage A – Low hazard content</td>
<td>5000</td>
<td>Storage areas for noncombustible materials</td>
</tr>
<tr>
<td>Storage B – medium hazard content</td>
<td>3000</td>
<td>Storage areas for noncombustible or combustible materials packed using combustible packaging materials</td>
</tr>
<tr>
<td>Storage C – High hazard content</td>
<td>1000</td>
<td>Storage areas for high hazard materials</td>
</tr>
</tbody>
</table>

Apart from the buildings fire compartment areas indicated in Table 4, the following occupancies shall be considered as independent fire compartments:

- Occupancy having a distinct occupancy from the building main use.
- The vertical opening in buildings such as the stair, shafts.
- Means of egress from the building, such as lobby, protected exit stair, exit access corridor.

- Special Hazard content areas such as the combustible liquid storage areas.
- The construction adjacent to the neighboring plot is considered a fire barrier.
- If the building is used for different uses, the sections dedicated for each use is considered as fire compartment whatever its area.
1.11 Control of External Fire Spread Between Buildings

To prevent the external fire spread between buildings, a minimum separation distance shall be ensured between buildings depending on the external wall conditions, the area of the related openings, and the type of external wall cladding. Table 5 specifies the minimum separation distance required between buildings and the plot limits while Table 6 specifies the fire resistance of the building’s structural elements. The critical radiant flux of the construction materials is classified in Table 7.

### Table 5:
The separation distance required between the building and the plot limits depending on the building height and area of the facades openings

<table>
<thead>
<tr>
<th>Percentage of the façade openings area to the total façade area</th>
<th>Building Height in meter</th>
<th>Distance in Meters</th>
</tr>
</thead>
<tbody>
<tr>
<td>zero</td>
<td>More than 8</td>
<td>No requirements</td>
</tr>
<tr>
<td>1 – 50%</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>50 - 100%</td>
<td></td>
<td>7.5</td>
</tr>
</tbody>
</table>

### Table 6:
Fire resistance required for the building structure

<table>
<thead>
<tr>
<th>Structural elements</th>
<th>Residential and commercial buildings with multiple floors</th>
<th>Industrial warehouses</th>
<th>buildings and</th>
</tr>
</thead>
<tbody>
<tr>
<td>Columns, beams and slabs</td>
<td>2 hours</td>
<td>4 hours</td>
<td></td>
</tr>
<tr>
<td>Internal walls and internal separations</td>
<td>2 hours</td>
<td>4 hours</td>
<td></td>
</tr>
<tr>
<td>The walls separating the means of egress including the exit stair, the elevator hoist, shaft, horizontal and vertical utilities shafts and others</td>
<td>2 hours</td>
<td>4 hours</td>
<td></td>
</tr>
</tbody>
</table>

**Note:**
The fire resistance of the columns and beams could be raised according to the civil defense requirements in case the building has several uses, the fire resistance of the most hazardous occupancy shall be implemented.
Reference: Safety and Security requirements in Gulf Cooperation Council

According to the NFPA 101, the Critical Radiant Flux is the level of incident radiant heat energy on a floor-covering system at the most distant flameout point. Knowing that the Interior floor finishes shall be classified based on test results from NFPA 253, Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source, or ASTM E 6481, Standard Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source.

The external non-load bearing wall assemblies containing combustible components are to be evaluated as per the NFPA 285, “Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components”.

**Table 7:**

<table>
<thead>
<tr>
<th>Type</th>
<th>Minimum Critical Radiant Flux</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.45 w/cm²</td>
</tr>
<tr>
<td>2</td>
<td>0.22 w/cm²</td>
</tr>
</tbody>
</table>

1. ASTME: American society for testing and materials (ATME), standard test for critical radiant flux of floor-covering systems using a radiant heat energy source.
1.12 Requirements for Buildings Fire Resistance Depending on the Construction Type

**Metallic steel structure**
When the building structural elements are made of metallic structure, this structure shall be treated depending on the required fire resistance rating of the structure necessary to protect the building from collapse due to fire, and the treatment shall be in accordance with the following requirements;

**Jacketing**
The jacketing of the columns by reinforced concrete section shall be based on the thickness and jacketing information given by the civil defense depending on the fire resistance rating of the structure.

**Enclosing**
The metallic structural element is enclosed by listed fire resistant panel. The method of enclosure shall be in accordance with the civil defense requirements.

**Coating**
Coating of the metallic structural elements shall be by fire-resistant materials, these materials are in form of film that is applied either by spraying or coating.

The three methods of metallic steel structure fire protection mentioned here above shall be according to the known engineering rules, and to the requirement of the bodies accredited by the civil defense.

**Plastic Materials**
The plastic materials shall be controlled in a way to reduce the severity of their fire hazard as per the following requirements depending on the type of plastic materials:

**Type I: Plastic materials with porosity**
These materials are classified in terms of their formation into two main types:

a. **Hard panel board:** such as polystyrene, polyurethane used for insulation and other works.

b. **Flexible panel boards:** such as spongy materials like polyethylene, which is used in the decoration and other works.

Fire retardant materials shall be added to the manufacturing mix of these plastic materials used in building in order to improve the fire rating of these materials.

The plastic materials shall be chosen as per specific standards such as the following NFPA standards:

- NFPA 275 Standard Method of Fire Tests for the Evaluation of Thermal Barriers
- NFPA 257 Standard on Fire Test for Window and Glass Block Assemblies
- NFPA 255 Standard Method of Test of Surface Burning Characteristics of Building Materials

**Remark:**
The technical specification for Standard for Fire Retardant−Treated Wood and Fire-Retardant Coatings for Building Materials conform to a specific standard such as NFPA703.
Type II: Hard plastic materials

The hard plastic materials are used as colored or transparent panel boards for covering the lighting openings, domes, skylights or other covers. This type of plastic materials is permitted to be used as per the following conditions:

- It is permitted to be used as insert materials having thickness not more than 10 cm between double wall of concrete masonry blocks having a minimum thickness of 5 cm provided that the void is filled by concrete of not less than 5 cm thickness as part of the construction system of the internal partitions and of roof cover.
- It is permitted to be used as insert materials within the non-fire rated doors provided that its thickness is not more than 5 cm.

The plastic materials are permitted to be used in interior of the building, either for thermal insulation or as inserts within the internal partitions as per the following conditions.

- The separation between the building’s compartment by fire barriers (walls, panels boards, doors) having the same fire resistance rating of the structure indicated in Table 2.
- The floor area shall not exceed 200 m² or the fire barrier area shall not exceed 100 m².
- The floor area shall be subdivided into compartments having an area of not more than 200 m². If the floor area is more than 200 m², the compartment shall be separated by fire rated doors.
- The thickness of the plastic materials used for thermal insulation is not more than 5 cm.
The General Requirements For Firefighting and Fire Alarm Systems
Chapter 2: The General Requirements For Firefighting and Fire Alarm Systems

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    Manual fire alarm systems ...........................................................................................................57
    Automatic fire alarm systems .......................................................................................................57
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2.1 Scope

The buildings and facilities shall be provided by firefighting, fire protection and fire alarm systems in order to protect the buildings and their occupants from fire hazards, by initiating an early alarm system in order to evacuate the building’s occupant and to control the spread of fire primarily by the trained personnel or by automatic extinguishing systems, subsequently notify the civil defense for the effective fire fighting and rescue operations if needed.
2.2 Classification of Firefighting Systems and Equipment

Manual firefighting equipment

The manual firefighting equipments are portable equipments used for fire fighting at the first fire stages by normal building occupants and by the trained personnel. Among these equipments are:

a. Several types of portable fire extinguishers with their manual pumps
b. Standpipes and hose systems.

er. Water Types. ANSI/UL 626, Standard for 21⁄2-Gallon Stored-Pressure, Water-Type Fire Extinguishers; CAN/ULC-S507, Standard for Water Fire Extinguishers,

d. Halon Types. ANSI/UL 1093, Standard for Halogenated Agent Fire Extinguishers; CAN/ULC-S512, Standard for Halogenated Agent Hand and Wheeled Fire Extinguishers,

e. Film-Forming Foam Types. ANSI/UL 8, Standard for Foam Fire Extinguishers; CAN/ULC-S554, Standard for Water Based Agent Fire Extinguishers,

f. Halocarbon Types. ANSI/UL 2129, Standard for Halocarbon Clean Agent Fire Extinguishers; CAN/ULC-S566, Standard for Halocarbon Clean Agent Fire Extinguishers

The identification of the listing and labeling organization, the fire test standard, and the performance standard that the fire extinguisher meets or exceeds shall be clearly marked on each fire extinguisher.

Fire Test Standards:

- ANSI/UL 711, Standard for Rating and Testing of Fire Extinguishers,
- CAN/ULC-S508, Standard for Rating and Testing of Fire Extinguishers

Performance Standards:

- a. Carbon Dioxide Types. ANSI/UL 154, Standard for Carbon Dioxide Fire Extinguishers; CAN/ULC-S503, Standard for Carbon Dioxide Fire Extinguishers,
- b. Dry Chemical Types. ANSI/UL 299, Standard for Dry Chemical Fire Extinguishers; CAN/ULC-S504, Standard for Dry Chemical Fire Extinguishers,
- c. Water Types. ANSI/UL 626, Standard for 21⁄2-Gallon Stored-Pressure, Water-Type Fire Extinguishers; CAN/ULC-S507, Standard for Water Fire Extinguishers,
- d. Halon Types. ANSI/UL 1093, Standard for Halogenated Agent Fire Extinguishers; CAN/ULC-S512, Standard for Halogenated Agent Hand and Wheeled Fire Extinguishers,
- e. Film-Forming Foam Types. ANSI/UL 8, Standard for Foam Fire Extinguishers; CAN/ULC-S554, Standard for Water Based Agent Fire Extinguishers,
- f. Halocarbon Types. ANSI/UL 2129, Standard for Halocarbon Clean Agent Fire Extinguishers; CAN/ULC-S566, Standard for Halocarbon Clean Agent Fire Extinguishers

The fires are classified into the following five main types:

Class A Fires

Class A fires are fires in ordinary combustible materials, such as wood, cloth, paper, rubber, and many plastics. The water based portable fire extinguisher is adequate for such type of fire class because of the cooling and water penetration through the materials pores characteristics.
Class B Fires

Class B fires are fires in flammable liquids, combustible liquids, petroleum greases, tars, oils, oil-based paints, solvents, lacquers, alcohols, and flammable gases. The following types of portable fire extinguishers are adequate for this fire class:

- **Portable fire extinguisher foam type:** Its advantage is that the foam lasts for a significant time on the liquid surface preventing the re-ignition of fire to note that foam is a good electrical conductor.

- **Portable fire extinguisher dry powder type:** It is effective for quick flame extinguishing characteristic, it is used when the liquid is spread and flowed on the floor or to promptly control fire flame spread, noting that dry powder is not an electrical conductor.

- **Portable fire extinguisher CO2 type:** It is similar to the portable fire extinguishers using chemical powder with exception that the CO2 gas has no harmful effect on the assets unlike the portable fire extinguishers foam and chemical powder types. The CO2 is not an electrical conductor.

- **Portable fire extinguishers liquid vaporized type:** It is used for small fires or for engines liquid fuel. The vaporized liquid is not an electrical conductor.

Class K Fires

Class K fires are fires in cooking appliances that involve combustible cooking media (vegetable or animal oils and fats).

The method of choosing and distribution of the portable fire extinguishers are specified in Tables 8,9, and 10.

**Distribution of portable fire extinguisher**

Classification of Hazards: Rooms or areas shall be classified generally as being light (low) hazard, ordinary (moderate) hazard, or extra (high) hazard.

**Light (Low) Hazards**

Light (low) hazard occupancies shall be classified as locations where the quantity and combustibility of Class A combustibles and Class B flammables are low and where fires with relatively low rates of heat release are expected. These occupancies consist of fire hazards having normally expected quantities of Class A combustible furnishings and/or the total quantity of Class B flammables present is expected to be less than 1 gal (3.8L) in any room or area.

**Ordinary (Moderate) Hazards**

Ordinary (moderate) hazard occupancies shall be classified as locations where the quantity and combustibility of Class A combustible materials and Class B flammables are moderate and fires with moderate rates of heat release are expected. These occupancies consist of fire hazards that only occasionally contain Class A combustible materials beyond normal anticipated furnishings and/or the total quantity of Class B flammables typically expected to be present is from 1 gal to 5 gal (3.8 L to 18.9 L) in any room or area.

Class D Fires

Class D fires are fires in combustible metals, such as magnesium, titanium, zirconium, sodium, lithium, and potassium. The adequate portable fire extinguisher dry powder type shall be used for this class of fires.
Extra (High) Hazards

Extra (high) hazard occupancies shall be classified as locations where the quantity and combustibility of Class A combustible material is high or where high amounts of Class B flammables are present and rapidly developing fires with high rates of heat release are expected. These occupancies consist of fire hazards involved with the storage, packaging, handling, or manufacture of Class A combustibles and/or the total quantity of Class B flammables expected to be present in more than 5 gal (18.9 L) in any room or area.

<table>
<thead>
<tr>
<th>Table 8: Fire extinguisher size and placement for Class A hazards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Criteria</td>
</tr>
<tr>
<td>Minimum rated single extinguisher</td>
</tr>
<tr>
<td>Maximum floor area per unit of A</td>
</tr>
<tr>
<td>Maximum floor area for extinguisher</td>
</tr>
<tr>
<td>Maximum travel distance to extinguisher</td>
</tr>
</tbody>
</table>

Installations for Class B Hazards: In addition to a minimum of 2 portable fire extinguishers per floor, the number of portable fire extinguishers for class B fires is specified as per the flaming liquid surface area. The following requirements should be taken into consideration:

- The portable fire extinguishers shall be installed within a box or wall cavity with an access door to be protected from weather and tampering.
- The portable fire extinguishers suspended on the wall shall be installed using a supporting system installed to be 1 m above the extinguisher base to the final floor level below the extinguisher.
- Appropriate signs shall be provided to indicate the location of the portable fire extinguishers, the necessary instructions for use, and the warnings that shall be considered.
- The portable fire extinguishers shall be installed at easily access location as per the following requirements:
  - The nearest possible location from the exit or the exit stair
  - The separation distance between two portable fire extinguishers shall not be more than 20 m.
  - The maximum height of installation from the final floor level is 1m
- The following requirements indicated in the table shall be implemented.
Table 9:
Fire extinguisher size and placement for Class B hazards

<table>
<thead>
<tr>
<th>Type of Hazard</th>
<th>Basic minimum extinguisher rating</th>
<th>Maximum travel distance to extinguishers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light (low)</td>
<td>5-B</td>
<td>9.15</td>
</tr>
<tr>
<td></td>
<td>10-B</td>
<td>15.25</td>
</tr>
<tr>
<td>Ordinary (moderate)</td>
<td>10-B</td>
<td>9.15</td>
</tr>
<tr>
<td></td>
<td>20-B</td>
<td>15.25</td>
</tr>
<tr>
<td>Extra (high)</td>
<td>40-B</td>
<td>9.15</td>
</tr>
<tr>
<td></td>
<td>80-B</td>
<td>15.25</td>
</tr>
</tbody>
</table>

Installations for Class C Hazards:
Fire extinguishers with Class C ratings shall be required where energized electrical equipment can be encountered.

Installations for Class D Hazards:
Fire extinguishers or extinguishing agents with Class D ratings shall be provided for fires involving combustible metals. Fire extinguishers or extinguishing agents (media) shall be located not more than 23m of travel distance from the Class D hazard. Portable fire extinguishers or extinguishing agents (media) for Class D hazards shall be provided in those work areas where combustible metal powders, flakes, shavings, chips, or similarly sized products are generated.

Installations for Class K Hazards:
Class K fire extinguishers shall be provided for hazards where there is a potential for fires involving combustible cooking media (vegetable or animal oils and fats). Maximum travel distance shall not exceed 9.15m from the hazard to the extinguishers.

Figure 8: Alternative installation method for portable fire extinguishers within wall cavity

Figure 9: Installation of portable fire extinguisher in wall cavity at 1 m high from final floor level
### Table 10:

**Distribution of portable fire extinguishers type A**

<table>
<thead>
<tr>
<th>Fires Class</th>
<th>Appropriate portable fire extinguisher</th>
<th>Remarks</th>
<th>Portable fire extinguisher Type</th>
<th>Portable fire extinguisher capacity</th>
<th>Portable fire extinguisher discharge reach</th>
<th>Approximate total weight</th>
<th>Portable fire extinguishers for Per floor</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Class A fires:</strong></td>
<td>Water</td>
<td>Water is a good electrical conductor and shall not be used to extinguish electrical fires</td>
<td>Compressed water and gas</td>
<td>9 Liters 2 Gallons</td>
<td>10 m 30 ft</td>
<td>10 – 18 Kg 40 – 33 lb</td>
<td>200 m 1 2</td>
</tr>
<tr>
<td>hard materials such as wood, papers, textile</td>
<td>Compressed water</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table 11:

**Distribution of portable fire extinguishers type B**

<table>
<thead>
<tr>
<th>Fire class</th>
<th>Appropriate portable fire extinguisher</th>
<th>Portable fire extinguisher Type</th>
<th>Portable fire extinguisher capacity</th>
<th>Approximate weight</th>
<th>Portable fire extinguisher discharge reach</th>
<th>Coverage area for one portable extinguisher</th>
<th>Remark</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Class B fires:</strong></td>
<td>Foam</td>
<td>Foam with mechanical mechanism</td>
<td>9 liters 2 gallons</td>
<td>15 – 18 Kg 40 – 33 lb</td>
<td>8 m 23 ft</td>
<td>2 ½ m² 5 ft²</td>
<td>2 ½ m² 5 ft²</td>
</tr>
<tr>
<td>flammable such as petroleum and chemical materials</td>
<td>Chemical foam</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flammable liquids such as petroleum and chemical materials</td>
<td>Dry powder extinguishers of various types</td>
<td>1 kg 4 – 5 lb 3 kg 7 lb 1 kg 20 lb</td>
<td>4 kg 10 lb 9 kg 18 lb 18 kg 20 lb</td>
<td>3 m 10 ft 5 m 15 ft 7 m 20 ft</td>
<td>1 m² 10 ft² 1 ½ m² 15 ft² 4 m² 40 ft²</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Flammable liquids such as petroleum and chemical materials</strong></td>
<td>CO₂ Extinguisher</td>
<td>1 kg 2 ½ lb 3 kg 7 lb 4 kg 10 lb</td>
<td>6 kg 13 lb 16 kg 23 lb 19 - 21 kg 28 - 42 lb</td>
<td>3 m 10 ft 5 m 15 ft 7 m 20 ft</td>
<td>1 m² 10 ft² 1 ½ m² 15 ft² 4 m² 40 ft²</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flammable liquids such as petroleum and chemical materials</td>
<td>Vaporizing liquid extinguishers C.B.M and B.C.F</td>
<td>½ liter 1/8 gallon</td>
<td>2 kg 6 lb</td>
<td>7 m 20 ft</td>
<td>1/3 m²</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Table 12

**Distribution of portable fire extinguishers type C and D**

<table>
<thead>
<tr>
<th>Fire Types</th>
<th>Appropriate extinguisher type</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class C: fires electrical or electronic equipment</td>
<td>CO₂</td>
<td>CO₂, dry powder, vaporizing liquids: These three types of extinguishing materials are the most favorable for extinguishing the electrical fires. Water based extinguishers shall not be used for the electrical fires to prevent electric shocks since the water and foam are considered as electrical conductors except in cases where the electrical power can be disconnected because water is one of the best materials to be used for fire fighting, however, for class B and class H fires special materials shall be used such as CO₂ extinguishers which are the best for electrical fires due to their light weight.</td>
</tr>
<tr>
<td>Class D: fires for combustible metals and for some petroleum materials</td>
<td>Dry powder</td>
<td>Dry chemical powder: There is no type of dry powder that is suitable for all metal fires, however, for each type of metal fire there is a special type of dry powder. Therefore, the instructions marked by the manufacturer on the extinguisher shall be followed and the civil defense shall be consulted when choosing the extinguishers types related to metal fires. Important Note: There is a great danger to health if the choice of the right type of metals fires extinguishers is abused.</td>
</tr>
</tbody>
</table>

### Maintenance of portable fire extinguishers

The plot’s owner, owner’s agent or plot’s tenant is responsible for the inspection, maintenance and refilling of the portable fire extinguishers within the plot.

### Fixed fire fighting equipment

The fixed fire fighting equipment is a network used for fire fighting in the fire’s early stages by ordinary building occupants and by qualified staff such as trained personnel or private control or civil defense teams. It includes the following systems:

#### a. Hose systems

The hose system is considered as a primary means for fire fighting used by the building’s occupants without a need for prior training. It consists of hose pipe having 25 mm diameter coiled on hose reel and inserted within a metallic box which is installed on the wall or within a wall cavity. It is connected directly to water supply network and ready for use hose release.

#### b. Standpipes

The standpipes are classified into the following three types:

- **Class I System**: a system that provides 2 ½ in. (65 mm) hose connections to supply water for use by fire departments and those trained in handling heavy fire streams.
### 2.1 Classification of Firefighting Systems and Equipment

#### The General Requirements For Firefighting and Fire Alarm Systems

**Class II System:** A system that provides 1 ½ in. (40 mm) hose stations to supply water for use primarily by trained personnel or by the fire department during initial response.

**Class III System:** A system that provides 1½ in. (40 mm) hose stations to supply water for use by trained personnel and 2½ in. (65 mm) hose connections to supply a larger volume of water for use by fire departments and those trained in handling heavy fire streams. The following shall be taken into consideration:

- Hose connections and hose stations shall be unobstructed and located not less than 3 ft (0.9 m) or more than 5 ft (1.5 m) above the floor.
- The hose connections shall not be obstructed by the closed or open doors or other objects on the landing.
- Hose connections for Class I systems should be located in a stairway enclosure. Hose connections for Class II systems should be located in the corridor or space adjacent to the stairway enclosure and connected through the wall to the standpipe. For Class III systems, the connections for 2½ in. (65 mm) hose should be located in a stairway enclosure, and Class II connections should be located in the corridor or space adjacent to the stairway enclosure.
- Separate standpipes shall be provided in each required exit stairway.
- The valves shall be installed within boxes or closets to prevent public tampering.
- The cabinet shall be used for fire equipment only. Each cabinet shall be conspicuously identified.
- Where a “break glass” type protective cover for a latching device is provided, the device provided to break the glass panel shall be attached in the immediate area of the break glass panel and shall be arranged so that the device cannot be used to break other glass panels in the cabinet door.

#### b-1: Dry Standpipes

The dry standpipes system is a fixed network not connected to a water supply network, they are provided by Siamese connections for pumping water from outside the building and landing valves distributed in the proper locations to facilitate the civil defense firefighters operation by pumping and use of water in the upper floors. The dry standpipes are used in buildings for the following cases:

- In buildings having more than two stories and the story area is more than 1000 m².
- In buildings where the contents are presenting risk to life and content as per the civil defense discretion

#### b-2: Wet standpipes

The wet standpipes system is a fixed network connected to a permanent water supply network serving the landing valves distributed in the proper locations of the building and used by the civil defense firefighters or by trained building’s occupants. The use of the wet standpipes shall be limited exclusively for the firefighting works.
c. Foam spray network

- The foam-water spray network is a fixed network used to spray the foam-water mixture and deliver it to the unoccupiable areas that are used usually for storage or for handling combustible liquids. The mixture is sprayed as bubbles forming a curtain insulating the burning surface from the outside air and the cooling process is generated by the water.

- The design and installation of the foam-water spray system shall be in accordance with a specific standard such as NFPA16 Standard for the Installation of Foam-Water Sprinkler and Foam-Water Spray Systems and NFPA11 Standard for Low-, Medium-, and High-Expansion Foam.

d. Fire Hydrant

The fire hydrants network is an infrastructure network having a permanent water source serving the hydrant outlets and used as a water supply mean for the use in the fire fighting operations by the civil defense firefighters from outside the building. The fire hydrant shall be provided in the following locations:

- On all the public streets of the industrial city.

- Outside buildings provided by wet standpipe systems and it is considered as a complementary system.

- At the streets and yards of large facilities having a special hazard content such as large manufactures, buildings complex and others.


- Fire department connections for standpipe systems shall be located not more than 100 ft (30.5 m) from a fire hydrant along an approved path from a fire hydrant and shall be arranged so that hose lines can be readily and conveniently attached to the inlets without interference from any nearby objects, including buildings, fences, posts, or other fire department connections.
e. **Firefighting Water ground outlets (water tanks)**

The system consists of a pipe equipped with a valve and ending with an outlet having a cap attached by a steel wire. The firefighting water supply outlet is installed within a manhole as per the civil defense requirements.

The **automatic firefighting systems and equipment**

The automatic firefighting systems consist of fixed networks having nozzles distributed in locations to be protected. The network is supplied by a permanent source of the corresponding extinguishing material. The operation of the system is automatically initiated by detecting the fire heat, smoke heat or both as per the following systems:

a. **Automatic water sprinkler extinguishing system (wet pipes)**

It consists of piping network installed at the floor's cover slab of areas to be protected. It is served by relevant water sources having proper capacity and pumping pressure for effective operation of the sprinkler nozzles (wet sprinklers) that operates automatically upon heat sensing; or the water is flowed from open nozzles to flood totally the protected area and open automatically upon the fire alarm initiation.

b. **Water sprinkler system dry pipes type**

This water sprinkler system dry pipes type is similar to the wet pipes sprinkler system, however, it consists of compressed air blocking the flow of water at the control valve. The control valve opens automatically when there is an air leak at the sprinkler nozzles that open by heat detection allowing water to flow from the sprinkler nozzles.

c. **Water sprinkler pre-action system (wet pipes)**

The water sprinkler pre-action system (wet pipes) is similar to the water sprinkler system (wet pipes), the flow of water is blocked at the valve, completed by electrical or pneumatic detection system, that accuates the automatic valve upon heat detection allowing water to flow from the system nozzles that open upon heat detection.

d. **Deluge system**

The deluge system is similar to water sprinkler pre-action system (wet pipes) provided by sprinkler nozzles that are always open, flooding the entire area when the system is in operation.

e. **Composite system**

The composite system consists of wet pipes sprinkler pre-action system and the dry pipes sprinkler system.

f. **Halon Extinguishing system or Its alternatives**

The halon extinguishing sytem is a piping network distributed on the areas that shall be protected, it is supplied via cylinders containing the Halon gas or its alternatives (as extinguishing material) kept under the Nitrogen pressure to flow from the nozzles in the required protected area further to the system's operation. The civil defense technical specifications shall be respected, noting that the use of halon extinguishing system is on the way to an international ban due to its environmental impact. It will be replaced by alternative materials.
g. CO2 extinguishing system

The CO2 extinguishing system is a piping network distributed on the areas that shall be protected. It is supplied via cylinders containing the CO2 gas (as extinguishing material) kept under pressure to flow through the pipes nozzles that are distributed in the protected area further to the system’s operation.

h. Dry chemical extinguishing system

The dry chemical extinguishing system is a piping network distributed on the areas that shall be protected, it is supplied via cylinders containing the dry chemical material (as extinguishing material) kept under pressure by the Nitrogen gas or the CO2 gas to flow from the pipes nozzles in the protected area. The extinguishing materials used are usually the sodium bicarbonate, potassium bicarbonate, monoammonium phosphate.

The dry chemicals extinguishing system consists of the following types depending on the related protection method:

- Total flooding system: a system that covers a specific area in the building or place.
- Foam-water spray system: is a piping network distributed on the areas that shall be protected, it is supplied by the foam and water source, that could be mixed, or mixed before the flowing to the burning surface. The mixture is sprayed as bubbles forming a curtain insulating the burning surface from the outside air and the cooling process is generated by the water.

Figure 10: High pressure system for the CO2 extinguishing

Figure 11: dry chemical extinguishing system (modular system for the protection of kitchen hoods and exhaust systems)
The design and installation of the automatic extinguishing system shall be in accordance with a specific standard such as:

- **NFPA 17A**, Standard for Wet Chemical Extinguishing Systems
- **NFPA 12**, Standard on Carbon Dioxide Extinguishing Systems - Effective Date 8152007
- **NFPA 12A**, Standard on Halon 1301 Fire Extinguishing Systems, Effective Date 7182008
- **NFPA 13**, Standard for the Installation of Sprinkler Systems
- **NFPA 750**, Standard on Water Mist Fire Protection Systems
- **NFPA 2001**, Standard on Clean Agent Fire Extinguishing Systems
2.3 Fire Alarm System

The fire alarm systems consist of two types:
- The manual alarm system
- The automatic alarm system

**Manual fire alarm systems**
The manual fire alarm systems consist of a system that operates electrically by manual fire alarm boxes distributed in specific locations and having two types:
- Break glass fire alarm box
- Manual pull station fire alarm box
The manual fire alarm system consists of:
- Fire alarm box (break glass or pull station)
- Alarm sounders
- Fire alarm panel board and building’s sounders wiring network

**Automatic fire alarm systems**
The automatic fire alarm system is an electric system that is capable of detecting the fire and transmitting the alarm within the premises. The automatic fire alarm system consists of:
- Fire detectors (smoke detectors, flame detectors, heat detectors, etc.)
- Alarm sounders
- Fire alarm panel board and wiring network
The fire alarm system is automatically initiated by one of the following means:
- Automatic devices connected to fire equipment or central air conditioning system.
- Detectors such as smoke, heat or infrared flame detectors
- Mechanical alarm system (sounder, etc.) actuated by the high pressure of the automatic sprinkler system’s operation.

The design and installation of the fire alarm system shall be in accordance with specific standards especially:
- NFPA 72, National fire alarm code.
- NFPA 70, National electrical code.

A complete fire alarm system shall provide functions for initiation, notification, and control which shall perform as follows:
- The initiation function provides the input signal to the system.
- The notification function is the means by which the system advises that human action is required in response to a particular condition.
- The control function provides outputs to control building equipment to enhance protection of life.

**Signal Initiation**
Actuation of the complete fire alarm system shall be initiated by, but shall not be limited to any or all of the following means:
- Manual fire alarm initiation
- Automatic detection
- Extinguishing system operation
**Occupant Notification**

Occupant notification shall be provided to alert occupants of a fire or other emergency. Notification signals for occupants to evacuate shall be audible and visible signals or other means of notification acceptable to the authority having jurisdiction.

Audible alarm notification appliances shall be of character and distribution to be effectively heard regardless of the average ambient sound level that exists under normal conditions of occupancy. Audible alarm notification appliances shall produce signals that are distinctive from audible signals used for other purposes in a given building.

Emergency forces notification shall be provided to alert the municipal fire department and fire brigade (if provided) of fire or other emergency. The fire alarm system shall be arranged to transmit the alarm automatically via any of the following means acceptable to the authority having jurisdiction and shall be in accordance with the National Fire Alarm Code NFPA 72:

- Release of hold-open devices for doors or other opening protectives
- Stairwell or elevator shaft pressurization
- Smoke management or smoke control systems
- Unlocking of doors
- Elevator recall and shutdown

**Fire Safety Functions**

Fire safety functions shall be installed in accordance with the requirements of NFPA 72, National Fire Alarm Code. The following functions shall be actuated:

- Auxiliary fire alarm system
- Central station fire alarm system
- Remote supervising station fire alarm system
Means of Egress General Requirements - Emergency Exits
Chapter 3: Means of Egress General Requirements - Emergency Exits

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3.1 Emergency Exits

An emergency exit is a free and safe access that enables the occupants to egress from any area of the building directly to the exterior, to a courtyard or to a safe place protected from the fire hazard that lead directly to the exterior of the building according to the following criterias:

- The building, facilities and shops shall be provided with appropriate means of egress (emergency exits) leading to an exit or exit way facilitating the occupants evacuation away from the fire area. The emergency exit door leading shall open from inside of the building.
- The means of egress consist of different components such as exit access corridors, stairs, balconies, bridges, ramps, doors and exits forming a combined means of egress components.
- Modifications or additions to the building shall not be permitted in case they are jeopardizing the means of egress requirements, and the change of use of the building shall not be permitted unless the means of egress are modified as per the new building use.

The Civil defense has the right to require conditions deemed to be appropriate for the special cases not included in this guide or for the unusual fire hazard cases.
3.2 Means of Egress Requirements (Emergency Exits)

- The exit access shall not pass, in any case, through closed rooms or next to a special fire hazard content location unless it is separated from them by appropriate fire barrier.
- Appropriate exit signs and marking of means of egress shall be provided along the exit access leading to the exit. In case a dead end or a special hazard area's door is encountered along the exit access path, a proper readily and visible warning sign shall be installed on that door.
- The exit shall not be covered by combustible materials, or by materials presenting slipping or tripping hazard.
- Mobile and fixed furniture, barriers, and equipment shall be placed in a way not to reduce the exit access width or to impede its use.
- The emergency exit shall be kept in a good and usable condition to meet its maximum egress capacity and shall not be used for any purposes other than its design intent.

- The guards, used for fall protection means, shall be installed at the open parts of the means of egress (emergency exits) such as the stair, bridge, or roof edge. Glass guards shall not be considered as a fall protection mean.
- Adequate mechanical or normal lighting and ventilation shall be provided for the means of egress.
- Adequate normal or industrial lighting shall be provided for the means of egress. In crowded, public, industrial or other building types, emergency power supply system shall be provided in case of electrical failure. The emergency power supply system shall be provided for the emergency lighting, exit and marking signs.
- The building's owner shall be responsible for the provision and maintainance of the fire alarm and fire fighting systems. The tenant is responsible for removing the obstructions from the means of egress, and to protect the fire alarm and fire fighting system provided for his rented part of the building.
- If the occupant load of the building is more than 300 persons, the egress width shall be increased by 0.05 m for each 10 additional persons for the horizontal means of egress components and for each 8 additional persons for the vertical means of egress components (stairs).
- The total capacity of the means of egress for any story, balcony, tier, or other occupied space shall be sufficient for the occupant load thereof. Where more than one means of egress is required, the means of egress shall be of such width and capacity that the loss of any one means of egress leaves available not less than 50 percent of the required capacity.
Where means of egress from different stories converge at an intermediate story, the capacity of the means of egress from the point of convergence shall be not less than the sum of the capacity of the two means of egress.

The number of means of egress from any balcony, mezzanine, story, or portion thereof shall be not less than two.

The number of means of egress from any story or portion thereof, shall be as follows:

- If occupant load is between 500 - 1000, means of egress should not be less than 3.
- If occupant load is more than 1000, means of egress should not be less than 4.

In typical floors, the maximum occupant load of the floor is considered for the calculation of the egress capacity which shall not be less than the egress capacity of the main exits (emergency exits) that lead to the exterior of the building by using doors equipped by panic hardware or fire exit device; or by locks, in this case, to open the door in case of emergency, the lock’s key shall be provided within breakable wooden box in the door, and equipped by alarm sounder to prevent its misuse.

The means of egress shall be designed for minimum headroom of 2.2 m.

The egress capacity is related to the building’s evacuation time and occupant load. The building evacuation time differs from building to another depending on the buildings’ fire protection means.

---

### Table 13:

Minimum width of means of egress (emergency exits) depending on the occupant load

<table>
<thead>
<tr>
<th>Means of egress components</th>
<th>Minimum clear width of means of egress in meters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occupant Load</td>
<td>100 150 200 250 300</td>
</tr>
<tr>
<td>Doors and Corridors</td>
<td>0.80 0.85 1.00 1.25 1.5</td>
</tr>
<tr>
<td>Stairs</td>
<td>0.75 1.00 1.30 1.65 3.00</td>
</tr>
</tbody>
</table>

### Table 14:

Minimum width of means of egress (emergency exits) depending on the hazard content classification

<table>
<thead>
<tr>
<th>Area</th>
<th>Stairways (width per person)</th>
<th>Level components and ramps (width per person)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mm</td>
<td>In.</td>
</tr>
<tr>
<td>High hazard contents</td>
<td>18</td>
<td>0.7</td>
</tr>
<tr>
<td>All others</td>
<td>7.6</td>
<td>0.3</td>
</tr>
</tbody>
</table>

### Table 15:

Building Evacuation time in case of fire

<table>
<thead>
<tr>
<th>Type of buildings</th>
<th>Estimated Evacuation Time in minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buildings meeting the fire safety requirements and not having fire hazards</td>
<td>Three minutes</td>
</tr>
<tr>
<td>Buildings meeting the fire safety requirements and having fire hazards</td>
<td>Two and a half minutes</td>
</tr>
<tr>
<td>Buildings not meeting the fire safety requirements and having fire hazards, or Buildings meeting the fire safety requirements and having high fire hazard</td>
<td>Two minutes</td>
</tr>
</tbody>
</table>

---

2: For occupant load evaluation, please refer to chapter 4 related to the requirements and conditions of fire protection in buildings depending on its occupancy classifications.
Walking Surfaces in the Means of Egress

- Walking surfaces shall be slip resistant under foreseeable conditions.
- The walking surface of each element in the means of egress shall be uniformly slip resistant along the natural path of travel.

Changes in Elevation

- Abrupt changes in elevation of walking surfaces shall not exceed 6.3 mm. Changes in elevation exceeding 6.3 mm, but not exceeding 13 mm, shall be beveled with a slope of 1 in 2.
- Walking surfaces shall be horizontally leveled. The slope of a walking surface in the direction of travel shall not exceed 5%, unless it is considered as ramp. The slope perpendicular to the direction of travel shall not exceed 2%.
- Changes in level of means of egress not in excess of 535 mm shall be achieved either by a ramp or by a stair.

Guards and Handrails

- Stairs and ramps shall have handrails on both sides.
- Guards shall be provided at the open sides of means of egress that exceed 760 mm above the floor or the finished ground level below.
- Required guards and handrails shall continue for the full length of each flight of stairs. At turns of new stairs, inside handrails shall be continuous between flights at landings.
- New handrails on stairs shall be not less than 865 mm, and not more than 965 mm, above the surface of the tread, measured vertically to the top of the rail from the leading edge of the tread.
- The height of required handrails that form part of a guard shall be permitted to exceed 965 mm, but shall not exceed 1065 mm, measured vertically to the top of the rail from the leading edge of the tread. New handrails shall be installed to provide a clearance of not less than 57 mm between the handrail and the wall to which it is fastened.

![Figure 13: Minimum separation distance between side handrails and adjacent wall](image)

- Handrails shall include one of the following features:
  - Circular cross section with an exterior diameter of not less than 1 1/4 in. (32 mm) and not more than 51 mm.
  - Shape that is other than circular with a perimeter dimension of not less than 100 mm, but not more than 160 mm, and with the largest cross-sectional dimension not more than 57 mm, provided that graspable edges are rounded so as to provide a radius of not less than 3.2 mm.
  - Handrails shall be continuously graspable along their entire length.
  - Handrails that are not continuous between flights shall extend horizontally, at the required height, not less than 305 mm beyond the top riser and continue to slope for a depth of one tread beyond the bottom riser. The height of guards shall be measured vertically to the top of the guard from the surface adjacent thereto and shall be not less than 1065 mm.
Open guards, other than approved existing open guards, shall have intermediate rails or an ornamental pattern such that a sphere 100 mm in diameter is not able to pass through any opening up to a height of 865 mm. The triangular openings formed by the riser, tread, and bottom element of a guardrail at the open side of a stair shall be of such size that a sphere 150 mm in diameter is not able to pass through the triangular opening.

Figure 14: Exhibit showing the guardrails

Figure 15: Open guard requirements

Figure 16: Stair’s guard
3.3 Stairs

Inside Stairs Requirements:
The inside stair is considered as an important component of the means of egress (emergency exits) since it is a vertical opening within the building. The following requirements shall be respected for the exit stairs, the tread depth shall be not less than 28 cm, the riser height shall be not less than 15 cm and not more than 18 cm, so that the arithmetic formulas $2 \times \text{riser height} + \text{tread depth} = (60 \text{ to } 65 \text{ cm})$.

### Table 16:
Dimensional criteria of inside stairs

<table>
<thead>
<tr>
<th>Feature</th>
<th>Dimensional</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ft/in.</td>
</tr>
<tr>
<td>Maximum height of risers</td>
<td>7 in.</td>
</tr>
<tr>
<td>Minimum height of risers</td>
<td>4 in.</td>
</tr>
<tr>
<td>Minimum tread depth</td>
<td>11 in.</td>
</tr>
<tr>
<td>Minimum headroom</td>
<td>6 ft 8 in.</td>
</tr>
</tbody>
</table>

![Figure 17: Inside stairs as part of the means of egress](image)

Minimum Stair Width:

- Where the total occupant load of all stories served by the stair is fewer than 50 persons, the minimum width clear of all obstructions, except projections less than 4½ in. (114 mm) at or below handrail height on each side, shall be 36 in. (915 mm).
- Where stairs serve occupant loads exceeding 50 persons, the minimum width clear of all obstructions, except projections not more than 4½ in. (114 mm) at or below handrail height on each side, shall be in accordance with Table 17 here below:
### Table 17:

<table>
<thead>
<tr>
<th>Total Cumulative Occupant Load assigned to the stairs</th>
<th>Width</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;2000 persons</td>
<td>44 in. (1120 mm)</td>
</tr>
<tr>
<td>≥2000 persons</td>
<td>56 in. (1420 mm)</td>
</tr>
</tbody>
</table>

### Enclosure and protection of stairs

All inside stairs serving as an exit or exit component shall be enclosed and separated from the other parts of the buildings by fire barriers as follows:

- The separation shall have a minimum 1-hour fire resistance rating where the exit connects three or fewer stories. Openings in the separation shall be protected by fire door assemblies having 1-hour fire rating and equipped with door closers.

- The separation shall have a minimum 2-hour fire resistance rating where the exit connects four or more stories. Openings in the separation shall be protected by fire door assemblies having 1½ hour fire rating and equipped with door closers.

- Openings in exit enclosures shall be limited to door assemblies from normally occupied spaces and corridors and door assemblies for egress from the enclosure.

- New enclosed stairs serving three or more stories shall be provided with special signage within the enclosure at each floor landing. The signage shall indicate the floor level, the terminus of the top and bottom of the stair enclosure, the identification of the stair enclosure, the floor level of, and the direction to exit discharge.

### Special Provisions for Outside Stairs

- Outside stairs shall be separated from the interior of the building by construction of fire resistance rating required for enclosed stairs with fixed or self-closing opening protectives. The required separation shall extend as follows:
  - Vertically from the finished ground level to a point 3050 mm above the topmost landing of the stairs or to the roofline, whichever is lower
  - Horizontally for not less than 3050 mm.
  - All openings below an outside stair shall be protected with an assembly having a minimum 3/4-hour fire protection rating.
3.4 Exit Access Corridors

Corridors used as exit access and serving an area having an occupant load exceeding 30 persons shall be separated from other parts of the building by walls having not less than a 1-hour fire resistance rating constructed as fire barriers.

Door openings

- Every door opening and every principal entrance that is required to serve as an exit shall be designed and constructed so that the path of egress travel is obvious and direct.
- Door openings in means of egress shall be not less than 810 mm in clear width. Where a pair of door leaves is provided, one door leaf shall provide not less than 810 mm clear width opening.
- The elevation of the floor surfaces on both sides of a door opening shall not vary by more than 13 mm.
- Door leaves required to be of the side-hinged or pivot-ended swinging type shall swing in the direction of egress travel under any of the following conditions:
  - Where serving a room or area with an occupant load of 50 persons or more
  - Where the door assembly is used in an exit enclosure
  - Where the door opening serves a high hazard contents area.

- During its swing, any door leaf in a means of egress shall leave not less than one-half of the required width of an aisle, a corridor, a passageway, or a landing unobstructed and shall project not more than 180 mm into the required width of an aisle, a corridor, a passageway, or a landing, when fully open.

Figure 18: method of measuring the clear width of the door

Figure 19: Required width for the stair landing at doors openings
The forces required to fully open any door leaf manually in a means of egress shall not exceed 67 N to release the latch, 133 N to set the leaf in motion, and 67 N to open the leaf to the minimum required width.

Door leaves shall be arranged to be opened readily from the egress side whenever the building is occupied. Locks, if provided, shall not require the use of a key, a tool, or special knowledge or effort for operation from the egress side.

### Ramps

New ramps shall be in accordance with Table 18 here below:

**Table 18:**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Dimensional criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum width clear of all obstructions, except projections not more than 4½ in. (114 mm) at or below handrail height on each side</td>
<td>44 in. 1120 mm</td>
</tr>
<tr>
<td>Maximum slope</td>
<td>1 in 12</td>
</tr>
<tr>
<td>Maximum cross slope</td>
<td>1 in 48</td>
</tr>
<tr>
<td>Maximum rise for a single ramp run</td>
<td>30 in. 760 mm</td>
</tr>
</tbody>
</table>

- All ramps serving as means of egress shall be of permanent fixed construction.
- Ramps shall have landings located at the top, at the bottom, and at door leaves opening onto the ramp and at any changes in travel direction.
- Guards shall be provided for ramps. Handrails shall be provided along both sides of a ramp run with a rise greater than 150 mm.
- Ramps in a required means of egress shall be enclosed or protected as a stair.

**Horizontal exits**

- Horizontal exits shall be substituted with other exits where the total egress capacity and the total number of other exits (stairs, ramps, door openings leading to the exterior of the building) is not less than half that required for the entire area of the building or connected buildings, and provided that none of the other exits is a horizontal exit.
Every fire compartment in connection with a horizontal exit(s) shall also have at least one additional exit with at least 50% of the required capacity of exits that are not horizontal. Any fire compartment not having an exit outside shall be considered as part of an adjoining compartment with an exit leading to the outside. Every horizontal exit shall be provided continuously available paths of travel leading from each side of the exit to stairways or other means of egress leading to the exterior of the building. Wherever either side of a horizontal exit is occupied, the door leaves used in connection with the horizontal exit shall be unlocked from the egress side.

The floor area on either side of a horizontal exit shall be sufficient to hold the occupants of both floor areas and shall provide at least 0.28 m² clear floor area per person.

Fire barriers separating buildings or areas between which there are horizontal exits shall have a minimum 2-hour fire resistance rating, and shall provide a separation that is continuous to the finished ground level.

Fire barriers forming horizontal exits shall not be penetrated by ducts, unless one of the building is protected throughout by an approved, supervised automatic sprinkler system.

Swinging fire door assemblies shall be permitted in horizontal exits, provided that door leaves shall swing in the direction of egress travel. Door leaves in horizontal exits shall be designed and installed to minimize air leakage. New door assemblies in horizontal exits shall be installed in accordance with NFPA 105, Standard for the Installation of Smoke Door Assemblies and Other Opening Protective. All fire door assemblies in horizontal exits shall be self-closing or automatic-closing.

Where exits are not immediately accessible from an open floor area, continuous passageways, aisles, or corridors leading directly to every exit shall be maintained.

Common paths of travel and dead end corridors shall not exceed the limit specified in the table here below. It is to be noted that the travel distance to an exit shall be measured on the floor or other walking surface as follows:

- Along the centerline of the natural path of travel, starting from the most remote point subject to occupancy,
- Curving around any corners or obstructions, with a 12 in. (305 mm) clearance therefrom
- Terminating at one of the following: (a) Center of the doorway, (b) Other point at which the exit begins.
### Table 19:
Longest common path limits and dead-end limits

<table>
<thead>
<tr>
<th>Type of occupancy</th>
<th>Common Path Limit</th>
<th>Dead-end limit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sprinklered</td>
<td>Sprinklered</td>
</tr>
<tr>
<td></td>
<td>Ft</td>
<td>m</td>
</tr>
<tr>
<td>Assembly</td>
<td></td>
<td></td>
</tr>
<tr>
<td>New</td>
<td>20/75</td>
<td>6.1/23</td>
</tr>
<tr>
<td>Existing</td>
<td>20/75</td>
<td>6.1/23</td>
</tr>
<tr>
<td>Hotels &amp; Dormitories</td>
<td></td>
<td></td>
</tr>
<tr>
<td>New</td>
<td>35</td>
<td>10.7</td>
</tr>
<tr>
<td>Existing</td>
<td>35</td>
<td>10.7</td>
</tr>
<tr>
<td>Apartments</td>
<td></td>
<td></td>
</tr>
<tr>
<td>New</td>
<td>35</td>
<td>10.7</td>
</tr>
<tr>
<td>Existing</td>
<td>35</td>
<td>10.7</td>
</tr>
<tr>
<td>Board &amp; Care</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small, new and existing</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Large, new</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Large, existing</td>
<td>110</td>
<td>33</td>
</tr>
<tr>
<td>Mercantile</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Class A, B, C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>New</td>
<td>75</td>
<td>23</td>
</tr>
<tr>
<td>Business</td>
<td></td>
<td></td>
</tr>
<tr>
<td>New</td>
<td>75</td>
<td>23</td>
</tr>
<tr>
<td>Existing</td>
<td>75</td>
<td>23</td>
</tr>
<tr>
<td>Industrial</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General</td>
<td>50</td>
<td>15</td>
</tr>
<tr>
<td>Special purpose</td>
<td>50</td>
<td>15</td>
</tr>
<tr>
<td>High hazard</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Aircraft servicing hangars, finished ground level floor</td>
<td>50</td>
<td>15</td>
</tr>
</tbody>
</table>

NR: No Requirement
NA: Not applicable

Continued on the next page
### Exit Access Corridors

#### Construction Conditions within the Industrial City

<table>
<thead>
<tr>
<th>Type of occupancy</th>
<th>Common Path Limit</th>
<th>Dead-end limit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unsprinklered</td>
<td>sprinklered</td>
</tr>
<tr>
<td></td>
<td>Ft</td>
<td>m</td>
</tr>
<tr>
<td>Storage</td>
<td>50</td>
<td>15</td>
</tr>
<tr>
<td>Low hazard</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Ordinary hazard</td>
<td>50</td>
<td>15</td>
</tr>
<tr>
<td>High hazard</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Parking structures, open</td>
<td>50</td>
<td>15</td>
</tr>
<tr>
<td>Parking structures, enclosed</td>
<td>50</td>
<td>15</td>
</tr>
<tr>
<td>Aircraft servicing hangars, finished ground level floor</td>
<td>50</td>
<td>15</td>
</tr>
<tr>
<td>Aircraft servicing hangars, mezzanine floor</td>
<td>50</td>
<td>15</td>
</tr>
<tr>
<td>Underground spaces in grain elevators</td>
<td>50</td>
<td>15</td>
</tr>
</tbody>
</table>

Exit passage way used to keep travel distance from becoming excessive.

C-E> required travel distance

C-D≤ required travel distance

1. On the floor or other walking surface
2. Along the centerline of the natural path of travel
3. Starting at 305 mm from the most remote point
4. Around corners and obstructions with clearance of 305 mm
5. Ending where the exit begins
6. Over open exit access ramps and open exit access stairs in the plane of tread nosings

![Figure 23: Measuring Travel distance to an exit](image)
▪ Where more than one exit, exit access, or exit discharge is required from a building or portion, such exits, exit accesses, or exit discharges shall be remotely located from each other and be arranged to minimize the possibility that more than one has the potential to be blocked by any one fire or other emergency condition.

▪ Where two exits, exit accesses, or exit discharges are required, they shall be located at a distance from one another not less than one-half the length of the maximum overall diagonal dimension of the building or area to be served, measured in a straight line between the nearest edges of the exits, exit accesses, or exit discharges.

▪ In buildings protected by an approved and supervised automatic sprinkler system, the minimum separation distance between two exits, exit accesses, or exit discharges shall be not less than one-third the length of the maximum overall diagonal dimension of the building or area to be served.

▪ Access to an exit shall not be through kitchens, storerooms, restrooms, workrooms, closets, bedrooms or similar spaces, or other rooms or spaces subject to locking.

▪ Hangings or draperies shall not be placed over exit doors or located so that they conceal or obscure any exit.

▪ Exits shall terminate directly, at a public way or at an exterior exit discharge, or through areas on level of exit discharge. However, not more than 50 percent of the required number of exits and egress capacity shall discharge through areas on the level of exit discharge, provided that the following criteria are met:
▪ The discharge specified shall lead to a free and unobstructed way to the exterior of the building, and such way shall be readily visible and identifiable from the point of discharge from the exit.

Figure 26: horizontal section for exit stair at the level of exit discharge

▪ The level of discharge shall be protected throughout by an approved automatic sprinkler system, or the portion of the level of discharge used for discharge shall be protected by an approved automatic sprinkler and shall be separated from the nonsprinklered portion of the floor by a fire resistance rating meeting the requirements for the enclosure of exits.

Figure 27: Some locations of the exit signs

▪ The entire area on the level of discharge shall be separated from areas below by construction having a fire resistance rating not less than that required for the exit enclosure.

▪ The exit discharge shall be arranged and marked to clarify the direction of egress to a public way. Stairs shall be arranged so as to make clear the direction of egress to a public way. Stairs that continue more than one-half story beyond the level of exit discharge shall be interrupted at the level of exit discharge by partitions, doors, or other effective means.

▪ Illumination of means of egress shall be continuous during the time that the conditions of occupancy require that the means of egress be available for use.

▪ Emergency lighting facilities for means of egress shall be provided.

▪ Means of egress shall be marked. Exits, other than main exterior exit doors that are clearly identifiable as exits shall be marked by an approved sign that is readily visible from any direction of exit access. Horizontal components of the egress path within an exit enclosure shall be marked by approved exit or directional exit signs where the continuation of the egress path is not obvious.

▪ The signs, other than approved self-luminous signs and listed photo-luminescent signs in, shall be illuminated by the emergency lighting facilities.

Figure 28: Exit sign
Underground and limited access structures

- Underground and limited access structures and all areas and floor levels traversed in traveling to the exit discharge shall be protected by an approved, supervised automatic sprinkler system, unless such structures have an occupant load of 50 persons or fewer in new underground portions of the structure.

- Underground portions of structures and all areas traversed in traveling to the exit discharge shall be provided with emergency lighting.

- Exits from underground structures with an occupant load of more than 100 persons in the underground portions of the structure and having a floor used for human occupancy located more than 30 ft (9140 mm) below the lowest level of exit discharge, or having more than one level located below the lowest level of exit discharge, shall be provided with exterior smoke-venting facilities or other means to prevent the exits from becoming charged with smoke from any fire in the areas served by the exits.

- The underground portions of an underground structure shall be provided with approved automatic smoke venting where the underground structure has the following features:
  - Occupant load of more than 100 persons in the underground portions of the structure
  - Floor level used for human occupancy located more than 30 ft (9140 mm) below the lowest level of exit discharge, or more than one level located below the lowest level of exit discharge
  - Combustible contents, combustible interior finish, or combustible construction

- Exit stair enclosures in underground structures having a floor level used for human occupancy located more than 30 ft (9140 mm) below the lowest level of exit discharge, or having more than one level located below the lowest level of exit discharge, shall be provided with signage at each floor level landing traversed in traveling to the exit discharge. The signs shall include a chevron-shaped indicator to show direction to the exit discharge.

Occupant Load

- The occupant load, in number of persons for whom means of egress and other provisions are required, shall be determined on the basis of the occupant load factors of Table 20 that are characteristic of the use of the space or shall be determined as the maximum probable population of the space under consideration, whichever is greater.

- The occupant load in any building or portion thereof shall be not less than the number of persons determined by dividing the floor area assigned to that use by the occupant load factor for that use as specified in Table 20 here below.

- Areas accessible to people with severe mobility impairment, shall have not less than two accessible means of egress. Access within the allowable travel distance shall be provided to not less than one accessible area of refuge or one accessible exit providing an accessible route to an exit discharge.
### Table 20: Occupant load

<table>
<thead>
<tr>
<th>Use</th>
<th>$\text{Ft}^2$ per person</th>
<th>$\text{M}^2$ per person</th>
<th>Use</th>
<th>$\text{Ft}^2$ per person</th>
<th>$\text{M}^2$ per person</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assembly Use</strong></td>
<td></td>
<td></td>
<td><strong>Residential Use</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Concentrated use, without fixed seating</td>
<td>7 net</td>
<td>0.65 net</td>
<td>Hotels &amp; dormitories</td>
<td>200</td>
<td>18.6</td>
</tr>
<tr>
<td>Less concentrated use, without fixed seating</td>
<td>15 net</td>
<td>1.4 net</td>
<td>Workers’ accommodation</td>
<td>81</td>
<td>6.25</td>
</tr>
<tr>
<td>Bench-type seating</td>
<td>1 person/18 linear in.</td>
<td>1 person/455 linear in.</td>
<td>Apartment buildings</td>
<td>200</td>
<td>18.6</td>
</tr>
<tr>
<td>Fixed seating</td>
<td>Number of fixed seating</td>
<td>Number of fixed seating</td>
<td>Board and care, large</td>
<td>200</td>
<td>18.6</td>
</tr>
<tr>
<td>Kitchens</td>
<td>100</td>
<td>9.3</td>
<td>Industrial Use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Library stack areas</td>
<td>100</td>
<td>9.3</td>
<td>General and high hazard industrial</td>
<td>100</td>
<td>9.3</td>
</tr>
<tr>
<td>Library reading rooms</td>
<td>50 net</td>
<td>4.6 net</td>
<td>Special purpose industrial</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Swimming pools</td>
<td>50 (water surface)</td>
<td>4.6 (water surface)</td>
<td>Business Use (other than below)</td>
<td>100</td>
<td>9.3</td>
</tr>
<tr>
<td>Swimming pools decks</td>
<td>30</td>
<td>2.8</td>
<td>Air traffic control tower observation levels</td>
<td>40</td>
<td>3.7</td>
</tr>
<tr>
<td>Educational Use</td>
<td></td>
<td></td>
<td>Storage Use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Classrooms</td>
<td>20 net</td>
<td>1.9 net</td>
<td>In storage occupancies</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Shops, laboratories, vocational rooms</td>
<td>50 net</td>
<td>4.6 net</td>
<td>In mercantile occupancies</td>
<td>300</td>
<td>27.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>In other than storage and mercantile occupancies</td>
<td>500</td>
<td>46.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Mercantile Use</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Sales area on street floor</td>
<td>30</td>
<td>2.8</td>
</tr>
</tbody>
</table>

Continued on the next page
<table>
<thead>
<tr>
<th>Use</th>
<th>$\text{Ft}^2$</th>
<th>$\text{M}^2$</th>
<th>Use</th>
<th>$\text{Ft}^2$</th>
<th>$\text{M}^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day-care Use</td>
<td>35 net</td>
<td>3.3 net</td>
<td>Sales area on two or more street floors</td>
<td>40</td>
<td>3.7</td>
</tr>
<tr>
<td>Health Care Use</td>
<td></td>
<td></td>
<td>Sales area on floor below street floor</td>
<td>30</td>
<td>2.8</td>
</tr>
<tr>
<td>Inpatient treatment departments</td>
<td>240</td>
<td>22.3</td>
<td>Sales area on floors above street floor</td>
<td>60</td>
<td>5.6</td>
</tr>
<tr>
<td>Sleeping departments</td>
<td>120</td>
<td>11.1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambulatory health care</td>
<td>100</td>
<td>9.3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Every opening in a fire barrier shall be protected to limit the spread of fire and restrict the movement of smoke from one side of the fire barrier to the other. The fire protection rating for opening protectives in fire barriers, fire-rated smoke barriers, and fire-rated smoke partitions shall be in accordance with Table 21 below.

### Table 21:

<table>
<thead>
<tr>
<th>Component</th>
<th>Walls &amp; Partitions (hr)</th>
<th>First Door Assemblies (hr)</th>
<th>Fire Window Assemblies (hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elevator hoistways</td>
<td>2</td>
<td>1½</td>
<td>NP</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>1</td>
<td>NP</td>
</tr>
<tr>
<td>Vertical shafts (including stairways, exits, and refuse chutes)</td>
<td>2</td>
<td>1½</td>
<td>NP</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>1</td>
<td>NP</td>
</tr>
<tr>
<td></td>
<td>½</td>
<td>½</td>
<td>NP</td>
</tr>
<tr>
<td>Fire barriers</td>
<td>3</td>
<td>3</td>
<td>NP</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>½</td>
<td>NP</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>¼</td>
<td>¼</td>
</tr>
<tr>
<td></td>
<td>½</td>
<td>½</td>
<td>½</td>
</tr>
<tr>
<td>Horizontal exits</td>
<td>2</td>
<td>1½</td>
<td>NP</td>
</tr>
<tr>
<td>Horizontal exits served by bridges between buildings</td>
<td>2</td>
<td>¼</td>
<td>¼</td>
</tr>
<tr>
<td>Exit access corridors</td>
<td>1</td>
<td>½</td>
<td>¾</td>
</tr>
<tr>
<td></td>
<td>½</td>
<td>½</td>
<td>½</td>
</tr>
<tr>
<td>Smoke barriers</td>
<td>1</td>
<td>½</td>
<td>¾</td>
</tr>
<tr>
<td>Smoke partitions</td>
<td>½</td>
<td>½</td>
<td>½</td>
</tr>
</tbody>
</table>

NP: Not permitted
Penetrations for cables, cable trays, conduits, pipes, tubes, combustion vents and exhaust vents, wires, and similar items to accommodate electrical, mechanical, plumbing, and communications systems that pass through a wall, floor, or floor/ceiling assembly constructed as a fire barrier shall be protected by a firestop system or device. The firestop system or device shall be tested in accordance with ASTM E 814, Standard Test Method for Fire Tests of Through Penetration Fire Stops, or ANSI/UL 1479, Standard for Fire Tests of Through-Penetration Firestop, at a minimum positive pressure differential of 0.01 in. water column (2.5 N/m²) between the exposed and the unexposed surface of the test assembly.

Figure 29: Fire barrier vertical continuity

Figure 30: Protection of exit access corridor

Figure 31: Example of protection of exit passageway
3.5 Openings in Fire Barriers
Construction Conditions within the Industrial City

Vertical openings

Every floor that separates stories in a building shall be constructed as a smoke barrier and shall be permitted to have communicating space, atrium and convenience opening. Openings through floors shall be enclosed with fire barrier walls, shall be continuous from floor to floor, or floor to roof, and shall be protected as appropriate for the fire resistance rating of the barrier.

Shafts

Shafts shall be enclosed by fire barriers having fire resistance rating as follows:

A. Enclosures connecting four or more stories
   - 2-hour fire barriers
   - Other enclosures: 1-hour fire barriers

B. Communicating space

Unenclosed floor openings forming a communicating space between floor levels shall be permitted, provided that the following conditions are met:
   - The communicating space does not connect more than three contiguous stories.
   - The lowest or next-to-lowest story within the communicating space is a street floor.
   - The entire floor area of the communicating space is open and unobstructed, such that a fire in any part of the space will be readily obvious to the occupants of the space prior to the time it becomes an occupant hazard.
   - The communicating space is separated from the remainder of the building by fire barriers with not less than a 1-hour fire resistance rating, unless the buildings are protected throughout by an approved automatic sprinkler system, a smoke barrier shall be permitted to serve as the separation.
   - The communicating space has ordinary hazard contents protected throughout by an approved automatic sprinkler system or has only low hazard contents.
- Egress capacity is sufficient to allow all the occupants of all levels within the communicating space to simultaneously egress the communicating space by considering it as a single floor area in determining the required egress capacity.
- Each occupant within the communicating space has access to not less than one exit without having to traverse another story within the communicating space.
- Each occupant not in the communicating space has access to not less than one exit without having to enter the communicating space.

**Atrium:**

1. An atrium shall be permitted provided that the following conditions are met:

   - The atrium is separated from the adjacent spaces by fire barriers with not less than a 1-hour fire resistance rating with opening protectives for corridor walls, unless one of the following is met:
     a. Any number of levels of the building shall be permitted to open directly to the atrium without enclosure based on the results of the engineering analysis of the smoke extraction within the atrium.
     b. Glass walls and inoperable windows shall be permitted in lieu of the fire barriers where all the following are met:

   - b-1. Automatic sprinklers are spaced along both sides of the glass wall and the inoperable windows at intervals not to exceed 6 ft (1830 mm)
   - b-2. Automatic sprinklers are located at a distance from the glass wall not to exceed 12 in. (305 mm) and arranged so that the entire surface of the glass is wet upon operation of the sprinklers, the glass wall is of tempered, wired, or laminated glass held in place by a gasket system that allows the glass framing system to deflect without breaking (loading) the glass before the sprinklers operate
   - b-3. Automatic sprinklers are not required on the atrium side of the glass wall and the inoperable window where there is no walkway or other floor area on the atrium side above the main floor level
   - b-4. Doors in the glass walls are of glass or other material that resists the passage of smoke, doors in the glass walls are self-closing or automatic-closing upon detection of smoke, the glass is continuous vertically,
without horizontal mullions, window treatments, or other obstructions that would interfere with the wetting of the entire glass surface.

3. Access to exits is permitted to be within the atrium, and exit discharge is permitted to be within the atrium.

4. The occupancy within the atrium meets the specifications for classification as low or ordinary hazard contents.

5. The entire building is protected throughout by an approved, supervised automatic sprinkler.

6. An engineering analysis is performed that demonstrates that the building is designed to keep the smoke layer interface above the highest unprotected opening to adjoining spaces, or 6 ft (1830 mm) above the highest floor level of exit access open to the atrium, for a period equal to 1.5 times the calculated egress time or 20 minutes, whichever is greater. The smoke control system is independently activated by each of the following: required automatic sprinkler system, and manual controls that are readily accessible to the fire department.

**Convenience Openings**

Convenience opening is a vertical opening serving as other than an exit enclosure, connecting only two adjacent stories and piercing only one floor, shall be permitted to be open to one of the two stories. Such openings shall connect not more than two adjacent stories (one floor pierced only), such openings shall be separated from unprotected vertical openings serving other floors by a fire barrier having the same fire resistance rating of the shafts. Such openings shall be separated from corridors. In new construction, the convenience opening shall be separated from the corridor by a smoke partition, unless the corridor is required to have a fire resistance rating. Such openings shall not serve as a required means of egress.

![Figure 37: Plan view of a typical atrium](image)

![Figure 38: Convenience opening between two floors](image)
Interior Finishes
Classification of interior finish materials shall be in accordance with tests made under conditions simulating actual installations as per the following:

Interior Wall or Ceiling Finish Testing and Classification

Products shall be classified as follows in accordance with their flame spread and smoke development:

- **Class A interior wall and ceiling finish** shall be characterized by the following:
  - Flame spread index, 0–25
  - Smoke developed index, 0–450

- **Class B interior wall and ceiling finish** shall be characterized by the following:
  - Flame spread index, 26–75
  - Smoke developed index, 0–450

- **Class C interior wall and ceiling finish** shall be characterized by the following:
  - Flame spread index, 76–200
  - Smoke developed index, 0–450

Interior Floor Finish Testing and Classification:
Interior floor finishes shall be classified based on test results from NFPA 253, Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source, or ASTM E 648, Standard Test Method for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source. Interior floor finishes shall be classified as follows in accordance with the critical radiant flux ratings:

1. **Class I interior floor finish** shall be characterized by a critical radiant flux not less than 0.45 W/cm².
2. **Class II interior floor finish** shall be characterized by a critical radiant flux not less than 0.22 W/cm² but less than 0.45 W/cm².
3. **Class III interior floor finish** shall be characterized by a critical radiant flux not less than 0.022 W/cm² but less than 0.22 W/cm².

Elevators:
- Elevators shall not be considered a component in a required means of egress but shall be permitted as a component in an accessible means of egress.
- New elevators shall be in accordance with the requirements of ASME A17.1/CSA B44, Safety Code for Elevators and Escalators.
- Elevator machine rooms that contain solid-state equipment for elevators, having a travel distance exceeding 50 ft (15 m) above the level of exit discharge, or exceeding 30 ft (9150 mm) below the level of exit discharge, shall be provided with independent ventilation or air-conditioning systems to maintain temperature during fire fighters’ emergency operations for elevator operation. The operating temperature shall be established by the elevator equipment manufacturer’s specifications. When standby power is connected to the elevator, the machine room ventilation or air-conditioning shall be connected to standby power.
Requirements and Conditions of Fire Protection in Buildings depending on its Occupancy Classifications
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4.1 Buildings Classifications

The occupancy of a building or structure, or portion of a building or structure, shall be classified as per the following occupancies:

Assembly Occupancy:
An occupancy used for a gathering of 50 or more persons for deliberation, worship, entertainment, eating, drinking, amusement, awaiting transportation, or similar uses; or used as a special amusement building, regardless of occupant load.

Educational Occupancy:
An occupancy used for educational purposes through the twelfth grade by six or more persons for 4 or more hours per day or more than 12 hours per week.

Day-Care Occupancy:
An occupancy in which four or more clients receive care, maintenance, and supervision, by other than their relatives or legal guardians, for less than 24 hours per day.

Health Care Occupancy:
An occupancy used to provide medical or other treatment or care simultaneously to four or more patients on an inpatient basis, where such patients are mostly incapable of self-preservation due to age, physical or mental disability, or because of security measures not under the occupants’ control.

Ambulatory Health Care Occupancy:
An occupancy used to provide services or treatment simultaneously to four or more patients that provides, on an outpatient basis, one or more of the following:

- Treatment for patients that renders the patients incapable of taking action for self-preservation under emergency conditions without the assistance of others
- Anesthesia that renders the patients incapable of taking action for self-preservation under emergency conditions without the assistance of others
- Emergency or urgent care for patients who, due to the nature of their injury or illness, are incapable of taking action for self-preservation under emergency conditions without the assistance of others.

Residential Occupancy:
An occupancy that provides sleeping accommodations for purposes other than health care or detention and correctional.

One- and Two-Family Dwelling Unit:
A building that contains not more than two dwelling units with independent cooking and bathroom facilities.
Lodging or Rooming House:
A building or portion thereof that does not qualify as a one- or two family dwelling, that provides sleeping accommodations for a total of 16 or fewer people on a transient or permanent basis, without personal care services, with or without meals, but without separate cooking facilities for individual occupants.

Hotel:
A building or groups of buildings under the same management in which there are sleeping accommodations for more than 16 persons and primarily used by transients for lodging with or without meals.

Dormitory:
A building or a space in a building in which group sleeping accommodations are provided for more than 16 persons who are not members of the same family in one room, or a series of closely associated rooms, under joint occupancy and single management, with or without meals, but without individual cooking facilities.

Apartment Building:
A building or portion thereof containing three or more dwelling units with independent cooking and bathroom facilities.

Mercantile Occupancy:
An occupancy used for the display and sale of merchandise.

Business Occupancy:
An occupancy used for the transaction of business other than mercantile.

Industrial Occupancy:
An occupancy in which products are manufactured or in which processing, assembling, mixing, packaging, finishing, decorating, or repair operations are conducted.

Storage Occupancy:
An occupancy used primarily for the storage or sheltering of goods, merchandise, products, or vehicles.

When the different occupancies within the building as per the definitions here above are separated, the separation of each occupancy shall be by fire barriers and fire rated doors as per the below table showing the required separation in hours of fire resistance rating.
Table 22:

<table>
<thead>
<tr>
<th>Occupancy</th>
<th>Apartment Buildings</th>
<th>Day-care</th>
<th>Day-care Homes</th>
<th>Mercantile</th>
<th>Mercantile, Malls</th>
<th>Mercantile, Bulk Retail</th>
<th>Business</th>
<th>Industrial, General Purpose</th>
<th>Industrial, Special Purpose</th>
<th>Industrial, High Hazard</th>
<th>Storage, Low &amp; Ordinary Hazard</th>
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# Buildings Classifications

## Requirements and Conditions of Fire Protection in Buildings depending on its Occupancy Classifications

### Table 23: Required separation of occupancies (hours)

<table>
<thead>
<tr>
<th>Occupancy</th>
<th>Assembly ≤300</th>
<th>Assembly &gt;300 to ≤1000</th>
<th>Assembly &gt;1000</th>
<th>Educational</th>
<th>Health Care</th>
<th>Ambulatory Health Care</th>
<th>One- &amp; Two- Family Dwellings</th>
<th>Lodging or rooming</th>
<th>Hotels &amp; dormitories</th>
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<td>Assembly ≤300</td>
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<tr>
<td>Health Care</td>
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<td>Ambulatory Health Care</td>
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<td>Lodging or rooming</td>
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<tr>
<td>Hotels &amp; dormitories</td>
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</tr>
</tbody>
</table>

* It is permitted to reduce the fire resistance rating by one hour only if the building is protected throughout by automatic sprinkler system.

** the 1-hour reduction due to the presence of sprinklers is not permitted.
4.2 Fire Protection Requirements for Assembly Occupancy Buildings

The assembly occupancy are the buildings or the buildings parts used for gathering 50 or more persons such as mosques, meeting rooms, lecture halls, exhibition halls, banks halls, libraries.

The assembly occupancy buildings are classified depending on the occupant load on the following three types:

▪ Class A: buildings accommodating more than 1000 persons
▪ Class B: buildings accommodating 300 to 1000 persons
▪ Class C: buildings accommodating 50 to 300 persons

▪ The assembly occupancy buildings are classified as buildings having low hazard contents.

▪ In case the assembly occupancy building is used for other purposes, or in case the assembly occupancy is part of a building having other occupancy classification, the different occupancies within the building shall be separated from each other and each occupancy shall be considered as independent fire compartment having its own independent means of egress.

▪ The assembly occupancy Class A buildings or parts of shall not be mixed with other occupancies except for the ancillary occupancy that are related to the assembly occupancy such as the restaurant, cafeteria. Beyond that, each case is considered and decided by the civil defense as deemed appropriate.

▪ The assembly occupancy shall be limited to the building construction types specified in the table here below based on the number of stories in height.

▪ The separation between the assembly occupancy from the remainder of the building shall be as per the tables 22 and 23 indicated in the occupancy classification section here above.
### Table 24: Construction Type Limitations

<table>
<thead>
<tr>
<th>Construction Type</th>
<th>Sprinklered</th>
<th>Stories Below</th>
<th>Stories in Height</th>
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<tbody>
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<td>I (442) c,d,r</td>
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<td>X</td>
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<td></td>
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<tr>
<td></td>
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</tr>
<tr>
<td>II (000)</td>
<td>Yes</td>
<td>X2 X3 X4</td>
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<tr>
<td>III (211)d</td>
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<td></td>
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<td>V (111)</td>
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<td>1 2 3 3 NP</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>NP</td>
<td></td>
</tr>
</tbody>
</table>

**X:** Permitted for assembly of any occupant load

**X1:** Permitted for assembly of any occupant load, but limited to one story below the level of exit discharge

**X2:** Permitted for assembly limited to an occupant load of 1000 or less, and limited to one story below the level of exit discharge

**X3:** Permitted for assembly limited to an occupant load of 1000 or less

**X4:** Permitted for assembly limited to an occupant load of 300 or less

**NP:** Not permitted
Control of Fire Spread

In addition to the general requirements mentioned above, the following requirements shall be considered:

**Horizontal Fire Spread**

The fire compartment volume shall not be more than 7000 m³ separated from different sections of the assembly occupancy building, and each fire compartment is considered as an independent compartment, such as the meeting rooms and waiting hall. This fire compartment shall be also separated from the different occupancies within the building.

**Vertical Fire Spread**

Each floor is considered as independent fire compartment. In case an atrium is provided, the specific requirements of the atrium here above shall be implemented.

**Fire Department Equipment Access**

The fire department trucks and equipment access shall be ensured for the assembly occupancy buildings as per the following requirements:

- Road or street around the assembly occupancy building shall be ensured by providing a road or street for fire department equipment / trucks access to a minimum of two buildings’ facades and the building entrance shall be on one of these facades.
- The building entrance shall be on one of these facades.
- Parking areas for the fire department trucks and equipment shall be ensured.

**Emergency Exits**

- The emergency exits from the assembly occupancy areas shall be independent from the other occupancy areas in class A or class B buildings such as the workshops, storage rooms which shall be provided by independent emergency exits leading directly to the exterior of the building.
- The means of egress shall be protected from the fire spread and shall be considered as fire compartment constructed by noncombustible materials separated from the remainder of the building by fire barriers having 1-hour fire resistance rating and self-closing doors having 1-hour fire protection rating.
- In all class A and class B buildings, the access to the exit or to the exit stairs shall be through a space protected from fire as per the following requirements:

**Egress capacity:**

The egress capacity shall depend on the occupant load such as the number of the fixed seats.

**Travel distance**

- The travel distance from any point of the floor to the final exit or to the protected exit stair shall not exceed the following:
  - 20 m in a hall with armchairs seats.
  - 15 m in a hall with ordinary seats.
  - 30 m in an open space multipurpose room.
  - 15 m in a small hall providing that the occupant load within the room is not more than 30 persons.
- In large multipurpose halls without internal partitions and in conference centers, it is permitted to have a travel distance exceeding 30 m provided that the exit and exit stairs are distributed at the building perimeter and the separation distance between exits is not more than 60 m.
- The number of exits shall be in accordance with the general requirements of the means of egress of this guide.
- The common path of travel and dead end corridor shall be in accordance with the general requirements of the means of egress of this guide.
- Any door in a required means of egress within an area having an occupant load of 100 or more persons shall be permitted to be provided with a latch or lock only if the latch or lock is panic hardware or fire exit hardware.
Doors in the means of egress shall be permitted to be equipped with an approved access control system, and such doors shall not be locked from the egress side when the assembly occupancy is occupied.

No turnstiles or other devices that restrict the movement of persons shall be installed in any assembly occupancy in such a manner as to interfere with required means of egress facilities.

Main Entrance/Exit:

Every assembly occupancy shall be provided with a main entrance/exit. The main entrance/exit width shall accommodate one-half of the total occupant load. The main entrance/exit shall be at the level of exit discharge or shall connect to a stairway or ramp leading to a street.

Corridors

The width of any exit access corridor serving 50 or more persons shall be not less than 44 in. (1120 mm).

Interior wall and ceiling finish materials shall be Class A or Class B in all corridors and lobbies and shall be Class A in enclosed stairways.

Interior wall and ceiling finish materials shall be Class A or Class B in general assembly areas having occupant loads of more than 300 and shall be Class A, Class B, or Class C in assembly areas having occupant loads of 300 or fewer.

Interior floor finish in exit enclosures and exit access corridors and in spaces not separated from them by fire barrier walls having not less than one 1-hour fire resistance rating shall be not less than Class II.

Fire fighting and fire alarm systems

The firefighting and fire alarm systems shall be designed and installed as per the civil defense guide.

The civil defense may require additional firefighting and fire alarm systems as alternatives of some protection means as per the civil defense requirements.

The firefighting and fire alarm systems required for the assembly occupancy buildings are indicated in Table 25.

The requirements for automatic water sprinkler system are indicated in Table 26.
### Table 25:
Firefighting system in assembly occupancy buildings depending on the classification, height and structural construction type

<table>
<thead>
<tr>
<th>Type</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Manual firefighting equipment</td>
</tr>
<tr>
<td>1</td>
<td>Portable fire extinguishers All floors</td>
</tr>
<tr>
<td>2</td>
<td>Fixed installations</td>
</tr>
<tr>
<td>1</td>
<td>Hose system All floors</td>
</tr>
<tr>
<td>2</td>
<td>Dry Standpipe network More than 4 stories (ground floor + three upper floors) + building height is less than 28 m or two floors having a gross floor area of more than 1000 m²</td>
</tr>
<tr>
<td>3</td>
<td>Wet Standpipe network Building height is 28 m or more or two floors having a gross floor area of more than 1000 m²</td>
</tr>
<tr>
<td>4</td>
<td>External fire hydrant network Depending on building size</td>
</tr>
<tr>
<td>3</td>
<td>Automatic fixed systems</td>
</tr>
<tr>
<td>1</td>
<td>Automatic water sprinkler system As per Table 26 for the requirements of automatic sprinkler system in assembly occupancy buildings</td>
</tr>
<tr>
<td>2</td>
<td>Automatic extinguishing system with non-water firefighting materials Special hazard premises where water cannot be used as firefighting material</td>
</tr>
<tr>
<td>4</td>
<td>Fire alarm equipment and systems</td>
</tr>
<tr>
<td>1</td>
<td>Manual fire alarm system In multipurpose rooms, and corridors</td>
</tr>
</tbody>
</table>

### Table 26:
Requirements for automatic water sprinkler system in assembly occupancy depending on the classification, height and structural construction type

<table>
<thead>
<tr>
<th>Type</th>
<th>Occupant load</th>
<th>Floor</th>
<th>Structural construction type</th>
<th>Requirements for water sprinkler</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>More than 1000 persons</td>
<td>Ground floor to third floor</td>
<td>Type I</td>
<td>Not required</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Fourth floor and above</td>
<td>All types</td>
<td>Required</td>
</tr>
<tr>
<td>B</td>
<td>300 to 1000 persons</td>
<td>Ground and 1st floors</td>
<td>Type I and II</td>
<td>Required</td>
</tr>
<tr>
<td>C</td>
<td>50 to 300 persons</td>
<td>Ground and 1st floors</td>
<td>Types: I and II and IV</td>
<td>Not required</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Ground floor only</td>
<td>Type V temporary and special conditions</td>
<td>Required</td>
</tr>
</tbody>
</table>

**Remark:** Refer to Table 2 for buildings fire resistance
Fire Protection Requirements for Assembly Occupancy Buildings
Requirements and Conditions of Fire Protection in Buildings depending on its Occupancy Classifications

- Any building containing one or more assembly occupancies where the aggregate occupant load of the assembly occupancies exceeds 300 shall be protected by an approved, supervised automatic sprinkler system as:
  - Throughout the story containing the assembly occupancy
  - Throughout all stories below the story containing the assembly occupancy
  - In the case of an assembly occupancy located below the level of exit discharge, throughout all stories intervening between that story and the level of exit discharge, including the level of exit discharge.
  - In assembly occupancy with occupant loads of more than 300 persons, the initiation of the required fire alarm system shall be manual means throughout the building where initiation is not provided by approved automatic fire detection system or by an approved automatic sprinkler system.
  - In assembly occupancies with occupant loads of more than 300, automatic detection shall be provided in all hazardous areas that are not normally occupied, unless such areas are protected throughout by an approved, supervised automatic sprinkler system
  - Where automatic sprinklers are provided, sprinkler system waterflow shall initiate the fire alarm system, even where manual fire alarm boxes are provided.
  - The initiating device shall be capable of transmitting an alarm to a receiving station, located within the building that is constantly attended when the assembly occupancy is occupied.

Notification:
- The required fire alarm system shall activate an audible and visible alarm in a constantly attended receiving station within the building when occupied for purposes of initiating emergency action.
- Occupant notification shall be by means of voice and by means of visible signals initiated by the person in the constantly attended receiving station.
4.3 Fire Protection Requirements for Residential Occupancy Buildings

The residential buildings are classified in two groups categories as follows:

- Collective Residential buildings
- Individual Residential buildings such as the small villas

**Protection requirements for collective residential buildings**

Collective residential buildings are the buildings or buildings’ parts allocated for contiguous housing, they are of 3 classes depending on the type of use:

- **Class A** are the buildings consisting of permanent dwelling units (residential apartment buildings)
- **Class B** are the buildings consisting of rooms or dormitories for permanent individual or collective accommodation such as the employees and workers accommodations and the like.
- **Class C** are the buildings consisting of rooms used for paid or unpaid temporary accommodation such as guesthouses, furnished apartments and the like.

**Fire Hazard**

The fire hazard in residential buildings is classified as low hazard. Table 27 specifies the travel distance and the direct distance in residential building.

**Means of egress**

- In buildings protected throughout by an approved, supervised automatic sprinkler system, common path of travel shall not exceed 50 ft (15 m); travel within a guest room or guest suite shall not be included when determining common path of travel.
- In buildings not protected throughout by an approved, supervised automatic sprinkler system, common path of travel shall not exceed 35 ft (10.7 m); travel within a guest room or guest suite shall not be included when calculating common path of travel.

**Hotels and Dormitories**

No hotel or dormitory shall have its sole means of egress pass through any nonresidential occupancy in the same building, unless one of the following criteria are met:

- In buildings that are protected by an automatic sprinkler system, hotels and dormitories shall be permitted to have their sole means of egress pass through a nonresidential occupancy in the same building, provided that the sole means of egress from the hotel or dormitory shall not pass through a high hazard contents area.
- In buildings that are not protected by an automatic sprinkler, hotels and dormitories shall be permitted to have their sole means of egress pass through a nonresidential occupancy in the same building, provided that the sole means of egress from the hotel or dormitory to the exterior shall be separated from the remainder of the building by fire barriers having a minimum 1-hour fire resistance rating and the sole means of egress from the hotel or dormitory shall not pass through a high hazard contents area.

**Residential Buildings**

No dwelling unit of an apartment building shall have its sole means of egress pass through any nonresidential occupancy in the same building unless one of the following criteria are met:
In buildings that are protected by an automatic sprinkler system, dwelling units of an apartment building shall be permitted to have their sole means of egress pass through a nonresidential occupancy in the same building, provided that the sole means of egress from the dwelling unit of the apartment building shall not pass through a high hazard contents area.

In buildings that are not protected by an automatic sprinkler system, dwelling units of an apartment building shall be permitted to have their sole means of egress pass through a nonresidential occupancy in the same building, provided that the sole means of egress from the dwelling unit of the apartment building to the exterior shall be separated from the remainder of the building by fire barriers having a minimum 1-hour fire resistance rating and the sole means of egress from the dwelling unit of the apartment building shall not pass through a high hazard contents area.

### Table 27:

<table>
<thead>
<tr>
<th>Location</th>
<th>Distance by meter</th>
<th>Floor</th>
<th>Type and Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct distance within the dwelling unit</td>
<td>15</td>
<td>Upper floors</td>
<td>Buildings class A</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>Upper floors</td>
<td>Buildings class B</td>
</tr>
<tr>
<td>Travel distance from the dwelling unit entrance doors to the exit or protected stair</td>
<td>30</td>
<td>Other floors</td>
<td>—</td>
</tr>
<tr>
<td>Dead end</td>
<td>7.5</td>
<td>Any floor</td>
<td>Dead end case</td>
</tr>
</tbody>
</table>

### Corridors

- The width of the main corridors shall not be less than 1.5 m and that of the secondary corridors shall not be less than 1.2 m in residential buildings class A consisting of buildings with permanent accommodation for one family dwelling units (apartments) such as residential apartment building.

- The width of the main corridors shall not be less than 2.0 m and that of the secondary corridors shall not be less than 1.2 m in residential building class B consisting of rooms or dormitories with permanent individual or grouped accommodation such as the accommodation of employees or workers.

- The width of the main corridors shall not be less than 2.0 m and that of the secondary exit corridors shall not be less than 1.2 m in residential buildings class C consisting of buildings with temporary paid or unpaid accommodation such as hotels, motels, guest houses, and furnished apartments.

### Exits

- All exits shall lead directly to the exterior of the building or to stairs or passageways protected from fire and separated from the remainder of the building by fire barriers.

- If the main internal stair of the dwelling unit, Villa duplex type, is not leading directly to the main entrance door, the emergency exit of the second floor of the dwelling unit shall lead to the main stairs or passageway of the building.

- An additional exit for each dwelling unit or residential room leading to outside or to a protected passageway shall be provided if the travel distance exceeds that indicated in the table here above.
• The exit access doors shall have not less than 81 cm width and shall be remotely located from the main entrance door.

• The protection of the exit stairs and corridors shall be in accordance with general requirements here above.

**Horizontal Exits**

• Temporary fire compartment shall be provided in residential building class B consisting of rooms or dormitories for individual or grouped permanent accommodation such as the residential buildings for employees and workers having floor area greater than 3000 m².

• The horizontal exits shall be in accordance with the means of egress general requirements here above.

**Stairs**

• The stairs shall be protected, enclosed and protected from the remainder of the building by fire barriers and the stairs shall lead directly to the exterior of the building.

• The number of stairs shall be not less than two, remotely located at the building perimeter and on the external façade leading directly to the outside.

• The details and dimensions of the exit stairs shall be in accordance with the means of egress general requirements here above.

**Ramps**

• Ramps shall be provided for residential buildings for persons with access disabilities at the ground floor and shall be in accordance with the means of egress general requirements here above.

• The details and dimensions shall be in accordance with the means of egress general requirements here above.

• Each floor area shall not exceed 600 m² and the total floor area shall not exceed 1800 m² and the total area is calculated as per the building code.

**Final Exit**

• In all cases, the means of egress shall lead to a final exit leading directly to the outside.

• The occupancies other than residential located in the residential building shall be in accordance with the most stringent requirements specific to these occupancies.

**Interior Finishes**

• Interior wall and ceiling finish materials shall be Class A for exit enclosures; Class A or Class B in all corridors and lobbies; and Class A, Class B or Class C in other spaces.

• Interior floor finish in exit enclosures and exit access corridors and spaces not separated from them by fire barrier walls shall be not less than Class II.


• Floor coverings, other than carpet shall have a minimum critical radiant flux of 0.1 W/cm².

**Contents and Furnishings**

• New draperies, curtains, and other similar loosely hanging furnishings and decorations shall be flame resistant as demonstrated by testing in accordance with NFPA 701, Standard Methods of Fire Tests for Flame Propagation of Textiles and Films.

• Newly introduced upholstered furniture, shall be resistant to cigarette ignition (i.e., smoldering) in accordance with one of the following:
The components of the upholstered furniture shall meet the requirements for Class I when tested in accordance with NFPA 260, Standard Methods of Tests and Classification System for Cigarette Ignition Resistance of Components of Upholstered Furniture, or with ASTM E 1353, Standard Test Methods for Cigarette Ignition Resistance of Components of Upholstered Furniture.

Mocked-up composites of the upholstered furniture shall have a char length not exceeding 1 1/2 in. (38 mm) when tested in accordance with NFPA 261, Standard Method of Test for Determining Resistance of Mock-Up Upholstered Furniture Material Assemblies to Ignition by Smoldering Cigarettes, or with ASTM E 1352 Standard Test Method for Cigarette Ignition Resistance of Mock-Up Upholstered Furniture Assemblies.

Upholstered furniture, unless the furniture is located in a building protected throughout by an approved automatic sprinkler system, shall have limited rates of heat release when tested in accordance with ASTM E 1537, Standard Test Method for Fire Testing of Upholstered Furniture, as follows:

- The peak rate of heat release for the single upholstered furniture item shall not exceed 80 kW.
- The total energy released by the single upholstered furniture item during the first 10 minutes of the test shall not exceed 25 MJ.

Newly introduced mattresses, shall have a char length not exceeding 2 in. (51 mm) when tested in accordance with 16 CFR 1632, “Standard for the Flammability of Mattresses and Mattress Pads” (FF 4-72).

Mattresses, unless the mattress is located in a building protected throughout by an approved automatic sprinkler system, shall have limited rates of heat release when tested in accordance with ASTM E 1590, Standard Test Method for Fire Testing of Mattresses. The peak rate of heat release for the mattress shall not exceed 100 kW and the total energy released by the mattress during the first 10 minutes of the test shall not exceed 25 MJ.

Subdivision of buildings spaces for hotels, dormitories, and apartment buildings

In buildings not protected throughout by an approved, supervised automatic sprinkler system, each hotel guest room, including guest suites, and dormitory room shall be separated from other guest rooms or dormitory rooms by walls and floors constructed as fire barriers having a minimum 1-hour fire resistance rating.

In buildings protected throughout by an approved, supervised automatic sprinkler system, each hotel guest room, including guest suites, and dormitory room shall be separated from other guest rooms or dormitory rooms by walls and floors constructed as fire barriers having a minimum 1/2-hour fire resistance rating.

Doors in the barriers shall have a fire protection rating of not less than 20 minutes and shall not be required to be self-closing.

Corridor protection for hotels, dormitories, and apartment buildings

In buildings not protected throughout by an approved, supervised automatic sprinkler system, dwelling units shall be separated from each other by walls and floors constructed as fire barriers having a minimum 1-hour fire resistance rating.

In buildings protected throughout by an approved, supervised, automatic sprinkler system, dwelling units shall be separated from each other by walls and floors constructed as fire barriers having a minimum 1/2-hour fire resistance rating.

Doors that open onto exit access corridors
shall have not less than a 20-minute fire protection rating. Doors that open onto exit access corridors shall be self-closing and self-latching.

- Unprotected openings, other than the following spaces, shall be prohibited in exit access corridor walls and doors:
  - The space is not used for guest rooms or guest suites or hazardous areas.
  - The building is protected throughout by an approved, supervised automatic sprinkler system
  - The space does not obstruct access to required exits.

**Firefghthing and fire alarm systems**

The firefighting and the fire alarm system shall be designed, installed and maintained as per their specific standards or as per the civil defense guidelines.

The civil defense may require additional or alternative systems / equipment to those required in this section. The firefighting and fire alarm system required for the residential buildings class A, B, C are specified in the following table:

### Table 28:
Firefighting and fire alarm systems / equipment for residential building class A

<table>
<thead>
<tr>
<th>Type</th>
<th>Required Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Manual Extinguishing Equipment</td>
<td></td>
</tr>
<tr>
<td>Portable fire extinguishers</td>
<td>All floors</td>
</tr>
<tr>
<td>2 Fixed installations</td>
<td></td>
</tr>
<tr>
<td>Standpipe system with dry riser</td>
<td>In building having two or more floors and having an area of more than 1000 m².</td>
</tr>
<tr>
<td>Fire hydrant network</td>
<td>For residential complexes</td>
</tr>
<tr>
<td>3 Automatic fixed systems</td>
<td></td>
</tr>
<tr>
<td>Automatic water sprinkler system</td>
<td>Partial coverage for all floors of high rise buildings and residential complexes</td>
</tr>
<tr>
<td>Automatic suppression system using materials other than water</td>
<td>Special Hazard premises where the water shall not be used</td>
</tr>
<tr>
<td>4 Fire alarm system</td>
<td></td>
</tr>
<tr>
<td>Manual fire alarm system</td>
<td>In all floors and residential complexes</td>
</tr>
<tr>
<td>Automatic fie alarm system</td>
<td>In all floors, and residential complexes buildings, corridors, special hazard premises, HVAC ducts, underground areas if any</td>
</tr>
</tbody>
</table>
Table 29:

<table>
<thead>
<tr>
<th>Type</th>
<th>Required Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Manual Extinguishing Equipment</td>
<td>Protabel fire extinguishers All floors</td>
</tr>
<tr>
<td>2 Fixed installations</td>
<td>Hose System All floors</td>
</tr>
<tr>
<td></td>
<td>Fire Hydrant network For residential complexes only</td>
</tr>
<tr>
<td>3 Automatic fixed systems</td>
<td>Automatic water sprinkler system Partial coverage for all floors of high rise buildings and residential complexes especially for means of egress</td>
</tr>
<tr>
<td></td>
<td>Automatic suppression system using materials other than water Special Hazard premises where the water shall not be used</td>
</tr>
<tr>
<td>4 Fire alarm system</td>
<td>Manual fire alarm system In all floors and residential complexes</td>
</tr>
<tr>
<td></td>
<td>Automatic fire alarm system In all floors, and residential complexes buildings, corridors, special hazard premises, HVAC ducts, underground areas if any</td>
</tr>
</tbody>
</table>

**Fire alarm system requirements**

**For hotels and dormitories**

The required fire alarm system shall be initiated by each of the following:

- Manual fire alarm box located at the hotel desk or other convenient central control point under continuous supervision by responsible employees.
- Required automatic sprinkler system.
- Required automatic detection system other than sleeping room smoke detectors
- Occupant notification shall be provided automatically.
- Guest rooms and guest suites specifically required and equipped to accommodate hearing-impaired individuals shall be provided with a visible notification appliance.
- Occupiable areas, other than guest rooms and guest suites, visible notification appliances shall be provided. Annunciation and annunciation zoning shall be provided in buildings three or more stories in height or having more than 50 guest rooms or guest suites. Annunciation shall be provided at a location readily accessible from the primary point of entry for emergency response personnel.
- Emergency forces notification shall be provided.
- A corridor smoke detection system shall be provided in buildings other than those protected throughout by an approved, supervised automatic sprinkler.
- An approved single-station smoke alarm shall be installed in every guest room and every living area and sleeping room within a guest suite.
For apartment buildings:

- The initiation of the fire alarm system shall be also by the operation of the automatic sprinkler system, in buildings protected throughout by an approved, supervised automatic sprinkler.
- Occupant notification shall be provided automatically and by visible signals installed in units designed for the hearing impaired.
- Annunciation, and annunciation zoning, shall be provided. Annunciation shall be provided at a location readily accessible from the primary point of entry for emergency response personnel.
- Fire department notification shall be provided.
- Smoke alarms shall be installed in every sleeping area, outside every sleeping area in the immediate vicinity of the bedrooms, and on all levels of the dwelling unit, including basements.

Firefighting requirements

For hotels and dormitories

All buildings, other than those complying with the below requirements, shall be protected throughout by an approved, supervised automatic sprinkler system.

Automatic sprinkler protection shall not be required in buildings where all guest sleeping rooms or guest suites have a door opening directly to either of the following:

- Outside at the street or the finished ground level

- Exterior exit access in buildings three or fewer stories in height
- Listed quick-response or listed residential sprinklers shall be used throughout guest rooms and guest room suites.
- Portable fire extinguishers shall be provided in hazardous areas.

For apartment buildings:

- All buildings shall be protected throughout by an approved, supervised automatic sprinkler system.
- In buildings sprinklered in accordance with NFPA 13, Standard for the Installation of Sprinkler Systems, closets less than 12 ft² (1.1 m²) in area in individual dwelling units shall not be required to be sprinklered. Closets that contain equipment such as washers, dryers, furnaces, or water heaters shall be sprinklered, regardless of size.
- Listed quick-response or listed residential sprinklers shall be used throughout all dwelling units.
- Portable fire extinguishers shall be provided in hazardous areas.
Fire Protection Requirements for Residential Occupancy Buildings
Requirements and Conditions of Fire Protection in Buildings depending on its Occupancy Classifications

Table 30:

<table>
<thead>
<tr>
<th>Type</th>
<th>Building services specific for fire protection in residential buildings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ventilation system</td>
</tr>
<tr>
<td></td>
<td>As per the international standards adopted by the civil defense</td>
</tr>
<tr>
<td>2</td>
<td>Illuminated exit signs</td>
</tr>
<tr>
<td></td>
<td>Corridors, means of egress and emergency exits</td>
</tr>
<tr>
<td>3</td>
<td>Emergency Lighting system</td>
</tr>
<tr>
<td></td>
<td>Corridor, means of egress and emergency exits</td>
</tr>
<tr>
<td>4</td>
<td>Emergency power supply system</td>
</tr>
<tr>
<td></td>
<td>High rise buildings, residential complexes, and the buildings requiring a fire fighter lift.</td>
</tr>
</tbody>
</table>

**Emergency lighting requirements**

**For hotels and dormitories**

Emergency lighting in accordance shall be provided. The emergency lighting shall not apply where each guest room or guest suite has an exit direct to the outside of the building at street or the finished ground level.

**For apartment buildings:**

Emergency lighting shall be provided in all buildings four or more stories in height, or with more than 12 dwelling units, unless every dwelling unit has a direct exit to the outside of the building at the finished ground level.
4.4 Fire Protection Requirements for Commercial Buildings

Mercantile occupancies shall be sub-classified as follows:

- **Class A**: all mercantile occupancies having an aggregate gross area of more than 30,000 ft² (2800m²) or occupying more than three stories for sales purposes
- **Class B**: All mercantile occupancies of more than 3000 ft² (280 m²), but not more than 30,000 ft² (2800 m²), and aggregate gross area occupying not more than three stories for sales purposes
- **Class C**: all small mercantile occupancies

**Category A: Mercantile Shops**
Are the buildings or their parts used for displaying and selling goods such as:
- Wholesale and retail shops – commercial centers
- Light professions services such as
  - Sewing and hairdressing shops
  - Photography shops and the like
- Supermarkets

**Category B: Buildings dedicated for offices use**
These buildings consist of the following:
- Business Administration offices
- Banks branches
- Establishments offices
- Corporate offices
- Consulting and engineering offices
- Real estate offices and the like

- All shops having a total gross area of not more than 280 square meters and occupies two or three floors for the purposes of sales.

**Category C: All the small shops area**
These shops are the shops having a gross area of not more than 280 m² and used for sales purposes and occupying one floor only.

**Fire hazard**
- The fire hazard in commercial buildings is classified depending on the related category as follows:
  - Commercial buildings category A - Mercantile shops: Medium Hazard.
  - Commercial buildings category B - Offices: Low Hazard
  - Commercial buildings category C - Mixed mercantile shops: Medium Hazard
- The commercial buildings that are part of buildings having another occupancy classification or used for categories A or B purposes shall be separated from other occupancies in a way to be treated as separate fire compartments having its independent means of egress.
- The separation between occupancies shall be done in accordance with requirements of the occupancy classification chapter here above.
- The mixed use with high hazard or industrial occupancy shall not be permitted.
Fire Spread control
The general and the following specific requirements shall be implemented:

Horizontal Fire Spread
The different fire compartments shall be separated as per the building construction type and means of egress for such fire compartment shall be in accordance with the means of egress requirements mentioned previously.

The area of the fire compartment shall not exceed the following:
- Category A: Mercantile shops, the fire compartment area shall not exceed 2000 m² and each rented mercantile unit is considered as secondary independent fire compartment.
- Category B: Offices, the fire compartment shall not exceed 3000 m², each rented mercantile unit is considered as secondary independent fire compartment.

Vertical fire spread:
- The requirements of control and protection measures related to the vertical fire spread are those of the residential buildings.
- The vertical openings shall be enclosed as per engineered protection requirements except for medium opening (Atrium) if the following requirements are met:
  - The height of the medium opening shall not exceed 3 floors (ground floor, two mezzanines).
  - All floors of the mercantile shops shall be protected by automatic water sprinkler system and provided by natural or mechanical ventilation system at the upper level of the opening.
  - The medium opening is permitted to open through all the buildings levels if the following requirements are met:
    - The minimum dimensions of the medium opening is not less than 6 meters.
- Automatic water sprinkler system shall be provided forming a water curtain around the medium opening in addition to a system than restrict the horizontal spread of the fire and smoke as per the civil defense requirements.
- The vertical opening shall be in accordance with the specific section of the related general requirements here above.

External fire spread
- The buildings or sectors of the mercantile units shall be separated from each other by fire barriers having not less than one hour fire resistance rating.
- The walls separating the commercial buildings from other occupancy buildings shall be constructed as fire barrier having the most stringent fire resistance rating related to these occupancies.

Fire Department Access
The fire department access roads for trucks and equipment shall be provided for commercial building.

Means of egress (emergency exits)
Capacity
- The width of means of egress shall be calculated to accommodate the occupant load to be served.
- The capacity of means of egress shall be in accordance with the related general requirements.
- Street floor exits shall be sufficient for the occupant load of the street floor plus the required capacity of open stairs and ramps discharging through the street floor.

Travel distance and direct distance
The travel distance from any point to the final exit or to a protected stairs shall not exceed the values mentioned in the Table 31.
Table 31: Travel distance and direct distance for commercial buildings

<table>
<thead>
<tr>
<th>Location</th>
<th>Distance (meters)</th>
<th>Maximum number of persons</th>
<th>Floor</th>
<th>Cases and Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct distance within a mercantile shop or office</td>
<td>15</td>
<td>30</td>
<td>Ground floor</td>
<td>Independent and not connected to a basement or mezzanine</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>30</td>
<td>mezzanine</td>
<td>Independent and connected to the building</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>15</td>
<td>mezzanine</td>
<td>connected to the building</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>30</td>
<td>All floors</td>
<td>Office case</td>
</tr>
<tr>
<td>Direct distance from the most far point of the floor to the stair landing door</td>
<td>12</td>
<td>-</td>
<td>all floors</td>
<td>In case of middle stair in commercial buildings (offices)</td>
</tr>
<tr>
<td>Travel distance from the shop door or office to the protected stair’s landing door or to the outside exit</td>
<td>20</td>
<td>-</td>
<td>Basement</td>
<td>When more than one exit exists in many direction</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>-</td>
<td>All floors</td>
<td>When more than one exit exists in many direction</td>
</tr>
<tr>
<td></td>
<td>7.5</td>
<td>-</td>
<td>All floors</td>
<td>In dead end corridor</td>
</tr>
</tbody>
</table>

- The requirements for travel distance shall be in accordance with the general requirements of means of egress hereabove, in case the number of persons exceeds that mentioned in column 3 of Table 31 of Chapter 3 of this guide.
- The common path of travel and the dead end corridor shall be in accordance with the general requirements of means of egress of Chapter 3.
- The number of means of egress shall be in accordance with general requirements of means of egress of Chapter 3.

**For mercantile occupancy:**

Not less than two separate exits shall be provided on every story, however:

- A single means of egress shall be permitted in a Class C mercantile occupancy, provided that the travel distance to the exit does not exceed 75 ft (23 m).
- A single means of egress shall be permitted in a Class C mercantile occupancy, provided that the travel distance to the exit does not exceed 100 ft (30 m), and the story on which the occupancy is located, and all communicating levels that are traversed to reach the exit, are protected throughout by an approved, supervised automatic sprinkler system.
- A single means of egress to an exit shall be permitted from a mezzanine within any Class A, Class B, or Class C mercantile occupancy, provided that the common path of travel does not exceed 75 ft (23 m), or does not exceed 100 ft (30 m) if protected throughout by an approved, supervised automatic sprinkler system.
Fire Protection Requirements for Commercial Buildings

Requirements and Conditions of Fire Protection in Buildings depending on its Occupancy Classifications

For business occupancy:
Not less than two separate exits shall be provided on every story, however:
A single exit shall be permitted for a room or area with a total occupant load of fewer than 100 persons, provided that the following criteria are met:

1. The exit shall discharge directly to the outside at the level of exit discharge for the building.
2. The total distance of travel from any point, including travel within the exit, shall not exceed 100 ft (30 m).
3. The total distance of travel specified in shall be on the same floor level or, if traversing of stairs is necessary, such stairs shall not exceed 15 ft (4570 mm) in height, and the stairs shall be provided with complete enclosures to separate them from any other part of the building, with no door openings therein.

A single outside stair shall be permitted to serve all floors permitted within the 15 ft (4570 mm) vertical travel limitation.

Any business occupancy three or fewer stories in height, and not exceeding an occupant load of 30 people per floor, shall be permitted a single separate exit to each floor, provided that the following criteria are met:

1. The total travel distance to the outside of the building does not exceed 100 ft (30 m).
2. The exit is enclosed, serves as an exit from no other levels, and discharges directly to the outside.
3. A single means of egress shall be permitted from a mezzanine within business occupancy, provided that the common path of travel does not exceed 75 ft (23 m), or 100 ft (30 m) if protected throughout by an approved, supervised automatic sprinkler system.

A single exit shall be permitted for a single-tenant space/building two or fewer stories in height, provided that both of the following criteria are met:
1. The building is protected throughout by an approved, supervised automatic sprinkler system.
2. The total travel to the outside does not exceed 100 ft (30 m).

Corridors
The corridors shall be organized and readily accessible to lead directly to outside.

Gridiron Corridors
- Gridiron corridors shall be provided by guardrails and the following requirements shall be respected.
- The width of corridors shall be sufficient to accommodate number of persons using this corridor provided that the width shall not be less than 2 m in commercial buildings category A of commercial shops, and not less than 1.5 m in commercial buildings category B, offices.

Exits
- The exits shall lead directly to outside or to stair or passageway protected from fire and separated from the remainder of the building by fire barrier.
- The enclosure of the exit stair shall be in accordance with the general requirements of means of egress here above.
- The number of exits shall be in accordance with the means of egress’s general requirements i.e. not less than two remote exits shall be provided and located at the building perimeter on the exterior façade walls and leading to outside of the building.
Horizontal exits
- Temporary fire compartment shall be provided in commercial buildings with big areas exceeding 3000 m².
- 50% of the means of egress shall be discharged to protected areas within the building.
- The horizontal exits shall be in accordance with general requirements of means of egress here above. A single exit is permitted in commercial buildings category B offices further to the approval of the civil defense, if the following criteria are met:
  - The direct distance within the office is not more than 15 m.
  - The travel distance between the office door to the final exits or to the protected exits shall not exceed 30 m.
  - The dead end corridor shall not exceed 7.5 m.
  - The remaining requirements of the means of egress shall be respected especially the stair.

Interior finishes
For business occupancy:
- Interior wall and ceiling finish material shall be Class A or Class B in exits and in exit access corridors. Interior wall and ceiling finishes shall be Class A, Class B, or Class C in areas other spaces.
- Interior floor finish in exit enclosures shall be Class I or Class II.
- Floor coverings, other than carpets, shall have a minimum critical radiant flux of 0.1 W/cm².

For mercantile occupancy:
- Interior wall and ceiling finish materials shall be Class A or Class B.
- Interior floor finish in exit enclosures shall be Class I or Class II.
- Floor coverings, other than carpet shall have a minimum critical radiant flux of 0.1 W/cm².

Mercantile and Business occupancies:
- The required fire alarm system shall be initiated also by the operation of the automatic sprinkler system.
- The firefighting and the fire alarm systems shall be designed, installed, and maintained in accordance with the civil defense specific requirements.
- The civil defense may require additional or alternative systems to some required preventive protection requirements.

Occupant Notification:
- During all times that the mercantile occupancy is occupied, the required fire alarm system, once initiated, shall activate an alarm throughout the mercantile occupancy.
- The civil defense notification shall be provided.
Table 32:
Firefighting and fire alarm system in commercial buildings.

<table>
<thead>
<tr>
<th>Type</th>
<th>Required cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Manual Extinguishing equipment</td>
</tr>
<tr>
<td></td>
<td>Portable fire extinguishers</td>
</tr>
<tr>
<td>2</td>
<td>Fixed installations</td>
</tr>
<tr>
<td></td>
<td>Hose system</td>
</tr>
<tr>
<td></td>
<td>Standpipe dry riser type</td>
</tr>
<tr>
<td></td>
<td>Standpipe wet riser type</td>
</tr>
<tr>
<td></td>
<td>Fire hydrant network</td>
</tr>
<tr>
<td>3</td>
<td>Fixed automatic systems</td>
</tr>
<tr>
<td></td>
<td>Automatic water sprinkler system</td>
</tr>
<tr>
<td></td>
<td>Automatic extinguishing system using materials other than water</td>
</tr>
<tr>
<td>4</td>
<td>Fire alarm system</td>
</tr>
<tr>
<td></td>
<td>Manual alarm system</td>
</tr>
<tr>
<td></td>
<td>Automatic fire alarm system</td>
</tr>
</tbody>
</table>

**Extinguishing requirements:**
Mercantile occupancies shall be protected by an approved automatic sprinkler system as follows:
- Throughout all mercantile occupancies three or more stories in height.
- Throughout all mercantile occupancies exceeding 1115 m² in gross area.
- Throughout stories below the level of exit discharge where such stories have an area exceeding 232 m² and are used for the sale, storage, or handling of combustible goods and merchandise.

**Special protection requirements**

**Meantile Shops and Central markets**
The following requirements shall be provided for the mercantile shops and central markets:
- At least 50% of the number of exits shall be discharged directly on the public way and shall be separated from the sales area by fire barrier or fire rated door.
- The minimum width of the sales area secondary aisles shall be 1.5 m and the minimum width of the main aisles shall be 2 m clearly and easily organized to lead directly to the exits without any difficulties.
▪ The public corridor leading to the exit shall be not less than 1 m.
▪ The display stands shall be organized in way to not impede the means of egress or obstruct the marking signs.
▪ The means of egress shall not pass through the storage areas related to the sales area unless the following criteria are met:
  ▪ The storage area is separated from the sales area by the fire rated door and fire barrier
  ▪ The number of exits passing through the storage area is not more than 50%.
  ▪ A corridor protected from the fire hazard leading directly to the outside shall be provided by automatic water sprinkler system.
▪ The sales areas shall be separated from the storage areas by a fire barrier having not less than one hour fire resistance rating and fire rated doors having not less than ¾ hours fire rating
▪ Exit access in Class A and Class B mercantile occupancies that are protected throughout by an approved, supervised automatic sprinkler system, and exit access in all Class C mercantile occupancies, shall be permitted to pass through storerooms, provided that the following conditions are met:
  ▪ Not more than 50 percent of exit access shall be provided through the storeroom.
  ▪ The storeroom shall not be subject to locking.
  ▪ The main aisle through the storeroom shall be not less than 44 in. (1120 mm) wide.
  ▪ The path of travel through the storeroom shall be defined, direct, and continuously maintained in an unobstructed condition

For Mercantile and Business Occupancies:
Where access to exits is provided by corridors, such corridors shall be separated from use areas by fire barriers having a minimum 1-hour fire resistance rating, except under any of the following conditions:
▪ Where exits are available from an open floor area.
▪ Within a space occupied by a single tenant.
▪ Within buildings protected throughout by an approved, supervised automatic sprinkler system.
Openings in corridor walls required have a fire resistance rating shall be protected in accordance doors having not less than a 20-minute fire protection rating. Doors that open onto exit access corridors shall be self-closing and self-latching
Industrial buildings definition

The industrial buildings are those or their parts dedicated for manufacturing purposes or for industrial professions. They consist of different manufacturing establishments such as dairy and furniture factories, central laundries, laboratories using chemicals materials, printing presses, and industrial crafts buildings including the industrial workshops of all kinds:

- Industrial Buildings are those or their parts used for manufacturing purposes including installation, mixing and packaging operations.
- Buildings for Industrial Crafts are those or their parts dedicated for repair operations.

Fire Hazard

The fire hazard in industrial buildings is related to the type of manufacturing process used in these buildings and it is as follows:

Medium Hazard

Are the factories for manufacturing, assembling or production of non-combustible materials or materials having medium burning and smoke development characteristics but without emission of toxic gas and don’t explode when burned.

High Hazard

Are the factories for manufacturing, assembling or production of combustible materials that have high burning characteristics and produce toxic gases or can explode.

The life safety in industrial occupancy classification is concerned with determining the overall hazard to occupants in a manufacturing building for purposes of implementing an adequate means of egress system. To assess the risk to life safety in an industrial occupancy, a number of factors should be considered:

- It should be determined if the manufacturing process includes the handling of flammable, reactive, or explosive materials in quantities that could directly expose occupants to a fire or explosion risks. If so, the occupancy is particularly considered for high hazard classification.
- It should also be determined whether the manufacturing process requires a large number of people or whether it is basically a large collection of machines or equipment occasionally attended by operators. In some instances, operators might be clustered in one location, such as a control room. If a building is predominately occupied by machinery or equipment and is used by few employees, the building can be classified as special-purpose industrial occupancy.
- If an industrial building is used mostly for storage of materials, it might meet the requirements for classification as storage occupancy.
- Occupancy classification is based on the burning and explosive characteristics of the materials contained in the building, not on the quantity of combustibles.

The sub-classification of the industrial occupancy shall be according to its use as described here after:
1. **General Industrial Occupancy.** General industrial occupancies shall include the industrial occupancies that conduct ordinary and low hazard industrial operations in buildings of conventional design that are usable for various types of industrial processes.

2. **Multistory Industrial Occupancy.** Industrial occupancies that include multistory buildings where floors are occupied by different tenants, or buildings that are usable for such occupancy and, therefore, are subject to possible use for types of industrial processes with a high density of employee population.

3. **Special-Purpose Industrial Occupancy.** Special-purpose industrial occupancies shall include the following:
   1. Industrial occupancies that conduct ordinary and low hazard industrial operations in buildings designed for, and that are usable only for, particular types of operations
   2. Industrial occupancies that are characterized by a relatively low density of employee population, with much of the area occupied by machinery or equipment

Some examples of special-purpose industrial occupancy: Steel mills, paper plants, power generating plants and other operations with large machines.

4. **High Hazard Industrial Occupancy.** High hazard industrial occupancies shall include the following:
   1. Industrial occupancies that conduct industrial operations that use high hazard materials or processes or house high hazard contents.
   2. Industrial occupancies in which incidental high hazard operations in low or ordinary hazard occupancies that are protected by one hour fire rating enclosure and by automatic sprinkler system are not required to be the basis for overall occupancy classification.

A high hazard industrial occupancy includes occupancies where gasoline and other flammable liquids are handled, used, or stored under such conditions that involve possible release of flammable vapors; where grain dust, wood flour or plastic dust, aluminum or magnesium dust, or other explosive dusts are produced; where hazardous chemicals or explosives are manufactured, stored, or handled; where materials are processed or handled under conditions that might produce flammable flyings; and where other situations of similar hazard exist.

**Fire Spread Control**

**Horizontal fire spread**

- The area of the fire compartment shall not exceed the area specified in Table 33. If the subdivision is not possible due to the manufacturing processes, the civil defense shall define the alternative protection requirements as per the actual situation.
**Table 33:**

<table>
<thead>
<tr>
<th>Fire Hazard class in industrial buildings</th>
<th>Fire compartment area in m² by floor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ground floor</td>
<td></td>
</tr>
<tr>
<td>Buildings having Medium Hazard</td>
<td>5000 m²</td>
</tr>
<tr>
<td>Buildings having high Hazard</td>
<td>1000 m²</td>
</tr>
</tbody>
</table>

**Vertical fire spread**

The requirements of Chapter 1 and the additional requirements of this chapter shall be respected.

For multiple story buildings, each floor shall be considered as a separate fire compartment.

**External fire spread**

The requirements of Chapter 1 and the additional requirements of this chapter shall be respected.

The external wall located on the plot limit facing the neighboring plot shall be concrete or concrete masonry materials.

**Fire department access**

The fire department access for fire truck and equipment shall be provided.

**Means of egress (emergency exits)**

**Egress capacity**

The egress capacity of the means of egress shall be evaluated depending on the served occupant load provided that the minimum width for the main corridors industrial buildings is 2 m and 1.5 m for the secondary corridors.

**Travel distance and direct distance**

The travel distance from any point to reach the final exit or the protected stairs shall no exceed the values specified in Table 34.

**Table 34:**

<table>
<thead>
<tr>
<th>Location</th>
<th>Hazard class</th>
<th>Ground floor</th>
<th>Basement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct distance within a sector</td>
<td>Medium</td>
<td>15</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>7.5</td>
<td>7.5</td>
</tr>
<tr>
<td>Travel distance to the exit or to the protected stair</td>
<td>Medium</td>
<td>40</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>high</td>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td>Dead End</td>
<td>Medium</td>
<td>7.5</td>
<td>7.5</td>
</tr>
<tr>
<td></td>
<td>high</td>
<td>Not permitted</td>
<td>Not permitted</td>
</tr>
</tbody>
</table>
Corridors
- The minimum width of the main corridors shall be 2 m and 1.5 m for the secondary corridors.
- If the industrial premises are not permanent and fixed, and the aisles and corridors are not clear, the aisles shall be marked by reflective color to clarify the aisles, corridors, workplaces and storage areas.
- The common path of travel shall be not more than 15 m in general and special purpose industrial occupancies not protected throughout by an approved, supervised automatic sprinkler system and 30 m in general and special purpose industrial occupancies protected throughout by an approved, supervised automatic sprinkler system.

Special Provisions for occupancies with high hazard contents
- Where the contents are classified as high hazard, exits shall be provided and arranged to allow all occupants to escape from the building or structure, or from the hazardous area thereof, to the outside or to a place of safety with a travel distance of not more than 75 ft (23 m).
- Egress capacity for high hazard contents areas shall be based on 0.7 in./person (18 mm/person) for stairs or 0.4 in./person (10 mm/person) for level components and ramps.
- Not less than two means of egress shall be provided from each building or hazardous area thereof and means of egress, for rooms or spaces, shall be arranged so that there are no dead ends in corridors, unless all of the following criteria are met:
  - Rooms or spaces do not exceed 200 ft² (18.6 m²).
  - Rooms or spaces have an occupant load not exceeding three persons.
  - Rooms or spaces have a travel distance to the room door not exceeding 25 ft (7620 mm).
  - Doors serving high hazard contents areas with occupant loads in excess of five shall be permitted to be provided with a latch or lock only if the latch or lock is panic hardware or fire exit hardware.

Exits
- The number of exits shall be as per the general requirements, so that not less than two remotely separated exits located at the building perimeter on the external wall, and leading each to outside of the building.
- All the exits shall lead directly to outside of the building or to a protected stair or protected corridor separated from the remainder of the building by fire barriers.

Stair
- The number of stairs shall be not less than two for each floor, remotely separated and located on the building perimeter at the external wall leading directly to the exterior of the building.
- The exit stair shall be separated from the building by fire barrier leading directly to the exterior of the building.
- A single exit shall be permitted in industrial buildings having medium hazard content classification, further to the approval of the civil defense, and provided that the following requirements are met:
  - The maximum direct distance and depth within a premises shall be 15 m.
  - The maximum travel distance from the premises door to the final exit or to the protected stair shall be 30 m.
  - The maximum dead end corridor shall be 7.5 m.
  - The remaining requirements for means of egress especially for the stair shall be respected.
The number of means of egress shall be as per the general and specific requirements of means of egress in Chapter 3.

- A single means of egress shall be permitted from any story or section in low hazard industrial occupancies, provided that the exit can be reached within the distance permitted as a common path of travel.

**Final Exit**

- In all cases, the means of egress shall lead to a final exit leading directly to the outside.
- The specific requirements related to the building sections of different occupancies uses in high hazard industrial occupancy shall be ensured and the most stringent requirement related to the high hazard industrial occupancy.

**General Requirements**

- New ancillary facilities, such as the control room, shall be arranged to allow travel in independent directions after leaving the ancillary facility so that both means of egress paths do not become compromised by the same fire or similar emergency.
- New ancillary facilities in special-purpose industrial occupancies where delayed evacuation is anticipated shall have not less than a 2-hour fire resistance–rated separation from the predominant industrial occupancy, and shall have one means of egress that is separated from the predominant industrial occupancy by 2-hour fire resistance–rated construction.
- Industrial equipment access doors, walkways, platforms, ramps, and stairs that serve as a component of the means of egress from the involved equipment shall be permitted in accordance with the Table 35 provided that they shall serve not more than 20 people.

A single exit from medium hazard industrial occupancy buildings shall be permitted if it is accepted by the civil defense provided that the all protection requirements for industrial buildings are respected.
### Table 35:
Industrial equipment access dimensional criteria

<table>
<thead>
<tr>
<th>Feature</th>
<th>Dimensional criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum horizontal dimension of any walkway, landing, or platform</td>
<td>560 mm clear</td>
</tr>
<tr>
<td>Minimum stair or ramp width</td>
<td>560 mm clear between rails</td>
</tr>
<tr>
<td>Minimum tread width</td>
<td>560 clear</td>
</tr>
<tr>
<td>Minimum tread depth</td>
<td>255 mm</td>
</tr>
<tr>
<td>Maximum riser height</td>
<td>230 mm</td>
</tr>
<tr>
<td>Handrails are permitted to terminate, at the required height, at a point directly above the top and bottom risers</td>
<td></td>
</tr>
<tr>
<td>Maximum height between landings</td>
<td>3660 mm</td>
</tr>
<tr>
<td>Minimum headroom</td>
<td>2030 mm</td>
</tr>
</tbody>
</table>

**Interior Wall and Ceiling Finish:**

- Interior wall and ceiling finish materials shall be Class A, Class B, or Class C in operating areas and shall be Class A or Class B in exit enclosures.

**Interior Floor Finish**

Interior floor finish in exit enclosures and in exit access corridors shall be not less than Class II.

**Firefighting and fire alarm systems**

In addition to the general requirements, the following requirements shall be considered:

- The firefighting and fire alarm systems shall be designed, installed and maintained as per the related specific standards or as per the civil defense guidelines.

- The different firefighting requirements are depending on the different types of industrial processes and on materials used in the manufacturing processes. Therefore, the required firefighting and the fire alarm systems are different between factories. The related minimum requirements are mentioned in Table 36. The civil defense may request additional firefighting and fire alarm systems.
The required fire alarm system shall meet one of the following criteria:

- It shall provide occupant notification to evacuate by audible and visible signals. Audible alarm notification appliances shall be of such character and so distributed as to be effectively heard above the average ambient sound level that exists under normal conditions of occupancy. Audible alarm notification appliances shall produce signals that are distinctive from the audible signals used for other purposes in a given building.

- It shall sound an audible and visible signal in a constantly attended location for the purposes of initiating emergency action.

- In high hazard industrial occupancies, the required fire alarm system shall automatically initiate an occupant evacuation alarm signal.
### Table 37:
Engineering services related to the fire protection in industrial buildings

<table>
<thead>
<tr>
<th>Type</th>
<th>Required systems</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ventilation system</td>
<td>As per the international standards adopted by the civil defense</td>
</tr>
<tr>
<td>2</td>
<td>Illuminated exit signs</td>
<td>Corridors and means of egress (emergency exits)</td>
</tr>
<tr>
<td>3</td>
<td>Emergency lighting network</td>
<td>Corridors and means of egress (emergency exits)</td>
</tr>
<tr>
<td>4</td>
<td>Emergency power supply system</td>
<td>All high hazard industrial occupancy buildings</td>
</tr>
<tr>
<td>5</td>
<td>Firefighter elevator</td>
<td>Not required</td>
</tr>
<tr>
<td>6</td>
<td>Automated fire rated doors</td>
<td>According to preventive precautions in engineering fields</td>
</tr>
</tbody>
</table>
4.6 Fire Protection Requirements for Storage and Car Parking Buildings

**Storage buildings definition**

The storage buildings are those or their parts dedicated for the purposes to store raw materials, manufactured materials, or semi-manufactured materials, this type of occupancy could be located in separate buildings or in parts of building used for manufacturing or commercial purposes. The storage buildings are classified depending on the following hazard content classification:

- **Low hazard content storage occupancy (class A):** are the storage buildings having low combustible content materials, not self ignited materials, such as the non-combustible materials, for example: construction materials, equipment, spare parts.

- **Medium hazard storage occupancy (class B):** are the storage buildings having a medium combustible materials content developing remarkable amount of smoke, butthey do not produce combustible fumes or noncombustible materials packaged by combustible materials such as cardboard, plastic or foam granules, wood saw dust.

- **High Hazard storage occupancy (class C):** are the storage buildings for materials having high burning characteristics, or producing optic gases or explosions or generally are the buildings for storage of high hazard materials, gas, combustible liquids, extremely combustible materials such as wood, papers, bulk fiber, plastic foam.

- The preventive protection requirements in engineered fields shall be respected in general to ensure the fire resistance required for the building structure.

- The fire resistance requirements of the building structural construction type shall be as per Table 38.

- If the storage buildings are parts of buildings used for different uses, they shall be separated to be independent fire compartments having their independent means of egress.

- The construction types shall be in accordance with specific construction type section here above.

<table>
<thead>
<tr>
<th>Table 38: Structural Construction type of buildings depending on the type and hazard class of the storage contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction type</td>
</tr>
<tr>
<td>Type I and II only</td>
</tr>
<tr>
<td>Type I, II and III with special conditions</td>
</tr>
<tr>
<td>All types and type V as temporary type with special conditions</td>
</tr>
</tbody>
</table>
The separation between the storage occupancy and other occupancy as per the specific occupancy section here above.

The parts of the buildings used for other that storage uses shall be in accordance with the related specific requirements here above.

**Vertical Spread**
- For multiple stories building, each story shall be considered as separated fire compartment

**External fire spread**
- The external wall located on the plot limit at the neighbors side shall be constructed by concrete or concrete masonry blocks.

### Table 39:

<table>
<thead>
<tr>
<th>Hazard class in storage occupancy buildings</th>
<th>Fire compartment area in m² according to the floor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Ground floor</td>
</tr>
<tr>
<td>Low Hazard</td>
<td>5000 m²</td>
</tr>
<tr>
<td>Medium Hazard</td>
<td>3000 m²</td>
</tr>
<tr>
<td>High Hazard</td>
<td>1000 m²</td>
</tr>
</tbody>
</table>

- The fire compartments shall be separated from each other by fire barriers having not less than 2 hours fire resistance rating

**Fire spread control**
The general and the following requirements shall be considered:

**Horizontal fire spread**
- The fire compartment area shall not exceed the values specified in Table 39
- The different occupancies shall be separated apart from the area.
- The special hazard premises shall be separated apart from the area.

**Fire department access**
The fire department access to fire trucks and equipment shall be ensured for the storage occupancy buildings.

**Means of egress**
The general requirements for means of egress (emergency exits) shall be respected as well as the following additional requirements:

**Egress capacity**
The egress capacity shall be evaluated depending on the occupant load to be served provided that the minimum width of the main corridors in
storage occupancy buildings shall be 2 m and 1.5 m for the secondary corridors.

**Travel distance and direct distance**
The travel distance from any point to reach the final exit or to the protected stair shall be as per Table 40.

**Special Provisions for Occupancies with High Hazard Contents**
- Where the contents are classified as high hazard, exits shall be provided and arranged to allow all occupants to escape from the building or structure, or from the hazardous area thereof to the outside or to a place of safety with a travel distance of not more than 23 m.
- Egress capacity for high hazard content areas shall be based on 18 mm/person for stairs or 10 mm/person for level components and ramps.
- At least two means of egress shall be provided for each building or its hazardous areas. Means of egress for rooms or spaces shall be arranged so that there are no dead ends in corridors unless all of the following criteria are met:
  - Rooms or spaces do not exceed 18.6 m².
  - Rooms or spaces have an occupant load not exceeding three persons.
  - Rooms or spaces have a travel distance to the room door not exceeding 7620 mm.
  - Doors serving high hazard content areas with occupant load in excess of five shall be provided with a latch or lock only if the latch or lock is panic hardware or fire exit hardware.
- The depth or direct distance from a building section shall not be more than 15 m.
- The travel distance from the building section door to the final exit or to a protected stair shall not be more than 30 m.
- Dead end corridor shall be not more than 7.5 m.
- The remaining conditions related to the means of egress shall be considered.

**Table 40:**
Measuring travel distance and direct distance in storage occupancy building

<table>
<thead>
<tr>
<th>Location</th>
<th>Hazard class</th>
<th>Ground floor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct distance within a building section</td>
<td>Low or medium</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>7.5</td>
</tr>
<tr>
<td>Travel distance to the exit or to protected stair</td>
<td>Low</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>Medium</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>20</td>
</tr>
</tbody>
</table>

**Stairs**
- The number of stairs shall be not less than two for each floor, remotely located on the building perimeter on the external walls and leading directly to outside.
- The stairs shall be protected and separated from the remainder of the building by fire barrier and leading directly to outside.
- The number of means of egress shall be in accordance with the general requirements of means of egress.
- The common path of travel shall be not more than 15 m in ordinary hazard storage occupancy not protected throughout by an
approved, supervised automatic sprinkler system and 30 m in ordinary hazard storage occupancy protected throughout by an approved, supervised automatic sprinkler system

**Final exit**

- In all cases, all the means of egress shall lead to final exit leading directly to the outside.
- In storage occupancy buildings having higher hazard content, the building sections of other occupancy classification shall be protected as per the related specific requirements or the most stringent that provided the better fire protection.

**Firefighting and fire alarm systems**

The firefighting and fire alarm systems shall be designed, installed and maintained according to the related specific standards or as per the civil defense guidelines.

The civil defense may request additional or alternative systems for some protection requirements required in this guide.

| Table 41: Firefighting and fire alarm systems in storage occupancy buildings |
|-----------------------------|-----------------------------|
| Type                        | Required cases              |
| 1 Manual firefighting systems | Portable fire extinguishers, All floors and cases |
| 2 Fixed installations        |                           |
| Hose systems                 | All floors and cases        |
| Dry standpipes network       | Not required                |
| Wet standpipes network       | Not required                |
| External fire hydrant network| In high hazard storage occupancy buildings |
| 3 The fixed automatic systems | Automatic water sprinkler system, Basements in medium or high hazard storage occupancy buildings |
| Automatic fire extinguishing system using materials other than water | Special hazard premises where water shall not be used |
| 4 Fire alarm system          | Manual fire alarm system, In all floors and cases |
|                             | Automatic fire alarm system, In medium or high hazard storage occupancy and in high hazard content premises of the low hazard storage occupancy |
Warning System

The required fire alarm system shall meet one of the following criteria:

- The fire alarm system shall ensure the occupant notification by audible and visible signals. Audible alarm notification devices shall be of such characteristics and distributed to be effectively heard above the average ambient sound level that exists under normal conditions of occupancy. Audible alarm notification devices shall produce signals that are distinctive from the audible signals used for other purposes in a given building.

- It shall sound an audible and visible signal in a constantly attended location for the purposes of initiating emergency action.

- In high hazard storage occupancies, the required fire alarm system shall automatically initiate an occupant evacuation alarm signal.

| Table 42: Engineering services specific for fire protection in storage buildings |
|---------------------------------|----------------------------------|
| Type                           | Required cases                   |
| 1 Ventilation system           | According to the international standard adopted by the civil defense |
| 2 Illuminated exit signs        | Basement, means of egress (emergency exits) |
| 3 Emergency lighting network   | Corridors and means of egress (emergency exits) |
| 4 Emergency power supply system| Not protection required           |
| 5 Firefighter lift             | Not required                      |
| 6 Automatic fire rated doors   | According to the protection requirement in engineering fields |
Special protection requirements for car parking

The car parking buildings are used for car storage for temporary or continuous parking time, and are considered, by this concept, as storage occupancy buildings. Thus, the fire protection requirements for storage occupancy buildings shall be adopted for the car parking in addition to the following specific requirements:

The car parking buildings are classified depending on the architectural design to the following classes:

- **Class A**: open sided buildings where the cars are driven to the parking place and to the way out.
- **Class B**: enclosed sided buildings where the cars are driven to the parking place and to the way out.
- **Class C**: building where cars could be driven automatically to the parking place and to the way out.

Fire Hazard

The fire hazard in the car parking is classified as medium hazard class.

Ramps

The underground car parking shall meet the following requirements:

- The ramps used as cars’ entrance and exit shall not be considered as means of egress unless a part of the ramp is protected by fire barrier and meets the general requirements of means of egress.
- The ramps are permitted to be used as means of egress as per the following requirements:
- The ramps specified in Chapter 3 of the general requirements of means of egress and shall not be subject to the cars circulation when used as exit

- In a ramp-type open parking structure with open vehicle ramps not subject to closure, the ramp shall be permitted to serve in lieu of the second means of egress from floors above the level of exit discharge, provided that the ramp discharges directly outside at the street level.
- For parking structures extending only one floor level below the level of exit discharge, a vehicle ramp leading directly to the outside shall be permitted to serve in lieu of the second means of egress, provided that no door or shutter is installed therein.
- Parking structures located within, immediately below, attached to, or less than 3 m from a building used for any other purpose shall be separated by walls, partitions, floors, or floor–ceiling assemblies having fire resistance ratings of not less than 2 hours.
- Offices or other similar spaces that are related to the operation of the parking structure and are less than 300m² in area, other than cashier or attendant booths, shall be separated from parking areas by walls or partitions that resist the passage of smoke.
- Not less than two means of egress shall be provided from every floor or section of every parking structure.
- A common path of travel shall be permitted for the first 15 m from any point in the parking structure.
- Dead ends shall not exceed 15 m.
- Travel distance shall not exceed that provided by Table 43
Floor
The basement floor of the car parking shall be sloped towards gutters to collect the water or leaked oil through the floor drains into the oil collector and then to the public sewage network as per the engineering rules.

The Facade walls
- The facades’ windows overlooking the public streets shall be closed by wired glass or by thick steel wire mesh in order to prevent littering of cigarettes and other waste into the car parking.
- For open façade parking structure, the automatic water sprinkler system shall not be required.

Vertical Openings in Enclosed Parking Structures:
- Vertical openings through floors in buildings four or more stories in height shall be enclosed with walls or partitions having a minimum 2-hour fire resistance rating.
- For buildings three or fewer stories in height, the enclosure of shafts shall have a minimum 1-hour fire resistance rating.
- Ramps in enclosed parking structures shall not be required to be enclosed when one of the following safeguards is provided:

1. An approved, automatic sprinkler system fully protecting the enclosed parking structure.
2. An approved, automatic, supervised fire detection system installed throughout the enclosed parking structure, and a mechanical ventilation system capable of providing a minimum of 300 L/min per m² of floor area during hours of normal operation.
3. Where a parking structure consists of sprinklered enclosed parking levels, and sprinklered or non-sprinklered open parking levels.
- Unprotected vertical openings through floors in open parking structures shall be permitted.
- Interior wall and ceiling finish materials shall be Class A, Class B, or Class C in parking structures and shall be Class or Class B in exit enclosures.
- Interior floor finish in exit enclosures shall be not less than Class II.

Ventilation and Smoke Venting System
- Adequate mechanical or natural ventilation shall be provided as per the international standards adopted by the civil defense.

<table>
<thead>
<tr>
<th>Level of protection</th>
<th>Eclosed parking structure</th>
<th>Open parking structure</th>
<th>Parking structure open not less than 50% on all sides</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protected throught by an approved, supervised automatic sprinkler system</td>
<td>61 m</td>
<td>122 m</td>
<td>122 m</td>
</tr>
<tr>
<td>Not protected throught by an approved, supervised automatic sprinkler system</td>
<td>46 m</td>
<td>91 m</td>
<td>122 m</td>
</tr>
</tbody>
</table>
The mechanical ventilation system of the basement levels shall be independent from the other systems in the building and shall be designed to be operational on two separate units to overcome the worst conditions.

All enclosed parking structures shall be ventilated by a mechanical system capable of providing a minimum of 300 L/min per m² of floor area during hours of normal operation.

Mechanical ventilating systems shall be installed in accordance with NFPA 90A. Ductwork shall be constructed of noncombustible material.

The civil defense may require additional or alternative systems from some other fire protection requirements.

The engineered utilities related to the fire protection in storage occupancy buildings are provided in Table 44.

- The required fire alarm system shall sound an audible alarm in a continuously attended location for purposes of initiating emergency action.
- Except for open car parking structure, all buildings having height of 15 m or more, or having a car parking level below grade, shall be provided by standpipes as per the requirements of “NFPA14”.

### Table 44:

<table>
<thead>
<tr>
<th>Type</th>
<th>Required Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Ventilation system</td>
<td>According to the international standards adopted by the civil defense</td>
</tr>
<tr>
<td>2 Illuminated exit signs</td>
<td>Basement, all floors</td>
</tr>
<tr>
<td>3 Emergency lighting network</td>
<td>Basement, all floors</td>
</tr>
<tr>
<td>4 Emergency power supply system</td>
<td>Required in enclosed car parking</td>
</tr>
<tr>
<td>5 Firefighter elevator</td>
<td>Not required</td>
</tr>
<tr>
<td>6 Automatic fire rated doors</td>
<td>According to the preventive protection in engineered fields</td>
</tr>
</tbody>
</table>
Annexes
Chapter 5: Annexes

5.1 Annex I: Accessible Means of Egress ......................................................................................................................... 133
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5.1 Annex I: Accessible Means of Egress

Definitions

Accessible Route: A continuous unobstructed path that complies with this Code and ICC/ANSI A117.1, American National Standard for Accessible and Usable Buildings and Facilities.

Area of Refuge: An area that is either (1) a story in a building where the building is protected throughout by an approved, supervised automatic sprinkler system and has not less than two accessible rooms or spaces separated from each other by smoke-resisting partitions; or (2) a space located in a path of travel leading to a public way that is protected from the effects of fire, either by means of separation from other spaces in the same building or by virtue of location, thereby permitting a delay in egress travel from any level.

Accessible Means of Egress: A means of egress that provides an accessible route to an area of refuge, a horizontal exit, or a public way.

Requirements for security and safety for the disabled access persons

The requirements of security and safety of persons with disabilities shall meet the following:

1. Areas accessible to people with severe mobility impairment shall have not less than two accessible means of egress.

2. Access within the allowable travel distance shall be provided to not less than one accessible area of refuge or one accessible exit providing an accessible route to an exit discharge.

3. Exit access travel along the accessible means of egress shall be permitted to be common for the distances permitted as common paths of travel.

4. Where two accessible means of egress are required, the exits serving such means of egress shall be located at a distance from one another not less than one-half the length of the maximum overall diagonal dimension of the building or area to be served. This distance shall be measured in a straight line between the nearest edge of the exit doors or exit access doors. Where exit enclosures are provided as the required exits are interconnected by not less than a 1-hour fire resistance-rated corridor, exit separation shall be permitted to be measured along the line of travel within the corridor.

5. Requirement 4 shall not apply to buildings protected throughout by an approved, supervised automatic sprinkler system.

6. Each required accessible means of egress shall be continuous from each accessible occupied area to a public way or area of refuge.
7. Where an exit stairs is used in an accessible means of egress, it shall comply with the requirement here below:

- The clear width of landings and stair flights, measured between handrails and at all points below handrail height shall be not less than 48 in. (1220 mm),
- The exit stair either shall incorporate an area of refuge within an enlarged story-level landing or shall be accessed from an area of refuge.

3. The two-way communication system shall include both audible and visible signals.

b. An area of refuge used as part of a required accessible means of egress in other than a building that is protected throughout by an approved, supervised automatic sprinkler system shall meet the following criteria:

1. The general requirements of enclosure of exit stair.
2. Accessibility: Required portions of an area of refuge shall be accessible from the space they serve by an accessible means of egress. Required portions of an area of refuge shall have access to a public way via an exit or an elevator without requiring return to the building spaces through which travel to the area of refuge occurred.
3. Each area of refuge shall be sized to accommodate one wheelchair space of 760 mm × 1220 mm for every 200 occupants, or portion thereof, based on the occupant load served by the area of refuge. Such wheelchair spaces shall maintain the width of a means of egress to not less than that required for the occupant load served and to not less than 915 mm.
4. For any area of refuge that does not exceed 93m², it shall be demonstrated by calculation or test that tenable conditions are maintained within the area of refuge for a period of 15 minutes when the exposed space on the other side of the separation creating the area of refuge is subjected to the maximum expected fire conditions.
5. Access to any designated wheelchair space in an area of refuge shall not pass through more than one adjoining wheelchair space.

Areas of Refuge:

a. An area of refuge used as part of a required accessible means of egress; consisting of a story in a building that is protected throughout by an approved, supervised automatic sprinkler system; and having an accessible story that is one or more stories above or below a story of exit discharge shall meet the following criteria:

1. Each elevator landing shall be provided with a two-way communication system for communication between the elevator landing and the fire command center or a central control point approved by the authority having jurisdiction.
2. Directions for the use of the two-way communication system, instructions for summoning assistance via the two way communication system, and written identification of the location shall be posted adjacent to the two-way communication system.
6. Each area of refuge shall be separated from the remainder of the story by a barrier having a minimum 1-hour fire resistance rating. The barriers and any openings in them shall minimize air leakage and resist the passage of smoke. New fire door assemblies serving an area of refuge shall be smoke leakage-rated.

7. Door assemblies in the barriers specified shall have not less than a 20-minute fire protection rating, and shall be either self-closing or automatic-closing.

8. Ducts shall be permitted to penetrate the barrier and shall be provided with smoke-actuated dampers or other approved means to resist the transfer of smoke into the area of refuge.

9. The area of refuge shall be provided with a two-way communication system for communication between the area of refuge and a central control point.

10. Instructions for summoning assistance, via the two-way communication system, and written identification of the area of refuge location shall be posted adjacent to the two-way communication system.

11. Each area of refuge shall be identified by a sign that reads as “AREA OF REFUGE” and shall display the international symbol of accessibility. Signs also shall be located as follows:
   ▪ At each door opening providing access to the area of refuge
   ▪ At all exits not providing an accessible means of egress,
   ▪ Where necessary to indicate clearly the direction to an area of refuge

12. Signs shall be illuminated as required for exit signs where exit sign illumination is required.


**Elevators**

Where an elevator provides access from an area of refuge to a public way, the following criteria shall be met:

1. The elevator shall be approved for fire fighters’ emergency operations as provided in ASME A17.1/CSA B44, Safety Code for Elevators and Escalators.

2. The power supply shall be protected against interruption from fire occurring within the building but outside the area of refuge.

3. The elevator shall be located in a shaft system meeting the requirements for smoke-proof enclosures.
Evacuation plan is case of fire or emergency

If you wish to use this document, please adjust and complete it with respect to workplace with your specific actions
(The location name)

<table>
<thead>
<tr>
<th></th>
<th>The action employees should take if they discover a fire</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>• Immediately operate the nearest alarm call-point.</td>
</tr>
<tr>
<td></td>
<td>• Attack the fire if possible, with appliances available, without taking personal risks.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>How people will be warned in the case of a fire</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>• The electrical fire alarm system will sound on operation of the manually operated alarm call-point.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>How the evacuation of the building will be carried out</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>• Everyone in the building should leave the building by the nearest exit and report to the assembly point at the front of the building.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Identification of escape routes</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>• All exit doors can be used as escape routes.</td>
</tr>
<tr>
<td></td>
<td>• The staircase and routes leading to the front door are protected routes.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Fire fighting equipment provided</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Fire extinguishers are located in circulation areas and near fire exit doors.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Duties and identity of employees with specific responsibilities in the event of fire</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>• On hearing the alarm:</td>
</tr>
<tr>
<td></td>
<td>• All staff will escort visitors out of the building and assemble at the assembly point.</td>
</tr>
<tr>
<td></td>
<td>• Fire wardens will ensure:</td>
</tr>
<tr>
<td></td>
<td>• Their areas are cleared of people</td>
</tr>
<tr>
<td></td>
<td>• Registers are collected on the way out</td>
</tr>
<tr>
<td></td>
<td>• The Fire Brigade is called.</td>
</tr>
<tr>
<td></td>
<td>• A roll call is made to ensure everyone is out.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Arrangements for the safe evacuation of people identified as being especially at risk, such as contractors, those with disabilities, members of the public and visitors.</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td><strong>Visitors</strong>: The host / employee must take responsibility for any visitor they may have and ensure they leave the building by the nearest exit.</td>
</tr>
<tr>
<td></td>
<td><strong>Contractors</strong>: must be given information about fire procedures and leave the building at the nearest exit.</td>
</tr>
<tr>
<td></td>
<td><strong>People with disabilities</strong>: Specific arrangements may need to be made for those with disabilities.  These arrangements may be made with the assistance of the Area Health and Safety Adviser.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>How will the Fire Brigade and any necessary emergency services be called and who will be responsible for doing this.</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>• On hearing the alarm ...........................................will Dial 999 and ask for the Fire Brigade or other emergency service as appropriate.</td>
</tr>
<tr>
<td></td>
<td>• Fire Wardens will call the Fire Brigade in the absence of ...................................................... (this may be best achieved using a mobile phone)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Procedures for liaising with the Fire Brigade on arrival and notifying them of any specific risks, e.g. the location of highly flammable materials.</th>
</tr>
</thead>
<tbody>
<tr>
<td>9</td>
<td>• ..................................................or other member of the Fire Wardens will liaise with the Fire Brigade on their arrival.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>The following arrangements and training is given to staff at the centre:</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>• All staff: Fire Drills three times a year</td>
</tr>
<tr>
<td></td>
<td>• All staff: Fire briefing once a year (may be in conjunction with fire drill.</td>
</tr>
<tr>
<td></td>
<td>• Fire Wardens training: for designated fire wardens</td>
</tr>
<tr>
<td></td>
<td>• Record of training to be kept within Fire Manual.</td>
</tr>
<tr>
<td></td>
<td>• Training to be reviewed on a yearly basis and planned into budget.</td>
</tr>
</tbody>
</table>
Instructions in case of emergency
In buildings where the floor of an occupiable story is greater than 23 m above the lowest level of fire department vehicle access, the building is considered as high rise building. The following requirements shall be respected:

Extinguishing Requirements:
▪ High-rise buildings shall be protected throughout by an approved, supervised automatic sprinkler system. A sprinkler control valve and a waterflow device shall be provided for each floor.
▪ High-rise buildings shall be protected throughout by a Class I standpipe.

Detection, Alarm, and Communications Systems:
▪ A fire alarm system using an approved emergency voice/alarm communication system shall be installed.
▪ Two-way telephone communication service shall be provided for fire department use. This system shall be in accordance with NFPA 72, National Fire Alarm Code. The communications system shall operate between the emergency command center and every elevator car, every elevator lobby, and each floor level of exit stairs.

Emergency Lighting and Standby Power:
▪ Emergency lighting shall be provided.
▪ Type 60, Class 1, Level 1, standby power in accordance with Article 701 of NFPA 70, National Electrical Code, and NFPA 110, Standard for Emergency and Standby Power Systems, shall be provided. The standby power system shall have a capacity and rating sufficient to supply (1) Electric fire pump, (2) Emergency command center equipment and lighting, (3) Not less than one elevator serving all floors, with standby, power transferable to any elevator, (4) Mechanical equipment for smokeproof enclosures, (5) Mechanical equipment required smoke control systems.

Emergency Command Center shall be provided in a location approved by the fire department.
References

- Fire protection requirements in buildings of the culf cooperation council
- Saudi building fire protection code no.801
  - NFPA13 – Standard for the installation of sprinkler system.
  - NFPA14 – Standard for the installation of standpipe and hose systems.
  - NFPA30 – Flammable and combustible liquids code.
  - NFPA31 – Standard for the installation of oil-burning equipment.
  - NFPA58 – Liquefied petroleum gas code.
  - NFPA70 – National electrical code.
  - NFPA72 – National fire alarm code.
  - NFPA80 – Standard for fire doors and other openings protective.
  - NFPA90A – Standard for the installation of air-conditioning and ventilating systems.
  - NFPA92A – Standard for smoke-control systems utilizing barriers and pressure differences.
  - NFPA 92B – Standard for smoke management systems in malls, atria, and large spaces.
  - NFPA 110 – Standard for emergency and standby power systems.
  - NFPA 430 – Code for the storage of liquid and solid oxidizers.
  - NFPA432 – Code for the storage of organic peroxide formulations.
  - NFPA5000 – Building construction and safety code.