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OF THE PEOPLE'S REPUBLIC OF CHINA

中华人民共和国国家标准

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Code of Design on Building Fire Protection and Prevention

建筑设计防火规范

（英 文 版）

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1 General principles

1.0.1 This code is formulated with a view to preventing and reducing building fire hazards and safeguarding people's life and property.

1.0.2 This code shall be applicable to the construction, extension and renovation of the buildings specified as follows:

1 Residential buildings of 9 stories or below (including residential buildings with commercial service facilities);

2 Public buildings not over 24m high;

3 Single story public buildings over 24m high;

4 Underground and semi-underground buildings (including basementand semi-basement of the building);

5 Factory building;

6 Storage;

7 Storage tank (tank farm) for Class A, B and C liquid;

8 Storage tank (tank farm) for combustible and combustion-supporting gas;

9 Combustible stackyard;

10 City traffic tunnel.

Note: 1 Measurement of the building height: When the roof is slope, the height of the building shall be measured from the design ground level outside the building to the eaves; when the roof is flat (including the flat roof with parapet wall), the height of the building shall be measured from the design ground level outside of the building to the surface of the roof; when the building has various roof shapes, the height of the building shall be measured respectively with the same measurement method and take the greatest value. The sticking out constructions such as observation tower, cooling tower, water tank room, microwave antenna room or equipment, elevator machine room, air and smoke exhaust fan room, staircase exit etc. on the roof may not be counted in the building height.

2 Measurement of the building stories: The basement and semi-basement with its top slab not more than 1.5m high above the design ground level outside of the building, the bicycle storage space, storage and open space not more than 2.2m high at the lower part of the building, and the local equipment room, staircase etc. above the roof may not be counted in the stories. The apartment on the top of the building with two stories as one unit can be considered as one story. The two-story apartment not on the top of the building and the apartment on the top of the building with more than two stories as one unit shall be counted in the stories.

1.0.3 This code is not applicable to the fire protection design of explosive plants (storage) and firecrackers work shops (storage).

If there are current national standards for the fire protection design of civil air defense works, oil and gas installations, petrochemical plants, thermal power plants or transformer substations, it should meet the special requirements of those standards .

1.0.4 The design of building fire protection shall be consistent with the relevant national policies, and the designer shall consider the overall situation to achieve the purpose of ensuring safety, serviceability, technical superiority and economy.

1.0.5 The design of building fire protection shall comply with the stipulation of this code and it shall furthermore comply with the relevant current national codes.

2 Terminology

2.0.1 Fire resistance rating

The time in hour that from the building elements, components or structures affected by fire to the time that they lose their fire stability, integrity or insulation under standard fire test conditions.

2.0.2 Non-combustible component

The building elements made of non-combustible materials.

2.0.3 Difficult-combustible component

The building elements made of difficult-combustible materials or those elements made of combustibles but protected by a layer of non-combustible materials.

2.0.4 Combustible component

The building elements made of combustibles.

2.0.5 Flash Point

Minimum temperature to which a material or a product must be heated for the vapors emitted to ignite momentarily in the presence of flame under specified test conditions(using closed-cup testing method).

2.0.6 Lower explosion limit

Minimum concentration (concentration of combustible vapor and gas, calculated based on their volumetric ratio) of the mixture of combustible vapor, gas or dust and air that will explode in the presence of an ignition source.

2.0.7 Boiling spill oil

Oil that contains water and will generate heat wave when combusted, e.g. raw oil, residual oil, heavy oil etc..

2.0.8 Semi-basement

Story of a building partly below and partly above ground level, located so that the average vertical distance from ground level to the floor below is higher than 1/3 of the story's net height and less than or equal to 1/2 of the story's net height.

2.0.9 Basement

Story of a building partly below and partly above ground level, located so that the average vertical distance from ground level to the floor below is higher than half of the story's net height.

2.0.10 Multi-story factory building (storage)

Factory building (storage) with 2 or more stories and building height not over 24m.

2.0.11 High-rise factory building (storage)

Factory building (storage) with 2 or more stories and building height over 24m.

2.0.12 High rack storage

Mechanical or automatically controlled rack storage with rack height over 7m.

2.0.13 Important public building

Public building with a large assembly of people which may cause great life and property loss and great effect in case of fire.

2.0.14 Commercial service facilities

Small commercial service facilities refer to those areas used as department store, food store, grain shop, post office, bank, barber-shop etc. located at the first floor or the first and second floor of the residential building. Its total building area shall not be over $300m^2$, and it shall be separated completely from the residential area or the other areas of the building with fire rated floor slab not less than 1.50h and fire rated partition wall (without any opening) not less than 2.00h. Its exit and stairs used for evacuation shall be established independently.

2.0.15 Open flame site

The fixed place where there is open flame or red heat surface inside or outside a building (except the cooking utensils, induction cooker etc.).

2.0.16 Sparking site

The fixed place where there is chimney with flying spark or grinding wheel, electric welding or gas welding (cutting) outside a building.

2.0.17 Exit

The gateway of staircase used for safe evacuation of people and outside stairway or the exit directly leading to the indoor and outdoor safety refuge.

2.0.18 Enclosed staircase

The staircase that is separated from the other parts of the building with building components and is capable of keeping out smoke and heat.

2.0.19 Smoke-proof staircase

The staircase with smoke proof lobby or with open balcony or corridor designed to pipe smoke at the entrance of the staircase, and Class B fire door provided at the opening for evacuation corridor entering the lobby and the lobby entering the staircase.

2.0.20 Fire compartment

Enclosed space, which may be subdivided, separated from adjoining spaces within a building by elements of construction with a specified fire resistance rating such as fire wall, floor slab etc. that can prevent fire from spreading to the other parts of the building within certain time.

2.0.21 Fire separation distance

The separation distance to prevent the radiation heat of the burning building from igniting the adjacent buildings within certain time and to be convenient for fire fighting and rescue.

2.0.22 Smoke compartment

A space within a building from floor to roof or ceiling bounded with roof smoke screen, ceiling screen or beam to accommodate smoke.

2.0.23 Full water spout

The jet length from the hose nozzle to the hole with its diameter as 380mm, and from which 90% of the spout flow is through.

3 Factory buildings （storages）

3.1 Classification of fire hazards

3.1.1 Fire hazards in production shall be divided into Class A, B, C, D and E according to the factors like properties and quantities of the materials used or produced during the production, and they shall conform to the requirements of Table 3.1.1.

Table 3.1.1 Classification of fire hazards in production

Production class	Characteristics of fire hazards for the production using or producing the following substances
A	1. Liquid with a flash point below 28℃. 2. Gas with a lower explosion limit below 10%. 3. Substance that can self-decompose at normal temperature or oxidize in the air, and result in rapid spontaneous combustion or explosion. 4. Substance that can generate combustible gas and set off combustion or explosion when it reacts with water or vapor in the air at normal temperature. 5. Strong oxidant that can set off combustion or explosion when it is in contact with acid, heated, shocked, rubbed, catalyzed or in contact with organic matter or flammable inorganic matter such as sulphur. 6. Substance that can set off combustion or explosion when it is struck, rubbed or in contact with oxidant or organic matter. 7. Production operated in sealed apparatus with a temperature at or above the spontaneous combustion point of the matter being processed.
B	1. Liquid with a flash point at or above 28℃ but below 60℃. 2. Gas with a lower explosion limit at or above 10%. 3. Oxidant other than Class A. 4. Chemical flammable hazardous solid other than Class A. 5. Combustion-supporting gas. 6. Suspended dust or fiber or fog droplet of liquid with a flash point at or above 60℃ that can form explosion mixture with the air.
C	1. Liquid with a flash point at or above 60℃. 2. Combustible solid.
D	1. Production in which non-combustible substance is processed and strong radiation heat, spark or flame are emitted at high temperature or in molten state. 2. Various productions that use gas, liquid and solid as fuel or use the combustion of gas and liquid for the other purposes. 3. Production that uses or processes difficult-combustible matter at normal temperature.
E	Production that uses or processes non-combustible matter at normal temperature.

3.1.2 In case where there are productions with different fire hazards in a factory building or a fire compartment within a factory building, the fire hazard in the factory building or its fire compartment shall be determined according to the higher fire hazard for this portion. When one of the following conditions is met, the fire hazard can be determined according to the portion with lower fire hazard:

1 The ratio of this portion area with higher fire hazard to this story or fire compartment is below 5% or the painting section in a factory building of Class D and E below 10%, and the fire in this portion cannot spread to the other portions in the event of fire, or effective fire protection measures have been taken in the portion with higher fire hazard to prevent fire from spreading;

2 For the painting section in a factory building with fire hazard of Class D and E, when the closed process of spraying paint is used, a negative pressure is maintained in the enclosed space, the automatic alarm system for combustible gas concentration or the automatic explosion inhibiting system has been provided, and the ratio of the painting section to the fire compartment it belongs to does not exceed 20%.

3.1.3 Fire hazards of the stored goods shall be divided into Class A, B, C, D and E according to the factors like properties of the stored goods and quantities of the combustibles among the stored goods, and they shall conform to the requirements of Table 3.1.3.

Table 3.1.3 Classification of fire hazards of stored goods

Class of stored goods	Fire hazard characteristics of stored goods
A	1. Liquid with a flash point below 28℃. 2. Gas with a lower explosion limit below 10%, and solid material that can produce gas with a lower explosion limit of less than 10% under the action of water or vapor. 3. Substance that can self-decompose at normal temperature or oxidize in the air, and result in rapid spontaneous combustion or explosion. 4. Substance that can generate combustible gas and set off combustion or explosion when it reacts with water or vapor in the air at normal temperature. 5. Strong oxidant that can set off combustion or explosion when it is in contact with acid, heated, shocked, rubbed, catalyzed or in contact with organic matter or flammable inorganic matter such as sulphur. 6. Substance that can set off combustion or explosion when it is struck, rubbed or in contact with oxidant or organic matter.
B	1. Liquid with a flash point at or above 28℃ but below 60℃. 2. Gas with a lower explosion limit at or above 10%. 3. Oxidant other than Class A. 4. Chemical flammable hazardous solid other than Class A. 5. Combustion-supporting gas. 6. Material that may slowly be oxidized in the air at ambient temperature and accumulate heat resulted from the oxidation and cause spontaneous combustion.
C	1. Liquid with a flash point at or above 60℃. 2. Combustible solid.
D	Difficult-combustible good.
E	Non-combustible good.

3.1.4 Where several kinds of goods with different fire hazards are stored in a storage or a fire compartment of the storage, the fire hazard of the storage or the fire compartment shall be determined by the stored goods with the highest fire hazard.

3.1.5 When the weight of combustible packing of Class D and E goods is over one quarter of its self-weight, the fire hazard of the storage shall be classified as Class C.

3.2 Fire resistance class of factory buildings (storages) and fire resistance rating of its components

3.2.1 Fire resistance class of the factory buildings (storages) can be divided into Class I, II, III and IV. The combustion performance and fire resistance rating of its building components, unless otherwise specified in this code, shall not be less than what is required in Table 3.2.1.

Table 3.2.1 Combustion performance and fire resistance rating of the building components of factory buildings (storages)(h)

Building components		Fire resistance class			
		Class I	Class II	Class III	Class IV
Wall	Fire wall	Non-combustible 3.00	Non-combustible 3.00	Non-combustible 3.00	Non-combustible 3.00
	Load-bearing wall	Non-combustible 3.00	Non-combustible 2.50	Non-combustible 2.00	Difficult-combustible 0.50
	Sidewall of staircase, elevator shaft	Non-combustible 2.00	Non-combustible 2.00	Non-combustible 1.50	Difficult-combustible 0.50
	Sidewall of exit passageway	Non-combustible 1.00	Non-combustible 1.00	Non-combustible 0.50	Difficult-combustible 0.25
	Non-load bearing exterior wall	Non-combustible 0.75	Non-combustible 0.50	Difficult-combustible 0.50	Difficult-combustible 0.25
	Room partition wall	Non-combustible 0.75	Non-combustible 0.50	Difficult-combustible 0.50	Difficult-combustible 0.25
Column		Non-combustible 3.00	Non-combustible 2.50	Non-combustible 2.00	Difficult-combustible 0.50
Beam		Non-combustible 2.00	Non-combustible 1.50	Non-combustible 1.00	Difficult-combustible 0.50
Floor		Non-combustible 1.50	Non-combustible 1.00	Non-combustible 0.75	Difficult-combustible 0.50
Roof load-bearing component		Non-combustible 1.50	Non-combustible 1.00	Difficult-combustible 0.50	Combustible
Egress stairway		Non-combustible 1.50	Non-combustible 1.00	Non-combustible 0.75	Combustible

Table 3.2.1(continued)

Building components	Fire resistance class			
	Class I	Class II	Class III	Class IV
Ceiling (including ceiling joist)	Non-combustible 0.25	Difficult-combustible 0.25	Difficult -combustible 0.15	Combustible

Note: When the ceiling of a building with Class II fire resistance class is non-combustible, there is no requirement for its fire resistance rating.

3.2.2 The fire resistance rating of the fire walls of the following buildings shall be 1.00h higher than the value given in Table 3.2.1 of this code:

1 Class A and B factory buildings;

2 Class A, B and C storages

3.2.3 For the columns of single-story Class I and Class II factory buildings (storages), their fire resistance ratings may be 0.50h less than the value given in Table 3.2.1 of the code.

3.2.4 Columns and beams of the following Class II buildings may both be bare metal structures. However, for the part (parts) of the columns or beams that may be affected by liquids of Class A, B, C or the flame of combustible gases, fire prevention and heat insulation measures shall be taken either by cladding non-combustible materials or by using other insulation methods:

1 Single-story Class C factory buildings with automatic fire extinguishing system installed;

2 Class D and E factory buildings (storages).

3.2.5 The exterior non-load bearing walls of Class I and II buildings shall conform to the following requirements:

1 Except Class A and B storages and high-rise storages, the fire resistance rating for an exterior non-bearing wall of non-combustible components shall not be less than 0.25h, and for an exterior non-bearing wall of difficult-combustible components, its fire resistance rating shall not be less than 0.50h;

2 For aboveground Class D and E factory buildings (storages) with 4 or less than 4 stories, the fire resistance ratings of the exterior non-load bearing walls are not limited when they are non-combustible constructions; however, when the exterior non-load bearing walls are constructed as B1 light-weight composite walls, their surface materials shall be non-combustible and the combustion performance of the in-filling materials shall not be less than B2. The B1 and B2 materials shall conform to the related requirements of the current national standard *Classification on Burning Behavior for Building Materials* GB 8624.

3.2.6 When the partition walls of Class II fire rated factory building (storage) are constructed as difficult-combustible constructions, their fire resistance ratings shall be increased by 0.25h.

3.2.7 When the floor slab of Class II multi-story factory building (storage) is constructed with pre-stressed and pre-cast reinforced concrete, its fire resistance rating shall not be less than 0.75h.

3.2.8 For the accessible flat roofs of Class I and II factory buildings (storages), the fire resistance ratings of the roof panels shall not be less than 1.50h and 1.00h respectively.

When Class I single and multi-story factory building (storage) is protected throughout by automatic sprinkler system, the fire resistance rating of the load-bearing roof components shall not be less than 1.00h.

The load-bearing roof component of Class II factory building may be constructed with bare metal. However, the part that can be affected by Class A, B and C liquid flame shall be insulated and protected from fire.

3.2.9 The roof panel of Class I and II factory buildings (storages) shall be constructed with non-combustible materials, but the water proof layer and heat insulation layer may be constructed with combustible materials; when Class D and E factory buildings (storages) is not more than 4 stories, the roof can be constructed with B1 light-weight composite materials, but the surface material of the composite panel shall be non-combustible, and the combustion performance of its in-filling material shall not be less than B2.

3.2.10 Unless otherwise specified in this code, the fire resistance class for a factory buildings (storages) with load-bearing timber column and wall of non-combustible material shall be classified as Class IV.

3.2.11 The exposed joint part of pre-cast reinforced concrete member shall be protected from fire, and the fire resistance rating of the joint shall not be less than that of the corresponding structure.

3.3 Fire resistance class, number of stories, occupied area and plane arrangement of factory buildings (storages)

3.3.1 Unless otherwise specified in this code, the fire resistance rating, number of stories and the maximum permitted area of each fire compartment of the factory buildings shall comply with those shown in Table 3.3.1.

Table 3.3.1 Fire resistance ratings, number of stories and the maximum permitted area of each fire compartment of factory building

Class of production	Fire resistance class of the factory building	Maximum permitted stories	Maximum permitted area of each fire compartment (m^2)			
			Single-story factory building	Multi-Story factory building	High-rise factory building	Underground and semi-underground factory building, basement and semi-basement of the factory building
A	Class I Class II	Single story is recommended unless the production requires multi-story	4000 3000	3000 2000	— —	— —

Table3.3.1(continued)

Class of production	Fire resistance class of the factory building	Maximum permitted stories	Maximum permitted area of each fire compartment (m^2)			
			Single-story factory building	Multi-Story factory building	High-rise factory building	Underground and semi-underground factory building, basement and semi-basement of the factory building
B	Class I	No limit	5000	4000	2000	—
	Class II	6	4000	3000	1500	—
C	Class I	No limit	No limit	6000	3000	500
	Class II	No limit	8000	4000	2000	500
	Class III	2	3000	2000	—	—
D	Class I, II	No limit	No limit	No limit	4000	1000
	Class III	3	4000	2000	—	—
	Class IV	1	1000	—	—	—
E	Class I, II	No limit	No limit	No limit	6000	1000
	Class III	3	5000	3000	—	—
	Class IV	1	1500	—	—	—

Note: 1 Fire wall shall be designed between fire compartments. Class I and II fire rated single-story factory building (except Class A factory building) may use fire roller shutter or fire water curtain as fire separation, if its fire compartment area is larger than what is stipulated in this table and it is hard to build the fire wall. When fire roller shutter is used, the requirements of 7.5.3 of this code shall be met; when fire water curtain is used, the related requirements in the current national standard *Code for Design of Automatic Sprinkler System* GB 50084 shall be met.

2 The maximum permitted area for each fire compartment for Class I multi-story and class II single and multi-story textile mill building (except flax mill) may be increased by 50% according to those given in this table, but the raw cotton unpacking and the cotton cleaning workshops in the above-mentioned factory buildings shall be separated by fire walls.

3 The maximum permitted area for each fire compartment for Class I and II single-story and multi-story paper mill complex may be increased by 1.5 times according to those given in this table. For Class I and II fire rated wet paper mill complex, when the hood of the drying apparatus is provided with automatic fire extinguishing system and the finishing section is provided with effective fire extinguishing system, the maximum permitted area for each fire compartment may be determined by the requirement of the paper production process.

4 For a working tower of Class I and II fire rated grain silo, the number of stories may not be limited by the table when the number of people is not more than 2 for each story.

5 The rooms in the Class I or Class II combined cigarette building used for raw materials, stocks and grouping formula, tobacco cutting, cut tobacco storing, tobacco rolling,

connecting with cigarette holder and packing, auxiliary materials turnover, temporary storing of finished product, CO_2 expanded cut tobacco etc. shall be separated as independent fire units. If the technological conditions permit, the fire unit shall be separated by fire wall. The workshops for tobacco cutting, cut tobacco storing, tobacco rolling, connecting with cigarette holder and packing may be designed in one fire compartment and the maximum permitted area of the fire compartment may be determined by the requirements of the production process. And the workshops for tobacco cutting, cut tobacco storing, tobacco rolling, connecting with cigarette holder and packing shall be separated from each other with the fire rated wall of not less than 2.00h and the floor slab of not less than 1.00h. The openings in horizontal or vertical partition walls in the factory building shall be protected to prevent fire from spreading.

6 The "—" in the table means "not permitted".

3.3.2 Unless otherwise specified in this code, the fire resistance class, number of stories and area of the storage shall comply with the requirements of Table 3.3.2.

Table 3.3.2 Fire resistance class, number of stories and area of storage

Class of the stored goods		Fire resistance class of the storage	Maximum permitted stories	Maximum floor area of each storage and maximum permitted building area of each fire compartment(m^2)						
				Single-story storage		Multi-story storage		High-rise storage		Underground and semi-underground storage, basement and semi-basement of storage
				Each storage	Fire compartment	Each storage	Fire compartment	Each storage	Fire compartment	Fire compartment
A	Item 3, 4	Class I	1	180	60	—	—	—	—	—
	Item 1,2,5,6	Class I, II	1	750	250	—	—	—	—	—
B	Item 1,3,4	Class I,II	3	2000	500	900	300	—	—	—
		Class III	1	500	250	—	—	—	—	—
	Item 2,5,6	Class I,II	5	2800	700	1500	500	—	—	—
		Class III	1	900	300	—	—	—	—	—
C	Item 1	Class I,II	5	4000	1000	2800	700	—	—	150
		Class III	1	1200	400	—	—	—	—	—
	Item 2	Class I,II	No limit	6000	1500	4800	1200	4000	1000	300
		Class III	3	2100	700	1200	400	—	—	—
D		Class I,II	No limit	No limit	3000	No limit	1500	4800	1200	500
		Class III	3	3000	1000	1500	500	—	—	—
		Class IV	1	2100	700	—	—	—	—	—
E		Class I,II	No limit	No limit	No limit	No limit	2000	6000	1500	1000
		Class III	3	3000	1000	2100	700	—	—	—
		Class IV	1	2100	700	—	—	—	—	—

Note: 1 The fire compartments in storage shall be separated by fire wall.

2 Petroleum depot with petroleum filled in barrels shall comply with the related requirements of the current national standard *Code for Design of Oil Depot* GB 50074.

3 The maximum permitted floor area of a fire compartment in Class I, II coal homogenization storages shall not be more than 12000m^2.

4 For independently built storages for ammonium nitrate, calcium carbide, polyethylene, carbamide, coal distribution and finished product storage of pape mill as well as intermediate storages in railway station, wharf and airport, when the fire resistance class is not less than Class II, their maximum permitted floor areas for each storage and the maximum permitted building area for each fire compartment may be increased by 1.0 time according to the stipulation in this table.

5 The maximum permitted floor area for Class I, II fire resistance class single-story grain storage shall not be larger than 12000m^2, and the maximum permitted building area of each fire compartment shall not be larger than 3000m^2; the maximum permitted floor area for Class III fire resistance class single-story grain storage shall not be larger than 3000m^2, and the maximum permitted building area for each fire compartment shall not be larger than 1000m^2.

6 The maximum permitted floor area of the Class I, II fire resistance class cold storage and the maximum permitted building area for each fire compartment shall conform to the related requirements of the current national standard *Code for Design of Cold Storages* GB 50072.

7 The storage for distilled spirit with a degree over 50 should not be over three stories.

8 The "—" in the table means "not permitted."

3.3.3 The maximum permitted area for each fire compartment may be increased by 1.0 time of what is given in Table 3.3.1 when the factory building is provided with automatic fire extinguishing system. The maximum permitted area for each compartment of Class D and E aboveground factory building is not limited when automatic fire extinguishing system is installed.

The maximum permitted floor area of each storage and the maximum permitted area for each fire compartment can be increased by 1.0 time of what are required in 3.3.2 of this code when automatic fire extinguishing system is provided.

When automatic fire extinguishing system is locally installed in a portion of a factory building, the increased area for each fire compartment can be computed by 1.0 time of the said portion area.

3.3.4 Buildings for using or storing equipment such as special valuable machines, instruments, apparatuses etc. shall be classified as Class I building.

3.3.5 Class A, B independent single-story factory building with building area not more than 300m^2 may be given with fire resistance class of Class III.

3.3.6 Factory building that uses or generates Class C liquid and Class D factory building

where there is spark, hot surface or open flame shall be constructed as Class I or Class II building. However, if the area of the said Class C factory building is not more than $500m^2$ and the area of the said Class D factory building is not more than $1000m^2$, they may also be constructed as Class III single-story building.

3.3.7 Class A and B production places shall not be set up in the underground or semi-underground facilities. Class A and B storages shall not be set up in the underground or semi-underground facilities.

3.3.8 Dormitory for workers is prohibited in a factory building.

Offices and lounges shall not be provided in Class A or B factory building. If an office or lounge must be adjacent to the said factory building, the fire resistance class shall be Class I or II, and adopted protective partition of non-combustible component with fire resistance rating not below 3.00h and independent exit shall be provided.

Offices or lounges in Class C factory buildings shall be separated from the other areas of the factory building by non-combustible partitions with fire resistance rating not less than 2.50h and the floors with fire resistance rating not less than 1.00h, and at least one independent exit shall be provided. Class B fire door shall be used if there is a door in the partition wall.

3.3.9 When an intermediate storage for Class A, B products is provided in a factory building, its storage quantity should not be more than that required for one day and one night.

The intermediate storage shall be laid out close to the exterior wall. It shall be separated from the remaining part of the building by fire wall and the non-combustible floor slab with a fire resistance rating not below 1.50 h.

3.3.10 When Class C storage is provided in a factory building, it shall be separated from the remaining part of the building by fire wall and non-combustible floor with fire resistance rating not less than 1.50h. When Class D or E storage is provided, it shall be separated from the remaining part of the building by non-combustible wall with fire resistance rating of not less than 2.50h and floor not less than 1.00h. The fire resistance class and area of the storage shall comply with 3.3.2 and 3.3.3 of this code.

3.3.11 An intermediate Class C liquid tank shall have its volume not larger than $1m^3$ and shall be set up in an independent room with a fire resistance class not lower than Class II, and the door of the said room shall be a Class A fire door.

3.3.12 A boiler room shall be a Class I or II fire resistance class building, however, when the total evaporation quantity per hour for a coal-burning boiler is not more than 4t, the boiler room may be a Class III fire resistance class building.

3.3.13 The fire-resistance class of the rooms for combustible oil-immersed electrical power transformer and for high-voltage distribution installation shall not be lower than

Class II. The other fire protection requirements shall be implemented according to the current national standard *Code for Fire Protection Design of Power Plant and Substation* GB 50229 etc.

3.3.14 A transformer or a distribution substation shall not be set up in or adjacent to Class A or B factory building and shall not be set up in an environment with explosive gas or dust. However, when a transformer or a distribution substation (below 10kV), which specially provides power to Class A, B factory buildings mentioned above, may be built adjacent to one side of the factory building. It shall be separated from the factory by fire wall without door and window openings and it shall meet the related requirements of the current national standard *Code for Design of Electrical Facilities in Explosion and Fire Environment* GB 50058 etc..

For a distribution substation of a Class B factory building, when a window has to be set up on its fire wall, it shall be a sealed and fixed Class A fire window.

3.3.15 Dormitory for workers is prohibited in a storage building.

Offices or lounges shall not be provided in Class A or B storage and shall not be built adjacent to the said storage.

Offices or lounges in Class C, D storages shall be separated from the other areas of the storage by non-combustible partitions not less than 2.50h fire resistance rating and floors not less than 1.00h fire resistance rating and independent exit shall be provided. Class B fire door shall be used if there is a door in the partition wall.

3.3.16 The fire resistance Class for high rack storage shall not be less than Class II.

3.3.17 The fire resistance Class for grain silo shall not be less than Class II. Class II fire resistance class grain silo can be steel silo.

The fire resistance class for single-story grain storage shall not be less than Class III. Class II single-story grain storage for grain in bulk can be built with metal load-bearing components without fire protection.

3.3.18 There shall be no railways in factory buildings (storages) of Class A and B.

Where the steam locomotive and the diesel locomotive are needed in and out of the Class C, D and E factory buildings (storages), the roofs of the buildings shall be non-combustible structures or be protected by the other fire-protection measures.

3.4 Fire separation distance for factory building

3.4.1 Unless otherwise specified in this code, the fire separation distance between factory buildings, factory buildings and Class B, C, D, E storages, factory buildings and civil buildings shall not be less than those given in Table 3.4.1.

Table 3.4.1 Fire separation distance between factory buildings, factory buildings and Class B, C, D, E storages, factory buildings and civil buildings (m)

Name			Class A factory building	Single, multi-story Class B factory building (storage)	Single, multi-story Class C, D, E factory building (storage)			High-rise factory building (storage)	Civil building		
					Fire resistance class				Fire resistance class		
					Class I, II	Class III	Class IV		Class I, II	Class III	Class IV
Class A factory building			12	12	12	14	16	13	25		
Single, multi-story Class B factory building			12	10	10	12	14	13	25		
Single, multi-story Class C, D factory building	Fire resistance class	Class I, II	12	10	10	12	14	13	10	12	14
		Class III	14	12	12	14	16	15	12	14	16
		Class IV	16	14	14	16	18	17	14	16	18
Single, multi-story Class E factory building		Class I, II	12	10	10	12	14	13	6	7	9
		Class III	14	12	12	14	16	15	7	8	10
		Class IV	16	14	14	16	18	17	9	10	12
High-rise factory building			13	13	13	15	17	13	13	15	17
Total oil quantity of transformer of outdoor substation and electricity distribution station (t)	≥5, ≤10		25	25	12	15	20	12	15	20	25
	>10, ≤50				15	20	25	15	20	25	30
	>50				20	25	30	20	25	30	35

Note: 1 Fire separation distance between buildings shall be computed according to the nearest distance between the exterior walls of two adjacent buildings. If there are projecting combustible members on the exterior walls, the fire separation distance shall be computed from the external fringe of the projecting portion.

2 Fire separation distance between Class B factory building and important public building should not be less than 50m. Fire separation distance between single, multi-story Class E

factory buildings and the distance to Class E storages can be 2m less than the value given in this table. Independently set-up living rooms serving Class C, D or E factory building shall be classified as civil buildings. The fire separation distance between the living room and the factory building it serves shall not be less than 6m. If the living room has to be adjacently to the factory building, the requirements of Note 3 and 4 of this table shall be met;

3 When the higher exterior wall between two neighboring factory buildings is a fire wall, there is no limit for the fire separation distance. But for Class A factory buildings, it shall be not less than 4m. If the two adjacent exterior walls of two Class C, D, E factory buildings are non-combustible, and there is no exposed combustible eaves, and the total area of openings of doors and windows on each exterior wall is not more than 5% of the area of the wall respectively, and doors and windows are not opened opposite to each other, the fire separation distance may be reduced by 25% based on the requirements given in this table;

4 When the lower exterior wall between two adjacent Class I or II fire resistance class factory buildings is a fire wall and the fire resistance rating of the roof of the lower factory building is not less than 1.00h, or when the openings such as doors, windows in the higher exterior wall between two Class I or II fire resistance class factory buildings are fitted with Class A fire doors, fire windows, or fire separation water curtains, or fire roller shutters installed according to the requirement of 7.5.3 of the code, the fire separation distance between Class A, B factory buildings shall not be less than 6m and the fire separation distance between Class C, D, E factory buildings shall not be less than 4m;

5 The fire separation distance between a transformer and a building shall be computed from the exterior wall of the transformer that is the closest to the building. The oil quantity of a main transformer in a power plant may be determined according to a single unit;

6 If the fire resistance class of an existing factory building is below Class IV, its fire separation distance shall be determined according to Class IV building.

3.4.2 The fire separation distance between Class A factories and important public buildings shall not be less than 50m and for the Class A factory and the sites with open flames or sparkles shall not be less than 30m; the minimum horizontal distance between Class A factory and elevated electric wire shall meet the requirements of 11.2.1 of this code; the fire separation distance between Class A factory and Class A, B, C liquid tanks, combustible, combustion-supporting gas tanks, LPG tanks as well as combustible stackyard shall meet the related requirements of Chapter 4 of the code.

3.4.3 The fire separation distance between a Class A factory building that emits combustible gas and vapor and railway, road shall not be less than the requirements of Table 3.4.3. However, when fire protection measures have been provided for the railway load and unload lines within the Class A factory building, the fire separation distance shall

not be limited by the requirements of Table 3.4.3.

Table 3.4.3 Fire separation distance between Class A factory building and railway, road etc. (m)

Name	Off-site railway line (center line)	In-plant railway line (center line)	Off-site road way (road side)	In-plant road side	
				Main	Secondary
Class A factory building	30	20	15	10	5

Note: The fire separation distance between the factory building and the road side shall be the least distance calculated from the nearest road to the building.

3.4.4 The fire separation distance between high-rise factory building and Class A, B, C liquid tank, combustible and combustion-supporting gas tank, LPG tank, combustible stackyard (except coal and coke yard) shall meet the related requirements of Chapter 4 of this code, and shall not be less than 13m.

3.4.5 When the fire resistance class of Class C, D, E factory building and the fire resistance class of the public buildings are both Class I, II, the fire separation distance between them can be as follows:

1 When the higher exterior wall is fire wall without openings for door or window, or 15m over the lower building roof is fire wall without openings for door or window, there is no limit for the fire separation distance of the buildings;

2 The fire separation distance of two buildings may be decreased and shall not be less than 4m, when the adjacent external wall of the lower building is fire wall, there is no skylight on the roof and the fire resistance rating of the load-bearing members of the roof is not less than 1.00h, or the adjacent external wall of the higher building is fire wall and fire protection measures are taken for the openings of the wall.

3.4.6 When an outdoor installation of a factory building is filled with flammable chemicals, the distance between the outer wall of the outdoor installation and the outer wall of an outdoor installation attached to the adjacent factory building or the adjacent exterior walls of the factory building shall not be less than the value given in 3.4.1 of this code. The distance between the outdoor installations of non-combustible can be determined according to the requirements for Class I ,II fire resistance class buildings.

When a Class C liquid storage tank with a total storing quantity not larger than $15m^3$ is directly buried near the exterior wall of a factory building, and the exterior wall facing the storage tank within 4.0m is a fire wall, the fire separation distance may not be limited.

3.4.7 The fire separation distance between two wings of a U-shaped or W-shaped factory

building should not be less than the requirements given in 3.4.1. If the floor area of the factory building is not more than the maximum permitted building area of the fire compartment given in 3.3.1 in this code, the fire separation distance between the two wings may be 6m.

3.4.8 When the total floor area of several factory buildings (except high-rise factory buildings and Class A factory buildings) is not more than the maximum permitted area of the fire compartment (determined according to the factory building with less floor area, but it shall not be more than $10000m^2$ for a factory building without limit for the floor area) specified in 3.3.1 of this code, the lay-out of these buildings can be designed in groups. The distance between factory buildings in one group shall not be less than 4m for the factory buildings with a height not over 7m, and shall not be less than 6m for those with a height over 7m.

The fire separation distance between groups or between a group of factory buildings and its adjacent buildings shall conform to the requirements of 3.4.1 in this code according to the building with lower fire resistance class in the two adjacent buildings.

3.4.9 Grade I refueling station, Grade I LPG gas station and Grade I united refueling and gas station shall not be provided in urban built-up area.

3.4.10 The grading of the motor refueling station, the fire separation distance between refueling station, gas station, united refueling and gas station as well as the refueling (gas) machine, oil (gas) storage tank and the site of open flame or spark, building, railway, road, and the fire separation distance between the buildings or facilities within the station, shall meet the requirements of the current national standard *Code for Design and Construction of Automobile Gasoline and Gas Filling Station* GB 50156.

3.4.11 For the outdoor transformer, distribution station with a 35~500 kV voltage of the electrical power system and more than 10MV·A capacity per transformer, the outdoor voltage drop transformer of the industrials with the total oil quantity more than 5t, their fire separation distance to the buildings shall not be less than what is required in 3.4.1 and 3.5.1 of this code.

3.4.12 The distance of the enclosing wall for a factory to the factory buildings should not be less than 5 m. The distance between buildings which are situated on both sides of the enclosing wall shall conform to the requirements of the related fire separation distance.

3.5 Fire separation distance for storage

3.5.1 The fire separation distance between Class A storages, Class A storage and the other buildings, sites with open flame or spark, railway, road etc. shall not be less than the value given in Table 3.5.1. The minimum horizontal distance between Class A storage and elevated electric wire shall meet the requirements of 11.2.1 of this code. The fire separation

distance between the in-plant loading and unloading railway line and the Class A storage with loading and unloading platform may not be limited by Table 3.5.1.

Table 3.5.1 Fire separation distance between Class A storages, Class A storage and the other buildings, sites with open flame or spark, railway etc. (m)

Name		Class A storage and its reserves (t)			
		Item 3, 4 of Class A stored goods		Item 1,2,5,6 of Class A stored goods	
		≤5	>5	≤10	> 10
Important public building		50			
Class A Storage		20			
Civil building, sites with open flame or spark		30	40	25	30
Other buildings	Class I, II	15	20	12	15
	Class III	20	25	15	20
	Class IV	25	30	20	25
The outdoor transformer, distribution station with a 35~500 kV voltage of the electrical power system and more than 10MV • A capacity per transformer, outdoor voltage drop transformer of the industrials with the total oil quantity more than 5t		30	40	25	30
Off-site railway line (center line)		40			
In-plant railway line (center line)		30			
Off-site road way (road side)		20			
Road side of road way	Main	10			
	Secondary	5			

Note: The fire separation distance between Class A factory buildings, when the reserves of the goods in Item 3, 4 are not more than 2t, and the reserves of the goods in Item 1, 2, 5, 6 are not more than 5t, shall not be less than 12m. The fire separation distance between Class A storage and high-rise storage shall not be less than 13m.

3.5.2 Unless otherwise specified in this code, the fire separation distance between Class B, C , D, E storages and their distance to civil buildings shall not be less than what is given in Table 3.5.2.

Table 3.5.2 Fire separation distance between Class B, C , D, E Storages and their distance to civil buildings (m)

Building occupancy		Single, multi-story Class B, C, D, E storage						High-rise storage	Class A factory building
		Single, multi-story Class B, C, E storage			Single, multi-story Class E storage				
Single, multi-story Class B, C, D, E storage	Fire resistance rating	Class I, II	Class III	Class IV	Class I, II	Class III	Class IV	Class I, II	Class I, II
	Class I, II	10	12	14	10	12	14	13	12
	Class III	12	14	16	12	14	16	15	14

Table 3.5.2(continued)

Building occupancy		Single, multi-story Class B, C, D, E storage						High-rise storage	Class A factory building
		Single, multi-story Class B, C, E storage			Single, multi-story Class E storage				
	Class IV	14	16	18	14	16	18	17	16
High-rise storage	Class I, II	13	15	17	13	15	17	13	13
Civil building	Class I, II	10	12	14	6	7	9	13	25
	Class III	12	14	16	7	8	10	15	
	Class IV	14	16	18	9	10	12	17	

Note: 1 The fire separation distance between single, multi-story Class E storages can be decreased by 2m based on the value in this table.

2 When the higher exterior wall of two adjacent storages is a fire wall and the total floor area of the storages is not more than that of one storage stipulated in 3.3.2 of this code, there shall be no limit for the fire separation distance between them.

3 For Class B storage except Item 6, its fire separation distance to civil building should not be less than 25m, should not be less than 30m to important public building, and to railway and road etc. should not be less than what is required in Table 3.5.1 for Class A storage and railway and road etc.

3.5.3 When the fire resistance class of Class D, E storage and public building are both Class I, II, the fire separation distance between them can be as follows:

1 When the higher exterior wall is a fire wall without door or window, or 15m over the lower building roof is fire wall without openings for door or window, there shall be no limit for the fire separation distance of the buildings;

2 The fire separation distance of the two buildings may be decreased and shall not be less than 4m, when the adjacent external wall of the lower building is fire wall, there is no skylight on the roof and the fire resistance rating of the load bearing members of the roof is not less than 1.00h, or the adjacent external wall of the higher building is fire wall, and fire protection measures are taken for the openings of the wall.

3.5.4 The fire separation distance between grain silo and the other buildings, and between grain silo groups shall not be less than what is given in Table 3.5.4.

Table 3.5.4 Fire separation distance between grain silo and the other buildings, and between grain silo groups(m)

Name	Total reserves of the grain W (t)	Grain cylindrical silo			Grain flat silo		Fire resistance class of the building		
		$W \leqslant 40000$	$40000 < W \leqslant 50000$	$W > 50000$	$W \leqslant 50000$	$W > 50000$	Class I, II	Class III	Class IV
Grain cylindrical silo	$500 < W \leqslant 10000$	15	20	25	20	25	10	15	20
Grain cylindrical silo	$10000 < W \leqslant 40000$	15	20	25	20	25	10	15	20
							15	20	25
	$40000 < W \leqslant 50000$	20	20	25	20	25	20	25	30
	$W > 50000$	25					25	30	—
Grain flat silo	$W \leqslant 50000$	20	20	25	20	25	20	25	—
	$W > 50000$	25					25	30	—

Note: 1 When the grain cylinder silo, grain flat silo and working tower, receiving tower and distribution tower are in complete technological group, the fire separation distance between buildings in the same group shall not be limited by this table;

2 The reserves in each individual silo within the grain flat silo group shall not be more than 10000t.

3.5.5 Distance between the enclosing walls of a storage area and the buildings in the same area should not be less than 5m, and at the same time, shall meet the requirements of the fire separation distance between buildings on both sides of the enclosing walls.

3.6 Explosion prevention of factory buildings (storages)

3.6.1 Class A, B factory buildings with explosion hazard should be set up independently, and should be of open or semi-open style. The load-bearing structures should be reinforced concrete or steel framed or bent framed.

3.6.2 Class A, B factory buildings with explosion hazard shall be provided with necessary pressure-relieving devices.

3.6.3 The pressure-relieving area of Class A, B factory buildings with explosion hazard should be calculated according to the following formula. However, when the length-diameter ratio of the factory building is more than 3, the building should be divided into many calculation

sections with the length-diameter ratio less than or equal to 3, and the common cross section of each calculation section shall not be used as pressure-relieving area:

$$A=10CV^{2/3} \tag{3.6.3}$$

Where A——Pressure relieving area (m^2);

V——Volume of the factory building (m^3);

C——Pressure ratio when the volume of the factory building is $1000m^3$, which can be chosen from Table 3.6.3 (m^2/m^3).

Table 3.6.3 Explosion risk grading and pressure-relieving ratio of the factory building (m^2/m^3)

Explosion risk grading of factory building	C value
Ammonia and dust (K_{dust}<10MPa • m • s^{-1}) of grain, paper, leather, lead, chrome, copper, etc.	≥0.030
Dust (10MPa • m • s^{-1}≤K_{dust}≤30MPa • m • s^{-1}) of wood flour, carbon, coal, antimony, stannum, etc.	≥0.055
Acetone, gasoline, methyl alcohol, LPG, methane, paint spraying room or drying room and dust (K_{dust}>30MPa • m • s^{-1}) of phenol resin, aluminum, magnesium, zirconium, etc.	≥0.110
Ethylene	≥0.160
Acetylene	≥0.200
Hydrogen	≥0.250

Note: Length-diameter ratio is the ratio of the product of the longest size of the building plane geometry and the perimeter of its cross section to 4.0 times of the cross section area of the building.

3.6.4 The pressure-relieving devices should be light-weight roof, wall and door or window that is easy to relieve pressures. Ordinary glass shall not be used.

The location of pressure-relieving area shall be away from densely populated area and main line of transportation, and should be as close as possible to the positions where explosion may be liable to take place.

The weight of light-weight roof and wall which serves as a pressure-relieving area should not be over $60kg/m^2$.

Measures shall be taken to prevent the snow or ice from accumulating on the roof pressure-relieving devices .

3.6.5 Where a Class A factory building emits combustible gas and vapor lighter than air, the whole or partial light-weight roof should be used as its pressure-relieving area. The ceiling of the factory shall be as level as possible so that dead corners can be avoided. The ventilation in the top space of the factory building shall be able to prevent gas from accumulating.

3.6.6 Where a Class A factory building emits combustible gas and vapor heavier than air, and a Class B factory building with the danger of dust or fiber explosion, the floor that does not produce sparks shall be used. If insulation material is adopted as the integral surface layer, anti-static measures shall be taken.

The internal surface of a factory building emitting combustible dust or fiber shall be level, smooth and easy to clean.

A ground trench should not be set up below the floor; if it is necessary, its cover shall be sealed and tightly packed. Effective measures shall be taken to prevent the accumulation of combustible gas, vapor and dust as well as fiber in the ground trench. The parts connecting with the adjacent factory building shall be sealed with non-combustible fire stopping material.

3.6.7 The production section of Class A, B materials with explosion hazard should be located near the pressure-relieving facilities of the exterior wall in a single-story factory building or on the top floor of a multi-storied factory building.

The devices with explosion hazard shall be arranged as far as possible from the load-bearing members of the factory building such as beam, column, etc.

3.6.8 The master control room for a Class A, B factory building with explosion hazard shall be set up separately.

3.6.9 The sub-control room for a Class A, B factory building with explosion hazard should be set up separately; when it is adjacent to an exterior wall, it shall be separated from the remaining part with a non-combustible wall with fire resistance rating not less than 3.00h.

3.6.10 The piping, trench of a factory building in which Class A, B and C liquids are used and produced shall not be connected with those of the adjacent factory buildings. Its sewer shall have the grease trap equipment installed.

3.6.11 Facilities capable of preventing liquids from flooding and spreading shall be provided in storage storing Class A, B and C liquids. Water immersion-proofing facilities shall be installed in storage storing goods that can burn and explode when in contact with water.

3.6.12 There shall be a pressure-relieving facility on the top-covering plate of a silo with potential danger of dust-explosion.

The pressure-relieving area of the working tower, up-going porch of a grain silo shall be in accordance with the requirements of 3.6.3 in this code. The other grain storage facilities with dust-explosion hazard shall be explosion-proof.

3.6.13 Class A, B storages with explosion hazard should be provided with explosion-proof and pressure-relieving facilities according to the requirements of this section.

3.7 Safe evacuation in factory buildings

3.7.1 The exits of the factory building shall be arranged separately. The horizontal distance between the nearest edges of the two adjacent exits of each fire compartment and each floor of the same fire compartment shall not be less than 5m.

3.7.2 The number of exits for each fire compartment or each floor of the same fire

compartment shall be determined by calculation, and shall not be less than two. If the following requirements is met, one exit may be provided:

1 For a class A factory building, the floor area of each story is not more than 100m^2, and the number of workers working at the same time is not more than 5;

2 For a class B factory building, the floor area of each story is not more than 150m^2, and the number of workers working at the same time is not more than 10;

3 For a class C factory building, the floor area of each story is not more than 250m^2, and the number of workers working at the same time is not more than 20;

4 For a class D or E factory building, the floor area of each story is not more than 400m^2, and the number of workers working at the same time is not more than 30;

5 For the underground, semi-underground factory buildings or the basement, semi-basement of the factory buildings, the floor area is not more than 50m^2, and the number of workers constantly attended is not more than 15.

3.7.3 For the underground, semi-underground factory buildings or the basement, semi-basement of the factory buildings when there are several fire compartments arranged adjacently, and the compartments are separated by fire wall, the Class A fire door in the fire wall of each fire compartment leading to the neighboring fire compartment may be used as the second exit, but each fire compartment must be set up with at least one exit directly leading to the outside.

3.7.4 The distance from any point in the factory building to the nearest exit shall not exceed the requirements in Table 3.7.4.

Table 3.7.4 The distance from any point in the factory building to the nearest exit(m)

Production class	Fire resistance class	Single-story factory building	Multi-story factory building	High-rise factory building	Underground, semi-underground factory building or Basement, semi-basement of factory building
A	Class I, II	30	25	—	—
B	Class I, II	75	50	30	—
C	Class I, II	80	60	40	30
	Class III	60	40	—	—

Table 3.7.4(continued)

Production class	Fire resistance class	Single-story factory building	Multi-story factory building	High-rise factory building	Underground, semi-underground factory building or Basement, semi-basement of factory building
D	Class I, II	No limit	No limit	50	45
	Class III	60	50	—	—
	Class IV	50	—	—	—
E	Class I, II	No limit	No limit	75	60
	Class III	100	75	—	—
	Class IV	60	—	—	—

3.7.5 The respective total net width for evacuation stairs, passages and doors of a factory building shall be determined based on the occupant number according to the requirements in Table 3.7.5. However, the minimum net width of the evacuation stair should not be less than 1.1m, the minimum net width of the passage should not be less than 1.4m, and the minimum net width of the door should not be less than 0.9m. When the number of persons on each story is not equal, the total width of its stairs shall be computed by floor to floor, and the total width of stairs in the lower story is computed according to the said story or the upper story with the maximum number of persons.

The total net width of the exterior door on the first floor shall be computed according to the number of persons on the said floor or the floor above with the maximum number of persons, and the minimum net width of the door shall not be less than 1.2m.

Table 3.7.5 Width indices for evacuation stairs, passages and doors in factory building (m/ 100 persons)

Number of stories in factory building	1 or 2 stories	3 stories	≥4 stories
Width index	0.6	0.8	1.0

3.7.6 The evacuation stair of high-rise factory building and Class A, B, C multi-story factory building shall be enclosed or outside stairway. A high-rise factory building with a height over 32m and occupants more than 10 on any story shall be provided with smoke-proof or outside stairway.

The design of the outside stairway, enclosed staircase and smoke-proof staircase shall comply with the practical requirements of section 7.4 of this code.

3.7.7 When a high-rise factory building is over 32m high and equipped with elevators, every fire compartment should be provided with a fire lift. The fire lift may be concurrently used for passengers and goods. The fire protection design of the fire lift shall conform to the requirements of 7.4.10 of this code.

The buildings that meet the following conditions may not be equipped with fire lifts:

1 A high-rise tower with a height over 32m is equipped with elevator, and the number of persons on every story of the working platform is not more than 2.

2 The partial building height of a Class D or E factory building exceeds 32m and the floor area of each story of the partially rising part does not exceed $50m^2$.

3.8 Safe evacuation in storages

3.8.1 The exits of the storage shall be arranged separately. The horizontal distance between the nearest edges of the two adjacent exits of each fire compartment and each floor of the same fire compartment shall not be less than 5m.

3.8.2 The number of the exits for every storage shall not be less than 2. Where the floor area of a storage is not more than $300m^2$, one exit may be provided. The number of exits from every fire compartment within the storage to the passageway, staircase or the door to outside should not be less than 2. Where the building area of the fire compartment is not more than $100m^2$, one exit may be provided. The door leading to the passageway or staircase should be Class B fire door.

3.8.3 Underground, semi-underground storage or the basement, semi-basement of the storage shall be provided with at least 2 exits; where the building area is not more than $100m^2$, one exit may be provided.

For the underground, semi-underground storage or the basement and semi-basement of the storage, when there are several fire compartments arranged adjacently, and the compartments are separated by fire wall, the Class A fire door in the fire wall of each fire compartment leading to the neighboring fire compartment may be used as the second exit, but each fire compartment must be set up with at least one exit directly leading to the outside.

3.8.4 Design for safe evacuation of grain silo, cold store, treasury shall comply respectivel y with the practical requirements of current national standards *Code for Design of Cold Store* GB 50072, *Code for Design of Grain Steel Silos* GB 50322 etc.

3.8.5 Where the upper floor area of the grain silo is less than $1000m^2$, and the number of workers on this floor is not more than 2, one exit may be provided.

3.8.6 The outdoor metal stair of a storage or a grain silo may be used for the evacuation purpose, but it shall comply with the requirement of 7.4.5 of this code. However, the fire resistance rating of the external stair platform of the grain silo shall not be less than 0.25h.

3.8.7 Enclosed stairway shall be provided for high-rise storage.

3.8.8 Except the Class E multi-story storage with Class I or II fire resistance class, the elevator for conveying goods vertically should be set up outside the storage. When the elevator has to be provided in the storage, it shall be installed in a shaft with fire resistance rating not less than 2.00h. The door in the hoisting facilities in and outside the storage that leads to the entrance

of the storage shall be Class B fire door or fire roller shutter.

3.8.9 When a high-rise storage is over 32m high and equipped with elevators, every fire compartment should be provided with a fire lift. The fire lift may be concurrently used for passengers and goods. The fire protection design of the fire lift shall conform to the requirements of 7.4.10 of this code.

4 Class A, B, C liquid, gas tank (tank farm) and combustible stackyard

4.1 General requirements

4.1.1 Class A, B, C liquid tank farm, LPG tank farm, combustible and combustion-supporting gas tank farm, combustible material stackyard etc. shall be set up at the outskirt of the city (city area) or relatively safe separated place, and should be set up in the area of the upwind with least frequency of a whole year.

Class A, B, C liquid tank (tank farm) should be arranged at a lower place. Safety protection measures shall be taken when they are arranged at a higher place.

LPG tank (tank farm) should be arranged in a flat and open place where LPG is not easily accumulated.

4.1.2 Barreled and bottled liquids of Class A shall not be arranged in the open air.

4.1.3 Non-combustible solid protection wall with height not less than 1.0m shall be provided around the LPG tank group or tank farm.

4.1.4 Class A, B, C liquid tank farm, LPG tank farm, combustible and combustion-supporting gas tank farm and combustible material stackyard shall be separated from the loading and unloading area, subsidiary production area and office area.

4.1.5 The nearest horizontal distance between Class A, B, C liquid tank, LPG tank, combustible and combustion-supporting gas tank, combustible material stackyard and elevated electrical line shall comply with the requirements of 11.2.1 of this code.

4.2 Fire separation distance for Class A, B, C liquid tank (tank farm)

4.2.1 The fire separation distance between Class A, B ,C liquid tank (tank farm), Class B, C liquid barrels and buildings shall not be less than what is given in Table 4.2.1.

Table 4.2.1 Fire separation distance between Class A, B ,C liquid tank (tank farm), Class B, C liquid barrels and buildings (m)

Item			Fire resistance class of the building			Outdoor transformer, distribution substation
			Class I, II	Class III	Class IV	
Class A, B liquid	Total reserves of one tank farm or stackyard V (m^3)	$1 \le V < 50$	12	15	20	30
		$50 \le V < 200$	15	20	25	35
		$200 \le V < 1000$	20	25	30	40
		$1000 \le V < 5000$	25	30	40	50
Class C liquid		$5 \le V < 250$	12.	15	20	24
		$250 \le V < 1000$	15	20	25	28
		$1000 \le V < 5000$	20	25	30	32
		$5000 \le V < 25000$	25	30	40	40

Note: 1 When Class A, B liquid and Class C liquid are stored in the same tank farm, the total reserves of the tank farm can be calculated by the method of taking $1m^3$ Class A, B liquid as $5m^3$ Class C liquid.

2 Fire separation distance shall be measured from the exterior wall of a tank or the external boundary of a stack that is closest to a building, but the distance from the exterior foot line of a fire protection embankment of a storage tank to a building shall snot be less than 10m.

3 The fire separation distance from Class A, B, C storage tank farm with fixed roof, semi-open air stackyard, and the stackyard for Class B, C barrels to Class A factory buildings (storages) and civil buildings shall be increased by 25% based on the requirements in the table. However, the fire separation distance from Class A, B tank farm with fixed roof, semi-open air stackyard and the stackyard for Class B, C barrels to Class A factory buildings (storages) and civil buildings shall not be less than 25m, the fire separation distance to the site with open flame or spark shall be increased by 25% based on the requirements in the table for Class IV fire resistance class buildings.

4 The fire separation distance from the floating roof tanks or tanks containing a liquid with a flash point over 120℃ to buildings, may be decreased by 25% based on the requirements in this table.

5 Where there are several storage tank farms being arranged in the same storage area, the fire separation distance between the tank farms shall not be less than the bigger value of the tank farm with a corresponding volume to Class IV buildings in the table.

6 When the capacity of a single tank is not more than $50m^3$, and the total capacity is not more than $200m^3$, the fire separation distance between the horizontal tanks for Class A, B, C liquids directly buried underground and buildings may be decreased by 50% based on the requirements in this table.

7 Outdoor transformers, distribution substations are the outdoor transformers, distribution substations with system voltage of 35~500kV and the capacity of each transformer more than 10MV · A. They also include the outdoor voltage drop transformer of the industrials with the total oil quantity more than 5t.

4.2.2 The fire separation distance between Class A, B, C liquid tanks shall not be less than the requirements in Table 4.2.2.

Table 4.2.2 Fire separation distance between Class A, B, C liquid tanks (m)

Classification			Storage type				
			Fixed roof tank			Floating roof tank	Horizontal tank
			Above-ground	Semi-Above ground	Under ground		
Class A, B liquid	Capacity of single tank V (m^3)	$V \leqslant 1000$	0.75D	0.5D	0.4D	0.4D	Not less than 0.8m
		$V>1000$	0.6D				
Class C liquid		Regardless of capacity	0.4D	No limit	No limit	—	

Note: 1 D is the diameter (m) of the bigger tank of two adjacent vertical tanks; in case of a rectangular tank, its diameter is the half of the sum of the longer and shorter sides.

2 The fire separation distance between tanks with different liquids or different types shall adopt the bigger value in the table.

3 The fire separation distance between two rows of horizontal tanks shall not be less than 3m.

4 The fire separation distance between liquid-containing tanks with nitrogen-filling protection may be determined according to the distance of floating roof tanks.

5 If the volume of a single tank is not over 1000 m^3 and the fixed cooling fire fighting measures are taken, the fire separation distance between the Class A, B aboveground fixed-roof liquid tanks shall not be less than 0.6D.

6 Where the under-surface foam spray fire-fighting equipment, the fixed water cooling fire-fighting equipment and the foam fire-fighting equipment for extinguishing liquid fires in the fire-protection embankment are installed at the same time, the distance between storage tanks may be decreased appropriately, but the distance between aboveground tanks should not be less than 0.4D.

7 Where liquids with a flash point over 120℃ are contained in tanks with a volume of more than 1000 m^3, the fire separation distance between the storage tanks shall not be less than 5m; when the volume of the tank is less than 1000m^3, the fire separation distance between the storage tanks shall not be less than 2m.

4.2.3 Where Class A, B and C liquid tanks are arranged in groups, the following requirements shall be complied with:

1 The volume of a single tank and the total volume of the tanks in the group shall

not be more than the value given in Table 4.2.3.

2 The arrangement of the storage tanks in the group shall not be more than two rows. Where the storage tanks containing liquids of Class A and B are vertical tanks, the distances between them shall not be less than 2m; the distance between horizontal storage tanks shall not be less than 0.8m. No restriction applies to the distance between storage tanks containing Class C liquids.

3 The fire separation distance between two groups of storage tanks shall be determined by the type of the storage tanks in the group and the standard single tanks with the same type that are converted according to the total reserves of the tanks within the group and by the requirements of 4.2.2 of this code.

Table 4.2.3 Limitation for Class A, B, C liquid storage tanks arranged in groups

Name of storage tank	Maximum quantity of storage for a single tank (m^3)	Maximum quantity of storage for a group of tanks (m^3)
Liquid of Class A, B	200	1000
Liquid of Class C	500	3000

4.2.4 Tanks with the same or similar fire hazards should be arranged in one fire protected embankment with aboveground, semi-underground storage tanks of Class A, B, C liquid. Storage tanks containing liquid with boiling-spill properties shall not be arranged in the same fire protected embankment with the tanks containing liquid without boiling-spill properties. Aboveground, semi-underground storage tanks shall not be arranged in the same fire protected embankment with the under-ground tanks, and the above-ground tanks and the semi-undergro ground tanks shall be arranged in different fire protected embankments.

4.2.5 Aboveground and semi-underground storage tanks or groups of storage tanks of Class A, B, and C liquid shall be protected around the tanks or groups of tanks by the fire protected embankment made of non-combustible material. The design for the embankment shall be in accordance with the following requirements:

1 The arrangement of the storage tanks in a fire protected embankment shall not be more than two rows; when the storage volume of a single tank is not more than $1000m^3$ and the flash point of the liquid is over 120℃, they should not be more than four rows;

2 The effective volume in a fire protected embankment shall not be less than the volume of the largest tank; for floating roof tanks, the effective volume of the fire protected embankment may be half the volume of the largest tank;

3 The horizontal distance from the interior foot line of a fire protected embankment to the exterior wall of a vertical storage tank shall not be less than a half of the height of the tank. The horizontal distance from a horizontal storage tank to the interior foot line of a fire protected embankment shall not be less than 3m.

4 The design height of the fire protected embankment shall be 0.2m higher than the

calculated height, and its height shall be 1.0~2.2m. Stairs for the convenience of the fire fighters to put out fire shall be provided at the appropriate place of the embankment.

5 For each aboveground or semi-underground storage tank containing liquid with boiling-spill properties, there shall be one fire protected embankment or one fire separation embankment.

6 Water seal devices shall be provided for the oil-containing sewerage pipes at the position passing through the fire protected embankment. Drain pipes for rain water shall be provided with sealing, separation devices such as valves.

4.2.6 Where facilities protecting liquids from flooding away are provided for Class A semi-open air stackyard, Class B, C barrel stackyard and liquid tank (tank farm) with flash point over 120℃, fire protected embankment may not be provided.

4.2.7 The fire separation distances from the storage tanks containing liquids of Class A, B, C to their pump room and loading and unloading pick pipe shall not be less than the requirements in Table 4.2.7.

Table 4.2.7 Fire separation distances from the storage tanks containing liquids of Class A, B, C to their pump room and loading and unloading pick pipe

(m)

Liquid classification and tank type		Pump room	Loading and unloading pick pipe for railway, vehicle
Class A, B liquid tank	Vault roof tank	15	20
	Floating roof tank	12	15
Class C liquid tank		10	12

Note: 1 The fire separation distance for the storage tanks containing liquids of Class A, B and with total reserves not more than 1000m^3, and for Class C storage tanks with total reserves not more than 5000m^3 may be decreased by 25% based on the requirements in this table.

2 The distance from the pump rooms, or loading and unloading pick pipes to the external foot line of the fire protected embankment of storage tanks shall not be less than 5m.

4.2.8 The fire separation distances from the loading and unloading pick pipes for liquids of Class A, B and C to buildings and in-plant railway shall not be less than the requirements in Table 4.2.8.

4.2.9 The fire separation distance between tanks containing Class A, B, C liquids and railway, road shall not be less than the requirements in Table 4.2.9.

4.2.10 The distance between a buffer vessel and its railway operation line shall not be less than 6m.

Table 4.2.8 Fire separation distances from the loading and unloading pick pipes for liquids of Class A, B and C to buildings and in-plant railway (m)

Name	Fire resistance class of building			In-plant railway	Pump room
	Class I, II	Class III	Class IV		
Loading and unloading pick pipe for liquids of Class A, B	14	16	18	20	8
Loading and unloading pick pipe for liquids of Class C	10	12	14	10	

Note: There is no limitation for the fire separation distance between loading and unloading pick pipe and the railway for loading and unloading Class A, B, C liquids directly.

Table 4.2.9 Fire separation distance between tanks containing Class A, B, C liquids and railway, road (m)

Name	Off-site railway line (center line)	In-plant railway line (center line)	Off-site road way (road side)	In-plant road side	
				Main	Secondary
Class A, B liquid storage tank	35	25	20	15	10
Class C liquid storage tank	30	20	15	10	5

4.2.11 The fire separation distance from the storage tank (tank farm) in a petroleum storage depot to a building, the arrangement of the tanks in it and the fire separation distance between them as well as the fire separation distance between the storage tank and a pump room and a loading and unloading pick pipe shall be in accordance with the related requirements of the current national standard *Code for Design of Oil Depot* GB 50074.

4.3 Fire separation distance between combustible and combustion-supporting gas tanks (tank farms)

4.3.1 The fire separation distance between storage tanks containing combustible gases and buildings, tanks, stackyards shall conform to the following requirements:

1 The fire separation distance between wet storage tanks containing combustible gases and buildings, tanks, stackyards shall not be less than what is given in Table 4.3.1;

2 The fire separation distance between dry storage tanks containing combustible gases and buildings, tanks, stackyards: where the density of the combustible gas is higher than the air's, the fire separation distance shall be increased by 25% based on what is given in Table 4.3.1; where the density of the combustible gas is lower than the air's, it can be determined on the basis of what is given in Table 4.3.1;

3 The fire separation distance between the water sealing well, the pump room and the stairwell of the wet or dry combustible gas tank and the tank itself shall be determined by the requirements of technology;

4 The fire separation distance between combustible gas tank with volume not more than $20m^3$ and the factory building that uses the tank is not limited.

5 The fire separation distance between fixed-volume combustible gas tanks and buildings, tanks, stackyards shall not be less than what is given in Table 4.3.1.

Table 4.3.1 Fire separation distance between wet combustible gas tanks and buildings, tanks and stackyards

Name			Total volume of wet combustible gas tank $V(m^3)$			
			$V<1000$	$1000\leqslant V<10000$	$10000\leqslant V<50000$	$50000\leqslant V<100000$
Class A storage Sites with open flame or spark Class A, B, C liquid tank Combustible stackyard Outdoor transformer, distribution substation			20	25	30	35
Civil building			18	20	25	30
The other buildings	Fire resistance class	Class I, II	12	15	20	25
		Class III	15	20	25	30
		Class IV	20	25	30	35

Note: The total volume of the fixed-volume gas tank can be calculated by the product of geometry volume of the tank (m^3) and the design storage pressure (absolute pressure, 10^5Pa).

4.3.2 The fire separation distance between storage tanks (tank farms) containing combustible gases shall conform to the following requirements:

1 The fire separation distance between wet storage tanks, dry storage tanks as well as the wet and dry storage tanks shall not be less than half of the diameter of the bigger tank of two adjacent tanks.

2 The fire separation distance between fixed-volume combustible gas tanks shall not be less than 2/3 of the diameter of the bigger tank of two adjacent tanks.

3 The fire separation distance between fixed-volume combustible gas tank and dry or wet gas tank shall not be less than half of the diameter of the bigger tank of two adjacent tanks.

4 Where the total volume of several fixed-volume gas tanks is more than 200000m^3, they shall be arranged in groups. The fire separation distance between horizontal tank groups shall not be less than half of the length of the bigger tank of two adjacent tanks; the fire separation distance between spherical tank groups shall not be less than the diameter of the bigger adjacent tank and shall not be less than 20m.

4.3.3 The fire separation distance of oxygen-containing tanks to buildings, storage tanks or stackyards shall comply with the following requirements:

1 The fire separation distance between wet type oxygen-containing tanks and buildings, storage tanks or stackyards shall not be less than what is given in Table 4.3.3;

2 The fire separation distance between oxygen-containing tanks shall not be less than half of the diameter of the bigger tank of two adjacent tanks;

3 The fire separation distance between oxygen-containing tanks and combustible gas tanks shall not be less than the diameter of the bigger tank of two adjacent tanks;

4 The fire separation distance between oxygen-containing tanks and the oxygen-producing factory buildings may be determined by the technology arrangement;

5 The fire separation distance between oxygen-containing tank with volume not more than 50m^3 and the factory building that uses the tank is not limited.

6 The fire separation distance between oxygen-containing tanks with fixed-volume and buildings, tanks, stackyards shall not be less than what is given in Table 4.3.3.

Table 4.3.3 Fire separation distance between wet oxygen-containing tanks and buildings, tanks, stackyards (m)

Name			Total volume of wet oxygen-containing tank V(m^3)		
			$V\leqslant1000$	$1000<V\leqslant50000$	$V>50000$
Class A, B, C liquid tank Combustible stackyard Class A storage Outdoor transformer, distribution substation			20	25	30
Civil building			18	20	25
The other buildings	Fire resistance class	Class I, II	10	12	14
		Class III	12	14	16
		Class IV	14	16	18

Note: The total volume of the fixed-volume oxygen-containing tank can be calculated by the product of geometry volume of the tank (m^3) and the design storage pressure (absolute pressure, 10^5Pa).

4.3.4 The fire separation distance of liquid oxygen-containing tanks to buildings, storage tanks or stackyards shall meet the requirements of 4.3.3 of this code for the fire separation distance of the corresponding storage volume of wet oxygen-containing tanks. The distance between liquid oxygen-containing tanks and their pump rooms should not be less than 3m. The fire separation distance between liquid oxygen-containing tanks with total volume not more than $3m^3$ and the buildings that use the tanks shall meet the following requirements:

1 Where the liquid oxygen-containing tanks are provided in a separated Class I or II fire resistance class building that can not be used for other purposes, the fire separation distance shall not be less than 10m;

2 Where the liquid oxygen-containing tanks are provided in a separated Class I, II fire resistance class building that can not be used for other purposes, and the side facing to the building is fire wall without any openings such as door or window, the fire separation distance shall not be limited;

3 Where the fire protection measures have been taken to protect the low-temperature liquid oxygen tanks, the fire separation distance shall not be less than 5m.

Note: $1m^3$ liquid oxygen is converted to $800m^3$ oxygen in normal phase.

4.3.5 There shall be no combustible substances and asphalt road pavement within 5m around liquid oxygen-containing tanks.

4.3.6 The fire separation distance between combustible, combustion-supporting gas tanks and railway, road shall not be less than the requirements of Table 4.3.6.

Table 4.3.6 Fire separation distance between combustible, combustion-supporting gas tanks and railway, road (m)

Name	Off-site railway Line (center line)	In-plant railway line (center line)	Off-site road way (road side)	In-plant road side	
				Main	Secondary
Combustible, combustion-Supporting gas storage tank	25	20	15	10	5

4.3.7 The fire separation distance of the tanks containing liquid hydrogen to buildings, storage tanks, stackyards may be decreased by 25% based on the requirements of 4.4.1 of this code for the fire separation distance of the corresponding storage volume of the LPG tank.

4.4 Fire separation distance for LPG tank (tank farm)

4.4.1 The fire separation distance of the wholly pressurized and semi-cooling tank or tank farm within the storage base to the site with open flames, sparks as well as the building or construction outside the storage base shall not be less than what is required in Table 4.4.1.

Table 4.4.1 The fire separation distance of the wholly pressurized and semi-cooling tank or tank farm within the storage base to the site with open flames, sparks as well as the building or construction outside the storage base

(m)

Total volume V (m^3)	$30<V\leqslant50$	$50<V\leqslant200$	$200<V\leqslant500$	$500<V\leqslant1000$	$1000<V\leqslant2500$	$2500<V\leqslant5000$	$V>5000$
Volume of single tank V (m^3)	$V\leqslant20$	$V\leqslant50$	$V\leqslant100$	$V\leqslant200$	$V\leqslant400$	$V\leqslant1000$	$V>1000$
Important public buildings such as residential area, village and school, theater, stadium (the exterior wall of the outmost building or construction)	45	50	70	90	110	130	150
Enterprise (the exterior wall of the outmost building or construction)	27	30	35	40	50	60	75
Sites with open flames or sparks, outdoor transformer, distribution substation	45	50	55	60	70	80	120
Civil building, Class A, B liquid tank, Class A, B storage (Class A, B factory building), stackyard for rice and wheat straw, reed, waste paper package etc.	40	45	50	55	65	75	100

Table 4.4.1(continued)

Total volume V (m^3)			30<V ≤50	50<V ≤200	200< V≤ 500	500< V≤ 1000	1000< V≤ 2500	2500< V≤ 5000	V>5000
Volume of single tank V (m^3)			V≤ 20	V≤ 50	V≤ 100	V≤ 200	V≤ 400	V≤ 1000	V>1000
Class C liquid tank, combustible gas tank, Class C, D factory building (Class C, D storage)			32	35	40	45	55	65	80
Combustion-supporting gas tank, stackyard of wood etc.			27	30	35	40	50	60	75
The other buildings	Fire resistance class	Class I, II	18	20	22	25	30	40	50
		Class III	22	25	27	30	40	50	60
		Class IV	27	30	35	40	50	60	75
Road (road side)	Expressway, Grade I, II		20	25					30
	Grade III, IV		15	20					25
Elevated electric line (central line)			The requirements of 11.2.1 in this code shall be met.						
Elevated communication line (central line)	Grade I, II		30	40					
	Grade III, IV		1.5 times of the wire pole						
Railway (central line)	National railway		60	70		80		100	
	Enterprise railway		25	30		35		40	

Note: 1 The fire separation distance shall be determined according to the bigger one of the total tank volume or single tank volume given in this table, and shall be measured from the exterior wall, outside line of the stackyard nearest to the building;

2 Where the volume of a single tank of underground LPG tank is not more than $50m^3$, and the total volume is not more than $400m^3$, the fire separation distance can be decreased by 50% based on the requirement of this table;

3 Residential area or village refers to the area with more than 1000 persons or 300 families;

if lower than that, the fire separation distance may meet the requirements for civil buildings.

4 The fire separation distance to the other buildings or constructions that is not regulated in this table shall be determined according to the related requirements of the current national standard *Code for Design of City Gas Engineering* GB 50028.

4.4.2 The fire separation distance between LPG tanks shall not be less than the diameter of the larger tank of the two adjacent tanks.

Where the total volume for several tanks is more than 3000m^3, the tanks shall be arranged in groups, and should be arranged in a single row within the group. The fire separation distance between the adjacent tanks of different groups shall not be less than 20m.

4.4.3 The distance between the LPG tanks and the pump rooms attached to them shall not be less than 15m. When the exterior wall of the pump room facing to the tank is a fire wall without any openings such as door or window, the fire separation distance may be reduced to 6m. When the LPG pump is installed directly in the open air of a tank farm, there shall be no limit for the distance between the pump and the tank.

4.4.4 The fire separation distance between wholly cooling LPG tank and the building or constructions around it shall be determined according to the related requirements of the current national standard *Code for Design of City Gas Engineering* GB 50028.

4.4.5 The fire separation distance between the storage tanks in the LPG gasification station, gas-mixing station and the buildings or constructions around them shall be determined according to the related requirements of the current national standard *Code for Design of City Gas Engineering* GB 50028.

If a LPG gasification station or a gas-mixing station in a industrial enterprise is set up in a separate building, and the total volume of the storage tanks is not more than 10m^3, the fire separation distance between the external walls of the separate building and the neighboring factory buildings or the facilities attached to the buildings may conform to the fire separation distance requirements for Class A factory buildings. When the storage tanks are installed in the open air, the fire separation distance from these tanks to buildings, storage tanks, stackyards shall be determined according to the related requirements of the current national standard *Code for Design of City Gas Engineering* GB 50028..

4.4.6 The fire separation distance between the cylinder storage of Grade I, II LPG cylinder distribution station and the buildings outside of the station shall not be less than what is given in Table 4.4.6.

4.4.7 Non-combustible enclosed solid wall should be provided around the Grade I LPG

cylinder distribution station, however, the wall facing to the entrance can be non-combustible non-solid wall.

Non-combustible enclosed solid wall should be provided around the Grade II LPG cylinder distribution station,or the height of the solid part at the bottom shall not be less than 0.6m.

Table 4.4.6 Fire separation distance between the cylinder storage of Grade I, II LPG cylinder distribution station and the buildings outside of the station (m)

Name	Grade I		Grade II	
Total volume of the cylinders in cylinder storage V (m^3)	$6<V\leqslant10$	$10<V\leqslant20$	$1<V\leqslant3$	$3<V\leqslant6$
Sites with open flames, sparks	30	35	20	25
Important public building	20	25	12	15
Civil building	10	15	6	8
Main road side	10	10	8	8
Secondary road side	5	5	5	5

Note: 1 The total volume of the cylinders in LPG cylinder storage shall be the product of the real number of the cylinders and the geometry volume of a single cylinder.

2 The grading of the cylinder LPG distribution station and the arrangement of the cylinder LPG distribution station with total volume not more than $1m^3$ shall meet the related requirements of *Code for Design of City Gas Engineering* GB 50028..

4.5 Fire separation distance of combustible material stackyard

4.5.1 The fire separation distance between open air, semi-open air combustible stackyard and buildings shall not be less than what is required in Table 4.5.1.

When the total reserves of a wood stackyard are more than $25000m^3$ or the total reserves of a stackyard for a rice straw, wheat straw, reed, waste paper package etc. are more than 20000t, the stackyards should be arranged separately. The fire separation distance between them shall not be less than the distance between the adjacent larger stackyard and Class IV buildings.

The fire separation distance between stackyards with different properties shall not be less than the maximum distance between the stackyard with corresponding reserves required in this table and Class IV buildings.

Table 4.5.1 Fire separation distance between open air, semi-open air combustible stackyard and buildings (m)

Name	Total reserves of one stackyard	Fire resistance class of buildings		
		Class I, II	Class III	Class IV
Grain mat silo W (t)	$10 \leqslant W < 5000$	15	20	25
	$5000 \leqslant W < 20000$	20	25	30
Grain silo made of earth W (t)	$500 \leqslant W < 10000$	10	15	20
	$10000 \leqslant W < 20000$	15	20	25
Wool, hemp, fur, chemical fiber, general merchandise W (t)	$10 \leqslant W < 500$	10	15	20
	$500 \leqslant W < 1000$	15	20	25
	$1000 \leqslant W < 5000$	20	25	30
Rice straw, wheat straw, reed, waste paper package etc. W (t)	$10 \leqslant W < 5000$	15	20	25
	$5000 \leqslant W < 10000$	20	25	30
	$W \geqslant 10000$	25	30	40
Timbering etc. V (m^3)	$50 \leqslant V < 1000$	10	15	20
	$1000 \leqslant V < 10000$	15	20	25
	$V \geqslant 10000$	20	25	30
Coal and coke W (t)	$100 \leqslant W < 5000$	6	8	10
	$W \geqslant 5000$	8	10	12

Note: The fire separation distance between open air, semi-open air rice straw, wheat straw, reed, waste paper package stackyard and Class A factory building (storage) as well as civil building shall be increased by 25% respectively according to what is given in this table based on the fire resistance class of the building, and shall not be less than 25m; its distance to the outdoor transformer, distribution substation shall not be less than 50m; its distance to the sites with open flames or sparks shall be increased by 25% based on the corresponding requirement for Class IV fire resistance class building in this table.

4.5.2 The fire separation distance between open air, semi-open air combustible stackyard and Class A, B, C liquid storage tank shall not be less than the fire separation distance between the stackyard with corresponding reserves in Table 4.2.1 and Table 4.5.1 of this code and Class IV building.

4.5.3 The fire separation distance between open air, semi-open air combustible stackyard and railway, road shall not be less than what is required in Table 4.5.3.

Table 4.5.3 Fire separation distance between open air, semi-open air combustible stackyard and railway, road (m)

Name	Off-site railway line (center line)	In-plant railway line (center line)	Off-site road way (road side)	In-plant road side	
				main	secondary
Rice straw, wheat straw, reed, waste paper package stackyard	30	20	15	10	5

Note: The fire separation distance between the combustible stackyard not listed in this table and the railway,road can be determined according to the fire hazard compared to the material listed in thetable.

NOTICE

This is the English translation of Code of Design on Building Fire Protection and Prevention. In case of any inconsistency between the Chinese version and the English version, the Chinese one shall prevail.

Bulletin of the Ministry of Construction of the People's Republic of China

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The Bulletin of Issuing National Standard

Code of Design on Building Fire Protection and Prevention

Code of Design on Building Fire Protection and Prevention has been approved as a national standard with a serial number of GB 50016-2006, and it shall come into force upon December 1, 2006. The following articles are compulsory rules and must be enforced strictly: 3.1.2, 3.2.1, 3.2.2, 3.2.7, 3.2.8, 3.3.1, 3.3.2, 3.3.7, 3.3.8, 3.3.10, 3.3.11, 3.3.13, 3.3.14, 3.3.15, 3.3.16, 3.3.18, 3.4.1, 3.4.2, 3.4.3, 3.4.4, 3.4.9, 3.4.11, 3.5.1, 3.5.2, 3.6.2, 3.6.6, 3.6.8, 3.6.10, 3.6.11, 3.7.1, 3.7.2, 3.7.3, 3.7.4, 3.7.5, 3.7.6, 3.8.1, 3.8.2, 3.8.3, 3.8.7, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.2.2, 4.2.3, 4.2.5, 4.3.1, 4.3.2, 4.3.3, 4.3.5, 4.3.6, 4.4.1, 4.4.2, 4.4.3, 4.4.4, 4.4.5, 4.4.6, 5.1.1, 5.1.2, 5.1.3, 5.1.6, 5.1.7, 5.1.8, 5.1.9, 5.1.10, 5.1.11, 5.1.12, 5.1.13, 5.1.15, 5.2.1, 5.3.1, 5.3.2, 5.3.3, 5.3.4, 5.3.5, 5.3.6, 5.3.8, 5.3.9, 5.3.11, 5.3.12, 5.3.13, 5.3.14, 5.3.16, 5.3.17, 5.4.2, 5.4.3, 5.4.4, 5.4.5, 5.4.6, 6.0.1, 6.0.4, 6.0.6, 6.0.7（3, 4）, 6.0.8, 6.0.9, 6.0.10, 7.1.1, 7.1.2, 7.1.3, 7.1.5, 7.1.6, 7.2.1, 7.2.2, 7.2.3, 7.2.4, 7.2.5, 7.2.7, 7.2.9, 7.2.10, 7.2.11, 7.3.5, 7.4.1（1, 4, 5, 6）, 7.4.2（1, 2, 3, 4）, 7.4.3, 7.4.4, 7.4.10, 7.4.12, 7.5.2, 7.5.3, 7.6.2, 8.1.2, 8.1.3, 8.2.1, 8.2.2, 8.2.3, 8.2.4, 8.2.5, 8.2.6, 8.3.1, 8.4.1, 8.5.1, 8.5.3, 8.5.4, 8.5.5, 8.5.6, 8.6.1, 8.6.2, 8.6.3, 8.6.4, 8.6.5, 8.6.9, 9.1.2, 9.1.3, 9.1.5, 9.2.2（1, 2, 3）, 9.3.1, 9.3.3, 9.4.1, 9.4.3（3）, 9.4.5, 10.1.2, 10.1.3, 10.1.4, 10.2.2, 10.2.3, 10.3.2, 10.3.5, 10.3.6（1）, 10.3.8, 10.3.9, 10.3.10, 10.3.12, 10.3.17, 11.1.1（1, 2）, 11.1.3, 11.1.4, 11.1.6(1), 11.2.1, 11.2.4, 11.3.1, 11.3.2, 11.3.4, 11.3.5, 11.4.1, 11.4.2, 11.4.4. *Code of Design on Building Fire Protection and Prevention* GBJ 16-87 shall be abolished simultaneously.

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Ministry of Construction of the People's Republic of China
July 12, 2006

Preface

According to the requirements of Document Jian Biao [1998] No.94 issued by the Ministry of Construction(MOC) "The Notice of Printing and Distributing for the Preparation and Revision Plan of National Engineering Construction Standards (the First Batch) in 1998", the code was revised by Tianjin Fire Research Institute of the Ministry of Public Security (MPS), together with Tianjin Architectural Design Institute, Beijing Institute of Architectural Design, Institute of Architectural Design of Tsinghua University, China IPPR Engineering Corporation, Shanghai General Fire Brigade, Sichuan General Fire Brigade, Liaoning General Fire Brigade, Sichuan Fire Research Institute of the Ministry of Public Security, Institute of Architectural Design of Ministry of Construction, North China Municipal Engineering Design & Research Institute, North East Electric Power Design Institute, Beijing Design Institute of China Light Industry, China Huanqiu Chemical Engineering Corporation and Shanghai Tunnel Engineering & Rail Transit Design and Research Institute.

According to the fundamental policy of the government in capital construction and the working policy of fire protection- "prevention first and combining prevention with fire fighting", the code was revised on the basis of the national research achievements of building fire protection, fire science and technology as well as the experiences and lessons from actual building design practices and building fires. The code has been reviewed and finalized by some related departments and units based on the comments from some research and design institutes, manufacturers, fire supervision departments as well as some universities, and by refering to some related codes and standards from other countries.

The code includes 12 chapters with the main contents as the following: general principles; terminology; factory buildings (storages); Class A, B, C liquid, gas tank (tank farm) and combustible stackyard; civil buildings; fire fighting vehicle access; building structure; fire water supply and fire extinguishing facility; smoke control and smoke exhaust; heating, ventilating and air conditioning; electric system and city traffic tunnel etc.

The provisions printed in bold type are compulsory rules and must be enforced strictly.

The Ministry of Construction is in charge of the management of the code and the explanation of the compulsory provisions. The Ministry of Public Security is in charge of the daily management of the code. Tianjin Fire Research Institute of MPS is responsible for the technical explanation of the code.

Considering the comprehensiveness of the code, which is both directive and practical, and the involvement of numerous fields, it is expected that in the course of implementation of the code, the related units may carefully summarize the experiences in connection with the engineering practices and scientific research, pay attention to accumulation of related information. If somewhere needs to be modified and supplemented in the code, please send your

opinions and materials concerned directly to the Tianjin Fire Research Institute of MPS for further revision of the code.

The address of Tianjin Fire Research Institute is: 110 Weijin South Road, Nankai District, Tianjin, China;Postcode: 300381.

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5 Civil buildings

5.1 Fire resistance class, number of stories, and building area of civil buildings

5.1.1 Fire resistance class of civil buildings shall be divided into Class I, II, III, and IV. The combustion performance and fire resistance rating of a structural member shall not be less than what is required in Table 5.1.1 unless otherwise specified in this code.

Table 5.1.1 Combustion performance and fire resistance rating of civil building structural members (h)

Structural member		Fire resistance class			
		Class Ⅰ	Class Ⅱ	Class Ⅲ	Class Ⅳ
Wall	Fire wall	Non-combustible 3.00	Non-combustible 3.00	Non-combustible 3.00	Non-combustible 3.00
	Load-bearing wall	Non-combustible 3.00	Non-combustible 2.50	Non-combustible 2.00	Difficult-combustible 0.50
	Nonload-bearing wall	Non-combustible 1.00	Non-combustible 1.00	Non-combustible 0.50	Combustible
	Sidewall of stairway, elevator shaft, wall between units, family separation wall	Non-combustible 2.00	Non-combustible 2.00	Non-combustible 1.50	Difficult-combustible 0.50
	Sidewall of exit passageway	Non-combustible 1.00	Non-combustible 1.00	Non-combustible 0.50	Difficult-combustible 0.25
	Room partition wall	Non-combustible 0.75	Non-combustible 0.50	Difficult-combustible 0.50	Difficult-combustible 0.25
Column		Non-combustible 3.00	Non-combustible 2.50	Non-combustible 2.00	Difficult-combustible 0.50
Beam		Non-combustible 2.00	Non-combustible 1.50	Non-combustible 1.00	Difficult-combustible 0.50
Floor slab		Non-combustible 1.50	Non-combustible 1.00	Non-combustible 0.50	Combustible
Roof load-bearing member		Non-combustible 1.50	Non-combustible 1.00	Combustible	Combustible

Table 5.1.1(continued)

Structural member	Fire resistance class			
	Class I	Class II	Class III	Class IV
Evacuation stair	Non-combustible 1.50	Non-combustible 1.00	Non-combustible 0.50	Combustible
Ceiling (including ceiling joist)	Non-combustible 0.25	Difficult-combustible 0.25	Difficult-combustible 0.15	Combustible

Note: 1 The fire resistance class shall be considered as Class IV for a building with timber load-bearing column and wall of non-combustible material unless otherwise specified in this code.

2 If the ceiling in Class II building is constructed with non-combustible material, its fire resistance rating shall not be limited.

3 In Class II buildings, if a room's building area is not more than 100m^2 and it is difficult to meet the requirements of room partition wall specified in this table, the partition wall can be non-combustible with fire resistance rating not less than 0.30h.

4 Sidewalls of exit passageway in Class I and II civil buildings can be non-combustible with fire resistance rating not less than 0.75h, if it is difficult to implement the requirements in this table.

5 The fire resistance rating and combustion performance of structural members of residential buildings may be designed according to the requirements of current national standard *Residential Building Code* GB 50368.

5.1.2 In Class II buildings, the fire resistance rating of the partition wall shall be increased by 0.25h if it is constructed with difficult-combustible material.

5.1.3 The fire resistance rating for roof slab of an accessible flat roof in Class I and II buildings shall not be less than 1.50h and 1.00h respectively.

5.1.4 The roof slab of Class I and II buildings shall be constructed with non-combustible materials. The waterproof and thermal insulation layers of the roof can be constructed with combustible materials.

5.1.5 If the floor slab of Class II residential building is prestressed reinforced concrete, its fire resistance rating shall not be less than 0.75h.

5.1.6 Ceilings of difficult-combustible materials with fire resistance rating not less than 0.25h or ceilings of non-combustible materials shall be installed in the following Class III buildings or portions:

1 Hospital, sanitarium, elementary or middle school, building for aged people and the children's activity room like children's studying room and playroom in the nursery and kindergarten;

2 Halls and corridors in buildings with three or more than three stories.

5.1.7 The fire resistance class, maximum permitted number of stories, and maximum

permitted area of fire compartment in civil buildings shall conform to the requirements in Table 5.1.7.

5.1.8 The fire resistance class of basement and semi-basement shall be Class I. The fire resistance class of important public building shall not be lower than Class II.

5.1.9 If there are escalators, open stairs etc. which connect the upper and lower floors in a multi-story building, the connected floors shall be considered as an integral fire compartment. If the total building area is larger than the fire compartment area required in 5.1.7, it shall be divided to meet the requirements.

Table 5.1.7 Fire resistance class, maximum permitted number of stories, and maximum permitted area of fire compartment in civil buildings

Fire resistance class	Maximum permitted number of stories	Maximum permitted area of fire compartment (m^2)	Remarks
Class I Class II	See 1.0.2	2500	1. The maximum permitted area of the fire compartment of the gymnasium and auditorium of the theater and exhibit hall may be enlarged. 2. Children's activity room like children's studying room and playroom in the nursery and kindergarten shall not be more than three stories. And portions for the above occupancy shall not be on the fourth or above floors, or in the basement or semi-basement of a building.
Class III	5	1200	1. Children's activity room like children's studying room and playroom in the nursery and kindergarten, building for the aged, buildings for inpatients in hospitals and sanitariums, shall not be more than two stories, or on third or above floors, or in the basement or semi-basement of a building. 2. Shop, school, movie theater, showplace, auditorium, dinning hall, food market etc. shall not be more than two stories, or on the third or above floor of a building.

Table 5.1.7(continued)

Fire resistance class	Maximum permitted number of stories	Maximum permitted area of fire compartment (m^2)	Remarks
Class IV	2	600	School, dinning hall, food market, nursery center, kindergarten, building for the aged, hospital etc. shall not be on the second floor.
Basement and semi-basement		500	—

Note: If the automatic fire-extinguishing system is installed in a building, the maximum permitted area for a fire compartment may be enlarged to 2 times of the area specified in this table. If the automatic fire-extinguishing system is installed only in a part of the building, the area with the system may be expanded to 2 times.

5.1.10 If there is an atrium in a building, all the floors connected shall be considered as an integral fire compartment. If the fire compartment is larger than what is required in 5.1.7, all of the following requirements shall be met:

1 Self-closed Class A fire doors or windows shall be set up in the opening connecting rooms with atrium.

2 Class A fire doors and fire roller shutters shall be set up in openings connecting with hall and passage leading to the atrium. The doors and shutters shall be self-closed in case of fire. The fire roller shutters shall meet the requirements of 7.5.3.

3 The smoke exhausting facilities shall be installed in the atrium according to the related requirements of Chapter 9.

5.1.11 Fire compartments shall be separated by fire walls. Fire shutters may be installed if it is difficult to use fire walls. The use of fire roller shutters shall meet the requirements of 7.5.3.

5.1.12 The fire compartments for above-ground business area and exhibiting hall shall not be larger than 10000m^2 as long as the following requirements are met:

1 The fire compartments are in a single-story building or the first floor of a multi-story building with Class I or Class II fire resistance class;

2 The automatic fire extinguishing sprinkler system, smoke exhausting facilities and automatic fire alarm system shall be provided according to the requirements of Chapter 8, Chapter 9 and Chapter 11 in this code;

3 The interior finish shall meet the requirements of current national standard *Code for Fire Prevention in Design of Interior Decoration of Buildings* GB 50222.

5.1.13 The underground shops shall meet the following requirements:

1 The business area shall not be located in the third or lower underground floors;

2 The shop shall not sell or store merchandise with fire hazard characteristics of Class A or Class B;

3 The fire compartment of business area may be up to 2000m^2, in condition that automatic fire extinguishing system and automatic fire alarm system are installed and the interior finish meets the requirements of current national standard *Code for Fire Prevention in Design of Interior Decoration of Buildings* GB 50222.

4 Smoke exhausting and proof facilities shall be installed.

5 If the total building area of the underground shops is more than 20000m^2, the shops shall be separated from each other by fire wall without openings such as doors, windows, etc. If the shops do need connection part, one of the following fire separation measures shall be taken:

1) Open space such as a subsided square exposing to the outside. The place shall be able to prevent fire from spreading to adjacent areas and meet the requirements of safe evacuation.

2) Fire separation room. Its partition wall shall be solid fire wall. The door leading to the adjacent area shall be self-closed Class A fire door opening all the time.

3) Refuge passageway. It shall meet the requirements of current national standard *Code for Fire Protection Design of Civil Air Defense Works* GB 50098; the sidewalls of the passageway shall be solid fire walls, and self-closed Class A fire door opening all the time shall be installed in the openings of the wall.

4) Smoke proof staircase. The door of the staircase and lobby shall be self-closed Class A fire door opening all the time.

5.1.14 Places such as singing and dancing hall, video room, night club, movie hall, karaoke hall (including restaurant providing karaoke), recreation hall (including computer game hall), sauna room (except the bath portion), commercial internet service room etc. should be set up along the exterior wall of the first, second or third floor of Class I and II buildings. They should not be located on the two sides of pocket-shaped corridor or at its extreme end.

5.1.15 If Places such as singing and dancing hall, video room, night club, movie hall, karaoke hall (including restaurant providing karaoke), recreation hall (including computer game hall), sauna room (except the bath portion), commercial internet service room etc. have to be located at the two sides of pocket-shaped corridor or at its extreme end, the distance between the farthest room's evacuation door and the nearest exit shall not be more than 9m. If they have to be located on the floors other than the first, second and third floor of the building, the following requirements shall be met:

1 They shall not be located on the underground second and lower floors. If they are located on the first underground floor, the distance between the floor of the room and the outside ground shall not be more than 10m;

2 Room's building area shall not be more than 200m^2. The room shall be separated from other portion by non-combustible partition wall and floor with fire resistance rating not less than 2.00h and 1.00h respectively. The evacuation door of the room shall be a Class B fire door;

3 The smoke proof and exhausting facilities shall be installed according to the requirements of Chapter 9.

5.2 Fire separation distance of civil buildings

5.2.1 The fire separation distance between civil buildings shall not be less than the requirements in Table 5.2.1. The fire separation distance between civil buildings and other buildings shall meet the requirements of Chapter 3 and Chapter 4 in this code.

Table 5.2.1 Fire separation distance between civil buildings (m)

Fire resistance class	Class I, II	Class III	Class IV
Class I, II	6	7	9
Class III	7	8	10
Class IV	9	10	12

Note: 1 If the higher adjacent exterior wall of two buildings is fire wall or the exterior wall that is 15m high over a Class I or II building' s roof is fire wall, and without openings for doors or windows, there is no restriction for the fire separation distance between the buildings;

2 For two adjacent buildings, if the fire-resistance class of the lower building is not less than Class II, there is no skylight on the roof, the fire-resistance rating of the load-bearing elements for the roof and the roof panel is not less than 1.00h, and the lower wall of the adjacent external walls is fire wall, their fire-separation distance shall not be less than 3.5m;

3 For two adjacent buildings, if the fire-resistance class of the lower building is not less than Class II, and when Class A fire doors and windows or fire water curtains that meet the requirements of current national standard *Code of Design for Sprinkler Systems* GB 50084 or fire roller shutters that meet the requirements of 7.5.3 in this code are installed in the openings in the higher wall of the adjacent external walls, their fire separation distance shall not be less than 3.5m.

4 For two adjacent buildings, if their two adjacent external walls are non-combustible, and there are no combustible eaves sticking out, and when the total area of the doors and windows on each external wall is not more than 5% of its total area respectively, and the doors and windows without fire protection measures are not opened opposite to each other, the fire separation distance between the two buildings may be reduced by 25% on the basis of this table.

5 For existing buildings with a fire resistance class lower than Class IV, the fire separation distance may be determined according to requirements for Class IV buildings. The fire

resistance class shall be Class IV for a building with timber load-bearing column and wall of non-combustible material.

6 Fire separation distance shall be calculated according to the shortest distance between the exterior walls of two adjacent buildings. If there are projecting combustible members on the exterior walls, the fire separation distance shall be calculated from the external fringe of the projecting portion.

5.2.2 The fire separation distance between civil buildings and their independently built facilities, such as the terminal transformer room and the coal-burning boiler room (the evaporation capacity of a boiler is not more than 4t/h or the rated power of a boiler is not more than 2.8MW), may be determined according to the requirements of 5.2.1 in this code.

For the other independently built transformers, oil-burning or gas-burning boiler rooms, and coal-burning boiler rooms with an evaporation capacity or rating power greater than the capacity or rated power given above, the fire separation distance shall conform to the requirements of outdoor transformer and distribution rooms and Class D plants in 3.4.1 of this code. The fire separation distance between building and box transformer with voltage lower than 10kV shall not be less than 3m.

5.2.3 For several Class I or II residential buildings or office buildings, when their total floor area is not more than 2500m^2, they may be arranged in groups. But the fire separation distance between the buildings in a group should not be less than 4m. The fire separation distance between groups or a group and the adjacent buildings shall not be less than the requirements of 5.2.1 in this code.

5.3 Safe evacuation in civil buildings

5.3.1 The exits of civil buildings shall be arranged separately. The horizontal distance between the nearest sides of two adjacent exits in each fire compartment or each floor of the same fire compartment shall not be less than 5m.

5.3.2 The exits of public buildings in each fire compartment or each floor of the same fire compartment shall be designed according to calculation, and shall not be less than two. One safety exit or evacuation stair is permitted if one of the following requirements is met:

1 A single-story public building (except nursery and kindergarten) with building area not more than 200m^2 and the occupants not more than 50.

2 Public buildings with two or three stories (except hospital, sanitarium, building for the aged, children's activity room like children's studying room and playroom in the nursery and kindergarten etc.) that meet the requirements of Table 5.3.2.

Table 5.3.2 Conditions for providing one evacuation stair for public buildings

Fire resistance class	Maximum permitted stories	Maximum permitted building area of each floor (m^2)	Occupants
Class I, II	3	500	The total occupants of the second and third floor are not more than 100.
Class III	3	200	The total occupants of the second and third floor are not more than 50.
Class IV	2	200	The occupants of the second floor are not more than 30.

5.3.3 Building for the aged, children's activity room like children's studying room and playroom in the nursery and kindergarten should be set up in independent buildings. If it has to be set up in other civil buildings, it should be designed with an independent exit and shall meet the requirements of 5.1.7 in this code.

5.3.4 For a public building with fire-resistance class of Class I or II, when no less than two evacuation staircases are set up, a partial rising structure on the top story of the building is not higher than two stories, the area of each floor is not more than 200m^2 and the total occupants are not more than 50, one evacuation stairway may be set up in the rising part and the stairs shall be directly connected to the lower stair of the main building. At the same time, at least one exit leading to the accessible flat roof of the building shall be set up. The accessible flat roof shall meet the requirements of safe evacuation.

5.3.5 The evacuation stairs in the following public buildings shall be enclosed staircases (including enlarged enclosed staircases on the first floor) or outdoor evacuation stairs.

1 The buildings for inpatients in a hospital or sanitarium;

2 Hotel;

3 Public assembly buildings with more than two stories such as shop etc.;

4 Buildings with parts for singing, dancing, amusement and entertainment etc. and more than two stories;

5 Other public buildings with more than five stories.

5.3.6 Escalators and lifts shall not be used as safe evacuation facilities.

5.3.7 The passenger lift and goods lift in public buildings should have independent shaft and should not be directly set up in the business area, exhibit hall, multi-functional hall etc.

5.3.8 The number of evacuation doors for rooms of the public building and the habitation building not for residential use with shared corridor shall be designed according to calculation and not be less than two. The distance between the nearest sides of two adjacent doors in a room shall not be less than 5m. If one of the following

requirements is met, one evacuation door is permitted:

1 The building area of a room is not more than 120m^2, the door's net width is not less than 0.9m and the room is between two exits;

2 A room (not of child-care center and kindergarten, buildings for the aged) is located at the extreme end of a corridor, the straight distance from the farthest point in the room to its evacuation door is not more than 15m, and the net width of the door is not less than 1.4m;

3 Places used for singing, dancing, amusement and entertainment etc. with building area not more than 50m^2.

5.3.9 The number of evacuation doors in the auditorium of a theater, cinema and assembly hall shall be designed according to calculation and not be less than two. The average evacuation capacity of each door shall not be more than 250 persons. If the number of the total audience is more than 2000, the average evacuation capacity of each door for the extra part over 2000 shall not be more than 400 persons.

5.3.10 The number of evacuation doors in the auditorium of a stadium shall be designed according to calculation and not be less than two. The average evacuation capacity for each door should not be more than 400 to 700 persons.

5.3.11 The exits of any floor of the residential building unit shall not be less than two if the building area of one floor of the building is more than 650m^2 or the distance between the outer door of one resident and the exit is more than 15m. There shall not be less than two exits if the habitation building not for residential use with shared corridor does not meet the requirements of Table 5.3.11. The design of staircase for residential building shall meet the following requirements:

1 Closed staircase shall be designed if there are more than two stories in habitation building with shared corridor. Closed staircase may not be used if the entrance door of each unit is Class B fire door;

2 Closed staircase shall be designed if there are more than six stories or each floor area is more than 500m^2 in other residential buildings. Closed staircase may not be used if the door of each unit or the door and window opening to the corridor or staircase is Class B fire door or window.

The staircase of residential building should be designed with an exit leading to the roof. The door of the exit or the window opening to the roof shall be opened to the outside direction.

If there is a staircase adjacent to the lift shaft in the residential building, the staircase shall be enclosed staircase unless the door of the unit is Class B fire door. If there is an entrance in the lift shaft directly leading to the garage under the residential building, a waiting room shall be constructed and fire separation measures shall be taken.

Table 5.3.11 Conditions for setting up one evacuation staircase for habitation building not for residential use with shared corridor

Fire resistance class	Maximum permitted stories	Maximum permitted building area of each floor (m^2)	Occupants
Class I, II	3	500	The total occupants of the second and third floor are not more than 100.
Class III	3	200	The total occupants of the second and third floor are not more than 50.
Class IV	2	200	The occupants of the second floor are not more than 30.

5.3.12 The exits and evacuation doors of rooms in basement and semi-basement shall meet the following requirements:

1 The exit number of each fire compartment shall be designed according to calculation and not less than two. If two or more fire compartments are on the same floor, each fire compartment may use a fire door in the fire wall which leads to the adjacent fire compartment as a second exit, but each fire compartment must be designed with at least one exit leading directly to the outside;

2 If a basement or semi-basement's occupants are no more than 30 and its building area is not more than $500m^2$, its vertical stairs made of metal leading directly to the outside may be used as the second exit;

3 If a room's building area is not more than $50m^2$ and its occupants are not more than 15, one evacuation door may be provided;

4 The exits of places for singing, dancing, amusement and entertainment etc. shall not be less than two, and the evacuation doors of each room and hall in such buildings shall not be less than two. If the room building area is not more than $50m^2$ and the occupants are not more than 15, one evacuation door may be provided;

5 For shops and places for singing, dancing, amusement and entertainment etc. , smoke proof staircase shall be designed if there are three or more underground floors or the distance between the lowest floor of the room and the entrance ground is more than 10m; the other underground shops and underground buildings with places for singing, dancing, amusement and entertainment etc. shall be provided with enclosed staircase;

6 The evacuation staircase of basement and semi-basement shall meet the requirements of 7.4.4 in this code.

5.3.13 The safe evacuation distance for civil buildings shall conform to the following requirements:

1 The distance from a room's evacuation door that leads directly to the evacuation corridor to the nearest exit shall conform to the requirements in Table 5.3.13;

2 The distance from a room's evacuation door that leads directly to the evacuation corridor to the nearest non-enclosed staircase shall be decreased by 5m according to Table 5.3.13 if the room is located between two staircases. It shall be decreased by 2m according to Table 5.3.13 if the room is located on the two sides of a pocket-shaped corridor or at its extreme end;

3 An exit directly leading to the outside shall be set up on the first floor of the staircase or an enlarged enclosed staircase on the first floor shall be provided. If the number of stories is not more than four, the exit leading to the outside should be provided at a place within 15m from the staircase;

4 The distance of any point in a room to its evacuation door that leads directly to the evacuation corridor shall not be more than the maximum distance from the evacuation door located on the two sides of a pocket-shaped corridor or at its extreme end to the exit according to Table 5.3.13;

Table 5.3.13 The maximum distance from a room evacuation door that leads directly to the evacuation corridor to the nearest exit (m)

Building	The evacuation door between two exits			The evacuation door located on the two sides of a pocket-shaped corridor or at its extreme end		
	Fire resistance class			Fire resistance class		
	Class I, II	Class III	Class IV	Class I, II	Class III	Class IV
Nursery, kindergarten	25	20	—	20	15	—
Hospital, sanitarium	35	30	—	20	15	—
School	35	30	—	22	20	—
The other civil buildings	40	35	25	22	20	15

Note: 1 The direct linear distance from any point in auditorium, exhibition hall, multi-functional hall, dinning room, business area, reading room etc. of Class I or II building to the nearest exit should not be more than 30m.

2 For buildings with open external corridors, the maximum distance from the room door to the exit may be increased by 5m based on the requirements in this table;

3 The safe evacuation distance for buildings with automatic sprinkler system throughout may be increased by 25% based on the requirements in this table and Note 1.

4 The distance calculation methods of any point in a room to the evacuation door: In a residential building, it shall be from any point in the farthest room to the entrance door of

the unit; in an apartment with two stories as one unit, the distance of an inner stair should be calculated by the total length of its horizontal projection.

5.3.14 The respective total width of evacuation corridor, exit, staircase or evacuation door of a room in a building shall be determined by calculating unless there are other requirements in this code.

The net width of exit and evacuation door shall not be less than 0.9m. The net width of evacuation corridor and evacuation staircase shall not be less than 1.1m. If an apartment building of not more than six stories is set up with an evacuation stair with railing on its one side, its minimum net width should not be less than 1 m.

5.3.15 Evacuation doors of public assembly buildings and auditorium shall not be set up with thresholds, and the net width of the thresholds shall not be less than 1.4m and no steps shall be set up within 1.4m of the doorway.

The evacuation doors of theater, cinema and auditorium shall comply with the requirements of 7.4.12 in this code.

The net width of the outdoor evacuation lane of the public assembly buildings shall not be less than 3m and the lane shall lead directly to open space.

5.3.16 For the public assembly buildings, such as theater, cinema, auditorium, and stadium etc., the respective total width of the evacuation corridors, evacuation staircases, evacuation doors and exits shall be designed according to the number of the occupants and the index of net evacuation width, and the following requirements shall be met:

1 The net width of the evacuation corridor in the auditorium shall be calculated on the basis of no less than 0.6m per 100 occupants and the minimum net width shall not be less than 1m; the side aisle should not be less than 0.8m;

On the arrangement of the evacuation aisle, the row number of the seats between the cross aisle should not be more than 20. The number of the seats between the longitudinal aisle should not be more than 22 for each row in theater, cinema, and auditorium and should not be more than 26 in gymnasium. If the distance between the two adjacent rows of seats is not less than 0.9m, the number of seats for each row may be doubled but shall not be more than 50. If there is only one side aisle, the number of seats in the row shall be decreased to one half.

2 For buildings such as theater, cinema, auditorium etc., the respective total width for the inner and outer evacuation doors, the stairs, and the corridors shall be calculated according to the requirements in Table 5.3.16-1;

3 The respective width for the inner and outer evacuation doors, the stairs and the corridors of the gymnasium auditorium shall be designed according to the requirements in Table 5.3.16-2;

4 The entrance door used for waiting purpose shall not be used as the evacuation door of the auditorium.

Table 5.3.16-1 The minimum net evacuation width per 100 occupants of buildings such as theater, cinema, auditorium etc. (m)

Seat number of the auditorium			≤2500	≤1200
Fire resistance class			Class I or II	Class III
Evacuation portion	Door and corridor	Plain, ramp step	0.65	0.85
			0.75	1.00
	Stairs		0.75	1.00

Table 5.3.16-2 The minimum net evacuation width per 100 occupants of gymnasium(m)

Seat number of the auditorium			3000～5000	5001～10000	10001～20000
Evacuation portion	Door and corridor	Plain, ramp	0.43	0.37	0.32
		Step	0.50	0.43	0.37
	Stairs		0.50	0.43	0.37

Note: The total evacuation width of the higher class of seats calculated on the basis of the specified parameters shall not be less than the total evacuation width of the adjacent lower class of seats calculated according to the maximum seats in the table.

5.3.17 The total respective width for evacuation corridor, exit, evacuation staircase and room's evacuation door of the civil buildings, such as schools, shops, office buildings, and waiting rooms for bus, ship or airplane, exhibit hall, places for singing, dancing, amusement and entertainment etc. shall be calculated according to the following requirements:

1 The net width of per 100 occupants of the evacuation corridors, exits, stairs and evacuation doors of a room on each floor shall be not less than the requirements of Table 5.3.17-1. If the occupant number on each floor is not the same, the total width of the stairs on each floor may be calculated separately. For the aboveground buildings, the total width of the stairs of the lower floor shall be calculated based on the number of the occupants of the most populous upper floor. And for the underground buildings, the total width of the stairs of the upper floor shall be calculated based on the number of the occupants of the most populous lower floor.

2 The total respective width for evacuation corridor, exit, evacuation staircase and room's evacuation door of the public assembly hall or room and places for singing, dancing, amusement and entertainment etc. which are in the basement or semi-basement shall be calculated based on 1m or more per 100 occupants.

3 The total width of the external doors on the first floor shall be calculated depending on the occupants on the floor or the most populous floor above. If the external doors are not used for evacuation purpose for the upper floors, the width may be

determined by the occupants of the floor.

4 The number of evacuation occupants of video room and cinema shall be calculated based on 1 occupant per square meter according to its building area. And the number of evacuation occupants of other places for singing, dancing, amusement and entertainment etc. shall be calculated based on 0.5 occupant per square meter according to its building area.

5 The number of evacuation occupants in shops shall be calculated by the building area of business area of each floor multiplying area convert value and conversion factor of the number of evacuation occupants. The area convert value for aboveground shops should be 50%~70 %, and for underground shops, it shall not be less than 70%. The conversion factor of the number of evacuation occupants can be determined according to the requirements in Table 5.3.17-2.

Table 5.3.17-1 The net width of per 100 occupants of evacuation corridors, exits, stairs and a room's evacuation doors (m)

Stories		Fire resistance class		
		Class I or II	Class III	Class IV
Above-ground	First and second floor	0.65	0.75	1.00
	Third floor	0.75	1.00	—
	Fourth and upper floors	1.00	1.25	—
Under-ground	The distance between the lowest floor and the entrance ground is not more than 10m	0.75	—	—
	The distance between the lowest floor and the entrance ground is more than 10m	1.00	—	—

Table 5.3.17-2 The conversion factor of number of evacuation occupants in shop business area (person /m^2)

Floor	Second underground floor	First underground floor, first and second aboveground floor	third floor (aboveground)	Fourth and upper floors (aboveground)
Conversion factor	0.80	0.85	0.77	0.60

5.3.18 Public assembly building's window and balcony etc. should not be installed with metal barriers. If a metal barrier has to be installed, there shall be a device that can open the barrier from the inside easily. Assistant evacuation facilities should be installed on window and balcony etc.

5.4 Other requirements

5.4.1 The rooms for coal-burning, oil-burning or gas-burning boilers, oil immersed power transformers, combustible oil-filling high-voltage condensers and multi-position oil switches, etc. should be built independently. If such rooms have to be adjacent to civil buildings, they shall be separated by fire wall and shall not be adjacent to public assembly places.

5.4.2 If the rooms for oil-burning or gas-burning boilers, oil immersed power transformers, combustible oil-filling high-voltage condensers and multi-position oil switches, etc. have to be set up in civil buildings, they shall not be on or under the floor of public assembly places or adjacent to such places and shall meet the following requirements:

1 The rooms for oil-burning and gas-burning boilers and transformers shall be set up along the exterior wall of the first floor or the first underground floor. The rooms for oil-burning and gas-burning boilers with normal or negative pressure may be set up in the second underground floor. The gas-burning boilers with normal or negative pressure may be set up on the roof if the distance between the boiler and the exit is more than 6m.

The boiler that uses combustible gas whose density is 0.75 times of the air as fuel shall not be set up in basement or semi-basement.

2 The rooms for boilers and transformers shall have doors open directly to the outside or lead directly to the exit. Fire resisting overhanging eaves with the width not less than 1 m or a wall between windows of upper and lower floors with the height not less than 1.2m shall be constructed on the upper portion over the opening in the exterior wall.

3 The rooms for boilers and transformers shall be separated from other parts by walls with the fire resistance rating not less than 2.00h and floor slabs with the fire resistance rating not less than 1.50h. There shall be no openings in these walls and floor slabs. If there have to be openings for doors or windows, the door or window shall be Class A fire door or window.

4 If there is an oil storage room in rooms for boilers, the total capacity shall not be more than $1m^3$. The oil storage room shall be separated from the rooms for boilers by fire wall. If there has to be an opening for door, the door shall be Class A fire door.

5 The following walls shall be non-combustible and with the fire resistance rating not less than 2.00h:

1) Walls between rooms for transformers.

2) Walls between room for distribution and room for transformer.

6 Facilities for preventing oil from scattering shall be provided in rooms for oil immersed power transformer, multi-position oil switches and high-voltage condensers. An emergency oil storage facility with the capacity of containing all the oil for the transformer shall be designed under the transformer.

7 The capacity of a boiler shall meet the requirements of current national standard *Code for Design of Rooms for Boilers* GB 50041. The total capacity of the combustible oil-immersed power transformers shall not be more than 1260 kV · A and a single capacity shall not be more than 630 kV · A.

8 Fire alarm devices shall be installed.

9 Fire extinguishing facilities shall be designed according to the capacity of boilers and oil-immersed power transformers and the size of the building.

10 Explosion proof facilities shall be installed in rooms for gas-burning boilers. Independent ventilation system shall be installed in rooms for oil-burning or gas-burning boilers and shall meet the requirements of Chapter 10 in this code.

5.4.3 If a diesel generator room is set up in civil buildings, the following requirements shall be met:

1 The room should be set up in the first floor or the first and second underground floor.

2 Non-combustible partition wall and floor slab with fire resistance rating not less than 2.00h and 1.50h respectively shall be provided to separate the room from other parts. The door for the diesel generator room shall be Class A fire door.

3 Oil storage room shall be designed in the house for diesel generator. Its total capacity shall not be more than the consuming amount of 8.0 h. The oil storage room shall be separated from the room for generator by fire wall. When there has to be an opening for door, Class A fire door shall be installed.

4 Fire alarm devices shall be installed.

5 Fire extinguishing facilities shall be designed according to the capacity of diesel generator and the size of the building.

5.4.4 If there are boilers and diesel generators in a building, the pipeline supplying combustible materials for these facilities shall meet the following requirements:

1 The pipes shall be installed with manual and automatic shutting off valves before they enter the building and the rooms for the above facilities.

2 The oil container in the oil storage room shall be airproofed. Ventilating pipe shall be installed in the oil storage room. The pipe shall be equipped with respiration valve with filter. Facilities for preventing oil from flooding shall be designed under the oil container.

3 The design of gas supply pipe shall meet the requirements of the current national standard *Code for Design of City Gas Engineering* GB 50028.

4 The layout of liquid tank such as diesel oil etc. for boilers and diesel generators shall meet the requirements of section 3.4 or section 4.2 in this code.

5.4.5 Shops, workshops and storage rooms for selling, storing and using Class A and Class B goods are prohibited to be set up in civil buildings.

5.4.6 If residential occupancy and other occupancies are in the same building, the

following requirements shall be met:

1 The residential part and nonresidential part shall be separated by non-combustible partition wall and floor slab without openings and with fire resistance rating not less than 2.00h and 1.50h respectively. The exits and evacuation stairs for the residential part shall be independent.

2 The design for evacuation, fire extinguishing facilities etc. of the residential part and the other occupant parts shall meet the requirements of residential buildings and public buildings in this code respectively. The story number of the residential part shall include the story of the other occupant parts.

5.5 Timber civil buildings

5.5.1 The combustion performance and fire resistance rating of timber-structured building members shall not be less than what is required in Table 5.5.1.

Table 5.5.1 Combustion performance and fire resistance rating of timber-structured building members (h)

Building components	Combustion performance and fire resistance rating
Firewall	Non-combustible 3.00
Load-bearing wall, wall between units, family separation wall, and the sidewalls of stairway and elevator shaft	Difficult-combustible 1.00
Non-load bearing exterior wall, sidewalls of exit passageway	Difficult-combustible 1.00
Room partition wall	Difficult-combustible 0.50
Multi-story load-bearing column	Difficult-combustible 1.00
Single-story load-bearing column	Difficult-combustible 1.00
Beam	Difficult-combustible 1.00
Floor	Difficult-combustible 1.00
Roof load-bearing element	Difficult-combustible 1.00
Egress stairway	Difficult-combustible 0.50
Interior suspended ceiling	Difficult-combustible 0.25

Note: 1 Non-combustible materials shall be used for the roof coverings.

2 When a building is the timber structure with various heights, the roof load-bearing members of the lower height shall not be combustible members. If difficult-combustible components are used, the fire resistance rating shall not be less than 1.00h.

5.5.2 The story number of timber-structured buildings shall not be over 3. The maximum permitted length and fire compartment area for buildings with different stories shall not be more than what is required in Table 5.5.2.

Table 5.5.2 Stories, length and area of timber-structured buildings

Number of story	Maximum permitted length (m)	Maximum permitted area for each floor (m^2)
1 story	100	1200
2 stories	80	900
3 stories	60	600

Note: For the timber-structured building with automatic water sprinkler fire extinguishing system, the maximum permitted length and area for each floor can be doubled based on the requirements in the table. If it is installed partially, the maximum permitted length and area for that part can be doubled.

5.5.3 The fire separation distance between timber-structured buildings or between the timber-structured building and other structural civil buildings shall not be less than what is required in Table 5.5.3.

Table 5.5.3 The fire separation distance between timber-structured buildings or between timber-structured building and other structural civil buildings (m)

Building class	Class I or II	Class III	Building of timber structure	Class IV
Building of timber structure	8	9	10	11

Note: Fire separation distance shall be calculated based on the shortest distance between the exterior walls of two neighboring buildings. When there is combustible member projecting out of the wall, the calculation shall be conducted from the outer edge of the projection.

5.5.4 The fire separation distance between two timber structures or between the timber structure and other structural civil buildings shall not be less than 4m provided that no openings of doors and windows are in the exterior walls.

5.5.5 The fire separation distance between two timber structures or between the timber structure and other structural civil buildings shall not be less than the requirements shown in Table 5.5.5, provided that the sum of the areas of all the openings in the exterior walls does not exceed 10% of the area of the exterior wall.

Table 5.5.5 Fire separation distance when the opening area on exterior wall is less than 10% (m)

Building class	Class I, II or III	Building of timber structure	Class IV
Building of timber structure	5	6	7

6 Fire fighting vehicle access

6.0.1 Access for fire fighting vehicles shall be considered in the designing of streets in blocks, and the distance of the central lines between two adjacent streets should not be more than 160m. If the length of the building along the street is more than 150m or its total length is more than 220m, the fire fighting vehicle access going through the building shall be provided. If it is difficult to design the fire fighting vehicle access going through the building, a circle access for the fire fighting vehicles shall be designed.

6.0.2 If the short side of the enclosed courtyard of a building is more than 24m, the fire fighting vehicle access into the courtyard should be provided.

6.0.3 For buildings with enclosed courtyard along the streets, walkways connecting the streets and the courtyard of the buildings shall be set up (staircases may be used for this purpose), and the distance between two adjacent walkways should not be more than 80m.

6.0.4 On both sides of fire fighting vehicle access going through the buildings or into the courtyard, there shall be no facilities that might affect the fire fighting vehicles going through or occupants evacuating.

6.0.5 Public buildings, such as gymnasium with more than 3000 seats, auditorium with more than 2000 seats and exhibition hall with an occupied area of more than 3000m^2, should be provided with fire fighting vehicle access.

6.0.6 Fire fighting vehicle access shall be designed in factories and storages.

For a factory building of Class A, B or C with an occupied area of more than 3000 m^2, or a Class B or C storage with an occupied area of more than 1500m^2, a circle fire fighting vehicle access shall be built up. If it is difficult to build up such an access, the fire fighting vehicle access shall be arranged along the two longer sides of the factory or storage.

6.0.7 Open stackyards for combustible materials, LPG tank farm, and tank farm for Class A, B or C liquid shall be provided with fire fighting vehicle access. The design of the fire fighting vehicle access shall meet the following requirements:

1 If the total storage quantity of a stackyard or a tank farm is more than what is required in Table 6.0.7, a circle fire fighting vehicle access should be provided.

2 If a stackyard for combustible materials occupies an area of more than 30000m^2, intermediate fire fighting vehicle access connecting with the circle fire fighting vehicle access shall be provided, and the distance between them should not be more than 150m. The circle fire fighting vehicle access of LPG tank farm, and tank farm for combustible gas or Class A, B or C liquid should be designed with an access between them.

3 The minimum distance between fire fighting vehicle access and combustible materials stackyard shall not be less than 5m.

4 Where the fire fighting vehicle access going through the building connects with the circle one, there shall be enough space for fire fighting vehicles to swerve.

Table 6.0.7 The total storage quantity of stackyards and storage tank farm

Contents	Cotton, hemp, wool, fiber (t)	Straw of rice or wheat, reed (t)	Wood (m^3)	Class A, B or C liquid tank (m^3)	LPG tank (m^3)	Combustible gas tank (m^3)
Quantity	1000	5000	5000	1500	500	30000

6.0.8 Natural water resource and fire water pool which are provided for fire fighting vehicles to fetch water, shall be provided with fire fighting vehicle access.

6.0.9 The net width and height of the fire fighting vehicle access shall not be less than 4.0m. The grade of the space for fire fighting vehicle to park should not be more than 3%.

There shall be no barriers between the fire fighting vehicle access and factory buildings (storages) as well as civil buildings to affect the operation of fire fighting.

6.0.10 A circle fire fighting vehicle access shall be designed with at least two connections leading to the other carriageways. Where a fire fighting vehicle access has a dead-end, a turning lane or a turning area with an area of not less than 12m×12m shall be provided. The turning area for large fire fighting vehicles should not be less than 18m×18m.

The road surface of the fire fighting vehicle access, fire fighting vehicle operating areas, pipes and covered drains underneath them shall be capable of bearing the pressure of the large fire fighting vehicles.

Roads for transportation may be used as the fire fighting vehicle access in condition that they meet the traffic and park requirements of the fire fighting vehicles.

6.0.11 The fire fighting vehicle access should avoid at-grade intersection with railways. If the fire fighting vehicle access has to cross with railways, a stand-by access shall be built and the distance between the two accesses shall not be less than the length of the train.

7 Building structure

7.1 Fire wall

7.1.1 Fire wall shall be constructed directly onto the foundation or the load-bearing structures like the reinforced concrete frame and beam etc. Light-weight fire wall doesn't need to follow this restriction.

Fire wall shall be constructed from the foundation base to the base of the upper floor. Where the fire resistance rating of the roof load-bearing structure and roof panel is less than 0.50h, and the fire resistance rating of the roof panel of high-rise factory building (storage) is less than 1.00h, the fire wall shall be 0.4m higher than the non-combustible roof and shall be 0.5m higher than the combustible or difficult-combustible roof. Otherwise, the fire wall doesn't need to stick out of the roof, but it shall be built up to the base of the roof structure.

7.1.2 Where the horizontal distance from the center of a fire wall to the end-surface of a skylight is less than 4m, and the end-surface of the skylight is combustible, measures shall be taken to protect the fire from spreading.

7.1.3 Where the exterior wall of a building is difficult-combustible, the fire wall shall stick 0.4m out of the exterior wall surface; the exterior wall on each side of the fire wall shall be non-combustible, the width of which shall not be less than 2m on each side and its fire resistance rating shall not be less than that of the exterior wall.

Where the exterior wall of a building is non-combustible, the fire wall may not stick out of the wall surface. The horizontal distance between the nearest edges of the openings like door or window at both sides of the fire wall shall not be less than 2m; however, if the window is a Class B fire window provided with fixed window sash or it can automatically close in case of fire, there is no limit for the horizontal distance between the openings.

7.1.4 The fire wall should not be constructed at the corner of a building. If it is constructed near the corner, the horizontal distance between the nearest edges of the openings like door or window in the wall on both sides of the inner angel shall not be less than 4m.

7.1.5 No openings shall be permitted in the fire wall. Where there is opening in the fire wall, the opening shall be provided with fixed or automatically closing Class A fire door or window.

Pipes conveying combustible gas and Class A, B, C liquid are strictly prohibited from penetrating the fire wall. The other pipes should not penetrate the fire wall either, but where there is a pipe penetrating it, fire stopping material shall be used to tightly fill the space between the wall and the pipe; where the pipe is combustible or difficult-combustible, the pipe at both sides of the fire wall shall be fire protected.

Exhaust duct shall not be installed inside the fire wall.

7.1.6 The construction of the fire wall shall be able to keep it standing still even the roof truss, beam or floor slab at its either side is damaged under the effect of fire.

7.2 Building component and conduit shaft

7.2.1 The partition wall between the stage and the auditorium of the building like theatre shall be non-combustible and with its fire resistance rating not less than 3.00h.

The partition wall between the upper part of the stage and the blind ceiling of the auditorium can be non-combustible and with its fire resistance rating not less than 1.50h. The door in the partition wall shall be a Class B fire door.

The light control room and combustible storeroom under the stage shall be separated from the other parts of the building with a non-combustible wall with its fire resistance rating not less than 2.00h.

Film projection room, rewinding room shall be separated from the other parts of the building with a non-combustible partition wall with its fire resistance rating not less than 1.50h. The observation hole and projection hole shall be fire protected.

7.2.2 The clean operating room or clean operating department in the hospital, the singing, dancing, amusement and entertainment center etc. in a building, the children's activity room like children's studying room and playroom in the nursery and kindergarten and the building for the aged shall be separated from the other areas or parts of the building with at least 2.00h fire rated non-combustible wall and at least 1.00h fire rated floor slab. Where an opening must be set in the wall, the door shall be a Class B fire door.

7.2.3 The partition wall in the following buildings or parts shall be non-combustible and with its fire resistance rating not less than 2.00h; the openings in the partition wall shall be protected by Class B fire door or window:

1 Class A, B factory building and factory building using Class C liquid;

2 Factory building with open flame and high temperature;

3 Subsidiary room behind the backstage of theatres;

4 Hall of Class I, II fire rated building;

5 Kitchen of non-residential buildings;

6 Class A, B, C factory building or storage with rooms of different classified fire hazards.

7.2.4 The partition wall inside the building shall be constructed from the foundation base to the base of the upper floor.

The family separation wall and the walls between units shall be constructed to the base of the roof panel. The fire resistance rating of the roof panel shall not be less than

0.50h.

7.2.5 The rooms within the building such as the fire control room, equipment room for fixed fire extinguishing system, fire pump room and machine room for air conditioning etc. shall be separated from the other parts of the building with at least 2.00h fire rated partition wall and 1.50h fire rated floor slab. The machine room for air ventilation in Class D, E factory building shall be separated from the other parts of the building with at least 1.00h fire rated partition wall and 0.50h fire rated floor slab. Except otherwise regulated in the code, the door in the partition wall shall be a Class B fire door.

7.2.6 Where foam plastic or rice husk is used as the insulation layer of the wall in cold storage, non-combustible thermal insulated material should be applied to each floor slab to form horizontal fire partition. Its fire resistance rating shall be the same as that of the floor slab.

Non-combustible wall should be used to separate the attic of the cold storage from the combustible thermal insulation of the wall.

7.2.7 The fire protection design of the curtain wall shall meet the following requirements:

1 The in-filling material for the walls between two windows in vertical and horizontal directions shall be non-combustible. Where the exterior wall surface is non-combustible and with its fire resistance rating not less than 1.00h, its in-filling material can be difficult-combustible;

2 Where there is no wall between two windows in vertical and horizontal directions, an annexed solid non-combustible wall with its fire resistance rating not less than 1.00h and height not less than 0.8m shall be constructed at the outer edge of each floor slab;

3 The gap between the curtain wall and each floor slab as well as partition wall shall be filled with fire-proof sealing materials.

7.2.8 The pipes in the buildings that are easily deformed when subjected to high temperature or flame should be fire protected when they penetrate floor slab and wall with fire resistance rating not less than 2.00h.

7.2.9 Elevator shaft shall be constructed independently. No pipes for combustible gases and Class A, B, C liquids and no cables or wires that don't contribute to the elevator operation shall be permitted in elevator shaft. The shaft wall of the elevator shall not be designed with openings except elevator door or vent. The elevator door shall not be fence door.

The vertical shafts for cables, pipes, smoke extraction, air ventilation and trash shall be constructed independently; the shaft wall shall be non-combustible and with its fire resistance rating not less than 1.00h; the inspection hole in the shaft wall shall be protected by Class C fire rated door.

7.2.10 The cable shaft or pipe shaft within the building shall be protected at the joint of each floor slab with non-combustible or fire-proof sealing materials that at least have the same fire resistance rating as that of the floor slab.

The openings that connect the cable shaft or pipe shaft with rooms or corridors shall be filled with fire-proof sealing materials.

7.2.11 The exterior surface of air duct connecting the fire dampers or exhaust smoke valves at both sides of wall and floor slab shall be fire protected.

7.3 Roof, blind ceiling and building gap

7.3.1 The tile with no adhesive shall not be used if the thermal insulation material of the blind ceiling of Class III or IV building is combustible material such as sawdust etc.

Non-combustible thermal insulation material shall be used within 0.5m of non-metal chimney and 0.7m of metal chimney in the blind ceiling.

7.3.2 Dormers shall be installed in every compartment if there is blind ceiling in Class III building with more than 2 stories. The interval distance between the dormers should not be more than 50m.

7.3.3 An entrance with size not less than 0.7m×0.7m shall be designed in every fire compartment if there is combustible material in the blind ceiling. The number of the blind ceiling entrance for public buildings of each compartment should not be less than 2. The entrance of the blind ceiling should be in the corridor close to the staircase.

7.3.4 The electrical wire, cable and pipe for combustible gas and Class A, B, C liquid should not traverse building gap. If they have to traverse the building gap, non-combustible bushing shall be used to prevent distortion and shall be sealed with fire-proof sealing material.

7.3.5 Fire-proof sealing material shall be used for the gap which is caused by the smoke proof, smoke control, heating, ventilation and air conditioning pipe traversing the partition wall, floor and the compartment wall.

7.4 Staircase, stairs and door

7.4.1 The evacuation staircase shall meet the following requirements:

1 Natural lighting and ventilation shall be provided and the staircase should be designed near the outside wall;

2 Water boiling room, combustible material storage room, rubbish shaft shall not be designed in the staircase;

3 There shall be no protrusion or other barriers that hinder evacuation in the staircase;

4 Class A, B, C liquid pipe shall not be installed in the staircase;

5 Combustible gas pipe shall not be installed in the staircase of public buildings;

6 Combustible gas pipe and its meter shall not be installed in the staircase of residential buildings. If they have to be installed in the residential building staircase, protection measures such as metal bushing and gas shutting off equipments etc. shall be taken.

7.4.2 Enclosed staircase shall meet the requirements of 7.4.1 in this code and the following requirements:

1 If there is no natural lighting and ventilation in a staircase, the design of the staircase shall meet the requirements of smoke proof staircase;

2 On the first floor, enlarged staircase can include the corridor and hall etc. However, Class B fire door or other measures shall be used to separate the enlarged staircase from the rest corridors and rooms;

3 No doors or windows shall be opened to the staircase except the door of the staircase;

4 If enclosed staircase is designed in high-rise factory building (storage), public assembly building, Class C assembly factory building, the door of the staircase shall be Class B fire door and shall be opened to the evacuation direction;

5 The door of enclosed staircase of the other buildings may be swing door that can be opened from either side.

7.4.3 Smoke proof staircase shall meet the requirements of 7.4.1 in this code and the following requirements:

1 If there is no natural lighting and ventilation, the staircase shall be provided with smoke control facilities according to the requirements of Chapter 9 in this code and shall be provided with fire emergency lighting facilities according to the requirements of Chapter 11 in this code;

2 Smoke proof lobby, open balcony, or concaved corridor shall be designed at the entrance of the staircase. The smoke proof lobby of the smoke proof staircase and fire lift can be combined;

3 The usable area of lobby for public building shall not be less than $6.0m^2$, for residential building shall not be less than $4.5m^2$; the usable area of combined lobby for public building, high-rise factory and storage shall not be less than $10.0m^2$, for residential building shall not be less than $6.0m^2$;

4 Class B fire door shall be provided at the opening for evacuation corridor entering the lobby and the lobby entering the staircase;

5 Except the lobby of residential building, no other doors or windows shall be

opened to the staircase and lobby except the door of the staircase and the lobby;

6 On the first floor, enlarged smoke proof lobby of the staircase can include the corridor and hall. Class B fire door or other measures shall be used to separate the enlarged smoke proof lobby from the other corridors and rooms.

7.4.4 The location of evacuation staircase of every floor in the building shall not be changed.

The staircase of the basement or semi-basement shall be separated from the other parts of the building by non-combustible partition wall with fire resistance rating of not less than 2.00h. If a door has to be opened in the wall, it shall be Class B fire door.

The basement and semi-basement shall not share the same staircase with the aboveground stories. If they have to share the same staircase, non-combustible partition wall with fire resistance rating of not less than 2.00h and Class B fire door shall be used to separate the basement, semi-basement completely from the first floor and obvious signs shall be provided.

7.4.5 If the outside stairs meet the following requirements, the stairs may be used as evacuation stairs:

1 The height of the handrail shall not be less than 1.1m and the net width of the stairs shall not be less than 0.9m;

2 The slope angle of the stairs shall not be more than 45° ;

3 The stairs and landing part shall be made of non-combustible material. The fire resistance rating of the landing part and stairs shall not be less than 1.00h and 0.25h respectively;

4 The door leading to the outside stairs should be Class B fire door, and shall be opened to the outside direction;

5 Except the evacuation door, there shall be no other doors and windows in the wall within 2m of the outside stairs. The evacuation door shall not face the stairs directly.

7.4.6 Metal stairs may be used as the second exit in Class D, E factory building on condition that the net width of the stairs shall not be less than 0.9m and the slope angle of the stairs shall not be more than 45° .

Open stairs or metal stairs with net width no less than 0.9m and slope angle no more than 60° may be doubled as evacuation stairs if there are not more than 2 persons on each flat and not more than 10 persons of all the working platforms in Class D, E high-rise factory building.

7.4.7 Spiral stairs and sector steps should not be adopted in evacuation stair and corridor. If they have to be adopted, the surface angle of the two steps shall not be more than 10° and the

depth of the steps in the place of 250mm away from the handrail shall not be less than 220mm.

7.4.8 For the inside evacuation stairs in public building, the net horizontal distance between the handrails of the two stair flights should not be less than 150mm.

7.4.9 Outside fire ladder shall be installed on Class III building with height more than 10m and shall lead to the roof. The outside fire ladder shall not face the windows of the blind ceiling and its width shall not be less than 0.6m. The outside fire ladder should be installed from 3.0m above the ground.

7.4.10 The design of fire lift shall meet the following requirements:

1 Lobby shall be designed for the fire lift shaft. The usable area of the lobby shall meet the requirements of 7.4.3 in this code and the door of the lobby shall be Class B fire door;

Note: The fire lift installed in the connected corridor of the storage, cold store or work tower of the corn silo may not be provided with lobby.

2 The lobby should be near the outside wall and shall have exit directly leading to the outside or through a corridor with length no more than 30m to the outside on the first floor;

3 The fire lift shaft, machine room shall be separated from the nearby lift shaft and machine room by non-combustible partition wall with fire resistance rating not less than 2.00h. If a door is opened in the wall, it shall be Class A fire door;

4 Buttons only to be used by fire department shall be installed on the fire lift wall on the first floor. The inner finishing of the fire lift shall be non-combustible material and there shall be fire communication phone in the fire lift;

5 Water drainage facility shall be designed under the fire lift and its capacity shall not be less than $2m^3$. The ability of water pump shall not be less than 10L/s. Water blocking facilities should be designed at the entrance of the fire lift lobby;

6 The capacity of the fire lift shall not be less than 800kg;

7 The velocity of the fire lift shall be calculated to ensure it will not take more than 60s from the first floor to the top floor;

8 The power, control wire, cable of the fire lift shall be proof against water.

7.4.11 Fire roller shutters shall not be used in the enclosed staircase, smoke proof staircase, fire lift lobby and the combined lobby.

Keeping open Class A fire door shall be provided in the evacuation corridor at the fire compartment separation location.

7.4.12 The evacuation door in the building shall meet the following requirements:

1 The evacuation door in the civil building and factory building shall be opened to the evacuation direction. Except Class A, B factory building, there is no restriction on the opening direction of the door if there is no more than 60 persons in the room and the average evacuation capacity of each door is no more than 30 persons;

2 The evacuation door of the civil building and factory shall be side-hung door, and shall not be sliding door, roller shutter, overhung door or revolving door;

3 The evacuation door of storage shall be side-hung door to the evacuation direction. Sliding door or roller shutter may be used at the outside surface of the wall on the first floor. Sliding door or roller shutter shall not be used in Class A, B storage.

4 The evacuation door that needs to be controlled for people going in and out at will in densely populated place or the outdoor of the residential building controlled by electric devices shall be opened easily from the inside without using any tools such as key etc. in case of fire. Signs and operation explanation shall be labeled at the well-marked place.

7.5 Fire door and fire roller shutter

7.5.1 Fire door is classified as Class A, B, C fire door according to its fire resistance rating. And the fire resistance rating shall not be less than 1.20h, 0.90h and 0.60h respectively.

7.5.2 The installation of the fire door shall meet the following requirements:

1 The fire door shall be self-closing. Double-leaf fire door shall be closed according to the sequence;

2 Keeping open fire door shall be self-closed in case of fire and its closed signal shall be sent to the control center;

3 The fire door shall be opened by hand from either side, except the requirements of the fourth item in 7.4.12;

4 If the fire door is near the building gap, it shall not go over the gap when opened and shall be installed on the side with more stories.

7.5.3 If fire roller shutter is used to separate fire compartments, the following requirements shall be met:

1 The fire resistance rating of the fire roller shutter shall not be less than 3.00h. Automatic sprinkler protection may not be used if the fire resistance rating of the fire roller shutter meets the temperature rising condition of unexposed side required by the

current national standard *Fire Resistance Testing Method of Door and Roller Shutter* GB7633; automatic sprinkler protection shall be used if the fire resistance rating of the fire roller shutter meets the heat radiant condition of the unexposed side required by the current national standard *Fire Resistance Testing Method of Door and Roller Shutter* GB7633. The design of automatic sprinkler system shall meet the requirements of the current national standard *Code of Design for Sprinkler Systems* GB 50084,but the fire sustaining time shall not be less than 3.0h;

2 Fire roller shutter shall be smoke-proof. The gap between the shutter and the floor, beam, wall and column shall be sealed by fire proofing material.

7.6 Crossover, trestle and pipe trench

7.6.1 Crossover, the trestle over building or the trestle carrying combustible gas, Class A, B, C liquid and combustible material shall be made of non-combustible material.

7.6.2 The trestle shall not be used as evacuation means if it is carrying material with hazard characteristic of fire or blast.

7.6.3 Fire preventing measures should be taken at the joint where enclosed crossover or trestle connects with the building and in the enclosed pipe trench that is installed with pipes transporting Class A, B, C liquid.

7.6.4 For the crossover that connects two buildings, the door opening to the crossover may be used as safety exit of the buildings if the crossover is made of non-combustible material and the doors meet the requirements of exit.

8 Fire water supply and fire extinguishing facility

8.1 General requirements

8.1.1 The design of fire water supply and fire extinguishing facilities shall be based on the factors such as building occupancy and its importance, fire properties and fire hazard etc. of the building.

8.1.2 Fire water supply system must be designed at the same time while the planning of a building or city, residential area, factory building or storage is conducted. Municipal fire hydrant shall be designed in city or residential area. Outdoor fire hydrant shall be installed for civil building, factory building, storage, tank or tank farm and stackyard. Indoor fire hydrant shall be installed in civil building, factory building and storage and shall meet the requirements of 8.3.1 in this code.

Water for fire fighting may be supplied by a municipal water supply pipe network, a natural water source or a fire water pool. If a natural water source is used, it shall be ensured that the rate of water supply for fire fighting is not less than 97%, and a reliable water intake facility shall be installed.

Fire water supply may not be provided for such places as Class E factory building with Class I or II fire resistance class and the volume of the building not exceeding 3000m^3, or a small residential area in which every building is not taller than two stories with total occupants not exceeding 500.

8.1.3 If a high pressure or temporary high pressure water supply system is adopted, the water pressure in the piping shall be high enough to ensure that a fire water branch at the highest place of a building can have a full water spout of no less than 10m even when total water consuming is at its maximum. If a low pressure water supply system is adopted, the water pressure in piping shall ensure that any fire hydrant can have water pressure for fire extinguishing of no less than 0.1MPa calculated from the outdoor ground level.

Note: 1 When calculating water pressure, fire water branch with its nozzle diameter as 19mm and lined hose with its diameter as 65mm and length as 120m shall be used. The calculated flow rate for each branch shall not be less than 5L/s.

2 The pressure of a high pressure or temporary high pressure water supply system for a high-rise factory building or storage shall meet the pressure requirements for fire equipment at the most unfavorable indoor location.

3 Design flow velocity of water supply pipe for fire hydrant should not be more than 2.5m/s.

8.1.4 Outdoor low pressure water supply system for fire fighting may be combined with water supply system for production and livelihood. For a water supply system which

combines water usage for fire fighting, production, and livelihood altogether, the amount of water for both indoor and outdoor fire fighting shall be still ensured even when the consumption of water for production and livelihood reaches its maximum amount per hour. The amount of water for bathing should be counted as 15%, and water for washing and watering may be neglected. If it does not cause production accidents, the production water supply may be used as fire fighting water. But the number of the valves for converting production water into fire fighting water shall not be more than two, and the valve shall be installed in place easy to be operated and shall have distinguished label.

8.1.5 The total fire fighting water amount shall be the sum of indoor and outdoor fire fighting water amount.

The outdoor fire fighting water amount shall be the sum of the fire fighting or cooling systems working at the same time such as the fire hydrant, water mist, water curtain, foam and so on outside the civil building, factory building, storage, tank or tank farm, stackyard.

The indoor fire fighting water amount shall be the sum of the fire fighting systems working at the same time such as the fire hydrant, automatic sprinkler, foam and so on in the civil building, factory building or storage.

8.1.6 Fire extinguisher shall be provided in factory building, storage, tank or tank farm, stackyard and civil building (not including residential buildings). Residential building should be installed with fire extinguisher or portable fire fighting hose. The design of fire extinguisher shall meet the current national standard *Code for Design of Extinguisher Distribution in Buildings* GB 50140.

8.2 Outdoor fire fighting water amount, water supply pipe and fire hydrant

8.2.1 Outdoor fire fighting water amount for cities and residential areas shall be determined according to the number of fires possibly breaking out at the same time and the quantity of water needed to extinguish the fires at one time. The number of fires breaking out at the same time and the quantity of water to extinguish the fire at one time shall not be less than the value given in Table 8.2.1.

Table 8.2.1 The number of fires breaking out at the same time and the quantity of water to extinguish the fire at one time for cities and residential areas

Occupants N (10000 persons)	The number of fires breaking out at the same time (times)	The quantity of water to extinguish the fire at one time (L/s)
$N \leqslant 1$	1	10
$1 < N \leqslant 2.5$	1	15
$2 < N \leqslant 5$	2	25
$5 < N \leqslant 10$	2	35
$10 < N \leqslant 20$	2	45
$20 < N \leqslant 30$	2	55
$30 < N \leqslant 40$	2	65
$40 < N \leqslant 50$	3	75
$50 < N \leqslant 60$	3	85
$60 < N \leqslant 70$	3	90
$70 < N \leqslant 80$	3	95
$80 < N \leqslant 100$	3	100

Note: Outdoor fire fighting water quantity for cities shall include outdoor fire hydrant water quantity for residential areas, factories, storages, stackyards and tanks or tank farms and civil buildings. When the outdoor fire hydrant water quantity for factories, storages and civil buildings calculated according to Table 8.2.2-2 does not comply with the quantity calculated according to this table, the bigger value shall be taken.

8.2.2 Outdoor fire fighting water quantity for factories, storages, stackyards, tanks or tank farms and civil buildings shall be determined according to the number of fires breaking out at the same time and the quantity of water needed to extinguish the fires at one time .

1 The number of fires at the same time for factories, storages, stackyards, tanks or tank farms and civil buildings shall not be less than the value listed in Table 8.2.2-1.

2 The water supply quantity of outdoor fire hydrants to extinguish the fire at one time of a factory, storage or civil building shall not be less than the required amount listed in Table 8.2.2-2.

3 If a unit has foam equipment, water branches with stands, automatic sprinkler systems, and the other outdoor fire protection equipment using water, the total water amount shall be what is needed by the equipment above plus 50% of the amount needed by the outdoor hydrants which is specified in Table 8.2.2-2. However, the water supply amount shall not be less than the quantity specified in Table 8.2.2-2.

Table 8.2.2-1 The number of fires at the same time for factory buildings,storages, stackyards, tanks or tank farms and civil buildings

Building	Base area(ha)	Occupants of the residential area (10000 persons)	The number of fires at the same time	Remarks
Factory	≤100	≤1.5	1	Calculated based on the biggest water quantity requirement of one building, stackyard or tank
		>1.5	2	One in factory, one in residential area
	>100	Not limited	2	Calculated based on the sum of the biggest water quantity requirement of two buildings, stackyards or tanks
Storage, civil building	Not limited	Not limited	1	Calculated based on the biggest water quantity requirement of one building, stackyard or tank

Note: 1 If an industrial enterprise, such as mining, ore dressing, etc., has dispersed bases with independent fire water supply system, it should be calculated separately.

2 1ha=10000m^2.

Table 8.2.2-2 Water supply quantity for outdoor hydrants to extinguish the fire at one time of a factory, storage or civil building

Fire resistance class	Occupant of building		Volume of building V(m^3)					
			V≤1500	1500<V≤3000	3000<V≤5000	5000<V≤20000	20000<V≤50000	V>50000
Class I, or II	Factory building	Class A, B	10	15	20	25	30	35
		Class C	10	15	20	25	30	40
		Class D, E	10	10	10	15	15	20
	Storage	Class A, B	15	15	25	25	—	—
		Class C	15	15	25	25	35	45
		Class D, E	10	10	10	15	15	20
	Civil building		10	15	15	20	25	30

Table 8.2.2-2 (continued)

Fire resistance class	Occupant of building		Volume of building V(m^3)					
			$V\leqslant$ 1500	1500< $V\leqslant$ 3000	3000< $V\leqslant$ 5000	5000< $V\leqslant$ 20000	20000< $V\leqslant$ 50000	$V>$ 50000
Class III	Factory building (storage)	Class B, C	15	20	30	40	45	—
		Class D, E	10	10	15	20	25	35
	Civil building		10	15	20	25	30	—
Class IV	Class D, E factory (storage)		10	15	20	25	—	—
	Civil building		10	15	20	25	—	—

Note: 1 Water supply amount for outdoor hydrants shall be calculated according to the building which requires the greatest amount of water. For buildings arranged in groups, it shall be calculated according to the two neighboring buildings which require a greater amount of water.

2 Outdoor hydrant water supply amount for important buildings of wood structure, or of wood and brick structure belonging to a national protected cultural relics unit, shall be determined according to civil buildings of Class III fire resistance class.

3 Water supply amount for outdoor hydrants of transit storages of a railway station, a wharf or an airport shall be determined according to Class C goods storages.

8.2.3 Outdoor hydrant water supply amount for a combustible stackyard, or a tank or tank farm of combustible gases, shall not be less than the value specified in Table 8.2.3.

Table 8.2.3 Water supply amount for outdoor hydrants of a combustible stackyard or a combustible gas storage tank or tank farm (L/s)

Material		Total capacity	Water supply amount
Foodstuff W(t)	Circle soil silo	$30<W\leqslant500$	15
		$500<W\leqslant5000$	25
		$5000<W\leqslant20000$	40
		$W>20000$	45
	Grain mat silo	$30<W\leqslant500$	20
		$500<W\leqslant5000$	35
		$5000<W\leqslant20000$	50
Cotton, wool, hemp, fur, chemical fibre, general merchandise W (t)		$10<W\leqslant500$	20
		$500<W\leqslant1000$	35
		$1000<W\leqslant5000$	50

Table 8.2.3(continued)

Material	Total capacity	Water supply amount
Flammable material such as rice straw, wheat straw, reed etc. W (t)	$50<W\leqslant500$	20
	$500<W\leqslant5000$	35
	$5000<W\leqslant10000$	50
	$W>10000$	60
Combustible material such as timbering etc. V (m^3)	$50<V\leqslant1000$	20
	$1000<V\leqslant5000$	30
	$5000<V\leqslant10000$	45
	$V>10000$	55
Coal and coke W (t)	$100<W\leqslant5000$	15
	$W>5000$	20
Combustible gas storage tank or tank farm V (m^3)	$500<V\leqslant10000$	15
	$10000<V\leqslant50000$	20
	$50000<V\leqslant100000$	25
	$100000<V\leqslant200000$	30
	$V>200000$	35

Note: The total volume of the fixed volume gas tank can be calculated by the product of geometry volume of the tank (m^3) and the design storage pressure (absolute pressure, 10^5 Pa).

8.2.4 Outdoor fire fighting water amount for the tank or tank farm of Class A, B or C liquid shall be calculated according to the sum of the water quantity for extinguishing fire and cooling water.

1 The water quantity for extinguishing fire shall be determined according to the sum of the water quantity needed by the foam system, foam monitor, and foam sprayer for the biggest tank in the tank farm and shall be calculated according to the current national standard *Code for Design of Low Expansion Foam System* GB 50151, *Code for Design of High & Medium Expansion Foam Systems* GB 50196 or *Code for Design for Fixed Fire Monitor Extinguishing Systems* GB 50338.

2 The cooling water quantity for the tank farm shall be calculated according to the maximum water quantity needed to extinguish the fire for one time. Neighboring tanks within 1.5 times the diameter of the tank catching fire shall be cooled, and the supply range and supply intensity shall not be less than the stipulation of Table 8.2.4.

Table 8.2.4 Supply intensity and range of cooling water for Class A, B, C liquid tank

Facility	Tank			Range	Intensity
Fire branch	Tank on fire	Fixed roof tank (including heat preservation tank)		Perimeter of the tank	0.60[L/(s·m)]
		Floating roof tank (including heat preservation tank)		Perimeter of the tank	0.45[L/(s·m)]
		Horizontal tank		Area of the tank exterior	0.10[L/(s·m^2)]
		Underground vertical tank, semi-underground or underground horizontal tank		Area of the tank exterior uncovered with soil	0.10[L/(s·m^2)]
	The adjacent tank	Fixed roof tank	Tank without heat preservation	Half length of the tank perimeter	0.35[L(/s·m)]
			Tank with heat preservation		0.20[L/(s·m)]
		Horizontal tank		Half the area of the tank exterior	0.10[L/(s·m^2)]
		Semi-underground or underground tank		Half the area of the tank exterior uncovered with soil	0.10[L/(s·m^2)]
Fixed facility	Tank on fire		Vertical tank	Perimeter of the tank	0.50[L/(s·m)]
			Horizontal tank	Area of the tank exterior	0.10[L/(s·m^2)]
	The adjacent tank		Vertical tank	Half length of the tank perimeter	0.50[L/(s·m)]
			Horizontal tank	Half the area of the tank exterior	0.10[L/(s·m^2)]

Note: 1 The supply intensity of the cooling water shall be further checked on the basis of the fire-fighting equipment applied in the actual extinguishing tactics.

2 If non-combustible material is used for insulation in the neighboring tank, the supply intensity of its cooling water may be decreased by 50% according to this table.

3 The storage tank may use movable water branch or fixed equipment for cooling. When the movable water branch is used for cooling, and the fire-fighting water quantity for the horizontal tank without earth covering is less than 15 L/s according to the calculation, the value of 15 L/s shall be still adopted.

4 If the height of a ground tank exceeds 15m or its single capacity is more than 2000m^3, the fixed cooling equipment should be installed.

5 If the number of neighboring tanks exceeds four, the cooling water quantity may be calculated based on four tanks.

3 The underground oil tank with earth covering shall be equipped with water cooling facility. The cooling water quantity shall be calculated according to the surface area of the roof of the biggest tank on fire (for the horizontal tank, it shall be calculated according to its projected area)and the supply intensity of the cooling water. The supply intensity shall not be less than 0.10L/(s.m^2). When the calculated water intensity is less than 15L/s, the value of 15L/s shall be adopted.

8.2.5 The amount of fire-fighting water for a LPG storage tank farm shall be calculated according to the sum of the amount required by the fixed cooling equipment and water branches. And the following requirements shall be met:

1 The fixed sprinkler facility shall be set up for a storage tank farm with a total volume exceeding 50m^3 or a single storage tank with a volume over 20 m^3.

The cooling water quantity of the fixed facility shall be calculated according to the area under protection and the supply intensity. The supply intensity for the sprinkler facility shall not be less than 0.15L/(s.m^2), and the protected area of the tank on fire is calculated according to its whole surface area; the protected area of the neighboring tanks within the range of 1.5 times the diameter of the tank on fire is calculated according to one half of their surface area. The diameter of the horizontal tank shall be half the sum of its length and diameter.

2 The water quantity for water branches shall not be less than the stipulation of Table 8.2.5.

3 The underground LPG tank may not be installed with fixed sprinkling facility.

Table 8.2.5 Water quantity for branches in LPG tank farm

Total volume V(m^3)	$V \leqslant 500$	$500 < V \leqslant 2500$	$V > 2500$
Single tank volume V(m^3)	$V \leqslant 100$	$V \leqslant 400$	$V > 400$
Water quantity for branches(L/s)	20	30	45

Note: 1 The water quantity for branches shall be determined according to the bigger value of the total volume and single tank volume in this table.

2 The tank farm with total volume not more than 50m^3 or single tank with volume not more than 20m^3 may be provided with the fixed sprinkling facility or the movable water branches independently. The water quantity for fire fighting shall be calculated according to the water quantity for branches.

8.2.6 If the outdoor combustible oil-immersed transformer is protected by water spray extinguishing system, the water amount for fire extinguishing shall be calculated according

to the requirements of the current national standard *Code of Design for Water Spray Extinguishing System* GB 50219.

8.2.7 The arrangement of the outdoor fire fighting water supply piping shall meet the following requirements:

1 The outdoor fire water supply piping shall be arranged in loop. It may be in branch shape if the outdoor water quantity for fire fighting is less than 15L/s.

2 The pipes supplying water to the loop pipe network shall not be less than 2. If one of them is in trouble, the rest can still be able to supply the total amount of fire water.

3 A looping pipe network shall be divided into several independent sections by valves. The number of outdoor fire hydrants in each section should not be more than 5.

4 The diameter of the outdoor fire water supply piping shall not be less than DN100.

5 The other design requirements of the outdoor fire water supply piping shall meet the stipulation of the current national standard *Code of Design for Outdoor Water Supply* GB 50013.

8.2.8 The arrangement of outdoor fire hydrants shall meet the following requirements:

1 Outdoor fire hydrant shall be installed along roads. If the road width is more than 60m, fire hydrants should be installed on both sides of the road and close to the crossroad.

2 The fire hydrants for a tank farm of Class A, B or C liquid or a tank yard for LPG shall be installed outside its fire embankment. The fire hydrants within 15m from tank wall shall not be counted as applicable to this tank.

3 Outdoor fire hydrants shall be at intervals of not more than 120m.

4 The protected radius of an outdoor fire hydrant shall not be more than 150m. If the supply intensity of fire water does not exceed 15L/s, outdoor fire hydrants may not be installed for a building which is within the 150m protected radius of municipal fire hydrants.

5 The number of outdoor fire hydrants shall be determined according to the combined factors such as water amount required for outdoor fire fighting, the protected radius and so on. The fire water amount for each outdoor fire hydrant shall be 10~15L/s. The number of the municipal fire hydrants that are within 5~40m of the protected building may be counted in the number of outdoor fire hydrants.

6 The outdoor fire hydrant should be above ground and shall have one outlet connection of DN150 or DN100 and two outlet connections of DN65. If underground outdoor fire hydrant is used, the hydrant shall have one outlet connection of DN100 and one of DN65. Measures shall be taken to prevent outdoor fire hydrants from freezing in cold areas.

7 Fire hydrants shall not be more than 2m away from the road edge. They should not be within 5m from the outside wall of a building.

8 The fire hydrant for technical equipment area shall be around the equipment and should be at intervals of not more than 60m. If the width of the technical equipment area is more than 120m, fire hydrants should be installed along the road in the area.

8.2.9 The place where outdoor fire hydrant, valve, fire department connection etc. are installed shall be provided with permanent label.

8.2.10 If it is difficult to install municipal fire hydrant and outdoor fire hydrant in the cold area, the fire fighting vehicle adding water facility such as crane may be used. Its protection radius may be determined according to the actual needs.

8.3 The setting places of indoor fire hydrants etc.

8.3.1 The indoor fire hydrants of DN65 shall be installed in the following buildings unless the requirements of 8.3.4 in this code is met:

1 Factory building(storage) with occupied building area more than 300m^2.

2 Building with volume more than 5000m^3 such as the waiting building for bus, ship or airplane, exhibition building, department store, hotel, building for inpatients, building for outpatients, library and so on.

3 Special and Class A theater, theater of other classes and cinema etc. with more than 800 seats, assembly hall and gymnasium with more than 1200 seats.

4 The other civil buildings such as teaching building, office building and apartment building not for family etc. with more than five stories or with a volume of more than 10000 m^3 .

5 The residential building with more than seven stories shall be installed with indoor fire hydrant. If it is difficult to meet the requirements, dry standpipe and indoor fire hydrant of DN65 without fire hydrant box may be installed. The diameter of standpipe shall not be less than DN65.

Note: Indoor fire hydrants may not be installed in the following buildings: single or multi-story Class D and E factory building(storage) with few combustible materials and fire resistance class of Class I or II, Class D factory building with fire resistance class of Class III or IV and a volume not more than 3000m^3 with Class E factory building(storage) with fire resistance class of Class III or IV and a volume not more than 5000m^3, storage for foodstuff, cashbox.

8.3.2 Indoor fire hydrants should be installed in important ancient buildings of brick-and-timber or timber construction belonging to the state protected cultural relics unit.

8.3.3 Fire hose reel should be installed in the following buildings:

1 Public assembly buildings with indoor fire hydrants;

2 The other public buildings that do not belong to the buildings of 8.3.1 in this code.

Fire hose reel or portable hose assemblies shall be installed in the commercial service facilities with building area more than 200m^2.

8.3.4 Indoor fire hydrants may not be installed in the following buildings:

1 Buildings with storage of materials which may cause combustion or explosion when in contact with water;

2 Buildings with volume not more than 5000m^3 and no indoor water supply piping for production and everyday life, and whose outdoor water for fire fighting is from a reservoir.

8.4 Amount of water required by indoor fire fighting and water supply piping, fire hydrant and reservoir

8.4.1 The indoor fire fighting water amount shall be calculated according to the following requirements:

1 If there are fire hydrant system, automatic sprinkler system, water spray system, foam system and fixed fire monitor system in the same building, the sum of the water amount required by all of the above mentioned equipment opened simultaneously shall be taken as the amount of water for indoor fire fighting. The water amount of indoor fire hydrants may be decreased by 50% and shall not be less than 10L/s if there are more than one fire extinguishing system working at the same time.

2 The amount of water for indoor fire hydrants shall be determined according to the number of the fire branches used at the same time and the length of the full water spout, and it shall not be less than the value specified in Table 8.4.1.

3 The amount of water for water sprayed extinguishing system shall be determined according to the current national standard *Code of Design for Water Spray Extinguishing Systems* GB 50219; the amount of water for automatic sprinkler fire extinguishing system shall be determined according to the current national standard *Code for Design of Automatic Sprinkler System* GB 50084; the amount of water for foam extinguishing system shall be determined according to the current national standard *Code for Design of Low Expansion Foam System* GB 50151, *Code for Design of High & Medium Expansion Foam System* GB 50196; the amount of water for fixed fire monitor system shall be determined according to the current national standard *Code for Design of Fixed Fire Monitor Extinguishing Systems* GB 50338.

Table 8.4.1 Amount of water for indoor fire hydrant

Building	Height h(m), the number of stories, volume V (m^3) or seats N		Amount of water for hydrant (L/s)	The number of fire branches used at the same time	The minimum amount of each standpipe (L/s)
Factory building	$h \leqslant 24$	$V \leqslant 10000$	5	2	5
		$V > 10000$	10	2	10
	$24 < h \leqslant 50$		25	5	15
	$h > 50$		30	6	15
Storage	$h \leqslant 24$	$V \leqslant 5000$	5	1	5
		$V > 5000$	10	2	10
	$24 < h \leqslant 50$		30	6	15
	$h > 50$		40	8	15
Scientific researchbuilding, experiment building	$H \leqslant 24$, $V \leqslant 10000$		10	2	10
	$H \leqslant 24$, $V > 10000$		15	3	10
The waiting building for train or bus, ship, airplane and exhibit building etc.	$5000 < V \leqslant 25000$		10	2	10
	$25000 < V \leqslant 50000$		15	3	10
	$V > 50000$		20	4	15
Theater, cinema, auditorium, gymnasium etc.	$800 < n \leqslant 1200$		10	2	10
	$1200 < n \leqslant 5000$		15	3	10
	$5000 < n \leqslant 10000$		20	4	15
	$n > 10000$		30	6	15
Shop, hotel etc.	$5000 < V \leqslant 10000$		10	2	10
	$10000 < V \leqslant 25000$		15	3	10
	$V > 25000$		20	4	15
Inpatient building, outpatient building etc.	$5000 < V \leqslant 10000$		5	2	5
	$10000 < V \leqslant 25000$		10	2	10
	$V > 25000$		15	3	10
The other civil buildings such as office building, teaching building etc.	The number of stories $\geqslant 6$ or $V > 10000$		15	3	10

Table 8.4.1(continued)

Building	Height h(m), the number of stories, volume V (m^3) or seats N	Amount of water for hydrant (L/s)	The number of fire branches used at the same time	The minimum amount of each standpipe (L/s)
Important ancient building of brick-and-timber or timber construction belonging to the state protected cultural relics unit	$V \leqslant 10000$ $V > 10000$	20 25	4 5	10 15
Residential building	The number of stories $\geqslant 8$	5	2	5

Note: 1 For indoor fire hydrant of Class D and E high-rise factory building or storage, 10L/s may be subtracted from the value listed in the table, and the number of fire branches may also be two less than the value listed in the table.

2 The fire fighting water amount of fire hose reel, portable hose assemblies and the fire hydrant of the dry standpipe in residential building staircase may not be counted into the amount of indoor fire fighting water.

8.4.2 The indoor fire water supply piping shall meet the following requirements:

1 If there are more than ten indoor fire hydrants, and the water amount for outdoor fire fighting is more than 15L/s, the indoor fire water supply pipe shall be in loop form and there shall be at least two inlet pipes connecting with the outdoor piping or fire pump. If one of the inlet pipes is in trouble, the others shall be able to supply the whole amount of water required.

2 Independent fire water supply system shall be installed in high-rise factory building or storage and the indoor standpipes shall be connected into loop form.

3 The indoor fire standpipe diameter shall not be less than DN100.

4 The indoor fire hydrant piping should be separated from the piping of automatic sprinkler system. If the two systems use the same fire pumps, the water supply pipe shall be separated in front of the alarm valve.

5 For high-rise factory buildings or storages, factory buildings and storages of more than four stories with indoor fire hydrant installed and public buildings of more than 5 stories with indoor fire hydrant installed, the indoor fire hydrant water supply piping shall be provided with fire pump connections.

The fire pump connection shall be designed in the outdoor place where fire vehicle can easily access it. Within the distance of 15~40m from the fire pump connection, the outdoor fire

hydrant or fire water pool should be set up.

The number of fire pump connections shall be calculated according to the water amount for indoor fire fighting, and each should be calculated according to a flow rate of 10~15 L/s.

6 The indoor fire water supply pipes shall be divided into several independent sections with valves. For single-story factory buildings or storages and public buildings, the number of unusable fire hydrants shall not exceed five in case of inspection and maintenance. The arrangement of valves on indoor fire water supply pipes in multi-story civil buildings and the other factories or storages shall be such that it ensures no more than one standpipe to be closed when the pipe is under repairing, and when the standpipes exceed three in number, two of them may be closed.

Valves shall be in opened status, and there shall be obvious open and close labels or signs.

7 If the fire fighting water and water for other purposes share the same indoor piping, and the water amount for other purpose reaches its maximum per hour flow rate, all the fire fighting water amount shall also be provided.

8 The fire pump should pump from the municipal water supply piping if it is allowed and when water amount for production and life reaches its maximum and water amount of outdoor and indoor fire fighting can still be guaranteed.

9 Dry indoor fire hydrant system may be used in factory or storage and the other buildings of cold areas without heating. Equipment that can open and close quickly shall be installed in the water supply pipe. Automatic air exhaust valve shall be installed on the pipe of the highest part.

8.4.3 The arrangement of indoor fire hydrant shall meet the following requirements:

1 If fire hydrant is required to be installed in the building, it shall be installed in every floor except the mezzanine for equipment without combustible material.

The fire hydrant of apartment building and tower apartment building should be installed on the first floor and the rest land of each story. If it is difficult to install two fire fighting standpipes, one standpipe may be used on condition that the fire hydrant must be with two valves and two mouths. The dry fire fighting standpipe shall be installed with connection and non-return valve to be easily used by the fire department on the first floor near the exit.

2 Fire hydrant shall be installed in the lobby of the fire fighting lift shaft.

3 Indoor fire hydrant shall be installed in a conspicuous place where it is easy for operation. The adaptor of the fire hydrant should be 1.1m from the floor or operation surface. The water spout should face the ground or be upright to the wall where the fire hydrant is installed. The distance between the mouth of the fire hydrant and the edge of the fire hydrant box shall not hinder the connection of the fire hose.

4 The fire hydrant of cold store shall be installed in the staircase or normal temperature lobby.

5 The interval of indoor fire hydrant shall be determined according to calculation and shall meet the following requirements:

a) The interval of indoor fire hydrant shall not be more than 30m for high-rise factory building or storage, high rack storage and Class A, B factory.

b) For the other single or multi-story buildings, the interval of indoor fire hydrant shall not be more than 50m.

6 In the same building, the fire hydrant, fire branch and hose shall be of the same type. The length of each hose shall not be more than 25m.

7 The arrangement of indoor fire hydrant shall ensure that there are full water spouts of two fire branches that can reach any point of the same floor in one fire compartment. If the multi-story storage with building height not more than 24m and volume not more than 5000m^3, one fire branch's full water spout that can reach any point in the room may be used.

The full water spout of fire branch shall be determined by calculating and shall meet the following requirements:

a) The length of full water spout shall not be less than 10m for Class A, B factory building, public building with more than six stories and factory building or storage with more than four stories.

b) The length of full water spout shall not be less than 13m for high-rise factory building or storage, high rack storage and buildings with volume more than 25000m^3 such as shop, gymnasium, theater, auditorium, exhibit building, bus or train station, dock, airplane building etc.

c) For the other buildings, it should not be less than 7m.

8 Button to start the fire pump directly shall be designed in every indoor fire hydrant and protection measures shall be taken for high-rise factory building or storage and the other buildings where the static pressure of the fire water container in the high position can not meet the pressure requirements of the fire hydrant in the most disadvantageous point.

9 Measures for pressure decreasing shall be taken if the water pressure of the indoor fire hydrant mouth is more than 0.5MPa. If the static water pressure is more than 1.0MPa, the water supply system shall be divided into subsystems.

10 If the buildings is installed with indoor fire hydrant and flat roof, fire hydrant for testing and inspecting should be installed on the roof.

8.4.4 The fire water container may not be installed in the following two types of buildings: the building which is installed with high pressure water supply system and the water amount and pressure meet the requirements of the fire hydrant or automatic water sprinkler system etc. in the most disadvantageous location; the building which is installed with dry fire standpipe.

If temporary high pressure water supply system is installed in the building, fire water container, including air pressure water tank, water tower, water container of the water supply subsystem, shall be installed and shall meet the following requirements:

1 The fire water container of gravity water flowing shall be installed on the highest part of the building.

2 The water amount in the fire water container shall meet the requirements of at least 10 minutes' fire water consumption. The water amount of the fire container may be $12m^3$, if the indoor fire fighting water flow rate is not more than 25L/s and the calculating water amount of the fire water container is more than $12m^3$. If the indoor fire fighting water flow rate is more than 25L/s and the calculating water amount of the fire water container is more than $18m^3$, the water amount of the fire container may be $18m^3$.

3 If the fire fighting water and the water for other purposes share combined water container, measures preventing fire fighting water from being used as other purposes shall be taken.

4 In case of fire, the water provided by the fire pump shall not enter the fire water container.

5 The fire water container may be designed into subsystems.

8.4.5 The site where indoor fire hydrant or valve is installed shall have permanent label fixed.

8.5 The places where automatic fire extinguishing system is installed

8.5.1 Automatic fire extinguishing system shall be installed in the following places and automatic water sprinkler system should be used except the places that should not use water protection or fire extinguishing or there are other requirements in this code:

1 The package unwrapping and cotton processing workshop of cotton spinning factory with more than 50000 spindles; the rating and hemp processing workshop of hemp spinning factory with more than 5000 spindles; the stalk baking and rating parts of match factory; the preparing, moulding, slicing, empaistic parts of foam factory; carpentry factory with occupied building area more than $1500m^2$; single or multi-story factories such as shoe making, clothes making, toy making and electron factory with occupied building area more than $1500m^2$ or total building area more than $3000m^2$; Class C high-rise factory; the preparing part of plane engine test-bed; Class C underground factory with building area more than $500m^2$.

2 Storage with occupied building area more than $1000m^2$ storing cotton, wool, silk, hemp, chemical fibre, fur and their products; the match storage with occupied building area more than $600m^2$; the mailbag storage of the post building with building area more than $500m^2$; the underground combustible material storage with building area more than $500m^2$; combustible, difficult-combustible high rack storage and high-rise storage except the cold store.

3 Special and Class A theater or theater of other classes with more than 1500 seats; auditorium with more than 2000 seats; gymnasium with more than 3000 seats; the indoor rest and equipment room of the stadium for more than 5000 persons.

4 The exhibit building, shop, hotel, hospital building (including building for inpatient, outpatient and operation) with building area of any floor more than 1500m^2 or total building area more than 3000m^2; underground shop with building area more than 500m^2.

5 Buildings such as office building etc. with total building area more than 3000m^2 and with centralized air conditioning system that is installed with air supply and return ducts or pipes.

6 Places used for singing, dancing, amusement and entertainment etc. (except the swimming places) which are located in the underground or semi-underground building, the fourth or upper floor of the building, or on the first, second or third floor of the aboveground building with each floor building area more than 300m^2.

7 Library storing more than 500000 books.

8.5.2 The following places should be installed with drencher system:

1 The stage opening of the special and Class A theater or theater of other classes with more than 1500 seats and auditorium with more than 2000 seats, and the door or window opening of the side stage or tiring-room that connects with the stage.

2 The opening that fire separation measures such as fire wall etc. shall be used, but it is difficult to implement.

3 The upper part of the fire roller shutter or fire curtain that needs cooling protection.

8.5.3 Deluge system shall be installed in the following places:

1 The potassium chlorate grinding workshop of match factory; factory producing and using materials such as nitration cotton, spray paint cotton, collodion, celluloid film, nitrocellulose with building area more than 100m^2.

2 The nitration cotton, spray paint cotton, collodion, celluloid film, nitrocellulose storage with building area more than 60m^2 or the store amount more than 2t.

3 The filling bottle room and full bottle room of the LPG store and distribution station with daily filling bottle amount more than 3000.

4 The under part of the stage rack of the special and Class A theater or theater of other classes with more than 1500 seats and auditorium with more than 2000 seats.

5 The television studio with building area not less than 400m^2; the film studio with building area not less than 500m^2.

6 The modeling, slicing, ball grinding, and ball inspecting part of the ping-pong factory.

8.5.4 Automatic fire extinguishing system shall be designed in the following places and water spray system should be used:

1 The factory and mine's oil immersed power transformers with single capacity not less than 40MV·A, the power plant's oil immersed power transformers with single capacity not less than 90MV·A, the independent transformer substation's oil immersed power transformers with single capacity not less than 125MV·A.

2 The breaking-in part of the plane engine test-bed.

8.5.5 Automatic fire extinguishing system shall be designed in the following places and gas extinguishing system should be used;

1 The microwave room, decimeter-wave room, meter-wave room, transformer room and the UPS room of the broadcast and television tower for the province, state or the city with more than 1 million population;

2 The program controlled switch for long-distance phone-call of international telephone office, the region telephone center, the province center and local telephone center serving more than 10000 phones;

3 The program controlled switch for local phone-call of city telephone office serving more than 20000 phones and other telephone office serving more than 60000 phones;

4 The communication room and control room of the control center for public security, emergency control of state or province and power dispatching center of bureau and the upper rating;

5 The main computer room and the medium storage of operation room with main computer room's building area more than 140m^2;

6 The medium storage room of the central and provincial broadcast and television center with building area more than 120m^2;

7 The special book storage room of national, provincial library or library with storage volume more than 1 million; the special file storage room and non-paper file storage room of national, provincial file building; the precious articles storage room of Class A, B museum; the exhibit room of Class A paper or thin silk cultural relic;

8 The other rooms which are installed with important facility.

Note: Pre-action sprinkler system may be installed in the places required by the fifth article in this section if there is stand-by main host computer and spare storage material and the stand-by main host computer, spare storage material are in the other buildings or in the other fire compartment of the same building.

8.5.6 The design of the foam fire extinguishing system for the Class A, B, C liquid tank etc. shall meet the requirements of the current national standard *Code for Design of Oil Depot* GB 50074, *Fire Prevention Code of Petrochemical Enterprise Design* GB 50160, *Code for Fire Prevention Design of Petroleum and Natural Gas Engineering* GB 50183 and so on.

8.5.7 The fixed fire monitor extinguishing system should be installed in the following places where automatic water sprinkler system can not be used: public assembly places such as exhibit hall, stadium auditorium etc. with building area more than 3000m^2; Class C factory with building area more than 5000m^2.

8.5.8 Automatic fire extinguishing equipment should be installed in the smoke exhausting hood and the cooking place of the kitchen in the public food and drink serving place with service area more than 500m^2. Automatic emergency shutting off equipment shall be installed on combustible gas or oil supply pipes.

8.6 Fire water pool and fire pump room

8.6.1 A fire water pool shall be built if one of following requirements is met:

1 The municipal water supply, intake piping or natural water source can not meet the amount of water required by the outdoor and indoor fire fighting if the amount of water for production and everyday life reaches its maximum.

2 The municipal water supply piping is in branch form or there is only one intake pipe, and the sum of indoor and outdoor water flow required for fire fighting exceeds 25L/s.

8.6.2 The water pool for fire fighting shall meet the following requirements:

1 The valid volume of a fire water pool shall meet the water amount required by indoor fire fighting within the fire duration if the outdoor water supply piping can meet the amount of outdoor fire fighting. If the outdoor water supply piping can not meet the amount of outdoor fire fighting, the valid volume of a fire water pool shall meet the sum of the water amount required by indoor fire fighting and the shortage amount of outdoor fire fighting.

If continuous water supplement is ensured in case of fire, the volume of a fire pool may subtract the amount of water volume supplemented during the fire duration.

2 The water supplement amount shall be determined according to calculation and the water flow velocity should not be more than 2.5m/s.

3 Water supplement time for a fire water pool should not be more than 48h. It shall not be more than 96h for a drought area or an independent oil depot.

4 If the total volume of a fire water pool exceeds 500m^3, it shall be separated into two pools that can be used independently.

5 A fire water pool for fire fighting vehicle water supply shall have a water intake port. And the water suction height shall not exceed 6.0m. The distance between the water intake port spot and a building other than a pump room should not be less than 15m. It should not be less than 40m from the Class A, B or C liquid tank, 60m from the LPG tank, and 40m from the LPG tank protected by the heat-insulating equipment.

6 The protecting radius of a fire water pool for the fire fighting vehicle shall not be more than 150m.

7 There shall be technical facilities to ensure that fire water is not used for other purposes in a combined pool for water supply to fire fighting, production and everyday life.

8 In cold areas, there shall be measures to protect fire water pool from freezing.

8.6.3 The fire duration of different places shall meet the requirements of Table 8.6.3.

Table 8.6.3 The fire duration of different places (h)

Building	Places	Fire duration (h)
Class A, B and C liquid tank	Floating roof tank	4.0
	Underground and semi-underground fixed roof standing tank, earth covered tank	4.0
	Ground fixed roof standing tank with diameter not more than 20m	4.0
	Ground fixed roof standing tank with diameter more than 20m	6.0
LPG tank	Tank farm with total volume more than 220m^3, or single tank with volume more than 50m^3	6.0
	Tank farm with total volume not more than 220m^3, and single tank with volume not more than 50m^3	3.0
Combustible gas tank	Wet tank	3.0
	Dry tank	
	Fixed volume tank	

Table 8.6.3(continued)

Building	Places	Fire duration (h)
Combustible material stackyard	Coal, coke outdoor stackyard	3.0
	The other combustible material stackyards	6.0
Storage	Class A, B and C	3.0
	Class D and E	2.0
Factory building	Class A, B and C	3.0
	Class D and E	2.0
Civil building	Public building	2.0
	Residential building	
Fire extinguishing system	Automatic water sprinkler system	The corresponding requirements of current national standards shall be met
	Foam fire extinguishing system	
	Water curtain for fire separation	

8.6.4 The fire resistance class shall not be less than Class II for the independent fire pump building. The fire pump room in the building shall be separated with the other parts and shall meet the requirements of 7.2.5 in this code.

If the fire pump room is built on the first floor, the evacuation door should directly open to the outside. If the fire pump room is designed on the underground floor or the second or the upper floor, the evacuation door shall be adjacent to the exit. The door of the fire pump room shall be Class A fire door.

8.6.5 There shall be at least two pipes of the fire pump room linked with the loop fire piping of the building. If one of the pipe is shut off, the other pipes shall still be able to supply the required water amount.

Testing and inspecting meter and water release valve of DN65 shall be installed in water discharge pipes. Measures shall be taken to prevent pressure surplus.

8.6.6 There shall be at least two water sucking pipes for a group of fire pumps. If one of the pipes is shut off, the rest shall still be able to supply the fire pumps.

The fire pumps shall be started with automatic water sucking, and inspecting valve shall be installed on the sucking pipes.

8.6.7 If the fire pump sucks water directly from the circle municipal water supply piping, the fire pump water supply ability shall be calculated according to the lowest water pressure of the municipal water supply piping and shall be checked according to the highest water pressure of

the municipal water supply piping.

8.6.8 Spare fire pump shall be designed and its water supply ability shall not be less than the most powerful fire pump. If the outdoor fire fighting water amount of the factory, storage, stackyard and tank is not more than 25L/s or the indoor fire fighting water amount of the building is not more than 10L/s, the spare fire pump may not be installed.

8.6.9 The fire pump shall be started in 30s after the fire alarm.

The fire pump shall be linked with the drive machine directly.

9 Smoke control and smoke exhaust

9.1 General requirements

9.1.1 The smoke control of a building should be mechanical pressurization air supply or natural smoke exhaust through the outside window that can be opened.

The smoke exhaust of a building should be mechanical smoke exhaust or natural smoke exhaust through the outside window that can be opened.

9.1.2 Smoke control facility shall be installed in smoke proof staircase and its lobby, the lobby of fire fighting lift shaft or the lobby for combined use.

9.1.3 Smoke exhaust facility shall be installed in the following places:

1 A ground room with building area more than 300m^2 in Class C factory; the inner corridor with length more than 20m in Class C factory with occupants and combustible material more than normal or in high-rise factory with height more than 32m; Class D factory with building area of any floor more than 5000m^2;

2 The Class C storage with occupied building area more than 1000m^2;

3 The ground room in public buildings with the building area more than 300m^2, where there is more combustible material than normal condition or occupants constantly stay; the inner corridor with length more than 20m in public buildings;

4 Atrium;

5 The places used for singing, dancing, amusement and entertainment etc. which are on the first, second or third floor with building area more than 200m^2, or are on the fourth or upper floors or in underground or semi-underground building or basement.

6 Underground or semi-underground building or basement, semi-basement with total building area more than 200m^2 or the building area of a room more than 50m^2, where occupants constantly stay or there is more combustible material than normal condition.

7 The evacuation corridor in the other ground buildings with length more than 40m.

9.1.4 The mechanical smoke exhaust system should be separated from the ventilation, air condition system. If they are combined, reliable fire protection measures must be taken and they shall meet the requirements of mechanical smoke exhaust system.

9.1.5 The duct, opening, valve and so on of smoke control and exhaust system must be made of non-combustible material. Thermal insulation measures shall be taken for smoke exhaust duct or the duct shall keep a distance of not less than 150mm from the combustible members.

The thickness of smoke exhaust duct shall meet the requirements of the current national standard *Code of Acceptance for Construction Quality of Ventilation and Air Condition* GB 50243.

9.1.6 The air speed in mechanical pressurized air supply duct, smoke exhaust duct and fresh air supply duct shall meet the following requirements:

1 If metal duct is used, the air speed should not be more than 20m/s;

2 If non-metal duct is used, the air speed should not be more than 15m/s.

9.2 Natural smoke exhaust

9.2.1 Natural smoke exhaust facility should be installed in the following places:

1 The place where smoke exhaust facility shall be installed according to the requirements of 9.1.3 in this code and natural smoke exhaust is possible.

2 The place where smoke control facility shall be installed according to the requirements of 9.1.2 and natural smoke exhaust is possible except the high-rise factory (storage) with building height more than 50m.

9.2.2 If natural smoke exhaust facility is installed, the net area of the natural smoke exhaust opening shall meet the following requirements:

1 In the lobby of smoke proof staircase and the fire lift shaft, it shall not be less than 2.0m^2; in the lobby for combined use, it shall not be less than 3.0m^2;

2 If the smoke proof staircase is near the outside wall, the total area of window that can be opened and used for smoke exhaust every 5 stories shall not be less than 2.0m^2;

3 In arium, the stage of theater, it shall not be less than 5% of the floor area of the atrium and the stage of theater;

4 In the other places, it should not be less than 2%~5% of the building area.

9.2.3 The smoke control facility may not be installed in the smoke proof staircase if open balcony or outside corridor is used for smoke control in the smoke proof staircase lobby or combined lobby, or there are openings with different directions in the lobby or combined lobby, and the opening area meets the requirements of 9.2.2 in this code.

9.2.4 The window used for natural smoke exhaust should be installed on the outside wall or the roof of the room, and the equipment used for easy opening shall be installed. The horizontal distance between the farthest point in the smoke compartment and the natural smoke exhaust opening shall not be more than 30m.

9.3 Mechanical smoke control

9.3.1 The mechanical pressurized air supply smoke control facility shall be installed in the following places:

1 The smoke proof staircase that is not provide with natural smoke exhaust.

2 The lobby of fire lift shaft or combined lobby that is not provided with natural smoke exhaust.

3 The lobby of the smoke proof staircase that is not provided with natural smoke exhaust and the smoke proof staircase which is installed natural smoke exhaust facilities .

9.3.2 The air supply volume of the mechanical pressurized air supply smoke control system shall be determined according to calculation. If the result is different from the value given in Table 9.3.2, the bigger one shall be adopted.

Table 9.3.2 The minimum mechanical pressurized air supply volume

Condition and position		Pressurized air supply volume(m^3/h)
The smoke proof staircase with lobby without air supply		25000
The smoke proof staircase and its combined lobby are pressurized with air supply respectively	The smoke proof staircase	16000
	Combined lobby	13000
Lobby of fire lift shaft		15000
Natural smoke exhaust is used in smoke proof staircase and pressurized air supply is used in the lobby or combined lobby		22000

Note: The air supply volume in this table is calculated based on the double-leaf door with width × height =1.5m×2.1m. If single-leaf door is used, the air supply volume should be the product of 0.75 and the value given in this table. If there are two or more than two doors in the lobby, the air supply volume shall be the product of 1.50~1.75 and the value given in this table. When the door is opened, the velocity of the air passing through the door shall not be less than 0.70m/s.

9.3.3 The surplus pressure of the smoke proof staircase with mechanical pressurized air supply smoke control system shall not be less than 40～50Pa. For the lobby or combined lobby, the surplus pressure shall not be less than 25～30Pa.

9.3.4 The mechanical smoke control system with pressurized air supply for smoke proof staircase and combined lobby should be designed separately.

9.3.5 The lobby or combined lobby of smoke proof staircase shall be installed with one pressurized air supply opening in every floor. One pressurized air supply opening for smoke proof staircase should be installed every 2~3 floors.

9.3.6 The opening air velocity of mechanical smoke control system with pressurized air supply should not be more than 7m/s.

9.3.7 The other design requirements of mechanical smoke control system for high-rise factory building (storage) shall meet the requirements of the current national standard *Code for Fire Protection Design of High-rise Civil Buildings* GB 50045.

9.4 Mechanical smoke exhaust

9.4.1 If a place installed with smoke exhaust facility is not provided with natural smoke exhaust, mechanical smoke exhaust shall be used in the place.

9.4.2 Smoke compartment shall be designed in the place where mechanical smoke exhaust facility is needed and the net inner height of the room is not more than 6m. The building area of each smoke compartment should not be more than 500m^2. The smoke compartment shall be in the same fire compartment.

Smoke compartment should be separated with partition wall, structural beam and non-combustible ceiling assembly. The under ceiling height of beam and non-combustible ceiling assembly shall not be less than 500mm.

9.4.3 The design of mechanical smoke exhaust system shall meet the following requirements:

1 Horizontally, the system should be designed according to the fire compartment.

2 Vertically, if there are more than one fire compartment, the vertical smoke exhaust duct should be installed in the duct shaft.

3 Smoke exhaust fire damper shall be installed in the traversing point if the smoke exhaust duct has connected more than one fire compartment. The smoke exhaust fire damper shall meet the requirements of the current national standard *Test Method of Smoke Exhaust Fire Damper* GB 15931.

9.4.4 Fresh air supply system shall be installed if the mechanical smoke exhaust system is

installed in the underground building or the aboveground places without openings to the outside. The mechanical fresh air supply volume should not be less than 50% of the smoke exhaust volume.

9.4.5 The smoke exhaust volume of mechanical smoke exhaust system shall not be less than the value given in Table 9.4.5.

Table 9.4.5 The minimum smoke exhaust volume of mechanical smoke exhaust system

Condition and position		Smoke exhaust volume of a unit [$m^3/(h \cdot m^2)$]	Ventilating rate (time/h)	Remarks
Responsible for one smoke compartment		60	—	The smoke exhaust volume of a single-leaf shall not be less than 7200m^3/h.
The space where the net height of inner room is more than 6m and with no smoke compartment.				
Responsible for two or more than two smoke compartments		120	—	It shall be determined according to the maximum smoke compartment area.
Atrium	Volume not more than 17000m^3	—	6	If the volume is more than 17000m^3, the smoke exhaust volume shall not be less than 102000m^3/h.
	Volume more than 17000m^3	—	4	

9.4.6 The arrangement of the smoke exhaust opening, smoke exhaust damper and smoke exhaust fire damper of the mechanical smoke exhaust system shall meet the following requirements:

1 The design of smoke exhaust opening or smoke exhaust damper shall be based on the smoke compartment. The smoke exhaust opening or smoke exhaust damper shall be interlocked with the smoke exhaust fan. If any smoke exhaust opening or smoke exhaust damper starts up, the smoke exhaust fan shall run automatically.

2 If the smoke exhaust opening or smoke exhaust damper is closed in peacetime, manual and automatic equipment shall be installed to run it.

3 The smoke exhaust opening shall be located in the ceiling or in the part of wall near the ceiling. The minimum horizontal distance in the corridor direction between the smoke exhaust opening and the nearby exit edge shall not be less than 1.5m. If the smoke exhaust opening is in

the ceiling, the distance between the opening and the combustible building member or material shall not be less than 1.0m.

4 The smoke exhaust opening may be installed in the evacuation corridor if the mechanical smoke exhaust system is installed in the underground or semi-underground place except the places used for singing, dancing, amusement and entertainment etc. and the rooms with building area more than $50m^2$.

5 The distance between the farthest point in the smoke compartment and the smoke exhaust opening shall not be more than 30m. The smoke exhaust fire damper that can automatically shut off when the smoke temperature is more than 280℃shall be installed in the branch smoke exhaust duct.

6 The velocity of air in the smoke exhaust opening should not be more than 10m/s.

9.4.7 The outside air supply opening of mechanical smoke control system with pressurized air supply and fresh air supply for smoke exhaust system should be designed under the outside smoke exhaust opening. Vertically, the distance between the air supply opening and smoke exhaust opening should not be less than 3.0m. If the air supply opening and smoke exhaust opening are in the horizontal direction, the horizontal distance between them should not be less than 10m.

9.4.8 The design of smoke exhaust fan shall meet the following requirements:

1 The full pressure of smoke exhaust fan shall meet the requirement of the most disadvantageous circle of the smoke exhaust system. The smoke exhaust volume shall include 10%～20% of the air leakage.

2 The smoke exhaust fan may be an centrifugal fan or an axial fan specified for smoke exhaust.

3 The smoke exhaust fan shall be able to work continuously for at least 30min when the environmental temperature is at 280℃.

4 The smoke exhaust fire damper that can automatically shut off if the smoke temperature is more than 280℃ shall be installed at the entrance of the main duct to the smoke exhaust fan. The smoke exhaust fire damper shall be interlocked with the smoke exhaust fan. If the damper shuts off, the smoke exhaust fan shall be able to stop running.

9.4.9 If there is flexible joint in the smoke exhaust fan and system, the joint shall work continuously for at least 30min when the environmental temperature is at 280℃. The smoke exhaust fan and fresh air supply fan for smoke exhaust system should be installed in the ventilation room.

10 Heating, ventilating and air conditioning

10.1 General requirements

10.1.1 Fire protection safety measures shall be taken in ventilating and air conditioning system.

10.1.2 The air in Class A or B factory building shall not be reused.

If there is combustible or explosive hazard of dust, fiber in the air in Class C factory building, the air shall be purified to make the dust concentration less than 25% of its explosive limit before it is reused.

10.1.3 The air supply equipment and air exhaust equipment of Class A or B factory building shall not be designed in the same air ventilating room. The air exhaust equipment for Class A or B factory building shall not be designed in the same air ventilating room with air supply equipment and air exhaust equipment for the other occupants.

10.1.4 If the air contains flammable or explosive material in the rooms of civil building, the rooms shall be provided with good natural air ventilating facility or independent mechanical air ventilating facility and the air shall not be reused.

10.1.5 If the combustible gas is lighter than the air in the mixture that is to be exhausted, the horizontal air exhaust duct shall be installed up grade along the gas flowing direction.

10.1.6 The combustible gas pipe and Class A, B, or C liquid pipe shall not penetrate air ventilating room, air ventilating duct and shall not be installed adjacent to the outside of air ventilating duct.

10.2 Heating

10.2.1 The average temperature of the radiator surface in factory buildings where combustible dust and fiber are reeking shall not be more than 82.5℃. The average temperature of the radiator surface in coal transport passage shall not be more than 130℃.

10.2.2 Open flame and electric radiator must not be used for heating in Class A, B factory building or Class A, B storage.

10.2.3 The heating of the following factory buildings shall use the hot air without being reused:

1 Factory building where burning can occur when combustible gas, vapour, dust or fiber that is reeking in the factory meets the surface of heating duct or radiator.

2 Factory building where dust is reeking and can generate spontaneous combustible

or explosive gas when it reacts with water or vapour in air.

10.2.4 Heating pipe shall not penetrate in the room where burning and explosion can occur when gas, vapour or dust in the room meets the heating pipe unless non-combustible insulating material is used.

10.2.5 A distance shall be kept between the heating pipe and the combustible material. If the temperature is more than 100℃, the distance shall not be less than 100mm unless non-combustible insulating material is used. If the temperature is not more than 100℃, the distance shall not be more than 50mm.

10.2.6 The insulating material of the heating pipe and heating equipment in the building shall meet the following requirements:

1 Non-combustible material shall be used for Class A, B factory building or Class A, B storage.

2 Non-combustible material should be used and combustible material shall not be used for the other buildings.

10.3 Ventilating and air conditioning

10.3.1 The arrangement of duct for ventilating and air conditioning system should be in the same fire compartment horizontally and not over five stories vertically unless back-flow preventer or fire damper is installed in the duct. The vertical air duct shall be installed in shaft.

10.3.2 The air exhaust duct in the factory with explosive hazard must not be designed to penetrate the fire wall and the partition wall of the room with explosive hazard.

10.3.3 The air supply and exhaust duct should be designed according to each floor for Class A, B or C factory building. If fire damper is installed at the entrance where the horizontal or vertical air supply duct enters the workshop, the horizontal or vertical air supply ducts of each floor may use the same air supply system.

10.3.4 Explosion proof air ventilating equipment shall be used in the room where there is flammable or explosive material in the air. If an air supply fan is in a room that is separated independently and non-return damper is installed on the main air supply duct, ordinary air ventilating equipment may be used.

10.3.5 If there is combustible and explosive dust in the air, the air shall be disposed with dust catcher that can not produce spark before flowing into the air exhaust fan. If the dust can react with water and explode, wet dust catcher must not be used.

10.3.6 The design of dust catcher and air exhaust fan that process explosive dust shall meet the following requirements:

1 The said catcher and fan shall be separated from the other ordinary fans and dust catchers.

2 The catcher and fan should be grouped according to the type of dust.

10.3.7 Dry dust catcher and filter that process explosive dust should be installed in an independent room outside the factory building. The fire separation distance between the room and the factory building shall not be less than 10m.

The dry dust catcher and filter that meet one of the following requirements may be installed in a separated room in the factory building, and the fire resistance rating of partition wall and floor shall not be less than 3.00h and 1.50h respectively:

1 Equipment that can clear dust without stopping is installed.

2 For the dust catcher and filter that are cleared regularly, the air volume is not more than 15000m^3/h and the capacity of the dust container is not less than 60kg.

10.3.8 Pressure relieving equipment shall be installed in the dust catcher, filter and duct that process explosive dust and chipping.

The dry dust catcher and filter that process explosive dust shall be installed in the negative pressure part of the system.

10.3.9 The grounding devices transmitting static electricity shall be installed in air exhaust system that processes combustible or explosive gas, vapour and dust. The air exhaust equipment shall not be designed in underground and semi-underground building or basement and semi-basement.

10.3.10 Metallic duct shall be used for air exhaust duct that processes combustible or explosive gas, vapour and dust. The duct shall directly lead to the outside and shall not be hidden.

10.3.11 The distance between the combustible or difficult-combustible material and the duct that processes air or the other gases with temperature more than 80℃ or combustible chipping shall not be less than 150mm, unless non-combustible insulating material with thickness not less than 50mm is used. The duct with higher temperature shall on the cooler one if the ducts are arranged up-and-down.

10.3.12 Fire damper shall be installed in the duct of ventilating and air conditioning system if the duct meets one of the following conditions:

1 Penetrating the fire compartment separation.

2 Penetrating the partition wall and floor of the ventilating or air conditioning machine room.

3 Penetrating the partition wall and floor of the important or higher fire hazard room.

4 Penetrating both sides of the building gap that is located at the fire separation facility.

5 At the horizontal duct near the junction where the vertical duct meets the horizontal duct of each floor. If the ventilating or air conditioning system of each fire compartment is independent, fire damper may not be installed at the junction where the vertical duct meets the horizontal duct.

10.3.13 Back flow preventer or fire damper in the branch duct shall be installed in the vertical air exhaust duct in public bathroom, toilet and kitchen. The air exhaust duct of the public kitchen should be designed according to the fire compartment and fire damper with the action temperature of 150℃ shall be installed in the branch duct near the junction with the vertical air exhaust duct.

10.3.14 The design of fire damper shall meet the following requirements:

1 The action temperature shall be 70℃ unless otherwise specified in this code.

2 The fire damper should be near the fire separation facility.

3 If the fire damper is concealed, an opening for maintenance shall be designed in the installed place in case of inspection.

4 The duct and its thermal insulating material shall be non-combustible material on the two sides of damper within 2.0m.

5 The fire damper shall meet the requirements of the current national standard *Test Method of Fire Damper* GB 15930.

10.3.15 The duct of ventilating and air conditioning system shall be made of non-combustib le material except the following cases:

1 The duct that processes corrosive material and the flexible joint may be made of difficult-combustible material.

2 Difficult-combustible material with low burning toxicity and smoke density rate not more than 25 may be used, if the duct is designed according to the fire compartment and smoke exhaust fire damper is installed in the ventilating or air conditioning system in the building with large volume space such as stadium, exhibit hall, waiting rooms or hall for bus, ship or airplane etc. office building, and Class C, D or E factory building.

10.3.16 Non-combustible material should be used as the thermal insulating material of equipment and duct, the humidification material for humidifier and the noise elimination material and adhere material. If it is difficult to meet the above requirements, the

difficult-combustible material with low burning toxicity and smoke density rate not more than 50 may be used.

If electric heater is installed in the duct, the on-off of the heater shall be interlocked with the fan. Non-combustible material shall be used for the duct within the range of 0.8m of the heater and the duct that penetrates the room with fire resource that can burn easily.

10.3.17 The oil burning or gas burning boiler room shall be installed with good natural air ventilating or mechanical ventilating facility. The gas burning boiler room shall be installed with explosion proof emergency ventilating machine. If mechanical ventilating facility is used, the grounding devices that transmitting static electricity shall be connected with the facility, and the ventilating volume shall meet the following requirements:

1 The normal ventilating volume of oil burning boiler room should be based on the air changes not less than 3 times/h;

2 The normal ventilating volume of gas burning boiler room should be based on the air changes not less than 6 times/h;

3 The emergency ventilating volume of gas burning boiler room should be based on the air changes not less than 12 times/h.

11 Electric system

11.1 Fire protection power supply and distribution

11.1.1 The power supply of the electrical equipment used in the fire protection of buildings, storage tanks (tank farms) and stackyards shall meet the following requirements:

1 Except grain storages and the operating tower of the grain silo, the electricity used for fire protection of the Class B, C factory buildings and Class C storages with the height over 50m shall be supplied according to the requirement for Grade I electricity load;

2 The electricity used for the following buildings, storage tanks(tank farms) and stackyards shall be supplied according to the requirement for Grade II electricity load:

1) The factories, storages with outdoor fire water supply amount over 30L/s;

2) Combustible material stackyard, combustible gas storage tanks(tank farms) and Class A, B liquid storage tank farm with outdoor fire water supply amount over 35L/s;

3) Cinema, theatre with seats over 1500; stadium with seats over 3000; the following buildings with the building area of any floor over 3000m^2: shop, exhibition building, radio and TV tower, telecom building and finance building of provincial (municipal) level or over; and the other public buildings with outdoor fire water supply amount over 25L/s.

3 The electricity used for the building, tank (tank farm) and stackyard other than the buildings mentioned in Item 1 and 2 may be supplied according to the requirement for Grade III electricity load;

4 The grading of electricity load of fire protection power supply shall be in accordance with the related requirements of the current national standard *Code for Design of Electric Power Supply Systems* GB50052.

11.1.2 In the buildings with Grade I power supply, when standby electricity generation equipment is used as the back up power, the equipment shall be provided with manual and automatic activation device, and the automatic activation shall supply power within 30s.

11.1.3 The continuous power supply time of the back up power supply for emergency lights and evacuation indication sign shall not be less than 30min.

11.1.4 The power supply equipment for fire protection shall be supplied by a special wire loop. When electricity for production and daily life use is cut, the power supply for fire protection shall be secured. Its power distribution equipment shall be provided with distinct sign.

11.1.5 The electricity supply for the fire protection equipment in the fire protection control room, fire water pump room, smoke control and smoke removal fan room and fire lift shall be

provided with automatic switch device in the last distributing box at the end of its distribution line.

11.1.6 The distribution line of the equipment used for fire protection shall meet the needs of continuous power supply in case of fire; its layout shall be in accordance with the following requirements:

1 When concealed wiring is applied, the wire shall be put in a pipe and shall be concealed in a non-combustible structure with the thickness of the protection layer not less than 30mm. When the exposed wiring is applied (including the wiring within the ceiling), the wire shall be put in a metal pipe or an enclosed metal duct, and fire protection measures shall be taken.

2 When fire retardant or fire resistant cable is used and is wired in the cable well or cable duct, no fire protection measures are required.

3 When non-combustible cable of mineral insulation kind is used, it can be wired directly without any protection.

4 The wire should be wired separately from other distribution lines; when wired within the same well or duct, it should be wired separately at the two sides.

11.2 Power line and electrical equipment

11.2.1 The nearest horizontal distance between Class A factory building, Class A storage, combustible material stackyard, Class A, B liquid storage tank, LPG storage tank, combustible and combustion supporting gas storage tank and the overhead power wire shall not be less than 1.5 times of the height of electric pole (tower). The nearest horizontal distance between Class C liquid storage tank and the overhead power wire shall not be less than 1.2 times of the height of electric pole (tower).

The nearest horizontal distance between the overhead power wire over 35kV and the LPG storage tank (tank farm) with the volume of the single tank over 200m^3 or the total volume of the tanks over 1000m^3 shall not be less than 40m. When the tank is directly buried underground, the nearest horizontal distance between the overhead wire and the tank may be reduced by 50%.

11.2.2 Power cable shall not be put within the same pipeline with the pipe conveying Class A, B, C liquid, combustible gas pipe and the heating pipe.

The distribution line shall not penetrate the ventilation duct or be wired on the external wall of the ventilation duct. The distribution line within metal pipe can be put closely together with the external wall of the ventilation duct.

11.2.3 When the distribution line is wired in blind ceiling with combustible materials, it shall be fire protected with metal pipe or the like; when wired in the ceiling with combustible materials, it should be fire protected with metal pipe, enclosed metal duct or plastic pipe made of difficult-combustible material etc.

11.2.4 When the switch, electric socket and light fixture are near the combustible material, the fire protection measures related to thermal insulation, heat dissipation etc. shall be taken.

For tungsten-halogen lamp and the ceiling-mounted, built-in lamp with invandesent bulb and with rated power not less than 100W, the wire shall be thermal insulated with non-combustible materials like porcelain pipe and mineral wool.

Incandescent lamp, tungsten-halogen lamp, high pressure sodium lamp, metal halide lamp, fluorescent high pressure mercury lamp (including current induction ballast) etc. with rated power over 60W shall not be installed directly onto the combustible finishing materials or combustible elements.

11.2.5 Storage with combustible materials should be provided with low temperature lighting fixtures. Fire protection measures shall be taken to protect their heat generation parts; high temperature lighting fixtures, such as tungsten-halogen lamp etc. shall not be provided.

Distribution box and switches should be installed outside the storage.

11.2.6 The power equipment in explosion and fire environment shall be designed according to the related requirements of the current national standard *Code for Design of Electrical Facilities in Explosion and Fire Environment* GB 50058.

11.2.7 Electrical fire monitoring system for residual current should be provided in the following places:

1 Class B, C factory building and Class C storage with building height over 50m and provided with Grade I power supply;

2 Factory building (storage) with outdoor fire water supply over 30L/s and provided with Grade II power supply;

3 Theater, cinema, shop, exhibition center, radio and TV building, telecom building, finance and trade building as well as the other public buildings with outdoor fire water supply over 25L/s provided with Grade II power supply;

4 The important ancient brick-timber and timber structure buildings that belong to cultural relics of national level;

5 Electrical equipment for fire protection provided with Grade I, II power supply.

11.3 Emergency lighting and evacuation indicating sign

11.3.1 The following portions of the civil building (other than residential building), factory building and Class C storage shall be provided with emergency lighting fixtures:

1 Enclosed staircase, smoke proof staircase and its lobby, the lobby or combined lobby of fire lift shaft;

2 Fire control room, fire pump room, standby electric generator room, electricity distribution room, smoke control and exhaust fan room as well as the other rooms that must be in normal operation in case of fire;

3 Exhibition hall , business hall, multi-functional hall, dinning hall with building area over 400m^2, studio with building area over 200m^2, and auditorium;

4 The common activity space with building area over 300m^2 of the underground, semi-underground building or basement and semi-basement;

5 The exit passageway of public building.

11.3.2 The illuminance of the emergency lighting fixtures in building shall meet the following requirements:

1 The minimum horizontal illuminance at the floor level of the exit passageway shall not be less than 0.5lx;

2 The minimum horizontal illuminance at the floor level of public assembly building shall not be less than 1.0lx;

3 The minimum horizontal illuminance at the floor level of staircase shall not be less than 5.0lx;

4 The emergency lighting fixtures installed in fire control room, fire pump room, standby electric generator room, electricity distribution room, smoke control and exhaust fan room as well as the other rooms that must be in normal operation in case of fire shall keep its normal illuminance.

11.3.3 The emergency lighting fixtures should be installed at the upper part of the wall, ceiling or the top of the exit.

11.3.4 Light evacuation indicating sign shall be installed along the exit passageway of public building, high-rise factory building (storage) and Class A, B, C factory building and shall be installed at the place right over the exit and the evacuation door of the public assembly places. It also shall meet the following requirements:

1 "EXIT" shall be installed at the place right over the exit and evacuation door as the indicating sign;

2 The evacuation indicating sign along the exit passageway shall be installed on the wall surface along the exit passageway and the corner where its distance to the floor shall be less than 1.0m, and the spacing of the indicating signs shall not be over 20m. For pocket-shaped passageway, the spacing shall not be over 10m. At the corner of the passageway, the spacing shall not be over 1.0m; the indicating signs shall meet the related requirements of the current national standard *Fire Safety Sign* GB 13495.

11.3.5 Light and luminated indicating sign that can provide continuous lumination shall be provided on the floor of the exit passageway and the main evacuation route of the following buildings and places:

1 Exhibition building with total building area over 8000m^2;

2 Aboveground shops with total building area over 5000m^2;

3 Underground, semi-underground shops with total building area over 500m^2;

4 Places used for singing, dancing, amusement and entertainment etc.;

5 Cinema and theater with over 1500 seats; stadium, conference hall and

auditorium with over 3000 seats.

11.3.6 The evacuation indicating sign and emergency lighting fixtures installed in buildings shall meet the requirements of the current national standard *Fire Safety Sign* GB 13495 and *Emergency Lighting Fixtures for Fire Protection* GB 17945 in addition to what is required in this code.

11.4 Automatic fire alarm system and fire control room

11.4.1 Automatic fire alarm system shall be installed in the following places:

1 Large and medium computer room and its control room; record reservation room; room for machinery, instrument and apparatus, storage for valuables which are extraordinarily expensive and of great fire hazard; room provided with gas fire extinguishing system.

2 Storage for cotton, wool, silk, hemp or chemical fiber or its products with occupied building area over 1000m^2. Cigarette storage building with occupied building area over 500m^2 or total building area over 1000m^2.

3 Factory building for shoes, clothes, toys etc. with building area over 1500m^2 for any story or with total building area over 3000m^2.

4 Shop, exhibition building, finance and trade building, passenger and freight transport station etc. with building area over 3000m^2 for any story or with total building area over 6000m^2.

5 Treasure room for books and cultural relics, library with more than 1 million books, important archives.

6 Radio and TV station building, post-office, telecom building at provincial level or above, municipal or local commanding and dispatching building for electricity, transportation and disaster prevention and rescue.

7 Top grade and first class theater or the other theaters, cinemas with more than 1500 seats, conference hall or auditorium with more than 2000 seats, stadium with more than 3000 seats.

8 Building for aged people; hotel, inpatient building in sanitarium and activity room for children with building area over 1500m^2 for any story or total building area over 3000m^2; outpatient service building, building for inpatients and operation section of the hospital with not less than 200 beds.

9 Underground, semi-underground shops with building area over 500m^2.

10 Places used for singing, dancing, amusement and entertainment located in underground or semi-underground buildings or on the fourth and higher floors.

11 Mechanical mezzanine with lots of combustibles and with its net height over 2.6m; space inside the blind or dropped ceiling with combustibles and with its net height over 0.8m.

11.4.2 Combustible gas alarm shall be provided in portion (or portions) of building where there may exist combustible gas or vapor.

11.4.3 Buildings provided with automatic fire alarm system and fire extinguishing system or automatic fire alarm system and mechanical smoke control (exhaust) system shall be equipped with fire control room.

11.4.4 The fire control room shall meet the following requirements:

1 The fire resistance class of independent fire control room shall not be less than Class II;

2 The fire control room within a building should be located near the exterior wall of the first floor, or the first floor of its underground part. However, it shall be separated from the other portions of the building according to what is required in 7.2.5 of this code and shall be provided with exit directly leading to the outside of the building.

3 No electrical circuit and tube that has no relation to the fire control room shall be permitted to penetrate the fire control room.

4 It shall not be located near places with strong electromagnetic or near equipment room which may hinder the normal operation of the facilities in the fire control room.

11.4.5 The design of the automatic fire alarm system shall be in accordance with the requirements in the current national standard *Code for Design of Automatic Fire Alarm System* GB 50116.

12 City traffic tunnel

12.1 General requirements

12.1.1 The design of fire protection for city traffic tunnel (hereinafter for short as tunnel) shall be based on the combination of the factors such as the traffic constitution, the use of the tunnel, the natural conditions, the length of the tunnel and so on.

12.1.2 The single-hole tunnel or two-hole tunnel shall be classified into four classes (Class A, B, C, D) according to the length and traffic conditions of the tunnel. The requirements in Table 12.1.2 shall be met.

Table 12.1.2 Classification of tunnel

Occupancy	The length of the enclosed part of the tunnel L(m)			
	Class A	Class B	Class C	Class D
Vehicles such as hazardous chemistry cargo vehicle can pass through	$L>1500$	$500<L\leqslant1500$	$L\leqslant500$	—
Only vehicles that do not carry hazardous chemistry cargo can pass through	$L>3000$	$1500<L\leqslant3000$	$500<L\leqslant1500$	$L\leqslant500$
For pedestrians or non-motor vehicles	—	—	$L>1500$	$L\leqslant1500$

12.1.3 The fire resistance rating of bearing structure in Class A tunnel shall not be less than 2.00h. For Class B tunnel it shall not be less than 1.50h and for Class C tunnel it shall not be less than 2.00h. There are no special requirements for the fire resistance rating of bearing structure in Class D tunnel.

The tunnel underwater shall be provided with heat impact and high temperature proof material on its top. The fire resistance rating shall meet the requirements according to the class of the tunnel.

Note : 1 The fire resistance rating of bearing structure in Class A or B tunnel shall be determined by the test using RABT standard temperature curve. The bearing structure of Class C tunnel that motor vehicles can pass through shall be tested by using HC standard temperature curve. And

the requirements in Appendix A shall be met.

2 The fire resistance rating of bearing structure in Class D tunnel that motor vehicles can pass through and Class C tunnel that pedestrians and non-motor vehicles can pass through shall be determined by the test using standard temperature curve.

12.1.4 The interior finishing of tunnel except the filleting material shall be non-combusti ble

12.1.5 The cross passageway or evacuation passageway for motor vehicle of the Class A, B, and C two-hole tunnel shall meet the following requirements:

1 Cross passageway or evacuation passageway for vehicle should be designed in underwater tunnel. The cross passageway for vehicle or the entrance to the evacuation passageway for vehicle should be at intervals of 500~1500m.

2 Cross passageway or evacuation passageway for vehicle should be designed in non-underwater tunnel. The cross passageway for vehicle or the entrance to the evacuation passageway for vehicle should be at intervals of 200~500m.

3 The cross passageway for vehicle shall be designed upright to the tunnel along the length direction and connected to the adjacent tunnel. The evacuation passageway for vehicle shall be along the tunnel and between the two holes and shall lead to the outside of the tunnel.

4 The net width of the cross passageway and evacuation passageway for vehicle shall not be less than 4.0m and the net height shall not be less than 4.5m.

5 Fire separation measures shall be taken at the junction of the tunnel and the cross passageway or evacuation passageway for vehicle.

12.1.6 The cross passageway or evacuation passageway for pedestrian of the Class A, B, and C two-hole tunnel shall meet the following requirements:

1 Cross passageway or evacuation passageway for pedestrian shall be designed in tunnel. The cross passageway for pedestrian or the entrance to the evacuation passageway for pedestrian should be at intervals of 250~300m.

2 The cross passageway for pedestrian shall be designed upright to the tunnel along the length direction and connected to the adjacent hole. The evacuation passageway for pedestrian shall be along the tunnel and between the two holes and shall lead to the outside of the tunnel.

3 The cross passageway for vehicle may be used for pedestrian in the two-hole tunnel.

4 The net width of the cross passageway and evacuation passageway for pedestrian shall not be less than 2.0m and the net height shall not be less than 2.2m.

5 Fire separation measures shall be taken at the junction of the tunnel and the cross passageway or evacuation passageway for pedestrian.

12.1.7 Facilities such as independent shelter or evacuation door leading directly to the outside for pedestrian shall be designed according to the circumstances in the following tunnels: Class A, B or C single hole tunnel with longitudinal ventilation; Class A or B underwater tunnel.

12.1.8 Fire separation measures shall be taken between the tunnel for vehicle and the transformer room, pipe corridor, passageway for evacuation, ventilation room or the other assistant rooms in the tunnel.

12.2 Fire fighting water supply and fire extinguishing equipment

12.2.1 Fire fighting water supply system shall be designed at the same time when the city traffic tunnel is planned and designed. Fire fighting water supply system may not be designed for Class C tunnel for pedestrian and non-motor vehicle and Class D tunnel.

12.2.2 The design of the fire fighting water supply system shall meet the following requirements:

1 The fire fighting water resource shall meet the requirements of 8.1.2 in this code. The water supply piping shall meet the requirements of 8.2.7 in this code.

2 The fire fighting water quantity shall be calculated according to the time of the fire duration and the only one fire accident in the tunnel at the same time. The fire duration for Class B tunnel shall not be less than 3.0h and for Class C tunnel shall not be less than 2.0h.

3 Independent fire fighting water supply system should be installed in tunnel. Measures shall be taken to prevent fire fighting water supply pipe and outdoor fire hydrant from freezing in the cold area. If dry piping is used, automatic valve for exhausting air shall be installed on the highest part of the piping and the time for water to fill the dry piping shall not be more than 90s.

4 The fire fighting water supply amount for fire hydrant in tunnel shall not be less than

20L/s and for the fire hydrant at the entrance of the tunnel shall not be less than 30L/s. For Class C tunnel, if the length of the tunnel is less than 1000m, the fire fighting water supply amount for fire hydrant in the tunnel and outside the entrance of the tunnel can be 10L/s and 20L/s respectively.

5 The water pressure in the piping shall be high enough to ensure that a fire fighting water branch at the most disadvantageous place must have a full water spout not less than 10.0m when the water consuming is at its maximum. Decompression facilities shall be used if the water pressure of the fire hydrant mouth is more than 0.5Mpa.

6 Outdoor fire hydrant and fire department connection shall be designed at the entrance of the tunnel.

7 The fire hydrants shall be at intervals of not more than 50m. The height of the fire hydrant mouth from the ground should be 1.1m.

8 If water supply facility with fire pump is installed in the tunnel, the button to run the pump shall be designed in the fire hydrant box.

9 Indoor fire hydrant shall be installed on one side of the tunnel. The fire hydrant box shall be provided with one fire fighting water branch with nozzle of 19mm in diameter, one 25-meter-long hose with 65mm in diameter, and fire hose reel should be attached.

12.2.3 Drainage facility shall be designed in tunnels except Class D tunnel. The water from seeping, raining, washing the tunnel and the fire fighting water shall be considered when designing the drainage facility. Measures shall be taken to prevent the combustible or hazardous liquid of the incident from flooding along the tunnel.

12.2.4 Fire extinguisher shall be designed according to the following requirements:

1 Class B tunnel shall be equipped with fire extinguisher suitable for Class A, B and C fire on both sides. Every point shall be equipped with at least four fire extinguishers.

2 Class D tunnel for motor vehicle and Class C tunnel for pedestrian and non-motor vehicle shall be equipped with fire extinguisher suitable for Class A, B and C fire on one side. Every point shall be equipped with at least two fire extinguishers.

3 The points where fire extinguishers are settled shall be at intervals of not more than 100m.

12.3 Ventilating and smoke exhaust system

12.3.1 Mechanical smoke exhaust system shall be installed in Class A, B or C tunnel for motor vehicle. Natural smoke exhaust may be designed for Class D tunnel for motor vehicle.

12.3.2 The mechanical smoke exhaust system may be combined with the ventilating system of the tunnel. The ventilating system of the tunnel shall meet the requirements of the mechanical smoke exhaust system and the following requirements:

1 If full transverse or semi-transverse ventilation is used, the ventilating exhaust duct may be used as smoke exhaust duct. If longitudinal ventilation is used, it shall be able to organize the air current rapidly and exhaust the smoke effectively.

2 If longitudinal ventilation is used in the tunnel, the velocity of the smoke exhaust shall be determined according to the most disadvantageous fire size.

3 The smoke exhaust fan must be able to work continuously for at least 1.0h under the circumstance of a temperature of 250℃. The fire resistance rating of the smoke exhaust duct shall not be less than 1.00h.

12.3.3 Independent mechanical pressurized air supply system shall be designed in the fire shelter facility of the tunnel. The surplus pressure of air supply shall be 30~50Pa.

12.4 Automatic fire alarm system

12.4.1 Alarm facility that can send alarm signals prohibiting the vehicle from entering the tunnel after a fire incident occurs in the tunnel shall be installed on the point with a distance of 100~150m from the entrance of the tunnel.

12.4.2 Automatic fire alarm system shall be installed in Class A or B tunnel for motor vehicle and shall meet the following requirements:

1 Automatic fire detective equipment shall be installed.

2 Alarm phone and button shall be installed at the entrance of the tunnel and at intervals of 100~150m in the tunnel.

3 If the closed length of the tunnel is more than 1000m, fire commanding center shall be designed.

4 Fire emergency broadcasting shall be designed. If not, luminescence alarm equipment

shall be installed in the tunnel at intervals of 100~150m.

12.4.3 Automatic fire alarm system should be installed in Class C tunnel for motor vehicle.

12.4.4 Automatic fire alarm equipment shall be installed in the cable channel and the main facility room of the tunnel.

12.4.5 If communication is shielded in the tunnel, measures shall be taken to keep communication smooth in case of fire, and wireless communication facility should be installed.

12.4.6 The design of the automatic fire alarm system in the tunnel shall meet the requirements of the current national standard *Code for Design of Automatic Fire Alarm System* GB 50116.

12.5 Power supply and the other requirements

12.5.1 The fire fighting power supply shall be Grade I electricity load for Class A or B tunnel. The fire fighting power supply shall be Grade II electricity load for Class C tunnel.

12.5.2 The design of fire fighting power supply resource, the supply and distribution wire etc. shall meet the requirements of Chapter 11 in this code.

12.5.3 The fire emergency light and evacuation indicating sign shall be installed on both sides of the tunnel and their height should not be more than 1.5m. The power supply time for the fire emergency head lamp and evacuation indicating sign of Class A or B tunnel shall not be less than 3.0h continuously and for Class C tunnel shall not be less than 1.5h. For the other restrictions, the related requirements in Chapter 11 of this code shall be met.

12.5.4 High voltage wire cable and combustible gas pipe must not be designed in the tunnel. Cable trough and the other pipes shall be buried separately.

12.5.5 The fire fighting facilities of all kinds installed in the tunnel shall be provided with the protection measures suitable to the circumstance of the tunnel. Distinct luminescence fire indicating sign shall be installed.

Appendix A The temperature curve of test for fire resistance rating and standard determinant value of bearing structure in tunnel

A.0.1 RABT standard temperature curve (See Fig.A.0.1).

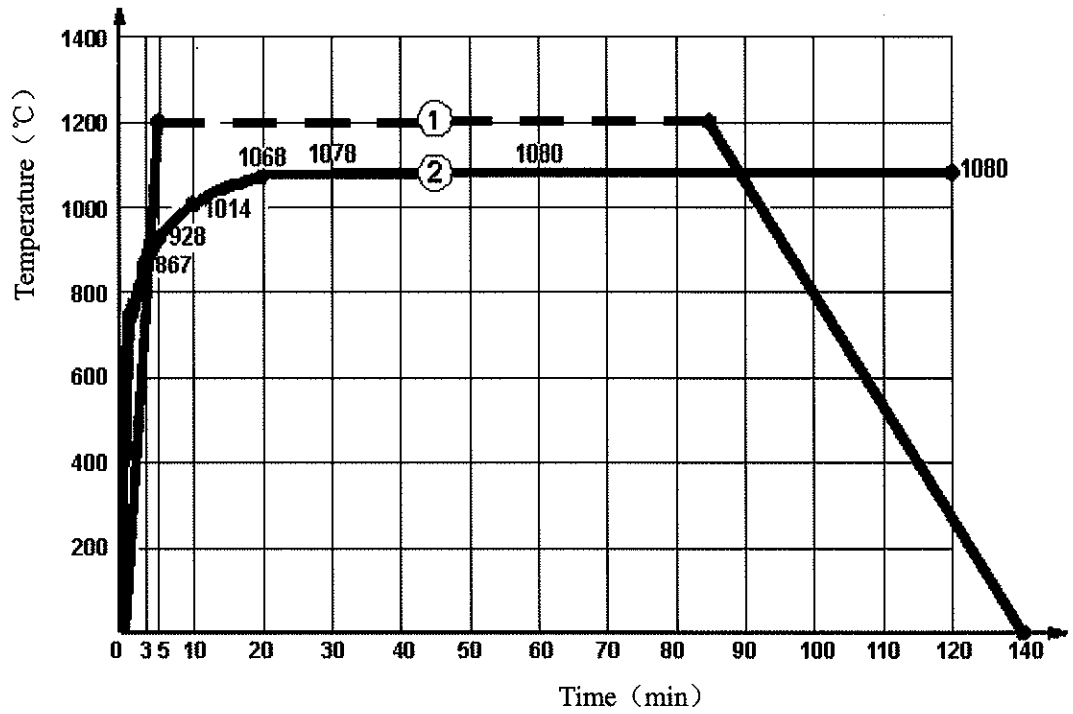

Fig.A.0.1 RABT standard temperature curve

①—RABT curve ②—Hydrocarbon curve

A.0.2 HC standard temperature curve (See Table A.0.2).

Table A.0.2 Table of Hydrocarbon temperature curve

Time (min)	3	5	10	30
Temperature in the furnace (℃)	887	948	982	1110
Time (min)	60	90	120	After 120
Temperature in the furnace (℃)	1150	1150	1150	1150

A.0.3 Fire resistance rating regulation for determination

1 If HC standard temperature curve is used in test, the fire resistance rating shall be determined according to the following conditions: the temperature of reinforcing steel bar that is

25 mm from the surface of the concrete is more than 250℃ or the surface temperature of the concrete is more than 380℃.

2 If RABT standard temperature curve is used in test, the fire resistance rating shall be determined according to the following conditions: the temperature of reinforcing steel bar that is 25mm from the surface of the concrete is more than 300℃ or the surface temperature of the concrete is more than 380℃.

Explanation of wording in this code

1. Words used for expressing different degrees of strictness are explained as follows in order to mark the difference in executing the requirements in this code.

1) Words denoting a very strict or mandatory requirement:

"must" is used for affirmation;

"must not" is used for negation.

2) Words denoting a strict requirement under normal conditions:

"shall" is used for affirmation;

"shall not" is used for negation.

3) Words denoting a permission of slight choice or an indication of the most suitable choice when conditions allow:

"should", "may" or "can" is used for affirmation;

"should not" is used for negation.

Expressing choice is permitted, if condition is allowed it is a choice using the word "may".

2. "shall comply with..." or "shall meet the requirements of..." is used in this code to indicate that it is necessary to implement other relative standards and stipulations.

中华人民共和国国家标准

建筑设计防火规范

Code of design on building fire protection and prevention

GB 50016 - 2006

主编部门：中华人民共和国公安部
批准部门：中华人民共和国建设部
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中华人民共和国建设部公告

第 450 号

建设部关于发布国家标准《建筑设计防火规范》的公告

现批准《建筑设计防火规范》为国家标准，编号为 GB 50016—2006，自 2006 年 12 月 1 日起实施。其中，第 3.1.2、3.2.1、3.2.2、3.2.7、3.2.8、3.3.1、3.3.2、3.3.7、3.3.8、3.3.10、3.3.11、3.3.13、3.3.14、3.3.15、3.3.16、3.3.18、3.4.1、3.4.2、3.4.3、3.4.4、3.4.9、3.4.11、3.5.1、3.5.2、3.6.2、3.6.6、3.6.8、3.6.10、3.6.11、3.7.1、3.7.2、3.7.3、3.7.4、3.7.5、3.7.6、3.8.1、3.8.2、3.8.3、3.8.7、4.1.2、4.1.3、4.1.4、4.2.1、4.2.2、4.2.3、4.2.5、4.3.1、4.3.2、4.3.3、4.3.5、4.3.6、4.4.1、4.4.2、4.4.3、4.4.4、4.4.5、4.4.6、5.1.1、5.1.2、5.1.3、5.1.6、5.1.7、5.1.8、5.1.9、5.1.10、5.1.11、5.1.12、5.1.13、5.1.15、5.2.1、5.3.1、5.3.2、5.3.3、5.3.4、5.3.5、5.3.6、5.3.8、5.3.9、5.3.11、5.3.12、5.3.13、5.3.14、5.3.16、5.3.17、5.4.2、5.4.3、5.4.4、5.4.5、5.4.6、6.0.1、6.0.4、6.0.6、6.0.7（3、4）、6.0.8、6.0.9、6.0.10、7.1.1、7.1.2、7.1.3、7.1.5、7.1.6、7.2.1、7.2.2、7.2.3、7.2.4、7.2.5、7.2.7、7.2.9、7.2.10、7.2.11、7.3.5、7.4.1（1、4、5、6）、7.4.2（1、2、3、4）、7.4.3、7.4.4、7.4.10、7.4.12、7.5.2、7.5.3、7.6.2、8.1.2、8.1.3、8.2.1、8.2.2、8.2.3、8.2.4、8.2.5、8.2.6、8.3.1、8.4.1、8.5.1、8.5.3、8.5.4、8.5.5、8.5.6、8.6.1、8.6.2、8.6.3、8.6.4、8.6.5、8.6.9、9.1.2、9.1.3、9.1.5、9.2.2（1、2、3）、9.3.1、9.3.3、9.4.1、9.4.3（3）、9.4.5、10.1.2、10.1.3、10.1.4、10.2.2、10.2.3、10.3.2、10.3.5、10.3.6（1）、10.3.8、10.3.9、10.3.10、10.3.12、10.3.17、11.1.1（1、2）、11.1.3、11.1.4、11.1.6（1）、11.2.1、11.2.4、11.3.1、11.3.2、11.3.4、11.3.5、11.4.1、11.4.2、11.4.4 条（款）为强制性条文，必须严格执行。原《建筑设计防火规范》GBJ 16—87 同时废止。

本规范由建设部标准定额研究所组织中国计划出版社出版发行。

中华人民共和国建设部

二〇〇六年七月十二日

前　言

根据建设部建标[1998]94号《关于印发"一九九八年工程建设国家标准制订、修订计划(第一批)"的通知》的要求，本规范由公安部天津消防研究所会同天津市建筑设计院、北京市建筑设计研究院、清华大学建筑设计研究院、中国中元兴华工程公司、上海市公安消防总队、四川省公安消防总队、辽宁省公安消防总队、公安部四川消防研究所、建设部建筑设计研究院、中国市政工程华北设计研究院、东北电力设计院、中国轻工业北京设计院、中国寰球化学工程公司、上海隧道工程轨道交通设计研究院等单位共同修订。

本规范的修订，遵照国家有关基本建设的方针和"预防为主、防消结合"的消防工作方针，在总结我国建筑防火和消防科学技术研究成果、建筑设计和建筑火灾经验教训的基础上，广泛征求了有关科研、设计、生产、消防监督、高等院校等部门和单位的意见，同时研究和消化吸收了国外有关规范标准，最后经有关部门共同审查定稿。

本规范共分12章，其主要内容有：总则，术语，厂房(仓库)，甲、乙、丙类液体、气体储罐(区)与可燃材料堆场，民用建筑，消防车道，建筑构造，消防给水和灭火设施，防烟与排烟，采暖、通风和空气调节，电气，城市交通隧道等。

本规范中以黑体字标志的条文为强制性条文，必须严格执行。

本规范由建设部负责管理和对强制性条文的解释，公安部负责日常管理，公安部天津消防研究所负责具体技术内容的解释。

鉴于本规范是一项综合性的防火技术标准，政策性和技术性强，涉及面广，希望各单位在执行过程中，结合工程实践和科学研究，认真总结经验，注意积累资料，如发现需要修改和补充之处，请将意见和资料径寄公安部天津消防研究所(地址：天津市卫津南路110号，邮政编码：300381)，以便今后修订时参考。

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东北电力设计院
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1 总　　则

1.0.1 为了防止和减少建筑火灾危害，保护人身和财产安全，制定本规范。

1.0.2 本规范适用于下列新建、扩建和改建的建筑：

1 9层及9层以下的居住建筑(包括设置商业服务网点的居住建筑)；

2 建筑高度小于等于24m的公共建筑；

3 建筑高度大于24m的单层公共建筑；

4 地下、半地下建筑(包括建筑附属的地下室、半地下室)；

5 厂房；

6 仓库；

7 甲、乙、丙类液体储罐(区)；

8 可燃、助燃气体储罐(区)；

9 可燃材料堆场；

10 城市交通隧道。

注：1 建筑高度的计算：当为坡屋面时，应为建筑物室外设计地面到其檐口的高度；当为平屋面(包括有女儿墙的平屋面)时，应为建筑物室外设计地面到其屋面面层的高度；当同一座建筑物有多种屋面形式时，建筑高度应按上述方法分别计算后取其中最大值。局部突出屋顶的瞭望塔、冷却塔、水箱间、微波天线间或设施、电梯机房、排风和排烟机房以及楼梯出口小间等，可不计入建筑高度内。

2 建筑层数的计算：建筑的地下室、半地下室的顶板面高出室外设计地面的高度小于等于1.5m者，建筑底部设置的高度不超过2.2m的自行车库、储藏室、敞开空间，以及建筑屋顶上突出的局部设备用房、出屋面的楼梯间等，可不计入建筑层数内。住宅顶部为2层一套的跃层，可按1层计，其他部位的跃层以及顶部多于2层一套的跃层，应计入层数。

1.0.3 本规范不适用于炸药厂房(仓库)、花炮厂房(仓库)的建筑防火设计。

人民防空工程、石油和天然气工程、石油化工企业、火力发电厂与变电站等的建筑防火设计，当有专门的国家现行标准时，宜从其规定。

1.0.4 建筑防火设计应遵循国家的有关方针政策，从全局出发，统筹兼顾，做到安全适用、技术先进、经济合理。

1.0.5 建筑防火设计除应符合本规范的规定外，尚应符合国家现行有关标准的规定。

2 术　　语

2.0.1 耐火极限　fire resistance rating

在标准耐火试验条件下，建筑构件、配件或结构从受到火的作用时起，到失去稳定性、完整性或隔热性时止的这段时间，用小时表示。

2.0.2 不燃烧体　non-combustible component

用不燃材料做成的建筑构件。

2.0.3 难燃烧体　difficult-combustible component

用难燃材料做成的建筑构件或用可燃材料做成而用不燃材料做保护层的建筑构件。

2.0.4 燃烧体　combustible component

用可燃材料做成的建筑构件。

2.0.5 闪点　flash point

在规定的试验条件下，液体挥发的蒸气与空气形成的混合物，遇火源能够闪燃的液体最低温度(采用闭杯法测定)。

2.0.6 爆炸下限　lower explosion limit

可燃的蒸气、气体或粉尘与空气组成的混合物，遇火源即能发生爆炸的最低浓度(可燃蒸气、气体的浓度，按体积比计算)。

2.0.7 沸溢性油品　boiling spill oil

含水并在燃烧时可产生热波作用的油品，如原油、渣油、重油等。

2.0.8 半地下室　semi-basement

房间地面低于室外设计地面的平均高度大于该房间平均净高1/3，且小于等于1/2者。

2.0.9 地下室　basement

房间地面低于室外设计地面的平均高度大于该房间平均净高1/2者。

2.0.10 多层厂房(仓库)　multi-storied industrial building

2层及2层以上，且建筑高度不超过24m的厂房(仓库)。

2.0.11 高层厂房(仓库)　high-rise industrial building

2层及2层以上，且建筑高度超过24m的厂房(仓库)。

2.0.12 高架仓库　high rack storage

货架高度超过7m且机械化操作或自动化控制的货架仓库。

2.0.13 重要公共建筑　important public building

人员密集、发生火灾后伤亡大、损失大、影响大的公共建筑。

2.0.14 商业服务网点　commercial service facilities

居住建筑的首层或首层及二层设置的百货店、副食店、粮店、邮政所、储蓄所、理发店等小型营业性用房。该用房建筑面积不超过300m^2，采用耐火极限不低于1.50h的楼板和耐火极限不低于2.00h且无门窗洞口的隔墙与居住部分及其他用房完全分隔，其安全出口、疏散楼梯与居住部分的安全出口、疏散楼梯分别独立设置。

2.0.15 明火地点 open flame site

室内外有外露火焰或赤热表面的固定地点(民用建筑内的灶具、电磁炉等除外)。

2.0.16 散发火花地点 sparking site

有飞火的烟囱或室外的砂轮、电焊、气焊(割)等固定地点。

2.0.17 安全出口 safety exit

供人员安全疏散用的楼梯间、室外楼梯的出入口或直通室内外安全区域的出口。

2.0.18 封闭楼梯间 enclosed staircase

用建筑构配件分隔,能防止烟和热气进入的楼梯间。

2.0.19 防烟楼梯间 smoke -proof staircase

在楼梯间入口处设有防烟前室,或设有专供排烟用的阳台、凹廊等,且通向前室和楼梯间的门均为乙级防火门的楼梯间。

2.0.20 防火分区 fire compartment

在建筑内部采用防火墙、耐火楼板及其他防火分隔设施分隔而成,能在一定时间内防止火灾向同一建筑的其余部分蔓延的局部空间。

2.0.21 防火间距 fire separation distance

防止着火建筑的辐射热在一定时间内引燃相邻建筑,且便于消防扑救的间隔距离。

2.0.22 防烟分区 smoke bay

在建筑内部屋顶或顶板、吊顶下采用具有挡烟功能的构配件进行分隔所形成的,具有一定蓄烟能力的空间。

2.0.23 充实水柱 full water spout

由水枪喷嘴起到射流90%的水柱水量穿过直径380mm圆孔处的一段射流长度。

3 厂房(仓库)

3.1 火灾危险性分类

3.1.1 生产的火灾危险性应根据生产中使用或产生的物质性质及其数量等因素,分为甲、乙、丙、丁、戊类,并应符合表 3.1.1 的规定。

表 3.1.1 生产的火灾危险性分类

生产类别	使用或产生下列物质生产的火灾危险性特征
甲	1. 闪点小于 28℃的液体; 2. 爆炸下限小于 10%的气体; 3. 常温下能自行分解或在空气中氧化能导致迅速自燃或爆炸的物质; 4. 常温下受到水或空气中水蒸气的作用,能产生可燃气体并引起燃烧或爆炸的物质; 5. 遇酸、受热、撞击、摩擦、催化以及遇有机物或硫磺等易燃的无机物,极易引起燃烧或爆炸的强氧化剂; 6. 受撞击、摩擦或与氧化剂、有机物接触时能引起燃烧或爆炸的物质; 7. 在密闭设备内操作温度大于等于物质本身自燃点的生产
乙	1. 闪点大于等于 28℃,但小于 60℃的液体; 2. 爆炸下限大于等于 10%的气体; 3. 不属于甲类的氧化剂; 4. 不属于甲类的化学易燃危险固体; 5. 助燃气体; 6. 能与空气形成爆炸性混合物的浮游状态的粉尘、纤维、闪点大于等于 60℃的液体雾滴
丙	1. 闪点大于等于 60℃的液体; 2. 可燃固体
丁	1. 对不燃烧物质进行加工,并在高温或熔化状态下经常产生强辐射热、火花或火焰的生产; 2. 利用气体、液体、固体作为燃料或将气体、液体进行燃烧作其他用的各种生产; 3. 常温下使用或加工难燃烧物质的生产
戊	常温下使用或加工不燃烧物质的生产

3.1.2 同一座厂房或厂房的任一防火分区内有不同火灾危险性生产时,该厂房或防火分区内的生产火灾危险性分类应按火灾危险性较大的部分确定。当符合下述条件之一时,可按火灾危险性较小的部分确定:

1 火灾危险性较大的生产部分占本层或本防火分区面积的比例小于 5%或丁、戊类厂房内的油漆工段小于 10%,且发生火灾事故时不足以蔓延到其他部位或火灾危险性较大的生产部分采取了有效的防火措施;

2 丁、戊类厂房内的油漆工段,当采用封闭喷漆工艺,封闭喷漆空间内保持负压、油漆工段设置可燃气体自动报警系统或自动抑爆系统,且油漆工段占其所在防火分区面积的比例小于等于 20%。

3.1.3 储存物品的火灾危险性应根据储存物品的性质和储存物品中的可燃物数量等因素,分为甲、乙、丙、丁、戊类,并应符合表 3.1.3 的规定。

表 3.1.3　储存物品的火灾危险性分类

仓库类别	储存物品的火灾危险性特征
甲	1. 闪点小于 28℃的液体； 2. 爆炸下限小于 10%的气体，以及受到水或空气中水蒸气的作用，能产生爆炸下限小于 10%气体的固体物质； 3. 常温下能自行分解或在空气中氧化能导致迅速自燃或爆炸的物质； 4. 常温下受到水或空气中水蒸气的作用，能产生可燃气体并引起燃烧或爆炸的物质； 5. 遇酸、受热、撞击、摩擦以及遇有机物或硫磺等易燃的无机物，极易引起燃烧或爆炸的强氧化剂； 6. 受撞击、摩擦或与氧化剂、有机物接触时能引起燃烧或爆炸的物质
乙	1. 闪点大于等于 28℃，但小于 60℃的液体； 2. 爆炸下限大于等于 10%的气体； 3. 不属于甲类的氧化剂； 4. 不属于甲类的化学易燃危险固体； 5. 助燃气体； 6. 常温下与空气接触能缓慢氧化，积热不散引起自燃的物品

续表 3.1.3

仓库类别	储存物品的火灾危险性特征
丙	1. 闪点大于等于 60℃的液体； 2. 可燃固体
丁	难燃烧物品
戊	不燃烧物品

3.1.4　同一座仓库或仓库的任一防火分区内储存不同火灾危险性物品时，该仓库或防火分区的火灾危险性应按其中火灾危险性最大的类别确定。

3.1.5　丁、戊类储存物品的可燃包装重量大于物品本身重量 1/4 的仓库，其火灾危险性应按丙类确定。

3.2　厂房(仓库)的耐火等级与构件的耐火极限

3.2.1　厂房(仓库)的耐火等级可分为一、二、三、四级。其构件的燃烧性能和耐火极限除本规范另有规定者外，不应低于表 3.2.1 的规定。

表 3.2.1　厂房(仓库)建筑构件的燃烧性能和耐火极限(h)

构件名称		耐火等级			
		一级	二级	三级	四级
墙	防火墙	不燃烧体 3.00	不燃烧体 3.00	不燃烧体 3.00	不燃烧体 3.00
	承重墙	不燃烧体 3.00	不燃烧体 2.50	不燃烧体 2.00	难燃烧体 0.50
	楼梯间和电梯井的墙	不燃烧体 2.00	不燃烧体 2.00	不燃烧体 1.50	难燃烧体 0.50
	疏散走道两侧的隔墙	不燃烧体 1.00	不燃烧体 1.00	不燃烧体 0.50	难燃烧体 0.25
	非承重外墙	不燃烧体 0.75	不燃烧体 0.50	难燃烧体 0.50	难燃烧体 0.25
	房间隔墙	不燃烧体 0.75	不燃烧体 0.50	难燃烧体 0.50	难燃烧体 0.25

续表 3.2.1

构件名称	耐火等级			
	一级	二级	三级	四级
柱	不燃烧体 3.00	不燃烧体 2.50	不燃烧体 2.00	难燃烧体 0.50
梁	不燃烧体 2.00	不燃烧体 1.50	不燃烧体 1.00	难燃烧体 0.50
楼板	不燃烧体 1.50	不燃烧体 1.00	不燃烧体 0.75	难燃烧体 0.50
屋顶承重构件	不燃烧体 1.50	不燃烧体 1.00	难燃烧体 0.50	燃烧体
疏散楼梯	不燃烧体 1.50	不燃烧体 1.00	不燃烧体 0.75	燃烧体
吊顶(包括吊顶搁栅)	不燃烧体 0.25	难燃烧体 0.25	难燃烧体 0.15	燃烧体

注:二级耐火等级建筑的吊顶采用不燃烧体时,其耐火极限不限。

3.2.2 下列建筑中的防火墙,其耐火极限应按本规范表 3.2.1 的规定提高 1.00h:

1 甲、乙类厂房;

2 甲、乙、丙类仓库。

3.2.3 一、二级耐火等级的单层厂房(仓库)的柱,其耐火极限可按本规范表 3.2.1 的规定降低 0.50h。

3.2.4 下列二级耐火等级建筑的梁、柱可采用无防火保护的金属结构,其中能受到甲、乙、丙类液体或可燃气体火焰影响的部位,应采取外包敷不燃材料或其他防火隔热保护措施:

1 设置自动灭火系统的单层丙类厂房;

2 丁、戊类厂房(仓库)。

3.2.5 一、二级耐火等级建筑的非承重外墙应符合下列规定:

1 除甲、乙类仓库和高层仓库外,当非承重外墙采用不燃烧体时,其耐火极限不应低于 0.25h;当采用难燃烧体时,不应低于 0.50h;

2 4 层及 4 层以下的丁、戊类地上厂房(仓库),当非承重外墙采用不燃烧体时,其耐火极限不限;当非承重外墙采用难燃烧体的轻质复合墙体时,其表面材料应为不燃材料,内填充材料的燃烧性能不应低于 B2 级。B1、B2 级材料应符合现行国家标准《建筑材料燃烧性能分级方法》GB 8624 的有关要求。

3.2.6 二级耐火等级厂房(仓库)中的房间隔墙,当采用难燃烧体时,其耐火极限应提高 0.25h。

3.2.7 二级耐火等级的多层厂房或多层仓库中的楼板,当采用预应力和预制钢筋混凝土楼板时,其耐火极限不应低于 0.75h。

3.2.8 一、二级耐火等级厂房(仓库)的上人平屋顶,其屋面板的耐火极限分别不应低于 1.50h 和 1.00h。

一级耐火等级的单层、多层厂房(仓库)中采用自动喷水灭火系统进行全保护时,其屋顶承重构件的耐火极限不应低于 1.00h。

二级耐火等级厂房的屋顶承重构件可采用无保护层的金属构件,其中能受到甲、乙、丙类液体火焰影响的部位应采取防火隔热保护措施。

3.2.9 一、二级耐火等级厂房(仓库)的屋面板应采用不燃烧材料,但其屋面防水层和绝热层可采用可燃材料;当丁、戊类厂房(仓库)不超过 4 层时,其屋面可采用难燃烧体的轻质复

合屋面板，但该板材的表面材料应为不燃烧材料，内填充材料的燃烧性能不应低于B2级。

3.2.10 除本规范另有规定者外，以木柱承重且以不燃烧材料作为墙体的厂房（仓库），其耐火等级应按四级确定。

3.2.11 预制钢筋混凝土构件的节点外露部位，应采取防火保护措施，且该节点的耐火极限不应低于相应构件的规定。

3.3 厂房（仓库）的耐火等级、层数、面积和平面布置

3.3.1 厂房的耐火等级、层数和每个防火分区的最大允许建筑面积除本规范另有规定者外，应符合表3.3.1的规定。

表3.3.1 厂房的耐火等级、层数和防火分区的最大允许建筑面积

生产类别	厂房的耐火等级	最多允许层数	每个防火分区的最大允许建筑面积（m^2）			
			单层厂房	多层厂房	高层厂房	地下、半地下厂房，厂房的地下室、半地下室
甲	一级	除生产必须采用多层者外，宜采用单层	4000	3000	—	—
	二级		3000	2000	—	—
乙	一级	不限	5000	4000	2000	—
	二级	6	4000	3000	1500	—
丙	一级	不限	不限	6000	3000	500
	二级	不限	8000	4000	2000	500
	三级	2	3000	2000	—	—
丁	一、二级	不限	不限	不限	4000	1000
	三级	3	4000	2000	—	—
	四级	1	1000	—	—	—
戊	一、二级	不限	不限	不限	6000	1000
	三级	3	5000	3000	—	—
	四级	1	1500	—	—	—

注：1 防火分区之间应采用防火墙分隔。除甲类厂房外的一、二级耐火等级单层厂房，当其防火分区的建筑面积大于本表规定，且设置防火墙确有困难时，可采用防火卷帘或防火分隔水幕分隔。采用防火卷帘时应符合本规范第7.5.3条的规定；采用防火分隔水幕时，应符合现行国家标准《自动喷水灭火系统设计规范》GB 50084的有关规定。

2 除麻纺厂房外，一级耐火等级的多层纺织厂房和二级耐火等级的单层、多层纺织厂房，其每个防火分区的最大允许建筑面积可按本表的规定增加0.5倍，但厂房内的原棉开包、清花车间均应采用防火墙分隔。

3 一、二级耐火等级的单层、多层造纸生产联合厂房，其每个防火分区的最大允许建筑面积可按本表的规定增加1.5倍。一、二级耐火等级的湿式造纸联合厂房，当纸机烘缸罩内设置自动灭火系统，完成工段设置有效灭火设施保护时，其每个防火分区的最大允许建筑面积可按工艺要求确定。

4 一、二级耐火等级的谷物筒仓工作塔，当每层工作人数不超过2人时，其层数不限。

5 一、二级耐火等级卷烟生产联合厂房内的原料、备料及成组配方、制丝、储丝和卷接包、辅料周转、成品暂存、二氧化碳膨胀烟丝等生产用房应划分独立的防火分隔单元，当工艺条件许可时，应采用防火墙进行分隔。其中制丝、储丝和卷接包车间可划分为一个防火分区，且每个防火分区的最大允许建筑面积可按工艺要求确定。但制丝、储丝及卷接包车间之间应采用耐火极限不低于2.00h的墙体和1.00h的楼板进行分隔。厂房内各水平和竖向分隔间的开口应采取防止火灾蔓延的措施。

6 本表中"—"表示不允许。

3.3.2 仓库的耐火等级、层数和面积除本规范另有规定者外，应符合表3.3.2的规定。

表 3.3.2　仓库的耐火等级、层数和面积

储存物品类别		仓库的耐火等级	最多允许层数	每座仓库的最大允许占地面积和每个防火分区的最大允许建筑面积(m²)						
				单层仓库		多层仓库		高层仓库		地下、半地下仓库或仓库的地下室、半地下室
				每座仓库	防火分区	每座仓库	防火分区	每座仓库	防火分区	防火分区
甲	3、4 项	一级	1	180	60	—	—	—	—	—
	1、2、5、6 项	一、二级	1	750	250	—	—	—	—	—
乙	1、3、4 项	一、二级	3	2000	500	900	300	—	—	—
		三级	1	500	250	—	—	—	—	—
	2、5、6 项	一、二级	5	2800	700	1500	500	—	—	—
		三级	1	900	300	—	—	—	—	—
丙	1 项	一、二级	5	4000	1000	2800	700	—	—	150
		三级	1	1200	400	—	—	—	—	—
	2 项	一、二级	不限	6000	1500	4800	1200	4000	1000	300
		三级	3	2100	700	1200	400	—	—	—
丁		一、二级	不限	不限	3000	不限	1500	4800	1200	500
		三级	3	3000	1000	1500	500	—	—	—
		四级	1	2100	700	—	—	—	—	—
戊		一、二级	不限	不限	不限	不限	2000	6000	1500	1000
		三级	3	3000	1000	2100	700	—	—	—
		四级	1	2100	700	—	—	—	—	—

注：1　仓库中的防火分区之间必须采用防火墙分隔。

2　石油库内桶装油品仓库应按现行国家标准《石油库设计规范》GB 50074 的有关规定执行。

3　一、二级耐火等级的煤均化库，每个防火分区的最大允许建筑面积不应大于 12000m²。

4　独立建造的硝酸铵仓库、电石仓库、聚乙烯等高分子制品仓库、尿素仓库、配煤仓库、造纸厂的独立成品仓库以及车站、码头、机场内的中转仓库，当建筑的耐火等级不低于二级时，每座仓库的最大允许占地面积和每个防火分区的最大允许建筑面积可按本表的规定增加 1.0 倍。

5　一、二级耐火等级粮食平房仓的最大允许占地面积不应大于 12000m²，每个防火分区的最大允许建筑面积不应大于 3000m²；三级耐火等级粮食平房仓的最大允许占地面积不应大于 3000m²，每个防火分区的最大允许建筑面积不应大于 1000m²。

6　一、二级耐火等级冷库的最大允许占地面积和防火分区的最大允许建筑面积，应按现行国家标准《冷库设计规范》GB 50072的有关规定执行。

7　酒精度为 50%(V/V)以上的白酒仓库不宜超过 3 层。

8　本表中“—”表示不允许。

3.3.3 厂房内设置自动灭火系统时，每个防火分区的最大允许建筑面积可按本规范第3.3.1条的规定增加1.0倍。当丁、戊类的地上厂房内设置自动灭火系统时，每个防火分区的最大允许建筑面积不限。

仓库内设置自动灭火系统时，每座仓库最大允许占地面积和每个防火分区最大允许建筑面积可按本规范第3.3.2条的规定增加1.0倍。

厂房内局部设置自动灭火系统时，其防火分区增加面积可按该局部面积的1.0倍计算。

3.3.4 使用或储存特殊贵重的机器、仪表、仪器等设备或物品的建筑，其耐火等级应为一级。

3.3.5 建筑面积小于等于300m^{2}的独立甲、乙类单层厂房，可采用三级耐火等级的建筑。

3.3.6 使用或产生丙类液体的厂房和有火花、赤热表面、明火的丁类厂房，均应采用一、二级耐火等级建筑，当上述丙类厂房的建筑面积小于等于500m^2，丁类厂房的建筑面积小于等于1000m^{2}时，也可采用三级耐火等级的单层建筑。

3.3.7 甲、乙类生产场所不应设置在地下或半地下。甲、乙类仓库不应设置在地下或半地下。

3.3.8 厂房内严禁设置员工宿舍。

办公室、休息室等不应设置在甲、乙类厂房内，当必须与本厂房贴邻建造时，其耐火等级不应低于二级，并应采用耐火极限不低于3.00h的不燃烧体防爆墙隔开和设置独立的安全出口。

在丙类厂房内设置的办公室、休息室，应采用耐火极限不低于2.50h的不燃烧体隔墙和不低于1.00h的楼板与厂房隔开，并应至少设置1个独立的安全出口。如隔墙上需开设相互连通的门时，应采用乙级防火门。

3.3.9 厂房内设置甲、乙类中间仓库时，其储量不宜超过1昼夜的需要量。

中间仓库应靠外墙布置，并应采用防火墙和耐火极限不低于1.50h的不燃烧体楼板与其他部分隔开。

3.3.10 厂房内设置丙类仓库时，必须采用防火墙和耐火极限不低于1.50h的楼板与厂房隔开，设置丁、戊类仓库时，必须采用耐火极限不低于2.50h的不燃烧体隔墙和不低于1.00h的楼板与厂房隔开。仓库的耐火等级和面积应符合本规范第3.3.2条和第3.3.3条的规定。

3.3.11 厂房中的丙类液体中间储罐应设置在单独房间内，其容积不应大于1m^3。设置该中间储罐的房间，其围护构件的耐火极限不应低于二级耐火等级建筑的相应要求，房间的门应采用甲级防火门。

3.3.12 除锅炉的总蒸发量小于等于4t/h的燃煤锅炉房可采用三级耐火等级的建筑外，其他锅炉房均应采用一、二级耐火等级的建筑。

3.3.13 油浸变压器室、高压配电装置室的耐火等级不应低于二级，其他防火设计应按现行国家标准《火力发电厂和变电所设计防火规范》GB 50229等规范的有关规定执行。

3.3.14 变、配电所不应设置在甲、乙类厂房内或贴邻建造，且不应设置在爆炸性气体、粉尘环境的危险区域内。供甲、乙类厂房专用的10kV及以下的变、配电所，当采用无门窗洞口的防火墙隔开时，可一面贴邻建造，并应符合现行国家标准《爆炸和火灾危险环境电力装置设计规范》GB 50058等规范的有关规定。

乙类厂房的配电所必须在防火墙上开窗时，应设置密封固定的甲级防火窗。

3.3.15 仓库内严禁设置员工宿舍。

甲、乙类仓库内严禁设置办公室、休息室等，并不应贴邻建造。

在丙、丁类仓库内设置的办公室、休息室，应采用耐火极限不低于2.50h的不燃烧体隔墙和不低于1.00h的楼板与库房隔开，并应设置独立的安全出口。如隔墙上需开设相互连通的门时，应采用乙级防火门。

3.3.16 高架仓库的耐火等级不应低于二级。

3.3.17 粮食筒仓的耐火等级不应低于二级；二级耐火等级的粮食筒仓可采用钢板仓。

粮食平房仓的耐火等级不应低于三级；二级耐火等级的散装粮食平房仓可采用无防火保护的金属承重构件。

3.3.18 甲、乙类厂房(仓库)内不应设置铁路线。

丙、丁、戊类厂房(仓库)，当需要出入蒸汽机车和内燃机车时，其屋顶应采用不燃烧体或采取其他防火保护措施。

3.4 厂房的防火间距

3.4.1 除本规范另有规定者外，厂房之间及其与乙、丙、丁、戊类仓库、民用建筑等之间的防火间距不应小于表3.4.1的规定。

表3.4.1 厂房之间及其与乙、丙、丁、戊类仓库、民用建筑等之间的防火间距(m)

名称			甲类厂房	单层、多层乙类厂房(仓库)	单层、多层丙、丁、戊类厂房(仓库)			高层厂房(仓库)	民用建筑		
					耐火等级				耐火等级		
					一、二级	三级	四级		一、二级	三级	四级
甲类厂房			12	12	12	14	16	13	25		
单层、多层乙类厂房			12	10	10	12	14	13	25		
单层、多层丙、丁类厂房	耐火等级	一、二级	12	10	10	12	14	13	10	12	14
		三级	14	12	12	14	16	15	12	14	16
		四级	16	14	14	16	18	17	14	16	18
单层、多层戊类厂房		一、二级	12	10	10	12	14	13	6	7	9
		三级	14	12	12	14	16	15	7	8	10
		四级	16	14	14	16	18	17	9	10	12
高层厂房			13	13	13	15	17	13	13	15	17

续表 3.4.1

名称		甲类厂房	单层、多层乙类厂房(仓库)	单层、多层丙、丁、戊类厂房(仓库)			高层厂房(仓库)	民用建筑		
				耐火等级				耐火等级		
				一、二级	三级	四级		一、二级	三级	四级
室外变、配电站变压器总油量(t)	≥5,≤10	25	25	12	15	20	12	15	20	25
	>10,≤50			15	20	25	15	20	25	30
	>50			20	25	30	20	25	30	35

注:1 建筑之间的防火间距应按相邻建筑外墙的最近距离计算,如外墙有凸出的燃烧构件,应从其凸出部分外缘算起。

2 乙类厂房与重要公共建筑之间的防火间距不宜小于 50m。单层、多层戊类厂房之间及其与戊类仓库之间的防火间距,可按本表的规定减少 2m。为丙、丁、戊类厂房服务而单独设立的生活用房应按民用建筑确定,与所属厂房之间的防火间距不应小于 6m。必须相邻建造时,应符合本表注 3、4 的规定。

3 两座厂房相邻较高一面的外墙为防火墙时,其防火间距不限,但甲类厂房之间不应小于 4m。两座丙、丁、戊类厂房相邻两面的外墙均为不燃烧体,当无外露的燃烧体屋檐,每面外墙上的门窗洞口面积之和各小于等于该外墙面积的 5%,且门窗洞口不正对开设时,其防火间距可按本表的规定减少 25%。

4 两座一、二级耐火等级的厂房,当相邻较低一面外墙为防火墙且较低一座厂房的屋顶耐火极限不低于 1.00h,或相邻较高一面外墙的门窗等开口部位设置甲级防火门窗或防火分隔水幕或按本规范第 7.5.3 条的规定设置防火卷帘时,甲、乙类厂房之间的防火间距不应小于 6m;丙、丁、戊类厂房之间的防火间距不应小于 4m。

5 变压器与建筑之间的防火间距应从距建筑最近的变压器外壁算起。发电厂内的主变压器,其油量可按单台确定。

6 耐火等级低于四级的原有厂房,其耐火等级应按四级确定。

3.4.2 甲类厂房与重要公共建筑之间的防火间距不应小于50m,与明火或散发火花地点之间的防火间距不应小于30m,与架空电力线的最小水平距离应符合本规范第 11.2.1 条的规定,与甲、乙、丙类液体储罐,可燃、助燃气体储罐,液化石油气储罐,可燃材料堆场的防火间距,应符合本规范第 4 章的有关规定。

3.4.3 散发可燃气体、可燃蒸气的甲类厂房与铁路、道路等的防火间距不应小于表 3.4.3 的规定,但甲类厂房所属厂内铁路装卸线当有安全措施时,其间距可不受表 3.4.3 规定的限制。

表 3.4.3 甲类厂房与铁路、道路等的防火间距(m)

名称	厂外铁路线中心线	厂内铁路线中心线	厂外道路路边	厂内道路路边	
				主要	次要
甲类厂房	30	20	15	10	5

注:厂房与道路路边的防火间距按建筑距道路最近一侧路边的最小距离计算。

3.4.4 高层厂房与甲、乙、丙类液体储罐,可燃、助燃气体储罐,液化石油气储罐,可燃材料堆场(煤和焦炭场除外)的防火间距,应符合本规范第 4 章的有关规定,且不应小于 13m。

3.4.5 当丙、丁、戊类厂房与公共建筑的耐火等级均为一、二级时,其防火间距可按下列规定执行:

1 当较高一面外墙为不开设门窗洞口的防火墙，或比相邻较低一座建筑屋面高15m及以下范围内的外墙为不开设门窗洞口的防火墙时，其防火间距可不限；

2 相邻较低一面外墙为防火墙，且屋顶不设天窗，屋顶耐火极限不低于1.00h，或相邻较高一面外墙为防火墙，且墙上开口部位采取了防火保护措施，其防火间距可适当减小，但不应小于4m。

3.4.6 厂房外附设有化学易燃物品的设备时，其室外设备外壁与相邻厂房室外附设设备外壁或相邻厂房外墙之间的距离，不应小于本规范第3.4.1条的规定。用不燃烧材料制作的室外设备，可按一、二级耐火等级建筑确定。

总储量小于等于15m³的丙类液体储罐，当直埋于厂房外墙外，且面向储罐一面4.0m范围内的外墙为防火墙时，其防火间距可不限。

3.4.7 同一座U形或山形厂房中相邻两翼之间的防火间距，不宜小于本规范第3.4.1条的规定，但当该厂房的占地面积小于本规范第3.3.1条规定的每个防火分区的最大允许建筑面积时，其防火间距可为6m。

3.4.8 除高层厂房和甲类厂房外，其他类别的数座厂房占地面积之和小于本规范第3.3.1条规定的防火分区最大允许建筑面积（按其中较小者确定，但防火分区的最大允许建筑面积不限者，不应超过10000 m²）时，可成组布置。当厂房建筑高度小于等于7m时，组内厂房之间的防火间距不应小于4m；当厂房建筑高度大于7m时，组内厂房之间的防火间距不应小于6m。

组与组或组与相邻建筑之间的防火间距，应根据相邻两座耐火等级较低的建筑，按本规范第3.4.1条的规定确定。

3.4.9 一级汽车加油站、一级汽车液化石油气加气站和一级汽车加油加气合建站不应建在城市建成区内。

3.4.10 汽车加油、加气站和加油加气合建站的分级，汽车加油、加气站和加油加气合建站及其加油（气）机、储油（气）罐等与站外明火或散发火花地点、建筑、铁路、道路之间的防火间距，以及站内各建筑或设施之间的防火间距，应符合现行国家标准《汽车加油加气站设计与施工规范》GB 50156的有关规定。

3.4.11 电力系统电压为35～500kV且每台变压器容量在10MV·A以上的室外变、配电站以及工业企业的变压器总油量大于5t的室外降压变电站，与建筑之间的防火间距不应小于本规范第3.4.1条和第3.5.1条的规定。

3.4.12 厂区围墙与厂内建筑之间的间距不宜小于5m，且围墙两侧的建筑之间还应满足相应的防火间距要求。

3.5 仓库的防火间距

3.5.1 甲类仓库之间及其与其他建筑、明火或散发火花地点、铁路、道路等的防火间距不应小于表3.5.1的规定，与架空电力线的最小水平距离应符合本规范第11.2.1条的规定。厂内铁路装卸线与设置装卸站台的甲类仓库的防火间距，可不受表3.5.1规定的限制。

表 3.5.1　甲类仓库之间及其与其他建筑、明火或散发火花地点、铁路等的防火间距(m)

名　称		甲类仓库及其储量(t)			
		甲类储存物品第 3、4 项		甲类储存物品第 1、2、5、6 项	
		≤5	>5	≤10	>10
重要公共建筑		50			
甲类仓库		20			
民用建筑、明火或散发火花地点		30	40	25	30
其他建筑	一、二级耐火等级	15	20	12	15
	三级耐火等级	20	25	15	20
	四级耐火等级	25	30	20	25
电力系统电压为 35～500kV 且每台变压器容量在 10MV·A 以上的室外变、配电站 工业企业的变压器总油量大于 5t 的室外降压变电站		30	40	25	30
厂外铁路线中心线		40			
厂内铁路线中心线		30			
厂外道路路边		20			
厂内道路路边	主要	10			
	次要	5			

注：甲类仓库之间的防火间距，当第 3、4 项物品储量小于等于 2t，第 1、2、5、6 项物品储量小于等于 5t 时，不应小于 12m，甲类仓库与高层仓库之间的防火间距不应小于 13m。

3.5.2　除本规范另有规定者外，乙、丙、丁、戊类仓库之间及其与民用建筑之间的防火间距，不应小于表 3.5.2 的规定。

表 3.5.2　乙、丙、丁、戊类仓库之间及其与民用建筑之间的防火间距(m)

建筑类型		单层、多层乙、丙、丁、戊类仓库						高层仓库	甲类厂房
		单层、多层乙、丙、丁类仓库			单层、多层戊类仓库				
单层、多层乙、丙、丁、戊类仓库	耐火等级	一、二级	三级	四级	一、二级	三级	四级	一、二级	一、二级
	一、二级	10	12	14	10	12	14	13	12
	三级	12	14	16	12	14	16	15	14
	四级	14	16	18	14	16	18	17	16
高层仓库	一、二级	13	15	17	13	15	17	13	13
民用建筑	一、二级	10	12	14	6	7	9	13	25
	三级	12	14	16	7	8	10	15	
	四级	14	16	18	9	10	12	17	

注：1　单层、多层戊类仓库之间的防火间距，可按本表减少 2m。

2　两座仓库相邻较高一面外墙为防火墙，且总占地面积小于等于本规范第3.3.2条 1 座仓库的最大允许占地面积规定时，其防火间距不限。

3　除乙类第 6 项物品外的乙类仓库，与民用建筑之间的防火间距不宜小于 25m，与重要公共建筑之间的防火间距不宜小于 30m，与铁路、道路等的防火间距不宜小于表 3.5.1 中甲类仓库与铁路、道路等的防火间距。

3.5.3　当丁、戊类仓库与公共建筑的耐火等级均为一、二级时，其防火间距可按下列规定执行：

1 当较高一面外墙为不开设门窗洞口的防火墙，或比相邻较低一座建筑屋面高15m及以下范围内的外墙为不开设门窗洞口的防火墙时，其防火间距可不限；

2 相邻较低一面外墙为防火墙，且屋顶不设天窗，屋顶耐火极限不低于1.00h，或相邻较高一面外墙为防火墙，且墙上开口部位采取了防火保护措施，其防火间距可适当减小，但不应小于4m。

3.5.4 粮食筒仓与其他建筑之间及粮食筒仓组与组之间的防火间距，不应小于表3.5.4的规定。

表3.5.4 粮食筒仓与其他建筑之间及粮食筒仓组与组之间的防火间距(m)

名称	粮食总储量 W(t)	粮食立筒仓			粮食浅圆仓		建筑的耐火等级		
		$W\leqslant 40000$	$40000<W\leqslant 50000$	$W>50000$	$W\leqslant 50000$	$W>50000$	一、二级	三级	四级
粮食立筒仓	$500<W\leqslant 10000$	15	20	25	20	25	10	15	20
	$10000<W\leqslant 40000$						15	20	25
	$40000<W\leqslant 50000$	20					20	25	30
	$W>50000$	25					25	30	—
粮食浅圆仓	$W\leqslant 50000$	20	20	25	20	25	20	25	—
	$W>50000$	25					25	30	—

注：1 当粮食立筒仓、粮食浅圆仓与工作塔、接收塔、发放站为一个完整工艺单元的组群时，组内各建筑之间的防火间距不受本表限制。

2 粮食浅圆仓组内每个独立仓的储量不应大于10000t。

3.5.5 库区围墙与库区内建筑之间的间距不宜小于5m，且围墙两侧的建筑之间还应满足相应的防火间距要求。

3.6 厂房(仓库)的防爆

3.6.1 有爆炸危险的甲、乙类厂房宜独立设置，并宜采用敞开或半敞开式。其承重结构宜采用钢筋混凝土或钢框架、排架结构。

3.6.2 有爆炸危险的甲、乙类厂房应设置泄压设施。

3.6.3 有爆炸危险的甲、乙类厂房，其泄压面积宜按下式计算，但当厂房的长径比大于3时，宜将该建筑划分为长径比小于等于3的多个计算段，各计算段中的公共截面不得作为泄压面积：

$$A=10CV^{2/3} \tag{3.6.3}$$

式中 A——泄压面积(m^2)；

V——厂房的容积(m^3)；

C——厂房容积为$1000m^3$时的泄压比，可按表3.6.3选取，(m^2/m^3)。

表3.6.3 厂房内爆炸性危险物质的类别与泄压比值(m^2/m^3)

厂房内爆炸性危险物质的类别	C值
氨以及粮食、纸、皮革、铅、铬、铜等$K_{尘}<10MPa\cdot m\cdot s^{-1}$的粉尘	≥0.030
木屑、炭屑、煤粉、锑、锡等$10MPa\cdot m\cdot s^{-1}\leqslant K_{尘}\leqslant 30MPa\cdot m\cdot s^{-1}$的粉尘	≥0.055

丙酮、汽油、甲醇、液化石油气、甲烷、喷漆间或干燥室以及苯酚树脂、铝、镁、锆等 $K_{\text{尘}}>30\text{MPa}\cdot\text{m}\cdot\text{s}^{-1}$ 的粉尘	≥0.110
乙烯	≥0.160
乙炔	≥0.200
氢	≥0.250

注：长径比为建筑平面几何外形尺寸中的最长尺寸与其横截面周长的积和4.0倍的该建筑横截面积之比。

3.6.4 泄压设施宜采用轻质屋面板、轻质墙体和易于泄压的门、窗等，不应采用普通玻璃。

泄压设施的设置应避开人员密集场所和主要交通道路，并宜靠近有爆炸危险的部位。

作为泄压设施的轻质屋面板和轻质墙体的单位质量不宜超过60kg/m²。

屋顶上的泄压设施应采取防冰雪积聚措施。

3.6.5 散发较空气轻的可燃气体、可燃蒸气的甲类厂房，宜采用轻质屋面板的全部或局部作为泄压面积。顶棚应尽量平整、避免死角，厂房上部空间应通风良好。

3.6.6 散发较空气重的可燃气体、可燃蒸气的甲类厂房以及有粉尘、纤维爆炸危险的乙类厂房，应采用不发火花的地面。采用绝缘材料作整体面层时，应采取防静电措施。

散发可燃粉尘、纤维的厂房内表面应平整、光滑，并易于清扫。

厂房内不宜设置地沟，必须设置时，其盖板应严密，地沟应采取防止可燃气体、可燃蒸气及粉尘、纤维在地沟积聚的有效措施，且与相邻厂房连通处应采用防火材料密封。

3.6.7 有爆炸危险的甲、乙类生产部位，宜设置在单层厂房靠外墙的泄压设施或多层厂房顶层靠外墙的泄压设施附近。

有爆炸危险的设备宜避开厂房的梁、柱等主要承重构件布置。

3.6.8 有爆炸危险的甲、乙类厂房的总控制室应独立设置。

3.6.9 有爆炸危险的甲、乙类厂房的分控制室宜独立设置，当贴邻外墙设置时，应采用耐火极限不低于3.00h的不燃烧体墙体与其他部分隔开。

3.6.10 使用和生产甲、乙、丙类液体厂房的管、沟不应和相邻厂房的管、沟相通，该厂房的下水道应设置隔油设施。

3.6.11 甲、乙、丙类液体仓库应设置防止液体流散的设施。遇湿会发生燃烧爆炸的物品仓库应设置防止水浸渍的措施。

3.6.12 有粉尘爆炸危险的筒仓，其顶部盖板应设置必要的泄压设施。

粮食筒仓的工作塔、上通廊的泄压面积应按本规范第3.6.3条的规定执行。有粉尘爆炸危险的其他粮食储存设施应采取防爆措施。

3.6.13 有爆炸危险的甲、乙类仓库，宜按本节规定采取防爆措施、设置泄压设施。

3.7 厂房的安全疏散

3.7.1 厂房的安全出口应分散布置。每个防火分区、一个防火分区的每个楼层，其相邻2个安全出口最近边缘之间的水平距离不应小于5m。

3.7.2 厂房的每个防火分区、一个防火分区内的每个楼层，其安全出口的数量应经计算确定，且不应少于2个；当符合下列条件时，可设置1个安全出口：

1 甲类厂房，每层建筑面积小于等于100m²，且同一时间的生产人数不超过5人；

2 乙类厂房，每层建筑面积小于等于150m²，且同一时间的生产人数不超过10人；

3　丙类厂房，每层建筑面积小于等于 250m²，且同一时间的生产人数不超过 20 人；

4　丁、戊类厂房，每层建筑面积小于等于 400m²，且同一时间的生产人数不超过 30 人；

5　地下、半地下厂房或厂房的地下室、半地下室，其建筑面积小于等于 50m²，经常停留人数不超过 15 人。

3.7.3　地下、半地下厂房或厂房的地下室、半地下室，当有多个防火分区相邻布置，并采用防火墙分隔时，每个防火分区可利用防火墙上通向相邻防火分区的甲级防火门作为第二安全出口，但每个防火分区必须至少有 1 个直通室外的安全出口。

3.7.4　厂房内任一点到最近安全出口的距离不应大于表 3.7.4 的规定。

表 3.7.4　厂房内任一点到最近安全出口的距离(m)

生产类别	耐火等级	单层厂房	多层厂房	高层厂房	地下、半地下厂房或厂房的地下室、半地下室
甲	一、二级	30	25	—	—
乙	一、二级	75	50	30	—
丙	一、二级	80	60	40	30
	三级	60	40	—	—
丁	一、二级	不限	不限	50	45
	三级	60	50	—	—
	四级	50	—	—	—
戊	一、二级	不限	不限	75	60
	三级	100	75	—	—
	四级	60	—	—	—

3.7.5　厂房内的疏散楼梯、走道、门的各自总净宽度应根据疏散人数，按表 3.7.5 的规定经计算确定。但疏散楼梯的最小净宽度不宜小于 1.1m，疏散走道的最小净宽度不宜小于 1.4m，门的最小净宽度不宜小于 0.9m。当每层人数不相等时，疏散楼梯的总净宽度应分层计算，下层楼梯总净宽度应按该层或该层以上人数最多的一层计算。

首层外门的总净宽度应按该层或该层以上人数最多的一层计算，且该门的最小净宽度不应小于 1.2m。

表 3.7.5　厂房疏散楼梯、走道和门的净宽度指标(m/百人)

厂房层数	一、二层	三层	≥四层
宽度指标	0.6	0.8	1.0

3.7.6　高层厂房和甲、乙、丙类多层厂房应设置封闭楼梯间或室外楼梯。建筑高度大于 32m 且任一层人数超过 10 人的高层厂房，应设置防烟楼梯间或室外楼梯。

室外楼梯、封闭楼梯间、防烟楼梯间的设计，应符合本规范第 7.4 节的有关规定。

3.7.7　建筑高度大于 32m 且设置电梯的高层厂房，每个防火分区内宜设置一部消防电梯。消防电梯可与客、货梯兼用，消防电梯的防火设计应符合本规范第 7.4.10 条的规定。

符合下列条件的建筑可不设置消防电梯：

1　高度大于 32m 且设置电梯，任一层工作平台人数不超过 2 人的高层塔架；

2　局部建筑高度大于 32m，且升起部分的每层建筑面积小于等于 50m² 的丁、戊类厂房。

3.8 仓库的安全疏散

3.8.1 仓库的安全出口应分散布置。每个防火分区、一个防火分区的每个楼层，其相邻2个安全出口最近边缘之间的水平距离不应小于5m。

3.8.2 每座仓库的安全出口不应少于2个，当一座仓库的占地面积小于等于300m² 时，可设置1个安全出口。仓库内每个防火分区通向疏散走道、楼梯或室外的出口不宜少于2个，当防火分区的建筑面积小于等于100m² 时，可设置1个。通向疏散走道或楼梯的门应为乙级防火门。

3.8.3 地下、半地下仓库或仓库的地下室、半地下室的安全出口不应少于2个；当建筑面积小于等于100m² 时，可设置1个安全出口。

地下、半地下仓库或仓库的地下室、半地下室当有多个防火分区相邻布置，并采用防火墙分隔时，每个防火分区可利用防火墙上通向相邻防火分区的甲级防火门作为第二安全出口，但每个防火分区必须至少有1个直通室外的安全出口。

3.8.4 粮食筒仓、冷库、金库的安全疏散设计应分别符合现行国家标准《冷库设计规范》GB 50072和《粮食钢板筒仓设计规范》GB 50322等的有关规定。

3.8.5 粮食筒仓上层面积小于1000m²，且该层作业人数不超过2人时，可设置1个安全出口。

3.8.6 仓库、筒仓的室外金属梯，当符合本规范第7.4.5条的规定时可作为疏散楼梯，但筒仓室外楼梯平台的耐火极限不应低于0.25h。

3.8.7 高层仓库应设置封闭楼梯间。

3.8.8 除一、二级耐火等级的多层戊类仓库外，其他仓库中供垂直运输物品的提升设施宜设置在仓库外，当必须设置在仓库内时，应设置在井壁的耐火极限不低于2.00h的井筒内。室内外提升设施通向仓库入口上的门应采用乙级防火门或防火卷帘。

3.8.9 建筑高度大于32m且设置电梯的高层仓库，每个防火分区内宜设置一台消防电梯。消防电梯可与客、货梯兼用，消防电梯的防火设计应符合本规范第7.4.10条的规定。

4 甲、乙、丙类液体、气体储罐(区)与可燃材料堆场

4.1 一般规定

4.1.1 甲、乙、丙类液体储罐区，液化石油气储罐区，可燃、助燃气体储罐区，可燃材料堆场等，应设置在城市(区域)的边缘或相对独立的安全地带，并宜设置在城市(区域)全年最小频率风向的上风侧。

甲、乙、丙类液体储罐(区)宜布置在地势较低的地带。当布置在地势较高的地带时，应采取安全防护设施。

液化石油气储罐(区)宜布置在地势平坦、开阔等不易积存液化石油气的地带。

4.1.2 桶装、瓶装甲类液体不应露天存放。

4.1.3 液化石油气储罐组或储罐区四周应设置高度不小于1.0m的不燃烧体实体防护墙。

4.1.4 甲、乙、丙类液体储罐区，液化石油气储罐区，可燃、助燃气体储罐区，可燃材料堆场，应与装卸区、辅助生产区及办公区分开布置。

4.1.5 甲、乙、丙类液体储罐，液化石油气储罐，可燃、助燃气体储罐，可燃材料堆垛与架空电力线的最近水平距离应符合本规范第11.2.1条的规定。

4.2 甲、乙、丙类液体储罐(区)的防火间距

4.2.1 甲、乙、丙类液体储罐(区)及乙、丙类液体桶装堆场与建筑物的防火间距，不应小于表4.2.1的规定。

表4.2.1 甲、乙、丙类液体储罐(区)及乙、丙类液体桶装堆场与建筑物的防火间距(m)

项目			建筑物的耐火等级			室外变、配电站
			一、二级	三级	四级	
甲、乙类液体	一个罐区或堆场的总储量 $V(m^3)$	$1 \leqslant V < 50$	12	15	20	30
		$50 \leqslant V < 200$	15	20	25	35
		$200 \leqslant V < 1000$	20	25	30	40
		$1000 \leqslant V < 5000$	25	30	40	50
丙类液体		$5 \leqslant V < 250$	12	15	20	24
		$250 \leqslant V < 1000$	15	20	25	28
		$1000 \leqslant V < 5000$	20	25	30	32
		$5000 \leqslant V < 25000$	25	30	40	40

注：1 当甲、乙类液体和丙类液体储罐布置在同一储罐区时，其总储量可按1m^3甲、乙类液体相当于5m^3丙类液体折算。

2 防火间距应从距建筑物最近的储罐外壁、堆垛外缘算起，但储罐防火堤外侧基脚线至建筑物的距离不应小于10m。

3 甲、乙、丙类液体的固定顶储罐区或半露天堆场和乙、丙类液体桶装堆场与甲类厂房(仓库)、民用建筑的防火间距，应按本表的规定增加25%，且甲、乙类液体的固定顶储罐区或半露天堆场及乙、丙类液体桶装堆场与甲类厂房(仓库)、民用建筑的防火间距不应小于25m，与明火或散发火花地点的防火间距，应按本表四级耐火等级建筑的规定增加25%。

4 浮顶储罐区或闪点大于120℃的液体储罐区与建筑物的防火间距，可按本表的规定减少25%。

5 当数个储罐区布置在同一库区内时，储罐区之间的防火间距不应小于本表相应储量的储罐区与四级耐火等级建筑之间防火间距的较大值。

6 直埋地下的甲、乙、丙类液体卧式罐，当单罐容积小于等于50m³，总容积小于等于200m³时，与建筑物之间的防火间距可按本表规定减少50%。

7 室外变、配电站指电力系统电压为35～500kV且每台变压器容量在10 MV·A以上的室外变、配电站以及工业企业的变压器总油量大于5t的室外降压变电站。

4.2.2 甲、乙、丙类液体储罐之间的防火间距不应小于表4.2.2的规定。

表4.2.2 甲、乙、丙类液体储罐之间的防火间距(m)

类别			储罐形式				
			固定顶罐			浮顶储罐	卧式储罐
			地上式	半地下式	地下式		
甲、乙类液体	单罐容量V(m³)	$V\leqslant1000$	0.75D	0.5D	0.4D	0.4D	不小于0.8m
		$V>1000$	0.6D				
丙类液体		不论容量大小	0.4D	不限	不限	—	

注：1 D为相邻较大立式储罐的直径(m)；矩形储罐的直径为长边与短边之和的一半。

2 不同液体、不同形式储罐之间的防火间距不应小于本表规定的较大值。

3 两排卧式储罐之间的防火间距不应小于3m。

4 设置充氮保护设备的液体储罐之间的防火间距可按浮顶储罐的间距确定。

5 当单罐容量小于等于1000m³且采用固定冷却消防方式时，甲、乙类液体的地上式固定顶罐之间的防火间距不应小于0.6D。

6 同时设有液下喷射泡沫灭火设备、固定冷却水设备和扑救防火堤内液体火灾的泡沫灭火设备时，储罐之间的防火间距可适当减小，但地上式储罐不宜小于0.4D。

7 闪点大于120℃的液体，当储罐容量大于1000m³时，其储罐之间的防火间距不应小于5m；当储罐容量小于等于1000m³时，其储罐之间的防火间距不应小于2m。

4.2.3 甲、乙、丙类液体储罐成组布置时，应符合下列规定：

1 组内储罐的单罐储量和总储量不应大于表4.2.3的规定；

2 组内储罐的布置不应超过两排。甲、乙类液体立式储罐之间的防火间距不应小于2m，卧式储罐之间的防火间距不应小于0.8m；丙类液体储罐之间的防火间距不限；

3 储罐组之间的防火间距应根据组内储罐的形式和总储量折算为相同类别的标准单罐，并应按本规范第4.2.2条的规定确定。

表4.2.3 甲、乙、丙类液体储罐分组布置的限量

名称	单罐最大储量(m³)	一组罐最大储量(m³)
甲、乙类液体	200	1000
丙类液体	500	3000

4.2.4 甲、乙、丙类液体的地上式、半地下式储罐区的每个防火堤内，宜布置火灾危险性类别相同或相近的储罐。沸溢性液体储罐与非沸溢性液体储罐不应布置在同一防火堤内。

地上式、半地下式储罐与地下式储罐，不应布置在同一防火堤内，且地上式、半地下式储罐应分别布置在不同的防火堤内。

4.2.5 甲、乙、丙类液体的地上式、半地下式储罐或储罐组，其四周应设置不燃烧体防火堤。防火堤的设置应符合下列规定：

1 防火堤内的储罐布置不宜超过2排，单罐容量小于等于1000m³且闪点大于120℃的液体储罐不宜超过4排；

2 防火堤的有效容量不应小于其中最大储罐的容量。对于浮顶罐，防火堤的有效容量可为其中最大储罐容量的一半；

3 防火堤内侧基脚线至立式储罐外壁的水平距离不应小于罐壁高度的一半。防火堤内侧基脚线至卧式储罐的水平距离不应小于3m；

4 防火堤的设计高度应比计算高度高出0.2m，且其高度应为1.0～2.2m，并应在防火堤的适当位置设置灭火时便于消防队员进出防火堤的踏步；

5 沸溢性液体地上式、半地下式储罐，每个储罐应设置一个防火堤或防火隔堤；

6 含油污水排水管应在防火堤的出口处设置水封设施，雨水排水管应设置阀门等封闭、隔离装置。

4.2.6 甲类液体半露天堆场，乙、丙类液体桶装堆场和闪点大于120℃的液体储罐(区)，当采取了防止液体流散的设施时，可不设置防火堤。

4.2.7 甲、乙、丙类液体储罐与其泵房、装卸鹤管的防火间距不应小于表4.2.7的规定。

表4.2.7 甲、乙、丙类液体储罐与其泵房、装卸鹤管的防火间距(m)

液体类别和储罐形式		泵房	铁路装卸鹤管、汽车装卸鹤管
甲、乙类液体储罐	拱顶罐	15	20
	浮顶罐	12	15
丙类液体储罐		10	12

注：1 总储量小于等于1000m³的甲、乙类液体储罐，总储量小于等于5000m³的丙类液体储罐，其防火间距可按本表的规定减少25%。

2 泵房、装卸鹤管与储罐防火堤外侧基脚线的距离不应小于5m。

4.2.8 甲、乙、丙类液体装卸鹤管与建筑物、厂内铁路线的防火间距不应小于表4.2.8的规定。

表4.2.8 甲、乙、丙类液体装卸鹤管与建筑物、厂内铁路线的防火间距(m)

名　称	建筑物的耐火等级			厂内铁路线	泵房
	一、二级	三级	四级		
甲、乙类液体装卸鹤管	14	16	18	20	8
丙类液体装卸鹤管	10	12	14	10	

注：装卸鹤管与其直接装卸用的甲、乙、丙类液体装卸铁路线的防火间距不限。

4.2.9 甲、乙、丙类液体储罐与铁路、道路的防火间距不应小于表4.2.9的规定。

表 4.2.9　甲、乙、丙类液体储罐与铁路、道路的防火间距(m)

名　称	厂外铁路线中心线	厂内铁路线中心线	厂外道路路边	厂内道路路边	
				主要	次要
甲、乙类液体储罐	35	25	20	15	10
丙类液体储罐	30	20	15	10	5

4.2.10　零位罐与所属铁路装卸线的距离不应小于 6m。

4.2.11　石油库的储罐(区)与建筑物的防火间距,石油库内的储罐布置和防火间距以及储罐与泵房、装卸鹤管等库内建筑物的防火间距,应按现行国家标准《石油库设计规范》GB 50074 的有关规定执行。

4.3　可燃、助燃气体储罐(区)的防火间距

4.3.1　可燃气体储罐与建筑物、储罐、堆场的防火间距应符合下列规定:

1　湿式可燃气体储罐与建筑物、储罐、堆场的防火间距不应小于表 4.3.1 的规定;

2　干式可燃气体储罐与建筑物、储罐、堆场的防火间距:当可燃气体的密度比空气大时,应按表 4.3.1 的规定增加 25%;当可燃气体的密度比空气小时,可按表 4.3.1 的规定确定;

3　湿式或干式可燃气体储罐的水封井、油泵房和电梯间等附属设施与该储罐的防火间距,可按工艺要求布置;

4　容积小于等于 $20m^3$ 的可燃气体储罐与其使用厂房的防火间距不限;

5　固定容积的可燃气体储罐与建筑物、储罐、堆场的防火间距不应小于表 4.3.1 的规定。

表 4.3.1　湿式可燃气体储罐与建筑物、储罐、堆场的防火间距(m)

名　称			湿式可燃气体储罐的总容积 $V(m^3)$			
			$V<1000$	$1000\leqslant V<10000$	$10000\leqslant V<50000$	$50000\leqslant V<100000$
甲类物品仓库 明火或散发火花的地点 甲、乙、丙类液体储罐 可燃材料堆场 室外变、配电站			20	25	30	35
民用建筑			18	20	25	30
其他建筑	耐火等级	一、二级	12	15	20	25
		三级	15	20	25	30
		四级	20	25	30	35

注:固定容积可燃气体储罐的总容积按储罐几何容积(m^3)和设计储存压力(绝对压力,10^5Pa)的乘积计算。

4.3.2　可燃气体储罐或罐区之间的防火间距应符合下列规定:

1　湿式可燃气体储罐之间、干式可燃气体储罐之间以及湿式与干式可燃气体储罐之间的防火间距,不应小于相邻较大罐直径的 1/2;

2　固定容积的可燃气体储罐之间的防火间距不应小于相邻较大罐直径的 2/3;

3　固定容积的可燃气体储罐与湿式或干式可燃气体储罐之间的防火间距,不应小于相邻较大罐直径的 1/2;

4 数个固定容积的可燃气体储罐的总容积大于200000m³时，应分组布置。卧式储罐组与组之间的防火间距不应小于相邻较大罐长度的一半；球形储罐组与组之间的防火间距不应小于相邻较大罐直径，且不应小于20m。

4.3.3 氧气储罐与建筑物、储罐、堆场的防火间距应符合下列规定：

1 湿式氧气储罐与建筑物、储罐、堆场的防火间距不应小于表4.3.3的规定；

2 氧气储罐之间的防火间距不应小于相邻较大罐直径的1/2；

3 氧气储罐与可燃气体储罐之间的防火间距，不应小于相邻较大罐的直径；

4 氧气储罐与其制氧厂房的防火间距可按工艺布置要求确定；

5 容积小于等于50m³的氧气储罐与其使用厂房的防火间距不限；

6 固定容积的氧气储罐与建筑物、储罐、堆场的防火间距不应小于表4.3.3的规定。

表4.3.3 湿式氧气储罐与建筑物、储罐、堆场的防火间距(m)

名称			湿式氧气储罐的总容积 V(m³)		
			$V\leqslant1000$	$1000<V\leqslant50000$	$V>50000$
甲、乙、丙类液体储罐 可燃材料堆场 甲类物品仓库 室外变、配电站			20	25	30
民用建筑			18	20	25
其他建筑	耐火等级	一、二级	10	12	14
		三级	12	14	16
		四级	14	16	18

注：固定容积氧气储罐的总容积按储罐几何容积(m³)和设计储存压力(绝对压力，10^5Pa)的乘积计算。

4.3.4 液氧储罐与建筑物、储罐、堆场的防火间距应符合本规范第4.3.3条相应储量湿式氧气储罐防火间距的规定。液氧储罐与其泵房的间距不宜小于3m。总容积小于等于3m³的液氧储罐与其使用建筑的防火间距应符合下列规定：

1 当设置在独立的一、二级耐火等级的专用建筑物内时，其防火间距不应小于10m；

2 当设置在独立的一、二级耐火等级的专用建筑物内，且面向使用建筑物一侧采用无门窗洞口的防火墙隔开时，其防火间距不限；

3 当低温储存的液氧储罐采取了防火措施时，其防火间距不应小于5m。

注：1m³液氧折合标准状态下800m³气态氧。

4.3.5 液氧储罐周围5.0m范围内不应有可燃物和设置沥青路面。

4.3.6 可燃、助燃气体储罐与铁路、道路的防火间距不应小于表4.3.6的规定。

表4.3.6 可燃、助燃气体储罐与铁路、道路的防火间距(m)

名称	厂外铁路线中心线	厂内铁路线中心线	厂外道路路边	厂内道路路边	
				主要	次要
可燃、助燃气体储罐	25	20	15	10	5

4.3.7 液氢储罐与建筑物、储罐、堆场的防火间距可按本规范4.4.1条相应储量液化石油气储

罐防火间距的规定减少25%确定。

4.4 液化石油气储罐(区)的防火间距

4.4.1 液化石油气供应基地的全压式和半冷冻式储罐或罐区与明火、散发火花地点和基地外建筑物之间的防火间距,不应小于表4.4.1的规定。

表4.4.1 液化石油气供应基地的全压式和半冷冻式储罐(区)与明火、散发火花地点和基地外建构筑物之间的防火间距(m)

总容积 $V(m^3)$	$30<V\leqslant50$	$50<V\leqslant200$	$200<V\leqslant500$	$500<V\leqslant1000$	$1000<V\leqslant2500$	$2500<V\leqslant5000$	$V>5000$
单罐容量 $V(m^3)$	$V\leqslant20$	$V\leqslant50$	$V\leqslant100$	$V\leqslant200$	$V\leqslant400$	$V\leqslant1000$	$V>1000$
居住区、村镇和学校、影剧院、体育馆等重要公共建筑(最外侧建筑物外墙)	45	50	70	90	110	130	150
工业企业(最外侧建筑物外墙)	27	30	35	40	50	60	75
明火或散发火花地点,室外变、配电站	45	50	55	60	70	80	120
民用建筑,甲、乙类液体储罐,甲、乙类仓库(厂房)稻草、麦秸、芦苇、打包废纸等材料堆场	40	45	50	55	65	75	100
丙类液体储罐,可燃气体储罐,丙、丁类厂房(仓库)	32	35	40	45	55	65	80
助燃气体储罐,木材等材料堆场	27	30	35	40	50	60	75

续表4.4.1

总容积 $V(m^3)$		$30<V\leqslant50$	$50<V\leqslant200$	$200<V\leqslant500$	$500<V\leqslant1000$	$1000<V\leqslant2500$	$2500<V\leqslant5000$	$V>5000$
单罐容量 $V(m^3)$		$V\leqslant20$	$V\leqslant50$	$V\leqslant100$	$V\leqslant200$	$V\leqslant400$	$V\leqslant1000$	$V>1000$
其他建筑	耐火等级 一、二级	18	20	22	25	30	40	50
	三级	22	25	27	30	40	50	60
	四级	27	30	35	40	50	60	75
公路(路边)	高速、Ⅰ、Ⅱ级	20	25					30
	Ⅲ、Ⅳ级	15	20					25
架空电力线(中心线)		应符合本规范第11.2.1条的规定						
架空通信线(中心线)	Ⅰ、Ⅱ级	30	40					
	Ⅲ、Ⅳ级	1.5倍杆高						
铁路(中心线)	国家线	60	70		80		100	
	企业专用线	25	30		35		40	

注:1 防火间距应按本表储罐总容积或单罐容积较大者确定,并应从距建筑最近的储罐外壁、堆垛外缘算起。

2 当地下液化石油气储罐的单罐容积小于等于50m³,总容积小于等于400m³时,其防火间距可按本表减少

50%。

3 居住区、村镇系指1000人或300户以上者，以下者按本表民用建筑执行。

4 与本表规定以外的其他建筑物的防火间距，应按现行国家标准《城镇燃气设计规范》GB 50028的有关规定执行。

4.4.2 液化石油气储罐之间的防火间距不应小于相邻较大罐的直径。

数个储罐的总容积大于3000m³时，应分组布置，组内储罐宜采用单排布置。组与组相邻储罐之间的防火间距，不应小于20m。

4.4.3 液化石油气储罐与所属泵房的距离不应小于15m。当泵房面向储罐一侧的外墙采用无门窗洞口的防火墙时，其防火间距可减少至6m。液化石油气泵露天设置在储罐区内时，泵与储罐之间的距离不限。

4.4.4 全冷冻式液化石油气储罐与周围建筑物之间的防火间距，应按现行国家标准《城镇燃气设计规范》GB 50028的有关规定执行。

4.4.5 液化石油气气化站、混气站的储罐与周围建筑物之间的防火间距，应按现行国家标准《城镇燃气设计规范》GB 50028的有关规定执行。

工业企业内总容积小于等于10m³的液化石油气气化站、混气站的储罐，当设置在专用的独立建筑内时，其外墙与相邻厂房及其附属设备之间的防火间距可按甲类厂房有关防火间距的规定执行。当露天设置时，与建筑物、储罐、堆场的防火间距应按现行国家标准《城镇燃气设计规范》GB 50028的有关规定执行。

4.4.6 Ⅰ、Ⅱ级瓶装液化石油气供应站瓶库与站外建筑之间的防火间距不应小于表4.4.6的规定。

表4.4.6 Ⅰ、Ⅱ级瓶装液化石油气供应站瓶库与站外建筑之间的防火间距(m)

名　称	Ⅰ级		Ⅱ级	
瓶库的总存瓶容积V(m³)	$6<V\leqslant10$	$10<V\leqslant20$	$1<V\leqslant3$	$3<V\leqslant6$
明火、散发火花地点	30	35	20	25
重要公共建筑	20	25	12	15
民用建筑	10	15	6	8
主要道路路边	10	10	8	8
次要道路路边	5	5	5	5

注：1 总存瓶容积应按实瓶个数与单瓶几何容积的乘积计算。

2 瓶装液化石油气供应站的分级及总存瓶容积小于等于1m³的瓶装供应站瓶库的设置应符合现行国家标准《城镇燃气设计规范》GB 50028的有关规定。

4.4.7 Ⅰ级瓶装液化石油气供应站的四周宜设置不燃烧体的实体围墙，但面向出入口一侧可设置不燃烧体非实体围墙。

Ⅱ级瓶装液化石油气供应站的四周宜设置不燃烧体的实体围墙，或其底部实体部分高度不应低于0.6m的围墙。

4.5 可燃材料堆场的防火间距

4.5.1 露天、半露天可燃材料堆场与建筑物的防火间距不应小于表 4.5.1 的规定。

表 4.5.1 露天、半露天可燃材料堆场与建筑物的防火间距(m)

名称	一个堆场的总储量	建筑物的耐火等级		
		一、二级	三级	四级
粮食席穴囤 W(t)	$10 \leqslant W < 5000$	15	20	25
	$5000 \leqslant W < 20000$	20	25	30
粮食土圆仓 W(t)	$500 \leqslant W < 10000$	10	15	20
	$10000 \leqslant W < 20000$	15	20	25
棉、麻、毛、化纤、百货 W(t)	$10 \leqslant W < 500$	10	15	20
	$500 \leqslant W < 1000$	15	20	25
	$1000 \leqslant W < 5000$	20	25	30
稻草、麦秸、芦苇、打包废纸等 W(t)	$10 \leqslant W < 5000$	15	20	25
	$5000 \leqslant W < 10000$	20	25	30
	$W \geqslant 10000$	25	30	40
木材等 V(m^3)	$50 \leqslant V < 1000$	10	15	20
	$1000 \leqslant V < 10000$	15	20	25
	$V \geqslant 10000$	20	25	30
煤和焦炭 W(t)	$100 \leqslant W < 5000$	6	8	10
	$W \geqslant 5000$	8	10	12

注:露天、半露天稻草、麦秸、芦苇、打包废纸等材料堆场与甲类厂房(仓库)以及民用建筑的防火间距,应根据建筑物的耐火等级分别按本表的规定增加 25%,且不应小于 25m;与室外变、配电站的防火间距不应小于 50m;与明火或散发火花地点的防火间距,应按本表四级耐火等级建筑的相应规定增加 25%。

当一个木材堆场的总储量大于 25000m^3 或一个稻草、麦秸、芦苇、打包废纸等材料堆场的总储量大于 20000t 时,宜分设堆场。各堆场之间的防火间距不应小于相邻较大堆场与四级耐火等级建筑的间距。

不同性质物品堆场之间的防火间距,不应小于本表相应储量堆场与四级耐火等级建筑之间防火间距的较大值。

4.5.2 露天、半露天可燃材料堆场与甲、乙、丙类液体储罐的防火间距,不应小于本规范表 4.2.1 和表 4.5.1 中相应储量的堆场与四级耐火等级建筑之间防火间距的较大值。

4.5.3 露天、半露天可燃材料堆场与铁路、道路的防火间距不应小于表 4.5.3 的规定。

表 4.5.3 露天、半露天可燃材料堆场与铁路、道路的防火间距(m)

名称	厂外铁路线中心线	厂内铁路线中心线	厂外道路路边	厂内道路路边	
				主要	次要
稻草、麦秸、芦苇、打包废纸等材料堆场	30	20	15	10	5

注:未列入本表的可燃材料堆场与铁路、道路的防火间距,可根据储存物品的火灾危险性按类比原则确定。

5 民用建筑

5.1 民用建筑的耐火等级、层数和建筑面积

5.1.1 民用建筑的耐火等级应分为一、二、三、四级。除本规范另有规定者外，不同耐火等级建筑物相应构件的燃烧性能和耐火极限不应低于表 5.1.1 的规定。

表 5.1.1 建筑物构件的燃烧性能和耐火极限(h)

构件名称		耐火等级			
		一级	二级	三级	四级
墙	防火墙	不燃烧体 3.00	不燃烧体 3.00	不燃烧体 3.00	不燃烧体 3.00
	承重墙	不燃烧体 3.00	不燃烧体 2.50	不燃烧体 2.00	难燃烧体 0.50
	非承重外墙	不燃烧体 1.00	不燃烧体 1.00	不燃烧体 0.50	燃烧体
	楼梯间的墙 电梯井的墙 住宅单元之间的墙 住宅分户墙	不燃烧体 2.00	不燃烧体 2.00	不燃烧体 1.50	难燃烧体 0.50
	疏散走道两侧的隔墙	不燃烧体 1.00	不燃烧体 1.00	不燃烧体 0.50	难燃烧体 0.25
	房间隔墙	不燃烧体 0.75	不燃烧体 0.50	难燃烧体 0.50	难燃烧体 0.25
柱		不燃烧体 3.00	不燃烧体 2.50	不燃烧体 2.00	难燃烧体 0.50
梁		不燃烧体 2.00	不燃烧体 1.50	不燃烧体 1.00	难燃烧体 0.50
楼板		不燃烧体 1.50	不燃烧体 1.00	不燃烧体 0.50	燃烧体
屋顶承重构件		不燃烧体 1.50	不燃烧体 1.00	燃烧体	燃烧体

续表 5.1.1

构件名称	耐火等级			
	一级	二级	三级	四级
疏散楼梯	不燃烧体 1.50	不燃烧体 1.00	不燃烧体 0.50	燃烧体
吊顶(包括吊顶搁栅)	不燃烧体 0.25	难燃烧体 0.25	难燃烧体 0.15	燃烧体

注：1 除本规范另有规定者外，以木柱承重且以不燃烧材料作为墙体的建筑物，其耐火等级应按四级确定。

2 二级耐火等级建筑的吊顶采用不燃烧体时，其耐火极限不限。

3 在二级耐火等级的建筑中，面积不超过 $100m^2$ 的房间隔墙，如执行本表的规定确有困难时，可采用耐火极限不低于 0.30h 的不燃烧体。

4 一、二级耐火等级建筑疏散走道两侧的隔墙，按本表规定执行确有困难时，可采用耐火极限不低于 0.75h 的

不燃烧体。

5 住宅建筑构件的耐火极限和燃烧性能可按现行国家标准《住宅建筑规范》GB 50368 的规定执行。

5.1.2 二级耐火等级的建筑，当房间隔墙采用难燃烧体时，其耐火极限应提高 0.25h。

5.1.3 一、二级耐火等级建筑的上人平屋顶，其屋面板的耐火极限分别不应低于 1.50h 和 1.00h。

5.1.4 一、二级耐火等级建筑的屋面板应采用不燃烧材料，但其屋面防水层和绝热层可采用可燃材料。

5.1.5 二级耐火等级住宅的楼板采用预应力钢筋混凝土楼板时，该楼板的耐火极限不应低于 0.75h。

5.1.6 三级耐火等级的下列建筑或部位的吊顶，应采用不燃烧体或耐火极限不低于 0.25h 的难燃烧体：

1 医院、疗养院、中小学校、老年人建筑及托儿所、幼儿园的儿童用房和儿童游乐厅等儿童活动场所；

2 3 层及 3 层以上建筑中的门厅、走道。

5.1.7 民用建筑的耐火等级、最多允许层数和防火分区最大允许建筑面积应符合表 5.1.7 的规定。

表 5.1.7 民用建筑的耐火等级、最多允许层数和防火分区最大允许建筑面积

耐火等级	最多允许层数	防火分区的最大允许建筑面积(m^2)	备注
一、二级	按本规范第 1.0.2 条规定	2500	1. 体育馆、剧院的观众厅，展览建筑的展厅，其防火分区最大允许建筑面积可适当放宽； 2. 托儿所、幼儿园的儿童用房和儿童游乐厅等儿童活动场所不应超过 3 层或设置在四层及四层以上楼层或地下、半地下建筑(室)内
三级	5 层	1200	1. 托儿所、幼儿园的儿童用房和儿童游乐厅等儿童活动场所、老年人建筑和医院、疗养院的住院部分不应超过 2 层或设置在三层及三层以上楼层或地下、半地下建筑(室)内； 2. 商店、学校、电影院、剧院、礼堂、食堂、菜市场不应超过 2 层或设置在三层及三层以上楼层
四级	2 层	600	学校、食堂、菜市场、托儿所、幼儿园、老年人建筑、医院等不应设置在二层
地下、半地下建筑(室)		500	—

注：建筑内设置自动灭火系统时，该防火分区的最大允许建筑面积可按本表的规定增加 1.0 倍。局部设置时，增加面积可按该局部面积的 1.0 倍计算。

5.1.8 地下、半地下建筑(室)的耐火等级应为一级；重要公共建筑的耐火等级不应低于二级。

5.1.9 当多层建筑物内设置自动扶梯、敞开楼梯等上下层相连通的开口时，其防火分区面积应按上下层相连通的面积叠加计算；当其建筑面积之和大于本规范第 5.1.7 条的规定时，应划分防火分区。

5.1.10 建筑物内设置中庭时，其防火分区面积应按上下层相连通的面积叠加计算；当超过一个防火分区最大允许建筑面积时，应符合下列规定：

1 房间与中庭相通的开口部位应设置能自行关闭的甲级防火门窗；

2 与中庭相通的过厅、通道等处应设置甲级防火门或防火卷帘；防火门或防火卷帘应能在火灾时自动关闭或降落。防火卷帘的设置应符合本规范第7.5.3条的规定；

3 中庭应按本规范第9章的规定设置排烟设施。

5.1.11 防火分区之间应采用防火墙分隔。当采用防火墙确有困难时，可采用防火卷帘等防火分隔设施分隔。采用防火卷帘时应符合本规范第7.5.3条的规定。

5.1.12 地上商店营业厅、展览建筑的展览厅符合下列条件时，其每个防火分区的最大允许建筑面积不应大于10000m²：

1 设置在一、二级耐火等级的单层建筑内或多层建筑的首层；

2 按本规范第8、9、11章的规定设置有自动喷水灭火系统、排烟设施和火灾自动报警系统；

3 内部装修设计符合现行国家标准《建筑内部装修设计防火规范》GB 50222的有关规定。

5.1.13 地下商店应符合下列规定：

1 营业厅不应设置在地下三层及三层以下；

2 不应经营和储存火灾危险性为甲、乙类储存物品属性的商品；

3 当设有火灾自动报警系统和自动灭火系统，且建筑内部装修符合现行国家标准《建筑内部装修设计防火规范》GB 50222的有关规定时，其营业厅每个防火分区的最大允许建筑面积可增加到2000m²；

4 应设置防烟与排烟设施；

5 当地下商店总建筑面积大于20000m²时，应采用不开设门窗洞口的防火墙分隔。相邻区域确需局部连通时，应选择采取下列措施进行防火分隔：

1)下沉式广场等室外开敞空间。该室外开敞空间的设置应能防止相邻区域的火灾蔓延和便于安全疏散；

2)防火隔间。该防火隔间的墙应为实体防火墙，在隔间的相邻区域分别设置火灾时能自行关闭的常开式甲级防火门；

3)避难走道。该避难走道除应符合现行国家标准《人民防空工程设计防火规范》GB 50098的有关规定外，其两侧的墙应为实体防火墙，且在局部连通处的墙上应分别设置火灾时能自行关闭的常开式甲级防火门；

4)防烟楼梯间。该防烟楼梯间及前室的门应为火灾时能自行关闭的常开式甲级防火门。

5.1.14 歌舞厅、录像厅、夜总会、放映厅、卡拉OK厅(含具有卡拉OK功能的餐厅)、游艺厅(含电子游艺厅)、桑拿浴室(不包括洗浴部分)、网吧等歌舞娱乐放映游艺场所，宜设置在一、二级耐火等级建筑物内的首层、二层或三层的靠外墙部位，不宜布置在袋形走道的两侧或尽端。

5.1.15 当歌舞厅、录像厅、夜总会、放映厅、卡拉OK厅(含具有卡拉OK功能的餐厅)、游艺厅(含电子游艺厅)、桑拿浴室(不包括洗浴部分)、网吧等歌舞娱乐放映游艺场所必须布置在袋形走道的两侧或尽端时，最远房间的疏散门至最近安全出口的距离不应大于9m。当必须布置在建筑物内首层、二层或三层以外的其他楼层时，尚应符合下列规定：

1 不应布置在地下二层及二层以下。当布置在地下一层时，地下一层地面与室外出

入口地坪的高差不应大于10m；

2 一个厅、室的建筑面积不应大于200m²，并应采用耐火极限不低于2.00h的不燃烧体隔墙和不低于1.00h的不燃烧体楼板与其他部位隔开，厅、室的疏散门应设置乙级防火门；

3 应按本规范第9章设置防烟与排烟设施。

5.2 民用建筑的防火间距

5.2.1 民用建筑之间的防火间距不应小于表5.2.1的规定，与其他建筑物之间的防火间距应按本规范第3章和第4章的有关规定执行。

表5.2.1 民用建筑之间的防火间距(m)

耐火等级	一、二级	三级	四级
一、二级	6	7	9
三级	7	8	10
四级	9	10	12

注：1 两座建筑物相邻较高一面外墙为防火墙或高出相邻较低一座一、二级耐火等级建筑物的屋面15m范围内的外墙为防火墙且不开设门窗洞口时，其防火间距可不限。

2 相邻的两座建筑物，当较低一座的耐火等级不低于二级、屋顶不设置天窗、屋顶承重构件及屋面板的耐火极限不低于1.00h，且相邻的较低一面外墙为防火墙时，其防火间距不应小于3.5m。

3 相邻的两座建筑物，当较低一座的耐火等级不低于二级，相邻较高一面外墙的开口部位设置甲级防火门窗，或设置符合现行国家标准《自动喷水灭火系统设计规范》GB 50084规定的防火分隔水幕或本规范第7.5.3条规定的防火卷帘时，其防火间距不应小于3.5m。

4 相邻两座建筑物，当相邻外墙为不燃烧体且无外露的燃烧体屋檐，每面外墙上未设置防火保护措施的门窗洞口不正对开设，且面积之和小于等于该外墙面积的5%时，其防火间距可按本表规定减少25%。

5 耐火等级低于四级的原有建筑物，其耐火等级可按四级确定；以木柱承重且以不燃烧材料作为墙体的建筑，其耐火等级应按四级确定。

6 防火间距应按相邻建筑物外墙的最近距离计算，当外墙有凸出的燃烧构件时，应从其凸出部分外缘算起。

5.2.2 民用建筑与单独建造的终端变电所、单台蒸汽锅炉的蒸发量小于等于4t/h或单台热水锅炉的额定热功率小于等于2.8MW的燃煤锅炉房，其防火间距可按本规范第5.2.1条的规定执行。

民用建筑与单独建造的其他变电所、燃油或燃气锅炉房及蒸发量或额定热功率大于上述规定的燃煤锅炉房，其防火间距应按本规范第3.4.1条有关室外变、配电站和丁类厂房的规定执行。10kV以下的箱式变压器与建筑物的防火间距不应小于3m。

5.2.3 数座一、二级耐火等级的多层住宅或办公楼，当建筑物的占地面积的总和小于等于2500m²时，可成组布置，但组内建筑物之间的间距不宜小于4m。组与组或组与相邻建筑物之间的防火间距不应小于本规范第5.2.1条的规定。

5.3 民用建筑的安全疏散

5.3.1 民用建筑的安全出口应分散布置。每个防火分区、一个防火分区的每个楼层，其相邻2个安全出口最近边缘之间的水平距离不应小于5m。

5.3.2 公共建筑内的每个防火分区、一个防火分区内的每个楼层，其安全出口的数量应经

计算确定，且不应少于2个。当符合下列条件之一时，可设一个安全出口或疏散楼梯：

1 除托儿所、幼儿园外，建筑面积小于等于200m² 且人数不超过50人的单层公共建筑；

2 除医院、疗养院、老年人建筑及托儿所、幼儿园的儿童用房和儿童游乐厅等儿童活动场所等外，符合表5.3.2规定的2、3层公共建筑。

表5.3.2 公共建筑可设置1个疏散楼梯的条件

耐火等级	最多层数	每层最大建筑面积(m²)	人数
一、二级	3层	500	第二层和第三层的人数之和不超过100人
三级	3层	200	第二层和第三层的人数之和不超过50人
四级	2层	200	第二层人数不超过30人

5.3.3 老年人建筑及托儿所、幼儿园的儿童用房和儿童游乐厅等儿童活动场所宜设置在独立的建筑内。当必须设置在其他民用建筑内时，宜设置独立的安全出口，并应符合本规范第5.1.7条的规定。

5.3.4 一、二级耐火等级的公共建筑，当设置不少于2部疏散楼梯且顶层局部升高部位的层数不超过2层、人数之和不超过50人、每层建筑面积小于等于200m² 时，该局部高出部位可设置1部与下部主体建筑楼梯间直接连通的疏散楼梯，但至少应另外设置1个直通主体建筑上人平屋面的安全出口，该上人屋面应符合人员安全疏散要求。

5.3.5 下列公共建筑的疏散楼梯应采用室内封闭楼梯间(包括首层扩大封闭楼梯间)或室外疏散楼梯：

1 医院、疗养院的病房楼；

2 旅馆；

3 超过2层的商店等人员密集的公共建筑；

4 设置有歌舞娱乐放映游艺场所且建筑层数超过2层的建筑；

5 超过5层的其他公共建筑。

5.3.6 自动扶梯和电梯不应作为安全疏散设施。

5.3.7 公共建筑中的客、货电梯宜设置独立的电梯间，不宜直接设置在营业厅、展览厅、多功能厅等场所内。

5.3.8 公共建筑和通廊式非住宅类居住建筑中各房间疏散门的数量应经计算确定，且不应少于2个，该房间相邻2个疏散门最近边缘之间的水平距离不应小于5m。当符合下列条件之一时，可设置1个：

1 房间位于2个安全出口之间，且建筑面积小于等于120m²，疏散门的净宽度不小于0.9m；

2 除托儿所、幼儿园、老年人建筑外，房间位于走道尽端，且由房间内任一点到疏散门的直线距离小于等于15m、其疏散门的净宽度不小于1.4m；

3 歌舞娱乐放映游艺场所内建筑面积小于等于50m² 的房间。

5.3.9 剧院、电影院和礼堂的观众厅，其疏散门的数量应经计算确定，且不应少于2个。每个疏散门的平均疏散人数不应超过250人；当容纳人数超过2000人时，其超过2000人的部分，每个疏散门的平均疏散人数不应超过400人。

5.3.10　体育馆的观众厅，其疏散门的数量应经计算确定，且不应少于2个，每个疏散门的平均疏散人数不宜超过400～700人。

5.3.11　居住建筑单元任一层建筑面积大于650m²，或任一住户的户门至安全出口的距离大于15m时，该建筑单元每层安全出口不应少于2个。当通廊式非住宅类居住建筑超过表5.3.11规定时，安全出口不应少于2个。居住建筑的楼梯间设置形式应符合下列规定：

1　通廊式居住建筑当建筑层数超过2层时应设封闭楼梯间；当户门采用乙级防火门时，可不设置封闭楼梯间；

2　其他形式的居住建筑当建筑层数超过6层或任一层建筑面积大于500m²时，应设置封闭楼梯间；当户门或通向疏散走道、楼梯间的门、窗为乙级防火门、窗时，可不设置封闭楼梯间。

居住建筑的楼梯间宜通至屋顶，通向平屋面的门或窗应向外开启。

当住宅中的电梯井与疏散楼梯相邻布置时，应设置封闭楼梯间，当户门采用乙级防火门时，可不设置封闭楼梯间。当电梯直通住宅楼层下部的汽车库时，应设置电梯候梯厅并采用防火分隔措施。

表5.3.11　通廊式非住宅类居住建筑可设置1个疏散楼梯的条件

耐火等级	最多层数	每层最大建筑面积（m²）	人　数
一、二级	3层	500	第二层和第三层的人数之和不超过100人
三级	3层	200	第二层和第三层的人数之和不超过50人
四级	2层	200	第二层人数不超过30人

5.3.12　地下、半地下建筑（室）安全出口和房间疏散门的设置应符合下列规定：

1　每个防火分区的安全出口数量应经计算确定，且不应少于2个。当平面上有2个或2个以上防火分区相邻布置时，每个防火分区可利用防火墙上1个通向相邻分区的防火门作为第二安全出口，但必须有1个直通室外的安全出口；

2　使用人数不超过30人且建筑面积小于等于500m²的地下、半地下建筑（室），其直通室外的金属竖向梯可作为第二安全出口；

3　房间建筑面积小于等于50m²，且经常停留人数不超过15人时，可设置1个疏散门；

4　歌舞娱乐放映游艺场所的安全出口不应少于2个，其中每个厅室或房间的疏散门不应少于2个。当其建筑面积小于等于50m²且经常停留人数不超过15人时，可设置1个疏散门；

5　地下商店和设置歌舞娱乐放映游艺场所的地下建筑（室），当地下层数为3层及3层以上或地下室内地面与室外出入口地坪高差大于10m时，应设置防烟楼梯间；其他地下商店和设置歌舞娱乐放映游艺场所的地下建筑，应设置封闭楼梯间；

6　地下、半地下建筑的疏散楼梯间应符合本规范第7.4.4条的规定。

5.3.13　民用建筑的安全疏散距离应符合下列规定：

1　直接通向疏散走道的房间疏散门至最近安全出口的距离应符合表5.3.13的规定；

2　直接通向疏散走道的房间疏散门至最近非封闭楼梯间的距离，当房间位于两个楼梯间之间时，应按表5.3.13的规定减少5m；当房间位于袋形走道两侧或尽端时，应按表5.3.13的规定减少2m；

3 楼梯间的首层应设置直通室外的安全出口或在首层采用扩大封闭楼梯间。当层数不超过4层时，可将直通室外的安全出口设置在离楼梯间小于等于15m处；

4 房间内任一点到该房间直接通向疏散走道的疏散门的距离，不应大于表5.3.13中规定的袋形走道两侧或尽端的疏散门至安全出口的最大距离。

表5.3.13 直接通向疏散走道的房间疏散门至最近安全出口的最大距离(m)

名称	位于两个安全出口之间的疏散门			位于袋形走道两侧或尽端的疏散门		
	耐火等级			耐火等级		
	一、二级	三级	四级	一、二级	三级	四级
托儿所、幼儿园	25	20	—	20	15	—
医院、疗养院	35	30	—	20	15	—
学校	35	30	—	22	20	—
其他民用建筑	40	35	25	22	20	15

注：1 一、二级耐火等级的建筑物内的观众厅、展览厅、多功能厅、餐厅、营业厅和阅览室等，其室内任何一点至最近安全出口的直线距离不宜大于30m。

2 敞开式外廊建筑的房间疏散门至安全出口的最大距离可按本表增加5m。

3 建筑物内全部设置自动喷水灭火系统时，其安全疏散距离可按本表和本表注1的规定增加25%。

4 房间内任一点到该房间直接通向疏散走道的疏散门的距离计算：住宅应为最远房间内任一点到户门的距离，跃层式住宅内的户内楼梯的距离可按其梯段总长度的水平投影尺寸计算。

5.3.14 除本规范另有规定者外，建筑中的疏散走道、安全出口、疏散楼梯以及房间疏散门的各自总宽度应经计算确定。

安全出口、房间疏散门的净宽度不应小于0.9m，疏散走道和疏散楼梯的净宽度不应小于1.1m；不超过6层的单元式住宅，当疏散楼梯的一边设置栏杆时，最小净宽度不宜小于1m。

5.3.15 人员密集的公共场所、观众厅的疏散门不应设置门槛，其净宽度不应小于1.4m，且紧靠门口内外各1.4m范围内不应设置踏步。

剧院、电影院、礼堂的疏散门应符合本规范第7.4.12条的规定。

人员密集的公共场所的室外疏散小巷的净宽度不应小于3m，并应直接通向宽敞地带。

5.3.16 剧院、电影院、礼堂、体育馆等人员密集场所的疏散走道、疏散楼梯、疏散门、安全出口的各自总宽度，应根据其通过人数和疏散净宽度指标计算确定，并应符合下列规定：

1 观众厅内疏散走道的净宽度应按每100人不小于0.6m的净宽度计算，且不应小于1m；边走道的净宽度不宜小于0.8m。

在布置疏散走道时，横走道之间的座位排数不宜超过20排；纵走道之间的座位数：剧院、电影院、礼堂等，每排不宜超过22个；体育馆，每排不宜超过26个；前后排座椅的排距不小于0.9m时，可增加1倍，但不得超过50个；仅一侧有纵走道时，座位数应减少一半；

2 剧院、电影院、礼堂等场所供观众疏散的所有内门、外门、楼梯和走道的各自总宽度，应按表5.3.16-1的规定计算确定；

3 体育馆供观众疏散的所有内门、外门、楼梯和走道的各自总宽度，应按表5.3.16-2的规定计算确定；

4　有等场需要的入场门不应作为观众厅的疏散门。

表 5.3.16-1　剧院、电影院、礼堂等场所每 100 人所需最小疏散净宽度(m)

观众厅座位数(座)			≤2500	≤1200
耐火等级			一、二级	三级
疏散部位	门和走道	平坡地面	0.65	0.85
		阶梯地面	0.75	1.00
	楼梯		0.75	1.00

表 5.3.16-2　体育馆每 100 人所需最小疏散净宽度(m)

观众厅座位数档次(座)			3000～5000	5001～10000	10001～20000
疏散部位	门和走道	平坡地面	0.43	0.37	0.32
		阶梯地面	0.50	0.43	0.37
	楼梯		0.50	0.43	0.37

注：表 5.3.16-2 中较大座位数档次按规定计算的疏散总宽度，不应小于相邻较小座位数档次按其最多座位数计算的疏散总宽度。

5.3.17　学校、商店、办公楼、候车(船)室、民航候机厅、展览厅及歌舞娱乐放映游艺场所等民用建筑中的疏散走道、安全出口、疏散楼梯以及房间疏散门的各自总宽度，应按下列规定经计算确定：

1　每层疏散走道、安全出口、疏散楼梯以及房间疏散门的每 100 人净宽度不应小于表 5.3.17-1 的规定；当每层人数不等时，疏散楼梯的总宽度可分层计算，地上建筑中下层楼梯的总宽度应按其上层人数最多一层的人数计算；地下建筑中上层楼梯的总宽度应按其下层人数最多一层的人数计算；

2　当人员密集的厅、室以及歌舞娱乐放映游艺场所设置在地下或半地下时，其疏散走道、安全出口、疏散楼梯以及房间疏散门的各自总宽度，应按其通过人数每 100 人不小于 1m 计算确定；

3　首层外门的总宽度应按该层或该层以上人数最多的一层人数计算确定，不供楼上人员疏散的外门，可按本层人数计算确定；

4　录像厅、放映厅的疏散人数应按该场所的建筑面积 1 人/m^2 计算确定；其他歌舞娱乐放映游艺场所的疏散人数应按该场所的建筑面积 0.5 人/m^2 计算确定；

5　商店的疏散人数应按每层营业厅建筑面积乘以面积折算值和疏散人数换算系数计算。地上商店的面积折算值宜为 50%～70%，地下商店的面积折算值不应小于 70%。疏散人数的换算系数可按表 5.3.17-2 确定。

表 5.3.17-1　疏散走道、安全出口、疏散楼梯和房间疏散门每 100 人的净宽度(m)

楼层位置	耐火等级		
	一、二级	三级	四级
地上一、二层	0.65	0.75	1.00
地上三层	0.75	1.00	—
地上四层及四层以上各层	1.00	1.25	—
与地面出入口地面的高差不超过 10m 的地下建筑	0.75	—	—
与地面出入口地面的高差超过 10m 的地下建筑	1.00	—	—

表 5.3.17-2　商店营业厅内的疏散人数换算系数(人/m^2)

楼层位置	地下二层	地下一层、地上第一、二层	地上第三层	地上第四层及四层以上各层
换算系数	0.80	0.85	0.77	0.60

5.3.18　人员密集的公共建筑不宜在窗口、阳台等部位设置金属栅栏，当必须设置时，应有从内部易于开启的装置。窗口、阳台等部位宜设置辅助疏散逃生设施。

5.4　其　　他

5.4.1　燃煤、燃油或燃气锅炉、油浸电力变压器、充有可燃油的高压电容器和多油开关等用房宜独立建造。当确有困难时可贴邻民用建筑布置，但应采用防火墙隔开，且不应贴邻人员密集场所。

5.4.2　燃油或燃气锅炉、油浸电力变压器、充有可燃油的高压电容器和多油开关等用房受条件限制必须布置在民用建筑内时，不应布置在人员密集场所的上一层、下一层或贴邻，并应符合下列规定：

1　燃油和燃气锅炉房、变压器室应设置在首层或地下一层靠外墙部位，但常(负)压燃油、燃气锅炉可设置在地下二层，当常(负)压燃气锅炉距安全出口的距离大于 6m 时，可设置在屋顶上。

采用相对密度(与空气密度的比值)大于等于 0.75 的可燃气体为燃料的锅炉，不得设置在地下或半地下建筑(室)内；

2　锅炉房、变压器室的门均应直通室外或直通安全出口；外墙开口部位的上方应设置宽度不小于 1m 的不燃烧体防火挑檐或高度不小于 1.2m 的窗槛墙；

3　锅炉房、变压器室与其他部位之间应采用耐火极限不低于 2.00h 的不燃烧体隔墙和 1.50h 的不燃烧体楼板隔开。在隔墙和楼板上不应开设洞口，当必须在隔墙上开设门窗时，应设置甲级防火门窗；

4　当锅炉房内设置储油间时，其总储存量不应大于 $1m^3$，且储油间应采用防火墙与锅炉间隔开；当必须在防火墙上开门时，应设置甲级防火门；

5　变压器室之间、变压器室与配电室之间，应采用耐火极限不低于 2.00h 的不燃烧体墙隔开；

6　油浸电力变压器、多油开关室、高压电容器室，应设置防止油品流散的设施。油浸电力变压器下面应设置储存变压器全部油量的事故储油设施；

7　锅炉的容量应符合现行国家标准《锅炉房设计规范》GB 50041的有关规定。油浸电力变压器的总容量不应大于 1260 kV·A，单台容量不应大于 630 kV·A；

8　应设置火灾报警装置；

9　应设置与锅炉、油浸变压器容量和建筑规模相适应的灭火设施；

10　燃气锅炉房应设置防爆泄压设施，燃气、燃油锅炉房应设置独立的通风系统，并应符合本规范第 10 章的有关规定。

5.4.3　柴油发电机房布置在民用建筑内时应符合下列规定：

1　宜布置在建筑物的首层及地下一、二层；

2　应采用耐火极限不低于 2.00h 的不燃烧体隔墙和不低于 1.50h 的不燃烧体楼板

与其他部位隔开，门应采用甲级防火门；

3 机房内应设置储油间，其总储存量不应大于8.0h的需要量，且储油间应采用防火墙与发电机间隔开；当必须在防火墙上开门时，应设置甲级防火门；

4 应设置火灾报警装置；

5 应设置与柴油发电机容量和建筑规模相适应的灭火设施。

5.4.4 设置在建筑物内的锅炉、柴油发电机，其进入建筑物内的燃料供给管道应符合下列规定：

1 应在进入建筑物前和设备间内，设置自动和手动切断阀；

2 储油间的油箱应密闭且应设置通向室外的通气管，通气管应设置带阻火器的呼吸阀，油箱的下部应设置防止油品流散的设施；

3 燃气供给管道的敷设应符合现行国家标准《城镇燃气设计规范》GB 50028的有关规定；

4 供锅炉及柴油发电机使用的柴油等液体燃料储罐，其布置应符合本规范第3.4节或第4.2节的有关规定。

5.4.5 经营、存放和使用甲、乙类物品的商店、作坊和储藏间，严禁设置在民用建筑内。

5.4.6 住宅与其他功能空间处于同一建筑内时，应符合下列规定：

1 住宅部分与非住宅部分之间应采用不开设门窗洞口的耐火极限不低于1.50h的不燃烧体楼板和不低于2.00h的不燃烧体隔墙与居住部分完全分隔，且居住部分的安全出口和疏散楼梯应独立设置；

2 其他功能场所和居住部分的安全疏散、消防设施等防火设计，应分别按照本规范中住宅建筑和公共建筑的有关规定执行，其中居住部分的层数确定应包括其他功能部分的层数。

5.5 木结构民用建筑

5.5.1 当木结构建筑构件的燃烧性能和耐火极限满足表5.5.1的规定时，木结构可按本节的规定进行建筑防火设计。

表5.5.1 木结构建筑中构件的燃烧性能和耐火极限(h)

构件名称	燃烧性能和耐火极限
防火墙	不燃烧体3.00
承重墙、住宅单元之间的墙、住宅分户墙、楼梯间和电梯井墙体	难燃烧体1.00
非承重外墙、疏散走道两侧的隔墙	难燃烧体1.00
房间隔墙	难燃烧体0.50

续表5.5.1

构件名称	燃烧性能和耐火极限
多层承重柱	难燃烧体1.00
单层承重柱	难燃烧体1.00
梁	难燃烧体1.00

楼板	难燃烧体 1.00
屋顶承重构件	难燃烧体 1.00
疏散楼梯	难燃烧体 0.50
室内吊顶	难燃烧体 0.25

注：1 屋顶表层应采用不可燃材料。

2 当同一座木结构建筑由不同高度组成，较低部分的屋顶承重构件不得采用燃烧体；采用难燃烧体时，其耐火极限不应低于 1.00h。

5.5.2 木结构建筑不应超过 3 层。不同层数建筑最大允许长度和防火分区面积不应超过表 5.5.2 的规定。

表 5.5.2 木结构建筑的层数、长度和面积

层 数	最大允许长度(m)	每层最大允许面积(m^2)
1 层	100	1200
2 层	80	900
3 层	60	600

注：安装有自动喷水灭火系统的木结构建筑，每层楼最大允许长度、面积可按本表规定增加 1.0 倍，局部设置时，增加面积可按该局部面积的 1.0 倍计算。

5.5.3 木结构建筑之间及其与其他耐火等级的民用建筑之间的防火间距不应小于表 5.5.3 的规定。

表 5.5.3 木结构建筑之间及其与其他耐火等级的民用建筑之间的防火间距(m)

建筑耐火等级或类别	一、二级	三级	木结构建筑	四级
木结构建筑	8	9	10	11

注：防火间距应按相邻建筑外墙的最近距离计算，当外墙有凸出的可燃构件时，应从凸出部分的外缘算起。

5.5.4 两座木结构建筑之间及其与相邻其他结构民用建筑之间的外墙均无任何门窗洞口时，其防火间距不应小于 4m。

5.5.5 两座木结构建筑之间及其与其他耐火等级的民用建筑之间，外墙的门窗洞口面积之和不超过该外墙面积的 10%时，其防火间距不应小于表 5.5.5 的规定。

表 5.5.5 外墙开口率小于 10%时的防火间距(m)

建筑耐火等级或类别	一、二、三级	木结构建筑	四级
木结构建筑	5	6	7

6 消防车道

6.0.1 街区内的道路应考虑消防车的通行，其道路中心线间的距离不宜大于160m。当建筑物沿街道部分的长度大于150m或总长度大于220m时，应设置穿过建筑物的消防车道。当确有困难时，应设置环形消防车道。

6.0.2 有封闭内院或天井的建筑物，当其短边长度大于24m时，宜设置进入内院或天井的消防车道。

6.0.3 有封闭内院或天井的建筑物沿街时，应设置连通街道和内院的人行通道（可利用楼梯间），其间距不宜大于80m。

6.0.4 在穿过建筑物或进入建筑物内院的消防车道两侧，不应设置影响消防车通行或人员安全疏散的设施。

6.0.5 超过3000个座位的体育馆、超过2000个座位的会堂和占地面积大于3000m^{2}的展览馆等公共建筑，宜设置环形消防车道。

6.0.6 工厂、仓库区内应设置消防车道。

占地面积大于3000m^{2}的甲、乙、丙类厂房或占地面积大于1500m^{2}的乙、丙类仓库，应设置环形消防车道，确有困难时，应沿建筑物的两个长边设置消防车道。

6.0.7 可燃材料露天堆场区，液化石油气储罐区，甲、乙、丙类液体储罐区和可燃气体储罐区，应设置消防车道。消防车道的设置应符合下列规定：

1 储量大于表6.0.7规定的堆场、储罐区，宜设置环形消防车道；

表6.0.7 堆场、储罐区的储量

名称	棉、麻、毛、化纤(t)	稻草、麦秸、芦苇(t)	木材(m^3)	甲、乙、丙类液体储罐(m^3)	液化石油气储罐(m^3)	可燃气体储罐(m^3)
储量	1000	5000	5000	1500	500	30000

2 占地面积大于30000m^{2}的可燃材料堆场，应设置与环形消防车道相连的中间消防车道，消防车道的间距不宜大于150m。液化石油气储罐区，甲、乙、丙类液体储罐区，可燃气体储罐区，区内的环形消防车道之间宜设置连通的消防车道；

3 消防车道与材料堆场堆垛的最小距离不应小于5m；

4 中间消防车道与环形消防车道交接处应满足消防车转弯半径的要求。

6.0.8 供消防车取水的天然水源和消防水池应设置消防车道。

6.0.9 消防车道的净宽度和净空高度均不应小于4.0m。供消防车停留的空地，其坡度不宜大于3%。

消防车道与厂房（仓库）、民用建筑之间不应设置妨碍消防车作业的障碍物。

6.0.10 环形消防车道至少应有两处与其他车道连通。尽头式消防车道应设置回车道或回车场，回车场的面积不应小于12m×12m；供大型消防车使用时，不宜小于18m×18m。

消防车道路面、扑救作业场地及其下面的管道和暗沟等应能承受大型消防车的压力。

消防车道可利用交通道路，但应满足消防车通行与停靠的要求。

6.0.11 消防车道不宜与铁路正线平交。如必须平交，应设置备用车道，且两车道之间的间距不应小于一列火车的长度。

7 建筑构造

7.1 防 火 墙

7.1.1 防火墙应直接设置在建筑物的基础或钢筋混凝土框架、梁等承重结构上，轻质防火墙体可不受此限。

防火墙应从楼地面基层隔断至顶板底面基层。当屋顶承重结构和屋面板的耐火极限低于0.50h，高层厂房(仓库)屋面板的耐火极限低于1.00h时，防火墙应高出不燃烧体屋面0.4m以上，高出燃烧体或难燃烧体屋面0.5m以上。其他情况时，防火墙可不高出屋面，但应砌至屋面结构层的底面。

7.1.2 防火墙横截面中心线距天窗端面的水平距离小于4m，且天窗端面为燃烧体时，应采取防止火势蔓延的措施。

7.1.3 当建筑物的外墙为难燃烧体时，防火墙应凸出墙的外表面0.4m以上，且在防火墙两侧的外墙应为宽度不小于2m的不燃烧体，其耐火极限不应低于该外墙的耐火极限。

当建筑物的外墙为不燃烧体时，防火墙可不凸出墙的外表面。紧靠防火墙两侧的门、窗洞口之间最近边缘的水平距离不应小于2m；但装有固定窗扇或火灾时可自动关闭的乙级防火窗时，该距离可不限。

7.1.4 建筑物内的防火墙不宜设置在转角处。如设置在转角附近，内转角两侧墙上的门、窗洞口之间最近边缘的水平距离不应小于4m。

7.1.5 防火墙上不应开设门窗洞口，当必须开设时，应设置固定的或火灾时能自动关闭的甲级防火门窗。

可燃气体和甲、乙、丙类液体的管道严禁穿过防火墙。其他管道不宜穿过防火墙，当必须穿过时，应采用防火封堵材料将墙与管道之间的空隙紧密填实；当管道为难燃及可燃材质时，应在防火墙两侧的管道上采取防火措施。

防火墙内不应设置排气道。

7.1.6 防火墙的构造应使防火墙任意一侧的屋架、梁、楼板等受到火灾的影响而破坏时，不致使防火墙倒塌。

7.2 建筑构件和管道井

7.2.1 剧院等建筑的舞台与观众厅之间的隔墙应采用耐火极限不低于3.00h的不燃烧体。

舞台上部与观众厅闷顶之间的隔墙可采用耐火极限不低于1.50h的不燃烧体，隔墙上的门应采用乙级防火门。

舞台下面的灯光操作室和可燃物储藏室应采用耐火极限不低于2.00h的不燃烧体墙与其他部位隔开。

电影放映室、卷片室应采用耐火极限不低于1.50h的不燃烧体隔墙与其他部分隔开。观察孔和放映孔应采取防火分隔措施。

7.2.2 医院中的洁净手术室或洁净手术部、附设在建筑中的歌舞娱乐放映游艺场所以及附设在居住建筑中的托儿所、幼儿园的儿童用房和儿童游乐厅等儿童活动场所、老年人建筑，应采用耐火极限不低于2.00h的不燃烧体墙和不低于1.00h的楼板与其他场所或部位隔开，当墙上必须开门时应设置乙级防火门。

7.2.3 下列建筑或部位的隔墙应采用耐火极限不低于2.00h的不燃烧体，隔墙上的门窗应为乙级防火门窗：

1 甲、乙类厂房和使用丙类液体的厂房；

2 有明火和高温的厂房；

3 剧院后台的辅助用房；

4 一、二级耐火等级建筑的门厅；

5 除住宅外，其他建筑内的厨房；

6 甲、乙、丙类厂房或甲、乙、丙类仓库内布置有不同类别火灾危险性的房间。

7.2.4 建筑内的隔墙应从楼地面基层隔断至顶板底面基层。

住宅分户墙和单元之间的墙应砌至屋面板底部，屋面板的耐火极限不应低于0.50h。

7.2.5 附设在建筑物内的消防控制室、固定灭火系统的设备室、消防水泵房和通风空气调节机房等，应采用耐火极限不低于2.00h的隔墙和不低于1.50h的楼板与其他部位隔开。设置在丁、戊类厂房中的通风机房应采用耐火极限不低于1.00h的隔墙和不低于0.50h的楼板与其他部位隔开。隔墙上的门除本规范另有规定者外，均应采用乙级防火门。

7.2.6 冷库采用泡沫塑料、稻壳等可燃材料作墙体内的绝热层时，宜采用不燃烧绝热材料在每层楼板处做水平防火分隔。防火分隔部位的耐火极限应与楼板的相同。

冷库阁楼层和墙体的可燃绝热层宜采用不燃烧体墙分隔。

7.2.7 建筑幕墙的防火设计应符合下列规定：

1 窗槛墙、窗间墙的填充材料应采用不燃材料。当外墙面采用耐火极限不低于1.00h的不燃烧体时，其墙内填充材料可采用难燃材料；

2 无窗间墙和窗槛墙的幕墙，应在每层楼板外沿设置耐火极限不低于1.00h、高度不低于0.8m的不燃烧实体裙墙；

3 幕墙与每层楼板、隔墙处的缝隙应采用防火封堵材料封堵。

7.2.8 建筑中受高温或火焰作用易变形的管道，在其贯穿楼板部位和穿越耐火极限不低于2.00h的墙体两侧宜采取阻火措施。

7.2.9 电梯井应独立设置，井内严禁敷设可燃气体和甲、乙、丙类液体管道，并不应敷设与电梯无关的电缆、电线等。电梯井的井壁除开设电梯门洞和通气孔洞外，不应开设其他洞口。电梯门不应采用栅栏门。

电缆井、管道井、排烟道、排气道、垃圾道等竖向管道井，应分别独立设置；其井壁应为耐火极限不低于1.00h的不燃烧体；井壁上的检查门应采用丙级防火门。

7.2.10 建筑内的电缆井、管道井应在每层楼板处采用不低于楼板耐火极限的不燃烧体或防火封堵材料封堵。

建筑内的电缆井、管道井与房间、走道等相连通的孔洞应采用防火封堵材料封堵。

7.2.11 位于墙、楼板两侧的防火阀、排烟防火阀之间的风管外壁应采取防火保护措施。

7.3 屋顶、闷顶和建筑缝隙

7.3.1 在三、四级耐火等级建筑的闷顶内采用锯末等可燃材料作绝热层时，其屋顶不应采用冷摊瓦。

闷顶内的非金属烟囱周围0.5m、金属烟囱0.7m范围内，应采用不燃材料作绝热层。

7.3.2 建筑层数超过2层的三级耐火等级建筑，当设置有闷顶时，应在每个防火隔断范围内设置老虎窗，且老虎窗的间距不宜大于50m。

7.3.3 闷顶内有可燃物的建筑，应在每个防火隔断范围内设置不小于0.7m×0.7m的闷顶入口，且公共建筑的每个防火隔断范围内的闷顶入口不宜少于2个。闷顶入口宜布置在走廊中靠近楼梯间的部位。

7.3.4 电线电缆、可燃气体和甲、乙、丙类液体的管道不宜穿过建筑内的变形缝；当必须穿过时，应在穿过处加设不燃材料制作的套管或采取其他防变形措施，并应采用防火封堵材料封堵。

7.3.5 防烟、排烟、采暖、通风和空气调节系统中的管道，在穿越隔墙、楼板及防火分区处的缝隙应采用防火封堵材料封堵。

7.4 楼梯间、楼梯和门

7.4.1 疏散用的楼梯间应符合下列规定：

1 楼梯间应能天然采光和自然通风，并宜靠外墙设置；

2 楼梯间内不应设置烧水间、可燃材料储藏室、垃圾道；

3 楼梯间内不应有影响疏散的凸出物或其他障碍物；

4 楼梯间内不应敷设甲、乙、丙类液体管道；

5 公共建筑的楼梯间内不应敷设可燃气体管道；

6 居住建筑的楼梯间内不应敷设可燃气体管道和设置可燃气体计量表。当住宅建筑必须设置时，应采用金属套管和设置切断气源的装置等保护措施。

7.4.2 封闭楼梯间除应符合本规范第7.4.1条的规定外，尚应符合下列规定：

1 当不能天然采光和自然通风时，应按防烟楼梯间的要求设置；

2 楼梯间的首层可将走道和门厅等包括在楼梯间内，形成扩大的封闭楼梯间，但应采用乙级防火门等措施与其他走道和房间隔开；

3 除楼梯间的门之外，楼梯间的内墙上不应开设其他门窗洞口；

4 高层厂房(仓库)、人员密集的公共建筑、人员密集的多层丙类厂房设置封闭楼梯间时，通向楼梯间的门应采用乙级防火门，并应向疏散方向开启；

5 其他建筑封闭楼梯间的门可采用双向弹簧门。

7.4.3 防烟楼梯间除应符合本规范第7.4.1条的有关规定外，尚应符合下列规定：

1 当不能天然采光和自然通风时，楼梯间应按本规范第9章的规定设置防烟或排烟设施，应按本规范第11章的规定设置消防应急照明设施；

2 在楼梯间入口处应设置防烟前室、开敞式阳台或凹廊等。防烟前室可与消防电梯间前室合用；

3 前室的使用面积：公共建筑不应小于6.0m^2，居住建筑不应小于4.5m^2；合用前室的

使用面积：公共建筑、高层厂房以及高层仓库不应小于 10.0m²，居住建筑不应小于 6.0m²；

4 疏散走道通向前室以及前室通向楼梯间的门应采用乙级防火门；

5 除楼梯间门和前室门外，防烟楼梯间及其前室的内墙上不应开设其他门窗洞口（住宅的楼梯间前室除外）；

6 楼梯间的首层可将走道和门厅等包括在楼梯间前室内，形成扩大的防烟前室，但应采用乙级防火门等措施与其他走道和房间隔开。

7.4.4 建筑物中的疏散楼梯间在各层的平面位置不应改变。

地下室、半地下室的楼梯间，在首层应采用耐火极限不低于 2.00h 的不燃烧体隔墙与其他部位隔开并应直通室外，当必须在隔墙上开门时，应采用乙级防火门。

地下室、半地下室与地上层不应共用楼梯间，当必须共用楼梯间时，在首层应采用耐火极限不低于 2.00h 的不燃烧体隔墙和乙级防火门将地下、半地下部分与地上部分的连通部位完全隔开，并应有明显标志。

7.4.5 室外楼梯符合下列规定时可作为疏散楼梯：

1 栏杆扶手的高度不应小于 1.1m，楼梯的净宽度不应小于 0.9m；

2 倾斜角度不应大于 45°；

3 楼梯段和平台均应采取不燃材料制作。平台的耐火极限不应低于 1.00h，楼梯段的耐火极限不应低于 0.25h；

4 通向室外楼梯的门宜采用乙级防火门，并应向室外开启；

5 除疏散门外，楼梯周围 2m 内的墙面上不应设置门窗洞口。疏散门不应正对楼梯段。

7.4.6 用作丁、戊类厂房内第二安全出口的楼梯可采用金属梯，但其净宽度不应小于 0.9m，倾斜角度不应大于 45°。

丁、戊类高层厂房，当每层工作平台人数不超过 2 人且各层工作平台上同时生产人数总和不超过 10 人时，可采用敞开楼梯，或采用净宽度不小于 0.9m、倾斜角度小于等于 60°的金属梯兼作疏散梯。

7.4.7 疏散用楼梯和疏散通道上的阶梯不宜采用螺旋楼梯和扇形踏步。当必须采用时，踏步上下两级所形成的平面角度不应大于 10°，且每级离扶手 250mm 处的踏步深度不应小于 220mm。

7.4.8 公共建筑的室内疏散楼梯两梯段扶手间的水平净距不宜小于 150mm。

7.4.9 高度大于 10m 的三级耐火等级建筑应设置通至屋顶的室外消防梯。室外消防梯不应面对老虎窗，宽度不应小于 0.6m，且宜从离地面 3.0m 高处设置。

7.4.10 消防电梯的设置应符合下列规定：

1 消防电梯间应设置前室。前室的使用面积应符合本规范第 7.4.3 条的规定，前室的门应采用乙级防火门；

注：设置在仓库连廊、冷库穿堂或谷物筒仓工作塔内的消防电梯，可不设置前室。

2 前室宜靠外墙设置，在首层应设置直通室外的安全出口或经过长度小于等于 30m 的通道通向室外；

3 消防电梯井、机房与相邻电梯井、机房之间，应采用耐火极限不低于 2.00h 的不燃烧体隔墙隔开；当在隔墙上开门时，应设置甲级防火门；

4 在首层的消防电梯井外壁上应设置供消防队员专用的操作按钮，消防电梯轿厢的内装修应采用不燃烧材料且其内部应设置专用消防对讲电话；

5 消防电梯的井底应设置排水设施，排水井的容量不应小于 $2m^3$，排水泵的排水量不应小于 10L/s。消防电梯间前室门口宜设置挡水设施；

6 消防电梯的载重量不应小于 800kg；

7 消防电梯的行驶速度，应按从首层到顶层的运行时间不超过 60s 计算确定；

8 消防电梯的动力与控制电缆、电线应采取防水措施。

7.4.11 建筑中的封闭楼梯间、防烟楼梯间、消防电梯间前室及合用前室，不应设置卷帘门。

疏散走道在防火分区处应设置甲级常开防火门。

7.4.12 建筑中的疏散用门应符合下列规定：

1 民用建筑和厂房的疏散用门应向疏散方向开启。除甲、乙类生产房间外，人数不超过 60 人的房间且每樘门的平均疏散人数不超过 30 人时，其门的开启方向不限；

2 民用建筑及厂房的疏散用门应采用平开门，不应采用推拉门、卷帘门、吊门、转门；

3 仓库的疏散用门应为向疏散方向开启的平开门，首层靠墙的外侧可设推拉门或卷帘门，但甲、乙类仓库不应采用推拉门或卷帘门；

4 人员密集场所平时需要控制人员随意出入的疏散用门，或设有门禁系统的居住建筑外门，应保证火灾时不需使用钥匙等任何工具即能从内部易于打开，并应在显著位置设置标识和使用提示。

7.5 防火门和防火卷帘

7.5.1 防火门按其耐火极限可分为甲级、乙级和丙级防火门，其耐火极限分别不应低于 1.20h、0.90h 和 0.60h。

7.5.2 防火门的设置应符合下列规定：

1 应具有自闭功能。双扇防火门应具有按顺序关闭的功能；

2 常开防火门应能在火灾时自行关闭，并应有信号反馈的功能；

3 防火门内外两侧应能手动开启（本规范第 7.4.12 条第 4 款规定除外）；

4 设置在变形缝附近时，防火门开启后，其门扇不应跨越变形缝，并应设置在楼层较多的一侧。

7.5.3 防火分区间采用防火卷帘分隔时，应符合下列规定：

1 防火卷帘的耐火极限不应低于 3.00h。当防火卷帘的耐火极限符合现行国家标准《门和卷帘耐火试验方法》GB 7633 有关背火面温升的判定条件时，可不设置自动喷水灭火系统保护；符合现行国家标准《门和卷帘耐火试验方法》GB 7633 有关背火面辐射热的判定条件时，应设置自动喷水灭火系统保护。自动喷水灭火系统的设计应符合现行国家标准《自动喷水灭火系统设计规范》GB 50084 的有关规定，但其火灾延续时间不应小于 3.0h。

2 防火卷帘应具有防烟性能，与楼板、梁和墙、柱之间的空隙应采用防火封堵材料封堵。

7.6 天桥、栈桥和管沟

7.6.1 天桥、跨越房屋的栈桥，供输送可燃气体和甲、乙、丙类液体及可燃材料的栈桥，均应采用不燃烧体。

7.6.2 输送有火灾、爆炸危险物质的栈桥不应兼作疏散通道。

7.6.3 封闭天桥、栈桥与建筑物连接处的门洞以及敷设甲、乙、丙类液体管道的封闭管沟（廊），均宜设置防止火势蔓延的保护设施。

7.6.4 连接两座建筑物的天桥，当天桥采用不燃烧体且通向天桥的出口符合安全出口的设置要求时，该出口可作为建筑物的安全出口。

8 消防给水和灭火设施

8.1 一般规定

8.1.1 消防给水和灭火设施的设计应根据建筑用途及其重要性、火灾特性和火灾危险性等综合因素进行。

8.1.2 在城市、居住区、工厂、仓库等的规划和建筑设计时，必须同时设计消防给水系统。城市、居住区应设市政消火栓。民用建筑、厂房(仓库)、储罐(区)、堆场应设室外消火栓。民用建筑、厂房(仓库)应设室内消火栓，并应符合本规范第8.3.1条的规定。

消防用水可由城市给水管网、天然水源或消防水池供给。利用天然水源时，其保证率不应小于97%，且应设置可靠的取水设施。

耐火等级不低于二级，且建筑物体积小于等于3000m³的戊类厂房或居住区人数不超过500人且建筑物层数不超过两层的居住区，可不设置消防给水。

8.1.3 室外消防给水当采用高压或临时高压给水系统时，管道的供水压力应能保证用水总量达到最大且水枪在任何建筑物的最高处时，水枪的充实水柱仍不小于10m；当采用低压给水系统时，室外消火栓栓口处的水压从室外设计地面算起不应小于0.1MPa。

注：1 在计算水压时，应采用喷嘴口径19mm的水枪和直径65mm、长度120m的有衬里消防水带的参数，每支水枪的计算流量不应小于5L/s。

2 高层厂房(仓库)的高压或临时高压给水系统的压力应满足室内最不利点消防设备水压的要求。

3 消火栓给水管道的设计流速不宜大于2.5m/s。

8.1.4 建筑的低压室外消防给水系统可与生产、生活给水管道系统合并。合并的给水管道系统，当生产、生活用水达到最大小时用水量时(淋浴用水量可按15%计算，浇洒及洗刷用水量可不计算在内)，仍应保证全部消防用水量。如不引起生产事故，生产用水可作为消防用水，但生产用水转为消防用水的阀门不应超过2个。该阀门应设置在易于操作的场所，并应有明显标志。

8.1.5 建筑的全部消防用水量应为其室内、室外消防用水量之和。

室外消防用水量应为民用建筑、厂房(仓库)、储罐(区)、堆场室外设置的消火栓、水喷雾、水幕、泡沫等灭火、冷却系统等需要同时开启的用水量之和。

室内消防用水量应为民用建筑、厂房(仓库)室内设置的消火栓、自动喷水、泡沫等灭火系统需要同时开启的用水量之和。

8.1.6 除住宅外的民用建筑、厂房(仓库)、储罐(区)、堆场应设置灭火器；住宅宜设置灭火器或轻便消防水龙。灭火器的配置设计应符合现行国家标准《建筑灭火器配置设计规范》GB 50140的有关规定。

8.2 室外消防用水量、消防给水管道和消火栓

8.2.1 城市、居住区的室外消防用水量应按同一时间内的火灾次数和一次灭火用水量确定。同一时间内的火灾次数和一次灭火用水量不应小于表8.2.1的规定。

表 8.2.1　城市、居住区同一时间内的火灾次数和一次灭火用水量

人数 N(万人)	同一时间内的火灾次数(次)	一次灭火用水量(L/s)
$N\leqslant1$	1	10
$1<N\leqslant2.5$	1	15
$2<N\leqslant5$	2	25
$5<N\leqslant10$	2	35
$10<N\leqslant20$	2	45
$20<N\leqslant30$	2	55
$30<N\leqslant40$	2	65
$40<N\leqslant50$	3	75
$50<N\leqslant60$	3	85
$60<N\leqslant70$	3	90
$70<N\leqslant80$	3	95
$80<N\leqslant100$	3	100

注:城市的室外消防用水量应包括居住区、工厂、仓库、堆场、储罐(区)和民用建筑的室外消火栓用水量。当工厂、仓库和民用建筑的室外消火栓用水量按本规范表 8.2.2-2 的规定计算,其值与按本表计算不一致时,应取较大值。

8.2.2　工厂、仓库、堆场、储罐(区)和民用建筑的室外消防用水量,应按同一时间内的火灾次数和一次灭火用水量确定:

1　工厂、仓库、堆场、储罐(区)和民用建筑在同一时间内的火灾次数不应小于表 8.2.2-1 的规定;

表 8.2.2-1　工厂、仓库、堆场、储罐(区)和民用建筑在同一时间内的火灾次数

名　称	基地面积(ha)	附有居住区人数(万人)	同一时间内的火灾次数(次)	备　注
工厂	≤100	≤1.5	1	按需水量最大的一座建筑物(或堆场、储罐)计算
		>1.5	2	工厂、居住区各一次
	>100	不限	2	按需水量最大的两座建筑物(或堆场、储罐)之和计算
仓库、民用建筑	不限	不限	1	按需水量最大的一座建筑物(或堆场、储罐)计算

注:1　采矿、选矿等工业企业当各分散基地有单独的消防给水系统时,可分别计算。

2　1ha=10000m²。

2　工厂、仓库和民用建筑一次灭火的室外消火栓用水量不应小于表 8.2.2-2 的规定;

3　一个单位内有泡沫灭火设备、带架水枪、自动喷水灭火系统以及其他室外消防用水设备时,其室外消防用水量应按上述同时使用的设备所需的全部消防用水量加上表 8.2.2-2 规定的室外消火栓用水量的 50%计算确定,且不应小于表 8.2.2-2 的规定。

表 8.2.2-2　工厂、仓库和民用建筑一次灭火的室外消火栓用水量(L/s)

耐火等级	建筑物类别		建筑物体积 V(m³)					
			$V\leqslant1500$	$1500<V\leqslant3000$	$3000<V\leqslant5000$	$5000<V\leqslant20000$	$20000<V\leqslant50000$	$V>50000$
一、二级	厂房	甲、乙类	10	15	20	25	30	35
		丙类	10	15	20	25	30	40
		丁、戊类	10	10	10	15	15	20
	仓库	甲、乙类	15	15	25	25	—	—
		丙类	15	15	25	25	35	45
		丁、戊类	10	10	10	15	15	20
	民用建筑		10	15	15	20	25	30

续表 8.2.2-2

耐火等级	建筑物类别		建筑物体积 $V(m^3)$					
			$V\leqslant1500$	$1500<V\leqslant3000$	$3000<V\leqslant5000$	$5000<V\leqslant20000$	$20000<V\leqslant50000$	$V>50000$
三级	厂房（仓库）	乙、丙类	15	20	30	40	45	—
		丁、戊类	10	10	15	20	25	35
	民用建筑		10	15	20	25	30	—
四级	丁、戊类厂房（仓库）		10	15	20	25	—	—
	民用建筑		10	15	20	25	—	—

注：1 室外消火栓用水量应按消防用水量最大的一座建筑物计算。成组布置的建筑物应按消防用水量较大的相邻两座计算。

2 国家级文物保护单位的重点砖木或木结构的建筑物，其室外消火栓用水量应按三级耐火等级民用建筑的消防用水量确定。

3 铁路车站、码头和机场的中转仓库其室外消火栓用水量可按丙类仓库确定。

8.2.3 可燃材料堆场、可燃气体储罐（区）的室外消防用水量，不应小于表 8.2.3 的规定。

表 8.2.3 可燃材料堆场、可燃气体储罐（区）的室外消防用水量（L/s）

名称		总储量或总容量	消防用水量
粮食 $W(t)$	土圆囤	$30<W\leqslant500$	15
		$500<W\leqslant5000$	25
		$5000<W\leqslant20000$	40
		$W>20000$	45
	席穴囤	$30<W\leqslant500$	20
		$500<W\leqslant5000$	35
		$5000<W\leqslant20000$	50
棉、麻、毛、化纤百货 $W(t)$		$10<W\leqslant500$	20
		$500<W\leqslant1000$	35
		$1000<W\leqslant5000$	50
稻草、麦秸、芦苇等易燃材料 $W(t)$		$50<W\leqslant500$	20
		$500<W\leqslant5000$	35
		$5000<W\leqslant10000$	50
		$W>10000$	60

续表 8.2.3

名称	总储量或总容量	消防用水量
木材等可燃材料 $V(m^3)$	$50<V\leqslant1000$	20
	$1000<V\leqslant5000$	30
	$5000<V\leqslant10000$	45
	$V>10000$	55
煤和焦炭 $W(t)$	$100<W\leqslant5000$	15
	$W>5000$	20
可燃气体储罐（区）$V(m^3)$	$500<V\leqslant10000$	15
	$10000<V\leqslant50000$	20
	$50000<V\leqslant100000$	25
	$100000<V\leqslant200000$	30
	$V>200000$	35

注：固定容积的可燃气体储罐的总容积按其几何容积（m^3）和设计工作压力（绝对压力，10^5Pa）的乘积计算。

8.2.4　甲、乙、丙类液体储罐(区)的室外消防用水量应按灭火用水量和冷却用水量之和计算。

1　灭火用水量应按罐区内最大罐泡沫灭火系统、泡沫炮和泡沫管枪灭火所需的灭火用水量之和确定，并应按现行国家标准《低倍数泡沫灭火系统设计规范》GB 50151、《高倍数、中倍数泡沫灭火系统设计规范》GB 50196 或《固定消防炮灭火系统设计规范》GB 50338 的有关规定计算；

2　冷却用水量应按储罐区一次灭火最大需水量计算。距着火罐罐壁 1.5 倍直径范围内的相邻储罐应进行冷却，其冷却水的供给范围和供给强度不应小于表 8.2.4 的规定；

表 8.2.4　甲、乙、丙类液体储罐冷却水的供给范围和供给强度

设备类型	储罐名称		供给范围	供给强度
移动式水枪	着火罐	固定顶立式罐(包括保温罐)	罐周长	0.60[L/(s·m)]
		浮顶罐(包括保温罐)	罐周长	0.45[L/(s·m)]
		卧式罐	罐壁表面积	0.10[L/(s·m²)]
		地下立式罐、半地下和地下卧式罐	无覆土罐壁表面积	0.10[L/(s·m²)]

续表 8.2.4

设备类型	储罐名称			供给范围	供给强度
移动式水枪	相邻罐	固定顶立式罐	不保温罐	罐周长的一半	0.35[L/(s·m)]
			保温罐		0.20[L/(s·m)]
		卧式罐		罐壁表面积的一半	0.10[L/(s·m²)]
		半地下、地下罐		无覆土罐壁表面积的一半	0.10[L/(s·m²)]
固定式设备	着火罐		立式罐	罐周长	0.50[L/(s·m)]
			卧式罐	罐壁表面积	0.10[L/(s·m²)]
	相邻罐		立式罐	罐周长的一半	0.50[L/(s·m)]
			卧式罐	罐壁表面积的一半	0.10[L/(s·m²)]

注：1　冷却水的供给强度还应根据实地灭火战术所使用的消防设备进行校核。

2　当相邻罐采用不燃材料作绝热层时，其冷却水供给强度可按本表减少 50%。

3　储罐可采用移动式水枪或固定式设备进行冷却。当采用移动式水枪进行冷却时，无覆土保护的卧式罐的消防用水量，当计算出的水量小于 15L/s 时，仍应采用 15L/s。

4　地上储罐的高度大于 15m 或单罐容积大于 2000m³ 时，宜采用固定式冷却水设施。

5　当相邻储罐超过 4 个时，冷却用水量可按 4 个计算。

3　覆土保护的地下油罐应设置冷却用水设施。冷却用水量应按最大着火罐罐顶的表面积(卧式罐按其投影面积)和冷却水供给强度等计算确定。冷却水的供给强度不应小于 0.10L/(s·m²)。当计算水量小于 15L/s 时，仍应采用 15L/s。

8.2.5　液化石油气储罐(区)的消防用水量应按储罐固定喷水冷却装置用水量和水枪用水量之和计算，其设计应符合下列规定：

1　总容积大于 50m³ 的储罐区或单罐容积大于 20m³ 的储罐应设置固定喷水冷却装置。

固定喷水冷却装置的用水量应按储罐的保护面积与冷却水的供水强度等经计算确定。冷却水的供水强度不应小于 0.15L/(s·m²)，着火罐的保护面积按其全表面积计算，距着火罐直

径(卧式罐按其直径和长度之和的一半)1.5倍范围内的相邻储罐的保护面积按其表面积的一半计算。

2 水枪用水量不应小于表8.2.5的规定;

表8.2.5 液化石油气储罐(区)的水枪用水量

总容积 $V(m^3)$	$V\leqslant500$	$500<V\leqslant2500$	$V>2500$
单罐容积 $V(m^3)$	$V\leqslant100$	$V\leqslant400$	$V>400$
水枪用水量(L/s)	20	30	45

注:1 水枪用水量应按本表总容积和单罐容积较大者确定。

2 总容积小于50m³的储罐区或单罐容积小于等于20m³的储罐,可单独设置固定喷水冷却装置或移动式水枪,其消防用水量应按水枪用水量计算。

3 埋地的液化石油气储罐可不设固定喷水冷却装置。

8.2.6 室外油浸电力变压器设置水喷雾灭火系统保护时,其消防用水量应按现行国家标准《水喷雾灭火系统设计规范》GB 50219的有关规定确定。

8.2.7 室外消防给水管道的布置应符合下列规定:

1 室外消防给水管网应布置成环状,当室外消防用水量小于等于15L/s时,可布置成枝状;

2 向环状管网输水的进水管不应少于2条,当其中1条发生故障时,其余的进水管应能满足消防用水总量的供给要求;

3 环状管道应采用阀门分成若干独立段,每段内室外消火栓的数量不宜超过5个;

4 室外消防给水管道的直径不应小于*DN*100;

5 室外消防给水管道设置的其他要求应符合现行国家标准《室外给水设计规范》GB 50013的有关规定。

8.2.8 室外消火栓的布置应符合下列规定:

1 室外消火栓应沿道路设置。当道路宽度大于60m时,宜在道路两边设置消火栓,并宜靠近十字路口;

2 甲、乙、丙类液体储罐区和液化石油气储罐区的消火栓应设置在防火堤或防护墙外。距罐壁15m范围内的消火栓,不应计算在该罐可使用的数量内;

3 室外消火栓的间距不应大于120m;

4 室外消火栓的保护半径不应大于150m;在市政消火栓保护半径150m以内,当室外消防用水量小于等于15L/s时,可不设置室外消火栓;

5 室外消火栓的数量应按其保护半径和室外消防用水量等综合计算确定,每个室外消火栓的用水量应按10~15L/s计算;与保护对象的距离在5~40m范围内的市政消火栓,可计入室外消火栓的数量内;

6 室外消火栓宜采用地上式消火栓。地上式消火栓应有1个*DN*150或*DN*100和2个*DN*65的栓口。采用室外地下式消火栓时,应有*DN*100和*DN*65的栓口各1个。寒冷地区设置的室外消火栓应有防冻措施;

7 消火栓距路边不应大于2m,距房屋外墙不宜小于5m;

8 工艺装置区内的消火栓应设置在工艺装置的周围,其间距不宜大于60m。当工艺装置区宽度大于120m时,宜在该装置区内的道路边设置消火栓。

8.2.9 建筑的室外消火栓、阀门、消防水泵接合器等设置地点应设置相应的永久性固定标识。

8.2.10 寒冷地区设置市政消火栓、室外消火栓确有困难的，可设置水鹤等为消防车加水的设施，其保护范围可根据需要确定。

8.3 室内消火栓等的设置场所

8.3.1 除符合本规范第8.3.4条规定外，下列建筑应设置*DN*65的室内消火栓：

1 建筑占地面积大于300m²的厂房(仓库)；

2 体积大于5000m³的车站、码头、机场的候车(船、机)楼、展览建筑、商店、旅馆建筑、病房楼、门诊楼、图书馆建筑等；

3 特等、甲等剧场，超过800个座位的其他等级的剧场和电影院等，超过1200个座位的礼堂、体育馆等；

4 超过5层或体积大于10000m³的办公楼、教学楼、非住宅类居住建筑等其他民用建筑；

5 超过7层的住宅应设置室内消火栓系统，当确有困难时，可只设置干式消防竖管和不带消火栓箱的*DN*65的室内消火栓。消防竖管的直径不应小于*DN*65。

注：耐火等级为一、二级且可燃物较少的单层、多层丁、戊类厂房(仓库)，耐火等级为三、四级且建筑体积小于等于3000m³的丁类厂房和建筑体积小于等于5000m³的戊类厂房(仓库)，粮食仓库、金库可不设置室内消火栓。

8.3.2 国家级文物保护单位的重点砖木或木结构的古建筑，宜设置室内消火栓。

8.3.3 设有室内消火栓的人员密集公共建筑以及低于本规范第8.3.1条规定规模的其他公共建筑宜设置消防软管卷盘；建筑面积大于200m²的商业服务网点应设置消防软管卷盘或轻便消防水龙。

8.3.4 存有与水接触能引起燃烧爆炸的物品的建筑物和室内没有生产、生活给水管道，室外消防用水取自储水池且建筑体积小于等于5000m³的其他建筑可不设置室内消火栓。

8.4 室内消防用水量及消防给水管道、消火栓和消防水箱

8.4.1 室内消防用水量应按下列规定经计算确定：

1 建筑物内同时设置室内消火栓系统、自动喷水灭火系统、水喷雾灭火系统、泡沫灭火系统或固定消防炮灭火系统时，其室内消防用水量应按需要同时开启的上述系统用水量之和计算；当上述多种消防系统需要同时开启时，室内消火栓用水量可减少50%，但不得小于10L/s；

2 室内消火栓用水量应根据水枪充实水柱长度和同时使用水枪数量经计算确定，且不应小于表8.4.1的规定；

3 水喷雾灭火系统的用水量应按现行国家标准《水喷雾灭火系统设计规范》GB 50219的有关规定确定；自动喷水灭火系统的用水量应按现行国家标准《自动喷水灭火系统设计规范》GB 50084的有关规定确定；泡沫灭火系统的用水量应按现行国家标准《低倍数泡沫灭火系统设计规范》GB 50151、《高倍数、中倍数泡沫灭火系统设计规范》GB 50196的有关规定确定；固定消防炮灭火系统的用水量应按现行国家标准《固定消防炮灭火系统设计规范》GB 50338的有关规定确定。

表 8.4.1　室内消火栓用水量

建筑物名称	高度 h(m)、层数、体积 V (m³)或座位数 N(个)		消火栓用水量 (L/s)	同时使用水枪数量 (支)	每根竖管最小流量 (L/s)
厂房	$h\leqslant24$	$V\leqslant10000$	5	2	5
		$V>10000$	10	2	10
	$24<h\leqslant50$		25	5	15
	$h>50$		30	6	15
仓库	$h\leqslant24$	$V\leqslant5000$	5	1	5
		$V>5000$	10	2	10
	$24<h\leqslant50$		30	6	15
	$h>50$		40	8	15
科研楼、试验楼	$H\leqslant24, V\leqslant10000$		10	2	10
	$H\leqslant24, V>10000$		15	3	10
车站、码头、机场的候车(船、机)楼和展览建筑等	$5000<V\leqslant25000$		10	2	10
	$25000<V\leqslant50000$		15	3	10
	$V>50000$		20	4	15
剧院、电影院、会堂、礼堂、体育馆等	$800<n\leqslant1200$		10	2	10
	$1200<n\leqslant5000$		15	3	10
	$5000<n\leqslant10000$		20	4	15
	$n>10000$		30	6	15
商店、旅馆等	$5000<V\leqslant10000$		10	2	10
	$10000<V\leqslant25000$		15	3	10
	$V>25000$		20	4	15

续表 8.4.1

建筑物名称	高度 h(m)、层数、体积 V (m³)或座位数 N(个)	消火栓用水量 (L/s)	同时使用水枪数量 (支)	每根竖管最小流量 (L/s)
病房楼、门诊楼等	$5000<V\leqslant10000$	5	2	5
	$10000<V\leqslant25000$	10	2	10
	$V>25000$	15	3	10
办公楼、教学楼等其他民用建筑	层数≥6 层或 $V>10000$	15	3	10
国家级文物保护单位的重点砖木或木结构的古建筑	$V\leqslant10000$	20	4	10
	$V>10000$	25	5	15
住宅	层数≥8	5	2	5

注：1　丁、戊类高层厂房(仓库)室内消火栓的用水量可按本表减少 10L/s，同时使用水枪数量可按本表减少 2 支。

2　消防软管卷盘或轻便消防水龙及住宅楼梯间中的干式消防竖管上设置的消火栓，其消防用水量可不计入室内消防用水量。

8.4.2　室内消防给水管道的布置应符合下列规定：

1　室内消火栓超过 10 个且室外消防用水量大于 15L/s 时，其消防给水管道应连成环状，且至少应有 2 条进水管与室外管网或消防水泵连接。当其中 1 条进水管发生事故时，其余的进水管应仍能供应全部消防用水量。

2　高层厂房(仓库)应设置独立的消防给水系统。室内消防竖管应连成环状。

3 室内消防竖管直径不应小于 $DN100$。

4 室内消火栓给水管网宜与自动喷水灭火系统的管网分开设置；当合用消防泵时，供水管路应在报警阀前分开设置。

5 高层厂房(仓库)、设置室内消火栓且层数超过 4 层的厂房(仓库)、设置室内消火栓且层数超过 5 层的公共建筑，其室内消火栓给水系统应设置消防水泵接合器。

消防水泵接合器应设置在室外便于消防车使用的地点，与室外消火栓或消防水池取水口的距离宜为 15～40m。

消防水泵接合器的数量应按室内消防用水量计算确定，每个消防水泵接合器的流量宜按 10～15L/s 计算。

6 室内消防给水管道应采用阀门分成若干独立段。对于单层厂房(仓库)和公共建筑，检修停止使用的消火栓不应超过 5 个。对于多层民用建筑和其他厂房(仓库)，室内消防给水管道上阀门的布置应保证检修管道时关闭的竖管不超过 1 根，但设置的竖管超过 3 根时，可关闭 2 根。

阀门应保持常开，并应有明显的启闭标志或信号。

7 消防用水与其他用水合用的室内管道，当其他用水达到最大小时流量时，应仍能保证供应全部消防用水量。

8 允许直接吸水的市政给水管网，当生产、生活用水量达到最大且仍能满足室内外消防用水量时，消防泵宜直接从市政给水管网吸水。

9 严寒和寒冷地区非采暖的厂房(仓库)及其他建筑的室内消火栓系统，可采用干式系统，但在进水管上应设置快速启闭装置，管道最高处应设置自动排气阀。

8.4.3 室内消火栓的布置应符合下列规定：

1 除无可燃物的设备层外，设置室内消火栓的建筑物，其各层均应设置消火栓。

单元式、塔式住宅的消火栓宜设置在楼梯间的首层和各层楼层休息平台上，当设 2 根消防竖管确有困难时，可设 1 根消防竖管，但必须采用双口双阀型消火栓。干式消火栓竖管应在首层靠出口部位设置便于消防车供水的快速接口和止回阀。

2 消防电梯间前室内应设置消火栓。

3 室内消火栓应设置在位置明显且易于操作的部位。栓口离地面或操作基面高度宜为 1.1m，其出水方向宜向下或与设置消火栓的墙面成 90°角；栓口与消火栓箱内边缘的距离不应影响消防水带的连接。

4 冷库内的消火栓应设置在常温穿堂或楼梯间内。

5 室内消火栓的间距应由计算确定。高层厂房(仓库)、高架仓库和甲、乙类厂房中室内消火栓的间距不应大于 30m；其他单层和多层建筑中室内消火栓的间距不应大于 50m。

6 同一建筑物内应采用统一规格的消火栓、水枪和水带。每条水带的长度不应大于 25m。

7 室内消火栓的布置应保证每一个防火分区同层有两支水枪的充实水柱同时到达任何部位。建筑高度小于等于 24m 且体积小于等于 5000m^3 的多层仓库，可采用 1 支水枪充实水柱到达室内任何部位。

水枪的充实水柱应经计算确定，甲、乙类厂房、层数超过 6 层的公共建筑和层数超过 4 层的厂房(仓库)，不应小于 10m；高层厂房(仓库)、高架仓库和体积大于 25000m^3 的商店、

体育馆、影剧院、会堂、展览建筑，车站、码头、机场建筑等，不应小于13m；其他建筑，不宜小于7m。

8 高层厂房(仓库)和高位消防水箱静压不能满足最不利点消火栓水压要求的其他建筑，应在每个室内消火栓处设置直接启动消防水泵的按钮，并应有保护设施。

9 室内消火栓栓口处的出水压力大于0.5MPa时，应设置减压设施；静水压力大于1.0MPa时，应采用分区给水系统。

10 设有室内消火栓的建筑，如为平屋顶时，宜在平屋顶上设置试验和检查用的消火栓。

8.4.4 设置常高压给水系统并能保证最不利点消火栓和自动喷水灭火系统等的水量和水压的建筑物，或设置干式消防竖管的建筑物，可不设置消防水箱。

设置临时高压给水系统的建筑物应设置消防水箱(包括气压水罐、水塔、分区给水系统的分区水箱)。消防水箱的设置应符合下列规定：

1 重力自流的消防水箱应设置在建筑的最高部位；

2 消防水箱应储存10min的消防用水量。当室内消防用水量小于等于25L/s，经计算消防水箱所需消防储水量大于12m³时，仍可采用12m³；当室内消防用水量大于25L/s，经计算消防水箱所需消防储水量大于18m³时，仍可采用18m³；

3 消防用水与其他用水合用的水箱应采取消防用水不作他用的技术措施；

4 发生火灾后，由消防水泵供给的消防用水不应进入消防水箱；

5 消防水箱可分区设置。

8.4.5 建筑的室内消火栓、阀门等设置地点应设置永久性固定标识。

8.5 自动灭火系统的设置场所

8.5.1 下列场所应设置自动灭火系统，除不宜用水保护或灭火者以及本规范另有规定者外，宜采用自动喷水灭火系统：

1 大于等于50000纱锭的棉纺厂的开包、清花车间；大于等于5000锭的麻纺厂的分级、梳麻车间；火柴厂的烤梗、筛选部位；泡沫塑料厂的预发、成型、切片、压花部位；占地面积大于1500m²的木器厂房；占地面积大于1500m²或总建筑面积大于3000m²的单层、多层制鞋、制衣、玩具及电子等厂房；高层丙类厂房；飞机发动机试验台的准备部位；建筑面积大于500m²的丙类地下厂房；

2 每座占地面积大于1000m²的棉、毛、丝、麻、化纤、毛皮及其制品的仓库；每座占地面积大于600m²的火柴仓库；邮政楼中建筑面积大于500m²的空邮袋库；建筑面积大于500m²的可燃物品地下仓库；可燃、难燃物品的高架仓库和高层仓库(冷库除外)；

3 特等、甲等或超过1500个座位的其他等级的剧院；超过2000个座位的会堂或礼堂；超过3000个座位的体育馆；超过5000人的体育场的室内人员休息室与器材间等；

4 任一楼层建筑面积大于1500m²或总建筑面积大于3000m²的展览建筑、商店、旅馆建筑，以及医院中同样建筑规模的病房楼、门诊楼、手术部；建筑面积大于500m²的地下商店；

5 设置有送回风道(管)的集中空气调节系统且总建筑面积大于3000m²的办公楼等；

6 设置在地下、半地下或地上四层及四层以上或设置在建筑的首层、二层和三层且任

一层建筑面积大于300m² 的地上歌舞娱乐放映游艺场所(游泳场所除外);

7 藏书量超过50万册的图书馆。

8.5.2 下列部位宜设置水幕系统:

1 特等、甲等或超过1500个座位的其他等级的剧院和超过2000个座位的会堂或礼堂的舞台口,以及与舞台相连的侧台、后台的门窗洞口;

2 应设防火墙等防火分隔物而无法设置的局部开口部位;

3 需要冷却保护的防火卷帘或防火幕的上部。

8.5.3 下列场所应设置雨淋喷水灭火系统:

1 火柴厂的氯酸钾压碾厂房;建筑面积大于100m² 生产、使用硝化棉、喷漆棉、火胶棉、赛璐珞胶片、硝化纤维的厂房;

2 建筑面积超过60m² 或储存量超过2t的硝化棉、喷漆棉、火胶棉、赛璐珞胶片、硝化纤维的仓库;

3 日装瓶数量超过3000瓶的液化石油气储配站的灌瓶间、实瓶库;

4 特等、甲等或超过1500个座位的其他等级的剧院和超过2000个座位的会堂或礼堂的舞台的葡萄架下部;

5 建筑面积大于等于400m² 的演播室,建筑面积大于等于500m² 的电影摄影棚;

6 乒乓球厂的轧坯、切片、磨球、分球检验部位。

8.5.4 下列场所应设置自动灭火系统,且宜采用水喷雾灭火系统:

1 单台容量在40MV·A及以上的厂矿企业油浸电力变压器、单台容量在90MV·A及以上的电厂油浸电力变压器,或单台容量在125MV·A及以上的独立变电所油浸电力变压器;

2 飞机发动机试验台的试车部位。

8.5.5 下列场所应设置自动灭火系统,且宜采用气体灭火系统:

1 国家、省级或人口超过100万的城市广播电视发射塔楼内的微波机房、分米波机房、米波机房、变配电室和不间断电源(UPS)室;

2 国际电信局、大区中心、省中心和1万路以上的地区中心内的长途程控交换机房、控制室和信令转接点室;

3 2万线以上的市话汇接局和6万门以上的市话端局内的程控交换机房、控制室和信令转接点室;

4 中央及省级治安、防灾和网局级及以上的电力等调度指挥中心内的通信机房和控制室;

5 主机房建筑面积大于等于140m² 的电子计算机房内的主机房和基本工作间的已记录磁(纸)介质库;

6 中央和省级广播电视中心内建筑面积不小于120m² 的音像制品仓库;

7 国家、省级或藏书量超过100万册的图书馆内的特藏库;中央和省级档案馆内的珍藏库和非纸质档案库;大、中型博物馆内的珍品仓库;一级纸(绢)质文物的陈列室;

8 其他特殊重要设备室。

注:当有备用主机和备用已记录磁(纸)介质,且设置在不同建筑中或同一建筑中的不同防火分区内时,本条第5款规定的部位亦可采用预作用自动喷水灭火系统。

8.5.6 甲、乙、丙类液体储罐等泡沫灭火系统的设置场所应符合现行国家标准《石油库设计规范》GB 50074、《石油化工企业设计防火规范》GB 50160、《石油天然气工程设计防火规范》GB 50183 等的有关规定。

8.5.7 建筑面积大于 3000m² 且无法采用自动喷水灭火系统的展览厅、体育馆观众厅等人员密集场所，建筑面积大于 5000m² 且无法采用自动喷水灭火系统的丙类厂房，宜设置固定消防炮等灭火系统。

8.5.8 公共建筑中营业面积大于 500m² 的餐饮场所，其烹饪操作间的排油烟罩及烹饪部位宜设置自动灭火装置，且应在燃气或燃油管道上设置紧急事故自动切断装置。

8.6 消防水池与消防水泵房

8.6.1 符合下列规定之一的，应设置消防水池：

1 当生产、生活用水量达到最大时，市政给水管道、进水管或天然水源不能满足室内外消防用水量；

2 市政给水管道为枝状或只有 1 条进水管，且室内外消防用水量之和大于 25L/s。

8.6.2 消防水池应符合下列规定：

1 当室外给水管网能保证室外消防用水量时，消防水池的有效容量应满足在火灾延续时间内室内消防用水量的要求。当室外给水管网不能保证室外消防用水量时，消防水池的有效容量应满足在火灾延续时间内室内消防用水量与室外消防用水量不足部分之和的要求。

当室外给水管网供水充足且在火灾情况下能保证连续补水时，消防水池的容量可减去火灾延续时间内补充的水量。

2 补水量应经计算确定，且补水管的设计流速不宜大于2.5m/s。

3 消防水池的补水时间不宜超过 48h；对于缺水地区或独立的石油库区，不应超过 96h。

4 容量大于 500m³ 的消防水池，应分设成两个能独立使用的消防水池。

5 供消防车取水的消防水池应设置取水口或取水井，且吸水高度不应大于 6.0m。取水口或取水井与建筑物（水泵房除外）的距离不宜小于 15m；与甲、乙、丙类液体储罐的距离不宜小于 40m；与液化石油气储罐的距离不宜小于 60m，如采取防止辐射热的保护措施时，可减为 40m。

6 供消防车取水的消防水池，其保护半径不应大于 150m。

7 消防用水与生产、生活用水合并的水池，应采取确保消防用水不作他用的技术措施。

8 严寒和寒冷地区的消防水池应采取防冻保护设施。

8.6.3 不同场所的火灾延续时间不应小于表 8.6.3 的规定：

表 8.6.3　不同场所的火灾延续时间(h)

建筑类别	场　所　名　称	火灾延续时间(h)
甲、乙、丙类液体储罐	浮顶罐	4.0
	地下和半地下固定顶立式罐、覆土储罐	
	直径小于等于 20m 的地上固定顶立式罐	
	直径大于 20m 的地上固定顶立式罐	6.0
液化石油气储罐	总容积大于 220m³ 的储罐区或单罐容积大于 50m³ 的储罐	
	总容积小于等于 220m³ 的储罐区且单罐容积小于等于 50m³ 的储罐	3.0
可燃气体储罐	湿式储罐	
	干式储罐	
	固定容积储罐	
可燃材料堆场	煤、焦炭露天堆场	
	其他可燃材料露天、半露天堆场	6.0
仓库	甲、乙、丙类仓库	3.0
	丁、戊类仓库	2.0
厂房	甲、乙、丙类厂房	3.0
	丁、戊类厂房	2.0

续表 8.6.3

建筑类别	场　所　名　称	火灾延续时间(h)
民用建筑	公共建筑	2.0
	居住建筑	
灭火系统	自动喷水灭火系统	应按相应现行国家标准确定
	泡沫灭火系统	
	防火分隔水幕	

8.6.4　独立建造的消防水泵房，其耐火等级不应低于二级。附设在建筑中的消防水泵房应按本规范第 7.2.5 条的规定与其他部位隔开。

消防水泵房设置在首层时，其疏散门宜直通室外；设置在地下层或楼层上时，其疏散门应靠近安全出口。消防水泵房的门应采用甲级防火门。

8.6.5　消防水泵房应有不少于 2 条的出水管直接与环状消防给水管网连接。当其中 1 条出水管关闭时，其余的出水管应仍能通过全部用水量。

出水管上应设置试验和检查用的压力表和 *DN*65 的放水阀门。当存在超压可能时，出水管上应设置防超压设施。

8.6.6　一组消防水泵的吸水管不应少于 2 条。当其中 1 条关闭时，其余的吸水管应仍能通过全部用水量。

消防水泵应采用自灌式吸水，并应在吸水管上设置检修阀门。

8.6.7　当消防水泵直接从环状市政给水管网吸水时，消防水泵的扬程应按市政给水管网的最低压力计算，并以市政给水管网的最高水压校核。

8.6.8 消防水泵应设置备用泵，其工作能力不应小于最大一台消防工作泵。当工厂、仓库、堆场和储罐的室外消防用水量小于等于 25L/s 或建筑的室内消防用水量小于等于 10L/s 时，可不设置备用泵。

8.6.9 消防水泵应保证在火警后 30s 内启动。

消防水泵与动力机械应直接连接。

9 防烟与排烟

9.1 一般规定

9.1.1 建筑中的防烟可采用机械加压送风防烟方式或可开启外窗的自然排烟方式。

建筑中的排烟可采用机械排烟方式或可开启外窗的自然排烟方式。

9.1.2 防烟楼梯间及其前室、消防电梯间前室或合用前室应设置防烟设施。

9.1.3 下列场所应设置排烟设施：

1 丙类厂房中建筑面积大于300m² 的地上房间；人员、可燃物较多的丙类厂房或高度大于32m的高层厂房中长度大于20m的内走道；任一层建筑面积大于5000m² 的丁类厂房；

2 占地面积大于1000m² 的丙类仓库；

3 公共建筑中经常有人停留或可燃物较多，且建筑面积大于300m² 的地上房间；公共建筑中长度大于20m的内走道；

4 中庭；

5 设置在一、二、三层且房间建筑面积大于200m² 或设置在四层及四层以上或地下、半地下的歌舞娱乐放映游艺场所；

6 总建筑面积大于200m² 或一个房间建筑面积大于50m² 且经常有人停留或可燃物较多的地下、半地下建筑或地下室、半地下室；

7 其他建筑中地上长度大于40m的疏散走道。

9.1.4 机械排烟系统与通风、空气调节系统宜分开设置。当合用时，必须采取可靠的防火安全措施，并应符合机械排烟系统的有关要求。

9.1.5 防烟与排烟系统中的管道、风口及阀门等必须采用不燃材料制作。排烟管道应采取隔热防火措施或与可燃物保持不小于150mm的距离。

排烟管道的厚度应按现行国家标准《通风与空调工程施工质量验收规范》GB 50243的有关规定执行。

9.1.6 机械加压送风管道、排烟管道和补风管道内的风速应符合下列规定：

1 采用金属管道时，不宜大于20m/s；

2 采用非金属管道时，不宜大于15m/s。

9.2 自然排烟

9.2.1 下列场所宜设置自然排烟设施：

1 按本规范第9.1.3条规定应设置排烟设施且具备自然排烟条件的场所；

2 除建筑高度超过50m的厂房(仓库)外，按第9.1.2条规定应设置防烟设施且具备自然排烟条件的场所。

9.2.2 设置自然排烟设施的场所，其自然排烟口的净面积应符合下列规定：

1 防烟楼梯间前室、消防电梯间前室，不应小于2.0m²；合用前室，不应小于3.0m²；

2 靠外墙的防烟楼梯间，每5层内可开启排烟窗的总面积不应小于2.0m²；

3 中庭、剧场舞台，不应小于该中庭、剧场舞台楼地面面积的5%；

4 其他场所，宜取该场所建筑面积的2%～5%。

9.2.3 当防烟楼梯间前室、合用前室采用敞开的阳台、凹廊进行防烟，或前室、合用前室内有不同朝向且开口面积符合本规范第9.2.2条规定的可开启外窗时，该防烟楼梯间可不设置防烟设施。

9.2.4 作为自然排烟的窗口宜设置在房间的外墙上方或屋顶上，并应有方便开启的装置。自然排烟口距该防烟分区最远点的水平距离不应超过30m。

9.3 机械防烟

9.3.1 下列场所应设置机械加压送风防烟设施：

1 不具备自然排烟条件的防烟楼梯间；

2 不具备自然排烟条件的消防电梯间前室或合用前室；

3 设置自然排烟设施的防烟楼梯间，其不具备自然排烟条件的前室。

9.3.2 机械加压送风防烟系统的加压送风量应经计算确定。当计算结果与表9.3.2的规定不一致时，应采用较大值。

表9.3.2 最小机械加压送风量

条件和部位		加压送风量(m^3/h)
前室不送风的防烟楼梯间		25000
防烟楼梯间及其合用前室分别加压送风	防烟楼梯间	16000
	合用前室	13000
消防电梯间前室		15000
防烟楼梯间采用自然排烟，前室或合用前室加压送风		22000

注：表内风量数值系按开启宽×高=1.5m×2.1m的双扇门为基础的计算值。当采用单扇门时，其风量宜按表列数值乘以0.75确定；当前室有2个或2个以上门时，其风量应按表列数值乘以1.50～1.75确定。开启门时，通过门的风速不应小于0.70m/s。

9.3.3 防烟楼梯间内机械加压送风防烟系统的余压值应为40～50Pa；前室、合用前室应为25～30Pa。

9.3.4 防烟楼梯间和合用前室的机械加压送风防烟系统宜分别独立设置。

9.3.5 防烟楼梯间的前室或合用前室的加压送风口应每层设置1个。防烟楼梯间的加压送风口宜每隔2～3层设置1个。

9.3.6 机械加压送风防烟系统中送风口的风速不宜大于7m/s。

9.3.7 高层厂房(仓库)的机械防烟系统的其他设计要求应按现行国家标准《高层民用建筑设计防火规范》GB 50045的有关规定执行。

9.4 机械排烟

9.4.1 设置排烟设施的场所当不具备自然排烟条件时，应设置机械排烟设施。

9.4.2 需设置机械排烟设施且室内净高小于等于6m的场所应划分防烟分区；每个防烟分区的建筑面积不宜超过500m²，防烟分区不应跨越防火分区。

防烟分区宜采用隔墙、顶棚下凸出不小于500mm的结构梁以及顶棚或吊顶下凸出不小于500mm的不燃烧体等进行分隔。

9.4.3 机械排烟系统的设置应符合下列规定：

1 横向宜按防火分区设置；

2 竖向穿越防火分区时，垂直排烟管道宜设置在管井内；

3 穿越防火分区的排烟管道应在穿越处设置排烟防火阀。排烟防火阀应符合现行国家标准《排烟防火阀的试验方法》GB 15931的有关规定。

9.4.4 在地下建筑和地上密闭场所中设置机械排烟系统时，应同时设置补风系统。当设置机械补风系统时，其补风量不宜小于排烟量的50%。

9.4.5 机械排烟系统的排烟量不应小于表9.4.5的规定。

表9.4.5 机械排烟系统的最小排烟量

条件和部位		单位排烟量 [m³/(h·m²)]	换气次数 (次/h)	备注
担负1个防烟分区		60	—	单台风机排烟量不应小于7200m³/h
室内净高大于6m且不划分防烟分区的空间				
担负2个及2个以上防烟分区		120	—	应按最大的防烟分区面积确定
中庭	体积小于等于17000m³	—	6	体积大于17000m³时，排烟量不应小于102000m³/h
	体积大于17000m³	—	4	

9.4.6 机械排烟系统中的排烟口、排烟阀和排烟防火阀的设置应符合下列规定：

1 排烟口或排烟阀应按防烟分区设置。排烟口或排烟阀应与排烟风机连锁，当任一排烟口或排烟阀开启时，排烟风机应能自行启动；

2 排烟口或排烟阀平时为关闭时，应设置手动和自动开启装置；

3 排烟口应设置在顶棚或靠近顶棚的墙面上，且与附近安全出口沿走道方向相邻边缘之间的最小水平距离不应小于1.5m。设在顶棚上的排烟口，距可燃构件或可燃物的距离不应小于1.0m；

4 设置机械排烟系统的地下、半地下场所，除歌舞娱乐放映游艺场所和建筑面积大于50m²的房间外，排烟口可设置在疏散走道；

5 防烟分区内的排烟口距最远点的水平距离不应超过30m；排烟支管上应设置当烟气温度超过280℃时能自行关闭的排烟防火阀；

6 排烟口的风速不宜大于10m/s。

9.4.7 机械加压送风防烟系统和排烟补风系统的室外进风口宜布置在室外排烟口的下方，且高差不宜小于3.0m；当水平布置时，水平距离不宜小于10m。

9.4.8 排烟风机的设置应符合下列规定：

1 排烟风机的全压应满足排烟系统最不利环路的要求，其排烟量应考虑10%～20%的漏风量；

2 排烟风机可采用离心风机或排烟专用的轴流风机；

3 排烟风机应能在280℃的环境条件下连续工作不少于30min；

4 在排烟风机入口处的总管上应设置当烟气温度超过280℃时能自行关闭的排烟防火阀，该阀应与排烟风机连锁，当该阀关闭时，排烟风机应能停止运转。

9.4.9 当排烟风机及系统中设置有软接头时，该软接头应能在280℃的环境条件下连续工作不少于30min。排烟风机和用于排烟补风的送风风机宜设置在通风机房内。

10 采暖、通风和空气调节

10.1 一般规定

10.1.1 通风、空气调节系统应采取防火安全措施。

10.1.2 甲、乙类厂房中的空气不应循环使用。

含有燃烧或爆炸危险粉尘、纤维的丙类厂房中的空气，在循环使用前应经净化处理，并应使空气中的含尘浓度低于其爆炸下限的25%。

10.1.3 甲、乙类厂房用的送风设备与排风设备不应布置在同一通风机房内，且排风设备不应和其他房间的送、排风设备布置在同一通风机房内。

10.1.4 民用建筑内空气中含有容易起火或爆炸危险物质的房间，应有良好的自然通风或独立的机械通风设施，且其空气不应循环使用。

10.1.5 排除含有比空气轻的可燃气体与空气的混合物时，其排风水平管全长应顺气流方向向上坡度敷设。

10.1.6 可燃气体管道和甲、乙、丙类液体管道不应穿过通风机房和通风管道，且不应紧贴通风管道的外壁敷设。

10.2 采　暖

10.2.1 在散发可燃粉尘、纤维的厂房内，散热器表面平均温度不应超过82.5℃。输煤廊的采暖散热器表面温度不应超过130℃。

10.2.2 甲、乙类厂房和甲、乙类仓库内严禁采用明火和电热散热器采暖。

10.2.3 下列厂房应采用不循环使用的热风采暖：

1 生产过程中散发的可燃气体、可燃蒸气、可燃粉尘、可燃纤维与采暖管道、散热器表面接触能引起燃烧的厂房；

2 生产过程中散发的粉尘受到水、水蒸气的作用能引起自燃、爆炸或产生爆炸性气体的厂房。

10.2.4 存在与采暖管道接触能引起燃烧爆炸的气体、蒸气或粉尘的房间内不应穿过采暖管道，当必须穿过时，应采用不燃材料隔热。

10.2.5 采暖管道与可燃物之间应保持一定距离。当温度大于100℃时，不应小于100mm或采用不燃材料隔热。当温度小于等于100℃时，不应小于50mm。

10.2.6 建筑内采暖管道和设备的绝热材料应符合下列规定：

1 对于甲、乙类厂房或甲、乙类仓库，应采用不燃材料；

2 对于其他建筑，宜采用不燃材料，不得采用可燃材料。

10.3 通风和空气调节

10.3.1 通风和空气调节系统的管道布置，横向宜按防火分区设置，竖向不宜超过5层。当管道设置防止回流设施或防火阀时，其管道布置可不受此限制。垂直风管应设置在管井内。

10.3.2 **有爆炸危险的厂房内的排风管道，严禁穿过防火墙和有爆炸危险的车间隔墙。**

10.3.3 甲、乙、丙类厂房中的送、排风管道宜分层设置。当水平或垂直送风管在进入生产车间处设置防火阀时，各层的水平或垂直送风管可合用一个送风系统。

10.3.4 空气中含有易燃易爆危险物质的房间，其送、排风系统应采用防爆型的通风设备。当送风机设置在单独隔开的通风机房内且送风干管上设置了止回阀门时，可采用普通型的通风设备。

10.3.5 **含有燃烧和爆炸危险粉尘的空气，在进入排风机前应采用不产生火花的除尘器进行处理。对于遇水可能形成爆炸的粉尘，严禁采用湿式除尘器。**

10.3.6 处理有爆炸危险粉尘的除尘器、排风机的设置应符合下列规定：

1 **应与其他普通型的风机、除尘器分开设置；**

2 宜按单一粉尘分组布置。

10.3.7 处理有爆炸危险粉尘的干式除尘器和过滤器宜布置在厂房外的独立建筑中。该建筑与所属厂房的防火间距不应小于10m。

符合下列规定之一的干式除尘器和过滤器，可布置在厂房内的单独房间内，但应采用耐火极限分别不低于3.00h的隔墙和1.50h的楼板与其他部位分隔：

1 有连续清灰设备；

2 定期清灰的除尘器和过滤器，且其风量不超过15000m^3/h、集尘斗的储尘量小于60kg。

10.3.8 **处理有爆炸危险粉尘和碎屑的除尘器、过滤器、管道，均应设置泄压装置。**

净化有爆炸危险粉尘的干式除尘器和过滤器应布置在系统的负压段上。

10.3.9 **排除、输送有燃烧或爆炸危险气体、蒸气和粉尘的排风系统，均应设置导除静电的接地装置，且排风设备不应布置在地下、半地下建筑(室)中。**

10.3.10 **排除有爆炸或燃烧危险气体、蒸气和粉尘的排风管应采用金属管道，并应直接通到室外的安全处，不应暗设。**

10.3.11 排除和输送温度超过80℃的空气或其他气体以及易燃碎屑的管道，与可燃或难燃物体之间应保持不小于150mm的间隙，或采用厚度不小于50mm的不燃材料隔热。当管道互为上下布置时，表面温度较高者应布置在上面。

10.3.12 **下列情况之一的通风、空气调节系统的风管上应设置防火阀：**

1 **穿越防火分区处；**

2 **穿越通风、空气调节机房的房间隔墙和楼板处；**

3 **穿越重要的或火灾危险性大的房间隔墙和楼板处；**

4 **穿越防火分隔处的变形缝两侧；**

5 **垂直风管与每层水平风管交接处的水平管段上，但当建筑内每个防火分区的通风、空气调节系统均独立设置时，该防火分区内的水平风管与垂直总管的交接处可不设置防火阀。**

10.3.13 公共建筑的浴室、卫生间和厨房的垂直排风管，应采取防回流措施或在支管上设置防火阀。公共建筑的厨房的排油烟管道宜按防火分区设置，且在与垂直排风管连接的支管处应设置动作温度为150℃的防火阀。

10.3.14 防火阀的设置应符合下列规定：

1 除本规范另有规定者外，动作温度应为 70℃；

2 防火阀宜靠近防火分隔处设置；

3 防火阀暗装时，应在安装部位设置方便检修的检修口；

4 在防火阀两侧各 2.0m 范围内的风管及其绝热材料应采用不燃材料；

5 防火阀应符合现行国家标准《防火阀试验方法》GB 15930 的有关规定。

10.3.15 通风、空气调节系统的风管应采用不燃材料，但下列情况除外：

1 接触腐蚀性介质的风管和柔性接头可采用难燃材料；

2 体育馆、展览馆、候机(车、船)楼(厅)等大空间建筑、办公楼和丙、丁、戊类厂房内的通风、空气调节系统，当风管按防火分区设置且设置了防烟防火阀时，可采用燃烧产物毒性较小且烟密度等级小于等于 25 的难燃材料。

10.3.16 设备和风管的绝热材料、用于加湿器的加湿材料、消声材料及其粘结剂，宜采用不燃材料，当确有困难时，可采用燃烧产物毒性较小且烟密度等级小于等于 50 的难燃材料。

风管内设置电加热器时，电加热器的开关应与风机的启停联锁控制。电加热器前后各 0.8m 范围内的风管和穿过设置有火源等容易起火房间的风管，均应采用不燃材料。

10.3.17 燃油、燃气锅炉房应有良好的自然通风或机械通风设施。燃气锅炉房应选用防爆型的事故排风机。当设置机械通风设施时，该机械通风设施应设置导除静电的接地装置，通风量应符合下列规定：

1 燃油锅炉房的正常通风量按换气次数不少于 3 次/h 确定；

2 燃气锅炉房的正常通风量按换气次数不少于 6 次/h 确定；

3 燃气锅炉房的事故排风量按换气次数不少于 12 次/h 确定。

11 电　气

11.1 消防电源及其配电

11.1.1 建筑物、储罐(区)、堆场的消防用电设备，其电源应符合下列规定：

1 除粮食仓库及粮食筒仓工作塔外，建筑高度大于50m的乙、丙类厂房和丙类仓库的消防用电应按一级负荷供电；

2 下列建筑物、储罐(区)和堆场的消防用电应按二级负荷供电：

1)室外消防用水量大于30L/s的工厂、仓库；

2)室外消防用水量大于35L/s的可燃材料堆场、可燃气体储罐(区)和甲、乙类液体储罐(区)；

3)座位数超过1500个的电影院、剧院，座位数超过3000个的体育馆、任一层建筑面积大于3000m² 的商店、展览建筑、省(市)级及以上的广播电视楼、电信楼和财贸金融楼，室外消防用水量大于25L/s的其他公共建筑；

3 除本条第1、2款外的建筑物、储罐(区)和堆场等的消防用电可采用三级负荷供电；

4 消防电源的负荷分级应符合现行国家标准《供配电系统设计规范》GB 50052的有关规定。

11.1.2 一级负荷供电的建筑，当采用自备发电设备作备用电源时，自备发电设备应设置自动和手动启动装置，且自动启动方式应能在30s内供电。

11.1.3 消防应急照明灯具和灯光疏散指示标志的备用电源的连续供电时间不应少于30min。

11.1.4 消防用电设备应采用专用的供电回路，当生产、生活用电被切断时，应仍能保证消防用电。其配电设备应有明显标志。

11.1.5 消防控制室、消防水泵房、防烟与排烟风机房的消防用电设备及消防电梯等的供电，应在其配电线路的最末一级配电箱处设置自动切换装置。

11.1.6 消防用电设备的配电线路应满足火灾时连续供电的需要，其敷设应符合下列规定：

1 暗敷时，应穿管并应敷设在不燃烧体结构内且保护层厚度不应小于30mm。明敷时(包括敷设在吊顶内)，应穿金属管或封闭式金属线槽，并应采取防火保护措施；

2 当采用阻燃或耐火电缆时，敷设在电缆井、电缆沟内可不采取防火保护措施；

3 当采用矿物绝缘类不燃性电缆时，可直接明敷；

4 宜与其他配电线路分开敷设；当敷设在同一井沟内时，宜分别布置在井沟的两侧。

11.2 电力线路及电器装置

11.2.1 甲类厂房、甲类仓库，可燃材料堆垛，甲、乙类液体储罐，液化石油气储罐，可燃、助燃气体储罐与架空电力线的最近水平距离不应小于电杆(塔)高度的1.5倍，丙类液体储罐与架空电力线的最近水平距离不应小于电杆(塔)高度的1.2倍。

35kV 以上的架空电力线与单罐容积大于 200m³ 或总容积大于 1000m³ 的液化石油气储罐(区)的最近水平距离不应小于40m;当储罐为地下直埋式时,架空电力线与储罐的最近水平距离可减小 50%。

11.2.2 电力电缆不应和输送甲、乙、丙类液体管道、可燃气体管道、热力管道敷设在同一管沟内。

配电线路不得穿越通风管道内腔或敷设在通风管道外壁上,穿金属管保护的配电线路可紧贴通风管道外壁敷设。

11.2.3 配电线路敷设在有可燃物的闷顶内时,应采取穿金属管等防火保护措施;敷设在有可燃物的吊顶内时,宜采取穿金属管、采用封闭式金属线槽或难燃材料的塑料管等防火保护措施。

11.2.4 开关、插座和照明灯具靠近可燃物时,应采取隔热、散热等防火保护措施。

卤钨灯和额定功率大于等于 100W 的白炽灯泡的吸顶灯、槽灯、嵌入式灯,其引入线应采用瓷管、矿棉等不燃材料作隔热保护。

大于 60W 的白炽灯、卤钨灯、高压钠灯、金属卤灯光源、荧光高压汞灯(包括电感镇流器)等不应直接安装在可燃装修材料或可燃构件上。

11.2.5 可燃材料仓库内宜使用低温照明灯具,并应对灯具的发热部件采取隔热等防火保护措施;不应设置卤钨灯等高温照明灯具。

配电箱及开关宜设置在仓库外。

11.2.6 爆炸和火灾危险环境电力装置的设计应按现行国家标准《爆炸和火灾危险环境电力装置设计规范》GB 50058 的有关规定执行。

11.2.7 下列场所宜设置漏电火灾报警系统:

1 按一级负荷供电且建筑高度大于 50m 的乙、丙类厂房和丙类仓库;

2 按二级负荷供电且室外消防用水量大于 30L/s 的厂房(仓库);

3 按二级负荷供电的剧院、电影院、商店、展览馆、广播电视楼、电信楼、财贸金融楼和室外消防用水量大于 25L/s 的其他公共建筑;

4 国家级文物保护单位的重点砖木或木结构的古建筑;

5 按一、二级负荷供电的消防用电设备。

11.3 消防应急照明和消防疏散指示标志

11.3.1 除住宅外的民用建筑、厂房和丙类仓库的下列部位,应设置消防应急照明灯具:

1 封闭楼梯间、防烟楼梯间及其前室、消防电梯间的前室或合用前室;

2 消防控制室、消防水泵房、自备发电机房、配电室、防烟与排烟机房以及发生火灾时仍需正常工作的其他房间;

3 观众厅,建筑面积大于 400m² 的展览厅、营业厅、多功能厅、餐厅,建筑面积大于 200m² 的演播室;

4 建筑面积大于 300m² 的地下、半地下建筑或地下室、半地下室中的公共活动房间;

5 公共建筑中的疏散走道。

11.3.2 建筑内消防应急照明灯具的照度应符合下列规定:

1 疏散走道的地面最低水平照度不应低于 0.5 lx;

2 人员密集场所内的地面最低水平照度不应低于 1.0 lx;

3 楼梯间内的地面最低水平照度不应低于 5.0 lx;

4 消防控制室、消防水泵房、自备发电机房、配电室、防烟与排烟机房以及发生火灾时仍需正常工作的其他房间的消防应急照明,仍应保证正常照明的照度。

11.3.3 消防应急照明灯具宜设置在墙面的上部、顶棚上或出口的顶部。

11.3.4 公共建筑、高层厂房(仓库)及甲、乙、丙类厂房应沿疏散走道和在安全出口、人员密集场所的疏散门的正上方设置灯光疏散指示标志,并应符合下列规定:

1 安全出口和疏散门的正上方应采用"安全出口"作为指示标志;

2 沿疏散走道设置的灯光疏散指示标志,应设置在疏散走道及其转角处距地面高度 1.0m 以下的墙面上,且灯光疏散指示标志间距不应大于 20m;对于袋形走道,不应大于 10m;在走道转角区,不应大于 1.0m,其指示标志应符合现行国家标准《消防安全标志》GB 13495 的有关规定。

11.3.5 下列建筑或场所应在其内疏散走道和主要疏散路线的地面上增设能保持视觉连续的灯光疏散指示标志或蓄光疏散指示标志:

1 总建筑面积超过 8000m² 的展览建筑;

2 总建筑面积超过 5000m² 的地上商店;

3 总建筑面积超过 500m² 的地下、半地下商店;

4 歌舞娱乐放映游艺场所;

5 座位数超过 1500 个的电影院、剧院,座位数超过 3000 个的体育馆、会堂或礼堂。

11.3.6 建筑内设置的消防疏散指示标志和消防应急照明灯具,除应符合本规范的规定外,还应符合现行国家标准《消防安全标志》GB 13495 和《消防应急灯具》GB 17945 的有关规定。

11.4 火灾自动报警系统和消防控制室

11.4.1 下列场所应设置火灾自动报警系统:

1 大中型电子计算机房及其控制室、记录介质库,特殊贵重或火灾危险性大的机器、仪表、仪器设备室、贵重物品库房,设有气体灭火系统的房间;

2 每座占地面积大于 1000m² 的棉、毛、丝、麻、化纤及其织物的库房,占地面积超过 500m² 或总建筑面积超过 1000m² 的卷烟库房;

3 任一层建筑面积大于 1500m² 或总建筑面积大于 3000m² 的制鞋、制衣、玩具等厂房;

4 任一层建筑面积大于 3000m² 或总建筑面积大于 6000m² 的商店、展览建筑、财贸金融建筑、客运和货运建筑等;

5 图书、文物珍藏库,每座藏书超过 100 万册的图书馆,重要的档案馆;

6 地市级及以上广播电视建筑、邮政楼、电信楼,城市或区域性电力、交通和防灾救灾指挥调度等建筑;

7 特等、甲等剧院或座位数超过 1500 个的其他等级的剧院、电影院,座位数超过 2000 个的会堂或礼堂,座位数超过 3000 个的体育馆;

8 老年人建筑、任一楼层建筑面积大于 1500m² 或总建筑面积大于 3000m² 的旅馆建

筑、疗养院的病房楼、儿童活动场所和大于等于200床位的医院的门诊楼、病房楼、手术部等；

9 建筑面积大于500m² 的地下、半地下商店；

10 设置在地下、半地下或建筑的地上四层及四层以上的歌舞娱乐放映游艺场所；

11 净高大于2.6m且可燃物较多的技术夹层，净高大于0.8m且有可燃物的闷顶或吊顶内。

11.4.2 建筑内可能散发可燃气体、可燃蒸气的场所应设可燃气体报警装置。

11.4.3 设有火灾自动报警系统和自动灭火系统或设有火灾自动报警系统和机械防(排)烟设施的建筑，应设置消防控制室。

11.4.4 消防控制室的设置应符合下列规定：

1 单独建造的消防控制室，其耐火等级不应低于二级；

2 附设在建筑物内的消防控制室，宜设置在建筑物内首层的靠外墙部位，亦可设置在建筑物的地下一层，但应按本规范第7.2.5条的规定与其他部位隔开，并应设置直通室外的安全出口；

3 严禁与消防控制室无关的电气线路和管路穿过；

4 不应设置在电磁场干扰较强及其他可能影响消防控制设备工作的设备用房附近。

11.4.5 火灾自动报警系统的设计，应符合现行国家标准《火灾自动报警系统设计规范》GB 50116的有关规定。

12 城市交通隧道

12.1 一般规定

12.1.1 城市交通隧道(以下简称隧道)的防火设计应综合考虑隧道内的交通组成、隧道的用途、自然条件、长度等因素进行。

12.1.2 单孔和双孔隧道应按其封闭段长度及交通情况分为一、二、三、四类,并应符合表12.1.2的规定。

表12.1.2 隧道分类

用途	隧道封闭段长度 L(m)			
	一类	二类	三类	四类
可通行危险化学品等机动车	$L>1500$	$500<L\leqslant1500$	$L\leqslant500$	—
仅限通行非危险化学品等机动车	$L>3000$	$1500<L\leqslant3000$	$500<L\leqslant1500$	$L\leqslant500$
仅限人行或通行非机动车	—	—	$L>1500$	$L\leqslant1500$

12.1.3 一类隧道内承重结构体的耐火极限不应低于2.00h;二类不应低于1.50h;三类不应低于2.00h;四类隧道的耐火极限不限。

水底隧道的顶部应设置抗热冲击、耐高温的防火衬砌,其耐火极限应按相应隧道类别确定。

注:1 一、二类隧道内承重结构体的耐火极限应采用RABT标准升温曲线测试,通行机动车的三类隧道的耐火极限应采用HC标准升温曲线测试,并应符合本规范附录A的规定。

2 通行机动车的四类隧道和仅限人行或通行非机动车的三类隧道,其耐火极限试验可采用标准升温曲线和判定标准。

12.1.4 隧道内装修材料除嵌缝材料外,应采用不燃材料。

12.1.5 一、二、三类通行机动车的双孔隧道,其车行横通道或车行疏散通道应按下列规定设置:

1 水底隧道宜设置车行横通道或车行疏散通道。车行横通道间隔及隧道通向车行疏散通道的人口间隔,宜为500~1500m;

2 非水底隧道应设置车行横通道或车行疏散通道。车行横通道间隔及隧道通向车行疏散通道的人口间隔,宜为200~500m;

3 车行横通道应沿垂直隧道长度方向设置,并应通向相邻隧道;车行疏散通道应沿隧道长度方向在双孔中间设置,并应直通隧道外;

4 车行横通道和车行疏散通道的净宽度不应小于4.0m,净高度不应小于4.5m;

5 隧道与车行横通道或车行疏散通道的连通处,应采取防火分隔措施。

12.1.6 一、二、三类通行机动车的双孔隧道,其人行横通道或人行疏散通道应按下列规定设置:

1 隧道应设置人行横通道或人行疏散通道。人行横通道间隔及隧道通向人行疏散通

道的入口间隔，宜为250～300m；

2 人行疏散横通道应沿垂直双孔隧道长度方向设置，并应通向相邻隧道。人行疏散通道应在双孔中间沿隧道长度方向设置，并应直通隧道外；

3 双孔隧道内的人行横通道可利用车行横通道；

4 人行横通道或人行疏散通道的净宽度不应小于2.0m，净高度不应小于2.2m；

5 隧道与人行横通道或人行疏散通道的连通处，应采取防火分隔措施。

12.1.7 一、二、三类采用纵向通风方式的单孔隧道或一、二类水底隧道，应根据实际情况设置直通室外的人员疏散出口或独立避难所等避难设施。

12.1.8 隧道内的变电所、管廊、专用疏散通道、通风机房及其他辅助用房等，与车行隧道之间应采取防火分隔措施。

12.2 消防给水与灭火设施

12.2.1 在进行城市交通隧道的规划与设计时，应同时设计消防给水系统。四类隧道和行人或通行非机动车辆的三类隧道，可不设置消防给水系统。

12.2.2 消防给水系统的设置应符合下列规定：

1 消防水源应符合本规范第8.1.2的规定，供水管网应符合本规范第8.2.7条的规定。

2 消防用水量应按其火灾延续时间和隧道全线同一时间内发生一次火灾，经计算确定。二类隧道的火灾延续时间不应小于3.0h；三类隧道不应小于2.0h。

3 隧道内宜设置独立的消防给水系统。严寒和寒冷地区的消防给水管道及室外消火栓应采取防冻措施；当采用干管系统时，应在管网最高部位设置自动排气阀，管道充水时间不应大于90s。

4 隧道内的消火栓用水量不应小于20L/s，隧道洞口外的消火栓用水量不应小于30L/s。长度小于1000m的三类隧道，隧道内和隧道洞口外的消火栓用水量可分别为10L/s和20L/s。

5 管道内的消防供水压力应保证用水量达到最大时，最不利点水枪充实水柱不应小于10.0m。消火栓栓口处的出水压力超过0.5MPa时，应设置减压设施。

6 在隧道出入口处应设置消防水泵接合器及室外消火栓。

7 消火栓的间距不应大于50m。消火栓的栓口距地面高度宜为1.1m。

8 设置有消防水泵供水设施的隧道，应在消火栓箱内设置消防水泵启动按钮。

9 应在隧道单侧设置室内消火栓，消火栓箱内应配置1支喷嘴口径19mm的水枪、1盘长25m、直径65mm的水带，宜附设消防软管卷盘。

12.2.3 除四类隧道外，隧道内应设置排水设施。排水设施除应考虑排除渗水、雨水、隧道清洗等水量外，还应考虑灭火时的消防用水量，并应采取防止事故时可燃液体或有害液体沿隧道漫流的措施。

12.2.4 灭火器的设置应符合下列规定：

1 二类隧道应在隧道两侧设置ABC类灭火器。每个设置点不应少于4具。

2 通行机动车的四类隧道和人行或通行非机动车的三类隧道，应在隧道一侧设置ABC类灭火器。每个设置点不应少于2具。

3 灭火器设置点的间距不应大于100m。

12.3 通风和排烟系统

12.3.1 通行机动车的一、二、三类隧道应设置机械排烟系统，通行机动车的四类隧道可采取自然排烟方式。

12.3.2 机械排烟系统可与隧道的通风系统合用，且通风系统应符合机械排烟系统的有关要求，并应符合下列规定：

1 采用全横向和半横向通风方式时，可通过排风管道排烟；采用纵向通风方式时，应能迅速组织气流有效地排烟；

2 采用纵向通风方式的隧道，其排烟风速应根据隧道内的最不利火灾规模确定；

3 排烟风机必须能在250℃环境条件下连续正常运行不小于1.0h。排烟管道的耐火极限不应低于1.00h。

12.3.3 隧道火灾避难设施内应设置独立的机械加压送风系统，其送风的余压值应为30～50Pa。

12.4 火灾自动报警系统

12.4.1 隧道入口外100～150m处，应设置火灾事故发生后提示车辆禁入隧道的报警信号装置。

12.4.2 一、二类通行机动车辆的隧道应设置火灾自动报警系统，其设置应符合下列规定：

1 应设置自动火灾探测装置；

2 隧道出入口以及隧道内每隔100～150m处，应设置报警电话和报警按钮；

3 隧道封闭段长度超过1000m时，应设置消防控制中心；

4 应设置火灾应急广播。未设置火灾应急广播的隧道，每隔100～150m处，应设置发光警报装置。

12.4.3 通行机动车辆的三类隧道宜设置火灾自动报警系统。

12.4.4 隧道用电缆通道和主要设备用房内应设置火灾自动报警装置。

12.4.5 对于可能产生屏蔽的隧道，应采取能保证灭火时通信联络畅通的措施，宜设置无线通信设施。

12.4.6 隧道内火灾自动报警系统的设计应符合现行国家标准《火灾自动报警系统设计规范》GB 50116的有关规定。

12.5 供电及其他

12.5.1 一、二类隧道的消防用电应按一级负荷要求供电；三类隧道的消防用电应按二级负荷要求供电。

12.5.2 隧道的消防电源及其供电、配电线路等的设计应按本规范第11章的有关规定执行。

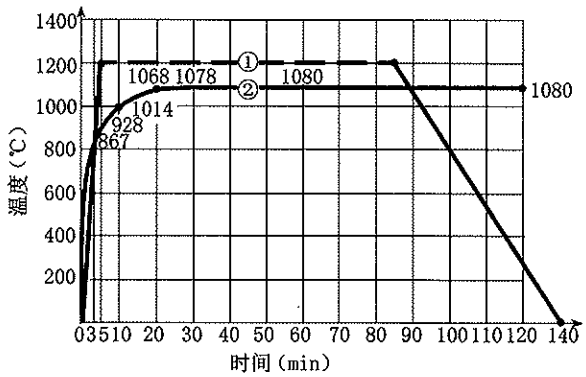
12.5.3 隧道两侧应设置消防应急照明灯具和疏散指示标志，其高度不宜大于1.5m。一、二类隧道内消防应急照明灯具和疏散指示标志的连续供电时间不应小于3.0h；三类隧道，不应小于1.5h。其他要求可按本规范第11章的有关规定执行。

12.5.4 隧道内严禁设置高压电线电缆和可燃气体管道；电缆线槽应与其他管道分开埋设。

12.5.5 隧道内设置的各类消防设施均应采取与隧道内环境条件相适应的保护措施，并应设置明显的发光消防疏散指示标志。

附录A 隧道内承重结构体的耐火极限试验升温曲线和相应的判定标准

A.0.1 RABT标准升温曲线(见图A.0.1)。



图A.0.1 RABT标准升温曲线

①—RABT曲线；②—碳氢化合物曲线

A.0.2 HC标准升温曲线(见表A.0.2)。

表A.0.2 碳氢化合物升温曲线表

时间(min)	3	5	10	30
炉内温升(℃)	887	948	982	1110
时间(min)	60	90	120	120以后
炉内温升(℃)	1150	1150	1150	1150

A.0.3 耐火极限判定标准。

1 当采用HC标准升温曲线测试时，其耐火极限的判定标准为：受火后，当距离混凝土底表面25mm处钢筋的温度超过250℃，或者混凝土表面的温度超过380℃时，则判定为达到耐火极限。

2 当采用RABT标准升温曲线测试时，其耐火极限的判定标准为：受火后，当距离混凝土底表面25mm处钢筋的温度超过300℃，或者混凝土表面的温度超过380℃时，则判定为达到耐火极限。

本规范用词说明

1 为便于在执行本规范条文时区别对待，对要求严格程度不同的用词说明如下：

1)表示很严格，非这样做不可的用词：

正面词采用“必须”，反面词采用“严禁”。

2)表示严格，在正常情况下均应这样做的用词：

正面词采用“应”，反面词采用“不应”或“不得”。

3)表示允许稍有选择，在条件许可时首先应这样做的用词：

正面词采用“宜”，反面词采用“不宜”；

表示有选择，在一定条件下可以这样做的用词，采用“可”。

2 本规范中指明应按其他有关标准、规范执行的写法为“应符合……的规定”或“应按……执行”。