

Foreword

According to the requirements of Document JIANBIAO [2007] No.125-"Notice on Printing the Development and Revision Plan of National Engineering Construction Standards and Codes(the First List)in 2007" and Document JIANBIAO [2009] No.94-"Letter on the Modification of Revision Plan for *Code of Design on Building Fire Protection and Prevention* and *Code for Fire Protection Design of Tall Building*" issued by the Ministry of Housing and Urban-Rural Development, this code was revised by integrating GB 50016-2006 *Code of Design on Building Fire Protection and Prevention* and GB 50045-95 *Code for Fire Protection Design of Tall Building* by Tianjin Fire Research Institute and Sichuan Fire Research Institute of Ministry of Public Security, together with other organizations.

During the revision of this code, the working group followed the relevant national principles and policies in capital construction, implemented the fire policy of "prevention first and combining prevention with fire-fighting", learned the lessons from major fire accidents in recent years, summarized practical experiences in fire protection design of buildings and achievements in fire science and technology at home and abroad, carried out researches on the new conditions and problems in engineering construction and the issues arisen during the code implementation, seriously studied and learned experiences from developed countries, carried out series of research projects, technical discussions and necessary tests, solicited wide opinions from design, production, construction, scientific research, education and fire supervision organizations, etc. and finalized this code based on authority approval.

This code includes twelve chapters and three appendixes. Its main technical contents include: requirements for fire hazard classification of production and storage and classification of high-rise buildings, basic requirements for fire-resistance class of industrial and civil buildings such as factory buildings, storages, residential buildings and public buildings and basic requirements for fire-resistance rating of building elements, plane arrangement, fire compartmentation, fire separation, building construction for fire protection, fire separation distance and fire protection facilities, basic measures and requirements for explosion prevention of industrial buildings; basic requirements for distance, exit width, exit stairway, emergency lighting and evacuation indicating signs, and exit and exit door of industrial and civil buildings; basic requirements for fire separation distance, grouped layout and storage volume of Class A, B, C liquid and gas tanks(tank farms) and stackyard for combustibles; basic requirements for fire protection design of timber building and urban road tunnel engineering; basic requirements for firefighting and rescue area, fire vehicle access road, fire service access elevator and other facilities set to meet the fire fighting and rescue requirements; fire protection requirements in such aspects as heating, ventilating and air conditioning and electricity of buildings as well as basic requirements for fire power supply, distribution lines etc. of fire-fighting electrical equipment.

There have been some significant changes of this code over GB 50016-2006 *Code of Design on Building Fire Protection and Prevention* and GB 50045-95(2005 edition) *Code for Fire Protection Design of Tall Building* as follows:

1. *Code of Design on Building Fire Protection and Prevention* and *Code for Fire Protection Design of Tall Building* are combined, with their inconsistent requirements amended. The residential buildings are classified by their building height.

2. Two chapters("Fire fighting and rescue facilities" and "Timber buildings")are added, improving the relevant requirements of fire-fighting and rescue and standardizing the fire protection requirements of timber buildings.

3. Fire protection requirements of thermal insulation system for buildings are supplemented.

4. Specific requirements are made for the arrangement of fire-fighting facilities and the relevant contents are improved;the requirements for the design of fire water supply systems, indoor and outdoor fire hydrant systems and smoke control and smoke exhaust systems are specified in corresponding national standards respectively.

5. Fire protection requirements of high-rise residential buildings and the high-rise civil buildings with building height greater than 100m are properly improved.

6. Fire protection requirements of roofed commercial common pedestrian area when it is used for the evacuation of the buildings on both sides are supplemented;the designed occupant density of the business hall and exhibition hall of building materials, furniture and light fixture stores are amended and supplemented.

7. Fire protection requirements for underground storages, logistics buildings, large combustible gas tanks (tank farms), liquid ammonia tanks and LNG tanks are supplemented, and the fire separation distance of liquid oxygen tanks and the like are amended.

8. The relevant requirements for preventing vertical or horizontal fire spread in buildings are improved.

Provisions printed in bold type in this code are compulsory and must be implemented strictly.

The Ministry of Housing and Urban-Rural Development of the People's Republic of China is in charge of the administration of this code and the explanation of compulsory provisions;the Ministry of Public Security of the People's Republic of China is responsible for the routine management;authorized by Fire Department of MPS, Tianjin Fire Research Institute and Sichuan Fire Research Institute are responsible for the explanation of specific technical contents.

Whereas this code is a comprehensive technical standard for fire protection with strong policy and technology orientations and wide coverage, all relevant organizations are kindly requested to summarize your experiences in actual practice and scientific research during the process of implementing this code, and relevant comments, recommendations and questions, whenever necessary, can be posted or passed on to the Fire Department of MPS (Address: No.70 Guang'anmen South Street, Xicheng District, Beijing, 100054, China) for reference in the future revision and for explanation by Tianjin and Sichuan Fire Research Institutes of MPS.

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1 General provisions

1.0.1 This code is formulated with a view to preventing fire accidents in buildings, reducing fire hazards and protecting safety of life and property.

1.0.2 This code is applicable to the following newly constructed, enlarged and altered buildings:

- 1 Factory buildings;
- 2 Storages;
- 3 Civil buildings;
- 4 Class A, B, C liquid tanks (tank farms);
- 5 Combustible and combustion-supporting gas tanks (tank farms);
- 6 Stackyards for combustibles;
- 7 Urban road tunnels.

If dedicated national standards are available, the fire protection design of buildings for civil air defense engineering, petroleum and natural gas engineering, petrochemical engineering, fossil fuel power plants and substations should comply with the requirements of those standards.

1.0.3 This code is not applicable to the fire protection design of buildings such as factory buildings (storages) for gunpowder, explosives and their products as well as fireworks and firecrackers.

1.0.4 Where a building is multi-used, fire separations shall be provided between different uses. Fire protection design of buildings and the areas of different uses shall be determined according to the relevant requirements of this code.

1.0.5 Fire protection design of buildings shall comply with the relevant national major policies, and guarantee, on the whole, the overall planning, safety and applicability, advanced technology as well as economical rationality according to the occupancies and fire hazards of the building.

1.0.6 In addition to comply with the requirements of this code, buildings with height greater than 250m shall be protected with stricter fire protection measures according to the actual situation. Fire protection design solutions of such buildings shall be discussed and reviewed by the national fire authorities.

1.0.7 In addition to the requirements of this code, fire protection design of buildings shall also comply with those specified in the relevant current national standards.

2 Terms and symbols

2.1 Terms

2.1.1 high-rise building

Residential buildings with building height greater than 27m and non-single-storey factory buildings, storages and other civil buildings with building height greater than 24m.

Note: The calculation of building height shall comply with those specified in Appendix A of this code.

2.1.2 podium

The ancillary part of a high-rise building, whose height is not greater than 24m, and is connected to the main body of the high-rise building but is beyond the projection range of the main body.

2.1.3 important public building

The civil building other than residential building that may cause heavy casualties and property losses, severe social impact in case of fire.

2.1.4 small commercial spaces

Commercial spaces such as shops, post offices, banks, barbershops located on the first floor or the first and second floors of the residential buildings, with the building area of each separated unit not greater than 300m².

2.1.5 high rack storage

Rack storage with rack height greater than 7m and with mechanical operation or automatic control.

2.1.6 semi-basement

A space having its average clear height greater than 1/3 but less than 1/2 below finished ground level.

2.1.7 basement

A space having more than half its average clear height below finished ground level.

2.1.8 open flame location

An indoor or outdoor location with open flame or red-hot subjects, excluding cooking utensils, induction cooker and the like in a civil building.

2.1.9 sparking site

A location like chimney with flying fire, or for such operations as outdoor grinding wheel, electric welding, gas welding and gas cutting.

2.1.10 fire-resistance rating

A period of time that starts from a building element, component or assembly that are exposed to fire under standard fire conditions, to the time that they lose bearing capacity, integrity or insulation, expressed in hours.

2.1.11 fire partition wall

Noncombustible wall in a building which prevents fire from spreading to adjoining areas with fire-resistance rating not less than the specified requirements of the code.

2.1.12 fire wall

Noncombustible wall which prevents fire from spreading to adjoining buildings or adjoining horizontal fire compartments with fire-resistance rating not less than 3.00h.

2.1.13 refuge floor(room)

A floor(room)in a building that temporarily protects people from fire and smoke.

2.1.14 exit

Entrance to a staircase/external stairs for evacuation of people or that directly leading to internal and/or external safe places ,including storey exit and final exit.

2.1.15 enclosed stairway

Staircase with a door at its entrance to prevent smoke and heat from entering into it.

2.1.16 smokeproof staircase

Staircase with such facilities as smokeproof vestibule ,open balcony or concave corridor(collectively named as "vestibule")at its entrance, all the doors leading to the vestibule and staircase are fire doors, which prevent smoke and heat from entering into it.

2.1.17 refuge passageway

Passageway for people to refuge temporarily and evacuate safely to the outside by providing smoke proof measures and fire partition walls with fire-resistance rating not less than 3.00h on both sides.

2.1.18 flash point

Under specified test conditions ,the minimum temperature(determined by closed cup method)of a liquid or solid at which vapor gives off near the surface of the liquid or solid to form an ignitable mixture with air, and will flash in the presence of an ignition source.

2.1.19 lower explosive limit(LEL)

The minimum concentration of the mixture of combustible vapor, gas or dust with air that is capable of exploding in the presence of an ignition source.

2.1.20 boil-over oil

Oil products that contain water and can produce thermal wave during combustion.

2.1.21 fire separation distance

A spatial separation that prevents a burning building from igniting its adjacent buildings within certain time and facilitates fire-fighting.

Note: The calculation method of fire separation distance shall comply with those specified in Appendix B of the code.

2.1.22 fire compartment

Enclosed space within a building separated from adjoining spaces by fire walls, floors and other constructions having a specified fire resistance.

2.1.23 solid stream

A jet length from the hose nozzle to the hole with diameter as 380mm, from which 90% of the water stream passes through.

2.2 Symbols

A —Pressure relief area;

C —Pressure relief ratio;

D —Diameter of storage tank;

DN —Nominal diameter of pipe;

ΔH —Height difference of buildings;

L —Length of Enclosed section of a tunnel;

N —Number of people;

n —Number of seats;

K —Characteristic index of explosion;

V —Volume of building and stackyard or the volume or capacity of tank or cylinder;

W —Capacity of stackyard for combustibles or grain silo, bin and barn.

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3 Factory buildings and storages

3.1 Classification of fire hazards

3.1.1 Fire hazard of production shall be classified according to such factors as the properties and quantity of substances used or generated during production. It is classified into Class A, B, C, D and E, and shall be in accordance with those specified in Table 3.1.1.

Table 3.1.1 Classification of fire hazards of production

Fire hazard class of production	Fire hazard characteristics of production using or generating the following substances
A	<ol style="list-style-type: none"> 1. Liquid with flash point less than 28°C; 2. Gas with LEL less than 10%; 3. Substances being capable of spontaneous decomposition at normal temperature or oxidizing in the air and result in rapid spontaneous ignition or explosion; 4. Substances being capable of generating combustible gas and causing combustion or explosion at normal temperature under the action of water or the water vapor in the air; 5. Strong oxidizer which tends to cause combustion or explosion in case of meeting acid, heat, impact, friction, catalysis as well as organic substance or flammable inorganic substances like sulphur etc.; 6. Substances which can cause combustion or explosion in case of being impacted, rubbed or being exposed to oxidizer and organic substances; 7. Production where the operating temperature inside the enclosed equipment is not less than the spontaneous ignition temperature of the substance
B	<ol style="list-style-type: none"> 1. Liquid with flash point not less than 28°C but less than 60°C; 2. Gas with LEL not less than 10%; 3. Oxidizer not belonging to Class A; 4. Flammable solid not belonging to Class A; 5. Combustion-supporting gas; 6. Floating dust, fiber and liquid fog drop with flash point not less than 60°C, which is capable of forming explosive mixture with the air
C	<ol style="list-style-type: none"> 1. Liquid with flash point not less than 60°C; 2. Combustible solid
D	<ol style="list-style-type: none"> 1. Production where noncombustible substance is processed, with strong radiant heat, spark or flame frequently generated at high temperature or molten state; 2. Various production where gas, liquid and solid are used as fuel or gas and liquid combusts for other purpose; 3. Difficult combustibles that are used or processed at ambient temperature
E	Noncombustibles that are used or processed at ambient temperature

3.1.2 When production with different fire hazards is carried out in the same factory building or in any fire compartment thereof, the fire hazard classification of production in that factory building or in that fire compartment shall be determined according to the part with higher fire hazard; when the quantity of flammables or combustibles used or generated during production is small and is insufficient to cause explosion/fire hazard, the fire hazard classification may be determined according to the actual conditions; when one of the following conditions is met, the fire hazard classification may be determined according to the part with lower fire hazard:

1 The floor area of the production part with higher fire hazard is less than 5% of the gross floor area of the floor or the fire compartment or the area of paint spray section in Class D and E factory buildings is less than 10%, and fire cannot spread to other parts during fire accident or the production part with higher fire hazard has been taken with effective fire prevention measures;

2 The area of paint spray section in Class D and E factory buildings is not larger than 20% of the gross floor area of the fire compartment, provided that the section is enclosed and negatively pressurized, combustible gas detection and alarm system or automatic explosion suppression system is installed.

3.1.3 The fire hazard of stored materials shall be classified according to such factors as the properties of stored materials and the quantity of combustibles in the stored materials. It is classified into Class A, B, C, D and E, and shall be in accordance with those specified in Table 3.1.3.

Table 3.1.3 Classification of fire hazards of stored materials

Fire hazard class of stored materials	Fire hazard characteristics of stored materials
A	1. Liquid with flash point less than 28°C; 2. Gas with LEL less than 10%, solid substance which can generate gas with LEL less than 10% under the action of water or the water vapor in the air; 3. Substances being capable of spontaneous decomposition at normal temperature or oxidizing in the air and result in rapid spontaneous ignition or explosion; 4. Substances being capable of generating combustible gas and causing combustion or explosion at normal temperature under the action of water or the water vapor in the air; 5. Strong oxidizer which is apt to cause combustion or explosion in case of meeting acid, heat, impact and friction as well as organic substance or flammable inorganic substances like sulphur etc.; 6. Substance which can cause combustion or explosion in case of being impacted, rubbed or being exposed to oxidizer and organic substance
B	1. Liquid with flash point not less than 28°C but less than 60°C; 2. Gas with LEL not less than 10%; 3. Oxidizer not belonging to Class A; 4. Flammable solid not belonging to Class A; 5. Combustion-supporting gas; 6. Materials which oxidize slowly at normal temperature if being exposed to the air and cause spontaneous ignition due to accumulated heat
C	1. Liquid with flash point not less than 60°C; 2. Combustible solid
D	Difficult-combustibles
E	Noncombustibles

3.1.4 When materials with different fire hazards are stored in the same storage or in the same fire compartment thereof, the fire hazard of the storage or the fire compartment shall be determined according to the stored materials with the highest fire hazard.

3.1.5 As for the storages of Class D and E, if the weight of combustible package is larger than 1/4 of that of the stored materials or the volume of combustible package is larger than 1/2 of that of the stored materials, the classification of the fire hazard shall be Class C.

3.2 Fire-resistance class of factory buildings and storages

3.2.1 The fire-resistance class of factory buildings and storages are classified into Class I, II, III and IV. The combustibility and fire-resistance rating of corresponding building elements shall be not less than those specified in Table 3.2.1 unless otherwise required by provisions of this code.

Table 3.2.1 Combustibility and fire-resistance rating(h) of building elements for factory building and storage with different fire-resistance class

Elements		Fire-resistance class			
		Class I	Class II	Class III	Class IV
Wall	Fire wall	Noncombustible 3.00	Noncombustible 3.00	Noncombustible 3.00	Noncombustible 3.00
	Load-bearing wall	Noncombustible 3.00	Noncombustible 2.50	Noncombustible 2.00	Difficult-combustible 0.50
	Walls of staircase and vestibule Walls of elevator shaft	Noncombustible 2.00	Noncombustible 2.00	Noncombustible 1.50	Difficult-combustible 0.50
	Partition walls on both sides of exit passageway	Noncombustible 1.00	Noncombustible 1.00	Noncombustible 0.50	Difficult-combustible 0.25
	Nonbearing exterior wall Room partition wall	Noncombustible 0.75	Noncombustible 0.50	Difficult-combustible 0.50	Difficult-combustible 0.25
Column		Noncombustible 3.00	Noncombustible 2.50	Noncombustible 2.00	Difficult-combustible 0.50
Beam		Noncombustible 2.00	Noncombustible 1.50	Noncombustible 1.00	Difficult-combustible 0.50
Floor		Noncombustible 1.50	Noncombustible 1.00	Noncombustible 0.75	Difficult-combustible 0.50
Roof load-bearing elements		Noncombustible 1.50	Noncombustible 1.00	Difficult-combustible 0.50	Combustible
Exit stair		Noncombustible 1.50	Noncombustible 1.00	Noncombustible 0.75	Combustible
Suspended ceiling(including ceiling joist)		Noncombustible 0.25	Difficult-combustible 0.25	Difficult-combustible 0.15	Combustible

Note: As for the suspended ceiling made of noncombustible materials in buildings with Class II fire resistance, its fire-resistance rating is not required.

3.2.2 The fire-resistance class of high-rise factory buildings and Class A and B factory buildings shall be at least Class II . Independent single-storey Class A and B factory buildings with building area not greater than 300m² may be Class III .

3.2.3 The fire-resistance class shall be not less than Class III for single-/multi-storey Class C factory buildings and multi-storey Class D and E factory buildings.

The fire-resistance class shall be not less than Class II for factory buildings where Class C liquids are used or generated , and Class D factory buildings where spark , red-hot subjects or open flame are present. The fire-resistance class may be Class III for single-storey Class C factory buildings with building area not greater than 500m² or single-storey Class D factory buildings with building area not greater than 1 000m².

3.2.4 The fire-resistance class shall be not less than Class II for buildings where particularly valuable equipment or articles such as machinery , instruments and apparatuses are installed or stored.

3.2.5 Fire-resistance class shall be not less than Class II for boiler room. In case of coal-fired boiler room with total evaporation capacity not greater than 4t/h, the fire-resistance class may be Class III .

3.2.6 Fire-resistance class shall be not less than Class II for oil-immersed transformer room and high-voltage distribution substation. The other fire protection design shall comply with the requirements of current national standards like GB 50229, *Standard for Design of Fire Protection for Fossil Fuel Power Plants and Substations* etc.

3.2.7 Fire-resistance class shall be not less than Class II for high rack storages, high-rise storages, Class A storages, multi-storey Class B storages, multi-storey Class C storages storing combustible liquid.

Fire-resistance class shall be not less than Class III for single-storey Class B storages, single-storey Class C storages, multi-storey Class C storages storing combustible solids and multi-storey Class D and E storages.

3.2.8 Fire-resistance class of grain silos shall be not less than Class II ; Class II grain silo can be constructed with steel.

Fire-resistance class of grain storehouses shall be not less than Class III ; unprotected metal load-bearing elements can be used for Class II bulk grain storehouses.

3.2.9 Fire-resistance rating of fire walls shall be not less than 4.00h for Class A and B factory buildings and Class A, B and C storages.

3.2.10 Fire-resistance rating of columns shall be not less than 2.50h and 2.00h respectively for Class I or Class II single-storey factory buildings(storages).

3.2.11 Fire-resistance rating of roof load-bearing elements shall be not less than 1.00h for Class I single-/multi-storey factory buildings(storages) fully protected by sprinkler system.

3.2.12 For nonbearing exterior wall of Class I and Class II buildings, other than Class A and B storages and high-rise storages, when it is noncombustible, the fire-resistance rating shall be not less than 0.25h; when it is difficult-combustible, the fire-resistance rating shall be not less than 0.50h.

The fire-resistance rating of the nonbearing exterior wall is not required for Class D and E factory building (storage) , provided that the fire-resistance class of the building is Class I or Class II buildings, the height of the building is 4 storeys or less, and nonbearing exterior walls are noncombustible.

3.2.13 When the room partition wall of Class II factory buildings(storages)is difficult-combustible, its fire-resistance rating shall be increased by 0.25h.

3.2.14 When pre-stressed reinforced concrete floor slab is used in Class II multi-storey factory buildings and storages, its fire-resistance rating shall be not less than 0.75h.

3.2.15 For the accessible flat roof of Class I or Class II factory buildings (storages) , the fire-resistance rating of the roof slab shall be not less than 1.50h and 1.00h respectively.

3.2.16 Roof slab of Class I or Class II factory buildings(storages)shall be noncombustible.

Roof water barrier should be noncombustible or difficult-combustible. When combustible water barrier is used and laid on combustible or difficult-combustible thermal insulation materials, the water barrier or the combustible, difficult-combustible thermal insulation materials shall be protected with noncombustible materials.

3.2.17 If it is necessary to use metal sandwich board as nonbearing exterior wall, room partition wall or roof slab, the core material shall be noncombustible and its fire-resistance rating shall comply with the relevant requirements of this code.

3.2.18 Unless otherwise required by provisions of this code, the fire-resistance class may be classified as Class IV for factory buildings (storages) with load-bearing wooden columns and noncombustible walls.

3.2.19 Fire protection measures shall be taken for the exposed joints of precast reinforced concrete elements, and the fire-resistance rating of the joints shall be not less than that of the corresponding elements.

3.3 Storeys, areas and plane arrangement of factory buildings and storages

3.3.1 Unless otherwise required by provisions of this code, the number of storeys of factory buildings and the maximum permissible gross floor area of each fire compartment shall be in accordance with those specified in Table 3.3.1.

Table 3.3.1 Number of storeys of factory buildings and maximum permissible gross floor area of each fire compartment

Fire hazard classification of production	Fire-resistance class of factory building	Maximum permissible number of storeys	Maximum permissible gross floor area of each fire compartment(m ²)			
			Single-storey factory building	Multi-storey factory building	High-rise factory building	Underground or semi-underground factory building(including basement and semi-basement)
A	Class I	Preferably	4 000	3 000	-	-
	Class II	Single storey	3 000	2 000	-	-
B	Class I	Unlimited	5 000	4 000	2 000	-
	Class II	6	4 000	3 000	1 500	-
C	Class I	Unlimited	Unlimited	6 000	3 000	500
	Class II	Unlimited	8 000	4 000	2 000	500
	Class III	2	3 000	2 000	-	-

Table 3.3.1(continued)

Fire hazard classification of production	Fire-resistance class of factory building	Maximum permissible number of storeys	Maximum permissible gross floor area of each fire compartment(m ²)			
			Single-storey factory building	Multi-storey factory building	High-rise factory building	Underground or semi-underground factory building(including basement and semi-basement)
D	Class I and II	Unlimited	Unlimited	Unlimited	4 000	1 000
	Class III	3	4 000	2 000	-	-
	Class IV	1	1 000	-	-	-
E	Class I and II	Unlimited	Unlimited	Unlimited	6 000	1 000
	Class III	3	5 000	3 000	-	-
	Class IV	1	1 500	-	-	-

Notes: 1 The fire compartments shall be separated by fire walls. Class I or Class II factory buildings other than Class A factory building may use fire shutter or water curtain as fire separation if the gross floor area of its fire compartment is larger than what required in this table and it is indeed difficult to be separated by a fire wall. If a fire shutter is used, it shall comply with the requirements of Section 6.5.3 of this code; if water curtain is used, it shall comply with the requirements of the current national standard GB 50084 *Code for Design of Sprinkler Systems*.

2 As for Class I multi-storey textile factory buildings and Class II single-/multi-storey textile factory buildings other than flax mills, the maximum permissible gross floor area of each fire compartment may be increased by 0.5 times of those specified in this table, but the raw cotton unpacking and blowing workshops shall be separated from the remainder of the building by fire partition walls with fire-resistance rating not less than 2.50h; if openings such as doors, windows or the like are provided, the openings shall be protected by Class A fire doors or windows.

3 As for Class I or II single-/multi-storey paper mills with multiple processes, the maximum permissible gross floor area of each fire compartment may be increased by 1.5 times of those specified in this table. As for Class I or II wet paper mills, if automatic fire extinguishing system is provided in the dryer hood of paper machine and effective fire extinguishing facilities are provided at the finishing section for the purpose of fire protection, the maximum permissible gross floor area of each fire compartment may be determined according to the process needs.

4 If the number of workers at each storey does not exceed 2, the number of storey of Class I or II grain silo is not limited.

5 The production areas in Class I or II multi-process cigarette factory buildings for raw material, stock, grouping formulation, cigarette processing, storing and packing, auxiliary material turnover, temporary storage of finished products and carbon dioxide dilute tobacco shred shall be fire separated from each other. Fire walls shall be used when the process conditions permit. However, the spaces for cigarette processing, storing and packing may be arranged within one fire compartment. The maximum permissible gross floor area of the fire compartment may be determined according to the needs of the process, but the spaces for cigarette processing, storing and packing shall be separated by 2.00h fire-resistance-rated partition walls and 1.00h fire-resistance-rated floors. In addition, proper measures shall be taken to protect the openings between horizontal and vertical fire separations so as to prevent fire spreading.

6 As for the operation platform and repair platform in factory buildings, if the occupant load is less than 10, the platform area may not be counted into the gross floor area of the fire compartment.

7 "-" means "not permitted".

3.3.2 Unless otherwise required by provisions of this code, the number of storeys and area of storages shall be in accordance with those specified in Table 3.3.2.

Table 3.3.2 Number of storeys and area of storages

Fire hazard classification of stored materials	Fire-resistance class of storages	Maximum permissible number of storeys	Maximum permissible first floor area of each storage and maximum permissible gross floor area of each fire compartment (m ²)						
			Single-storey storage		Multi-storey storage		High-rise storage		Underground or semi-underground storage (including basement and semi-basement)
			Each storage	Fire compartment	Each storage	Fire compartment	Each storage	Fire compartment	
A Item 3 and 4 Item 1, 2, 5 and 6	Class I	1	180	60	-	-	-	-	-
	Class I and II	1	750	250	-	-	-	-	-
B Item 1, 3 and 4	Class I and II	3	2 000	500	900	300	-	-	-
	Class III	1	500	250	-	-	-	-	-
Item 2, 5 and 6	Class I and II	5	2 800	700	1 500	500	-	-	-
	Class III	1	900	300	-	-	-	-	-
Item 1	Class I and II	5	4 000	1 000	2 800	700	-	-	150
	Class III	1	1 200	400	-	-	-	-	-
Item 2	Class I and II	Unlimited	6 000	1 500	4 800	1 200	4 000	1 000	300
	Class III	3	2 100	700	1 200	400	-	-	-

Table 3.3.2(continued)

Fire hazard classification of stored materials	Fire-resistance class of storages	Maximum permissible number of storeys	Maximum permissible first floor area of each storage and maximum permissible gross floor area of each fire compartment(m ²)						
			Single-storey storage		Multi-storey storage		High-rise storage		Underground or semi-underground storage (including basement and semi-basement)
			Each storage	Fire compartment	Each storage	Fire compartment	Each storage	Fire compartment	
D	Class I and II Class III Class IV	Unlimited 3 1	Unlimited	3 000	Unlimited	1 500	4 800	1 200	500
			3 000	1 000	1 500	500	-	-	-
			2 100	700	-	-	-	-	-
E	Class I and II Class III Class IV	Unlimited 3 1	Unlimited	Unlimited	Unlimited	2 000	6 000	1 500	1 000
			3 000	1 000	2 100	700	-	-	-
			2 100	700	-	-	-	-	-

Notes: 1 Fire compartments in the storages must be separated by fire walls. There shall be no openings like doors, windows and the like in the fire walls of Class A and B storages. The maximum permissible first floor area of underground or semi-underground storages (including basement and semi-basement) shall be not greater than that of the aboveground storages of the corresponding class.

2 The barrel oil storages in oil depot shall comply with the requirements of the current national standard GB 50074 Code for Design of Oil Depot.

3 For Class I, II coal homogenization silo, the maximum permissible gross floor area of each fire compartment shall be not greater than 12 000m².

4 For independently built ammonium nitrate storages, calcium carbide storages, the storages of molecule products such as polyethylene, urea storages, blended coal storages, independent finished product storages of paper mill, when the fire-resistance class of the building is not less than Class II, the maximum permissible first floor area of each storage and the maximum permissible gross floor area of each fire compartment may be increased by 1.0 times of those specified in this table.

5 The maximum permissible first floor area of Class I or II grain storehouse shall be not greater than 12 000m², and the maximum permissible gross floor area of each fire compartment shall be not greater than 3 000m²; the maximum permissible first floor area of Class III grain storehouse shall be not greater than 3 000m², and the maximum permissible gross floor area of each fire compartment shall be not greater than 1 000m².

6 For Class I or II single-storey cotton warehouse with first floor area not greater than 2 000m², the maximum permissible gross floor area of each fire compartment shall be not greater than 2 000m².

7 The maximum permissible first floor area of Class I or II cold store and its maximum permissible gross floor area of fire compartment shall comply with the requirements of the current national standard GB 50072 Code for Design of Cold Store.

8 "-" means "not permitted".

3.3.3 Where automatic fire extinguishing system is provided in factory buildings, the maximum permissible gross floor area of each fire compartment may be increased by 1.0 times of those specified in Section 3.3.1 of this code. Where automatic fire extinguishing system is provided in Class D and E factory buildings, the maximum permissible gross floor area of each fire compartment is not limited. Where automatic fire extinguishing system is provided in part of the factory buildings, only the area of that part can be increased by 1.0 times.

Where automatic fire extinguishing system is provided in the storages, both the maximum permissible first floor area of the storages and the maximum permissible gross floor area of each fire compartment may be increased by 1.0 times of those specified in Section 3.3.2 of this code. The maximum permissible gross floor area of the fire compartment of cold store shall not be increased even if automatic fire extinguishing system is provided.

3.3.4 Places using, generating or storing Class A and B substances shall not be permitted in underground or semi-underground buildings.

3.3.5 Staff dormitory must be strictly prohibited in factory buildings.

Offices and staff lounges shall be not permitted in Class A and B factory buildings; if offices and staff lounges must be built adjoining to the factory buildings, the fire-resistance class of the office (staff lounge) building shall be not less than Class II, and the common wall shall be explosion-proof wall with fire-resistance rating not less than 3.00h, and dedicated exits shall be provided.

Offices and staff lounges located in Class C factory buildings shall be separated from the remainder of the building by fire partition walls with fire-resistance rating not less than 2.50h and floor with fire-resistance rating not less than 1.00h, and at least 1 dedicated exit shall be provided. Doors in the fire partition wall shall be Class B fire doors.

3.3.6 Intermediate storages located in factory buildings shall comply with the following requirements:

1 Class A or B intermediate storages shall be close to the external walls, the storage capacity should not exceed the demand for 24h;

2 Class A, B and C intermediate storages shall be separated from the remainder of the building by fire walls and noncombustible floors with fire-resistance rating not less than 1.50h;

3 Class D and E intermediate storages shall be separated from the remainder of the building by fire partition walls with fire-resistance rating not less than 2.00h and floors with fire-resistance rating not less than 1.00h;

4 The fire-resistance class and first floor area of storages shall comply with the requirements of Article 3.3.2 and Article 3.3.3 of this code.

3.3.7 Class C intermediate tanks in the factory buildings shall be arranged in a separated room and its capacity shall be not greater than 5m³. The rooms with intermediate tanks shall be separated from the remainder of the building by fire partition walls with fire-resistance rating not less than 3.00h and floors with fire-resistance rating not less than 1.50h, the door of the room shall be Class A fire door.

3.3.8 Transformer and distribution substation shall not be permitted to be in or adjoining to Class A and B factory buildings, and shall not be exposed to hazardous areas containing explosive gas or dust. Transformer and distribution substation with capacity as 10kV or less dedicated for the power supply of Class A or B factory buildings may be adjoined to only one external wall of the

factory building, and the wall shall be fire wall without openings such as door, window or the like. Moreover, the substation shall comply with the requirements of the current national standard GB 50058 Code for Design of Electrical Installations in Explosive Atmospheres, etc..

For distribution substation dedicated for Class B factory buildings, windows in the fire wall shall be Class A fire windows.

3.3.9 Staff dormitory must be strictly prohibited in the storages.

Offices and staff lounges must not be permitted in or adjoining to Class A and B storages.

Where offices and staff lounges are permitted in Class C and D storages, the offices and staff lounges shall be separated from the remainder of the building by fire partition wall with fire-resistance rating not less than 2.50h and floor with fire-resistance rating not less than 1.00h, and dedicated exit shall be provided. Where it is necessary to provide doors in the partition wall, Class B fire doors shall be installed.

3.3.10 Fire protection design of logistics buildings shall comply with the following requirements:

1 Where the main function of the building is sorting or processing, the fire protection design shall comply with the relevant requirements of factory buildings of this code; the storage part shall comply with the requirements for intermediate storages.

2 Where the main function of the building is storage or it is difficult to distinguish its main function, the fire protection design shall comply with the relevant requirements of storages of this code. However, where the operating areas such as sorting area are completely separated from storage areas, the fire protection requirements of operating areas may comply with the relevant requirements of factory buildings and storage areas may comply with the requirements of storages of this code.

Where the operating areas such as sorting area are completely separated from the storage areas by fire wall, and when the following conditions are met, except Class C high rack storages with automatic control, the maximum permissible gross floor area of the fire compartments in the storage area and the maximum permissible first floor area of the storage may be increased by 3.0 times of the requirements specified in Table 3.3.2(not include the notes) of this code:

- 1)** Storing Class C materials except combustible liquid, cotton, linen, silk, wool and other textiles, foam plastic, and the fire-resistance class of the building is not less than Class I ;
- 2)** Storing Class D and E materials and the fire-resistance class of the building is not less than Class II ;
- 3)** The whole building is protected by automatic water fire extinguishing systems and fire alarm systems.

3.3.11 No railway line shall be permitted in Class A and B factory buildings(storages).

For Class C, D and E factory buildings (storages) , where steam or diesel locomotives are permitted to access, the roof shall be noncombustible or fire protected by other means.

3.4 Fire separation distance of factory buildings

3.4.1 Unless otherwise required by provisions of this code, the fire separation distance between any two factory buildings, between any factory buildings and any Class B, C, D and E storages, between any factory buildings and civil buildings etc. shall be not less than those specified in Table 3.4.1. Fire separation distance between factory building and Class A storage shall comply with those specified in Article 3.5.1 of this code.

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

Name	Class A factory buildings (storages)			Class B, C, D and E storages, factory buildings and civil buildings (m)			Class C, D and E factory buildings (storages)			Civil buildings				
	Single/multi-storey	Single-/multi-storey		High-rise	Single-/multi-storey		High-rise	Podium and single-/multi-storey		High-rise		High-rise		
		Class I and II	Class III		Class I and II	Class III		Class I and II	Class III	Class I and II	Class III	Class IV	Class I	Class II
Class A factory buildings	12	12	14	13	12	14	16	13	Class I and II	Class I and II	Class I and II	Class I and II	Class I and II	Class I and II
	12	10	12	13	10	12	14	13	Class I and II	Class I and II	Class I and II	Class I and II	Class I and II	Class I and II
	14	12	14	15	12	14	16	15	Class III	Class III	Class III	Class III	Class III	Class III
Class B factory buildings	13	13	15	13	13	15	17	13	Class I and II	Class I and II	Class I and II	Class I and II	Class I and II	Class I and II
	12	10	12	13	10	12	14	13	Class I and II	Class I and II	Class I and II	Class I and II	Class I and II	Class I and II
	14	12	14	15	12	14	16	15	Class III	Class III	Class III	Class III	Class III	Class III
Class C factory buildings	14	12	14	15	12	14	16	15	Class III	Class III	Class III	Class III	Class III	Class III
	16	14	16	17	14	16	18	17	Class IV	Class IV	Class IV	Class IV	Class IV	Class IV
	13	13	15	13	13	15	17	13	Class I and II	Class I and II	Class I and II	Class I and II	Class I and II	Class I and II
Class D and E factory buildings	12	10	12	13	10	12	14	13	Class I and II	Class I and II	Class I and II	Class I and II	Class I and II	Class I and II
	14	12	14	15	12	14	16	15	Class III	Class III	Class III	Class III	Class III	Class III
	16	14	16	17	14	16	18	17	Class IV	Class IV	Class IV	Class IV	Class IV	Class IV

Table 3.4.1(continued)

Name	Class A factory buildings		Class B factory buildings (storages)		Class C, D and E factory buildings (storages)		Civil buildings								
	Single/multi-storey	High-rise	Single-/multi-storey	High-rise	Single-/multi-storey	High-rise	Podium and single-/multi-storey			High-rise					
Outdoor transformer and distribution substation	25	25	Class I and II	Class I and II	Class I and II	Class I and II	Class I and II	Class I and II	Class I and II	Class I and II	Class I and II	Class I	Class II		
							12	15	20	12	15	20	20	25	20
							15	20	25	15	20	25	25	30	25
	$\geq 5, \leq 10$														
	$> 10, \leq 50$														
	> 50														

Notes: 1 Fire separation distance between Class B factory buildings and important public buildings should not be less than 50m; fire separation distance between Class B factory buildings and open flame or parking site should not be less than 30m. Fire separation distance between single-/multi-storey Class E factory buildings, Class E factory buildings and Class E storages may be reduced by 2m based on those specified in this table. Fire separation distance between single-/multi-storey Class E factory buildings and civil buildings may take Class E factory buildings as civil buildings and then be determined according to the requirements of 5.2.2 of this code. The separate living area provided for Class C, D and E factory buildings shall be designed according to the requirements for civil buildings. Fire separation distance between the living areas and the factory buildings shall be not less than 6m. If it is really necessary to be adjacent, it shall comply with the requirements of Note 2 and Note 3 of this table.

2 When the higher exterior wall of two adjacent factory buildings is a fire wall, or any of the exterior walls of two adjacent Class I or Class II buildings with the same height is a fire wall and the fire-resistance rating of the roof is not less than 1.00h, the fire separation distance is not limited, but the distance between Class A factory buildings meeting the above conditions shall be not less than 4m. If two adjacent exterior walls of two Class C, D and E factory buildings are noncombustible, the sum of the area of openings like door, window or the like in each wall shall be not greater than 5% of the exterior wall area, there is no exposed combustible eave, and the door, window or other openings in the two adjacent walls are not right opposite to each other, then the fire separation distance may be reduced by 25% based on those specified in this table. Class A and B factory buildings (storages) shall not be adjoining with the buildings not specified in Article 3.3.5 of this code.

3 For two factory buildings with Class I, II fire-resistance class, where the lower exterior wall is a fire wall and the roof of the lower factory building has no skylight and fire-resistance rating of the roof is not less than 1.00h, or Class A fire door and window or water curtain are provided for the openings of door and window in the higher exterior wall or fire shutter is provided for them according to the requirements of Article 6.5.3 of this code, the fire separation distance between Class A and B factory buildings shall be not less than 6m, and not be less than 4m for Class C, D and E factory buildings.

4 The total oil amount of main transformer in the power plant may be determined by one set.

5 Fire-resistance class of the existing factory buildings with the fire-resistance class lower than IV may be deemed as Class IV.

6 Where Class C, D and E factory buildings are adjacent to Class C, D and E storages, it shall comply with the requirements of Note 2 and Note 3 of this table.

3.4.2 Fire separation distance between Class A factory building and important public building shall be not less than 50m, and shall be at least 30m away from open flame or sparking site.

3.4.3 Fire separation distance between Class A factory buildings with combustible gas or vapor and railway or road shall be not less than those specified in Table 3.4.3. However, if safety measures are taken for the loading and unloading lines of the railway in Class A factory buildings, their fire separation distance may not be limited by those specified in Table 3.4.3.

Table 3.4.3 Fire separation distance between Class A factory buildings with combustible gas or vapor and railway or road(m)

Name	Centerline of off-factory railway	Centerline of in-factory railway	Off-factory roadside	In-factory roadside	
				Primary	Secondary
Class A factory building	30	20	15	10	5

3.4.4 Fire separation distance between high-rise factory building and Class A, B, C liquid tank, combustible and combustion-supporting gas tank, LPG tank, stackyard for combustibles (except coal and coke yards) shall comply with the requirements of Chapter 4 of this code, and shall be not less than 13m.

3.4.5 Where the fire-resistance class of Class C, D and E factory building and civil building is Class I or Class II, the fire separation distance between the factory building and civil building may be reduced to some extent, but shall comply with the following requirements:

1 Where the higher exterior wall is a fire wall without door, window or other openings, or the exterior wall within 15m higher than the roofing of the adjacent lower building and the part of the exterior wall below is fire wall without door, window or other openings, the fire separation distance is not limited;

2 If the adjacent lower exterior wall is fire wall and the roof has no skylight or opening and the fire-resistance rating of roof is not less than 1.00h, or the adjacent higher exterior wall is fire wall and the opening in the wall is properly fire protected, the fire separation distance may be reduced, but shall be not less than 4m.

3.4.6 If equipment for chemical flammables is provided outside the factory building, the fire separation distance between the outer surface of the equipment and the outer surface of auxiliary equipment of the adjacent factory building or the exterior wall of the adjacent factory building shall be not less than those specified in Article 3.4.1 of this code. The outdoor equipment made of noncombustible materials may be regarded as Class I or Class II building when determining the fire separation distance.

If Class C liquid tank with the total volume not greater than 15m³ is directly buried outside the exterior wall of the factory building and the exterior wall within 4.0m from the tank is fire wall, the fire separation distance is not limited.

3.4.7 Fire separation distance between two adjacent wings of a U-shaped or W-shaped factory building should not be less than those specified in Article 3.4.1 of this code. However, where the first floor area of the factory building is less than the maximum permissible gross floor area of each fire compartment specified in Article 3.3.1 of this code, the fire separation distance may be not less than 6m.

3.4.8 Except high-rise factory buildings and Class A factory buildings, where the sum of the first floor area of several factory buildings is less than the maximum permissible gross floor area of the fire

compartment specified in Article 3.3.1 of this code (the maximum permissible gross floor area of fire compartment shall be determined according to the smaller one, but shall be not greater than 10 000m² if it is not limited), these factory buildings may be arranged by group. Where the height of factory buildings is not greater than 7m, the fire separation distance between factory buildings within a group shall be not less than 4m; otherwise the distance shall be not less than 6m.

Fire separation distance between groups or between the group and adjacent buildings shall be determined based on the one with lower fire-resistance class in two adjacent buildings and those specified in Article 3.4.1 of this code.

3.4.9 Class I motor gas and/or gasoline dispensing station shall not be located in urban built-up areas.

3.4.10 The classification of motor gas and/or gasoline dispensing station, the fire separation distance from motor gas and/or gasoline dispensing station as well as the gasoline (gas) dispenser, gasoline (gas) tank to off-station open flame location, sparking site, building, railway or road, and the fire separation distance between in-station buildings or facilities, shall comply with the requirements of the current national standard GB 50156 *Code for Design and Construction of Filling Station*.

3.4.11 Fire separation distance from the outdoor transformer and distribution substation with the voltage of 35kV–500kV and the capacity of each transformer not less than 10MV·A, the outdoor step-down substations with the total oil amount of transformers for industrial enterprises greater than 5t to the other buildings shall be not less than those specified in Article 3.4.1 and Article 3.5.1 of this code, respectively.

3.4.12 The distance between the bounding wall of the factory and the buildings in the factory should not be less than 5m. The distance between two buildings on each side of a bounding wall shall comply with the fire separation distance requirements for corresponding buildings.

3.5 Fire separation distance of storages

3.5.1 Fire separation distance between any two Class A storages, Class A storage and other building, open flame location or sparking site, railway, road etc. shall be not less than those specified in Table 3.5.1.

Table 3.5.1 Fire separation distance(m) between any two Class A storages, Class A storage and other building, open flame location or sparking site, railway, road etc.(m)

Name	Class A storage(storage capacity, t)				
	Class A stored materials Item 3 and 4		Class A stored materials Item 1, 2, 5, and 6		
	≤5	>5	≤10	>10	
High-rise civil buildings and important public buildings	50				
Podium, other civil buildings, open flame locations or sparking sites	30	40	25	30	
Class A storages	20	20	20	20	
Factory buildings and Class B, C, D and E storages	Class I and II	15	20	12	15
	Class III	20	25	15	20
	Class IV	25	30	20	25

Table 3.5.1(continued)

Name		Class A storage(storage capacity,t)			
		Class A stored materials Item 3 and 4		Class A stored materials Item 1,2,5,and 6	
		≤5	>5	≤10	>10
Outdoor transformer and distribution substation with the voltage of 35kV to 500kV and the capacity of each transformer not less than 10MV·A, outdoor step-down electric power substations with the total oil amount of transformers for industrial enterprises greater than 5t		30	40	25	30
Centerline of off-factory railway		40			
Centerline of in-factory railway		30			
Off-factory roadside		20			
In-factory roadside	Primary	10			
	Secondary	5			

Note: Where the storage capacity of Item 3 or 4 is not greater than 2t and the storage capacity of Item 1, 2, 5 and 6 is not greater than 5t, the fire separation distance between such Class A storages shall be not less than 12m and the fire separation distance between such Class A storage and high-rise storage shall be not less than 13m.

3.5.2 Unless otherwise required by provisions of this code, the fire separation distance between any two Class B, C, D, E storages, and between any Class B, C, D, E storages and any civil buildings shall be not less than those specified in Table 3.5.2.

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

Name			Class B storage			Class C storage				Class D and E storage			
			Single-/multi-storey		High-rise	Single-/multi-storey		High-rise	Single-/multi-storey		High-rise		
			Class I and II	Class III	Class I and II	Class I and II	Class III	Class IV	Class I and II	Class I, II	Class III	Class IV	Class I and II
Class B, C, D and E storage	Single-/multi-storey	Class I and II	10	12	13	10	12	14	13	10	12	14	13
		Class III	12	14	15	12	14	16	15	12	14	16	15
		Class IV	14	16	17	14	16	18	17	14	16	18	17

Table 3.5.2(continued)

Name			Class B storage			Class C storage				Class D and E storage			
			Single-/multi-storey		High-rise	Single-/multi-storey			High-rise	Single-/multi-storey			High-rise
			Class I and II	Class III	Class I and II	Class I and II	Class III	Class IV	Class I and II	Class I, II	Class III	Class IV	Class I and II
Class B, C, D and E storage	High-rise	Class I and II	13	15	13	13	15	17	13	13	15	17	13
Civil building	Podium and single-/multi-storey	Class I and II	25			10	12	14	13	10	12	14	13
		Class III				12	14	16	15	12	14	16	15
		Class IV				14	16	18	17	14	16	18	17
	High-rise	Class I	50			20	25	25	20	15	18	18	15
		Class II				15	20	20	15	13	15	15	13

Notes: 1 Fire separation distance between single-/multi-storey Class E storages may be reduced by 2m based on those specified in this table.

2 Where the adjacent external walls of two storages are both fire walls, the fire separation distance may be reduced, but it shall be not less than 6m for Class C storages, and 4m for Class D and E storages. Where the adjacent higher exterior walls of two storages are fire walls, or where the external wall on any side of two adjacent Class I, II buildings with the same height is a fire wall and the fire-resistance rating of the roof is not less than 1.00h, and where the total first floor area is not greater than the maximum permissible first floor area of a storage required in Section 3.3.2 of this code, the fire separation distance is not limited.

3 The fire separation distance from Class B storages (except those for Class B Item 6 articles) to civil buildings should not be less than 25m, and shall be not less than 50m to important public buildings. The fire separation distance to railway, road etc. should not be less than those between Class A storages and railway, road etc. as specified in Table 3.5.1.

3.5.3 Where the fire-resistance class of Class D and E storages and civil buildings are Class I or II, the fire separation distance between storages and civil buildings may be reduced, but shall comply with the following requirements:

1 The fire separation distance is not limited, provided that the higher exterior wall is a fire wall without door, window or other openings, or the exterior wall within 15m higher than the roof of the adjacent lower building and the part of the exterior wall below is a fire wall without door, window or other openings;

2 The fire separation distance may be reduced but shall be not less than 4m, provided that the adjacent lower exterior wall is a fire wall, the roof has no skylight or opening and the fire-resistance rating of the roof is not less than 1.00h, or the adjacent higher exterior wall is a fire wall and the opening in the wall is properly fire protected.

3.5.4 Fire separation distance between any grain silos and other buildings, between any two grain silo groups shall be not less than those specified in Table 3.5.4.

Table 3.5.4 Fire separation distance between any grain silos and other buildings and between any two grain silo groups(m)

Name	Total stored quantity of grains $W(t)$	Grain silo			Grain squat silo		Other building		
		$W \leq 40\,000$	$40\,000 < W \leq 50\,000$	$W > 50\,000$	$W \leq 50\,000$	$W > 50\,000$	Class I, II	Class III	Class IV
Grain silo	$500 < W \leq 10\,000$	15	20	25	20	25	10	15	20
	$10\,000 < W \leq 40\,000$						15	20	25
	$40\,000 < W \leq 50\,000$	20					20	25	30
	$W > 50\,000$	25					25	30	—
Grain squat silo	$W \leq 50\,000$	20	20	25	20	25	20	25	—
	$W > 50\,000$	25					25	30	—

Notes: 1 Where grain silo, grain squat silo, operation tower, receiving tower and distribution station are an integral process unit, the fire separation distance between buildings within the unit doesn't need to follow those specified in this table.

2 The stored quantity of each independent silo in the grain squat silo cluster shall be not greater than 10 000t.

3.5.5 The distance between the bounding wall of the storage area and the buildings in the storage area should not be less than 5m. The distance between two buildings on each side of a bounding wall shall comply with the fire separation distance requirements for corresponding buildings.

3.6 Explosion prevention of factory buildings and storages

3.6.1 Class A and Class B factory buildings with explosion hazard should be built independently, and should be unenclosed or partially enclosed. The load-bearing structure should be reinforced concrete, steel or bent frame structure.

3.6.2 Pressure relief shall be provided for factory buildings with explosion hazard or any part with explosion hazard in a factory building.

3.6.3 The areas for pressure relief should be doors, windows, light-weighted roof slabs or walls. Materials that may break into sharp fragments in explosion shall not be used.

The areas for pressure relief shall be away from assembly places or main roads, and should be close to spaces with explosion hazard.

The density of light-weighted roof slabs or walls used as the area of pressure relief should be less than 60kg/m².

Measures shall be taken for the area of pressure relief on the roof to avoid ice and snow accumulation.

3.6.4 Pressure relief area in the roofs or walls of factory buildings should be calculated according to the following equation. However, where the length-diameter ratio of a factory building is greater than 3, the building should be divided into several calculated section with the length-diameter ratio not greater than 3. The cross-section between two calculated section shall not be used as the pressure relief area:

$$A = 10CV^{\frac{2}{3}} \quad (3.6.4)$$

where, A —Pressure relief area(m²);

V —Volume of the calculated section in the factory building(m³);

C —Pressure relief ratio, given in Table 3.6.4(m²/m³).

Table 3.6.4 Classification of substances with explosion hazard in factory buildings and the minimum pressure relief ratio (m^2/m^3)

Classification of substances with explosion hazard in factory buildings	C
Ammonia, grain, paper, leather, lead, chromium and copper etc. with $K_{\text{dust}} < 10\text{MPa}\cdot\text{m}\cdot\text{s}^{-1}$	≥ 0.030
Wood chip, carbon dust, pulverized coal, stibium and tin etc. with $10\text{MPa}\cdot\text{m}\cdot\text{s}^{-1} \leq K_{\text{dust}} \leq 30\text{MPa}\cdot\text{m}\cdot\text{s}^{-1}$	≥ 0.055
Acetone, gasoline, methanol, LPG, methane, paint spray or drying room, phenol resin, aluminium, magnesium and zirconium etc. with $K_{\text{dust}} > 30\text{MPa}\cdot\text{m}\cdot\text{s}^{-1}$	≥ 0.110
Ethylene	≥ 0.160
Acetylene	≥ 0.200
Hydrogen	≥ 0.250

Notes: 1 The length-diameter ratio = longest dimension of the building plane \times the perimeter of its cross-section \div (4.0 \times the calculated cross-section area of the building).

2 K_{dust} , the dust explosion index.

3.6.5 Where air inside the Class A factory buildings contains combustible gas or vapor, whose density is less than that of air, the light-weighted roof slab should be regarded as the area for pressure relief; the ceiling shall be flat and smooth without dead corner; the upper space of the factory buildings shall be well ventilated.

3.6.6 The Class A factory buildings with air inside containing combustible gas or vapor, whose density is more than that of air, and Class B factory buildings with explosion hazard of dust and fiber shall comply with the following requirements:

1 Spark-free floor shall be provided. Where insulating materials are used as monolithic floor surface, electrostatic protection measures shall be taken.

2 Where the factory buildings generate combustible dust or fiber, the interior surface shall be flat, smooth and easy for cleaning.

3 Trench should not be provided in the factory buildings. If trench must be provided, its cover shall be tight and effective measures shall be taken to prevent combustible gas, vapor, dust, fiber from accumulating in the trench. In addition, fire stopping shall be used to seal the connection between trench and adjacent factory buildings.

3.6.7 Class A and B production parts with explosion hazard should be arranged close to the area for pressure relief in the exterior wall for single-storey factory buildings or in the exterior wall of the top storey for multi-storey factory buildings.

The equipment with explosion hazard should be installed away from the primary load-bearing elements of factory buildings, such as beams and columns etc.

3.6.8 The central control room of Class A and B factory buildings with explosion hazard shall be built independently outside the factory buildings.

3.6.9 The sub-control rooms of Class A and B factory buildings with explosion hazard should be built independently outside the factory buildings. If such rooms are adjoining to the exterior walls of the factory buildings, fire partition walls with fire-resistance rating not less than 3.00h shall be used to separate such rooms from other portions of the building.

3.6.10 Protective measures, like a vestibule, shall be taken for staircases, outdoor stairways in areas with explosion hazard or connecting part between areas with explosion hazard and adjoining areas. The partition walls of the vestibule shall be fire rated and the fire-resistance rating shall be not less than 2.00h; doors of the vestibule shall be Class A fire doors and shall not be placed at the right opposite of the door leading to the staircase.

3.6.11 For factory buildings using and generating Class A, B and C liquids, the pipes and trenches shall not be connected with those of adjacent factory buildings. Grease traps and separators shall be provided for the sewers.

3.6.12 The storages for Class A, B and C liquids shall be provided with facilities to prevent liquid from dispersion. Storages containing materials with combustion or explosion hazard in humid environment shall be protected with waterproof measures.

3.6.13 The cover shall be provided with proper pressure relief facilities for silos with dust explosion hazard.

Pressure relief area of the operation tower and upper connecting corridor in grain silo shall be calculated according to Article 3.6.4 of this code. Explosion prevention measures shall be taken for other grain storages with dust explosion hazard.

3.6.14 Storages or portions thereof with explosion hazard, explosion prevention measures should be taken and pressure relief facilities shall be provided according to the requirements of this section.

3.7 Evacuation of factory buildings

3.7.1 Exits of factory buildings shall be separated from each other. For each fire compartment or each floor in a fire compartment, the distance between any two adjacent exits shall be not less than 5m.

3.7.2 For each fire compartment in factory buildings or each floor in a fire compartment, the number of exits shall be determined by calculation and shall be not less than 2; in case the following conditions are met, 1 exit is permitted:

1 For Class A factory building, the gross floor area of each floor is not greater than 100m² and the occupant load at the same time is not more than 5;

2 For Class B factory building, the gross floor area of each floor is not greater than 150m² and the occupant load at the same time is not more than 10;

3 For Class C factory building, the gross floor area of each floor is not greater than 250m² and the occupant load at the same time is not more than 20;

4 For Class D and E factory building, the gross floor area of each floor is not greater than 400m² and the occupant load at the same time is not more than 30;

5 For underground or semi-underground factory buildings (including basement and semi-basement), the gross floor area of each floor is not greater than 50m² and the occupant load at the same time is not more than 15.

3.7.3 For underground or semi-underground factory buildings (including basement and semi-basement), the Class A fire door in a fire wall of the fire compartment that leads to the adjoining fire compartment may be used as the second exit, but at least one independent exit directly leading to the outdoors must be provided for each fire compartment.

3.7.4 The distance from any point to the nearest exit in the factory buildings shall be not greater than those specified in Table 3.7.4.

Table 3.7.4 Distance from any point to the nearest exit in the factory buildings(m)

Fire hazard classification of production	Fire-resistance class	Single-storey factory building	Multi-storey factory building	High-rise factory building	Underground or semi-underground factory building(including basement and semi-basement)
A	Class I and II	30	25	-	-
B	Class I and II	75	50	30	-
C	Class I and II	80	60	40	30
	Class III	60	40	-	-
D	Class I and II	Not limited	Not limited	50	45
	Class III	60	50	-	-
	Class IV	50	-	-	-
E	Class I and II	Not limited	Not limited	75	60
	Class III	100	75	-	-
	Class IV	60	-	-	-

3.7.5 The total clear width of exit stairway, passageway and door in the factory buildings shall be determined by calculation based on the minimum clear width for evacuation per 100 persons not less than those specified in Table 3.7.5. However, the minimum clear width of exit stairway, passageway and door should not be less than 1.10m, 1.40m and 0.90m, respectively. If the occupant loads are not equal on each floor, the total clear width of exit stairway shall be determined by calculation floor by floor. The total clear width of stairways on any floor shall be determined by calculation according to maximum occupant loads of this floor and the floors above.

Table 3.7.5 Minimum clear width for evacuation per 100 persons of exit stairway, passageway and door in the factory buildings

Number of storeys in factory building(storey)	1-2	3	≥4
Minimum clear width for evacuation(m/100 persons)	0.60	0.80	1.00

The total clear width of the exterior door on the first floor shall be determined by calculation according to the occupant loads on this floor and the floors above. The minimum clear width of the door shall be not less than 1.20 m.

3.7.6 For high-rise factory building and Class A, B and C multi-storey factory buildings, the exit stairway shall be enclosed stairway or outdoor stairway. For factory buildings higher than 32m and the operators on each floor exceeding 10, the exit stairway shall be smokeproof staircase or outdoor stairway.

3.8 Evacuation of storages

3.8.1 Exits of storages shall be separated from each other. For each fire compartment or each floor in a fire compartment, the distance between two adjacent exits shall be not less than 5m.

3.8.2 The number of exits for each storage shall be not less than 2; 1 exit is permitted provided that the first floor area of a storage is not greater than 300m². At least 2 exits should be provided for each fire compartment in storage to lead to exit passageway, stairway or the outdoors. 1 exit is permitted provided that the floor area of a fire compartment is not greater than 100m². The door

leading to the exit passageway or stairway shall be Class B fire door.

3.8.3 The number of exits of underground or semi-underground storages (including basement and semi-basement) shall be not less than 2; one exit is permitted provided that the floor area is not greater than 100m².

For underground or semi-underground storages (including basement and semi-basement), the Class A fire door in a fire wall of the fire compartment that leads to the adjoining fire compartment may be used as the second exit, but at least one independent exit directly leading to the outdoors must be provided for each fire compartment.

3.8.4 The evacuation arrangement of cold store, grain silo and bank vault shall comply with the requirements of the current national standards GB 50072 *Code for Design of Cold Store* and GB 50322 *Code for Design of Grain Steel Silos* respectively.

3.8.5 Where the area of the working area at the top of the grain silo is less than 1 000m² and the number of operators is not more than 2, 1 exit is permitted.

3.8.6 The outdoor metal stairway in storage and silo meeting the requirements of Article 6.4.5 of this code may be permitted to be the exit stairway, provided that the fire-resistance rating of the outdoor stairway landing of the silo shall be not less than 0.25h.

3.8.7 The exit stairway of high-rise storage shall be enclosed stairway.

3.8.8 Vertical lifting facility should be installed outside for storages other than multi-storey Class E storages with Class I or Class II fire-resistance class. If it must be installed inside, it shall be placed in a shaft with the fire-resistance rating of the shaft wall not less than 2.00h. The door to the indoor or outdoor lifting facility leading to the storage shall be Class B fire door or fire shutter complying with the requirements of Article 6.5.3.

4 Class A, B, C liquid and gas tanks (tank farm) and stackyard for combustibles

4.1 General requirements

4.1.1 Class A, B and C liquid tank farm, LPG tank farm, combustible and combustion-supporting gas tank farm and stackyard for combustibles, shall be located at the edge of the urban (zone) or in the relatively independent and safe zone, and should be located in the downwind direction with the annual minimum frequency.

Class A, B and C liquid tanks (tank farm) should be located in places with lower terrain, otherwise fire protection measures shall be taken.

LPG tank (tank farm) should be located in flat or open places where LPG is not easily accumulated.

4.1.2 Class A liquid in barrels or cylinders shall not be stored outdoors.

4.1.3 Noncombustible solid wall with the height not less than 1.0m shall be provided around the LPG tank groups or tank farms.

4.1.4 Class A, B and C liquid tank farm, LPG tank farm, combustible and combustion-supporting gas tank farm and stackyard for combustibles shall be arranged away from the loading and unloading area, accessory production area and office area.

4.1.5 The minimum distance between Class A, B, C liquid tanks, LPG tanks, combustible or combustion-supporting gas tanks, combustibles stacks and overhead power lines shall comply with the requirements of Article 40.2.1 of this code.

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

4.2.1 Fire separation distance between Class A, B, C liquid tanks (tank farm), stacks of Class B, C liquid barrels and other buildings shall be not less than those specified in Table 4.2.1.

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

Class	Total volume of a tank farm or stacks of barrels $V(m^3)$	Buildings				Outdoor transformer and distribution substation
		Class I and II		Class III	Class IV	
		High-rise civil building	Podium, other building			
Class A and B liquid tanks (tank farms)	$1 \leq V < 50$	40	12	15	20	30
	$50 \leq V < 200$	50	15	20	25	35
	$200 \leq V < 1\ 000$	60	20	25	30	40
	$1\ 000 \leq V < 5\ 000$	70	25	30	40	50
Class C liquid tank (tank farm)	$5 \leq V < 250$	40	12	15	20	24
	$250 \leq V < 1\ 000$	50	15	20	25	28
	$1\ 000 \leq V < 5\ 000$	60	20	25	30	32
	$5\ 000 \leq V < 25\ 000$	70	25	30	40	40

- Notes: 1 Where Class A, B, C liquid tanks are arranged in the same tank farm, the total volume of the tank farm may be converted according to the followings: 1m³ Class A and B liquids is equivalent to 5m³ Class C liquid.
- 2 The distance between the outer edge of the fire dike of the storage tank and the adjacent building shall be not less than 10m.
- 3 Fire separation distance from Class A, B, C liquid fixed roof tank farm or semi-open stackyard, stacks of Class B and C liquid barrels to Class A factory buildings (storages) and civil buildings shall be increased by 25% of those specified in this table. However, the fire separation distance from Class A, B liquid fixed roof tank farms or semi-open stackyard, stacks of Class B and C liquid barrels to Class A factory buildings (storage), podium, single or multi-storey civil buildings shall be not less than 25m, and the distance to the open flame or sparking site shall be increased by 25% of those for Class IV building specified in this table.
- 4 Fire separation distance between floating roof tank farm or tank farm with liquid's flash point over 120°C and other buildings may be reduced by 25% of those specified in this table.
- 5 In case several tank farms are arranged on the same lot, the fire separation distance between tank farms shall be not less than the greater value of the fire separation distance specified in this table for tank farm with different volumes and Class IV buildings.
- 6 For directly buried Class A, B and C liquid horizontal tanks, where the volume of a single tank is not greater than 50m³ and the total volume is not greater than 200m³, the fire separation distance between the horizontal tanks and the buildings may be reduced by 50% of those specified in this table.
- 7 Outdoor transformer and distribution substation are those with the voltage of 35kV-500kV and the capacity of each transformer not less than 10MV·A, or outdoor step down substations for industrial use with the total oil amount greater than 5t.

4.2.2 Fire separation distance between any two Class A, B, C liquid tanks shall be not less than those specified in Table 4.2.2.

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

Classification		Fixed roof tank				Floating roof tank or storage tank with nitrogen-filling protection equipment	Horizontal tank
		Aboveground	Semi-underground	Underground			
Class A and B liquid tank	Volume of single tank	$V \leq 1000$	$0.75D$	$0.5D$	$0.4D$	$0.4D$	$\geq 0.8m$
		$V > 1000$	$0.6D$				
Class C liquid tank	V(m ³)	Unlimited	$0.4D$	Unlimited	Unlimited	-	

- Notes: 1 D is the diameter(m) of the larger adjacent vertical storage tank. The diameter of the rectangular storage tank is half of the sum of the long-side and short-side of the rectangular.
- 2 Fire separation distance between any two tanks with different liquids and different tank types shall be not less than the greater value specified in this table.
- 3 Fire separation distance between any two rows of horizontal tanks shall be not less than 3m.
- 4 Where the volume of single tank is not greater than 1000m³ and fixed cooling system is provided, the fire separation distance between aboveground fixed roof tanks of Class A and B liquids shall be not less than $0.6D$.
- 5 Where aboveground storage tank is provided with subsurface injection foam extinguishing system, fixed cooling water system and foam fire extinguishing facilities used for putting out liquid fire in the fire dike, the fire separation distance between any two storage tanks may be reduced, but should not be less than $0.4D$.
- 6 For the combustible liquid with the flash point greater than 120°C, where the volume of a single tank is greater than 1000m³, the fire separation distance between any two storage tanks shall be not less than 5m; where the volume of a single tank is not greater than 1000m³, the fire separation distance shall be not less than 2m.

4.2.3 Where Class A, B and C liquid tanks are arranged by group, the following requirements shall be met:

1 The volume of a single tank and the total volume of the tank group shall be not greater than those specified in Table 4.2.3.

Table 4.2.3 Maximum volume of Class A, B and C liquid tanks arranged by group(m³)

Class	Maximum volume of a single tank	Maximum volume of a tank group
Class A and B liquid	200	1 000
Class C liquid	500	3 000

2 The storage tanks in a group shall not be arranged in more than two rows. The fire separation distance between vertical tanks for Class A and B liquids shall be not less than 2m, and that between horizontal tanks for Class A and B liquids shall be not less than 0.8 m. The fire separation distance between Class C liquid tanks is not limited.

3 Fire separation distance between storage tank groups shall be determined according to the requirements of Article 4.2.2 of this code by firstly converting the storage tanks in the group based on the type and total volume into standard single tank of the same class.

4.2.4 For the aboveground and semi-underground tank farms of Class A, B and C liquids, the storage tanks with the same or similar fire hazard should be arranged within a fire dike. Storage tank for boil-over oil and that for non-oil-over oil shall not be arranged in the same fire dike. Aboveground and semi-underground storage tanks shall not be arranged in the same fire dike with the underground storage tank.

4.2.5 Noncombustible fire dike shall be arranged around the aboveground and semi-underground storage tanks or storage tank group for Class A, B and C liquids. The arrangement of fire dike shall comply with the following requirements:

1 The storage tanks in the same fire dike should not be arranged in more than 2 rows. The volume of a single tank not greater than 1 000m³ and the liquid tanks with the flash point greater than 120°C should not be arranged in more than 4 rows.

2 The effective capacity of a fire dike shall be not less than the volume of the maximum storage tank therein. For floating roof tank, the effective capacity of a fire dike may be half of the volume of the tank with maximum volume.

3 The horizontal distance from the inner edge of the fire dike to the outer wall of the vertical tank shall be not less than half of the height of the tank wall. The horizontal distance from the inner edge of the fire dike to the horizontal tank shall be not less than 3m.

4 The designed height of the fire dike shall be 0.2m higher than the calculated height, and the height shall be 1.0m–2.2m; the footboard convenient for the fire-fighting and rescue staff going in and out of the fire dike shall be provided at reasonable location.

5 For the aboveground and semi-underground storage tanks used for boil-over oil, every storage tank shall be provided with a fire dike or fire separation dike.

6 Oily sewer shall be provided with water seal facilities at the exit of the fire dike; rain drainage pipes shall be provided with sealing and isolation devices such as valves.

4.2.6 For the semi-open stackyard for Class A liquid, stackyard for barreled Class B and C liquids and liquid tanks (tank farm) with flash point greater than 120°C, fire dikes may not be required when measures to prevent liquid from flowing have been taken.

4.2.7 Fire separation distance from Class A, B and C liquid tanks to the pump room and liquid loading and unloading arms shall be not less than those specified in Table 4.2.7.

Table 4.2.7 Fire separation distance from Class A, B and C liquid tanks and the pump room and liquid loading and unloading arms(m)

Liquid classification and storage tank type		Pump room	Railway or automobile loading and unloading arms
Class A and B liquid tank	Dome roof tank	15	20
	Floating roof tank	12	15
Class C liquid tank		10	12

Notes: 1 For Class A and B liquid tanks with total volume not greater than 1 000m³ and Class C liquid tank with total volume not greater than 5 000m³, the fire separation distance may be reduced by 25% of those specified in this table.

2 The distance from pump room and liquid loading and unloading arms to the outer edge of the fire dike of the storage tank shall be not less than 5m.

4.2.8 Fire separation distance from the loading and unloading arms of Class A, B and C liquids to the building or the in-factory railway track shall be not less than those specified in Table 4.2.8.

Table 4.2.8 Fire separation distance from the loading and unloading arms of Class A, B and C liquids to building or in-factory railway track(m)

Name	Building			In-factory railway track	Pump room
	Class I and II	Class III	Class IV		
Loading and unloading arms of Class A and B liquid	14	16	18	20	8
Loading and unloading arms of Class C liquid	10	12	14	10	

Note: Fire separation distance from the loading and unloading arms to Class A, B and C liquid loading and unloading railway used for directly loading and unloading is not limited.

4.2.9 Fire separation distance between Class A, B and C liquid tanks and railway/road shall be not less than those specified in Table 4.2.9.

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

Name	Centerline of off-factory railway	Centerline of in-factory railway	Off-factory roadside	In-factory roadside	
				Main	Secondary
Class A and B liquid tanks	35	25	20	15	10
Class C liquid tank	30	20	15	10	5

4.2.10 The distance between surge tank and the loading and unloading railway line shall be not less than 6m.

4.2.11 Fire separation distance between the tanks (tank farm) of the oil depot and the building, the arrangement of tanks, fire separation distance between the storage tanks in the oil depot, fire separation distance between storage tank and such buildings as pump room and liquid loading and unloading arms in the oil depot etc., shall comply with the requirements of the current national standard GB 50074 *Code for Design of Oil Depot*.

4.3 Fire separation distance of combustible and combustion-supporting gas tanks (tank farm)

4.3.1 Fire separation distance between combustible gas tank and the building, storage tank, and stackyard shall comply with the following requirements:

1 Fire separation distance between wet combustible gas tank and building, storage tank, stackyard shall be not less than those specified in Table 4.3.1.

Table 4.3.1 Fire separation distance between wet combustible gas tank and building/storage tank/stackyard (m)

Name		Wet combustible gas tank (total volume V, m^3)				
		$V < 1\ 000$	$1\ 000 \leq V < 10\ 000$	$10\ 000 \leq V < 50\ 000$	$50\ 000 \leq V < 100\ 000$	$100\ 000 \leq V < 300\ 000$
Class A storage Class A, B and C liquid tanks stackyard for combustibles outdoor transformer and distribution substation open flame or sparking site		20	25	30	35	40
High-rise civil buildings		25	30	35	40	45
Podium; single-, multi-storey civil buildings		18	20	25	30	35
Other buildings	Class I and II	12	15	20	25	30
	Class III	15	20	25	30	35
	Class IV	20	25	30	35	40

Note: The total volume of combustible gas tank with constant volume shall be calculated according to the product of the geometrical volume of the storage tank (m^3) and the designed storage pressure (absolute pressure, $10^5 Pa$).

2 Fire separation distance between the combustible gas tank with constant volume and the building, storage tank and stackyard shall be not less than those specified in Table 4.3.1.

3 Fire separation distance between dry combustible gas tank and building, storage tank, and stackyard: where the density of the combustible gas is greater than that of the air, the distance shall be increased by 25% of those specified in Table 4.3.1; where the density of combustible gas is smaller than that of the air, the distance shall be determined according to those specified in Table 4.3.1.

4 Fire separation distance from such auxiliary facilities as water sealed well, oil pump room and elevator room of wet or dry combustible gas tank to the storage tank may be arranged according to the process requirements.

5 Fire separation distance between the combustible gas tank with volume not greater than $20m^3$ and the factory building using the tank is not limited.

4.3.2 Fire separation distance between the combustible gas tanks (tank farms) shall comply with the following requirements:

1 Fire separation distance between wet combustible gas tanks or between dry combustible gas tanks or between wet combustible gas tank and dry combustible gas tank shall be not less than 1/2 of the diameter of the larger adjacent tank.

2 Fire separation distance between combustible gas tanks with constant volume shall be not less than 2/3 of the diameter of the larger adjacent tank.

3 Fire separation distance from combustible gas tank with constant volume to the wet or dry combustible gas tank shall be not less than 1/2 of the diameter of the larger adjacent tank.

4 Where the total volume of several combustible gas tanks with constant volume is greater than $200\ 000m^3$, they shall be arranged by group. Fire separation distance between horizontal tank groups shall be not less than half of the length of the larger adjacent tank; fire separation distance between spherical tank groups shall be not less than the diameter of the larger adjacent tank, and shall be not less than 20m.

4.3.3 Fire separation distance between the oxygen tank and the building, storage tank and stackyard shall comply with the following requirements:

1 Fire separation distance between the wet oxygen tank and the building, storage tank and stackyard shall be not less than those specified in Table 4.3.3.

Table 4.3.3 Fire separation distance between the wet oxygen tank and building/storage tank/stackyard (m)

Name		Wet oxygen tank (total volume V, m^3)		
		$V \leq 1\,000$	$1\,000 < V \leq 50\,000$	$V > 50\,000$
Open flame or sparking site		25	30	35
Class A, B, C liquid tanks, combustibles stackyards, Class A storage, outdoor transformer and distribution substations		20	25	30
Civil buildings		18	20	25
Other buildings	Class I and II	10	12	14
	Class III	12	14	16
	Class IV	14	16	18

Note: The total volume of oxygen tank with constant volume shall be calculated according to the product of the geometrical volume of the storage tank (m^3) and the designed storage pressure (absolute pressure, $10^5 Pa$).

2 Fire separation distance between the oxygen tanks shall be not less than 1/2 of the diameter of the larger adjacent tank.

3 Fire separation distance between the oxygen tank and the combustible gas tank shall be not less than the diameter of the larger adjacent tank.

4 Fire separation distance from the oxygen tank with constant volume to the building, tank and stackyard shall be not less than those specified in Table 4.3.3.

5 Fire separation distance between the oxygen tank and oxygen station may be determined according to the requirements of the process layout.

6 Fire separation distance between the oxygen tank with volume not greater than $50m^3$ and the factory building using the tank is not limited.

Note: $1m^3$ liquid oxygen is converted into $800m^3$ gaseous oxygen under standard condition.

4.3.4 Fire separation distance between the liquid oxygen tank and the building, storage tank and stackyard shall comply with the requirements for the fire separation distance of wet oxygen tanks with the corresponding volume in Article 4.3.3 of this code. The distance between the liquid oxygen tank and its pump room should not be less than 3m. The fire separation distance from the liquid oxygen tank with total volume not more than $3m^3$ to the building using the tanks shall comply with the following requirements:

1 When located in the dedicated Class I or Class II buildings, the fire separation distance shall be not less than 10m.

2 When located in the dedicated Class I or Class II building, and the side facing to the building is fire wall without door, window or other openings, the fire separation distance is not limited.

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

The liquid oxygen tank at the gas supply station in the medical organizations shall comply with the following requirements:

1 The volume of a single tank shall be not greater than 5m^3 and the total volume should not be greater than 20m^3 ;

2 The distance between the adjacent storage tanks shall be not less than 0.75 times the diameter of the largest tank;

3 The fire separation distance from the medical liquid oxygen tank to the buildings outside the medical organizations shall comply with the requirements of Article 4.3.3 of this code. The fire separation distance from the medical liquid oxygen tank to the buildings inside of the medical organizations shall comply with the requirements of current national standard GB 50751 *Technical Code for Medical Gases Engineering*.

4.3.5 There shall be no combustibles and asphalt pavement within 5m around the liquid oxygen tank.

4.3.6 Fire separation distance from the combustibles and combustion-supporting gas tank to the railways and roads shall be not less than those specified in Table 4.3.6.

Table 4.3.6 Fire separation distance from combustible and combustion-supporting gas tank to railways and roads(m)

Name	Centerline of off-factory railway	Centerline of in-factory railway	Off-factory roadside	In-factory roadside	
				Main	Secondary
Combustibles, combustion-supporting gas tank	25	20	15	10	5

4.3.7 Fire separation distance from the liquid hydrogen and liquid ammonia tanks to the building, storage tank and stackyard may be determined by reducing 25% of the value for the fire separation distance of LPG tank with corresponding volume as specified in Article 4.4.1 of this code.

4.3.8 Fire separation distance from the LNG tank (tank farm) of LNG gasification station to the buildings outside the station shall be not less than those specified in Table 4.3.8. The fire separation distance to other buildings not specified in Table 4.3.8 shall comply with the requirements of current national standard GB 50028 Code for Design of City Gas Engineering.

Table 4.3.8 Fire separation distance from LNG tank (tank farm) of LNG gasification station to buildings outside the station(m)

Name	LNG tank (tank farm) (total volume V, m^3)							Natural gas bleeder (main) of concentrated bleeder facility
	$V \leq 10$	$10 < V \leq 30$	$30 < V \leq 50$	$50 < V \leq 200$	$200 < V \leq 500$	$500 < V \leq 1000$	$1000 < V \leq 2000$	
Volume of a single tank $V(\text{m}^3)$	$V \leq 10$	$V \leq 30$	$V \leq 50$	$V \leq 200$	$V \leq 500$	$V \leq 1000$	$V \leq 2000$	
The residential area, village and small town and important public buildings (external wall of the outermost building)	30	35	45	50	70	90	110	45
Industrial enterprise (external wall of the outermost building)	22	25	27	30	35	40	50	20
Open flame or sparking sites, outdoor transformer and distribution substations	30	35	45	50	55	60	70	30

Table 4.3.8(continued)

Name		LNG tank(tank farm)(total volume V, m^3)						Natural gas bleeder(main) of concentrated bleeder facility	
		$V \leq 10$	$10 < V \leq 30$	$30 < V \leq 50$	$50 < V \leq 200$	$200 < V \leq 500$	$500 < V \leq 1\,000$		$1\,000 < V \leq 2\,000$
Volume of a single tank $V(m^3)$		$V \leq 10$	$V \leq 30$	$V \leq 50$	$V \leq 200$	$V \leq 500$	$V \leq 1\,000$	$V \leq 2\,000$	
Other civil buildings, Class A and B liquid tanks, Class A and B storages, Class A and B factory buildings and the stackyard of the materials such as straw, reed and packed waste paper etc.		27	32	40	45	50	55	65	25
Class C liquid tank, combustible gas tank, Class C and D factory buildings, Class C and D storages		25	27	32	35	40	45	55	20
Road(roadside)	highway, Class I and II roads, urban express	20			25			15	
	Others	15			20			10	
Overhead power line (central line)		1.5 times of pole height				1.5 times of pole height, but for overhead power line at 35kV or above, the height shall be not less than 40m		2.0 times of pole height	
Overhead communication line(central line)	Class I and II	1.5 times of pole height		30		40		1.5 times of pole height	
	Others	1.5 times of pole height							
Railway (central line)	National line	40	50	60	70	80		40	
	Dedicated lines for enterprises	25			30		35		30

Note: The residential area or village and small town refers to those with 1 000 inhabitants or 300 households and above; when there are less than 1 000 inhabitants and 300 households, the fire separation distance shall be determined according to the requirements for other civil buildings of this table.

4.4 Fire separation distance of LPG tanks(tank farm)

4.4.1 Fire separation distance from fully pressurized & semi-refrigerated tanks (tank farms) of LPG supply base to the open flame or sparking site or buildings outside the supply base shall be not less than those specified in Table 4.4.1. Fire separation distance from other buildings not specified in Table 4.4.1 shall comply with the requirements of current national standard GB 50028 Code for Design of City Gas Engineering.

Table 4.4.1 Fire separation distance from fully pressurized & semi-refrigerated tanks(tank farm)of LPG supply base to the open flame or sparking site or buildings outside the base(m)

Name	LNG tanks(tank farm)(total volume V,m ³)							
	30<V ≤50	50<V≤ 200	200<V≤ 500	500<V≤ 1 000	1 000<V≤ 2 500	2 500<V≤ 5 000	5 000<V≤ 10 000	
Volume of a single tank V(m ³)	V≤20	V≤50	V≤100	V≤200	V≤400	V≤1 000	V>1 000	
The residential area, village and small town, important public buildings(exterior wall of the outermost building)	45	50	70	90	110	130	150	
Industrial enterprises(exterior wall of the outermost building)	27	30	35	40	50	60	75	
Open fire or sparking sites, outdoor transformer and distribution substation	45	50	55	60	70	80	120	
Other civil buildings, Class A and B liquid tanks, Class A and B storages, Class A and B factory buildings and the stackyards of the materials such as straw, reed, and packed waste paper etc.	40	45	50	55	65	75	100	
Class C liquid tank, combustible gas tank, Class C and D factory buildings, Class C and D storages	32	35	40	45	55	65	80	
Combustion-supporting gas tank and the stackyard of materials such as timber etc.	27	30	35	40	50	60	75	
Other buildings	Class I and 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 (roadside)	Highway, Class I and II	20	25				30	

Table 4.4.1(continued)

Name		LNG tanks(tank farm) (total volume V, m^3)						
		$30 < V \leq 50$	$50 < V \leq 200$	$200 < V \leq 500$	$500 < V \leq 1\,000$	$1\,000 < V \leq 2\,500$	$2\,500 < V \leq 5\,000$	$5\,000 < V \leq 10\,000$
Volume of a single tank $V(m^3)$		$V \leq 20$	$V \leq 50$	$V \leq 100$	$V \leq 200$	$V \leq 400$	$V \leq 1\,000$	$V > 1\,000$
Road (roadside)	Class III and IV	15	20				25	
Overhead power line(centerline)		It shall comply with the requirements of Article 10.2.1 of this code						
Overhead communication line (centerline)	Class I and II	30		40				
	Class III and IV	1.5 times of pole height						
Railway (centerline)	National line	60	70	80		100		
	Dedicated lines for enterprises	25	30	35		40		

Notes: 1 Fire separation distance shall be determined according to the total volume of the tank farm or the volume of a single tank (whichever is larger) of this table.

2 When the volume of a single underground LPG tanks is not greater than $50m^3$ and the total volume is not greater than $400m^3$, the fire separation distance may be reduced by 50% based on the requirements specified in this table.

3 The residential area or village and small town refers to those with 1 000 inhabitants or 300 households and above; when there are less than 1 000 inhabitants and 300 households, the fire separation distance shall be determined according to the requirements for other civil buildings in this table.

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

Where the total volume of several storage tanks is greater than $3\,000m^3$, they shall be arranged by groups and should be arranged in single row in each group. The fire separation distance of the adjacent storage tanks between groups shall be not less than 20m.

4.4.3 Fire separation distance between the LPG tanks and its pump room shall be not less than 15m. When the external wall of the pump room faces towards the tank is a fire wall without doors, windows and other openings, the fire separation distance may be reduced to 6m. When the LPG pump is installed outdoors in the tank farm, the distance between the tank and the pump is not limited.

4.4.4 Fire separation distance from the fully-refrigerated LPG tanks, the tanks of the LPG vaporizing station and air mixing station to the surrounding buildings shall comply with the requirements of current national standard GB 50028 *Code for Design of City Gas Engineering*.

When the storage tanks of LPG vaporizing station and air mixing station with total volume not greater than $10m^3$ in the industrial enterprises are arranged within the dedicated buildings, the fire separation distance from the exterior wall of the building to the adjacent factory building and its auxiliary equipment shall be determined according to the relevant requirements for the fire separation distance of Class A factory buildings. When they are arranged outdoors, the fire separation distance to the buildings, storage tanks and stackyards shall comply with the requirements of current national standard GB 50028 *Code for Design of City Gas Engineering*.

4.4.5 Fire separation distance from the cylinder storages of the Class I or Class II cylinder LPG

supply station to the buildings outside the station shall be not less than those specified in Table 4.4.5. The grading of the cylinder LPG supply station and the arrangement of the cylinder storage with the total volume of the stored cylinders not greater than 1m³ shall comply with the requirements of current national standard GB 50028 *Code for Design of City Gas Engineering*.

Table 4.4.5 Fire separation distance from the cylinder storages of Class I or Class II cylinder LPG supply station to buildings outside the station(m)

Name	Class I		Class II	
	6 < V ≤ 10	10 < V ≤ 20	1 < V ≤ 3	3 < V ≤ 6
Total volume of stored cylinders for cylinder storages V(m³)				
Open flame or sparking site	30	35	20	25
Important public buildings	20	25	12	15
Other civil buildings	10	15	6	8
Main roadside	10	10	8	8
Secondary roadside	5	5	5	5

Note:The total volume of stored cylinders shall be the product of actual number of cylinders multiplied by the geometric volume of the single cylinder.

4.4.6 Noncombustible solid enclosure walls should be provided around the Class I cylinder LPG supply station, but the wall facing to the exit / entrance may be noncombustible and non-solid.

Noncombustible solid enclosure walls or walls with the height of the lower solid section not less than 0.6m should be provided around Class II cylinder LPG supply stations.

4.5 Fire separation distance of stackyard for combustibles

4.5.1 Fire separation distance from the outdoor and semi-outdoor stackyard for combustibles to the buildings shall be not less than those specified in Table 4.5.1.

Table 4.5.1 Fire separation distance from the outdoor and semi-outdoor stackyard for combustibles to the buildings(m)

Name	Total storage volume of a stackyard	Building		
		Class I and II	Class III	Class IV
Grain bin W(t)	10 ≤ W < 5 000	15	20	25
	5 000 ≤ W < 20 000	20	25	30
Grain barn W(t)	500 ≤ W < 10 000	10	15	20
	10 000 ≤ W < 20 000	15	20	25
Cotton, flax, wool, chemical fibre and general merchandises W(t)	10 ≤ W < 500	10	15	20
	500 ≤ W < 1 000	15	20	25
	1 000 ≤ W < 5 000	20	25	30
Stover, reed and packed waste paper W(t)	10 ≤ W < 5 000	15	20	25
	5 000 ≤ W < 10 000	20	25	30
	W ≥ 10 000	25	30	40
Timber, etc. V(m ³)	50 ≤ V < 1 000	10	15	20
	1 000 ≤ V < 10 000	15	20	25

Table 4.5.1(continued)

Name	Total storage volume of a stackyard	Building		
		Class I and II	Class III	Class IV
Timber, etc. $V(m^3)$	$V \geq 10\,000$	20	25	30
Coal and coke $W(t)$	$100 \leq W < 5\,000$	6	8	10
	$W \geq 5\,000$	8	10	12

Note: For the outdoor and semi-outdoor stackyards for materials such as stover, reed and packed waste paper, the fire separation distance to the Class A factory buildings (storages) and the civil buildings shall be increased by 25% respectively according to those specified in this table based on the fire-resistance class of the buildings, and shall be not less than 25m; the fire separation distance to the outdoor transformer and distribution substations shall be not less than 50m; and that to the open flame or sparking site shall be increased by 25% according to the corresponding requirements for Class IV buildings in this table.

Where the total storage volume of a timber stackyard is greater than 25 000m³ or the total storage volume of the stackyard for such materials as stover, reed and packed waste paper is greater than 20 000t, stackyards should be arranged separately. The fire separation distance between different stackyards shall not be less than that for the adjacent larger stackyard and Class IV buildings.

Fire separation distance between stackyards for materials of different properties shall be not less than the larger value of that for the stackyard with corresponding storage volume and Class IV buildings as specified in this table.

4.5.2 Fire separation distance from the outdoor or semi-outdoor stackyards for combustibles to the Class A, B, C liquid tanks shall be not less than the larger value of that for the stackyard with corresponding storage volume and Class IV buildings as specified in Table 4.2.1 and Table 4.5.1 of this code.

4.5.3 Fire separation distance from the outdoor or semi-outdoor stackyards for such materials as stover, reed and packed waste paper to the railways and roads shall be not less than those specified in Table 4.5.3. The fire separation distance between stackyards for other combustibles and the railways or roads shall be determined through analogy principle according to the fire hazards of the materials.

Table 4.5.3 Fire separation distance from outdoor or semi-outdoor stackyards for combustibles to the railways or roads(m)

Name	Central line of off-factory railway	Central line of in-factory railway	Off-factory roadside	In-factory roadside	
				Main	Secondary
Stackyards for such materials as stover, reed, packed waste paper, etc.	30	20	15	10	5

5 Civil buildings

5.1 Classification and fire-resistance class

5.1.1 Civil buildings may be classified into single-/multi-storey and high-rise civil buildings according to the building height and number of storeys. High-rise civil buildings may be classified into Category I and Category II according to the building height, function and building area. The classification of civil buildings shall be in accordance with those specified in Table 5.1.1.

Table 5.1.1 Classification of civil buildings

Name	High-rise civil building		Single-/multi-storey civil building
	Category I	Category II	
Residential building	Building height > 54m (including buildings with small commercial spaces)	Building height > 27m, ≤ 54m (including buildings with small commercial spaces)	Building height ≤ 27m (including buildings with small commercial spaces)
Public building	1. Public buildings with height greater than 50m; 2. The following buildings with the building area of any floor above 24m greater than 1 000m ² : stores; buildings for exhibition, telecommunication, postal service, finance and trade; other mixed-use buildings; 3. Health care buildings, important public buildings, independent aged care facilities; 4. Radio & television buildings, disaster-prevention commanding buildings, dispatching buildings at the provincial level or above, large-scale or provincial power dispatching buildings; 5. Libraries and buildings with stack rooms (collection of books > 1 000 000)	High-rise public buildings other than Category I	1. Single-storey public buildings with height greater than 24m; 2. Other public buildings with height not greater than 24m

Notes: 1 For buildings not listed in the table, the categories shall be determined by analogy based on the table.

- 2 Unless otherwise required in this code, the fire protection requirements for such buildings as dormitory and apartment shall comply with the requirements for public buildings of this code.
- 3 Unless otherwise required in this code, the fire protection requirements for podium shall comply with the requirements for high-rise civil buildings of this code.

5.1.2 Fire-resistance class of civil buildings may be classified into Class I, II, III and IV. Unless otherwise required in this code, the combustibility and fire-resistance rating of the building elements shall be not less than those specified in Table 5.1.2.

Table 5.1.2 Combustibility and fire-resistance rating(h) of the building elements

Name of element		Fire-resistance class			
		Class I	Class II	Class III	Class IV
Wall	Fire wall	Noncombustible 3.00	Noncombustible 3.00	Noncombustible 3.00	Noncombustible 3.00

Table 5.1.2(continued)

Name of element		Fire-resistance class			
		Class I	Class II	Class III	Class IV
Wall	Load-bearing wall	Noncombustible 3.00	Noncombustible 2.50	Noncombustible 2.00	Difficult-combustible 0.50
	Nonbearing exterior wall	Noncombustible 1.00	Noncombustible 1.00	Noncombustible 0.50	Combustible
	Walls of staircase and vestibule, Walls of elevator shaft, Walls between units of residential buildings and walls between families	Noncombustible 2.00	Noncombustible 2.00	Noncombustible 1.50	Difficult-combustible 0.50
	Partition walls on both sides of the exit passageway	Noncombustible 1.00	Noncombustible 1.00	Noncombustible 0.50	Difficult-combustible 0.25
	Room partition wall	Noncombustible 0.75	Noncombustible 0.50	Difficult-combustible 0.50	Difficult-combustible 0.25
Column	Noncombustible 3.00	Noncombustible 2.50	Noncombustible 2.00	Difficult-combustible 0.50	
Beam	Noncombustible 2.00	Noncombustible 1.50	Noncombustible 1.00	Difficult-combustible 0.50	
Floor	Noncombustible 1.50	Noncombustible 1.00	Noncombustible 0.50	Combustible	
Load-bearing roof element	Noncombustible 1.50	Noncombustible 1.00	Combustible 0.50	Combustible	
Exit stair	Noncombustible 1.50	Noncombustible 1.00	Noncombustible 0.50	Combustible	
Suspended ceiling(including ceiling joist)	Noncombustible 0.25	Difficult-combustible 0.25	Difficult-combustible 0.15	Combustible	

Notes: 1 Unless otherwise required in this code, the fire-resistance class of the buildings with wooden columns and noncombustible walls shall be classified as Class IV.

2 The fire-resistance rating and combustibility of the residential building elements may comply with the requirements of the current national standard GB 50368 *Residential Building Code*.

5.1.3 Fire-resistance class of civil buildings shall be determined according to such factors as the building height, function, importance of the building and firefighting and rescue conditions outside the building, and shall comply with the following requirements:

1 The fire-resistance class shall be not less than Class I for underground or semi-underground buildings(basement or semi-basement)and Category I high-rise buildings;

2 The fire-resistance class shall be not less than Class II for single-/multi-storey important

public buildings and Category II high-rise buildings.

5.1.3A Other than timber structures, the fire-resistance class shall be not less than Class III for the aged care facilities.

5.1.4 For civil buildings with height greater than 100m, the fire-resistance rating of the floor shall be not less than 2.00h.

For the accessible flat roof of Class I and Class II buildings, the fire-resistance rating of the roof slab shall be not less than 1.50h and 1.00h respectively.

5.1.5 The roof slab of the Class I and Class II buildings shall be noncombustible.

Roof water barrier should be noncombustible or difficult-combustible. When combustible water barrier is used and laid on combustible or difficult-combustible thermal insulation materials, the water barrier or the combustible, difficult-combustible thermal insulation materials shall be protected with noncombustible materials.

5.1.6 The fire-resistance rating of the difficult-combustible room partition walls in Class II buildings shall be not less than 0.75h; when the floor area of the room is not greater than 100m², the room partition walls may be difficult-combustible with fire-resistance rating not less than 0.50h or noncombustible with fire-resistance rating not less than 0.30h.

The fire-resistance rating of pre-stressed reinforced concrete floor in Class II multi-storey residential buildings shall be not less than 0.75h.

5.1.7 If it is necessary to use metal sandwich board as the nonbearing exterior wall, room partition wall or roof slab, the core material shall be noncombustible and its fire-resistance rating shall comply with the relevant requirements of this code.

5.1.8 The fire-resistance rating of noncombustible suspended ceiling in Class II buildings is not required.

For health care buildings, teaching buildings of middle and primary schools, aged care facilities, children's play rooms such as children's living and amusement rooms in nurseries and kindergartens with Class III fire-resistance class, the suspended ceiling shall be noncombustible. If the suspended ceiling is difficult-combustible, the fire-resistance rating shall be not less than 0.25h.

The suspended ceilings of the lobby and passageway in Class II or Class III buildings shall be noncombustible.

5.1.9 Fire protection measures shall be taken for the exposed joints of the precast reinforced concrete elements, and the fire-resistance rating of the joints shall be not less than that of the corresponding elements.

5.2 General layout

5.2.1 The location of buildings, fire separation distance, fire vehicle access road, fire water supply shall be arranged reasonably in the layout. Civil buildings should not be close to Class A or Class B factory buildings (storages); Class A, B, C liquid tanks; combustible gas tanks and stackyards for combustibles.

5.2.2 Fire separation distance between any two civil buildings shall be not less than those specified in Table 5.2.2. Fire separation distance between civil buildings and other buildings shall not only comply with the requirements of this section, but also those specified in other chapters of the code.

Table 5.2.2 Fire separation distance(m)between civil buildings

Building classification		High-rise civil building	Podium and other civil buildings		
		Class I and II	Class I and II	Class III	Class IV
High-rise civil buildings	Class I and II	13	9	11	14
Podiums and other civil buildings	Class I and II	9	6	7	9
	Class III	11	7	8	10
	Class IV	14	9	10	12

Notes: 1 For two adjacent single-/multi-storey buildings, the fire separation distance may be reduced by 25% of those specified in this table, provided that: the two adjacent exterior walls are noncombustible and there are no exposed combustible eaves; the unprotected doors, windows and other openings in each exterior wall are not directly opposite to each other; and the sum of area of the unprotected doors, windows and other openings is not greater than 5% of the area of the exterior wall.

2 For two adjacent buildings, the fire separation distance is not limited, provided that the higher exterior wall is a fire wall or the exterior wall within the scope of 15m or less above the roof of the adjacent lower Class I or Class II building is a fire wall.

3 Where any of the exterior walls of two adjacent Class I or Class II buildings with the same height is a fire wall and the fire-resistance rating of the roof is not less than 1.00h, the fire separation distance is not limited.

4 For two adjacent buildings, the fire separation distance shall be not less than 3.5m, provided that the fire-resistance class of the lower one is not less than Class II; the adjacent lower exterior wall is a fire wall; the roof of the lower building has no skylights and the fire-resistance rating of the roof is not less than 1.00h. For high-rise buildings meeting the above conditions, the fire separation distance shall be not less than 4m.

5 For two adjacent buildings with the fire-resistance class of the lower one not less than Class II and the roof of the lower building without skylights, the fire separation distance shall be not less than 3.5m, provided that the opening in the adjacent higher exterior wall within the scope of 15m or less above the roof of the lower building is protected with Class A fire door or window.

For two adjacent buildings with the fire-resistance class of the lower one not less than Class II and the roof of the lower building without skylights, the fire separation distance shall be not less than 3.5m, provided that the opening in the adjacent higher exterior wall within the scope of 15m or less above the roof of the lower building is protected by water curtain meeting the requirements of the current national standard GB 50084 *Code for Design of Sprinkler Systems* or the fire shutter meeting the requirements of Article 6.5.3 of this code.

For high-rise buildings meeting the above conditions, the fire separation distance shall be not less than 4m.

6 Where buildings are connected by galleries, overpasses or a building like the podium, the distance between the buildings shall be not less than those specified in this table.

7 The fire-resistance class may be regarded as Class IV for existing buildings with fire-resistance class less than Class IV.

5.2.3 Fire separation distance between civil buildings and the separately built transformer substations shall comply with the requirements for the outdoor transformers and distribution substations in Article 3.4.1 of this code. The fire separation distance between civil buildings and the separately built terminal transformer substations may be determined based on the fire-resistance class of the terminal transformer substation according to the requirements for civil buildings in Article 5.2.2 of this code.

Fire separation distance between civil buildings and prefabricated transformer substations (10kV or less) shall be not less than 3m.

Fire separation distance between civil buildings and the oil-fired, gas-fired or coal-fired boiler rooms shall comply with the requirements for Class D factory buildings in Article 3.4.1 of this code. The fire separation distance between civil buildings and the coal-fired boiler rooms with evaporation capacity of a single steam boiler not greater than 4t/h, or the rated thermal power of a single hot water boiler not greater than 2.8MW may be determined based on the fire-resistance class of the boiler room according to the requirements in Article 5.2.2 of this code.

5.2.4 Class I or Class II residential or office buildings, other than high-rise civil buildings, may be arranged in groups if the sum of the first floor area of each building is not greater than 2 500m². The distance between any two buildings within a group should not be less than 4m. The fire separation distance between any two buildings in adjacent groups, or between the buildings in the group and the adjacent buildings shall be not less than those specified in Article 5.2.2 of this code.

5.2.5 Fire separation distance between civil buildings and gas regulator stations, LPG gasification stations, LPG gas mixing stations, urban LPG cylinder stations shall comply with the requirements of the current national standard GB 50028 *Code for Design of City Gas Engineering*.

5.2.6 Fire separation distance between civil buildings with height greater than 100m and the adjacent buildings shall not be reduced, even if the requirements specified in Article 3.4.5, Article 3.5.3, Article 4.2.1 and Article 5.2.2 of this code are met.

5.3 Fire compartment and number of storeys

5.3.1 Unless otherwise required by provisions of this code, the permissible building height or number of storeys and the maximum permissible gross floor area of a fire compartment of the buildings with different fire-resistance classes shall comply with those specified in Table 5.3.1.

Table 5.3.1 Permissible building height or number of storeys, maximum permissible gross floor area of fire compartment of the buildings

Name	Fire-resistance class	Permissible building height or number of storeys	Maximum permissible gross floor area of a fire compartment(m ²)	Remarks
High-rise civil building	Class I , II	Determined according to Article 5.1.1 of this code	1 500	As for the audience halls of gymnasiums and theatres, the maximum permissible gross floor area of a fire compartment may be increased based on review by authorities
Single-/multi-storey civil building	Class I , II	Determined according to Article 5.1.1 of this code	2 500	
	Class III	5 storeys	1 200	
	Class IV	2 storeys	600	
Underground or semi-underground civil buildings(basement or semi-basement)	Class I	-	500	The maximum permissible gross floor area of a fire compartment for equipment rooms shall be not greater than 1 000m ²

Notes: 1 If an automatic fire extinguishing system is provided in the building, the maximum permissible gross floor area of a fire compartment may be increased by 1.0 times according to those specified in this table; if the automatic fire extinguishing system is provided partially, the increased area of the fire compartment may be 1.0 times of the area of that part.

2 If a fire wall is provided between the podium and the main body of the high-rise building, the fire compartment of the podium may be determined according to the requirements of single-/multi-storey buildings.

5.3.1A The building height of the independent Class I and Class II aged care facilities should be not greater than 32m, and shall be not greater than 54m; the independent Class III aged care facilities shall be not greater than 2 storeys.

5.3.2 If openings connecting upper and lower floors such as escalators and open stairs are provided in the building, the gross floor area of a fire compartment shall be the sum of the floor

area of upper and lower floors; if the gross floor area is greater than those specified in Article 5.3.1 of this code, the fire compartment shall be further divided.

For a fire compartment with an atrium connecting multiple floors, the gross floor area of the fire compartment shall be the sum of the floor areas of each floor not divided by fire walls. Where the sum of the area is greater than those specified in Article 5.3.1 of this code, the following requirements shall be met:

1 The atrium shall be fire separated from the surrounding connected spaces: if fire partition walls are used, the fire-resistance rating shall be not less than 1.00h; if fire-resisting glass partition wall is used, its property of insulation and integrity shall be not less than 1.00h; if non-insulating fire-resisting glass partition wall with fire integrity not less than 1.00h is used, sprinkler system shall be provided to protect the wall; if fire shutters are used, the fire-resistance rating shall be not less than 3.00h and shall comply with those specified in Article 6.5.3 of this code; the doors and windows connected with the atrium shall be Class A fire doors and windows, and shall be capable of self-closing in case of fire;

2 The gallery around the atrium in high-rise buildings shall be provided with sprinkler systems and fire alarm systems;

3 The atrium shall be provided with proper smoke control systems;

4 No combustibles shall be permitted in the atrium.

5.3.3 Fire separation between fire compartments shall be fire walls. If it is difficult to provide fire walls, fire separation facilities like fire shutters may be used. When the fire shutter is used, it shall comply with those specified in Article 6.5.3 of this code.

5.3.4 For display and sell areas and exhibition halls in Class I or II buildings provided with automatic fire extinguishing systems and fire alarm systems, decorated with noncombustible or difficult-combustible materials, the maximum permissible gross floor area of a fire compartment shall comply with the following requirements:

1 No greater than 4 000m² in high-rise buildings;

2 No greater than 10 000m² in single-storey buildings or only on the first floor of multi-storey buildings;

3 No greater than 2 000m² in underground or semi-underground spaces.

5.3.5 The underground or semi-underground mercantile with total floor area greater than 20 000m² shall be divided into several parts by fire walls without doors, windows and other openings and floors with fire-resistance rating not less than 2.00h, and the gross floor area of each part shall be not greater than 20 000m².

If the adjoining parts are connected, the connecting spaces shall be sunken yard, fire separation room, refuge passageway, smokeproof staircase, and such spaces shall comply with the following requirements:

1 Sunken yard shall be able to prevent fire spread from one part to other parts, and shall be easy for evacuation, and shall comply with those specified in Article 6.4.12 of this code;

2 The walls of the fire separation room shall be fire partition walls with fire-resistance rating not less than 3.00h, and shall comply with those specified in Article 6.4.13 of this code;

3 The refuge passageway shall comply with those specified in Article 6.4.14 of this code;

4 The doors of smokeproof staircase shall be Class A fire doors.

5.3.6 For a covered mall housing a number of commercial occupancies such as catering services and stores, where the common pedestrian area is to be used for evacuation, the following requirements shall be met:

1 The fire-resistance class of the buildings on both sides of the common pedestrian area shall be not less than Class II.

2 The minimum distance between any two buildings on both sides of the common pedestrian area shall be not less than the fire separation distance required in this code, and shall be not less than 9m. The ends of the common pedestrian area should not be enclosed on any floors; if the ends are to be enclosed, openable doors and windows with area not less than half of the end wall areas shall be provided. The length of the common pedestrian area should not exceed 300m.

3 The fire partition walls with fire-resistance rating not less than 2.00h shall be provided between the tenants, and the floor area of each tenant should not exceed 300m².

4 The fire-resistance rating of the walls facing towards the common pedestrian area shall be not less than 1.00h. The walls should be solid walls, and the doors and windows shall be Class B fire doors and windows. If fire-resisting glass partition walls (including door and window) are provided, the fire insulation and fire integrity shall be not less than 1.00h; if non-insulating fire-resisting glass partition walls (including door and window) with fire integrity not less than 1.00h are provided, they shall be protected by closed-type sprinkler systems. The T-shaped wall between two adjoining tenants shall be solid wall with the width not less than 1.0m and the fire-resistance rating shall be not less than 1.00h.

If the buildings on both sides of the common pedestrian area are multi-storey buildings, proper measures shall be taken for the tenants on both sides of the common pedestrian area to prevent the vertical fire spreading and shall comply with those specified in Article 6.2.5 of this code; if walkways or overhanging eaves are provided, the projecting width shall be not less than 1.2m; if the tenants on the second floor and above need to be connected by walkways or connecting overpasses, the opening area on each floor over the common pedestrian area shall be not less than 37% of the area of the common pedestrian area, and the openings should be arranged uniformly.

5 The exit stairways of the buildings on both sides of the common pedestrian area shall be adjacent to the exterior walls and should directly lead to the outdoors; if it is really difficult to do so, exit stairways may directly lead to the common pedestrian area on the first floor; the exit doors of the tenants on the first floor may directly lead to the common pedestrian area, and the distance from any point of the common pedestrian area to the nearest outdoors shall be not greater than 60m. The distance from the exit doors of the tenants on the second floor and above to the nearest exit stairways or other exits on the corresponding floor shall be not greater than 37.5m.

6 The ceiling of the common pedestrian area shall be noncombustible or difficult-combustible. The fire-resistance rating of its load-bearing structure shall be not less than 1.00h. No combustibles shall be permitted within the common pedestrian area.

7 The height from the lower edge of the ceiling eave to the ground of the common pedestrian area shall be not less than 6.0m. The ceiling shall be provided with natural smoke exhaust system and the vent should be normally-open. The effective area of the natural smoke vents shall be not less than 25% of the ground area of the common pedestrian area. If a normally-closed natural smoke exhaust system is installed, it shall be opened manually and automatically in case of fire.

8 The common pedestrian area shall be protected by DN65 fire hydrants with fire hose reels and

fire hoses; and the spacing of the fire hydrants shall be 30m; the tenants shall be protected by sprinkler systems and fire alarm systems; the walkways on the second floor and above shall be protected by sprinkler system. The common pedestrian area should be protected by automatic tracking and targeting jet suppression system.

9 The covered mall shall be provided with evacuation lighting, lighting directional indicator signs and fire emergency broadcast system.

5.4 Plane arrangement

5.4.1 The plane arrangement of civil buildings shall be determined based on the fire-resistance class, fire hazards, occupancies, evacuation and other factors of the building.

5.4.2 **Workshops and storages, other than auxiliary storerooms, shall not be provided in civil buildings.**

Stores, workshops and storerooms for handling, storing or using Class A and B fire-hazardous materials must be prohibited in civil buildings.

5.4.3 For Class III stores and exhibition buildings, the number of storeys shall not exceed 2; for Class IV stores and exhibition buildings, it shall be 1. Salesrooms and exhibition halls in Class III buildings shall be arranged on the first or second floor; Salesrooms and exhibition halls in Class IV buildings shall be arranged on the first floor.

The salesrooms and exhibition halls shall not be arranged at the basement level 3 and the levels below in any buildings. Class A and B fire hazardous materials shall not be sold, stored or exhibited in underground or semi-underground salesrooms and exhibition halls.

5.4.4 Children's activity rooms and amusement halls should be arranged in an independent building, and shall not be located at underground or semi-underground levels. Where the fire-resistance class of the independent building is Class I or Class II, the number of storeys shall not exceed 3; where the fire-resistance class is Class III, it shall not exceed 2; where the fire-resistance class is Class IV, it shall be 1. Where such rooms or halls are arranged in other civil buildings, the following requirements shall be met:

1 For Class I or Class II buildings, such rooms or halls shall be on the first, second or third floor;

2 For Class III buildings, such rooms or halls shall be on the first or second floor;

3 For Class IV buildings, such rooms or halls shall be on the first floor;

4 For high-rise buildings, such rooms or halls shall be provided with independent exits and exit stairways;

5 For single-/multi-storey buildings, such rooms or halls should be provided with independent exits and exit stairways.

5.4.4A Aged care facilities should be arranged in an independent building. Where the aged care facilities are arranged in a mixed-use building, such facilities should be arranged on the lower floors, and shall comply with the following requirements:

1 The number of storey, building height or the height of the floor containing the aged care facilities shall comply with the requirements of Article 5.3.1A of this code.

2 The aged care facilities shall be separated from the remainder of the building. The fire separation shall comply with the requirements of Article 6.2.2 of this code.

5.4.4B Where the group activity spaces, recovery rooms and treatment rooms of the aged care facilities are arranged underground or semi-underground, such spaces or rooms shall be at the first basement level, the floor area of each room shall be not greater than 200m², and the occupant load shall be not greater than 30.

Where the group activity spaces, recovery rooms and treatment rooms of the aged care facilities are arranged on the fourth floor or above, the floor area of each room shall be not greater than 200m², and the occupant load shall be not greater than 30.

5.4.5 The inpatient medical care areas in hospitals and nursing homes shall not be arranged underground or semi-underground.

Where the fire-resistance class of inpatient medical care areas in hospitals and nursing homes is Class Ⅲ, the number of storeys shall not exceed 2; where the fire-resistance class is Class Ⅳ, it shall be 1. Where such areas are arranged in Class Ⅲ buildings, they shall be on the first or second floor; where such areas are arranged in Class Ⅳ buildings, they shall be on the first floor.

Two adjoining care suites of such areas shall be separated by fire partition walls with fire-resistance rating not less than 2.00h. Doors in the fire partition walls shall be Class B fire doors. Fire doors in corridors shall be normally open.

5.4.6 For Class Ⅲ teaching buildings, dining halls or vegetable markets, the number of storeys shall not exceed 2; for Class Ⅳ teaching buildings, dining halls or vegetable markets, it shall be 1. Where teaching rooms, dining halls or vegetable markets are arranged in Class Ⅲ buildings, they shall be on the first or second floor; where teaching rooms, dining halls or vegetable markets are arranged in Class Ⅳ buildings, they shall be on the first floor.

5.4.7 Theatres, cinemas and auditoriums should be arranged in an independent building; where the fire-resistance class of the independent building is Class Ⅲ, the number of storeys shall not exceed 2; where such occupancies are arranged in a mixed-use building, they shall be provided with at least one independent exit and one exit stairway, and shall comply with the following requirements:

1 Such occupancies shall be separated from the remainder of the building by fire partition walls with fire-resistance rating not less than 2.00h and Class A fire doors.

2 Where such occupancies are arranged in Class I or Class II buildings, the audience halls should be arranged on the first, second or third floor; if it is necessary to be arranged on the fourth floor or above, the number of exit doors of each hall or room shall be not less than 2, and the floor area of each audience hall should be not greater than 400m².

3 Where such occupancies are arranged in Class Ⅲ buildings, they shall not be located on the third floor or above.

4 Where such occupancies are arranged underground or semi-underground, they should be located at the first basement level, but shall not be located at the basement level 3 or below.

5 Where such occupancies are arranged in high-rise buildings, they shall be provided with fire alarm systems, and sprinkler systems or other automatic fire extinguishing systems.

5.4.8 Occupancies such as conference rooms, multi-functional halls used for assembly purposes in a building should be located on the first, second or third floor. Where such occupancies are arranged in Class Ⅲ buildings, they shall not be located on the third floor or above. Where such occupancies are to be arranged on other floors of Class I or Class II buildings, they shall comply with the following requirements:

1 The number of exit doors of each hall/room shall be not less than 2, and the floor area of each hall/room should not be greater than 400m²;

2 Where such occupancies are arranged underground or semi-underground, such occupancies should be at the first underground level but shall not be arranged at the third underground level or below;

3 Where such occupancies are arranged in high-rise buildings, such occupancies shall be provided with fire alarm systems, and sprinkler systems or other automatic fire extinguishing systems.

5.4.9 The arrangement of the entertainment and amusement occupancies (excluding theatres and cinemas) such as ball rooms, video halls, nightclubs, karaoke halls (including restaurants with karaoke function), recreation halls (including video game rooms), sauna rooms (excluding the bathing part) and internet bars shall comply with the following requirements:

1 Such occupancies shall be arranged at the first basement level and above;

2 Such occupancies should be arranged closely to the exterior walls on the first, second or third floor in Class I, Class II buildings;

3 Such occupancies should not be arranged at both sides or at the end of the dead end;

4 Where such occupancies are to be arranged at the first basement level, the height difference between the floor of the first basement level and the level of exit to outdoors shall be not greater than 10m;

5 Where such occupancies are to be arranged on the fourth floor or above, or at basement levels, the floor area of each hall or room shall be not greater than 200m²;

6 The halls or rooms shall be separated from each other, and from the remainder of the building by fire partition walls with fire-resistance rating not less than 2.00h and noncombustible floors with fire-resistance rating not less than 1.00h; The doors in the partition walls and the doors connecting such occupancies with other parts of the building shall be Class B fire doors.

5.4.10 Where a residential building is mixed-used with other occupancies (excluding small commercial spaces), the following requirements shall be met:

1 Residential part shall be completely separated from non-residential part by fire partition walls (without any opening) with fire-resistance rating not less than 2.00h and noncombustible floors with fire-resistance rating not less than 1.50h; for high-rise buildings, such parts shall be completely separated by fire walls (without any opening) and noncombustible floors with fire-resistance rating not less than 2.00h. The fire protection measures for preventing vertical fire spread through openings in exterior walls shall comply with the requirements specified in Article 6.2.5 of this code.

2 The exits and exit stairways of the residential part and non-residential part shall be arranged independently; the aboveground garage serving for residential part shall be provided with independent exit stairways or exits. The exit stairways of the underground garage shall be separated according to those specified in Article 6.4.4 of this code.

3 Egress, fire compartmentation and indoor fire protection facilities for the residential part and non-residential part may comply with the requirements for residential buildings and public buildings, respectively based on the building height of each part; other fire protection design of the mixed-use building shall comply with the requirements for public buildings based on the total height and scale of the building.

5.4.11 For the residential buildings with small commercial spaces, the residential part shall be completely separated from the small commercial spaces by fire partition walls (without any opening) with fire-resistance rating not less than 2.00h and noncombustible floors with fire-resistance rating not less than 1.50h; the exits and exit stairways of residential buildings shall be completely separated from the small commercial spaces.

The small commercial spaces shall be separated into units by fire partition walls (without any opening) with fire-resistance rating not less than 2.00h. Where the floor area of a unit on any floor is greater than 200m², 2 exits or exit doors shall be provided. The distance from any point in each unit to the nearest exit directly leading to the outdoors shall be not greater than the maximum distance (as specified in Table 5.5.17 of this code) from the exit door on both sides or at the end of the dead end in other multi-storey buildings to the nearest exit.

Note: The distance of the indoor stair may be calculated as 1.50 times of the horizontal projection length of the stair flight.

5.4.12 The oil-fired or gas-fired boiler, oil-immersed transformer, and high voltage capacitor and bulk oil circuit breaker filled with combustible oil should be located in an independent building. Where such buildings must be adjoining to a civil building, a fire wall shall be provided and the fire-resistance class of such buildings shall be not less than Class II, but such buildings shall not be adjoining to the assembly occupancies.

Where such facilities must be arranged in a dedicated room of a civil building, such room shall not be arranged on the floors directly above or below the assembly occupancies and shall not be adjoining to the assembly occupancies, and shall comply with the following requirements:

1 The oil-fired or gas-fired boiler room, transformer room shall be arranged adjacent to the exterior wall on the first floor or at the first basement level. The atmospheric or negative pressure oil-fired or gas-fired boiler may be arranged at the second basement level or on the roof. Where the atmospheric or negative pressure gas-fired boiler is arranged on the roof, the distance from the boiler to the roof exit shall be not less than 6m.

The gas-fired boiler with the relative density of the gas (ratio to air density) not less than 0.75 shall not be arranged underground or semi-underground.

2 All exit doors of boiler rooms and transformer rooms shall directly lead to the outdoors or final exits.

3 The boiler rooms and transformer rooms shall be separated from the remainder of the building by 2.00h fire-resistance-rated partition walls and 1.50h fire-resistance-rated non-combustible floors. No openings shall be permitted in the separation walls and floors. Where doors or windows are to be provided in the partition walls, such doors or windows shall be Class A.

4 Where an oil storage room is arranged in a boiler room, the total storage volume shall be not greater than 1m³, and 3.00h fire-resistance-rated partition walls shall be provided to separate the oil storage room from the remainder of the boiler room. Doors in the partition walls shall be Class A.

5 The fire partition walls with fire-resistance rating not less than 2.00h shall be provided between any two transformer rooms, and between transformer rooms and power distribution rooms.

6 Measures to prevent oil from dispersing shall be taken for oil-immersed transformers and bulk oil circuit breaker rooms, and high voltage capacitor rooms. Accidental oil storage facilities

shall be provided under the oil-immersed transformers, and shall be capable of storing total oil volume of the transformers.

7 Fire alarm shall be provided.

8 Fire extinguishing facilities corresponding to the fire hazard of the boilers, transformers, electric capacitors and bulk oil circuit breaker shall be provided; where sprinkler systems are provided in other parts of the building, sprinkler systems is permitted to replace other fire extinguishing facilities.

9 The boiler's capacity shall comply with the requirements of the current national standard GB 50041 *Standard for Design of Boiler Plant*. The total capacity of an oil immersed transformers shall be not greater than 1 260kV·A and the capacity of a single set shall be not greater than 630kV·A.

10 Explosion pressure relief shall be provided in the gas-fired boiler room. Independent ventilation systems shall be provided for oil-fired or gas-fired boiler rooms and shall comply with the requirements of Chapter 9 of this code.

5.4.13 The diesel generator room in civil buildings shall comply with the following requirements:

1 Such room should be arranged on the first floor or at the first and second basement levels.

2 Such room shall not be arranged on the floors directly above or below the assembly occupancies and shall not be adjoining to the assembly occupancies.

3 Such room shall be separated from the remainder of the building by 2.00h fire-resistance-rated partition walls and 1.50h fire-resistance-rated non-combustible floors. Doors in the partition walls shall be Class A.

4 Where an oil storage room is arranged in the diesel generator room, the total storage volume shall be not greater than 1m³, and 3.00h fire-resistance-rated partition walls shall be provided to separate the oil storage room from the remainder of the generator room. Doors in the partition walls shall be Class A.

5 Fire alarm devices shall be provided.

6 Fire extinguishing facilities corresponding to the fire hazard of the diesel generators shall be provided; where sprinkler systems are provided in other parts of the building, sprinkler systems is permitted to replace other fire extinguishing facilities.

5.4.14 The storage tanks of Class C liquid fuels serving a building shall be arranged outdoors, and shall comply with the following requirements:

1 For storage tanks directly buried underground, where the total capacity is not greater than 15m³ and the exterior wall of the building within 4.0m away from the side facing the tank is a fire wall, the fire separation distance between the storage tank and the building is not required.

2 For storage tanks where the total capacity is greater than 15m³, the arrangement of the storage tank shall comply with the requirements of Section 4.2 of this code.

3 Where intermediate tank is arranged, the capacity of the intermediate tank shall be not greater than 1m³ and shall be arranged in a separate room within a Class I or Class II building. Doors in the walls of the separate room shall be Class A.

5.4.15 The fuel pipes for boilers and diesel generators arranged in a building shall comply with the following requirements:

1 Automatic and manual shutoff valves shall be provided on the pipes at the point before

entering the building and at the point after entering the equipment room ;

2 The tanks in the fuel storage room shall be sealed and provided with vent pipe to the outdoors; the air valve with flame arrester shall be installed on the vent pipe, and the facilities to prevent fuel from dispersing shall be provided under the tanks;

3 The installing of fuel gas pipes shall comply with the requirements of the current national standard GB 50028 *Code for Design of City Gas Engineering*.

5.4.16 Where combustible gas is used in high-rise civil buildings, piping system shall be used to supply the gas. The rooms or parts where combustible gas is used should be arranged adjacent to the exterior wall and shall comply with the requirements of the current national standard GB 50028 *Code for Design of City Gas Engineering*.

5.4.17 Where LPG cylinders are used to supply gas to a building, the following requirements shall be met:

1 LPG cylinders shall be arranged in an independent room ;

2 The LPG cylinder room shall not be adjoining to residential buildings, important public buildings and other high-rise public buildings; where the room with the total capacity not greater than 1m³ is adjoining to buildings other than the buildings mentioned above, natural gasification method shall be used for gas supply;

3 Fire separation distance between the independent cylinder room (with total capacity greater than 1m³ but less than 4m³) and the serving building shall comply with the requirements of Table 5.4.17 of this code;

Table 5.4.17 Fire separation distance between independent LPG cylinder room and the serving building(m)

Name	Total volume(<i>V</i>) of independent cylinder group room of LPG cylinder(m ³)	
	$V \leq 2$	$2 < V \leq 4$
Open flame location or sparking site	25	30
Important public buildings and Category I high-rise civil buildings	15	20
Podiums and other civil buildings	8	10
Roads(road side)	Primary	10
	Secondary	5

Note: The total capacity of LPG cylinders shall be the sum of the geometrical capacity of each single cylinder.

4 Emergency automatic shutoff valves shall be provided on the general outlet pipes of the cylinder room ;

5 Gas alarm shall be provided in the cylinder room ;

6 The other fire protection requirements shall comply with the current national standard GB 50028 *Code for Design of City Gas Engineering*.

5.5 Evacuation and refuge

I General requirement

5.5.1 Evacuation and refuge facilities shall be provided for civil buildings based on the building height,

gross floor area, type of occupancy and fire-resistance class etc. The location, number and width of the exit and type of exit stairway shall comply with the performance of safe evacuation.

5.5.2 Exits shall be remote from each other. The distance between any two adjacent exits of each fire compartment or each floor as one fire compartment shall be not less than 5m; the horizontal distance between any two adjacent exits of each floor of a residential unit shall be not less than 5m; the distance between any two adjacent exit doors of a room in civil buildings shall be not less than 5m.

5.5.3 The exit staircase of a building should lead to the roof, and the door or window of such staircase shall open outward.

5.5.4 The escalator and elevator shall not be used as evacuation facilities.

5.5.5 Other than assembly occupancies, one of the exits may be a fixed vertical metal ladder directly leading to the outdoors, provided that the underground or semi-underground buildings (rooms) with floor area is greater than 500m², the occupant load does not exceed 30, the height difference between the floor of the lowest basement level and the level of exit to outdoors is not greater than 10m, and the other exit shall lead directly to the outdoors.

Other than entertainment and amusement occupancies, where one exit or one exit stairway is permitted for underground or semi-underground equipment rooms or basement, the floor area of the equipment room as a fire compartment shall be not greater than 200m², or the floor area of the basement as a fire compartment shall be not greater than 50m² and the number of occupants constantly attended shall not exceed 15.

Unless otherwise required by provisions of this code, where one exit door is permitted for underground or semi-underground equipment rooms or basement, the floor area of the equipment room shall be not greater than 200m², or the floor area of the basement shall be not greater than 50m² and the number of occupants constantly attended shall not exceed 15.

5.5.6 As for the elevators directly leading to the garage in the building, a lobby shall be provided in the garage, and the lobby shall be separated from the garage with 2.00h fire-resistance-rated fire partition walls and Class B fire doors.

5.5.7 Cornice with projection not less than 1.0m shall be provided above the exit of a high-rise building directly leading to the outdoors.

II Public buildings

5.5.8 The number of exits for each fire compartment or each floor as one fire compartment of the public building shall be established by calculation and shall be not less than 2. Where one exit or one exit stairway is permitted, such buildings shall comply with one of the following conditions:

1 Other than nurseries and kindergartens, the single-storey public building or the first floor of a multi-storey public building with the occupant load less than 50 and floor area less than 200m²;

2 Other than health care buildings, aged care facilities, the rooms for children's use in nurseries and kindergartens, children's play areas such as children's amusement halls as well as entertainment and amusement occupancies, the public buildings in accordance with those specified in Table 5.5.8.

Table 5.5.8 Public buildings where one exit stairway may be provided

Fire-resistance class	Maximum number of storeys	Maximum floor area of each floor(m ²)	Occupant load
Class I and II	3	200	Occupant load on the second and third floor not exceed 50
Class III	3	200	Occupant load on the second and third floor not exceed 25
Class IV	2	200	Occupant load on the second floor not exceed 15

5.5.9 In case that all of the exits in any fire compartment of Class I ,Class II public buildings are not able to lead to the outdoors, doors leading to the adjoining fire compartments may be used as exits, provided that such doors are Class A fire doors and the following requirements are met:

1 Two adjoining fire compartments shall be separated by a fire wall;

2 For fire compartments with floor area greater than 1 000m², the number of exits leading directly to the outdoors shall be not less than 2;

For fire compartments with floor area not greater than 1 000m², the number of exits directly leading to the outdoors shall be not less than 1;

3 The clear egress width of the exit doors leading to the adjoining fire compartment shall be not greater than 30% of the aggregate clear egress width according to the requirements of Article 5.5.21 of this code; the sum of clear width of all of the exits and exit stairways on each floor directly leading to the outdoors shall be not less than the aggregate egress clear width according to the requirements of Article 5.5.21 of this code.

5.5.10 For high-rise public buildings, where the distance from any exit door to the nearest exit stairway entrance does not meet requirements of this code and is not greater than 10m, scissor staircases used as exit stairways shall comply with the following requirements:

1 Staircase shall be smokeproof;

2 Fire partition wall with fire-resistance rating not less than 1.00h shall be provided between two interlocking stairways;

3 Separate vestibules shall be provided for the interlocking stairways.

5.5.11 For Class I ,Class II multi-storey public buildings with not less than 2 exit stairways, where the top floors raise partially provided with one exit stairway, the number of storeys of the raised part shall not exceed 2, the total occupant load shall not exceed 50 and the floor area of each storey shall not exceed 200m². However, at least one exit directly leading to the accessible flat roof of the main body of the building shall be provided and the accessible roof shall comply with the requirements for refuge.

5.5.12 Category II high-rise public buildings with building height greater than 32m and Category I high-rise public buildings shall be provided with smokeproof staircases.

Category II high-rise public buildings with building height not greater than 32m and podiums shall be provided with enclosed stairways.

Note: Where the exit stairs of the podium are designed according to the relevant requirements of single-/multi-storey buildings of this code, the podium shall be separated by fire walls and Class A fire doors from the main body of the high-rise building.

5.5.13 Other than the staircases connected directly with an open walkways, exit stairways for the following multi-storey public buildings shall be enclosed:

1 Health care buildings, hotels, aged care facilities or the like;

2 **Buildings with entertainment and amusement occupancies;**

3 **Stores, libraries, exhibition buildings, conference centers or the like;**

4 Other buildings not less than 5 storeys.

5.5.13A The exit stairs or staircases of the aged care facilities should directly lead to an open walkway. Such exit stairs or staircases not leading to an open walkway shall be enclosed. Exit staircases of the aged care facilities with the building height greater than 24m shall be smokeproof.

For the aged care facilities with the building height greater than 32m, the rooms of the aged and the public activity areas on the floors above 32m should be connected with corridors or walkways. Such corridors or walkways on each floor shall directly lead to the exit stairs, exits or outdoor refuge areas.

5.5.14 Lobbies should be provided for elevators (passenger or freight) in public buildings. Such elevators should not be open directly to the spaces such as salesrooms, exhibition halls and multi-functional halls. Elevators in aged care facilities shall take smoke control measures. Such elevators for the aged in case of fire shall comply with the related requirements for fire elevators in this code.

5.5.15 **The number of exit doors for each room of public buildings shall be established by calculation and shall be not less than 2. Other than rooms located at the dead end of the corridors in nurseries, kindergartens, aged care facilities, health care buildings and teaching buildings, Where one exit door is permitted, such rooms shall comply with one of the following conditions:**

1 **The rooms located between two exits or at the two sides of the dead end, the floor area of the room not greater than 50m² for nurseries, kindergartens and aged care facilities; 75m² for health care and teaching buildings; 120m² for other buildings or areas.**

2 **The rooms at the dead end of the corridors, the floor area of the room less than 50m² and the clear width of the exit door not less than 0.90m; or the distance from any point in the room to the exit door not greater than 15m, the floor area of the room not greater than 200m² and the clear width of the exit door not less than 1.40m.**

3 **For entertainment and amusement occupancies, the halls or rooms with floor area not exceeding 50m² and the number of occupants constantly attended not exceeding 15.**

5.5.16 For theatres, cinemas, auditoriums and gymnasiums, the number of exit doors of the audience halls or multi-functional halls shall be established by calculation and shall be not less than 2, and shall comply with the following requirements:

1 **For theatres, cinemas and auditoriums, the average number of persons evacuated through each exit door of the audience halls or multi-functional halls shall not exceed 250; when the occupant load exceeds 2 000, the average number of persons evacuated through each exit door shall not exceed 400 for the number of persons over 2 000.**

2 For the audience hall of gymnasium, the average number of persons evacuated through each exit door should not exceed 400–700.

5.5.17 **The distance for public buildings shall comply with the following requirements:**

1 **The distance from the exit door of a room to the nearest exit shall be not greater than those specified in Table 5.5.17.**

2 **The staircase shall directly lead to the outdoors on the first floor; in case that any staircase is unable to directly lead to the outdoors, an enlarged enclosed stairway or smokeproof vestibule shall be provided on the first floor. In case that the number of storeys does not exceed 4, and the enlarged enclosed stairway or smokeproof vestibule is not provided, the distance between the staircase and the door leading directly to the outdoors shall be not more than 15m.**

Table 5.5.17 Distance from the exit door of a room to the nearest exit(m)

Occupancy		Exit door located between two exits			Exit door located at the both sides or the end of the dead end			
		Class I and II	Class III	Class IV	Class I and II	Class III	Class IV	
Nurseries, kindergartens and aged care facilities		25	20	15	20	15	10	
Entertainment and amusement occupancies		25	20	15	9	-	-	
Health care buildings	Single-/multi-storey	35	30	25	20	15	10	
	High-rise	Ward part	24	-	-	12	-	-
		Other parts	30	-	-	15	-	-
Teaching buildings	Single-/multi-storey	35	30	25	22	20	10	
	High-rise	30	-	-	15	-	-	
High-rise hotels and exhibition buildings		30	-	-	15	-	-	
Other buildings	Single-/multi-storey	40	35	25	22	20	15	
	High-rise	40	-	-	20	-	-	

Notes: 1 The distance from the exit door of a room opening to an open walkway in a building to the nearest exit may be increased by 5m according to those specified in this table.

2 Where the room is located between two staircases, the distance from the exit door of a room to the nearest open stairway shall be reduced by 5m according to those specified in this table; where the room is located at both sides or the end of the dead end, the distance shall be reduced by 2m according to those specified in this table.

3 Where the building is fully sprinklered, the distance may be increased by 25% according to those specified in this table.

3 The distance from any point in the room to the exit door shall be not greater than that from the exit door at the both sides or the end of the dead end to the nearest exit as specified in Table 5.5.17.

4 For the audience hall, exhibition hall, multi-functional hall, dining hall and salesroom in Class I, II public buildings provided with at least 2 exit, the distance from any point in the room to the nearest exit door or exit shall be not greater than 30m, provided that the number of exit doors or exits of such halls or rooms is not less than 2; where the exit door cannot lead directly to the outdoors or exit staircases, an exit passageway with length not greater than 10m shall be provided to lead directly to the nearest exit. Where the building is sprinklered, such distance may be increased by 25% respectively.

5.5.18 Unless otherwise required by provisions of this code, the clear width of the exit doors and exits in public buildings shall be not less than 0.90m and the clear width of the exit passageway and exit stairways shall be not less than 1.10m.

The minimum clear width of the exit door of the staircase on the first floor, exit to the outdoors on the first floor, exit passageway and exit stairways in high-rise public buildings shall comply with the requirements of Table 5.5.18.

Table 5.5.18 The minimum clear width of exit door of staircase on the first floor, exit to the outdoors on the first floor, exit passageway and exit stairways in high-rise public buildings(m)

Building category	Exit door of staircase on the first floor and exit to the outdoors on the first floor	Corridor		Exit stairways
		Rooms on one side	Rooms on both sides	
High-rise health care buildings	1.30	1.40	1.50	1.30
Other high-rise public buildings	1.20	1.30	1.40	1.20

5.5.19 The exit doors of public-use areas in the assembly occupancies and audience halls shall not be provided with threshold, the clear width of the doors shall be not less than 1.40m, and no stair steps shall be provided within 1.4m inside and outside of the doorway.

The clear width of the outdoor passageway of the public-use areas in the assembly occupancies shall be not less than 3.00m and shall lead directly to a spacious area.

5.5.20 For theatres, cinemas, audience halls and gymnasiums, the aggregate clear width of the exit passageway, exit stairways, exit doors and exits shall comply with the following requirements:

1 The clear width of aisle accessways in the audience halls shall be calculated at the rate of not less than 0.60m per 100 persons and shall be not less than 1.00m; the clear width of the side walkway should not be less than 0.80m.

The rows of seats between horizontal aisles should not exceed 20; the number of seats between vertical aisles shall comply with the following requirements: for theatre, cinema and auditorium, the number of seats per row should not exceed 22; for gymnasium, the number should not exceed 26; where the distance between two adjacent rows is not less than 0.90m, the number of seats per row may be increased by 1.0 times, but shall not exceed 50; where the seats has only one vertical aisle, the number of seats per row shall be reduced by half.

2 For theatres, cinemas and auditoriums, the aggregate clear width of all the interior doors, exterior doors, stairways and accessways shall be calculated at the rate of the value (minimum clear width per 100 persons) not less than those specified in Table 5.5.20-1.

Table 5.5.20-1 Minimum clear width per 100 persons in theatre, cinema and auditorium (m/100 persons)

Number of seats in audience hall (seat)		≤ 2 500	≤ 1 200	
Fire-resistance class		Class I and II	Class III	
Location	Door and aisle	Flat	0.65	0.85
		Steps	0.75	1.00
	Stairways	0.75	1.00	

3 For gymnasiums, the aggregate clear width of all the interior doors, exterior doors, stairways and accessways shall be calculated at the rate of the value (minimum clear width per 100 persons) not less than those specified in Table 5.5.20-2.

Table 5.5.20-2 Minimum clear width per 100 persons in gymnasiums (m/100 persons)

Number of seats in audience hall (seat)		3 000-5 000	5 001-10 000	10 001-20 000	
Location	Door and accessway	Flat	0.43	0.37	0.32
		Steps	0.50	0.43	0.37
	Stairways	0.50	0.43	0.37	

Note: The aggregate clear width calculated according to the requirement for the range with greater seat number (for example 5 001-10 000) in this table shall be not less than that calculated according to the requirement for maximum seat number (for example 3 000-5 000) in the first range. For the gymnasium with the number of seats in an audience hall that is less than 3 000, the aggregate clear width of all interior doors, exterior doors, stairs and accessways shall be calculated according to the minimum clear width per 100 persons not less than those specified in Table 5.5.20-1.

4 The entrance from the waiting spaces to the audience hall shall not be used as the exit door.

5.5.21 For public buildings other than theatres, cinemas, auditoriums and gymnasiums, the aggregate clear width of the room exit doors, exits, exit passageways and exit stairways shall comply with the

following requirements:

1 The aggregate clear width of the room exit doors, exits, exit passageways and exit stairways of each floor shall be calculated at the rate of the value (minimum clear width per 100 persons) not less than those specified in Table 5.5.21-1.

Where the number of occupants on each floor is different, the aggregate clear width of the exit stairways may be calculated floor by floor. For aboveground buildings, the aggregate clear width of the stairways of each floor shall be calculated based on the largest number of occupants of this floor or the floors above; For underground buildings, the aggregate clear width of the stairways of each floor shall be calculated based on the largest number of occupants on this floor or the floors below.

Table 5.5.21-1 Minimum clear width of the room exit doors, exits, exit passageways and exit stairways of each floor per 100 persons(m/100 persons)

Number of storeys		Fire-resistance class of buildings		
		Class I and II	Class III	Class IV
Aboveground	1-2	0.65	0.75	1.00
	3	0.75	1.00	-
	≥4	1.00	1.25	-
Underground	Height difference to the level of entrance/exit to outdoors $\Delta H \leq 10\text{m}$	0.75	-	-
	Height difference to the ground entrance/exit to outdoors $\Delta H > 10\text{m}$	1.00	-	-

2 For underground or semi-underground assembly halls, rooms, entertainment and amusement occupancies, the aggregate clear width of the room exit doors, exits, exit passageways and exit stairways shall be calculated at the rate of no less than 1.00m per 100 persons.

3 For doors to the outdoors on the first floor serving the entire building, the aggregate clear width shall be calculated based on the maximum number of occupants of the floor in the building; For doors to the outdoors only serving the first floor, the aggregate clear width may be calculated based on the number of occupants on the first floor.

4 The occupant load of entertainment and amusement occupancies shall be calculated based on the floor area and the occupant density. For video halls, the occupant density should be at least 1.0 person/m²; for other kinds of entertainment and amusement occupancies, the occupant density should be at least 0.5 person/m².

5 For areas having fixed seats, the occupant load shall be calculated by 1.1 times of the actual number of the seats installed therein.

6 The occupant load of the exhibition hall shall be calculated based on the floor area and the occupant density, and the occupant density should be not less than 0.75 person/m².

7 The occupant load of mercantile occupancies shall be calculated based on the floor area of the salesrooms on each floor multiplied by the occupant density specified in Table 5.5.21-2. The occupant density of the stores for building materials, furniture and light fixture exhibition buildings may be calculated according to 30% of the values specified in Table 5.5.21-2.

Table 5.5.21-2 Occupant density in salesroom of mercantile occupancies(person/m²)

Floor	Second basement level	First basement level	First and second floors aboveground	Third floor aboveground	Fourth floor or above aboveground
Occupant density	0.56	0.60	0.43-0.60	0.39-0.54	0.30-0.42

5.5.22 Metal security grills should not be provided for windows and balconies for public assembly buildings; where such grills are to be provided, they shall be able to open from inside, and applicable escape measures corresponding to the location of the windows or balconies should be provided.

5.5.23 Refuge floors(rooms)shall be provided in public buildings with the building height greater than 100m. The refuge floor(room)shall comply with the following requirements:

1 The height from the floor of the first refuge floor (room) to the ground of the operation site for fire fighting and rescue shall be not greater than 50m and the height between two refuge floors (rooms)should be not greater than 50m.

2 The exit stairways passing through a refuge floor (room) shall be separated or discontinued on such floor so that the exit route is diverted to pass through part of the refuge area before it is continued to exit downwards.

3 The net area of a refuge floor (room) shall be able to meet the requirements of the designed number of refugees, and should be calculated at the rate of 5.0 persons/m².

4 The refuge floor may be used as a floor for equipment. The equipment pipes should be arranged together. Flammable, combustible liquid or gas pipes shall be arranged together. The area for equipment pipes shall be separated from the refuge areas by a fire partition wall with fire-resistance rating not less than 3.00h. Pipe shafts and equipment rooms shall be separated from the refuge area by a fire partition wall with fire-resistance rating not less than 2.00h. The doors of pipe shafts and equipment rooms shall not open toward the refuge area directly; where such doors are to be provided, the distance to the entrance/exit of the refuge floor shall be not less than 5m, and the doors shall be Class A fire doors.

Flammable, combustible liquid or gas pipes shall be prohibited in the refuge room. No openings other than exterior windows or exit doors shall be provided for the refuge room.

5 Exits for fire elevator shall be provided.

6 Fire hydrants and fire hose reels shall be provided.

7 Dedicated telephone and emergency broadcasting shall be provided.

8 Readily distinguished indication signs shall be provided at the entrance from the refuge floor(room) to the staircase and at the exit from the staircase to the refuge floor (room).

9 Openable windows that open outwards or independent mechanical smokeproof facilities shall be provided, the exterior window shall be Class B fire window.

5.5.24 For high-rise inpatient medical care buildings, refuge rooms shall be provided for the inpatient building floors and clean operating departments on the second floor and above and shall comply with the following requirements:

1 The number of care suites serviced by a refuge room shall not exceed 2; the net area of the refuge room shall be established based on the size that each care suite shall be not less than 25.0m².

2 Where the refuge room is also used for other purposes, the safety of the refugees shall be

guaranteed and the net area for refuge shall not be reduced.

3 Refuge rooms shall be close to the staircases and shall be separated from the remainder of the building by a fire partition wall with fire-resistance rating not less than 2.00h and a Class A fire door.

4 Dedicated telephone and emergency broadcasting shall be provided.

5 Readily distinguished indication signs shall be provided at the entrance of the refuge room.

6 Openable Windows that open outwards or independent mechanical smokeproof facilities shall be provided, the exterior window shall be Class B fire window.

5.5.24A Aged care facilities 3 storeys or above and the total building area greater than 3 000m² (including those arranged on the third floor or above in other building occupancies) shall be provided with one refuge room close to each exit stairway on the second floor or each floor above, where aged care facilities are provided. Refuge rooms may not be required in case that the aged care facilities are provided with open verandas leading directly to the exit stairways or exits, or outdoor platforms directly leading to the exit passageways and complying with requirements for refuge. The net area for refuge in the refuge room shall be not less than 12m². The refuge room may be provided within the vestibules of the smokeproof staircases and fire elevators. The other requirements for refuge rooms shall comply with those specified in Article 5.5.24 of this code.

The aged care facilities for the disabled, where the number of storeys is 2 or above, shall be provided with gas masks based on the actual occupant load.

III Residential buildings

5.5.25 The arrangement of exits of residential buildings shall comply with the following requirements:

1 For buildings with height not greater than 27m, where the gross floor area on any floor of each unit is greater than 650m² or the distance from any household door to the nearest exit is greater than 15m, the number of exits on each floor of each unit shall be not less than 2.

2 For buildings with height greater than 27m but not greater than 54m, where the gross floor area on any floor of each unit is greater than 650m² or the distance from any household door to the nearest exit is greater than 10m, the number of exits on each floor of each unit shall be not less than 2.

3 For buildings with height greater than 54m, the number of exits on each floor of each unit shall be not less than 2.

5.5.26 For residential buildings with height greater than 27m but not greater than 54m, where one exit stairway is provided for each unit, the exit stairway shall be able to lead to the roof, the exit stairways between any two adjacent units shall be connected at the roof, and the household door shall be Class B fire door. Where the exit stairways are not able to lead to the roof or be connected at the roof, two exits shall be provided for each unit.

5.5.27 Exit stairways of residential buildings shall comply with the following requirements:

1 For residential buildings with height not greater than 21m, open stairway is permitted. Where the exit stairway is arranged adjacent to elevator shafts, such stairway shall be enclosed; open stairway is permitted in case that the household doors opening to such stairway are Class B fire door.

2 For residential buildings with height greater than 21m but not greater than 33m, enclosed stairway shall be provided; open staircase is permitted where the household doors opening to such

stairway is Class B fire door.

3 For residential buildings with the height greater than 33m, smokeproof staircases shall be provided. Household doors should not directly open to the vestibule. Where household doors are to directly open to the vestibule, the number of household doors opening to the same vestibule on each floor shall be not more than 3, and the doors shall be Class B fire door.

5.5.28 For residential units, where the exit stairways are not able to be arranged remotely from each other and the distance from any household door to the entrance of the nearest exit stairway is not greater than 10m, scissor staircases are permitted and the following requirements shall be met:

1 Smokeproof staircases shall be provided.

2 Fire partition walls with fire-resistance rating not less than 1.00h shall be provided between the stair flights.

3 The vestibule of the staircases should not be shared; where it is to be shared, the net area of the vestibule shall be not less than 6.0m².

4 The vestibule of the staircase or the shared vestibules should not be shared with the vestibule of the fire elevator; where the shared vestibule of the staircases are to be shared with the vestibule of the fire elevator, the net area of the shared vestibule shall be not less than 12.0m² and the length of the short side shall be not less than 2.4m.

5.5.29 The evacuation distance of the residential building shall comply with the following requirements:

1 The distance from the household door directly leading to the exit passageway to the nearest exit shall be not greater than those specified in Table 5.5.29.

Table 5.5.29 Distance from the household door directly leading to exit passageways to the nearest exit(m)

Category	Household door between two exits			Household door at both sides of the dead end or at the end		
	Class I and II	Class III	Class IV	Class I and II	Class III	Class IV
Single-/multi-storey	40	35	25	22	20	15
High-rise	40	-	-	20	-	-

Notes: 1 The maximum distance from the household door to an open veranda to the nearest exit may be increased by 5m based on those specified in this table.

2 The distance from the household door directly leading to exit passageways to the nearest open stairway shall be 5m shorter than those specified in this table where the household door locates between two stairways; and it shall be 2m shorter than those specified in this table where the door locates at both sides or at the end of the dead end.

3 Where the sprinkler system is provided in the residential buildings, the distance may be increased by 25% on the basis of those specified in this table.

4 The distance from the household door of skip floor apartment building to the nearest exit shall be measured from the household door; the distance of the indoor stair may be calculated as 1.50 times of the horizontal projection length of the stair flight.

2 The staircase shall directly lead to the outdoors on the first floor, or an enlarged enclosed stairway or smokeproof vestibule shall be provided on the first floor. Where the number of storeys does not exceed 4, the distance between the staircase and the door leading directly to the outdoors shall be not more than 15m.

3 The distance from any point of the room to the household door directly leading to the exit passageways shall be not greater than the maximum distance from the exit door at both sides or the end of the dead end to the nearest exit as specified in Table 5.5.29.

Note: For duplex apartment buildings, the distance of the indoor stair may be calculated as 1.50 times of the horizontal projection length of the stair flight.

5.5.30 The aggregate clear width of the household doors, exits, exit passageways and exit staircases of residential buildings shall be established by calculation, and the clear width of household doors and exits shall be not less than 0.90m, and the clear width of exit passageways, exit stairways and doors to the outdoors on the first floor shall be not less than 1.10m. For the exit stairways with one side provided with handrail in residential buildings with the height not greater than 18m, the clear width shall be not less than 1.0m.

5.5.31 Refuge floors shall be arranged in residential buildings with height greater than 100m; the refuge floors shall comply with those specified in Article 5.5.23 of this code.

5.5.32 For residential buildings with height greater than 54m, one room of each household shall comply with the following requirements:

1 It shall be arranged to be adjacent to the exterior wall and be provided with openable exterior window;

2 The fire-resistance rating of the enclosing walls of the room shall be not less than 1.00h; the room door shall be Class B fire door; the fire integrity of the exterior window should be not less than 1.00h.

6 Building construction

6.1 Fire wall

6.1.1 Fire wall shall be constructed directly onto the foundation or the load-bearing structures like structural frames and beams; the fire-resistance rating of load-bearing structures like frames and beams shall be not less than that of the fire wall.

The fire wall shall extend continuously from the foundation to the beam, floor slab or roof deck. Where the fire-resistance rating of the roof load-bearing structure and roof panel in high-rise factory buildings (storages) is less than 1.00h, and the fire-resistance rating of the roof load-bearing structure and roof panel in other buildings is less than 0.50h, the fire wall shall be extended up through the roof for a height of at least 0.5m above the top surface of the roof covering.

6.1.2 Where the horizontal distance from the centerline of the fire wall cross section to the end-surface of the skylight is less than 4.0m, and the end-surface of the skylight is combustible, measures shall be taken to prevent fire spread.

6.1.3 Where the exterior wall of a building is difficult-combustible or combustible, the fire wall shall protrude not less than 0.4m from the surface of the exterior wall; the exterior walls on both sides of the fire wall shall be noncombustible, the width of which shall be not less than 2.0m and its fire-resistance rating shall be not less than that of the exterior wall.

In case the exterior wall of a building is noncombustible, fire wall may not protrude from the surface of the exterior wall. The horizontal distance between any two doors, windows or other openings on both sides of the fire wall shall be not less than 2.0m; where measures such as using Class B fire windows to prevent fire spread horizontally has been taken, such distance is not limited.

6.1.4 The Fire wall in a building should not be provided at the corner. Where it is to be provided, the horizontal distance between any two doors, windows or other openings in the walls on both sides of the interior angle shall be not less than 4.0m; where measures such as using Class B fire windows to prevent fire spread horizontally has been taken, such distance is not limited.

6.1.5 Doors, windows and other openings shall not be permitted in the fire wall; where it is to be provided, such openings shall be protected by Class A fire doors and windows unable to be opened or self-closing in case of fire.

The fire wall shall not be penetrated by pipes for combustible gases and Class A, B, C liquids. Exhaust ducts shall not be installed inside the fire wall.

6.1.6 Pipes, except those specified in Article 6.1.5 of this code, should not penetrate the fire wall; where it is to be penetrated, firestop shall be used to fill or seal the gap between the wall and the pipe tightly; noncombustible material shall be used as the insulation material for pipes penetrating through the fire wall; where the pipes are difficult-combustible or combustible, fire prevention measures shall be taken for pipes on both sides of the fire wall.

6.1.7 The construction of the fire wall shall ensure sufficient structural stability under fire conditions to allow the failure of the roof trusses, beams or floor slabs on either side without collapse of the wall.

6.2 Building elements and pipe shafts

6.2.1 The stage and the audience hall of the buildings like theatres shall be separated by fire partition walls with the fire-resistance rating not less than 3.00h.

Fire partition walls with fire-resistance rating not less than 1.50h may be used to separate the upper part of the stage from the concealed space above the suspended ceiling of the audience hall. The door in the partition wall shall be Class B fire door.

Light control room and storeroom for combustible material in the lower part of the stage shall be separated from other parts by fire partition wall with fire-resistance rating not less than 2.00h.

Film projection room and rewind room shall be separated from other parts by fire partition walls with the fire-resistance rating not less than 1.50h. Openings for observation and projection shall be fire protected.

6.2.2 Operating rooms or departments, delivery rooms, intensive care units(ICU) , rooms for precise and precious medical equipment, storerooms, laboratories and film rooms in the health care buildings, children's play areas such as the nurseries, rooms for children use in the kindergartens and the entertainment halls in mixed-use buildings as well as the aged care facilities shall be separated from the remainder of the building by 2.00h fire-resistance-rated partition walls and 1.00h fire-resistance-rated floors. The doors and windows which must be provided in the wall shall be Class B fire doors and windows.

6.2.3 The partition walls with fire-resistance rating not less than 2.00h shall be used to separate the following locations from other parts; doors and windows in the wall shall be Class B fire doors and windows, where it is impractical to provide fire doors, fire shutters may be installed, but it shall comply with those specified in Article 6.5.3 of this code.

- 1 Portions for Class A and B production and portions using Class C liquid in the factory building;
- 2 Places of production with open flame and high temperature in the factory building;
- 3 Rooms with different fire classification arranged in Class A, B and C factory buildings (storages);
- 4 Auxiliary storerooms in civil buildings; auxiliary rooms at the backstage of theatres;
- 5 Kitchens other than those in residential buildings, the common kitchen in dormitories or apartment buildings and kitchens in other buildings;
- 6 Mobile garages provided in residential buildings.

6.2.4 Fire partition walls in buildings shall extend continuously from the foundation to the beam, floor slab or roof deck. Walls between families and between units of the residential buildings shall extend to the beam, floor slab or roof deck; the fire-resistance rating of the roof deck shall be not less than 0.50h.

6.2.5 Unless otherwise required by this code, solid walls with height not less than 1.2m or fire-rated horizontal projections with depth not less than 1.0m and width not less than that of the opening shall be provided between the openings of upper and lower storeys in exterior walls of the building; where sprinkler system is installed, the height of the solid wall between openings of upper and lower storeys shall be not less than 0.8m. Where it is difficult to provide solid walls, fire-resisting glass walls may be provided instead; the fire integrity of such glass walls of high-rise buildings shall be not less than 1.00h, and the fire integrity of such glass walls of multi-storey

buildings shall be not less than 0.50h. The fire integrity of the exterior windows shall be not less than that of the fire-resisting glass walls.

The width of the exterior walls between any two horizontal openings of the adjacent households in residential buildings shall be not less than 1.0m; where the width is less than 1.0m, vertical projection protruding at least 0.6m from the exterior walls shall be provided between openings.

Fire-resistance rating and combustibility of the solid wall, fire-rated horizontal or vertical projection shall be not less than those required for the exterior walls of buildings with corresponding fire-resistance class.

6.2.6 As for curtain walls, fire protection measures complying with those specified in Section 6.2.5 of this code shall be taken at the perimeter of the floor slabs on each storey; perimeter fire barriers shall be used to seal the gaps and joints between curtain walls and floor slabs/partition walls on each storey.

6.2.7 Fire command centers, extinguishing equipment rooms, fire pump rooms, equipment rooms for ventilating and air conditioning, transformer and distribution rooms provided in buildings shall be separated from the remainder of the building by 2.00h fire-resistance-rated partition walls and 1.50h fire-resistance-rated floors.

The ventilating equipment rooms provided in Class D and E factory buildings shall be separated from other parts by 1.00h fire-resistance-rated partition walls and 0.50h fire-resistance-rated floors.

The doors of ventilating and air conditioning equipment rooms, or transformer and distribution rooms opening to other space of the building shall be Class A fire doors; the doors of fire command centers and other equipment rooms opening to other space of the building shall be Class B fire doors.

6.2.8 If foam plastics and other combustibles are used as the thermal insulation of walls of the cold stores and low temperature production locations, noncombustible thermal insulating materials should be installed at the connections of the walls and each floor slabs for horizontal fire separation. The fire-resistance rating of the horizontal fire separation shall be not less than that of the floor slab. The thermal insulation of the attic floors and the partition walls of the cold stores should be separated by non-combustible walls.

Where foam plastics etc. are used as interior thermal insulation of cold stores and low temperature production places, the combustibility of the thermal insulation shall be not less than Class B₁ and the surface of the thermal insulation layer shall be protected with noncombustible materials.

Where storerooms and workshops of cold stores are built adjoining to each other, such portions shall be separated by fire walls. Where opening connections are to be provided in the fire walls, measures such as fire separation room shall be taken, and doors on both sides of such room shall be Class A fire doors. Where ammonia compressor room is adjoining to the workshop, the partition wall shall be fire wall without any door or window.

6.2.9 The vertical shafts such as elevator shafts in buildings shall comply with the following requirements:

1 Elevator shafts shall be arranged independently. Pipes for combustible gases and Class A, B, and C liquids must not be laid inside the shaft. Cables, wires irrelevant to the elevator operation

shall not be laid inside such shaft. Other than elevator doors, emergency escape openings and vents, no other openings shall be provided in the walls of elevator shafts.

2 Such vertical shafts as cable shafts, pipe shafts, flues, exhaust ducts and refuse chutes shall be arranged independently. The fire-resistance rating of shaft enclosures shall be not less than 1.00h; the access door in the shaft enclosure shall be Class C fire door.

3 Cable shafts and pipe shafts within the buildings shall be blocked at the joints of floor slabs on each floor with noncombustible material or firestops with the fire-resistance rating not less than that of the floor.

Openings that connect the cable shafts, pipe shafts with rooms, corridors in buildings shall be blocked with firestops.

4 Refuse chutes in the building should be arranged adjacently to the exterior wall; the exhaust outlets of refuse chutes shall be open directly to the outdoors; refuse hopper shall be made of noncombustible material and be capable to close automatically.

5 The fire-resistance rating of the elevator landing door shall be not less than 1.00h and shall comply with the requirements of integrity and insulation specified in current national standard GB/T 27903 *Fire Resistance Test for Lift Landing Doors—Methods of Measuring Integrity, Thermal Insulation and Heat Flux*.

6.2.10 Outdoor electroluminescent billboards shall not be directly installed onto the combustible or difficult-combustible walls.

The arrangement of outdoor billboards shall not block the exterior windows of the building from view and shall not influence the outdoor fire-fighting and rescue operations.

6.3 Roof, concealed spaces above suspended ceiling and joints

6.3.1 Where combustible materials are used for the insulation of the concealed spaces above suspended ceiling of buildings with Class III, IV fire-resistance class, grey tiles shall not be permitted for the roof.

Noncombustible materials shall be used as the insulation within 0.5m around the nonmetal chimney or 0.7m around the metal chimney in the concealed spaces above suspended ceiling.

6.3.2 For concealed spaces above suspended ceiling in Class III buildings with more than 2 storeys, dormers shall be provided within each fire partition area. The spacing of the dormers should not be greater than 50m.

6.3.3 For concealed spaces above suspended ceiling containing combustible materials, each fire partition area shall be provided with entrances of the size not less than 0.7m both in width and height; for public buildings, the number of such entrances should not be less than 2. Such entrances should be in the corridors close to the staircases.

6.3.4 Deformation joints shall be sealed by noncombustible materials and the construction base of such joints shall be noncombustible.

The wires, cables and pipes for combustible gases and Class A, B, C liquids should not penetrate the deformation joints of buildings. Where it is inevitable, sleeves made of noncombustible materials shall be provided at the place where the deformation joints are penetrated, or shall take other measures to prevent the effect of the deformation. The penetration shall be fire stopped.

6.3.5 Firestops shall be used to seal the joints where ducts or pipes for smoke control, smoke exhaust, heating, ventilating and air conditioning and other pipes in buildings penetrate the fire

partition walls, floors or fire walls.

Where air ducts penetrate the fire partition walls, floor slabs and fire walls, the air ducts within 2.0m of each side of the fire dampers or smoke fire dampers at the penetration shall be fire resisting ducts, or such ducts shall be fire protected, and the fire protection rating shall be not less than that of the fire partition wall.

6.3.6 For pipes in buildings that are subject to deformation under high temperatures and flames, fire retardant measures should be taken at the floor penetrations and on both sides of the fire partition wall penetrations.

6.3.7 Measures preventing fire spread shall be taken between openings of roofs and the adjacent buildings or facilities.

6.4 Exit staircase and stairway

6.4.1 Exit staircase shall comply with the following requirements:

1 Natural lighting and ventilation shall be available for the staircases which should be arranged so as to be adjacent to the exterior walls. Where it is adjacent to the exterior wall, the horizontal distance from the windows in the exterior walls of staircases, vestibules and shared vestibules to the nearest edges of the doors, windows and other openings on both sides of such windows shall be not less than 1.0m.

2 Water boiling rooms, combustible material storages, refuse chutes shall not be permitted in the staircases.

3 Staircases shall be designed without any protrusions or other obstacles that hinder occupant evacuation.

4 Enclosed stairways, smokeproof staircases and their vestibules shall not be permitted to be enclosed with roller shutters.

5 Class A, B, C liquid pipes shall not be permitted in staircases.

6 Combustible gas pipes must not penetrate or be permitted in the enclosed stairways, smokeproof staircases and their vestibules. Combustible gas pipes shall not be permitted in open staircases; where it is necessary to install combustible gas pipes and combustible gas meters in the open staircases of residential buildings, metal pipes shall be used and valves shutting off the gas source shall be installed.

6.4.2 Enclosed stairways shall comply with the requirements of Article 6.4.1 of this code, and the following requirements as well:

1 Where the natural ventilation is unavailable or the natural ventilation fails to meet the requirements, mechanical pressurized air supply system shall be provided or smokeproof staircases shall be provided.

2 Other than exits/entrances and exterior windows of the staircases, other doors, windows or openings shall not be permitted in the walls of the staircases.

3 For the high-rise buildings, assembly public buildings, assembly multi-storey Class C factory buildings and Class A and B factory buildings, the doors of the enclosed stairways shall be Class B fire door and shall open in the direction of egress; two-way swinging doors may be permitted for other buildings.

4 On the first floor, the passageway and hallway may be included in the staircase to form an

enlarged enclosed stairway. Class B fire door shall be provided to separate it from the remainder of the building.

6.4.3 Smokeproof staircases shall comply with the requirements of Article 6.4.1 of this code, and the following requirements as well:

1 Smokeproof facilities shall be provided.

2 The vestibule may be shared with the lobby of the fire elevator.

3 Net area of the vestibule: for public buildings and high-rise factory buildings (storages), the area shall be not less than 6.0m²; for residential buildings, the area shall be not less than 4.5m².

Where the vestibule is shared with the lobby of the fire elevator, the net area of the shared vestibule: for public buildings and high-rise factory buildings (storages), it shall be not less than 10.0m²; for residential buildings, it shall be not less than 6.0m².

4 The doors leading from the exit passageways to the vestibules and from the vestibules to the staircases shall be Class B fire doors.

5 Except vestibules of the staircases for residential buildings, no doors, windows or other openings other than exit doors and air supply inlets shall be permitted in the walls of the smokeproof staircases and vestibules.

6 On the first floor, the passageway and hallway may be included in the staircase vestibule to form an enlarged smokeproof vestibule. Class B fire doors shall be provided to separate it from the remainder of the building.

6.4.4 Other than discontinued exit staircases leading to the refuge floors, the plane position of the exit staircase on every floor in the building shall not be changed.

Other than indoor stairs in the residential buildings, the exit staircases of underground or semi-underground buildings (basement) shall comply with the following requirements:

1 For underground or semi-underground buildings (basements) with the height difference between the lowest floor of the basement level and the level of exit to outdoors greater than 10m or with 3 or more basement levels, smokeproof staircases shall be provided; enclosed stairways shall be provided for other underground or semi-underground buildings (basements).

2 It shall be separated from the other parts on the first floor with fire partition walls with fire-resistance rating not less than 2.00h and shall directly lead to the outdoors; where it is necessary to provide doors in the partition wall, Class B fire door shall be installed.

3 The portions of underground or semi-underground and aboveground of the building shall not share the same staircase. Where it is to be shared, fire partition walls with fire-resistance rating not less than 2.00h and Class B fire doors shall be provided to separate the underground or semi-underground portions and the aboveground portions on the first floor, and readily distinguished signs shall be installed.

6.4.5 Outdoor exit stairways shall comply with the following requirements:

1 The handrail height shall be not less than 1.10m; the clear width of the stairway shall be not less than 0.90m.

2 The inclination of the flights shall be not greater than 45°.

3 Flights and landings shall be noncombustible. The fire-resistance rating of the landing shall be not less than 1.00h, and the fire-resistance rating of the stair flight shall be not less than 0.25h.

4 The doors leading to the exterior stairs shall be Class B fire doors, and the doors shall open in direction of egress.

5 Other than exit doors, openings like doors, windows shall not be permitted in the walls within 2m around the stairways. Landings shall be provided between the exit doors and the stair flights.

6.4.6 Metal stairs may be used as the second exit in Class D and E factory buildings, but the clear width shall be not less than 0.90m and the inclination of the flight shall be not greater than 45°.

For Class D and E high-rise factory buildings, where the operators on each storey of the operating platform does not exceed 2 and the total number of operators of the operating platform does not exceed 10, open stairs may be permitted, or metal stairs with clear width not less than 0.90m and flight inclination not greater than 60° may be permitted.

6.4.7 Spiral stairs and stairs with winder treads should not be used as the exit stairways or stairs on the passageway. Where it is inevitable, the plane angle formed by the upper and lower treads shall be not greater than 10°, and the tread depth measured at a point 250mm from the handrail at the narrower end of the tread shall be not less than 220mm.

6.4.8 The horizontal clear spacing between any two stair flights and any two handrails of the exit stairways in buildings for public use should not be less than 150mm.

6.4.9 Class III buildings with building height greater than 10m shall be provided with outdoor fire ladder leading to the roof. The fire ladder shall not face the dormer, its width shall be not less than 0.6m and it should be started 3.0m away from the ground level.

6.4.10 Normally-open Class A fire doors shall be installed for exit passageways leading from one fire compartment to the other.

6.4.11 Exit doors in buildings shall comply with the following requirements:

1 For exit doors of civil buildings and factory buildings, side-hinged or pivoted swing doors opening in the direction of egress shall be provided. Sliding doors, roller shutters, overhang doors, revolving doors and folding doors shall not be permitted. Other than Class A and B workshops, for rooms with the occupant load not exceeding 60 and the average number of occupants through each door not exceeding 30, the opening direction of the exit door shall not be limited.

2 Exit doors of storages shall be side-hinged or pivoted swing doors opening in the direction of egress; sliding doors or roller shutters installed on the outside of the exterior wall may be permitted for Class C, D and E storages on the first floor.

3 For doors to exit stairways or staircases, the opening of such doors in any position shall not reduce the effective widths of the landings.

4 For exit doors of assembly places necessary for access control and doors leading to the outside of residential buildings, dormitories or apartment buildings provided with access control systems, such doors shall be guaranteed to be easily opened from inside without key or any other tools in case of fire, and there shall be readily distinguished sign for usage notice at visible positions.

6.4.12 The outdoor open spaces like sunken yards used as means of fire separation shall comply with the following requirements:

1 The horizontal distance between any two openings leading to the outdoor open spaces like sunken yards of fire areas complying with Article 5.3.5 shall be not less than 13m. Except for occupant evacuation, the outdoor open space shall not be used for other commercial purposes or purposes that

may result in fire spreading. The net area for evacuation shall be not less than 169m².

2 At least one exit stairway directly leading to the ground level shall be provided in the outdoor open spaces like sunken yards. Where fire compartments connecting to the sunken yards needs to use it for evacuation, the total clear width of the exit stairways of such sunken yards shall be not less than the total design clear width of the exits to the outdoor open space for any fire compartment.

3 Where rain sheds are provided, such sheds shall not completely enclose the sunken yards; the openings around the sheds shall be arranged uniformly. The area of such openings shall be not less than 25% of the gross ground area of the sunken yards and the opening height shall be not less than 1.0m. If louver is provided for such openings, the effective smoke exhaust area of such louver may be calculated by 60% of the air vent area of the louver.

6.4.13 Fire separation room shall comply with the following requirements:

- 1 The gross floor area shall be not less than 6.0m².
- 2 The door shall be Class A fire door.
- 3 The doors leading to the fire separation room from different fire compartments shall not be counted as exits; the minimum spacing between such doors shall be not less than 4m.
- 4 The internal decoration materials shall be Class A.
- 5 It shall not be used for other purposes other than evacuation.

6.4.14 Refuge passageways shall comply with the following requirements:

1 The fire-resistance rating of the fire partition walls for refuge passageways shall be not less than 3.00h; the fire-resistance rating of the floor shall be not less than 1.50h.

2 The number of exits directly leading to the outdoors shall be not less than 2, and such exits shall be arranged in different directions; 1 exit directly leading to the outdoors may be permitted where the refuge passageway is only connected with one fire compartment and such fire compartment has at least 1 exit directly leading to the outdoors; the distance between the doors of any fire compartment leading to the refuge passageway and exits directly leading to the outdoors shall be not greater than 60m.

3 The clear width of the refuge passageway shall be not less than that of the total design clear width of the exits to the passageway for evacuation from any fire compartment.

4 The combustibility of the internal decoration materials shall be Class A.

5 A smokeproof vestibule shall be provided between the fire compartment and the refuge passageway. The net area of the vestibule shall be not less than 6.0m²; the door opening to the vestibule shall be Class A fire door, and door of vestibules opening to the refuge passageway shall be Class B fire door.

6 Fire hydrant, fire emergency lighting, emergency broadcast and fire department direct line shall be installed in the refuge passageway.

6.5 Fire door, fire window and fire shutter

6.5.1 Fire doors shall comply with the following requirements:

1 Fire doors for frequent access in a building should be normally open. The normally-open fire door shall be able to close automatically in case of fire and shall have the function of signal feedback.

2 Other than the location where normally-open fire door is permitted, fire doors in other locations shall be normally closed. The normally-closed fire door shall be provided with a warning sign in visible position, such as "Keep Closed".

3 Other than the access fire door of the pipe shaft and the household fire door of the residential building, fire doors shall have the function of automatic closing in case of fire. Fire doors with two leaves shall have the function of automatic closing in sequence.

4 Other than those specified in Item 4 of Article 6.4.11 of this code, fire doors shall be able to be opened manually on both sides.

5 Where installed near the building deformation joints, fire doors shall be installed at the side with more storeys and shall guarantee that the open leaves of fire doors shall not cross the deformation joints.

6 Fire doors shall be smokeproof when being closed.

7 Class A, B and C fire doors shall comply with the requirements of the current national standard GB 12955 *Fire Resistant Doorsets*.

6.5.2 Fire windows installed in the fire walls and fire partition walls shall be unopenable or have the function of automatic closing in case of fire.

Fire windows shall comply with the requirements of the current national standard GB 16809 *Fire Resistant Windows*.

6.5.3 Where fire shutters are installed at locations for fire separation, such fire shutters shall comply with the following requirements:

1 Other than atriums, where the width of the location needing to be fire separated is not greater than 30m, the width of the fire shutter shall be not greater than 10m; where the width of such locations is greater than 30m, the width of the fire shutter shall be not greater than 1/3 of the width of such locations and shall be not greater than 20m.

2 Fire shutters shall automatically close by gravity in case of fire.

3 Unless otherwise required by provisions of this code, the fire-resistance rating of the fire shutter shall be not less than that required for the wall provided at the same location.

Sprinkler systems may not be provided where the fire-resistance rating of the fire shutter meets the relevant performance criteria for fire integrity and insulation required by current national standard GB/T 7633 *Fire Resistance Tests—Door and Shutter Assemblies*.

Sprinkler systems shall be provided where the fire-resistance rating of the fire shutter only meets the relevant performance criteria for fire integrity required by current national standard GB/T 7633 *Fire Resistance Tests—Door and Shutter Assemblies*. The design of the sprinkler system shall comply with the requirements of the current national standard GB 50084 *Code for Design of Sprinkler Systems*, the design fire duration of the sprinkler system shall be not less than the fire-resistance rating of the fire shutter.

4 Fire shutters shall be smokeproof, and firestops shall be used to seal the gaps between the fire shutters and floors, beams, walls and columns.

5 Fire shutters that need to descend automatically in case of fire shall have the function of signal feedback.

6 Other requirements shall comply with the requirements of the current national standard GB 14102 *Fire Resistant Shutter*.

6.6 Overpass, trestle and pipe trench

6.6.1 Overpasses, trestles over/above buildings as well as trestles for conveying combustible materials, combustible gases and Class A, B, C liquids shall be noncombustible.

6.6.2 Trestles for conveying substances with fire and explosion hazard shall not be used as evacuation routes.

6.6.3 Fire spread prevention measures should be taken for enclosed overpasses, door openings connecting trestles and buildings as well as the enclosed pipe trenches(galleries)for laying Class A,B,C liquid pipes.

6.6.4 Measures shall be taken for overpasses and galleries connecting two buildings to prevent fire spread between them. When overpasses or galleries are noncombustible and only used for passing through, and the openings leading to the overpasses or galleries meet the requirements for exits, such openings may be used as exits.

6.7 Building thermal insulation and exterior wall finish

6.7.1 For interior and exterior insulation system of buildings, Class A insulation materials should be recommended, Class B₂ should not be used, and Class B₃ must not be used; the fire-resistance rating of the walls or roof panels supporting the insulation systems shall comply with the relevant requirements of this code.

6.7.2 Where the exterior wall is provided with interior insulation system, the system shall comply with the following requirements:

1 Insulation shall be Class A materials for assembly occupancies, locations with fire hazard due to the application of fire, oil and gas, and such locations or parts as exit staircase, refuge passageway, refuge room and refuge floor in buildings;

2 For locations other than those specified in Item 1 above, insulation shall be Class A or Class B₁ materials with properties of low smoke density and toxicity in case of fire;

3 Insulation system shall be protected with noncombustible materials. Where Class B₁ insulation materials are used, the thickness of the protective layer shall be not less than 10mm.

6.7.3 Where exterior walls are composite wall without cavity between insulation materials in the middle and wall claddings on both sides, the fire-resistance rating of such composite exterior wall shall comply with the relevant requirements of this code; where Class B₁ and B₂ insulation materials are used, the wall claddings on both sides of the insulation material shall be noncombustible and the thickness of the cladding on each side shall be not less than 50mm.

6.7.4 For assembly occupancies and buildings with assembly occupancies, combustibility of the exterior insulation materials of the exterior wall shall be Class A.

6.7.4A Other than those specified in Article 6.7.3 of this code, the combustibility of the interior, exterior and roof insulation materials of the following aged care facilities shall be Class A:

1 Independent aged care facilities;

2 The total area of the aged care facilities within mixed-use buildings is greater than 500m².

6.7.5 Where there is no cavity between the insulation and the exterior wall or decoration layer, the combustibility of the insulation material shall comply with the following requirements:

1 For residential buildings:

1)It shall be Class A where the building height is greater than 100m;

2)It shall be not less than Class B₁, where the building height is between 27m to 100m;

3)It shall be not less than Class B₂, where the building height is not greater than 27m.

2 For buildings other than residential buildings, assembly occupancies and buildings with

assembly occupancies:

- 1) It shall be Class A where the building height is greater than 50m;**
- 2) It shall be not less than Class B₁ where the building height is between 24m to 50m;**
- 3) It shall be not less than Class B₂ where the building height is not greater than 24m.**

6.7.6 Other than assembly occupancies and buildings with assembly occupancies, where there is a cavity between the insulation and the exterior wall or decoration layer, the combustibility of the insulation material shall comply with the following requirements:

- 1 It shall be Class A where the building height is greater than 24m;**
- 2 It shall be not less than Class B₁ where the building height is not greater than 24m.**

6.7.7 Other than those specified in Article 6.7.3 of this code, where the exterior wall finish uses Class B₁, B₂ insulation materials according to the requirements of this section, it shall comply with the following requirements:

1 Other than public buildings using Class B₁ insulation materials as the exterior wall finish and with building height not greater than 24m, and residential building using Class B₁ insulation materials and with building height not greater than 27m, the fire integrity of doors and windows in the exterior walls shall be not less than 0.50h.

2 Horizontal fire separation belts shall be provided on each storey. The fire separation belt shall be Class A material and the width shall be not less than 300mm.

6.7.8 Exterior wall insulation systems shall be completely protected by noncombustible materials. Other than those specified in Article 6.7.3 of this code, where Class B₁ and B₂ insulation materials are used according to this section, the thickness of the protective layers shall be not less than 15mm on the first floor and shall be not less than 5mm for other floors.

6.7.9 The cavity between the insulation and the exterior wall or decoration layer shall be fire stopped at the floor slab of each storey.

6.7.10 For the exterior insulation system on roof, the combustibility of insulation material shall be not less than Class B₂ where the fire-resistance rating of the roof slab is not less than 1.00h; the combustibility of insulation material shall be not less than Class B₁ where the fire-resistance rating of the roof slab is less than 1.00h. Noncombustible materials shall be used as the protective layers and the thickness of the protective layer shall be not less than 10mm where Class B₁ or B₂ materials are used for the exterior wall insulation system.

Where Class B₁ and B₂ insulation materials are used for exterior insulation system on roof and exterior insulation system on exterior wall, noncombustible fire separation belts with width not less than 500mm shall be provided between the roof and the exterior wall.

6.7.11 Electric circuits shall not penetrate or be laid in Class B₁ or B₂ insulation materials; otherwise, fire protection measures shall be taken, such as protected by metal pipes with noncombustible insulation materials. Perimeters of switches, sockets and other electric accessories shall be protected with noncombustible insulation materials.

6.7.12 The combustibility of exterior wall decoration and cladding material shall be Class A. Class B₁ may be permitted where the building height is not greater than 50m.

7 Fire fighting and rescue facilities

7.1 Fire vehicle access road

7.1.1 The municipal roads in blocks shall consider the pass of fire vehicles, and the distance between the road centerlines should not be greater than 160m.

Fire vehicle access road shall be provided to cross the building where the length of the building along the street is greater than 150m or its total length is greater than 220m. Otherwise, circular fire vehicle access road around the building shall be provided.

7.1.2 For high-rise civil buildings and such single-/multi-storey public buildings as gymnasiums with seats over 3 000, assembly halls with seats over 2 000, mercantile buildings with first floor area over 3 000m² and exhibition halls with first floor area over 3 000m², circular fire vehicle access road shall be provided. Otherwise, fire vehicle access roads shall be provided at least along the two longer sides of the building.

For high-rise residential buildings and high-rise civil buildings adjacent to hillsides or riversides, fire vehicle access road shall be provided at least along one longer side of such buildings, and the facade of such side shall be accessible for firefighting.

7.1.3 Fire vehicle access roads shall be provided in factories and storages.

For high-rise factory buildings, Class A, B and C factory buildings with first floor area over 3 000m², Class B and C storages with first floor area over 1 500m², circular fire vehicle access roads shall be provided. Otherwise, fire vehicle access roads shall be provided along the two longer sides of such buildings.

7.1.4 For buildings with enclosed courtyards, where the length of the shorter side of the courtyard is greater than 24m, a fire vehicle access road leading to the courtyard should be provided; where the buildings are along the streets, pedestrian passageways (or stairway) connecting the street and the courtyard shall be provided, and the spacing of such passageways should not be greater than 80m.

7.1.5 Obstacles hindering the pass of the fire vehicles or the evacuation of people shall not be permitted on neither side of the fire vehicle access roads crossing the building or leading to the courtyard.

7.1.6 For open stackyards of combustible materials, LPG tank farms, Class A, B, C liquid tank farms as well as combustible gas tank farms, the fire vehicle access roads shall be provided. The fire vehicle access road shall comply with the following requirements:

1 For stackyards and tank farms with the storage volumes greater than those specified in Table 7.1.6, circular fire vehicle access roads should be provided.

Table 7.1.6 Storage volumes of stackyards or tank farms

Name	Cotton, linen, wool and chemical fiber(t)	Straw and reed(t)	Timber(m ³)	Class A, B, C liquid tanks(m ³)	LPG tanks(m ³)	Combustible gas tanks(m ³)
Storage volume	1 000	5 000	5 000	1 500	500	30 000

2 For stackyards of combustibles with site area over 30 000m², fire vehicle access roads shall be provided to interconnect the circular roads; the spacing between the interconnecting fire vehicle access roads should not be greater than 150m.

Fire vehicle access roads should be provided to interconnect the circular roads in LPG tank farms, Class A, B, C liquid tank farms and combustible gas tank farms.

3 The distance from the near edge of the fire vehicle access road to the near edge of combustible material stacks shall be not less than 5m.

7.1.7 Fire vehicle access roads shall be provided for the natural water sources or fire pools supplying water for fire vehicles. The distance from the edge of the fire vehicle access road to the water-intaking point should not be greater than 2m.

7.1.8 The technical requirements of fire vehicle access roads shall comply with the following :

1 **The unobstructed width and vertical clearance shall be not less than 4.0m.**

2 **The turning radius shall be adequate for fire vehicle turning.**

3 **Trees, overhead pipelines and other obstacles hindering the fire vehicle operation shall not be permitted between the fire vehicle access road and the building.**

4 The distance from the near edge to the exterior wall should not be less than 5m.

5 The slope gradient should not be greater than 8%.

7.1.9 The circular fire vehicle access road shall have at least two access roads. The dead-end fire vehicle access road shall be provided with loops or turnarounds, and the area of the turnarounds shall be not less than 12m×12m; for high-rise building, such area should not be less than 15m×15m; for heavy-loaded fire vehicles, such area should not be less than 18m×18m.

The pavement of fire vehicle access roads, the operation site for fire fighting and rescue, pipes and underdrains below fire vehicle access roads shall be designed and maintained to support the imposed loads of fire vehicles.

Where urban, rural roads and roads in factories are used as the fire vehicle access roads, such roads shall comply with the passing, turning and parking requirements of fire vehicles.

7.1.10 Fire vehicle access roads should not cross the main tracks of railways. Otherwise, standby accesses shall be provided and the spacing between two accesses shall be not less than the length of one train.

7.2 Operation site for fire fighting and rescue and opening for fire fighter access

7.2.1 For high-rise buildings, operation sites for fire fighting and rescue shall be provided continuously at least along one long side or 1/4 of the peripheral length but not less than the length of one long side of the building. The podium depth at such site shall be not greater than 4m.

Where it's difficult to provide the operation site for fire fighting and rescue continuously for buildings with height not greater than 50m, such operation sites may be provided at intervals, but such intervals should not be greater than 30m and the total length of the operation sites shall comply with the above requirements.

7.2.2 The operation site for fire fighting and rescue shall comply with the following requirements :

1 **Trees, overhead pipelines and other obstacles and garage exits / entrances hindering the fire vehicle operation shall not be permitted between the operation sites and the factory buildings,**

storages and civil buildings.

2 The length and width of the operation sites shall be not less than 15m and 10m respectively, but the length shall be increased to not less than 20m for buildings with height greater than 50m.

3 The pavement of operation sites, and structures, pipes, underdrains below such sites shall be designed and maintained to support the imposed loads of fire vehicles.

4 The operation sites shall be connected to the fire vehicle access roads; the distance from the nearest edge to the exterior wall should be not less than 5m and shall be not greater than 10m; and the gradient should not be greater than 3%.

7.2.3 For the part of the building within the scope of the operation site, stairways directly leading to the outdoors or entrances directly leading to staircases shall be provided.

7.2.4 The exterior walls of factory buildings, storages and public buildings shall be provided with openings for fire fighter access at the proper locations of each storey.

7.2.5 Both the clear height and clear width of openings for fire fighter access shall be not less than 1.0m, and the height from the indoor ground to the lower edge of the opening should not be greater than 1.2m. The spacing between adjacent two such openings should not be greater than 20m and at least 2 openings shall be arranged for each fire compartment.

Openings for fire fighter access shall be provided corresponding to the operation site. The window glass shall be easy to break and readily distinguished signs shall be provided from outside.

7.3 Fire elevator

7.3.1 Fire elevator shall be provided for the following buildings:

1 Residential buildings with height greater than 33m.

2 Category I high-rise public buildings or Category II high-rise public buildings with height greater than 32m; aged care facilities not less than 5 storeys and total gross floor area greater than 3000m²(including aged care facilities arranged at the 5th floor or above in mixed-use buildings).

3 Basements and semi-basements in buildings with fire elevators installed in the above ground portion of the building.

Underground or semi-underground buildings(basements and semi-basements)with the height difference between the lowest floor of the basement level and the level of exit to outdoors greater than 10m, and the total building area greater than 3 000m².

7.3.2 Fire elevators shall be installed in different fire compartments, and each fire compartment shall be served by at least one fire elevator.

7.3.3 For high-rise factory buildings (storages) with height greater than 32m, and provided with elevators, each fire compartment should be served by one fire elevator. Fire elevators may not be required for buildings meeting the following requirements:

1 High-rise towers with height greater than 32m and provided with elevators, where the operators on each storey of the operating platform does not exceed 2;

2 Class D and E factory buildings with partial height greater than 32m and the building area of the raised part not greater than 50m².

7.3.4 Passenger elevators or freight elevators which meet the requirements of fire elevators may also be used as fire elevators.

7.3.5 Other than fire elevators installed in storage galleries, hallways in cold stores or operation

tower of cereal silos, fire elevators shall be provided in vestibules and shall comply with the following requirements:

1 The vestibule should be adjacent to the exterior wall and shall directly leads to the outdoors on the first floor or leads to the outdoors through a passageway not greater than 30m;

2 The net area of the vestibule shall be not less than 6.0m², the shorter side shall be not less than 2.4m; for the vestibule shared with smokeproof staircases, its net area shall also comply with the requirements of Article 5.5.28 and Article 6.4.3 of this code;

3 Other than the entrance/exit of the vestibule, forced air supply outlets provided in the vestibule and household doors specified in Article 5.5.27 of this code, other doors, windows and openings shall not be permitted in the vestibule;

4 Class B fire doors shall be installed for the vestibules or shared vestibules. Roller shutters shall not be permitted.

7.3.6 Fire partition walls with fire-resistance rating not less than 2.00h shall be provided between any two fire elevator shafts, between the fire elevator shaft and the adjacent elevator equipment rooms, and between any two fire elevator equipment rooms. Doors in such partition walls shall be protected by Class A fire doors.

7.3.7 Drainage facilities shall be provided at the bottom of the fire elevator shafts. The capacity of the drainage shafts shall be not less than 2m³ and the discharge rate of drainage pump shall be not less than 10L/s. Water retaining facilities should be provided at the doorway of the vestibules of fire elevators.

7.3.8 The technical requirements of fire elevators shall comply with the following:

- 1** The elevator shall have the function to stop at each floor;
- 2** The load capacity shall be not less than 800kg;
- 3** The running time from the first floor to the top should not be greater than 60s;
- 4** Water-proof measures shall be taken for the power and control cables/electric wires and control panels;
- 5** Special call buttons for fire fighters shall be provided at the entrance of the elevator on the first floor;
- 6** Noncombustible materials shall be used for the internal decoration of the elevator car;
- 7** Dedicated telephone shall be provided in the elevator car.

7.4 Helicopter landing pad

7.4.1 For high-rise public buildings with height greater than 100m, and with floor area of the standard storey greater than 2 000m², rooftop landing pad or rescue facilities for helicopters should be provided.

7.4.2 The helicopter landing pad shall comply with the following requirements:

1 Where provided on the rooftop, the helicopter landing pad shall be at least 5m away from any projections like equipment rooms, elevator machine rooms, water tank rooms as well as common antennas etc.;

2 At least two exits/entrances leading to the landing pad shall be provided and the width of each exit/entrance should not be less than 0.90m;

3 Aircraft obstruction lights and emergency lighting shall be provided around the landing pad;

4 Fire hydrants shall be provided at a proper location on the landing pad;

5 Other requirements shall comply with the relevant current standards on aviation management.

8 Fire-fighting facilities

8.1 General requirements

8.1.1 Fire water supply and fire-fighting facilities shall be provided according to such factors as occupancy, significance, fire hazard, fire characteristics and surrounding environment of the building.

8.1.2 In urban areas including residential, commercial, industrial areas and new economic zones, etc., municipal fire hydrant system shall be provided along roads that are accessible to fire vehicles.

Outdoor fire hydrant systems shall be provided at the surrounding of civil buildings, factory buildings, storages, tanks (tank farms) and stackyards.

Outdoor fire hydrant systems shall be provided on roofs for fire-fighting and rescue or parking of fire vehicles.

Note: Outdoor fire hydrant systems may not be provided at the surrounding of Class E factory buildings with fire-resistance class not less than Class II, and volume of the building not greater than 3 000m³; residential area with the number of building storeys not greater than 2 and number of residents not greater than 500.

8.1.3 Fire water pump adapters shall be provided for such systems as sprinkler system, water spray system, foam extinguishing system, fixed fire monitor extinguishing system, water supply system for indoor fire hydrant of the following buildings:

- 1 Public buildings over 5 storeys;
- 2 Factory buildings (storages) over 4 storeys;
- 3 Other high-rise buildings;
- 4 Underground buildings (basement) over 2 basement levels or with floor area greater than 10 000m².

8.1.4 Movable fire hose nozzles or fixed water cooling facilities shall be provided for Class A, B, C liquid tanks (tank farms). Fixed water cooling facilities should be provided for Class A, B, C aboveground liquid tanks with height greater than 15m or the single tank volume greater than 2 000m³.

8.1.5 Fixed water cooling facilities shall be provided for LPG tanks (tank farms) with total volume greater than 50m³ or single tank volume greater than 20m³. Fixed spray cooling devices may not be provided for embedded LPG tanks. Movable fire hose nozzles shall be provided for LPG tanks (tank farms) with total volume not greater than 50m³ or single tank volume not greater than 20m³.

8.1.6 Fire water pump room shall comply with the following requirements:

- 1 Fire-resistance class of the independent fire water pump room shall be at least Class II;
- 2 Fire water pump room located in buildings shall not be arranged on the third underground floor or below, or the basement where the height difference between the lowest floor of the basement level and the level of exit to outdoors is greater than 10m;
- 3 Exit door shall directly lead to outdoor or exit.

8.1.7 Fire command center shall be required for buildings (groups) with fire alarm system and fire-fighting facilities requiring linkage control. The design of fire command center shall comply with the following requirements:

- 1 Fire-resistance class of independent fire command center building shall be at least Class II;

2 Fire command center located in buildings should be arranged on the first floor or at the first basement level and at a location close to the exterior wall;

3 Fire command center shall not be arranged close to rooms that are subject to strong electromagnetic field interference and may affect the normal operation of fire control equipment;

4 Exit door shall directly lead to outdoor or exit;

5 Equipment in fire command center, its control and display function of building fire-fighting facilities and the function of transmitting relevant information to remote monitoring system shall comply with the requirements of the current national standards GB 50116 *Code for Design of Automatic Fire Alarm System* and GB 25506 *General Technical Requirements for Fire Control Center*.

8.1.8 Technical measures protecting against flood shall be taken for fire pump rooms and the fire command center.

8.1.9 Smoke control and exhaust fans provided in buildings shall be installed in different dedicated rooms. Relevant fire separation measures shall comply with the requirements of Article 6.2.7 of this code.

8.1.10 Portable fire extinguisher shall be provided at the public areas of high-rise residential buildings and in public buildings, and portable fire extinguisher should be provided at the public areas of other residential buildings.

Portable fire extinguishers shall be provided for factory buildings, storages, tanks (tank farms) and stackyards.

8.1.11 If the exterior wall is glass curtain wall or be decorated with materials or constructions which may cause the falling-off of the materials in case of fire, the outdoor fire-fighting facilities such as fire water pump adapter and outdoor fire hydrant for fire-fighting and rescue shall be installed at locations with a relatively safe distance from the exterior wall or be provided with safety protection measures.

8.1.12 Fire-fighting facilities installed inside or outside of buildings for personnel to operate shall be provided with visible signs which can be easily distinguished from the surroundings.

8.1.13 The design of fire-fighting systems and facilities shall comply with the requirements of the current national standards GB 50974 *Technical Code for Fire Protection Water Supply and Hydrant Systems*, GB 50084 *Code for Design of Sprinkler Systems* and GB 50116 *Code for Design of Automatic Fire Alarm System*.

8.2 Indoor fire hydrant system

8.2.1 Indoor fire hydrant system shall be provided for the following buildings or locations:

1 Factory buildings and storages with first floor area over 300m²;

2 High-rise public buildings, residential buildings with building height over 21m;

Note: Where indoor fire hydrant system is to be installed for residential building with building height not greater than 27m, dry fire standpipe and DN65 indoor fire hydrant without fire cabinet is permitted.

3 Single-/multi-storey buildings with a volume of more than 5 000m³, such as bus (railway) stations, passenger terminals of wharfs or airports, exhibition buildings, mercantile buildings, hotels, healthcare buildings, aged care facilities and libraries, etc.;

4 Single-/multi-storey buildings such as top-class and first-class theatres, other classes of theatres and cinemas with seats over 800, as well as auditoriums and gymnasiums with seats over 1 200, etc.;

5 Office buildings, teaching buildings as well as other single-/multi-storey civil buildings with the height greater than 15m or a volume of more than 10 000m³.

8.2.2 For buildings or locations not specified in Article 8.2.1 of this code as well as the following buildings or locations which comply with the requirements of Article 8.2.1 of this code, indoor fire hydrant system is not required, but fire hose reels or portable fire hoses should be provided:

1 Single-/multi-storey Class D and E factory buildings (storages) with fire resistance class as Class I or II and with few combustibles.

2 Class D factory buildings with fire resistance class as Class III or IV and with building volume not greater than 3 000m³; Class E factory buildings (storages) with fire resistance class as Class III or IV and with building volume not greater than 5 000m³.

3 Grain storages, treasuries, unattended independent buildings far away from cities and towns.

4 Buildings with stored materials which can cause combustion and explosion if contacted with water.

5 Other buildings without indoor production and domestic water supply pipelines, and with outdoor fire water supply from water tanks, and with a volume of not more than 5 000m³.

8.2.3 Indoor fire hydrant systems should be provided for important brick-timber or timber historical buildings of National-level cultural relics preservation units.

8.2.4 Fire hose reels or portable fire hoses shall be provided for assembly public buildings, buildings with height greater than 100m and small commercial spaces with floor area greater than 200m². Portable fire hose should be provided for high-rise residential buildings.

For aged care facilities, fire hose reels directly connecting to the indoor water supply system shall be provided and the spacing of the fire hose reels shall be not greater than 30.0m.

8.3 Automatic fire extinguishing system

8.3.1 Unless otherwise required by this code or locations where water should not be used for fire protection or suppression, automatic fire extinguishing systems shall be provided at the following factory buildings or production areas. Sprinkler systems should be recommended:

1 Unpacking and blowing workshops of the cotton mill with not less than 50 000 spindles, sorting and carding workshops of flax mill with not less than 5 000 spindles, and stick toasting and screening areas of match factories;

2 Single-/multi-storey factory buildings with first floor area greater than 1 500m² or total floor area greater than 3 000m² for the similar production purposes such as shoemaking, clothing making, toys or electronics;

3 Woodenware factory buildings with first floor area greater than 1 500m²;

4 Pre-foaming, forming, slicing and embossing areas of foam plastic factories;

5 Class B and C high-rise factory buildings;

6 Underground or semi-underground Class C factory buildings with floor area of each floor greater than 500m².

8.3.2 Unless otherwise required by this code or storages where water should not be used for fire protection or suppression, automatic fire extinguishing systems shall be provided at the following storages. Sprinkler systems should be recommended:

1 Storages of cotton, wool, silk, linen, chemical fiber, fur and their products, with the first

floor area greater than 1 000m²;

Note: For single-storey cotton storerooms with the floor area not greater than 2 000m², sprinkler systems may not be required.

- 2 Match storages with first floor area greater than 600m²;**
- 3 Empty post bag storages with floor area greater than 500m² in a post building;**
- 4 High rack/high-rise storages of combustible and difficult-combustible materials;**
- 5 High rack cool stores with designed temperature greater than 0°C , non-high rack cool stores with designed temperature greater than 0°C and the building area of each fire compartment greater than 1 500m²;**
- 6 Underground storages of combustible materials with total floor area greater than 500m²;**
- 7 Other single- /multi-storey Class C storages with first floor area greater than 1 500m² or total floor area greater than 3 000m².**

8.3.3 Unless otherwise required by this code or locations where water should not be used for fire protection or suppression, automatic fire extinguishing system shall be required in following high-rise civil buildings or locations. Sprinkler systems should be recommended:

- 1 Category I high-rise public buildings (except swimming pools and skating rinks) and their basements and semi-basements;**
- 2 Public activities rooms, passageways, offices, hotel guest rooms, combustible material storerooms, and bottoms of escalators in Category II high-rise public buildings and their basements and semi-basements;**
- 3 Entertainment and amusement occupancies in high-rise civil buildings;**
- 4 Residential buildings with building height greater than 100m.**

8.3.4 Unless otherwise required by this code or locations where water should not be used for fire protection or suppression, automatic fire extinguishing system shall be required in following single-/multi-storey civil buildings or locations. Sprinkler system should be recommended:

- 1 Top-class and first-class theatres, theatres of other classes with seats more than 1 500, assembly halls or auditoriums with seats more than 2 000, gymnasiums with more seats than 3 000, indoor lounges and equipment rooms of stadiums accommodating more than 5 000 persons;**
- 2 Buildings for exhibition, mercantile, catering service and hotel with floor area of any floor greater than 1 500m² or the total floor area greater than 3 000m², and the inpatient medical care buildings, outpatient buildings and operating departments with the same building scale as mentioned above in hospitals;**
- 3 Office buildings etc. with total floor area greater than 3 000m² and have been provided with central air conditioning systems with supply and return air ducts (pipes);**
- 4 Libraries with collection of books exceeding 500 000;**
- 5 Large and medium sized kindergartens, and aged care facilities;**
- 6 Underground or semi-underground mercantile buildings with total floor area greater than 500m²;**
- 7 Entertainment and amusement occupancies (except rooms for swimming) being arranged at underground or semi-underground levels or on the fourth floor aboveground or above; the aboveground entertainment and amusement occupancies (except rooms for swimming) being arranged on the first, second or third floor and with the floor area of any floor greater than 300m².**

8.3.5 For locations with high height and large area such as exhibition or audience halls, Class C

production workshops and Class C storerooms, where it is not applicable for automatic sprinkler systems according to what specified in this code, other automatic fire extinguishing systems shall be installed, and fire extinguishing systems like fixed fire monitor extinguishing systems should be recommended.

8.3.6 Water curtain systems should be installed at the following locations:

1 The proscenium opening and openings of side stages and back stages connecting with the proscenium in the top-class and first-class theatres, the theatres of other classes with seats more than 1 500, the assembly halls or auditoriums with seats more than 2 000 and the theatres or auditoriums with seats more than 800 in high-rise civil buildings;

2 Partial openings that shall be separated with fire walls etc. but are unable to do so;

3 The upper part of the fire shutter or fire curtain in need of cooling.

Note: Proscenium openings may also be protected by fire curtains. The smaller openings of side stages and back stages should be Class B fire doors or windows.

8.3.7 Deluge sprinkler systems shall be installed in the following buildings or at the following locations:

1 Potassium chlorate grinding factory buildings of match factories, workshops of factory buildings with floor area greater than 100m^2 and used for the production or application of nitrocotton, paint spray cotton, collodion cotton, xylonite rubber sheet or nitrocellulose;

2 Base rolling, sectioning, ball-grinding and sorting inspection areas of table tennis factories;

3 Storages of nitrocotton, paint spray cotton, collodion, xylonite rubber sheet or nitrocellulose, with floor area greater than 60m^2 or storage capacity greater than 2t;

4 Cylinder filling rooms and cylinder storerooms in LPG storages and distribution stations with daily filling quantity exceeding 3 000;

5 The lower part of stage drops in top-class and first-class theatres, theatres of other classes with more than 1 500 seats and assembly halls or auditoriums with more than 2 000 seats;

6 Television and Radio studios with floor area not less than 400m^2 and film studios with floor area not less than 500m^2 .

8.3.8 Automatic fire extinguishing systems shall be provided in the following locations, and water spray extinguishing systems should be recommended:

1 Oil immersed transformers of the factories with the capacity of a single set as $40\text{MV}\cdot\text{A}$ or above, oil immersed transformers of power plants with the capacity of a single set as $90\text{MV}\cdot\text{A}$ or above and oil immersed transformers of independent electric power substations with the capacity of a single set as $125\text{MV}\cdot\text{A}$ or above;

2 The testbed of the aeroengine test cell;

3 Rooms for high voltage capacitors and bulk oil circuit breakers filled with combustible oil and being arranged in high-rise civil buildings.

Note: For indoor oil-immersed transformers and rooms for high voltage capacitors and bulk oil circuit breaker filled with combustible oil, water mist fire extinguishing systems is permitted.

8.3.9 Automatic fire extinguishing systems shall be provided in the following locations, gas fire extinguishing systems should be recommended:

1 Microwave, decimeter wave and metric wave machine rooms, transformer and distribution rooms and uninterrupted power supply (UPS) rooms in radio and television towers at national and provincial levels, or cities with population more than 1 million;

2 Long-distance SPC (stored program control) exchange rooms, control rooms and signaling transfer point rooms of international telecommunication offices, regional centers, provincial centers and district centers with more than 10 000 lines;

3 SPC exchange rooms, control rooms and signaling transfer point rooms of local telephone tandem offices with more than 20 000 lines and local exchange offices with more than 60 000 entries;

4 Communication rooms and control rooms in public security and disaster prevention dispatch control centers at national and provincial levels, and those in power dispatch control centers of large-scale or above;

5 Computer rooms and magnetic (paper) recording media storages of Class A and B buildings for electronic information system;

6 The audiovisual products storerooms with building area not less than 120m² in national and provincial radio & television centers;

7 Repositories of special collection of national and provincial libraries or libraries with the collection of books more than 1 million; storages for precious files and non-paper files in the national and provincial archives; treasure storages in large and medium scale museums; showrooms of Grade I paper and thin-silk cultural relics;

8 Other very important equipment rooms.

Notes: 1 Water mist fire extinguishing system may be provided at the locations specified in Item 1, 4, 5 and 8 of this article.

2 Where there are standby main machines and standby magnetism (paper) recording media, which are arranged in different buildings or different fire compartments in the same building, pre-action sprinkler systems may be provided at the locations specified in Item 5 of this article.

8.3.10 Fire extinguishing systems for Class A, B, C liquid tanks shall be provided according to the following requirements:

1 Fixed foam extinguishing systems shall be provided for fixed roof tanks with single capacity greater than 1 000m³;

2 Mobile foam fire extinguishing systems may be provided for storage tanks with the wall height less than 7m or capacity not greater than 200m³;

3 Semi-fixed foam extinguishing systems should be provided for other storage tanks;

4 For Class A, B, C liquid tanks in the oil depots, petrochemical industries and petroleum natural gas engineering, fire extinguishing systems shall be installed according to the requirements of the current national standard GB 50074 *Code for Design of Oil Depot* and other relevant standards.

8.3.11 For restaurants or canteens with floor area of the dining room greater than 1 000m², automatic fire extinguishers shall be equipped at the fume exhaust covers and cooking areas in the cooking rooms, and automatic shut-off devices linked with automatic fire extinguishing facilities shall be installed on the gas or fuel pipes.

Automatic fire extinguishing facilities should be provided at the food processing areas in food industries with open fire operation or high temperature edible oil.

8.4 Fire alarm system

8.4.1 Fire alarm systems shall be provided for the following buildings or locations:

1 Factory buildings for shoemaking, clothing making, toys and electronics with floor area of

any floor greater than 1 500m² or total floor area greater than 3 000m².

2 Storages for cotton, wool, silk, linen, chemical fiber and their products with first floor area greater than 1 000m²; cigarette storages with first floor area greater than 500m² or total floor area greater than 1 000m².

3 Buildings for stores, exhibitions, finance and trades, passenger transports and freights, with floor area of any floor greater than 1 500m² or total floor area greater than 3 000m²; underground or semi-underground stores with total floor area greater than 500m².

4 Storages for precious books or cultural relics; libraries with collection of books more than 500 000 and important archives.

5 Radio & television buildings, post buildings and telecommunication buildings at prefectural-level or above; urban or regional commanding and dispatching buildings for electricity, transportation and disaster prevention.

6 Top-class and first-class theatres; other theatres or cinemas with seats more than 1 500; assembly halls or auditoriums with seats more than 2 000; gymnasiums with seats more than 3 000.

7 Rooms for children use in large or medium size kindergartens; aged care facilities; inpatient medical care buildings in sanatoriums, hotels and other children's play areas with floor area of any floor greater than 1 500m² or total floor area greater than 3 000m²; outpatient buildings, inpatient medical care buildings and operating departments of hospitals with at least 200 beds.

8 Entertainment and amusement occupancies.

9 Concealed spaces for pipes, ducts etc. containing lots of combustibles and with clear height greater than 2.6m; inside spaces above suspended ceiling containing combustibles and with clear height greater than 0.8m.

10 Computer rooms, control rooms and recording media storages of buildings for electronic information system; rooms for machinery, meters and instruments of special values or heavy fire hazards; storages of valuables.

11 Storages for combustibles with floor area greater than 50m² or stores with floor area greater than 500m² in Category II high-rise public buildings.

12 Category I high-rise public buildings other than those specified above.

13 Locations that are provided with mechanical smoke exhaust and smoke control systems, deluge or pre-action sprinkler systems, fixed fire monitor extinguishing systems and gas fire extinguishing systems that need to be activated by fire alarm systems.

Note: Fire detectors, sound alarm devices or fire broadcasts shall be provided in rooms for the aged or the public corridors of the aged care facilities.

8.4.2 Residential buildings with building height greater than 100m shall be provided with fire alarm system.

Fire alarm systems shall be installed at the public areas of residential buildings with building height greater than 54m but not less than 100m; fire detectors should be installed inside the suites.

Fire alarm systems should be installed at the public areas of high-rise residential buildings with building height not greater than 54m. Where fire-fighting facilities is activated by fire alarm systems, fire alarm systems shall be installed at the public areas.

Alarm devices or emergency fire broadcast provided with voice function shall be provided at the public areas of high-rise residential buildings.

8.4.3 Combustible gas alarm devices shall be provided at locations of a building where combustible gases or vapors may give off.

8.5 Smoke control and smoke exhaust system

8.5.1 Smoke control facilities shall be installed at the following locations or parts of the building :

- 1 Smokeproof staircases and vestibules;**
- 2 Vestibules or shared vestibules of fire elevator;**
- 3 Vestibules of refuge passageways, refuge floors (rooms).**

For public buildings with building height not greater than 50m, factory buildings, storages, residential buildings with building height not greater than 100m, where the vestibule or shared vestibule of the smokeproof staircase meets one of the following conditions, smoke control system may not be required in the staircase :

- 1 Using open exterior balconies or concave corridors as vestibules or shared vestibules;**
- 2 Vestibules or shared vestibules are provided with exterior windows that can be opened to different directions and the area of such windows meet the area requirements for natural vents.**

8.5.2 Smoke exhaust facilities shall be installed at the following locations or areas of factory buildings or storages :

- 1 Class C production areas with lots of people or combustibles; aboveground rooms of Class C factory buildings with building area greater than 300m² and being frequently occupied by people or containing lots of combustibles;**
- 2 Class D production workshops with building area greater than 5 000m²;**
- 3 Class C storages with first floor area greater than 1 000m²;**
- 4 Exit passageways longer than 20m in high-rise factory buildings (storages) higher than 32m; exit passageways longer than 40m in other factory buildings (storages).**

8.5.3 Smoke exhaust facilities shall be installed at the following locations of civil buildings :

- 1 Entertainment and amusement occupancies located on the first, second, third floor and with building area greater than 100m²; entertainment and amusement occupancies locates on the floors other than specified above.**
- 2 Atriums;**
- 3 Aboveground rooms in public buildings with floor area greater than 100m² and frequently occupied by people;**
- 4 Aboveground rooms in public buildings with floor area greater than 300m² and containing lots of combustibles;**
- 5 Exit passageways longer than 20m.**

8.5.4 Smoke exhaust facilities shall be provided for underground or semi-underground buildings (basements or semi-basements) and rooms without windows in aboveground buildings, where the total floor area is greater than 200m² or the floor area of one room is greater than 50m², and frequently occupied by people or with lots of combustibles.

9 Heating, ventilating and air conditioning

9.1 General requirements

9.1.1 Heating, ventilating and air conditioning systems shall be provided with fire protection measures.

9.1.2 Air in Class A and B factory buildings shall not be recirculated.

Air containing combustibles or explosive dusts or fibers in Class C factory buildings shall be purified before recirculation. The dust concentration in such air shall be 25% lower than its LEL.

9.1.3 Air supply and exhaust equipment serving Class A and B factory buildings shall be installed in different ventilation rooms; such exhaust equipment shall not be installed in the same ventilation room with the air supply/exhaust equipment serving for other rooms.

9.1.4 Natural ventilating or independent mechanical ventilating facilities shall be provided for rooms containing substances of fire or explosion hazards in civil buildings, and such air shall not be recirculated.

9.1.5 Where air contains combustible gases which are lighter than air, the horizontal air exhaust pipes shall be laid upward along the airflow direction.

9.1.6 Combustible gas pipelines and the pipelines for Class A, B, C liquids shall not penetrate any ventilation equipment rooms or ventilating pipes, and shall not be laid next to the ventilating pipes.

9.2 Heating

9.2.1 The average surface temperature of radiators in factory buildings that have combustible dusts and fibers shall be not greater than 82.5°C. The average surface temperature of radiators at coal handling trestles shall be not greater than 130°C.

9.2.2 Open flame and electric heating devices must be strictly prohibited in Class A and B factory buildings (storages).

9.2.3 Non-recirculating warm air shall be provided for the heating of the following factory buildings:

1 Factory buildings that accumulate combustible gases, vapors, dusts or fibers during the production process and may cause fire when contacting with the surfaces of heating pipelines and radiators;

2 Factory buildings that accumulate dusts during the production process and may cause spontaneous ignition, explosion or generate explosive gases when contacting with water or water vapor.

9.2.4 Heating pipelines shall not penetrate rooms containing such gases, vapors or dusts that may cause combustion or explosion when contacting with the heating pipelines. Noncombustible materials shall be used for heat insulation if they are to penetrate such rooms.

9.2.5 A certain distance shall be kept between heating pipelines and combustibles, and shall comply with the following requirements:

1 The distance shall be not less than 100mm or noncombustible materials shall be used for heat insulation, where the surface temperature of heating pipeline is greater than 100°C;

2 The distance shall be not less than 50mm or noncombustible materials shall be used for heat insulation, where the surface temperature of the heating pipeline is not greater than 100°C.

9.2.6 Thermal insulation materials for heating pipelines and equipment in buildings shall comply with the following requirements:

- 1 For Class A and B factory buildings(storages), noncombustible materials shall be used;
- 2 For buildings other than those listed in Item 1, noncombustible materials should be used, and combustibles shall not be permitted.

9.3 Ventilating and air conditioning

9.3.1 Ventilating and air conditioning systems shall be designed such that, horizontally, the system shall be installed to serve single fire compartment by single fire compartment, and vertically, the number of storeys served should not exceed 5. Where backflow prevention devices or fire dampers are installed in the ducts, the above-mentioned requirements may not be followed. Vertical air ducts shall be installed in shafts.

9.3.2 Air exhaust ducts from explosion hazardous locations of factory buildings must not penetrate fire walls and partition walls of rooms with explosion hazards.

9.3.3 Air supply/exhaust ducts in Class A, B and C factory buildings should be installed floor by floor. When fire dampers are installed at positions where horizontal or vertical air supply ducts enter the production section, such air supply system is permitted to share.

9.3.4 For rooms containing combustible or explosive substances in the air, explosion-proof ventilating equipment shall be provided for the air supply/exhaust system. Conventional ventilating equipment is permitted to be used when the blower is installed in a separated ventilation room and backflow prevention device is installed in the main air supply duct.

9.3.5 Air containing combustible and explosive dusts shall be treated by non-sparking dust collector before entering the exhaust fan. For dusts with explosion potential when contacting with water, wet dust collectors must not be used.

9.3.6 Dust collectors and exhaust fans treating explosive dusts shall be installed separately from conventional collectors and fans, and should be installed in groups based on the dust classification.

9.3.7 Dry dust collectors and filters filtering explosive dusts should be installed in an independent building. The fire separation distance between the exterior walls of such building and the factory building shall be not less than 10m.

Dry dust collectors and filters which are provided with continuous or periodical dust cleaning function, whose air volume is not greater than 15 000m³/h and dust storage of the dust hopper is less than 60kg, are permitted to be installed in a separate room within the factory building. Such room shall be separated from the remainder of the building by fire partition walls with fire-resistance rating not less than 3.00h and floors not less than 1.50h.

9.3.8 Pressure relief devices shall be installed for all the dust collectors, filters or ducts filtering or conveying explosive dusts and chips.

Dry dust collectors and filters filtering explosive dusts shall be installed at the negative pressure section of the system.

9.3.9 Air exhaust system for combustible or explosive gases, vapor and dusts shall comply with the following requirements:

- 1 Air exhaust system shall be provided with grounding device to dissipate static electricity ;**
- 2 Air exhaust equipment shall not be installed in underground or semi-underground buildings(basements or semi-basements) ;**
- 3 Exhaust ducts shall be metal and shall directly discharge to a safe location outside the building. Ducts shall not be laid in concealed spaces.**

9.3.10 For ducts exhausting or conveying air or other gases or combustible chips with temperature greater than 80℃ ,the clearance between such ducts and the combustible or difficult-combustible objects shall be not less than 150mm, or shall be heat insulated with noncombustible materials with thickness not less than 50mm. When ducts are arranged one above another, ducts with higher surface temperature shall be arranged above the ones with lower surface temperature.

9.3.11 Ducts of ventilating and air conditioning systems shall be provided with fire dampers with nominal operating temperature of 70℃ at the following locations:

- 1 Locations penetrating fire compartments;**
- 2 Locations penetrating the room partition walls and floor assemblies of ventilating and air conditioning rooms;**
- 3 Locations penetrating the room partition walls and floor assemblies of rooms with important functions or rooms with high fire hazards;**
- 4 Both sides of the building deformation joint at the fire separation position ;**
- 5 In the horizontal air duct where the horizontal air duct of each storey connecting to the vertical air duct of the building.**

Note:When ventilating and air conditioning systems are installed one fire compartment by one fire compartment in the building, fire dampers may not be provided for the locations where the horizontal air ducts connect to the vertical main ducts.

9.3.12 For vertical exhaust ducts in bathrooms, toilets and kitchens of public buildings, backflow prevention devices shall be provided, and fire dampers with nominal operating temperature of 70℃ should be installed in the branch ducts.

Grease-laden vapor exhaust ducts in the kitchens of public buildings should be installed one fire compartment by one fire compartment. Fire dampers with nominal operating temperature of 150℃ shall be installed in branch ducts before connecting to the vertical air exhaust ducts of the building.

9.3.13 Arrangement of fire dampers shall comply with the following requirements:

- 1 Fire dampers should be installed close to the fire separation position ;**
- 2 Manhole for convenient maintenance shall be provided when fire dampers are installed in a concealed space ;**
- 3 Air ducts and heat insulation materials within 2.0m at both sides of the fire dampers shall be noncombustible ;**
- 4 Fire dampers shall comply with the requirements of the current national standard GB 15930 *Fire Dampers for Building Venting and Smoke-venting System*.**

9.3.14 Air ducts of ventilating and air conditioning systems shall be noncombustible.

Exceptions:

- 1 Air ducts contacting with corrosive media and flexible joints may be difficult-combustible ;**
- 2 For air ducts of ventilating and air conditioning systems in such large-space buildings as gymnasiums, exhibition halls and terminals; single-/multi-storey office buildings and Class C, D, E factory buildings, where such air ducts do not penetrate the fire compartment, and are provided with fire**

dampers when penetrating the room partition walls, such ducts may be difficult-combustible.

9.3.15 Heat insulation materials for equipment and air ducts, humidifying materials for humidifiers, muffling materials and binders shall be noncombustible. Difficult-combustible materials are permitted to use where noncombustible materials are difficult to be used.

Where the electric heater is installed in the air duct, the on-off of the electric heater shall be interlocked with the start/stop of the blower. For the air ducts within 0.8m before and after the electric heater and those penetrating the rooms that is easily to be on fire due to high temperature or ignition source in the room, the air ducts shall be noncombustible.

9.3.16 Natural or mechanical ventilating facilities shall be installed in the oil-fired/gas-fired boiler rooms. Gas-fired boiler rooms shall be provided with explosion-proof emergency exhaust fans. If mechanical ventilation is installed, mechanical ventilating facilities shall be equipped with grounding devices for static dissipation, and the ventilation rate shall comply with the following requirements:

1 Normal ventilation rate of oil-fired boiler room shall be determined according to an air change rate of not less than 3 times/h; while the emergency ventilation rate shall be determined according to an air change rate of not less than 6 times/h;

2 Normal ventilation volume of gas-fired boiler rooms shall be determined according to an air change rate not less than 6 times/h; while the emergency ventilation rate shall be determined according to an air change rate not less than 12 times/h.

10 Electrical system

10.1 Fire power supply and distribution

10.1.1 Fire power supply shall be provided with first grade electrical load for the following buildings:

- 1 Class B, C factory buildings and Class C storages with building height greater than 50m;
- 2 Category I high-rise civil buildings.

10.1.2 Fire power supply shall be provided with second grade electrical load for the following buildings, tanks (tank farms) and stockyards:

- 1 Factory buildings (storages) with the outdoor fire water demand greater than 30L/s;
- 2 Combustible stockyards, combustible gas tanks (tank farm) and Class A, B liquid tanks (tank farm) with the outdoor fire water demand greater than 35L/s;
- 3 Grain storages and grain silos;
- 4 Category II high-rise civil buildings;
- 5 Cinemas and theaters with seats more than 1 500, gymnasiums with seats more than 3 000, mercantile and exhibition buildings with floor area of any storey greater than 3 000m². Radio and television, telecommunication, finance and trade buildings at provincial (municipal) level and above; other public buildings with the outdoor fire water demand greater than 25L/s.

10.1.3 The third grade electrical load of fire power supply is permitted for buildings, tanks (tank farms) and stockyards not specified in Article 10.1.1 and Article 10.1.2 of this code.

10.1.4 For buildings provided with first or second grade electrical load, where self-provided generating equipment is used as the standby power supply, such equipment shall be provided with automatic and manual startup device. Where automatic startup is provided, such equipment shall be able to supply power within 30s.

Power supply with different electrical load grades shall comply with the requirements of current national standard GB 50052 *Code for Design Electric Power Supply Systems*.

10.1.5 Continuous power supply duration of the standby power system for fire emergency lighting and evacuation indicating signs in buildings shall comply with the following requirements:

- 1 For civil buildings with building height greater than 100m, shall be not less than 1.50h;
- 2 For healthcare buildings, aged care facilities, public buildings with total floor area greater than 100 000m² and underground & semi-underground buildings with total floor area greater than 20 000m², shall be not less than 1.00h;
- 3 For other buildings, shall be not less than 0.50h.

10.1.6 Dedicated power supply circuits shall be provided for fire-fighting electrical equipment; when production and household power in buildings is shut off, the fire power supply shall be guaranteed.

The power supply duration and capacity of standby fire power supply systems shall comply with the power supply demands of all the electrical equipment used for fire fighting.

10.1.7 Fire power distribution mains should be designed to provide service for one fire compartment

by one fire compartment. Fire power distribution branches should not penetrate the fire wall between two adjoining fire compartments.

10.1.8 Power supply for the electrical equipment in fire command center, fire pump rooms, smoke control & exhaust fan rooms and fire power supply for fire elevators shall be equipped with automatic switch devices at the end electrical box of the distribution line.

10.1.9 For fire-fighting equipment powered with first or second grade electrical load, independent electrical box shall be installed; For fire-fighting equipment powered with third grade electrical load, independent electrical box should be installed.

Visible signs shall be provided for fire power distribution equipment.

10.1.10 Fire power distribution lines shall comply with the demands of uninterrupted power supply in case of fire. The laying of the wire shall comply with the following requirements:

1 For exposed laying (including laying in the suspended ceiling), the wire shall be protected with metal tubes or enclosed metal slots. Fire protection measures shall be taken for such metal tubes or enclosed metal slots; protection by metal tubes or enclosed metal slots may not be required when flame-retardant or fire resistant cables are used and laid in cable shafts or trenches; the cables may be exposed when mineral insulated noncombustible cables are used.

2 For concealed laying, wires shall be protected with tubes and shall be laid in a noncombustible structure with the thickness of the protection layer not less than 30mm.

3 Fire power distribution lines and other distribution lines should be laid separately in different cable shafts or trenches; where they must be laid in the same cable shaft or trench, they shall be arranged at opposite sides separately, and fire power distribution lines shall be mineral insulated noncombustible cables.

10.2 Power line and electrical equipment

10.2.1 The minimum horizontal distance between the overhead power line and Class A, B factory buildings (storages), combustible stackyards, Class A, B and C liquid tanks, LPG tanks or combustible and combustion-supporting gas tanks shall be in accordance with those specified in Table 10.2.1.

The minimum horizontal distance between overhead power line with voltage not less than 35kV and the LPG tanks (tank farm) with single tank volume greater than 200m³ or total volume greater than 1 000m³ shall comply with the requirements of Table 10.2.1, and shall be not less than 40m.

Table 10.2.1 Minimum horizontal distance between overhead power line and Class A, B factory buildings (storages) and combustible stackyards (m)

Item	Overhead power line
Class A, B factory buildings (storages); combustible stackyards; Class A, B liquid tanks; LPG tanks, combustible and combustion-supporting gas tanks	1.5 times of the height of power pole (tower)
Directly-buried Class A, B liquid tanks and combustible gas tanks	0.75 times of the height of power pole (tower)
Class C liquid tanks	1.2 times of the height of power pole (tower)
Directly-buried Class C liquid tanks	0.6 times of the height of power pole (tower)

10.2.2 Power lines shall not be laid in the same pipe trench with Class A, B and C liquid pipelines, combustible gas pipelines and heating pipelines.

10.2.3 Distribution lines shall not pass through the inner cavity of the ventilating ducts or be directly laid on the external wall of the ventilating ducts. Distribution lines protected by metal tubes may be laid next to the external wall of the ventilating ducts.

Where distribution lines are laid in the concealed space above the suspended ceilings with combustibles, the lines shall be protected by metal tubes or be enclosed inside the metal slots.

10.2.4 Where switches, sockets and lighting fixtures are close to the combustibles, fire protection measures such as heat insulation and dissipation shall be taken.

For ceiling lamps, recessed lamps, embedded lamps using incandescent bulbs with rated power not less than 100W and tungsten halogen lamps, the income lines shall be heat insulated by noncombustible materials such as porcelain tube or mineral wool.

The incandescent lamps, tungsten halogen lamps, high voltage sodium lamps, metal halide lamps and fluorescent high-voltage mercury lamps (including inductive ballast) with rated power not less than 60W shall not be directly mounted onto combustibles, otherwise, fire prevention measures shall be taken.

10.2.5 Low temperature lighting fixtures should be installed in storages for combustibles, and heat insulation and other fire protection measures shall be taken for the parts of the lighting fixtures with high temperature; high temperature lighting fixtures such as tungsten halogen lamp shall not be permitted.

Distribution box and switch shall be installed outside the storages.

10.2.6 Design of electrical installations in explosive places shall comply with the requirements of the current national standard GB 50058 *Code for Design of Electrical Installations in Explosive Atmospheres*.

10.2.7 Electrical fire monitoring system shall be provided for the non-fire electrical load in aged care facilities. Electrical fire monitoring systems should be provided for the non-fire electrical load in the following buildings or locations:

- 1 Class B, C factory buildings and Class C storages with height greater than 50m; factory buildings (storages) with outdoor fire water demand greater than 30L/s;
- 2 Category I high-rise civil buildings;
- 3 Cinemas and theaters with seats more than 1 500, gymnasiums with seats more than 3 000, mercantile and exhibition buildings with the floor area of any storey greater than 3 000m², Radio & television, telecommunication, finance and trade buildings of provincial (municipal) level or above; other public buildings with outdoor fire water demand greater than 25L/s;
- 4 Historical buildings of brick-wood or timber structure of national-level cultural relics.

10.3 Fire emergency lighting and directional exit sign

10.3.1 Emergency lighting shall be installed at the following locations of civil buildings other than residential buildings with building height less than 27m, factory buildings and Class C storages:

- 1 Enclosed stairways, smoke proof staircases and their vestibules, vestibules or shared vestibules of fire elevator, refuge passageways and refuge floors (rooms);
- 2 Assembly locations such as auditoriums, exhibition halls, multi-functional halls as well as business or sales areas, dining halls and studios with floor area greater than 200m²;

- 3 Public places at underground or semi-underground levels with floor area greater than 100m²;
- 4 Exit passageways of public buildings;
- 5 Production sites and exit passageways in factory buildings with high occupant load.

10.3.2 The minimum illumination level of emergency lighting at the walking surfaces of the following locations shall comply with the following requirements:

- 1 For exit passageways, the minimum illumination level shall be not less than 1.0 lx.
- 2 For assembly occupancies and refuge floors (rooms), the minimum illumination level shall be not less than 3.0 lx; for aged care facilities, refuge rooms of inpatient medical care buildings or surgery departments, the minimum illumination level shall be not less than 10.0 lx.

3 For staircases, vestibules (shared vestibules) and refuge passageway, the minimum illumination level shall be not less than 5.0 lx; for staircases, vestibules (shared vestibules) and refuge passageway of assembly occupancies, aged care facilities, inpatient medical care buildings or surgery departments, the minimum illumination level shall be not less than 10.0 lx.

10.3.3 Stand-by lighting shall be provided for fire command centers, fire pump rooms, self-contained generator rooms, power distribution rooms, smoke control/exhaust machine rooms and fire-fighting equipment rooms which need normal operation in case of fire. The minimum illumination level of such places shall be not less than the working lighting illumination.

10.3.4 Emergency lighting luminaires shall be mounted above the exit, the upper part of the wall or the ceiling; stand-by lighting luminaires shall be mounted on the upper part of the wall or the ceiling.

10.3.5 Electro-luminescent directional exit signs shall be provided in public buildings, residential buildings with building height greater than 54m, high-rise factory buildings (storerooms) and Class A, B, C single-/multi-storey factory buildings, and shall comply with the following requirements:

- 1 It shall be mounted right above the exit or the exit door of the assembly locations.
- 2 It shall be mounted on the wall of the exit passageway, at a location not more than 1.0m above the floor or on the floor. The spacing between electro-luminescent directional exit signs shall be not greater than 20m; such spacing shall be not greater than 10m for dead ends and not be greater than 1.0m at the corner of the passageway.

10.3.6 Electro-luminescent directional exit signs or photo-luminescent directional exit signs for ensuring the visual continuity shall be installed on the floor of the exit passageway and the main escape route in the following buildings or locations:

- 1 Exhibition buildings with gross floor area greater than 8 000m²;
- 2 Aboveground mercantile buildings with gross floor area greater than 5 000m²;
- 3 Underground or semi-underground mercantile buildings with gross floor area greater than 500m²;
- 4 Entertainment and amusement occupancies;
- 5 Cinemas or theaters with seats more than 1 500, gymnasiums, assembly halls or auditoriums with seats more than 3 000;

6 Waiting rooms or public areas with floor area greater than 3 000m² in bus stations, wharf structures and civil airport terminals.

10.3.7 Directional exit signs and fire emergency lighting luminaires shall comply with those specified in this code, and the requirements of the current national standards GB 13495 *Fire Safety Signs* and GB 17945 *Fire Emergency Lighting and Evacuate Indicating System*.

11 Timber buildings

11.0.1 Fire safety of timber buildings shall be designed according to the requirements of this chapter. Combustibility and fire-resistance rating of timber elements shall comply with those specified in Table 11.0.1.

Table 11.0.1 Combustibility and fire-resistance rating of timber elements

Elements	Combustibility and fire-resistance rating(h)
Fire wall	Noncombustible 3.00
Load-bearing wall; walls between units of residential buildings and walls between families, walls of staircase	Difficult-combustible 1.00
Walls of elevator shaft	Noncombustible 1.00
Nonbearing exterior wall, partition walls on both sides of the exit passageway	Difficult-combustible 0.75
Room partition wall	Difficult-combustible 0.50
Load-bearing column	Combustible 1.00
Beam	Combustible 1.00
Floor assembly	Difficult-combustible 0.75
Load-bearing roof assembly	Combustible 0.50
Exit stair	Difficult-combustible 0.50
Suspended ceiling	Difficult-combustible 0.15

Notes: 1 Unless otherwise required by provisions of this code, where a timber building has roofs with different heights, combustible elements shall not be permitted for the load-bearing roof assemblies and roof coverings of the lower part. Where difficult-combustible load-bearing roof assemblies are used, the fire-resistance rating of such roof assemblies shall be not less than 0.75h.

2 For the roof of light wood-frame buildings, parts of the roof assembly other than waterproof membranes, insulation and roof sheathings shall be regarded as the load-bearing roof assembly, and shall not be combustible. The fire-resistance rating shall be not less than 0.50h.

3 In terms of timber buildings not higher than 2 storeys, when construction area per storey between fire walls is less than 600m², and the length of the building between fire walls is less than 60m, combustibility and fire-resistance rating of the building elements can be determined according to the requirements for Class IV building stipulated in this code.

11.0.2 Where partition walls with timber framework is used, the following requirements shall be complied with:

1 Room partition walls and nonbearing exterior walls with timber framework can be used in residential buildings not greater than 18m, office buildings not greater than 24m, and Class D, E factory buildings (storages), such nonbearing exterior walls shall not be permitted to use in buildings other than mentioned above;

2 Combustibility of the insulation of such walls shall be Class A;

3 The combustibility and fire-resistance rating of such walls shall comply with those specified in Table 11.0.2. Other requirements shall comply with those specified in current national standard GB/T 50361 *Technical Standard for Infills or Partitions with Timber Framework*.

Table 11.0.2 Combustibility and fire-resistance rating(h) of partition walls with timber framework

Elements	Fire-resistance rating or type of buildings				
	Class I	Class II	Class III	Timber buildings	Class IV
Nonbearing exterior wall	Not permitted	Difficult-combustible 1.25	Difficult-combustible 0.75	Difficult-combustible 0.75	No requirement
Room partition wall	Difficult-combustible 1.00	Difficult-combustible 0.75	Difficult-combustible 0.50	Difficult-combustible 0.50	Difficult-combustible 0.25

11.0.3 Timber buildings or hybrid timber buildings shall not be permitted for Class A, B and C factory buildings (storages). Where Class D, E factory buildings (storages) and civil buildings are timber structures or hybrid timber structures, the permissible number of storeys and building height shall comply with those specified in Table 11.0.3-1. The permissible building length and the maximum permissible gross floor area per storey between fire walls shall comply with those specified in Table 11.0.3-2.

Table 11.0.3-1 Permissible number of storeys and permissible building height of timber buildings or hybrid timber buildings

Type of timber buildings	Square and log structure	Light wood-frame structure	Glulam structure		Hybrid structure
Permissible number of storeys(storey)	2	3	1	3	7
Permissible building height(m)	10	10	unlimited	15	24

Table 11.0.3-2 Permissible building length and maximum permissible gross floor area per storey between fire walls

Number of storeys(storey)	Permissible building length between fire walls(m)	Maximum permissible gross floor area per storey between fire walls(m ²)
1	100	1 800
2	80	900
3	60	600

Notes: 1 Where sprinkler system is installed, the permissible building length and maximum permissible gross floor area per storey between fire walls can be increased by 1.0 times according to those specified in this table, the maximum permissible gross floor area per storey between fire walls is not limited for Class D, E aboveground factory buildings.

2 For large space buildings like gymnasiums or stadiums etc., the building height and floor area can be increased.

11.0.4 Aged care facilities, children's activity rooms and amusement halls in nurseries and kindergartens located in timber buildings shall be arranged on the first or second floor.

Mercantile buildings, gymnasiums, Class D and E factory buildings (storages) shall be single storey.

11.0.5 Other than residential buildings, the design and fire protection requirements for generator rooms, power distribution rooms and boiler rooms in buildings shall comply with the requirements of Article 5.4.12~ Article 5.4.15 and Article 6.2.3~ Article 6.2.6 of this code.

11.0.6 Garages, generator rooms, power distribution rooms and boiler rooms that are attached to the residential buildings of timber structure shall be separated from the other parts of the building by fire partition walls with fire-resistance rating not less than 2.00h and 1-hour-fire-resistance-rated

noncombustible floor slabs. No windows, doors and other openings should be permitted in such walls and floors. Where such openings are to be provided, such openings shall not directly lead to the bedroom and shall be protected by one single-leaf Class B fire doors. The floor area of the garage should not be greater than 60m².

11.0.7 Egress of civil timber buildings shall comply with the following requirements :

1 Exits and exit doors of rooms shall comply with the requirements of Section 5.5 of this code. Where 1 exit stairway is provided, the floor area per storey shall be less than 200m² and the total occupant load on the second and third floor shall be not greater than 25.

2 Distance from a room exit door that leads directly to the exit passageway to the nearest exit shall be not greater than those specified in Table 11.0.7-1.

Table 11.0.7-1 Distance from exit door directly leading to exit passageways to the nearest exit (m)

Name	Exit door located between two exits	Exit door located at both sides or end of dead end
Nursery, kindergarten and aged care facility	15	10
Entertainment and amusement occupancy	15	6
Hospital, sanatorium and teaching buildings	25	12
Other civil buildings	30	15

3 Distance from any point in a room to the exit door of the room which directly leads to the exit passageway shall not be greater than the distance specified in Table 11.0.7-1, which is the distance from the exit door located at both sides or the end of the dead end to the nearest exit.

4 Clear width per 100 occupants of exit passageways, exits, exit stairs and room exit doors in buildings shall be established by calculation based on those specified in Table 11.0.7-2.

Table 11.0.7-2 Minimum clear width per 100 persons of exit passageways, exits, exit stairs and room exit doors (m/100 persons)

Number of storeys	1 st and 2 nd floors aboveground	3 rd floor aboveground
Clear exit width per 100 persons	0.75	1.00

11.0.8 Distances from any point in a Class D, E timber factory buildings to the nearest exit shall be not greater than 50m and 60m respectively. Other egress requirements shall comply with those specified in Section 3.7 of this code.

11.0.9 Pipelines and electrical wires inside wall cavities or penetrations through walls and floors shall be fire protected. Gaps between such pipelines or wires and walls or floors shall be fire-stopped.

Locations exposed to open fires or with high temperatures in kitchens and exhaust ducts shall be fire protected.

11.0.10 Fire separation distance between any two civil timber buildings, civil timber building and other civil buildings shall be not less than those specified in Table 11.0.10.

Fire separation distance between civil timber buildings and factory buildings (storages) , between any two timber factory buildings (storages) , between timber factory buildings (storages) and other civil buildings shall comply with the requirements for Class IV buildings as required in Chapter 3 and Chapter 4 of this code.

**Table 11.0.10 Fire separation distance(m)between any two civil timber buildings,
civil timber buildings and other civil buildings**

Fire-resistance class or type of buildings	Class I and II	Class III	Timber buildings	Class IV
Timber buildings	8	9	10	11

Notes: 1 Fire separation distance can be 4m provided that there are no openings of doors or windows in the two adjacent exterior walls of any two timber buildings or the timber building and other types of civil building. Provided that openings of doors and windows in the exterior walls are not right opposite to each other and total area of the openings do not exceed 10% of the exterior wall areas, the fire separation distance shall reduce 25% based on those specified in this table.

2 No fire separation distance is required provided that one of the exterior walls between any two neighboring buildings is a fire wall; or the partition wall between two timber buildings is a fire wall, and such fire wall separates the noncombustible roof or extends up through the difficult combustible/combustible roof for a height of at least 0.5m above the top surface of the roof covering.

11.0.11 Fire separation measures shall be taken in timber walls, floors, and concealed ceilings or concealed spaces under the roof. Horizontal fire separations shall be installed so that either the length or width is not more than 20m, and the area of each horizontal space is not more than 300m²; fire separations shall be installed vertically every 3m in the wall.

Fire separations shall be installed at stair stringers of every flight in light wood frame constructions.

11.0.12 Where timber structure is constructed with other structures, such as steel, reinforced concrete or masonry structure, the following requirements shall be complied with:

1 When constructed vertically, the timber structure shall be built on the upper part of the building. The light wood frame construction on the upper part shall be 3 storeys or less. The timber structure shall be separated from the other structures by noncombustible floor assemblies with fire-resistance rating no less than 1.00h.

When constructed horizontally, they should be separated by fire walls.

2 Where timber structure is separated from other structures by fire separations according to Item 1 specified above, fire safety design of timber structure and other structures shall comply with respectively the requirements for timber structures and other structures stipulated in this code; otherwise, fire safety designs of the hybrid building shall comply with the requirements for timber structures stipulated in this code.

3 Indoor firefighting water supply shall be defined according to chapter 8 of this code and related national standards based on total building height, volume, number of storeys and occupancies of the hybrid building. Outdoor firefighting water supply shall be defined according to the requirements in this code for Class IV buildings.

11.0.13 Public light wood frame constructions with gross floor area greater than 1 500m² shall be provided with automatic fire alarm systems. Light wood frame residential buildings shall be provided with fire detections and alarm devices.

11.0.14 Unless otherwise specified in this chapter, fire safety design requirements of timber buildings shall comply with those of Class IV buildings specified in this code. Fire protection construction requirements shall comply with those specified in the code, and the national standard GB 50005 *Standard for Design of Timber Structures* as well.

12 Urban road tunnel

12.1 General requirements

12.1.1 Fire protection design of the urban road tunnel (hereinafter referred to as tunnel) shall have an overall consideration of the vehicle types, function, natural conditions and length of the tunnel.

12.1.2 Single-bore and two-bore tunnels shall be classified into Class I, II, III and IV according to the enclosed length and traffic situations, and shall comply with those specified in Table 12.1.2.

Table 12.1.2 Classification of single-bore and twin-bore runnels

Function	Class I	Class II	Class III	Class IV
	Enclosed length of the tunnel $L(m)$			
Motor vehicles with dangerous chemicals are permitted	$L > 1\,500$	$500 < L \leq 1\,500$	$L \leq 500$	-
Only motor vehicles with non-dangerous chemicals are permitted	$L > 3\,000$	$1\,500 < L \leq 3\,000$	$500 < L \leq 1\,500$	$L \leq 500$
Only pedestrians or non-motor vehicles are permitted	-	-	$L > 1\,500$	$L \leq 1\,500$

12.1.3 The fire-resistance rating of the load-bearing structure of the tunnel shall comply with the following requirements:

1 For Class I, II tunnels and Class III tunnels for vehicles, the fire-resistance rating of the load-bearing structures shall be determined according to those specified in Appendix C of this code; For Class I or Class II tunnels, such load-bearing structures shall comply with RABT standard temperature-rise curve specified in Article C.0.1 in Appendix C of this code, and the fire-resistance rating shall be not less than 2.00h and 1.50h respectively; for Class III vehicle tunnels, such load-bearing structures shall comply with HC standard temperature-rise curve specified in Article C.0.1 in Appendix C of this code, and the fire-resistance rating shall be not less than 2.00h.

2 For other tunnels, the testing of the fire-resistance rating of the load-bearing structures shall comply with the requirements of the current national standard GB/T 9978.1 *Fire-resistance Tests-Elements of Building Construction Part 1: General Requirements*. The fire-resistance rating of Class III tunnels shall be not less than 2.00h. The fire-resistance rating of Class IV tunnels is not required.

12.1.4 The fire-resistance class shall be Class I for underground equipment rooms, air shafts, openings for fire fighter access of tunnels. The fire-resistance class shall be not less than Class II for above-ground important equipment rooms, operation and management centers as well as other auxiliary rooms.

12.1.5 Except the joint caulking materials, noncombustible materials shall be used for the internal decoration of tunnels.

12.1.6 For two-bore vehicle tunnels, the transverse connections or evacuation tunnel for vehicles shall comply with the following requirements:

1 Transverse connections or evacuation tunnels for vehicles should be provided for underwater tunnels; the spacing between the entrances to the transverse connection or the entrances from the tunnels to the evacuation tunnel for vehicles should be not greater than 1 000m to 1 500m.

2 Transverse connections or evacuation tunnels for vehicles shall be provided for non-underwater tunnels; the spacing between the entrances to the transverse connections or the entrances from tunnels to the evacuation tunnel for vehicles should be not greater than 1 000m.

3 The transverse connections shall be provided perpendicular to the tunnels and leads to the other bore; the evacuation tunnel for vehicles shall be provided between the two bores in the lengthwise direction of the tunnel and directly leads to the outdoors.

4 Clear width of the transverse connections or evacuation tunnel for vehicles shall be not less than 4.0m and the clear height shall be not less than 4.5m.

5 Fire separation measures shall be taken at the entrance from the tunnel to the transverse connections or the evacuation tunnel for vehicles.

12.1.7 Transverse connections or exit passageway for pedestrians shall be provided in the two-bore tunnels and shall comply with the following requirements:

1 The spacing between the entrance to the transverse connections or the entrance from the tunnel to the exit passageway should be 250m to 300m.

2 The transverse connections shall be provided perpendicular to the two-bore tunnel and leads to the other bore; the exit passageway shall be provided between the two bores in the lengthwise direction of the tunnel and directly leads to the outdoors.

3 The transverse connections for vehicles can be used as pedestrian passageway.

4 Clear width of the transverse connections or exit passageway shall be not less than 1.2m and the clear height shall be not less than 2.1m.

5 Fire separations such as Class B fire doors shall be installed at the entrance from the tunnel to the transverse connections or the exit passageway.

12.1.8 Single-bore tunnels should be provided with refuge areas or exits directly leading to the outdoors.

12.1.9 Fire partition walls shall be provided to separate the substations, utility tunnels, dedicated exit passageways, ventilation machine rooms or other auxiliary rooms from the vehicle tunnels. The fire-resistance rating of the fire partition wall shall be not less than 2.00h. Door openings in fire partition walls shall be protected by Class B fire doors.

12.1.10 The maximum permissible gross floor area of each fire compartment of the underground equipment rooms of a tunnel shall be not greater than 1 500m²; the number of exits of each fire compartment shall be not less than 2; the exits leading to the tunnel or other fire compartments may be used as the secondary exit, but at least one exit directly leading to the outdoors must be provided. Unattended equipment rooms with floor area not greater than 500m² may be permitted to have only one exit that leads directly to the outdoors.

12.2 Fire water supply and fire extinguishing equipment

12.2.1 During urban traffic planning and design, fire water supply systems shall be designed at the same time. Class IV tunnels, Class III tunnels for pedestrians or non-motor vehicles may not be provided with fire water supply system.

12.2.2 The arrangement of fire water supply systems shall comply with the following requirements:

1 Fire water sources and water supply networks shall comply with the relevant current national standards.

2 Fire water demands shall be calculated according to the fire duration of the tunnel and the situation that the entire length of the tunnel is involved in one fire at the same time. The fire duration of Class I or Class II tunnels shall be not less than 3.0h, and that of the Class III tunnels shall be not less than 2.0h.

3 Fire water demand in the tunnel shall be calculated according to the total water consumption when all the fire extinguishing facilities are activated at the same time.

4 Independent fire water supply systems should be provided in the tunnel. Anti-freezing measures shall be taken for fire water supply pipelines and outdoor fire hydrants in severe cold and cold zones; where dry-type water supply system is provided, automatic air exhaust valve shall be installed at the highest position of the pipe network and the filling time of the pipeline should not be greater than 90s.

5 The water demand of fire hydrants inside the tunnel shall be not less than 20L/s; and that of fire hydrants outside the tunnel shall be not less than 30L/s. For Class III tunnels with the length less than 1 000m, the water demand of fire hydrants inside and outside the tunnel may be 10L/s and 20L/s respectively.

6 The fire water supply pressure in the pipelines shall guarantee that the solid stream of the water gun at the most unfavorable point shall be not less than 10.0m when the water demand reaches the maximum; when the outflow pressure at fire hydrant outlet is greater than 0.5MPa, relief pressure devices shall be equipped.

7 Fire pump adapters and outdoor fire hydrants shall be installed at the exits/entrances of the tunnel.

8 The spacing of fire hydrants in the tunnel shall be not greater than 50m; the height of the fire hydrant outlet should be 1.1m above the ground.

9 For tunnels with fire pumps for water supply, the switch to start the fire pump shall be installed in the fire hydrant cabinet.

10 Indoor fire hydrant cabinets shall be installed along one side of the tunnel. The fire hydrant cabinet shall be equipped with a water gun with the diameter of jet hole of 19mm, a water hose with length of 25m and diameter of 65mm. A fire hose reel should be provided in the same cabinet.

12.2.3 Drainage facilities shall be provided in the tunnel with the consideration of discharging seeped water, rainwater, tunnel cleaning water and water from firefighting. Measures shall be taken to prevent combustible or harmful liquids from flowing along the tunnel during the accident.

12.2.4 ABC fire extinguishers shall be equipped in the tunnel and shall comply with the following requirements:

1 For Class I or Class II vehicle tunnels, Class III vehicle tunnels with 3 or more lanes, fire extinguishers shall be located along both sides of the tunnel. The number of the fire extinguishers at each fire extinguisher location shall be not less than 4;

2 For tunnels other than those mentioned in Item 1, fire extinguishers is permitted to locate along one side of the tunnel. The number of fire extinguishers at each fire extinguisher location shall be not less than 2;

3 The spacing of the fire extinguisher locations shall be not greater than 100m.

12.3 Ventilating and smoke exhaust system

12.3.1 Smoke exhaust facilities shall be provided for Class I, II and III vehicle tunnels.

12.3.2 Mechanical smoke exhaust systems in the tunnel shall comply with the following requirements:

1 Longitudinal smoke exhaust by sections or/and zone transverse smoke exhaust should be provided for tunnels with length exceeding 3 000m;

2 Longitudinal smoke exhaust should be provided for single-bore one-way vehicle tunnels with length not greater than 3 000m;

3 Zone transverse smoke exhaust should be provided for single-bore two-way vehicle tunnels.

12.3.3 Mechanical smoke exhaust systems and ventilating systems of the tunnel should be installed separately, otherwise the ventilating system shall have quick switching function in case of fire and shall comply with the requirements for mechanical smoke exhaust system.

12.3.4 Mechanical smoke exhaust systems installed in the tunnel shall comply with the following requirements:

1 Where full-transverse or semi-transverse ventilation is adopted, smoke is permitted to be exhausted through exhaust duct.

2 Where longitudinal smoke exhaust is adopted, it shall be able to rapidly organize the air flow and effectively exhaust the smoke; the smoke exhaust velocity shall be determined according to the worst fire scenario; the longitudinal air velocity shall be not less than 2m/s and shall be greater than the critical air velocity.

3 Smoke exhaust fans and auxiliary equipment such as air valves, mufflers and soft joints shall be able to bear the designed fire smoke temperature and shall keep working for no less than 1.0h at 250°C. The fire-resistance rating of the smoke exhaust pipelines shall be not less than 1.00h.

12.3.5 Independent mechanical pressurized air supply systems shall be provided in the refuge rooms of the tunnel. The residual pressure value of the air supply shall be 30Pa to 50Pa.

12.3.6 At least a set of standby jet fan shall be equipped in the tunnel for fire smoke exhaust.

12.4 Fire alarm system

12.4.1 Alarm signal devices shall be installed at locations 100m to 150m to the tunnel entrance to warn "No Entrance" for vehicles in case of fire.

12.4.2 Fire alarm systems shall be provided for Class I or Class II tunnels and should be provided for Class III vehicle tunnels. Fire alarm systems in the tunnel shall comply with the following requirements:

1 Automatic fire detection devices shall be provided;

2 Alarm telephones and alarm buttons shall be installed at the tunnel exits /entrances and the spacing shall be 100m–150m;

3 Fire emergency broadcast shall be provided or luminous alarm devices shall be installed and the spacing shall be 100m–150m.

12.4.3 Fire alarm systems shall be provided in the tunnel cable channels and main equipment rooms.

12.4.4 Facilities such as wireless communication to ensure effective communication during fire fighting shall be equipped for such tunnels where signals has the potential to be shielded.

12.4.5 The tunnel with enclosed length exceeding 1 000m should be provided with a fire command center; fire protection requirements for the fire command center shall comply with those specified in Article 8.1.7 and Article 8.1.8 of this code.

The design of fire alarm systems in the tunnel shall comply with the requirements of the current national standard GB 50116 *Code for Design of Automatic Fire Alarm System*.

12.5 Power supply and other requirements

12.5.1 The power for fire protection of Class I or Class II tunnels shall be supplied according to the requirements for the first grade electrical load; the power for fire protection of Class III tunnels shall be supplied according to the requirements for the second grade electrical load.

12.5.2 Unless otherwise specified in this section, other requirements for the fire power source, power supply and distribution lines of the tunnel shall comply with those specified in Section 10.1 of this code.

12.5.3 Emergency lighting and directional exit signs shall be installed along both sides of the tunnel or above the transverse connections and exit passageways for pedestrians. The installation height should not be greater than 1.5m above the ground.

The time for continuous power supply of emergency lighting and directional exit signs in Class I or Class II tunnels shall be not less than 1.50h, while that for other tunnels shall be not less than 1.00h. Additional requirements may be determined according to those specified in Chapter 10 of this code.

12.5.4 Combustible gas pipelines must not be installed in the tunnel; the cable trays shall be laid separately from other pipelines. Where high-voltage cable of 10kV or above is installed, it shall be separated from the remainder of the tunnel by fire separation with fire-resistance rating not less than 2.00h.

12.5.5 Protection measures shall be taken for all the fire-fighting facilities installed in the tunnel to be consistent with the environmental conditions of the tunnel; visible luminous indicating signs shall be provided.

Appendix A Calculation method of building height and number of storeys

A.0.1 The calculation of building height shall comply with the following requirements:

1 Building height shall be the average height from the outdoor finished ground level to the eave or roof ridge of the building when the building has a sloping roof.

2 Building height shall be the height from the outdoor finished ground level to the roof covering of the building when the building has a flat roof(including the flat roof with parapet walls).

3 When a building has roofs with different heights, the building height shall be the largest one among values calculated respectively according to the methods specified in Item 1 and 2.

4 For a building that is located on a ground with different elevations, the building height can be calculated respectively provided that the parts of the building at different elevations are separated by a fire wall; the parts at different elevations are provided with exits meeting the requirements of this code; fire vehicle access roads that connect with public streets/roads or dead-end with turnarounds provided along the two long sides of the building. Otherwise, the building height shall be the height of the part with the largest height.

5 The building height may not count for the height of the following auxiliary rooms or facilities accounting for less than 1/4 of the area of the roof: watchtower, cooling tower, water tank cabinets, microwave antenna cabinets, elevator machine rooms, air and smoke exhaust rooms and stair penthouses etc.

6 The residential building height may not count for the height of the following: bicycle garages, storerooms and open spaces with the indoor height not greater than 2.2m at the bottom of the building; the parts of the building with height difference of the indoor floor and the outdoor finished ground level no greater than 1.5m; the basements or semi-basements of the building with height difference of the indoor ceiling and the outdoor finished ground level no greater than 1.5m.

A.0.2 The number of building storeys shall be calculated according to the natural storeys of the building. The following spaces may not be counted in the number of storeys:

1 Basement and semi-basements with height difference of the indoor ceiling and the outdoor finished ground level no greater than 1.5m;

2 Bicycle garages, storerooms and open spaces with the indoor height not greater than 2.2m at the bottom of the building;

3 Equipment rooms and stair penthouses on the roof of the building.

Appendix B Calculation method of fire separation distance

B.0.1 Fire separation distance between any two buildings shall be calculated according to the nearest horizontal distance between exterior walls of two neighboring buildings; in case of protruding combustible or difficult-combustible elements on the exterior wall, the fire separation distance shall be calculated from the outer edge of protruding parts.

Fire separation distance between buildings and storage tanks, stackyards shall be calculated according to the nearest horizontal distance from the exterior wall of the buildings to the outer wall of storage tanks or to the outer edges of adjacent stacks.

B.0.2 Fire separation distance between any two storage tanks shall be the nearest horizontal distance between the outer walls of two adjacent storage tanks.

Fire separation distance between storage tanks and stackyards shall be the nearest horizontal distance from the outer walls of storage tanks to the outer edges of adjacent stacks.

B.0.3 Fire separation distances between any two stackyards shall be the nearest horizontal distances between the outer edges of adjacent stacks in two stackyards.

B.0.4 Fire separation distance between any two transformers shall be the nearest horizontal distance between the outer walls of adjacent transformers.

Fire separation distance from transformers to buildings, storage tanks or stackyards shall be the nearest horizontal distance from the outer wall of the transformer to the exterior wall of the building, outer wall of the storage tank or the outer edges of the adjacent stacks.

B.0.5 Fire separation distance from buildings, storage tanks or stackyards to the roads or railways shall be the nearest horizontal distance from the exterior wall of the building, outer wall of the storage tank or the outer edge of the adjacent stacks to the nearest roadside of the road or the centerline of the railway.

Appendix C Temperature-rise curve for fire-resistance rating test and performance criteria of load-bearing structure in tunnels

C.0.1 RABT and HC standard temperature-rise curves shall comply with the requirements of the current national standard GB/T 26784 *Fire Resistance Test for Elements of Building Construction Alternative and Additional Procedures*.

C.0.2 Performance criteria of the fire-resistance rating shall comply with the following requirements:

1 When the test is carried out by following HC standard temperature-rise curve, the performance criteria of the fire-resistance rating shall be judged by the following: when the temperature of the steel bars 25mm away from the exposed surface of the concrete tunnel sample is greater than 250°C, or the temperature of the exposed surface of the concrete tunnel sample is greater than 380°C.

2 When the test is carried out by following the RABT standard temperature-rise curve, the performance criteria of the fire-resistance rating shall be judged by the following: when the temperature of the steel bars 25mm away from the exposed surface of the concrete tunnel sample is greater than 300°C, or the temperature of the the exposed surface of the concrete tunnel sample is greater than 380°C.

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Explanation of wording in this code

1 Words used for different degrees of strictness are explained as follows in order to mark the differences in implementing the requirements of this standard.

1) Words denoting a very strict or mandatory requirement:

"Must" is used for affirmation, "must not" for negation.

2) Words denoting a strict requirement under normal conditions:

"Shall" is used for affirmation, "shall not" for negation.

3) Words denoting a permission of a slight choice or an indication of the most suitable choice when conditions permit:

"Should" is used for affirmation, "should not" for negation.

4) "May" is used to express the option available, sometimes with the conditional permit.

2 "Shall comply with..." or "shall meet the requirements of..." is used in this code to indicate that it is necessary to comply with the requirements stipulated in other relative standards and codes.

List of quoted standards

- GB 50005 *Standard for Design of Timber Structures*
- GB 50028 *Code for Design of City Gas Engineering*
- GB 50041 *Standard for Design of Boiler Plant*
- GB 50052 *Code for Design Electric Power Supply Systems*
- GB 50058 *Code for Design of Electrical Installations in Explosive Atmospheres*
- GB 50072 *Code for Design of Cold Store*
- GB 50074 *Code for Design of Oil Depot*
- GB 50084 *Code for Design of Sprinkler Systems*
- GB 50116 *Code for Design of Automatic Fire Alarm System*
- GB 50156 *Code for Design and Construction of Filling Station*
- GB 50229 *Standard for Design of Fire Protection for Fossil Fuel Power Plants and Substations*
- GB 50322 *Code for Design of Grain Steel Silos*
- GB/T 50361 *Technical Standard for Infills or Partitions with Timber Framework*
- GB 50368 *Residential Building Code*
- GB 50751 *Technical Code for Medical Gases Engineering*
- GB 50974 *Technical Code for Fire Protection Water Supply and Hydrant Systems*
- GB/T 7633 *Fire Resistance Tests-Door and Shutter Assemblies*
- GB/T 9978.1 *Fire-resistance Tests-Elements of Building Construction Part 1: General Requirements*
- GB 12955 *Fire Resistant Doorsets*
- GB 13495 *Fire Safety Signs*
- GB 14102 *Fire Resistant Shutter*
- GB 15930 *Fire Dampers for Building Venting and Smoke-venting System*
- GB 16809 *Fire Resistant Windows*
- GB 17945 *Fire Emergency Lighting and Evacuate Indicating System*
- GB 25506 *General Technical Requirements for Fire Control Center*
- GB/T 26784 *Fire Resistance Test for Elements of Building Construction Alternative and Additional Procedures*
- GB/T 27903 *Fire Resistance Test for Lift Landing Doors-Methods of Measuring Integrity, Thermal Insulation and Heat Flux*