

# **Fire prevention and protection for buildings and structures – Design requirements**

## **1. Scope of Applications**

This standard is obligatorily applicable. It is allowable to apply other standards when technology and safety levels which are higher than the regulations of this standard are ensured – This standard define basic requirements for fire prevention and protection when designing, newly building or improving buildings and structures, and when assessing designs and considering the decision to put buildings and structures into use.

The designs of buildings and structures besides complying with the regulations of this standard must conform to related regulations of other current standards. Specific professional structures with special requirements for fire prevention and protection are particularly regulated on fire prevention and protection, e.g. storehouses for inflammables, explosives, harmful chemical products – Above structures apply only some suitable regulations of this standard.

Provisional structures, having service lives not more than 5 years only apply the exist parts and make reference to other parts of this standard.

## **2. General regulations**

- 2.1. The designs of buildings, structures, structures' groups, including structures designed and/or invested by foreigners, must apply the requirements for fire prevention and protection and these requirements must be agreed by fire prevention and protection organs.
- 2.2. Buildings and structures are divided into 5 classes of fireproof ness I, II, III, IV and V. The fireproof class of a building and structure is determined according to fireproof limits of their major construction components. See table 2.
- 2.3. Industrial production structures are divided into six classes of fire and explosion risks for production technologies and material natures located therein as in table 1.

Table 1

Production categories	Natures of substances and materials available in production processes
A Fire and explosion risks	Gases having lower limits of combustion and explosion concentration not more than 10% of air volume and liquids having a flash temperature below 28°C, if these liquids and gases can form a mixture which is easily explosive with a volume over 5% of room air volume; substances that can explode and fire when interact with one another, water or oxygen in the air.
B Fire and explosion risks	Gases having lower limits of explosion concentration more than 10% of air volume, liquids having a flash temperature from 28°C to 61°C, liquids being heated in production conditions up to or over the flash temperature, combustible dusts or fibers having lower limits of explosion not more than 65g/m <sup>3</sup> , if these liquids, gases and dusts or fibers can form a mixture which is easily explosive with a volume over 5% of room air volume.
C Fire risks	Liquids with a flash temperature over 61°C; combustible dusts or fibers with lower limits of explosion more than 65g/m <sup>3</sup> ; combustible solid substances and materials. Substances that can only start fire when interact with water, air or when interact with one another.
D Not showing any dangerous production natures	Non-flammable substances and materials in hot, hot red and melting states, that working processes associated with the generation of heat radiation, sparks and flames; solids, liquids and gases are combusted or used as fuel.
E Not showing any dangerous production natures	Non-flammable substances and materials in a cold state.
F Explosion risks	Gases that are inflammable not through liquidization, dusts associated with explosion risks with the quantity that can form an explosive mixture with a volume exceeding 5% of room air volume where according to the conditions of technological processes only will explosion occur (not associated with fire). Substances that are explosible (not associated with fire) when interacting with one another or with water, oxygen and air.

**Notes:**

- 1) Production structures of respective production classes to see appendix B;
- 2) Storehouses according to the natures of fire and explosion risks of the goods and materials stored therein to determine production classes in accordance with the regulations in Table 1;
- 3) Production technologies using combustion fuel that is liquids, gases and steams or bare flame do not belong to production classes A, B, C.

2.4. Construction materials and components are divided into three groups according to their combustion levels: incombustible, unflammable, and combustible. See appendix A.

**3. Terminology – definitions**

(According to TCVN 5303 – 1990. Fire safety. Terminology – definitions)

<b>Terminology</b>	<b>Definitions</b>
1	2
1. Combustible substance	A substance that under the effect of fire or a high temperature goes up in flames, smolders or is carbonized and continues to smolder or be carbonized after the firing sources have been isolated.
2. Uninflammable Substance	A substance that under the effect of fire or a high temperature goes up in flames, smolders or is carbonized and continues to burn, smolder or be carbonized when fire sources are available. But after isolating the firing sources, the substance stops burning or smoldering.
3. Incombustible Substance	A substance that under the effect of fire or a high temperature does not go up in flames or smolder and is not carbonized.
4. Fire resistance	Properties of construction components and structures to maintain their fire-resistance abilities, as well as their abilities to resist the formation of gaps and heating-up to critical temperatures and spreading a flame.
5. Fire resistance level	Time (in hours or minutes) as from the start of standard fire-resistance test of samples up to the appearance of one of limited states of structures and components.
6. Type of fire resisting construction of a building	A specific strait of standard fire resistance of buildings and structures that is defined by fire resistance levels of major construction components.
7. Inflammation temperature	The lowest temperature of a combustible substance, at which when influenced by a fire source the combustible substance will go up in flames and keep burning after discontinuing the firing source.
8. Limited concentration of inflammation	The lower or upper limits of a combustible substance (combustible steams, gases and dusts) in its mixture with oxidizing substances that can go up in flames when being influenced by a firing source.
9. Limited temperature of inflammation	The lower or upper limits of a combustible substance corresponding to the lower and upper limits of inflammation concentration.
10. Fire spreading speed	The spreading distance of a flame in horizontal or vertical directions in one unit of time.
11. Firing/Burning source	An energy source resulting in burning of matters.
12. Burning	An oxidation reaction with heat radiation and light generation
13. Flame	The outer shape to show burning in the states of gases or dust clouds.
14. Spark	Incandescent elements of matters that are spattered or electric discharge in the air.
15. Incandescence	The incandescent state of solids, featuring heat radiation and light generation.
16. Smolder	Burning of organic solids without formation of flames, normally happening due to insufficient amount of oxygen and generating smoke.
17. Carbonization	The formation of carbon and ashes resulting from partial pyrolysis or burning of organic substances.
18. Combustion	Deliberate and controllable firing
19. Fire	Uncontrollable burning, with possibility to cause human and/or property losses.

20. Fire cause	Conditions and/or states directly resulting in a fire
21. Threat of fire	The situation that is typical of the ability to directly give rise to a fire.
22. Fire hazard	The ability to give rise to and develop a fire inherent in matters, in certain environmental conditions and processes.
23. Fire safety	The states or natures of products, methods, means of production and areas that eliminate the possibility of a potential fire and reduce the consequences of a happening fire thanks to organizational measures, technical and technological solutions.
24. Evacuation	Removal of human from a place with a fire hazard through exits to a safe place.
25. Evacuation plan	Written instructions of exits and regulations on behavior of everyone, responsibilities of responsible personnel upon performance of evacuation from a fire.
26. Fire prevention system	A combination of requirements, measures, means and methods in order to eliminate a potential fire.
27. Fire protection system	A combination of requirements, measures, means and methods in order to prevent a fire, keep it from spreading, assure of stamping out the fire, stop hazardous and harmful factors against human, and minimize property losses.
28. Fire fighting operations	Operations of men and fire fighting means with the application of certain methods to stop the spread of and stamp out a fire.
29. Fire extinguishing agent	A matter with physical and chemical properties that can create conditions to stop and stamp out a fire.
30. Fire fighting water supply	A combination of measures means and devices to reserve and transport water for fire fighting operations.
31. Method of fire fighting	The method of using fire fighting agent with necessary equipment and other means to stop the spread of and stamp out a fire.
32. Fire liquidation	Operations of men and fire fighting means, applying certain methods to thoroughly stamp out a fire and eliminate possible recovery of the fire.

#### 4. Quotation documents

1. TCVN 2622:1978 Fire prevention and fighting for buildings and structures- Design requirements
2. TCVN 5303:1990 Fire safety – Terminology and definitions
3. TCVN 4513:1988 Internal water supply
4. TCVN 5760:1993 Fire fighting system – General requirements for designs, installation and application
5. TCVN 5738:1993 Fire warning system – Design requirements

#### 5. Fire resistance of construction materials and components of buildings and structures

- 5.1. Minimum fire resistance and burning levels of major construction components corresponding to types of fire resisting construction of buildings and structures are defined in table 2.

Table 2

Type of fire resisting construction of a building	Fire resistance levels (minutes)					
	Columns, bearing walls, elevators' chambers, staircase	Landings, steps and other components of stairs	Outside (external) non-bearing walls	Inside non-bearing walls (partitions)	Paving tiles and other bearing components of floor slabs	Paving tiles and other bearing components of roofs
(1)	(2)	(3)	(4)	(5)	(6)	(7)
I	150	60	30	30	30	60
II	120	60	15	15	45	15
III	120	60	15	15	60	Not stipulated
IV	30	15	15	15	15	Not stipulated
V	Not stipulated					

**Notes:**

- 1) *In buildings with fire resistance level III, first and second storeys' floors must be made of unflammable substances, basement or wall-foot floors must be made of incombustible substances, with fire resistance levels not below 60 minutes;*
  - 2) *In buildings with fire resistance levels IV and V, basement or wall-foot floors must be made of unflammable substances with fire resistance levels not below 45 minutes;*
  - 3) *In production, application or storage rooms of combustible and inflammable liquids, floors must be made of incombustible substances.*
  - 4) *For buildings with roof basements that roofs' bearing structures are incombustible substances, roofs are allowable to be made of combustible substances and not depending on fire resistance levels of the buildings;*
  - 5) *For buildings 30m and less distant from steam-engine train railways, roofing are not allowed to be made of combustible substances;*
- 5.2. An increase or reduction in the fire resistance levels of some construction components cannot be considered as upgrading the fire resistance levels of a building or structure.
- 5.3. For fire resistance levels I&II, it is allowable not to comply with fire resistance levels as already defined in table 2 when:
- a) Using steel structures without protection in one-storey production buildings, and not depending on considerations of fire risks of produced items arranged therein;

- b) Using steel structures without protection in multi-storey production buildings when produced items D and E are arranged therein;
- c) Using steel structures in multi-storey production buildings when technologies of A, B and C classes are arranged therein on conditions that steel structures must be protected by incombustible substances with fire resistance levels not below 45 minutes in all storeys, except the top storey;
- d) Using steel structures to cover the roofs, basements and floors in public buildings and structures with types of fire resistance I, II that the steel structures are protected by combustible substances or fireproof paints, with fire resistance levels not below 45 minutes. For public buildings and structures having ten storeys and more, their steel structures must be protected by fireproof materials, with fire resistance levels not below 60 minutes.

Fire resistance levels (minutes) of major wooden components in one-storey buildings of industrial works, public works, production buildings' storehouses with types of fire resisting construction II are defined in table 3.

**Table 3**

Types of fire resisting construction of buildings, structures	Major wooden components				
	Columns	Outside walls made of hanging panels	Roofs		Inside bearing walls (partitions)
II	120	30	30	45	15

**Notes:**

- 1) For production buildings, public buildings and structures, storehouses and produced items B buildings, components stated in table 3 must be processed for fire protection;
- 2) It is not allowed to use above-mentioned components for production buildings, storehouses with produced items A and B.

5.5. Minimum fire resistance levels (minutes) of fire-blocking parts or in buildings of all five types of fire resisting construction are defined as below:

Fire-blocking parts	Minimum fire resistance levels (minutes)
1. Fire-blocking walls	150
2. Doors, windows and gates in fire-blocking walls	70
3. Fire-blocking partitions	45

4. Doors, windows and fire-blocking partitions, fire-blocking doors in buffer rooms of production buildings of classes A, B, C, entrances to ceiling basements, fireproof ceiling entrances.	40
5. Fireproof floors (floors between storeys, floors of ceiling basements, mezzanine floors) in buildings of fire-resisting construction type I	60
6. Fireproof floors (floor between storeys, floors of ceiling basements, floors above basements, mezzanine floors) in buildings of fire-resisting construction type II, III, IV.	45

Fire-blocking parts must be made of incombustible materials.

- 5.6. Doors, windows, roof openings, floor surfaces, mezzanine partitions, ceiling and wall decorations in buildings of all fire-resisting types are allowed to be made of combustible materials, except those components and structures stated in paragraph 5.5.
- 5.7. Fireproof stairs' parts in buildings of fire-resisting types I, II and III (beams, landings, stairs, stair-steps) must be made incombustible materials with fire resistance levels at least 60 minutes.

In apartment type two-storey buildings, stairs' steps and landings are allowed to be made of wood.

- 5.8. Walls, partitions and floors of elevators' chambers and lifting-engine parts arranged in buildings of any fire-resisting types must be made of incombustible substances with fire resistance levels at least 60 minutes. If elevators are located outdoors, these levels must be not below 30 minutes.
- 5.9. In roofs of buildings of fire-resisting types I, II, it is allowed to use combustible substances for thermal insulation on the surfaces of concrete blocks, concrete beams and fibro-cement blocks. Insulation layers in corrugated iron or metal roofs must be made of unflammable or incombustible substances.

In one- or two-storey production buildings of fire-resisting types I and II, one-storey storehouses of fire-resisting types II having steel construction components without protection layers, it is allowed to use thermal insulators made of combustible substances on the surfaces of steel plates, fibro-cement blocks and hollow panels. For production buildings, storehouses of production classes A, B, C, it is possible automatic water cooling system. It is not allowed to use combustible synthetic substances as thermal insulators in these buildings.

- 5.10. If outside walls of one-, two-storey buildings of fire-resisting types II, III are made of steel plates or fibro-cement panels, insulation layers must be made of unflammable substances.
- 5.11. In apartment type residential buildings having three or more storeys, partitions between units must be made of incombustible substances with fire resistance levels at least 60 minutes. Partitions between apartments must be made of incombustible substances with fire resistance levels at least 40 minutes. In residential buildings with fire-resisting types II, III and less than six storeys, partitions between the rooms on the first

floors of the buildings are allowed to be made of unflammable substances with fire resistance levels at least 15 minutes.

- 5.12. Partitions which protect the central corridors of buildings with fire-resisting type I must be made of incombustible substances with fire resistance levels at least 30 minutes and those of buildings with fire-resisting types II, III, IV must be made of incombustible or unflammable substances with fire-resisting levels at least 15 minutes. For fire-resisting type II buildings only of production classes D, E, it is possible to protect with glass walls.
- 5.13. In buildings with fire-resisting types I, II, III, the floors and ceilings of their basements and wall-foot storeys must be made of incombustible substances with fire resistance levels at least 90 minutes.
- 5.14. In buildings with fire-resisting types I, II, III and having three storeys and more, the floors of elevators' chambers, waiting-rooms with paths leading from elevators to outside doors must have fire-resisting levels at least 60 minutes.

**Notes:**

- 1) *Buildings with fire-resisting type III and having up to three storeys are allowed to have floors, elevators' and waiting-rooms' doors with fire resistance levels of 45 minutes, if having direct ways-out;*
  - 2) *In movie houses, club houses, literature houses, meeting-halls with fire-resisting type II, the floors of audience rooms and waiting-rooms must be made of incombustible substances with fire resistance levels at least 60 minutes;*
  - 3) *Floors and ceilings of stage equipment storehouses must be made of incombustible substances with fire resistance levels of at least 60 minutes;*
  - 4) *In hospitals, medical examination and treatment houses, maternity hospitals, movie houses, club-houses, literature houses, shops with built-in compartments to place boilers and combustibles, these compartments' floors and ceilings must be made of incombustible substances and fire resistance levels are at least 90 minutes for the buildings and fire-resisting types II and III, and for buildings with fire-resisting types IV and V, the fire resistance levels must be at least 60 minutes;*
  - 5) *In structures with fire-resisting types IV and V if built-in with basements and wall-foot storeys, the floors on these basements and storeys must be made of incombustible substances, with fire resistance levels of at least 60 minutes;*
  - 6) *In conference rooms, audience compartments, meeting rooms, if built-in with roof basements, the floors of roof basements must be made of unflammable substances with fire resistance levels of at least 60 minutes.*
- 5.15. The frameworks of hanging ceilings must be made of incombustible substances. The linings of hanging ceilings are allowed to be made of combustible substances except those in shared corridors, staircases, elevators' chambers, lobbies, greenrooms, waiting-rooms of buildings with fire-resisting types from I to IV.



In the spaces between hanging ceilings and roofs, do not lay gas, dust mixture, liquid and combustible substance channels and pipes.

5.16. Structures creating the slope of rooms' floors must be appropriate to the fire resistance levels of fireproof boards, pavement surfaces and components of floors defined in table 2.

5.17. In production rooms that apply or preserve liquid combustibles, the floors must be made of incombustible substances. In buildings of all fire-resisting types, except type V, it is not allowed to improve the facing of main walls and corridors' doors, elevators' chambers, waiting-rooms, guest rooms with combustible substances. In buildings with fire-resisting types from I to III, it is not allowed to apply combustible and unflammable substances to improve the surfaces of outside walls.

The doors of wall cupboards for installation of fire fighting throats are allowed to be made of combustible substances.

5.18. In industrial areas, structures of any production classes upon the start of production are not allowed to use all types of provisional buildings made of combustible substances.

## 6. Fire-blocking parts

6.1. Fire-blocking parts of a building include walls, fire-blocking partitions, fire-blocking floors, fire-blocking areas; fire-blocking holds; fire-blocking door holes and doors, fire-blocking partitions.

6.2. Fire-blocking parts must be made of incombustible substances. Doors, windows, door holes and structures located in fire-blocking parts must be made of incombustible or unflammable substances with defined fire resistance levels.

6.3. Fire-blocking walls must be constructed from foundations or foundation beams up to the full height of a building, passing through all structures and storeys. It is allowed to locate fire-blocking walls directly onto structural frameworks made of incombustible substances of a building or structure on conditions that the fire resistance levels of the frameworks' part contiguous to the fire-blocking walls are not lower than those of the fire-blocking walls.

6.4. Fire-blocking walls must be 60 cm higher than roof surfaces if the roofs or parts of the roofs or roof basements are made of combustible substances, not less than 30 cm if being made of unflammable substances.

It is allowed to build fire-blocking walls not higher than roofs if all parts of the roofs and roof basements are made of incombustible substances.

### Notes:

*Fire-blocking walls or partitions in rooms with hanging ceilings, imitation ceilings must protect the entire space above the ceilings.*

6.5. In buildings with outside walls of unflammable or combustible substances, fire-blocking walls must pass through all the outside walls and surpass them at least 30 cm.

The fire-blocking walls are allowed not to surpass the surfaces of outside walls if the outside walls are made of incombustible substances.

- 6.6. Door holes located in wall surfaces contiguous to fire-blocking walls must be at least 4m horizontally distant from the intersection of these two walls and the doors must have fire resistance levels of at least 45 minutes.
- 6.7. In fire-blocking walls, it is allowed to place fume and ventilation pipelines; contiguous sections between the walls and pipelines must be tightly filled in with mortar and fire resistance levels of walls and the places where installed the pipelines must not be below 150 minutes.
- 6.8. The designs of fire-blocking walls must be calculated to ensure their strength in case of destruction from one side due to burning of floors, roofs or other structures.
- 6.9. Fire-blocking floors closely connected to outside walls must be made of incombustible substances. When the outside walls of a building can spread a fire or are fitted with glasses, the fire-blocking floors must pass through these walls and glass-fitted parts.
- 6.10. In all cases, it is allowed to replace a fire-blocking wall with a fire-blocking area with the width of at least 12m. A fire-blocking area is a buffer space that divide a building along its full width (length) and height.

The rooms in a fire-blocking area are not allowed to apply or preserve gases, combustible liquids or substances, as well as those processes that can create combustible dusts. Fire resistance levels of the components and parts of a building in a fire-blocking area must ensure:

- 45 minutes for the separating walls between a fire-blocking area and others;
- 15 minutes for partitions;
- 150 minutes for columns;
- 45 minutes for floors, roofs and outside walls.

**Notes:**

*In one-storey buildings with fire-resisting types III, IV, V, not applying and preserving gases, combustible liquids and not having any processes that can create combustible dusts, it is allowed to replace fire-blocking walls with fire-blocking areas with not less than 6m width.*

- 6.11. In the frontiers between a fire-blocking area and other areas, there must be fire-blocking walls with fire resistance levels not less than 45 minutes and vertical blocking plates made of incombustible substances within the height limits of bearing roof structures but not lower than 1.5m.
- 6.12. Design solutions to a fire-blocking area in designed structures must ensure appropriate functions of the fire-blocking area in case the structures connected this area are partially destroyed due to a fire.
- 6.13. In fire-blocking parts, it is allowed to install doors, windows, gates, door holes on conditions that they have fire-blocking areas or fire-blocking buffer areas.

Total area of all kinds of openings and holes in a fire-blocking part is not allowed to exceed 25% of this part area, fire-blocking doors and gates must be auto-closed types, fire-blocking windows must be manual-closed types.

- 6.14. Walls, floors, doors of buffer holds must be fire-blocking types. In a buffer hold, it is allowed to install glass openings made of combustible substances with thickness not less than 4cm if these openings are opened to the rooms wherein not applying, preserving combustible materials and substances and not having any processes associated with creation of combustible dusts.
- 6.15. It is not allowed to install pipelines, ditches and wells to convey gas, liquid, solid and dust combustibles and combustible substances through a fire-blocking wall, floor and area.
- 6.16. Pipelines, channels, wells (except water, steam pipelines) to convey materials and substances other than those stated in paragraph 6.15., when passing through a fire-blocking wall, floor and area must be equipped with automatic equipment to stop the spread of combustible matters in channels, wells and pipelines in case of a fire.
- 6.17. Structures surrounding an elevator's well and engine installing room, channels, wells, niches to install pipelines must ensure the requirements of fire-blocking walls, partitions and floors with fire resistance levels not less than 60 minutes.

**Notes:**

*When it is impossible to equip the surrounding walls of an elevator's well with fire-blocking doors, it must be to arrange buffer holds with fire-blocking partitions having fire resistance levels of 45 minutes.*

## **7. Emergency exits**

- 7.1. Emergency exits must ensure that everyone in a room, building can safely escape, not being covered by smokes and dusts, within necessary time for evacuation in case of a fire happening.
- 7.2. Ways-out is considered as for danger escapes if they meet one of following conditions:
  - a) Leading from the first floors' rooms out directly or through corridors, waiting-rooms, elevators' chambers;
  - b) Leading from rooms of any floors, except the first floors, to the corridors leading to elevators' chambers, including passing through buffer compartments. Then elevators' chambers must have ways-out directly or through waiting-rooms which are separated from corridors by partitions with built-in doors;
  - c) Leading to next rooms on the same floor that have ways-out as in items a) and b).

Upon arrangement of danger exits originating from two elevators' chambers through a shared waiting-room, one of these two elevators' chambers must have a direct way-out in addition to its entrance to the waiting-room.

Ways-out are allowed to pass through buffer door's compartments;

Ways-out originating from a basement, wall-foot storey must lead out directly.

- 7.3. A way-out can be a door, corridor or a path to outside or inside staircases to a parthouse leading to streets or roof, or a safe place. A way-out also includes a horizontal path leading to next structures at the same height.
- 7.4. Elevators and other human-carrying means are not considered as danger exits.
- 7.5. Ways-out must be easily found and paths leading to these ways-out must be clearly indicated by guiding symbols.
- 7.6. It is not allowed to install mirrors near a way-out.
- 7.7. Numbers of danger exits of a building must not be less than two; danger exits must be located dispersedly.

The maximum distances from people-gathering places to the nearest danger exit are defined in Tables 4 and 5.

**Table 4**  
**Maximum distances from working places to nearest exits in production buildings**

Production classes	Types of fire-resisting construction	Max. allowable distances in a building (m)		
		One-storey buildings	Multi-storey buildings	
			Two storeys	Over two storeys
A	I and II	50	40	40
B	I and II	100	75	75
C	III	80	60	60
	IV	50	30	-
	V	50	-	-
D	I and II	-	NA	NA
	III	100	60	60
	IV	50	40	-
	V	50	-	-
E	I and II	NA	NA	-
	III	100	75	75
	IV	60	50	75
	V	50	40	75
F	Major construction components of a building (walls, columns, floors) must be made of incombustible substances	100	80	75

**Notes:**

- Distances defined in this table can be applied for the first storey of a multi-storey building as for a one-storey building;
- Distances defined in this table are allowed to increase by 5% if the average area of one working place of the most crowded shifts is over 75m<sup>2</sup>;

- 3) For rooms having entrances to a blind corridor, the nearest distance from the rooms' doors to direct ways-out, entrances to waiting-rooms or elevators' chambers must not be over 25m;
- 4) Distances defined in this table are included the length of central corridors if the central corridors are considered as danger exits;
- 5) In one-storey buildings, with fire-resisting types I and II and production of C class, when it is impossible to apply the regulations defined in table 5, danger exits must be arranged according to the buildings' circumference and their distances not over 75m.

**Table 5**

**Maximum distances from people-gathering places to nearest exits in civil structures**

Max. allowable distances (m)							
Types of fire-resisting construction	From rooms within two exits					From rooms with entrances to central corridors or side blind corridors	
	Auxiliary buildings in industrial structures	Nursery houses	Hospitals	Public structures	Tenement houses	Structures stated in columns 2, 3, 4, 5	Apartment type tenement houses
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
I	50	20	30	40	40	25	25
II	50	20	30	40	40	25	25
III	30	15	25	30	30	15	20
IV	25	12	20	25	25	12	15
V	20	10	15	20	20	10	10

**Notes:**

- 1) In buildings with audience areas, distances defined in table 5 must be calculated from the furthest seat to the nearest exit;
  - 2) Distances from the doors of auxiliary compartments in production buildings to the nearest exit out or elevators' chamber must not exceed the defined distances from the furthest working place to the exits of an one-storey production building, with fire-resisting types equivalent to those defined in table 4.
- 7.8. For a room with area up to 300m<sup>2</sup> in a basement or wall-foot storey, it is allowable to one exit only if number of people who are regularly present in this room is not over five. When the number of people is from six to fifteen, it is all able to arrange the

second exit passing through an opening with dimensions not less than 0.6x0.8m, having vertical staircases or through a door with an opening not less than 0.75x1.5m.

- 7.9. Handrails or retaining walls must be laid on the roofs of such buildings that have following conditions:

Roof slope, (%)	Height from the ground up to the top of outside walls or canopy
12	10
12	7

Handrails must be laid along the walls for a flat roof (if it is used), balconies, outside corridors, open-air staircases and staircases' landings.

- 7.10. For buildings with their heights calculated from the ground floors up to protruding roofs or the top of outside walls (roof-retaining walls) from 10m and more, it must be to arrange paths leading up to the roofs from elevators' chambers (directly or passing through roof basements, open-air fire fighting ladders).

For residential, public and administrative-service buildings with roof basements, it must be to arrange paths up to the roofs in each 100m distance along the length of the buildings, where there is no a roof basement, it must be to lay a way-out for each 1000m<sup>2</sup> area.

For production buildings and storehouses, a fire fighting ladder must be laid in each 200m distance along their circumferences. It is allowable not to lay a fire fighting ladder in the main side of a building if its width is not over 150m and there is a fire-fighting water supply pipeline. When determining the number of paths up to a roof, it is allowable to include other outside ladders with entrances up to the roof.

In the roof basement of a building, it must be to provide the paths leading up to its roof with ladders fixed to doors, door holes or windows with dimensions not less than 0.6x0.8m. It is allowed to provide paths up to the roofs of one-storey buildings with their roofs' areas less than 100m<sup>2</sup>.

- 7.11. In front of the ways-out originating from elevators' chambers up to roofs or roof basements, the staircases must be provided with landings.

In public, administrative and service buildings having a height up to five storeys, it is allowed to set paths up to the roof basements or roofs from elevators' chambers through fire protection door-holes with fire resistance levels of 36 minutes dimensions 0.6x0.8m with fixed steel steps.

- 7.12. On a building's roof, not depending on its height, where height differences are more than 1 meter (including the places leading up to the roof), it must be to set up an open-type fire fighting ladder.

- 7.13. Fire fighting storeys must be arranged in easily seen and accessible places, with the lowest stairs' steps of 2m above the ground. Calculating from foundations,

If reaching a height up to 20m, a vertically-placed steel ladder must have the width of 0.7m, from a 10m height there must be a safety arc with the radius of 0.35m and its centre 0.45m distant from the ladder and 0.7m from one another, having landings at the entrance to the roof and surrounding these landings having handrails of at least 0.6m high.

If reaching a height of over 20m, use inclined steel ladders with an inclination not more than 80°, a width of 0.7m, having landings arranged not more than 8m distant from one another and built-in handrails.

- 7.14. In case outside fire fighting ladders are used as the second danger exits, they must be 0.7m wide, with an inclination of not more than 60° and having built-in handrails.
- 7.15. In a production building and public works' buildings (including auxiliary buildings of industrial works), the total width of danger exits on ladders' flight or paths in emergency exits must be calculated according to number of the most crowded storeys (excluding the fires storeys) in compliance with minimum widths' regulations as follow:
- For one- to two-storey buildings: 0.8m for 100 people
  - For three- and more-storey buildings: 1m for 100 people
  - For audience rooms (theatres, movie-houses, circuses, meeting-halls, ...): 0.55m for 100 people.

**Notes:**

*In audience rooms of fire-resisting types III, IV, V, the total width of doors, staircases' flight or paths in emergency exits must be set 0.8m for 100 people.*

- 7.16. When rooms' doors open to a shared corridor, the calculated width of an emergency exit is set as follows:

When the doors are open on one side of the corridor: the width of the corridor minus the width of the doors.

When the doors are open on two sides of the corridor: the width of the corridor minus two times of the width of the doors.

- 7.17. The minimum allowable water-flow width of an emergency exit are defined as below:

Emergency exits	Minimum allowable width (m)
Paths	1
Corridors	1.4
Doors	0.8
Staircases' sides	1.05

**Notes:**

- 1) *The width of a path to an isolated working place is allowed to reduce to 0.7m. The width of a staircases' flight and landings into a basement, roof basement and emergency staircase for not more than 60 people is allowed to reduce to 0.90m.*

- 2) *The width of a residential building's corridor is allowed to reduce to 1.20m when the straight length of the corridor is not more than 40m;  
In hotels and schools, the width of central corridors is at least 1.60m.*
- 3) *The width of a staircases' landing must not be less than that of the staircases' side. The width of a landing before the entrance to an elevator with a horizontally-pushed opening is not allowed to be less than 1.60m. The width of a staircases' landing in medical prevention and treatment works, nursery houses is not allowed to be less than 1.90m.*

*There must be a gap of at least 50mm between two flights of a staircase.*

7.18. The water-flow height of a door in emergency exits must not be less than 2m. The height of a door or an opening leading to infrequently-occupied rooms as well as basements, wall-foot storeys and technical storeys is allowed to reduce to 1.90m. The height of doors leading out to the next-to-roof storeys or roofs (when there is not a next-to-roof storey) is allowed to reduce to 1.50m.

7.19. In shared corridors, it is not allowed to install wall cupboards except technical ones and boxes for placing fire fighting throats.

It is not allowed to set up spiral staircases, fan-shaped stairs' steps; folded doors, push doors, lift-up doors, rotating doors in an emergency exit.

7.20. In an elevator's chamber use for emergency exit, it is not allowed to set up rooms with any functions. It is not allowed to set up any parts protruding out from walls' surfaces at a height up to 2.2m from staircase steps' and landings' surfaces.

7.21. In buildings with fire-resisting types I and II, it is allowed to set up an inside staircase of open type (not having wall fences of elevators' chambers) from waiting rooms up to second storeys if the waiting rooms are separated from the corridor close to next rooms with fire protection partitions having fire resistance levels of 45 minutes.

7.22. Outside open type staircases intended for use as spare emergency exits must be made of incombustible substances and connected to rooms through landings or balconies at the same height of the exits. Above staircases must have a slope of not more than 45° and width not less than 0.7m. Doors, paths out to the staircases must not have locks or fastening bolts from outside.

7.23. It is not allowed to make entrance-holes (except door-holes) in the inside walls of an elevator's chamber. In light-guiding holes of an elevator's chamber fitted with glass plates or blocks, openable frames with an area not less than 1.2m<sup>2</sup> must be installed in each storey.

7.24. Doors located in a emergency exit must be open outward of a building.

Doors out to a balconies, courtyards, outside staircases' landings for emergency exit; doors out of rooms that are frequently occupied by not more than 15 people, storehouses with an area of not more than 200m<sup>2</sup>; doors of medical stations, rest rooms are allowed to be designed to open inward.



- 7.25. In a ten- and more-storey building, the elevator's chamber must be designed to ensure that smokes will not concentrate in case of a fire – At the first storey, the elevator's chamber must have a direct way-out.
- 7.26. In high buildings with ten storeys and more, the corridors must be divided into sections with the length of each section not more than 60m by fireproof partitions that have fire resistance levels of at least 15 minutes.

Corridors, buffer rooms, waiting-rooms must be equipped with ventilation systems and automatic opening valves that operate in case of a fire.

## **8. Requirements for traffic and fire prevention and protection distances**

- 8.1. Requirements for fire prevention and protection between buildings and works and traffic ways in service of fire prevention and protection must be decided in combination with the requirements for planning the areas to place the works.
- 8.2. Fire prevention and protection distances between buildings and works are water-flow distances between outside walls or structures of these buildings and works.

In case a building has such structures that protrude more than 1m from wall surfaces and made of combustible substances, fire prevention and protection distances are those between two edges of these structures.

- 8.3. For residential and civil buildings, fire prevention and protection between these buildings are defined in table 6.

**Table 6**

Types of fire-resisting construction of the first building	Distances to second with fire-resisting types (min.)			
	I and II	III	IV	V
I and II	6	8	10	10
III	8	8	10	10
IV	10	10	12	15
V	10	10	15	15

**Notes:**

- 1) *The fire prevention distances between buildings' gables are not applicable if the gable walls of the highest building are fire-blocking walls;*
- 2) *For two-storey buildings, with frameworks- and panel-type structures of fire-resisting type V, distances as defined in table above must increase by 20%;*
- 3) *For mountainous areas, localities influenced by hot and dry wind (Southwester in construction climate sub-area IIB in design standard TCXD 49:1972), the distances from a building, structure with any fire-resisting types to a building and structure with fire-resisting types IV and V must increase by 25%;*

- 4) When the opposite outside walls of two buildings do not have door holes, fire prevention distances as defined in table 6 are allowed to reduce by 20%.
- 8.4. Main roads and local ways must be not less than 5m distant from public buildings' walls and buildings to the side with entrances into these buildings.
- 8.5. The distances between such areas that pass through or lay in-between buildings must be not more than 180m.
- 8.6. Blind one-lane roads must not more than 150m in length; at the end of the roads must there be a U-turning ground with an area defined as:
- Equilateral triangle shapes, sides not less than 7m
  - Square shapes, side dimensions not less than 12x12m
  - Circle shapes, diameters not less than 10m
- 8.7. Local traffic roads which pass through a building, gate or corridor must ensure that:
- the water-flow width is not less than 3.5m
  - the water-flow height is not less than 4.25m.
- 8.8. For industrial structures, fire prevention and fighting distances between buildings are defined in table 7.

**Table 7**

Types of fire-resisting construction of a building and structure	Distances between buildings and structures (m)		
	Types of fire-resisting construction of next buildings and structures		
	I + II	III	IV + V
-1	-2	-3	-4
I+II	- Not applicable for buildings and structures of production classes D and E,  9- (for buildings and structures of production classes A, B and C)	9	12
III	9	12	15
IV+V	12	15	18

**Notes:**

*For buildings and structures with fire-resisting types I and II of production classes A, B and C as defined in table 7, the distances between buildings and structures are allowed to reduce from 9m to 6m if one of following conditions is met:*

- a) *An automatic fire warning system is provided;*
- b) *The volume of frequently available combustible substances in such buildings and structures is 10kg/m<sup>2</sup> and less.*
- 8.9. In industrial structures, arrangement of traffic roads to each building must combine industrial requirements and roads for outside fire engines.
- 8.10. Roads for outside fire engines must ensure:  
Running along one side of a building when the building's width is 18m and less;  
Running along two sides of a building when the building's width is more than 18m.
- 8.11. A traffic road for fire-engine operations must ensure:
- Its width is not less than 3.5m.
  - The strengthened surface must ensure its ability of water drainage.
- 8.12. The distance between a building's wall to the edge of the road for fire-engine operations must not be more than 25m.

**Notes:**

- 1) *It is possible to arrange a blind road for fire-engine operations if there is a U-turning ground at the end of the road in compliance with the requirements stated in paragraph 8.6;*
- 2) *It must be to arrange a road leading to a fire fighting supply (lakes, ponds, rivers, water basins...). At the fire fighting supply must there be a U-turning in compliance with the requirements stated in paragraph 8.6.*
- 8.13. The minimum distances from open-air storehouses storing combustible substances to buildings and structures are defined in table 8.

**Table 8**

Storehouses	Distances from storehouses to buildings and structures (m)		
	Fire-resisting types		
	I+II	III	IV
(1)	(2)	(3)	(4)
Coals with volume:			
- Below 1000 tons	NA	6	6
- From 1000 tons up to below 100,000 tons	6	6	6
Dust peat:			
- From 1000 tons up to below 100,000 tons	24	30	36
- Below 1000 tons	18	24	30
Peat in pieces			
- From 1000 tons up to below 100,000 tons	18	18	24
- Below 1000 tons	12	15	18
Firewood (round, sawn timber):			
- From 1000m <sup>3</sup> up to below 10,000m <sup>3</sup>	15	24	30
Shavings, saw dusts:			
- From 1000m <sup>3</sup> up to 5,000m <sup>3</sup>	18	30	36
- Below 1000m <sup>3</sup>	13	13	24

Liquid combustibles: - From 1000m <sup>3</sup> up to below 2,000m <sup>3</sup> - From 600m <sup>3</sup> up to below 1,000m <sup>3</sup> - Below 600m <sup>3</sup>	30 24 18	30 24 18	36 30 24
Liquid substances with a burning possibility: - From 5,000m <sup>3</sup> up to below 10,000m <sup>3</sup> - From 3,000m <sup>3</sup> up to below 5,000m <sup>3</sup> - Below 3,000m <sup>3</sup> - Below 1,000m <sup>3</sup>	30 24 18 12	30 24 18 15	36 30 24 18

**Notes:**

- 1) *There are no regulations on distances from buildings or structures to following storehouses:*
  - *Coal storehouses below 100 tons*
  - *Storehouses for liquid combustibles and liquid substances with a burning possibility with a volume below 100m<sup>3</sup> or storehouses for coal, dust peat, peat in pieces with a volume below 1,000 tons and that buildings' walls to the sides of these storehouses are fire-blocking walls;*
- 2) *For storehouses for timber and coal, when being filled up to a height of more than 2.5m, the minimum distances indicated in table 8 for buildings and structures with fire-resisting types IV and V must increase by 28%;*
- 3) *Distances shown in table 8 from storehouses for dust peat, peat in pieces, timber, liquid combustibles and liquids with a burning possibility to buildings and structures of production classes A and B as well as to residential and public buildings must increase by 25%;*
- 4) *Distances from fuel distribution stations to next buildings and structures are applied as stated in point 6 of the table.*

**9 – Structural, technological and equipment solutions**

9.1. Number of a building's storeys, limited lengths, maximum building area corresponding to fire-resisting types of civil structures are defined in table 9.

Table 9

Fire-resisting types	No. of storeys	Max. limited length of a building (m)		Max. allowable building area (m <sup>2</sup> )	
		With fire-blocking walls	Without fire-blocking walls	With fire-blocking walls	Without fire-blocking walls
I+II	NA	NA	110	NA	2,200
III	1-5	NA	90	NA	1,800
IV	1	140	70	2,800	1,400

IV	2	100	50	2,000	1,000
V	1	100	50	2,000	1,000
V	2	80	40	1,600	800

**Notes:**

*Unit type residential buildings with fire-resisting types I and II having fireproof bearing roof structures are allowed not be built in with fire-blocking walls.*

- 9.2. Required fire-resisting types and limited numbers of storeys of nursery schools, hospitals, maternity hospitals, schools, shops, meeting halls, literature houses, club houses, movie houses depend on the structures' sizes and are defined in table 10.

**Table 10**

Structures and sizes	Fire-resisting types of a structure	Limited numbers of storeys
Nursery schools:		
a) Below 50 children	V-IV	One storey
b) Over 50 children	III-II	Two storeys
Hospitals, maternity hospitals:		
a) Below 50 beds	V-IV	One storey
b) Over 50 beds	III	Two storeys
c) Not depending on numbers of beds	II	NA
School buildings:		
a) Below 360 seats	V-IV	One storey
b) From 360 to 720 seats	III	Two storeys
c) 720 seats and more	II	Four storeys
Literature structures (movie houses, theatres, ...):		
a) Below 800 seats		
b) Over 800 seats	III	Two storeys
	II	NA
Meeting halls, club houses, literature houses:		
a) Below 300 seats	V-IV	One storey
b) From 300 up to 800 seats	III	Three storeys
c) Over 800 seats	II	NA
Commercial structures (groceries, foodstuff and food stores) not depending on sizes	V	One storey
	IV	Two storeys
	III	Three storeys
	II	NA

- 9.3. In residential buildings, when providing rooms for public uses (shops, rooms for common activities, nursery schools), these rooms must be separated from living rooms by incombustible walls and floors, with fire resistance levels of less than 45 minutes.
- 9.4. Maximum allowable numbers of storeys, required fire-resisting types of a building and maximum allowable floor areas between fire-blocking walls corresponding to production classes must follow the regulations in table 11.

Table 11

Production classes	Max. allowable number of storeys	Fire-resisting types of a building	maximum allowable floor areas between fire-blocking walls		
1. A and B	6		NA		
2. A and B (not producing chemicals and processing oils and gases)	6	II			
3. A (including production of chemicals and processing oils and gases)	6	II	NA	5,200	3,500
4. B (including production of chemicals and processing oils and gases)	6	II		10,400	7,800
5. C	NA	I   II	NA		
	3	III	5,200	3,500	2,600
	1	IV	2,600		
	1	V	1,200		
6. D	NA	I   II	NA		
	3	III	6,500	2,500	8,500
	1	IV	3,500		
	1	V	1,500		
7. E	NA	I   II	NA		
	3	III	7,800	6,500	3,500
	1	IV	8,500		
	1	V	2,600		
8. F	NA	See table 4	NA		

**Notes:**

- 1) *In production apartments with automatic fire fighting equipment (water-screen or water-flush types), floor areas between fire-blocking walls are allowed to increase by 100% compared with standards defined in table 11;*
- 2) *When production rooms or apartments are equipped with automatic fire warning devices, floor areas between fire-blocking walls are allowed to increase by 250% compared with standards defined in table 11;*
- 3) *The first floor areas between fire-blocking walls of a multi-storey building are set as standards for a one-storey building when the first floor has a fire resistance level of 150 minutes;*
- 4) *For buildings with fire-resisting type II, wherein being engaged in producing and processing wood, floor areas between fire-blocking walls are not applicable for one-storey buildings. For two-storey buildings, the maximum floor area between*

*two fire-blocking walls is 7,800m<sup>2</sup> and for buildings with more storeys, the maximum floor area between two fire-blocking walls is 5,200m<sup>2</sup>;*

- 5) *In one-storey production buildings with fire-resisting types I and II, it is allowable not to provide fire-blocking walls. This regulation is not applicable for buildings with fire-resisting type II wherein producing chemicals, processing oils and gases, or having storehouses for combustible materials and substances; buildings for production and processing of wood products;*
  - 6) *In one-storey buildings, with fire-resisting types II, IV and V due to technical requirements that allow to design fire-blocking areas in stead of fire-blocking walls, the floor areas between two fire-fighting areas are allowed to comply with standards as set out for those between two fire-blocking walls as defined in table 11.*
- 9.5. In case several production classes are arranged in the same building, or part of a building which is restricted by two fire-blocking walls, the fire-resisting types and allowable number of storeys of the building must be determined according to the production class with the highest level of fire and explosion hazards arranged therein.

**Notes:**

*When the areas and volumes of the rooms with highest levels of fire and explosion hazards do not exceed 5% of those of the entire building or part of the building restricted by two fire-blocking walls, this regulation is not applicable. Then, there must be special fire prevention measures (partial ventilation to prevent the possibility of a fire in these rooms and fire spreading from these rooms to the entire building).*

- 9.6. It is not allowed to arrange any production classes, or cellulose's and soft synthetic combustibles' storehouses in basements. In special cases, due to requirements of production lines and technologies, it is allowed to arrange production classes C, D, E in basements and wall-foot storeys but the regulations stated in item 9.13 of this standard must be observed.
- 9.7. Rooms of production classes A and B, if technological requirements are met, should be located near outside walls if the building is a one-storey building or on the top storey of the building is a multi-storey building.
- 9.8. In rooms of production classes A and B, outside components that can easily come apart must be designed. The areas of easily-coming-apart components are determined by calculations. If there are no data for calculations, the areas of easily-coming-apart components must not be less than 0.05m<sup>2</sup> for each cubic meter of rooms of production class A and must not be less than 0.03m<sup>3</sup> for rooms of production class B.

**Notes:**

- 1) *Glass windows with vent holes are considered as easily-coming-apart components if their thickness is 3, 4 or 5mm with areas 0.8; 1 and 1.5m<sup>2</sup> respectively. Glass windows with steel rods are not considered as easily-coming-apart components;*
- 2) *Easily-coming-apart roof components must be divided into sections with an area not more than 180m<sup>2</sup> each;*
- 3) *Calculated load of easily-coming-apart components is not over 700N/m<sup>2</sup>.*

9.9. Floor areas where technological machinery and equipment that consume liquid combustibles and toxic substances are located must be separated by partitions made of incombustible substances or covered by catching pallets. The height of partitions and areas between partitions or areas of catching pallets must be clearly specified in technological designs.

9.10. When production classes with various levels of fire and explosion hazards are arranged in the same room, it must be to design preventive measures of local explosion and fire spreading (equipment covering, local fire extinguish, protecting equipment,...).

When production classes A, B and C are located in individual rooms of a building with fire-resisting types I and II, these rooms must be separated from next ones by fire-blocking partitions with fire resistance levels of at least 45 minutes; the doors of the fire-blocking partitions must have fire resistance levels of at least 40 minutes.

9.11. When it is impossible to equip the entrances in fire-blocking walls and partitions with fire-blocking doors between rooms of production classes C, D and E, these entrances must have built-in buffer rooms with a length of not less than 4m, equipped with automatic fire fighting equipment, with required water flow of 11 lt./s per one square meter of buffer rooms' floors. The partitions of buffer rooms must have fire resistance levels of not less than 45 minutes.

9.12. In one-storey buildings with fire-resisting type IV, it is allowed to arrange rooms of production classes A and B with a total area of not more than 300m<sup>2</sup>. In this case, these rooms must be separated by fire-blocking partitions. The enclosing walls of these rooms must be made of incombustible or unflammable substances.

9.13. Basements where rooms of production classes C, D and E, storehouses of combustible substances and incombustible substances packed in combustible packing are arranged must be equipped with automatic fire fighting equipment and be sectioned by fire-blocking partitions with the area of not over 3,000m<sup>2</sup> for each section and the width of each section including enclosing walls not over 30m. In these rooms, it is required to design windows with a width of not less than 0.7m and height not less than 1.2m. The total area of all windows must not be less than 2% of the floor area. In rooms with an area of over 1,000m<sup>2</sup>, there must be two and more windows. Basements' ceilings must have fire resistance levels of not below 45 minutes.

Corridors must be 2m and more in width and have a direct way-out or passing through an elevator's chamber – Partitions that separate a corridor from rooms are fire-blocking partitions.

9.14. Open-air buildings, structures and equipment whose production processes generate gases, dusts and fumes with fire and explosion hazards, as well as storehouses for oil and gas and petroleum products, storehouses for combustible substances, storehouses for toxic substances are not allowed to locate in prevalent wind-swept places to other buildings and structures.



9.15. It is not allowed to arrange rooms therein applying or storing combustible substances in gas and liquid states and processes associated with generation of combustible dusts underneath the rooms that are frequently occupied by up to 50 people.

9.16. It is not allowed to locate boilers with a pressure higher than 0.7 at or water temperature higher than 1150C in residential buildings, public buildings and structures.

Never locate gas-powered boilers underneath apartments, therein frequently occupied by more than 50 people.

In case a boiler is required by a structure, it must be located in a separate apartment in order to ensure the requirements for fire and explosion prevention.

9.17. It is not allowed to locate a pipeline for combustible and flammable liquid gases underneath buildings or structures.

9.18. In tunnels with few passers-by, it is allowed to locate gas pipelines with a pressure below 6.105 N/m<sup>2</sup> (6 kg/cm<sup>2</sup>) along with other pipelines and communication cables provided that ventilation and lighting equipment are installed therein.

9.19. It is not allowed to put together in the same tunnel:

- gas pipelines and electric power and lighting cables;
- heat-conducting pipelines, combustible and unflammable liquid substances' pipelines and cold conducting pipelines;
- fire fighting water pipelines, combustible and unflammable liquid substances' pipelines and combustible gas pipelines or electric power cables;
- combustible and unflammable liquid substances' pipelines, electric power cables and water supply and drainage systems;
- Oxygen pipelines and combustible gas pipelines or toxic substances' pipelines and electric power cables.

9.20. It is not allowed to locate gas pipelines and pipelines that conduct such substances with fire, explosion and environmental pollution risks on the ground.

9.21. Combustible or unflammable liquid substances' pipelines, if located underground, must be at least 30cm distant from the foundation and divided into segments not longer than 60m, the segments must be separated from one another by fire-blocking edges covered around the pipelines that are made of incombustible substances.

**Notes:**

*Toxic substances' pipelines and gas pipelines with a pressure higher than 1 atm must not be located through a tunnel with a pedestrian walkway.*

9.22. Combustible and unflammable liquid substances' pipelines located high above must be distant from a building's walls with openings at least 3m and walls without openings at least 0.5m.

It is not allowed to locate the pipelines high above in following cases:

- a) Combustible and unflammable liquid and gas substances' pipelines that are located on viaducts, towers and columns made of combustible substances or placed on the combustible walls and roofs of a building.

- b) Pipelines conducting such a mixture with fire and explosion risks along with combustible liquids' and gas products' pipelines placed in side corridors.
- c) Combustible gas pipelines
  - being located on the roofs and walls of a building therein storing dangerous, explosive substances;
  - passing through separate buildings and structures, without any requirements for gas supply;
  - on combustibles' storehouses;
  - on a power transmission line.

9.23. Land bridges for installation of technical pipelines, of which including pipelines conducting combustible or unflammable liquids must be made of incombustible substances.

**Notes:**

- 1) *It is not allowed to place in the same road bridge or supply route the pipelines for conducting liquid and gas substances whose mixtures can cause explosions, fires or poisoning.*
- 2) *Land bridges and supply routes therein technical pipelines are installed for conducting combustible or unflammable liquids and gases are allowed to be provided with paths in service of these land bridges and supply routes.*

9.24. Land bridges and supply routes therein being equipped with equipment for transporting incombustible and unflammable substances in form of clotted pieces (coal, peat, firewood, shavings,...) or incombustible liquids' pipelines, as well as conveyors or land bridges for walking other than emergency exits can be made of combustible substances.

In case the land bridges and conveyors are located above buildings, they must be made of incombustible substances.

9.25. Land bridges and conveyors made of unflammable or combustible substances must ensure following conditions:

- a) Land bridges and conveyors are divided into segments with a length of not over 100m each, these segments must be separated from one another by a fire-blocking space with a length of at least 5m;
- b) Land bridges and conveyors intersect with one another, even at the same or different heights, then the intersections must be a fire-blocking space with length of at least 5m.
- c) Corridors and land bridges made of combustible substances must ensure:
  - Being distant at least 8m from buildings with fire-resisting type III
  - Being distant at least 18m from buildings with fire-resisting types IV and V.
- d) If corridors, land bridges do not ensure above defined distances, they must be made of incombustible substances. The above distances are not applicable when

corridors, land bridges are contiguous to fire-blocking walls or tight stopping walls without doors.

9.26. It is allowed to combine land bridges, supply routes and roads in following cases:

- a) Transported items must be made of incombustible, in explosive substances
- b) Means of transport must be safe to pedestrians.

9.27. In rooms where gases are available, using or storing fuel gases, combustible, explosive liquids or dusts, ventilation measures must be taken to eliminate the possibility of fire, explosion in these rooms. It is not allowed to locate heat-conducting pipelines through these rooms. In case heat-conducting pipelines must be placed through them, these pipelines must be isolated from surroundings by incombustible substances. If there are no risks of fire and explosion, heat-conducting pipelines can be isolated by unflammable substances.

9.28. Gas pipelines, gas-storing compartments, air filtering elements and others of ventilation systems, that conduct fuel gases with a temperature higher than 300C, gases, combustible or explosive liquid gases and dusts, as well as combustible scraps (saw dusts, shavings, wool, cotton-wool, ...) must all be made of incombustible substances.

In rooms with hazards of fire and explosion, all gas pipelines must be made of incombustible substances.

In other cases, elements of a ventilation system can be made of unflammable substances.

**Notes:**

1) *In such a ventilation system with heated air lower than 800C, following elements can be made of combustible substances:*

a) *Air filtering elements, filtering chambers having fire-blocking partitions made of unflammable substances;*

b) *In special technical conditions, gas pipelines cannot be made of incombustible or unflammable or rusty substances (if these pipelines do not pass through inlaid floors);*

2) *Structures made of combustible and unflammable substances and pipelines conducting air, gases with a temperature higher than 800C, as well as combustible scraps' pipelines must be separated from one another by incombustible and insulating substances.*

9.29. Pipelines must be vertically placed and air ducts into rooms of production classes A, B and C must be provided for each individual room; except multi-storey buildings, in which inlaid-floor holes are used for technical purposes.

In case where main air ducts have fire-blocking elements, it is allowed to conduct air into production compartments of classes A, B and C through horizontal ducts.

Individual vertical ducts (exhaust and supply ducts) in each storey, where production classes D, E and F are arranged, can be connected to main air ducts; if equipment are made of incombustible substances.

Pipelines conducting condensable gases, dusts and other substances that can generate a toxic, flammable or explosive mixture due to physical or chemical causes must not be connected to share discharging equipment.

- 9.30. In rooms without skylights for ventilation where production classes A, B and C are arranged, it is imperative to provide exhaust ducts and chimneys controlled manually or automatically in case of a fire. The cross-section of the exhaust duct must be at least 0.2% of the floor area of a room. (if the room does not have roof basements) and at least 0.15% (if the room has roof basements).

Exhaust ducts must be located evenly and made of incombustible or unflammable substances; the cross-section of each duct is not more than 2m<sup>2</sup>.

**Notes:**

- 1) *For rooms with a width of less than 30m and being next to outside walls with openings, these regulations are not applicable.*
- 2) *Chimneys are used to replace air ducts.*

- 9.31. For residential buildings and public structures with 5 storeys and more, it is allowed to place vertical shared exhaust ducts, provided that vertical ducts originating from each storey and passing through two storeys must be connected to the main ducts. It is allowed to put these ducts in a combination into a main gathering duct to connect to exhaust ducts for four to five storeys.

In case there are separate rooms and where combustible substances are stored, these rooms must be installed with their own exhaust ducts conduct fumes out.

- 9.32. It is required to make holes for installation of gas pipelines in fire-blocking walls and floors made of incombustible substances (including other fire-blocking parts).

In case it must be to put gas pipelines through fire-blocking parts, inside the pipelines must be provided with flame-blocking (and fire-blocking ...) equipment and in these places, the pipelines must be made of incombustible substances.

**Notes:**

*It is allowed to install ventilation ducts and chimneys in fire-blocking walls of residential buildings, public structures and their auxiliary buildings when the minimum thickness of fire-blocking walls (minus ducts' cross-sections) in these places must not be less than 25cm, and the thickness between chimneys and ventilation ducts must be at least 12cm.*

*Those places where water pipelines are installed must be tight plastered with mortar.*

- 9.33. It is allowed to install a shared exhaust duct for fuel gases, gases of liquids and dusts if their chemical mixtures are not inflammable, combustible or explosive.

- 9.34. In rooms generating combustible, explosive substances that can pervade the air, ventilation parts and controlling equipment of ventilation ducts must be design in such a way that cannot create sparks. In filtering elements of dusts', inflammables', explosives' exhaust systems, automatic and continuous dust suppression methods must be provided to prevent the possibility of creating sparks.

In production rooms with a risk of explosions, electric motors of air exhaust ducts installed therein together with ventilation electric fans must be explosion-proof types.

**Notes:**

- 1) *For production rooms, when automatic dust suppression is not economically profitable, it is allowed to apply periodical manual dust suppression methods if the capacity of filtering elements is about 15,000 m<sup>2</sup>/hour.*
  - 2) *If electric motors are of normal types, they must be isolated from electric fans' chambers.*
  - 3) *For production classes A, B and C, isolating structures of electric fans must be made of incombustible substances.*
- 9.35. When designing and executing electrical, water supply, ventilation, heat supply and lightning-arrester parts of a structure, the regulations of Vietnam's concerned standards must be observed.
- 9.36. When designing fire warning systems for buildings and structures, the standard TCVN 5788:1993 - "Fire warning systems – Technical requirements", and concerned specialist standards must be applicable. Basing on design requirements and applicable standards to choose automatic, semi-automatic or through-common-communication-network fire warning solutions.
- 9.37. Besides water fire fighting systems, in buildings and structures must other dedicated fire fighting means and devices be provided. Their locations, quantity and types comply with the regulations of standard TCVN 5760:1993 and instructions given by fire prevention and fighting organs.
- 9.38. Designing automatic fire fighting systems and other special fire fighting systems must comply with the standard TCVN 5760:1993 – "Fire fighting systems – General requirements for designing, installation and application", and concerned specialist standards.

## **10. Fire fighting water supply**

- 10.1. Fire fighting water supplies must be designed for civil buildings and structures, storehouses, industrial structures.

A fire fighting water supply includes indoors and outdoor fire fighting water supplies.

It is allowed to design an independent fire fighting water supply when the combination of the same and a running- or production-water supply is not economically profitable.

10.2. A fire fighting water supply pipeline can be a high- or low-pressure pipeline. In a high-pressure fire fighting water supply pipeline, the required pressure for fire fighting is generated by stationary fire fighting pumps.

In a low-pressure fire fighting water supply pipeline, the required pressure for fire fighting is generated by movable fire fighting pumps or fire fighting carriages, getting water from fire fighting water posts placed outdoors.

10.3. In civil areas, the outdoor fire fighting water flows of a fire fighting water supply system and the number of fires occurring at the same time are defined in table 12.

**Table 12**

Local population (1000 people)	Calculated water flow for one fire (liters/sec.)				
	Number of fires occurring at the same time	Fire-resisting types of one- to two-storey buildings		Mixed buildings, storeys' types not depending on fire-resisting types	Buildings with three storeys and more not depending on fire-resisting types
		I, II and III	IV and V		
Up to 5	1	5	5	10	10
Up to 10	1	10	10	15	15
Up to 25	2	10	10	15	15
Up to 50	2	15	20	20	25
Up to 100	2	20	25	30	35
Up to 200	3	20		30	40
Up to 300	3			40	55
Up to 400	3			50	75
Up to 500	3			60	80
Up to 600	3				85
Up to 700	3				90
Up to 800	3				95
Up to 1000	3				100

**Notes:**

1) In a buildings' area consists of buildings with one, two and more storeys, each type of buildings must be defined individually, taking into account the population thereof.

*Calculated amount of water for the entire area is the total amount of water calculated for individual type of buildings therein;*

2) Water amount for and numbers of fires occurring at the same time in a civil area populated by more than 1000 people are determined according to specific requirements;

3) Numbers of fires, occurring at the same time in an urban area including those in industrial structures and work sites must be appropriate to required fire fighting water amount but must not be lower than the amount as stated in table 12.

10.4. In industrial areas, the numbers of fires occurring at the same time are calculated as:

- a) If the ground area is less than 150 ha, one fire;
- b) If the ground area is from 150 ha and up, two fires and the fire fighting water flow is the calculated flow for two buildings that need biggest amounts of fire fighting water.

10.5. In industrial structures, outside water flows taken from fire fighting water posts, basing on the amount required by the building that needs the biggest amount of fire fighting water and calculated for one fire are defined in table 13.

**Table 13**

Fire-resisting types	Production classes	Calculated water flow for one fire (liters/sec.)				
		Cubic unit of the structures (1,000m <sup>3</sup> )				
		Less than 3	From 3÷5	From 5÷20	From 20÷50	More than 50
I and II	D, E, F	5	5	10	10	15
I and II	A, B, C	10	10	15	20	30
III	D, E	5	10	15	25	35
III	C	10	15	20	30	40
IV and V	E, D	10	15	20	30	
IV and V	C	15	20	25		

**Notes:**

*For a building with fire-blocking walls, only the part of it that needs the biggest amount of fire fighting water is considered.*

- 10.6. Outside fire fighting water amounts for schools, hospitals, cultural houses, administrative offices, auxiliary buildings of industrial buildings are calculated according to the definitions in table 13 and these buildings are considered as of production class C.
- 10.7. For industrial areas or industrial buildings, in which production classes C, D, E with area not over 200,000m<sup>2</sup>, outdoor fire fighting water amount not more than 20 liters/sec. and for residential areas populated by not more than 8,000 people, it is not required to design outdoor fire fighting water supply pipelines and it is possible to use water pumps or fire fighting pump carriages taking water from natural water sources like rivers, lakes, basins or artificial lakes on conditions that:
- a) These sources have sufficient reserved amount of fire fighting water in all seasons according under defined regulations;
  - b) Water suction depth is not over 4m from the ground down to water surfaces and water levels do not come down to below 0.5m;
  - c) There must be secured places for pump carriages and water pumps to stop and take water there from.
- 10.8. Outside fire fighting water supply pipelines must be designed in a ring network. When a fire fighting water supply pipeline is within a distance of not more than 200m, it is

allowed to design a cut-off pipeline, but there must be provisions for a ring pipeline. It is allowed to install a cut-off fire fighting water supply branch pipe to each building individually if the length of this cut-off branch pipe is not longer than 200m, but there must be water tanks or lakes for reservation of fire fighting water and provisions for a ring pipeline.

**Notes:**

- 1) *In the beginning of water pipeline installation, it is possible to lay a cut-off fire fighting water branch pipe without limitations in length if approved by responsible fire prevention and fighting organs,*
- 2) *In civil areas, if the population is not over 10,000 people, it is possible lay shortened pipelines;*
- 3) *The diameters of outdoor fire fighting water pipelines must be at least 100mm.*

10.9. Outdoor fire fighting water posts must be arranged alongside a traffic road, distances between these post must not be more than 150m. Outdoor fire fighting water posts must be located at least 5m far from the road and should be arranged at crossroads. If the posts are arranged along two sides of a traffic road, it should not be to located over 2.5m far from the edges of the road, fire fighting pipelines must be divided into segments and calculated so that the number of fire fighting posts in each segment is not more than 5 posts.

**Notes:**

*In industrial, urban or civil structures whose outdoor fire fighting water flows are not more than 20 liters/sec, the distances between two outdoor fire fighting water posts must not be over 120m.*

10.10. Those valves that lock water from cut-off branch pipes and big valves locking water from a closed pipeline must be arranged in such a way to ensure that each segment of a pipeline can lock 5 at most fire fighting throats in the same storey.

10.11. The required free pressure inside a low-pressure fire fighting water supply pipeline must not be lower than 10m water columns. In a high-pressure fire fighting water supply pipeline, the free pressure at the nozzle of a throat placed at the furthest and highest point of the highest building must ensure that the solid water column is not below 10m.

10.12. An indoor fire fighting water supply pipeline must be designed in following cases:

- a) In production buildings except those defined in item 10.13 of this standard;
- b) In family residential buildings with four storeys and more and tenement houses, hotels, restaurants with five storeys and more;
- c) In administrative bodies with six storeys and more, schools with three storeys and more;
- d) In railway stations, storehouses, other public structures, auxiliary buildings of industrial structures when their volume is from 5,000m<sup>2</sup> and more;
- e) In theatres, movie houses, meeting halls, club houses having 300 seats and more.



**Notes:**

- 1) *In those buildings stated in items (b), (c) with different heights, a fire fighting water supply pipeline is designed only for the buildings with a height as defined in this section;*
- 2) *In production buildings of fire-resisting types I and II, production classes D, E, fire fighting water supply pipelines are only required to be installed in those parts that store or produce combustible substances.*

10.13. An indoor fire fighting water supply pipeline is not designed in following cases:

- a) In buildings applying and storing those substances that upon contacting with water can cause a fire, explosion, spreading flames;
- b) In production buildings with fire-resisting types I, II and equipped with indoor equipment made of incombustible substances for processing, transporting and storing finished-products, unfinished products that are incombustible substances;
- c) In production buildings of classes D, E and fire-resisting types III, IV, V with a volume not over 1,000m<sup>3</sup>;
- d) In public bathrooms and washing houses;
- e) In storehouses made of incombustible substances, storing incombustible items;
- f) In water pump stations, filtering stations of contaminated-water sewage systems;
- h) In production buildings and auxiliary buildings of industrial structures, not having a running or production water supply pipeline and outdoor fire fighting water supplies are taken from water reservation rivers, lakes, ponds or tanks.

10.14. The number of fire fighting water throats for each indoor location and the water flow of each throat are defined in table 14.

**Table 14**

Types of buildings	Number of fire fighting water throats	Calculated water flow of each flow (litres/sec.)
(1)	(2)	(3)
1. Administrative buildings with 6 to 12 storeys and volume up to 25,000m <sup>3</sup>	1	2.5
2. Family residential houses with 4 storeys and more, hotels and tenement houses, public buildings with 5 storeys and more and volume up to 25,000m <sup>3</sup> . Unit-type residential buildings with up to 16 storeys.	1	2.5
3. Hospitals, medical buildings, nursery schools, shops, railway stations, auxiliary buildings of industrial structures with volume from 5,000m <sup>3</sup> to 25,000m <sup>3</sup>	1	2.5

(1)	(2)	(3)
4. Rooms located under the stands of a stadium with volume from 5,000m <sup>3</sup> to 25,000m <sup>3</sup> and gymnastics' and sports' compartments with volume up to 25,000m <sup>3</sup>	1	2.5
5. Convalescent houses, pleasure houses, museums, libraries, designing offices with volume from 7,500m <sup>3</sup> to 25,000m <sup>3</sup> . Exhibition buildings with show-rooms area of less than 500m <sup>2</sup> .	1	2.5
6. Meeting-halls, audience rooms equipped with stationary projectors, with a holding capacity of 300 to 800 seats	1	2.5
7. Residential buildings of all kinds with 12-16 storeys	2	2.5
8. Administrative buildings with 6-12 storeys with volume over 25,000m <sup>3</sup>	2	2.5
9. Hotels, tenement houses, convalescent houses, rest houses, hospitals, nursery schools, museums, libraries, exhibition buildings, shops of all kinds, railway stations, schools with volume over 25,000m <sup>3</sup>	2	2.5
10. Auxiliary buildings of industrial structures with volume over 25,000m <sup>3</sup>	2	2.5
11. Compartments located under the stands of a stadium and gymnastics' and sports' compartments with volume over 25,000m <sup>3</sup>	2	2.5
12. Theatres, movie houses, club houses, literature houses, circuses, concert-halls with over 800 seats, institutes for scientific research	2	2.5
13. Production buildings except those defined in item 10.17	2	2.5
14. Storehouses with volume from 5,000m <sup>3</sup> and up storing combustible substances or incombustible substances packed in combustible packing.	2	2.5

10.15. Required pressure of indoor fire fighting throats must ensure generating dense water jets with required heights as defined in table 15.

**Table 15**

The nature of buildings and structures	Required height of densely-spraying water columns (m)
Residential houses, public structures, auxiliary buildings with fire-resisting types I, II	6
Residential houses, public structures, auxiliary buildings and production buildings with fire-resisting type I and II during production using combustible and combusting substances.	Required height for the ability to spray up to one of the furthest and highest locations of a building but not less than 6m

- 10.16. In buildings provided with more than twelve fire fighting water throats or automatic fire fighting systems, the indoor fire fighting water supply systems, whether separately designed or in a combination, must have at least two pipelines conducting water indoors and must be connected in ring networks.
- 10.17. Arrangement of indoor fire fighting throats must ensure that each location of a room is provided with the number of reaching fire fighting water throats as defined in table 14. In buildings with volume from 1,000m<sup>3</sup> and less with production classes C, D and E and not depending on the volume of selling compartments or storehouses below 25,000m<sup>3</sup>, it is allowed to provide each location with only one reaching fire fighting throat.
- 10.18. Indoor fire fighting throats must be placed next to the ways in and out, on landings of elevators' chambers, in waiting-rooms, corridors and easily seen and convenient places.
- 10.19. Centers of fire fighting throats must be located at a height of 1.25m above floor surfaces.
- 10.20. Each indoor fire fighting throat must be equipped with a locking valve, sprinkler, flexible hose reels with sufficient length by calculations.

In each building, used pipe diameters, length of flexible hose reels, sprinkler diameters must be of the same types.

- 10.21. Calculations of a water supply network must base on required fire fighting water pressure, numbers of fires occurring at the same time, time for stamping a fire out.
- 10.22. In case water cannot be directly taken from water supply sources or can be directly taken from urban water supply pipelines but the flows and pressure are not regularly adequate, then measures for reservation of fire fighting water must be taken. Required amount of reservation water for fire fighting must be calculated basing on largest amounts of fire fighting water for three hours.

Calculations on required water supplies for fire fighting must also take into accounts the amounts of running and production water excluding such amounts used for watering plants, watering roads, cleaning floors and machinery. Water used for bathing, washing, hygiene only are just calculated as 15% of the calculated amount.

**Notes:**

*In case fire fighting water supply pipelines have a low pressure, it is allowed to use a portion (not over 50%) of production water amount for fire fighting if this does not influence production.*

- 10.23. Time for recovery of reserved fire fighting water is defined as below:
- 1) In civil areas, civil structures and industrial structures of production classes A, B, C, it is not over twenty-four hours.
  - 2) Industrial structures of production classes D, E, F, it is not over thirty-six hours.

**Notes:**

- *Industrial structures whose outdoor fire fighting water flows are below 25 liters/sec. are allowed to extend the water recovery time.*
- *For production class C, it is sixteen hours;*
- *For production class E, it is eighteen hours.*

10.24. Pumps used for supplying running, production and fire fighting water whether individually or in a combination must all come with standby pumps, with capacities equivalent to those of main pumps.

Numbers of standby pumps are defined as below:

- a) When the number of operating pumps by calculations is from one to three, it is required to have one standby pump;
- b) When the number of operating pumps by calculations is four and more, it is required to have two standby pumps: Main fire fighting pumps must be connected to two separate power supply sources, or standby power sources of power generating stations, or standby motors at pumps' stations. It is allowed to use water pumps to supply fire fighting water without requirements for standby pumps and main fire fighting pumps, only connected to a single power supply source when outside fire fighting water flows are below 20 liters/sec or in enterprises of production classes E, D with structures having fire-resisting types I, II or in production buildings when outside fire fighting water flows are not over 20 liters/sec.

10.25. Fire fighting water supplying pumps can be controlled manually at site or automatically by a remote control unit.

**Notes:**

- 1) *When outside fire fighting water flows are from 25 liters/sec and up, fire fighting pumps must imperatively have a remote control unit. Then, a manual control unit must be provided at the same time.*
- 2) *The control units of fire fighting pumps must ensure putting the pumps into operation within less than three minutes as from fire warning signals.*

10.26. For buildings where water pressure are frequently not adequate for supplying water to fire fighting throats, there must be remote control units of pumps located directly at these fire fighting throats.

When reserved amount of fire fighting water is from 1,000m<sup>3</sup> and up, it must be divided and reserved in two containers.

**Notes:**

- 1) *It is possible to have the same reservation design for fire fighting water, run-in water and production water but there must be a controlling unit to control the use of reserved fire fighting water for other needs;*

- 2) *In calculations on the volume of a fire fighting water reservation container, it is allowed to include the water amount that is continuously added to the container, even the fire extinguishing time is three hours;*
- 3) *In case outside fire fighting water taken from water reservation lakes, posts, that inside of a building are there also pipelines for supplying running water and fire fighting, the volume of reservation water containers must ensure the water amount to be used for one hour, for one fire fighting throat and other needs for water.*
- 10.28. Pressure water tanks and water containers having pressurized pumps used for fire fighting must reserve an amount of water as below:
- a) For industrial structures, reserved water for fire fighting is based on the required amount for indoor fire fighting throats and automatic sprinkling equipment for first 10 minutes of a fire.
- b) For residential areas, reserved water must ensure supplying water to extinguish one indoor fire and one outdoor fire for 10 minutes with maximum required amount, at the same time ensuring the maximum required amount of running water.
- 10.29. Water stations using pressurized air, besides operational pressurizing machines, it is needed to have standby ones.
- 10.30. Pressure containers and water stations for extinguishing a fire must be equipped with water level measuring devices, equipment signaling water levels to pumps' stations or communicating with water distribution stations. If a water station is connected to a pressurized fire fighting pump, there must be an automatic control unit to cut off the water supplied to the water station when the fire fighting pump is in operation.

**Notes:**

- 1) *If the fire fighting pump automatically operates when the water levels in the water station come down low, the volume of reserved water in the water station can be as much as 50% of those as defined in item 7.28;*
- 2) *When a pipeline supplying water to all enterprises, plants and workers' areas, the reserved amount of water in the water station for fire fighting will only base on the operations of fire fighting throats inside these enterprises and plants without taking into accounts the workers' areas.*
- 10.31. The location and service radius of a reservation water container are determined according to means of fire fighting:
- a) If using fire-trucks, the service radius is 200m.
- b) If having movable pumps, depending on each type of pumps, the service radius is from 100m to 150m.

The distances from a fire fighting water reservation lake to a building with fire-resisting types III, IV, V or to an open-air store house made of combustible substances, is at least 20m, and to a building with fire-resisting types I, II, is at least 10m.

### **Appendix A** **Materials' group according to fire levels**

1. Materials of incombustible groups consist of natural or artificial inorganic materials, metal, board or fiber plasters with organic contents up to 8% in weight, mineral cotton-like materials' boards in synthetic or natural or bitumen-agglutinated forms with organic contents up to 6% in weight.
2. Materials of unflammable groups consist of mixtures of incombustible materials and combustible materials, e.g.: asphalt concrete, fibro-cement, plaster materials and concretes with organic contents over 8% in weight, mineral cotton-like materials boards in bitumen-agglutinated form with organic contents from 7% to 15%. Clay mixed with straw with volume of at least 900 kg/m<sup>3</sup>, fiber plates soaked in incombustible solutions, wood steeped and soaked in incombustible chemicals, cement-pressed fibers, polymer materials that meet requirements for incombustible materials.
3. Combustible materials, consisting of materials of organic type materials not steeped and soaked in incombustible substances.

### **Appendix B (for reference)** **Production industries' groups classified by production classes**

Production classes	Production properties	Production industries
(1)	(2)	(3)
A	Fire and explosion hazards	Workshops making and using sodium and potassium; workshops and plants producing artificial fibers, rubber, hydrogen producing stations; chemical workshops of near-silk plants; oil and petroleum producing workshops; gas hydrogenation, distillation and division workshops; workshops producing artificial liquid fuels, recovering and distillation dissolvable organic liquid substances with inflammation temperature in gas states of 28 <sup>0</sup> C and less, stores for gas cylinders, petroleum stores, rooms for storing alkali and acid accumulators of power plants, pump stations of liquid substances with inflammation temperature in gas states of 28 <sup>0</sup> C and less.
B	Fire and explosion hazards	Workshops producing and transporting coal dusts, saw dusts, stations for cleansing diesel oil drums and other liquids with inflammation temperature from 28 <sup>0</sup> C to 61 <sup>0</sup> C. Solid matter grinding compartments, workshops for manufacturing artificial rubber, sugar producing workshops, coal dust grinding equipment, diesel oil stores houses of power plants, pump stations of liquid substances with inflammation temperature in gas states of 28 <sup>0</sup> C to 61 <sup>0</sup> C.

(1)	(2)	(3)
C	Fire hazards	Timber sawing workshops; workshop producing timber fine art articles; timber models, timber boxes; textile and garment factories. Workshops of textile industry, paper industry with dry production processes, raw processing of cotton, jute and other fibers; sift and winnow workshops of grinder mill and grain warehouses. Oil reproducing workshops, bitumen refinery, combustible materials storage or oil storage; open-air oil storage and oil storage devices of power plant; power distribution devices with power breakers and electrical equipment with oil volume more than 60kg per unit; bridges and/or corridors for transportation of coal, peat, close coal storage, warehouse with assorted goods; pumping stations for liquids with combustible temperature of gas more than 61°C.
D	Not showing hazardous properties of production	Wood sawing workshops, workshops making wooden art objects, workshops making mock-up products, wooden box producing workshops, knitwear and garment plants. Industrial weaving and paper workshops with dry production processes, enterprises engaged in preliminary treatment of cotton fibers, plants engaged in preliminary treatment of flax, jute and other fibers, screening departments of grinding plants and seed stores. Lubricant recycling workshops, lubricant refinishing and tar distillation plants, incombustible substance and lubricant stores, open-air oil stores and lubricant storing equipment of power plants, electricity distribution equipment with breakers and electric equipment with the quantity of lubricant over 60 kg for each equipment unit, slides and corridors for transporting coal, coal dusts, closed coal stores, mixed items' stores, pump stations of liquid substances with inflammation temperature in gas states of over 61°C.
E	Not showing hazardous properties of production	Casting and metallurgy workshops, furnace units of gas producing stations, forging workshops, welding workshops, repair stations for steam and combustion motor locomotives, metal hot-rolling workshops, combustion motor testing station, internal combustion engine holding compartments, thermal metal working shops, main buildings of power plants (i.e. buildings with furnace compartments, turbine compartments, etc), electric equipment with the quantity of lubricant over 60 kg for each equipment unit, high voltage electricity testing laboratories, boilers' stations, etc.
F	Explosion hazards	

**Notes:**

*Production industries where combustion fuels are liquids, gases or using steady round flames are not of production classes A, B, C.*

## Appendix C

## Fire resistance levels and burning groups of construction materials and components

Components' list	Minimum thickness or sizes of components' cross sections	Fire resistance levels (min.)	Burning groups
(1)	(2)	(3)	(4)
1. Walls and partitions:	6	145	Incombustible
Walls and partitions made of silicate bricks, normal bricks and hollow clay bricks	11	150	
	12	330	
2. Walls made of natural stones, light concrete and glazed terra-cotta blocks, light building brick blocks reinforced by light concrete, normalized unflammmable or incombustible materials	33	660	Incombustible
	6	30	
	11	90	
	22	240	
	33	420	
3. Walls and partitions: Concrete, reinforced concrete or freestone concrete, as well as panel walls or concrete and reinforced concrete blocks. (see note item 1)	2.5	18	Incombustible
	5	36	
	6	45	
	11	150	
	15	222	
	17	270	
22	360		
4. Panel walls with solid cross sections made of beehive-type light concrete:			Incombustible
a) Keramzit concrete or cinder concrete with volume weight 1500 – 1800 kg/m <sup>3</sup> (see note item 1)	12	270	
b) Beehive-type concrete or light concrete with volume weight 900 – 1200 kg/m <sup>3</sup> (see note item 1)	20	360	
c) Above materials also with volume weight 700 – 900 kg/m <sup>3</sup> (see note item 1).	20	360	
5. Block walls with vertical cross sections made of beehive-type concrete with volume weight 900 – 1200 kg/m <sup>3</sup>	30	480	Incombustible
	40	660	
6. Panel walls made of reinforced refined bricks, silicate bricks and normal clay bricks (see note item 1).	16	222	Incombustible
7. Three-layer walls consisting of edge reinforced concrete plates and normalizing layers made of incombustible and unflammmable mineral cotton-like materials or fibrolite plates:			
a) For panel walls	15 to 22	Not less than 60 minutes	Incombustible
b) For bearing walls with thickness of internal concrete layers of 10cm made of mark 200 concrete and pressing stress of 25 kg/cm <sup>2</sup> and less (see note item 15)	25	Not less than 150 minutes	Incombustible
c) Above materials also with concrete of 14cm thickness made of mark 300 concrete and pressing stress of 100 kg/cm <sup>2</sup> and less (see note item 15).	27	150	Incombustible
8. Three-layer panel walls, with frameworks made of cement and side-paved with asbestos cement and fastened by steel pins when the normalizing layers are made of:			



a) Incombustible and unflammable mineral cotton-like materials' panels	12	45	Incombustible
b) Soft plastic substances		30	unflammable
9. Three-layer panel walls with wooden frameworks and side-paved with asbestos cement, fastening internal plates by small pins and external plates by aluminum profiles with normalizing layers:			
a) Made of incombustible and unflammable mineral cotton-like materials' panels or glass concrete panels		60	Unflammable
b) Made of soft plastic substances		30	Unflammable
10. Walls and partitions made of asbestos cement panels or steel plates (flat or wave-shaped), steel frames		15	Incombustible
11. Roof protecting walls and partitions made of bricks, concrete blocks and natural stone blocks with steel frames:			
a) Not having protection layers		15	Incombustible
b) Being located in the thickest walls, wall gaps not having protection, separating layers or frame dun age		45	Incombustible
c) Protection plastering layers with thickness of 2cm on steel layers		60	Incombustible
d) Hollow bricks with hollow gap of 6.5cm		150	Incombustible
12cm		360	Incombustible
12. Partitions made of plasters, plaster slag and plaster fibers with organic contents up to 8% in weight	5	78	Unflammable
	8	132	
	10	162	
	11	180	
13. Partitions made from hollow construction glass blocks	6	15	Unflammable
	10	15	
14. Partitions made from hollow construction keramzit blocks (see note item 5)	8.5	30	Unflammable
	4	60	
	6.5	90	
	8	120	
15. Fibrolite or plaster slag walls and partitions with wooden frameworks side-coated with mortar	10	45	Unflammable
	10	36	
16. Wooden walls and partitions, side-coated with mortar, when the thickness of motor layers is 2cm	15	45	Unflammable
	20	60	
	25	75	
17. Walls and partitions with wooden frameworks side-coated or side-paved with dry plaster mortar or reinforced fibro-cement			unflammable
a) Made from combustible substances		30	
b) Made from incombustible substances		45	
<b>Columns and pillars:</b>			
18. Bricks, cross sections (cm)			Incombustible
22x22		150	
22x33		180	
33x88		270	
33x45		315	
45x45		390	
19. Concrete and steel-rod concrete with load-bearing hard frames therein:			
a) Not over 75% of applicable cross sections (cm)			
20x20	25	75	Incombustible

20x30	-	150	
b) a) Not over 75% of applicable cross sections (cm)	-		
20x20	-	75	Incombustible
20x30	-	105	
20x40	-	150	
20x30 and 20x50	-	180	
30x50	-	210	
40x40		210	
20. Unprotected steel when thickness of minimum components is:			
up to 12 (mm)	-	15	Incombustible
from 13 to 20 (mm)	-	18	
from 21 to 30 (mm)	-	20	
from 31 to 50 (mm)	-	24	
21. Protected steel:	2.5	45	
a) Coatings on mesh surfaces or thick concrete panels	5	120	Incombustible
	6	150	
	7	180	
b) Thick normal or silicate bricks	6	120	Incombustible
	11	315	
c) Thick holed-bricks	3	60	Incombustible
	6	24	
	8	228	
d) Thick plaster plates	4	66	Incombustible
	5	90	
	7	120	
	8	150	
22. Wooden columns with cross sections not less than 20x20cm protected by plastering of 2cm in thickness	10	192	Uninflammable
	-	60	
<b>Floors and roofs</b>			
23. Floors and roofs made of flat reinforced concrete panels, when the thickness of concrete layers calculated from the lowest sides to tensile strength bearing concrete panels (see note item 9)			
20mm	10	64-78	
30mm	-	78-114	Incombustible
40mm	-	108-174	
50mm	-	114-222	
24. Floors or roofs made of reinforced concrete panels with "lower" longitudinal bearing edges as well as cross and longitudinal beams when the thickness of concrete layers calculated from the lowest sides or edge sides to longitudinal bearing reinforced panels (see note item 10)			
20mm	6.5	30	Incombustible
35mm	6.5	36-42	
20mm	10	36-42	
35mm	10	42-48	
50mm and more	10	48-54	
20mm	16	42-54	
30mm	16	48-72	
50mm	16	66-84	
20mm	20 and higher	48-60	
30mm	20	66-78	

40mm	20	84-108	
50mm	20	102-108	
60mm	20	132-144	
25. Floors and roofs on cross steel beams (longitudinal beams, rafters) with incombustible plates:			
a) When horizontal and longitudinal beams, rafters are not protected		15	
b) When the horizontal beams of the counter yard on meshes are protected by a concrete layer or plastering with thickness of:			
35mm	65	36	Incombustible
10mm	-	45	
20mm	-	90	
30mm	-	150	
26. Wooden counter yards with floor pavement boards or plates and plastered on the pavement boards or meshes, when the thickness of the plastering is 20mm			
27. Floors on cross wooden beams with counter yards' pavement boards made of plaster, when underneath the horizontal beams is protected by plaster layers or plastered coatings of:			
20mm		60	
30mm		90	Incombustible
28. Roofs made of fibro-cement panels or iron sheets on cross steel beams (longitudinal beams, rafters) without protection layers or coatings			
29. Three-layer panel roofs with frameworks made of fibro-cement with thickness of 10cm, fixed steel pins with normalizing layers made of soft plastic substances			
	14	30	Uninflammable
30. Mesh concrete roof without protection layers underneath			
	2	36	Incombustible
31. Structures of steel staircases: staircase beams, cross beams with 1cm plastering, doors' covers, windows, sky-lights, basement doors.			
32. Doors' covers made of wide glass blocks installed by cement mortar and reinforced by steel rods			
	6	90	Incombustible
	10	120	
33. Doors' covers made of one-layer steel plates or reinforced concrete with glasses having fastening elements of steel rods, rivets or clamps.			
	10	45	Incombustible
34. As above, by two-layer plates			
	-	72	Incombustible
35. Doors' covers made of one-layer steel plates or reinforced concrete with glasses having fastening elements of steel nails.			
36. Doors' covers made of one-layer steel plates or reinforced concrete with fixed glasses, clamped by split steel rods or tightening steel rivets.			
	-	15	
<b>Doors, hatches, gates</b>			
37. With hollow steel flaps (having a thin air layers)			
	-	30	Incombustible
38. As above, when protecting with thin layers of mineral fibers or cotton-like materials			
	8	78	Incombustible
39. With wooden flaps coated with an asbestos cardboard layer of at least 5mm in thickness, with protection iron layers (see note item 12)			
	3	72	Uninflammable
	4	78	
	5	90	
40. Doors with wooden flaps soaked in fire protecting substances and two sides lined with plywood			
	4	36	Uninflammable
	6	60	

**Notes:**

1) *Fire resistance levels of bearing walls and partitions, covered with panels against lining mortar layers, are determined according to the values instructed in item 3, 4, 6 with factors calculated according to average stress of standard vertical load combination.*

- a) *Walls under item 3 with thickness of over 10cm when the stress is:*  
50kg/cm<sup>2</sup> and less – factor 1  
70kg/cm<sup>2</sup> – factor 0.7  
over 70kg/cm<sup>2</sup> – basing on testing results.

*When determining fire resistance levels of full-block reinforced concrete walls with thickness of over 10cm, higher instructed factors must increase by 20%. Then fire resistance levels must be set not over those stated in item 3.*

- b) *Walls under item 4a, when the stress is:*  
10 kg/cm<sup>2</sup> and less – factor 1  
20 kg/cm<sup>2</sup> and less – factor 0.6  
over 20 kg/cm<sup>2</sup> – basing on testing results.

- c) *Walls under item 4b, when the stress is:*  
10 kg/cm<sup>2</sup> and less – factor 0.5  
over 20 kg/cm<sup>2</sup> – basing on testing results.

- d) *Walls under item 6 when the stress is:*  
30 kg/cm<sup>2</sup> and less – factor 1  
40 kg/cm<sup>2</sup> and less – factor 0.7  
over 40 kg/cm<sup>2</sup> – basing on testing results.

2) *The protection of strengthening joints of components must ensure their strength throughout service life time is equal to required fire resistance levels' values of the components; Fire resistance levels of unprotected strengthening steel components, defined according to expectations for steel structures, must be set at 30 minutes;*

3) *Covering parts of the gaps at positions adjacent to hanging-type walls and bearing-like walls with other parts of a building must have fire resistance levels equal to those of the walls;*

4) *When building partitions made of hollow construction plaster blocks, the fire resistance levels as instructed in item 12 must decrease to 30%;*

5) *Thickness of partitions made of construction keramzit blocks, as instructed in item 14, are defined as total thickness of wall-constructing blocks;*

6) *Fire resistance levels of light concrete blocks, with volume weight of 1200 kg/m<sup>3</sup> and more, as well as one-length bending-resistance structures made of silicate concrete must be set same as those of reinforced concrete;*

7) *Fire resistance levels of light concrete blocks, with volume weight of 1200 kg/m<sup>3</sup> and beehive-type concrete must be set same as those of reinforced concrete with factor 1.3;*

- 8) *Fire resistance levels of holed panels and concrete panels with side edges must be set according to items 2; 3 with factor 0.9;*
- 9) *Fire resistance levels of panels under items 2, 3, depending on calculated schemes of fulcrum doors, must be set as:*
- a) When freely leaning toward two opposite sides – factor 1*
  - b) When running along guide ways – with side co-relations as*
    - 1:1 with factor 2.5*
    - 1:1.5 with factor 1.3*
    - 1:1.5 with factor 0.3*
  - c) When being cushioned on two opposite sides, when thickness of panels is:*
    - 8cm and less – with factor 1.6*
    - 10cm and less – with factor 1.8*
    - 11cm and less – with factor 2*
    - 12cm and less – with factor 2.8*
    - 12 cm and less – with factor 4*
- 10) *Fire resistance levels of concrete panels with lower edges as well as horizontal beams, bars and longitudinal beams must be set according to item 2.4 depending on calculated schemes for fulcrums:*
- a) Free fulcrums with factor 1*
  - b) When being cushioned and having co-relations with the area of reinforced cross sections on cushioned sides and at a length of:*
    - 0.25:1 – with factor 1.22*
    - 0.50:1 – with factor 1.25*
    - 1:1 – with factor 1.5*
    - 1: 1 – with factor 2.5*
- 11) *Thickness of wooden parts of paneled doors and gates are according to instructions in item 3; 9.*
- Asbestos cardboard used for lining wooden paneled flaps, doors, hatches and gates is allowed to replace by wood soaked in clay mortar with thickness of 15mm, then fire resistance levels as instructed in table 38 needs to be reduced to 15%.*
- 12) *Thickness of incombustible plastering and alternating floor plastering is the common thickness of the structure.*
- 13) *Fire resistance levels of partitions do not depend on their door holes.*
- 14) *Fire resistance levels instructed under item 9a for those walls whose wooden panels, at horizontal and longitudinal joints adjacent to their buildings' incombustible parts are protected against direct effect of fire.*
- 15) *Fire resistance levels of burning groups as instructed in item 7a, b, c, belonging to a wall with or without openings for windows and doors in a condition that the normalizing*

*layers are combustible, are protected at two sides of its next opening by wooden boxes with thickness of at least 40mm.*

*Fire resistance levels as instructed in given items 7b and 7c, when laying flat plates of floors and panels higher than outside walls onto internal fire-resisting concrete layers of the panels located lower than the outside walls.*

**Appendix D**  
**Construction properties of constructing components of a building and structure classified by fire-resisting types**

Constructing components of a building and structure	Fire-resisting types of a building and structure				
	I	II	III	IV	V
(1)	(2)	(3)	(4)	(5)	(6)
Bearing walls and elevator's chamber walls	Natural or artificial stone materials, concrete, freestone concrete or reinforced concrete with fire resistance levels of at least 150 minutes.	Natural or artificial stone materials, concrete or reinforced concrete with fire resistance levels of at least 120 minutes.	Natural or artificial stone materials or freestone concrete or reinforced concrete with fire resistance levels of at least 120 minutes.	Timber walls, frameworks or boards with protection layers on two sides made of fibro-asbestos with fire resistance levels of at least 30 minutes.	Timber walls, frameworks or sawn boards without protection layers made of incombustible substances.
Wall filled within frame and non-bearing walls	Bricks, glazed terra-cotta, cinder concrete, reinforced concrete and foam concrete reinforced with steel meshes or foam concrete panels reinforced with steel rods with fire resistance levels of at least 30 minutes.	Bricks, glazed terra-cotta, cinder concrete, foam silicate blocks, reinforced concrete or silicate blocks reinforced with steel meshes. For one-storey buildings, it is allowed to use fibro-cement boards and wave-shaped iron sheets with fire resistance levels of at least 15 minutes.	Bricks, glazed terra-cotta, cinder concrete, foam silicate concrete blocks, reinforced concrete, concrete boards reinforced with steel meshes, foam silicate reinforced with steel meshes, wave-shaped fibro-cement with fire resistance levels of at least 15 minutes.	Wooden structures plastered with mortar or fibro-cement plates with fire resistance levels of at least 15 minutes.	Walls built with wooden boards or pressed in-between columns without protection layers made of incombustible substances.

**Appendix D (continued)**

## VIETNAMESE STANDARD

## TCVN 2622 : 1995

(1)	(2)	(3)	(4)	(5)	(6)
Columns	Bricks, concrete, concrete reinforced with steel rods and steel with fireproof protection layers with fire resistance levels of at least 150 minutes.	Bricks, concrete, reinforced concrete with fireproof protection layers with fire resistance levels of at least 120 minutes. For one- and multi-storey buildings of production classes D and E not containing inflammable liquids, it is possible to use steel structures without protection layers with fire resistance levels of at least 2 hours.	Bricks, concrete, concrete reinforce with steel rods and steel with fireproof protection layers with fire resistance levels of at least 120 minutes.	Wood with mortar protection layers with fire resistance levels of at least 30 minutes.	Wood without protection layers made of incombustible substances.
Floors and under-roof floors	Brick arches, prefabricated floor steel-rod concrete structures and site-poured structures with steel frames and woven frames of reinforced concrete with fireproof protection layers with fire resistance levels of at least 90 minutes.	Brick arches, reinforced concrete structures, prefabricated floors or site-poured structures with steel beams or reinforced concrete beams with fireproof protection layers with fire resistance levels of at least 45 minutes. For one-storey buildings as well as multi-storey buildings of production classes D and E provided not storing inflammable liquids can use steel structures without protection layers with fire resistance levels of at least 15 minutes.	Wooden floors protected by mortar layers with fire resistance levels of at least 45 minutes, as well as wooden floors laid on steel beams with protection layers with fire resistance levels of at least 45 minutes, individual incombustible floor parts with fire resistance levels of at least 45 minutes.	Wooden floors protected by mortar layers or fibro-cement with fire resistance levels of at least 15 minutes.	Wooden floors protected by incombustible substances.
Roof without under-roof floors	Reinforced concrete structures with fire resistance levels of at least 90 minutes.	Steel structures without protection layers as well as pre-stressed concrete beams with fire resistance levels of at least 15 minutes.	Wooden structures without protection layers.	Wooden structures without protection layers.	Wooden structures without protection layers.



## Appendix D (continued)

(1)	(2)	(3)	(4)	(5)	(6)
Partitions	Incombustible substances with fire resistance levels of at least 30 minutes.	Incombustible substances with fire resistance levels of at least 15 minutes.	Wooden partitions with protection layers having fire resistance levels of at least 15 minutes.	Wooden partitions with protection layers having fire resistance levels of at least 15 minutes.	Wooden partitions without protection layers made of incombustible substances.
<b>Building ceilings</b>	Incombustible substances with fire resistance levels of at least 45 minutes.	Incombustible substances with fire resistance levels of at least 45 minutes.	Unflammable substances with fire resistance levels of at least 45 minutes.	Combustible substances.	Combustible substances.
Fire-blocking walls	Natural or artificial materials, concrete, reinforce concrete with fire resistance levels of at least 150 minutes.				