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Vietnam Building Code on Fire Safety of Buildings

(This English version is for reference only)

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Foreword

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Vietnam Building Code on Fire Safety of Buildings

1. GENERAL PROVISIONS

1.1. Scope

1.1.1. This code regulates general requirements on fire safety for rooms, buildings and constructional works (hereinafter called in general as building) and is compulsorily applied for phases of new construction, renovation, repair or change in function. This code also regulates fire classification for buildings, building's portions and components, rooms, constructional structures and building materials.

NOTE: The term "fire safety for buildings and constructional works" is stated in A.1 of the Appendix A.

1.1.2. The parts 3, 4 and 5 of this Code are not applied for buildings of special functions (production house or reservation house of explosive materials and equipments, warehouse of oil and oil products, natural gas; warehouse of hazardous chemicals; military works; underground portions of subways; mining works…).

1.1.3. Standards and requirements on fire protection and prevention stated in standard documents and regulations in construction industry should base on this Code.

In addition to application of this Code, it is required to follow requirements on fire protection and prevention stated more specifically in other standards which are regulated to be applied for individual building and constructional work. In the case when there is not specific standard in accordance with requirement of this Code, it is allowable to apply specific regulations in current standards until these standards are revised; application of available foreign standards is also allowed provided that these standards meet requirements of this Code as well as the application follows legal regulations of Vietnam on applying foreign standards for fire protection and prevention and for construction in Vietnam.

In current standards related to fire protection and prevention for buildings and constructional works, if there are any regulations, technical requirements on lower fire safety in comparison with regulations and requirements in this Code, then this Code should be applied.

NOTE: The term "standard document" is stated in A.11 of the Appendix A.

1.1.4. Designing document and technical documents of buildings, structures, elements and building materials should clearly state their fire specifications in accordance with this Code.

1.1.5. When designing and constructing the works, in addition to meeting regulations in this Code, it is required to follow regulations in other available standards related to fire protection as well as other

requirements for the works, such as: planning, architecture, structure, water supply system, electricity system, electric equipments, lightning prevention, fuel supply system, heat system, ventilation system, air conditioning system, glass safety and falling and collision prevention.

1.1.6. For buildings not having standard for fire protection and prevention, as well as the buildings which are functionally classified as the group of fire hazard F.1.3 [(1)] higher than 75m [(2)]; buildings functionally classified as other fire hazard groups with height greater than 50m; buildings with more than one basement; buildings of specially complex and incredible structures, then, in addition to following this Code, they should meet other technical requirements and solutions in term of organization and constructional engineering to be in accordance with specific characteristics in fire prevention of those buildings, on the basis of current applicable standards.

These requirements and solutions should be approved by relevant fire and rescue department.

1.1.7. In several individual cases, some requirements in this Code can be only deduced by the Ministry of Construction for typical building when there are substantiations submitted to the Ministry to clearly state additional and replacement solutions. These substantiations should also be approved by the fire and rescue department.

1.1.8. When changing the building's function or changing space and structural planning conception of current buildings or individual rooms of those buildings, it is required to apply this Code and available standards to be in accordance with those changes.

1.1.9. For private houses with height of and below 6 floors, it is not compulsory to apply this Code but proprietary guidelines, suitable for each house and residential complex.

1.2. Subject for application

Agents, organizations and individuals related to construction of civil buildings and industrial buildings on Vietnam teritory should follow regulations in this Code.

1.3. Explanation of the terms

Terms and definitions in this Code are stated in Appendix A.

[(1)] See 2.6.5 – Table 6.

[(2)] From now on, except for particular cases, height of the building is determined to be equal to the layout height of the top floor, not including the top technical floor. The layout height of the floor us determined to be equal to the distance from the accessible road of the fire fighting vehicle to the lower edge of the window on outside wall of that floor.

1.4. General regulation

1.4.1. When designing the buildings, it is required to have structural conception, space planning and engineering solutions so that in the case of fire:

- Everyone in the building (independent in age and health status) can evacuate outward to safe area (hereinafter called outside area) before there is threat of life and health due to dangerous factors of the fire;
- There is ability of life rescue.
- Fire fighting force and equipments can access to the fire and execute measures of fire extinguishment and rescuing lives and assets.
- Fire is prevented from spreading to neighboring buildings, even when the burning building collapses.
- It is able to minimize direct and indirect damage on property, including the building itself and inside assets, with consideration of economic correlation between damaged value and cost for the solution and the fire protection and prevention equipments.

1.4.2. During the process of construction, it is required to ensure:

- To take priority in implementation of fire protection and prevention measures in accordance wiht current standards which have been approved as regulated;
- To follow requirements on fire prevention and protection for constructing buildings, auxiliary constructions and regulations on fire prevention and protection in erection and constructions in accordance with current laws;
- To equip fire fighting instruments in accordance with regulations and these instruments should be ready for operation;
- Capability of safe escape and life rescue as well as capability of protecting property in the case of fire for the building in construction phase and the case of fire on the construction site.

1.4.3. During the utilization of the building, it is required:

- To remain structure and interior design of the building as well as function of fire protection and prevention equipments in accordance with the design and their applied technical documents;
- To follow regulations on fire protection and prevention as stipulated in current laws;

- Not to change the structure or spacing and engineering planning conceptions without any design approved for this change.
- When repairing the work, it is not allowed to use structural components and materials not meeting requirements of current standards and codes.

When the building is licensed under condition that it has limitations in fire load, number of people inside or in any of its parts, then, there should be notifications about these limitations inside the building, at visible area and the building's management board should set up their own measure of fire protection and people evacuation in the case of fire.

1.4.4. When analyzing fire hazard of the building, it is able to use situations basing on correlation betwen parameters: development and spread of hazardous factors of the fire, evacuation of people and arrangement of fire extinguishment.

2. CLASSIFICATION OF FIRE

2.1. General regulation

2.1.1. Buildings, building's parts and components, rooms, materials and structural components are classified in term of fire basing on following properties:

- Fire hazard: is the property of generating and developing fire hazard factors;
- Fire resistance is the property of fighting against influence of the fire and preventing spread of fire hazard factors.

2.1.2. Technical classification of the fire is used to establish necessary requirements for fire protection for structural components, rooms, buildings, buildings' components and portions, depending on their fire resistance property and/or fire hazard property.

2.2. Building material

2.2.1. In aspect of fire safety, the building material is only characterized by fire hazard property.

The fire hazard property of the building material is determined basing on fire technical characteristics such as combustibility, ignitability, spread of fire on surface, ability of producing smoke and hazardous agents.

2.2.2. In term of combustibility, the building material is classified into combustible and noncombustible material. The combustible material is then classified into four groups:

- Ch1 (Low combustibility)
- Ch2 (Moderate combustibility)
- Ch3 (medium combustibility)

- Ch4 (High combustibility)

The combustibility and groups of building materials in term of combustibility are determines as in Appendix B, section B.2.

For the noncombustible material, fire hazard is not specified and the material is not defined with other criteria.

2.2.3. In aspect of ignitability, building material is classified into 3 groups:

- BC1 (slow-burning);
- BC2 (moderate ignitable);
- BC3 (ignitable).

Groups of material in term of ignitability are stated in accordance with Appendix B, section B.3.

2.2.4. In aspect of surface spread of flame, building material is classified into 4 groups:

- LT1 (not spreading);
- LT2 (low spreading);
- LT3 (moderate spreading);
- LT 4 (high spreading).

Groups of material in term of surface spread are stipulated for the surface material layer of roof and floor, even for floor covering as in Appendix B, section B.4.

2.2.5. In aspect of smoke production, building material is classified into 3 groups:

- SK1 (low smoke production);
- SK2 (moderate smoke production);
- SK3 (High smoke production).

The group of building material classified in aspect of smoke production is determined in Appendix B, section B.5.

2.2.6. In aspect of toxicity of the burning products, building material is classified into 4 groups:

- DT 1 (Low toxicity).
- DT 2 (Medium toxicity).
- DT3 (High toxicity).
- DT4 (Specially high toxicity).

The group of building material classified in aspect of toxicity of burning products is determined in Appendix B, section B.6.

2.3. Structural component

2.3.1. Structural component is characterized by fire resistance and fire hazard.

The fire resistance of a structural component is represented by its fire resistance limit. The fire hazard of a structural component is characterized by fire hazard level of that component.

2.3.2. Fire resistance limit of a structural component is determined to be the time duration (in minutes) from the moment of fire resistance test at standard temperature to the moment when there is one or several consecutive phenomenon of the limit states stated for the given component as follows:

- Losing bearing capacity (The bearing capacity is symbolized as R)
- Losing integrity (the integrity is symbolized as E).
- Losing thermal insulation (the thermal insulation is symbolized as I).

NOTE:

1. The fire resistance limit of structural component is determined by fire resistance test in accordance with TCXDVN 342: 2005 to TCXDVN 348: 2005 ([1]) or equivalent standards. The fire resistance limit of structural component can be determined by calculation in accordance with applied design standards).
2. Required fire resistance limit of specific structural components are stated in this Code and in technical regulations for individual work. The required fire resistance limit of structural component is symbolized by REI, EI, RE or R together with corresponding indexes about duration of fire impact measured in minutes. For example: The structural component having required fire resistance limit of REI 120 means that it should remain at the same time 3 abilities: load bearing, integrity and insulation during a duration of fire impact of 120 minutes; the structural component having required fire resistance limit of R60 means that it should remain its load bearing capacity in 60 minutes (this case does not require remaining thermal insulation and integrity).
3. One structural component is considered to meet requirements of fire resistance once it meets one of two following requirements:

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[1] Standards of TCXDVN will be converted to TCVN standards in compliance with the Law on Standards and technical regulations.

a) Its structure has specifications similar to the sample of fire resistance test which during the test has a fire resistance limit no less than required fire resistance limit of that component.

b) Its structure has specifications in compliance with the component stated in Appendix F of which the fire resistance limit is no less than the required fire resistance limit of this component.

2.3.3. In aspect of fire hazard, the structural component is classified into 4 grades:

- K0 (no fire hazard).
- K1 (low fire hazard).
- K2 (moderate fire hazard).
- K3 (fire hazard).

NOTE:

1) Fire hazard level of the structural component is determined by test in accordance with current Vietnam National standard or equivalent document.

2) It is allowed to determine the fire hazard level without test as follows:

+ Classified into grade K0, if the component is made from noncombustible material only.

+ Classified into grade K1, if the component's outside surface is made from material of which technical criteria at the same time are not greater than Ch1, BC1, SK1.

+ Classified into grade K2, if the component's outside surface is made from material of which technical criteria at the same time are not greater than Ch2, BC2, SK2.

+ Classified into grade K3, if the component's outside surface is made only from the material having one of technical criteria of Ch3, BC3 or SK3.

2.4. Fire stop component

2.4.1. Fire stop component is characterized by fire resistance and fire hazard.

Fire resistance of one fire stop component is determined by the fire resistance of its componential portions, including:

- Partition (bulkhead, wall, floor panel…);
- Structure to stabilize the partition (frame, girder…);
- Structure to support the partition (beam, jack, revetment…);
- Joints among them.

The fire resistance limit by state of losing bearing capacity (R) of the structure stabilizing the partition, of the structure supporting the partition and of their joints should not be lower than required fire resistance limit for the partition.

The fire hazard of the fire stop component is determined by fire hazard of the partition together with their joints and of the structures stabilizing the partitions.

2.4.3. The fire stop component is classified in aspect of fire resistance limit of the partitions as in Table 1. When the fire stop component contains entrance, gate, manhole, valve, window, barrier (called in general as fire entrance and fire stop component valve), or when there is antechamber (fire stop antechamber), then the fire stop door, valve and the antechamber should be the type meeting requirements of the type specified in table 1.

Fire resistance limit of fire stop door and valve in the fire stop component is stipulated in Table 2.

Fire resistance limit of parts of the fire stop antechamber (wall, floor, door and valve) at the fire stop door and valve of the fire stop component should meet requirements in table 3.

The fire stop component type 1 should be of K0 grade. In specific cases, it is allowed to use the fire hazard of K1 in the fire stop component type 2 to type 4.

Table 1- Classification of the fire stop component

The fire stop component	Type of the fire stop component	Fire resistance limit of the fire stop component, no less than	Type of door and fire stop vavle in the fire stop component, no less than	Type of fire stop antechamber, no less than
Fire stop wall	1	REI 150	1	1
	2	REI 60	2	2
Fire stop partition	1	EI 45	2	1
	2	EI 15	3	2
Fire stop floor	1	REI 150	1	1
	2	REI 60	2	1
	3	REI 45	2	1
	4	REI 15	3	2

Table 2 – Fire resistance limit of the fire stop door and valve in the fire stop component

The door and fire stop valve in the fire stop component	Type of the door and valve in the fire stop component	Fire resistance limit, no less than
Entrance, gate, manhole, valve	1	EI 70
	2	EI 45*
	3	EI 15
Window	1	E 70
	2	E 45
	3	E 15
Barrier	1	EI 70
NOTE: * - The fire resistance limit of the manhole in the hoistway is allowed not to be less than E45.		

Table 3 – The fire resistance limit of parts of the antechamber

at the fire stop doors and vavles in the fire stop component

Type of the fire stop antechamber	The fire resistance limit of parts of the antechamber, no less than		
	Bulkhead of the antechamber	Floor of the antechamber	Door and valve of the antechamber
1	EI 45	REI 45	EI 30
2	EI 15	REI 15	EI 15

2.5. Stair and staircase

2.5.1. The stair and staircase for emergency exit are classified as follows:

a) Types of stair

- Type 1: Stair inside the building, installed in the staircase.
- Type 2: Open stair inside the building.
- Type 3: Open stair outside the building.

NOTE: Open means that the stair is not installed inside the staircase.

b) Types of general staircase

+ L1: Having orifices on outside wall at each storey (to be left open or glassed).
+ L2: naturally illumintated via orifices on its roof (to be left open or glassed).

c) Types of unsmoked staircase

+ N1: having entrance into the staircase from each storey via an aerated area outside the building by an open pathway (this aerated area is usually in form of loggia or balcony). The pathway via this aerated area should not be smoked.
+ N2: Having positive atmospheric pressure in the staircase when in fire (atmospheric pressure in the staircase is greater than pressure outside the staircase);
+ N3: having entrance toward the staircase from each storey via a antechamber with positive atmospheric pressure (atmospheric pressure in the antechamber is usually positive or in the case of fire).

2.5.2. Fire ladder for serving fire fighting and rescuing activities is classified into two following types:

- P1: Vertical ladder
- P2: Step ladder, with inclination not over 6:1 (not over 80^o).

2.6. Building, fire chamber, room

2.6.1. Building or portions of the building which are separated by type 1 fire stop component wall (called fire chamber) are classified by fire resistance level, by fire hazard of the structure and by group of fire hazard in aspect of their functions.

- Fire resistance level of the building and fire chamber is determined by fire resistance limit of its structural components.
- Fire hazard level of structure of the building and fire chamber is determined by participation of that structure into development of the fire and into formation of dangerous factors of the fire.
- Group of fire hazard in aspect of function of the building and building components is determined basing on usage and characteristics of technological procedures inside the building.

2.6.2. Building and fire chamber are classified by fire resistance level as in Table 4.

Load bearing components of the building including walls, pillars, girders, rigid wall, floor's components (beam, panel...) take part in ensuring the general stability and unchange in form and shape of the building in the case of fire.

Load bearing structural components not participating into ensuring the general stability of the building should be instructed by design agency in technical profile of the building.

Fire resistance limit is not stated for components for obturation (door, gate, window, manhole , skylight, even roof light and other portions to let the light via the roof), except for doors and valves in the fire stop component and for specific cases.

When the minimum fire resistance limit of the structural component is required to be R15 (RE15, REI 15), it is allowed to use uncovered steel structures without depending on its practical fire resistance limit, except for the cases when fire resistance limit of load bearing components of the building is smaller than R8 as in the test.

In the unsmoked staircase type N1, it is allowed to use step plate and stair landing with fire resistance limit of R15 of fire hazard of K0.

Table 4 – Fire resistance level of the building

Fire resistance level of the building	**Fire resistance limit of the structural component, no less than**						
	Load bearing component of the building	**Unloaded outside wall**	**Floor between stories (including floor of attic and floor above basement)**	**Roof without attic**		**Staircase**	
				Roof plate (including insulated plate)	**Frame, beam, purlin**	**Wall of inside staircase**	**Step plate and stair landing**
I	R150	E30	REI60	RE 30	R30	REI 150	R60
II	R120	E15	REI 45	RE 15	R15	REI 120	R 60
III	R90	E15	REI 45	RE 15	R15	REI 90	R 60
IV	R30	E15	REI 15	RE 15	R15	REI 30	R15
V	Not stipulated						

NOTE:

1. In buildings with fire resistance level of I, II, III, the floor and ceiling of basement, semi-basement should be made of noncombustible material with fire resistance level of minimum 90 minutes. Floor of the first

storey and the top storey should be made of material with combustibility no less than Ch1.

2. In buildings with fire resistance level of IV, V, floor of the basement or semi-basement should be made of material with combustibility no less than Ch1 and fire resistance limit no less than 45 minutes.

3. In rooms where combustible fluids are produced or stored, the floor should be made of noncombustible material.

4. Wall, partition and floor of the hoistway and machine chamber of the elevator arranged in the building of any fire resistance level should be made of noncombustible material with fire resistance limit no less than 60 minutes. If the elevator is arranged outside the building, the fire resistance limit of mentioned components should not be less than 30 minutes.

5. Partition, barrier of the middle hall of the building with fire resistance level I should be made of noncombustible material, with fire resistance limit of at least 30 minutes; for buildings with fire resistance level of II, III and IV, these portions should be made of noncombustible material or Ch1, with fire resistance limit of minimum 15 minutes. For building with fire resistance level of II of production class D or E, the hall can be barried by glass wall.

2.6.3. In accordance with fire hazard of structure, the building and fire chamber are classified into 4 levels: S0, S1, S2 and S3 as in Table 5 and this is called structural fire hazard of the building.

Fire hazard is not stipulated for door, gate, window, manhole in the coverage structure of the building, except for specific case.

Table 5 – Structural fire hazard level of the building

Structural fire hazard level of the building	**Fire hazard level of structural component, no less than**				
	Bar load bearing components (pillar, beam, frame...)	**Outside wall**	**Wall, partition, floor and roof without attic**	**Wall of the staircase and the fire stop component**	**Step plate and stair landing in the staircase**
S0	K0	K0	K0	K0	K0
S1	K1	K2	K1	K0	K0
S2	K3	K3	K2	K1	K1
S3	Not stipulated			K1	K3

2.6.4. When applying in practical construction of structure or structural system but not being able to determine fire resistance limit or fire hazard level of the structure basing on the standard fire resistance test or basing on calculation, then it is required to perform fire resistance test for samples similarly to the practical structure of that component in accordance with requirements of current regulation for fire resistance test.

2.6.5. Buildings and building components (rooms or groups of room with correlated functions) will be classified into groups of functional fire hazard depending on their usage characteristic and danger level on human safety in the event of fire, taking into account their age, physical characteristic, ability of having people in sleep, group of people using the main function and number of the group's people. Classification in aspect of functional fire hazard is stated in table 6.

Buildings and rooms for production or storage will be classified in aspect of fire hazard and explosion, depending on quantity and fire and explosion risk of materials and agents stored inside, considering characteristics of the production process. This classification is specified in Appendix C.

Production rooms and warehouse, including laboratory and workshop in building of group F1, F2, F3 and F4 will be arranged into group F5.

Table 6 – Classification of building basing on functional fire hazard

Group	Aim of usage	Characteristics
(1)	(2)	(3)
F1	**Building for frequent usage or temporary accommodation (maybe day and night accommodation)**	Rooms in this building are usually used both day and night. People in there can of various ages and different physical states. Characteristic of these buildings are availability of bedroom.
F1.1	Nursery, kindergarten, dwelling for old age and disabilities (not type of apartment building), hospital, dormitory of residential school and children's place.	
F1.2.	Hotel, hostel, dormitory house of sanatorium, common rest house, camps, motel and salutarium.	
F1.3	Apartment house	
F1.4	Single bay residential house, even building with adjacent apartments each of which has a private exit.	
F2	**Public cultural and sport works**	Main rooms in these buildings

F2.1	Theater, cinema, concert hall, club, circus, stand works, library and other works with number of seats expected for audiences in closed spaces	are characterized by great amount of guests staying in a certain time period.
F2.2	Museum, exhibition place, dancing hall, and similar facilities in closed spaces	
F2.3	Facilities stated in F2.1, open to the air	
F2.4	Facilities stated in F2.2 open to the air	
F3	**Residential service facilities**	Rooms in these facilities are characterized by greater amount of guests than service staffs.
F3.1	Sales facilities	
F3.2	Public catering area	
F3.3	Station	
F3.4	Clinic and emergency aid station	
F3.5	Guest rooms of community life service facility with un-estimated number of seats (post-office, saving fund, booking office, law consultancy office, notary public's office, laundry, sewing house, shoes and clothes repairing shop, barber's shop , mortuary service, religious unit and similar units	
F3.6	Fitness and sports complex area without stand; service rooms; bathrooms	
F4	**Schools, science organizations and designs, management authorities**	Rooms in these factories are use in one certain time period each day. There is usually a fixed group of people working inside and they get acquainted with in-situ condition and they are of certain age and physical state.
F4.1	High school, vocational training, professional secondary school,	
F4.2	Universities, colleges, school for fostering and enhancing professional ability	
F4.3	Facilities of administration organization, design organization, communication and publishing house, scientific research organization, bank, organs, office	

F4.4	Fire fighting stations and rescuing stations	
F5	**Buildings, works, rooms for production or storage aim**	Rooms of this class are characterized by presence of stable amount of working people, even in day and night.
F5.1	Production buildings and works, production rooms, laboratory, workshop	
F5.2	Storage building and works, car parking place without technical and repairing service; book storage, archives, store rooms	
F5.3	Houses for agricultural services	

3. ENSURING HUMAN SAFETY

3.1. General provisions

3.1.1. Requirements in this section are to ensure:

- Timely escape for people without any obstruction.
- Rescuing people under impacts of fire dangerous factors.
- Protecting people on the way of escape from impacts of fire dangerous factors.

3.1.2. Escape is the process of people self-moving organizationally toward outside area from rooms where fire dangerous factors can act on them. Escape is also involuntary movement of inactive people groups due to operation of service staffs. Escape is carried out via escape route.

3.1.3. Rescuing is the forced movement of people toward outside area when they are influenced by fire dangerous factors or when there is direct risk of those influences. Rescuing is taken actively by help and support of fire fighting force or trained professional staffs, including usage of rescuing appliances and performed via escape and emergency exit.

3.1.4. Human protection on the escape route should be ensured by complex of space planning, conveniences, structures, constructional engineering and organization.

Escape route within area of the room should ensure safe escape via escape exit from that room without taking into consideration equipments for smoke protection and fire fighting in this room.

Outside the area of the room, it is required to consider protection of the escape route provided that it ensures safe escape for people with consideration of fire hazard by functions of the rooms on the escape route, number of escaping people, fire resistance level and structural fire hazard level of the building, quantity of escape exit from one storey and from the whole building.

In the rooms and on the escape route outside area of the room, it is required to restrict fire hazard of the building material of the surface layers (finishing layer and surfaced layer), depending on functional fire hazard of the room and the building with consideration of other solutions about protection of the escape route.

3.1.5. When arranging escape rout from rooms and the building, it should not take into account measures and appliances for rescuing, as well as exits not meeting requirements for escape exits stated in 3.2.1.

3.1.6. It is not allowed to arrange room of F5 class A or class B under the rooms used for more than 50 people presenting at the same time, as well as inside the basement or semi-basement.

It is not allowed to arrange room of group F1.1, F1.2 and F1.3 in basement and semi-basement.

NOTE:

1) The basement is the storey of which more than half height is under ground level where the work sits as in the approved layout.

2) Semi basement is the storey of which more than half height is above or equal to the ground level where the work sits as in the approved layout.

3.1.7. In order to ensure safe escape, fire detection and fire alarming should be timely. Building and its components should be equipped with fire alarming system as in current regulation.

NOTE: Basic requirements on arrangement of fire alarming system are stated in the standard TCVN 3890: 2009.

3.1.8. To protect people, it is required to prevent smoke from penetrating into the escape route of the building and its components.

NOTE: Basic requirements on the smoke prevention system are stated in Appendix D.

3.1.9. Effectiveness of methods to ensure human safety in the case of fire can be evaluated by calculations.

3.2. Escape exit and emergency exit

3.2.1. Exit will be called escape exit (or escape) if:

a) It leads from the room in the first storey outwardly by one of following ways:

- Directly outward.
- Via the corridor

- Via the entrance hall (or anteroom)
- Via the staircase
- Via the corridor and entrance hall (or anteroom)
- Via the corridor and the staircase.

b) It leads from room of any storey, except for the first storey, toward one of following places:

- Directly into the staircase or toward the stair of type 3.
- Toward the shared room (or anteroom) with direct exit into the staircase or toward the stair of type 3.

c) It leads to adjacent room (except for room group F5 class A or B) on the same storey from which it leads to exits as stated in a) and b). The exit toward the room class A or B is considered to be escape exit if it leads from the technical chamber with no space for frequent operator but only for serving the mentioned room class A or B.

3.2.2. Exits from the basement and semi-basement are the escapes when they run directly outward and separate from the shared staircase of the building.

It is allowed to arrange:

- Escape exits from the basement via the shared staircase which has private pathway toward the outside area, separated from the rest of the staircase by solid fire stop component partition type 1.
- Escape exits from the anteroom, luggage room, smoking room and water closet at the basement or semi-basement of the building of group F2, F3 and F4 toward the entrance hall of the first storey by private stair type 2.
- The antechamber, even dual antechamber on the direct exit from the building, basement and the semi-basement.

3.2.3. Exits will not be considered to be escapes if they have door or gate with sliding sash, folding door, rolling door or rotating door.

Door with hinged wings opened outwardly among above doors and gates is considered to be escape exit.

3.2.4. Quantity and width of escape exits from rooms, stories and buildings are determined basing on the maximum number of people escaping via them and the allowable limited distance from the longest area where people can be present (living, working) to the nearest escape exit.

NOTE:

1) Maximum number of people escaping from different spaces of the building or the building's components is determined as in Appendix G, section G.3.

2) In addition to general requirements stated in this Code, specific requirements on quantity and width of escape exit will be stipulated in technical regulation for each type of work. The Appendix G in this Code specifies some specific requirements for popular buildings.

Building's parts with fire hazard by different functions which are separated by fire stop component components should have private escape exit.

3.2.5. Following rooms should have no less than two escapes:

- Rooms of group F1.1 with presences of more than 10 people at the same time.
- Rooms in basement and semi-basement with presences of more than 15 people at the same time; for rooms in basement and semi-basement with 6 to 15 people present at the same time, it is allowed that they have one of two exits in accordance with requirements of 3.2.13d);
- Rooms with presences of more than 50 people at the same time;
- Rooms of group F5 class A, or B of which maximum number of working people is 5, class C – with more than 25 people or with area greater than 1,000 m^2;
- Open working platform or platform for operator and maintainer of equipments in the rooms of group F5 with area greater than 100m^2 – for rooms of class A and B or greater than 400m^2 for rooms of other types.

Rooms of group F1.3 (apartment) which are arranged at both stories (2 elevations – usually called duplex apartment) when the layout height of upper storey is greater than 18 m, should have escape at each storey.

3.2.6. Building's stories of following groups should have no less than 2 escapes:

- F1.1; F1.2; F2.1; F2.2; F3; F4;
- F1.3 when total area of apartments on a storey is not greater than 500m^2 (for sectional building, the area then is the area of on storey of the section). In the case when total area is less than 500m^2 and when there is only one escape on each storey, from each apartment at a height greater than 15m, in addition to the escape, there should be one emergency exit as in 3.2.13;
- F5, class A or B when amount of working people in the most crowded shift is greater than 5 people; class C when amount of working people in the most crowded shift is greater than 25 people.

The basement and semi-basement should have no less than two escapes when having area greater than 300m^2 or having more than 15 people at the same time.

In the buildings with height not greater than 15m, it is allowed that one escape is arranged for each storey (or part of storey separated from other parts by fire stop component) of fire hazard group in term of function of F1.2, F3, F4.3, with area not greater than 300m^2 and amount of people not greater than 20 people and when the escape leads to the staircase with fire stop door of type 2 (as in table 2).

3.2.7. Number of escapes from each storey should not be less than two, if the storey has room which requires greater than two escapes.

Escapes from each building should not be less than escapes from any storey of that building.

3.2.8. When there are two and more escapes, they should be allocated (except for exits from the corridor and un-smoked staircases). The minimum distance L (m) between the furthest escape (spacing with each other) is determined by the formula:

- For escapes from rooms: $L \geq 1.50\frac{\sqrt{P}}{(n-1)}$

- For escapes from corridors: $L \geq 0.33\frac{D}{(n-1)}$

where:

P – perimeter of the room, m

n – number of the escape

D – length of the corridor, m.

If there are two or more escapes in the room, on one storey or in the building, then when considering ability of escaping for the exits, it is required to assume that the fire would prevent people from escaping via one of those escapes. The remained escape should ensure ability of safe rescuing for all people in the room, on that storey or inside that building.

3.2.9. Clearance height of the escape should not be less than 1.9m and its clearance width should not be less than:

+ 1.2m – For rooms of group F1.1 when for more than 15 people; for rooms and buildings of other functional fire hazard groups when more than 50 peoples escape, except for group of F1.3.
+ 0.8m – In all the rest cases.

Width of outside doors of the staircase as well as door from the staircase toward the hall should not be less than estimated value or width of the step plate stated in 3.4.1.

In all cases, when determining width of one escape, it is required to take into consideration geometrical shape of the escape via the door or orifice to ensure there is no obstacle for transportation of casualties' stretchers.

3.2.10. Door of escapes and other doors on the escape route should be opened outwardly.

a) Opening direction of the door is not stated for:

b) Rooms of group F1.3 and F1.4.

c) Rooms with no more than 15 people presenting at the same time, except for rooms of class A or B;

d) Storing spaces with area no more than 200m^2 and not having people's frequent attendance.

e) Water-closets.

f) Exits toward stair landing of staircase type 3.

3.2.11. Doors of escapes from stories' corridor, shared space, anteroom, pavilion and staircase should not have lock so that they can be open freely from inside without keys. In buildings higher than 15m, in addition to mentioned above requirements, doors should be of solid type or having reinforced glass (except for doors of apartments).

For staircases, the doors should have automatic closing mechanism, and door gaps should be sealed. Doors of staircases which open directly outward are allowed not to have automatic closing mechanism and not to be sealed the gap.

Doors of escape from rooms or corridors which are protected from forced smoke should be solid class And equipped with automatic closing mechanism; their gaps should be sealed. Whenever needing to use these doors, they should be equipped with automatic closing mechanism in fire circumstances.

3.2.12. Exits not meeting requirements for escape exits can be considered to be emergency exits to increase safety level for people in fire cases. The emergency exits will not be considered when estimating escape ability in fire.

3.2.13. In addition to cases stated in 3.2.12, emergency exits can be:

a) Exit to balcony or loggia, at which there is solid wall with a width no less than 1.2m from edge of the balcony (or loggia) toward the window (or glassed door), or no less than 1.6m among glassed apertures opened toward the balcony (or loggia);

b) Exit which leads to an open transition route (overpass) to an adjacent sectional building of the building group F1.3 or to an adjacent burning chamber. This transition route should have width no less than 0.6m.

c) Exit to balcony or loggia where there is outside ladders to connect balcony or loggia in each storey.

d) Direct exit from rooms which have completed elevation of the floor not smaller than 4.5m underground and not higher than 5.0m, via window or door with dimension no less than 0.75m x 1.5m, as well as via manhole with dimension no less than 0.6m x 0.8m; then, at these exits, there should be ladder of which the inclination is not specified.

e) Exit to the roof of the building with fire resistance level of I, II and III of class S0 and S1 via the window, doorway or manhole with dimension and hung ladder stated in d).

3.2.14. On engineering stories, it is allowed to arrange escapes with height no less than 1.8m.

For engineering stories which are only used for locating constructional engineering network (pipeline, line…), it is allowed to arrange emergency exits via the doors with dimension no less than 0.75m x 1.5m or via manhole with dimension no less than 0.6m x 0.8m, without requiring to have escape.

When the engineering storey has area up to 300m^2, it is allowed to arrange one exit and for each next area smaller than or equal to 2,000m^2, one or more additional exit should be required.

In hidden engineering storey, these exits should be separated from other exits of the building and should lead directly to open air.

3.3. Escape route

3.3.1. The escape route is one continuous route which is not blocked from any point of the building or the work on the way leading to outside exit. The escape route should be illuminated and guided in accordance with requirements of the standard TCVN 3890: 2009 – Fire protection and prevention for buildings. Equipments, Arrangement, Inspection, Maintenance.

3.3.2. Allowable limit distance from the furthest position of the room or from the furthest working location to the nearest escape, measured along the route and should be limited depending on:

+ Functional fire hazard group and explosion hazard class of the room and the building;
+ Number of escaping people;
+ Geometrical parameters of the room and the escape route;
+ Fire hazard level of the structure and fire resistance level of the building.

Length of the escape route by staircase type 2 is equal to triple times of the height of that stair.

NOTE: Specific requirements for allowable limited distance from the furthest position to the nearest escape are stated in Codes for each type of constructional work. The Appendix G specifies some specific requirements for popular building groups.

3.3.3. When arranging, designing the escape route, it is required to base on requirement in 3.2.1. The escape route does not contain elevator, escalator and pathways stated as follows:

- Pathway via corridor with exit from the elevator's shaft, via elevator hall and space in front of the elevator, if the structure covering the elevator shaft, including gate of the elevator shaft, does not meet requirements for fire stop component;
- Pathway via the staircase when there is thoroughfare via the room where sitting the stair type 2 which is not an escape stair.
- Pathway via the roof, except for the roof being in used or roof's part which is specifically used for escape aim;
- Pathway via stair type 2, connecting up to and above 3 stories (floors) as well as pathway leading from the basement and semi-basement, except for cases stated in 3.2.2.

3.3.4. On the escape route in buildings of all fire resistance levels and structural fire hazards (except for building with fire resistance level V and building of class S3), it is not allowed to use material which has fire hazard greater than following groups:

- Ch1, BC1, SK2, DT2 – for finishing coat of wall, ceiling and ceiling sheet hanging in the halls, in staircase and in the elevator hall.
- Ch2, BC2, SK3, DT3 or Ch2, BC3, SK2, DT2 – for the finishing coat of wall, ceiling and ceiling sheet hanging in the shared corridor, shared spaces and anteroom.
- Ch2, LT2, SK2, DT2 – for floor covering layer in the hall, staircase and elevator hall;
- BC2, LT2, SK3 and DT2 – for floor covering layer in the shared hall, shared space and anteroom.

In rooms of group F5 class A, B and C1 where there is production, usage or storage of inflammable fluids, the floors should be made of noncombustible material or material with flammability Ch1.

Frames of ceiling hung on rooms and above escape route should be made of noncombustible material.

3.3.5. In the corridor along the escape route stated in 3.2.1, except for specific cases in regulation, it is not allowed to arrange equipment protruded from the wall surface at a height less than 2m; pipeline of gas and flammable fluids, wall cupboard (except for communication board and cabinet of fire hose reel) should also not be allowed.

Corridors stated in 3.2.1 should be covered by fire stop component in accordance with regulations in the code for each type of constructional work.

Corridors longer than 60m should be separated by fire stop wall of type 2 into sections with length determined in accordance with requirement for smoke prevention which is stated in Appendix D, but the sectional length will not exceed 60m. Doors in the fire stop wall should meet requirements in 3.2.11.

When wings of the room's door open toward the corridor, width of the escape route along the corridor will be equal to clearance width of the corridor subtracting:

- Half of protruded width of the door wing (for the most protruded door) when the door is arranged at one side of the corridor;
- The whole protruded width of the door wing (for the most protruded door) when the door is arrange at both sides of the corridor;
- This requirement is not applied for storey corridor (shared hall) between the door of the apartment and the door to a staircase in the sectional building of group F1.3.

3.3.6. Clearance height of horizontal sections of the escape route should not be less than 2m while clearance width of horizontal section and slope should not be less than:

+ 1.2m for the shared corridor used for escaping of more than 15 people from rooms of group F1, more than 50 people from rooms of other functional fire hazard group;
+ 0.7m for pathways to individual working place;
+ 1.0m – for all remained cases;

In any circumstance, the escape route should be wide enough, and its geometrical shape should be considered so that there will not be any obstacle for transportation of casualties' stretchers.

3.3.7. Floor of the escape route should not be stepped with height difference less than 45 cm or should not be edged, except for the door thresholds. At the stepped section, there should arrange steps with an amount no less than 3 or should build a slope with inclination not greater than 1:6 (elevation not exceeding 10cm on a whole length of 60cm or the angle formed by the inclined line with plane not greater than 9.5^{o}).

When building steps at areas with height difference greater than 45cm, it is required to have hand railed balcony.

On the escape route, there should not be spiral stair, totally curved stair or partially curved stair by the plane; within one tread and one staircase, it is not allowed to have steps with different height and different treads' width.

On the escape route, there should not be mirror to prevent misunderstanding of the escape.

3.4. Stair and staircase on the escape route

3.4.1. Tread's width of the stair for people rescuing, including tread inside the staircase, should not be smaller than estimated width or width of any escape (door) on the staircase, and at the same time, not be smaller than:

a) 1.35m – for buildings group F1.1;

b) 1.2m- for buildings with number of people on a certain storey (except the first floor) greater than 200;

c) 0.7m – for staircases leading to individual working place;

d) 0.9m – For the rest of cases.

3.4.2. Slope (inclined angle) of the stair on escape route should not be greater than 1:1 (45^o), while the tread's width should not be less than 25cm and tread's height should not be greater than 22cm.

Slope (inclined angle) of the open stair toward individual working place is allowed to be up to 2:1 (63.6^o).

It is allowed to reduce the tread's width of the receiving curved stair (usually at the hall of first floor) at its narrowed part to 22cm; Allow to reduce the tread's width to 12cm for stairs which are only used for rooms with total working people not over 15 (except for rooms of group F5 class A or B).

Stairs type 3 should be made of noncombustible material and should be placed adjacent to solid portions (not having window or light orifice) of the wall which has fire hazard not lower than K1 and fire resistance limit no less than REI30. These stairs should have landing plate on the same elevation with the escape, and should have rail height of 1.2m far from the window no less than 1m.

Stairs type 2 should meet requirements specified for tread and landing plate in the staircase.

3.4.3. Width of the stair's landing plate should not be less than width of the tread. Width of the landing plat at the elevator's entrance (the landing plate also playing part of elevator hall) for the elevator which has hinged wing, should not be less than total width of the tread added with half of the wing of the elevator, but not less than 1.6m.

Intermediate landing plate in the flat stair tread should have length no less than 1m.

For doorway opening toward the staircase, when the door opens, its wing should not reduced estimated width of the landing plate and the tread.

3.4.4. In the staircase, it is not allowed that:

- Pipeline of flammable gas and fluid.
- Cupboard, except for communication board and cabinet of fire hose reels.
- Open cable and electric wire (except for electric wire of low voltage equipment) to illuminate the corridor and the staircase;

- Exits from lifts and good lifts;
- Equipments protruded from the wall at a height under 2.2m from step's surface and the landing plate.

In the space of staircase, it is not allowed to have any functional room.

3.4.5. In the space of staircase, except for un-smoked case, it is allowed to arrange no more than two elevators for lowering people to the first floor; structure for covering the elevator shaft should be made of noncombustible material.

If it is required to cover the elevator's shafts which are outside the building, the material of this covering structure should be noncombustible.

3.4.6. Staircases on the first floor should have direct exit to adjacent land lot of the building or toward the hall separated from adjacent corridors by fire stop wall of type 1 which has door. When arranging escapes from two staircases via the shared hall, one of the two escapes (not the escape toward the hall) should have direct exit to the open air.

Staircases type N1 should have direct exit to the open air.

3.4.7. Staircases (except for type L2) should have light orifices with area no less than 1.2m^2 on the wall at each storey.

It is allowed to arrange no more than 50% of the staircases which do not have light orifice to be escape in following cases:

- Building of group F2, F3 and F4: for staircase type N2 or N3 with positive atmospheric pressure in fire;
- Building of group F5 class C with height up to 28m, for class D and E, not depending on the building's height; for staircase type N3 with positive atmospheric pressure in fire.

Staircases type L2 should have light orifice on the roof with area no less than 4m^2 in comparison with gap between flights of which the width is not less than 0.7m or the light orifice along the height of staircase with cross section no less than 2m^2.

3.4.8. Protection against smoke for staircases type N2 and N3 should be in compliance with Appendix D. When necessary, staircase type N2 should be divided into chambers in aspect of height by solid fire stop wall type 1 from entrances and pathways between chambers outside the staircase's space.

Windows in staircase type N2 should be un-openable.

3.4.9. Ability of not being smoked of the pathway via the open air toward un-smoked staircase type N1 should be guaranteed by structural solution and special planning.

These pathways should be let open and usually not at corners inside the building. They should also meet following requirements:

- When one part of outside wall of the building connects with other wall to form an angle less than 135^{o}, then horizontal distance from the nearest door at the outside space toward the top of adjacent angle should not be less than 4m; this distance can be reduced to be equal to protruded portion of the wall. This requirement is not applied for the pathway at contiguous angle greater or equal to 135^{o} as well as for the case when the protruded portion is not greater than 1.2m;
- Width of the wall portion between door of the open space and the nearest window of the room should not be less than 2m;
- Pathways should have width no less than 1.2m with balcony's height of 1.2m, width of wall portion between doors at the outside area should not be less than 1.2m.

3.4.10. Staircases type L1 are allowed in buildings of all functional fire hazard groups which have height up to 28m; then, in the building F5 class A or B, exit to stories' hall from rooms class A or B should be through one space where atmospheric pressure is positive.

3.4.11. Staircases type L2 are allowed in buildings with fire resistance levels I, II and III of the structural fire hazard S0, S1 and functional fire hazard F1, F2, F3 and F4 whose heights do not exceed 9 m. It is allowed to increase the building's height up to 12m when the upper light orifice automatically opens in fire and when the building of group F1.3 has fire automatic alarming system or independent fire detector.

When arranging staircases type L2, it is also required to meet following requirements:

- For buildings group F2, F3 and F4, amount of staircases type L2 should not account more than 50%, the remained staircases should have light orifices on outside wall at each storey (type L1);
- For buildings group F1.3 of sectional unit, in each apartment at elevation over 4m, there should be an emergency exit as in 3.2.13.

3.4.12. In the building higher than 28m as well as in buildings group F5 class A or B, it is required to have un-smoked staircase type N1.

Allow to:

- Arrange no more than 50% staircase type N2 in buildings of group F1.3 in form of corridor.
- Arrange no more than 50% staircase type N2 or N3 with positive atmospheric pressure in fire in buildings of group F1.1, F1.2, F2, F3 and F4.
- Arrange staircase type N2 and N3 which is naturally illuminated and always has positive atmospheric pressure in buildings of group F5 class A or B;

- Arrange staircase type N2 or N3 which has positive atmospheric pressure in fire in buildings of group F5 class B;
- Arrange staircase type N2 or N3 which has positive atmospheric pressure in buildings group F5 class C or D. When arranging the staircase type L1, it should be divided by solid fire stop wall for each 20m of height and pathway from chamber to chamber should be located outside the space of the staircase.

3.4.13. In buildings with un-smoked staircases, it is required to have solution for smoke prevention for shared hall, shared corridor and shared space as well as anteroom.

3.4.14. In buildings with fire resistance level I and II of the structural fire hazard S0, it is allowed to arrange stair type 2 from the main hall to the second floor, taking into account requirements in 4.26.

3.4.15. In buildings not higher than 28m of functional fire hazard F1.2, F2, F3 and F4, which have fire resistance level of I, II and structural fire hazard S0, it is allowed to use stair type 2 connected two and more stories when the escape staircase meet requirements in standard document and in 4.27.

3.4.16. Escalators should be arranged in accordance with regulation for stair type 2.

4. PREVENTION OF FIRE SPREAD

4.1. Prevention of fire spread is carried out by measures to limit fire area, fire intensity and fire duration. These measures specifically are:

- Using structural and special planning method to prevent spread of dangerous factors of the fire in one room, among rooms, among room groups of different functional fire hazard, among stories and sectional building, among burning chambers, as well as among buildings;
- Limiting fire hazard of the building material used at surface layers of the building structure, including roof covering, wall's finishing layer, rooms and escapes;
- Limiting fire hazard and explosion hazard in rooms and buildings;
- Having primary fire fighting equipments, including automatic and handheld equipments.
- Having fire detector and fire alarming equipment.

NOTE:

1) The regulation on fire prevention gap between residential building, public works and production houses is stated in Appendix E. Distance between storage of combustible fluids, open warehouses which contain flammable agents and LPG [1)] and gas to other works should be in compliance with specialized codes.

2) The term "fire intensity" is stated in Appendix A.

4.2. Residential buildings, public works, production house and warehouse should meet requirements for fire prevention and protection in this Code and regulations in design standard for those types of work. For stories (allowable height of the building), area of the burning chamber and the storey limiting arrangement of the auditorium of some works should be in accordance with regulations in Appendix H.

4.3. Building components (rooms, engineering storey, basement, semi-basement and other parts of the building) where it is difficult for performing fire fighting activities should have additional equipments to limit fire area, intensity and fire duration.

4.4. Efficiency of solutions to prevent spread of the fire can be assessed by technical and economical estimation basing on requirements in 1.4.1 for limiting direct and indirect damage of the fire.

4.5. Buildings and rooms of different functional fire hazards should be separated from each other by separating structure with regulated fire resistance limit and structural fire hazard or by fire stop component. In that case, requirements for the separating structure and fire stop component should be considered taking into account functional fire hazard of the rooms, fire load, fire resistance level and structural fire hazard of the buildings.

4.6. In the building when its portions which have different functional fire hazards are separated by fire stop components, then each portion should meet requirements for fire prevention as for buildings of corresponding functional fire hazard.

Selection of fire protection system for the building should be on the basis that: when building's portions have different functional fire hazard, then the building's functional fire hazard can be greater than functional fire hazard of any portion of that building.

4.7. In buildings of group F5, if allowed by technological requirement, rooms class A and B should be arranged near the outside wall meanwhile for multi-storied building, these rooms should be arranged on upper stories.

4.8. In basement and semi-basement, it is not allowed to arrange rooms which use or store flammable gas and fluids as well as rooms storing flammable material, except for specific cases.

4.9. Structural components should not facilitate underground fire spread.

4.10. Fire resistance of joints of the structural components should not be lower than required fire resistance of that component.

4.11. Structure to form floor slop in audience room should meet requirements on fire resistance limit and

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[1] LPG is abbreviated name of liquefied petroleum gas

fire hazard level in Table 4 and Table 5 as for stories' floors.

4.12. When arranging technical pipeline, cable line via structures of wall, floor and bulkhead, then the contiguous position between the pipeline, cable line with these structures should be tightly sealed or properly processed not to decrease technical criteria in term of fire for the structures.

4.13. Special fire proof coating and soaking layer on the open surface of structures should meet requirements for completion of these structures.

Technical documents of the coating and soaking layer should specify period for replacing or recovering these layers depending on application condition.

In order to increase fire resistance limit or to decrease fire hazard of structural component, it is not allowed to use the special fire proof coating and soaking layers at positions where they can not be recovered or replaced periodically.

4.14. Efficiency of solutions for fire prevention and protection, which are used for decreasing fire hazard of material, should be evaluated by fire hazard tests for the material as in Part 2 (Classification of fire).

Efficiency of fire protection solutions used for increasing fire resistance of the structural component should be evaluated by fire resistance limit tests for the components stated in Part 2 (Classification of fire).

Efficiency of fire protection solutions, not considering load bearing capability of metallic structures (pillar or beam) can be evaluated by comparison test mini-size models of the pillar with a height no less than 1.7m or spanned beam no less than 2.8m without static load.

4.15. Suspended ceiling used for increasing fire resistance limit of the floor and roof should meet requirements for that floor and roof in aspect of fire hazard.

Fire stop partitions in rooms which have suspended ceiling should divide the space above the ceiling.

In the space above the suspended ceiling, it is not allowed to arrange channel and pipeline to carry gas, dust-gas combination, fluid and flammable material.

Suspended ceiling should not be allowed in room class A or B.

4.16. At crossed position between the fire stop component with coverage structure of the building, even at the position where the building's shape changes, there should be solutions to prevent fire from spreading via these fire stop components.

4.17. Fire stop wall used for dividing building into fire chambers should be arranged on the whole height of the building and should ensure not to let the fire spread from fire source to the adjacent fire chamber when the burned building structure falls.

4.18. Vents in fire stop components should be closed when there is fire.

Windows in the fire stop components should be un-openable while doors, gates, manholes and valves should have automatic closing mechanisms and their gaps should be sealed. If needing to open the doors, gates, manholes and valves for use, they should be equipped with automatic closing mechanism in fire.

4.19. Total area of door apertures in the fire stop component, except for the covering structure of elevator's shaft should not exceed 25% of area of that fire stop component. Door and fire stop valve in the fire stop component should meet requirements in 2.4.3 and requirements in this section.

At the door of the fire stop component used for separating rooms class A or B from other spaces such as rooms of other classes, corridor, staircase and elevator hall, there should be antechamber with positive atmospheric pressure stated in Appendix D. It is not allowed to arrange shared antechamber for two and more rooms of the same class A or class B.

4.20. When it is not able to arrange fire stop antechamber in the fire stop components which are used to separated rooms of class A or rooms of class B from other rooms, or when it is not able to arrange door, gate, manhole and valve in the fire stop components which are used to separate rooms of class C from other rooms, it is required to establish combination of solutions to prevent fire from spreading and penetrating into adjacent rooms and stories storing flammable gas and vapor, fluid's vapor, dust and flammable fiber which can generate fire hazard concentration. Efficiency of these solutions should be proved.

In the door apertures of fire stop components among adjacent rooms class C, D and E, when they can not be filled by door or fire stop gate, open antechamber will be allowed once having automatic fire fighting equipments. Covering structure of these antechambers should be fire stop structure.

4.21. Door and fire stop valve in fire stop component should be made of noncombustible material.

It is allowed to use material of flammability no less than Ch3 which is protected by noncombustible material with thickness no less than 4mm to be material for building fire stop door, gate, manhole and valve.

Door of fire stop antechamber, doorway, gate, manhole in the fire stop component at the rooms where there is no storage or usage of flammable gas, fluid and material as well as there is no technological process relating to formation of flammable dust, can be made of material with flammability of Ch3 and thickness no less than 40mm without any void.

4.22. It is not allowed to arrange channel, well and pipelines of flammable gas, dust-gas combination, flammable fluid, material and agent via the fire stop wall and floor of type 1.

For channel, well and pipeline for carrying material and agent other than those mentioned above, at the crossed position with these fire stop component, there should be automatic device to prevent spread of fire products along this channel, well and pipeline.

NOTE:

1) Allow to install ventilation and chimney in the fire stop wall of residential building, public work and auxiliary building when minimum thickness of the fire stop wall (excluding pipe section) at that area is not less than 25cm while thickness of partition position between the chimney and the ventilation is minimum 12 cm.

2) Holes for installing water pipe at the fire stop component should be properly processed in accordance with 4.12.

4.23. Covering structure of the elevator shaft (except for shafts stated in 3.4.5) and machine room of the elevator (except for roof machine room) as well as covering structure of channel, well and technical box, should meet requirements for fire stop partition type 1 and fire stop floor type 3.

Fire resistance limit of covering structure between the elevator shaft and the machine room is not stipulated.

When it is not able to install fire stop door in the covering structure for above elevator shaft, it is required to arrange antechamber or hall with fire stop bulkhead type 1 and fire stop floor type 3 or barrier which automatically closes the door aperture of the shaft in the case of fire. This barrier should be made of noncombustible material and has fire resistance limit no less than EI 45.

In buildings with un-smoked staircases, it is required to have automatic smoke prevention system for the elevator shaft from which there is no fire stop antechamber with positive atmospheric pressure in event of fire.

4.24. Garbage room, rubbish chute and collector should be designed, installed in accordance with standard, technical requirements for these components as well as following requirements:

- Rubbish chute and garbage room should be isolated from other parts of the building by fire stop components; garbage collector at each storey should have fire stop manhole door which is automatically closed.
- It is not allowed to installed rubbish chute and garbage room inside staircase, waiting hall or the antechamber which are covered for escape.
- Chambers having rubbish chute or being used for storing garbage should have direct entrance via an open space from outside or via a fire stop antechamber which is frequently ventilated.
- Entrance into the garbage room should not be located adjacent to the escape or exit of the building or near the window of residential building.

4.25. In the buildings of all functional fire hazard groups, except for group F1.3, depending on technological condition then it is able to arrange individual stair for traveling between the basement or semi-basement with the first floor.

These stairs should be covered by fire stop partition type 1 and fire stop antechamber with positive atmospheric pressure in fire.

It is allowed not to arrange fire stop antechamber as specified for these stairs in buildings of group F5 provided that they lead from the basement or semi-basement having rooms class C4, D and E into rooms of similar class in the first floor.

These stairs should not be considered when estimating escape ability, except for the case stated in 3.2.1.

4.26. When arranging stair of type 2 from hall of the first floor to the second floor, this hall should be isolated from corridor and adjacent rooms by fire stop partition type 1.

4.27. The room where there is stair type 2 as in 3.4.15 should be isolated from the corridor which connects it with other rooms by fire stop partition type 1. It is allowed not to isolate the room with stair type 2 by fire stop partition when:

- There is automatic fire protection equipments in the whole area of the building;
- The building is not higher than 9m and area of one storey not greater than 300m^2.

4.28. In the basement or semi-basement, in front of the entrance into the elevator, there should be fire stop antechamber type 1 with positive pressure in fire.

4.29. Dimension selection for building and fire chamber as well as distance between the buildings should base on fire resistance level, structural fire hazard, functional fire hazard and value of fire load, with consideration of efficiency of fire prevention equipments which are used, presence, position and readiness of fire fighting organs as well as possible economical and environmental impact due to the fire.

4.30. During application and operation, all technical equipments for fire prevention and protection should ensure performance in accordance with requirements set forth.

4.31. Installation of automatic fire alarming and fire fighting system should be in accordance with TCVN 3890: 2009.

5. FIRE FIGHTING AND RESCUE

5.1. Building and constructional work should ensure fire fighting and rescuing by solutions of structure, special planning, engineering and organizational solution.

These solutions include:

- Arranging passageway for fire vehicle and access for fire fighting force and equipments, in combination with functional passageway and paths of the building or in individual.

- Arranging outdoor fire fighting ladders and ensuring other necessary equipments to take the fire fighting force and equipments to stories and roof of the building, including arrangement of lift which has function of carrying fire fighting force.
- Arranging water supply system for fire fighting activity, combining or not combining with water domestic supply. When necessary, arranging water supply hoses and water pipe into the building for the fire fighting force as well as arranging water tower, water tank or other water supply for fire fighting.
- Protecting against smoke for passageway of the fire fighting force inside the building;
- Providing the building with rescuing equipments for individual and collective in necessary situation;

Arranging fire station with sufficient fire fighters and equipments as required for the residential area, industrial zone or construction work in accordance with fire fighting condition for these area or within scope of the station.

Selection of above solution depends on fire resistance level, structural fire hazard and functional fire hazard group of the building.

5.2. Passageway for fire fighting vehicle should meet following requirements:

- Width of the passageway should not be less than 3.5m for each vehicle lane. Height of the space from passageway surface should not be less than 4.25m.
- The passageway surface should be able to bear load of fire fighting vehicle in accordance with design requirement and in accordance with vehicle type of fire prevention and protection organization at the area where there is the constructional work.
- Dead-end road for one lane of vehicle should not be longer than 150m and at its end there should be turnaround space as in 5.3. If the road is longer than 100m, it should have avoidance space as in 5.4.
- Accessibility to water supply of the construction as well as to positions convenient for fire fighting and rescuing. Distance from parking area of the vehicle to the water hose onto the building should not be greater than 18m.

5.3. Designing the turnaround space should be in accordance with one of following regulations:

- Equilateral triangle with the size no less than 7m, one peak on the dead-end road, two other peaks well-proportioned on two roads;
- Square with size no less than 12m;
- Circle, with diameter no less than 10m;

- Rectangle in perpendicular to the dead-end road, well-proportioned toward two sides of the road with dimension no less than 5m x 20m.

5.4. For narrow road which is only sufficient for one vehicle lane, at each section of minimum 100m there should be one expanded area of 7m wide and 8m long so that fire fighting vehicle can easily avoid other vehicles.

5.5. Road for fire vehicle for residential building, public work and auxiliary building of industrial units

It is required to ensure the road for fire fighting vehicles to access to residential building, public work and auxiliary building as well as ensure the road and parking area for ladder vehicle or crane to access individual apartment or room on high storey.

Distance from the road pavement to the building wall is allowed to be 5m to 8m for building up to 10 stories, from 8m to 10m for building of over 10 stories. In area of this distance, it is not allowed to have partition, overhead transmission line and row of high trees.

Along the outside of the building without any entrance, it is allow to arrange land space with minimum width of 6m and minimum length of 12m as parking place for the vehicle once considering allowable load of the vehicle on the ground and pavement.

5.6. Road for fire fighting vehicle for industrial building and construction work

Along the whole length of industrial building and construction work, it is required to have road for fire vehicle: from one side when width of the building or the work is less than 18m and from both sides when width of the building or the work is greater than 18m.

For building with constructional area greater than 10,000 m^2 or wider than 100m, there should be road for fire vehicle from all directions.

If production condition does not require passageway, then the road for fire vehicle can be arranged at a width of 3.5m for vehicle, of which the bed will be reinforced by materials bearing load of the fire vehicle and ensuring surface drainage.

Distance from the edge of the entrance for fire vehicle toward the building's wall should not be greater than 5m for building lower than 12m; not be greater than 8m for building higher than 12m to 28m and not be greater than 10m for building higher than 28m.

In necessary cases, distance from the edge of entrance road to outside wall of the building can be increased to 60m provided that the building has dead-end road together with turnaround space and water towers for fire fighting. In that case, distance from the building to the turnaround space should not be less than 5m and not be greater than 15m while distance between dead-end roads does not exceed 100m.

NOTE:

1) Width of the building and construction is equal to the distance between positioning axles.

2) For water lakes used for fire fighting, it is required to have entrance toward an yard of which each size is not less than 12m.

3) Water towers for fire fighting should be arranged along the vehicle road, ensuring distance toward the road edge not greater than 2.5m and distance toward the building's wall not smaller than 5m.

5.7. For buildings higher than or equal to 10m to the fascia board or upper edge of the outside wall (barrier wall), there should be direct exits to the roof from staircase or via attic or via the stair type 3, or outside ladder.

Quantity of exits to the roof and their arrangement should base on functional fire hazard and dimension of the building, but not less than one exit:

- For each distance less than or equal to 100m length of the building having attic.
- For each area smaller or equal to 1,000m^2 of the roof of the building having no attic of the groups F1, F2, F3 and F4.
- For each 200m perimeter of the building of group F5 along the fire ladder.

It is allowed not to arrange:

- Fire ladders at front face of the building if the building's width is not over 150m and when there is water supply in front of the building.
- Exit to the roof of one-storey building of which the roof has area not greater than 100m^2.

5.8. In the attic of the building, except for building of group F1.4, there should be exit to the roof via fixed ladder and doorway, manhole or window with dimension no less than 0.6m x 0.8m.

Exit to the roof or to the attic from staircase should be arranged by step plates with landing plate in front of the exit, via fire stop door type 2 with dimension no less than 0.75m x 1.5m. Step plate and landing plate can be made of steel but should have slope (inclination) not greater than 2:1 (63.5^o) and a width no less than 0.7m.

In the building group of F1, F2, F3 and F4 with a height up to 15m, it is allowed to arrange exit to the attic or to the roof from staircase via manhole door of fire stop type 2 with dimension of 0.6m x 0.8m by fixed steel ladder.

5.9. In the technical storey, including technical basement and technical attic, the clearance height of the passage should not be less than 1.8m; in the attic along the whole building, this value should not be less

than 1.6m. Width of this passage should not be less than 1.2m. In individual sections with length not greater than 2m, it is allowed to reduce height of the passage to 1.2m and minimum width is 0.9m.

5.10. In buildings having attics, there should be manhole in structure covering orifices of the attic.

5.11. At position where height difference of the roof is greater than 1m (where there is elevation for lifting light and ventilation holes), fire ladder will be required.

At the position where height difference of the roof is greater than 10m, if each of the roof's portion greater than $100m^2$ has its own exit to the roof met requirements in 5.7 or elevation of the lower portion of the roof determined in 5.7 does not exceed 10m, fire ladder will not be required.

5.12. It is required to use fire ladder of type P1 to access to a height of 20m and at position of height difference of the roof from 1m to 20m. Fire ladder type P2 should be used to access to a height greater than 20m and at height difference over 20m.

Fire ladder should be made of noncombustible material, placed at visible area and far from the window no les than 1m. Width of the ladder is 0.7m. For the ladder type P1, at a height of 10m and above, it is required to have a circular segment of protection of which the diameter is 0.35m and its center is 0.45m from the ladder. Circular segments should be spaced 0.7m and at the exit to the roof, it should be at a position at which its projection to the rail is minimum 0.6m. For ladder type P2, it is required to have hand rail and landing plate not over 8m from each other.

5.13. There should be gap between step plates and between hand rails of the ladder with clearance width projected onto the plane no less than 100mm.

5.14. In each fire chamber of the building which has height greater than 28m (except for building of group F1.3), there should be qualified elevator to carry fire fighting force and fire fighting apparatus.

NOTE: Specific technical requirements for the qualified elevator to carry fire fighting force and apparatus will be stated in specific standard.

5.15. In the buildings which have roof slope up to 12%, height toward fascia board or upper edge of outside wall (barrier wall) greater than 10m as well as in buildings which have roof slope greater than 12% and height toward fascia board greater than 7m, it is required to have hand rail on the roof in accordance with current standard. Handrail of this type should also be arranged on flat roof, balcony, loggia, outside hall, open stair, stair tread and landing plate without depending on the height of the building.

5.16. Water supply system for fire fighting for the building should be guaranteed so that the fire fighting force and apparatus can access and use all the time.

5.17. Supply of water as well as equipments, devices and other specialized apparatus for fire fighting for the building and constructional work should be in compliance with requirements in standard TCVN 3890: 2009.

5.18. Attendant room for fire fighting control

a) For buildings over 10 stories, crowded public houses, garage, production house, warehouse with area over 18,000m^2, there should be attendant room for fire fighting control and there should be frequent appearance of skilled staff at this room.

b) The attendant room for fire fighting control should:

- Have sufficient area for arranging equipments in accordance with requirement for fire prevention and protection of the building, but not les than 6m^2;
- Have two exits: one exit connects with outside open space and another connects with the main corridor for escape;
- Be separated from other parts of the building by fire stop component type 1.
- Be equipped with communication device and terminal of fire alarming system to connect all parts of the building.
- Have monitor board to control fire fighting equipments, smoke control device and have layout of fire fighting equipments of the building.

ANNEX A

Explanation of the terms

A.1. Fire safety for building and constructional work (construction item)

To ensure requirements for material properties and structure of structural component in term of architectural solution, planning, technical and technological solutions in accordance with application characteristics of the work in order to prevent fire (fire prevention), to limit fire spread, to guarantee fire extinguishment (fire protection), to prevent hazardous factors for people and to minimize property damage in the event of fire.

A.2. Silica aggregate concrete

The concrete which is formed by aggregates of normal density, with structural component mostly of silica (SiO_2) or silicate (salt of silicic acid).

A.3. Fire hazard level of the structural component (see 2.3 and Appendix B).

Grouping characteristic of the structural component, basing on different level of parameter of fire test result for the structural material of the component stipulated by standards.

A.4. Structural fire hazard of the building

Structural fire hazard of the building is determined by fire hazard level of primary structural components of the building (see 2.6.3).

A.5. Fire intensity

The quantity presenting the rate of heat released by a fire.

A.6. Functional fire hazard

Grouping characteristic of the building (or building's parts) basing on its usage and factors which can threaten human safety in the case of fire, taking into account factor of age, physical state, ability of people in sleep…of the people group using the main function.

A.7. Fire hazard group of building material (see 2.2 and Appendix B)

Grouping characteristic of building material basing on different levels of results of fire test for the material stipulated by the standards.

A.8. Fire chamber

One part of the building which is separated from other parts by fire stop partitions type 1.

A.9. Antechamber

The transition space between two doorways which is used to protect against penetration of cold air, smoke, or other gases when coming into the building, into the staircase or other rooms of the building.

A.10. Fire stop antechamber

The antechamber of which structural components have fire resistance limit meeting regulated requirements (see 2.4.3).

A.11. Standard document

The document stipulates rules, guidelines or characteristics for activities or their results (in accordance with TCVN 6450: 2007).

NOTE: The term "standard document" is one general term which includes documents like standards, technical specifications, code of practices and regulation.

A.12. Smoked zone

One part of the building which has area not greater than 3,000m^2 from which fire products (smoke) will be extracted and exhausted, ensuring escape from firing rooms.

A.13. Other terms and definitions are stated in the standard TCVN 5303: 1990 and TCVN 3991: 1985.

ANNEX B

Classification of building material in term of fire characteristics

B.1. Building material is classified into two types: flammable material and noncombustible material basing on value of fire test as follows:

a) Noncombustible material, should ensure that in the whole duration of the test:

- Temperature increase of the furnace does not exceed 50^{o}C.
- Reduction of sample amount is not greater than 50%.
- Prolonging time of the flame is not greater than 10 seconds.

b) Flammable material is the material not meeting one of above requirements during the test.

NOTE:

1) Test parameters are determined in accordance with standard TCXDVN 331: 2004([1]) (EN ISO 1182) "Construction material – Non-combustibility test" or equivalent standard.
2) Some practical building materials are considered to be noncombustible material such as inorganic material in general like concrete, baked clay brick, ceramic, metal, block masonry and mortar…

([1]) The standard TCXD VN 331: 2004 would be converted to TCVN as regulated by the Law on Standard and technical regulation.

B.2. In term of combustibility, the combustible material is classified into 4 groups corresponding with parameters of burning test as follows:

Table B1 – Classification of combustible material in term of combustibility

Combustibility group of the material	**Combustibility parameters**			
	Gas temperature in the smoke vent (T) (^{o}C)	**Damage level reducing length of the sample (L) (%)**	**Damage level reducing mass of the sample (m) (%)**	**Self-burning duration (second)**
Ch1 – Low combustibility	≤ 135	≤ 65	≤ 20	0
Ch2 – Moderate combustibility	≤ 235	≤ 85	≤ 50	≤ 30
Ch2- Medium	≤ 450	> 85	≤ 50	≤ 300

combustibility				
Ch3- High combustibility	> 450	> 85	> 50	> 300

NOTE:

1) Testing parameters are determined in accordance with current Vietnam National standards or equivalent standards in the method of combustibility test of the building material.
2) If testing as in TCXDVN 331: 2004, material meeting following requirements will also be classified as material of weak combustibility:
   - Temperature increase of the furnace not over 50°C.
   - Reduction of test sample not greater than 50% and prolonging time of the flame is not over 20 seconds.

B.3. In term of ignitability, combustible material is classified into 3 groups corresponding with parameter of test as follows:

Table B2 – Classification of combustible material in term of ignitability

Groups of ignitability of the material	Ultimate surface throughput strength (kW/m^2)
BC1- Slow burning	≥ 35.0
BC2 – Moderate ignitability	greater than or equal to 20.0 and smaller than 35.0
BC3- Ignitability	< 20.0
NOTE: Testing parameters are determined in accordance with standard ISO 5657 (Reaction to fire tests – Ignitability of building materials using a radiant heat source) or equivalent standard.	

B.4. In term of propagation on surface, combustible material is classified into 4 groups corresponding with parameters of fire test as follows:

Table B3 – Classification of combustible material in term of fire spread on the surface

Groups of fire spread on the surface of the material	Ultimate surface throughput strength (kW/m^2)
LT1 (not spreading);	≥ 11.0
LT2 (Low spreading);	greater than or equal to 8.0 and smaller than 11.0
LT3 (moderate spreading);	greater than or equal to 5.0 and smaller than 8.0

LT 4 (high spreading).	< 5.0
NOTE: Testing parameters are determined in accordance with standard ISO 9239 (Reaction to fire tests – Flame spread on surface of floorings. Determination of burning behavior using a radiant heat source) or equivalent standard.	

B.5. In term of smoke production, combustible material is classified into 3 groups corresponding with test parameters as follows:

Table B4 – Classification of combustible material in term of smoke production

Groups in term of smoke production of the material	**Value of smoke production factor of the material (m^2/kg)**
SK1- Low smoke production	≤ 50
SK2 – Moderate smoke production	greater than 50 and smaller than or equal to 500
SK3- High smoke production	> 500
NOTE: Testing parameters are determined in accordance with standard ISO 5660-2 (Reaction to fire tests – Heat release, smoke production and mass loss rate – Part 2: Smoke production rate) or equivalent standard.	

B.6. In term of toxicity, combustible material is classified into 4 groups corresponding with toxicity index H_{CL50} of the burning product as follows:

Table B5- Classification of combustible material in term of toxicity

Group in term of toxicity of the material	**Index H_{CL50} (g/m^3), corresponding with exposure time**			
	5 minutes	**15 minutes**	**30 minutes**	**60 minutes**
DT1: Low toxicity	> 210	> 150	> 120	> 90
DT2: Moderate toxicity	70 to 210	50 to 150	40 to 120	30 to 90
DT3: High toxicity	25 to 70	47 to 50	13 to 40	10 to 30
DT4: Specially high toxicity	≤ 25	≤47	≤ 13	≤ 10
NOTE: Testing parameters and calculations of index H_{CL50} are in accordance with the standard ISO 13571 (Life-threatening components of fire – Guidelines for the estimation of time available for escape using fire data) or equivalent standard.				

ANNEX C

Classification of buildings and rooms in term of fire and explosion hazard

C.1. In term of fire and explosion hazard, buildings and rooms are classified in to class A, B, C1 to C4, D and E.

C.1.1. Type of fire and explosion hazard of the room is classified as in Table C1.

Table C1 – Classification of rooms by fire and explosion hazard

Fire hazard class of the room	Characteristics of agents and materials available (formed) in the room
A Fire and explosion hazard	- Combustible gases, flammable fluid with igniting temperature not greater than 28^{o}C, with an amount which can form a combination of gas and vapor of explosion hazard when igniting, creating estimated residual bursting pressure in the room over 5kPa. - Agents and materials which can be exploded or burned when reacting with water, oxygen in the air or reacting with each other, with an amount so that estimated residual bursting pressure in the room exceed 5kPa.
B Fire and explosion hazard	Dusts or combustible fibers, flammable fluids, with igniting temperature greater than 28^{o}C with an amount creating a combination of dust-gas or gas-vapor which will produce estimated residual bursting pressure over 5kPa in the room.
C1 to C4 Fire hazard	Combustible fluids or slow-burning fluids, combustible and slow burning agents and materials in solid state (including dust and fiber), agent and material which will fire when reacting with water, oxygen or with each other at a condition of the room where these agents and materials are not of the class A or B. Classification of rooms into C1 to C4 in term of specific fire load of material that it stores is follows: C1: Specific fire load greater than 2200 MJ/m^2; C2: Specific fire load from 1401 MJ/m^2 to 2200 MJ/m^2; C3: Specific fire load from 181 MJ/m^2 to 1400 MJ/m^2;

	C4: Specific fire load from 1 MJ/m^2 to 180 MJ/m^2
D	Noncombustible agents and materials at hot state, red-hot state or melt state of which the processing procedure goes in conjunction with generation of heat radiant, spark and flame; Solid agent, liquid agent and combustible gas used as fuel.
E	Noncombustible agents and materials at cold state.

C1.2. Fire and explosion hazard of the building

a) Building is classified as A class if total area of rooms of class A accounts more than 5% of total area of all rooms in the building, or more than 200m^2.

It is allowed not to rank the building into class A if total area of all rooms class A does not exceed 25% of total area of all rooms (but not exceeding 1.000m^2) and these room class A should be equipped with automatic fire fighting equipments.

b) The building will be classified into class B if meeting both two following requirements:

- Not being building of class A.
- Total area of rooms class A and B exceeding 5% total area of all rooms or exceeding 200m^2.

It is allowed not to rank the building into class B if total area of the room class A and B in that building does not exceed 25% of total area of all rooms (but not exceeding 1.000m^2). These rooms of class A and B should be equipped with automatic fire fighting equipments.

c) The building will be classified into class C if meeting both these two requirements:

- Not being building of class A or B.
- Total area of rooms class A, B and C exceeding 5% (10% if the building does not have rooms of class A and B) total area of all rooms.

It is allowed not to rank the building into class C if total area of the room class A, B and C in that building does not exceed 25% of total area of all rooms (but not exceeding 3.500m^2). These rooms should be equipped with automatic fire fighting equipments.

d) The building will be classified as D if meeting both two following requirements:

- Not being building of class A, B or C.
- Total area of rooms class A, B, C and D exceeding 5% total area of all rooms.

It is allowed not to rank the building into class D if total area of the room class A, B, C and D in that building does not exceed 25% of total area of all rooms (but not exceeding 5.000m^2). These rooms of class A, B and C should be equipped with automatic fire fighting equipments.

e) Building will be classified into E class if it is not the class of A, B, C or D.

C.2. Some buildings and rooms of workshops, warehouse, production unit can be classified in term of fire and explosion hazard as follows:

a) Class A

- Workshop of producing and using sodium (Na) and potassium;
- Workshop of factory of artificial fiber, artificial rubber;
- Workshop of producing fuel and oil;
- Workshop for hydrogenating, distilling and separating gas;
- Workshop for producing artificial liquid fuel, collecting and distilling organic dissolvable fluids at igniting temperature at vapor state from 28^oC and less.
- Storage of fuel tank and fuel warehouse;
- Rooms of alkali and acid batteries of the electric power plant;
- Fluid pumping station with igniting temperature at vapor state of 28^oC and lower.

b) Class B

- Workshop for producing and transporting coal dust, sawdust, cleansing station of diesel oil tank and other fluids which have igniting temperature at vapor state of 28^oC to 61^oC.
- Grinding and milling area of solid agent, workshop for processing artificial rubber, workshop for producing sugar, storage of diesel oil of power plant, pumping station of fluids with igniting temperatures at vapor state of 28^oC to 61^oC.

c) Class C

- Sawing factory, workshop of wooden handicrafts;
- Textile and garment factory;
- Paperwork factory with dry production process;
- Preliminary processing workshop for cotton fiber, hemp and other fiber.
- Grain sifting and winnowing units of grinding factory and grain storage;

- Workshop for recycling grease, distilling asphalt, storages of combustible material and grease and lubricant.
- Electricity distribution equipment with circuit-breaker and electric devices of which grease amount greater than 60kg for one unit of equipment.
- Overpass, corridor used for transportation of coal and peat.
- Coal warehouse, storage of combined goods, pumping station of fluids with ignitability temperature at vapor state of more than 61^{o}C.

d) Class D

- Casting and metallurgical workshop. Welding and forging workshop;
- Repairing station of train machine;
- Hot rolled workshop, metal heat processing workshop;
- Rooms of internal combustion engine;
- High-voltage testing room.
- Main house of electric power plant (furnace chamber, turbine chamber…)
- Boiler station.

e) Class E

- Metal cold processing workshop (except for magnesium alloy);
- Material yard (core)
- Caustic production workshop (except for furnace);
- Fan station, compression station for air and noncombustible gases;
- Acid recycling workshop;
- Tram and tram engine repairing station;
- Quenching, molding and cold rolling workshop of asbestine core, salt and other noncombustible materials;
- Workshop of garment industry and workshop of paper production which has wet production procedure;
- Workshop for processing food, fish, meat, milk;
- Electricity control station;

- Water cleansing stations (depositing, filtering, sterilizing…);
- Water pumping and suctioning of electric power plant;
- Units containing carbonic acid and chlorine, cooling tower, pumping station of noncombustible fluids.

ANNEX D

Regulations on anti-fume defense for houses and constructions

D.1. Anti-fume defense for houses and constructions assures safe escaping in case of combustion. Anti-fume system need be separated from each cavity. Such function includes fume extraction (burnt issues included) and air inflation.

D.2. Fume extraction must be executed in such areas:

a) Corridors and pavilions of houses, public constructions, administration and welfare buildings, multiuse buildings standing more than 28 metres in height. Height standards are defined in article 1.1.6;

b) Passenger-ways of basements and semi-basements without daylight of houses, public constructions, administration and welfare buildings, production plants and multiuse buildings if there are always pedestrians;

c) More than 15 metres high corridors without daylight of production plants, warehouses type A, B and C from second floor, as well as public constructions and multiuse buildings from sixth floor.;

d) Corridors and pavilions using anti-fume infection staircases of different mixed-used building;

e) Corridors without daylight of houses which have farthest distance from apartment doors to staircase doors and/or packing spaces leading to outdoor air areas of stairs type N1 more than 12 metres in height;

f) Duplex pavilions of buildings more than 28 metres in height, and duplex pavilions more than 15 metres in height and gate-typed corridors or balconies connected openly to space of upper floor;

g) Staircases type L2 with automatic skylights in case of combustion at stay-in healthcare centers;

h) Manufacturing departments or depots type A, B, C, D or E in fire-resistant houses type IV with or without daylight through windows and/or skylights, without mechanical driver to open outlet ports (more than or equal to 2.2 metres in heights from surface to bottom margin of ports) and outlet ports of dormer windows (ports must have enough space to extract fume in case of combustion);

i) Departments without daylight, such as:

- Public and/or administration and welfare departments, if densely-populated;

- Greater than or equal to 50 square meter departments for use or for storage of combustible substances;

- Sale rooms;

- Greater than or equal to 200 square meter luggage rooms and/or dressing rooms .

Permission given for fume extraction from production departments type C which has fewer than or equal to 200 square meter area through nearby corridors.

D.3. Fume extraction is not applied to

a) Departments up to 200 square meters in area, equipped with automatic water or foam fire - extinguishers (except for departments type A and B);

b) Departments equipped with automatic inert gas or powder fire – extinguishers;

c) Corridors and/or pavilions of departments which are directly fume extracted already.

Note: Not necessary to set up separated fume extraction equipment for other departments less than or equal to 50 meters in area if they are located in the main compartment where is already equipped with fume extraction system.

D.4. Capacity of fume extracted is assumed by methods of calculation in case of:

a) Corridors mentioned in D.2 a), b), c), d), e) – as for sections up to 45 meters in length;

b) Departments mentioned in D.2 f), g), h), i) – as for fume zones up to 3.000 square meters in area.

Note: Calculation of capacity of fume extracted must be in accordance with current technical standards, accounting for fire loading, temperature, produced burnt issues, outdoor air parameters, geometric properties and hole positions.

D.5. Fume extraction systems for corridors must be separated from that for departments.

D.6. Fume control doors of fume shafts using for corridors must be established under ceilings and below the door upper edge. Permit to set up fume control doors over bleeder pipes to fume shafts. Corridors need to have a fume control door less than or equal to 45 meters in area.

D.7. On directly fume extraction from departments more than 3.000 square meters in area, split into fume zones less than or equal to 3.000 meters in area and be ready for potential combustions in any zone. Each fume control door attends to a zone less than or equal to 1.000 meters in area.

D.8. Direct fume extraction for departments of one – storied houses must include natural fume extraction through valve pipes, inlet air ports or unclosed light aperture.

As for zones nearby window up to 15 meters in width, permit to extract fume through window peeps (storm windows) with end edges standing more than 2.2 meter in height from the floor

Multi-storey buildings need to be equipped with mechanic fume force-extraction systems.

D.9. Conduits and accessories of fume extraction system must be made from incombustible materials which have fire – resistant rating in accordance with related current standards. When exhaust flues go through fire – insulated parts, there must be fire – proof valves.

Fume and burnt issues must be extracted outside houses and constructions. Fume masks must be at least 5 meters separated from air distributors of air supply system. Fume distributors must be established with warranted distance to combustible surfaces and other distributors in accordance with special design specifications.

Permission given for fume extraction from flues of basements and semi-basements through ventilation chambers. In this case, fume distributors must be separated at least 6 meters from foundation of ventilation chambers (between the fume distributors and the building's structure, the vertical space shall be 3 meters at least and the horizontal space shall be at least 1 meter) or at least 3 meters from the floor as for water ventilating devices. Do not set up fume valves onto such equipment.

D.10. Anti-fume defense must supply air in the following areas:

a) Elevator shafts (if unable to support supply support for packing spaces in case of combustion) of houses which have fume – tight staircases;

b) Elevator shafts in emergency "only for fire-fighters";

c) Fume – tight staircases type N2;

d) Fume – tight packing spaces of staircases type N3;

e) Packing spaces in front of staircases (including staircases) of basements and semi – basements;

f) Packing spaces of staircases type 2, leading to departments of the first floor of basements or semi – basements, in which there are combustible materials. As for packing spaces of workshops and soaking departments, permit to supply air from air ventilating departments of the house;

g) Packing spaces of entrance to pavilion and corridors of basements and semi – basements mentioned in D.2 f).

D.11. Capacity of air supply for anti – fume defense needs to be calculated to assume that air pressure is always under 20 pa as for:

a) Lower parts of elevator shafts when closing doors in all floors (except for lower floors);

b) Lower parts of fume – tight staircases type N2, when doors on the exit way along fire corridors and pavilions and/or outside houses are open, and when doors along other corridors and pavilions are close;

c) Packing spaces on fire floors of houses which have fume – tight staircases type N3, when entrances to corridors and/or pavilions in basements, elevator waiting room and packing spaces in front of staircases have one open door, others are close;

Capacity of air supply for packing spaces at one open door must be calculated in windy condition at average wind speed (no less than 1.3 m/s), and be ready for combinatory effects of air ventilation. Capacity of air supply for one packing space must eliminate amount of air drain through door holes.

Persistence of air pressure must be compared to spaces next to protected departments.

D.12. Calculation of parameters of air supply system must include:

a) Persistence of air pressure is not less than 20 pa and no more than 50 pa – at elevator shafts, fume – tight staircases type N2, packing spaces of fume – tight staircases type N3, consecutive spaces (corridors, pavilions);

b) Large two – leafed doors;

c) Stair cabins connected to staircases and elevator doors on the examined floor are open;

D.13. Conduits and accessories of air supply system must be made from incombustible materials which have fire – resistant rating in accordance with current related standards.

ANNEX E

Requirements on fire – protection distance among houses and constructions

E.1. For houses, public constructions and service buildings of industrial establishments

Fire protection distances among houses, public buildings and service buildings of industrial establishments are regulated in Table E 1.

Fire protection distances from houses, public buildings and service buildings which have fire resistant ability of level I and II to production plants and garages which have fire resistant ability of level I and II must be at least 9 meters; to production plants with insulated roofs made from Polymer or flammable materials must be at least 15 meters.

Table E 1. Fire protection distances among houses, public constructions and service buildings of industrial establishments

Fire resistant ability of 1st construction	Distance (m) to 2nd construction with fire resistant ability of level		
	I, II	III	IV, V
I, II	6	8	10
III	8	8	10
IV, V	10	10	15

Note:

1) Distance among houses and constructions is the clear span between their walls or outside structures. In cases where structures of houses or constructions are made from combustible materials and protrude out more than 1 meter, such distance shall be measured between these structures.

2) Distance between walls without windows is allowed to be less than 20%, except for houses which have fire resistant ability of level IV or V.

3) As for duplex – type houses with plate and frame structures, with fire resistant ability of level V, as well as houses with combustible roofs, fire protection distances must be increased by 20%.

4) Distance between houses which have fire – resistant ability of level I or II is allowed to be less than 6 meters, if walls of the higher house which are opposite to the other houses are fire resistant walls.

5) There are no regulations on distance between houses, or among houses and other living constructions if the total constructional area (including unbuilt area between them) does not exceed the maximum permissible floor area within a combustion chamber (see Appendix H, House group F.1, F.2).

E.2. For industrial constructions and buildings

Fire – protection distance among industrial constructions and buildings according to their fire – resistant ability and manufacture functions must not be less than values specified in Table E 2.

Table E 2 – Fire – protection distance among industrial constructions and buildings

Fire – resistant ability of the first construction	Distance (m) to the second construction with fire – resistant ability of level		
	I, II	III	IV, V
I, II	- For constructions and buildings of manufacture function D and E: not specified. - As for houses and constructions of manufacture function A, B and C: 9 meters (see Notice 3 for more details).	9	12
III	9	12	15
IV and V	12	15	18

Note:

1) Minimum distance between houses and constructions is the clear span between their walls or outside structures. In cases where houses or constructions contain structures that are made from combustible materials and protrude out more than 1 meter, the minimum distance shall be measured between these structures.
2) There shall be no regulation on distance between production plants and industrial constructions if:
   a) The total floor area of at least two buildings with fire resistant ability of level III, IV does not exceed the maximum permissible floor area within a combustion chamber (Appendix H);
   b) Walls of the larger construction or building which are opposite to another construction are fire resistant walls;
   c) If constructions and buildings of fire resistant level III which do not depend on fire hazard level according to manufacture functions are opposite solid or perforated walls which are made of glass brick blocks (or reinforced glass) with fire resistant rating of at least one hour.
3) The given distance among houses and constructions of fire resistant level I, II and manufacture function A, B, C shall be decreased from 9 meters to 6 meters if it satisfies one of the following conditions:
   a) Houses and constructions are equipped with automatic fire protection systems;
   b) Unit load of combustible materials of houses listed in manufacture function C is less than or equal to 10 kilograms/$1m^2$ floor area.

E.3. Cases where fire protection distance could be less than specified

Fire protection distance from a house to its surrounding buildings and constructions can be less than the values specified in E.1 (Table E 1) and E.2 (Table E 2) if it has the permission of competent fire protection agency and complies with the following regulations:

a) In this case, fire protection distance of a building is measured from the building to the border line of its site (not the distance to another house of side area);

NOTICE: The border line in this case is coincident or parallel with an edge of the house or the angle between the border line and an edge of the house is less than 80^{o}.

b) The distance from outside walls of the building to the border lines of its site could be between 0 and less than 1.0 m, if:

+ Outside walls must be fire resistant walls type 1 (REI 150) as for houses with fire resistant ability of level I and II; and type 2 (REI 60) as for houses with fire resistance ability of level III and IV;

+ Outside surface of outside walls must not be made from materials which have potential combustibility greater than that of group Ch1 and LT1.

c) If the distance between the outside wall of a building and the border lines of its site is more than 1.0 m, fire resistant ability of parts of the outside walls' surface is allowed to be lower than the value specifed for a fire resistant wall, and these part shall be considered as parts of the walls which are not protected from fire (the unprotected parts). The maximum area of unprotected parts of outside walls shall depend on the distance between that outside wall and the border line of the building's site, and is given in Table E 3.

Note: Unprotected parts of outside walls are often:

- Entrances (doors, windows, etc.) that do not meet the requirements for fire resistant entrance on fire resistant wall;

- Parts of the wall which have fire resistant ability less than that of respective fire resistant walls;

- Parts of the wall which have outside surfaces made from materials which have potential combustibility greater than that of group Ch2 and LT2.

Table E 3 – Distance from outside wall of house (or compartment) to border line of building area measured according to unprotected surface area of that wall

Minimum distance between side of house and border line of building area (m)		**Percentage of maximum area of unprotected surface compared to total surface area of the walls opposite the border line of building area**
Houses, public constructions, service buildings of industrial establishments	**Industrial constructions and buildings, warehouses**	
1.0	1.0	4.0
1.5	2.0	8.0
3.0	4.0	20.0
6.0	8.0	40.0

Note:

1) Calculation of maximum area of unprotected surface of outside wall can ignore these followings:

- Parts which are less than 1 square meter in area and at least 4 meters distant to any other unprotected parts;
- Unprotected parts are less than 0.1 square meter in area and at least 1.5 meters distant to any other unprotected parts;
- Outside walls of staircases which have cabins and inside walls of cabins complying with fire – isolation standards in accordance with house's fire – resistant ability;
- Outside surface of outside walls are made from materials which have potential combustibility greater than or equal to that of group Ch2 and LT2, unprotected area is half of total area.

2) Intermediate values can be determined by interpolation method.

ANNEX F

NOMINAL FIRE RESISTANCE LIMIT OF SOME STRUCTURAL MEMBERS

F.1. Wall member

Table F 1 - Enclosure or concrete wall

No.	Structure and material	Minimum thickness (excluding coat) (mm) to ensure fire resistance limit											
		Structural member						Non-structural member					
		REI 240	REI 180	REI 120	REI 90	REI 60	REI 30	EI 240	EI 180	EI 120	EI 90	EI 60	EI 30
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
1	Steel – enforced concrete, with the minimum thickness of protective concrete layer of the main bearing reinforcement is 25 mm.												
	a) Unrendered	180	-	100	100	75	75						
	b) Rendered with cement sand mortar 12.5 mm thick	180	-	100	100	75	75						
	c) Rendered with gypsum – sand 12.5 mm thick	180	-	100	100	75	75						
	d) Rendered with gypsum – Vermiculite 12.5 mm thick	125	-	75	75	63	63						
2	Aggregate concrete type 2([c]), no-fine												
	a) Cement sand rendered -13 mm thick							150	150	150	150	150	150
	b) Gypsum rendered – 13 mm thick							150	150	150	150	150	150
	c) Gypsum – Vermiculite							150	150	150	150	150	150

	rendered 13 mm thick												
3	Fire poured-clay wall, concrete or lime sand												
	a) Unrendered	200	200	100	100	100	100	170	170	100	100	75	75
	b) Rendered with cement sand 13 mm thick	200	200	100	100	100	100	170	170	100	100	75	75
	c) Gypsum rendered – 13 mm thick	200	200	100	100	100	100	170	170	100	100	75	75
	d) Gypsum – Vermiculite rendered or Gypsum – perlite ([a]) 13 mm thick	100	-	100	100	100	100	100	-	100	100	75	75
4	Aggregate concrete block wall type 1([b])												
	a) Unrendered	150	-	100	100	100	100	150	-	75	75	75	50
	b) Rendered with cement sand 12.5 mm thick	150	-	100	100	100	100	100	-	75	75	75	50
	c) Gypsum-sand rendered, 12.5 mm thick	150	-	100	100	100	100	100	-	75	75	75	50
	d) Gypsum – Vermiculite rendered, 12.5 mm thick	100	-	100	100	100	100	75	-	75	62	50	50
5	Aggregate concrete block wall type 2([c])												
	a) Unrendered	-	-	100	100	100	100	150	-	100	100	75	50
	b) Rendered with cement sand 12.5 mm thick	-	-	100	100	100	100	150	-	100	100	75	50
	c) Gypsum - sand rendered, 12.5 mm thick	-	-	100	100	100	100	150	-	100	100	75	50
	d) Gypsum – Vermiculite rendered, 12.5 mm thick	100	-	100	100	100	100	100	-	75	75	75	50

6	Aerated concrete block wall with volume of 475 kG/m ^{3} to 1.200 kG/m ^{3}	180	140	100	100	100	100	100	-	62	62	50	50
7	Cell concrete with an inside wall hollow core, aggregate type 1(^{b})												
	a) Unrendered	-	-	100	100	100	100	150	-	100	100	75	75
	b) Rendered with cement sand 12.5 mm thick	-	-	100	100	100	100	150	-	100	75	75	75
	c) Gypsum - sand rendered, 12.5 mm thick	-	-	100	100	100	100	150	-	100	75	75	75
	d) Gypsum – Vermiculite rendered, 12.5 mm thick	-	-	100	100	100	100	100	-	75	75	75	62
8	Cell concrete with an inside wall hollow core, aggregate type 2(^{c})	-	-	-	-	-	-	150	-	150	125	125	125
	a) Unrendered												
	b) Rendered with cement sand 12.5 mm thick	-	-	-	-	-	-	150	-	150	125	125	100
	c) Gypsum - sand rendered, 12.5 mm thick	-	-	-	-	-	-	150	-	150	125	125	100
	d) Gypsum – Vermiculite rendered, 12.5 mm thick	-	-	-	-	-	-	125	-	100	100	100	75
9	Natural calcined clay perforated brick wall with percentage of bedplate more than 50%												
	a) Rendered with cement sand 12.5	-	-	-	-	-	-	-			-	100	75

	mm thick b) Gypsum-sand rendered, 12.5 mm thick	- -	- -	- -	- -	- -	- -	- 200			- 100	100 100	75 62
	c) Gypsum – Vermiculite rendered, 12.5 mm thick												
10	Cavity wall with outside layer made from burnt brick or block clay which is at least 100 mm thick and if: a) Made from bricks or calcined block clay, mixture, concrete or lime sand	100	100	100	100	100	100	75	-	75	75	75	75
	b) Made from bricks or compact concrete, aerated concrete, aggregate type 1([b])	100	100	100	100	100	100	75	-	75	75	75	75
11	Cavity wall with outside layer made from burnt brick as in No. 9 and inside steamed concrete layer with volume of 480 kG/m^3 to 1,200 kG/ m^3	150	140	100	100	100	100	75	75	75	75	75	75

Note:

([a]) Only apply pertile - plaster rendered is applied to calcined clay only

([b]) "Aggregate type 1" means: foamed slag, pumice, breeze concrete, invert, broken brick and calcined clay products (including swell brick), hard calcined clinker and vinyl asbestos tiles.

([c]) "Aggregate type 2" means: pebble gravel, granite rock and other natural crushed stone except for limestone.

Table F 2 – Partition structure (nonbearing)

No.	Structure and material	Fire resistant limit
(1)	(2)	(3)
1	Steel framed partition which has 16 mm thick cover layer on lati steel and inside layer lined by steamed block aerocrete with volume of 480 to 1,120 kg/m ^{3} and thickness equal to:	
	50 mm	EI 120
	62 mm	EI 180
	75 mm	EI 240
2	Steel framed partition which has 100 mm block concrete cover layer and inside layer lined by 16 mm thick gypsum plaster on lati steel	EI 240
3	Steel framed partition which has 16 mm thick cover layer on lati steel and inside layer lined by 16 mm thick gypsum plaster on lati steel	EI 60
4	Steel or wooden framed, with finishing material used on two surfaces is:	
	a) Gypsum plaster or cement sand on lati steel with thickness of:	
	19 mm	EI 60
	12.5 mm	EI 30
	b) Gypsum plaster – Vermiculite or plaster – Perlite on lati steel with thickness of:	
	25 mm	EI 120
	19 mm	EI 90
	12.5 mm	EI 60
	c) 9.5 mm thick complete facing plate with 5 mm thick plastering coat	EI 30
	d) 9.5 mm thick complete facing plate with gypsum - Vermiculite coat with thickness of:	
	25 mm	EI 120
	16 mm	EI 90
	10 mm	EI 60
	5 mm	EI 30
	e) 12.5 mm thick complete facing plate	
	Unrendered	EI 30
	12.5 mm thick gypsum rendered layer	EI 60
	f) 12.5 mm thick complete facing plate with gypsum - Vermiculite coat with thickness of:	
	25 mm	EI 120
	16 mm	EI 90

	10 mm	EI 60
	g) 19 mm thick complete facing plate (or including two 9.5 mm thick layers on cutting edges) without cover coat	EI 60
	h) 19 mm thick complete facing plate for two 9.5 mm thick layers with gypsum – Vermiculite rendered cover coat with thickness of:	
	16 mm	EI 120
	10 mm	EI 90
	i) 12.5 mm thick fibrous insolated facing plate with a 12.5 mm thick plastering rendered layer	EI 30
	j) 25 mm thick wood-fiber board with a 12.5 mm thick gypsum rendered layer	EI 60
5	Integument compressed board in wooden cases whose two sides are rendered plaster of 5 mm thick.	EI 60
6	Hollow partition made from finish facing plate of 9.5 mm thick	
	Unrendered	EI 30
	12.5 mm thick plastering rendered	EI 30
	22 mm thick plastering – vermiculite rendered	EI 120
7	Hollow partition with thick 12.5 mm finish facing plate	
	Unrendered	EI 30
	12.5 mm thick plastering rendered	EI 60
	16 mm thick plastering – vermiculite rendered	EI 120
8	19 mm thick finish facing plate with two sides 16 mm thick gypsum rendered	EI 60
9	12.5 mm thick finish facing plate is connected to both sides of 19 mm thick facing plate by gypsum plaster	EI 90
10	Three 19 mm thick finish facing plates are connected by thin fine gypsum plaster	EI 120
11	12.5 mm thick wood-fiber board which has over layer or coat with thickness of	
	75 mm	EI 120
	50 mm	EI 60
12	50 mm thick integument compressed board whose coupling circuits are covered with wooden strips with cross section of 75 mm x 12.5 mm	EI 30

Table F 3 – Outside wall (non – bearing)

No.	Structure and material	Fire resistance limit
(1)	(2)	(3)
1	Steel framed wall with cover layers made of incombustible materials and inside lined by	
	a) 12.5 mm thick cement sand or plastering rendered layer on lati steel	EI 240
	b) Two layers of 9.5 mm thick finish facing plates	EI 30
	c) 9.5 mm thick facing plate with 12.5 mm thick plastering rendered layer	EI 30
	d) 12.5 mm thick facing plate with 5 mm thick plastering rendered layer	EI 30
	e) 50 mm integument compressed board	EI 30
	f) 50 mm integument compressed board with 5 mm thick plastering rendered layer	EI 120
2	Wooden framework wall with 10 mm thick cement sand or cement - lime ([a]) cover layer and inside lined by	
	a) 16 mm plastering rendered layer on lati steel	EI 60
	b) 9.5 mm thick finish facing plate with 12.5 mm thick plastering rendered layer	EI 60
	c) 12.5 mm thick finish facing plate with 5 mm thick plastering rendered layer	EI 60
	d) 50 mm integument compressed board	EI 60
	e) Aeroconcrete block with thickness of	
	50 mm	EI 180
	62 mm	EI 240
	75 mm	EI 240
	100 mm	EI 240

3	Wooden framed wall with 100 mm cover layer made of brick or block calcined clay, cement or lime – sand, 16 mm thick plastering rendered on lati steel inside	EI 240
	75 mm	EI 180
	75 mm	EI 180
4	Wooden framed wall with 9.5 mm ([a]) double casing or wooden cover layer and inside lined by	
	a) 16 mm thick plastering rendered layer on lati steel	EI 30
	b) 9.5 mm thick finish facing plate with 12.5 mm thick plastering rendered layer	EI 30
	c) 12.5 mm thick finish facing plate with 5 mm thick plastering rendered layer	EI 30
	d) 50 mm thick integument compressed board	EI 30
	e) Block aeroconcrete with thickness of:	
	50 mm	EI 180
	62 mm	EI 240
	75 mm	EI 240
	100 mm	EI 240
Note: ([a]) The appearance of protection parts of combustible aeriform materials of these structures does NOT contribute to their fire resistant abilities.		

F.2. Reinforced concrete beam

Table F 4 – Reinforced concrete beam

No.	Features	Minimum size of concrete part (mm) to assure fire resistant ability					
		R 240	R 180	R 120	R 90	R 60	R 30
1	Siliceous aggregate concrete						
	a) Average thickness of protective concrete layer for bearing reinforcing steel	65([a])	55([a])	45([a])	35	25	15
	b) Cross-section width of beam	280	240	180	140	110	80

2	Siliceous original reinforced concrete with 15 mm cement or plastering rendered layer on thin gauze						
	a) Average thickness of protective concrete layer for bearing reinforcing steel	50 ([a])	40	30	20	15	15
	b) Wide size of structural section	250	210	170	110	85	70
3	Siliceous original aggregate concrete with 15 mm thick plastering/ vermiculite rendered layer ([b])						
	a) Average thickness of protective concrete layer for bearing reinforcing steel	25	15	15	15	15	15
	b) Wide size of structural section	170	145	125	85	60	60
4	Light aggregate concrete						
	a) Average thickness of protective concrete layer for bearing reinforcing steel	50	45	35	30	20	15
	b) Wide size of structural section	250	200	160	130	100	80

Note:

([a]) May have to add some subsidiary reinforcement to retain protective concrete layer.

([b]) Vermiculite/plaster must have volume based mixing ratio between $1^{1/2}$ and 2:1

F.3. Prestress reinforced concrete beam

Table F 5 - Prestress reinforced concrete beam

No.	Features	Minimum size of concrete (mm) to assure fire – resistant ability					
		R 240	R 180	R 120	R 90	R 60	R 30
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	Siliceous original aggregate concrete						
	a) Average thickness of protective concrete layer for prestressing tendon	100 ([a])	85 ([a])	65 ([a])	50 ([a])	40	25
	b) Wide size of structural section	280	240	180	140	110	80
2	Siliceous original aggregate concrete with 15 mm thick vermiculite concrete board used as stable apron						
	a) Average thickness of protective concrete layer for prestressing tendon	75(a)	60	45	35	25	15
	b) Wide size of structural section	210	170	125	100	70	70
3	Siliceous original aggregate concrete with 25 mm thick vermiculite concrete board used as stable apron						
	a) Average thickness of protective concrete layer for prestressing tendon	65	50	35	25	15	15
	b) Wide size of structural section	180	140	100	70	60	60
4	Siliceous original aggregate concrete with 15 mm thick plastering rendered layer on thin gauze fabric						
	a) Average thickness of protective concrete layer for prestressing tendon	90 ([a])	75	50	40	30	15
	b) Wide size of structural section	250	210	170	110	85	70
5	Siliceous original aggregate concrete with 15 mm thick plastering/vermiculite rendered layer ([b])						

	a) Average thickness of protective concrete layer for prestressing tendon	75 ([a])	60	45	30	25	15
	b) Wide size of structural section	170	145	125	85	60	60
6	Siliceous original aggregate concrete with 25 mm thick plastering/vermiculite rendered layer ([b])						
	a) Average thickness of protective concrete layer for prestressing tendon	50	45	30	25	15	15
	b) Width of structural section	140	125	85	70	60	60
7	Light aggregate concrete						
	a) Average thickness of protective concrete layer for prestressing tendon	80	65	50	40	30	20
	b) Width of structural section	250	200	160	130	100	80

Note:

([a]) May add some subsidiary reinforcement to retain protective concrete layer.

([b]) Vermiculite/plaster must have volume based mixing ratio between $1^{1/2}$ and 2:1

F.4. Reinforced concrete column

Table F 6 – Reinforced concrete column (with four fire contact sides)

No.	Features	Minimum size of concrete (mm) to assure fire – resistant ability					
		R 240	R 180	R 120	R 90	R 60	R 30
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	Siliceous original aggregate concrete						
	a) Without any additional protection method	450	400	300	250	200	150
	b) With 15 mm thick cement or plastering rendered layer on thin gauze fabric	300	275	225	150	150	150
	c) With plastering/vermiculite rendered layer ([a])	275	225	200	150	120	120
2	Siliceous original or limestone aggregate concrete						
	With subsidiary reinforcement in protective concrete layer	300	275	225	200	190	150

3	Light aggregate concrete	300	275	225	200	190	150
Note: (a) Vermiculite/plaster must have volume based mixing ratio between $1^{1/2}$ and 2:1							

Table F 7 – Reinforced concrete column (with one fire contact side)

No.	Features	Minimum size of concrete (mm) to assure fire – resistant ability					
		R 240	R 180	R 120	R 90	R 60	R 30
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	Siliceous original aggregate concrete						
	a) Without any additional protection method	180	150	100	100	75	75
	b) With 15 mm thick plastering/vermiculite rendered layer ([a]) on fire contact side	125	100	75	75	65	65
NOTICE: ([a]) Vermiculite/plaster must have volume based mixing ratio between $1^{1/2}$ and 2:1							

F.5. Iron structure

Table F 8 – Protected steel shore

(With mass per 1 meter long of at least 45 kg)

No.	Structure and protective wrapping material	Minimum thickness (mm) of protective layer to assure fire – resistant ability					
		R 240	R 180	R 120	R 90	R 60	R 30
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
A	Solid protective layer ([a]) (unrendered)						
1	Natural aggregate concrete with cement at least 1:2:4						
	a) Non-bearing reinforced concrete ([b])	50	-	25	25	25	25
	b) Bearing steel – enforced concrete	75	-	50	50	50	50
2	Solid brick made of calcined clay, composite or lime - sand	100	75	50	50	50	50
3	Solid block made of foamed slag or pumice reinforced concrete	75	60	50	50	50	50

	([b]) at all transverse joints						
B	Hollow protective layer ([c])						
1	Solid brick made of calcined clay, composite or lime – sand reinforced at all unrendered transverse joints	115	-	50	50	50	50
2	Solid block made of foamed slag or pumice reinforced concrete ([b]) at all unrendered transverse joints	75	-	50	50	50	50
3	Lati steel cement or plastering rendered with thickness of:	-	-	38(d)	25	19	12.5
4	a) Lati steel plastering vermiculite or perlite rendered with thickness of:	50([d])	-	19	16	12.5	12.5
	b) Lati steels 25 mm away from each other from plastering vermiculite or perlite side with thickness of:	44	-	19	12.5	12.5	12.5
5	Finish plaster facing plate tied by 1.6 mm steel wire with distance of 100 mm						
	a) 9.5 mm plastering rendered finish facing plate with thickness of:	-	-	-	-	12.5	12.5
	b) 19 mm plastering rendered finish facing plate with thickness of:	-	-	12.5	10	7	7
6	Finish plaster facing plate tied by 1.6 mm steel wire with distance of 100 mm						
	a) 9.5 mm plastering vermiculite rendered finish facing plate with thickness of:	-	-	16	15	10	10
	b) 19 mm plastering vermiculite rendered finish facing plate with thickness of:	38([d])	-	20	13	10	10
7	Vermiculite – cement board 4:1 reinforced by finish gauze fabric with thickness of:	63	-	25	25	25	25

Note:

([a]) Solid protective layer means that one outside cover frozen to steel without making air gaps between contact surface and connected chains inside is tight and solid.

(^{b}) Reinforcing steel must be at least 2.3 mm thick tying steel wires or gauze fabric with at least 0.48 kg/m^2 density. Distance between reinforcing steel parts within protective concrete layer is not greater than 150 mm from any dimension.

(^{c}) Hollow protective layer means that there is space between protective material and steel. All hollow protection methods applied to columns must have effective block manners at each desk level.

(^{d}) There must be thin gauze fabric reinforced 12.5 to 19 mm away from surface, except for when using special corner bead

Table F 9 – Protected coated steel beam (with mass per 1 meter long of at least 30 kg)

No.	Structure and protective wrapping material	Minimum thickness (mm) of protective layer to assure fire – resistant ability					
		R 240	R 180	R 120	R 90	R 60	R 30
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
A	Protective layer of paste type ([a]) (non-renderred)						
1	Natural aggregate concrete with cement at least 1:2:4						
	a) Non-bearing reinforced concrete (b)	75	50	25	25	25	25
	b) Bearing steel – enforced concrete	75	75	50	50	50	50
2	Vermiculite cement atomization wrapped with thickness of:	-	-	38	32	19	12.5
B	Hollow protective layer ([c])						
1	Lati steel						
	a) Lime cement rendering with thickness of:	-	-	38	25	19	12.5
	b) Plastering rendering with thickness of:	-	-	22	19	16	12.5
	c) Plastering vermiculite or perlite rendering with thickness of:	32	-	12.5	12.5	12.5	12.5
2	Finish plaster facing plate tied by 1.6 mm steel wire with distance of 100 mm						
	a) 9.5 mm plastering rendered finish facing plate with thickness of:	-	-	-	-	12.5	12.5
	b) 19 mm plastering rendered finish facing plate with thickness of:	-	-	12.5	10	7	7
3	Finish plaster facing plate tied by 1.6 mm steel wire with distance of 100 mm						
	a) 9.5 mm finish facing plate fixed to wooden framework by nails and plastering rendered with thickness of:	-	-	-	-	-	12.5
	b) 19 mm plastering vermiculite	-	-	16	15	10	10

	rendered finish facing plate with thickness of: c) 19 mm plastering rendered facing plate with thickness of: d) 19 mm plastering rendered facing plate with thickness of:	32 -	- -	10 20	10 13	7 10	7 10
4	Vermiculite – cement at 4 : 1 reinforced by finish gauze fabric with thickness of:	63	-	25	25	25	25
5	12.5 mm plaster – sand rendered wooden reinforced fiber board with thickness of:	-	-	50	38	38	38

Note:

([a]) Solid protective layer means that one outside cover frozen to steel without making air gaps between contact surface and connected chains inside is tight and solid.

([b]) Reinforcing steel must be at least 2.3 mm thick tying steel wires, or gauze fabric with at least 0.48 kg/m^2 density. Distance between reinforcing steel parts within protective concrete layer is not greater than 150 mm from any dimension.

([c]) Hollow protective layer means that there is space between protective material and steel. All hollow protection methods applied to columns must have effective block manners at each desk level.

F.6. Aluminum structure

Table F 10 – Protected aluminum coated beam and column

(with mass per 1 meter long of at least 16 kg)

No.	Structure and protective wrapping material	Minimum thickness (mm) of protective layer to assure fire – resistant ability					
		R 240	R 180	R 120	R 90	R 60	R 30
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
A	Solid protective layer ([a])						
1	Vermiculite – cement atomization coated with thickness of:	-	-	-	-	44	19
B	Hollow protective layer ([b])						
1	Lati steel, plastering vermiculite or perlite rendered with thickness of:	-	-	32	22	16	12.5
2	Lati steel, fine plastering rendered with thickness of:	-	-	-	-	19	12.5
3	Finish plaster facing plate tied by 1.6 mm steel wires with distance of 100 mm, plastering rendered with thickness of:	-	-	22	16	10	10

NOTICE:

([a]) Solid protective layer means that one outside cover frozen to steel without making air gaps between contact surface and connected chains inside is tight and solid.

([b]) Hollow protective layer means that there is space between protective material and steel. All hollow protection methods applied to columns must have effective block manners at each desk level.

F.7. Floor structure

Table F 11 – Wood floor

No.	Structure and protective wrapping material	Minimum thickness (mm) of protective layer to assure fire – resistant ability	
		REI 60	REI 30
(1)	(2)	(3)	(4)
A	Flat folded edge fixed to wood beam with width of at least 38 mm and under ceiling surface made of:		
1	Wood molding and rendering with thickness of:	-	16.0
2	Wood molding and rendering with thickness of at least16 mm, under surface covered by finish facing plate with thickness of:	-	12.5
3	Lati steel and rendered by: a) Plastering with thickness of: b) Vermiculite with thickness of:	 - -	 16.0 12.5
4	Facing plate with thickness of:	-	12.5
5	9.5 mm thick finish facing plate, plastering rendered with thickness of:	-	12.5
6	12.5 mm finish thick facing plate, plastering rendered with thickness of:	-	12.5
7	Couple of finish facing plates with total length of:	-	25.0

8	Fibrous insulation layer with thickness of at least 9.5 mm, plastering rendered with thickness of:	-	5.0
9	Fibrous insulation layer with thickness of at least 12.5 mm, plastering rendered with thickness of:	-	12.5
10	25 mm thick wood fiber board, plastering rendered with thickness of:	-	5.0
B	Board with coupling edges of groove and rib type and has thickness (^{a})of at least 16 mm (finish thickness), fixed to wood beam with width of at least 38 mm, under ceiling surface made of:		
1	Wood molding and rendering with thickness of:	-	16.0
2	Wood molding and rendering with thickness of at least16 mm, under surface covered by finish facing plate with thickness of:	-	9.5
3	Lati steel and rendered by: a) Plastering with thickness of: b) Vermiculite with thickness of:	 22.0 12.5	 16.0 12.5
4	Facing plate with thickness of:	-	9.5
5	9.5 mm thick finish facing plate, plastering rendered with thickness of: a) Plastering with thickness of: b) Plastering Vermiculite with thickness of:	 - 12.5	 12.5 -
6	12.5 mm finish thick facing plate, plastering rendered with thickness of:	-	5.0
7	Couple of finish facing plates with total length of:	-	22.0

8	Fibrous insulation layer with thickness of at least 9.5 mm, plastering rendered with thickness of:	-	5.0
9	25 mm thick wood fiber board, rendered by: a) Plastering with thickness of: b) Plastering Vermiculite with thickness of:	 - 10.0	 5.0 -
C	Board with coupling edges of groove and rib type and has thickness (^{a}) of at least 21 mm (finish thickness), fixed to wood beam with size of at least 175 mm x 50 mm, under ceiling surface made of:		
1	Wood molding and rendering with thickness of:	-	16.0
2	Lati steel and rendered with thickness of:	-	16.0
3	Finish facing plate with thickness of:	-	9.5
4	At least 9.5 mm thick finish facing plate, plastering rendered with thickness of: a) Plastering with thickness of: b) Plastering Vermiculite with thickness of:	 - 12.5	 12.5 -
5	12.5 mm finish thick facing plate, plastering rendered with thickness of:	-	5.0
6	Couple of finish facing plates with total length of:	-	19.0
7	Fibrous insulation layer with thickness of:	-	12.5
8	Fibrous insulation layer with thickness of at least 12.5 mm, plastering rendered with thickness of:	-	12.5
9	25 mm thick wood fiber board, rendered by: a) Plastering with thickness of:	 -	 5.0

	b) Plastering Vermiculite with thickness of:	10.0	-
Note: (^{a}) Or respective thickness of chipped wood board			

Table F 12 – Reinforced concrete floor (lime or Siliceous original aggregate)

No.	Floor structure	Minimum size (mm) to assure fire – resistant ability					
		REI 240	REI 180	REI 120	REI 90	REI 60	REI 30
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	Solid floor slab						
	a) Average thickness of protective concrete layer	25	25	20	20	15	15
	b) Overall height (^{a}) of section	150	150	125	125	100	100
2	Tubular floor slab with circular or circular hollow section, the height is greater than the width. At least 50% of overall cross section is solid material						
	a) Average thickness of protective reinforced concrete layer	25	25	20	20	15	15
	b) Thickness of under edge	50	40	40	30	25	20
	c) Overall height (^{a}) of section	190	175	160	140	110	100
3	Box section with one or more vertically hollow blocks with the width is greater than the height						
	a) Average thickness of protective reinforced concrete layer	25	25	20	20	15	15
	b) Thickness of under edge	50	40	40	30	25	20
	c) Overall height (^{a}) of section	230	205	180	155	130	105
4	Section with stiffening rib reinforced to evacuated capsule blocked by concrete or calcined clay. If there is not greater than 50% overall cross section made of solid materials, must have a 15 mm thick under rendering cover.						
	a) Average thickness of protective reinforced concrete layer	25	25	20	20	15	15

	b) Width or stiffening ribs or under beam	125	100	90	80	70	50
	c) Overall height ([a]) of section	190	175	160	140	110	100
5	T-shaped stiffening rib						
	a) Average thickness of protective reinforced concrete layer	65([b])	55([b])	45([b])	35	25	15
	b) Thickness of upper protective concrete layer	65	55	45	35	25	15
	c) Width of rib or T bottom	150	140	115	90	75	60
	d) Thickness of edge	150	150	125	125	100	90
6	Channel section stiffening rib opposite to curve radius at crossover between bottom slab and rib top no greater than thickness of section						
	a) Average thickness of protective reinforced concrete layer	65([b])	55([b])	45([b])	35	25	15
	b) Thickness of upper protective concrete layer	40	30	25	20	15	10
	c) Width of rib or channel bottom	75	70	60	45	40	30
	d) Thickness of upper plate	150	150	125	125	100	90
7	Channel section stiffening rib opposite to curve radius at crossover between bottom slab and rib top greater than thickness of section						
	a) Average thickness of protective reinforced concrete layer	65([b])	55([b])	45([b])	35	25	15
	b) Thickness of upper protective concrete layer	40	30	25	20	15	10
	c) Width of rib or T bottom	70	60	50	40	35	25
	d) Thickness of upper plate	150	150	100	100	75	65

NOTICE:

([a]) May increase the thickness of glaze layers or incombustible finish layers

([b]) May add some subsidiary to retain protective concrete

Table F 13 – Prepressed reinforced concrete floor (Siliceous original or lime aggregate)

No.	Floor structure	Minimum size (mm) to assure fire – resistant ability					
		REI 240	REI 180	REI 120	REI 90	REI 60	REI 30
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	Solid floor slab						
	a) Average thickness of protective concrete layer	65 ([a])	50 ([a])	40	30	25	15
	b) Overall height ([b]) of section	150	150	125	125	100	100
2	Tubular floor slab with circular or circular hollow section, the height is greater than the width. At least 50% of overall cross section is solid material						
	a) Average thickness of protective reinforced concrete layer	65 ([a])	50 ([a])	40	30	25	15
	b) Thickness of under edge	50	40	40	30	25	20
	c) Overall height ([b]) of section	190	175	160	140	110	100
3	Box section with one or more vertically hollow blocks with the width is greater than the height						
	a) Average thickness of protective reinforced concrete layer	65 ([a])	50 ([a])	40	30	25	15
	b) Thickness of under edge	65	50	40	30	25	15
	c) Overall height ([b]) of section	230	205	180	155	130	105
4	Section with stiffening rib reinforced to evacuated capsule blocked by concrete or calcined clay. If there is not greater than 50% overall cross section made of solid materials, must have a 15 mm thick under rendering cover.						
	a) Average thickness of protective reinforced concrete layer	65 ([a])	50 ([a])	40	30	25	15
	b) Width or stiffening ribs or	125	100	90	80	70	50

	under beam c) Overall height ([b]) of section	190	175	160	140	110	100
5	T-shaped stiffening rib a) Average thickness of protective reinforced concrete layer	100([a])	85([a])	65([a])	50([a])	40	25
	b) Thickness of side protective concrete layer	100	85	65	50	40	25
	c) Width of rib or T bottom	250	200	150	110	90	60
	d) Thickness of edge	150	150	125	125	100	90
6	Channel section stiffening rib opposite to curve radius at crossover between bottom slab and rib top no greater than thickness of section a) Average thickness of protective reinforced concrete layer	100([a])	85([a])	65([a])	50([a])	40	25
	b) Thickness of side protective concrete layer	50	45	35	25	20	15
	c) Width of rib or channel bottom	125	100	75	55	45	30
	d) Thickness of upper plate	150	150	125	125	100	90
7	Channel section stiffening rib opposite to curve radius at crossover between bottom slab and rib top greater than thickness of section a) Average thickness of protective reinforced concrete layer	100([a])	85([a])	65([a])	50([a])	40	25
	b) Thickness of upper protective concrete layer	50	45	35	25	20	15
	c) Width of rib or channel bottom	110	90	70	50	40	30
	d) Thickness of upper plate	150	150	125	125	100	90

Note:

(a) May increase the thickness of glaze layers or incombustible finish layers

(b) May add some subsidiary to retain protective concrete

F.8. Glazing part

Table F 14 – Glazing part

No.	Structure and material	Minimum thickness (mm) of glazing part to ensure the fire-resistance rating	
		E 60	E 30
(1)	(2)	(3)	(4)
1	Glazing, indirect combination with melting point at 982.2 ^{0}C at least, square no greater than 0.015 m^2 in area. Thickness of glazing	-	6.35
2	Glazing, reinforced by square knitted metal gauze with at least 0.46 mm diameter, distance from center of gauze fibers no more than 12.70 mm, cross-over between metal fibers connected by point beading, or hexagon metal gauze with mesh distance between parallel edge of 25,4 mm. Thickness of glazing	-	6.35
3	Glazing, reinforced by metal gauze mentioned in (2) installed to door, window, light aperture, louver or skylight fixed to metal trim (fixed retaining) with no greater than 1.115 m^2 in area. That is operated by metal bracket and all metal accessories must have melting point at least 982.2 ^{0}C Thickness of glazing	6.35	6.35
4	Brick or glazing block in wall	-	98.43
Note: In the above table, a number of positions in fire – resistant ability column means that glazing part decorated is not allowed to be applied in such case. Suitable glazing for (1) and (2) above when installing to door, window, light aperture, louver and skylight fixed to wood frame (fixed retaining) has width and thickness of at least 44.45 mm and is unweakened. Fixing work is operated by bracket or metal or glazing combination and gripping accessories which are not greater than 0.372 m^2 in area.			

ANNEX G

REGULATIONS ON TRAVEL DISTANCE TO EXITS AND EXIT WIDTH

G.1. Allowable limited-distance from the farthest place (where human beings live and work) to the nearest exit

G.1.1. For residential buildings

Allowable limited-distance from the access door of apartments (buildings group F 1.3) or habitable rooms (buildings group F 1.2) to the nearest exit (staircases or exit ways) shall be in accordance with Table G 1.

Table G 1 – Allowable limited-distance from access doors of apartments or habitable rooms to the nearest exit

Fire resistance rate of building	Fire danger level of building's structure	Allowable limited-distance from access doors of apartments or habitable rooms to the nearest exit (m)	
		Where doors are located in the middle of staircases or exit ways	Where doors are located in dead-end corridors
I, II	S0	40	25
II	S1	30	20
III	S0	30	20
	S1	25	15
IV	S0	25	15
	S1, S2	20	10
V	Not specified	20	10

G.1.2. For public constructions

a) Allowable limited-distance for the escape path calculated from the access door of the farthest room (except for toilet, bath room and other service rooms) to the nearest exit (to staircases or outside of the buildings) shall be in accordance with Table G 2a.

Table G 2a- Allowable limited-distance from access door of the room to the nearest exit for public building.

Fire resistance rate of building	Distance (m) when the density of escape person is (person / m^2)				
	Up to 2	Above 2 to 3	Above 3 to 4	Above 4 to 5	Above 5
(1)	(2)	(3)	(4)	(5)	(6)
A. From rooms whose doors are located in the middle of staircases or exit ways					
I, II, III	60	50	40	35	20
IV	40	35	30	25	15
V	30	25	20	15	10
B. From rooms whose doors lead to dead-end corridors or public halls.					
I, II, III	30	25	20	15	10
IV	20	15	15	10	7
V	15	10	10	5	5

NOTE

1) Escape person density is defined by the ratio between the total number of the person that needs to use the escape path and the escape area.

2) The distance values given in Table G 2a should be applied as follow: For kinder gardens, apply column (6); For schools, vocational schools, colleges and universities, apply column (3); For residential treatment facilities, apply column (5); For hotel, apply column (4); For other type of public house, density of escape person shall be as specified in specific project.

b) In rooms of different bulks which do not have audience seat, allowable limited-distance from any position to the nearest exit shall be in accordance with Table G 2b. Where there is the joining of all main escape paths to a common path, the width of the join-path should not be less than the overall width of component paths.

Table G 2b – Allowable limited-distance from any position in a public room without audience seat to the nearest exit.

Room function	Fire resistance rate of building	Allowable limited-distance (m) from any position in the room to the nearest exit, with the room's bulk of (thousand m^3)		
		Up to 5	Above 5 to 10	From 10 and above
1- Rooms for waiting, ticket selling, displaying, dancing, resting and things alike.	I, II	30	45	55
	III, IV	20	30	-
	V	15	-	-
2- Dinning rooms, reading rooms where the main passage area per capita is at least 0.2 m^2.	I, II	65	-	-
	III, IV	45	-	-
	V	30	-	-
3a- Commercial rooms where the main passage area as a percentage of the room area is not less than 25%.	I, II	50	65	80
	III, IV	35	45	-
	V	25	-	-
3b- Commercial rooms where the main passage area as a percentage of the room area is less than 25%.	I, II	25	30	35
	III, IV	15	20	-
	V	10	-	-

G.1.3. For production buildings

a) Allowable limited-distance from the farthest working place in the room to the nearest exit (exit that leads to the outside area or staircase) shall be in accordance with Table G3. For rooms with cover area of over 1 000 m^2, the distance values provided in Table G3 includes the length of the path along the corridor that leads to the exit.

b) Allowable limited-distance given in table G3 with intermediate values of the room bulks is determined by using linear interpolation;

c) Allowable limited-distance given in G3 is set for rooms of up to 6.0 m height. If the height of the room is over 6.0 m, this distance shall increase as follow: where the room's height is up to 20.0 m, the distance should increase 20%; where the room's height is up to 18.0m, the distance should increase 30%; where the room's height is up to 24.0 m, the distance should increase 40%; but should not exceed 240.0 m for rooms of class A, B and not exceed 240.0 m for rooms of class C.

Table G 3 – Allowable limited-distance from the farthest working place to the nearest exit of production buildings.

Room's bulk (1000 m^3)	Room's class	Fire resistance rate of building	Fire danger level of building's structure	Distance (m) when the density of escape person on public path is (person / m^2)		
				Up to 1	Above 1 to 3	Above 3 to 5
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Up to 15	A, B	I, II, III, IV	S0	40	25	15
	C 1, C 2, C 3	I, II, III, IV	S0	100	60	40
		III, IV	S1	70	40	30
		V	S2, S3	50	30	20
30	A, B	I, II, III, IV	S0	60	35	25
	C 1, C 2, C 3	I, II, III, IV	S0	145	85	60
		III, IV	S1	100	60	40
40	A, B	I, II, III, IV	S0	80	50	35
	C 1, C 2, C 3	I, II, III, IV	S0	160	95	65
		III, IV	S1	110	65	45
50	A, B	I, II, III, IV	S0	120	70	50
	C 1, C 2, C 3	I, II, III, IV	S0	180	105	75
		III, IV	S1	160	95	65
60 and above	A, B	I, II, III, IV	S0	140	85	60
	C 1, C 2, C 3	I, II, III, IV	S0	200	110	85
		III, IV	S1	180	105	75
80 and above	C 1, C 2, C 3	I, II, III, IV	S0	240	140	100
		III, IV	S1	200	110	85
Not depend on	C 4, D	I, II, III, IV	S0	unlimited	unlimited	Unlimited
		III, IV	S1	160	95	65

bulk		V	Not specified	120	70	50
Not depend on bulk	E	I, II, III, IV	S0, S1	unlimited	unlimited	unlimited
		IV, V	S2, S3	160	95	65
NOTE: Escape person density is defined by the ratio between the total number of the person that needs to use the escape path and the escape area.						

d) Allowable limited-distance from the access door of the farthest production room that have the cover area of maximum 1 000 m^2 to the nearest exit (exit that leads to the outside area or staircase) shall be in accordance with table G 4.

Table G 4 - Allowable limited-distance from the access door of the farthest production room that have the cover area of maximum 1 000 m^2 to the nearest exit

Location of access door	**Room's class**	**Fire resistance rate of building**	**Fire danger level of building's structure**	**Distance (m) from the room's door to the nearest exit, when the density of escape person on public path is (person/m^2)**			
				Up to 2	**Above 2 to 3**	**Above 3 to 4**	**Above 4 to 5**
Between two exits	A, B	I, II, III, IV	S0	60	50	40	35
	C 1, C 2, C 3	I, II, III, IV	S0	120	95	80	65
		III, IV	S1	85	65	55	45
		Not specified	S2, S3	60	50	40	35
	C 4, D, E	I, II, III, IV	S0	180	140	120	100
	C 4, D, E	III, IV	S1	125	100	85	70
		Not specified	S2, S3	90	70	60	50

To dead-end corridor	Not depend on room's class	I, II, III, IV	S0	30	25	20	15
		III, IV	S1	20	15	15	10
		Not specified	S2, S3	15	10	10	8

G.2. Exit width

G.2.1. For public buildings

a) The width of an exit to escape from the hallway into the staircase, as well as the width of the stair board must be determined by the number of people to escape through the exit and the escape rate calculated for the 1 meter width of exits (doors). Depending on the degree of fire resistance of the buildings (not including theaters, clubs, theaters and other sports facilities) this rate shall not exceed the following values:

- Buildings with fire-resistant of degree I, II: not higher than 165 persons / m;

- Building with fire-resistant of degree III, IV: not higher than 115 persons / m;

- Buildings with fire-resistant of degree V: not higher than 80 persons / m.

b) To calculate the width of the exits of the common schools, boarding schools and school boarding areas, need to determine the largest number of people simultaneously present on a floor from the largest number of people of every class, training room and bedroom as well as sports space, conference room, lecture hall located on that floor (see Section G.3, Table G 9).

c) The width of the doors from the classrooms with over 15 students, should not be less than 0.9 m.

d) The width of an exit to escape from the room with no seat for spectators shall be determined according to the number of people that need to escape through the exit as specified in Table G 5. For rooms can accommodate more than 50 people, the width shall not be less than 1.2 m

Table G 5 - Maximum number of person per 1 meter of the exit width of rooms with no seat for spectators of public buildings

Room's function	**Fire resistance rate of building**	**Maximum number of person per 1 meter width of the exit in rooms with the bulk of (thousand m^3)**		
		Up to 5	**Above 5 to 10**	**10 and above**
1- Commercial rooms as the area of the main escape paths is not	I, II	165	220	275
	III, IV	115	155	-

less than 25% of the area of the room; Dining rooms and reading rooms when the density of person in each main entrance does not exceed 5 persons / m^2.	V	80	-	-
2- Commercial rooms where the area of the main escape paths is less than 25% of the room's area;	I, II	75	100	125
	III, IV	50	70	-
- Other rooms.	V	40	-	-

e) The width of the main escape paths in a commercial room shall be as follow:

- Not less than 1.4 m when the commercial area is no larger than 100m;

- Not less than 1.6 m when the commercial area is larger than 100m^2 but not exceed 150m^2;

- Not less than 2.0 m when the commercial area is larger than 150m^2 but not exceed 400m^2;

- Not less than 2.5 m when the commercial area is larger than 400m^2.

f) Number of person per 1 meter width of the escape path from the stands of outdoor sports and performance facilities shall be consistent with Table G6.

Table G 6 - Maximum number of person per 1 meter width of the escape path from the stands of outdoor sports and performance facilities

Fire resistance rate of the building	Maximum number of person per 1 meter width of the escape path			
	Following the stairs of the main paths of the stand		Go through the exit from the main paths of the stand	
	Go down	Go up	Go down	Go up
I, II	600	825	620	1,230
III, IV	420	580	435	860
V	300	415	310	615
NOTE: The total number of people escape through a escape door should not exceed 1,500 where the stage degree of refractory is I, II. If stage degree of refractory is III, the total number of people passing through shall be reduced by 30%, and if the degree is IV or V, the total number shall be reduced by 50%.				

G.2.2. For production buildings

a) The width of an exit to escape from a room shall be determined by the number of person that need to escape through the exit and the number of people on 1 meter width of the escape exit in accordance with Table G 7 , but not less than 0.9 m.

The number of person on 1 meter width of an escape exit for intermediate values of the building's bulk shall be determined by interpolation.

The number of person on 1 m width of an exit to escape from the room of more than 6 meter height be increased as follows: increase by 20% when the building height is 12 m, increase by 30% when the building height is 18 m and increase by 40% when the building height is 24 m. When the height of the building is intermediate values, the number of people on the 1 m width of an exit to escape shall be determined by using interpolation.

Table G 7 - Maximum number of person per 1 meter height of an exit to escape from a room of a production building.

Room's bulk (thousand m^3)	Room class	Fire resistance rate of building	Fire danger level of building's structure	Maximum number of person per 1 m exit width to escape from a room (person)
(1)	(2)	(3)	(4)	(5)
Up to 15	A, B	I, II, III, IV	S0	45
	C 1, C2, C 3	I, II, III, IV	S0	110
		III, IV	S1	75
		Not specified	S2, S3	55
30	A, B	I, II, III, IV	S0	65
	C 1, C2, C 3	I, II, III, IV	S0	155
		III, IV	S1	110
40	A, B	I, II, III, IV	S0	85
	C 1 , C2, C 3	I, II, III, IV	S0	175
		III, IV	S1	120
50	A, B	I, II, III, IV	S0	130
	C 1, C2, C 3	I, II, III, IV	S0	195
		III, IV	S1	135
60 and above	A, B	I, II, III, IV	S0	150
	C 1, C2, C 3	I, II, III, IV	S0	220
		III, IV	S1	155
80 and above	C 1, C2, C 3	I, II, III, IV	S0	260
		III, IV	S1	220
Not depend on bulk	C 4, D	I, II, III, IV	S0	260
		III, IV	S1	180
		Not specified	S2, S3	130
Not depend on bulk	E		Not specified	

b) The width of an exit to escape from the corridor to the outside or staircase shall be determined by the total number of people that need to escape through the exit and the rate of the number of person per 1 meter exit width in accordance with Table G 8 and not less than 0.9 m.

Table G 8 - Maximum number of person per 1 meter width of the escape path to escape from the corridor of the production building

Class of the room with the highest fire danger level whose exit leads to the corridor	Fire resistance rate of the building	Fire danger level of building's structure	Maximum number of person per 1 meter width of the escape path from the corridor (person)
A, B	I, II, III, IV	S0	85
C 1, C2, C 3	I, II, III, IV	S0	173
	IV	S1	120
	Not specified	S2, S3	85
C 4, D, E	I, II, III, IV	S0	260
	IV	S1	180
	Not specified	S2, S3	130

G.3. Determine the maximum number of person in the building or in a part of the building.

The maximum number of person in a room, a floor or a building is the maximum number of person as specified in the approved design. If this value is not specified in the design, the maximum number of person shall be determined by dividing the floor space of the room/floor/building by floor space ratio (m^2/person) as specified in Table G 9.

NOTE: Within this context, "floor space" does not include space for stair, elevator, toilet room and other add-on sections.

Table G 9 - Floor space ratio (a)

No.	Utilization area (b)(c)	Floor space ratio (m^2/person)
(1)	(2)	(3)
1	Spectator area, bar without seat and other similar break areas.	0.3
2	Play areas with roofs, halls, crowded places , clubs , dancing floors and similar areas	0.5
3	Halls, line up areas or wide commercial areas	0.7
4	Meeting rooms, guest rooms, conference rooms, dining rooms, reading rooms, restaurants, working rooms or waiting rooms.	1.0
5	Market, supermarket, shopping centers	1.35
6	Galleries or studios (film , broadcast , television , recording)	1.5
7	Trading shops and service shop: department stores, barber's shops, laundry, or similar	2.0
8	Art galleries, product displaying areas, museum or similar areas	5.0
9	Offices	6.0
10	Furniture shops that sell things like table, chair, rug…	7.0
11	Kitchens or libraries	7.0
12	Sleeping rooms or studying-sleeping rooms	8.0
13	Sitting room, recreation room	10.0
14	Stores or spaces for keeping things	30.0
15	Garages	2persons/car packing lot

NOTE:

a) If not using the values given in the table above, can determine the floor space ratio by using the experimental data of similar projects. In this case, the data must reflect average living density at the highest point in a year.

b) Where there is an subject that is not included in the list of utilization area above, it is possible to use appropriate values from a similar subject.

c) If a part of the building is used for many different purposes, it is necessary to apply the ratio for maximum number of people. If the building has many different areas, each area should be calculated with the space ratio that corresponds to that area.

ANNEX H

SOME REGULATIONS ON THE LIMITATION ON THE NUMBER OF FLOOR (ALLOWABLE HEIGHT) AND THE AREA OF COMBUSTION CHAMBER OF BUILDING

H.1. Residential building

H.1.1. Barrack

For barrack, allowable height of the building and maximum allowable area of a floor within the limit of a combustion chamber is specified in Table H 1.

Table H 1 - Combustion chamber area and maximum allowable height of barrack

Fire resistance rate of building	Fire danger level of building's structure	Maximum allowable height of building (m)	Maximum allowable area of a floor within the limit of a combustion chamber (m^2)
I	S0	75	2,200
II	S0	50	2,200
	S1	28	2,200
III	S0	25	1,800
	S1	15	1,800
IV	S0	5	1,000
		3	1,400
	S1	5	800
		3	1,200
	S2	5	500
		3	900
V	Not specified	5	500
		3	800

H.1.2. Hostel

For hostel, allowable height of the building and allowable area of a floor within the limit of a combustion chamber shall be as follow:

- For hostel of sectional type: as specified in table H 1 (same like barrack);

- For hostel of corridor type: as specified in table H 2.

Table H 2 - Combustion chamber area for hostel of public corridor type

Fire resistance rate of the building	Fire danger level of building's structure	Maximum allowable height of the building (m)	Maximum allowable area of a floor within the limit of a combustion chamber (m^2)
(1)	(2)	(3)	(4)
I	S0	50	2.200
II	S0	28	2.200
	S1	15	1.000
III	S0	15	1.000
	S1	9	1200
IV, V	Not specified	3	400

H.2. Public building and construction

H.2.1. Maximum number of story and maximum allowable area of a floor within the limit of a combustion chamber of some types of public construction are specified in table H 3.

Table H 3 - Maximum allowable area of a floor within the limit of a combustion chamber of some type of public construction.

Fire resistance rate of the building	Maximum number of story	Maximum allowable area of a floor within the limit of a combustion chamber (m^2)
I, II	According to H 4	2,200
III	According to H 4	1,800
IV	1	1,400
	2	1,000
V	1	1,000
	2	800

NOTE:

1) For building with fire resistance of degree I and II, if it is equipped with automatic fire fighting system, the combustion chamber area as given in table H 3 can be increased but only at the maximum of 2 times.

2) Wooden walls (wall surfaces), partitions and ceilings of buildings with fire resistance of degree V that are used as kindergartens, schools, boarding schools, medical facilities and outpatient treatment, health camps for children and the club (except for single storey club house with stone walls) must be protected against fire.

3) If a part of a two-storey-building lies within the combustion chamber area of a single storey building and the area does not exceed 15% of the combustion chamber area, that combustion chamber is still considered single storey building.

4) In passenger terminals and buildings or rooms with similar functions, if unable to arrange fire walls, it is allowed to use the Drencher water screen creating equipments arranged in two bands, the distance between these two bands is 0.5 m and the spray intensity is not less than 1 liter / second per 1 meter length of water screen (calculated for the both bands). The water screen needs to be maintained in at least 1 hour.

5) In the airport terminal with refractory grade I, the floor area between the fire walls (combustion chamber) may be increased up to 10,000 m^2 when there is no basement or when there is a basement but in the basement (semi basement) there is not any storage nor other kind of rooms that store flammable materials (except for rooms for keeping employees' things). In that case, the passage-ways from the rooms for sanitary equipments which are located in the basement and semi-basement to the first floor can follow the open staircases; if go from the keeping rooms, must follow the separate stairways located in the lift. The keeping rooms (except those equipped with the automatic sending bins) and a shirt chamber must be separated from other parts of the basement by using fire walls type I and be equipped with automatic fire fighting system. Command and control station must be separated by fire partitions.

6) In airport passenger platform, if there are automatic fire fighting system, there shall be no limitation on the floor area between the fire walls.

7) Fire resistance rate of the main building's supplements such as verandas, veranda floors, loggias, etc, is allowed to be one level lower than the fire resistance rate of the main building.

8) In sport arenas, indoor swimming pools (with or without seat) as well as in swimming training rooms, indoor gun shooting training areas (on the stands or in other public buildings), the combustion chamber area can be increased to 6,000 m^2 for single storey buildings with fire resistance rate of degree I or II; to 5,000 m^2 for buildings of two to five stories with fire resistance rate of degree I and be increased to 4,000 m^2 for buildings of two to five stories with fire resistance rate of degree II.

9) In independent gymnasium with fire resistance of degree I, II, the combustion chamber area can be up to 10,000 m^2. Where there is automatic fire fighting system, this value can be increased but not exceed 2 times.

10) Where the areas of entrance halls and waiting rooms are larger than the values provided in table H 3, it is allowed to use transparent fire partitions type 2 instead of fire walls.

H.2.2. Concerning kindergartens, hospitals, maternity hospitals, schools, theatres, cinemas, clubs, houses of cultural, units of selling center and units of living service center which are independent constructions, maximum allowable number of storey shall depend on the sizes of the constructions and the fire resistance rates of the buildings, and shall be in accordance with table H 4.

Table H 4 – Maximum allowable number of story for some types of independent buildings and public constructions.

Construction's name and size	Fire resistance rate	Maximum allowable number of story
(1)	(2)	(3)
1- Kindergarten		
a) Up to 50 children	V, IV	1 story
b) Up to 150 children	III	2 stories
c) Up to 350 children	II, I	2 stories, 3 stories ([a])
2- Hospital, maternity hospital		
a) Up to 50 beds	V, IV	1 story
b) More than 50 beds	III	2 stories
c) Not depend on the number of bed	II, I	9 stories ([b])
3- Learning unit in common school and residential college		
a) Up to 270 seats	V	1 story
b) Up to 360 seats	IV	1 story
c) Up to 720 seats	III	2 stories
d) Not depend on the number of seat	II, I	4 stories
4- Cinema		
a) Under 300 seats	V	1 story
b) Up to 400 seats	IV	2 stories
c) Up to 600 seats	III	2 stories
d) 600 seats and more	II, I	Not specified
5- Theatre	II, I	Not specified
6- Clubs, House of culture ([c])		
a) Under 300 seats	V	1 story
b) Under 400 seats	IV	2 stories
c) Under 600 seats	III	3 stories
d) 600 seats and more	I, II	Not specified
7- Unit of selling center (Department store, food store, supermarket)		
	V, IV	1 story
	III	2 stories
	II, I	5 stories
8- Unit of living service center		

V, IV	1 story
III	2 stories
II, I	6 stories

NOTE:

([a]) In a three-story-kindergarten, the third floor is for children of the oldest age only or for music studying, exercising or playing;

([b]) Area for children (including parents-accompanied children of under three years old) in hospital shall be located on the fifth floor or lower. Area for under-seven-year-old-children shall be located on the second floor or lower;

([c]) Rooms for spectators in a club, cultural house with fire resistance of grade IV shall be located on the first floor; rooms for spectators in a club, cultural house with fire resistance of grade III shall be located on the second floor or lower.

H.3. The highest floor that allows locating lecture room, conference room, meeting room or gym room.

In public buildings and multi-purpose building, lecture rooms, conference rooms, meeting rooms and gym rooms are only allowed to be located on the highest floor as specified in table H 5.

Table H 5 – The highest floor that allows locating lecture room, conference room, meeting room or gym room

Fire resistance rate of the building	Number of seat	Highest floor that allow locating
(1)	**(2)**	**(3)**
I, II	Up to 300	14
	From above 300 to 600	5
	Above 600	3
III	Up to 300	3
	From above 300 to 600	2
IV, V	Up to 300	1

NOTE:

1) When determining the highest floor for locating rooms with pitch board, the height level of the chosen floor shall be equal to the height level of the first seat row.

2) The halls of common schools and semi residential colleges with fire resistance of degree III must be located on the second floor or lower, The floors of these rooms must be fire-resistance-floors type 2.

H.4. For production building and storage

H.4.1. For production building, maximum allowable area of a floor within the limit of a combustion chamber shall depend on fire resistance rate, fire danger level of building's structure and the height of the building as given in table H 6.

Table H 6 – Combustion chamber area for production building (Buildings belong to group F 5.1)

Class of production building	Maximum allowable number of story (story)	Fire resistance rate of building	Maximum allowable area of a floor within the limit of a combustion chamber (m^2)		
			Single story building	Two-story-building	Over-three-story-building
(1)	(2)	(3)	(4)	(5)	(6)
A and B	6	I		(*)	
A and B (with the condition that there is no producing of chemical and petroleum)	6	II	(*)	5,200	3,500
A (there is producing of chemical and petroleum)	6	II	(*)	5,200	3,500
B (there is producing of chemical and petroleum)	6	II	(*)	10,400	7,800
C	Not specified	I to II		(*)	
	3	III	5,200	3,500	2,600
	1	IV	2,600		
	1	V	1,200		
D	Not specified	I to II		(*)	
	3	III	6,500	2,500	3,500
	1	IV	3,500		
	1	V	1,500		
E	Not specified	I and II		(*)	
	3	III	7,800	6,500	3,500
	1	IV	3,500		
	1	V	2,600		

Note:

(*) There is no specific regulation on combustion chamber area but the construction still has to meet the requirements on fire protection specified in the design standard that applied to it;

1) For production rooms that are equipped with automatic fire extinguishing equipments, the floor area between fire preventing walls can be maximum 2 times larger than as specified in table H 6;

2) Where production rooms or spaces are equipped with automatic fire alarming equipments, the floor area between fire preventing walls can be increased by 25% in comparison with the values specified in table H 6;

3) Combustion chamber area on the first floor of a multi-storey building, where the ceiling of the first floor has the fire resistance rating of 150 minutes, can be taken as the combustion chamber area of a single storey building.

4) In the case of wood producing building with fire resistance of degree II, the combustion chamber area of single storey building is maximum 10,400 m^2, the combustion chamber area of two storey building is maximum 7,800 m^2 and the combustion chamber area of more than two storey building is maximum 5,200 m^2;

5) In single storey production buildings with fire resistance of degree I and II, the absence of fire preventing walls is acceptable. This regulation does not apply to buildings with fire resistance of degree II which are used for producing chemical, petroleum or used as storages for materials or flammable products; wood processing and producing buildings.

H.4.2. For warehouse, height, fire resistance class, fire danger level of structure and floor area of a storey within a fire compartment shall be in accordance with table H7.

Table H 7 - Fire compartment area for storage

Storage's grade	Height of building (m)	Fire resistance class	Fire Danger level of building's structure	Maximum floor area of a storey within a fire compartment (m^2)		
				Single-storey building	Duplex building	Multi-storey building
(1)	(2)	(3)	(4)	(5)	(6)	(7)
A	-	I, II	S0	5,200	-	-
	-	III	S0	4,400	-	-
	-	IV	S0	3,600	-	-
B	18	I, II	S0	7,800	5,200	3,500
	-	III	S0	6,500	-	-
	-	IV	S0	5,200	-	-
C	36	I, II	S0	10,400	7,800	5,200
	24	III	S0	10,400	5,200	2,600
	-	IV	S0, S1	7,800	-	-
	-	IV	S2, S3	2,600	-	-
	-	V	Not specified	1,200	-	-
E	Unlimited	I, II	S0	Unlimited	10,400	7,800
	36	III	S0, S1	Unlimited	7,800	5,200
	12	IV	S0, S1	Unlimited	2,200	-
	-	IV	S2, S3	5,200	-	-
	9	V	Not specified	2,200	1,200	-

NOTE:

For class I, II, III warehouse equipped with automatic fire fighting equipments, the areas as regulated in table H7 can be increased but not exceed twice of that.