

## **FIRE SAFETY REQUIREMENTS FOR FULLY AUTOMATED MECHANISED CAR PARK (FAMCP)**

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The fully automated mechanized car park buildings (FAMCP) incorporates the revolutionary concept of parking and retrieving a vehicle by mechanical means without the driver entering the parking area. The building is therefore unmanned and is totally different from the conventional car parks e.g. car park in a multi-storey building, multi-storey car park (MSCP), etc. The main differences between the FAMCP and the conventional car parks are:-

- i) close stacking of cars one to another
- ii) lack of provision on fire separation to prevent rapid fire spread
- iii) non availability of fire fighting access
- iv) extensive height and depth involved with highly combustible load

The FAMCP buildings available in the market can be classified into three types, namely, i) small FAMCP, ii) underground FAMCP and iii) above ground FAMCP. Each type of FAMCP has its own specific fire safety requirements.

Please see Annex A for a brief description on the three types of FAMCP. The fire safety requirements are given in Annex B.

**Fully Automated Mechanised Car Park (FAMCP)**

The FAMCP is sub-divided into three categories. They are:

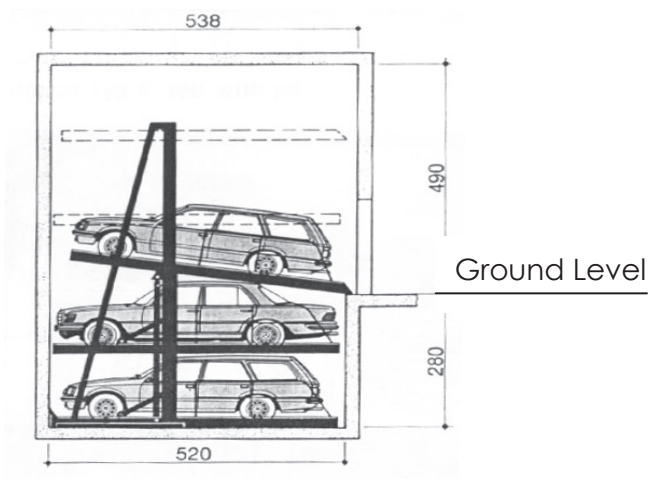
Category 1a: Small above ground with the following sizes:

|                        |                          |
|------------------------|--------------------------|
| Maximum floor area     | : 200m <sup>2</sup>      |
| Maximum cubical extent | : 1400m <sup>3</sup>     |
| Maximum parking height | : 10m                    |
| Minimum side openings  | : 50% of perimeter walls |



Category 1b: Small above ground with Decks Sunken

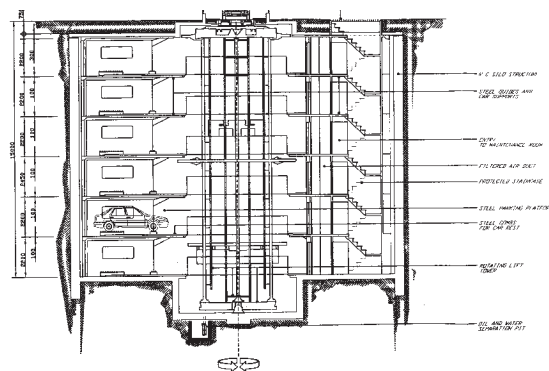
|                        |   |
|------------------------|---|
| Maximum floor area     | : 200m <sup>2</sup>   |
| Maximum cubical extent | : 1400m <sup>3</sup>  |
| Maximum parking height | : 14m (subject to maximum parking height of 10m above the ground level) |
| Minimum side openings  | : 50% of perimeter walls  |



Category 2: Any FAMCP that is above ground level and do not fall under Category 1



Category 3: Any FAMCP that is below ground level and do not fall under Category 1



Sectional view of an underground fully automated mechanised car park (FAMCP)

## **FIRE SAFETY REQUIREMENTS FOR FULLY AUTOMATED MECHANISED CAR PARK**

### **INTRODUCTION**

- 1 The purpose of this circular is to stipulate the fire safety requirements for the Fully Automated Mechanised Car Park (FAMCP). These requirements will assist the Qualified Person when making plans submission pertaining to the design, construction, protection, location and arrangement of the various fire safety provisions.

### **DEFINITION**

#### **Fully Automated Mechanised Car Park (FAMCP)**

- 2 The FAMCP is defined as a building or part of a building that is intended for the storage/parking of vehicles (passenger car) employing fully automated mechanical facilities to move the vehicle from the point of entry to the parking lot and vice-versa. The parking area would be accessible by trained staff when carrying out maintenance works only. The parking system is to cease during the maintenance operations.

#### **Parking Height**

- 3 The height shall be measured from the average level of the ground adjoining the outside of the external walls of the building to the highest/lowest car parking level. In situations where mixed usage involving above ground and underground car parking, the height shall be measured between the highest and the lowest car parking levels.

#### **Calculation of Cubical Extent**

- 4 The building height as defined in the Fire Code shall be used to calculate the cubical extent for all the car park types and in the event where there is no roof over, the highest/lowest car park level shall be used.

### **STANDARDS AND CODES**

- 5 The following standards and codes shall be complied with:-
  - a. SS EN 3 : Specifications for Portable Fire Extinguishers.
  - b. SS 550 : Code of Practice For Installation, Operation and Maintenance of Electrical Passenger and Goods Lifts
  - c. SS CP 5 : Wiring of Electrical Equipment of Buildings.
  - d. SS CP 10 : Code of Practice For The Installation and Servicing of Electrical Fire Alarm Systems

- e. SS 553 : Code of Practice For Mechanical Ventilation and air-conditioning in Buildings.
  - f. SS 563 : The Installation and Maintenance of Emergency Evacuation Lighting and Power Supply Systems in Buildings.
  - g. SS 546 : Emergency Voice Communication System in Buildings.
  - h. SS 575 : Code of Practice For Fire Hydrant Systems and Hose Reels
  - i. SS CP 52 : Code of Practice For Automatic Fire Sprinkler System
  - j. SS 578 : Code of Practice For Use and Maintenance of Portable Fire Extinguishers
- 6 All clauses and tables mentioned in this circular are extracts from the current “Code of Practice for Fire Precautions in Building”.

**CLASSIFICATION OF FAMCP**

- 7 The FAMCP shall be sub-divided into three categories as follows: -

Category 1a: Small Above ground

This type of FAMCP refers to those small sizes, above ground structure and having the following sizes:

- Maximum floor area : 200m<sup>2</sup>
- Maximum cubical extent: 1400m<sup>3</sup>
- Maximum parking height : 10m.
- Minimum side openings : 50% of perimeter walls

Category 1b: Small Above ground with Decks Sunken

This type of FAMCP refers to those small sizes, above ground structure without more than 2 car parking level sunken below the ground level and having the following sizes:

- Maximum floor area : 200m<sup>2</sup>
- Maximum cubical extent : 1400m<sup>3</sup>
- Maximum parking height : 14m.(subject to maximum parking height of 10m above the ground level)
- Minimum side openings : 50% of perimeter walls

Category 2: Above ground

Any FAMCP that is above ground level and do not fall under category 1.

Category 3: Underground

Any FAMCP that is below ground level and do not fall under category 1.

**FIRE SAFETY REQUIREMENTS THAT ARE APPLICABLE TO ALL THREE CATEGORIES OF FAMCP**

8 The fire safety requirements that are applicable to all three categories of car parks are as follows:-

a) Accessibility

Areas within the car park building shall not be accessible to the public.

b) Designation of Purpose Group

The car park building shall be classified as Purpose Group VIII (storage) as per Table 1.2B.

c) Means of Escape

Means of escape shall be provided where there are areas that are accessible by the public and these shall be in accordance with the requirements as for Purpose Group VIII.

d) Separation from Other Usage

Where a separation wall or floor is required, a minimum 2-hour fire resistance rating wall or floor subject to compliance with the requirements of the elements of structure for Purpose Group VIII shall be provided to separate the car park from other usage.

e) External Wall

Where an external wall is required as in Cl.3.5, a minimum 1-hour fire resistance rating floor subject to compliance with the requirements of the elements of structure for Purpose Group VIII shall be provided.

f) Unprotected Areas in any side of a building

For unprotected openings, "TABLE 2 TO PART II OF APPENDIX 'B' TO Cl. 3.5" shall be complied with.

g) Portable Fire Extinguisher

Extinguishers having a minimum rating of 70B, shall be provided at every entrance and exit of the car park.

h) Hose Reels

Hosereel coverage shall be provided for every entrance and exit of the car park.

i) Electrical Power Supplies

Where any such installation is required, its primary and secondary source of power supplies shall be in accordance with Chapter 5.

j) Fire Engine Accessway

Accessway for all the FAMCP shall comply with Cl.4.2.2.

**CATEGORY 1**

**FIRE SAFETY REQUIREMENTS FOR SMALL ABOVE GROUND FULLY AUTOMATED MECHANISED CAR PARK (SA-FAMCP)**

9 The specific fire safety requirements for the SA-FAMCP shall be as follows: -

a) Compartmentation

The SA-FAMCP shall not exceed the following compartment limits as indicated in the table below.

| Compartment   | Maximum Floor Area | Maximum Cubical Extent |
|---|--------------------|------------------------|
| Compartment between average ground level and a height of 10m. | 200m <sup>2</sup>  | 1400m <sup>3</sup>     |

b) Structural design

The SA-FAMCP shall be constructed of structural steel construction.

c) Vertical Deck Separation

For SA-FAMCP having multi-car parking level, vertical fire separation between the upper and lower decks by using a non-perforated and non-combustible materials (structural steel plate) shall be provided. This is to minimise direct impingement of flame to the car in the upper deck and also to prevent dripping of any possible leaking fuel to the lower deck.

d) Fire Engine Accessway

Accessway shall be provided for the fire engine to gain access to the car park entrance and exit.

e) Private Fire Hydrant

Private fire hydrants if required shall be provided in accordance with Cl.4.4.

f) Natural Ventilation

Each car parking deck shall be provided with at least 50% external ventilation openings of the perimeter wall areas and uniformly distributed.

**CATEGORY 2**

**FIRE SAFETY REQUIREMENTS FOR ABOVE GROUND FULLY AUTOMATED MECHANISED CAR PARK (A-FAMCP)**

10 The specific fire safety requirements for the A-FAMCP shall be as follows: -

a) Compartmentation

The car park shall not exceed the following dimension: If exceeded, sprinkler protection shall be provided.

| Maximum Parking Height | Maximum Floor Area | Maximum Cubical Extent |
|------------------------|--------------------|------------------------|
| 24m                    | 1000m <sup>2</sup> | 3500m <sup>3</sup>     |

b) Elements of Structure

The minimum period of fire resistance for the elements of structure shall be as follows: -

| Maximum dimensions |                                 |                                    | Min fire resistance rating (in hours) |
|--------------------|---------------------------------|------------------------------------|---------------------------------------|
| Height(in m)       | Floor area (in m <sup>2</sup> ) | Cubical Extent(in m <sup>3</sup> ) | Above ground storey                   |
| 7.5                | 150                             | NL                                 | 1/2                                   |
| 15                 | NL                              | 1,700                              | 1                                     |
| 28                 | NL                              | 7,000                              | 2                                     |
| 28                 | NL                              | 21,000                             | 4                                     |
| Over 28            | 1,000                           | NL                                 | 4                                     |

c) Vertical Fire Separation

Each car park deck shall be constructed with minimum 1-hour fire resistance. Where such building or compartment is fitted throughout with an automatic sprinkler system, a non-combustible, non-perforated deck will suffice.

d) Fire Fighting Provision

The A-FAMCP shall be provided with either fire fighting staircase(s) or access openings subject to the following:-



(1) Fire Fighting Staircase

For car park height exceeding 10m, the following provisions shall be complied with: -

- (i) All fire fighting staircases shall conform to the requirements of Cl.2.3.3;
- (ii) Smoke free approach as stated in Clauses 2.2.13 and 2.2.14;
- (iii) Fire doors of 1-hour fire resistance rating for the access of fire fighters via the staircase into the car park. The fire door shall be of at least 850mm wide by 1000mm high with a visual glass panel. Wordings of “For smoke venting, do no enter” shall be posted on the external side of the door. The wordings shall be of at least 25mm in height.
- (iv) The number of staircases provided shall depend on the number of rising mains. Each rising main serving every car parking level shall be within 8m coverage measured from the staircase door to the most remote part of the car parking lot:
- (v) Breeching inlet serving rising main shall be located within 18m of the accessway.
- (vi) Dry rising main shall be provided for height exceeding 10m and up to 60m. When the height exceeds 60m, wet rising main shall be provided. The breeching inlet shall be located at the foot of the riser stack. One standby fire hose of length 15m shall be provided at the ground level of each staircase provided.
- (vii) Fire lift shall be provided for height exceeding 24m.
- (viii) Where fire lift is required, a two way voice communication system shall be provided between the Fire Command Centre and the following areas:
  - (a) Every fire-fighting lobby, including 1<sup>st</sup> storey.
  - (b) All fire-fighting related mechanical equipment rooms inclusive of sprinkler pump room, wet riser pump room etc.
- (ix) Fire Command Centre shall be provided in accordance with Cl.8.2.3.

(2) Access Openings

- (i) The car parking height shall not exceed 40m
- (ii) Access openings shall be provided at every car parking level.
- (iii) The access openings shall be not less than 850mm wide by 1000mm high.

- (iv) There shall be one access opening to every 100m<sup>2</sup> of gross floor area on each side of the car parking level.
  - (v) Access openings shall be remote from each other and located along more than one side of the building. Such access openings shall be placed not more than 10m apart measured along the external wall from centre to centre of the access openings.
  - (vi) Accessway shall be provided in accordance with Cl.4.2.3(e) and allow for island site access.
- e) Private Fire Hydrant
- Private fire hydrant where required shall be provided in accordance with Cl.4.4.
- f) Sprinkler Protection
- Where sprinkler protection is required, it shall be in accordance with SS CP 52.
- g) Smoke Vents
- Ventilation openings (with exhaust air outlet sited at high level and fresh air inlet sited at low level) of at least 2.5% of the largest floor area of any car parking level shall be provided. It shall be operated automatically by activation of smoke detector, if such openings are not naturally ventilated.

**CATEGORY 3**  
**FIRE SAFETY REQUIREMENTS FOR UNDERGROUND FULLY AUTOMATED MECHANISED CAR PARK (U-FAMCP)**

11 The specific fire safety requirements for the U-FAMCP shall be as follows: -

- a) Compartmentation

The U-FAMP shall not exceed the following sizes:-

| Maximum Parking Depth | Maximum Floor Area | Maximum Extent     | Cubical |
|-----------------------|--------------------|--------------------|---------|
| 28m                   | 2000m <sup>2</sup> | 7000m <sup>3</sup> |         |

b) Elements of Structure

The minimum period of fire resistance for the elements of structure shall be as follows: -

| Maximum dimensions |                                    |                                       | Min fire resistance rating<br>(in hours) |
|--------------------|------------------------------------|---------------------------------------|--|
| Height(in m)       | Floor area (in<br>m <sup>2</sup> ) | Cubical<br>Extent(in m <sup>3</sup> ) | Basement storey                          |
| 7.5                | 150                                | NL                                    | 1  |
| 15                 | NL                                 | 1,700                                 | 1  |
| 15                 | NL                                 | 3,500                                 | 2  |
| 28                 | 2,000                              | 7,000                                 | 4  |

c) Vertical Fire Separation

Each car park deck shall be constructed with minimum 1-hour fire resistance.

d) Fire Fighting Provision

The U-FAMCP shall be provided with the following:-

(1) Fire-Fighting Staircase

- (i) All fire-fighting staircases shall conform to the requirements of Cl.2.3.3;
- (ii) Smoke free approach as stated in Clauses 2.2.13 and 2.2.14;
- (iii) Fire doors of 1-hour fire resistance rating for the access of fire fighters via the staircase into the car park; and
- (iv) The number of staircases provided shall depend on the number of rising mains. Each rising main serving every car parking level shall provide the following coverage:
  - a) Where internal access to every car parking lot is provided:
    - i) An access of minimum width of 0.9m shall be provided.
    - ii) No part of any car parking lot shall exceed 28m.
  - b) Where no internal access to every car parking lot is provided:
    - i) The maximum distance measured from the staircase door to the most remote part of the car parking lot shall not exceed 8m.

- (v) Breeching inlet serving rising main shall be located within 18m of the accessway.
- (vi) Dry rising main shall be provided for all basement depth and the breeching inlet shall be located near the riser stack. One standby fire hose of length 15m shall be provided at the ground level of each staircase.
- (vii) Fire lift shall be provided for basement depth exceeding 9m.
- (viii) Where fire lift is required, a two-way voice communication system shall be provided between the Fire Command Centre and the following areas:
  - (a) Every fire-fighting lobby, including 1<sup>st</sup> storey.
  - (b) All fire-fighting related mechanical equipment rooms inclusive of sprinkler pump room, wet riser pump room etc
- (ix) Fire Command Centre shall be provided in accordance with Cl.8.2.3.
- (iix) Basement levels shall be provided with two-way voice communication system in accordance with Cl.8.2.4.

e) Fire Engine Accessway

Accessway shall be provided for fire engine to gain access to the fire fighting staircases.

f) Private Fire Hydrant

Where required, private fire hydrant shall be provided in accordance with Cl.4.4.

g) Sprinkler Protection

Sprinkler protection shall be provided in accordance with SS CP 52.

h) Smoke Vents

Smoke vents of at least 2.5% of the basement floor area shall be provided in accordance with Cl.7.4.2. This requirement shall apply to basement not exceeding 1000m<sup>2</sup> in floor area and 5m in depth measured from the ground level area to the lowest floor level. If these limits are exceeded, smoke purging system shall be provided.

i) Foam Installation

Where fire lift is required, foam inlets in accordance with Cl.6.2.7 shall be provided.