

Fire Alarm Requirements for High-Rise Buildings in San Francisco

San Francisco Fire Department



Bureau of Fire Prevention
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March 20, 2009

Presentation Topics

- Discuss and clarify basic terms related to FA requirements for High-Rise Buildings
- Discuss the SF High-Rise Buildings Evacuation Policy
- Discuss new code requirements for elevator operation.

Reference Codes:

- CFC and CBC 2007 Edition
- SFFD High-Rise Manual (H.R.M) dated January 2008.
- SFFD Fire Code - Administrative Bulletins
Available Online:
http://www.sfgov.org/site/sffd_page.asp?id=79929
- NFPA 72, 2002 – Fire Alarm Requirements. The 2007 Edition will be enforced starting August 1st, 2009

Where to find Code requirements for High-Rise building Evacuation:

- CBC Section 403 – High-Rise Buildings
- CBC and CFC Section 907.2.12 – FA requirements for High-Rise buildings
- CBC Section 911 – Fire Command Center
- CFC Section 404 – Fire Safety and Evacuation Plans
- NFPA 72 – 2002: Section 6.9 – Emergency Voice/Alarm Communications
- SFFD High-Rise Manual (January 2008)
- SFFD Administrative Bulletins:
 - 2.01 – Fire Alarm Submittal
 - 3.03 – Fire Alarm Annunciation
 - 3.05 – Fire Alarm High-Rise Relocation Policy
 - 3.07 – Fire Alarm Notification Devices

High-Rise Building Definition:

- **High Rise Building**: A building which contains a floor area that is located more than 75 feet above the adjacent ground level.
- According to the H.R.M there are about 800 High-Rise buildings in San Francisco
- High Rise Buildings are divided into two classifications:
 - **Existing High Rises** – Those constructed before 1975
 - **Life Safety High Rises** – Those constructed after 1975

Existing High-Rise Building features (H.R.M):

- Most Existing High-Rise buildings do not have a Fire Command Center (FCC) formerly known as Building Control Station (BCS) or Fire Control Room (FCR) as indicated on the H.R.M
- They usually have a console located in the lobby staffed by security personnel. The console may contain some of the safety features found in a FCC.
- **All Existing High-Rises usually contain the following:**
 - Two means of exit from each floor. One may be a fire escape.
 - Keys to locked stairwell doors
 - A means of ventilation – operable windows, break-out windows, or mechanical ventilation
 - Elevator access to every floor
 - A standpipe – Class I, II, or III
 - An approved fire warning system or voice (public address) system. A voice system is required in buildings more than 150 feet in height.
 - A fire department communication system, where a radio test showed that radio communication was poor in the building
 - Building Operations Manual (BOM). May be located at the security console or engineer's office, if there is no FCC. The BOM should include the approved evacuation plan of the building.

Life Safety High Rise Building features (H.R.M):

- Life Safety High-Rises have a higher standard than existing High-Rises, and require a variety of fire protection systems and features.
- **All life safety High-Rise buildings have the following components:**
 - A Fire Command Center (FCC)
 - Standby power for emergency operation of life safety systems, essential lighting and one elevator in each bank. This is provided by an emergency generator.
 - A fire department communication system
 - An emergency voice alarm signaling system
 - A combined standpipe system
 - An automatic sprinkler system with backup water supply and fire pump
 - An automatic smoke control system (usually part of the building's HVAC system)
 - Enclosed elevator lobbies.
 - Firefighter air replenishment system (a few of the newest High-Rises in SF are equipped with these systems)

Fire Command Center (FCC) features, **(H.R.M. and CBC Section 911)**

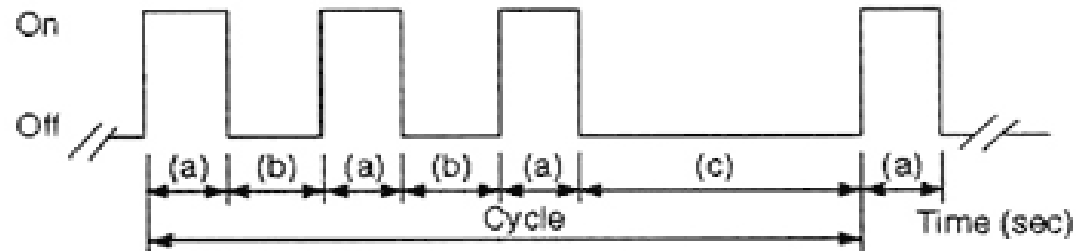
- In Life Safety Buildings, the FCC is the focal point for the fire department operations. It is usually located near the entrance of the building near the elevators.
- The FCC contains the following components:
 - Voice alarm and public address system panels which are designed to allow SFFD personnel to communicate with individual floors, select group of floors, or all floors at once. (Voice command overrides the building alarm tone)
 - Fire Department Communication Panel with a telephone connected to phone jacks located in: Elevators, Elevator lobbies, Emergency generator room, Fire pump room, and entries into enclosed stairways.
 - Fire Alarm annunciator panel (LED or Graphic)

High-Rise Building Evacuation Methods

- **Total Evacuation: (Horns or Speakers):**
 - A general alarm is sound in the building upon any alarm initiating device activation.
 - All occupants in the building are notified via the notification system (Strobes, Speakers, Horns)
 - All occupants evacuate the building

Total Evacuation Signal: NFPA 72 Section 6.8.6.4

- Distinctive Evacuation Signal - Temporal 3 Pattern
- All FA systems intended to notify occupant to evacuate the building shall use the Temporal 3 pattern, which is a common evacuation signal per ANSI S3.41.



Key:

Phase (a) signal is on for 0.5 sec \pm 10%

Phase (b) signal is off for 0.5 sec \pm 10%

Phase (c) signal is off for 1.5 sec \pm 10% [(c) = (a) + 2(b)]

Total cycle lasts for 4 sec \pm 10%

FIGURE A.6.8.6.4.1(a) Temporal Pattern Parameters.

High-Rise Building Evacuation Methods

- **Partial Evacuation: (Voice system only):**
 - In a High-Rise: The fire floor, the floor above and the two floor below completely evacuate the building, upon alarm initiating device activation on the fire floor.
 - In a complex of buildings provided with a single FA system (Ex. a few buildings on a common garage)
 - If the alarm is in one of the buildings, only that building and the common garage evacuate
 - If the alarm is in the garage, the entire complex (all buildings and the garage) evacuate.

Evacuation Signals: NFPA 72 Section 6.9.5.3

- Partial Evacuation Messaging:

- The pre-recorded evacuation message shall be preceded and followed by a minimum of two cycles of the Temporal 3 evacuation tone.

- Relocation Messaging:

- The Pre-Recorded Relocation message shall follow a Continuous Alert Tone of 6-10 Second
- This cycle shall be repeated at least 3 times

High-Rise Building Evacuation Methods

- **Relocation of occupants: (EVAC system only)**
SFFD Bulletin 3.05:
- **New Buildings (Except Tourist Hotels)**
 - Any alarm initiating device will cause four floors to go into alarm: The fire floor, two floors below, and the floor above the fire floor.
 - The occupants on each of these floors will be instructed to relocate down four floors.
 - Relocation down usually stops at the 8th floor, and then all occupants are instructed to evacuate the building
 - The building's Life Safety Program must include evacuation signage and emergency procedures.

High-Rise Building Evacuation Methods

- **Relocation of occupants: (EVAC system only)**
SFFD Bulletin 3.05:
- **Existing Buildings (Except Tourist Hotels)**
 - When a new Fire Alarm Panel is installed in an existing building, the 4-story relocation procedure shall be followed, if the building is equipped with the following features:
 - An automatic sprinkler system throughout
 - Two code complying exit stairs
 - Voice evacuation system
 - A smoke control system that was code compliant at the time of installation
 - **Existing Buildings not complying with these requirements, shall be evaluated on a case-by-case basis.**

High-Rise Building Evacuation Methods

- **Relocation of occupants: (EVAC system only) SFFD Bulletin 3.05:**
- **Tourist Hotels – New and Existing:**
- In general, tourist hotels will require complete evacuation.
- Proposals for partial evacuation or relocation of occupants in tourist hotels are reviewed on a case-by-case basis.

Emergency Voice/Alarm Communication “EVAC” system (CFC/CBC Section 907.2.12.2)

- Activation of any alarm initiating device, shall automatically sound an alert tone followed by voice instructions (pre-recorded message) giving information and directions for total or partial evacuation.
- The voice instructions shall be sound, on the fire floor, the floor above and the two floor below the fire floor.
- Speakers shall be provided throughout the building by the following paging zones (as a minimum):
 - Elevator groups
 - Exit stairways
 - Each floor
 - Areas of refuge

EVAC systems (Cont')

- **Manual Override or Selective Paging** – The EVAC system allows to transmit a specific pre-recorded message to a specific zone, or all paging zones in the building (CFC Section 907.2.12.2.1)
- **Live Voice Messages** – The EVAC system shall have the capability to broadcast live voice message, utilizing a microphone or a dedicated phone, through paging zones, on a selective and all-call basis. (CFC Section 907.2.12.2.2).
- Live messages shall override all automatic/pre-recorded messages.

Fire Department Communication System

CFC Section 907.2.12.3

- An approved two-way fire department communication system shall be provided per NFPA 72 requirements. (Communication panel at the FCC and Phone jacks throughout the building)
- Must be separate from emergency phones used for locked stairway doors
- Exception: An approved fire department radio system (Firefighter radios), if the building passed a radio test.

Survivability from attack by Fire

NFPA 72- Section 6.9.4

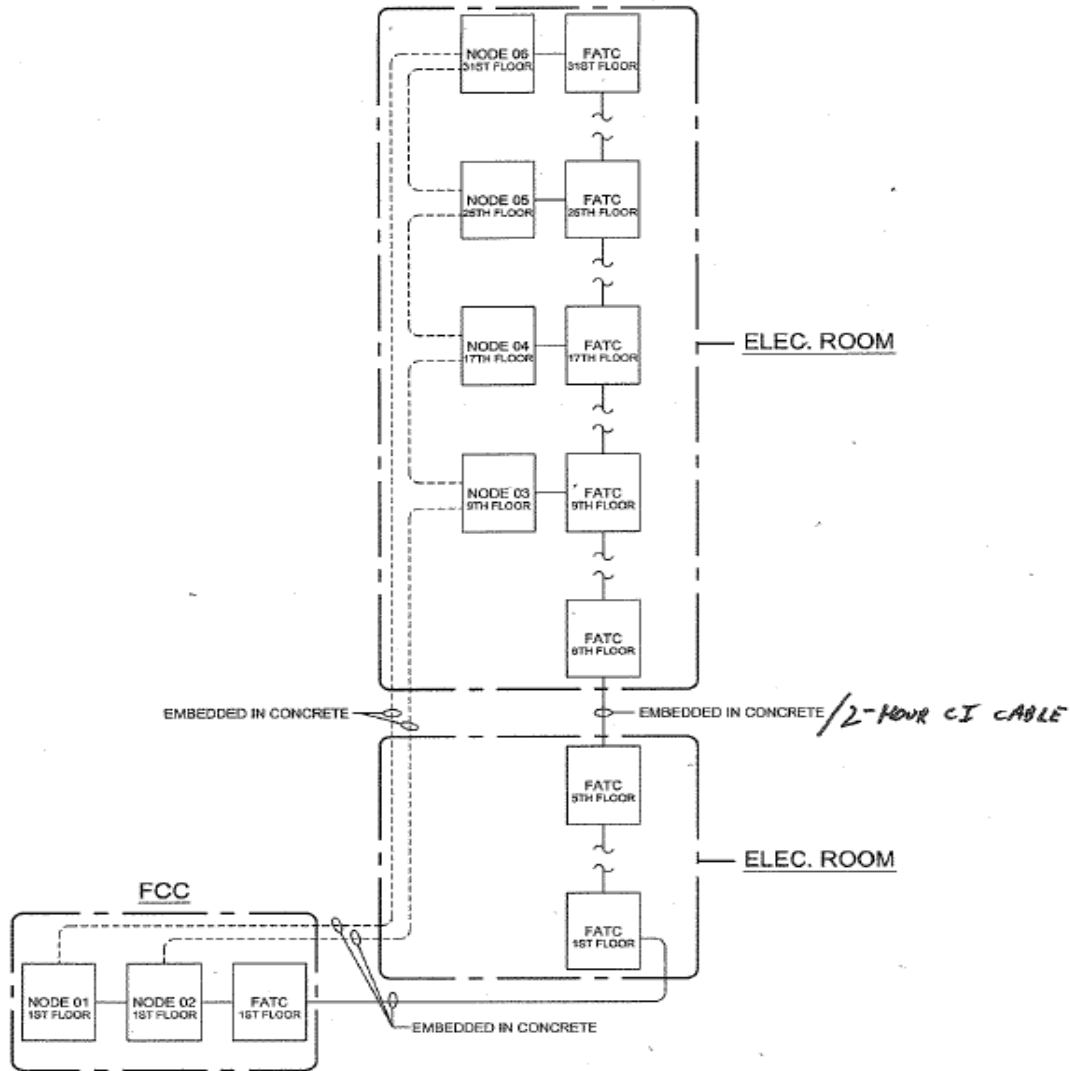
- Any FA system used for partial evacuation or relocation of occupants shall meet survivability requirements per NFPA 72.
- The intent is to provide a “beefed-up” FA system that could survive a fire for a longer time, and
- To maintain communication with occupants that remain in the building during a fire.
- Survivability FA systems shall be designed and installed such that attack by fire within an evacuation zone shall not impair control and operation of the notification appliances outside that zone.
- All circuits used for the operation of notification appliances shall be protected until they enter the evacuation zone that they serve

Survivability from attack by Fire

NFPA 72- Section 6.9.4.3

- Acceptable Survivability Methods:
 - A 2-hour rated cable or cable system – CI (Circuit Integrity cable)
 - A 2-hour rated enclosure (2-hour vertical shaft, stacked electrical rooms with 90 minutes doors, cables embedded in concrete slab, etc.) – Any penetration must be sealed with 2-hour fire resistive material.
 - Approved Performance Alternatives

Survivability Riser Example:



High-Rise FA Requirements

- **Audibility:**

- New High-Rise buildings and existing High-Rises over 150 feet require EVAC systems utilizing speakers. (Horns are used in total evacuation building only.)
- Where speakers are provided, they shall produce a message with “Voice Intelligibility” with a Common Intelligibility Scale (CIS) value of 0.7 or greater (NFPA 72, Section 7.4.1.4)
- General rule is: more speakers with lower wattage per speaker are more intelligible than fewer speakers with high wattage per speaker (ex. 16 speakers tapped at ½ Watt are more intelligible than 4 speakers tapped at 2 Watt)
- Residential sleeping room require 75 dBA at the pillow (NFPA 72 Section 7.4.4.1).
- Minimum 75 dBA **throughout** in Group R Occupancies (CBC Section 907.9.2)
- Maximum sound pressure shall not exceed 110dBA anywhere in the protected area (NFPA 72 Section 7.4.1.2)

High-Rise FA Requirements

- **Hearing Impaired Rooms in R-1 and R-2 Occupancies (CFC Section 907.9.1.3,4)**
 - In Group R-1 the number of Hearing Impaired room is based on CFC Table 907.9.1.3
 - In Group R-2, the FA system shall have the **capability to support** the Hearing Impaired operation for any unit.
 - Strobes in Hearing Impaired room shall be activated on any building alarm
 - Only the Hearing-Impaired in-room strobe shall be activated upon in-room smoke detection (No building general alarm)

High-Rise FA Requirements

• LED/ Graphic Annunciator

- Each High-Rise building shall be provided with an LED Annunciator located at the FCC room (or at the building's lobby if FCC is not provided)
- Graphic Annunciator is required for complicated buildings (on a case-by-case basis)
- General requirements for LED Annunciator indications:
 - Alarm signals for any type alarm initiating device, per floor.
 - Fire protection auxiliary systems

High-Rise FA Requirements

- LED Annunciator required indication (SFFD AB # 3.01):
- **Alarm initiating devices, Per Floor (RED LEDs):**
 - Manual Pull Station/s
 - Waterflow switch/es
 - Area smoke detectors
 - Area heat detectors
 - Duct smoke detectors
 - Elevator Lobby smoke detector/s
 - Elevator Hoistway/Machine room smoke detectors
 - Elevator Hoistway/Machine room Heat detectors
 - Suppression systems (Ansul, FM200, etc.)

High-Rise FA Requirements

- **LED Annunciator required indication (SFFD AB 3.01):**

Fire Pump:

- a) Running: green lamp
- b) Trouble: yellow lamp
- c) Phase reversal (electric): yellow lamp
- d) Low fuel (diesel): yellow lamp

Emergency Generator:

- a) Running: green lamp
- b) Trouble: yellow lamp
- c) Low fuel: yellow lamp

Secondary Water Supply:

- a) Low water level: yellow lamp
- b) High water level: yellow lamp

Firefighter's Air Replenishment System:

- a) System low air pressure: yellow lamp
- b) CO monitoring system (Existing systems with monitors): yellow lamp

Annunciation Panel Power On: green lamp

Lamp Test: push button

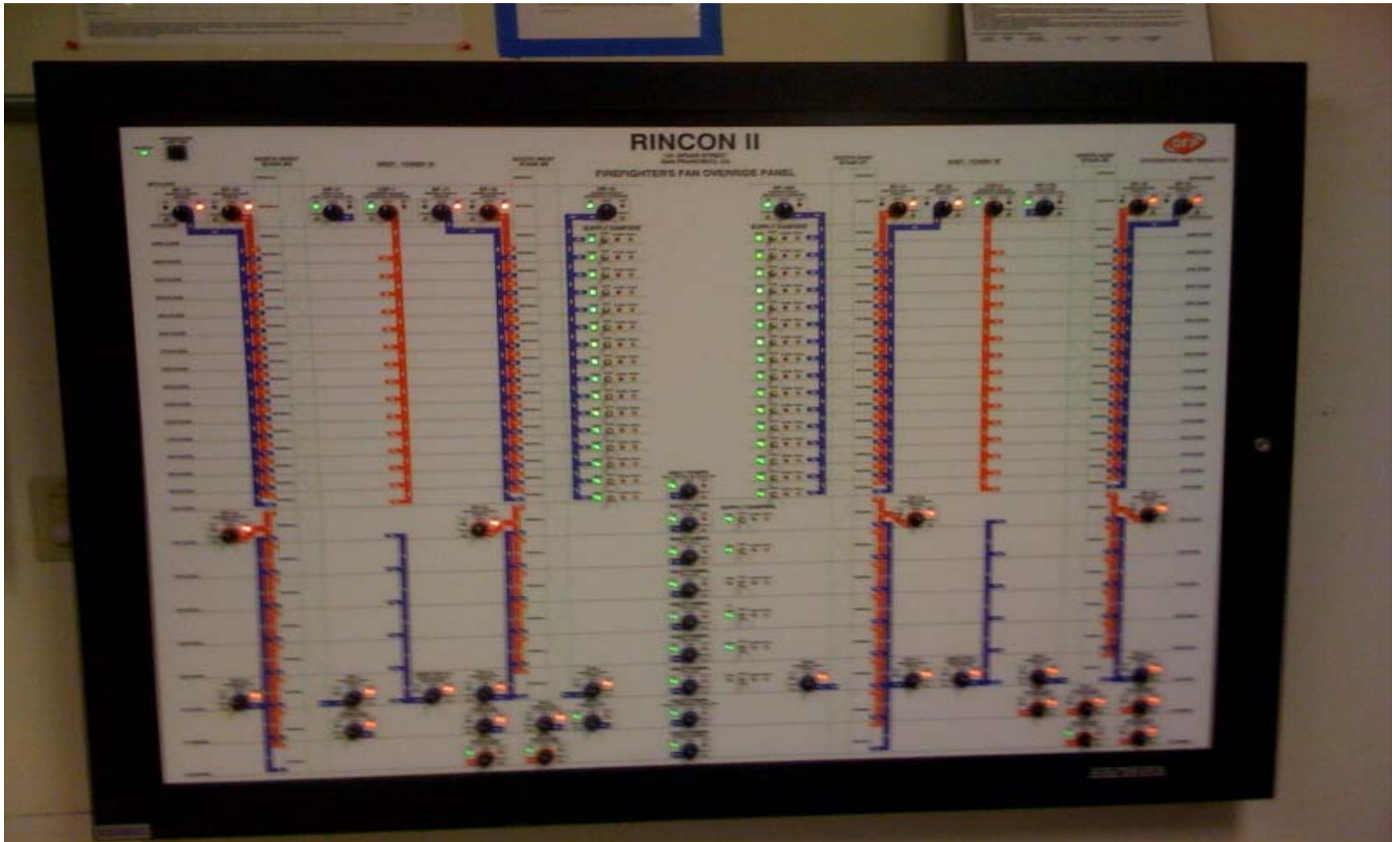
LED Annunciator



LED Annunciator



Firefighter Fan control panel



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High-Rise FA Requirements

- **Manual pull stations (MPS):**
 - In buildings protected throughout by sprinklers, only one MPS is required adjacent the FACP in the FCC room (Occupancies A, B, E, R, M)
 - This single MPS shall generate total building evacuation (general alarm)
 - If High-Rise buildings are provided with MPS at all floors, these MPS shall generate building evacuation in accordance with the building evacuation plan (Total, partial, relocation)

High-Rise FA Requirements

- **Smoke Detectors:**
- Smoke detectors shall be located at:
 - Each mechanical, electrical, telephone or similar room which is not provided with sprinkler protection (CBC Section 907.2.12.1). Beams in these rooms require many detectors, per NFPA 72 requirements
 - In diesel fire pump rooms, if detectors are provided, they shall be heat detectors type.
 - Elevator lobbies, machine rooms, and hoistways for elevator recall to primary and alternate floors.
 - Air conditioners over 2000 cfm on supply side. Duct smoke detectors associated with AHUs and FSDs may be provided.
 - All vertical HVAC risers serving more than two stories

Elevator Fire Service Operations

ASME A17.1-2004

- **PHASE I**: Recall of the Elevator by Fire Detectors or Fire Recall Key Switch at Designated Level (Automatic or Manual)
- **PHASE II: In-car operation** of the Elevator by Firefighters (Manual only)
- CFC Section 607.1 Requires Phase I and II operation for **ALL** new elevators (regardless travel distance).
- Existing elevators with a travel distance of 25 feet or more, are required to be provided with Phase I and II operation.

Phase I and II: Emergency Operation

ASME A17.1-2004

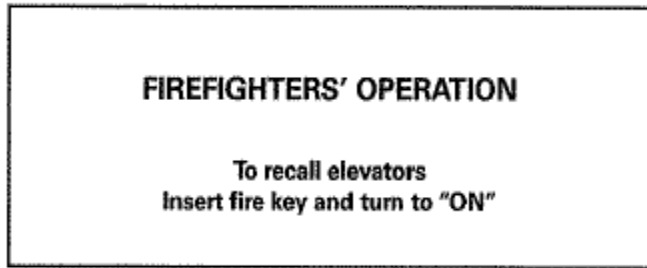


Fig. 2.27.7.1 Phase I Emergency Recall Operation Instructions

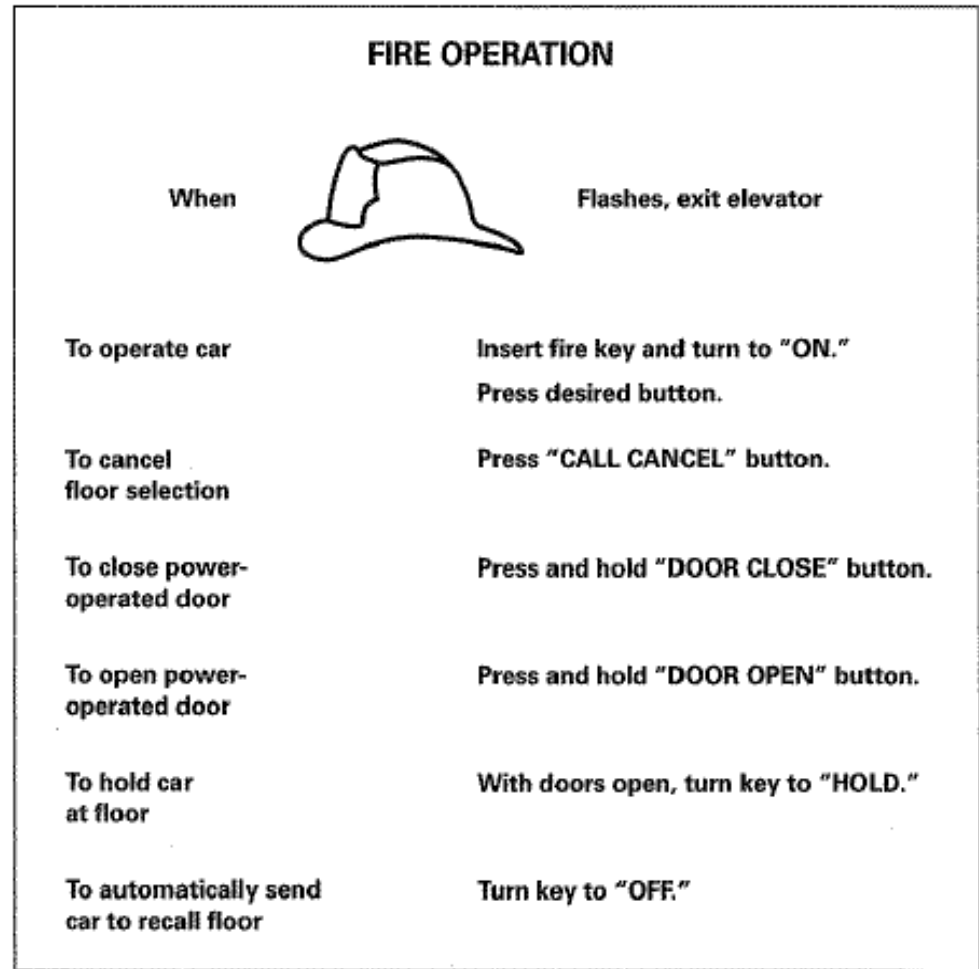


Fig. 2.27.7.2 Phase II Emergency In-Car Operation

Elevator Shunt Trip Requirements Per CBC and CFC, 2007 Edition

- CFC Section 607.4 (CBC 3006.5): For elevator machine rooms or hoistways containing elevator control equipment and provided with sprinklers, a shunt trip (not self-resetting) is required to automatically disconnect the main line power supply to the affected elevator prior the application of water (per NFPA 72 Section 6.16.4)
- CFC Section 607.4.1 (CBC 3006.5.1): Elevator power shunt trip shall not activate **prior to the completion** of Elevator phase I emergency recall to the recall floor.

Elevator Shunt Trip Cont.

- CFC Section 607.4.2 (CBC 3006.5.2): Elevator power shunt trip capability shall be disabled **during** Phase II emergency in-car operation.
- CFC Section 607.4.3 (CBC 3006.5.3): Audible and visual annunciation shall be provided at the FACP indicating the disabling of elevator power shunt trip capability under Phase II operation.
- CFC Section 607.4.4 (CBC 3006.5.4): Audible and Visual annunciation shall be provided at the FACP indicating that the sprinklers, smoke or heat detectors in the elevator hoistway or machine room have activated.

Elevator shunt trip Cont.

- CFC Section 607.4.5 (CBC 3006.5.5):
Visual annunciation shall be provided **inside all elevator cars** indicating that sprinklers, smoke or heat detectors in the elevator hoistway or machine room have activated.

Questions?

Contact Information :

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