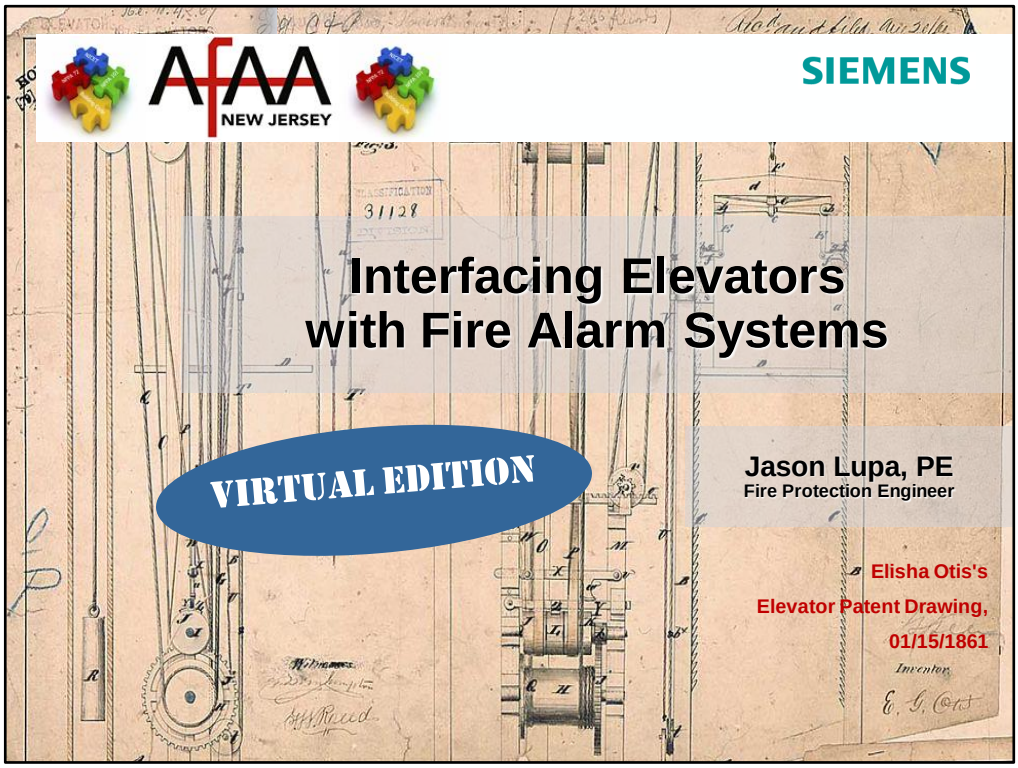

One hundred and sixty years ago, Elisha Otis invented the first braking mechanism for the elevator, which made vertical travel within a building feasible and safe. Since its introduction, the elevator has seen numerous advancements, but its purpose remains the same: moving people! This seminar is an overview of elevator fire alarm system interfacing fundamentals and the current life safety requirements. We will cover the necessary information to ensure elevator control functions are properly interfaced with the building fire alarm system. Topics to be discussed include: history, terminology, coordination of the International Building Code, International Fire Code, NFPA 72, and ASME A17.1; where initiating devices should be placed involving elevator equipment and proper signals generated at the fire alarm control panel. There is a specific focus on sequence of operations, cab recall, power shunt-trip, firefighter communication, and fire sprinkler interfacing.

Presentation by:

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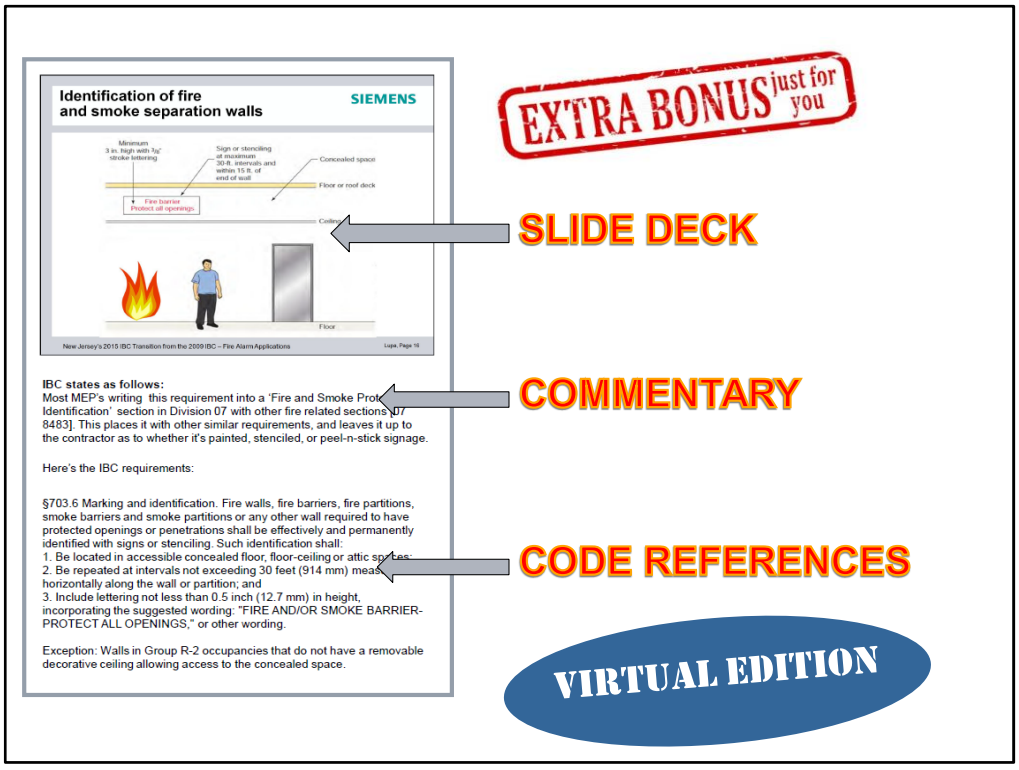
Icebreaker - I do other things which don't involve fire



For your convince, I have all of today's material available for future reference. This includes both the slidedeck along with supporting research notes which contain more detailed code references.

Interfacing Elevators with Fire Alarm Systems

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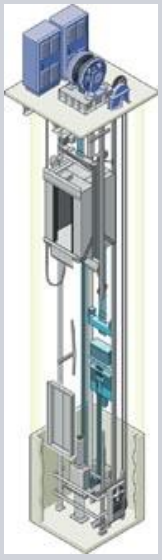

Objectives

1. Understand key elevator system components
2. Identify codes, standards & best practices associated with elevator fire alarm integration
3. Review common design applications
4. Discuss equipment placement & elevator interfacing applications common in today's construction of:
   - IBC 2018 edition
   - NFPA 72 2016 edition
   - NFPA 13 2016 edition
   - ASME A17.1 2016

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Course Synopsis

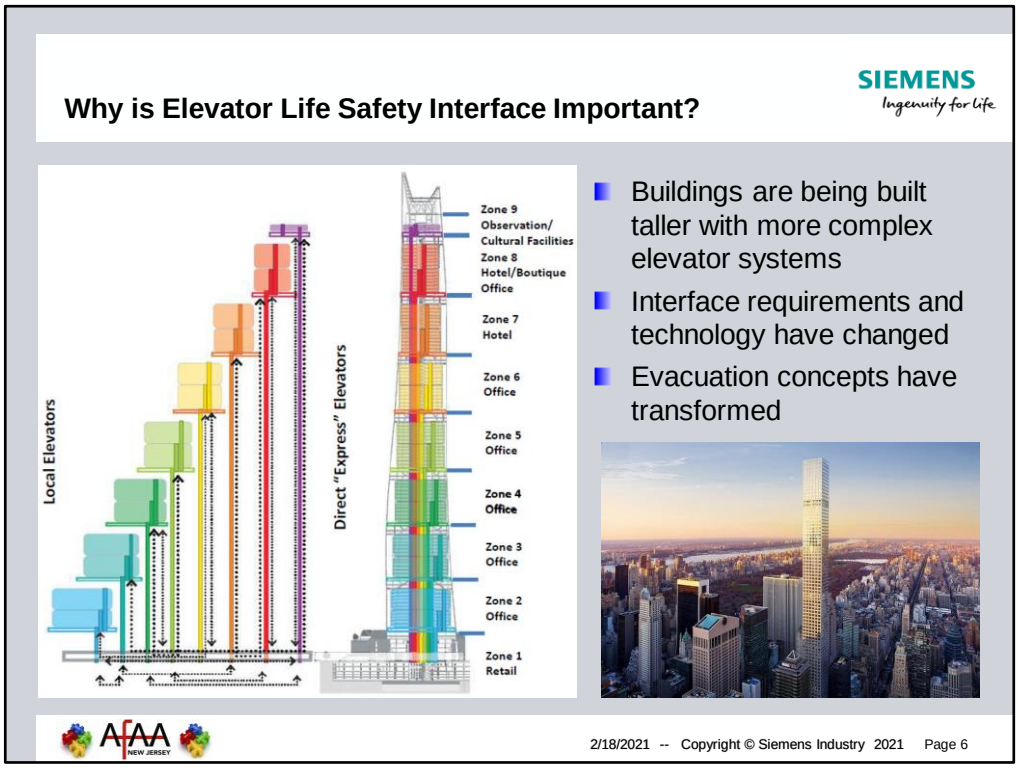
The 60 minute presentation discusses the interface between fire alarm and sprinkler systems for different type passenger elevator systems such as: hydraulic, traction, machine-room-less (MRL) elevators. It includes an applicational review of IBC-2018; ASME A17.1; NFPA 72 (2016) and NFPA 13 (2016) requirements associated with elevator life safety design. Key items include detector and fire alarm relay placement. (Learn and clarify elevator-fire code related terms such as Designated and Alternate Recall Levels, Phase I Emergency recall operation (Manual and automatic), phase II In-Car Emergency Operations by firefighters, Firefighters' flashing hat symbol, shunt-trip function Fire Service Access and Occupant Evacuation Elevators..

Presentation Material

The material will be presented in a PowerPoint format and available digitally/ paper afterwards. The information in this guide has been provided in an attempt to assist in making this decision and should in no way be construed as a formal approval or certification.

Presenter Background

Jason Lupa, P.E. is a Business Development Engineer for Siemens Industry and a licensed Fire Protection Engineer with a B.S. degree in Fire Protection from the University of Maryland and holds several safety certificates. He has 25 years of extensive experience in Fire Protection Engineering: project management, code consulting, fire protection system design, code enforcement, construction documentation and training. Jason has been an active firefighter for 30 years.



Safe operation of elevators has always been part of the building codes. But current construction designs yield taller buildings with increasing complex elevator systems. Both technology and codes have evolved to provide safer and more efficient installations – including the integration of various building systems. This includes new evacuation concepts for super tall skyscapers.

Elevators in modern towers are designed to move 12.5 percent of a building's occupants within five minutes. That means a building can be completely evacuated within 40 minutes if the elevators are used.

Codes & Standards

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Most building codes dictate the level of fire safety based on the occupancy of building.

Elevator life safety designs do not account for the type of building or its usage. Rather the fire sprinklers and alarm requirements are driven by the elevator equipment and the design engineer's intent.

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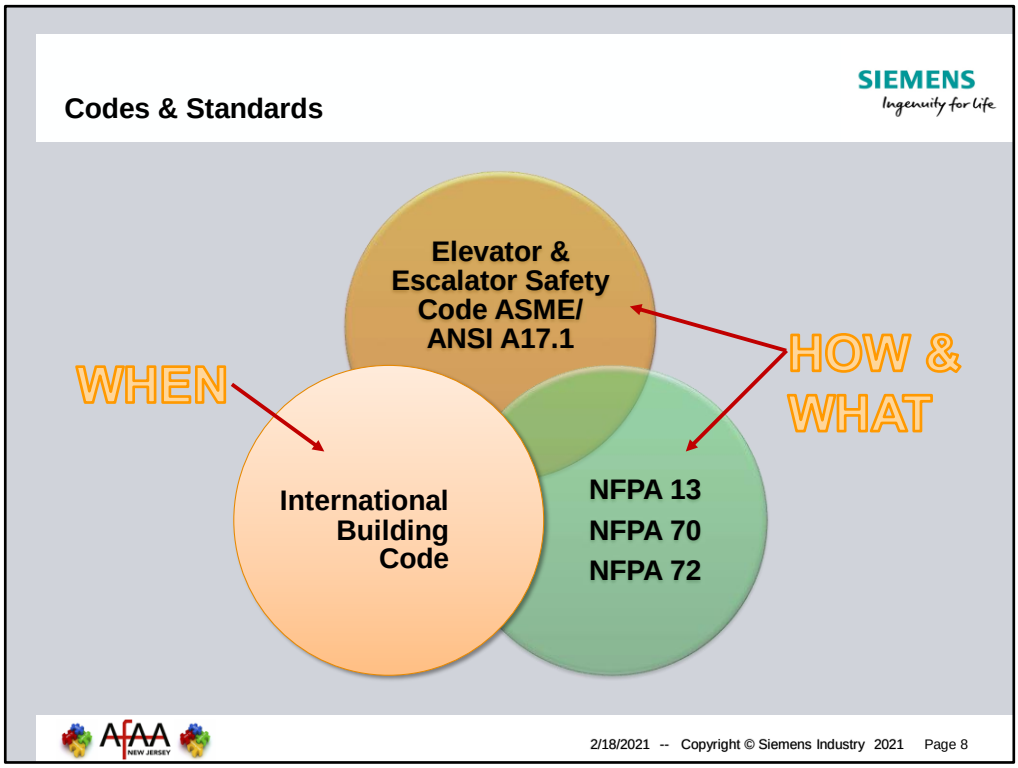
Most building codes dictate the level of fire safety based on the occupancy of building. For instance, minimum code requirements for a I-occupancy hospital dictates smoke detection in the patient corridors while an office building would not. Fire sprinklers are required throughout for both projects. Elevator life safety designs do not account for the type of building or its usage. Rather the fire sprinklers and alarm requirements are driven by the elevator equipment and the design engineer's intent.



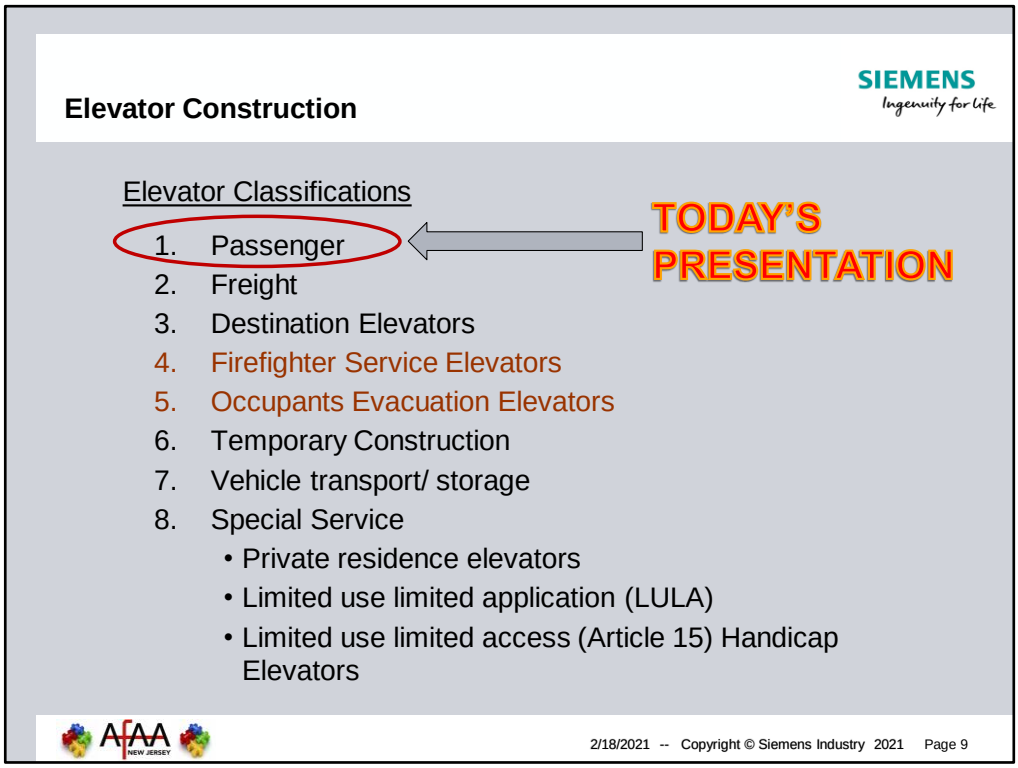
Like other systems within a building, elevators are regulated by the building code. In the International Building Code (IBC)1, Chapter 30 establishes the primary criteria for elevators, while other sections of the IBC supplement the primary criteria with special provisions, such as requirements for accessible means of egress, elevator lobbies, and shaft enclosures for hoistways. In addition to the provisions in the IBC, elevators must also comply with the requirements in the American Society of Mechanical Engineers' (ASME) A17.1, Safety Code for Elevators and Escalators2, and ICC/ANSI A117.1, Accessible and Usable Buildings and Facilities3, which are referenced by the IBC

Enabling Codes:

- IBC, Chapter 30, International Fire Code (IFC) or NFPA 101
- local building codes

Supporting Codes/Standards:

- ASME A17.1 – National Elevator Code
- ASME A17.2 – Inspection of Elevators
- ASME A17.3 – Existing Elevators
- NFPA 72, *National Fire Alarm and Signaling Code*
- NFPA 13, *Standard for the Installation of Sprinkler Systems*
- NFPA 70, *National Electrical Code*



There are many classifications of elevators, today we will discuss only passenger elevators. These systems are typical for 95% of the projects which have elevator installations. I also have a separate presentation dedicated Firefighter Service Elevators

and Occupants Evacuation Elevators.

Fire Service Access Elevator
IBC 2009, Section 403.6.1 added a new requirement to provide at least one fire service access elevator in buildings with an occupied floor more than 120 feet above the lowest level of fire department vehicle access. The intention of the requirement is to provide a reasonably safe means to access a staging area near the fire for firefighting operations.

Specific requirements for the elevator, including the requirement for the elevator to open into a rated elevator lobby and have direct access to an exit enclosure through the lobby, are provided in Section 3007.

Occupant Evacuation Elevators
IBC 2009, Section 403.6.2 now permits passenger elevators, installed in accordance to Section 3008, to be used for occupant self-evacuation in high-rise buildings. Section 3008 provides specific requirements for occupant evacuation elevators including special provisions for the elevator lobby and signage.

While the use of occupant evacuation elevators is not mandated, they may be voluntarily installed to provide an additional means of egress for occupants in high-rise buildings, and to be exempt from the requirement to provide an additional exit stairway as required by Section 403.5.2.

Limited Use / Limited Application Elevators

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Limited Use / Limited Application (LULA) elevators are a special light-duty classification for elevators which have a smaller capacity and a maximum travel distance of 25 feet. These light-duty commercial elevators are common in churches, schools, libraries, and back-of-house staff areas.

While LULA elevator may have the ability provide traditional elevator life safety functions, ASME A17.1 does not require them to provide functions such as recall or shunt trip.



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Commercial Limited Use/Limited Access (LULA) elevators have become a popular option to accommodate disabled persons in office buildings, universities, and back-of-house support areas. Today there is a growing awareness of the need for accessibility in private areas. Legislation such as the Americans with Disabilities Act emphasizes the need for churches, lodges, and clubs to provide accessibility to members and visitors. Limited Use Limited Application Elevator (LULA) is the product of years of experience and research and is designed to meet the needs of your church, lodge or club. However, the LULA elevator does NOT meet the requirements of the American with Disabilities Act (ADA).

- ASME A17.1, 2016 edition, section 5.2.1.27 provides an exemption of Phase 1 and Phase 2 emergency operations for Limited Use / Limited Application (LULA) elevators.
- A LULA elevator is usually much smaller than a commercial elevator, as its sole purpose is to lift up persons who are disabled or could not otherwise use a staircase.
- LULA elevators typically only have 18 square feet of cabin space (as opposed to a typical elevator with 22 square feet), with a weight capacity of a mere 1400 lbs (compared to 2200-2500 weight limits found in most commercial elevators). These are smaller elevators designed only for use by one or two persons with disabilities along with wheelchairs, crutches, walkers, etc.

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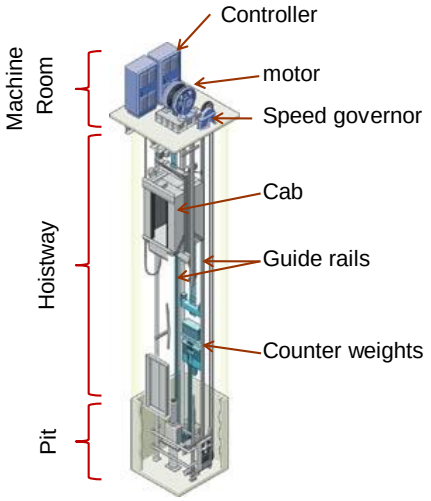
Elevator Construction: Traction



Traction systems use cables or direct drive gears to move the cab. This type can be used in buildings of any height, and are the most common type of elevators.

- Powered by an AC or DC motor
- Motor turns one way, elevator moves up. Motor turns the other way, elevator moves down
- The ropes are connected to a counterweight (40-50% capacity plus weight of the cab)
- Cab movement can be by geared, gearless, or drum drives

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Traction elevators use a counterweight to offset the weight of the cab and occupants. With this design, the motor doesn't have to move as much weight, making it much more energy efficient than hydraulic systems. Traction elevators are the most common type of elevator.

Geared Elevators

In geared elevators, there is a gearbox attached to the motor that drives the wheel and moves the ropes. Geared machines can reach speeds up to 500 ft./min. These models will have a middle-of-the-road cost in terms of initial investment, maintenance costs and energy consumption.

Gearless Elevators

In gearless traction elevators, the sheave is attached directly to the end of the motor. These models can reach speeds up to 2,000 ft./min. These models have a high initial cost investment and average maintenance costs. They are, however, more energy efficient than geared traction elevators.

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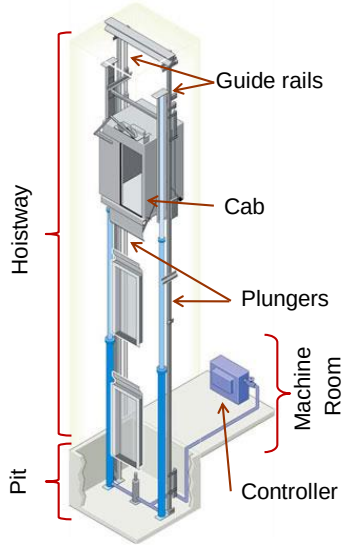
Elevator Construction: Hydraulic



Hydraulic type systems utilize fluid to move a piston, which pushes the cab. They are intended for low-rise applications and becoming less popular for new construction.

- Hydraulic fluid is flammable
- Tend to require more support space than traction elevators
- Machine room is typically at the bottom, adjacent to the hoistway
- Cab movement can be by holed, holess, telescopic or roped drives.

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Hydraulic elevators are becoming less popular for new construction and have a travel distance of 2 to 5 floors. Unlike traction systems, hydraulic elevators don't use overhead hoisting machinery. Instead, these elevators lift a cab by using a fluid-driven piston that is mounted inside of a cylinder. The necessary fluid has traditionally been oil-based but can be replaced with vegetable oil to decrease the environmental impact.

Another reason for their height limitations is that it takes a lot of energy to raise an elevator cab several stories. To reach high floors with a hydraulic elevator, you would need a longer cylinder and piston.

There are two different types of hydraulic elevators:

1. Holed type of hydraulic elevator has the hydraulic cylinders placed inside of a drilled hole and allows up to 60' of travel.

2. Holeless hydraulic elevators don't require a drilled hole, making this type of elevator ideal for existing buildings or in areas where drilling would be too difficult or expensive. Hole-less elevators shouldn't be installed anywhere that requires more than 40' of travel.

Elevator Components: Traveling Cables

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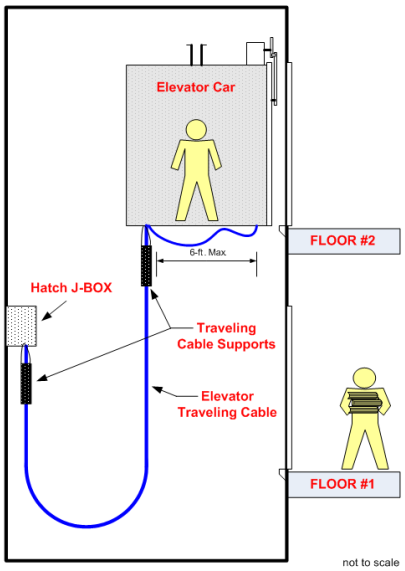
Traveling cables are flexible connections for cab power & communication circuits

These specialized circuits are provided and installed by the elevator contractor.

It is important to coordinate any required fire alarm circuits, such as a cab speaker, or a firefighter telephone jack.



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Regardless if it's traction or hydraulic, the elevator's car needs power and communication circuits. Since the car moves, a long travel cable must be provided by the elevator company. This cable may originate at the top, middle, or bottom of the elevator hoistway.

- Car (elevator) - The load-carrying unit, including its platform, frame, enclosure, and car door or gate.
- Car Counterweight - A set of weights roped directly to the elevator car of a winding-drum type installation. In practice, this weight is equal to approximately 70 percent of the car weight.
- Car Operating Panel - A panel mounted in the car containing the car operating controls, such as call register buttons, door open and close, alarm, emergency stop and whatever other buttons or key switches are required for operating.
- Car Operating Station - A panel mounted in the car containing the car operating controls, such as call register buttons, door open and close, alarm emergency stop and whatever other buttons or key switches are required for operation.
- Compensating Chain - A welded-link chain used for hoist rope weight compensation. One end of the chain is attached to the underside of the elevator car, and the other end is fastened to the counterweight or stationary fastening in the hoistway.
- Compounding Sheave - A pulley located on the car, and on the counterweight, under which the hoist cables run to double the capacity and reduce the speed of an elevator.

Elevator Components: Controls

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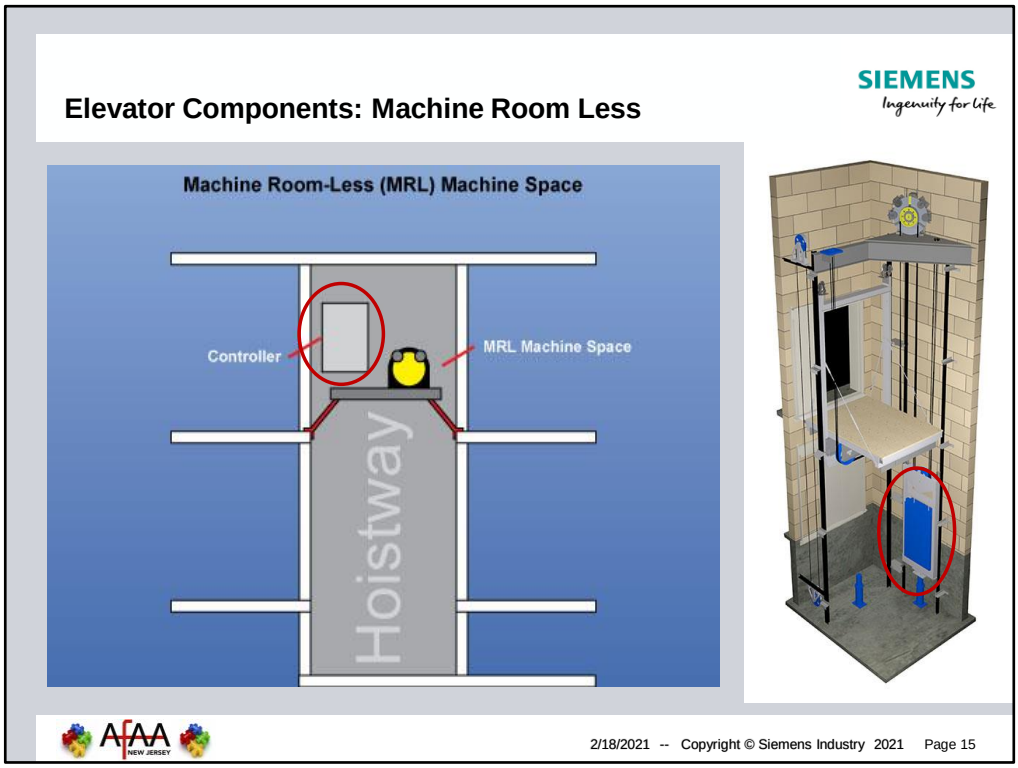
Elevator Machine/Equipment Room: This room will house all of the actual elevator equipment, machines, motors, and controls.

Elevator Control Room/ Closet: This is a smaller room that houses just the controls for the elevators. This room will not contain the actual motors or machinery for the cars themselves. The machinery and equipment will be located within the elevator shaft. This design has become more popular known as Machine-Room-Less (MRL) systems.

The Machine room is an area set aside for the elevator equipment and consists of the Controller, electrical disconnects and the pump unit, for hydraulic applications.



Machine room less elevators do not have a fixed machine room on the top of the hoistway, instead the traction hoisting machine is installed either on the top side wall of the hoistway or on the bottom of the hoistway. The motor is installed using a permanent magnet which "sticks" the motor permanently and work with Variable Voltage Variable Frequency (VVVF) drive. Some of the hoisting machines are using gearless synchronous motors instead conventional induction motors. This design eliminates the need of a fixed machine room and thus saves much building's space. All traction MRL elevators are gearless traction.

While the hoisting motor is installed on the hoistway side wall, the main controller is installed on the top floor next to the landing doors. This controller is situated behind a locked cabinet which have to be unlocked using a key for maintenance, repair or emergency purposes. Most elevators have their controller installed on the top floor but fewer elevators have their controller installed on the bottom-most floor. Some elevators may have the hoisting motor located on the bottom of the elevator shaft put, thus it is called as "bottom drive MRL" elevator. More recent installations have the controller cabinet installed within the door frame instead on the wall to save space.

Elevator Components: Hoistways

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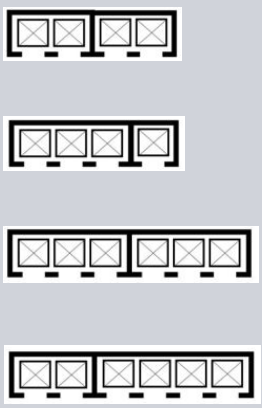
Built as 'shafts' using rated construction.

- Multiple cars permitted in same hoistway
- 1 hr. for < 4 stories (2 hr. for 4 or more) Maximum of 4 cars per hoistway when serve the same building area (IBC 3002.2)
- Elevators shall not be in a common enclosure with a stairway (IBC 3002.7)
- No plumbing or mechanical systems (IBC 3002.9). Only electrical power, controls and fire alarm circuits serving the elevator are permitted



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With a couple of exceptions, neither the IBC nor ASME A17.1 dictate the number of elevators that must be provided in a building—any number of elevators may be provided at the discretion of the building owner. The owner or architect may hire an elevator consultant to determine the elevator needs for buildings with high traffic or complex usage requirements.

As stated, there are a couple of exceptions in which the code regulates the number of elevator cars. The first exception is in Section 1007.2.1, which requires at least one elevator be provided as one of the required accessible means of egress if an accessible story is located four or more stories above or below the level of exit discharge. However, the elevator is not required if the building is sprinklered throughout per Section 903.3.1.1 (NFPA 13) or Section 903.3.1.2 (NFPA 13R), and includes either a ramp from the stories, or the stories incorporate a horizontal exit at or above the level of exit discharge. The second exception is in Section 403.6, which requires at least two elevators be designated as fire service access elevators in buildings with occupied floors greater than 120 feet above the lowest level of fire department vehicle access.

If multiple elevators are provided in a building, the IBC requires that the number of cars within a single hoistway enclosure be limited to no more than four. However, if four or more elevator cars serve all or the same stories, then the elevators must be located in a minimum of two hoistway enclosures. Thus, if four elevator cars are provided, then they must be located in two hoistways in a 2-2 or 1-3 combination (See A and B in Figure 1). If six elevator cars and two hoistways are provided, then the only combinations permitted would be 3-3 or 2-4 (See C and D in Figure 1)—a 1-5 combination would not be permitted, since no more than four cars are allowed in a single hoistway.

Elevator Life Safety Functions

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Elevators are required to automatically or manually recall their cabs to a designated level when there is a threat of fire. This is to prevent the possibility of the public being delivered to a floor which is on fire and also makes the cabs readily available to 1st responders. The cab will proceed immediately to a lower level, open its doors and lock the controls.

The Firefighter Emergency Operations (FEO) cab recall sequence involves two different phases.

PHASE I	**Automatic or Manual**
PHASE II	**Manual only**

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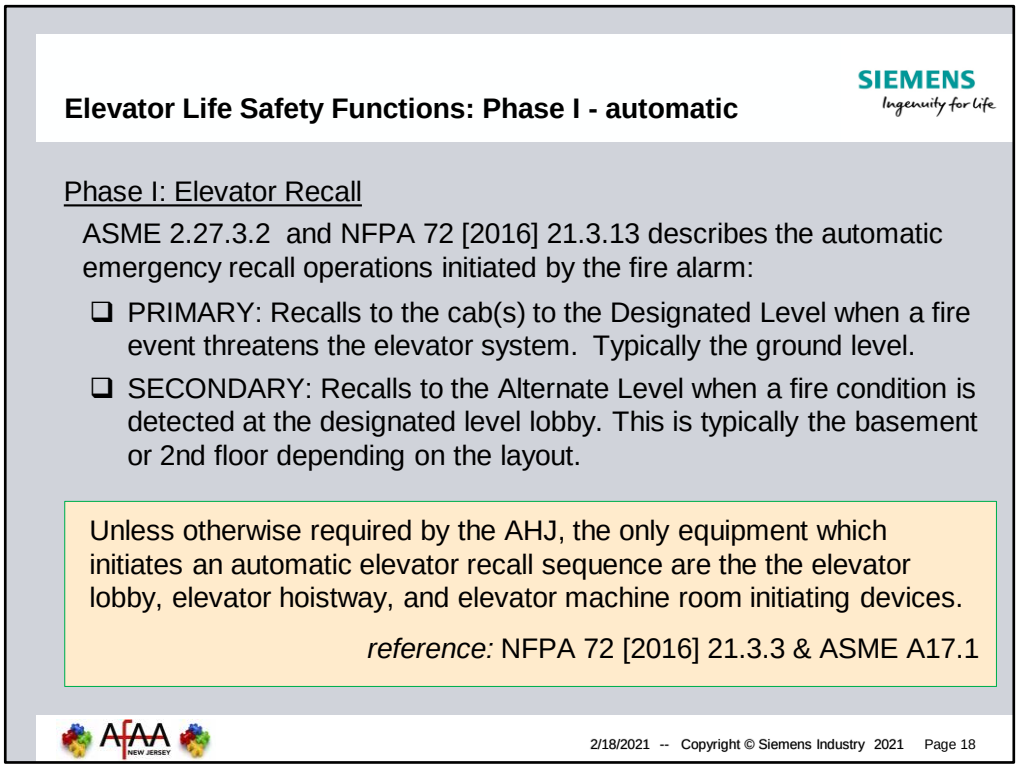
The primary purpose of the recall sequence of operations is to return the cars to the ground level if a fire is close to the elevator system. This takes them out of service so they are not used by the building occupants. It also allows the first responders to commander them for the emergency response.



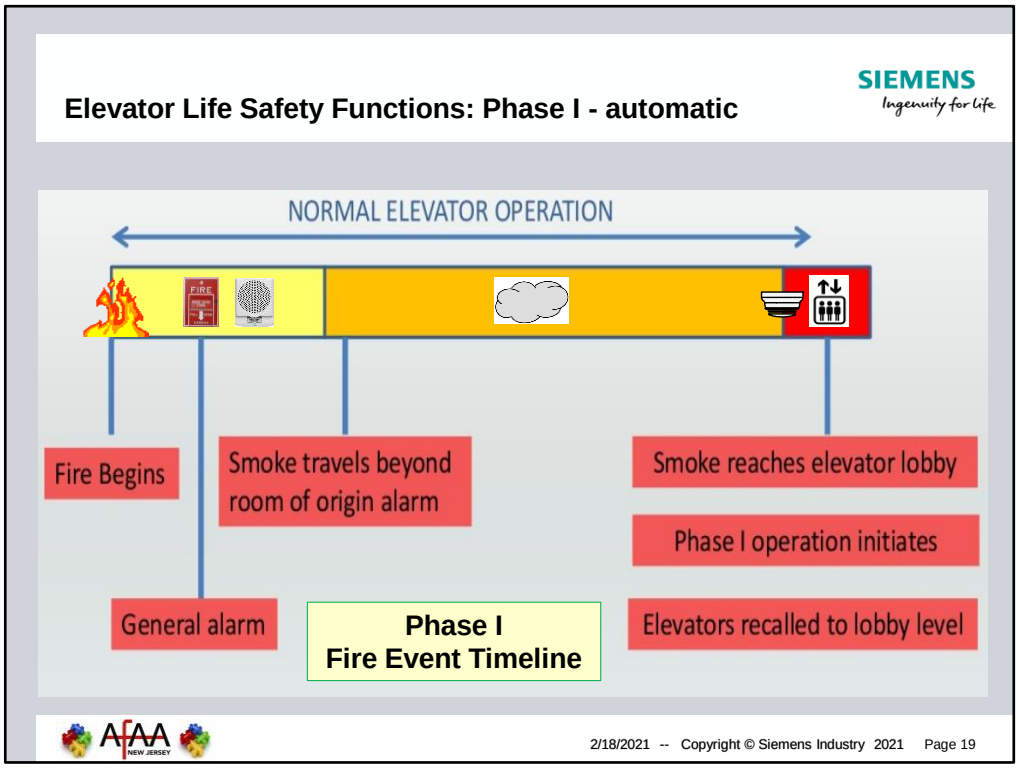
The Firefighter Emergency Operations (FEO) involves several phases of action, but essentially, it removes control and accessibility of the elevator cabs from the public and gives it to the firefighters. By giving firefighters total control of a facility's elevators, they have an additional tool to fight the fire. In a high rise situation, this tool is critically important. A second, equally important result is the consideration for public safety. By removing public access to elevators, the possibility of injury or death due to getting trapped in a non-operational cab or actually being delivered to the involved floor is removed.

Operation of elevator on Phase I Recall is covered by ASME A17.1, Rule 2.27:

- Recalls to the Designated Level when a fire condition is detected in the hoistway, elevator machine room, or respective lobbies
- Recalls to the Alternate Level when a fire condition is detected at the designated level lobby

Only the automatic detectors located in elevator lobbies, hoistway and machine rooms are permitted to initiate the recalling of elevators. In no case should an elevator be recalled by a manual pull station or by detectors located in other areas of the building unless mandated by AHJ.

All initiating devices used to initiate firefighters' service recall must be connected to the building fire alarm system. Locally powered smoke detectors and stand alone heat detectors are not permitted to be used.



Phase I automatic operation is activated by a Fire Alarm Initiating Device (FAID) NFPA 72 2.27.3.2. For example, a fire breaks out on the 6th story of a office building. An employee runs into the hallway and activates the manual pull station. The horns and strobes sound, the fire grows and smoke spills out into the hallway. Once the smoke reaches the elevator lobby, the detector initiates the elevator controller's Phase I operations and the car is recalled to the lobby level. Notice the elevator is operational until the threat of fire is near the elevator equipment. The goal is to automatically remove the elevators from service only when they are in danger.

2.27.3.2 Phase I Emergency Recall Operation by Fire Alarm Initiating Devices (FAIDs)

2.27.3.2.1 smoke detectors or other automatic fire detectors in environments not suitable for smoke detectors (fire alarm initiating devices) used to initiate Phase I Emergency Recall Operation shall be installed in conformance with the requirements of NFPA 72,and shall be Located

a) at each elevator lobby served by the elevator
b) in the associated elevator machine room, machinery space containing a motor controller or control room
c) in the elevator hoistway, when sprinklers are located in the top of shaft

- 1st Floor Elevator Lobby Smoke Detector (activates alternate level recall sending the elevator to the second floor) NFPA 72 2013 21.3.14.2
- 2nd Floor Elevator Lobby Smoke Detector (activates designated level recall sending the elevator to the first floor) NFPA 72 2013 21.3.14.1
- Elevator equipment room Smoke (if its on the designated recall level, it should send the elevator to the alternate recall level, if the room is on the alternate recall level, the smoke should send the elevator to the designated recall level)

Elevator Life Safety Functions: Phase I - manual

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Phase I: Elevator Recall

Firefighters can also manually initiate Phase I Recall from the 3-position key switch in the main lobby (primary floor). Keys are must be accessible.

If the building has a Fire Command Center, the elevator annunciator panel will also have a Phase I manual key switch.

Another means of activating Phase I is manually using a special key; typically found in the main elevator lobby, behind break glass. It's a good thing firefighters carry axes! Manual recall functions the same as automatic, but it is activated by a person that keys a switch which initiates the recall function. The key switch is usually located in the elevator lobby on the Primary level. If the facility has a Fire Command Center, a manual recall switch is also located on the elevator annunciator panel. Firefighters arriving at a facility may need to use the elevator before Phase I is automatically activated by a smoke detector. By using the key switch, firefighters can initiate Phase 1 manually. As long as the switch is in the 'On" position, the cabs will remain in Phase 1 operation.

Labeled "FIRE RECALL" and its positions marked "RESET," "OFF," and "ON" (in that order), with the "OFF" position as the center position.

Per ASME 17.1 Chapter 2.27.3.1.1, if not co-located, each elevator car would have its own Phase I switch.

Chapter 2.27.3 Firefighters' Emergency Operation shall apply to all automatic elevators except where the hoistway or a portion thereof is not required to be fire-resistive construction (see 2.1.1.1), the rise does not exceed 80 in., and the hoistway does not penetrate a floor.

When is Phase I required?

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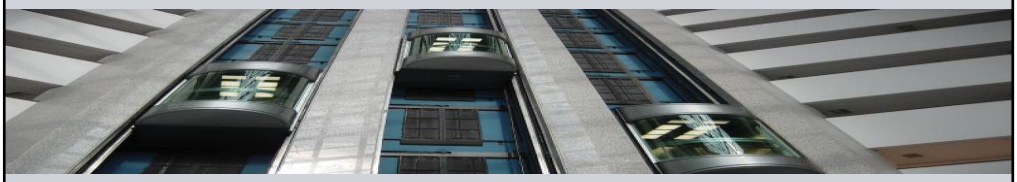
Older elevator controllers may not have been required to provide Phase I operations

In 1973 ASME 17.1 established a distance a cab had to travel of 25’ before Phase I was required.

In 1992 ASME 17.1 revised the a distance a cab had to travel to over 80” before Phase I was required.



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1981 code editions introduced the “Alternate” Level.

NFPA first mentions A17.1 requirements in 1987 edition of NFPA 72A, Installation, Maintenance and use of Local Protective Signaling Systems – “Elevator Recall for Firefighters’ Service”

A17.1b, 1992 Supplement drops the 25 ft. criterion now applies to all automatic elevators regardless of travel distance

Per ASME A17.1 section 2.27.3, Firefighter emergency operations (FEO) are required in all automatic passenger elevators with a rise of over 80″.

Elevator Life Safety Functions: Phase II - manual

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Phase II: Manual Override Cab Controls

This manual override is initiated by firefighters using a dedicated elevator key switch. Under Phase II operation, they can seize control of the cab controls and bypass the Phase I functions. Cab operations are similar to Freight Elevators.

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The same key used to manually initiate Phase I recall can be used to initiate Phase II. Phase II is also manually activated from inside the cab with a key switch. Once a firefighter is in the cab, the key overrides the Phase I's controls lockout. Once activated, many of the elevator's safeties are overridden and he can manually operate the cab by pressing and holding the cab command buttons. To close the doors, he must press and hold the 'Door Close' button until the doors are closed. If he releases the button before the doors close, the doors will open again. Once the doors are closed, he selects the desired floor and the cab will take him to that level. Upon arrival, he must press and hold the 'Door Open' button. Again, if he releases the button before the doors are fully open, they will close again.

The "FIRE OPERATION" panel will be located at the top of the main car operating panel, behind a locked cover. The same key that operates Phase I-Fire Recall and Phase II-Emergency In-Car Operation will be used to open the locked cover to that panel. (ASME A17.1-2.27.8). called the "Firefighter's Emergency Operation—Key 1" (FEO-K1). Elevators installed prior to the 2006 code may have different keys for Phase I and Phase II.

Elevator Life Safety Functions: Firefighter Hat

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The firefighter hat light warns First Responders if the elevator safety has been compromised.

Firefighter Hat Light Operations

1. Off – normal operations
2. SOLID - elevator lobby smoke detector activation
3. FLASHES – hoistway or elevator machine room smoke detector activation

Firefighters may still choose to utilize Phase II override controls!

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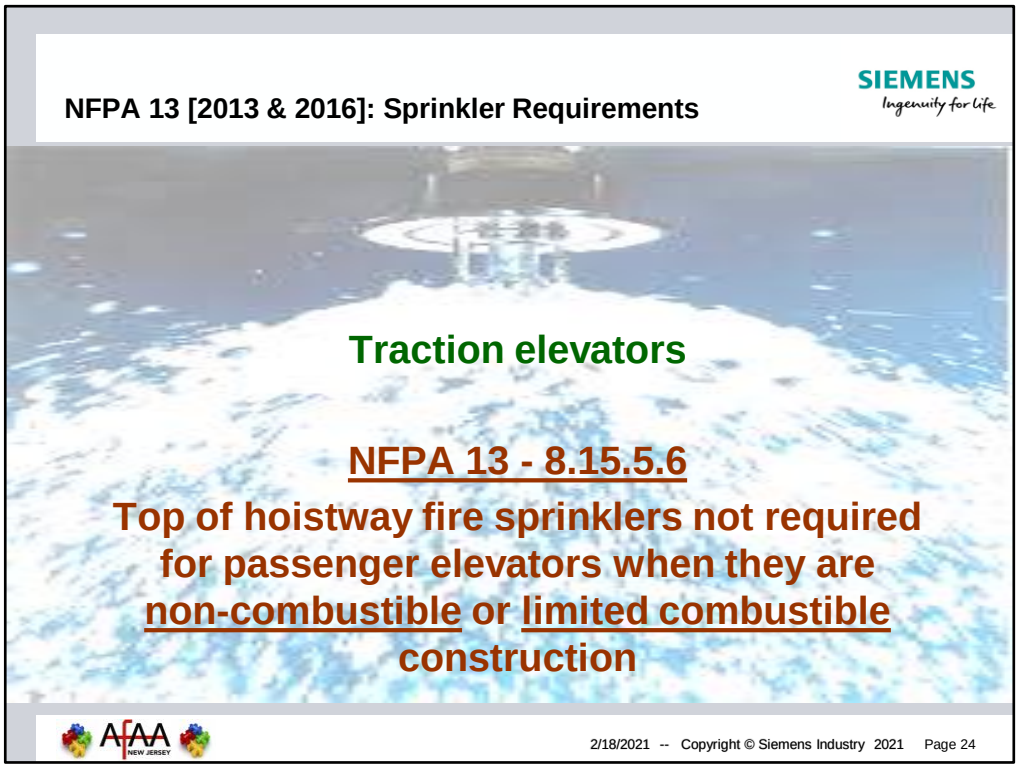
Elevators provide the third most common means of transport for firefighters, after apparatus and stairs. You have probably seen it, a small light located at the elevator controls depicting the side profile of a fireman's hat. The Fireman's hat will illuminate steady when the elevator car is placed in Phase I recall. This advises the first responders that the car is returning to the ground floor. It will illuminate intermittently when a fire has been detected in the hoistway or in the elevator equipment room. This warns firefighters that there is a fire is encroaching upon a critical area and the elevator has become unsafe to use. This helps prevent firefighters from becoming trapped between floors by an elevator power shunt trip. Firefighters may still choose to utilize Phase II override controls and manually move the the elevator care—even with a flashing light. We'll learn in a minute why it can be deadly to ignore this critical warning light. History is full of incidents where firefighters have been seriously injured or killed while using elevators

during a fire event. See the Regis Tower Fire, Memphis, Tennessee (April 11, 1994)

The Fireman's hat will extinguish when the associated elevator car is put back into normal operation.

- The elevator vendor supplies, powers and controls the firefighter hat.
- The elevator controller activates a solid light with any recall activity.
- The fire alarm vendor must provide a separate form C relay to the elevator controller to signal a flashing hat sequence.
- Generally, the elevator contractor will make the connection between the elevator controller and the fire alarm relay.

Additional requirements for annunciation in Command Room (where provided) for FSAE and OEE

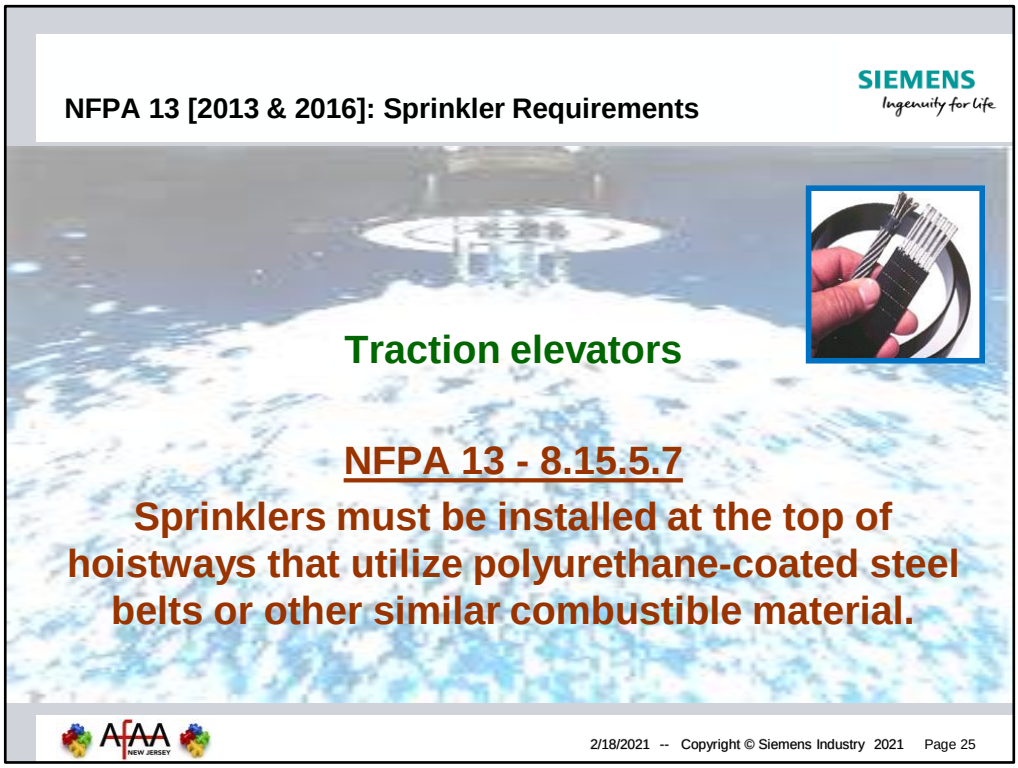


NFPA 13, 2013 & 16 Editions

8.15.5.5 Upright, pendant, or sidewall spray sprinklers shall be installed at the top of elevator hoistways.

8.15.5.6 The sprinklers required at the top of the elevator hoistway by 8.15.5.5 shall not be required where the hoistway for passenger elevators is non-combustible or limited combustible and the car enclosure materials meet the requirements of ASME A17.1, Safety Code for Elevators and Escalators.

IBC 703.4. Combustible or non-combustible construction can be summarized this way: If a wall or ceiling assembly contains only materials considered non-combustible such as drywall over steel studs or steel joists, the assembly is considered non-combustible. If any part of the assembly is combustible, such as drywall over wood studs or wood joists, the assembly is considered combustible.

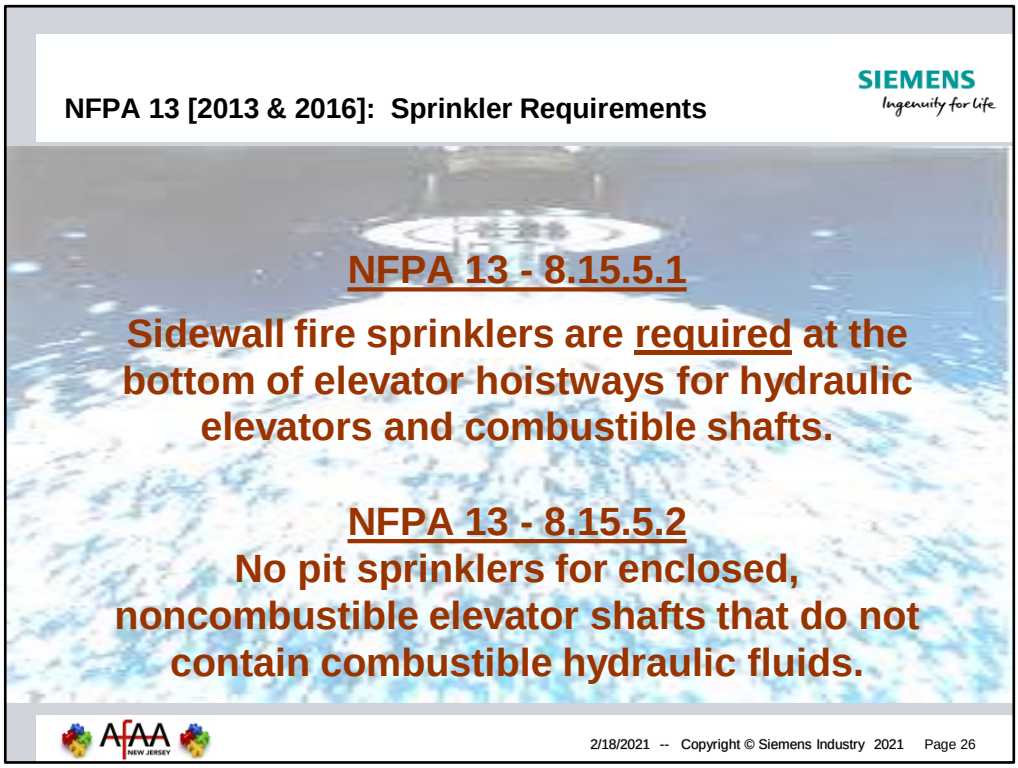


8.15.5.7 Combustible Suspension in Elevators

8.15.5.7.1 Sprinklers shall be installed at the top and bottom of elevator hoistways where elevators utilize combustible suspension means such as noncircular elastomeric-coated or polyurethanecoated steel belts.

8.15.5.7.2 The sprinklers in the elevator hoistway shall not be required when the suspension means provide not less than an FT-1 rating when tested to the vertical burn test requirements of UL 62, *Flexible Cords and Cables, and UL 1581, Reference Standard for Electrical Wires, Cables, and Flexible Cords.*

IBC 703.4. Combustible or non-combustible construction can be summarized this way: If a wall or ceiling assembly contains only materials considered non-combustible such as drywall over steel studs or steel joists, the assembly is considered non-combustible. If any part of the assembly is combustible, such as drywall over wood studs or wood joists, the assembly is considered combustible.



NFPA 13 – 2010 edition

- 8.15.5.1 A sidewall spray sprinkler must be installed at the bottom of the elevator hoistway within 2 ft of the pit floor.
- 8.15.5.2 The sprinkler required at the bottom of the elevator hoistway by 8.15.5.1 is not required for enclosed, noncombustible elevator shafts that do not contain combustible hydraulic fluids
- 8.15.5.3* Automatic sprinklers in elevator machine rooms or at the tops of hoistways to be of ordinary (135°F) or intermediate (175°F) temperature rating.
- A.8.15.5.3 ASME A17.1, Safety Code for Elevators and Escalators, requires the shutdown of power to the elevator upon or prior to the application of water in elevator machine rooms or hoistways.
- 8.15.5.4* Upright, pendent, or sidewall spray sprinklers to be installed at the top of elevator hoistways.
- A.8.15.5.4 Passenger elevator cars that have been constructed in accordance with ASME A17.1, Safety Code for Elevators and Escalators, Rule 204.2a (under A17.1a-1985 and later editions of the code) have limited combustibility.
- 8.15.5.5 The sprinkler required at the topof the elevator hoistway by 8.15.5.4 is not required where the hoistway for passenger elevators is noncombustible or limited-combustible and the car enclosure materials meet the requirements of ASME A17.1, Safety Code for Elevators and Escalators Materials exposed to the interior of the car and the hoistway, in their end-use composition, are limited to a flame spread index of 0 to 75 and a smoke developed index of 0 to 450, when tested in accordance with ASTM E 84, *Standard Test Method of Surface Burning Characteristics of Building Materials*
- *8.15.5.6 Sprinklers must be installed at the top and bottom of elevator hoistways where elevators utilize polyurethane-coated steel belts or other similar combustible belt material*

NFPA 13, 2013 & 16 Editions

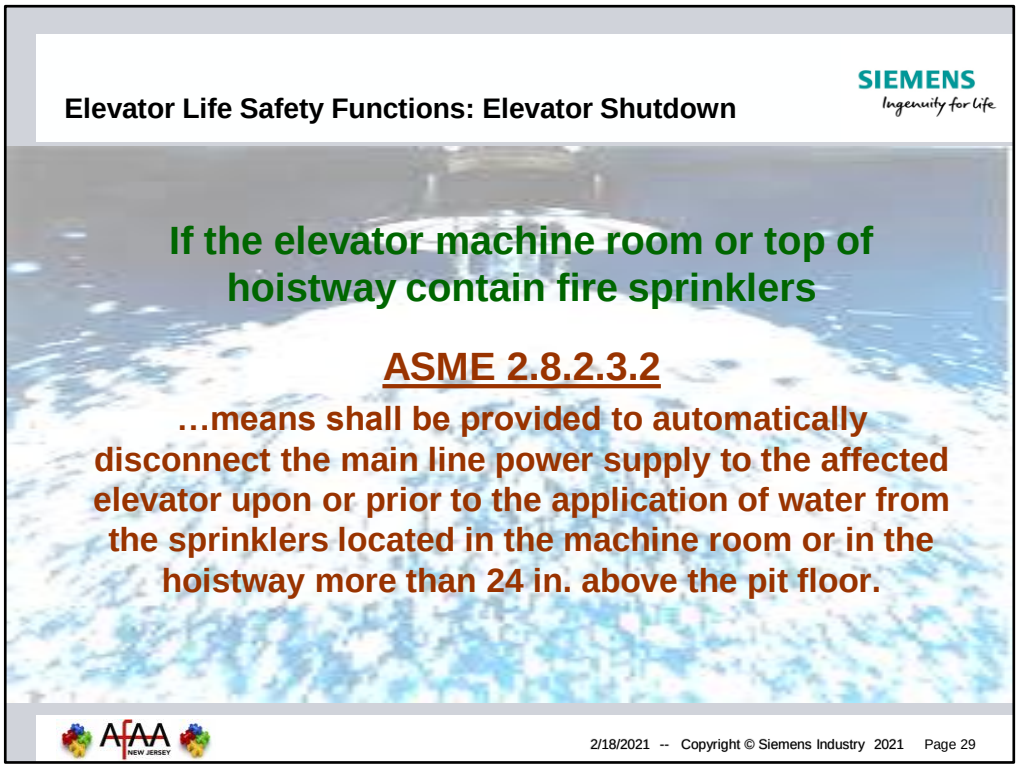
8.15.5.3 Automatic fire sprinklers shall not be required in elevator machine rooms, elevator machinery spaces, control spaces, or hoistways of traction elevators installed in accordance with the applicable provisions in NFPA 101, or the applicable building code, where all of the following conditions are met:

1. The elevator machine room, machinery space, control room, control space, or hoistway of traction elevator is dedicated to elevator equipment only.
2. The elevator machine room, machine room, machinery space, control room, control space, or hoistway of traction elevators are protected by smoke detectors, or other automatic fire detection, installed in accordance with NFPA 72.
3. The elevator machinery space, control room, control space, or hoistway of traction elevators is separated from the remainder of the building by walls and floor/ceiling or roof/ceiling assemblies having a fire resistance rating of not less than that specified by the applicable building code.
4. No materials unrelated to elevator equipment are permitted to be stored in elevator machine rooms, machinery spaces, control rooms, control spaces, or hoistways of traction elevators.
5. The elevator machinery is not of the hydraulic type.

A sprinkler head located in the bottom of the elevator pit is in place to control the spread of fire caused by the ignition of trash and debris that has fallen through the door opening and collected over time.

In combustible elevator hoistways, building codes require sprinkler heads to be located at the top of the elevator hoistway, elevator machine room and sometimes the bottom of the hoistway. If a sprinkler head were to discharge water into the hoistway or machine room during operation, it is likely that the elevator would operate unpredictably because of water on the control devices, brakes, electrical components, etc. Before power shunt trips were required for sprinklered elevator hoistways and machine rooms, elevators that became wet from sprinkler discharge were known to run with doors open, to miss floor landings, to stop between floors, and to crash into the elevator pit or into the top of the hoistway.

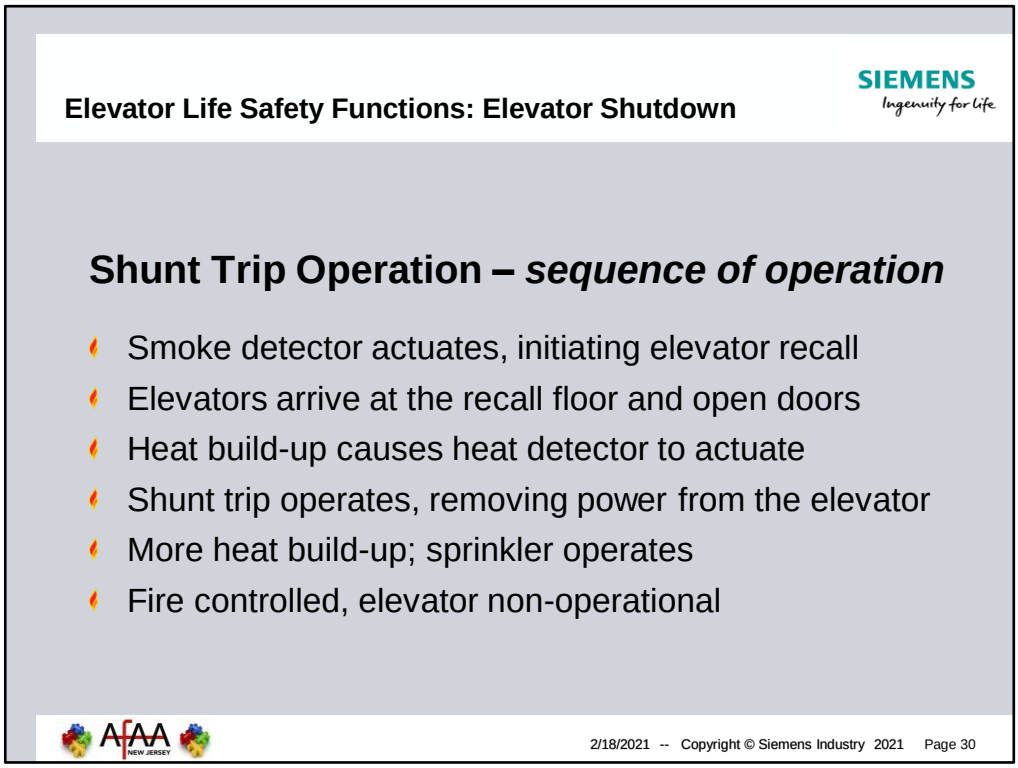
A power shunt trip in an elevator is designed to remove power prior to a sprinkler discharge. It is activated through the fire alarm by either a dedicated sprinkler waterflow switch or heat detectors. The most common and economical application is the use of heat detection. Heat detectors in the machine room and at the top of the hoistway are required to be within 24” of each sprinkler head. These detectors are set at a lower temperature and are more sensitive to temperature change than the sprinkler heads, and will signal that sprinkler discharge is imminent. The elevator’s main power shunt trip breaker will trip and stop the elevator car wherever it is, even between floors, so that it will not malfunction when the sprinkler discharges. This power shunt trip can only be reset manually at the elevator controller. Some jurisdictions may permit a delay in operation of the power shunt trip so that the elevator car can move to its primary recall floor level and open its doors. See NFPA 72 (2010) Article 21.4 and Appendix A.21.4.1; and NFPA 70 (2008) Article 620.51-B, for details.



Elevator Shunt Trip is a function that involves shunting the breaker that controls the elevator equipment prior to the release of the automatic sprinkler systems. This procedure is completed via the activation of heat detectors (addressable or conventional). Now keep in mind that not just any heat detector within the facility will be required to activate the elevator shunt trip procedure. The only heat detectors that will tell the fire alarm control panel to shunt the elevator breaker are the ones located in the elevator shaft or hoistway and elevator equipment room. Per NFPA 72 2013 edition section 21.4.2* the heat detectors that are in place to shunt the elevator power shall be installed within 24" of each sprinkler head within the area. On top of this section 21.4.1* states the heat detector used for shunt trip shall be set at a lower temperature and higher sensitivity than its adjacent sprinkler head.

One last thing, the activation of heat detectors can delay the shunt trip via programming for a delay time not to exceed the time it takes the elevator cab starting at the top level to reach the lowest level of exit discharge. The purpose behind this allowance is to increase the potential for elevators to complete their travel to the recall level. **Make note that the requirements of A17.1/B44 Safety Code for Elevators and Escalators would still apply.**

Now if you choose to use the method of waterflow or pressure switch to activate you elevator shunt trip, any time delay switches or capability will not be permitted per NFPA 72 2013 section 21.4.3.



Per NFPA 72, ASME17.1 and IBC 2015 3005.5, One final sequence of the FEO is the Shunt Trip. In facilities that have wet sprinklers in their T.O.S. elevator hoistway and machine room, code requires the placement of a heat detector connected to a fire alarm system. The purpose of the heat detector is to shut down the elevator's power via a shunt trip mechanism when activated. Beyond saving the equipment from electrical damage, wet brakes or an uncontrolled loss of power can have deadly results. Consequently, the heat detector must activate before the sprinklers do. The heat detector's alarm threshold must therefore be lower than that of the sprinkler head's. Once activated, the heat detector is programmed to initiate a shunt trip breaker that removes power from the elevator cab. To be effective (and per code), a heat detector must be placed within two feet of any sprinkler head in the hoistway or machine room.

ASME A17.1 [2013] 2.8.3.3.2 where elevator equipment is located or its enclosure is configured such that application of water from sprinklers could cause unsafe elevator operation, means shall be provided to automatically disconnect the main line power supply to the affected elevator and any other power supplies used to move the elevator upon or prior to the application of water.

a) This means shall be independent of the elevator control and shall not be self-resetting.
b) Heat detectors and sprinkler flow switches used to initiate main line elevator power shutdown shall comply with the requirements of NFPA 72.
c) The activation of sprinklers outside of such locations shall not disconnect the main line elevator power supply.

2.8.3.3.3 Smoke detectors shall not be used to activate sprinklers in these spaces or to disconnect the main line power supply.

Elevator Life Safety Functions: Elevator Shutdown

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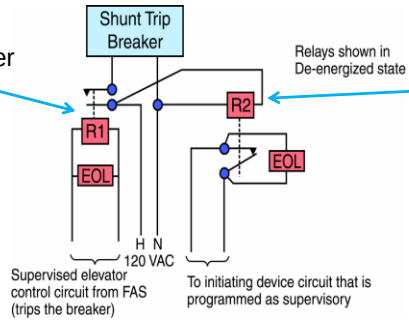
ASME A17.1 section 2.8.3.3.2/2.8.3.3.4 requires a means to automatically disconnect the elevator's electrical power supply prior to discharge of water from a sprinkler located **more than 2 ft from the pit floor.**

A shunt trip breaker automatically removes power and is activated by either:

1. A heat detector
2. A dedicated elevator fire sprinkler waterflow switch



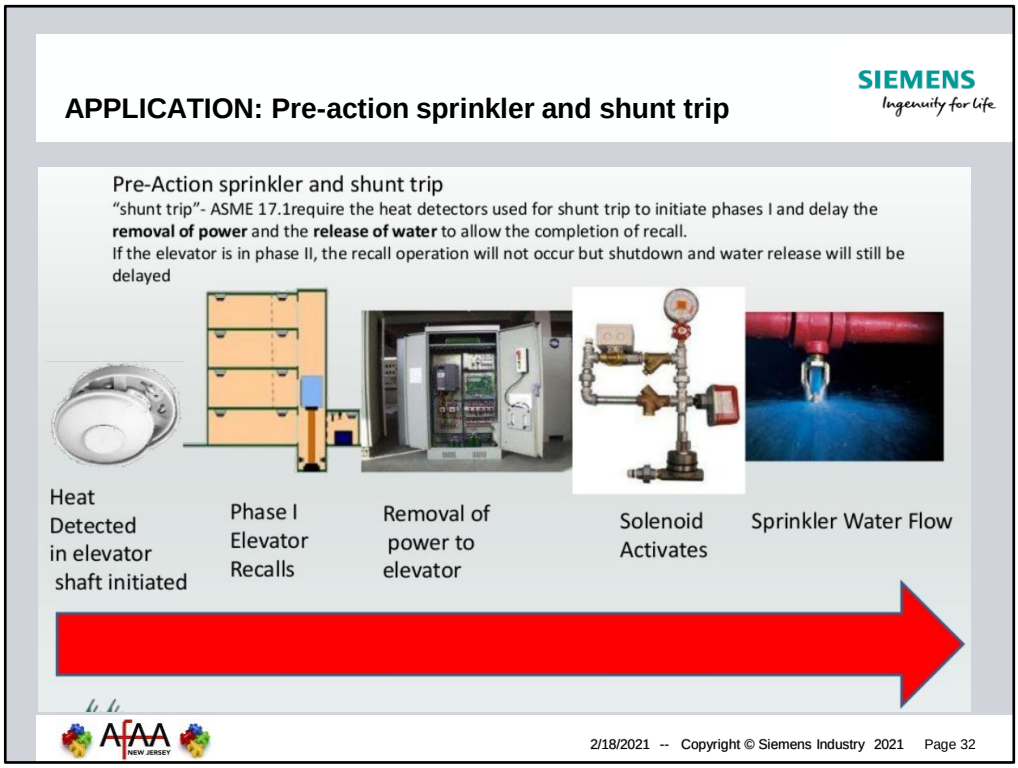
The FACP must also supervise the shunt trip breaker's 120VAC power status.

No shunt trip required when pit sprinkler is within 2' of the floor!

In the case of a sprinklered elevator hoist-way or motor room, ASME A17.1, Rule 102.2c(3) requires a "Means to automatically disconnect the main line power supply to the affected elevator upon or prior to the application of water." This is a performance based requirement. The most common system in use has been a shunt trip circuit breaker used in conjunction with heat detectors, the requirements for which are covered in NFPA 72,3-9.4. In no case can any type of time delay be used on the system. Sprinklers mounted in the pit, less than 2 ft above the floor are not required to be a part of this system. The heat detectors used should have both a lower temperature rating and a higher sensitivity ratings compared to the sprinkler heads used. The designer of the system should ensure that the heat detectors trigger before the sprinkler heads open. Heat detectors shall be installed within 2 ft of each sprinkler head. Smoke detectors shall not be used in the machine room or hoist way to activate sprinklers or to disconnect main power. The control circuit for the shunt trip circuit breaker shall be monitored for the presence of operating voltage. Loss of voltage to the control circuit shall cause a supervisory signal to be indicated at the building fire alarm panel or the "Elevator Recall Control and Supervisory Panel."

Most shunt trip breakers use a 120 volt coil, power source comes from same panel as the breaker source. Sometimes a 24 volt DC circuit from the fire alarm system will tie to a 120 volt relay with 24 volt coil and when the alarm goes off it will power the coil and close the 120 volt coil and trip breaker to elevator. The 120v circuit must also be monitored by the FACP, in case someone accidentally turns off that breaker. Elevator breakers should not be able to be reset until Fire Alarm is reset.

If the elevator disconnect is turned off to perform routine maintenance, the control voltage will be disconnected and will send a signal to the FACP—which will generate a supervisory signal. If this notification is not required, an optional micro switch mounted on the main switch can be supplied and field-wired in parallel with the alarm contact on the voltage monitoring relay. Wiring in this fashion would prevent a signal from being sent when the elevator disconnect is turned off for routine maintenance.



Theoretical Sequence of Events for Firefighter's Service and Main Power Disconnection

1. Smoke causes a smoke detector in the elevator machine room to activate.
2. Phase I Fire Recall is initiated.
3. Elevators associated with that motor room or hoist-way are called to the designated or alternate level and shut down with doors open.
4. Heat buildup in the fire area causes a heat detector to actuate.
5. Shunt trip circuit breaker actuates, causing elevator main line power disconnection.
6. Further heat buildup causes a sprinkler head to operate.

Designated Level- The main floor or other level that the AHJ determines best serves the needs of emergency personnel for fire fighting or rescue purposes.

Alternate Level- The floor designated by the AHJ to serve as the recall level if the designated floor detector activates first.

A17.1. Rule 102 states that only equipment which is used directly in connection with the operation of the elevator may be installed in the elevator machine room, machinery spaces and hoist-way.

NFPA 72 states that Elevator Firefighter's Service shall be connected to the building. fire alarm system. If there is no building fire alarm system, the elevator "fire alarm initiating devices" shall be connected to a dedicated fire alarm system control panel designated as the "Elevator Recall Control and Supervisory Panel". This should be located in a normally occupied area, monitored for integrity and have primary and secondary power sources. It should have audible and visible indicators to annunciate supervisory and trouble conditions. This panel shall be permanently identified on the panel and on the record drawings.

Detector Placement: Heat Detectors

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When heat detectors are used to shut down elevator power prior to sprinkler operation:

- They shall be placed within 24 in. of each sprinkler head. Multiple detectors may be required due to obstructions.
- The detector shall have both a lower temperature rating and a higher sensitivity as compared to the sprinkler.

AFAA NEW JERSEY

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Heat detectors used to shut down elevator electrical power prior to sprinkler operation, must be placed within 2 ft of each sprinkler and be installed in accordance with the requirements of NFPA 72. The use of Annex B, Engineering Guide for Automatic Fire Detector Spacing, is permitted.

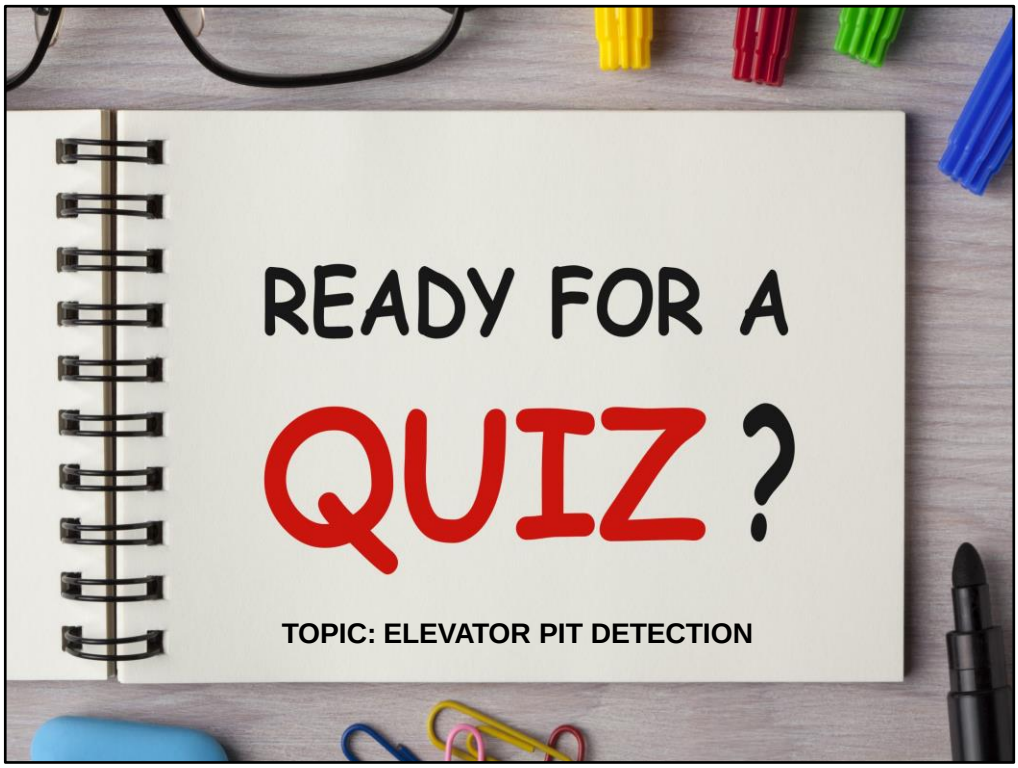
A pit sprinkler located 2 ft or less from the pit floor does not require a heat detector within 2 ft of it

Waterflow alarm initiating devices may be used to initiate shutdown of elevator electrical power–NO retard is permitted

Heat detectors used to shut down elevator power prior to sprinkler operation must have both a lower temperature rating and a higher sensitivity as compared to the sprinkler

Spot-type heat detectors are required to include in their installation instructions, technical data, and listing documentation the operating temperature and response time index (RTI) as determined by the organization listing the device

1. Heat s are required to be monitored for integrity by the fire alarm control unit
2. Stand alone heat detectors for the shunt trip circuit are NOT permitted



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If a hydraulic elevator pit has a sprinkler head, is a WP pit heat detector required???

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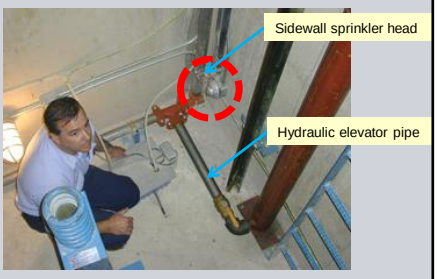
YES!



A weather-proof heat detector is used to initiate the Firefighters' Emergency Operation (FEO) sequence. Activation should only initiate alternate recall to position the cab further from the pit fire event per NFPA 72 [2016] 21.3.12.2 (3). The purpose is to move the cab to the alternate level, further away from the pit fire.

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ASME A17.1 states that if a sprinkler head is installed within 24" (2 feet) of the elevator pit floor, it shall be exempt from the special arrangements of inhibiting water flow until the elevator recall function has occurred…NO SHUNT TRIP. When sprinklers are installed in the hoistway all elevator electrical equipment, located less than 48" above the pit floor is required to be NEMA 4 rated and the wiring listed for use in wet locations. Since this equipment is designed for wet conditions, a sprinkler discharge would not adversely affect the operation of the elevator; therefore shunt-trip activation and heat detection is not required in an elevator pit for those sprinklers installed within 24" of the pit floor.

However NFPA 13 sometimes requires fire sprinklers in pits if due to potential fire scenarios. If fire sprinklers are installed, there is no need for shunt trip, but we do not want the elevator car to be in service during an elevator pit fire or worse, recall it closer to the fire. Therefore the code requires the installation of a detector to initiate the Firefighters' Emergency Operation (FEO) sequence of recall. Activation should only initiate alternate recall to position the cab further from the pit fire event per NFPA 72 [2016] 21.3.12.2 (3). The purpose is to move the cab to the alternate level, further away from the pit fire.

Because of the NEC wet-area classification, a weather-proof heat detector is the only UL listed detector for a pit application. The provisions of NFPA 72 [2016] 17.7.3.1.3 and 17.4.8 should be considered, which allows detectors to be placed closer to the sprinkler head. As an alternative, recall can also be initiated via sprinkler water flow detection.

If a hydraulic elevator pit has a sprinkler head, should the required pit heat detector activate shunt trip???

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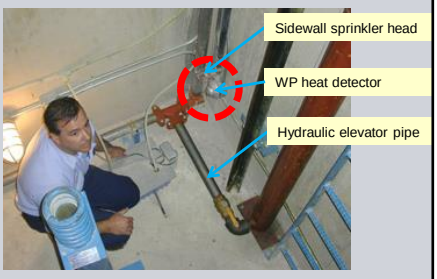
NO!



Shunt trip by pit heat detector is prohibited by code because it can trap firefighters. Any electrical equipment, or piping located less than 48 inches from pit floor must be weatherproof NEMA 4. If a sprinkler head is provided, water discharge will not harm or disrupt the elevator.

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ASME A17.1 states that if a sprinkler head is installed within 24" (2 feet) of the elevator pit floor, it shall be exempt from the special arrangements of inhibiting water flow until the elevator recall function has occurred…NO SHUNT TRIP.

However to comply with NFPA 72 you have to recall the elevator(s) to the alternate floor. That can be done with a heat at the top of the shaft set for recall only. If above 24" then you do it all (Recall and Shunt). You can also achieve the recall via a water flow detection. Most ppl think that the elimination of sprinkler head(s) in the elevator(s) shaft has to do with electrical. This is wrong, is has to do with the emergency breaks on the elevator. If they become wet, they may not work properly. When sprinklers are installed in the hoistway all elevator electrical equipment, located less than 48” above the pit floor is required to be NEMA4 rated and the wiring listed for use in wet locations. Since this equipment is designed for wet conditions, a sprinkler discharge would not adversely affect the operation of the elevator; therefore shunt-trip activation and heat detection is not required in an elevator pit for those sprinklers installed within 24” of the pit floor. ASME A17.1 states that if a sprinkler head is installed within 24" of the elevator pit floor, it shall be exempt from the special arrangements of inhibiting water flow until the elevator recall function has occurred.

NFPA 72, Chapter 5. Systems for elevator recall for firefighters emergency operation (6.16.3) and elevator shutdown (6.16.4) requires the designed and installation in accordance with Chapter 5.5.6.3.1. Elevator pits will not have a heat detector associated with a pit sprinkler because heat detectors are not permitted more than 12" below a ceiling. Also Elevator pits will not have a smoke detector because smoke detectors are not permitted more than 12" below a ceiling per 5.7.3.2.1.

If a hydraulic elevator pit has a sprinkler head, should a smoke detector be installed?

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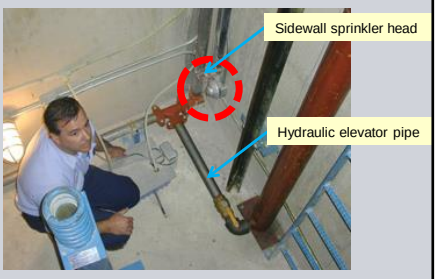
NO!



All electrical equipment within 4 feet of the pit must be NEMA rated for wet locations. The are no smoke detectors which meet the NFPA 72 requirements for spacing or the UL wet locations listings, to be installed in elevator pits NFPA [2016] 21.3.8.

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The are no smoke detectors meet the NFPA 72 or UL listing requirements for spacing to be installed in elevator pits. All electrical equipment within 4 feet of the pit must be NEMA rated for wet locations. The are no smoke detectors which meet the NFPA 72 requirements for spacing or the UL wet locations listings, to be installed in elevator pits NFPA [2016] 21.3.8.

If sprinkler head is below 24", you do not have to shunt trip the power. However to comply with NFPA 72 you have to recall the elevator(s) to the alternate floor. That can be done with a WP heat at the bottom of the shaft set for recall only. If the sprinkler is above 24“ from the floor, then the pit WP heat detector is used to initiate the Firefighters’ Emergency Operation (FEO). Activation should only initiate alternate recall to position the cab further from the pit fire event. NFPA 72 [2016] 21.3.12.2 (3). This same function can also be achieved via a sprinkler water flow switch dedicated for the elevator pit (NFPA 72 [2016] 21.3.3).

Elevator pits will not have a heat detector associated with a pit sprinkler because heat detectors are not permitted more than 12" below a ceiling. Also Elevator pits will not have a smoke detector because smoke detectors are not permitted more than 12" below a ceiling per 5.7.3.2.1.

Smoke detector in hoistways can be difficult to test, service and respond to alarms, so there's naturally a reason to avoid locating smoke detector where it's not practical or necessary. In general, smoke detectors are only installed in the top of elevator hoistways where the top of the elevator hoistway is protected by automatic sprinklers or where a smoke detector is installed to activate the elevator hoistway smoke relief equipment.

Elevator Life Safety Functions: Panels

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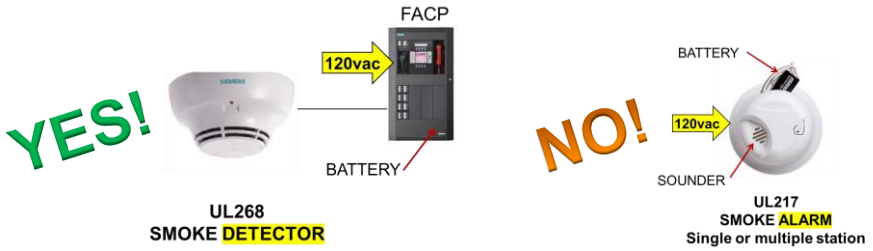
All elevator smoke and heat detector wiring must be monitored for integrity by a fire alarm control panel.

Locally powered 120 VAC smoke or heat alarms **are not** permitted for elevator life safety operations.

REF ASME 17.1 & NFPA 72: 21.3.1



NFPA 72 21.3.1 [2013] requires all initiating devices used for elevator recall service to be connected to the building fire alarm system.

Unless otherwise required by the AHJ, only the elevator lobby, elevator hoistway, and elevator machine room initiating devices are used to recall elevators for firefighters' service

Any actuated detector that has initiated firefighters' recall must be annunciated at the building fire alarm control unit.

Elevator Life Safety Functions: Panels

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In facilities without a building fire alarm system, detectors are supported to a dedicated control unit that is designated: "elevator recall control and supervisory control unit"

REF ASME 17.1 & NFPA 72: 21.3.2

For example, an open-air parking garage does not require suppression or a fire alarm system, so a dedicated elevator recall control and supervisory control unit would be provided. No manual pulls or notification appliances required.

NFPA 72 21.3.1 [2013] requires all initiating devices used for elevator recall service to be connected to the building fire alarm system.

NFPA 72 21.3.2 [2013] requires facilities without a building fire alarm system must connect elevator detectors to a dedicated function fire alarm control unit that is designated "elevator recall control and supervisory control unit," permanently identified on the dedicated function fire alarm control unit and on the record drawings. See also ASME 3.3.102.2.1. The use of a dedicated function system does not invoke any other fire detection and alarm system requirements. The only added feature that would be required is a smoke detector for protection of the control unit (NFPA 72 [2013] 10.15). There are no requirements to add occupant notification, duct smoke detectors, off premises signaling or any other system features. Also if the scope of work is only for an elevator modernization, this type of purpose dedicated panel may be installed. This is an especially useful option when the base building has an existing conventional panel; the new addressable elevator panel becomes a subpanel to the building FACP.

Detector Placement: Elevator Lobby

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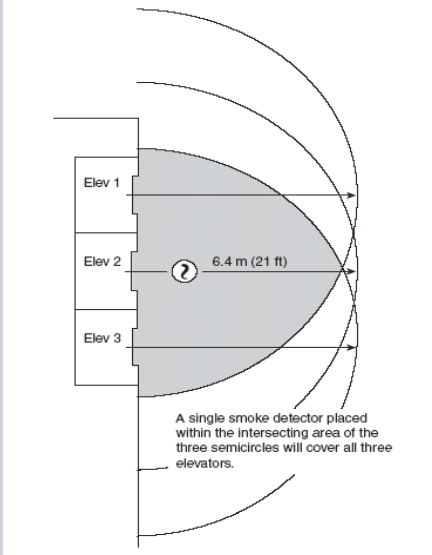
Flat Ceilings upto 15 feet

A lobby smoke detector must be ceiling mounted within 21 feet of the centerline of each elevator door within the elevator bank under control of the detector.
REF: NFPA 72 [2016] 21.3.5

Note that wall-mounted installations are not allowed for elevator lobby ceiling upto 15 feet.



The purpose of Phase I Emergency Recall Operation is to have the elevator automatically return to the recall level before fire can affect its safe operation. Lobby smoke detectors shall be located on the ceiling within 21 ft. (see NFPA 72 [2013] 21.3) of the centerline of each elevator door within the elevator bank under control of the detector. If the ceiling height exceeds 15 ft.. or is other than flat, the detectors should be located in accordance with NFPA 72. Smoke detectors shall not be installed in elevator hoist-ways except for the following two exceptions:

1. Where the top of the hoist-way is protected by automatic sprinklers
2. Where the detector is used to activate smoke relief equipment.

- Where approved by the AHJ, detectors for elevator recall may cause a supervisory signal in lieu of an alarm signal.
- Where lobby detectors are used for other than initiating elevator recall, they must initiate an alarm signal

Detector Placement: Elevator Lobby

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Lobby smoke detectors installed for elevator recall can also be used to:

1. Close lobby smoke dampers NFPA 72 [2016] 17.7.5.4.1 & 21.7
2. Release smoke curtains *NFPA 72 [2016] 21.8*
3. Unlock doors *NFPA 72 [2016] 21.9*
4. Initiate elevator hoistway pressurization *NFPA 72 [2016] 21.7*
5. Initiate smoke door release service *NFPA 72 [2016] 17.7.5.6*

Many lobbies are small. If the detector is within 21 feet, it can be programmed to preform multiple functions such as recalling the elevator and releasing magnetic door holders. This reduces equipment by utilizing detectors for multiple functions.

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Fire rated doors are in place to control the spread of fire through corridors and passageways. In a perfect world, these doors would be kept closed at all times. However, facilities typically want more of an open floor concept as well as ease of access for their visitors. This is where electromagnetic door holders came into play. These fire rated door holders have an energized coil which creates a magnet strong enough to hold the self closing fire rated doors in the open position.

On the fire alarm side, you would need a control relay to intercept a switch-leg of power to the door holder circuit as well as an initiating device such as a smoke detector to activate the relay. Once the detector senses smoke, the fire alarm control unit sends a signal to the relay which then opens the power circuit. Once power has been lost to the door holders, the coil is de-energized and the magnet no longer has the pulling force to hold the door in the open position. The self closing mechanism shall close the door from a fully open position (90 degrees) to 12 degrees from the latch at a minimum of 5 seconds. This insures the doors do not close to quickly. This information can be located in ANSI 117.1 2009 section 404.2.7.1.

Detector Placement: High Ceiling Elevator Lobby

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Previous versions of the codes did not provide direction for placement of detectors in elevator lobbies with high ceilings.

Typically designers placed the detector within 12” of the ceiling.

This satisfied the prescriptive installation standards, but resulted in detector placement which was difficult to inspect and did not provide the best smoke detection for the elevator doors.

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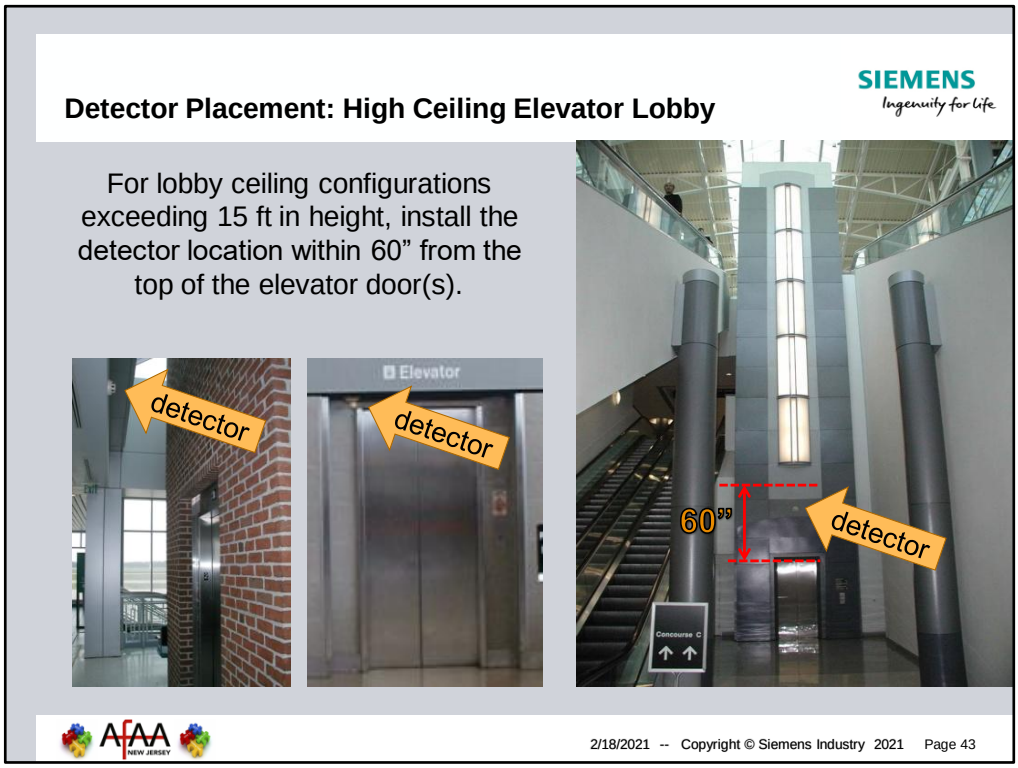
Most projects to do require full area smoke protection, but do require detection to initiate action when specific spaces are threatened by smoke or fire such as at elevator landings.

In high ceiling areas, locating the detector on the upper ceiling can delay activation and may not achieve the desired initiation such as for elevator recall.



For lobby ceiling configurations exceeding 15 ft in height or that are other than flat and smooth, detector locations are determined per NFPA 72 Chapter 17. The detector should be within 60" of the top of each elevator door opening to protect the opening, typically mounted on the wall. This is allowed because it is not being used for general detection, but rather, for the protection of the opening.

The 2007 and earlier NFPA 72 did not directly address elevator lobbies having high ceilings typically found at a mezzanine, atrium lobbies, industrial settings, etc.

The IBC references NFPA 72. Chapter 21.3.5 references Chapter 17 for proper detector placement in elevator lobbies which have ceilings exceeding 15’. NFPA 72 [2016] 17.7.3.1.3 & 17.4.8 states: “If the intent is to initiate action when smoke/fire threatens a specific object or space, the detector shall be permitted to be installed in close proximity to that object or space.” The Annex adds: When specific objects or spaces are threatened by smoke or fire, such as at elevator landings that have high ceilings in excess of 15 feet, detection should be placed on the wall above and within 60 inches from the top of the elevator doors. This allows the detector to be located where it may be readily installed, tested and serviced while also providing the necessary smoke detection coverage for the landing. For multiple elevators utilizing wall-mounted detectors, each door opening must be within 5ft of a detector, measured horizontally (perpendicular to the doorway) per Chapter 17.

Detector Placement: Exterior Elevator Lobby

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Unless specifically designed/ listed for the expected conditions, smoke detectors shall not be installed in the following ambient conditions:

1. Temperature below 32°F
2. Temperature above 100°F
3. Relative humidity above 93 percent
4. Air velocity greater than 300 ft/min

Elevator lobbies located outside should substitute the smoke detector with a weather proof heat detector.
Per NFPA 72 21.3.9 and ASME A17.1, 2.27.3.2.1

Some elevator lobbies, hoistways, and machine rooms are not suitable environments for the installation of spot-type smoke detectors. Dust, dirt, humidity, and temperature extremes may exceed the operating parameters of the smoke detector. A smoke detector installed in the elevator lobby of an unheated parking garage would likely experience problems due to vehicle exhaust, dust, dirt, humidity, and temperature extremes. The intent of 21.3.9 is to prevent nuisance alarms from smoke detectors installed in such areas and unnecessary initiation of elevator Phase I Emergency Recall Operation.

NFPA requires that the selection and placement of smoke detectors take into account both the performance characteristics of the detector and based on an evaluation of potential ambient sources of smoke, moisture, dust, and electrical or mechanical influences to minimize nuisance alarms. The goal is to balance the need for early warning while maintaining a reliable and stable fire alarm system. If ambient conditions prohibit installation of automatic smoke detection, other automatic fire detection (heat detectors) is permitted. (NFPA 72 9.6.1.8.1.2) also see NFPA [2016] A.21.3.7. NFPA 72 (2016) 21.3.9 states that if "ambient conditions prohibit installation of automatic smoke detection" that other automatic fire detection initiating devices shall be permitted.

I advise against installing smoke detectors in outdoor locations or unconditioned spaces because these environments can exceed the parameters of detector listing. Elevator lobbies located outside should substitute the smoke detector with a heat detector.

Detector Placement: Top of shaft

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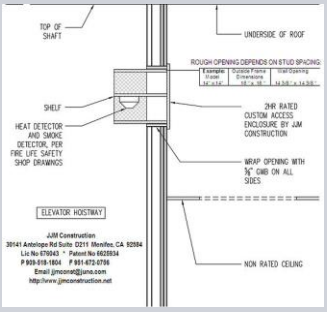
Smoke detectors shall not be installed in elevator hoistways except:

1. Where the top of the hoistway is protected by automatic sprinklers (hoistway and/or cab classified as combustible).
2. Where the smoke detector is used to activate smoke relief equipment (only required by 2009 edition of IBC 3004.1).

Alternatives to installing detectors at T.O.S. include utilizing fire-rated access and VESDA .



Smoke detector in hoistway with fire rated access enclosure

Smoke and heat detectors are only required at the top of the elevator hoistways if they are protected by fire sprinklers or if there is an automatic smoke relief damper.

The elevator hoistway will require fire sprinkers if the shafts, cab, suspension, etc. are classified as combustible. This includes elevators that utilize polyurethane-coated steel belts or other similar combustible belt material. When fire sprinklers are installed, smoke detection is required to initiate elevator recall (NFPA 72 [2016] 21.3.3) and heat detection to initiate power shunt trip (NFPA [2016] 21.4) prior to the sprinkler head activating.

Elevator hoistways classified as non-combustible do not require fire sprinklers, or heat detectors. Smoke detectors shall not be installed in un-sprinklered elevator hoistways unless they are installed to activate the elevator hoistway smoke relief equipment (NFPA 72 [2016] 21.3.6).

Detector Placement: Machine Room

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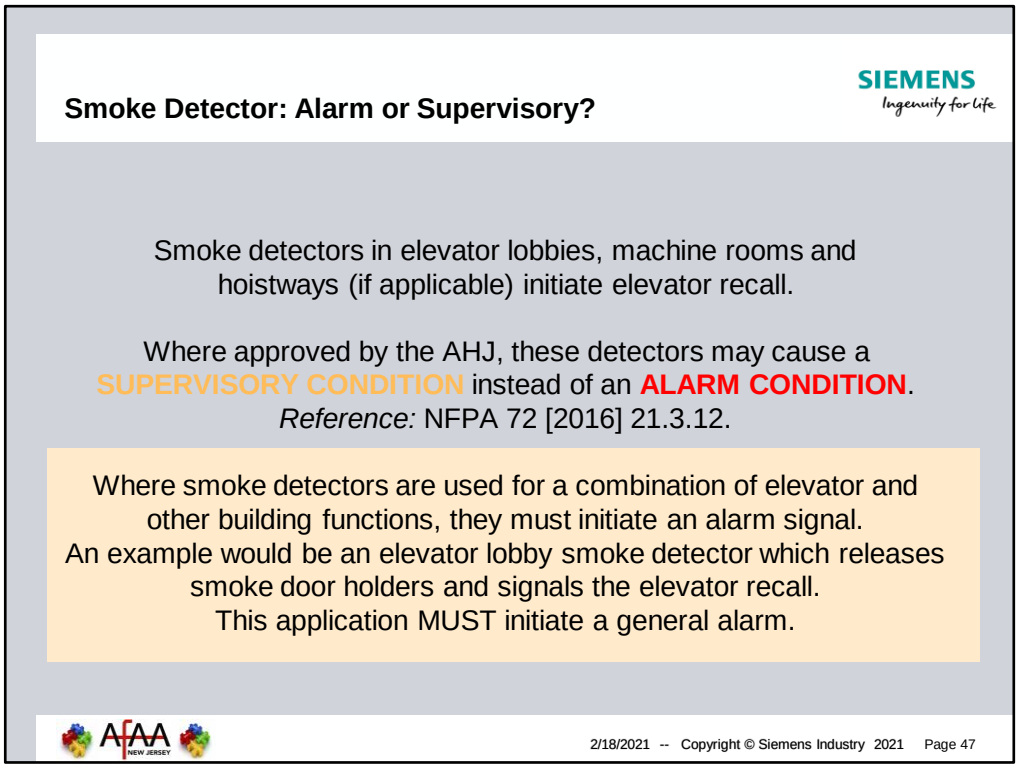
Smoke detectors must be installed in elevator machine rooms or machine spaces. NFPA 72 room spacing should be followed. For areas greater than 900 sq ft or with deep beams, more than one detectors will be required. NFPA 72 5.7.3.2.4.2 (5)] has a useful exception to provide only one detector for small rooms.

The elevator machine room smoke detector(s) must initiate Phase I. The purpose of Phase I Emergency Recall Operation is to have the elevator automatically return to the recall level before fire can affect its safe operation.

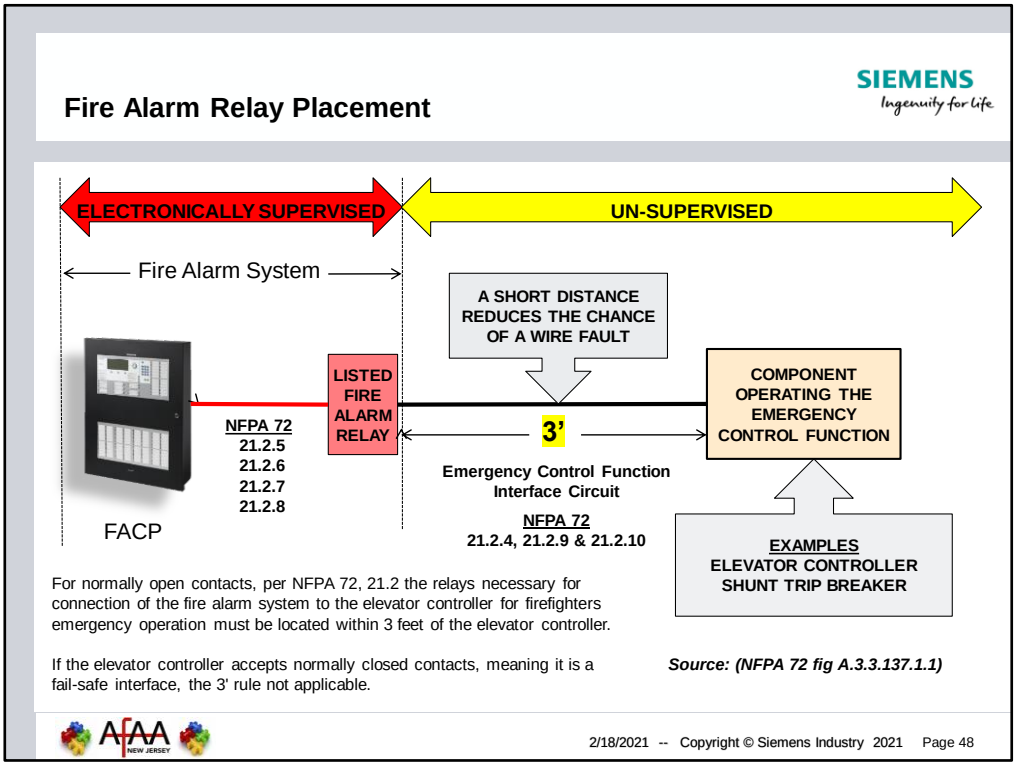
Elevator machine rooms can sometimes have exposed solid beamed ceiling configurations which can restrict smoke movement because they form 'pockets' that collect the smoke and increase detection time. NFPA 72 has special smoke detector spacing requirements, which have been revised from previous code versions. For rooms less than 900 ft^2 with deep beams, only one smoke detector required. [REF NFPA 72 5.7.3.2.4.2 (5)]. So for rooms measuring less than 900 square feet → only one detector is required and the detector is mounted on the ceiling.

Now in today's world we have three different rooms we want to research before we layout the fire alarm devices:

- **Elevator Machine/Equipment Room:** This is the standard room that we see on most projects. This room will house all of the actual elevator equipment, machines, motors, controls etc. In this room, we need to install the necessary relays for recall (primary and alternate as well as a relay for the fireman's hat light, smoke detection to cover the room space and heat detection if the area is is covered/protected by an automatic fire sprinkler system.
- **Elevator Control Room:** This is a smaller room that houses the controls for the elevators. This room will not contain the actual motors or machinery for the cars themselves. The machinery and equipment will be located within the elevator shaft. With that said, the
- **Elevator Closet:** This is a panel within the elevator shaft that houses all of the controls for the car's machinery. Like the elevator control room, the closet is a clear indication that the machinery is located in the shaft.



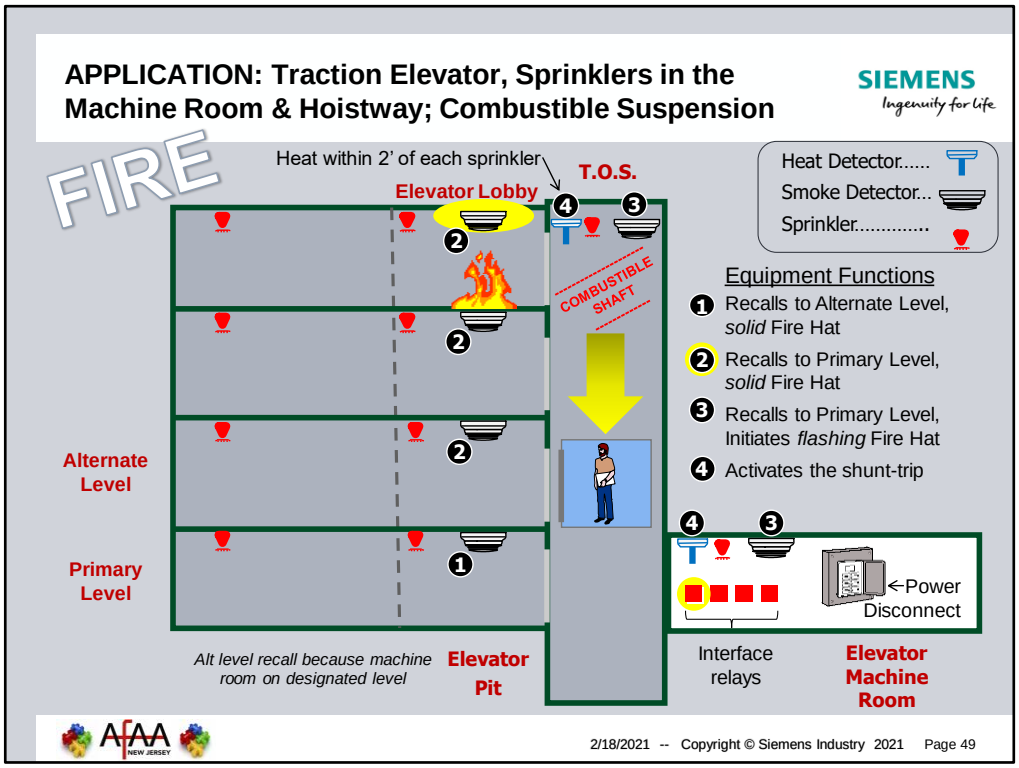
- Where approved by the AHJ, detectors for elevator recall may cause a supervisory signal in lieu of an alarm signal. NFPA 72 [2016] 21.3.12.
- Where smoke detectors are used for other than initiating elevator recall, they must initiate an alarm signal



This represents the Emergency Control Function interface between the fire alarm system emergency control function interface device and the component controlling the emergency control function.

The connections to all emergency control functions also require specific attention. For example, the contractor must locate a listed relay supervised by the FACP within 3 feet of the controlled breaker (NFPA 72-2016, Section 21.7.2). The wiring interconnection between the FACP and controlled electrical and mechanical systems must comply with the requirements of The National Electrical Code and, the FACP must monitor the integrity of the interconnected wiring. A wiring fault will be identified and report at a 'trouble condition' on the FACP. From the fire alarm relay out to the controlling equipment, the circuit is unsupervised electronically. A wiring fault will only be identified when the equipment fails to operate.

Per ASME A17.1, 2.27.3.2.7(c) these relays are not permitted to be accessed through the elevator hoistway. Provisions must be made to access the relays from the landing with the ITP. The relays may be enclosed in wall mounted or recessed boxes or panels, above the ceiling with access provided, or in rooms or other spaces within 3 feet of the ITP accessible to fire alarm servicing personnel.



ELEVATOR CONTROLLER INTERFACE RELAYS

- Relay #1 – primary recall
- Relay #2 – secondary recall
- Relay #3 – fire hat

ELEVATOR POWER SHUNT TRIP BREAKER INTERFACE RELAY

- Relay #4 – shunt trip

ASME A17.1 requires a steady firefighter's hat when relay #1 or #2 activate. Section 6.15.3.9 requires the hat to flash if an elevator machine room or hoistway smoke detector causes the recall. The elevator company programs the fire fighter hat to come on (steady) with relay #1 or #2 , along with the other required elevator functions. An input from Relay #3 overrides the steady light function and initiates flashing light function.

The fire alarm system provides three Form C contact relays and the elevator controller responds based on the sequence of relays pick. In logic (programming) terms, the fire alarm provides signals of the conditions and the elevator control makes control decisions based on those inputs.

Designated Level- The main floor or other level that the AHJ determines best serves the needs of emergency personnel for fire fighting or rescue purposes.

Alternate Level- The floor designated by the AHJ to serve as the recall level if the designated floor detector activates first.

A17.1. Rule 102 states that only equipment which is used directly in connection with the operation of the elevator may be installed in the elevator machine room, machinery spaces and hoist-way.

NFPA 72 states that Elevator Firefighter's Service shall be connected to the building. fire alarm system. If there is no building fire alarm system, the elevator "fire alarm initiating devices" shall be connected to a dedicated fire alarm system control panel designated as the "Elevator Recall Control and Supervisory Panel". This should be located in a normally occupied area, monitored for integrity and have primary and secondary power sources. It should have audible and visible indicators to annunciate supervisory and trouble conditions. This panel shall be permanently identified on the panel and on the record drawings.

Machine Room Example

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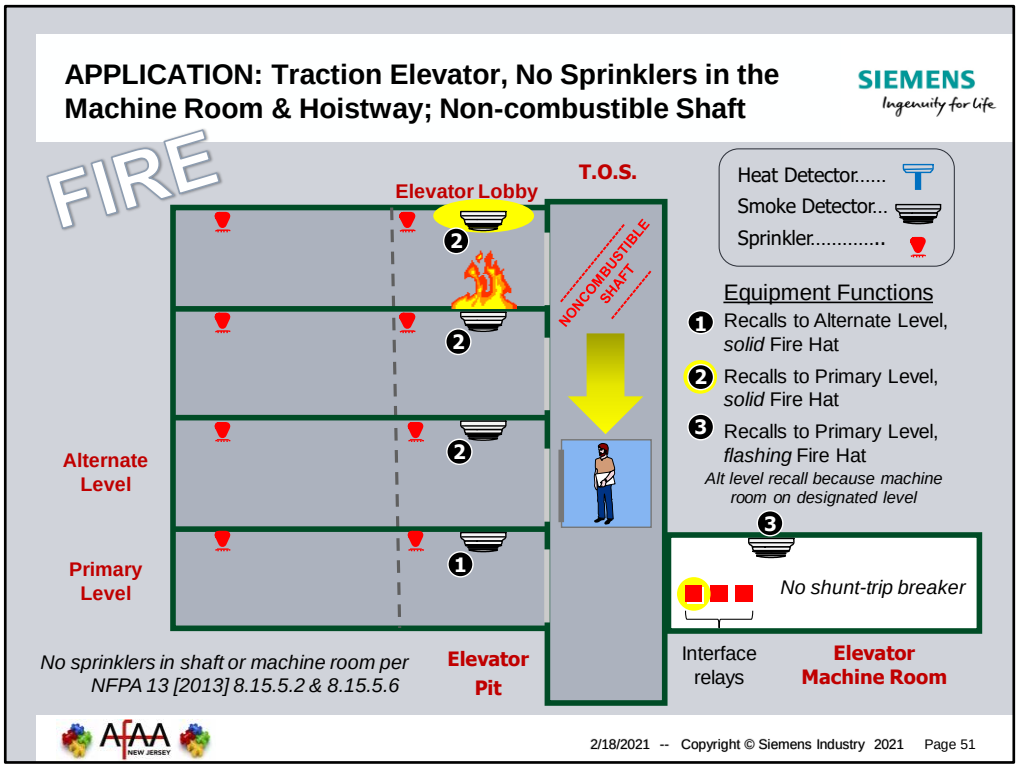
21.2.4. The relays necessary for connection of the fire alarm system to the elevator controller for firefighters emergency operation must be located within 3 feet of the elevator controller.

Per ASME A17.1, 2.27.3.2.7(c) these relays are not permitted to be accessed through the elevator hoistway. Provisions must be made to access the relays from the landing with the ITP. The relays may be enclosed in wallmounted or recessed boxes or panels, above the ceiling with access provided, or in rooms or other spaces within 3 feet of the ITP accessible to fire alarm servicing personnel.



Typically four (4) relays are required for elevator interface:

ELEVATOR CONTROLLER INTERFACE RELAYS

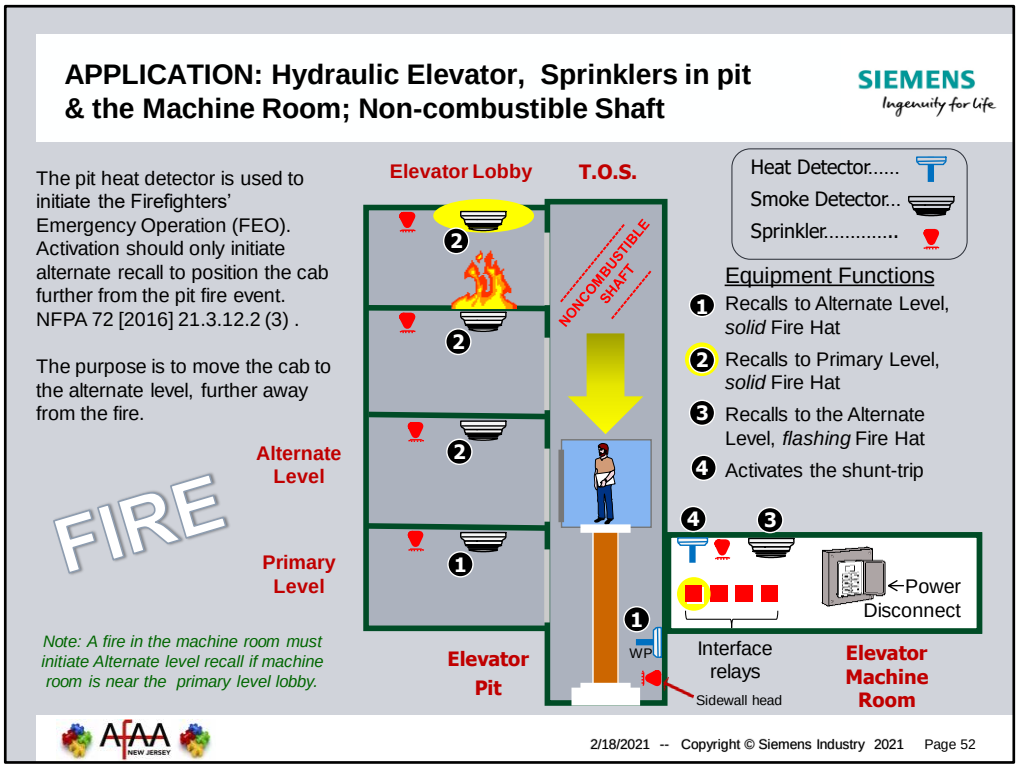
- Relay #1 – primary recall
- Relay #2 – secondary recall
- Relay #3 – fire hat

ASME A17.1 requires a steady firefighter's hat when relay #1 or #2 activate. Section 6.15.3.9 requires the hat to flash if an elevator machine room or hoistway smoke detector causes the recall. The elevator company programs the fire fighter hat to come on (steady) with relay #1 or #2 , along with the other required elevator functions. An input from Relay #3 overrides the steady light function and initiates flashing light function.

The fire alarm system provides three Form C contact relays and the elevator controller responds based on the sequence of relays pick. In logic (programming) terms, the fire alarm provides signals of the conditions and the elevator control makes control decisions based on those inputs.

Theoretical Sequence of Events for Firefighter's Service and Power Disconnection

1. Smoke causes a smoke detector in the elevator machine room to activate.
2. Phase I Fire Recall is initiated.
3. Elevators associated with that motor room or hoist-way are called to the designated or alternate level and shut down with doors open.
4. Heat buildup in the fire area causes a heat detector to actuate.
5. Shunt trip circuit breaker actuates, causing elevator main line power disconnection.
6. Further heat buildup causes a sprinkler head to operate.



Typically four (4) relays are required for elevator interface:

ELEVATOR CONTROLLER INTERFACE RELAYS

- Relay #1 – primary recall & SOLID firefighter hat light
- Relay #2 – secondary recall & SOLID firefighter hat light
- Relay #3 – secondary recall (elevator can not recall to the primary floor due to proximity of the machine room) & FLASHING firefighter hat light
- **ELEVATOR POWER SHUNT TRIP BREAKER INTERFACE RELAY – *provided for sprinkler applications***
- Relay #4 – shunt trip

ASME A17.1 requires a steady firefighter's hat when relay #1 or #2 activate. Section 6.15.3.9 requires the hat to flash if an elevator machine room or hoistway smoke detector causes the recall. The elevator company programs the fire fighter hat to come on (steady) with relay #1 or #2 , along with the other required elevator functions. An input from Relay #3 overrides the steady light function and initiates flashing light function.

The fire alarm system provides three Form C contact relays and the elevator controller responds based on the sequence of relays pick. In logic (programming) terms, the fire alarm provides signals of the conditions and the elevator control makes control decisions based on those inputs.

NFPA 72 [2016] 21.3.12.2 (3) requires activation of the heat initiating devices identified in 21.3.12.1(3) if they are installed at or below the lowest level of recall in the elevator hoistway and the alternate level is located above the designated level.

Machine Room Less Elevators

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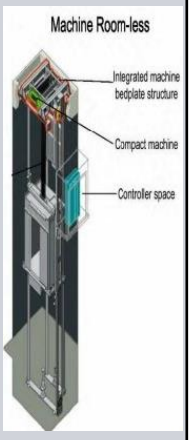
MRL elevators can be either hydraulic (holeless) or traction (Electric). They have their hoisting machines installed directly inside the elevator hoistway.

Machine space in hoistway has same requirements as a machine room, GFIC, HVAC, lighting. Some components such as a smoke detector, heat detector, and sprinkler protection depend on model of elevator.

Although elevators have been in use for over 100 years, in just the last 10 years, MRL elevators have become a dominant force in North America. Market share for MRL elevators is anticipated to continue growing in the coming years as well.



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All elevators, whether traction or hydraulic, require a machine room to store large electric motors (or hydraulic pumps) and a controller cabinet. This room is located above the hoist way (or below, for hydraulic elevators) and may contain machinery for a single or a group of elevators. Modern day traction motors boasting gearless and permanent drive can be more compact and efficient; electronic microprocessors have replaced the mechanical relays. As a result, traction elevators can be built without a dedicated room above the shaft, saving valuable space in building planning.

A MLR design presents a departure from the traditional, looped over-the-top traction rope routing of traction elevators. The ends of the cables are fixed to the supporting structure, and the length of the cable is connected to the car and counterweight by means of a force-multiplying, energy saving compound pulley system. Machine Room-less elevators have become a welcome alternative to the older hydraulic elevator for low to medium rise buildings.

Machine Room Less Elevators

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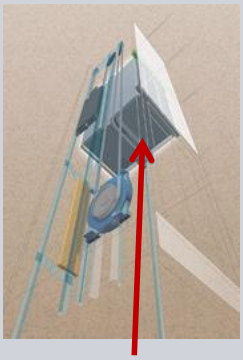
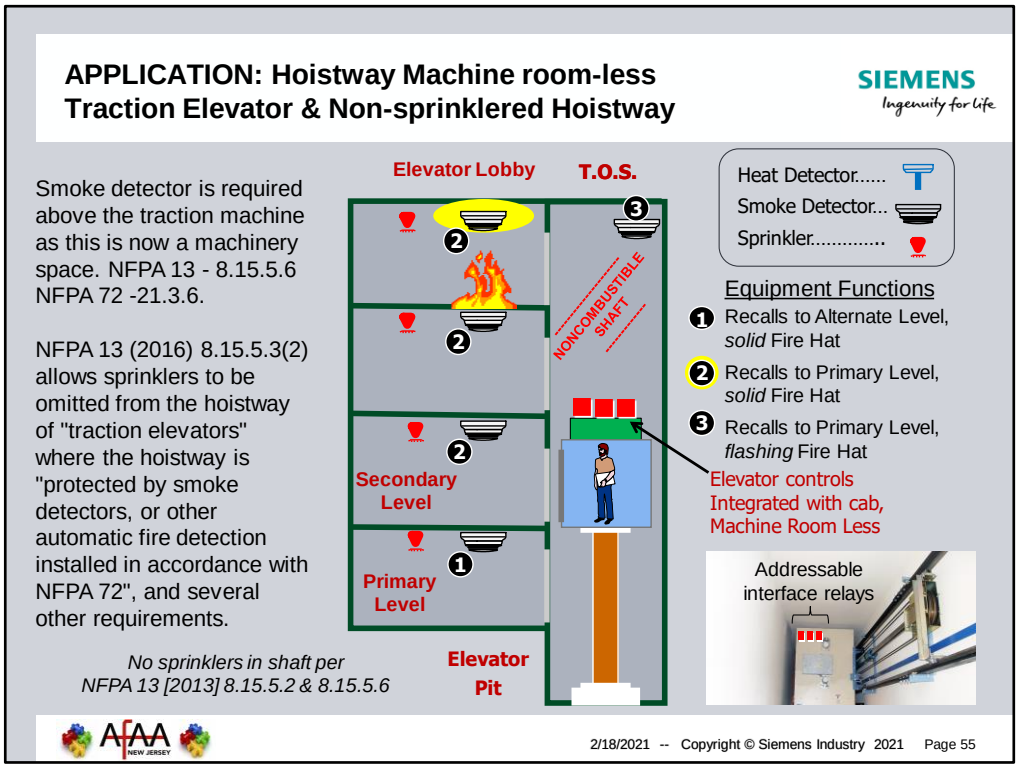
The elevator controller can be located anywhere in the building.



MRL options include adjacent or remote full control room, closet control space, control space in hoistway, machine space in hoistway, or at least part of controls mounted in elevator jamb.

Modern elevator hoistways are often non-combustible so they generally don't require any sprinkler protection or detection at the top of shafts since the fuel load is insufficient to actuate a sprinkler or affect persons in the cars. All MRL elevators have a drive motor located at the hoistway which maybe the source of ignition, not the suspension means. NFPA 13-16 Sec. 8.15.5.7.2 does not require sprinklers when limited combustible coated steel belts rated as FT-1 per UL 62 and UL 1581 are present in elevator hoistways including the pit. This requirement is based upon NFPA 13-16 Sec. 8.15.5.3 for traction (non-hydraulic) elevators only, whereby a smoke detector can be provided in lieu of a sprinkler in these spaces.

This is a perfect example of when you need to use some engineering judgment and good practice in addition to what is black and white in the book. It is true when there are no combustibles in a non-combustible shaft you want no sprinkler and no fire alarm detection in the shafts. However, when the controls and elevator equipment are in the shaft, the shaft itself becomes the machine room. Typically, most elevator code officials will require some sort of detection at the top of shaft for this. A modern smoke detector at the top of a shaft (assuming conditioned, dry space) would be fine. If it not heated or an exterior elevator a heat detector would be best suited. I can't speak for every jurisdiction, but in Philadelphia the latest NFPA 13 is now in effect which allows no sprinklers in shafts OR machine rooms. Here elevator code takes precedence, and the code official wants nothing more than what is absolutely required, which in the case you mention above, would be a smoke only at the top of shaft.



Theoretical Sequence of Events for Firefighter's Service and Main Line Power Disconnection

1. Smoke causes a smoke detector in the elevator machine room to activate.
2. Phase I Fire Recall is initiated.
3. Elevators associated with that motor room or hoist-way are called to the designated or alternate level and shut down with doors open.

Smoke detector is required above the traction machine as this is now a machinery space. NFPA 13 - 8.15.5.6 NFPA 72 -21.3.6

APPLICATION: Machine Room Less Traction Elevator & Non-sprinklered Hoistway

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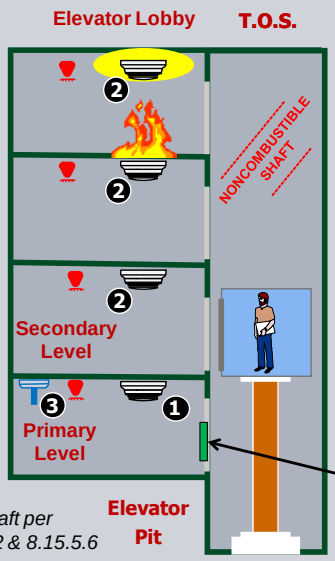
The MRL controls are in the elevator lobby, built-in to the elevator's door jamb. The lobby is also classified as a machinery space. A smoke detector is already provided for recall. A heat within 2' of the sprinkler head is required to initiate shunt trip.

The fire alarm modules should be installed outside of the shaft. In almost all cases the elevator takes a normally closed contacts, meaning it is a fail-safe interface and makes the 3' rule not applicable.



No sprinklers in shaft per NFPA 13 [2013] 8.15.5.2 & 8.15.5.6

Note: A fire in the Primary Level lobby/ elevator control room must initiate Alternate level recall along with flashing the firefighter hat lights.

Smoke detector is required above the traction machine as this is now a machinery space. NFPA 13 - 8.15.5.6 NFPA 72 -21.3.6

Hoistway Smoke Relief Venting

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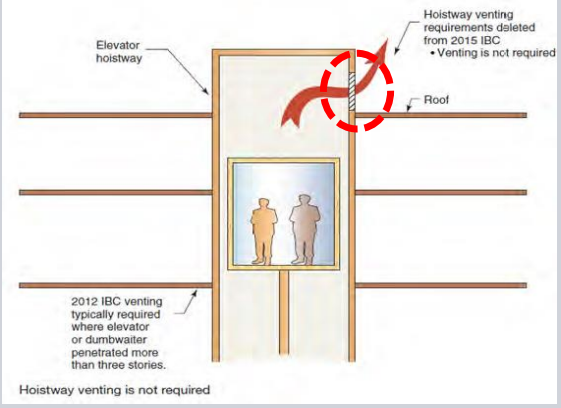
Previous versions of IBC 3004.1 required for venting elevator hoistways for certain occupancies to provided with a means for automatically venting smoke and hot gases: it has been removed.



The hoistway venting requirement automatedly opening a top of hoistway vent (no fan) so it actually did very little during an actual fire event.

Since the code requirement was expensive and very limited benefit, it was removed from the current code version.

In Chapter 30, Elevators and Conveying Systems, the requirements for elevator hoistway venting have been completely removed, as it seemed counterintuitive to the need for enclosed elevator lobbies in the code. The provisions were historic in nature and were provided for the fire service, but they were no longer seen as necessary. In addition, the hoistway venting requirements often conflicted with the hoistway pressurization option for elevator lobby enclosures. In addition, the requirements for the elevator lobbies and hoistway openings have been moved from Chapter 7, in previous editions, to Chapter 30 in the 2015 edition. [Section 3006].

The deletion of hoistway venting is balanced by the new requirements for high rise buildings – fire service access elevators. There was an increase of fire service elevators required in applicable high rise buildings from one to two where multiple elevators are provided in the building, except for those buildings that are provided with only a single elevator. A minimum of two fire service elevators better ensures that there will be a fire service access elevator available for the firefighters' use in the performance of their duties.

Elevator Lobby: Smoke Spread Mitigation

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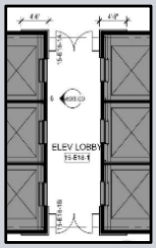
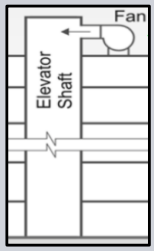
Some occupancies require methods to prevent the spread of smoke between floors through the elevator hoistway. Self closing doors are permitted to utilize magnetic door holders. To create a more open environment, architects may utilize fixed doors integrated into the elevator, drop-down smoke barriers, or hoistway pressurization.





Many elevator lobbies are small. If the detector is within 21 feet, it can be programmed to preform multiple functions such as recalling the elevator and releasing smoke barriers.

Certain occupancies may require protection of smoke migration in elevator lobbies. If the lobbies are required to be fire-resistance rated in accordance with Section 1020.1, elevator hoistway openings shall be protected in accordance with Section 3006.3.

Another way to avoid designing an enclosed elevator lobby onto each floor is to specify that a gasketed swing door be mounted directly at the elevator opening and held open with a magnetic hold device. The IBC refers to this door as an "additional door" and as long as it carries an S rating (smoke rating), is equipped with a closer, the device that pulls the door closed when the magnetic hold-open releases, is "openable from the elevator car side without the use of a key, tool, knowledge, or special effort", and is tested in accordance with UL 1784 for air leakage, this swing door solution readily meets the fire and smoke barrier code requirements for the space. In the event of a fire, the magnetic hold-open releases and the swing doors close over the elevator opening. The gasketing along the jamb of the door assembly fills in the space between the swing door and the door frame, creating a seal to block smoke from trespassing onto the floor. A drop seal is mounted to the door undercut to prevent smoke migration at the sill.

Elevator Life Safety Functions:
Automatic Emergency Lowering System

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An elevator system may have an optional emergency lowering system. It activates as soon as power is lost and will lower the car to the next floor. The doors will open, and the elevator will safely shut down. The elevator's power disconnect switch must provide auxiliary contacts to distinguish between an actual power failure and the opening of the disconnect for maintenance.

When installed, these auxiliary device may require a fire alarm addressable relay.

Some elevators are equipped with backup power supplies to allow the elevator to be lowered if power is lost. When this happens, it automatically cancels any floor calls. Then, using standby battery power, it safely lowers the elevator to the lowest landing and opens the car door. Rather than being inconvenienced for an indeterminate period of time, passengers are allowed to exit the car within seconds. After passengers have exited the car, the doors will close and the car will shutdown. When normal power becomes available, the elevator will automatically resume operation. The battery lowering feature is included in the elevator contract and does not utilize a building-supplied standby power source.

For example, many hydraulic elevators are equipped with a battery system that opens a solenoid to lower the elevator, and then provides power to open the elevator doors. This battery-lowering device is viewed by the NEC as an "emergency or standby power system," and is governed by Article 620.91 Paragraph (C) requires that the main disconnect be provided with an auxiliary contact that disconnects the additional power source from the load when the disconnecting means is in the open position. The purpose of this auxiliary contact is to disconnect the backup power system when the elevator switch is opened to prevent the elevator from automatically lowering while being maintained—which would endanger maintenance personnel.

Elevator Life Safety Functions:
Seismic Switch

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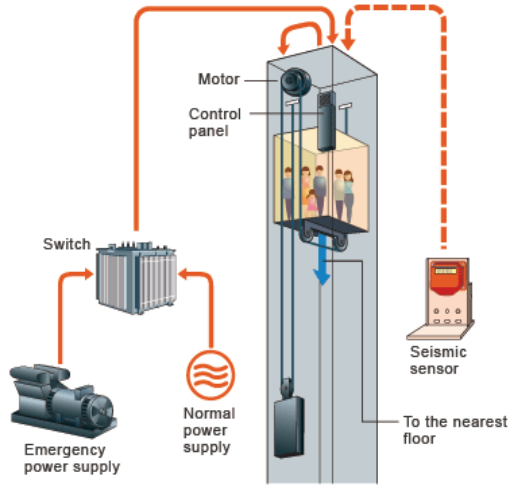

Some elevators installations utilize a UL 508 listed Seismic Switch which can disable elevators during an earthquake event.

This device overrides phase I and phase II operation unless phase II operation is already in effect.

No additional fire alarm interface or equipment is required.

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One of the general public's biggest fears, related to vertical transportation, is the prospect of being trapped inside an elevator during an earthquake. The industry has dedicated time and resource to reducing the likelihood of this happening. The earliest earthquake detection devices were called Seismoscopes and were invented in China during the second century, long before vertical transportation was an established industry. In the twentieth century earthquake detection became part of the vertical transportation industry in the form of a Seismic Switch. A Seismic Switch is a device that can disable or de-activate an elevator in the event of an earthquake.

A Seismic Switch works by monitoring seismic energy made up of Seismic Waves. Seismic Waves are waves of energy that travel through the earth's layers and are the result of an earthquake, volcano or an explosion. When the device detects fluctuations above a certain level it returns the elevator to the nearest floor and the doors open allowing passengers to get out. The switches are triggered by the preliminary P-waves of an earthquake. P-waves arrive before the more dangerous S-waves arrive. Seismic switches are also known as seismic triggers. Each seismic switch has an earthquake reset button with an indicating light that is lit when tripped.

ASME A17.1 code requirements 0.15 peak trigger level, 1 to 10HZ frequency range.

How to Handle Last-Minute Design Requests

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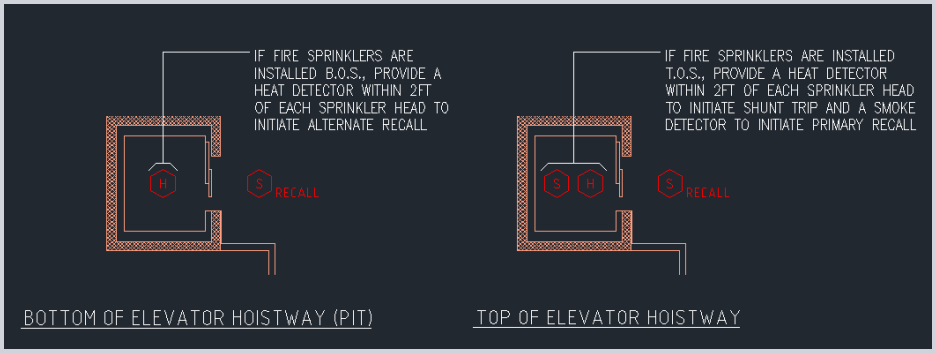
Scenario:

1. Design drawings due in an hour and there's no time to investigate the project conditions for a properly coordinated fire alarm design.



This method requires 'field engineering' by the installation team!

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Last-minute design requests are the bane of engineering firms. In an instant, they can turn a project from profitable to not, frustrating engineers in the process. Unfortunately, they're SOMETIMES unavoidable, especially as more engineering work is done in a parallel, rather than linear, fashion. No matter how well you plan and execute your projects on a regular basis, you'll likely have to deal with them from time to time. Here is a way to provide a code-compliant design while still keeping your cool. Of course the preferred method is for the engineer to coordinate the field conditions with the design to avoid scope gap and coordination issues.

Elevator Modernization

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Scenarios:

1. If an existing building modernizes the fire alarm system, the existing elevator controller is not required to be upgraded.
2. When the owner of an existing elevator decides to perform an alteration or modernize, the elevator life safety functions must be brought upto current code. This includes current phase I & II recall functions. All of the additional detection devices, components and wiring, must be included in the elevator project.

In some cases, it may be very expensive for an existing conventional FACP to support an elevator modernization project. Therefore an elevator project may drive either the replacement of the building FACP to an addressable platform or the installation of a dedicated elevator recall panel with addressable components.

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Elevator modernization (or lift modernization) is the process of upgrading the critical parts of the elevator in order for it to be able to handle new technology, have better performance, improve safety, and even give the aesthetics an up-to-date appeal.

Building owners are not required to upgrade the elevator controller; however, when the owner of an existing elevator decides to perform an alteration or modernize the elevators to current standards, the elevator(s) shall have FEO. The requirement to have FEO does not, create a requirement to install an FAS in a building.

Conversely having an FAS in the building does not, create any requirement to upgrade the elevator system to include FEO.

Where the elevator in an existing building which has an FAS is modernized and FEO is added, all of the additional detection devices, components and wiring, which are required when upgrading the elevator system to FEO, shall be part of the FAS.

Cab Occupant Notification – Evacuation Signals

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Horns and strobes should never be installed in elevator cabs. An alarm notification activation in this confined space could be both confusing and frustrating. The occupants are considered transient and AUTOMATIC alarm signals would be a dangerous distraction.

IBC 907.5.2.3 [2018] & NFPA 72 [2018] 23.8.6.2.2 state visible alarm notification appliances shall not be required in elevator cars.

NFPA 72 23.8.6.2: states automatic evacuation signals shall not operate in elevator cars, exit stairs and exit passageways

Previous versions of the code required the fire alarm to be heard in 'all occupiable areas.' The current code now clarifies this by prohibiting both audible and visual automatic evacuation signals in elevator cars.

The reasoning is that those who have passed through the exit (doors) on each floor have done so because they were already notified by the fire alarm system and they are already in the process of escaping the danger or already moving from one part of the building to another. Driving them on would likely cause more anxiety with unnecessary noise and disorienting flashing lights. In fact, all that additional distraction may be dangerous.

High Rise Elevators:
Cab Occupant Notification – Manual Paging

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High rise elevators cabs typically traversed many floors and will move through different evacuation zones. High rise fire alarm systems are required to have individual emergency voice communication capability with each stair tower and group of elevators (IBC 907 [2018] section 5.2.2) for MANUAL paging. NFPA 72 provides further clarification; section 24.4.2.8.4 states they are for manual paging only; visible signals are prohibited.

It is recommended that the speaker utilize a low tap setting (typically 1/16 watt) because of the confined area and hard surfaces in an elevator cab. A dedicated fire alarm audio circuit on one of the elevator's traveling cables will be required for this purpose.

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High-rise (buildings over 75') fire alarm systems are required to have individual emergency voice communication capability with each stair tower and elevators (IBC 907 [2018] section 5.2.2). Each stairtower and elevator group must be a separate paging zone. NFPA 72 provides further clarification; section 24.4.2.8.4 states they are for manual paging only; automatic evacuation signals are prohibited in these areas. This means that each stairtower and elevator hoistway must have speakers and be on a separate speaker circuits which only broadcast using the FACP microphone for live announcements. First Responders assess the emergency and can then broadcast a variety of specific messages to the stairwell occupants and direct them to continue their descent or stay where they are and await further instruction.

The IBC 907.5.2.2 requires speakers to be installed in the elevator cab and permits elevator cabs within the same hoistway to be grouped together under a single paging zone. These speakers are for manual paging by the fire department and do not receive any automatic alarm or standby messages. All elevator cabs must have a fire alarm speaker so that the fire department can communicate with the occupants. The building code does not provide any exceptions for passenger, freight or short-travel elevators. Also all cabs must have a firefighter jack for direct two-emergency communication with the Fire Command Center. Section 907.5.2.3 states visible alarm notification appliances (strobes) are not be required in elevator cars. NFPA 72 describes how the system must operate. Section 6.8.6 reinforces that automatic evacuation messages and strobes shall not operate inside elevator cabs.

High Rise Elevators:
Firefighter Communications

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If a wireless DAS utilizing BDA technology is not provided to enhance the first responder two-way radio service, then a wired Fire Fighter phone system must be provided. NFPA 72 requires Firefighter phone jacks be installed:

- **In each elevator cab**
- Each elevator lobby
- On every level in each enclosed stairway
- The fire pump room
- Emergency power room

The elevator contractor must provide a dedicated fire alarm phone circuit on one of the elevator's traveling cables to support the FF jack inside of the cab.

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A firefighter phone jacks for two-way fire department communication (not occupants) must be installed in accordance with NFPA 72 section 6.10 in elevator cabs per IBC 907.2.13.2.

All elevator cabs must have a fire alarm speaker so that the fire department can communicate with the occupants. The building code does not provide any exceptions for passenger, freight or short-travel elevators. Also all cabs must have a firefighter jack for direct two-emergency communication with the Fire Command Center.

Special Purpose Elevators:
Fire Service Access Elevator

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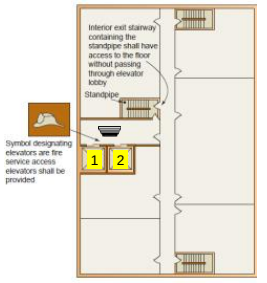
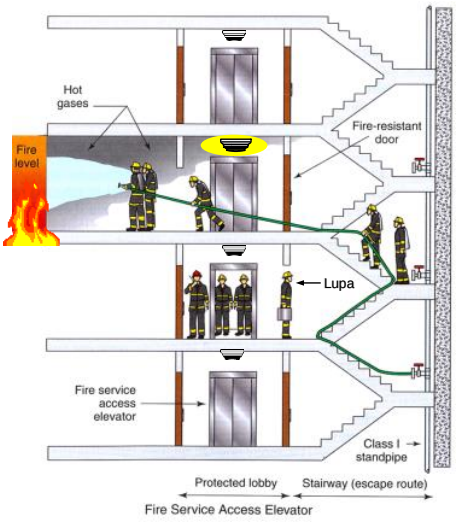
403.6.1 – Two fire service access elevators required in buildings over 125 feet.





3007 Fire Service Access Elevator

Many of the provisions addressing fire service access elevators have now been coordinated with those applicable to occupant evacuation elevators to ensure that the fire service access elevators are able to continue to function and serve their intended purpose during an emergency. This includes automatic sprinklers and their monitoring, water protection, shunt trips and the structural integrity of hoistway enclosures and their lighting.

Protection of Elevators §607.6

- Design must keep water from fire sprinklers outside of lobby from reaching
- Fire service access elevators, and Occupant evacuation elevators

Sprinklers in Elevator Machine Rooms §903.3.1.1.1

- Elevator shunt trip is specifically prohibited in both fire service access elevators and occupant evacuation elevators
- New exempt sprinkler locations have been added to protect the elevator hoistway:
- Machinery rooms
- Machinery spaces
- Control rooms
- Control spaces

Special Purpose Elevators:
Occupant Evacuation Elevators

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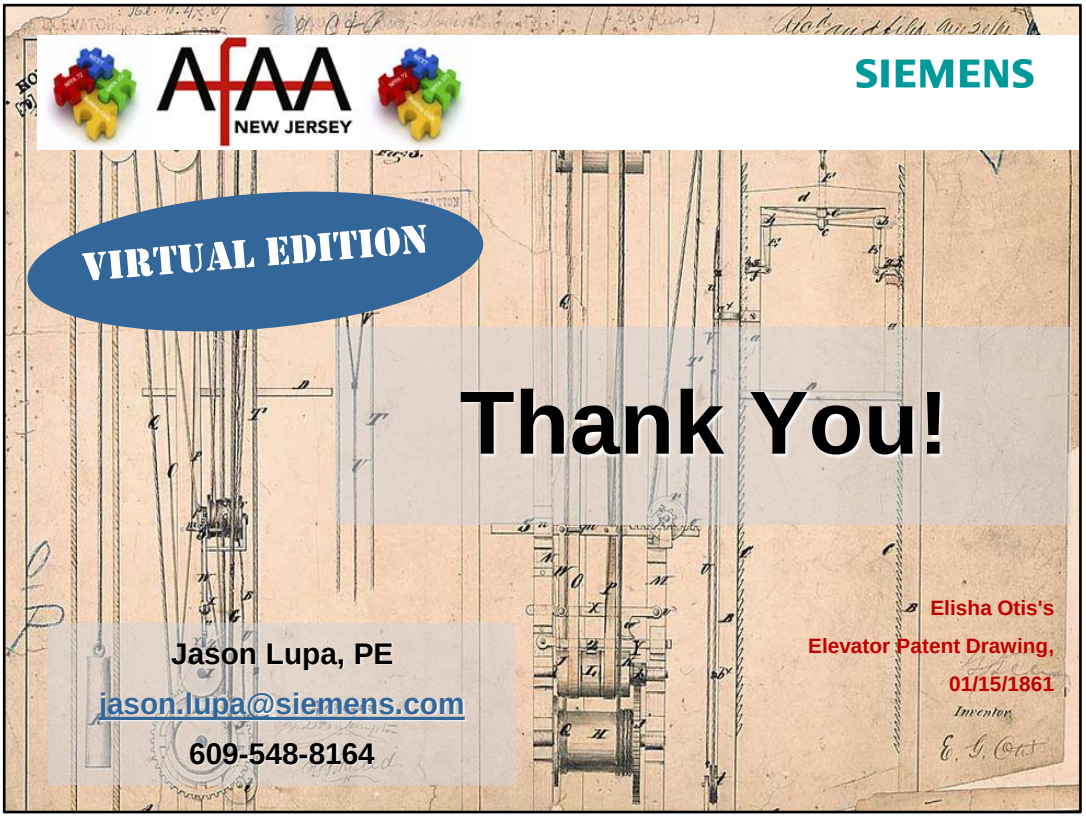
Occupant evacuation elevators (OEE's) are not mandated to be provided in any of the current codes.

May be provided in lieu of additional exit stairway required for buildings more than 420 feet in height required by IBC.

OEE is a new concept to the codes. requires time to ensure all involved parties are educated and fully understand requirements.

§3008 Occupant Evacuation Elevators: Many of the provisions addressing fire service access elevators have now been coordinated with those applicable to occupant evacuation elevators to ensure that the fire service access elevators are able to continue to function and serve their intended purpose during an emergency. Sprinkler system required
Elevator Hoistway Pressurization §909.21: Pressure differential of 0.1 to 0.25 inches of water column.
Emergency voice/alarm communication fire alarm system required throughout the building.
•Min. 1 audible notification appliance in Occupant Evacuation Elevator (OEE) lobby
•Min. 1 visible notification appliance in Occupant Evacuation Elevator (OEE) lobby Two-Way communication system required in OEE lobbies to building fire command center.
OEE lobby: Enclosed–1 hr Smoke barrier
•Minimum size: 25% of floor occupancy at 3 ft2 per occupant 2 hour fire resistance rated shafts Exit stair access from OEE Lobbies
•Directly adjacent to lobby or,
•Via separated protected path of travel with same protection level as lobby enclosure.
Permanent signage at all elevators
•Elevators are suitable for use by building occupants evacuating during fires.
Power Wiring: Protected by 2 hour fire resistance rating
2-hour rated circuit integrity cable systems or,
Within 2 hour rated construction or,
Listed circuit protective system with a 2-hour fire resistance rating
Standby Power: Type 60/Class 2/ Level 1 For equipment including:
1. Elevator equipment
2. Ventilation and cooling equipment for machine and control rooms and spaces
3. Elevator car lighting



This presentation does not attempt to address all the requirements relating to elevators. Most of the requirements associated with elevators—essentially those in ASME A17.1—pertain to the fabrication of elevators and associated equipment and accessories, of which elevator manufacturers are acutely aware. Specifications for elevators in the construction documents should require compliance with ASME A17.1 and with ICC/ANSI A117.1, the 2010 ADA Standards, or both. Since elevators vary among manufacturers, design professionals should consult manufacturer representatives when designing and specifying elevators, especially if custom designs are proposed for elevator cars, entrances, call stations, and hall signals.