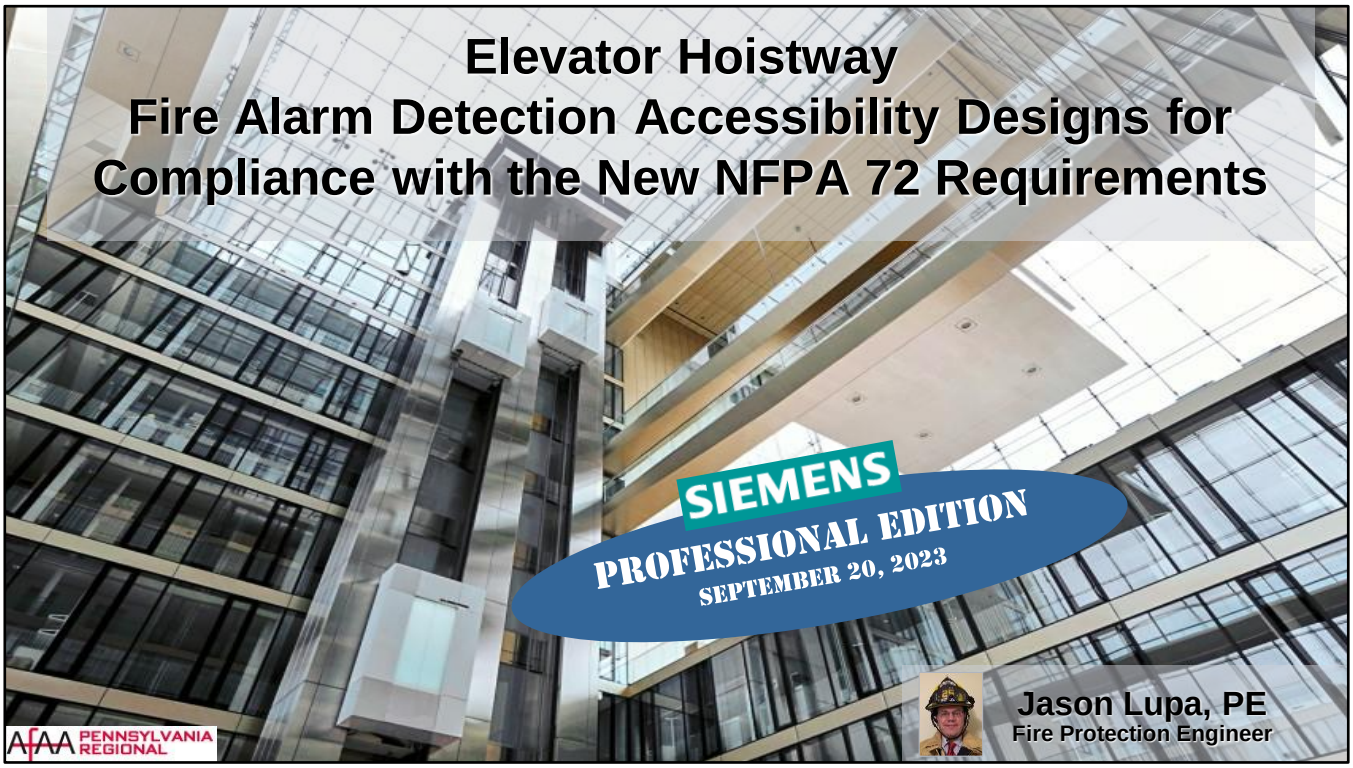


Historically, fire alarm service personnel and firefighters needed to ride the elevator car or lean into the open door of the hoistway to perform routine inspection, testing, and maintenance tasks. There are new NFPA 72 requirements which mandate these fire alarm devices be accessible from the from outside the elevator hoistway, to improve the safety of these tasks. The presentation will review the current hoistway requirements for fire sprinklers and fire alarm devices as required by IBC, NFPA and ASME A17.1/CSA B44 along with examples for providing access and remote detection.

Presenter

Jason Lupa, P.E. is a Business Development Engineer for Siemens Industry and a licensed Fire Protection Engineer. He has 30 years of extensive design experience for numerous occupancies including healthcare, industrial, and mercantile, but has had a particular focus on high-rise applications. Additionally, he has extensive experience in design-performance execution of projects from initial pre-construction through occupancy. Jason's 35 year of active firefighter experience provides both real-world knowledge of fire behavior and provide a communication pathway for Authority Having Jurisdiction negotiations.

33 years

Class of 1997

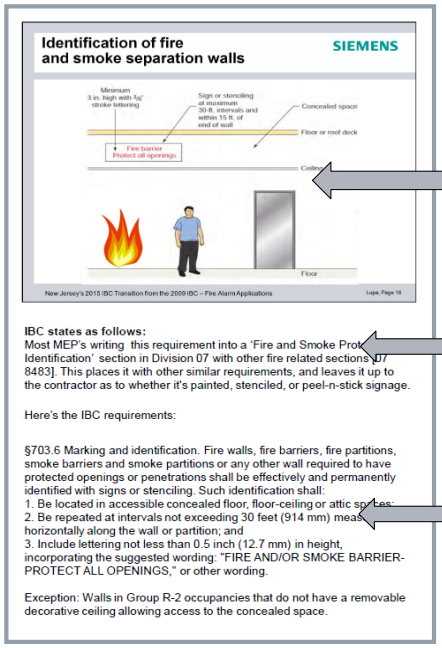
24 years

Flatiron wildland urban interface fire, June 1-4, 2023

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

The Fire Codes are written in ashes and blood! Honor those losses and lessons learned by being code compliant and fire safe.

Like most webinars, pls mute your mics and hold any questions until after the presentation.



EXTRA BONUS just for you

SLIDE DECK

COMMENTARY

CODE REFERENCES

If this class is relevant to your NICET certification and expands your knowledge, you may claim 1 CPD point per hour of instruction toward recertification

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.


Elevator Hoistway Applications Review

TOP OF HOISTWAY

REVIEW: Fire Suppression and Detection Requirements

SIEMENS

Per NFPA 13, top of shaft (TOS) fire sprinklers are required for:

1. A non-enclosed (open) hoistway.
2. Traction elevator with combustible suspension belts such as noncircular elastomeric-coated or polyurethane-coated steel belts. Not required if suspension belt has FT-1 rating.
3. Combustible elevator hoistway.

The elevator classification, venting design, and installation of fire sprinklers will determine the TOS fire detection design. If sprinklers are installed TOS per NFPA requirements or voluntarily, a smoke detector is required to initiate recall and a heat detector within 2 ft of each sprinkler head to initiate shunt trip (NFPA 72 [2016] 21.3.7).

No smoke detection is required unless:

- The elevator is a Firefighter Service Elevator (FSE) or Occupants Evacuation Elevator (OEE).
- A Machine Room-Less (MRL) type with equipment inside the hoistway.
- The elevator has a smoke damper for venting. Previous versions of IBC 3004.1 required this but is no longer mandated by code.
- The hoistway has fire sprinklers.

No heat detection is required unless:

- The hoistway has fire sprinklers. Power shunt trip is then also required.

To properly coordinate the fire alarm system with the elevator, some information will need to be gathered from other designers. Per NFPA 13 [2016] section 8.15.5, sprinklers may be omitted at the top of the shaft if the materials making up the hoistway, the elevator car itself, and the means of suspension are rated noncombustible/limited combustible by ASME A17.1. If the elevator and shaft do not meet those requirements, then a sprinkler (upright, pendant, or sidewall) must be installed at the top of the shaft.

FSE & OEE's are special use elevators which prohibit fire sprinklers and mandate smoke detection along with temperature monitoring.

The MRL type places the motor controller and/or driving machine in the hoistway which makes it a machinery spaces. NFPA 72 [2016] 21.3.13.1 which require smoke in the elevator machinery space to initiate Phase I recall. A smoke is required for all MRL's, regardless of the presence of fire sprinklers.

Smoke detectors shall not be installed in unsprinklered elevator hoistways unless:

1. They are installed to activate the elevator hoistway smoke relief equipment NFPA 72 [2016] 21.3.6.
2. They initiate Phase I Emergency Recall Operation per NFPA 72 [2016] 21.3.13.1(2) & 21.3.13.2(2).

Where sprinklers are located at the top of the hoistway, fire detection device(s) shall be installed per NFPA 72 [2016] 21.3.7(1). This requirement applies to smoke detectors installed in the hoistway to initiate elevator recall in accordance with 2.27.3.2.1(c) of ANSI/ASME A.17.1/CSA B44, *Safety Code for Elevators and Escalators*. A heat detector must be located within 24 in. of each sprinkler head NFPA 72 [2016] 21.4.2. A 135-degree heat detector is recommended to comply with NFPA 72 [2016] 21.4.1.

Generally, there are smoke detectors at the elevator lobbies for elevator recall and inside the elevator machine room. As far as detection in the hoistway, heat detectors will be placed near the locations of the sprinklers if they are present. Also, if the elevator has its machinery located within the hoistway, a smoke detector will be necessary at the top of the shaft.

BOTTOM OF HOISTWAY

REVIEW: Fire Suppression and Detection Requirements

SIEMENS

Per NFPA 13, bottom of shaft (BOS) fire sprinklers are required for:

1. A non-enclosed (open) hoistway.
2. Traction elevator with combustible suspension belts such as noncircular elastomeric-coated or polyurethane-coated steel belts. Not required if suspension belt has FT-1 rating.
3. Combustible elevator hoistway.
4. Hydraulic elevator with combustible fluids.

The installation of fire sprinklers will determine the BOS fire detection design.

No detection is required unless:

- The hoistway has fire sprinklers in the pit.

NEC classifies the bottom 4 feet of a elevator hoistway as 'a wet location.' If fire sprinklers are installed B.O.S. per NFPA requirements or voluntarily, detection is required. The type of detector (weather-proof heat or smoke) depends on the installation height of the detector above the pit floor. A dedicated fire sprinkler without any time –delay is also permitted, but not recommended. They are more expensive and tend to false trip.

Power shunt trip is prohibited for pit detection activation, regardless of the presence of fire sprinklers. A pit detector is only used to initiate recall, automatically moving the car away from the fire event.

The elevator pit requires sidewall sprinklers at a maximum of two feet above the floor of the pit. Per NFPA 13 [2016] section 8.15.5, these may be omitted if the shaft is enclosed, made of non-combustible material, and does not contain hydraulic (combustible) fluid. Typically, hydraulic type elevators will require a sprinkler head in the pit, while traction type elevators may be exempt if the building materials within the shaft are non-combustible.

Where sprinklers are located at the bottom of the hoistway, a fire detection device(s) must be installed per NFPA 72 [2016] 21.3.7(2). The type of detector (smoke or weather-proof heat) depends on the installation height of the detector above the pit floor. A dedicated fire sprinkler without any time –delay is also permitted, but not recommended. They are more expensive and tend to false trip.

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 rated. Water from a sprinkler discharge will not harm or disrupt the elevator's operation or the fire alarm equipment, if installer per code. Never shunt trip the elevator power from an elevator pit fire alarm device!

To comply with NFPA 72 and ASME 17.1, the fire alarm must initiate alternate recall of the Firefighters' Emergency Operation (FEO) sequence during a pit fire. The purpose is to move the cab to the alternate level, further away from the pit fire per NFPA 72 [2016] 21.3.12.2 (3). There are three methods to accomplish this:

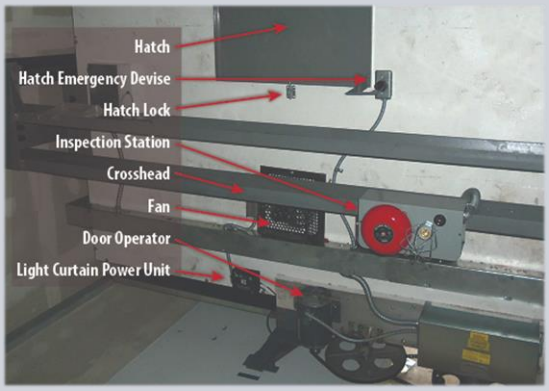
1. 135 degree fixed weather-proof heat detector, installed less than 4 feet from the pit floor.
   - Most common due to reliability, cost and quick reaction to a flammable liquid fire.
2. Smoke detector installed greater than 4 feet from the pit floor.
   - Susceptible to false alarms due to presence of dust, dirt and debris in the pit area. The pit can sometime also be damp further leading to false alarms.
3. Waterflow switch dedicated for the elevator pit with no time delay per NFPA 72 [2016] 21.3.3.2
   - Most expensive and slowest response time. Very rarely done.

Elevator Hoistway Accessibility

Elevator Hoistway Detector Access

SIEMENS

Fire alarm inspectors must ride on top of elevator cabs with elevator technicians to preform annual inspections. Even with proper safety gear, this is still a hazardous environment. Access to firefighters responding to a detector activation can also be difficult.



Elevator and fire alarm service personnel needed to ride the elevator or lean into the open door of the hoistway to perform routine inspection, testing, and maintenance tasks. To service a smoke detector in an elevator shaft, the cab must be taken out of service. For this reason, the work is done 'after hours.' The action of climbing onto the top of a car raises yet more problems. All operatives doing this work usually have to be harness trained, which often limits the workforce of the service providing company. Additionally, all personnel must be aware of safe electrical working practices.

One of the terms that you will hear often when talking about elevator service is the car top inspection station. The car top station is a control panel that sits directly above the elevator cab and is operated by an elevator technician. It enables the car to be removed from normal service and operated manually.

Elevator Hoistway Detector Access

SIEMENS

The 2019 edition of NFPA 72 now mandates fire alarm initiating devices installed in an elevator hoistway to be accessible from outside of the elevator hoistway.

NFPA 72 [2019] 21.3.7

"Fire alarm initiating device(s) required to be installed inside an elevator hoistway by other sections of this Code or by other governing laws, codes, or standards shall be required to be accessible for service, testing, and maintenance from outside the elevator hoistway."

This requirement has been mandated in some areas, such as California for the last 20 years per Title 8 ESO due to worker safety.




The 2018 code has general requirements that all fire alarm devices to be accessible. For elevators, installing a detector on the ceiling is acceptable, the technician can ride the top of the elevator car, it's done all the time. The 2021 edition specifically requires detectors installed in elevator hoistways be accessible only from the outside of the shaft.

Fire alarm service personnel needed to ride the elevator or lean into the open door of the hoistway to perform routine inspection, testing, and maintenance tasks. This new requirement for access from outside the elevator hoistway improves the safety of these inspection, testing, and maintenance tasks.

ASME A17.1/CSA B44, Safety Code for Elevators and Escalators" includes references to "smoke detectors" but does not include methods for providing access to a smoke detector in a hoistway. NFPA 72 National Fire Alarm and Signaling Code" (2019) is the applicable standard for FADS and requires this remote access.

Elevator Hoistway Detector Access

SIEMENS

Here are some compliance methods:

1. **Smoke & heat detectors mounted inside, with an access hatch**
2. **Remote smoke detection**
3. **Remote heat detection**

It is very important the pre-con team coordinates the design intent and depicts these requirements on design documentation. This information will determine material, equipment and installation trade selections.

Which design professional selects and designs the elevators?

NFPA 72 (2019) A.21.3.7 references (3) proposed methods for providing access to a smoke detector in a hoistway : (1) Access hatch door, (2) Provide sampling-type detector, (3) Heat detectors with connection points located outside the hoistway.

1. Provide an access hatch door and associated protective guard for a spot type fire detector (s), where the fire detector(s) is installed within the protective guard.
2. Provide an air sampling-type detector as specified in 17.7.3.6 installed outside the hoistway with its sampling tube installed to sample the air within the hoistway.
3. Linear heat detectors with connection points located outside the hoistway or spot type heat detectors installed in accordance with A.21.3.7(1) are acceptable.

TOP OF HOISTWAY

SIEMENS

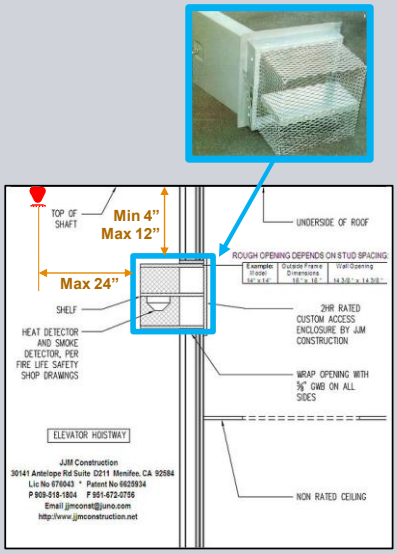
Smoke & Heat Detection Installed Inside the Hoistway

Smoke & heat detectors inside the hoistway

This method provides a fire-rated access hatch with an internal protective guard for the detector(s) installed inside the hoistway. The guard prevents objects from falling into the hoistway.

Placement of the hatch assembly is critical. The smoke detector must be within 12" of the hoistway ceiling and the heat detector must be within 2 feet of the fire sprinkler head. Multiple trades are required for this method.

Fire rated access enclosure installed in an elevator hoistway overrun



A spot-type smoke detector and heat detector is installed on a metal shelf within a metal protective cage combined with a 90-minute fire rated and listed (i.e., UL) access hatch door provided at the top (ceiling or wall) of the elevator hoistway. Locking and exterior applications available. If the access hatch door option is proposed, an approved detailed architectural plan must be submitted showing the access hatch detail with an approval letter from the elevator contractor for compliance with all required hoistway clearances. Then the sprinkler head must be installed within two feet of the heat detector.

Elevator Access hatch vendor: B.L. Wilcox & Associates, 7615 Baldwin Place, Whittier, CA 90602. Toll Free: 800-272-0643

TOP OF HOISTWAY

SIEMENS

Remote Smoke Detection

Smoke detectors outside the hoistway

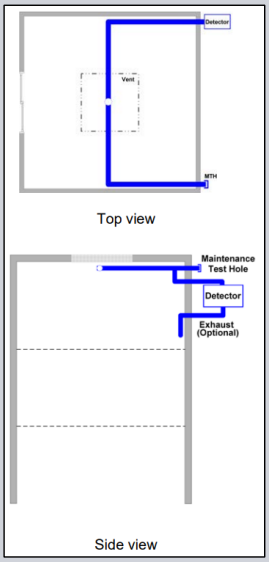
A remote air-sampling smoke detection system draw air in through CPVC pipes to the detector outside the hoistway per NFPA 72 [2019] 17.7.3.6. with returns to compensate for pressure differentials. Pipes configured for remote testing and maintenance. Versions include standard detectors and complete air aspirated panels.

XAS-1 **XAS-2**

- Single and dual inlet
- No calculations required
- Addressable smoke detector
- Max. 164 ft. sample pipe length
- Max. 50 feet flexible tube
- Upto 2 sample holes per pipe
- Circuits: SLC & 24VDC

Safe **Xtralis**

- Upto 4 sample pipes
- Pipe length and sample holes based on calculations
- Multiple sample points
- Local display
- Circuits: SLC & 24VDC or 120VAC for local power supply



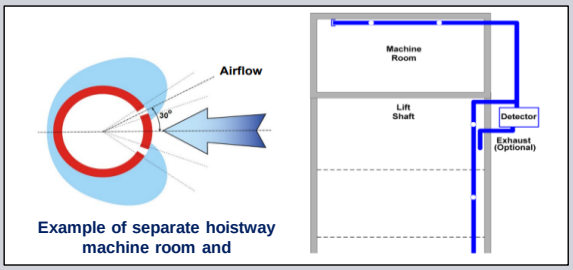
By continuously sampling air from the protected space through a pipe network, the air aspiration remote smoke detection application rapidly senses the slightest traces of smoke. Its filtering process and scan of incipient fire signatures verifies the presence of real smoke, thereby diminishing the occurrence of nuisance alarms. Electronics are mounted outside the hoistway for service. To ensure air balance, the exhaust side must be vented back into the hoistway which the sample holes originated. For buildings up to 4 floors, it is recommended to place sample holes at the top of the shaft and upstream from smoke vents if present.

The XAS-1-US and XAS-2-US Air-sampling Smoke Detectors (ASDs) are a reliable smoke detection solution for challenging spot detection applications, such as elevator hoistways. They use utilizes a standard Siemens addressable smoke detector(s) together with a high-performance active air sampling aspirator and configurable flow monitoring circuitry. The aspirator detector has air flow monitoring circuitry which is displayed on a ten element bargraph that can be adjusted for high and low flow thresholds. Fault flow failure is reported as a device fault via relays to the Siemens fire panel. Requires SLC and steady 24VDC power circuit. Filter life is approximately 1 year – maybe less in harsh environments. Power consumption for the XAS motor is – speed 1 = 120 ma and speed 9 =300 ma. The XAS-2 Dual inlet require two separate pipes one feeding to each detector. The air is not mixed between the two sides of the XAS housing.

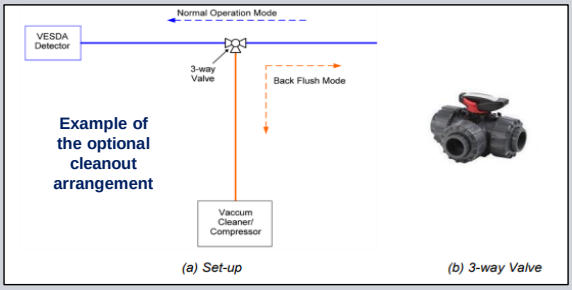
TOP OF HOISTWAY

Remote Smoke Detection

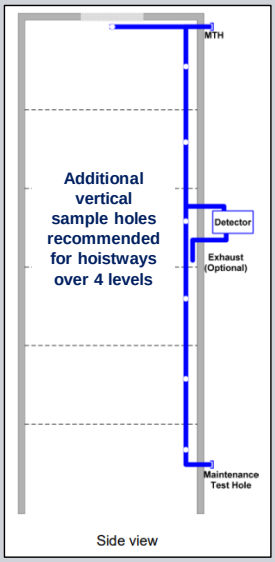
SIEMENS



Example of separate hoistway machine room and



Example of the optional cleanout arrangement



Additional vertical sample holes recommended for hoistways over 4 levels

For tall hoistways, a small fire starting at ground level may not have the thermal energy to push the smoke particles through the higher temperature air barrier. This would result in the smoke not reaching the detection points on the roof level until the fire is considerably larger.

To overcome the effects of stratification and dilution is to add a vertical pipe in addition to the main ceiling detection sampling point(s).

Sample holes should have a 30° orientation to the direction of the air flow across the vent. After the last hole, extend the sample pipe down to accessible level and terminate with a Normally Closed 2-way valve for remote testing. Initial NFPA 72 acceptance testing requires each sample hole tested and verify the transport time. Annual NFPA 72 testing can be performed by opening the 2-way valve and utilizing “canned smoke” directed at hole for a 4-6 second duration, then wait for transport. Transport time for smoke from the test port to alarm activation is 120 seconds. If this time is not meet, the motor speed must be increased or the pipe length/ bend adjusted. In shafts that experience particularly high levels of contamination it is recommended that an in-Line filter is used.

By installing a test point in a safe and easily accessible location outside the hoistway, the need for specialized equipment to carry out routine testing and system monitoring is removed. A single technician can fully test the system and check airflow from all sampling points. In the event of particulate / dust build-up, a manual blow through can be used to clear any particulate build-up that is preventing optimal detection in any sampling points within the total system.

Pipe network maintenance is intended to dislodge dust and contaminants from the pipe network through back flushing using vacuum pressure or compressed air. Good practice is to provide a maintenance test hole to back flush the pipe network. This is implemented close to the ASD detector (downstream from sample holes). Either 2 two –way valves or 1 three-way valve can be used.

TOP OF HOISTWAY | BOTTOM OF HOISTWAY

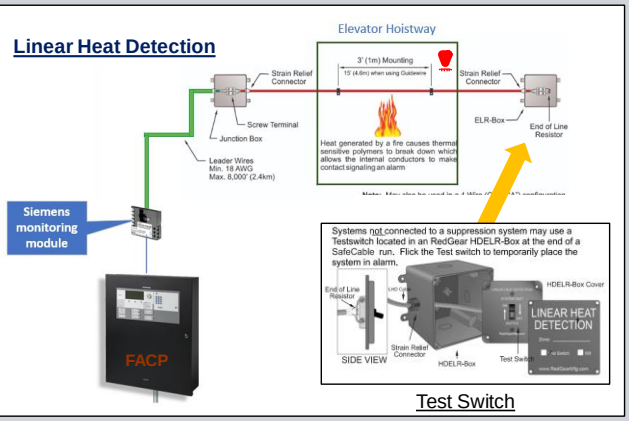
SIEMENS

Remote Heat Detection

Heat detection outside the hoistway

Only linear heat detection (LDH) or a mechanical fixed-temperature/ non-restorable conventional heat detector may be used inside the hoistway. Either detection option reports to an addressable monitoring module and has an inspection point located outside the hoistway.

Linear Heat Detection



Test Switch

Mechanical Heat Detector

DT-135F

Replaces the red LDH cable

RSM-1

Test Switch

NFPA 72 does not require a technician to access the hoistway for annual testing of these types of heat detectors. A key-operated switch which creates a 'dead-short' across the circuit to simulate a heat activation is acceptable for this type of application. Like sprinkler heads, these types of detectors are very reliable and require very little service.

Heat detection is required within 2ft of any sprinkler head. There are two options: linear-type detection wire or conventional fixed-temperature nonrestorable spot-type heat detector. The circuit must originate outside the hoistway then be routed back to accessible level and terminate with a local keyswitch. The end-of-line resistor is placed after the N.O. keyswitch. If a keyswitch is not provided, the junction box containing the end-of-line resistor should be located outside the elevator pit and labeled. NOTE: To meet NFPA 72 testing requirements, the heat detector must be fixed-temperature, typically 135 degree.

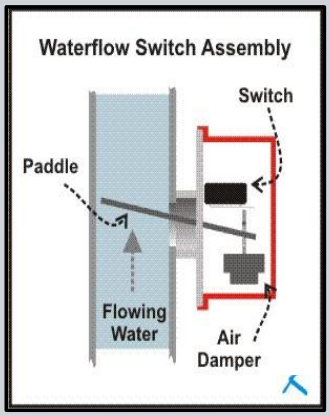
Do not use actual heat tests on the detectors, since it would be a destructive test. Test functionality of the nonrestorable heat detector mechanically and electrically to meet NFPA standards. Initial acceptance and annual NFPA 72 testing requires shorting the circuit with the keyswitch, and recording the loop resistance. After 15 years from initial installation, replace all devices or have 2 detectors per 100 laboratory tested. If a failure occurs on any of the detectors removed, remove and test additional detectors to determine either a general problem involving faulty detectors or a localized problem involving 1 or 2 defective detectors.

The RSM-2 is a momentary key-operated switch which creates a 'dead-short' across the circuit to simulate a heat activation. It has flying leads on a single pole, normally open contact for monitoring by a XTRI-M module. NOTE: fixed/ rate-of-rise and electronic conventional heat detectors are not permitted since they do not meet the NFPA 72 testing requirements for this remote testing method.

BOTTOM OF HOISTWAY

Remote Heat Detection

SIEMENS



Fire sprinkler waterflow option

If a waterflow switch is provided per NFPA 72, 21.3.3.2, install the waterflow switch outside the hoistway. The use of a time delay capability for this device is acceptable in order to ensure that water supply pressure fluctuations do not initiate unwanted Elevator Phase I Emergency Recall Operation.

NFPA 72 [2019] 21.3.3.2

A waterflow switch shall be permitted to initiate Elevator Phase I Emergency Recall Operation upon activation of a sprinkler installed at the bottom of the elevator hoistway (the elevator pit), provided the waterflow switch and pit sprinkler are installed on a separately valved sprinkler line dedicated solely for protecting the elevator pit.

The 2022 edition of NFPA 72's appendix lists this waterflow option for only the bottom of the hoistway. Since the appendix is not official part of the adopted standard (it's only explanative) and the 2019 specifically allows other methods as approved by the AHJ, this approach may be considered.

Final Thought

SIEMENS

1. The cost to install smoke and heat detection in an elevator hoistway has increased dramatically. If the engineer shows detection, which method should be used?
2. What language should be included in your proposal when a project has an elevator?
3. How will remote smoke and heat detection effect a test & inspect contract?

Thank You!

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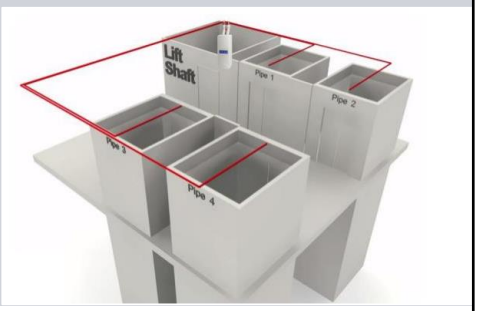
609-548-8164



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, 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.